DRAFT
ENVIRONMENTAL IMPACT STATEMENT

For issuing annual catch limits to the Alaska Eskimo Whaling Commission for a subsistence hunt on bowhead whales for the years 2019 and beyond

May 2018

Prepared by
U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

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Draft Environmental Impact Statement
for
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Lead Agency:	U.S. Department of Commerce National Oceanic and Atmospheric Administration National Marine Fisheries Service Office of International Affairs and Seafood Inspection
Responsible Official:	John Henderschedt, Director Office of International Affairs and Seafood Inspection
For Further Information Contact:	Office of International Affairs and Seafood Inspection Attn: Carolyn Doherty National Marine Fisheries Service 1315 East West Highway, Room 10711 Silver Spring, Maryland 20910 (301) 427-8385
Cooperating Agencies:	Alaska Eskimo Whaling Commission

Abstract: The National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) proposes to issue annual catch limits to the Alaska Eskimo Whaling Commission (AEWC) to allow continuation of its subsistence hunt for bowhead whales from the Western Arctic stock from 2019 onward, under the Whaling Convention Act (WCA) and the Cooperative Agreement with the Alaska Eskimo Whaling Commission (AEWC), and subject to International Whaling Commission (IWC)-set catch limits. Under the International Convention for the Regulation of Whaling (ICRW), the IWC has adopted management principles for setting subsistence catch limits for the Western Arctic stock of bowhead whales based upon the needs of Native hunters in Alaskan villages and in Russian Federation villages along the Chukotka Peninsula, and may adopt catch limits for specific years. NMFS issues the AEWC the United States' share of this catch limit. The subsequent hunt is managed under the WCA and the Marine Mammal Protection Act (MMPA), cooperatively by NMFS and the AEWC.

The purpose of this action is twofold: to manage the conservation and sustainable subsistence utilization of the Western Arctic stock of bowhead whales (as required under the ICRW, the WCA, the MMPA, and other applicable laws) and to fulfill the Federal Government's trust responsibility to recognize the cultural and subsistence needs of Alaska Natives.

The IWC will conduct its next meeting in September 2018 in Florianopolis, Brazil, and based on the management advice of the IWC Scientific Committee, is likely to adopt a catch limit for 2019 through 2024 or 2025 at the same or similar levels as the previous quota block. This DEIS considers five Alternatives and Alternative 4 is the preferred alternative. Under Alternative 4, NMFS would grant the AEWC the U.S. portion of a maximum annual strike limit of 100 strikes, i.e., 67 annual strikes plus up to 33 unused strikes from previous years which can be carried forward, subject to limits, and added to the annual strike quota of subsequent years. These strike limits would be subject to the U.S. portion of a maximum total of 336 landed whales over any six-year period. This Alternative is preferred because it meets the purpose and need of this action, and it achieves the socio-cultural benefits of the subsistence hunt at minimal environmental cost.

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List of Acronyms and Abbreviations

2-D	two-dimensional
3-D	three-dimensional
AAC	Alaska Administrative Code
ABF	Alaska Board of Fisheries
ACIA	Arctic Climate Impact Assessment
ADF&G	Alaska Department of Fish and Game
AEWC	Alaska Eskimo Whaling Commission
AGIA	Alaska Gasline Inducement Act
AMAP	Arctic Monitoring and Assessment Programme
AOGCM	Atmosphere-Ocean Global Climate Model
APP	Alaska Pipeline Project
ASAMM	Aerial Survey of Arctic Marine Mammals
ASAP	Alaska Stand Alone Gas Pipeline
AWI	Animal Welfare Institute
AWSC	Alaska Waterways Safety Committee
BCBS	Bering-Chuckchi-Beaufort Seas
Bcf	billion cubic feet
BOEM	Bureau of Ocean Energy Management
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
BPXA	BP Exploration
BWASP	Bowhead Whale Aerial Survey Project
CAA	Conflict Avoidance Agreement
Cd	cadmium
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CI	Confidence Interval
cm	centimeters
CO_2	carbon dioxide
COP	ConocoPhillips Company
COPA	ConocoPhillips Alaska, Inc.
CPAI	ConocoPhillips Alaska, Inc.
CPF	Central Processing Facility
CV	Coefficient of Variation
dB	decibels
dB re 1 μPa at 1 m	decibels re 1 microPascal at 1 meter
DDTs	Dichlorodiphenyltrichloroethanes
DPSs	Distinct Population Segments
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EIS	Environmental Impact Statement
EO	Executive Order
EP	Exploration Plan

EPA	Environmental Protection Agency
ESA	Endangered Species Act
FR	Federal Register
FMP	Fishery Management Plan
FONSI	Finding of No Significant Impact
Fr	Recovery Factor
ft	feet
G&G	Geological and Geophysical
GMT-1	Greater Mooses Tooth-1 project
GMT-2	Greater Mooses Tooth-2 project
GTP	gas treatment plant
HCHs	hexachlorocyclohexanes
Hg	mercury
HPDI	Highest Posterior Density Intervals
Hz	hertz
ICRW	International Convention for the Regulation of Whaling
IHLC	Iñupiat History, Language and Culture Commission
ISER	Institute of Social and Economic Research
in^3	cubic inches
IPCC	Intergovernmental Panel on Climate Change
IWC	International Whaling Commission
K	carrying capacity
kHz	kilohertz
km	kilometers
LDPI	Liberty Development and Production Island
m	meters
mi.	miles
MHW	Mean High Water
MMC	Marine Mammal Commission
MML	Marine Mammal Laboratory
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MPRSA	Marine Protection, Research, and Sanctuaries Act
MSY	Maximum Sustainable Yield
N(#)	number of whales estimated to have passed within # km of visual range based on visual surveys from shore
n. mi.	nautical miles
N/A	not available
NBSRA	Northern Bering Sea Research Area
ND	no data
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NPFMC	North Pacific Fishery Management Council
NOAA	National Oceanic and Atmospheric Administration
NPR-A	National Petroleum Reserve in Alaska

NRC	National Research Council
NSB	North Slope Borough
NSF	National Science Foundation
NWFSC	Northwest Fisheries Science Center
OCs	Organochlorines
OCS	Outer Continental Shelf
ONR	Office of Naval Research
OSP	optimum sustainable population
P(#)	proportion of whales estimated to have passed within #km range based on acoustic data and aerial surveys
PAHs	polycyclic aromatic hydrocarbons
PBR	potential biological removal
PCBs	polychlorinated biphenyls
POP	Platforms of Opportunity Program
psi	pounds per square inch
Q	A catch control rule developed by the IWC Scientific Committee
RFFAs	reasonably foreseeable future actions
ROD	Record of Decision
ROI	rate of increase
RY	replacement yield
SBI	Shelf Basin Interactions
SE	Standard Error
Se	selenium
SEIS	Supplemental Environmental Impact Statement
SLA	Strike Limit Algorithm
SLP	Sea Level Pressure
SPL	Sound Pressure Level
st. mi.	statute miles
TAPS	Trans-Alaska Pipeline System
TEK	traditional ecological knowledge
TOX	toxaphene
U.S.	United States
U.S.C.	United States Code
USGS	U.S. Geological Survey
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USFWS	United States Fish and Wildlife Service
VLOS	very large oil spill
WCA	Whaling Convention Act
WDC	Whale and Dolphin Conservation
WIP	Weapons Improvement Program
Y-K	Yukon-Kuskokwim

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EXECUTIVE SUMMARY

ES.1 Description of the Proposed Action

The National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) proposes to issue annual catch limits to the Alaska Eskimo Whaling Commission (AEWC) to allow continuation of its subsistence hunt for bowhead whales from the Western Arctic stock from 2019 onward, under the Whaling Convention Act (WCA) and the Cooperative Agreement with the Alaska Eskimo Whaling Commission (AEWC), and subject to International Whaling Commission (IWC)-set catch limits. Under the International Convention for the Regulation of Whaling (ICRW), the IWC has adopted management principles for setting subsistence catch limits for the Western Arctic stock of bowhead whales based upon the needs of Native hunters in Alaskan villages and in Russian villages along the Chukotka Peninsula, and may adopt catch limits for specific years. NMFS issues the AEWC the United States' share of this catch limit. The subsequent hunt is managed under the WCA and the Marine Mammal Protection Act (MMPA), cooperatively by NMFS and the AEWC. NMFS's issuance of any future catch limits will be subject to IWC requirements, which will in turn be based on IWC Scientific Committee advice on the sustainability of any catch limits.

The purpose of this action is twofold: (1) to manage the conservation and sustainable subsistence utilization of the Western Arctic stock of bowhead whales (as required under the ICRW, the WCA, the MMPA, and other applicable laws), and (2) to fulfill the Federal Government's trust responsibility to recognize the cultural and subsistence needs of Alaska Natives.

The IWC will conduct its next biennial meeting in September 2018 in Florianopolis, Brazil, and based on the management advice of the IWC Scientific Committee, is likely to adopt a catch limit for 2019 through 2024 or 2025, at the same or similar levels as the previous quota block. Among other things, the United States is likely to request a one-time seven-year catch limit for bowhead whales, where the numeric limits would expire at the end of 2025 rather than at the end of 2024. In 2024, one year before the numeric catch limits would expire, the IWC would review those limits, and could extend them for an additional six years from 2026 through 2031.

It is also possible that the IWC might not update the catch limit, notwithstanding IWC Scientific Committee management advice that the hunt is sustainable. If so, it should be noted that NOAA is considering issuing annual quotas for the time period described in the Alternatives under the current IWC Schedule language. For additional information on the legal context and regulatory history of the proposed action, see **Section 1.1** and **Section 1.2**.

The proposed action continues implementation of the IWC subsistence catch limits that have been in effect since 1997. The IWC, NMFS, and the AEWC have cooperated in conserving and managing the subsistence harvest of bowhead whales for 40 years. The Western Arctic bowhead whale stock has been the subject of extensive and continued research by NMFS and the North Slope Borough (NSB) scientists, so a considerable body of knowledge has been developed. In general, relatively few public and agency comments were received during the scoping period, and public comment focused on adequate assessment of the Alternatives under the National Environmental Policy Act (NEPA). For a summary of the comments, see **Section 1.3**.

ES.2 Status of the Western Arctic Stock of Bowhead Whales

The bowhead whale is listed as "endangered" under the Endangered Species Act (ESA) and the western Arctic (also known as Bering-Chukchi-Beaufort) stock is designated as "depleted" under the MMPA. However, the stock has been increasing in recent years at an estimated rate of 3.7 percent annually. The most recent point estimate of abundance for 2011 is 16,820 animals and is between 73 and 162 percent of the estimated abundance prior to the onset of commercial whaling in the mid-nineteenth century, estimated at 10,400-23,000 animals. Although recent abundance estimates suggest population level that is as high or higher than the prior estimate of carrying capacity, the population growth rate shows no sign of slowing.

Additional information about the status of the bowhead whale, include abundance, trends, and genetics can be found in **Section 3.2**.

ES.3 Subsistence Hunting of Bowhead Whales

Most of the Western Arctic bowhead whales migrate annually from wintering areas in the northern Bering Sea, through the Chukchi Sea in the spring, and into the Beaufort Sea where they spend the summer. In the autumn, they return to the Bering Sea to overwinter. Eleven Alaskan Native coastal villages along this migratory route participate in traditional subsistence hunts of these whales: Gambell, Savoonga, Little Diomede, and Wales (on the Bering Sea coast); Kivalina, Point Hope, Point Lay, Wainwright, and Utqiaġvik (Barrow) (on the coast of the Chukchi Sea); and Nuiqsut and Kaktovik (on the coast of the Beaufort Sea).

The bowhead whale hunt constitutes an important subsistence activity for these communities, providing substantial quantities of food, as well as reinforcing the traditional skills and social structure of local Alaska Native culture. Such hunts have been regulated by a catch limit adopted by the IWC since 1977, with Alaska Native subsistence hunters from northern Alaskan communities taking less than one percent of the stock of bowhead whales per year.

Additional information on the cultural traditions of Alaska Native bowhead whaling is found in **Section 3.5**, while **Section 3.6** describes the co-management role of the AEWC.

ES.4 Alternatives

This Draft Environmental Impact Statement (DEIS) is prepared pursuant to NEPA, (42 United States Code [U.S.C.] 4321 et seq.). Rather than the more limited review of an Environmental Assessment (EA), the fuller analysis of an EIS is provided here to provide greater transparency and opportunity for public review of NMFS's administration of the bowhead subsistence whaling program. The DEIS considers five alternatives for this proposed action, as described in detail in **Section 2**.

Under the ICRW Schedule provisions, the limits on aboriginal subsistence whaling of bowhead whales consist of three components; strike quota limits, carryover or carry-forward provisions, and landed limits. Since 1997, the IWC aboriginal subsistence whaling regime has largely been based on a five-year term in which no more than 255 bowhead whales may be landed. Starting in 2013, the regime has continued as six-year blocks over which no more than 336 bowhead whales may be landed. In addition to these landed limits, no more than 67 bowhead whales may be struck per year, with a provision for the annual addition of a carry-forward of up to 15 unused strikes from previous years, as detailed below Alternative 3. The term "strike quota" is used to refer to this limitation on the number of whales that may be struck, and the term "unused strike" refers to the unused portion of the limit on the number of whales that may be struck. Under some of the Alternatives listed below, these unused strikes may be "carried forward" into future years to accommodate for the variability in hunting conditions from one year to the next. The strike limit is larger than the landed limit, to take into account whales that may be struck but not successfully landed as a result of environmental conditions and other factors affecting hunting success in these remote villages.

For the four action alternatives, Alternative 2, Alternative 3, Alternative 4, and Alternative 5, bowhead subsistence whaling catch limits would be set annually by NMFS, subject to IWC requirements. In addition to receiving detailed monthly harvest reports from the AEWC, NMFS meets annually with the AEWC to review the stock status and results of the previous year's hunt. If it is determined that a hunt can proceed, NMFS issues the strike quota for the year. Further reporting requirements are also fulfilled in order to comply with IWC requirements, as described in **Section 3.6.4**.

If the IWC were to adopt a one-time seven-year catch limit for bowhead whales at its 2018 meeting, the numeric limits would expire at the end of 2025, whereas six-year limits would expire at the end of 2024. In addition to the annual review provided in the Schedule, the IWC would review and update the numeric limits in 2024, one year before those limits would expire. Presumably, the total number of bowhead whales that could be landed over that seven-year period would be increased by 1/6 from 336 to 392, and the total number of bowhead whales that could be landed over any 6-year period would remain unchanged at 336. Since the action Alternatives, below, evaluate the impacts of a take of 336 whales over any six-year period, they account for the possibility of a one-time seven-year renewal.

ES.4.1 Alternative 1 (No Action)

Do not grant the AEWC catch limits.

Under this alternative, NMFS would not grant the AEWC the U.S. portion of a subsistence whaling quota for cultural and nutritional purposes, notwithstanding the IWC Schedule's requirement to establish catch limits and permit aboriginal subsistence whaling for Western Arctic bowhead whales, subject to certain limitations. Increased catch limits would then become available for a bowhead hunt by Russian Chukotkan Natives, depending on their needs. This alternative would be contrary to the IWC Schedule, and because the WCA requires NMFS to implement requirements of the IWC Schedule, this alternative would also be contrary to the WCA.

ES.4.2 Alternative 2

Grant the AEWC an annual strike limit of 67 bowhead whales, not to exceed a total of 336 landed whales over any 6-year period, with no unused strikes from previous years added to the subsequent annual limit as carry-forward.

Under this alternative, NMFS would grant the AEWC the U.S. portion of an annual strike quota of 67 bowhead whales, not to exceed the U.S. portion of a total of 336 landed whales over any 6-year period. Under this alternative, no unused strikes from a previous year would be added to the strike quota for a subsequent year as carry-forward, notwithstanding the IWC's requirement to "carryover" or "carry forward" unused strikes in the bowhead subsistence catch limits. Because the IWC Schedule requires unused strikes to be carried forward and added to the strike quotas of subsequent years, subject to limits, this alternative would be contrary to the IWC Schedule. As the WCA requires NMFS to implement requirements of the IWC Schedule, this alternative would also be contrary to the WCA.

ES.4.3 Alternative 3

Grant the AEWC an annual strike limit of 67 bowhead whales, not to exceed a total of 336 landed whales over any 6-year period, with unused strikes from previous years carried forward and added to the annual strike limit of subsequent years (subject to limits), provided that no more than 15 additional strikes are added to any one year's allocation of strikes. This alternative would maintain the status quo for any 6-year period with respect to management of the hunt.

Under this alternative, NMFS would grant the AEWC the U.S. portion of an annual strike quota of 67 bowhead whales (plus up to 15 unused strikes as carry-forward from previous years), not to exceed the U.S. portion of a total of 336 landed whales over any 6-year period. This alternative differs from Alternatives 1 and 2 by allowing the AEWC to carry forward unused strikes from previous years, and add up to 15 of those unused strikes per year to the catch limits for any subsequent years, consistent with the current IWC Schedule. Carry-over of unused strikes from previous years allows for variability in hunting conditions from one year to the next within limits that conserve the Western Arctic bowhead stock and is a long-standing feature of this quota structure.

ES.4.4 Alternative 4 (Preferred Alternative)

Grant the AEWC an annual strike limit of 67 bowhead whales, not to exceed a total of 336 landed whales over any 6-year period, with unused strikes from previous years carried forward and added to the annual strike quota of subsequent years (subject to limits), provided that no more than 50 percent of the annual strike limit is added for any one year. This alternative would maintain the status quo for any 6-year period with respect to management of the hunt for landed whales and employ the Commission's agreed-upon 50 percent carryover principle.

Under this alternative, NMFS would grant the AEWC the U.S. portion of an annual strike quota of 67 bowhead whales (plus up to 50 percent of the annual strike limit of unused strikes as carry-forward from previous years), not to exceed the U.S. portion of a total of 336 landed whales over any 6-year period. This alternative differs from Alternatives 1 and 2 by allowing the AEWC to carry forward unused strikes from previous years. This alternative differs from Alternative 3 by allowing the AEWC to carry forward unused strikes from previous years, provided that no more than 50 percent of the annual strike limit is added for any one year, consistent with the IWC's 50 percent carryover principle. A carry-forward allows for variability in hunting conditions from one year to the next within limits that conserve the Western Arctic bowhead stock and, as noted, is a long-standing feature of this quota structure.

ES.4.5 Alternative 5

Grant the AEWC an annual strike limit of 100 bowhead whales, not to exceed a total of 504 landed whales over any 6-year period, with unused strikes from previous years carried forward and added to the annual strike quota of subsequent years (subject to limits), provided that no more than 50 percent of the annual strike limit is added for any one year. This alternative would increase the harvest levels by 50 percent and employ the Commission's agreed-upon 50 percent carryover principle.

Under this Alternative, NMFS would authorize of a higher level of harvest, given: (1) the timeframe for NMFS's proposed action, i.e., from 2019 onward, where it is likely that the AEWC's subsistence need for bowhead whales will increase over this timeframe; and (2) the increasing size of the Western Arctic bowhead whale population. As with the other alternatives, NMFS's issuance of any future catch limits will be subject to IWC requirements, which, in turn, will be based on IWC Scientific Committee advice on the sustainability of those catch limits.

Under this alternative, NMFS would grant the AEWC the U.S. portion of an annual strike quota of 100 bowhead whales, not to exceed the U.S. portion of a total of 504 landed whales over any 6-year period. This alternative differs from Alternatives 1 through 4 by increasing the harvest levels by 50 percent, and differs from Alternatives 1 through 3 by employing the IWC's 50 percent carryover principle. A carry-forward allows for variability in hunting conditions from one year to the next within limits that conserve the Western Arctic bowhead stock and, as noted, is a long-standing feature of this quota structure.

ES.4.6 Preferred Alternative

The agency has identified Alternative 4 as its preferred alternative because it best meets the purpose and need of this action, and it achieves the socio-cultural benefits of the subsistence hunt at minimal environmental cost.

ES.5 Summary of Effects

In the sections that follow, the analysis of the biological effects of the alternatives on the Western Arctic bowhead whale stock focuses on the strike quota (i.e., 67 per year, with carry-forward in some alternatives), rather than the limit for landed whales, which was 336 for the six-year period 2013-2018. There are no definitive data on the fate of whales struck and not landed, also referred to as struck and lost whales. Some of the struck and lost whales are likely to die as a result of the strike. As a precautionary measure, the analysis here estimates maximum mortality, and thus assumes for analytic purposes that all whale strikes result in mortality. The effects analysis follows the methodology described in **Section 4.1**.

ES.5.1 Alternative 1 (No Action)

Do not grant the AEWC a quota.

Under this alternative, NMFS would not grant the AEWC the U.S. portion of a subsistence whaling quota for cultural and nutritional purposes, notwithstanding the IWC Schedule's requirement to establish catch limits and permit aboriginal subsistence whaling for Western Arctic bowhead whales, subject to certain limitations. Increased catch limits would then become available for a bowhead hunt by Russian Chukotkan Natives, depending on their needs. Therefore, the magnitude, extent, and duration/frequency of direct mortality under this alternative are considered negligible to the population of bowheads (using the method outlined in Table 4.1-1). Human activities associated with subsistence whaling would be sharply reduced under this alternative, so that the amount of noise and disturbance from subsistence whaling would also be considered negligible. Considered in light of the most recent population estimate of 16,820 whales (95 percent CI: 15,176 to 18,643) from 2011 (Givens et al. 2016), the current level of subsistence take represents 0.3 percent of the 2011 population, and likely even less than the current population, if continued annual population growth of 3.7 percent is assumed. This alternative would be contrary to the IWC Schedule, and because the WCA requires NMFS to implement requirements of the IWC Schedule, this alternative would also be contrary to the WCA.

ES.5.2 Alternative 2

Grant the AEWC an annual strike limit of 67 bowhead whales, not to exceed a total of 336 landed whales over any 6-year period, with no unused strikes from previous years added to the subsequent annual limit as carry-forward.

Alternative 2 would allow a maximum annual strike limit of up to 67 bowheads per year for a six-year period, subject to a maximum total of 336 landed whales over six years. Under this alternative, no unused strikes from a previous year would be added to the strike quota for a subsequent year as carry-forward, notwithstanding the IWC's requirement to "carryover" or "carry forward" unused strikes in the bowhead subsistence catch limits. Because the IWC Schedule requires unused strikes to be carried forward and added to the strike quotas of subsequent years, subject to limits, this alternative would be contrary to the IWC Schedule. Given the IWC Scientific Committee advice regarding the sustainability of this strike limit, the magnitude, geographic extent, and duration/frequency of this level of mortality are considered negligible for the bowhead population (**Table 4.1-1**) (IWC Scientific Committee Report, 2012).

Human activities associated with subsistence whaling under Alternative 2 would vary from year to year and place to place depending on whale movements, weather, ice characteristics, and social factors. Effects of human activities are localized and timed to coincide with the presence of whales during spring and autumn migrations. The effects due to subsistence whaling activities under Alternative 2 would be minor in magnitude, localized in geographic extent, and periodic and short-term in duration/frequency.

ES.5.3 Alternative 3

Grant the AEWC an annual strike limit of 67 bowhead whales, not to exceed a total of 336 landed whales over any 6-year period, with unused strikes from previous years carried forward and added to the annual strike limit of subsequent years (subject to limits), provided that no more than 15 additional strikes are added to any one year's allocation of strikes. This alternative would maintain the status quo for any 6-year period with respect to management of the hunt.

Under this alternative, NMFS would grant the AEWC the U.S. portion of an annual strike quota of 67 bowhead whales (plus up to 15 strikes as carry-forward), not to exceed the U.S. portion of a total of 336 landed whales over any 6-year period. The direct and indirect effects of Alternative 3 on the bowhead whale population would be nearly identical to Alternative 2 since the annual strike quota remains the same, but would allow for additional flexibility through the carry-forward of 15 unused strikes. Given the IWC Scientific Committee advice on the sustainability of this strike limit and carry-forward provisions, the magnitude, geographic extent, and duration/frequency of this level of mortality are considered negligible for the bowhead population. The effects of subsistence whaling activities under Alternative 3 would be minor in magnitude, localized in geographic extent, and periodic and short-term in duration/frequency, comparable to those identified under Alternative 2.

ES.5.4 Alternative 4 (Preferred Alternative)

Grant the AEWC an annual strike limit of 67 bowhead whales, not to exceed a total of 336 landed whales over any 6-year period, with unused strikes from previous years carried forward and added to the annual strike quota of subsequent years (subject to limits), provided that no more than 50 percent of the annual strike limit is added for any one year. This alternative would maintain the status quo for any 6-year period with respect to management of the hunt for landed whales and employ the Commission's agreed-upon 50 percent carryover principle.

Under this alternative, NMFS would grant the AEWC the U.S. portion of an annual strike quota of 67 bowhead whales (plus carry-forward), not to exceed the U.S. portion of a total of 336 landed whales over any 6-year period. Given the IWC Scientific Committee advice on the sustainability of this strike limit and carry-forward provisions, the magnitude, geographic extent, and duration/frequency of this level of mortality are considered negligible for the bowhead population. The effects of subsistence whaling activities under Alternative 4 would be minor in magnitude, localized in geographic extent, and periodic and short-term in duration/frequency. The disturbance effect would be considered minor at the population level, comparable to those identified under Alternatives 2 and 3.

ES.5.5 Alternative 5

Grant the AEWC an annual strike limit of 100 bowhead whales, not to exceed a total of 504 landed whales over any 6-year period, with unused strikes from previous years carried forward and added to the annual strike quota of subsequent years (subject to limits), provided that no more than 50 percent of the annual strike limit is added for any one year. This alternative would increase the harvest levels by 50 percent and employ the Commission's agreed-upon 50 percent carryover principle.

Under this alternative, NMFS would grant the AEWC the U.S. portion of an annual strike quota of 100 bowhead whales, with up to 50 unused strikes carried forward from previous years, not to exceed the U.S. portion of a total of 504 landed whales over any 6-year period. Though the Bowhead SLA for the level of take described in this Alternative has not been calculated, the impacts of that level of take, i.e., up to 150 whales per year, which includes the maximum carryover of unused strikes, on the Western Arctic stock of bowhead whales would likely be sustainable given that the maximum level of take for this Alternative would be less than 1 percent of the current population estimate of 16,820 animals. The population would still likely increase in numbers, albeit at a lower rate. As with the other alternatives, NMFS's issuance of any future catch limits will be subject to IWC requirements, which will in turn, be based on IWC Scientific Committee advice on the sustainability of those catch limits. NMFS assumes that the SLA would provide conservative management advice and meet IWC objectives for the management of stocks subject to aboriginal subsistence takes (cf. IWC, 1999).

While the Bowhead SLA has not been used to assess the harvest levels of Alternative 5, the Marine Mammal Protection Act (MMPA) concept of Potential Biological Removal (PBR) can be used to assess the impacts of a harvest of up to 150 bowheads per year, not to exceed a total of 504 landed whales over any six-year period. PBR is defined by the MMPA as the maximum number of animals, not including natural mortalities that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population. The level of take in Alternative 5 would be below the 2016 PBR of 161 animals, and would have a minor impact.

In addition, the 2006 catch control rule Q indicates that a take below 155 whales per year would be considered to be a minor impact. Given that the Western Arctic bowhead whale abundance estimates have increased since the 2006 stock assessment, there is no reason to think that a current estimate of Q_{low} would be any lower today if a revised assessment were conducted.

Therefore, the effects of Alternative 5 on the bowhead whale population would be minor. The magnitude, geographic extent, and duration/frequency of this level of mortality are considered minor for the bowhead population. Effects of human activities are localized and timed to coincide with the presence of whales during spring and autumn migrations. The disturbance to the whales from subsistence whaling activities under Alternative 5 would be minor in magnitude, localized in geographic extent, and periodic, short-term in duration/frequency. The disturbance effect would be considered minor at the population level.

ES.5.6 Effects of the Alternatives on Individual Whales

In addition to the effects of subsistence hunting (i.e., mortality for harvested whales and injury or mortality for whales struck and lost) on the Western Arctic bowhead whale stock, there are indirect effects of disturbance on individual bowhead whales that are not subject to the harvest. This includes the presence of vessels and underwater noise. These impacts would be negligible in magnitude, extent, and duration/frequency under Alternative 1, since under this Alternative no subsistence whaling would occur by Alaska Natives. Under Alternatives 2, 3, 4, and 5, subsistence whaling would occur with mortality and disturbance effects at the population level, as described in **Section 4.4**. Regarding disturbance effects to individual bowhead whales, the magnitude, extent, and duration of the associated disturbance effects would also be minor. For additional information on the effects of the alternatives on individual whales, see **Section 4.5**.

ES.5.7 Effects of the Alternatives on Other Wildlife

In the absence of bowhead whaling under Alternative 1, subsistence hunting would be redirected to other species, especially seals, walrus, and caribou, resulting in minor to moderate localized effects in terms of direct effects of mortality of these alternative subsistence resource species. For species that often congregate in numbers, like walrus and caribou, indirect effects of disturbance could affect numerous animals for each hunting event, and the effects would be considered moderate. Although this increased effort on other species is unlikely to replace the whale harvest, it could lead to moderate and possibly major reductions in the populations of other subsistence species. Alternatives 2, 3, 4, and 5 would have no more than negligible or minor effects on other wildlife species. For additional information see **Section 4.7**.

ES.5.8 Socio-cultural Effects of the Alternatives

Alternative 1 would result in major adverse impacts to the communities that rely heavily on subsistence hunts of bowheads for nutritional and cultural sustenance. This alternative would raise environmental justice concerns, since it would result in disproportionate adverse impacts to the predominantly minority and low-income populations of the AEWC member communities. Alternative 1 would also likely be viewed as a failure on the part of NMFS to exercise its trust responsibility with respect to Alaska Natives and, possibly, to Native Americans in general. Alternatives 2, 3, 4, and 5, would provide for continuation of subsistence bowhead whaling, with many beneficial effects of major magnitude, extent, and duration. For further information, see **Section 4.8**.

ES.5.9 Cumulative Effects of the Alternatives

This DEIS analyzes the cumulative effects of the alternatives when taken together with impacts from other activities and phenomena, such as oil exploration and climate change. The analysis of cumulative effects on the Western Arctic bowhead whale stock, found in **Section 4.6**, concludes that none of the action alternatives, when other activities and ongoing mitigation measures are taken into consideration, would result in major adverse impacts on the bowhead whale population.

As shown in **Section 4.7**, none of the alternatives, other than possibly Alternative 1, when combined with other reasonably foreseeable activities, would result in major adverse effects on other wildlife species. As for socio-cultural effects, only Alternative 1 (No Action) would result in major adverse effects, and this holds true when the cumulative effects of other activities considered (**Section 4.8**).

However, it is important to note that a Very Large Oil Spill (VLOS) could have major adverse effects, in terms of magnitude, duration/frequency, and geographic extent. The duration of effects could range from temporary (such as skin irritations or short-term displacement) to permanent (e.g., endocrine impairment or reduced reproduction) and would depend on the length and means of exposure, such as how and how much oil was ingested. Displacement of bowheads from areas impacted by the spill due to the presence of oil and increased vessel activity would be likely. If the area is an important bowhead feeding area (such as off Barrow or Camden Bay) or along the migratory corridor, the magnitude of the effects could be major. The extent of the impact of a VLOS on bowhead whales could be widespread, given the migratory nature of bowhead whales.

The following tables reproduced from **Section 4** of this DEIS summarize the direct, indirect, and cumulative effects under each alternative for all resources where environmental consequences were evaluated.

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Table ES-1

Bowhead Whale Subsistence Harvest EIS Effects at a Glance

Type of Effect	Alternative 1 Do not grant AEWC a catch limit.	Alternative 2 Annual strike quota of 67 bowhead whales.	Alternative 3 Annual strike quota of 67 bowhead whales, plus up to 15 previously unused strikes as carry-forward.	Alternative 4 Annual strike quota of 67 bowhead whales, plus up to 33 (50% of annual strike quota) previously unused strikes as carry-forward.	Alternative 5 Annual strike quota of 100 bowhead whales, plus up to 50 (50% of annual strike quota) previously unused strikes as carry-forward.
Direct and Indirect Effects on Whale Population - Mortality	No Impact	Negligible	Negligible	Negligible	Minor Adverse
Direct and Indirect Effects on Whale Population - Disturbance	No Impact	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse
Direct and Indirect Effects on Individual Whales	No Impact	Disturbance - Minor Adverse	Disturbance - Minor Adverse	Disturbance - Minor Adverse	Disturbance – Minor Adverse
Cumulative Effects on Whale Stock	Mortality – Negligible Disturbance - Minor Adverse Very Large Oil Spill - Low probability, Major Adverse	Mortality – Negligible Disturbance - Minor Adverse Very Large Oil Spill - Low probability, Major Adverse	Mortality – Negligible Disturbance - Minor Adverse Very Large Oil Spill - Low probability, Major Adverse	Mortality – Negligible Disturbance - Minor Adverse Very Large Oil Spill - Low probability, Major Adverse	Mortality – Negligible Disturbance – Minor Adverse Very Large Oil Spill - Low probability, Major Adverse
Effects on Other Wildlife	Minor Adverse to Moderate Adverse	Negligible to Minor Adverse	Negligible to Minor Adverse	Negligible to Minor Adverse	Negligible to Minor Adverse
Effects on Subsistence Patterns	Major Adverse	Major Beneficial	Major Beneficial	Major Beneficial	Major Beneficial

Effects on Health	Major Adverse	Major Beneficial	Major Beneficial	Major Beneficial	Major Beneficial
Effects on Public Safety	Minor Beneficial	Minor Adverse	Minor Adverse	Minor Adverse	Minor Adverse
Effects on Other Tribes	Moderate Adverse to Major Adverse	Negligible	Negligible	Negligible	Negligible
Effects on the General Public	Anti-whaling Public - Moderate Beneficial Pro-indigenous Rights Public - Moderate Adverse	Anti-whaling Public - Minor Adverse Pro-indigenous Rights Public - Minor Beneficial	Anti-whaling Public - Minor Adverse Pro-indigenous Rights Public - Minor Beneficial	Anti-whaling Public - Minor Adverse Pro-indigenous Rights Public - Minor Beneficial	Anti-whaling Public - Minor to Moderate Adverse Pro-indigenous Rights Public - Minor Beneficial
Effects on Environmental Justice	Major Disproportionate Adverse Effects	No Disproportionate Adverse Effects	No Disproportionate Adverse Effects	No Disproportionate Adverse Effects	No Disproportionate Adverse Effects

Key:

Adverse ←			**Neutral**	→		**Beneficial**
Major Disproportionate Adverse Effects	Moderate	Minor	Negligible	Minor	Moderate	Major
				No Disproportionate Adverse Effects		

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Table ES-2
Summary of Direct, Indirect, and Cumulative Effects of the Alternatives and Other Activities in the Project Area on Bowhead Whales

Effect		Alternative 1 Do not grant AEWC a catch limit.	Alternative 2 Annual strike quota of 67 bowhead whales.	Alternative 3 Annual strike quota of 67 bowhead whales, plus up to 15 previously unused strikes as carry-forward.	Alternative 4 Annual strike quota of 67 bowhead whales, plus up to 33 (50% of annual strike quota) previously unused strikes as carry-forward.	Alternative 5 Annual strike quota of 100 bowhead whales, plus up to 50 (50% of annual strike quota) previously unused strikes as carry-forward.
Direct and Indirect Effects	**Mortality**	No direct or indirect effects of Alternative, as the Alternative would not contribute to mortality.	Negligible effects on mortality of Western Arctic bowhead whale population.	Same as Alternative 2.	Same as Alternative 2.	Minor adverse effects on mortality of Western Arctic bowhead whale population.
	Disturbance	No direct or indirect effects of Alternative, as the Alternative would not contribute to disturbance.	Minor effects of disturbance in magnitude, extent, and duration/frequency.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
Cumulative Effects		Cumulative effects to mortality would be negligible in magnitude, extent, and duration/frequency. Cumulative effects to disturbance would be negligible in magnitude, extent, and	Cumulative effects due to mortality would be negligible in magnitude, extent, and duration/frequency. Cumulative effects to disturbance would be moderate in magnitude, extent, and	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.

	duration/frequency. A VLOS could have major adverse effects in terms of magnitude, extent, and duration/frequency if the spill occurred during a time when bowheads were present.	duration/frequency. A VLOS could have major adverse effects in terms of magnitude, extent, and frequency if the spill occurred during a time when bowheads were present.			

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Table ES-3

Summary of Direct, Indirect, and Cumulative Effects of the Alternatives and Other Activities in the Project Area on Other Wildlife

Effect		Alternative 1 Do not grant AEWC a catch limit.	Alternative 2 Annual strike quota of 67 bowhead whales.	Alternative 3 Annual strike quota of 67 bowhead whales, plus up to 15 previously unused strikes as carry-forward.	Alternative 4 Annual strike quota of 67 bowhead whales, plus up to 33 (50% of annual strike quota) previously unused strikes as carry-forward.	Alternative 5 Annual strike quota of 100 bowhead whales, plus up to 50 (50% of annual strike quota) previously unused strikes as carry-forward.
Direct and Indirect Effects	**Mortality**	Minor to moderate effects in magnitude, extent, and duration/frequency.	Negligible to minor direct and indirect effects on mortality.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
	Disturbance	Minor to moderate effects in magnitude, extent, and duration/frequency.	Negligible to minor direct and indirect effects on disturbance.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
Cumulative Effects		Cumulative effects would be moderate for important game species (e.g. caribou) and minor for other species.	Negligible cumulative effects.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.

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Table ES-4
Summary of Direct, Indirect, and Cumulative Effects of the Alternatives and Other Activities in the Project Area on the Sociocultural Environment

Effect		Alternative 1 Do not grant AEWC a catch limit.	Alternative 2 Annual strike quota of 67 bowhead whales.	Alternative 3 Annual strike quota of 67 bowhead whales, plus up to 15 previously unused strikes as carry-forward.	Alternative 4 Annual strike quota of 67 bowhead whales, plus up to 33 (50% of annual strike quota) previously unused strikes as carry-forward.	Alternative 5 Annual strike quota of 100 bowhead whales, plus up to 50 (50% of annual strike quota) previously unused strikes as carry-forward.
Direct and Indirect Effects	**Subsistence**	Adverse effects and major in magnitude, extent, and duration/frequency.	Beneficial effects and major in magnitude, extent, and duration/frequency.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
	Public Health and Safety	Adverse effects and major in magnitude, extent, but unknown duration/frequency. The effects on safety are complex, with positive net effects to hunter safety that count be countervailed by adverse nutritional, psychological, and social consequences.	Beneficial effects that are major for public health, but effects on safety would be adverse and minor due to the inherent risks of whaling.	Substantially similar to Alternative 2, but with additional temporal flexibility as a result of carry-forward that would increase the beneficial effects to public safety.	Substantially similar to Alternative 2, but with additional temporal flexibility as a result of carry-forward that would increase the beneficial effects to public safety.	Substantially similar to Alternative 2, but with additional temporal flexibility as a result of additional strikes and carry-forward that would increase the beneficial effects to public safety.
Cumulative Effects		Cumulative effects on subsistence practices, nutrition, and health	The contribution of Alternative 2 to the cumulative effects on	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.

	would be adverse and major in magnitude, extent, and duration. Cumulative effects on public safety are unknown.	subsistence harvest practices would be beneficial and major in magnitude, extent, and duration. Cumulative effects on subsistence harvest practices would be adverse and minor to moderate, depending on the timing and location of oil and gas activities, and the efficacy of measure intended to mitigate impacts. In the case of a VLOS, the cumulative effects on subsistence practices could be major in magnitude, extent, and duration, and could countervail any beneficial effects.			

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1.0 PURPOSE AND NEED

1.1 Introduction

1.1.1 Summary of the Proposed Action

The National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) proposes to issue annual catch limits to the Alaska Eskimo Whaling Commission (AEWC) to allow continuation of its subsistence hunt for bowhead whales from the Western Arctic stock[1] from 2019 onward, subject to International Whaling Commission (IWC)-set catch limits[2]. In turn, IWC-set catch limits are based on IWC Scientific Committee advice on the sustainability of proposed catch limits using a population model, referred to as a "Strike Limit Algorithm" (SLA). The SLA used by the IWC is specific to this population of bowhead whales and is the IWC's formula for calculating sustainable aboriginal subsistence whaling removal levels, based on the size and productivity of a whale population, in order to satisfy subsistence need. The purpose of NMFS's proposed action is to fulfill its federal trust responsibilities by recognizing the nutritional and cultural needs of Alaska Natives, to meet the international obligations of the United States, and to ensure that any aboriginal subsistence hunt of whales does not adversely affect the conservation of the Western Arctic bowhead whale stock.

This Environmental Impact Statement (EIS), prepared pursuant to the National Environmental Policy Act (NEPA, 42 U.S.C. 4321 *et seq*.), considers five alternatives for issuing the AEWC catch limits for bowhead whales pursuant to the International Convention for the Regulation of Whaling (ICRW) (including its Schedule), which established the IWC. The proposed action would comply with NMFS's responsibilities under the Whaling Convention Act (WCA) and under Section 101(b) of the Marine Mammal Protection Act (MMPA).

1.1.2 Location of Action

The project area encompasses U.S. waters within the geographic range of the Western Arctic bowhead stock. The users of the bowhead resource affected by the proposed action are the residents of Alaska villages currently participating in subsistence hunts of Western Arctic bowhead whales. These include Gambell, Savoonga, Little Diomede, and Wales (located along the coast of the Bering Sea); Kivalina, Point Hope, Point Lay, Wainwright and Utqiaġvik

[1] Also referred to as the Bering-Chukchi-Beaufort seas stock and the Bering Sea stock.

[2] At IWC64 in 2012, the IWC extended the numerical aboriginal subsistence whaling catch limits for Western Arctic bowhead whales through 2018. NMFS's issuance of catch limits for 2019 and beyond would be subject to applicable IWC catch limits in effect at the time.

(Barrow) (along the coast of the Chukchi Sea); and Nuiqsut and Kaktovik (on the coast of the Beaufort Sea). The IWC-adopted catch limit is also shared with Russian subsistence hunters in villages along the Chukotka Peninsula (**Figure 1.1.2-1**).

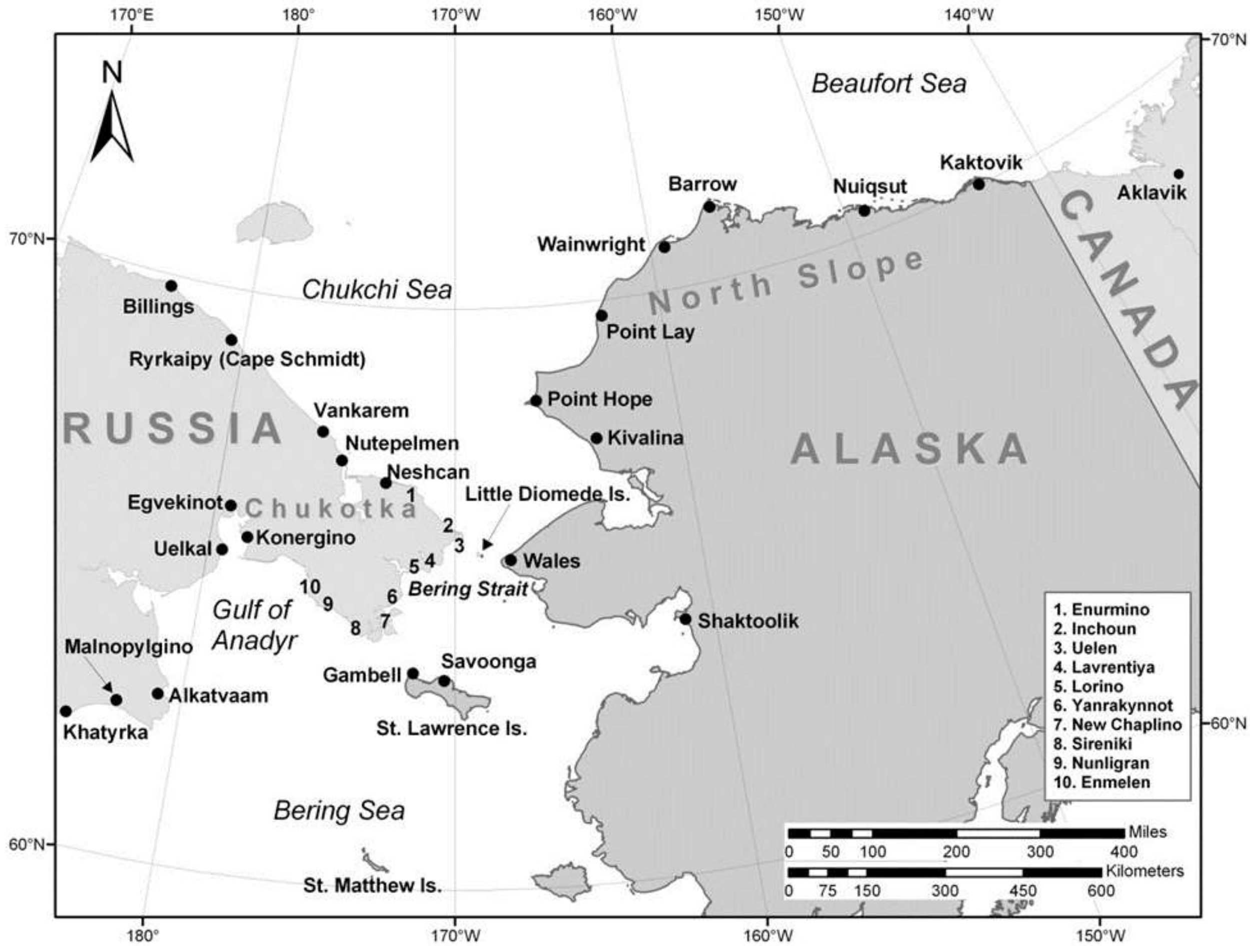

Figure 1.1.2-1. Historic and Current Bowhead Whaling Villages in Alaska, Canada, and the Russian Federation.

1.1.3 Summary of Western Arctic Bowhead Whale Status

The current understanding is that the majority of the Western Arctic bowhead whale population migrates annually from wintering areas in the northern Bering Sea, through the Chukchi Sea in the spring (March through June), to the Beaufort Sea where they spend much of the summer (mid-May through September). In the autumn (September through November), they return via the Beaufort and Chukchi seas to the Bering Sea to overwinter (November through March) (Braham *et al*., 1980; Moore and Reeves, 1993). Because the bowhead whale species is listed as "endangered" under the Endangered Species Act (ESA), the Western Arctic population is classified as a strategic stock under the MMPA and therefore also designated as "depleted" under the MMPA.

The Western Arctic bowhead whale population has been increasing in recent years at an estimated rate of increase of 3.7 percent (Givens *et al*., 2016). The IWC Scientific Committee currently estimates the population level at 16,820 animals, with a 95 percent confidence interval of 15,176 to 18,643, based on a 2011 ice-based survey conducted near Point Barrow, Alaska (2016 IWC Scientific Committee Report at 33). This estimated population level is between 73 percent and 161 percent of the pre-exploitation abundance estimated at 10,400-23,000 animals by Woodby and Botkin (1993). Some analyses suggest the population may be approaching carrying capacity (K) though there is no sign of slowing in the population growth rate (Brandon and Wade, 2006).

The estimated annual mortality rate incidental to commercial fisheries (0.2 whales per year) is not known to exceed 10 percent of the Potential Biological Removal (PBR) for the stock. Potential Biological Removal (PBR) is defined by the MMPA as the maximum number of animals, not including natural mortalities that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population. It is the product of the minimum population estimate of the stock; one-half the maximum theoretical or estimated net productivity rate of the stock at a small population size; and a recovery factor of between 0.1 and 1.0. The PBR for bowhead whales of the Western Arctic stock is 161 individuals annually (NMFS, 2016). Criteria developed for recovery of large whales in general (Angliss *et al*., 2002) and bowhead whales in particular (Shelden *et al*., 2001) will be considered in the next ESA status review. PBR was developed as a measure of the impact of total human-caused mortality, and under the MMPA, has direct management implications for commercial fisheries bycatch. However, PBR is not the metric used by the IWC to evaluate the effects of subsistence whaling. As described more fully in **Section 3.2.1** below, in 2002 the IWC adopted the SLA for Western Arctic bowhead whales (IWC, 2003a, b), to calculate appropriate levels for the strike limit that would achieve IWC management goals, including stock conservation, in a very wide range of scenarios.

On February 22, 2000, NMFS received a petition from the Center for Biological Diversity and Marine Biodiversity Protection Center to designate critical habitat for the Western Arctic bowhead stock under the ESA. Petitioners asserted that the nearshore areas from the U.S.-Canada border to Utqiaġvik (Barrow), Alaska should be considered critical habitat. On May 22, 2001, NMFS found the petition to have merit and initiated a formal review (66 FR 28141). On August 30, 2002 (67 FR 55767), NMFS announced its decision to not designate critical habitat for this population. NMFS decided not to designate critical habitat because: (1) the decline and reason for listing the species was over exploitation by commercial whaling, and habitat issues were not a factor in the decline; (2) there was no indication that habitat degradation is having any negative impact on the increasing population; (3) the population is abundant and increasing; and (4) existing laws and practices adequately protect the species and its habitat (67 FR at 55767).

1.1.4 Alaska Native Tradition of Subsistence Hunt of Bowhead Whales

Iñupiat and Siberian Yupik Alaska Natives have hunted bowhead whales for over 2,000 years (Stoker and Krupnik, 1993). Hunting bowhead whales in Alaska remains a communal activity that supplies highly valued meat and *maktak*[3] for the entire community, as well as for sharing with persons in locations other than the local community with whom local residents share familial, social, cultural, or economic ties (see Kofinas G. *et al*., 2016 for a discussion of sharing networks). Formalized patterns of hunting, sharing, and consumption characterize the modern bowhead harvest. In addition, whaling captains are highly respected for their traditional knowledge of ice, weather, and whale behavior, which is necessary to hunt successfully, for their generosity in supporting their whaling crews, communities, and others in need; and for their stewardship of traditions of sharing and distributing meat and *maktak*. Of all subsistence activities in these communities, the bowhead whale hunt represents one of the greatest concentrations of community-wide effort and time. It is highly productive, accounting for a substantial percentage of the food consumed in the AEWC communities, and is shared with relatives in other Alaskan communities, as well as with other Native subsistence communities throughout northern Alaska. As the principal activity through which traditional skills for survival in the Arctic are passed to younger generations, the bowhead hunt provides ongoing reinforcement of the traditional social structure. Thus, the bowhead subsistence hunt is a large part of the cultural tradition of these communities and their modern cultural identity (Worl, 1979; Braund *et al*., 1997; Kofinas G. *et al*., 2016).

Subsistence whaling has been regulated by a catch limit under the authority of the IWC since 1977. Alaska Native subsistence hunters from northern Alaskan communities (see **Figure 1.1.2-1**) take less than 1 percent of the stock of bowhead whales per year (Philo *et al*., 1993). After 1977, the number of whales landed ranged between 8 and 55 per year and the number of whales struck and lost ranged from 5 to 28 per year (AEWC and NSB, 2010). The efficiency of the hunt has increased since 1977, due to a number of factors discussed further in **Section 3.5**. The lower landed numbers are from the early years of the bowhead subsistence quota at the IWC.

1.2 Legal Framework

[3] *Maktak* is whale skin and a layer of blubber that is used for food.

The following section describes the legal framework that will guide agency decisions related to this project, including federal trust responsibility, governance of aboriginal subsistence whaling catch limits under the ICRW and WCA, species protection and conservation under the MMPA and ESA, and environmental review under NEPA.

1.2.1 Federal Trust Responsibility

NMFS, as an agent of the federal government, has a trust responsibility to Indian tribes. The concept of "trust responsibility" is derived from the special relationship between the federal government and Indians. Based upon provisions of the U.S. Constitution authorizing Congress to regulate commerce "among the several states, and with the Indian Tribes" (U.S. Constitution, Article I, Section 8, clause 3), the trust responsibility was first delineated by Supreme Court Chief Justice John Marshall in *Cherokee Nation v. Georgia,* 30 U.S. 1 (5 Pet.) (1831). Later, in *Seminole Nation v. United States*, 316 U.S. 286 (1942), the Court noted that the United States has charged itself with moral obligations of the highest responsibility and trust toward Indian tribes. The scope of the federal trust relationship is broad and incumbent upon all federal agencies. The U.S. government has an obligation to protect tribal land, assets, and resources as well as a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes. This unique relationship and its foundation in the Constitution provide the basis for legislation, treaties, and Executive Orders (EO) that grant unique rights or privileges to Native Americans (*Morton v. Mancari*, 417 U.S. 535, 551-53 (1974)).

In furtherance of this trust responsibility and to demonstrate respect for sovereign tribal governments, the principles described above were incorporated into Secretarial Order No. 3206, dated June 5, 1997, and signed by the Secretaries of Commerce and Interior. This Order, entitled "American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act," directs both departments to carry out their responsibilities under the ESA in a manner that brings into accord the federal trust responsibility to tribes, tribal sovereignty, and statutory missions of the departments to avoid or minimize the potential for conflict and confrontation. However, this Secretarial Order did not extend to Alaska Natives; and hence, on January 19, 2001, the Secretary of Commerce and the Secretary of the Interior signed Secretarial Order No. 3225, entitled "Endangered Species Act and Subsistence Uses in Alaska" (Supplement to Secretarial Order 3206), to extend to Alaska Natives the principles articulated in Order No. 3206.

On May 14, 1994, EO 13084 was issued, requiring each federal agency to establish meaningful consultation and collaboration with Indian tribal governments (including Alaska Natives) in formulating policies that significantly or uniquely affect their communities. Entitled "Consultation and Coordination with Indian Tribal Governments," the order requires agency policymaking to be guided by principles of respect for tribal treaty rights and responsibilities that arise from the unique legal relationship between the federal government and the Indian tribal governments. Furthermore, on issues relating to treaty rights, EO 13084 directs each agency to explore and, where appropriate, use consensual mechanisms for developing regulations.

On November 6, 2000, EO 13175 replaced EO 13084. The order carries the same title and undertakings as the previous order about the government-to-government relationship between the U.S. government and Indian tribes. EO 13175 requires that all executive departments and agencies consult with Indian tribes and respect tribal sovereignty in developing policy on issues that affect Indian communities.

1.2.2 International Convention for the Regulation of Whaling

The ICRW is an international treaty signed on December 2, 1946, to "provide for the proper conservation of whale stocks and thus make possible the orderly development of the whaling industry" (ICRW, December 2, 1946, 161 United Nations Treaty Series 72). The United States was an original signatory to the ICRW in 1946, and the treaty was ratified by the U.S. Senate and entered into force for the United States in 1948 (62 Stat. 1716). A main focus of the ICRW was the establishment of the IWC. The IWC is an international organization, administered by a Secretary and staff. IWC membership consists of one commissioner from each Contracting Government (i.e., government of a nation that signed the ICRW). Under Article V.1 of the ICRW, the IWC's charge is to adopt regulations with respect to the conservation and utilization of whale resources by periodically amending the provisions of the Schedule, a document that Article I.1 makes an integral part of the ICRW. IWC regulations adopted in the Schedule may establish protected and unprotected species; open and close seasons and waters; implement size limits, time, method, and intensity of whaling; and specify gear, methods of measurement, catch returns, and other statistical and biological records, and methods of inspection for whale stocks (Article V.1). The IWC seeks to reach its decisions by consensus. Voting procedures apply when consensus is not possible.

According to Article III.2 of the ICRW and IWC the Rules of Procedure, to amend the Schedule and adopt whaling regulations requires a three-fourths majority of all who voted yes or no (each Contracting Government has one vote). Article V.2 of the ICRW specifies that amendments to the Schedule shall meet the following criteria:

a) Be necessary to carry out the objectives and purposes of the ICRW and provide for the conservation, development, and optimum utilization of whale resources;
b) Be based on scientific findings;

c) Not involve restrictions on the number or nationality of factory ships or land stations, nor allocate specific quotas to any factory ship(s) or land station(s); and
d) Take into consideration the interests of the consumers of whale products and the whaling industry.

The IWC established a Scientific Committee— consisting of approximately 200 of the world's leading whale biologists— to provide advice on the status of whale stocks, in part, to inform the development of IWC whaling regulations. The Scientific Committee considers particular subject matter based on the scientific needs of the IWC. These needs are broadly expressed in the ICRW text, which directs the IWC to "encourage, recommend, or, if necessary, organize studies and investigations relating to whales and whaling; collect and analyze statistical information concerning the current condition and trend of the whale stocks and the effects of whaling activities thereon; and study, appraise, and disseminate information concerning methods of maintaining and increasing the populations of whale stocks" (Article IV.1).

The IWC recognizes a distinction between whaling for commercial purposes and whaling by aborigines for subsistence purposes. The ICRW and its predecessor treaties were negotiated to regulate commercial whaling and protect whale stocks endangered by commercial activity. In this context, provisions to allow aboriginal subsistence whaling to continue when commercial whaling was prohibited on specific whale stocks were included in the predecessor treaties and the original 1946 IWC Schedule (note that ‘aborigines’ and ‘aboriginal’ refers to indigenous groups for purposes of this EIS). In the case of bowhead whales, these provisions did not impose catch limits on aboriginal subsistence whaling. It was not until the mid-1970s, when the IWC became concerned about the status of the Western Arctic stock because of a lack of western scientific data (a concern later research showed to be unfounded), that the IWC sought to restrict aboriginal subsistence hunting on bowheads, first by briefly eliminating from the Schedule the provision that allowed subsistence hunting of bowheads in 1977, and then by adopting numeric limits on strikes and landings for 1978 and beyond. Then, in the context of preparing to adopt a global moratorium on commercial whaling, the IWC consolidated several different Schedule provisions applicable to aboriginal subsistence whaling on different stocks into a comprehensive aboriginal subsistence scheme that was placed in paragraph 13 of the Schedule.

Today, the IWC governs aboriginal whaling internationally by specifically identifying stocks subject to aboriginal subsistence whaling, establishing principles governing such whaling, and, since 1982, by requiring that overall catch limits be set for such whaling on such stocks. To initiate the process, Contracting Governments acting on behalf of aborigines in their respective nations make a proposal to the IWC based on cultural and nutritional needs[4]. At the 1994 meeting, the IWC adopted Resolution 1994-4 to reaffirm the following three broad objectives as general guidelines for evaluating such proposals from Contracting Governments:

(1) To ensure that the risks of extinction to individual stocks are not seriously increased by subsistence whaling;

(2) To enable aboriginal people to harvest whales in perpetuity at levels appropriate to their cultural and nutritional requirements, subject to the other objectives; and

(3) To maintain the status of whale stocks at or above the level giving the highest net recruitment and to ensure that stocks below that level are moved towards it, so far as the environment permits.

If the IWC agrees with the Contracting Government submission on need, then the IWC amends the Schedule to expressly permit aboriginal subsistence whaling on the requested stock. Since 1977, the IWC has set catch limits for aboriginal subsistence whaling, subject to annual review by the Commission, based on advice of the Scientific Committee. These catch limits are contained in paragraph 13 of the Schedule, and include numeric and non-numeric limits. Non-numeric catch limits include a prohibition on the striking, taking or killing of calves or any whale accompanied by a calf. Numeric catch limits for Western Arctic bowhead whales have been expressed in two components: (1) a limit on the number of whales landed; and (2) a slightly higher limit on the number of whales that may be struck. The term "strike quota" is often used to refer to this limitation on the number of whales that may be struck. This approach takes into account the fact that not all whales struck are landed, due in large part to the conditions under which the harvests occur, and ensures an upper limit on total whale mortality for conservation management. The Whaling Convention Act (WCA) defines aboriginal subsistence whaling as whaling authorized by paragraph 13 of the Schedule annexed to and constituting a part of the ICRW (50 CFR 230.2). Aboriginal subsistence whaling is not otherwise defined in the Schedule; however, the IWC adopted the following definition of aboriginal "subsistence use" by consensus at its 2004 meeting (2004 IWC Chair's Report at 15):

(1) The personal consumption of whale products for food, fuel, shelter, clothing, tools, or transportation by participants in the whale harvest.

[4] At IWC66 in 2016, the Commission stated, "Contracting Governments concerned will continue to submit information in support of proposed catch and strike limits for [Aboriginal Subsistence Whaling] to satisfy aboriginal subsistence needs (2016 IWC Chair's Report at 17).

(2) The barter, trade, or sharing of whale products in their harvested form with relatives of the participants in the harvest, with others in the local community or with persons in locations other than the local community with whom local residents share familial, social, cultural, or economic ties. A generalized currency is involved in this barter and trade, but the predominant portion of the products from such whales are ordinarily directly consumed or utilized in their harvested form within the local community.

(3) The making and selling of handicraft articles from whale products, when the whale is harvested for the purposes defined in (1) and (2) above.

General principles governing aboriginal subsistence whaling are contained in paragraph 13(a) of the Schedule, including a formula for calculating catch limits, and catch limits for specific years are contained in paragraph 13(b) of the Schedule. Paragraph 13(a) provides, in part, that “catch limits for aboriginal subsistence whaling to satisfy aboriginal subsistence need ... shall be established” according to certain management principles. Paragraph 13(a) of the current Schedule applicable to Western Arctic bowhead whales states that ,“…aboriginal subsistence catches shall be permitted so long as they are set at levels which will allow whale stocks to move to the MSY [Maximum Sustainable Yield] level,” and include a prohibition on the "strik[ing], tak[ing] or kill[ing] calves or any whale accompanied by a calf,” as well as a requirement that "all aboriginal whaling shall be conducted under national legislation that accords with [paragraph 13 of the Schedule]" (IWC 2012:13(a) (2),(4)&(5)). Accordingly, NOAA is generally required by the ICRW to establish aboriginal subsistence whaling catch limits for Western Arctic bowhead whales under the WCA.

Paragraph 13(b) of the current Schedule further provides that subsistence whaling of Western Arctic bowhead whales is permitted, subject to two limitations. One of those limitations is that “the meat and products of such whales are to be used exclusively for local consumption…” The second set is set forth in an independent sub-paragraph that establishes a set of numeric catch limits for a period of years, i.e., 2013 through 2018 (IWC 2012:13(b)(1)). The Schedule contains no numeric catch limits after 2018, and paragraph 13(b) (1) (i) will expire by its own terms at that time[5].

In addition, paragraph 13(b)(1)(i) includes a “carryover” or “carry forward” provision. “Carryover” has been used by the IWC for many years to allow for the inter-annual catch

[5] In 2002, the IWC did not update the numeric catch limits for bowhead whales in paragraph 13(b)(1)(i) at its Shimonoseki meeting. The IWC Secretary subsequently removed from the Schedule the outdated language which had expired by its own terms. See 2002 Annual Report of the IWC at 115. In contrast, outdated language continues to remain elsewhere in the Schedule. In either case, paragraph 13(a), including the requirement to set numeric catch limits, as well as the other provisions of paragraph 13(b), continues to apply whether or not new numeric catch limits are set for 2019 and beyond.

variation that is a feature of this harvest, within limits that conserve the Western Arctic bowhead stock. The principle of carryover is to allow an unused portion of a strike quota from any year to be carried forward and added to the strike quotas of any subsequent years. In its current iteration, this carryover is subject to two limitations. First, no more than 15 unused strikes may be carried forward from the 2008-2012 quota block, and second, no more than 15 unused strikes from prior years may be added to the strike quota for any one year. As currently applied, this carryover provision does not reflect the 50 percent carryover principle endorsed and used by the IWC Scientific Committee to develop the SLA for Western Arctic bowhead whales.

As described more fully in Section 3.2.1, below, in 2002, the IWC adopted an SLA for Western Arctic bowhead whales to calculate appropriate levels for the strike limit (IWC, 2003a, b) that would achieve IWC management goals, including stock conservation, in a very wide range of scenarios. In 2017, the IWC's Scientific Committee reiterated its previous agreement that SLAs are robust with respect to a 50 percent inter-annual variability within blocks and to the same 50 percent allowance between the last year of one block and the first year of the next (2017 IWC Scientific Committee Report).

Native peoples engaging in subsistence hunts do so under authorization from their governments. In the case of Alaska Native and Russian Native subsistence hunts, the United States and the Russian Federation make a joint request to the IWC for bowhead whale catch limits, based, in part, on the needs of their respective Native communities (see **Appendix 8.1** for the 2012 statement of Alaska Native subsistence and cultural needs). The WCA provides the mechanism for the U.S. to implement applicable Schedule requirements, including any numeric catch limits.

1.2.3 Whaling Convention Act

The WCA[6] was enacted to implement the domestic obligations of the U.S. government under the ICRW and its Schedule, and so NMFS's issuance of any catch limits in 2019 and beyond must implement those obligations. Schedule provisions to which the United States has not objected shall become effective with respect to all persons and vessels subject to the jurisdiction of the United States in accordance with the terms of the Schedule provisions and Article V of the ICRW (WCA § 916k). Further, Section 916c of the WCA makes it unlawful for any person to fail to do any act required by the ICRW, including the IWC Schedule, and Section 916j directs the Secretary of Commerce to implement the ICRW and the Schedule. Under Section 916b of the WCA, the Secretary of State (with concurrence by the Secretary of Commerce) is vested with the power of presenting or withdrawing objections to regulations of the IWC on behalf of the United States as a Contracting Government.

[6] The WCA is found at 16 U.S.C. §§ 916 *et seq*. For ease of reference, the U.S. Code cites to the sections of the WCA are used, and are shown as "WCA § 916 . . .".

The Secretary of Commerce holds general powers, which have been delegated to NMFS, to administer and enforce whaling[7] in the United States, including issuance of necessary regulations to carry out that authority (WCA §§ 916d, 916j, 916k). The regulations (at 50 CFR 230) prohibit whaling, except for aboriginal subsistence whaling authorized by paragraph 13 of the Schedule (50 CFR 230.2, 230.4). NMFS publishes aboriginal subsistence whaling catch limits set in accordance with paragraph 13 of the Schedule in the *Federal Register*, together with any relevant restrictions, and incorporates them into cooperative agreements with the appropriate Native American whaling organization, (entities recognized by this agency as representing and governing the relevant Native American whalers for the purposes of cooperative management of aboriginal subsistence whaling) (50 CFR 230.6(a)). Any catch limits issued are allocated to each whaling village or whaling captain by the appropriate Native American whaling organization.

The WCA regulations track the Schedule provisions that prohibit whaling of any calf or whale accompanied by a calf (50 CFR 230.4(c)); they also prohibit any person from selling or offering for sale whale products from whales taken in aboriginal subsistence hunts, except that "authentic articles of Native handicrafts" may be sold or offered for sale (50 CFR 230.4(f)) (defined under the MMPA as items composed wholly or in some significant respect of natural materials).

The WCA and its implementing regulations require licensing and reporting of aboriginal whale harvests (WCA § 916d; 50 CFR 230.5, 230.8). No one may engage in aboriginal subsistence whaling unless the person is a whaling captain or a crew member under the whaling captain's control (50 CFR 230.4(a)). The license may be suspended if the whaling captain fails to comply with WCA regulations (50 CFR 230.5(b)). No person may receive money for participation in aboriginal subsistence whaling (50 CFR 230.4(e)). The whaling captain and Native American whaling organization are also responsible for reporting to NMFS, among other things, the number, dates, and locations of strikes, attempted strikes, or landings of whales, including certain data from landed whales (50 CFR 230.8). For Alaska Native bowhead subsistence whaling, these provisions are also laid out in the Cooperative Agreement between NOAA and the AEWC for cooperative management of the bowhead whale subsistence hunt, entered into under section 112 of the MMPA (Appendix 8.2).

1.2.4 NOAA-AEWC Cooperative Agreement

The AEWC was formed in 1977 to represent the bowhead subsistence hunting communities of Alaska in an effort to convince the U.S. government to take action to preserve the Alaska

[7] Under Section 102(f) of the MMPA, 16 U.S.C. § 1371(f), commercial whaling is expressly banned in waters subject to the jurisdiction of the United States. (MMPA § 101(6)(2).) Regulations also require that whaling not be conducted in a wasteful manner (50 CFR 230.4(k), MMPA § 101(b)(3)).

Natives' subsistence hunt of bowhead whales. Alaskan whaling villages are among the most remote communities in the world. Not connected by a road system, they are reliant on the subsistence hunt of the bowhead whale for their survival. During the initial years of controversy over the health of the Western Arctic bowhead whale stock, the AEWC adopted its first Management Plan (November 1977), asserting the management and enforcement authority of the AEWC, requiring registration of whaling captains, specifying the traditional methods of whaling to be permitted, and requiring reporting of harvests and strikes by whaling captains (Langdon, 1984:45). With the signing of a Cooperative Agreement in 1981 under section 112 of the MMPA, the foundations for cooperation between NOAA and the AEWC were established, and this framework has endured to the present. The AEWC also agreed to cooperate with the United States in scientific research efforts and to develop a plan to be followed by all bowhead whale subsistence hunters to help improve the efficiency an animal welfare of the subsistence hunt.

The mission of the AEWC is "To safeguard the bowhead whale and its habitat, to defend the Aboriginal Subsistence Whaling Rights of our members, and to preserve the cultural and traditional values of our communities."

The AEWC's local management of the bowhead whale subsistence harvest ensures that the hunting is conducted in a traditional, non-wasteful manner. The AEWC promotes scientific research on bowhead whales to ensure their continued existence without unnecessary disruption to the whaling communities.

NOAA and the AEWC have agreed to work together through the Cooperative Agreement, but they bring different sources of authority to the cooperative effort. While federal authority for management of the bowhead whale subsistence hunt is governed by the WCA, the underlying authority of the AEWC is based on the formal cultural traditions of leadership by whaling captains. In addition, the tribal governments of the participating villages, including the Iñupiat Community of the Arctic Slope, have delegated to AEWC the tribal authority to manage the subsistence whaling of tribal members (Langdon, 1984:51). The members of the AEWC are the registered bowhead subsistence whaling captains and their crewmembers from the northern Alaskan communities. There are two classes of members: voting members and non-voting members from communities identified above in Section 1.1.2. Voting members are the registered bowhead subsistence whaling captains in each community. The crewmembers are non-voting members. The AEWC is directed by a board of elected Commissioners, one from each of the participating communities. This Board has authority over all of the Commission's affairs (AEWC By-Laws, 1981 and as amended and restated December 9, 2009).

The purposes of the NOAA-AEWC Cooperative Agreement are to:

- Protect the Western Arctic population of bowhead whales and the Eskimo culture;
- Promote scientific investigation of the bowhead whale; and
- Effectuate the other purposes of the WCA, the MMPA, and the ESA, as these acts relate to the aboriginal subsistence hunts for whales.

To achieve these purposes, the agreement provides for cooperation between members of the AEWC and NOAA in management of the subsistence bowhead whale hunt, and on any action undertaken or any action proposed to be undertaken by any agency or department of the Federal Government that may affect the bowhead whale and/or subsistence whaling. The agreement provides for an exclusive enforcement mechanism applied to any violation of the MMPA, the ESA, the WCA, the ICRW and its Schedule, the AEWC Management Plan, or the Cooperative Agreement itself by the registered member whaling captains or their crews. Thus, for actions of AEWC members as they relate to aboriginal subsistence bowhead hunts, the AEWC is the first line of enforcement (**Appendix 8.2** and **Section 3.6**). To support the scientific and administrative functions of the AEWC, NOAA has provided funds through annual grants, reaching as much as $400,000 per year in the early part of this decade (NOAA, 2007). The budget has been higher in recent years ($600,000 for 2013) (Lefevre, 2012).

Although the AEWC, the IWC, and NOAA initially had significantly different perspectives on the status of the bowhead population, the role of cooperative management in this case is highly distinctive in the degree to which the AEWC and the North Slope Borough (NSB) committed to a major peer-reviewed program of scientific research to improve understanding of the bowhead population status and dynamics in order to persuade the IWC to increase the subsistence catch limits (Langdon, 1984; Freeman, 1989). As improved census methods brought larger population estimates throughout the 1980s, the IWC raised the subsistence catch limits. This research vindicated the whaling captains' traditional knowledge perspective that the bowhead population was much larger than the alarmingly low science-based research estimates of the late 1970s.

1.2.5 Marine Mammal Protection Act and Endangered Species Act

The Marine Mammal Protection Act (MMPA) was enacted to protect and conserve marine mammals and their habitats. Section 2 of the MMPA contains the general purposes and policies of the act through congressional findings (16 U.S.C. 1361). Concerned that certain marine mammal species and population stocks were in danger of extinction or depletion, Congress established protections to encourage development of those stocks to the greatest extent feasible, commensurate with sound policies of resource management. Therefore, Congress specified that the primary objective of marine resource management under the MMPA is to maintain the health and stability of the marine ecosystem. Section 2 indicates that stocks should not be permitted to diminish beyond the point at which they cease to be a significant functioning element of the ecosystem, and they should not be permitted to diminish below their optimum sustainable population (OSP). To achieve Section 2 general purposes and policies, Congress established a moratorium on the taking and importing of marine mammals in Section 101(a) (16 U.S.C. 1371(a)). Under the MMPA, 'take' means to "harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal" (16 U.S.C. 1362(13)). Except for certain military readiness or scientific activities, the term 'harassment' means "any act of pursuit, torment, or annoyance which, (1) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A Harassment]; or (2) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B Harassment]" (16 U.S.C. 1362(18)(A)).

This moratorium is not absolute. In particular, the MMPA exempts the take of marine mammals by Alaska Natives for subsistence purposes from the moratorium, provided that such activities are not accomplished in a wasteful manner (16 U.S.C. 1371(b)). Further, Congress prohibited the issuance of permits to allow limited takes of marine mammals in other activities if doing so would result in an “unmitigable adverse impact” to the availability of marine mammals for Alaska Native subsistence hunting. (16 U.S.C. 1371(a) (5)). Inedible by-products such as baleen, bone, and ivory may be fabricated into Native handicrafts for sale under the same section of the MMPA. In addition, Section 113 of the MMPA specifically states that the provisions of the MMPA are in addition to, and not in contravention of, existing international treaties, conventions, or agreements (e.g., the ICRW) (16 U.S.C. 1383(a)).

The Endangered Species Act (ESA) is the principal federal law that guides the conservation of endangered or threatened species. Similar to the MMPA, the ESA expressly provides for Alaska Native subsistence activities (16 U.S.C. 1539(e)). Under section 7 of the ESA, NMFS consults with itself and with the U.S. Fish and Wildlife Service (USFWS) on the effects of its proposed actions on endangered and threatened species.

1.2.6 Marine Protection, Research, and Sanctuaries Act

Under the Marine Protection, Research and Sanctuaries Act (MPRSA), the Environmental Protection Agency (EPA) has issued a general permit to authorize the transport and disposal of marine mammal carcasses, including bowhead whale carcasses, in ocean waters under certain conditions. The MPRSA general permit does not require that marine mammal carcasses be disposed of in ocean water but authorizes ocean disposal when there is a need. The general permit was published in the Federal Register on December 6, 2016 (81 FR 87928). Subsistence use of Western Arctic bowhead whales generally does not include disposal of their carcasses in ocean waters.

1.2.7 National Environmental Policy Act

The National Environmental Policy Act (NEPA) was enacted to create and carry out a national policy designed to encourage harmony between humankind and the environment. While NEPA neither compels particular results nor imposes substantive environmental duties upon federal agencies (*Robertson v. Methow Valley Citizens Council*, 490 U.S. 332 (1989)), it does require that federal agencies follow certain procedures when making decisions about any proposed federal actions that may affect the environment. These procedures ensure that an agency has the best possible information with which to make an informed decision with regard to environmental effects of any proposed action. They also ensure that the public is fully apprised of any associated environmental risks. Regulations promulgated by the Council on Environmental Quality (CEQ) (40 CFR 1500-1508) contain specific guidance for complying with NEPA.

Under the CEQ regulations, federal agencies must prepare an environmental assessment (EA) to determine whether a proposed action is likely to have a significant impact or effect on the quality of the human environment, or an EIS, which involves a longer public process. Proposed alternatives are analyzed both in terms of context and intensity of the action. If information in an EA indicates that the environmental effects are not significant, the agency issues a finding of no significant impact (FONSI) to conclude the NEPA review. This was the case in 2003 when NMFS published a final EA and FONSI in support of the 2003 through 2007 bowhead whale catch limit allocations to AEWC (NMFS, 2003).

For the 2008 through 2018 catch limit blocks, NMFS decided to prepare EISs rather than EAs (NMFS 2008 a, b, 2013). These decisions were not based on any new determination that significant effects occur as a result of the bowhead subsistence hunt, but rather to take advantage of the EIS's longer process and to provide greater transparency and opportunity for public review of its administration of the bowhead subsistence whaling program. The 2008 and 2013 EISs provided a more detailed statement of the environmental impacts of the action, possible alternatives, and measures to mitigate adverse effects of the proposed actions. The EISs achieved NEPA's policy goals by ensuring that agencies were able to take a hard look at environmental consequences and by guaranteeing broad public dissemination of relevant information. Although the MMPA and NEPA requirements overlap in some respects, the scope of NEPA goes beyond that of the MMPA by considering the impacts of the proposed federal action on non-marine mammal resources such as human health and cultural resources.

For catch limits from 2019 onward, NMFS has again decided to prepare an EIS with a long timeframe for analysis. The last two decades have shown that the bowhead population continues to grow at a robust rate and that subsistence harvests do not adversely affect the bowhead population. NMFS proposes that the current EIS should provide an estimate of environmental effects for a 25- or 30-year period, recognizing that periodically NMFS would prepare an EA to examine whether any changes in the bowhead population, the subsistence harvest practices, or in cumulative effects would constitute significant effects requiring an EIS. As indicated in its scoping comments, the EPA would support NMFS utilizing an EA process in the future, as long as monitoring results continue to indicate that the subsistence bowhead whale harvest and other cumulative effects result in less than significant impacts to the marine environment.

An EIS culminates in a Record of Decision (ROD). The ROD will document the alternative selected for implementation as well as any conditions this agency imposes, and it will summarize the impacts expected to result from the action.

1.3 Public Involvement and Scoping Process

NEPA is often referred to as a "procedural statute." The law requires opportunities for public review and submission of comments. In preparing an EIS, the public process begins with scoping, which is the agency's first step in planning its analysis. The lead agency will typically consult with expert staff in determining the proper way to describe the proposed action, its alternative actions, and the environmental issues it feels are important to analyze in the document. The agency will also alert the public and affected stakeholders to its decision to prepare an EIS and solicit input into the scope of the document. With this information, the agency will prepare a draft EIS and make that document available for a minimum 45-day public review. Public meetings during the review period may be scheduled, depending on the level of interest in the proposed action by the public. Once the public review period on the draft EIS is completed, the agency will review comments received and respond to those comments and make revisions to the draft EIS to answer questions, provide increased clarity, and if need be, conduct additional analysis where previous analysis was found lacking. Once completed, the agency publishes a final EIS document and, after a minimum 30-day review period, issues its ROD. The scoping process for this EIS involved a number of activities that included both internal and public scoping. These activities are described in the following paragraphs.

1.3.1 Internal Scoping

During the internal scoping phase, NMFS identified a preliminary list of resources to address in the EIS, along with four preliminary alternatives, including the no-action alternative, to serve as starting points for discussion. These alternatives and issues were previously analyzed in the

2008 Final EIS for Issuing Annual Quotas to the Alaska Eskimo Whaling Commission for a Subsistence Hunt on Bowhead Whales for the Years 2008 through 2012 (NMFS, 2008a and 2008b), and the 2013 Final EIS for Issuing Annual Quotas to the Alaska Eskimo Whaling Commission for a Subsistence Hunt on Bowhead Whales for the Years 2013 through 2018 (NMFS 2013). This effort was conducted to help the public provide more meaningful comment on resource issues and alternatives to the proposed action during the public scoping period with the intention of reevaluating resources and alternatives, if needed, following receipt and review of public comment.

1.3.2 Public Scoping

On August 15, 2017, NMFS issued a Notice of Intent to prepare an EIS for issuing a bowhead whale subsistence catch limits to the AEWC from 2019 onward (82 FR 38671). NMFS requested comments on the proposed issuance of annual catch limits from 2019 onward, requested information on the affected environment, and requested comments on the issues to be analyzed in the document. Two local Alaska newspapers reported on NMFS's notice. Comments from the public were accepted through September 14, 2017.

During the scoping period, a total of eight scoping comment submissions were received: two from the general public; one from the AEWC; one from the Mayor of the North Slope Borough; one from the State of Alaska; one from the non-governmental organizations, the Animal Welfare Institute (AWI) and Whale and Dolphin Conservation (WDC); and two from federal agencies, i.e., the EPA and the Marine Mammal Commission (MMC).

NMFS' allocation of a bowhead whale subsistence harvest quota has been a recurring action for four decades. As a result, many stakeholders are familiar with the action, and this may explain why a limited number of public comments were received. The issues raised in the scoping comments are incorporated and addressed in the preparation of this DEIS. The following paragraphs summarize these comments, drawing attention to those that augmented the issues already identified for analysis by NMFS.

The scoping comments from a member of the general public questioned the need to hunt bowhead whales for food, and indicated in part that there should be better information on the population size of bowhead whales. **Section 3.2** describes the current abundance, trends, genetics, and status of Western Arctic bowhead whales. **Section 3.5** describes the Alaska Native subsistence uses of bowhead whales and the history of the IWC acceptance of determinations of the subsistence and cultural need for bowhead whales (see also **Appendix 8.1**). The commenter also identified a number of environmental factors and human activities that NMFS should assess in the EIS. **Sections 3.2 and 4.4 – 4.8** describe the affected environment and the environmental consequences of NMFS's proposed action within that context.

The scoping comments from AWI and WDC included NEPA procedural concerns and a variety of topics for analysis in the EIS, with emphasis on the importance of an up-to-date, accurate, credible, and objective analysis. AWI and WDC requested up-to-date scientific evidence about the ecology and biology of the bowhead whale. AWI and WDC requested that Alaska Native subsistence need for bowhead whales be evaluated in the context of the EIS. AWI and WDC also requested a disclosure of the level of federal funding allocated to the AEWC and the whaling villages for, at a minimum, the past twenty years, and how these funds were used. AWI and WDC requested that any and all known or potential threats to the bowhead whale, its habitat including its prey, and its migration pattern be disclosed and evaluated. Finally, with regard to harvest methods and techniques, AWI and WDC suggested a discussion of the likely fate of struck whales not landed, and data that shows struck/loss rate over time, as well as analysis of the reasons that caused struck whales to be lost; and a description of both the fall and spring bowhead hunts for each community, including analysis of hunting methods and hunting efficacy as measured in time to death data, and descriptions of use and sharing practices.

The DEIS addresses the required NEPA procedures throughout the development of the document, and a comprehensive and objective cumulative effects analysis is found in **Sections 4.6, 4.7** and **4.8**. The questions regarding funding for the AEWC are beyond the scope of this DEIS. The population biology and ecology of bowhead whales are addressed in Sections 3 and 4. For struck and lost rates over time, see **Figure 3.2.4-1**. The fate of struck and lost whales is reported by whaling captains and AEWC has made significant efforts to improve harvest efficiency in order to reduce the number of struck and lost whales. Efforts to improve harvest technology and to reduce average time-to-death are described in **Section 2.5.1**.

The scoping comments from the AEWC indicated that the Western Arctic bowhead population is increasing, as is the subsistence need for bowhead whales. Among other things, the AEWC stated that the bowhead harvest provides essential nutritional, cultural, and social benefits to its villages and to the many communities throughout northern Alaska with whom it shares the bowhead whale resource. In particular, the AEWC indicated that, as has been the case throughout history:

(1) The social complex of its communities rests on the organized activities that make up the bowhead whale harvest and the sharing of the whale;

(2) The quantity and nutritional value of the bowhead harvest for its communities and for those with whom it shares is not available by any other means; and

(3) The social cohesion crucial to its survival as an Arctic People would be lost without the opportunity for this harvest and the sharing that accompanies it.

The AEWC also indicated that as environmental conditions in the Arctic continue to change, the bowhead whale and the AEWC's bowhead harvest sharing networks are becoming increasingly important to its communities and to its sharing partners. Accordingly, the AEWC requested that NMFS analyze an additional alternative that allows for an increase in the harvest level to 100 strikes per year from the current 67 strikes.

NMFS has included an additional alternative that will assess the impacts of a higher level of harvest, given: (1) the timeframe for NMFS's proposed action, i.e., from 2019 onward, where it is likely that the AEWC's subsistence need for bowhead whales will increase over this timeframe; and (2) the increasing size of the Western Arctic bowhead whale population. As with the other alternatives, NMFS's issuance of any future catch limits will be subject to IWC requirements, which will in turn, be based on IWC Scientific Committee advice on the sustainability of those catch limits. **Section 3.2** describes the current abundance, trends, genetics and status of Western Arctic bowhead whales. **Sections 3.5 and 4.8** describe the importance of the bowhead whale hunt and Alaska Native subsistence uses of bowhead whales, including sharing of bowhead whale products with others in the local community or with persons in locations other than the local community with whom local residents share familial, social, cultural, or economic ties. Finally, changes in the environment and changing activities in the Arctic are addressed in **Sections 3.2 and 4.6**.

The scoping comments from the North Slope Borough (NSB) focused on the subsistence need for Western Arctic bowhead whales by Alaska Native communities, the increasing abundance of bowhead whales, and the successful management of bowheads. The NSB also reported that Alaska Native hunters continue to have challenges accessing whales, in part, due to a changing environment. Finally, the NSB agreed with the AEWC that there should be an alternative that allows for an increased quota.

The scoping comments from the State of Alaska expressed support for the continued harvest of bowhead whales as an important and sustainable harvest that provides substantial nutritional and cultural value to many Alaskans. The State of Alaska also requested that an additional alternative should be included in the EIS that allows for a higher level of harvest if a need for the increase can be demonstrated.

The scoping comments from federal agencies focused for the most part on NEPA procedural questions. The EPA letter emphasized the importance of meeting NEPA requirements for the components of the EIS, including a reasonable range of alternatives that meet the purpose and need. EPA also suggested a robust monitoring program with clear goals and objectives, specific responsibilities for conducting these monitoring activities, and wide availability of the results of these monitoring activities. In addition, attention was directed to requirements under the ESA, and under EOs concerning consultation with federally recognized tribes and analysis of environmental justice. EPA policy suggestions concerning cooperating agency status for affected Alaska Native tribes were highlighted. Finally, EPA also suggested recognition of impacts to the traditional trade and bartering activities with bowhead meat, bone, and baleen through the year with residents of non-whaling communities.

The DEIS has been developed in compliance with NEPA procedures and requirements. Monitoring activities regarding the subsistence harvest are described in **Section 3.6.3**, while population assessments are described in **Section 3.2.1**. Traditional trade and bartering are an important part of the cultural context of bowhead subsistence harvest patterns and are addressed in **Section 3.5**, Alaska Native Tradition of Subsistence Hunt of Bowhead Whales.

The MMC recommended an additional alternative if there is any possibility that the U.S. will seek an increase in the current annual strike limit or an increase in the catch limits. The MMC also indicated that, assuming NMFS will use its 2013 FEIS as the starting point for the new EIS, the sections most likely to be in need of updating are those concerning cumulative effects.

As indicated above, NMFS has included an additional alternative that will assess the impacts of increased catch limits, given: (1) the timeframe for NMFS's proposed action, i.e., from 2019 onward, where it is likely that the AEWC's subsistence need for bowhead whales will increase over this timeframe; and (2) the increasing size of the Western Arctic bowhead whale population. **Section 4** evaluates the environmental consequences of NMFS's proposed action, including an analysis of cumulative effects.

1.3.3 Public Review of the Draft EIS

Accompanying this draft document is a letter describing the public review schedule and ways of submitting comments to NMFS during the review period.

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2.0 ALTERNATIVES, INCLUDING THE PROPOSED ACTION

Under the WCA, NMFS is required to issue annual bowhead whale catch limits based on IWC Schedule provisions pertaining to the aboriginal subsistence harvest of Western Arctic bowhead whales.

NMFS's issuance of any future catch limits will be subject to IWC requirements, which will in turn, be based on IWC Scientific Committee advice on the sustainability of any catch limits. In 2003, the IWC adopted the "Bowhead Strike Limit Algorithm" (Bowhead SLA) for setting the quota for Western Arctic bowhead whales (IWC 2003a,b). The Bowhead SLA is further described in **Section 3.2.1**, but it is important to note that the SLA explicitly considered uncertainty in its population simulations and sought to ensure that the Bowhead SLA would provide conservative management advice and meet IWC objectives for the management of stocks subject to aboriginal subsistence takes (cf. IWC, 1999). The subsequent domestic bowhead hunt is managed cooperatively by NMFS and the AEWC (**Appendix 8.2**).

With respect to the use of unused strikes from previous years (carry-forward or carryover), it is important to note that the Bowhead SLA has confirmed that, over the long-term, carryover does not change the overall number of strikes taken, rather it alters the timing of the use of those already-allocated strikes. As a result, the SLA confirmed that a carry forward provision of up to 50 percent of the annual strike limit is sustainable.

The IWC quota for landed bowhead whales is allocated between Alaska Natives and Russian Chukotkan Natives through a bilateral agreement between the United States and Russian Federation governments (**Appendix 8.3**) in order to ensure that the limits in the Schedule are not exceeded. The actual allocation of strikes between these Native groups is determined on an annual basis through the agreement.[8] It is expected that, following the actions of the IWC at its September 2018 meeting in updating the bowhead aboriginal subsistence harvest catch limits, the U.S. and the Russian Federation would sign a new agreement later in 2018 with a similar allocation between the two Native groups.

The IWC will conduct its next meeting in September 2018 in Florianopolis, Brazil, and based on the management advice of the IWC Scientific Committee, is likely to adopt a catch limit for 2019 through 2024 or 2025 at the same or similar levels as the previous quota block. Among

[8] For 2018, the U.S./Russian agreement provides that, of the total allocation of 336 landed bowhead whales over six years, the AEWC can land up to 306. The total annual allocation of 67 strikes, plus a "carryover" or "carry forward" of up to 15 unused strikes, results in a combined strike quota of 82 (67 + 15). Of that total, NMFS granted the AEWC a 2018 strike limit of 75 strikes.

other things, the United States is likely to request a one-time seven-year catch limit[9] for bowhead whales at the 2018 IWC meeting, where the numeric limits would expire at the end of 2025, rather than at the end of 2024. In addition to the annual review provided in the Schedule, the IWC would review and update the numeric limits in 2024, one year before those limits would expire. Also in 2024, the IWC could preserve this “buffer year” by extending the catch limits for an additional six years from 2026 through 2031.

Presumably, the total number of bowhead whales that could be landed over that seven-year period would be increased by 1/6 from 336 to 392, and the total number of bowhead whales that could be landed over any 6-year period would remain unchanged at 336. Since the action Alternatives, below, evaluate the impacts of a take of 336 whales over any six-year period, they account for the possibility of a one-time seven-year renewal.

There are five Alternatives considered, but Alternative 4 is the preferred alternative. Under Alternative 4, NMFS would grant the AEWC the U.S. portion of a maximum annual strike limit of 100 strikes, i.e., 67 annual strikes plus up to 33 unused strikes from previous years which can be carried forward, subject to limits, and added to the annual strike quota of subsequent years. These strike limits would be subject to the U.S. portion of a maximum total of 336 landed whales over any six-year period. This Alternative is preferred because it meets the purpose and need of this action, and it achieves the socio-cultural benefits of the subsistence hunt at minimal environmental cost.

2.1. Alternative 1 (No Action)

Do not grant the AEWC a catch limit.

Under this alternative, NMFS would not grant the AEWC the U.S. portion of a subsistence whaling quota for cultural and nutritional purposes, notwithstanding the IWC Schedule’s requirement to establish catch limits and permit aboriginal subsistence whaling for Western Arctic bowhead whales, subject to certain limitations. Increased catch limits would then become available for a bowhead hunt by Russian Chukotkan Natives, depending on their needs. This alternative would be contrary to the IWC Schedule, and because the WCA requires NMFS to implement requirements of the IWC Schedule, this alternative would also be contrary to the WCA.

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[9] In September of 2015, the IWC held an expert workshop in Maniitsoq, Greenland, regarding several issues pertaining to aboriginal subsistence whaling. The report of that workshop notes the possibility of a one-time seven-year catch limit (IWC, 2015). That concept was also discussed by the IWC’s Aboriginal Subsistence Whaling Working Group, in Utqiaġvik (Barrow), in April of 2018 (IWC, 2018).

2.2. Alternative 2

Grant the AEWC an annual strike limit of 67 bowhead whales, not to exceed a total of 336 landed whales over any 6-year period, with no unused strikes from previous years added to the subsequent annual limit as carry-forward.

Under this alternative, NMFS would grant the AEWC the U.S. portion of an annual strike quota of 67 bowhead whales, not to exceed the U.S. portion of a total of 336 landed whales over any 6-year period. Under this alternative, no unused strikes from a previous year would be added to the strike quota for a subsequent year as carry-forward, notwithstanding the IWC's requirement to "carryover" or "carry forward" unused strikes in the bowhead subsistence catch limits. Because the IWC Schedule requires unused strikes to be carried forward and added to the strike quotas of subsequent years, subject to limits, this alternative would be contrary to the IWC Schedule. As the WCA requires NMFS to implement requirements of the IWC Schedule, this alternative would also be contrary to the WCA.

2.3. Alternative 3

Grant the AEWC an annual strike limit of 67 bowhead whales, not to exceed a total of 336 landed whales over any 6-year period, with unused strikes from previous years carried forward and added to the annual strike limit of subsequent years (subject to limits), provided that no more than 15 additional strikes are added to any one year's allocation of strikes. This alternative would maintain the status quo for any 6-year period with respect to management of the hunt.

Under this alternative, NMFS would grant the AEWC the U.S. portion of an annual strike quota of 67 bowhead whales (plus up to 15 strikes as carry-forward), not to exceed the U.S. portion of a total of 336 landed whales over any 6-year period. This alternative differs from Alternatives 1 and 2 by allowing the AEWC to carry forward unused strikes from previous years, and add up to 15 of those unused strikes per year to the catch limits for any subsequent years, consistent with the current IWC Schedule. A carry-forward allows for variability in hunting conditions from one year to the next within limits that conserve the Western Arctic bowhead stock and is a long-standing feature of this quota structure.

2.4. Alternative 4 (Preferred Alternative)

Grant the AEWC an annual strike limit of 67 bowhead whales, not to exceed a total of 336 landed whales over any 6-year period, with unused strikes from previous years carried forward and added to the annual strike quota of subsequent years (subject to limits),

provided that no more than 50 percent of the annual strike limit is added for any one year. This alternative would maintain the status quo for any 6-year period with respect to management of the hunt for landed whales and employ the Commission's agreed-upon 50 percent carryover principle.

Under this alternative, NMFS would grant the AEWC the U.S. portion of an annual strike quota of 67 bowhead whales (plus carry-forward), not to exceed the U.S. portion of a total of 336 landed whales over any 6-year period. This alternative differs from Alternatives 1 and 2 by allowing the AEWC to carry forward unused strikes from previous years. This alternative differs from Alternative 3 by allowing the AEWC to carry forward unused strikes from previous years, provided that no more than 50 percent of the annual strike limit is added for any one year, consistent with the IWC's 50 percent carryover principle[10]. A carry-forward allows for variability in hunting conditions from one year to the next within limits that conserve the Western Arctic bowhead stock and, as noted, is a long-standing feature of this quota structure.

2.5. Alternative 5

Grant the AEWC an annual strike limit of 100 bowhead whales, not to exceed a total of 504 landed whales over any 6-year period, with unused strikes from previous years carried forward and added to the annual strike quota of subsequent years (subject to limits), provided that no more than 50 percent of the annual strike limit is added for any one year. This alternative would increase the harvest levels by 50 percent and employ the Commission's agreed-upon 50 percent carryover principle.

Under this alternative, NMFS would assess the impacts of a higher level of harvest, given: (1) the timeframe for NMFS's proposed action, i.e., from 2019 onward, where it is likely that the AEWC's subsistence need for bowhead whales will increase over this timeframe; and (2) the increasing size of the Western Arctic bowhead whale population. As with the other alternatives, NMFS's issuance of any future catch limits will be subject to IWC requirements, which will in turn, be based on IWC Scientific Committee advice on the sustainability of those catch limits.

Under this alternative, NMFS would grant the AEWC the U.S. portion of an annual strike quota of 100 bowhead whales (plus carry-forward), not to exceed the U.S. portion of a total of 504 landed whales over any 6-year period. This alternative differs from Alternatives 1 through 4 by

[10] As described in Sections 1.2.2 and 3.2.1, in 2002, the IWC adopted a "Strike Limit Algorithm" (SLA) for Western Arctic bowhead whales to calculate appropriate levels for the strike limit (IWC, 2003a, b) that would achieve IWC management goals, including stock conservation, in a very wide range of scenarios. In 2017, the IWC's Scientific Committee reiterated its previous agreement that SLAs are robust with respect to a 50 percent inter-annual variability within blocks and to the same 50 percent allowance between the last year of one block and the first year of the next (2017 IWC Scientific Committee Report at 23.)

increasing the harvest levels by 50 percent, and differs from Alternatives 1 through 3 by employing the IWC's 50 percent carryover principle[11]. A carry-forward allows for variability in hunting conditions from one year to the next within limits that conserve the Western Arctic bowhead stock and, as noted, is a long-standing feature of this quota structure.

2.6. Alternatives Considered but Not Carried Forward

Alternatives considered but discarded included alternatives that substantially decreased the annual bowhead whale subsistence catch limits for Alaska Natives. A substantially decreased catch limit would not meet the documented need of Alaska Natives for bowhead subsistence foods. One option under Alternative 1 would be to compensate the AEWC for not exercising its aboriginal subsistence rights. While it may be appropriate for the AEWC to receive compensation for economic harm due to a prohibition of a commercial activity, in this case the AEWC is requesting a quota for cultural and nutritional subsistence purposes, something that cannot be compensated financially. Such alternatives were rejected because they do not meet the first objective of the proposed action, which is to meet the documented cultural and nutritional needs for bowhead whales by Alaska Natives. While the No Action Alternative does not meet this first objective, NMFS has included it in accordance with NEPA.

2.7. Environmentally Preferred Alternative

NEPA requires that an agency identify the environmentally preferred alternative when preparing the ROD for an EIS. The CEQ has advised that such an alternative is to be based only on the physical and biological impacts of the proposed action on the resources in question, and not the social or economic impacts of the action. In this DEIS, Alternative 1 (No Action) would not authorize annual subsistence bowhead whaling by Alaska Natives, and no bowhead whales would be taken by them. Therefore, Alternative 1 is identified as the environmentally preferred alternative based on impacts to bowhead whales from a hunt by Alaska Natives. See **Section 4** for a full analysis of predicted impacts of this alternative on the complete human environment.

2.8. Preliminary Preferred Alternative

For the purposes of public review of this DEIS, NMFS has identified Alternative 4 as its preliminary preferred alternative because it meets the purpose and need of this action, it achieves the socio-cultural benefits of the subsistence hunt at minimal environmental cost, and it keeps the harvest level at current, sustainable levels. During the upcoming September 2018 meeting of the IWC, the IWC will act on the management advice of the IWC Scientific Committee and adopt a

[11] See footnote 10, above.

catch limit. NMFS will consider the action of the IWC and make a final determination on the preferred alternative to include in the Final EIS. It is possible that the IWC might not update the catch limit, notwithstanding IWC Scientific Committee management advice that the hunt is sustainable. If so, it should be noted that: (1) NMFS is required to implement IWC Schedule provisions, including provisions regarding catch limits; and so, (2) NMFS is considering issuing annual quotas for the time periods described in the Alternatives under the current Schedule language.

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3.0 AFFECTED ENVIRONMENT

3.1 Geographic Location

The Western Arctic stock of bowhead whales occurs in the Bering, Chukchi, and Beaufort seas. The Bering Sea is in the northernmost region of the Pacific Ocean, bordered on the north and west by the Russian Federation, on the east by mainland Alaska, and on the south by the Aleutian Islands. The Bering Sea is connected to the Arctic Ocean, which includes the Chukchi Sea on the northern side of the Bering Strait and the Beaufort Sea to the east of the Chukchi Sea.

3.2 The Western Arctic Stock of Bowhead Whale

Bowhead whales are distributed in seasonally ice-covered waters of the Arctic and near-Arctic, generally north of 54°N and south of 75°N in the Western Arctic Basin (Moore and Reeves, 1993). The International Whaling Commission (IWC) recognizes four bowhead whale stocks (IWC, 2010a): the Davis Strait and Hudson Bay stock inhabiting western Greenland and eastern Canadian waters); the Okhotsk Sea stock located in Russia's Okhotsk Sea; the Spitsbergen stock near Svalbard in the eastern North Atlantic; and the Western Arctic Stock, sometimes referred to as the Bering-Chukchi-Beaufort Seas (BCBS) stock (**see Figure 3.2-1**), inhabiting waters of the Bering, Chukchi, and Beaufort seas off Alaska, northeastern Russia and northwestern Canada.

The Western Arctic stock is the largest of the four bowhead whale stocks and is the only stock found within U.S. waters (Rugh et al., 2003). Although Jorde et al. (2007) suggested there might be multiple stocks of bowhead whales in U.S. waters, several studies (George et al. 2007, Taylor et al. 2007, Rugh et al. 2009) and the IWC Scientific Committee concluded that data are most consistent with one stock that migrates throughout waters of northern and western Alaska (IWC 2008). Western Arctic bowhead whale stock structure was reevaluated at the IWC Scientific Committee's 2012 Implementation Review of bowhead whales associated with the quota renewal of that same year. Bickham et al. (2012) analyzed a larger and more current bowhead genetic dataset and Quakenbush et al (2012) reported on results of the satellite telemetry data. In their evaluation, the Scientific Committee found the new analyses confirmed earlier findings that the data are consistent with a single stock status for Bering-Chukchi-Beaufort bowhead whales (2012 IWC Scientific Committee Report).

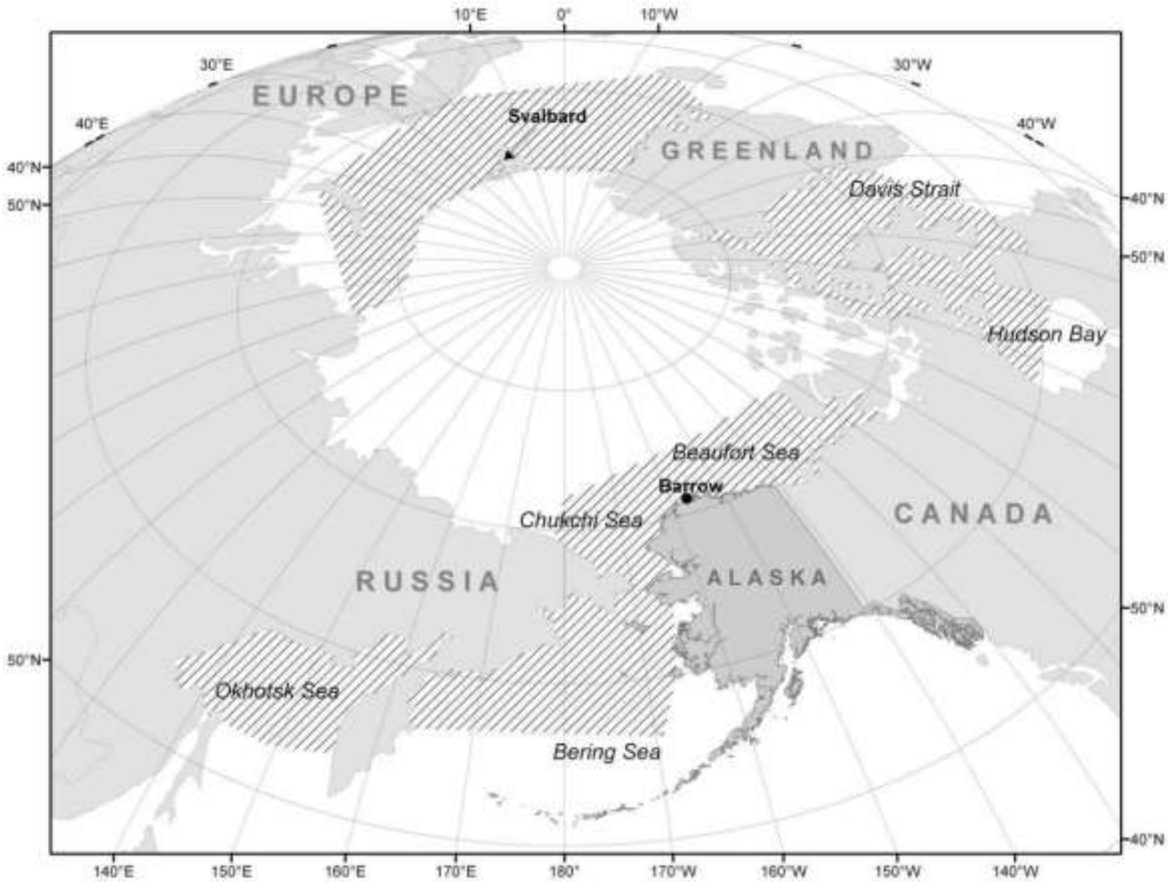

Figure 3.2-1. Circumpolar area occupied by the four bowhead whale stocks.

3.2.1 Current Abundance, Trends, Genetics, and Status

Abundance and Trends. All stocks of bowhead whales were severely depleted during intense commercial whaling, starting in the early 16th century near Labrador, Canada (Ross 1993), and spreading to the Bering Sea in the mid-19th century (Braham 1984, Bockstoce and Burns 1993, Bockstoce et al. 2007). The Sea of Okhostk and Spitsbergen bowhead stocks have not shown significant evidence of recovery even though a century has passed since commercial whaling stopped (Woodby and Botkin 1993). The Western Arctic and Davis Strait/Hudson Bay stocks have recovered significantly (Zeh et al. 1993).

In order to assess the size of this stock, the National Marine Fisheries Service (NMFS) began a study of abundance in 1976 by conducting visual counts of whales during the spring while they were migrating past ice-based sites north of Point Barrow, Alaska (Krogman 1980). The traditional ecological knowledge (TEK) of Alaska Native whalers pointed out shortcomings in the visual counts such as a lack of correction factors for whales that continued to migrate past the census site under the ice of closed leads or that migrate farther offshore (Huntington 2000).

Census counts have been conducted under the direction of the North Slope Borough Department of Wildlife Management since the mid-1980s (Dronenberg et al. 1986; George et al. 1988). These counts are corrected for whales missed by the observers, in particular through the use of acoustic arrays that detect the location of vocalizing whales (Zeh et al. 1993; George et al. 2004a, George et al. 2013; Givens et al. 2013; Givens et al. 2016.). These counts continue to be the primary source of abundance information for this stock though aerial surveys have produced a second estimate using photo-identification mark-recapture methods in spring (Koski et al.2010), and one minimal estimate using line-transect methods in autumn (Ferguson et al. 2017). At the meeting of the IWC's Scientific Committee in April/May 2018, a revised estimate for the stock was presented; this new estimate will be considered in the Final EIS for bowhead whales.

The last ice-based survey was conducted in 2011 (Givens et al., 2016). Correcting the count of 4,011 observed whales yielded an abundance estimate of 16,820 bowhead whales with a 95% confidence interval of 15,176 to 18,643, and an estimated annual rate of population increase of 3.7% (95% CI = 2.9%, 4.6%) (**Fig. 3.2.1-1**). An aerial photographic survey was conducted near Point Barrow concurrently with the ice-based spring census in 2011; these data were analyzed to produce an abundance estimate based on sight-re-sight data (Givens et al., 2017). The estimated abundance was 18,797 (CV=0.214, 95% CI = 12,403 to 28,486). Although much less precise than the ice-based abundance estimate, the photo-identification estimate provides independent support to the evidence that the stock is abundant and increasing from previous years.

The photo-identification data were also used to estimate bowhead survival rates. By comparing images from 1985, 1986, 2003, 2004, 2005 and 2011, estimated survival was 0.996 (lower bound = 0.976) which is consistent with previous estimates and with research showing that bowheads exhibit great longevity (up to 200 years old) (George et al. 1999, Rosa et al. 2013). Given the uncertainty of conducting a spring ice-based census in a warming Arctic (Suydam and George, 2017), an initial attempt was made to estimate abundance using aerial line-transect data collected in August 2016 (Ferguson et al., 2017). The IWC's Scientific Committee reviewed this estimate at its 2017 meeting and recommended that the results be modified to try to reduce the uncertainty before the estimate could be used in the bowhead strike limit algorithm.

The most recent point estimate of abundance for 2011 is 16,820 animal (Givens et al. 2016) and is between 73 and 162 percent of the estimated abundance prior to the onset of commercial whaling in the mid-nineteenth century, estimated at 10,400-23,000 (Woodby and Botkin 1993; see also Bockstoce et al. 2005). Schweder et al. (2009) estimated a yearly growth rate of 3.2 percent between 1984 and 2003 based on these data from aerial surveys. Although recent abundance estimates suggest population level that are as high as or higher than prior estimates of carrying capacity (K), the population growth rate shows no sign of slowing (Givens et al. 2016).

Genetics. Rooney et al. (2001) analyzed patterns of genetic variability among bowhead whales. Samples were taken from whales from the northern coast of Alaska, and from whales landed on St. Lawrence Island in the Bering Sea. The results of the research indicated that there was no genetic bottleneck (an evolutionary event that occurs when a population is reduced to a level insufficient to maintain diversity) in the Western Arctic stock and that the level of genetic variability has remained relatively high (nucleotide diversity = 1.63%) in spite of the depletion of the stock by commercial whalers in the 1800s. The stock reached its lowest abundance around 1914, when commercial whaling ceased; it is estimated that at that time there were 1,000 to 3,000 bowhead whales in the stock (Woodby and Botkin 1993).

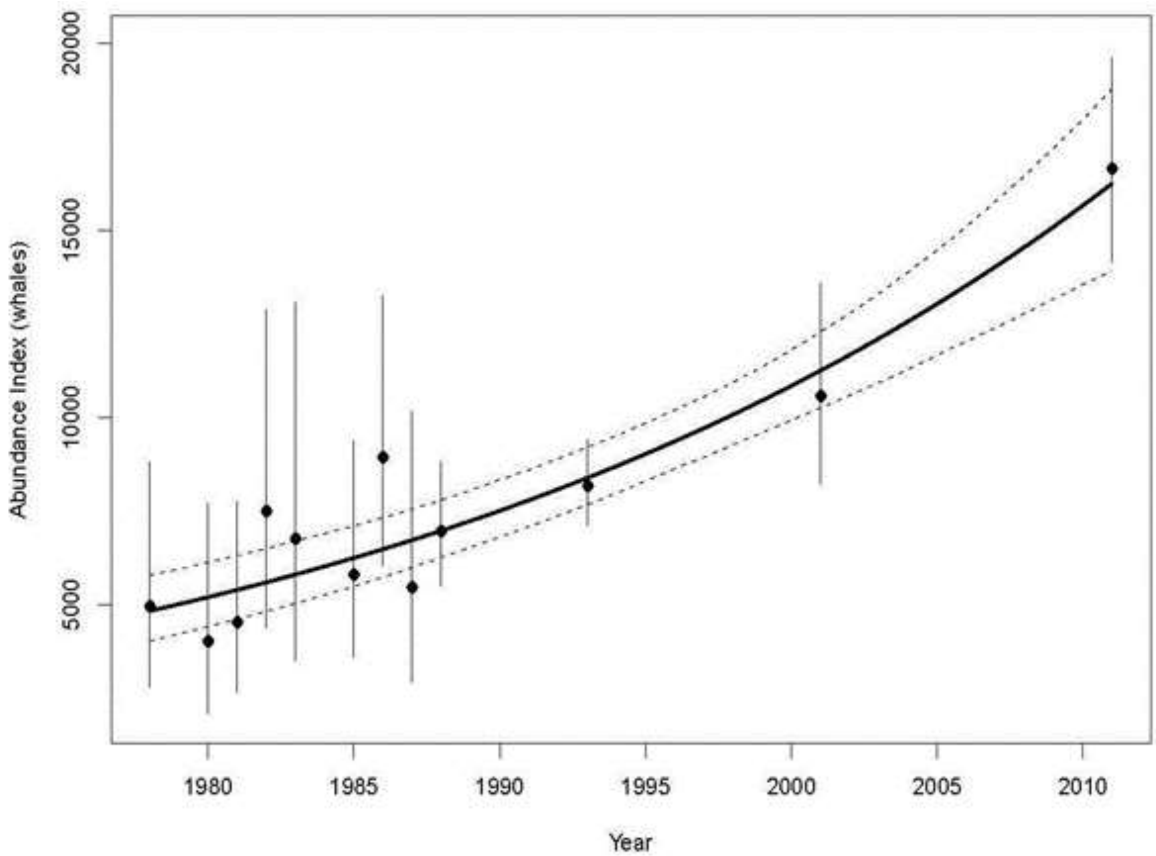

Figure 3.2.1-1. Abundance estimates for the Western Arctic stock of bowhead whales, 1978-2011 (Givens et al. 2016), as computed from ice-based counts, acoustic data, and aerial transect data collected during bowhead whale spring migrations past Point Barrow, Alaska.

Comparisons between the Western Arctic stock and the Okhotsk Sea stock showed a much greater haplotypic[12] diversity (0.93) in the Western Arctic samples than in the Okhotsk Sea samples (0.61). Analyses of microsatellite and sequence data revealed significant genetic differences between the two populations, indicating that the populations represent discrete gene pools (LeDuc et al. 2005). These differences indicate that the two populations should be considered genetically and demographically separate for management purposes; geneflow between them is negligible at most. The results also seem to parallel those for gray whales (LeDuc et al. 2002), another North Pacific species with a large eastern population showing high diversity and a small western population with considerably lower diversity.

Taylor et al. (2007) examined the plausibility of multiple bowhead whale stocks in the Western Arctic population. They synthesized four lines of evidence that related to understanding stock structure:

(1) Movement and distribution;
(2) Basic biology;
(3) History of commercial whaling; and
(4) Interpretation of genetic patterns.

The paper reviewed 30 years of research plus contributions from TEK. In terms of bowhead biology, bowhead whales have adapted to living in an arctic ecosystem where ice coverage and food resources vary through time. Taylor et al. (2007) concluded that this varying environment makes both the evolutionary reason for multiple breeding stocks within the Bering Sea and the biological feasibility of maintaining separation within a relatively small pelagic area unlikely. There is variability in the timing that individual bowhead whales migrate, in the timing of the peak of the migration itself, and in the location of both summering and wintering grounds. The variation is a result of both changing environmental conditions and changes in the whales' age and reproductive state. Furthermore, the available area for any potential segregation of feeding or breeding groups is well within the ability of individual whales to travel in a few days' time. There is no evidence of a possible small discrete stock within the Western Arctic bowhead

[12] Haplotypic diversity is a measure of the genetic variation between individuals or populations and is one way to describe the degree of relatedness between them. Most organisms have two sets of chromosomes (diploidy), one set inherited from each parent. Thus, different versions of each gene (alleles) may be present (Aa, Bb, Cc, etc.). The haplotype describes the genes on one set (ABC). Populations may have several haplotypes, or combinations of different alleles (ABC, ABc, AbC, etc). Comparison of haplotypes between populations is typically done by examining mitochondrial DNA, which is inherited from one parent only (mother), counting the number of differences in the nucleotide base pairs between them. This is used to calculate haplotypic diversity (h). High values, as in this case, indicate that the populations may be genetically distinct.

population. If there is, it is highly unlikely that any are present and harvested during the spring or autumn migration of Western Arctic bowhead whales. No data were found to support risk to a separate feeding group. Other insights using genetic data were weak, but nearly all results were consistent with a single stock that is out of genetic equilibrium following commercial depletion. Bowhead whales being out of genetic equilibrium was supported by differences found between age cohorts, both in empirical data and simulated data. The only significant genetic findings worth further consideration were differences involving whales taken from waters off St. Lawrence Island when compared with those landed at Utqiaġvik (Barrow). However, the comparisons that were significant involved small sample sizes and can be explained by genetic patterns found between different age cohorts (LeDuc et al. 2008). At the 2007 IWC meeting in Anchorage, Alaska, the IWC Scientific Committee Sub-Committee on Bowhead, Right and Gray Whales concluded after a three year investigation of the stock structure of the Bering-Chukchi-Beaufort population of bowhead whales, as summarized in Taylor et al. (2007), that the available evidence best supports a single-stock hypothesis for Western Arctic bowhead whales (IWC 2007:7). Updated data and new genetic markers were evaluated in 2018 (Baird et al. 2018).

Status and Management. Since 1931, bowhead whales have been protected from commercial whaling internationally, first under the League of Nations Convention, and since 1949 by the International Convention for the Regulation of Whaling (ICRW). Under the IWC, an important feature of the convention is the emphasis it places on scientific advice. The ICRW requires that amendments to the Schedule 'shall be based on scientific findings.' To address this requirement, the Commission established a Scientific Committee in 1950. The Scientific Committee is now comprised of more than 200 of the world's leading whale biologists, many of whom are nominated by IWC member governments. In addition, in recent years, the Scientific Committee has invited other scientists to supplement its expertise in various areas. The size of the Scientific Committee, as well as the subject matter it addresses, has increased considerably over time. In 1954, it comprised 11 scientists from seven member nations. The Scientific Committee is one of four Committees established by the Commission, the others being the Finance and Administration Committee, the Technical Committee and the Conservation Committee. Formally, the Scientific Committee reports directly to the Commission.

The IWC Schedule establishes in paragraph 13(a) the following principles to be followed by IWC member nations for setting aboriginal subsistence whaling catch limits: (1) for stocks above the Maximum Sustainable Yield (MSY) level, aboriginal subsistence catches shall be permitted so long as total removals do not exceed 90% of MSY; (2) for stocks below MSY level, but above a certain minimum level, aboriginal subsistence catches shall be permitted so long as they are set to allow stocks to increase to the MSY level; (3) catches will be kept under review; (4) for bowheads, it is forbidden to strike, take, or kill calves or any whale accompanied by a calf; and (5) all aboriginal whaling shall be conducted under national legislation that accords with paragraph 13 of the Schedule. In addition, the IWC Scientific Committee advises the IWC on a range of rates of increase to the MSY level. Prior to 2003, to achieve the goals of the principles set forth in paragraph 13(a), the IWC assessed aboriginal whale harvests under various catch control rules. The most important reference point for these rules was replacement yield (RY), which refers to the number of animals that could be killed while leaving the population the same size at the end of the year as at the beginning of the year.[13] Although the catch control rules varied somewhat during the decade, they shared a common strategy: RY would be statistically estimated from population dynamics models and available data, and a lower confidence bound for RY, or a function of it, was taken to be a safe harvest level (IWC, 1999). During this period, the lower bound (5th percentile) for RY was estimated to be more than 100 whales. For example, in 1998, the IWC Scientific Committee estimated that the population "appears to be near MSY, and would very likely increase under catches of up to 108 animals" (IWC, 1999). While the IWC Scientific Committee agreed that such a harvest level satisfied the principles for setting catch limits under sub- paragraph 13(a) of the IWC Schedule, the quota and the annual number of whales landed and struck has always fallen well below this number (**Figure 3.2.1-2**).

In 2003, the IWC replaced the practice of setting quotas based on RY with a new procedure relying on the "Bowhead Strike Limit Algorithm" (Bowhead SLA) it had adopted for setting the quota for Western Arctic bowhead whales (IWC 2003a,b). The algorithm requires as inputs the past history of strikes taken, the desired number of strikes for the next quota block, and periodic estimates of bowhead population abundance. Using those inputs, the Bowhead SLA calculates whether the desired strike level meets conservation objectives. To ensure that the Bowhead SLA maintains safe strike limits, the IWC Scientific Committee tested the algorithm under a very large number and variety of scenarios using thousands of computer simulations with mathematical models of whale population dynamics, future data, external factors, and potential management. These scenarios incorporated factors including, but not limited to, stock structure, changes in carrying capacity, episodic events resulting in mass mortality, survey bias, and changes in biological parameters (cf. 2003 IWC Scientific Committee Report, and its annexes for a complete list of evaluation and robustness trials conducted when evaluating the appropriateness of the Bowhead SLA). The simulation-testing framework explicitly considered uncertainty in these population simulations and sought to ensure that the Bowhead SLA would meet IWC objectives for the management of stocks subject to aboriginal subsistence takes (cf. IWC, 1999), which are to:

[13] Another catch control rule, designated Q, was developed to give an appropriate catch limit across any population level to meet the principles set forth in IWC Schedule paragraph 13(a) (Wade and Givens, 1997). The catch control rule Q allows the proportion of net production allocated to recovery to increase as a population becomes more depleted and decrease for a population above MSY and approaching K. For populations above the MSY level, Q is capped at 90% of MSY, as required by IWC Schedule paragraph 13(a). In 2006, the best estimate of Q was determined to be 257 bowhead whales (range: 155-412 animals; Brandon and Wade, 2006). (See **Section 4.1.2** on the use of Q for helping to evaluate the level of impact of Alternative 5.)

(1) Ensure that the risks of extinction to individual stocks are not seriously increased by subsistence whaling;
(2) Enable aboriginal people to harvest whales in perpetuity at levels appropriate to their cultural and nutritional requirements, subject to the other objectives; and
(3) Maintain the status of stocks at or above the level giving the highest net recruitment and to ensure that stocks below that level are moved towards it, so far as the environment permits[14].

In addition to the principles that must be followed in setting catch limits, the IWC Schedule, as adopted in 2012, also identifies specific catch limits for 2012 through 2018. IWC Schedule sub-paragraph 13(b)(1) provides:

> *(1) The taking of bowhead whales from the [Western Arctic] stock by aborigines is permitted, but only when the meat and products of such whales are to be used exclusively for local consumption by the aborigines and further provided that:*
>
> > *(i) For the years 2013, 2014, 2015, 2016, 2017 and 2018, the number of bowhead whales landed shall not exceed 336. For each of these years the number of bowhead whales struck shall not exceed 67, except that any unused portion of a strike quota from any year (including 15 unused strikes from the 2008-2012 quota) shall be carried forward and added to the strike quotas of any subsequent years, provided that no more than 15 strikes shall be added to the strike quota for any one year.*
> >
> > *(ii)This provision shall be reviewed annually by the Commission in light of the advice of the Scientific Committee.*

The IWC Scientific Committee has confirmed that these limits are safe according to the Bowhead SLA. It is important to note that the annual number of bowhead whales landed and struck and lost has always fallen below these specific catch limits (**Figure 3.2.1-2**).

[14] Note that the statement of these stock management objectives differs from, but is consistent with, the aboriginal subsistence whaling management principles of Schedule paragraph 13(a).

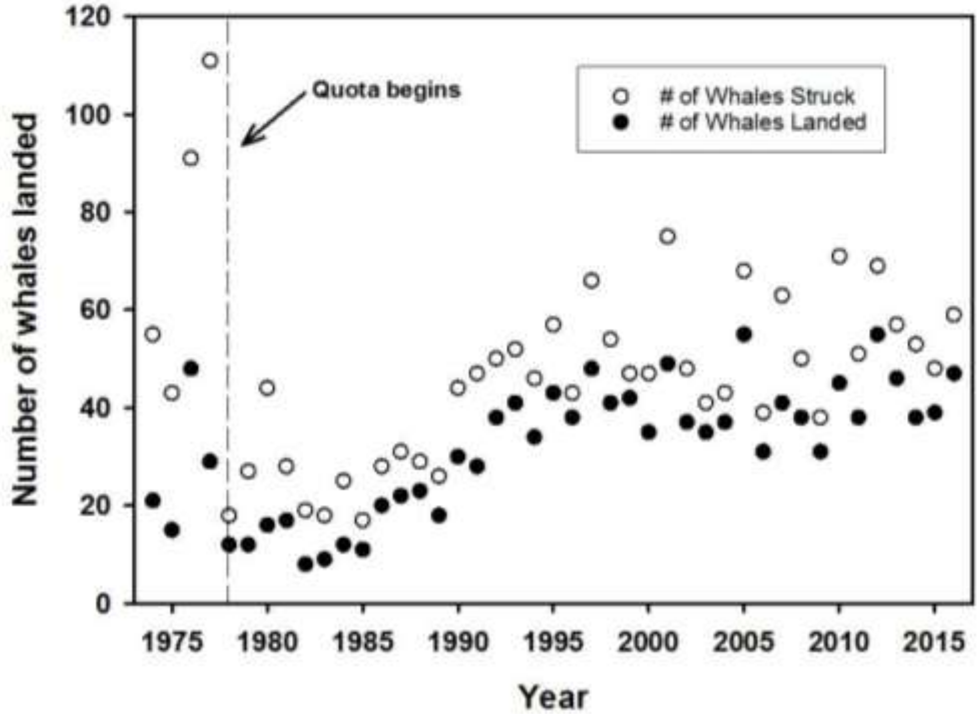

Figure 3.2.1-2. Annual number of Western Arctic bowhead whales landed and struck by Alaska Native villages in Alaska, 1998-2016**.**

Inuit in Alaska have been taking bowhead whales for at least 2,000 years (Marquette and Bockstoce, 1980; Stoker and Krupnik, 1993), and subsistence takes have been regulated by a management system under the authority of the IWC since 1977. Yet with a subsistence take that averages between 40 to 50 strikes per year, the Western Arctic stock has continued to grow 3.74% annually, adding roughly 623 bowhead whales to the population in 2011 (0.0374 x 16,820 whales) and likely similar numbers annually since then. Considered in light of the most recent population estimate of 16,820 whales (95 percent CI: 15,176 to 18,643) from 2011 (Givens et al. 2016), this level of subsistence take represents 0.3 percent of the 2011 population, and likely even less than the current population, if continued annual population growth of 3.7 percent is assumed.

The Western Arctic stock of bowhead whales remains listed as endangered under the Endangered Species Act (ESA); because of the ESA listing, the stock is classified as a depleted and a strategic stock under the Marine Mammal Protection Act (MMPA). Nonetheless, it is important to note that the Western Arctic bowhead whale population has continued increasing in abundance, while being affected by a managed hunt. Further, estimated abundance is now so high that it exceeds most past estimates of carrying capacity (K).

General Migration Pattern. The Western Arctic stock occupies seasonally ice-covered waters of the Bering, Chukchi, and Beaufort seas (Moore and Reeves, 1993). Most bowheads winter in the Bering Sea, in continental shelf waters north of the southern boundary of sea ice (Moore and Reeves, 1993; Citta et al., 2012). In March and April, whales begin to migrate north into the Chukchi Sea, most following leads (openings in the sea ice) along the Alaska coastline (**Fig. 3.2.1-3**). As they pass Point Barrow, they continue east crossing the Beaufort Sea to an area near Cape Bathurst in Amundsen Gulf, Canada, where they summer (Quakenbush et al., 2012, 2013). Whales migrate past Point Barrow from April into June. A few whales migrate westward along the Chukotka coast and may remain in the Chukchi Sea all summer (e.g., Melnikov and Zeh, 2007) although there is evidence that individual whales my vary their migration routes and summer distribution from year to year (Citta et al. 2012). Whales in the Canadian Beaufort Sea begin to migrate west in August, generally paralleling the coastline to Point Barrow. The westbound migration continues through October. From Point Barrow, whales cross the Chukchi Sea to the Chukotka coast and continue south. By the end of December, most bowhead whales have returned to the Bering Sea (Quakenbush et al. 2010; Citta et al. 2012).

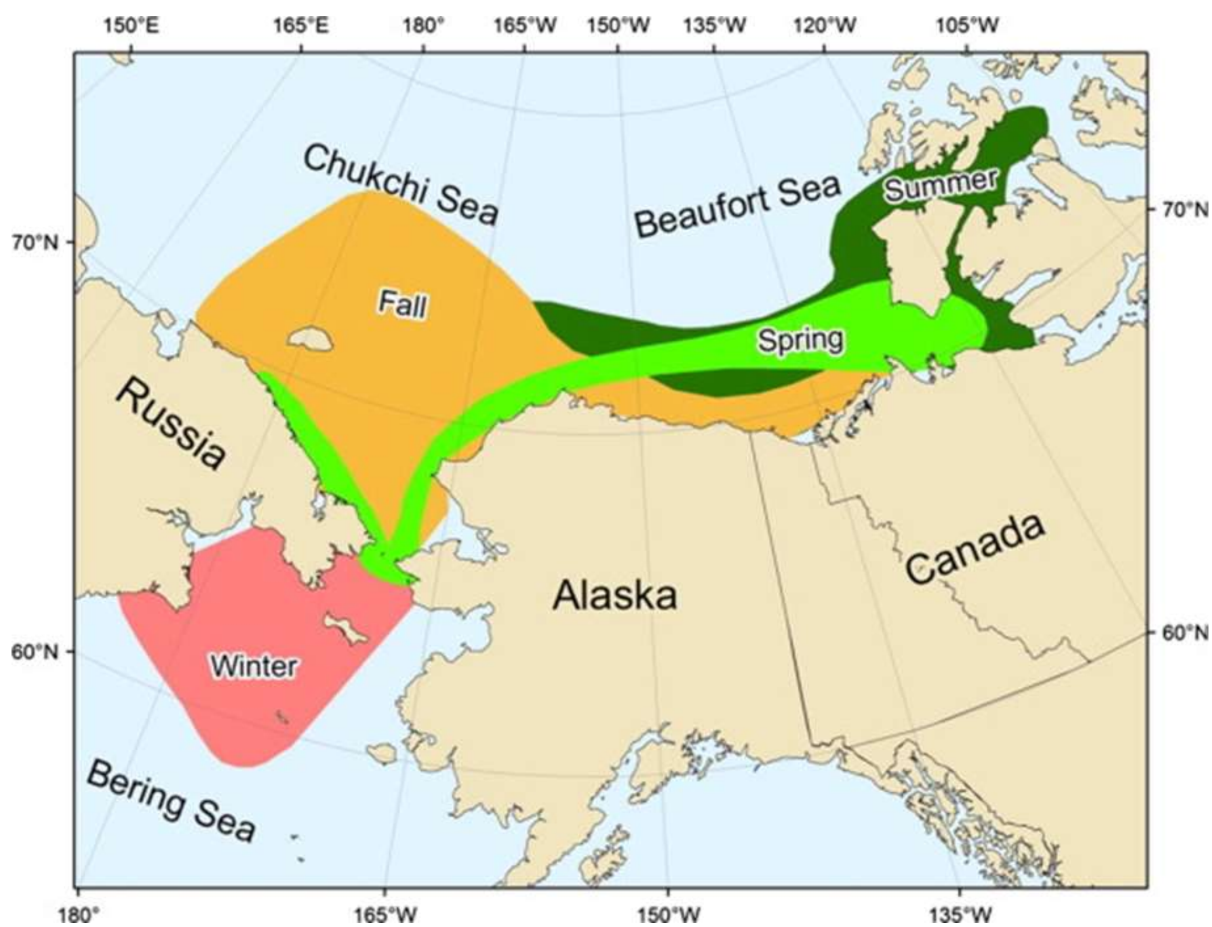

Figure 3.2.1-3. Range map for Western Arctic bowhead whales based on satellite telemetry data. Source: Quakenbush et al 2012.

Bowhead Core Use Areas. Citta et al. (2015) used locations from 54 satellite-tagged bowhead whales to define areas of concentrated use, termed "core-use areas", for Western Arctic whales that summered in the eastern Beaufort Sea (**Fig. 3.2.1-4**). They linked use of these areas to potential prey of these whales as follows: "In spring, most whales migrated from wintering grounds in the Bering Sea to the Cape Bathurst polynya, Canada (Area 1), and spent the most time in the vicinity of the halocline at depths <75 m, which are within the euphotic zone, where calanoid copepods ascend following winter diapause. Peak use of the polynya occurred between 7 May and 5 July; whales generally left in July, when copepods are expected to descend to deeper depths. Between 12 July and 25 September, most tagged whales were located in shallow shelf waters adjacent to the Tuktoyaktuk Peninsula, Canada (Area 2), where wind-driven upwelling promotes the concentration of calanoid copepods. Between 22 August and 2 November, whales also congregated near Point Barrow, Alaska (Area 3), where east winds promote upwelling that moves zooplankton onto the Beaufort shelf, and subsequent relaxation of these winds promoted zooplankton aggregations. Between 27 October and 8 January, whales congregated along the northern shore of Chukotka, Russia (Area 4), where zooplankton likely concentrated along a coastal front between the southeastward-flowing Siberian Coastal Current and northward-flowing Bering Sea waters. The two remaining core-use areas occurred in the Bering Sea: Anadyr Strait (Area 5), where peak use occurred between 29 November and 20 April, and the Gulf of Anadyr (Area 6), where peak use occurred between 4 December and 1 April; both areas exhibited highly fractured sea ice. Whales near the Gulf of Anadyr spent almost half of their time at depths between 75 and 100 m, usually near the seafloor, where a subsurface front between cold Anadyr Water and warmer Bering Shelf Water presumably aggregates zooplankton. The amount of time whales spent near the seafloor in the Gulf of Anadyr, where copepods (in diapause) and, possibly, euphausiids (small, shrimp-like crustaceans) are expected to aggregate provides strong evidence that bowhead whales are feeding in winter. The timing of bowhead spring migration corresponds with when zooplankton are expected to begin their spring ascent in April. The core-use areas we identified are also generally known from other studies to have high densities of whales and we are confident these areas represent the majority of important feeding areas during the study (2006–2012).

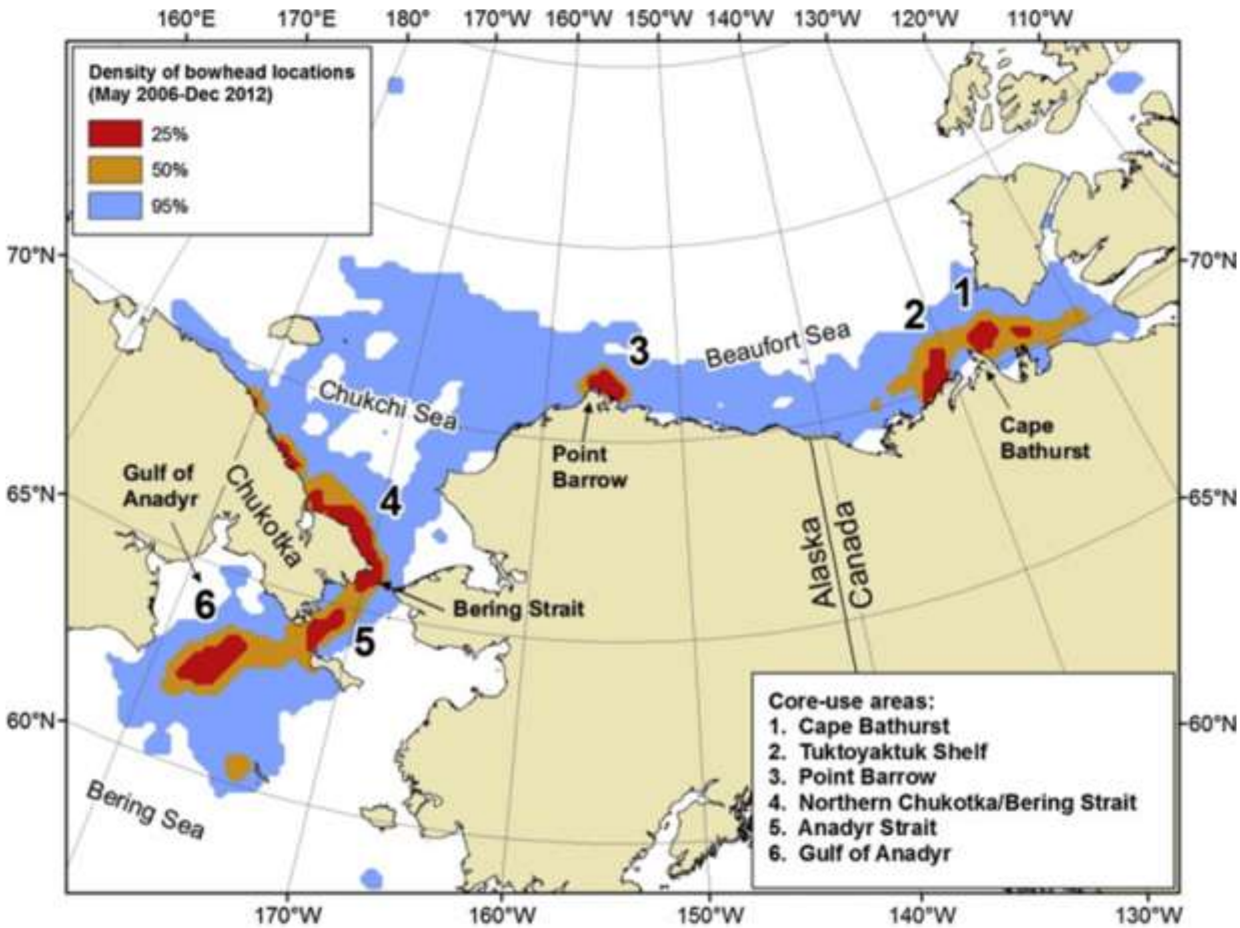

Figure 3.2.1-4. Seasonal core-use areas of Western Arctic bowhead whales (n = 54) tagged with satellite transmitters (2006-2011). Source: Citta et al., (2015).

Segregation by Size and Sex. During the spring migration, temporal segregation by size class and sex occurs in three overlapping pulses, the first consisting of sub-adults, the second of larger whales, and the third composed of even larger whales and cows with calves (Nerini et al., 1987; Rugh, 1990; Angliss et al., 1995; Suydam and George, 2004). However, more recently, these pulses are less distinguishable, possibly due to the increase in the population size or changing ice conditions in the Chukchi Sea or both. Along the Chukchi Peninsula, Russian Chukotkan Natives noted the appearance of mothers with calves in late-March and early April followed by immature and adult animals (Bogoslovskaya et al., 1982). In the Beaufort Sea in summer, aggregations have usually consisted of only juveniles or of large whales that may include calves (Richardson, 1987; Davis et al., 1986). In 1983, Cubbage and Calambokidis (1987) found a significant inverse correlation between longitude and size class; rates of encounter for larger whales increased moving west to east in the Beaufort Sea. Onshore and offshore distributions varied annually, suggesting that sex- or age-class segregation patterns are temporally and spatially fluid and cannot be defined rigidly for any region or period (Moore and Reeves, 1993).

Segregation by size also occurs during the autumn migration (Braham, 1995; Suydam and George, 2004). George et al. (1995) showed a clear trend in progressively smaller whales harvested between August and November. Along the Chukchi Peninsula, the autumn migration splits into two pulses (Bogoslovskaya et al., 1982; Mel'nikov and Bobkov, 1993, 199 4), though segregation by size class or sex was not confirmed as the cause.

3.2.2 Commercial Whaling

Bowheads were first commercially hunted in the Bering Sea in 1848, and in the following year more than 40 vessels took part in the hunt. By 1852, more than 200 ships were cruising in the Bering Strait region and fully one-third of all commercial catches had been made, rapidly reducing the stock (Bockstoce and Botkin 1980). Total catches were quite variable during the early years of commercial whaling. After low catches in 1853 and 1854, the fleet abandoned the Bering Strait and arctic grounds for the Okhotsk Sea grounds in 1855, 1856, and 1857. As hunting continued and the population was reduced, the whalers went farther and farther north and east. After almost eradicating the Okhotsk Sea population, the fleet returned to the Bering Strait in 1858, remaining there and farther north for the next half-century. In 1889, steamships reached the summer feeding grounds off the Mackenzie River Delta, Canada, which remained the major focus of the industry until 1914, about the time that commercial whaling collapsed (Bockstoce and Botkin, 1980; Bockstoce et al., 2007).

3.2.3 Subsistence Hunts

Inuit in Alaska have been taking bowhead whales for at least 2,000 years (Stoker and Krupnik, 1993). Although early historical records were not kept, it is estimated that Alaska Natives may have taken 20 whales per year (Ellis, 1991). Subsistence hunting is not a new contributor to cumulative effects on this population. There is no indication that, prior to commercial whaling, subsistence whaling caused significant adverse effects at the population level (Minerals Management Service [MMS], 2006a:201).

Subsistence takes have been regulated by catch limits under the authority of the IWC since 1977. The annual number of bowheads landed by Alaska Natives has ranged from 8 (in 1982 as a result of IWC setting a lower catch limit) to 55 (in 2005 and 2012) from the time records were first kept in 1973, while bowheads struck and lost have ranged from 5 (in 1999) to 82 (in 1977) (**Figure 3.2.3-1**). Hunters from the western Canadian Arctic community of Aklavik killed one bowhead whale in 1991 and one in 1996, though Canada is not a member of the IWC and thus harvests in Canada are not approved by the IWC. As part of the shared quota with the Russian Federation, one animal was killed by Russian subsistence hunters in each of 1999 (IWC, 2001a; 2002), 2000 (IWC, 2002), and 2001 (IWC, 2003c), three in 2002 (IWC, 2004) and 2003 (IWC, 2005b), one in 2004 (IWC, 2006a), two in 2005 (IWC, 2007), none in 2006 (IWC, 2008b) and 2007 (IWC, 2009a), two in 2008 (IWC, 2010c), none in 2009 (IWC, 2011a), two in 2010 (IWC, 2012a), none in 2011(IWC 2012b) and 2012 (Ilyashenko 2013), one in 2013 (Ilyashenko and Zharikov 2014), none in 2014 and 2015 (Ilyashenko and Zharikov 2015, 2016), and two in 2016 (Ilyashenko and Zharikov 2017). (Figure 3.2.4-1). Descriptions of the Alaska hunts and their management are provided in Sections 3.4 and 3.5, respectively.

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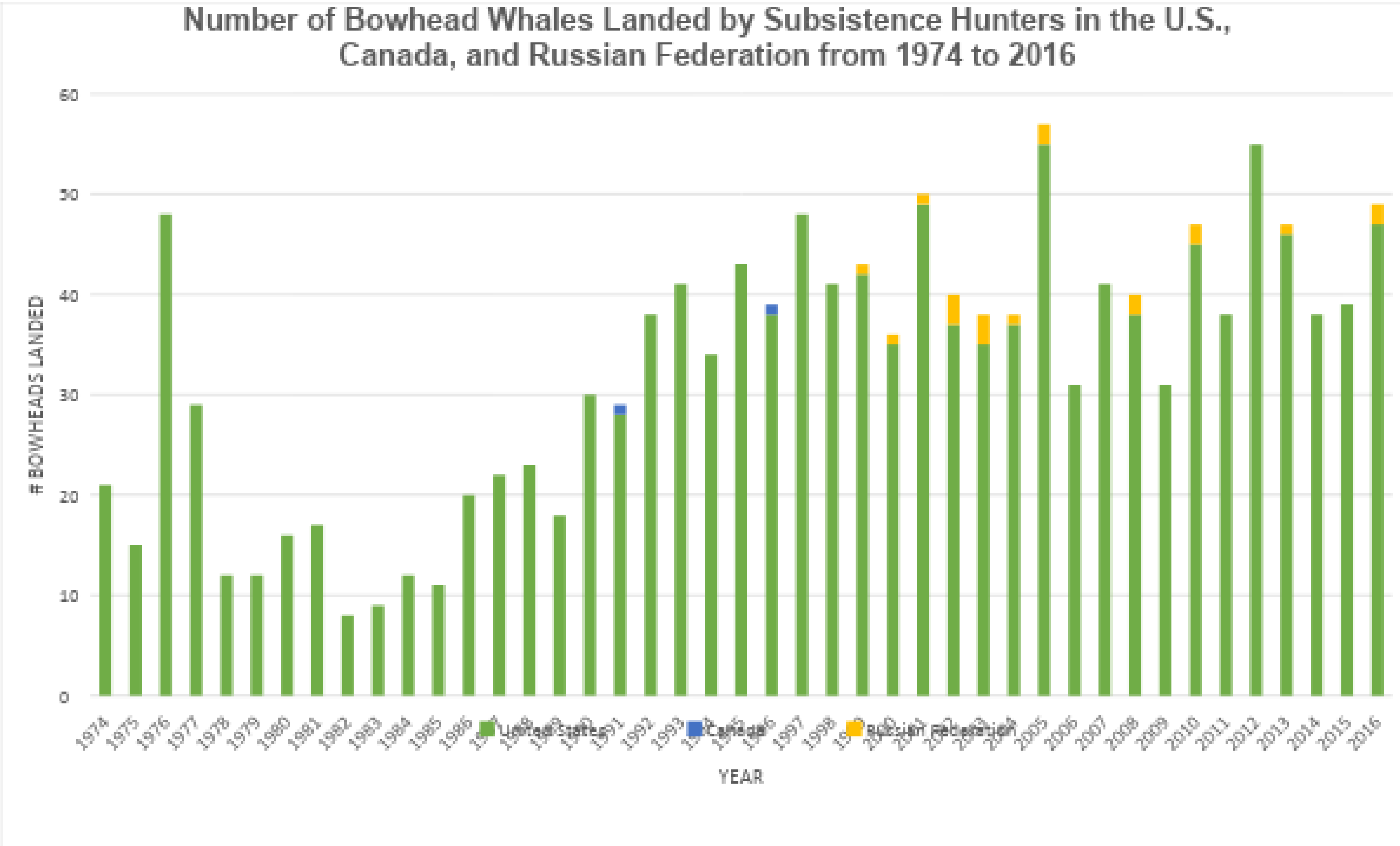

Figure 3.2.3-1. Number of bowhead whales landed by subsistence hunters in the U.S., Canada and the Russian Federation, 1974-2016. Source: Suydam et al. 2018.

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3.2.4 Natural Mortality

There is still a great deal to learn about naturally occurring diseases and death in bowhead whales (e.g., Heidel and Albert, 1994). Studies of harvested bowhead whales have discovered bacterial, mycotic, and viral infections but not at a level that might contribute to mortality and morbidity (Philo et al., 1993). Skin lesions, found on all harvested bowhead whales, were not malignant or contagious. However, potentially pathogenic microorganisms inhabit these lesions and may contribute to epidermal necrosis and the spread of disease (Shotts et al., 1990). Exposure of these roughened areas of skin to environmental contaminants, such as petroleum products, could have detrimental effects (Albert, 1981; Shotts et al., 1990); Bratton et al. (1993), however, concluded that such encounters were not likely to be hazardous.

The few infectious disease surveillance studies that have been conducted on bowhead whales indicate that a limited suite of infectious agents are present that could impact bowhead health or pose a public health risk (Philo et al. 1992; O'Hara et al 1998; Hughes-Hanks et al. 2005; Stimmelmayr 2015). Results from recent infectious disease surveillance studies in general corroborate previous findings (Stimmelmayr et al 2018). Tissue samples of major visceral organs collected from 61 landed bowhead whales (2011-2015) were analyzed for a suite of high priority marine mammal pathogens (Venn-Watson et al. 2010) by the University of Georgia. The only viral agent detected in 9.8% (6/61) bowhead whales belonged to the group of adenoviruses which Smith et al (1987) previously had reported upon. No lesions were associated with adeno virus presence. Molecular characterization identified several distinct genotypes and these data will be included in a draft manuscript to be completed in 2018 that will report on these findings in bowhead whales.

Endoparasites. Previous surveillance for endoparasites in subsistence-harvested bowhead whales demonstrated a limited suite of internal parasites, most likely reflecting the dietary habits of bowhead whales, and the presence of potential zoonotic protozoa (for review Philo et al. 1992; Hughes-Hanks et al. 2005). Recently feces (n=159) collected from landed bowhead whales during 2002 to 2015 were analyzed by University of Colorado (Stimmelmayr et al 2018) for helminths and protozoa. Cryptosporidium was absent in contrast to previous studies but marked interannual variation of *Giardia* spp. prevalence was observed. Prevalence ranged from 0 to 100 %. Molecular characterization of *Giardia* identified assemblages attributed most commonly to human hosts. These data will be included in a draft manuscript to be completed in 2018 that will report on temporal trends of protozoa prevalence and *Giardia* assemblages identified in these cetaceans.

Few macroparasites (e.g. *anisakis, crassicauda* spp.) occur in bowhead whales (Sheffield et al 2016; Stimmelmayr et al. 2018a). Recent molecular studies to further characterize nematodes to species level were inconclusive for *Anisakis* spp (Stimmelmayr unpubl.data) and *crassicauda* spp (Stimmelmayr et al. 2018b). Morphological and molecular studies are ongoing to further refine *crassicauda* and *anasakis* species identification.

Lesions. Neoplastic lesions in bowhead whales continue to be rare. However, benign fatty masses (lipomas; myelolipomas) of the liver, first seen in 1980 (Migaki and Albert 1982), have been annually observed in 1-2 landed bowhead whales in Utqiaġvik (Barrow) per year since 2012; Stimmelmayr et al 2017). The pathogenesis and exact cell origin of these benign fatty tumors in bowhead whales are undetermined, but lesions appear to not be associated with other significant disease in examined bowhead whales.

Evidence of ice entrapment and predation by killer whales (*Orcinus orca*) has been documented in almost every bowhead whale stock. The percentage of whales entrapped in ice is considered to be quite small, likely because this species is strongly ice-associated (Tomilin, 1957; Mitchell and Reeves, 1982; Nerini et al., 1984; Philo et al., 1993). The ice may also provide some protection from killer whale attacks. Transient killer whales are the only known predators of bowhead whales. In a study of marks on bowhead whales taken in the subsistence harvest between spring 1976 and fall 1992, 4.1% to 7.9% had scars indicating that they had survived attacks by killer whales (George et al. 1994). Of 378 complete records for killer whale scars collected from 1990 to 2012, 30 whales (7.9%) had scarring “rake marks” consistent with killer whale injuries and another 10 had possible injuries (George et al., 2017). The frequency of killer whale scars was much higher (> 40%) on whales more than 16 meters in length and statistically more frequent in the second half of the study (2002 – 2012), suggesting killer whale predation is increasing. George et al. (2017) noted this may be due to better reporting and/or sampling bias, an increase in killer whale population size, an increase in occurrence of killer whales at high latitudes (Clarke et al., 2013), or a longer open water period offering more opportunities to attack bowhead whales. Note that this rate of scarring should not be interpreted as the rate of attack by killer whales because carcasses from successful killer whale attacks are unlikely to be observed or recovered. At least 2 of 10 bowhead whale carcasses observed during the Aerial Survey of Arctic Marine Mammals (ASAMM) project in 2015 had evidence of killer whale predation (rake marks, missing jaw/tongue) (George et al., 2017).

3.2.5 Contaminants

A number of organochlorine contaminants persist in the Arctic marine environment, including but not limited to polychlorinated biphenyls (PCBs), and dichlorodiphenyltrichloroethanes (DDTs). However, very limited data are available on baseline organochlorine concentrations in prey or tissues of bowhead whales and on the normal biochemical and histologic (microscopic) determinants used to assess exposure and impacts. Organochlorines (OCs) are ubiquitous, persistent contaminants and are lipophilic (fat loving) and tend to bioaccumulate in lipid-rich tissues (i.e., blubber). Recent analyses were presented at a bowhead health and physiology workshop held in Utqiaġvik (Barrow), Alaska, in 2002 (Willetto et al., 2002). OC concentration levels varied from the Bering-Chukchi-Beaufort seas suggesting that contaminant levels varied along the migratory range of the bowhead whale (Hoekstra et al., 2002a). The OC levels consistently fluctuated with seasonal migration between the Beaufort and Bering seas over a 3.5-year period, indicating that active feeding must be occurring in both areas to alter contaminant levels and profiles in tissues (discussed in Willetto et al., 2002).

Approximately 350 high quality blubber samples from bowhead whales were analyzed for lipid content, and the proportion of neutral lipids (i.e., triglycerides, non-esterified free fatty acids) that are key factors affecting the accumulation of lipophilic OCs (discussed by Ylitalo in Willetto et al., 2002). Lipid concentrations of bowhead blubber ranged from 25% to 83%, primarily comprised of triglycerides (94% to 100%). The mean lipid concentrations were significantly different among the three collection years (1998, 1999, and 2000) and by season (autumn versus spring) (discussed by Zeh in Willetto et al., 2002). Blubber and liver samples were analyzed for selected OCs (toxaphene (TOX), PCBs, DDTs, hexachlorocyclohexanes (HCHs), chlordanes, and chlorobenzenes) to investigate bioaccumulation and biotransformation (Hoekstra et al., 2002a, b). In general and as expected, concentrations of OCs significantly increased with body length in male bowhead whales (Hoekstra et al., 2002a). Concentrations also increased with body length (e.g., age) in female whales but only up to the length of 13 m, the approximate length of sexual maturity. Adult females (greater than 13 m) had generally lower concentrations than juvenile whales, which was attributed to the transfer of OCs from mother to young during gestation and lactation.

Geographic differences in contaminant exposure and accumulation (contamination varied by region) were reflected in OC concentrations in blubber of the bowhead whale, which was very likely a result of feeding in the respective regions, i.e., the Bering and Beaufort seas (Hoekstra et al., 2002a). Age, gender, and concentration levels influence PCB biotransformation (Hoekstra et al., 2002b). The sum of PCB concentrations in bowhead whales was relatively low compared to levels found in other cetaceans.

Heavy metal concentrations (i.e., cadmium [Cd], mercury [Hg], selenium [Se]) increased with age and tended to be relatively high in Arctic marine mammals; however, Hg and Se were comparably low in bowhead whales (Woshner et al., 2001, 2002; O'Hara et al., 2006).

Recently, archived blubber and muscle samples collected from subsistence harvested male bowhead whales [whales harvested in Utqiaġvik (Barrow), Alaska in 2006 – 2015] were analyzed for persistent organic pollutants (POPs) by the NWFSC (Seattle, WA). The most abundant POPs determined in the bowhead tissue samples were PCBs, with mean concentrations ranging from 60 to 140 ng/g in blubber. Blubber concentrations of PCBs and DDTs determined in male bowhead whales sampled in 2015 were at least four times lower than those reported by O'Hara et al. 1999 in male bowheads sampled in 1992/1993 (**see Figure 3.2.4-1**). These data will be included in a draft manuscript to be completed in 2018 that will report on contemporary levels of POPs in these cetaceans.

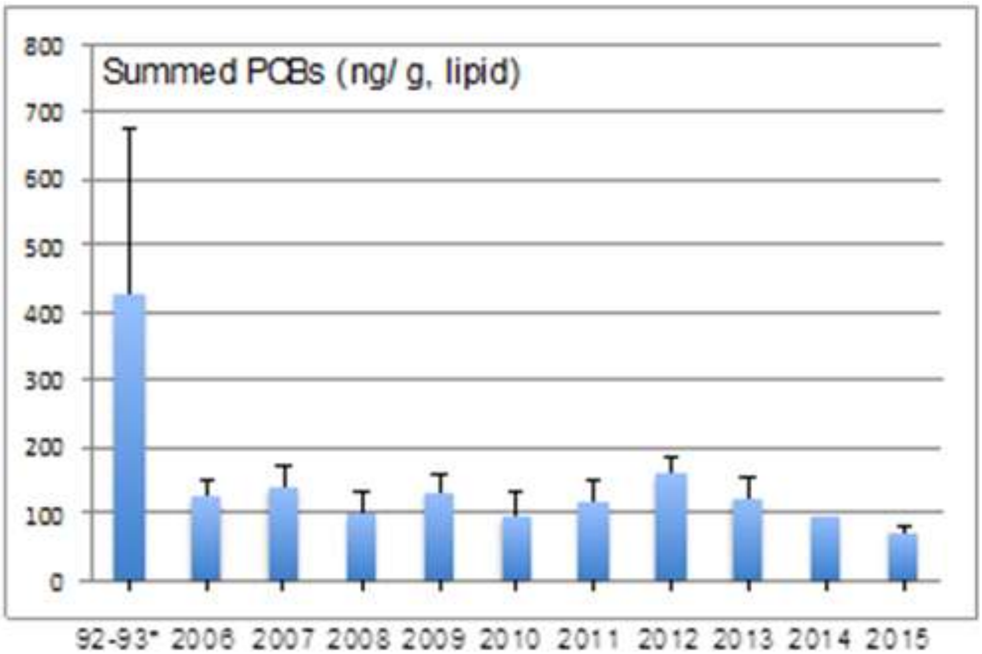

Figure 3.2.4-1. Blubber concentrations of PCBs and DDTs determined in male bowhead whales sampled in 1992 and 1993. Data from O'Hara et al. 1999.

In addition, blubber and muscle samples of these subsistence harvested male bowheads were also analyzed for petroleum-related polycyclic aromatic hydrocarbons (PAH). In general, the bowhead tissue concentrations of these compounds were low (< 50 ng/g, wet weight) and provide baseline PAH information for this Arctic species. These data will be included in a baseline PAH manuscript for subsistence-harvested Arctic marine mammals.

In summary, contaminant levels for bowhead whales varied by gender, length (i.e., age), and season, but most contaminants were relatively low compared to other marine mammals.

3.2.6 Fishery Interactions

The IWC's Scientific Committee has described bycatch as the most serious direct threat to cetaceans globally (https://iwc.int/bycatch, accessed 16 February, 2018).There is abundant evidence of bowhead whale entanglement in commercial fishing gear, probably pot gear (Philo et al. 1993, George et al. 2017). Most of this evidence derives from examination of scarring on subsistence caught whales or from aerial photographs of whales, but at least one bowhead has been found dead while entangled in crab pot gear from a U.S.-managed fishery (George et al. 2017). In 2017, two bowhead whales were harvested that were entangled in rope. Gear was consistent with crab pot gear (Stimmelmayr et al. 2018).

George et al. (2017) examined records for 904 bowhead whales harvested between 1990 and 2012. Of these, 521 records were examined for at least one of the three types of scars indicating injuries from line entanglement wounds (515 records). Their best estimate of the occurrence of entanglement scars was ~12.1% (59/486; an additional 29 records with possible entanglement scars were excluded from the analysis) with the source of entanglement most likely attributable to commercial pot gear in the Bering Sea (crab and codfish pots). Based on multi-year photo mark-recapture data, the probability of a bowhead acquiring an entanglement injury was estimated at 2.4% per year (Givens et al. 2017, IWC SC/67a 2017 page 63) and about 50% of large (≥17m) bowheads harvested by subsistence hunters bore entanglement scars (George et al. 2017). Most entanglement injuries occurred on the peduncle and were rarely observed on smaller subadult and juvenile whales (<10 m). These estimates of entanglement due to evidence of scarring should be considered minimum estimates of entanglement rates, as they do not include those whales that may have become anchored in place by pot gear, or that died because of entanglement and were not subsequently sighted or examined.

Citta et al. (2014) found that the distribution of satellite-tagged bowhead whales in the Bering Sea spatially, but not temporally, overlapped with areas where commercial pot fisheries occurred, noting the potential risk of whales becoming entangled in derelict gear. The nation of origin for fishing gear that results in bowhead entanglement is largely unknown, with only one entanglement thus far having been traced back to any particular fishery (see below). A dead bowhead whale that was found floating in Kotzebue Sound in early July 2010, entangled in crab pot gear similar to that used by commercial crabbers in the Bering Sea (Suydam et al. 2011; George et al. 2017). In July 2015, a dead adult female bowhead whale (2015-FD2) drifting near Saint Lawrence Island in the Bering Strait was found to be entangled in fishing gear (Suydam et al. 2016). The gear included lines, two floats, and an attached color coded/numbered permit tag that was traced back to the 2012/2013 U.S. winter commercial blue king crab fishery located in Saint Matthew Island waters of the northern Bering Sea (pers. comm. Gay Sheffield, Alaska Sea Grant and Savoonga Whaling Captains Association, 2015). Unpublished results from George et al. presented at the February 2018 Alaska Eskimo Whaling Commission Mini-convention in Utqiaġvik (Barrow), Alaska, indicates a three-fold spike in baleen glucocorticoids following entanglement of a subadult male bowhead that was subsequently harvested. As described in Hunt et al. (2014), baleen whales with elevated fecal glucocorticoids have been shown to reflect exposure to various acute and chronic stressors. While the Western Arctic bowhead stock is increasing at a relatively strong rate of 3.7 percent per year, these results indicate that entanglement in commercial fishing gear poses a direct threat to Western Arctic bowhead whales and that the issue warrants further monitoring and consideration. At the 2018 AEWC annual convention of whaling captains, the Alaska Bering Sea Crabbers attended and gave a presentation on their operations. In the discussion, they indicated their interest in engaging with AEWC and NSB to increase communication regarding bycatch, help determine the source of recovered gear (whether active or ghost gear), and availability to examine any new gear recovered from whales to assess gear-type and origin (Craig George, pers. comm; 2018).

3.2.7 Vessel Traffic

Shipping lanes in Northern Sea Route and the Northwest Passage to Europe and North America from Asia are now in use by cargo ships and fuel tankers, and there is projected to be as much as a 500% increase in traffic between 2015 and 2025 (Azzara et al. 2015). In response to increased Arctic shipping traffic (**Fig 3.2.7-1**), the United States and Russian Federation have proposed a system of voluntary two-way routes for all domestic and international ships to follow in the Bering Strait and Bering Sea (IMO 2017) (**Fig 3.2.7-2**). A similar effort for U.S. waters north of the Bering Strait and through the Alaskan Beaufort Sea is expected to commence in 2018.

Currently, vessel traffic in arctic waters is associated with extractive industries, commercial shipping, village resupply, and marine research, although cruise-based tourism is also beginning to occur. Variables that help determine whether marine mammals are likely to be disturbed by vessels include the number of vessels in an area, the distance from a vessel, vessel speed and direction, vessel noise, vessel type or size, and activity of the marine mammal. This increase in vessel traffic could result in an increased number of vessel collisions with bowhead whales (Huntington et al. 2015). Currently, ship-strike injuries appear to be uncommon on bowhead whales in Alaska (George et al., 2017b). Only ten whales harvested between 1990 and 2012 (approximately two percent of the total sample) showed clear evidence of scarring from ship propeller injuries. However, it should be noted that animals struck and killed immediately would not be available to hunters and therefore would not be reported; therefore, this estimate should be considered a minimum estimate.

Since the early 1990s, the Alaska Eskimo Whaling Commission, through its Open Water Season Conflict Avoidance Agreement with offshore oil and gas interests, has imposed vessel routing and speed guidelines that apply to vessels traveling in the vicinity of bowhead whales. The Agreement also calls for marine mammal observers to be stationed on vessels to ensure that the guidelines are observed. In recent years, as non-oil and gas-related vessel traffic in northern Alaskan waters, including marine research and cruise tourism, has increased, it is apparent that measures beyond the Conflict Avoidance Agreement are needed. In 2012 the Alaska Eskimo Whaling Commission, North Slope Borough, and other northern Alaska stakeholder groups, in consultation with the U.S. Coast Guard, established the Arctic Waterways Safety Committee. The Committee, established under the U.S. guidelines for Harbor Safety Committees, is in the process of developing an Arctic Waterways Safety Plan for U.S. waters extending from the northern Bering Sea to the border with Canada. The goal of these efforts is to protect bowhead whales from vessel interactions and to ensure the safety of subsistence hunters operating from small craft in the same waters as larger ocean-going vessels. See additional discussion of these initiatives in the following section.

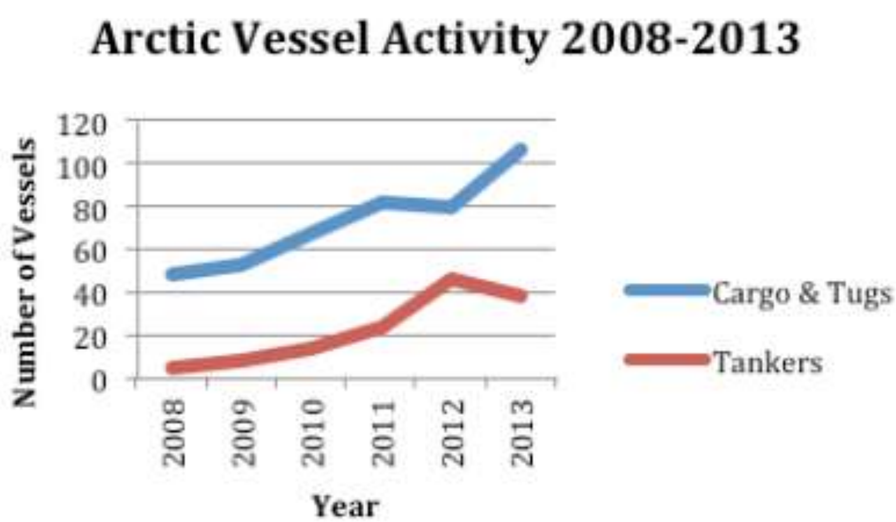

Figure 3.2.7-1. Increase in Arctic vessel activity from 2008-2013 (Azzara et al. 2015).

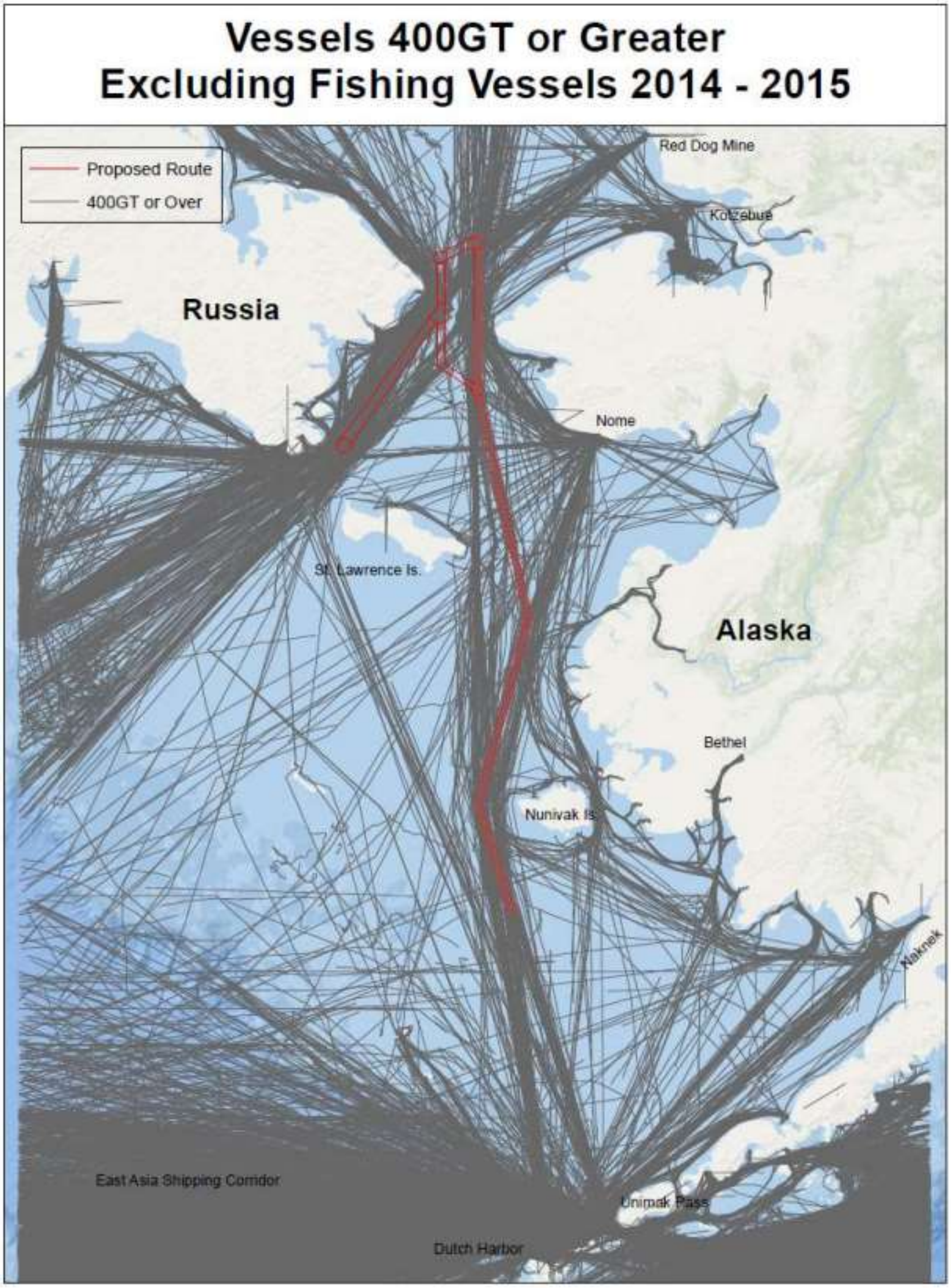

Figure 3.2.7-2. Vessel track lines for vessels of 400 gross tons or greater (excluding fishing vessels), with proposed United States and Russian Federation two-way vessel traffic routes in the Bering Strait and Bering Sea shown in red.

3.2.8 Offshore Activities, Petroleum Extraction

Oil and gas exploration and development were increasingly active in the Chukchi and Beaufort Sea through 2016 in portions of the Western Arctic bowhead whale stock habitat. Since then, activity decreased substantially because of low oil prices. Extensive information about the effects of oil and gas activities on bowhead whales is discussed in several documents. Biological opinions have been prepared by NMFS for the following projects:

(1) SAExploration, Inc. (SAE) 3D OBN Open-Water Seismic exploration in the Beaufort Sea, AK (NMFS, 2015a);

(2) Hilcorp Shallow Geohazard and Strudel Scour Surveys in Foggy Island Bay, Beaufort Sea, AK (NMFS, 2015b);

(3) Shell Exploration Drilling Program in the Chukchi Sea, AK (NMFS, 2015c);

(4) Lease Sale 193 Oil and Gas Exploration Activities, Chukchi Sea, Alaska (NMFS 2015d);

(5) SAExploration, Inc. (SAE) 3D OBN Open-Water Seismic in Colville River Delta, AK (NMFS, 2014a);

(6) BP Exploration (BPXA) Shallow Geohazard Survey Foggy Island Bay, Beaufort Sea, AK (2014b);

(7) BP Exploration (BPXA) 3D OBS Open-Water Seismic Survey Prudhoe Bay, Beaufort Sea, AK (2014c).

Additional biological opinions addressing federally funded, authorized, or conducted activities within the range of bowhead whales can be found at: https://alaskafisheries.noaa.gov/pr/biological-opinions. Many National Environmental Policy Act documents, such as Environmental Impact Statements, for Oil and Gas development operations, can be found at the Bureau of Ocean Energy Management (BOEM) Alaska Outer Continental Shelf (OCS) Region website: https://www.boem.gov/Alaska-Region/.

There have been 19 federal oil and gas lease sales proposed within the Alaskan Beaufort and Chukchi Seas, beginning with the Joint State of Alaska - Federal Sale held in December 1979 (BOEM Alaska website at https://www.boem.gov/Alaska-Leasing/, accessed 1/29/2018). The most recent federal lease sale in the Beaufort Sea planning area was Lease Sale 202, held on

April 18, 2007. Three federal lease sales for the OCS were in the Chukchi Sea planning area between 1979 and 2008. Most recently, Chukchi Sea Lease Sale 193 was held in February 2008, and resulted in the sale of 487 leases totaling approximately 2.8 million acres in the Chukchi Sea planning area (Bureau of Ocean Energy Management, Regulation and Enforcement [BOEMRE 2011a]). As a result of a lawsuit challenging the sale, the U.S. District Court for the District of Alaska remanded Sale 193 f or further analysis pursuant to NEPA. After issuance of a Supplemental Environmental Impact Statement (SEIS) (OCS EIS/EA BOEMRE 2011a) in August 2011, the Department of the Interior filed a Record of Decision affirming the sale of the 487 leases under Lease Sale 193. The Ninth Circuit Court of Appeals remanded Sale 193 for still further analysis pursuant to NEPA in January 2014. A second supplemental EIS was released in February 2015 and in March 2015, BOEM issued a Record of Decision affirming lease sale 193.

There are presently two offshore production facilities within state waters in the Beaufort Sea: (1) Northstar, and (2) Endicott. Another offshore facility, Liberty, is planned for OCS waters off Foggy Island Bay (BOEM 2017). Five exploration wells were drilled in the Chukchi Sea planning area between 1989 and 1991, while another well was drilled in 2015. As of January 2018, no commercial oil production has occurred in the Chukchi Sea.

The potential effects of exploration and development projects and leasing of the OCS have been considered in the biological opinions regarding oil and gas leasing and exploration activities and oil production facilities (NMFS,2014a, 2014b, 2014c, 2015a, 2015b, 2015c, 2015d). These oil and gas activities include seismic exploration, geophysical exploration, icebreaking, and drilling, all of which introduce noise into the marine environment that may disturb bowhead whales. Additional information on recent and planned oil and gas exploration and development activity is in **Section 4.6.1.1** and **Section 4.6.1.2**.

Anthropogenic noise has been shown to cause avoidance behavior in migrating bowhead whales (see Southall et al. 2007 for a full discussion on anthropogenic noise and bowhead whales). Seismic activities and the use of icebreakers to support OCS activities present the highest probability for avoidance of any of the activities associated with oil exploration (NMFS, 2006; Hildebrand 2009). Studies have shown noise from icebreakers may be detected by acoustic instruments at distances exceeding 100+ kilometers (Roth et al. 2013; Geyer et al. 2016). It is reasonable, therefore, to assume that bowheads could also detect such noise at this distance. The distance at which migrating bowheads may react to noise is poorly described, however, Richardson (1999) indicated that migrating bowheads are essentially excluded from waters within 20 km of a seismic operation, but more recent work has shown that bowhead whale reactions to seismic noise are very behavior-dependent (Southall et al. 2007). Blackwell et al. (2013) found bowhead calling rates dropped significantly near seismic operations, which they later showed was the reaction to a noise level of ~ 127 dB re 1 μPa^2-s, with calling ceasing altogether at ~160 dB re 1 μPa^2-s (Blackwell et al., 2015). They also showed that calling rates began to increase as soon as airgun pulses were detectable, leveling off around 94 dB re 1 μPa^2-s (Blackwell et al., 2015). Elevated sound levels in the marine environment could alter the hearing ability of whales, causing temporary or permanent threshold shifts if the sound levels are sufficiently high and the bowheads are in close proximity to the noise source (Guerra et al. 2011). While, at present, researchers have insufficient information on the hearing ability and sensitivities of bowhead whales to adequately describe this potential, it is generally understood that whales hear within similar frequency ranges of their vocalizations, which for bowheads seem to be in the range of 25-900 Hz with "songs" up to 5 kHz (Cummings and Holliday, 1998). Available information indicates that most continuous and impulsive underwater noise levels would be at levels or durations below those expected to injure hearing mechanisms. Nonetheless, marine seismic activities may present concerns with respect to hearing, which could impact the long-term survival of bowhead whales exposed to anthropogenic noise.

Since 1985, the AEWC has engaged in a project known as the Open Water Season Conflict Avoidance Agreement (CAA). This project involves annual negotiations with offshore exploration and development companies to reduce industrial impacts during bowhead whale migration, both to whales and to key areas of habitat for migrating bowhead whales. The Alaska Waterways Safety Committee (AWSC) was established in October 2014 as a self-governing multi-stakeholder (subsistence Hunters, industry, and other representatives) group focused on creating or documenting best practices to ensure a safe, efficient, and predictable operating environment for all users of the arctic waterways.

Seismic Surveys. Seismic surveys in marine waters in Alaska typically occur in the summer and fall when there is little ice on the ocean. These surveys are accomplished by sending sound waves down into the substratum (through the use of airguns) and receiving information about its oil-bearing potential based on the speed and strength of the returning echoes (National Research Council [NRC], 2003). Three types of offshore seismic surveys have occurred on the North Slope: marine streamer three-dimensional (3-D) and two-dimensional (2-D) surveys, ocean-bottom-cable seismic surveys, and high-resolution site-clearance surveys. Marine streamer 3-D and 2-D surveys involve a marine vessel that tows source arrays (airguns to generate acoustic energy) and passive-listening receiver equipment (called "streamers") to obtain geophysical data (MMS, 2006b). Streamers consist of long cables with multiple hydrophones that receive the echoes from the source energy as it bounces off the various substrata of the ocean floor. Airguns are the acoustic source for 3-D and 2-D seismic surveys.

Airgun arrays for both 3-D and 2-D seismic surveys emit pulsed rather than continuous sounds (MMS, 2006b, BOEM 2015). Airgun output usually is specified in terms of zero-to-peak or peak-to-peak levels (MMS, 2006b; Richardson et al., 1995a). Peak-to-peak values are about six decibels (dB) higher than zero-to-peak values (Richardson et al., 1995a). Airgun sizes refer to total airgun chamber volumes in cubic inches (in3), and individual guns may vary in size from a few tens to a few hundreds of cubic inches (MMS, 2006b). The sound-source level (zero-to-peak) associated with both 3-D and 2-D seismic surveys in Alaska can be as high as 240 dB relative to 1 microPascal at 1 meter (dB re 1 μPa at 1 m)[15] (MMS, 2006b). Seismic sounds vary, but a typical 2-D/3-D seismic survey with multiple guns would emit most energy at about 10-120 hertz (Hz), and pulses can contain energy up to 500-1,000 Hz (Richardson et al., 1995a). Goold and Fish (1998) recorded a pulse range of 200 Hz-22 kilohertz (kHz) from a 2-D survey using a 2,120-cubic-inch-array. While most of the energy is directed toward the ocean bottom and the short duration of each pulse limits the total energy, the sound can propagate horizontally for several kilometers (Greene and Richardson, 1988; Hall et al., 1994). In waters 25-50 m deep, sound produced by airguns can be detected 50-75 km away, and these detection ranges can exceed 100 km in deeper water (Richardson et al., 1995a). Blackwell et al. (2013) have received level measurements of >500K airgun pulses. Guerra et al. (2011) were able to show that the reverberation from air gun pulses could increase natural ambient levels out to >120 km. It is suspected that close proximity or long-term exposure to airgun noise could have effects on marine mammals, including hearing loss and elevated stress levels; it could also elicit behavioral disruptions (Richardson, 1995; Richardson and Würsig, 1995).

In any year in which offshore seismic activities occur in the Beaufort Sea, many migrating bowheads may be “taken” by harassment, as evidenced by changes in migratory behavior. In 2000, NMFS estimated the level of seismic takes between 1,275 and 2,550. While high noise levels may affect whale hearing, or impact whales’ use of sound to communicate or navigate, studies on seismic research in the Beaufort Sea show that such effects on bowhead whales are likely temporary, typically below exposure levels likely to cause serious injury or death, and therefore unlikely to prevent the survival and recovery of this species, provided these activities are properly authorized and mitigated. Typical monitoring and mitigation activities for seismic include:

- NMFS-approved protected species observers (PSOs) document the number and species of marine mammals exposed to sounds from airguns, as well as the behavior and responses of marine mammals to project-related activities;

[15] Sound pressure level (SPL) is typically measured in dB, which are a logarithmic unit that indicates the ratio of a physical quantity relative to a specified reference level. The standard reference level for sound pressure in water (through which sound waves propagate more efficiently than through air) is one microPascal (1 μPa), a measure of pressure. In underwater acoustics, the *source level* of a sound represents the pressure level at a certain distance, usually one meter, from the source, relative to one microPascal; thus, source levels are described using units of dB re 1 μPa at 1 m. The *received level* is the level of the sound at the listener's actual distance from the source; this is the value represented by the scientific phrase dB re 1 μPa rms (rms = root mean square, a statistical measure of the amplitude of the variable intensity of a sound wave).

- Passive acoustic monitoring (PAM) is used to improve detection, identification, and localization of cetaceans and to alert visual observers when vocalizing cetaceans are detected;

- Exclusion zones are established within which marine mammals could be exposed to received sound levels associated with injury;

- Airgun shutdown procedures are implemented during the activity when marine mammals are detected within or about to enter the exclusion zone, to reduce the noise exposure level to below that which could cause injury to marine mammals and to reduce sound output overall when animals are close to the vessel, and;

- Airgun ramp-up procedures are implemented when the array is started, to provide marine mammals with a warning and to allow marine mammals to vacate the area.

The deflection of bowheads from known migratory routes, however, does affect bowhead whale hunters. According to TEK, hunters were unable to find whales or bearded seals during seismic activities (B. Rexford, former Chair of the AEWC, Pers. comm.; H. Aishanna, Kaktovik Whaling Captain, Pers. comm., Kaktovik Whaling Captains Association, Pers. comm.). Research on the effects of offshore seismic exploration in the Beaufort Sea, supported by the testimony of Iñupiat hunters based on their experience, has shown that bowhead whales avoid these operations when within 20 km of the source and may begin to deflect at distances up to 35 km (Richardson et al., 1999).

High-resolution seismic surveys have been used by the oil and gas industry primarily to locate shallow hazards; obtain engineering data for placement of structures (e.g., proposed platform locations and pipeline routes); and detect geohazards, archaeological resources, and certain types of benthic communities (MMS, 2006b). All involved ships are designed to be quiet, as the higher frequencies used in high-resolution work are easily masked by the vessel noise if special attention is not paid to keeping the ships quiet. Airgun volumes for high-resolution surveys typically are 90-150 in^3, and the output of a 90 in^3 airgun ranges from 229-233 dB re 1 μPa at 1 m (MMS, 2006b). Airgun pressures typically are 2,000 pounds per square inch (psi), although they can be used at 3,000 psi under certain circumstances (MMS, 2006b). Marine geophysical research or other activities involving seismic airguns may introduce significant levels of noise into the marine environment and have been demonstrated to alter the behavior of migrating bowhead whales.

Drilling. After seismic surveys indicate that commercially feasible quantities of oil or gas may be present, exploratory drilling begins. Underwater noise levels from drill sites on natural or manmade islands are low, and inaudible at ranges beyond a few kilometers (Richardson et al., 1995a). Noise is transmitted very poorly from the drill rig machinery through land into the water (Richardson et al., 1995a). Drilling noise from icebound islands is generally confined to low frequencies and has a low source level. It would be audible at a range of 10 km only during unusually quiet periods; the usual audible range would be approximately 2 km (Richardson et al., 1995a). However, Davies (1997) concludes that bowheads were impacted much farther than 10 km away and avoided an active drilling rig at a distance of 20 km, and Schick and Urban (2000) found bowheads to avoid the rig at distances up to 50km. Similar to their work with airgun signals, Blackwell et al. (2017) again showed that sounds from drilling rigs have a multi-tiered effect on bowheads, with calling rates increasing once the drilling noise was detectable, leveling out at higher noise levels, and ceasing at high noise levels..

Under open water conditions, drilling sounds from islands may be detectable somewhat farther away, but the levels are still relatively low (Richardson et al., 1995a). Drilling noise from caisson-retained islands is much louder than natural or manmade islands (Richardson et al., 1995a). At least during open water conditions, noise is conducted more directly into the water at caisson-retained islands than at island drill sites. Noise levels are generally higher near drill ships than near semisubmersibles or caissons. The drill ship hull is well coupled to the water and semisubmersibles lack a large hull area. Machinery on semisubmersibles is mounted on decks raised above the sea on risers supported by submerged floating chambers. Sound and vibration paths to the water are through either the air or the risers, in contrast to the direct paths through the hull of a drill ship (Richardson et al., 1995a).

Acoustic research for the Northstar project, one of the activities covered under prior biological opinions, estimated that the numbers of bowhead whales that may have been deflected more than 2 km offshore due to that noise source ranged from 0 to 49 bowhead whales during 2001-2004. However, for the Liberty project (oil drilling conducted from a man-made island north of Foggy Island Bay), only 7 bowhead whales are expected to be subjected to MMPA Level B harassment take, while none are expected to experience Level A harassment during the first 5 years of the project (Hilcorp, 2018).

McDonald et al. (2012) showed that bowheads responded to industrial sounds at very low levels of received sounds. Often, the industrial sounds were below ambient. It is not clear whether their results indicated that bowheads deflected farther offshore or changed calling behavior, though the results did show that bowheads were very sensitive to low levels of anthropogenic sounds.

In summary, more sound is radiated underwater during drilling operations from drill ships than from semisubmersibles. In contrast, noise from drilling on natural islands radiates very poorly to water, making such operations relatively quiet. Noise levels from drilling platforms and certain types of caissons have not been well documented, but are apparently intermediate between those from vessels and islands (Richardson et al., 1995a), although they require the presence of many attending support vessels (Blackwell et al., 2017). By far, the noisiest exploratory activity is seismic surveys.

It should be noted that as exploration interest in the Beaufort Sea increased in the mid-2000s, the AEWC amended the Conflict Avoidance Agreement (CAA) to include restrictions on the disposal of drilling wastes into the water. Under the CAA, only seabed cuttings from the "top hole" may be discharged into the waters of the near shore Beaufort Sea. Once the top hole is established, all drilling waste must be re-injected or recovered and removed from the site.

Development. Once an economically viable discovery is made, development begins. This phase involves additional drilling, and the subsequent construction of roads; airstrips; and waste disposal, seawater treatment, gas handling, power generation, storage, maintenance, and residential facilities (NRC, 2003). McDonald et al. (2012) showed that ship sounds supporting a development island are some of the loudest sound sources associated with development. They also showed that bowheads respond most strongly to ship sounds. Greene (1983) measured noise under shorefast ice during winter construction of an artificial island near Prudhoe Bay. Roads were built on the sea ice and trucks hauled gravel to a site in water 12 m deep. At distances less than 3.6 km, there was no evidence of noise components above 1,000 Hz, and little energy below 1,000 Hz (Richardson et al., 1995a). Construction-related sounds did not propagate well in shallow water under the ice during winter (Richardson et al., 1995a).

Oil Spills. MMS investigated the probability of spilled oil contacting bowhead whales (MMS, 2002a). Specific offshore areas, termed Ice/Sea Segments were identified and modeled for probability of contact and overlay the migratory corridor of bowheads. Using data from the MMS oil spill analysis for Sale 170, and assuming an oil spill of 1,000 barrels or more occurred at any of several offshore release areas during the summer season, the chance of that oil contacting these regions within 30 days during the summer season ranged from 55 - 82%. Therefore, there is high variability from the effects of an oil spill impacting Ice/Sea Segment areas.

If an oil spill were concentrated in open water leads, it is possible that a bowhead whale could inhale enough vapors from a fresh spill to affect its health. The effects of oil contacting skin are largely speculative, but may include pre-disposing whales to infection. It has been suggested that if oil gets onto the eyes of bowhead whales it would enter the large conjunctival sac (Zhu, 1996) and move inward 4 to 5 inches (10 to 13 centimeters [cm]) and get behind most of the eye (T. Albert, NSB, Pers. comm.). The consequences of this event are uncertain, but some adverse effects are expected. Bowhead whales may ingest oil encountered on the surface of the sea during feeding, resulting in fouling of their baleen plates. Albert (1981) suggests that broken off baleen filaments and tar balls are of concern because of the structure of the bowhead's stomach and could cause a blockage within a narrow passage of the digestive system.

Engelhardt (1987) stated that bowhead whales are particularly vulnerable to effects from oil spills due to their use of ice edges and leads where spilled oil tends to accumulate. The impacts of oil exposure to the bowhead whale population would also depend upon how many animals contacted oil. If oil found its way into leads or ice-free areas frequented by migrating bowheads, a significant proportion of the population could be affected. The NSB believes there are some scenarios, such as an oil spill in a spring lead system near Utqiaġvik (Barrow), which could affect a large portion of the population. However, the likelihood of this is debatable, depending on how oil development proceeds (Craig George, North Slope Borough, Pers. comm., December 20, 2007).

While it is exceedingly difficult to predict the various aspects of an oil spill that would impact bowhead whales, it is reasonable to state that the numbers of whales that might be affected would be expected to be very small in terms of the current abundance. However, bowhead whales would be placed at particular risk in the event of a large oil spill occurring while the whales were migrating north through the Chukchi Sea, or east through the Beaufort Sea, traveling through the spring lead and polynya system. The number of whales affected may be much higher; however, as we must assume that the entire stock needs to make this migration to get to summering grounds. Whether such a spill would affect a significant portion of this population is uncertain.

Adult whales exposed to spilled oil likely would experience temporary, or perhaps permanent, effects. Recent work by Sformo et al. 2018 qualitatively confirms two previous studies by Geraci/St. Aubin and Braithwaite who also show that oil does not adhere well to baleen and would therefore be 'flushed' from the baleen plates and fringe hairs and not interfere with feeding to the degree described in NRC (2003). Prolonged exposure to freshly spilled oil could kill some whales, but the numbers are estimated to be small due to a low chance of such contact (MMS, 2006c). Studies of common bottlenose dolphins (*Tursiops truncates)* in Barataria Bay, Louisiana following the *Deepwater Horizon* oil spill provide evidence that a large oil spill can indeed affect cetaceans at the population level (Lane et al. 2015; Venn-Watson et al., 2015). However, there are no data available that definitively link a large oil spill with a significant population-level effect on a species of large cetacean.

While data from previous spills in other locations worldwide are broadly informative, there is uncertainty about the potential for population level effects or other potential outcomes should a large or very large spill occur in instances where whales are aggregated and/or constrained in their option for alternative routes (e.g., in the spring lead and polynya system due to ice conditions) or are aggregated in a feeding area, especially if aggregations contained large numbers of females and calves. The potential for a population level effect may exist if large numbers of females and calves, especially newborn or very young calves, were exposed to large amounts of freshly spilled oil. The uncertainty arises because:

(1) Of the unique ecology of the bowhead whale;
(2) Existing information about the effects of oil on very large cetaceans is inconclusive because of the challenges of studying large whales and, thus, it is not possible to confidently estimate the likelihood that serious injury to individual bowhead whales could or would occur with oil exposure;
(3) No agreement exists over the interpretation of post-Exxon Valdez oil-spill cetacean studies;
(4) There are not data sufficient to determine the vulnerability of newborn or other baleen calves to freshly spilled crude oil;
(5) It is very difficult, if not impossible, to obtain many of the kinds of data that have been gathered on some other marine mammals to assess acute or chronic adverse sublethal effects from an oil spill (or other affecters) on large cetaceans; and
(6) There is no other situation comparable to that which could exist if a large or very large oil spill occurred in, or moved into, the spring lead and polynya system[16], especially if this occurred when there were large numbers of females with newborn calves, occurred when calving was occurring, or occurred when hundreds of individuals were in the leads and polynya on their northward migration.

Most whales exposed to spilled oil could be expected to experience temporary, nonlethal effects from skin contact with oil, inhalation of hydrocarbon vapors, ingestion of oil-contaminated prey items, baleen fouling, reduction in food resources, or temporary displacement from some feeding areas. A few individuals may be killed as a result of exposure to freshly spilled oil. However, the combined probability of a spill occurring and also contacting bowhead habitat during periods when whales are present is considered to be low, and the percentage of the bowhead whale stock likely to be seriously affected by such a spill is expected to be very small. Contaminated food sources and displacement from feeding areas also may occur as a result of an oil spill, but NMFS has concluded it is unlikely that the availability of food sources for bowheads would be affected given the abundance of plankton resources in the Beaufort Sea (Bratton et al., 1993; NMFS, 2001).

[16] The NE Chukchi Sea lead system is a known bowhead whale calving area.

3.3 Other Wildlife

A wide variety of marine mammals, birds, and other marine organisms occurs in the area where Alaska Natives hunt for bowhead whales. These species are identified and discussed briefly below. Additional information about each marine mammal species can be found in Muto et al. (2017), and is hereby incorporated by reference.

3.3.1 Other Marine Mammals

Under the MMPA, marine mammals are protected by a prohibition on take; however, Section 101(b) of the MMPA generally provides that the provisions of the MMPA do not apply to subsistence hunting of marine mammals by Alaska Natives. The ESA contains a similar provision with respect to endangered or threatened species. Many Alaska Natives hunt a variety of marine mammals that occur within the range of the bowhead whale, including the spotted seal, bearded seal, ribbon seal, ringed seal, walrus, polar bear, and beluga whale,(NMFS 2009). A discussion of the current status and trends of all marine mammals that inhabit the area where Alaska Natives hunt for bowhead whales follows.

Spotted Seal. Spotted seals (*Phoca largha*) are distributed along the continental shelf of the Beaufort, Chukchi, Bering, and Okhotsk seas south to the western Sea of Japan and northern Yellow Sea (Shaughnessy and Fay, 1977). Eight main areas of spotted seal breeding have been reported (Shaughnessy and Fay 1977). On the basis of small samples and preliminary analyses of genetic composition, potential geographic barriers, and significance of breeding groups Boveng et al. (2009) grouped those breeding areas into three Distinct Population Segments (DPSs): The Bering DPS, which includes areas in the Beaufort, Chukchi and East Siberian seas; the Okhotsk DPS; and the Southern DPS, which includes spotted seals breeding in the Yellow Sea and Peter the Great Bay in the Sea of Japan.

Within the Bering Sea DPS, seals tagged with satellite-transmitters in the northeastern Chukchi Sea moved south in October and passed through the Bering Strait in November (Lowry et al., 1998). Spotted seals overwinter in the Bering Sea along the ice edge and tagged seals made east-west movements along the edge. During spring, seals tend to prefer small floes (i.e., less than 20 m in diameter), and inhabit mainly the southern margin of the ice in areas with water depths less than 200 m. Movement to coastal habitats occurs after the retreat of the sea ice (Fay, 1974; Shaughnessy and Fay, 1977; Lowry et al., 2000; Simpkins et al., 2003). Pups are born in the pack ice during March-April (Braham et al., 1984). In summer and fall, spotted seals use coastal haulouts (Frost et al., 1993; Lowry et al., 1998), and may be found as far north as 69° - 72° N in the Chukchi and Beaufort seas (Porsild, 1945; Shaughnessy and Fay, 1977).

A large segment (280,000 sq. km) of the breeding area was surveyed by helicopter from an icebreaker in the spring of 2007; the abundance of spotted seals was estimated using a model that incorporated variation due to detectability, availability (proportion hauled out), and changes in extent and concentration of sea ice during the surveys. The modal estimate of abundance was 233,700 spotted seals with a 95% credible interval of 137,300-793,100 (Ver Hoef et al., 2014). A more extensive fixed-wing aerial survey (767,000 sq. km) conducted during April-May of 2012 and 2013 encompassed the vast majority of the spotted seal breeding area. Analysis of a portion of the data, from 10 broadly distributed survey flights during 20-27 April 2012, resulted in a mean estimate of 460,268 spotted seals, with a 95% CI of 391,000-559,993 (Conn et al., 2014). The method accounted for uncertainty in detection rate and species classification, as well as availability. Currently, the Bering Sea DPS does not warrant listing under the ESA (74 FR 53683).

Spotted seals are an important species for Alaskan subsistence hunters, primarily in the Bering Strait and Yukon-Kuskokwim (Y-K) regions, with estimated annual harvests ranging from 850-3,600 seals taken during 1966-1976 (Lowry, 1984). As of August 2000, the subsistence harvest database indicated that the estimated number of spotted seals harvested for subsistence use per year was 5,265 animals (Muto et al. 2017). At this time, there are no efforts to quantify the total statewide level of harvest of spotted seals by all Alaska communities (Muto et al. 2017). The estimate of 5,265 spotted seals is the best estimate of harvest level currently available.

Bearded Seal. Bearded seals (*Erignathus barbatus*) are circumpolar in their distribution, extending from the Arctic Ocean south to Hokkaido in the western Pacific. In Alaskan waters, bearded seals occur on the continental shelves of the Bering, Chukchi, and Beaufort seas (Burns, 1981a; Johnson et al., 1966; Ognev, 1935). The majority of bearded seals move south with the seasonally advancing sea ice in winter (Burns, 1967). Pups are born in the pack ice from March through mid-May (Burns, 1967). In summer, many of the seals that winter in the Bering Sea move north through Bering Strait during April - June, and are distributed along the ice edge in the Chukchi Sea during the summer (Burns, 1967, 1981a). Some seals, particularly juveniles, may spend the summer in open-water areas of the Bering and Chukchi seas (Burns, 1981a).

Reliable estimates of abundance, abundance trends, and stock structure are not available. As part of a status review of the bearded seal, Cameron et al. (2010) defined longitude 112° W in the Canadian Arctic Archipelago as the North American delineation between the two subspecies, *E.b. barbatus* and *E. b. nauticus*, and 145° E as the Eurasian delineation between the two subspecies. Based on evidence for discreteness and ecological uniqueness of bearded seals in the Okhotsk Sea, the *E. b. nauticus* subspecies was further divided into an Okhotsk DPS and a Beringia DPS (that includes seals in the continental shelf waters of the Bering, Chukchi, Beaufort, and East Siberian seas). Early estimates of the Bering-Chukchi Sea stock range from

250,000 to 300,000 animals (Popov, 1976; Burns, 1981a; Burns et al., 1981a). A reliable population estimate for the entire stock is not available, but research programs have recently developed new survey methods and partial, but useful, abundance estimates. In spring of 2012 and 2013, U.S. and Russian researchers conducted aerial abundance and distribution surveys over the entire Bering Sea and Sea of Okhotsk (Moreland et al., 2013). The data from these image-based surveys are still being analyzed, but Conn et al. (2014), using a very limited sub-sample of the data collected from the U.S. portion of the Bering Sea in 2012, calculated an abundance estimate of approximately 299,174 (95% CI: 245,476-360,544) bearded seals in U.S. waters. These data do not include bearded seals that were in the Chukchi and Beaufort seas at the time of the surveys.

On December 28, 2012, NMFS listed the Beringia DPS bearded seal (*E. b. nauticus*) and, thus, the Alaska stock of bearded seals, as threatened under the ESA (77 FR 76740). The primary concern for this population is the ongoing and projected loss of sea-ice cover stemming from climate change, which is expected to pose a significant threat to the persistence of these seals in the near future (based on projections through the end of the 21st century; Cameron et al. 2010). On July 25, 2014, the U.S. District Court for the District of Alaska issued a decision vacating NMFS' listing of the Beringia DPS of bearded seals as a threatened species (*Alaska Oil and Gas Association, et al. v. Pritzker,* Case No. 4:13-cv-00018-RPB). However, on October 24, 2016, the U.S. Court of Appeals for the Ninth Circuit reversed the judgment of the District Court, and the Supreme Court subsequently declined to hear an appeal of the Ninth Circuit's decision. *See Alaska Oil and Gas Association, et al. v. Pritzker*, 840 F. 3d 671 (9th Cir. 2016), *cert. denied*, 583 U.S. ____ (U.S. Jan. 22, 2018). Therefore, the ESA listing remains in effect at this time.

Bearded seals are an important species for Alaskan subsistence hunters. Approximately 64 Alaska Native communities in western and northern Alaska, from Bristol Bay to the Beaufort Sea, regularly harvest ice seals (Ice Seal Committee 2016). The Ice Seal Committee, as co-managers with NMFS, recognizes the importance of harvest information and has collected it since 2008, when funding and personnel have allowed. Annual household survey results compiled in a statewide harvest report include historical ice seal harvest information back to 1960 (Quakenbush et al. 2011). This report is used to determine where and how often harvest information was collected and where to focus in the future (Ice Seal Committee 2016). Information for 2009-2013 is available for 12 communities (Point Lay, Kivalina, Noatak, Buckland, Deering, Emmonak, Scammon Bay, Hooper Bay, Tununak, Quinhagak, Togiak, and Twin Hills) (Table 2); but more than 50 other communities harvest bearded seals and have not been surveyed in this time period or have never been surveyed. Harvest surveys are designed to estimate harvest within the surveyed community, but because of differences in seal availability, cultural hunting practices, and environmental conditions, extrapolating harvest numbers beyond that community is not appropriate. For example, during 2009-2013, only 12 of 64 coastal communities were surveyed for bearded seals; and, of those communities, only 6 were surveyed for two or more consecutive years (Ice Seal Committee 2016). Based on the harvest data from 12 communities, a minimum estimate of the average annual harvest of bearded seals in 2009-2013 is 390 seals (Muto et al., 2017).

Ribbon Seal. Ribbon seals (*Phoca fasciata*) inhabit the North Pacific Ocean and adjacent parts of the Arctic Ocean. In Alaska waters, ribbon seals range from the North Pacific Ocean and Bering Sea into the Chukchi and western Beaufort seas. From late March to early May, ribbon seals inhabit the Bering Sea ice front (Burns 1970, 1981; Braham et al. 1984). Ribbon seals are very rarely seen on shorefast ice or land. They are most abundant in the northern part of the ice front in the central and western parts of the Bering Sea (Burns 1970, Burns et al. 1981). As the ice recedes in May to mid-July, the seals move farther to the north in the Bering Sea, where they haul out on the receding ice edge and remnant ice (Burns 1970, 1981; Burns et al. 1981). As the ice melts, seals become more concentrated, with at least part of the Bering Sea population moving towards the Bering Strait and the southern part of the Chukchi Sea. By the time the Bering Sea ice recedes through the Bering Strait, there is usually only a small number of ribbon seals hauled out on the ice. Ten ribbon seals tagged in the spring of 2005 near the eastern coast of Kamchatka spent the summer and fall throughout the Bering Sea and Aleutian Islands. However, of 72 ribbon seals satellite tagged in the central Bering Sea during 2007-2010, only 21 (29%) moved to the Bering Strait, Chukchi Sea, or Arctic Basin as the ice retreated northward. About 9.5% of ribbon seals' time budget during July through October was in those areas. The majority of the seals tagged in the central Bering Sea did not pass north of the Bering Strait. These seals, and the 10 seals tagged in 2005 near Kamchatka, dispersed widely, occupying coastal areas as well as the interior of the Bering Sea, both on and off the continental shelf (Boveng et al., 2013). Year-long passive acoustic sampling on the Chukchi Plateau from autumn 2008-2009 detected ribbon seal calls only in October and November 2008 (Moore et al., 2012).

A reliable population estimate for the entire stock is not available, but research programs have recently developed new survey methods and partial, but useful, abundance estimates. In spring of 2012 and 2013, U.S. and Russian researchers conducted aerial abundance and distribution surveys of the entire Bering Sea and Sea of Okhotsk (Moreland et al. 2013). The data from these image-based surveys are still being analyzed, but Conn et al. (2014), using a very limited sub-sample of the data collected from the U.S. portion of the Bering Sea in 2012, calculated an abundance estimate of approximately 184,000 (95% CI: 145,752-230,134) ribbon seals in those waters. Though this should be considered only a preliminary estimate, it is appropriate to consider this a reasonable estimate for the entire U.S. population of ribbon seals because few ribbon seals are expected to be north of the Bering Strait in the spring when these surveys were conducted. When the final analyses for both the Bering and Okhotsk seas are complete they should provide the first range-wide estimates of ribbon seal abundance (Muto et al. 2017). An

ESA status review of the ribbon seal was completed in 2008 (Boveng et al. 2008), at which time NMFS determined that listing ribbon seals was not warranted at this time (73 FR 79822).

Ribbon seals are an important resource for Alaska Native subsistence hunters. The Ice Seal Committee, as co-managers with NMFS, recognizes the importance of harvest information and has been collecting it since 2008 as funding and available personnel have allowed. Annual household survey results are compiled in a statewide harvest report that includes historical ice seal harvest information back to 1960. This report is used to determine where and how often harvest information has been collected and where efforts need to be focused in the future (Ice Seal Committee 2014). Current information, within the last 5 years, is available for 11 communities (Kivalina, Noatak, Buckland, Deering, Emmonak, Scammon Bay, Hooper Bay, Tununak, Quinhagak, Togiak, and Twin Hills) (Table 2), but more than 50 other communities harvest ribbon seals and have not been surveyed in the last 5 years or have never been surveyed. Harvest surveys are designed to confidently estimate harvest within the surveyed community, but because of differences in seal availability, cultural hunting practices, and environmental conditions, extrapolating harvest numbers beyond that community is misleading. For example, during the past 5 years (2009-2013), only 11 of the 64 coastal communities have been surveyed for ribbon seals and of those only 6 have been surveyed for two or more consecutive years (Ice Seal Committee 2015). Based on the harvest data from these 11 communities (Table 2), a minimum estimate of the average annual harvest of ribbon seals in 2009-2013 is 3.2 seals.

Ringed Seal. Ringed seals (*Phoca hispida*) have a circumpolar distribution and are found in all seasonally ice-covered seas of the Northern Hemisphere as well as in certain freshwater lakes (King 1983). Most taxonomists currently recognize five subspecies of ringed seals of which *Phoca hispida hispida* occurs in the Arctic Ocean and Bering Sea (Kelly et al., 2010a).

Throughout their range, ringed seals have an affinity for ice-covered waters and are well adapted to occupying both shorefast and pack ice (Kelly 1988a). They remain with the ice most of the year and use it as a platform for pupping and nursing in late winter to early spring, for molting in late spring to early summer, and for resting at other times of the year. This species rarely comes ashore in the Arctic; however, in more southerly portions of its range where sea or lake ice is absent during summer and fall, ringed seals are known to use isolated haul-out sites on land for molting and resting (Härkönen et al. 1998, Trukhin 2000, Kunnasranta 2001, Lukin et al. 2006). In Alaska waters, during winter and early spring when sea ice is at its maximal extent, ringed seals are abundant in the northern Bering Sea, Norton and Kotzebue Sounds, and throughout the Chukchi and Beaufort seas. They occur as far south as Bristol Bay in years of extensive ice coverage but generally are not abundant south of Norton Sound except in nearshore areas (Frost 1985). Although details of their seasonal movements have not been adequately documented, most ringed seals that winter in the Bering and Chukchi seas are thought to migrate north in spring as the seasonal ice melts and retreats (Burns 1970) and spend summers in the pack ice of the northern Chukchi and Beaufort seas, as well as in nearshore ice remnants in the Beaufort Sea (Frost 1985). During summer, ringed seals range hundreds to thousands of kilometers to forage along ice edges or in highly productive open-water areas (Harwood and Stirling 1992, Freitas et al. 2008, Kelly et al. 2010b, Harwood et al. 2015). With the onset of freeze-up in the fall, ringed seal movements become increasingly restricted. Seals that have summered in the Beaufort Sea are thought to move west and south with the advancing ice pack, with many seals dispersing throughout the Chukchi and Bering seas while some remain in the Beaufort Sea (Frost and Lowry 1984, Crawford et al. 2012, Harwood et al. 2012). Some adult ringed seals return to the same small home ranges they occupied during the previous winter (Kelly et al. 2010b).

Though a reliable population estimate for the entire Alaska stock is not available, research programs have recently developed new survey methods and partial, but useful, abundance estimates. In spring of 2012 and 2013, U.S. and Russian researchers conducted aerial abundance and distribution surveys of the entire Bering Sea and Sea of Okhotsk (Moreland et al. 2013). The data from these image-based surveys are still being analyzed, but Conn et al. (2014), using a very limited sub-sample of the data collected from the U.S. portion of the Bering Sea in 2012, calculated an abundance estimate of about 170,000 ringed seals. This estimate did not account for availability bias and did not include ringed seals in the shorefast ice zone, which were surveyed using a different method. Thus, the actual number of ringed seals in the U.S. sector of the Bering Sea is likely much higher, perhaps by a factor of two or more.

On December 28, 2012, NMFS listed Arctic ringed seals (*P. h. hispida*) and, thus, the Alaska stock of ringed seals, as threatened under the ESA (77 FR 76706). The primary concern for this population is the ongoing and anticipated loss of sea ice and snow cover stemming from climate change, which is expected to pose a significant threat to the persistence of these seals in the foreseeable future (based on projections through the end of the 21st century; Kelly et al. 2010a). Because of its threatened status under the ESA, this stock was designated as depleted under the MMPA. As a result, the stock was classified as a strategic stock. On March 11, 2016, the U.S. District Court for the District of Alaska issued a decision vacating NMFS' listing of Arctic ringed seals as a threatened species (*Alaska Oil and Gas Association, et al. v. Pritzker*, Case No. 4:14-cv-00029-RPB). However, on February 12, 2018, the U.S. Court of Appeals for the Ninth Circuit reversed the judgment of the District court. *See Alaska Oil and Gas Association, et al. v. Ross*, Case No. 16-35380 (9th Cir. filed Feb. 12, 2018). Therefore, the ESA listing remains in effect at this time.

Ringed seals are an important species for Alaska Native subsistence hunters. Information for 2009-2013 is available for 12 communities (Point Lay, Kivalina, Noatak, Buckland, Deering, Emmonak, Scammon Bay, Hooper Bay, Tununak, Quinhagak, Togiak, and Twin Hills) (Table

3), but more than 50 other communities harvest ringed seals and have not been surveyed in this time period or have never been surveyed. Harvest surveys are designed to estimate harvest within the surveyed community, but because of differences in seal availability, cultural hunting practices, and environmental conditions, extrapolating harvest numbers beyond that community is not appropriate. For example, during 2009-2013, only 12 of 64 coastal communities were surveyed for ringed seals; and, of those communities, only 6 were surveyed for two or more consecutive years (Ice Seal Committee 2016). Based on the harvest data from these 12 communities, a minimum estimate of the average annual harvest of ringed seals in 2009-2013 is 1,050 seals.

Pacific Walrus. The Pacific walrus (*Odobenus rosmarus*) range throughout the continental shelf waters of the Bering and Chukchi Seas, occasionally moving into the East Siberian Sea and the Beaufort Sea. During the summer months most of the population migrates into the Chukchi Sea; however, several thousand animals, primarily adult males, aggregate near coastal haulouts in the Gulf of Anadyr, Russia; Bering Strait, and Bristol Bay, Alaska. During the winter breeding season walruses are found in three concentration areas of the Bering Sea where open leads, polynyas, or thin ice occur (Fay et al. 1984, Garlich-Miller et al. 2011a). While the specific location of these groups varies annually and seasonally depending upon the extent of the sea ice, generally one group occurs near the Gulf of Anadyr, another south of St. Lawrence Island, and a third in the southeastern Bering Sea south of Nunivak Island into northwestern Bristol Bay. However, Pacific walruses are currently managed as a single panmictic population. Scribner et al. (1997) found no difference in mitochondrial and nuclear DNA among walruses sampled shortly after the breeding season from four areas of the Bering Sea (Gulf of Anadyr, Koryak Coast, Southeast Bering Sea, and St. Lawrence Island).

Pacific walruses typically use sea-ice as a resting platform between feeding dives, as a birthing substrate, for shelter from storms, isolation from predators, and passive transportation (Fay 1982). Historically, the summer distribution of walruses in the Chukchi Sea occurred primarily on sea ice over the continental shelf from the Alaska to Chukotka coasts with large numbers of animals near Hanna Shoal in the United States and Wrangel Island in the Russian Federation. A few animals would be observed utilizing haulouts along both the Alaska and Chukotka coasts, particularly in the fall. While the overall geographic range of Pacific walruses has not changed, over the past decade the number of walruses coming to shore along the coastline of the Chukchi Sea in both Alaska and Chukotka has increased from the hundreds to thousands to greater than 100,000 (Kavry et al. 2008, Garlich-Miller et al. 2011a, Jay et al. 2011). Additionally, adult female and young walruses are arriving at these coastal haulouts as much as a month earlier and staying at the coastal haulouts a week or two longer. In fall 2007, 2009, 2010, and 2011 large walrus aggregations (3,000 to 20,000) were observed along the Alaska coast (Garlich-Miller et al. 2011a). This increased use of coastal haulouts is a function of the loss of summer sea ice over the continental shelf (Garlich-Miller et al. 2011a). Summer sea ice extent in the Chukchi Sea has decreased by about 12% per decade (NSIDC 2012); retreating off the shallow continental shelf and remaining only over deep Arctic Ocean waters where walruses cannot reach the benthos to feed. Declines in Chukchi Sea ice extent, duration, and thickness are projected to continue in a linear fashion into the foreseeable future (Douglas 2010).

The current size and trend of the Pacific walrus population is unknown (Gorbics et al., 1998; Allen and Angliss, 2011; Speckman et al., 2011). The total initial estimate of 270,000 to 290,000 animals in 1980 was later adjusted to about 290,700 to 310,000 (Fay et al. 1997). A joint U.S. - Russia survey in 2006 led to a minimum estimate of 129,000 (95% CI 55,000-507,000) walrus for the ice habitat areas surveyed (Speckman et al. 2011).

Subsistence harvest mortality levels in the U.S. for 2006 - 2010 ranged from 3,828 to 6,119 animals per year (USFWS, 2012a). Pacific walrus are not designated as depleted under the MMPA. Further, the USFWS announced on 4 October 2017 that the listing of the Pacific walrus as threatened or endangered under the ESA was not warranted. The species is no longer listed as a candidate species under the ESA.

Polar Bear. Polar bears (*Ursus maritimus*) are circumpolar in their distribution in the northern hemisphere. Two stocks occur in Alaska: the Chukchi/Bering seas stock and the Southern Beaufort Sea stock. Polar bear movements are extensive and individual activity areas are enormous. Amstrup and DeMaster (1988) estimated the Alaska population (both stocks) at 3,000 to 5,000 animals based on densities calculated previously by Amstrup et al. (1986). The Chukchi Sea population is estimated to comprise 2,000 animals, based on extrapolation of aerial den surveys (Lunn et al. 2002). Estimates of the population have been derived from observations of dens and aerial surveys (Chelintsev 1977, Stishov 1991a, Stishov 1991b, Stishov et al. 1991); however, these estimates have wide confidence intervals and are considered to be of little value for management and cannot be used to evaluate status and trends for this population.

A population estimate of 1,526 (95% CI=1211−1841; Coefficient of Variation [CV] =0.106) (Regehr et al. 2006) for the Southern Beaufort Sea stock, which is based on open population capture-recapture data collected from 2001 to 2006, is considered the most current and valid population estimate. Polar bears in both stocks are currently classified as depleted under the MMPA and listed as threatened under the ESA (73 FR 28212). Critical habitat was designated December 7, 2010 and includes 464,924 sq. km of sea-ice habitat, 14,652 sq. km of terrestrial denning habitat, and 10,576 sq. km of barrier island habitat (75 FR 76086).

Prior to the twentieth century, when primarily Alaska Natives hunted Alaska’s polar bears, both stocks probably existed near K. The size of the Beaufort Sea stock appeared to decline substantially in the late 1960s and early 1970s due to excessive harvest rates when sport hunting was legal. Similar declines could have occurred in the Chukchi Sea, although data are unavailable to test that assumption. Since passage of the MMPA, only subsistence harvests by Alaska Natives have been permitted and overall harvest rates have declined.

As described in Rode et al. (2013) body size, condition, and reproductive indices of Chukchi/Bering Seas polar bears did not decline over time between 1986–1994 and 2008–2011 despite a 44-day increase in the number of reduced ice days. Chukchi and Bering Seas bears were larger, in better condition, and appeared to have higher recruitment compared to the adjacent southern Beaufort Sea population during 2008–2011.

The annual harvest from the Chukchi/Bering seas stock was 92 per year in the 1980s, 49 per year in the 1990s, and 43 per year in the 2000s. More recently, the 2003−2007 average Alaska harvest for the Chukchi/Bering seas stock in Alaska was 37 and the sex ratio was 66M to 34F (Muto et al. 2017). During the 1980−2007 period the Alaska harvest from the Southern Beaufort Sea accounted for 34% of the total Alaska kill (annual mean=33 bears) with the remaining 66% occurring in the Chukchi Sea. The sex ratio of the harvest from 1980−2007 in the Southern Beaufort Sea was 69M to 31F.

Gray Whale. Gray whales (*Eschrichtius robustus*) occur across the coastal and shallow water areas of both the eastern and western reaches of the North Pacific Ocean, as well as the Bering, Chukchi, and Beaufort seas. Two stocks are recognized: the western Pacific or Korean stock (listed as endangered under the ESA) and the eastern North Pacific stock (removed from the ESA in 1994, Rugh et al., 1999). Overlap in the ranges of these two stocks was recently determined via photographic matches of western Pacific gray whales obtained in areas thought to only be occupied by eastern North Pacific gray whales such as the Mexico lagoons and along the U.S. and Canadian coast (Weller et al. 2012). Western gray whales tagged with satellite transmitters have also traveled from Russian waters and crossed the Bering Sea/Aleutian Island passes and Gulf of Alaska to shelf waters off the Washington and Oregon coast (Mate et al. 2015). A majority of the eastern North Pacific population migrates annually along the coast of North America from summer feeding areas in the Bering, Chukchi, and Beaufort seas to winter grounds in sheltered waters along the Baja Peninsula (Rice and Wolman, 1971). A small number (< 200) of whales, called the Pacific Coast Feeding Group, summer and feed along the Pacific coast between southeast Alaska and northern California.

The eastern North Pacific gray whale population has made a remarkable recovery since its depletion in the early 1900s caused by commercial whaling. Gray whales were listed as endangered under the ESA on June 2, 1970 (35 FR 8495). Then, following a comprehensive evaluation of their status (Breiwick and Braham, 1984), NMFS concluded on November 9, 1984

(49 FR 44774), that this population should be listed as threatened, instead of endangered, under the ESA. However, no further action was taken until 1991 when a subsequent review was completed and made available to the public on June 27, 1991 (56 FR 29471). The latter review showed the best available abundance estimate (in 1987/88) was 21,296 whales with an average annual ROI of 3.29% (Buckland et al., 1993). Calculations indicated that this population was approaching K (Reilly, 1992) and on November 22, 1991 (56 FR 58869) NMFS proposed that this population be removed from the list of endangered and threatened wildlife under the ESA. After an extensive review period, NMFS published a final notice of determination (58 FR 3121) that this population should be removed from the list because the population had recovered to near its estimated original population size and was neither in danger of extinction throughout all or a significant portion of its range, nor likely to again become endangered within the foreseeable future. On June 16, 1994 (59 FR 31094), the eastern North Pacific gray whale population was formally removed from the list of endangered and threatened wildlife under the ESA.

The nearshore migration route of gray whales off the west coast of North America has enabled repeated abundance estimates from systematic shore-based counts off central California. In 23 years, between 1967 and 2007, counts of the number of observed pods travelling southbound have been rescaled using estimates of pods undetected during watch periods, pods passing outside watch periods, and night travel rate (see Laake et al. 2012). Rugh et al. (2008) evaluated the accuracy of various components of the shore-based survey method, with a focus on pod size estimation. They found that the correction factors that had been used to compensate for bias in pod size estimates have been calculated differently for different sets of years; thus a reevaluation of the analysis techniques and a reanalysis of the abundance estimates were warranted to apply a more uniform approach throughout the years. Laake et al. (2012) developed a more consistent approach to abundance estimation that used a better model for pod size bias with weaker assumptions. They applied their estimation approach to re-estimate abundance for all 23 surveys. The revised abundance estimates between 1967 and 1987 were generally larger than previous abundance estimates; differences by year between the revised and previous abundance estimates for this subset of years ranged from -2.5% to 21%. However, for the subset of surveys conducted between1992 and 2006, estimates were uniformly smaller (-4.9% to -29%) than previous estimates. Reevaluation of the correction for pod size bias and the other changes made to the estimation procedure yielded a somewhat different trajectory for population growth. The estimates still showed the population increased steadily from the 1960s until the 1980s. Previously, the peak abundance estimate was in 1998 followed by a large drop in numbers (Rugh et al., 2008). The revised estimates indicate the peak estimate of 26,916 (CV = 6.1%) was a decade earlier in 1987/88. The revised estimates for surveys conducted between 2000 and 2007 are: 16,369 (CV = 6.1%) in 2000/01, 16,033 (CV = 6.9%) in 2001/02, and 19,126 (CV = 7.1%) in 2006/07. Revised estimates from the three years prior are 20,103 (CV = 5.6%) in 1993/1994, 20,944 (CV = 6.1%) in 1995/1996, and 21,135 (CV = 6.8%) in 1997/1998

(Laake et al., 2012).

The shore-based counting method described above estimated detection probability (p) from the detection-non-detection of pods by two independent observers. However, tracking distinct pods in the field can be difficult for single observers; resulting in biased estimates of pod sizes that needed correcting, and matching observations of the same pod by both observers involved key assumptions. Due to these limitations, a new observation approach was adopted in 2006/2007 wherein a paired team of observers worked together and used a computerized mapping application to track and enumerate distinct pods and tally the number of whales passing during watch periods (Durban et al. 2015). This approach produced consistent counts over four monitored migrations (2006/07, 2007/08, 2009/10 and 2010/11), with an apparent increase in p compared to the previous method. To evaluate p and estimate abundance in these four years, counts from two independent stations of paired observers operating simultaneously were compared using a hierarchical Bayesian 'N-mixture' model to simultaneously estimate p and abundance without the challenge of matching pods between stations. The overall average detectability po =0.80 (95% Highest Posterior Density Intervals [HPDI] =0.75-0.85), which varied with observation conditions, observer effects and changes in whale abundance during the migration. Abundance changes were described using Bayesian model selection between a parametric model for a normally distributed common migration trend and a semi-parametric model that estimated the time trends independently for each year; the resultant migration curve was a weighted compromise between models, allowing for key departures from the common trend. The summed estimates of migration abundance ranged from 17,820 (95% HPDI=16,150-19,920) in 2007/8 to 21,210 (95% HPDI=19,420-23,230) in 2009/10, consistent with previous estimates and indicative of a stable population size.

Counting methods and analytical techniques for 2014/2015 and 2015/2016 estimates (see Durban et al. 2017) closely followed those mentioned above and described in Durban et al. (2015) for four previous abundance estimates between 2006/7 and 2011/12. The 2014/2015 estimate was 28,790 (95% HDPI=23,620-39,210) and the 2015/16 estimate was 26,960 (95% HDPI=24,420-29,830). There was consistency between the model predictions and observed counts for both years. However, daily and total abundance in 2014/15 were subject to considerable uncertainty, as shown by the large error bars associated with each of the daily estimates and the large coefficient of variation (CV = posterior standard deviation / posterior median; CV_{2015} =0.13). This is likely explained in part by the results of model fitting, as significant departures from the Normal migration model (probability of Normal model <0.25) were estimated in 18/90 days in 2014/2015 compared to only 9/90 days in 2015/16. These departures, and the uncertainty associated with estimating an independent migration curve, constrained estimation of a precise migration curve. In contrast, the CV_{2016} =0.05 was consistent with previous estimates using this counting approach and model (CV = 0.04-0.06 for four previous estimates since 2006/2007), and this estimate was therefore more useful for interpreting in the context of the abundance time series. Differences in the CVs from the two years demonstrated the value of completing two counts and abundance estimates in back-to-back years, which provided a measure of redundancy.

The Eastern North Pacific population of gray whales experienced an unusual mortality event in 1999 and 2000. An unusually high number of gray whales were stranded along the west coast of North America in those years (Moore et al., 2001; Gulland et al., 2005). Over 60% of the dead whales were adults, and more adults and subadults stranded in 1999 and 2000 relative to the years prior to the mortality event (1996 - 1998), when calf strandings were more common. Many of the stranded whales were in an emaciated condition, and aerial photogrammetry documented that gray whales were skinnier in girth in1999 relative to previous years (Perryman and Lynn, 2002). In addition, calf production in 1999, 2000 and 2001 was less than one-third of that in prior to the UME in 1997 and 1998 (Perryman et al. 2017). Several factors since this mortality event suggest that the high mortality rate was a short-term, acute event and not a chronic situation or trend: 1) in 2001 and 2002, strandings of gray whales along the coast decreased to levels that were below their pre- 1999 level (Gulland et al., 2005), 2) average calf production in 2002, 2003 and 2004 rebounded to levels similar to those seen prior to 1999, and 3) in 2001 living whales no longer appeared to be emaciated. A Working Group on Marine Mammal Unusual Mortality Events (Gulland et al., 2005) concluded that the emaciated condition of many of the stranded whales supported the idea that starvation could have been a significant contributing factor to the higher number of strandings in 1999 and 2000.

Perryman et al. (2002) found a significant positive correlation between an index of the amount of ice-free area in gray whale feeding areas in the Bering Sea and their estimates of calf production for the following spring; the suggested mechanism is that more open water for a longer period of time provides greater feeding opportunities for gray whales. Unusual oceanographic conditions in 1997 may also have decreased productivity in the region (Minobe, 2002). Regardless of the mechanism, visibly emaciated whales (LeBoeuf et al., 2000; Moore et al., 2001) suggest a decline in the availability of food resources, and it is clear that Eastern North Pacific gray whales were substantially affected in 1999 and 2000; whales were on average skinnier, they had a lower survival rate (particularly of adults), and calf production was dramatically lower. A modeling analysis estimates that 15.3% of the non-calf population died in each of the years of the mortality event, compared to about 2% in a normal year (Punt and Wade, 2010). The most recent abundance estimate from 2015/16 of 26,960 (95% HDPI=24,420-29,830) gray whales (Durban et al. 2017), is above the highest level seen in the 1990s (1997/98 = 21,135 CV = 6.1%) before the mortality event in 1999 and 2000 (Allen and Angliss, 2011).

Subsistence hunters in Washington State, the Bering Strait, and the Russian Federation have traditionally harvested whales from this stock (Allen and Angliss, 2011). In addition to the principles in IWC Schedule paragraph 13(a) that must be followed in setting catch limits, the Schedule, as adopted in 2012, also identifies specific catch limits for 2012 through 2018. IWC Schedule subparagraph 13(b)(2) provides:

> *13(b)(2): The taking of gray whales from the Eastern stock in the North Pacific is permitted, but only by aborigines or a Contracting Government on behalf of aborigines, and then only when the meat and products of such whales are to be used exclusively for local consumption by the aborigines.*
>
> > *(i) For the years 2013, 2014, 2015, 2016, 2017 and 2018, the number of gray whales taken in accordance with this sub-paragraph shall not exceed 744, provided that the number of gray whales taken in any one of the years 2013, 2014, 2015, 2016, 2017 and 2018 shall not exceed 140.*
> > *(ii) This provision shall be reviewed annually by the Commission in light of the advice of the Scientific Committee.*

That is, the annual catch limit will be capped at 140 whales per year and will be shared with an average annual harvest of 120 whales by the Russian Chukotka people and four whales by the Makah Indian Tribe, subject to the satisfaction of domestic legal requirements under NEPA and the MMPA, with respect to any subsistence hunt by the Makah Tribe. Russian aboriginals harvested 121 (+2 struck and lost) in 1999 (IWC, 2001b), 113 (+2 struck and lost) in 2000 (Borodin, 2001), 112 in 2001 (Borodin et al., 2002), 131 in 2002 (Borodin, 2003), and 126 (+2 struck and lost) in 2003 (Borodin, 2004), while the Makah Tribe harvested one whale in 1999 (IWC, 2001b). Based on this information, the annual subsistence take averaged 122 whales during the five year period from 1999 to 2003. Total takes, including 11 whales struck and lost, by Russian aboriginals were 118 in 2010, 130 in 2011, 143 in 2012, 127 in 2013, 124 in 2014, 125 in 2015 and 120 in 2016 (data available from the IWC Secretariat https://iwc.int/home). Based on this information, the annual subsistence take (inclusive of 11 whales struck and lost) averaged 127 whales during the seven year period from 2010 to 2016.

Beluga Whale. Beluga whales (*Delphinapterus leucas*) are distributed throughout seasonally ice-covered arctic and subarctic waters of the Northern Hemisphere (Gurevich, 1980), and some stocks are closely associated with open leads and polynyas (nonlinear openings in the sea ice) in ice-covered regions (Hazard, 1988). Depending on season and region, beluga whales that occur north of the Bering Strait may occur in both offshore and coastal Alaskan waters, with concentrations in areas now designated as separate stocks: eastern Bering Sea, eastern Chukchi Sea, and Beaufort Sea (Muto et al. 2017).

The population abundance estimate for each stock is 19,186 animals in the eastern Bering Sea stock, 20,752 animals in the eastern Chukchi Sea stock, and 39,258 animals in the Beaufort Sea stock (Lowry et al. 2017; Muto et al. 2017). Current population trends for the Beaufort Sea stock is likely stable and may be increasing and eastern Bering Sea stocks and eastern Chukchi Sea stocks are unknown (Muto et al. 2017).

The annual subsistence take by Alaska Natives between 2008 and 2012 averaged 65.6 animals per year from the Beaufort Sea stock, 57.4 animals per year from the eastern Chukchi sea stock, and 181 animals per year from the eastern Bering Sea stock (Muto et al. 2017). Beluga whales are managed by a cooperative agreement under the MMPA by the Alaska Beluga Whale Committee and NMFS.

Minke Whale. Minke whales (*Balaenoptera acutorostrata*) are distributed worldwide. Sightings range from Point Barrow, Alaska, in the Chukchi Sea, through the Bering Sea and Bristol Bay, and in coastal and offshore waters of the Gulf of Alaska (Leatherwood et al., 1982; Mizroch, 1992; Platforms of Opportunity Program [POP], 1997). Few data are available on migratory behavior and apparent "home ranges" of the Alaska stock of minke whales (e.g., Dorsey et al., 1990). Vessel surveys in 1999 and 2000 provided provisional abundance estimates of 810 (CV = 0.36) and 1,003 (CV = 0.26) minke whales in the central-eastern and southeastern Bering Sea, respectively (Moore et al., 2002). These estimates are considered provisional because they have not been corrected for animals missed on the trackline, animals submerged when the ship passed, or responsive movement. Additionally, line-transect surveys were conducted in shelf and nearshore waters (within 30 - 45 nautical miles [n. mi.] of land) in 2001-2003 from the Kenai Fjords in the Gulf of Alaska to the central Aleutian Islands. Minke whale abundance was estimated to be 1,233 (CV = 0.34) for this area (Zerbini et al., 2006). This estimate has also not been corrected for animals missed on the trackline. These surveys covered only a small portion of the Alaska stocks range. Seabird surveys around the Pribilof Islands indicated an increase in local abundance of minke whales between 1975 - 1978 and 1987 - 1989 (Baretta and Hunt, 1994). No data exist on trends in abundance in Alaskan waters (Muto et al. 2017).

Subsistence takes of minke whales by Alaska Natives are rare, but have been known to occur. Only seven minke whales are reported to have been taken for subsistence by Alaska Natives between 1930 and 1987 (C. Allison, IWC, Pers. comm.). A harvest (two whales) in Alaska occurred in 1989 (IWC, 1991).). In 2016, the village of Little Diomede, where climate change has created severe challenges for the bowhead whale harvest, two minke whales were reported taken in 2016.

Humpback Whale. Humpback whales (*Megaptera novaeangliae*) are distributed worldwide in all ocean basins. Humpback whales in the North Pacific are currently found throughout their historic range, with sightings during summer months occurring as far north as the Beaufort Sea (Hashagen et al. 2009) and along the north coast of the Chukotka Peninsula in the Chukchi Sea

(Mel'nikov, 2000). Subsistence hunters in Alaska have reported one subsistence take of a humpback whale that was stranded in Norton Sound in 2006 (Allen and Angliss, 2011). There were no reported takes of humpback whales from this stock by Native subsistence hunters in Alaska or Russia in 2010-2014 (Muto et al., 2017). However, in May of 2016 subsistence hunters from Toksook Bay killed a young humpback whale that had wandered into shallow water. It is illegal to hunt humpback whales as there is no IWC quota, and hence, no Whaling Convention Act quota, for the U.S.

The humpback whale ESA listing final rule (81 FR 62259) established 14 Distinct Population Segments (DPSs) with different listing statuses. The DPSs that occur in waters under the jurisdiction of the United States do not necessarily equate to the existingMMPA stocks. Some of the listed DPSs partially coincide with the currently defined Western North Pacific stock. Until such time as the MMPA stock delineations are reviewed in light of the DPS designations, NMFS considers this stock to be depleted for MMPA management purposes (e.g., selection of a recovery factor, stock status). As a result, the Western North Pacific stock of humpback whale is classified as a strategic stock.

Fin Whale. Fin whales (*Balaenoptera physalus*) in the Northeast Pacific stock range throughout the Gulf of Alaska and Bering Sea and north through the Bering Strait into the Chukchi Sea (Muto et al. 2017). Provisional estimates place the stock at 1,368 whales (Friday et al., 2013), increasing at an annual rate of 4.8% (Zerbini et al., 2006). Subsistence hunters in Alaska and Russia have not been reported to take fin whales from this stock. The fin whale is listed as endangered under the ESA, and therefore designated as depleted under the MMPA.

Killer Whale. Killer whales (*Orcinus orca*) have been observed in all oceans and seas of the world (Leatherwood et al., 1982) and are found throughout Alaska waters from the Chukchi Sea to southeast Alaska (Braham and Dahlheim, 1982). They occur primarily in coastal waters, although they have been sighted well offshore (Heyning and Dahlheim, 1988). Seasonal movements in Polar Regions may be influenced by ice cover and in other areas primarily by availability of food. An estimated 2,347 killer whales belong to the eastern North Pacific Alaska resident stock (Muto et al. 2017). Resident killer whales are not known to eat other marine mammals. Population trends for the entire stock are currently unknown though portions of the stock in Prince William Sound and Kenai Fjords have increased 3.2% per year from 1990 to 2005 (Matkin et al., 2008). Transient killer whales are the only known predators of bowhead whales (Angliss and Outlaw, 2005). In a study of marks on bowheads taken in the subsistence harvest, 4.1% to 7.9% had scars indicating the bowhead whales had survived attacks by killer whales (George et al., 1994). A minimum abundance of 587 transient killer whales has been estimated for the Gulf of Alaska, Aleutian Islands, and Bering Sea Transient stock (Muto et al. 2017). There is no reported subsistence harvest of killer whales in Alaska (Muto et al. 2017).

Harbor Porpoise. Harbor porpoises (*Phocoena phocoena*) are found in the eastern North Pacific Ocean from Point Barrow, along the Alaska coast, and down the west coast of North America to Point Conception, California (Gaskin, 1984; Suydam and George, 1992; Dahlheim et al., 2000). They occur primarily in coastal waters, but are also found where the shelf extends offshore (Gaskin, 1984; Dahlheim et al., 2000). In 1999, aerial surveys were conducted in Bristol Bay resulting in an abundance estimate of 48,215 (CV = 0.223) for this portion of the Bering Sea (Hobbs and Waite, 2010). Currently, there is no reliable information on population trends (Muto et al. 2017).

Subsistence hunters in Alaska are known to occasionally take from this stock of harbor porpoise. Bee and Hall (1956) reported on two entanglements in subsistence nets in Elson Lagoon in 1952. Subsistence fishermen in Utqiaġvik (Barrow), Alaska, state that it is not uncommon for one or two porpoises to be caught each summer (Suydam and George, 1992). In 1991, pack ice may have contributed to the relatively high number (four) of porpoises caught in subsistence nets (Suydam and George, 1992). In 2012, one harbor porpoise entangled in a subsistence salmon gillnet in Nome, Alaska (Helker et al. 2016), resulting in a minimum average annual mortality and serious injury rate of 0.2 harbor porpoise due to subsistence fishery interactions in 2010-2014. When porpoise are caught incidental to subsistence or commercial fisheries, subsistence hunters may claim the carcass for subsistence use (R. Suydam, North Slope Borough, pers. comm.).

3.3.2 Marine Birds

Many species of birds occur in substantial numbers in the Arctic Coastal Plain and Beaufort Sea habitats and nearly all are migratory, present sometime during the period from May to early November. Species include waterfowl, shorebirds, loons, seabirds, hawks and eagles, ptarmigan, and songbirds (MMS, 2002a). Birds hunted by Alaska Natives in Utqiaġvik (Barrow), Kaktovik, and Nuiqsut include the snowy owl, red-throated loon, tundra swan, eiders (common, king, spectacled, and Steller's), ducks, geese, and ptarmigan (MMS, 2002a). Four bird species listed under the ESA and inhabit the areas where Alaska Natives hunt for bowhead whales are Eskimo curlew, short-tailed albatross, spectacled eider, and Steller's eider.

Eskimo curlew. The Eskimo curlew (*Numenius borealis*) was originally listed as endangered under the Endangered Species Preservation Act of 1966 on March 11, 1967 (32 FR 4001). No information on the biology of the species or the threats to it was presented in the listing. No critical habitat has been designated for the species. Eskimo curlews are thought to have once numbered in the hundreds of thousands (Gill et al., 1998). The population declined precipitously and approached extinction in the late 19th century. Spring market hunting in the Midwestern

United States during the late 1800s was an important factor contributing to the species' decline. However, Gill et al. (1998) also implicate the conversion of prairie habitat to agriculture, fire suppression, and extinction of the Rocky Mountain grasshopper (*Melanoplus spretus*) in the rapid decline of Eskimo curlew. By 1900, sightings of Eskimo curlews were rare. The last confirmed observation took place in Nebraska in 1987. The only confirmed breeding grounds for the Eskimo curlew occurred in treeless tundra in the Northwest Territories, Canada, but their breeding range probably extended through similar habitats in northern Alaska and possibly eastern Siberia. On June 22, 2011, the USFWS announced their intent to initiate a five-year status review for this species (76 FR 36491). This review was completed on August 31, 2011 and concluded that a change in status was not warranted for the Eskimo curlew (https://ecos.fws.gov/docs/five_year_review/doc3902.pdf). On May 23, 2016, USFWS announced initiation of a five year status review (81 FR 32342) which also concluded no change in status for the species was warranted (https://ecos.fws.gov/docs/five_year_review/doc3902.pdf).

Short-tailed Albatross. The short-tailed albatross (*Phoebastria* (=*Diomedea*) *albatrus*) is listed as endangered under the ESA and by the State of Alaska (65 FR 46643). The short-tailed albatross was originally listed in 1970, under the Endangered Species Conservation Act of 1969, prior to the passage of today's ESA (35 FR 8495). However, as a result of an administrative error (and not from any biological evaluation of status), the species was listed as endangered throughout its range except within the U.S. (50 CFR 17.11). On July 31, 2000, this error was corrected when the USFWS published a final rule listing the short-tailed albatross as endangered throughout its range (65 FR 46643). These birds mate for life, laying eggs in October or November and incubating them for 65 days. The species is known to breed on only two remote islands in the western Pacific. Chicks leave the nest after five months to go to the North Pacific. Adults also spend the summer at sea, feeding on squid, fish, and other organisms. Most summer sightings of these birds are in the Aleutian Islands, Bering Sea, and Gulf of Alaska. Historical information on the species' range away from known breeding areas is scant. Evidence from archeological studies in middens suggests that indigenous hunters in kayaks had access to an abundant nearshore supply of short-tailed albatross from California north to St. Lawrence Island 4,000 years ago (Howard and Dodson, 1933; Yesner and Aigner, 1976; Murie, 1959). In the 1880s and 1890s, short-tailed albatross abundance and distribution during the non-breeding season was generalized by statements such as "more or less numerous" in the vicinity of the Aleutian Islands (Yesner, 1976). The species was reported as highly abundant around Cape Newenham, in western Alaska (DeGange, 1981). Veniaminof (in Gabrielson and Lincoln, 1959) regarded them as abundant near the Pribilof Islands. Presently, about 2,400 short-tailed albatrosses are known to exist (USFWS, 2008). Critical habitat has not been designated for this species. On May 20, 2009, the USFWS announced their intent to initiate a five-year status review for this species (74 FR 23739). This review was completed on September 30, 2009, and concluded that no change in status was warranted (https://ecos.fws.gov/docs/five_year_review/doc2623.pdf). On May 5, 2014, the USFWS requested submission of any new information for a five-year status review for the species (79 FR 25613). The completed review, published on September 23, 2014, again recommended no change in status for the short-tailed albatross species (https://ecos.fws.gov/docs/five_year_review/doc4445.pdf).

Spectacled Eider. The spectacled eider (*Somateria fischeri*) is a threatened species under the ESA and is also listed as a species of special concern in Alaska. An estimated 7,370 spectacled eiders occupied the Arctic Coastal Plain of Alaska in June 2001, about 2 percent of the estimated 363,000 world population (MMS, 2002a) of spectacled eiders nest in wet tundra near ponds on the Arctic coasts of Alaska and the Russian Federation and on the coast of the Y-K Delta in Alaska. Nesting pairs arrive together each spring, but the males leave after egg incubation begins. In late summer, the females and young join the males at sea (Alaska Department of Fish and Game [ADF&G], 2001a). The only known wintering area lies south of St. Lawrence Island in the Bering Sea. Because few eiders are observed in marine areas along the Beaufort coast in spring, a majority may migrate to the nesting areas overland from the Chukchi Sea (MMS, 2002a). Spectacled eiders have declined dramatically in Alaska since the 1960s (ADF&G, 2001a, Spectacled Eider). Causes for this decline are not known but may include some combination of reduced food supplies, pollution, overharvest, lead shot poisoning, increased predation, and other causes (ADF&G, 2001a).

The breeding population on the North Slope is currently the largest breeding population of spectacled eiders in North America. The most recent population estimate, uncorrected for aerial detection bias, is 4,744 ±907 pairs (arithmetic mean plus or minus two times the SE associated with the sample) (Larned et al., 1999). However, this breeding area is nearly nine times the size of the Y-K Delta breeding area. Consequently, the density of spectacled eiders on the North Slope is about one quarter that on the Y-K Delta (Larned and Balogh, 1997; USFWS, 1996; 66 FR 9146). Based on USFWS survey data, the spectacled eider breeding population on the North Slope does not show a significant decline throughout most of the 1990s. The downward trend of 2.6% per year is bounded by a 90% CI ranging from a 7.7% decline per year to a 2.7% increase per year (66 FR 9146). In February 2001, USFWS designated critical habitat on the Y-K Delta, in Norton Sound, Ledyard Bay, and the waters between St. Lawrence and St. Matthew Islands (66 FR 9146). All areas designated as critical habitat for the spectacled eider contained one or more of these physical or biological features: space for individual and population growth, and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, rearing of offspring; and habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species. On April 7, 2010, the USFWS announced their intent to initiate a five year status review for this species (75 FR17760). The review published on August 23, 2010, determined that no change in status was warranted for the spectacled eider species (https://ecos.fws.gov/docs/five_year_review/doc3281.pdf). On March 30, 2016, USFWS received a petition requesting that the spectacled eider and Alaska-breeding Steller's eider be delisted due to error in information under the Act. After review of the petition, USFWS determined it did not present substantial scientific or commercial information indicating that the petitioned action was warranted and, therefore, a status review would not be initiated (81 FR 63160).

Steller's Eider. The Steller's eider (*Polysticta stelleri*) is a threatened species under the ESA and an Alaska species of special concern. Steller's eiders are diving ducks that feed on mussels in marine waters during the winter and insect larvae in freshwater ponds during the breeding season of spring and summer. Their current breeding range includes the arctic coastal plain in northern Alaska and northern coastal areas of the Russian Federation, where they nest on the tundra near small ponds (ADF&G, 2001b). In winter, most of the world's population of Steller's eiders ranges throughout the Alaska Peninsula and eastern Aleutian Islands. Aerial surveys provide the only currently available means of objectively estimating Steller's eider population size in northern Alaska. Population size point estimates based on annual waterfowl breeding pair surveys from 1989 to 2000 ranged from 176 to 2,543 (Mallek, 2002). These surveys likely underestimated actual population size, however, because an unknown proportion of birds were missed when counting from aircraft, and no species-specific correction factor has been developed and applied (USFWS, 2002). Nonetheless, these observations indicated that hundreds or low thousands of Steller's eiders occur on the Arctic Coastal Plain. These surveys do not demonstrate a significant population trend from 1989-2000.

The current world population estimate is 150,000 to 200,000 birds, but the population is thought to have declined by as much as 50% between the 1960s and 1980s. When the Alaska breeding population of the Steller's eider was listed as threatened, the factor or factors causing the decline was (were) unknown. Factors identified as potential causes of decline in the final rule listing the population as threatened (62 FR 31748) included predation, hunting, ingestion of spent lead shot in wetlands, and changes in the marine environment that could affect Steller's eider food or other resources. Since listing, other potential threats, including exposure to oil or other contaminants near fish processing facilities in southwest Alaska, have been identified, but the causes of decline and obstacles to recovery remain poorly understood (USFWS, 2002). In February 2001, USFWS designated critical habitat for the Alaska-breeding population of Steller's eiders in one terrestrial and four marine areas: Y-K Delta, Kuskokwim Shoals, Seal Islands, Nelson Lagoon (including Nelson Lagoon and portions of Port Moller and Herendeen Bay), and Izembek Lagoon (66 FR 8850).

On March 30, 2016, the USFWS received a petition requesting that the spectacled eider and Alaska-breeding Steller's eider be delisted due to error in information under the ESA. After review of the petition, USFWS determined it did not present substantial scientific or commercial information indicating that the petitioned action was warranted and, therefore, a status review would not be initiated (81 FR 63160).

3.3.3 Other Species

Arctic coastal waters support a diverse community of planktonic and epontic species that are prey for fish, birds, and marine mammals. Both marine and anadromous fish inhabit coastal arctic waters. Marine fish include arctic cod, saffron cod, two-horn and four-horn sculpins, Canadian eelpout, arctic flounder, capelin, Pacific herring, Pacific sand lance, and snailfish. Migratory (anadromous) fish common to the arctic environment include arctic cisco, least cisco, Bering cisco, rainbow smelt, humpback whitefish, broad whitefish, Dolly Varden char, and inconnu. Although uncommon in the North Slope region, salmon are present in arctic waters and used by Alaska Natives (MMS, 2002a).

Fish species used by Alaska Natives in Utqiaġvik (Barrow), Kaktovik, and Nuiqsut include Pacific salmon (chum, pink, silver, king, and sockeye), whitefish (round, broad, humpback, least cisco, Bering/Arctic cisco), Arctic char, Arctic grayling, burbot, lake trout, northern pike, capelin, rainbow smelt, arctic cod, tomcod, and flounder (MMS, 2002a).

Terrestrial mammals hunted by Alaska Natives in Utqiaġvik (Barrow), Kaktovik, and Nuiqsut include caribou, moose, brown bear, Dall sheep, musk ox, arctic fox, red fox, porcupine, ground squirrel, wolverine, weasel, wolf, and marmot (MMS, 2002a).

3.4 Socioeconomic Environment

The proposed action has effects on the human environment, notably the 11 member communities of the AEWC. This section describes the population size and ethnic composition, along with a key indicator of economic status, as a basis for the Environmental Justice analysis found in **Section 4.8.5**.

These communities are small, predominantly Alaska Native villages, with the exception of Utqiaġvik (Barrow), as a regional service center, which is larger and more diverse. In 2010, the 11 AEWC communities counted a total 8,258 residents, of whom 6,674 or 80.8 percent are Alaska Native or part Alaska Native (Table 3.4-1). Utqiaġvik (Barrow) accounts for just over half of the total population, and is more diverse, with Alaska Native residents making up 68.6 percent of the community. The most recent population estimates are in the 2012-2016 American

Community Survey 5-Year Estimate. Comparing this dataset with the information from the 2010 U.S. Census, five AEWC communities have experienced a decrease in population, while the six other AEWC communities have experience population growth.

Table 3.4-1.
AEWC Community Population and Ethnicity 2000-2010

Community	Total Population (2010)[17]	AK Native Population (2010)[18]	Percent AK Native (2010)[19]	Total Population (2012-2016)[20]	AK Native Population (2012-2016)[21]	Percent AK Native (2012—2016)[22]	Total Population Percent Change (2010-2016)	AK Native Population Percent Change (2010-2016)
Barrow	4,212	2,889	68.60%	4,316	3,043	70.50%	2.50%	5.30%
Little Diomede	115	110	95.70%	55	52	94.50%	-52.20%	-52.70%
Gambell	681	654	96.00%	690	611	88.60%	1.30%	-6.60%
Kaktovik	239	215	90.00%	166	151	91.00%	-30.50%	-29.80%
Kivalina	374	366	97.90%	671	657	97.90%	79.40%	79.50%
Nuiqsut	402	360	89.60%	347	303	87.30%	-13.70%	-15.80%
Point Hope	674	629	93.30%	604	516	85.40%	-10.40%	-18.00%
Point Lay	189	168	88.90%	306	273	89.20%	61.90%	62.50%
Savoonga	671	637	94.90%	932	878	94.20%	38.90%	37.80%
Wainwright	556	510	91.70%	488	467	95.70%	-12.20%	-8.40%
Wales	145	136	93.80%	166	155	93.40%	14.50%	14.00%
Total	8,258	6,674	80.80%	8,741	7,106	81.30%	5.80%	6.50%

Sources: U.S. Census - Profile of General Population and Housing Characteristics: 2010; American Community Survey 5-Year Estimates for 2012-2016.

The most current information concerning income and poverty levels is the 2012-2016 American Communities Survey 5-Year Estimate. While it is the best information available, there is a significant margin of error for each estimate and the data should be taken with caution. Table 3.4-2 shows that, using the federally defined poverty level, two of the AEWC communities have

[17] Source: U.S. Census, 2010.
[18] See footnote 17, above.
[19] See footnote 17, above.
[20] Source: American Community Survey 5-Year Estimates for 2012-2016.
[21] See footnote 20, above.
[22] See footnote 20, above.

low levels (less than 10 percent of residents), while three communities have intermediate rates (10-18 percent of residents). The remaining six communities have higher rates, ranging from 23.7 percent through 52.7 percent of residents living below the poverty level. The available data suggests that population declines may be based on decreased economic activity for these communities. All but two of these communities exceed the average rate of Alaska residents living below the poverty level, which is 10.1 percent, and in many cases these rates are two and three times the Alaska average.

Table 3.4-2.
Portion of AEWC Community Residents Living Below Poverty Level

Community	Individuals Below Poverty Level (2012-16)
Barrow	14.1%
Little Diomede	52.7%
Gambell	43.7%
Kaktovik	3.8%
Kivalina	26.4%
Nuiqsut	6.4%
Point Hope	17.4%
Point Lay	23.7%
Savoonga	47.3%
Wainwright	16.4%
Wales	37.2%
State of Alaska Rate*	10.1%

Source: 2012-2016 American Community Survey 5-Year Estimates.

3.5 Inuit Tradition of Subsistence Hunt of Bowhead Whales

Bowhead whale hunting has been a part of Alaska Native culture for at least 2,000 years (Stocker and Krupnik, 1993). Subsistence hunting communities along the western and northern coasts of Alaska participate in annual bowhead whale hunts and rely on the hunts for both cultural and nutritional needs (Braund et al., 1997). Historically, residents of the villages participate in one or more of the semi-annual hunts (Stocker and Krupnik, 1993). This section describes the importance of the ongoing bowhead subsistence hunt, in relation to the overall pattern of subsistence production, in its key social organization features, and as a foundation of Iñupiat and Siberian Yupik cultural identity and ceremonial life.

As explained by George Noongwook, a whaling captain from Savoonga and former Chairman of the Alaska Eskimo Whaling Commission:

> *"Subsistence whaling is a way of life for the Inupiat and Yupik people who inhabit the Western and Northern coasts of Alaska. From Gambell to Kaktovik, the bowhead whale has been the center of our culture for centuries and our people are reliant on its abundant meat to feed their families and our communities.*
>
> *The bowhead whale is a significant resource that draws generations of Eskimos together and ensures our way of life will flourish into the future. As Alaska's first people, we are deeply connected to the land, the sea, and the resources of the area, and each is essential to our sense of identity and to our continued vitality. Through whaling, we express that connection and pass it on to the next generation along with the responsibility of sharing the food we harvest to provide for the needs of the entire community.*
>
> *To our people, the bowhead is more than food. It keeps our families together. It keeps our children in school. It allows our elders to pass generational knowledge to our youth. It teaches us patience and perseverance. It teaches us generosity. It strengthens our community. It provides wisdom and insight. It gives us hope. It is our way of life. The spirit of the whale lives within each of us."*

Bowhead subsistence whaling represents an especially important source of subsistence food among the AEWC communities. During the period of 2007 to 2017, the AEWC villages have landed 447 bowhead whales, or an average of 40.6 whales per year. As shown in Table 3.5- 1, the largest AEWC community of Utqiaġvik (Barrow) takes just under half of the total, with an average of 19.7 bowhead whales landed per year in the last decade. Most of the rest of the communities take one to five whales per year, while the small communities of Wales and Point Lay have highly intermittent harvests, and Kivalina and Little Diomede have taken no bowhead whales in this period.

Table 3.5-1
Bowhead Whales Landed by AEWC Communities in 2007 - 2017

	Gambell	Savoonga	Wales	Little Diomede	Kivalina	Point Hope	Point Lay	Wainwrig ht	Barrow	Nuiqsut	Kaktovik	Total
Total Landed	28	40	1	0	0	48	5	42	217	35	31	**447**
Annual Average	2.5	3.6	0.1	0	0	4.4	0.4	3.8	19.7	3.2	2.8	**40.6**

Bowhead whales provide exceptionally large quantities of high-quality food. During the late 1980s, a method was developed to estimate the edible pounds produced from bowhead whales of various sizes (Braund and Institute of Social and Economic Research [ISER], 1993). After weighing crew shares of *maktak* and meat from a number of harvests in Utqiaġvik (Barrow), the authors established the average pounds of food produced per foot of length for small, medium, and large bowhead whales.
Additional facets of the importance of bowhead whale within the total annual round of subsistence harvests can be shown through the comprehensive household surveys, conducted in the period from 1987 through 2007, and reported in the ADF&G Subsistence Division subsistence harvest database. Surveys of this sort permit a broad comparison of the variation in bowhead harvest levels between participating communities and of the variation in the proportion of bowhead food in relation to other major subsistence resources. However, the data are limited in that some studies are dated (such as Point Lay data for 1987 and Wainwright data for 1989). A single year from the ADFG Subsistence Division database was selected to provide a single point in time comparison among the communities. Where more than a single study year was available, the most recent year was selected. As displayed in **Table 3.5-3**, per capita harvest levels for bowhead whales, during the years studied, ranged from as high as 560 pounds in Kaktovik in 1992, to about 100 pounds per capita in Utqiaġvik (Barrow), and no bowhead harvest in Kivalina in 2007 or Wales in 2006.

Total subsistence production levels also varies among the communities, with the more heterogeneous community of Wales having the lowest annual per capita production total at 353 pounds, while the other ranged from 361 pounds to 1,110 pounds during the study years. When viewing the subsistence harvest survey data shown in **Table 3.5-3**, it is important to note that bowhead subsistence harvests vary from year to year, particularly for some of the smaller communities, so these results are indicative, and do not define a stable pattern. With the exception of Kivalina and Wales, surveyed in 2007 and 2006 respectively, the period covered in these community harvest studies had lower bowhead harvest levels, on the whole, than those of the past decade. From 1987 through 1993, years of highly restrictive IWC quotas set below documented subsistence need, AEWC communities averaged 28.6 bowheads whales landed per year. In the past decade, with IWC quotas set at a level more consistent with documented subsistence need, the average has been 40.6 bowhead whales landed per year.

Table 3.5-2.
Community Subsistence Harvest Levels by Species Group (Pounds per Capita)

Village	Bowhead whale	Other marine mammals	Game	Fish & marine invertebrates	Birds & eggs	Vegetation	Total
Barrow 2014	102.75	89.35	111.96	47.87	9.42	0.56	361.91
Kaktovik 1992	560.35	38.78	148.71	118.91	16.83	1.18	884.76
Kivalina 2007	0	291.20	90.20	183.20	10.20	18.70	593.70
Nuiqsut 2014	356.63	51.25	260.95	214.32	11.70	1.00	1110.8
Point Hope 2014	164.19	151.74	34.19	83.41	12.32	5.26	451.11
Point Lay 2012	170.36	147.16	187.73	53.12	30.70	5.77	594.84
Wainwright 1989	218.23	302.27	178.18	37.15	15.41	ND	751.24
Wales 2006	0	215.45	26.01	103.69	3.63	4.78	353.56

Source: ADF&G, 1989, 1992, 2006, 2007, 2012, 2014; Fuller and George, 1997. ND = no data

In addition to this high reliance on bowhead whales, Iñupiat and Siberian Yupik communities harvest many species throughout an intricate annual cycle of subsistence activities. The species composition of subsistence harvests in selected AEWC communities gives an indication of the flexible adaptation of subsistence patterns to ecological patterns of abundance and access to various resources. For example, while bowhead, caribou, and fish make up the majority of subsistence foods in most of the Iñupiat communities, the Chukchi Sea communities rely more heavily on walrus and seal than do the Beaufort Sea villages (MMS, 2006a:168). In **Table 3.5-5**, the communities of Kaktovik and Nuiqsut have high proportions of total subsistence food derived from the bowhead harvest, and lower proportions from other marine mammals, while the communities of Wainwright, Kivalina, and Wales show much greater harvests of other marine mammals.

Table 3.5-3.
Proportion of Subsistence Food Provided by Taxa

Village	Bowhead whale	Other marine mammals	Game	Fish & marine invertebrates	Birds & eggs	Vegetation	Total Percent
Barrow 2014	28.4%	24.7%	30.9%	13.3%	2.6%	0.2%	100.0%
Kaktovik 1992	63.3%	4.4%	16.8%	13.4%	1.9%	0.1%	100.0%
Kivalina 2007	0%	49.0%	15.2%	30.8%	1.7%	3.1%	100.0%
Nuiqsut 2014	39.8%	5.7%	29.1%	23.9%	1.3%	1.0%	100.0%
Point Hope 2014	36.4%	33.6%	7.6%	18.5%	2.7%	1.2%	100.0%
Point Lay 2012	28.6%	24.7%	31.6%	8.9%	5.2%	1%	100.0%
Wainwright 1989	29.0%	40.2%	23.7%	4.9%	2.1%	ND	100.0%
Wales 2006	0%	59.7%	7.2%	28.7%	1%	1.3%	100.0%

Source: ADF&G 1989, 1992, 2006, 2007, 2012, 2014; Fuller and George, 1997. ND = no data

Households in the AEWC communities have very high rates of participation in production and consumption of bowhead subsistence foods. The comprehensive household surveys also documented the percentage of households using bowhead, trying to harvest, actually harvesting, receiving bowhead food from others, and giving bowhead food to other households. As seen in **Table 3.5-7**, for the six smaller communities with data, 5 percent - 98 percent of households use bowhead whale foods. Note too that this is the result of widespread sharing of food, since a rather small proportion of households (0-22.9 percent) has actually harvested bowhead whales in the study years. In the larger community of Utqiaġvik (Barrow), the importance of resource sharing is even more pronounced, with only 12% of households harvesting bowhead while 70% of households use bowhead for food. More detailed accounts of the subsistence harvest patterns of Kaktovik, Nuiqsut, Utqiaġvik (Barrow), Wainwright, and Point Hope are found in Appendix C of MMS (2006a). In another important recent summary, Braund (2010) provided detailed harvest survey and subsistence use area mapping for Utqiaġvik (Barrow), Nuiqsut, and Kaktovik.

Table 3.5-4.
Rates of Participation in Bowhead Subsistence Activities

Village	Using Bowhead	Attempting to Harvest	Harvesting	Receiving Bowhead from Others	Giving Bowhead to Others
Barrow 2014	69.9%	24.3%	12%	67.2%	42.5%
Kaktovik 1992	87.2%	53.2%	6.4%	85.1%	61.7%
Kivalina 2007	64.3%	47.6%	0%	64.3%	16.7%
Nuiqsut 2014	93.1%	29.3%	20.7%	91.4%	56.9%
Point Hope 2014	98.1%	62.9%	22.9%	97.1%	65.7%
Point Lay 2012	85.7%	38.1%	2.4%	83.3%	59.5%
Wales 2006	5.1%	0%	0%	5.1%	0%

Source: ADF&G 1989, 1992, 2006, 2007, 2012, 2014. ND = no data

Subsistence harvests occur within traditional use areas, for which hunters have accumulated detailed knowledge of the physical geography of landscape and waters, the social geography of place names and the associated stories, and the wildlife ecology of likely animal distributions by seasons and under varying weather conditions. Hunters have a repertoire of effective harvest strategies to draw upon as they hunt throughout these traditional harvest areas. Bowhead subsistence whaling occurs in U.S. waters primarily during the spring and autumn migrations as the bowhead whales move north and east through near shore leads in the spring, and then west and south as ice forms in the autumn. The bowhead migration patterns are conducive to spring harvests for westerly AEWC communities, while Utqiaġvik's (Barrow's) location provides for successful spring and fall hunts, and the villages of Nuiqsut and Kaktovik participate in the fall hunts. The St. Lawrence Island communities of Gambell and Savoonga typically take bowhead whales in the early spring as well as in the later part of the fall migration, continuing as late as December. With changes in sea ice and bowhead whale abundance, these communities are beginning to continue their harvests into January and February.

AEWC residents can travel offshore great distances to find and pursue bowhead whales during both fall and spring harvests. The best available data on the extent of bowhead hunting activities are subsistence use area maps for several AEWC communities, based on resident surveys conducted by Braund and Associates in 2006. The subsistence use areas (**Figure 3.5-1**) represent the historical hunting range for AEWC communities over the ten-year period (1996 - 2006) prior to the surveys. Within each community, there is considerable inter-annual variation depending upon the location of bowhead whale migration and weather and sea ice conditions (Braund 2010). For example, in Utqiaġvik (Barrow), hunters indicated that ice leads were closer to shore in the year prior to the survey, greatly reducing the travel distances required to harvest bowhead whales relative to previous years' harvests. While hunters preferred to harvest bowhead whales closer to the community to prevent meat from spoiling, they were also willing to travel 48 – 80.5 km (30 - 50 mi.) offshore or away from the community for harvests if necessary. At times, those participating in the harvest reported that oil and gas exploration activities, including drilling ships, disturbed bowhead whale activities, forcing both the whales and hunters to go further offshore (Braund, 2010). For more detailed information on bowhead subsistence use areas and harvest inter-annual variation within the communities of Utqiaġvik (Barrow), Nuiqsut, and Kaktovik, see Braund (2010).

As described in Bacon et al. 2013, sharing of subsistence foods among individuals and households is an important part of the subsistence culture on the North Slope and in some villages there are persons who hunt for many people other than themselves. In all villages surveyed, active hunters routinely shared with elders and other households (Bacon et al. 2013). Subsistence activities are often centered in family groups, with widespread sharing of financial resources and equipment to support hunters, sharing of labor in harvesting, processing and distributing subsistence foods, and sharing of knowledge as elders provide practical information and ethical understandings for successful subsistence pursuits. The social organization of subsistence activities binds generations and families together across and even between communities. Subsistence whaling and the roles of whaling captains and whaling crews are especially prominent in the social organization of the Iñupiat and Siberian Yupik whaling communities. The wives of whaling captains and whaling crewmembers also have an intricate set of interlinked responsibilities. These are particularly important in the preparation of bearded seal (*ugruk*) skins for the *umiaks*, still preferred in Utqiaġvik (Barrow) for the spring hunts due to their light weight, durability, and silence in the water (see Bodenhorn, 2000 for additional discussion). From aboriginal times, the whaling captain, or *umailik*, was recognized as a leader for his knowledge, success at hunting, support for the needs of his whaling crews throughout the year, and generosity in sharing the fruits of a successful hunt. Cooperation among whaling crews was critically important in the success of any hunt, and customary laws prescribed how a captain would distribute portions of the whale to the crews that helped in the capture as well as to the entire community (Worl, 1979).

To further explore and illustrate the extent of substantial contributions of social relations unique to whaling in two AEWC communities, BurnSilver et al. 2016 constructed valued and directed multiplex social networks in which households, whaling crews, and other organizations were connected through flows of food and non-food items. As noted in BurnSilver et al. 2016, the three main elements of mixed economies -- (1) market exchange, (2) subsistence activities, and (3) culturally embedded social relationships sustained by flows of wild food and other resources

-- have proven persistent, rather than transitional, in Wainwright and Kaktovik (cf. BurnSilver et al. 2016).

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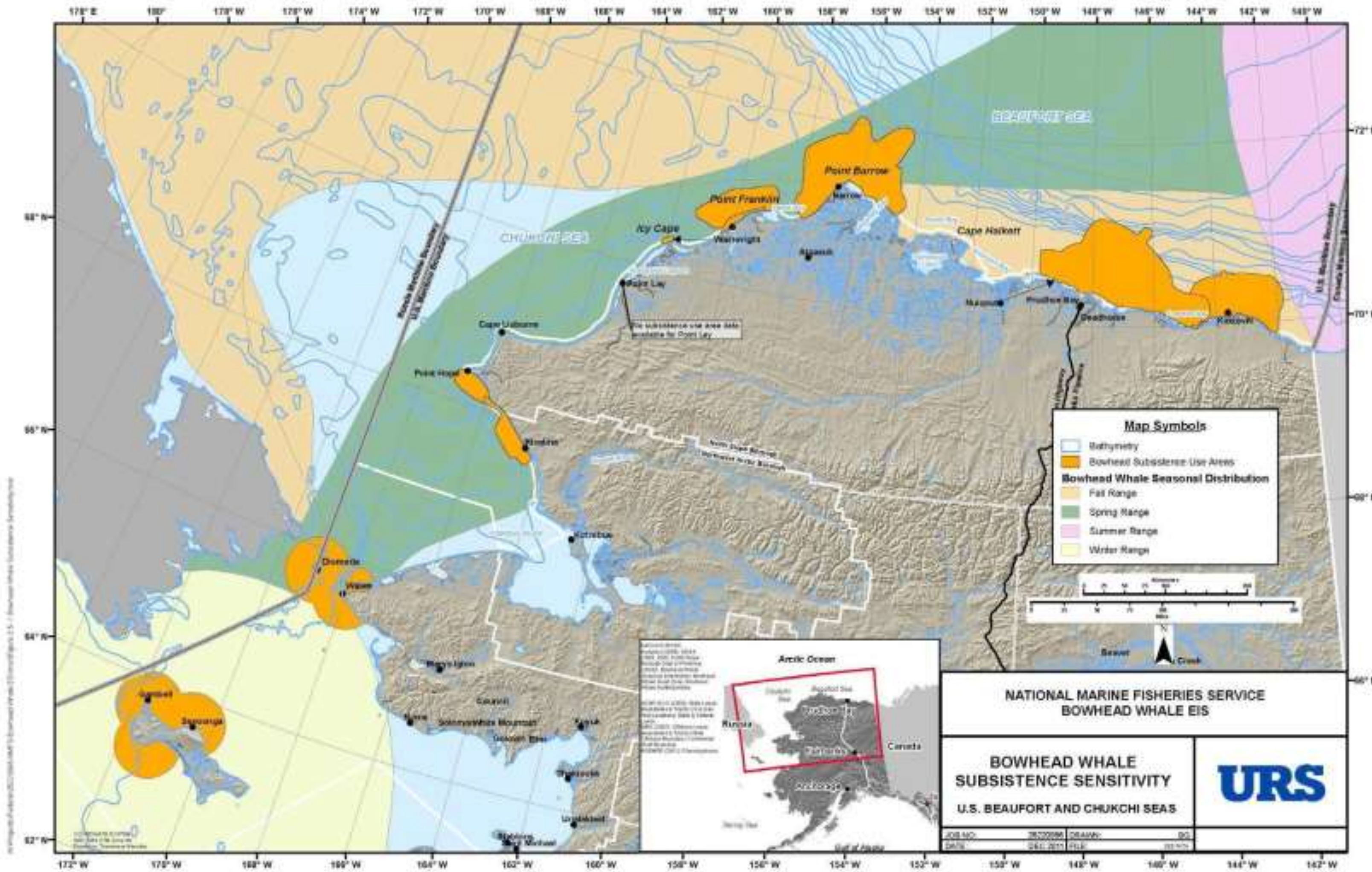

Figure 3.5-1. Bowhead whale subsistence use areas. U.S. Beaufort and Chukchi Seas. 2011.

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Hauling a whale onto the ice edge and processing the enormous amount of food provided required the cooperative labor of virtually the entire community. This remains true today.

In addition to the widespread sharing of bowhead whale foods, the nonedible parts of the whale such as baleen and bone are also valuable for craftwork. No specific data are available on the quantities of baleen and bone distributed within and between communities. However, representatives of the AEWC and the Iñupiat History, Language and Culture Commission (IHLC) provided an overview of these sharing and distribution patterns (Harry Brower Jr., Pers. comm., 2007; Dorcus Stein, Pers. comm., 2007). The whaling captains retain half of the baleen and bone, and distribute the remainder to the whaling crew. Captains and crewmembers share these materials with others in their communities and beyond. Some communities on the North Slope, the Bering Sea coast, and Norton Sound do not have access to bowhead whales, but value the baleen and bone as raw materials for use in making handicrafts. Craft producers may contact a whaling captain and offer to trade subsistence foods for such raw materials. A whaling captain might also take an interest in baleen craft courses at schools in the NSB and provide the raw materials for use in the class to support continuation of the artistic traditions. Craft production is widespread and important to Iñupiat and Yupik communities.

Spiritual and moral values, beliefs, and cultural identity are expressed and recreated through subsistence harvest activities. The great gifts of food from bowheads are recognized in the ceremonies of the *Nalukatak* festival at the conclusion of spring whaling.

Since the late 1970s, subsistence bowhead whaling has been governed in the formal structures of international treaties, national legislation, and the Cooperative Agreement between NOAA and the AEWC. Beginning in 1977, the IWC adopted catch limits for bowhead whale harvests, after considering the nutritional and cultural need for bowhead whales by Alaska Natives and the level of harvest that is sustainable.

Around the same time, the IWC passed a resolution calling for further research on the cultural and nutritional needs of Alaska Eskimos to hunt bowhead whales (Alaska Consultants, Inc. and Stephen R. Braund & Associates 1984, Braund 1992). The USDOI oversaw that research, which included the support and participation of the AEWC. A 1982-1983 survey in nine whaling communities documented and established the cultural importance of bowhead whales to Alaska Eskimos (*Subsistence Study of Alaska Eskimo Whaling Villages* [Alaska Consultants, Inc. and SRB&A 1984]); however, it did not quantify the number of bowhead whales necessary to fulfill that need. Subsequent research was conducted to develop a method to quantify the subsistence and cultural need for bowhead whales (USDOI 1980, U.S. Government 1983), and the resulting method was further developed and refined in *Quantification of Subsistence and Cultural Need for Bowhead Whales by Alaska Eskimos* (Braund et al., 1988). The method developed in these reports was accepted by the IWC, resulting in a quota of 41 landed bowhead whales in 1988, and this method has been used in subsequent years to update the quota. While the IWC granted an overall quota for Alaska Eskimo whaling communities, it was left to the AEWC to decide how to divide that quota among individual communities.

The method and documentation accepted in 1988 to quantify Alaska Eskimo need for bowhead whales was based on 1) historic bowhead harvest levels (for a “base period” of 1910-1969), and 2) Eskimo populations in whaling communities. Using historic harvest levels and Eskimo populations during the base period, the 1988 report established a per capita need for bowhead whales for each whaling community. Applying this method, determination of current need for bowhead whales, per capita harvests, by village, are multiplied by current Alaska Eskimo populations per village (as documented by the U.S. Census Bureau). Thus, the quantification of need takes into account only the population size within each whaling village (Braund, 2018).

A revised calculation of need was submitted to the IWC in 1994, based on July 1, 1992 human population data generated by the State of Alaska, Department of Labor. The next revised calculation, submitted to the IWC in 1997, used the same per capita method accepted by the IWC, presenting revised calculations based on July 1, 1997 human population data generated by the State of Alaska, Department of Labor (Braund et al., 1997). This accepted methodology was used for the need statement submitted to the annual IWC meeting in 2002. This need statement demonstrated a documented nutritional and cultural need for 56 landed bowhead whales per year. The 2012 calculation of subsistence need was submitted to the IWC, using the accepted methodology based on 2010 census data (see **Appendix 8.1**). This statement documented a subsistence and cultural need for 57 landed bowhead whales per year.

3.5.1 Methodology of Subsistence Hunts for Bowhead Whales

The hunting of bowhead whales by Alaska Natives is believed to date back several thousand years with the use of harpoons and lances fashioned from stone, ivory, and bone. Seal or walrus skin-covered whaling vessels known as *umiaks* were employed from aboriginal times and remain the most commonly used vessel for the spring hunt (Stocker and Krupnik, 1993). Starting in the early 1930’s, Alaska Native residents of Utqiaġvik (Barrow) also incorporated engine-powered boats for fall whaling activities (IWC 1982). Crew sizes currently average six persons per vessel (Rexford, Pers. comm., n.d.) Before the whales arrived during each migration, ritual ceremonies were performed in special houses known as *karigi*, to ensure a successful hunt and to honor the whale (Ellis 1991).

Alaska Natives continue to use traditional methods to take whales today, but have also incorporated Yankee whaling era technologies such as darting and shoulder guns as a method of improving efficiency and humane killing methods (Stocker and Krupnik 1993). The "darting gun" is used first, as it has a harpoon with line and float attached, to deliver an exploding projectile. The harpoon line and float allows a whale to be pursued and located. Under the AEWC Management Plan, a harpoon must be used to attach a float to a whale before it can be shot. Once the darting gun is thrown, the shoulder gun is often used as a secondary weapon.

Contemporary hunts occur twice a year in the spring and autumn seasons based on ice and weather conditions. Some communities hunt only in the spring (i.e., Wales, Little Diomede, Kivalina, Point Hope, and Point Lay), some only hunt in the autumn (i.e., Nuiqsut and Kaktovik) and others hunt in spring and autumn/winter (i.e., Gambell, Savoonga, Wainwright, and Barrow. In the autumn season, aluminum skiffs or small open boats with outboard motors are used for the hunt due to the open water conditions. In the spring, traditional skin- covered *umiaks* are preferred because they are durable, lighter to transport, and quieter, therefore more effective in the ice leads. Spring hunts are logistically more difficult than autumn hunts because of challenging and dynamic environmental conditions, difficulty in accessing open water, and changing sea ice thickness and dynamics (Suydam et al. 2017). The hunting efficiency during spring is usually lower than autumn (Suydam et al. 2017).

Traditionally, most of the whale was used for food, though other parts of the whale were used to make whaling gear, fishing equipment, traps, tools, and for many other practical day-to-day uses (Ellis 1991). The gut was made into translucent windows, and the oil was used for heating, cooking, lighting, and traditional drumheads (Ellis 1991). The bones were used for fences, house construction, and sled runners (Ellis 1991). Baleen and bone are used in many forms of handicraft, including baleen baskets, scrimshaw, and carvings.

Today, bowhead is still an important source of subsistence food, where the skin and blubber, known as *maktak*, are eaten raw or boiled in salted water (Ellis, 1991). Subsistence foods also include muscle, flukes, flipper, tongue, intestines, heart and kidney, as well as stomach and liver in Point Hope. Blood is used in *migiyaq* (fermented meat and blubber). The membrane on the liver is used for drum skins. The tympanic or 'ear' bones are kept by the captains and prized by family members, and used for artwork (Craig George, North Slope Borough, Pers. comm., December 20, 2007).

In recent years, the AEWC has focused on improving humane killing methods (e.g., reducing time to death) and the efficiency of the hunt (e.g., struck to landed ratio), including developing a highly successful Weapons Improvement Program (WIP) that reports annually to the IWC's Humane Killing Working Group. The primary objectives of the program are:

- Improving the reliability and safety of the weapons, including development of the penthrite projectile to replace the black powder explosive;
- Hunter safety;
- Ensuring humane harvest of the bowhead whale; and
- Increasing the efficiency of the harvest by landing a higher percentage of struck whales.

3.5.2 Results of Recent Hunts

Since 1981, the North Slope Borough Department of Wildlife Management (NSB DWM) has gathered basic data on landed whales in several communities and assists the AEWC with compilation of statistics on landed and struck and lost whales (Albert, 1988). Suydam and George (2018) summarize Alaskan subsistence harvests of bowheads from 1974 to 2016. Hunters from the 11 AEWC villages, and one additional village, landed 1,373 whales from 1974 to 2016. Utqiaġvik (Barrow) consistently landed the most whales (n = 700) while Shaktoolik landed one whale (prior to the formation of the AEWC), and Little Diomede landed two whales (Figure 3.5.2-1). Shaktoolik, a village located on the coast of Norton Sound, Alaska, harvested one whale in 1980 but has not been a regular participant in the hunt and is not an AEWC community. Little Diomede harvested one whale in 1999 and another in 2005, Point Lay became a member of the AEWC and has harvested a whale regularly since 2009 (Suydam and George, 2018). The number of whales landed at each village varied greatly from year to year (**Figure 3.5.2-1**), as success was influenced by village size and ice and weather conditions. The annual average subsistence take during the five year period from 2006 - 2010 is 38 bowhead whales (which also includes whales taken by Russian aboriginal hunters) (Allen and Angliss, 2011). The 2017 harvest of 50 whales was slightly higher that the recent average (Suydam et al. 2018).

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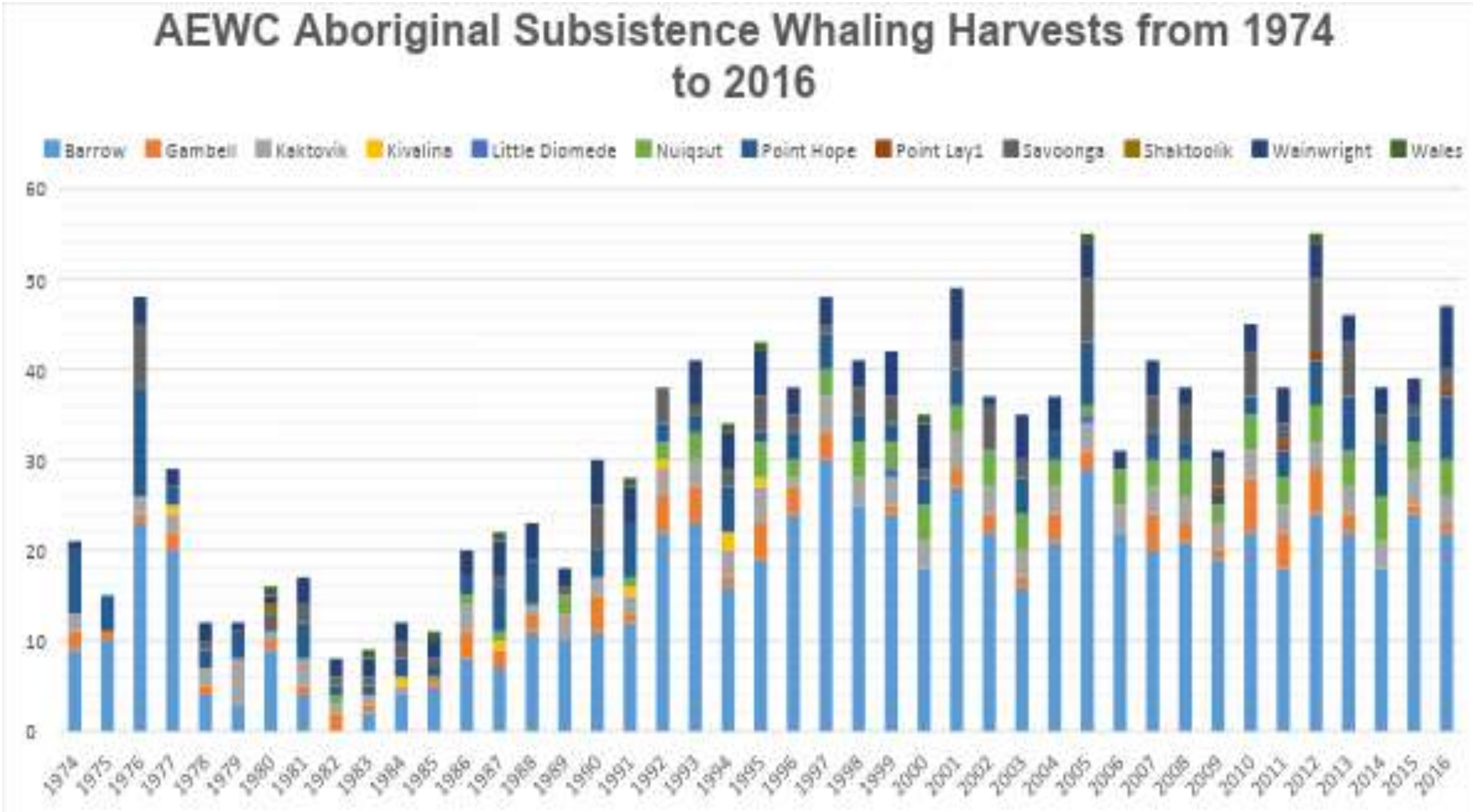

Figure 3.5.2-1. Summary of the number of bowhead whales landed by year in each village[23] between 1974 and 2016. Data were collected by the Alaska Eskimo Whaling Commission, the North Slope Borough and the National Marine Fisheries Service.

[23] Point Lay became a member of the AEWC in 2008 and landed its first whale in more than 70 years in 2009.

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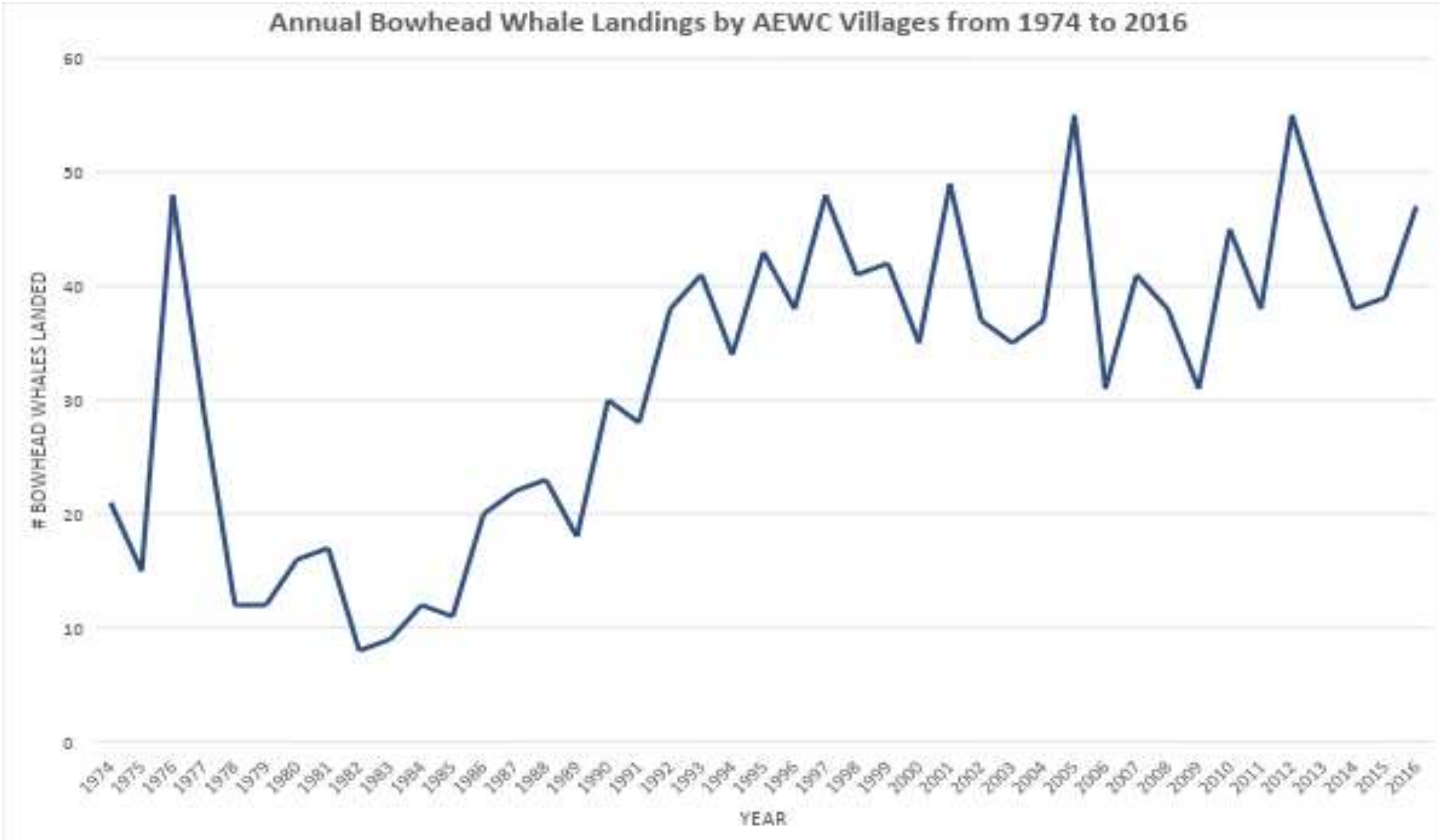

Figure 3.5.2-2. Total of Western Arctic bowhead whales landed by AEWC villages from 1974-2016. Source: Suydam and George 2018. Data were collected by the Alaska Eskimo Whaling Commission, the North Slope Borough and the National Marine Fisheries Service.

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Thinning, earlier thawing, and stability of shorefast ice, as well as weather conditions, are affecting the spring hunts, with Wainwright, Point Lay, and Point Hope expressing interest in the fall hunts, due to increasingly difficult conditions in the spring. Wainwright landed two whales in the fall, in 2010 and 2011 (Suydam and George, 2012). Additionally, Gambell and Savoonga are increasingly hunting during the winter because of difficult spring conditions (Suydam and George 2018). A report prepared by the AEWC and submitted by the U.S. to the IWC (AEWC and U.S. Government, 2012) elaborated on the effects of climate change:

> *The rapid advance of climate change in the Arctic also is having a dramatic impact on this hunt, as thinning sea ice increases the difficulty of reaching the edge of the shore-fast ice and creates an unstable and dangerous platform for conducting the hunt in the spring lead system. The thinner, less stable ice has greatly increased the danger in this already treacherous hunt and has increased the difficulty of landing whales that must be pulled onto an ever-thinner ice edge, which is subject to shifting and cracking under the weight of the whales. With the ice changes, the bowhead whale subsistence hunt at St. Lawrence Island, historically a spring hunting location, has shifted to winter months, with a number of whales now taken between November and March.*

The efficiency of the hunt (i.e., the number of whales landed compared to the number of whales struck) has increased since the implementation of the bowhead subsistence whaling catch limit in 1978. From 1973 to 1978 the efficiency was about 50%; in the last ten years (i.e., 2007-2016) efficiency has averaged 75.2% (**Figure 3.5.2-2**) and 2017 was 88%, near the highest level recorded (Suydam et al., 2018). The fall hunting conditions are generally better, with more open water, so the sea ice is less of an influence on harvest efficiency (Suydam et al., 2011).

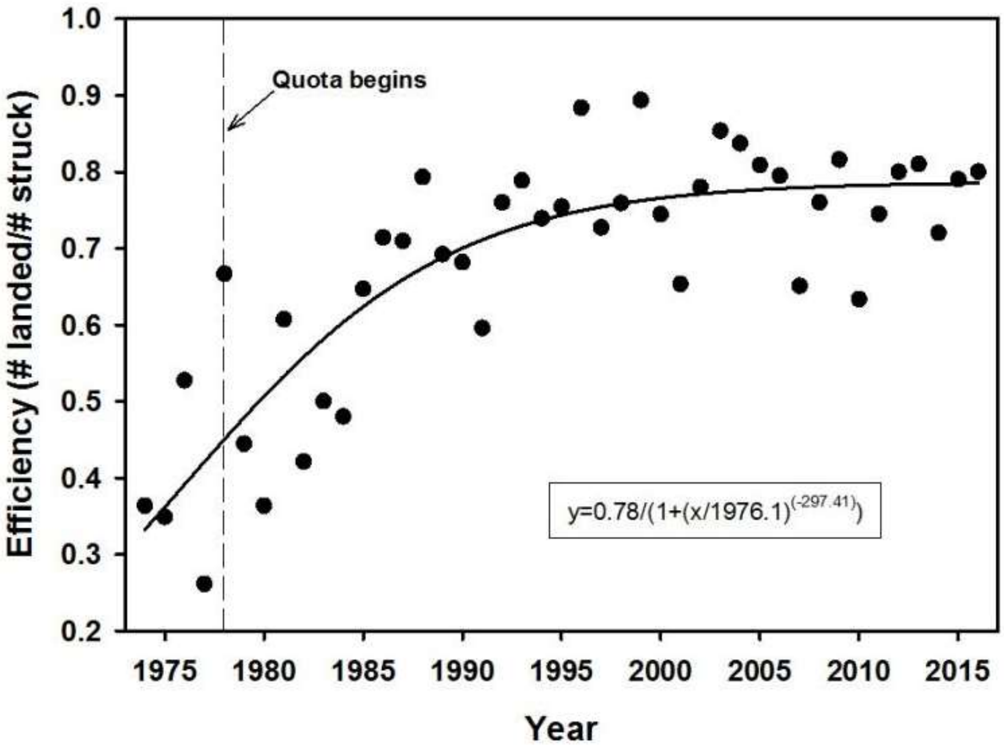

Figure 3.5.2-3. Efficiency of the Western Arctic bowhead whale subsistence hunt, 1973- 2016. Source: Suydam et al. 2018.

In a technical report submitted to the Scientific Committee of the IWC, Suydam et al. (2018) reported that the 2017 efficiency was 88 percent, which is higher than the average efficiency over the past 10 years (2007-2016: mean of efficiency = 75.2%; SD =6.5%). In addition, this report summarized the factors leading to improved efficiency over the years as follows:

(1) Enhanced training conducted by senior captains of the AEWC on where to strike a whale,
(2) Improved communication for alerting other crews that a whale had been struck,
(3) Efforts by some captains to only strike smaller whales,
(4) Enhanced efforts to locate and retrieve struck whales using (a) aircraft to spot struck whales and (b) dive teams to help retrieve whales that sank, and
(5) Establishment of a program to improve the weaponry.

The United States, on behalf of the AEWC, reports regularly to the IWC's Whale Killing Methods Working Group on the AEWC's progress with the penthrite projectile and the Weapons Improvement Program. The AEWC report on weapons and harvest techniques (AEWC, 2012) summarizes the history of participation by the AEWC in IWC workshops on Whale Killing

Methods and Associated Welfare Issues in 2003, and again in 2006. The report describes AEWC efforts in the following areas:

(1) Introduction of a penthrite explosive projectile into the bowhead whale subsistence hunt;
(2) Ongoing hunter training in the use of the new equipment;
(3) Ongoing hunter training in shot-placement and accuracy; and
(4) Ongoing upgrades to traditional hunting equipment to improve the performance of the penthrite projectile and to enhance hunter safety, animal welfare, and hunting efficiency.

The size of landed whales differs among villages. Gambell and Savoonga (two villages on St. Lawrence Island) and Wainwright typically harvest larger whales than Point Hope and Utqiaġvik (Barrow). These differences were likely due to hunter selectivity, whale availability and season. For example, during spring in Barrow, smaller whales were caught earlier in the season than larger whales while the opposite was true in the autumn (Suydam and George, 2018). Villages along the western coast of Alaska harvest bowhead whales primarily during the spring migration, while villages along the Beaufort Sea hunt during the autumn migration. In recent years, the villages on St. Lawrence Island have been able to hunt bowhead whales when they overwinter in the Bering Sea. Overall, the sex ratio of the harvest has been equal (Suydam and George, 2018).

3.6 Co-management of Subsistence Whaling with AEWC

The purposes of the NOAA-AEWC Cooperative Agreement are to protect the Western Arctic population of bowhead whales and the Eskimo culture, to promote scientific investigation of the bowhead whale, and to effectuate the other purposes of the WCA, the MMPA, and the ESA, as those Acts relate to the aboriginal subsistence hunts for whales. Cooperative Agreements have been in place between NOAA and the AEWC since the first agreement was signed in March 1981, and have been renewed regularly thereafter[24]. The Cooperative Agreement was most recently updated and signed in December 2017.

3.6.1 Description of Management

The NOAA-AEWC Cooperative Agreement establishes a structure of relationships between the authorities and activities of NOAA and the AEWC. The Cooperative Agreement generally represents a functional delegation of on-the-ground management from NOAA to the AEWC,

[24] NOAA and AEWC are signatories to the Cooperative Agreement, but NMFS has been delegated the responsibility for implementation on behalf of NOAA.

subject to NOAA oversight. The provisions of the Cooperative Agreement build on the provisions of the AEWC Management Plan (adopted in November 1977, renewed on March 4, 1981, and continuously since) (Appendix 8.4). The authority and responsibilities of the AEWC are contained in and limited by the Cooperative Agreement and Management Plan, as amended, to the extent that the Management Plan is not inconsistent with the Cooperative Agreement. If AEWC fails to carry out its responsibilities, NOAA may assert its federal management and enforcement authority to regulate the hunt after notifying the AEWC of its intent, and providing an opportunity to the AEWC to discuss the proposed action. Subsection 100.1 of the AEWC Management Plan provides that the AEWC is empowered to administer the following regulations:

(1) Ensure an efficient subsistence harvest of bowhead whales;
(2) Provide a means within the Alaska Eskimo customs and institution to protect bowhead whale habitat and limit harvest to prevent extinction of the species; and
(3) Provide for Eskimo regulation of all whaling activities by Eskimo members of the AEWC.

As described in Subsection 100.11(b), the AEWC may deny any person who violates these regulations the right to participate in the hunt, make civil assessments, and act as an enforcement agent. In addition to administering and enforcing regulations within the Management Plan, the AEWC also provides village education programs including training programs for whaling captains and crews, participates in scientific research on bowhead whales, and initiates research to improve the accuracy and reliability of weapons used to hunt bowhead whales.

3.6.2 Quota Distribution among Villages

Under the AEWC Management Plan Subsection 100.26, the AEWC consults with each whaling village before establishing the level of harvest for each of those whaling villages during each season and adjustments may be made during the season, if a village does not use its allocation. As described in the AEWC Management Plan Subsection 100.22, each whaling captain registers with the AEWC on forms that disclose name, address, and age, qualifications as a captain, and willingness to abide by and require the crew to abide by AEWC regulations.

3.6.3 Monitoring and Enforcement of Hunting Regulations

Reports of each hunt must include the date, place, time of strike, size, and sex of the bowhead whale, reasons if struck and lost, and condition of struck and lost whales (subsection 100.23). Whaling crews must use traditional harvesting methods (as defined under subsection 100.24). Meat and edible products must be used exclusively for consumption and not be sold or offered for sale. Repercussions for violators can be severe; after an opportunity for a hearing before the AEWC, violators are prohibited from hunting or attempting to hunt for a period of not less than one whaling season nor more than five whaling seasons and/or may be subject to a fine not to exceed $10,000. Should a dispute between NOAA and AEWC occur over any of these matters, and resolution does not occur after consulting with AEWC, the dispute will be referred to an administrative law judge (15 CFR 904.200-904.272).

From the earliest years of the Management Plan, the AEWC has shown a remarkable resolve to intervene with whaling captains to enforce subsistence whaling catch limits and other provisions. Langdon (1984:51) refers to examples from 1981 and 1982, while Freeman (1989:151) describes a 1985 incident.

The AEWC considers the intentional taking of a whale calf or a cow with a calf to be a very serious infraction. However, unaccompanied calves can be mistaken for young adults, a situation occurring with some frequency given the current calving rate in the population. Several infractions involving the harvest of calves occurred between 2008 and 2012. While the harvesting of a calf does not have implications for the conservation of the stock, consistent with the IWC Schedule, the management plan forbids “the taking of a calf.” The taking of a whale calf or a cow accompanied by a calf is prohibited by Alaska Native hunting tradition (Suydam and George, 2006), by the AEWC Management Plan for the bowhead subsistence hunt, the WCA regulations, and by the IWC Schedule. The following describes infractions from 2008 to present, as well as the actions taken as a result of the infractions.

During the fall 2008 hunt, one landed whale was a male calf, 7.2 m in length (Whale ID 08KK1, September 6, 2008) (Suydam et al., 2009). The whale’s baleen length was 42 cm and milk was present in his stomach. The calf was seen swimming alone in the eastern Beaufort Sea near Kaktovik. Hunters mistakenly harvested the calf thinking it was a small, independent subadult whale (IWC, 2009b). The AEWC Board of Commissioners met on March 2, 2009 to take testimony from the crew in question and crews nearby. After receiving testimony, the Commissioners determined that the crew had taken all possible precautions, but that the absence of a large whale in the area where the calf was taken led to an honest mistake

During the fall 2009 hunt, hunters mistakenly harvested two female bowhead calves thinking they were small, independent whales (IWC, 2010b). One animal (Whale ID 09KK3) landed at Kaktovik was 6.6 m in length with 38 cm long baleen, the other (09N2) landed at Nuiqsut was 6.2 m in length but baleen length was not measured (Suydam et al., 2010). There was no milk present in the stomach of either whale. Both calves were seen swimming alone in the Beaufort Sea. A whale landed in Utqiaġvik (Barrow) (09B11) was also short (7.2 m) but its baleen was 72 c m long, suggesting it was not a calf (Suydam et al., 2010).

In 2011, according to IWC Infractions reporting documents, one bowhead calf was inadvertently taken by a crew from the village of Kaktovik during the fall bowhead whale subsistence hunt. During a hearing by the AEWC Board of Commissioners, it was found that crew in the area observed a whale that appeared to be unaccompanied. After the whale was struck, another whale surfaced in the same area. After landing, it was determined that the struck whale was a calf. Therefore, it is assumed that the other whale which surfaced after the strike was a cow or another adult accompanying the calf. The AEWC Board of Commissioners found that the strike of the calf was unintentional and an accident resulting from the fact that the calf appeared to be unaccompanied prior to the strike. No sanction was imposed.

In 2013, according to IWC Infractions reporting documents, on two occasions during the fall hunt a bowhead whale swimming independently was taken in Utqiaġvik (Barrow), and upon landing was determined to be a calf, based on body length, baleen length, and stomach contents.

In 2016, during the spring hunt a very experienced crew inadvertently struck a bowhead calf, having incorrectly identified it as a larger whale. The AEWC staff and Board of Commissioners conducted an investigation of the incident and held a hearing to take testimony from the captain and crew. Under the circumstances, including recognition of the fact that this experienced captain had never before committed an infraction, it was determined that a warning would be issued, but no penalty would be imposed.

3.6.4 Reporting Requirements

It is the responsibility of the whaling captains and crew to report to the Commissioner of their village on a daily basis when they are whaling. The Commissioner of that village then reports to the AEWC's central office in Utqiaġvik (Barrow), AK. The AEWC office develops a report, which is then passed on to the NMFS office in Anchorage for compilation. According to the NOAA-AEWC Cooperative Agreement, on the first of each month during the whaling seasons, the AEWC must inform NOAA of the number of bowhead whales struck during the previous month. The final harvest report is due to NOAA within 30 days after the conclusion of the whaling season.

After completion of each whaling season (fall and spring), the AEWC submits a comprehensive harvest report to the NMFS offices in Anchorage, as well as the Office of International Affairs and Seafood Inspection. These harvest reports fulfill U.S. obligations to the IWC with respect to recording harvest information, including infractions.

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4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Methodology

This Section describes the predicted direct, indirect, and cumulative effects on the biological and human environment from implementing the alternatives described in **Section 2**.

4.1.1 Definition of Terms

The following terms are used throughout this document to discuss impacts:

Direct Effects – effects caused by the action and occurring at the same time and place (40 CFR 1508.8). Direct effects pertain to the proposed action and alternatives only.

Indirect Effects – effects caused by an action and later in time or farther removed in distance but still reasonably likely. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on air and water and other natural systems, including ecosystems (40 CFR 1508.8). Indirect effects are caused by the project, but do not occur at the same time or place as the direct effects. Indirect effects pertain to the proposed action and alternatives only.

Cumulative Effects – additive or interactive effects that would result from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions (RFFAs) regardless of what agency (federal or non-federal) or person undertakes such other actions (40 CFR 1508.7). Interactive impacts may be either countervailing (where the net cumulative effect is less than the sum of the individual effects) or synergistic (where the net cumulative effect is greater than the sum of the individual effects). EISs address reasonably foreseeable cumulative effects issues, rather than speculative impact relationships. **Section 4.1.3** describes steps involved in the cumulative effects assessment.

Reasonably Foreseeable Future Actions – used in concert with the CEQ definitions of cumulative effects, but the term itself is not further defined. Most regulations that refer to reasonably foreseeable do not define the meaning of the words, but do provide guidance on the term. For this analysis, RFFAs or impacts are those that are likely (or reasonably certain) to occur within the timeframe used for analyzing environmental consequences, and are not purely speculative. The determination of reasonably foreseeable is based on documents such as existing plans, permit applications, or announcements.

4.1.2 Steps for Determining Level of Impact

The National Environmental Policy Act (NEPA) requires federal agencies to prepare an EIS for any action that may significantly affect the quality of the human environment. The CEQ regulations implementing NEPA state that an EIS should discuss the significance, or level of impact, of the direct, indirect, and cumulative effects of the proposed alternatives (40 CFR 1502.16), and that significance is determined by considering both the context in which the action will occur and the intensity of the action (40 CFR 1508.27). Context and intensity are often further broken down into components for impact evaluation. The context is composed of the extent of the effect (geographic extent or extent within a species, ecosystem, or region) and any special conditions, such as endangered species status or other legal status. The intensity of an impact is the result of its magnitude and duration. Actions may have both adverse and beneficial effects on a particular resource. A component of both the context and the intensity of an effect is the likelihood of its occurrence.

The combination of context and intensity is used to determine the level of impact on each type of resource. The first step is to examine the mechanisms by which the proposed action could affect the particular resource. For each type of effect, the analysts develop a set of criteria to distinguish between major, moderate, minor, or negligible impacts. The analysts then use these impact criteria to rank the expected magnitude, extent, duration, and likelihood of each type of effect under each alternative.

Tables 4.1-1 through 4.1-3 provide a guideline for the analysts to place the effects of the alternatives in an appropriate context and to draw conclusions about the level of impact. The criteria used to assess the effects of the alternatives vary for the different types of resources analyzed. The impact criteria tables employ terms and thresholds that are quantitative for some components and qualitative for others. The terms used in the qualitative thresholds are somewhat imprecise and relative, necessarily requiring the analyst to make a judgment about where a particular effect falls in the continuum from "negligible" to "major." The following descriptions of the terms used in the criteria tables are intended to help the reader understand the distinctions made in the analyses.

The magnitude or intensity of effects on biological resources is generally assessed in terms relative to the population rather than the individual. The Marine Mammal Protection Act (MMPA), as amended, established a management objective to reduce incidental mortality of marine mammals in commercial fisheries. To this end, it defines an upper limit guideline for fishery-related mortality for each species or management stock, defined as the Potential Biological Removal (PBR). Potential Biological Removal (PBR) is defined by the MMPA as the maximum number of animals, not including natural mortalities, which may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population. It is the product of the minimum population estimate of the stock; one-half the maximum theoretical or estimated net productivity rate of the stock at a small population size; and a recovery factor of between 0.1 and 1.0. The PBR for bowhead whales of the Western Arctic stock is 161 individuals annually (NMFS, 2016).

PBR was developed as a measure of the impact of total human-caused mortality, with management implications under the MMPA for commercial fisheries bycatch. Whereas, the subsistence harvest of Western Arctic bowhead whales is managed under the authority of the Whaling Convention Act. Accordingly, the aboriginal subsistence whaling provisions in the International Whaling Commission (IWC) Schedule take precedence over the PBR estimate for the purpose of managing the Alaska Native subsistence harvest from this stock.

However, it is important in the EIS process to evaluate the impacts of different levels of subsistence harvest, and PBR can be used as a metric for that purpose in the absence of the IWC's Bowhead Strike Limit Algorithm (SLA). The 2016 PBR of 161 animals was calculated using a Recovery Factor (Fr) of 0.5. The results of Wade (1998) can be used to evaluate the impact of different levels of take calculated with different Fr levels for bowhead whales, assuming unbiased estimates of abundance, human-caused mortality, and R_{max}, which is reasonable in this case. Noting that PBR is not the metric used by the IWC to evaluate the effects of subsistence whaling, in the absence of an evaluation under the Bowhead SLA, an annual take of fewer than 32 bowheads (Fr=0.1) would have a negligible impact using PBR, i.e., would cause a slight change in a pristine population that would not be measurable, and would not cause a measurable change in the rate of recovery of a depleted population. An annual take of between 32 and161 bowheads (Fr = 0.5) would have a minor impact, i.e., could cause a minor change in a pristine population while allowing a depleted population to recover rapidly. An annual take of between 161 and 322 bowhead whales could cause a moderate change in a pristine population, but the population would stay at its optimum sustainable population, and would allow a depleted population to recover to its optimum sustainable population. An annual take of more than 322 bowhead whales would have a major impact, i.e., would cause a major population change and would lead to depletion of the population (Wade, Pers. comm., 2018). PBR will be used to help assess Alternative 5, given that the harvest levels in Alternative 5 have not yet been evaluated using the Bowhead SLA.

The IWC determines safe strike limits for bowhead whales using its Bowhead Strike Limit Algorithm (SLA). This SLA does not provide an upper limit for safe catch. Instead, it evaluates a requested level of catch and determines whether that would maintain the IWC stock conservation and recovery goals (see **Section 3.2.1**). Since adoption in 2003, the Bowhead SLA has always confirmed that the requested level of 67 strikes per year (plus carryover) is safe.

Prior to the IWC's use of the Bowhead SLA, one approach to setting the harvest limit was to use the values of the catch control rule Q. (See **Section 3.2.1** for the introductory discussion of the catch control rule Q.) Q from the 2006 stock assessment ranged from a low bound of 155 whales per year, termed Q_{low}, to a high bound of 412, termed Q_{high},with a best estimate value of 257, termed Q_{best} (Brandon and Wade, 2006). A take that was below Q_{low} (155 whales per year) was considered a minor impact. A take that was between Q_{low} (155 whales) and up to Q_{high} (412 whales) was considered a moderate impact. A take greater that Q_{high} (412 whales) was considered a major impact. The Western Arctic bowhead whale abundance estimates have increased since the 2006 stock assessment (see **Figure 3.2.1-1**), and so, there is no reason to think that a current estimate of Q_{low} would be any lower today if a revised assessment were conducted. These impact criteria will be used to help assess Alternative 5, given that the harvest levels in Alternative 5 have not yet been evaluated using the Bowhead SLA.

For wildlife species other than bowhead whales, the magnitude of the effects of the alternatives is based on potential mechanisms for effects on mortality and disturbance and the relationship of bowhead whaling activities with the species considered. The impact criteria for wildlife are summarized in **Table 4.1-2.**

The analysis of sociocultural impacts examines effects of the alternatives on subsistence use patterns, whaling community health and nutrition, and public safety. For impacts to subsistence users, the magnitude and intensity of effects are based on the potential for loss or substantial reduction in production of key subsistence resources. For impacts to health and nutrition, and to public safety, the magnitude of effects is based on the proportion of the communities and population affected.

The geographic extent component is intended to estimate the distribution of effects relative to a population or non-biological resource as a whole. For bowhead whales and other wildlife, local populations are defined as those populations that are generally distributed near a particular whaling community in some portion of their ecological range.

The geographic extent of sociocultural impacts is first defined in relation to the bowhead subsistence whaling communities and their traditional subsistence use areas. In addition, because these communities share bowhead subsistence foods widely, sociocultural effects could indirectly extend to those distant receiving communities, including those in neighboring regions, and also the Iñupiat and Siberian Yupik families living in Fairbanks and Anchorage who remain integrated in sharing networks. The impact criteria for sociocultural resources are summarized in **Table 4.1-3.**

The duration or frequency component provides the context of time. “Short-term” refers to a temporary effect that lasts from a few minutes to a few days, after which the affected animals or resources revert to a "normal" condition. “Moderate” duration refers to an intermediate period of one migration season to several years. "Long-term" describes more permanent effects that may last for years or from which the affected animals or resources never revert to a "normal" condition. Frequency can range from “infrequent” effects that occur twice a year or less, to “intermittent” effects that occur on the order of monthly during a year. "Frequent" refers to effects that occur on a regular or repeated basis each year. Other elements of the temporal context of effects, such as whether the effects occur primarily during a sensitive or critical part of the year, are described in the analyses for each species or resource.

This assessment also evaluates the likelihood of an effect, in other words whether the potential effects are plausible or speculative. "Likely" effects are those that could arise from reasonable or demonstrated mechanisms, and the probability of those mechanisms arising from an alternative is greater than 50 percent. This does not imply that the analysts perform a formal probability calculation. Instead analysts use professional judgment to make a qualitative determination that the probability of the effect occurring is more likely than not. The likelihood of occurrence is considered in assessing magnitude, extent, and duration, as these factors are defined above. The determination of level of impact for each of these three factors is made on the basis of effects that are more likely to occur than not.

4.1.2.1 Determining the Quota

Since the late 1970s, the IWC has adopted catch limits for Western Arctic bowhead whale harvests, after considering the nutritional and cultural need for bowhead whales by Alaska Natives and the level of harvest that is sustainable. Beginning in 1997, the IWC also has factored Russian Native needs and level of harvest into its consideration of bowhead whale catch limits. In 1986, the IWC accepted a method to calculate subsistence and cultural need of Alaska Natives for bowhead whales. This method incorporates the historic and current size of the Alaska Native population residing in Alaskan subsistence hunting villages and the number of bowhead whales historically landed by each community (**Appendix 8.1**).

The IWC first established five-year block catch limits for this stock in 1997, allowing a total of 280 bowhead whales to be landed in each five-year period, or an average of 56 landed whales per year, and no more than 67 whales struck each year with a carryover of 15 unused strikes. Starting in 2013, the catch limit regime has continued as six-year blocks over which no more than 336 bowhead whales may landed. The five- and six-year block catch limits continued the established practice of limiting strikes to 67 per year and providing for the carry-forward of up to 15 unused strikes, in order to allow for the fact that variable hunting conditions mean that not every struck whale is landed.

Since 2002, suitability of the bowhead whale strike limits has been determined using the Bowhead Strike Limit Algorithm (SLA) program (IWC, 2003a). Inputs of the SLA include bowhead whale catches, abundance estimates from 1978 to the present time, and the value of need (i.e., number of whales permitted to be struck each year multiplied by the number of years of the quota). The Bowhead SLA does not provide an upper limit for safe catch. Instead, it evaluates a requested level of catch and determines whether that would maintain the IWC stock conservation and recovery goals (see **Section 3.2.1**). In 2004, the results of the Bowhead SLA calculations showed “that this level of need can be satisfied while fully meeting the Commission’s management objectives” (IWC, 2005a:23).

The IWC Schedule authorizes the aboriginal harvest of Western Arctic bowhead whales by both the U.S. and the Russian Federation. Annual strike quotas and landed limits for aboriginal subsistence hunting of bowhead whales are determined at the beginning of each year after consultation with the Alaska Eskimo Whaling Commission (AEWC) and renewal of the U.S.-Russia bilateral agreement governing the allocation of the bowhead whale subsistence catch limit between the two countries. The U.S. and the Russian Federation have agreed on a sub-allocation of seven strikes of bowheads per year to the Chukotkan aboriginal whalers (**Appendix 8.3**).

4.1.2.2 Impact Criteria

Table 4.1-1 provides a framework within which effects on bowhead whales can be assessed. This table summarizes the criteria for determining the level of impact based on the type (mortality or disturbance), the components (magnitude, extent, and duration) and the thresholds for four levels of effects (negligible, minor, moderate, and major). As noted in **Section 4.1.2**, the components of impact (magnitude, extent, and duration) are established in CEQ regulations. This framework represents the best judgment of the analysts in identifying mortality and disturbance as the key types of effects, and in establishing thresholds for a range of impact levels from negligible to major. The results of applying this framework are found in **Sections 4.4 and 4.5**, which describe the anticipated direct and indirect effects for each alternative on bowhead whales. Since the provisions for carry- forward of strikes represent the key difference among the alternatives, the analysis focuses on evaluating the scope and intensity of effects from each level of the strike limit carry-forward.

Table 4.1-1.
Criteria for Determining Impact Level for Effects on Bowhead Whales

		Mortality effects but no measurable change in population	Causes minor population change	Causes moderate population change	Causes major population change
		No measurable population decline	Population decline measurable at one location	Population decline measurable at several locations	Population decline measurable across range of stock
		No measurable population decline	Short-term or infrequent population decline	Moderate-term or intermittent population decline	Long-term and/or repeated population decline
		No measurable effects	Disturbance effects occur but distribution remains similar to baseline	Noticeable change in localized distribution	Enough to cause shift in regional distribution
		No measurable effects	Effects limited to one location	Effects distributed among several locations	Effects distributed across range of stock
		No measurable effects	Periodic, temporary, or short-term	Moderately frequent or intermittent	Chronic and long-term

Table 4.1-2 provides a framework for assessing the effects of bowhead whale harvests and whaling-related activities on other biological resources (other than bowhead whales). These effects are primarily related to disturbance associated with whaling activities, or redirection of subsistence harvests to other species if bowhead whaling were prohibited. Some habitat damage can also occur from other actions and events. This table summarizes the criteria, developed by the project scientists, for determining the level of impact based on the magnitude, extent, and duration. **Section 4.7, Section 4.8, and Section 4.9** summarize the anticipated direct, indirect, and cumulative effects under each alternative for other biological resources.

Table 4.1-2.
Criteria for Determining Impact Level for Effects on Other Wildlife

Type of Effect	Impact Component	Impact Level			
		Negligible	**Minor**	**Moderate**	**Major**
Mortality	**Magnitude or Intensity**	Mortality effects but no measurable change in population	Causes minor population change	Causes moderate population change	Causes major population change
	Geographic Extent	No measurable effects	Effects limited to one location	Effects distributed among several locations	Effects distributed across range of population
	Duration or Frequency	No measurable effects	Short-term or moderate and intermittent or infrequent	Moderate and frequent or long- term and intermittent	Long-term and/or frequent
Disturbance	**Magnitude or Intensity**	No measurable effects	Disturbance effects occur but distribution similar to baseline	Noticeable change in localized distribution	Enough to cause shift in regional distribution
	Geographic Extent	No measurable effects	Effects limited to one location	Effects distributed among several locations	Effects distributed across range of stock
	Duration or Frequency	No measurable effects	Periodic, temporary, or short-term	Moderately frequent or intermittent	Chronic and long- term

Table 4.1-3 provides a framework for assessing the effects of bowhead whale harvests and whaling-related activities on the social and cultural environment, and the criteria, developed by the project scientists, for determining the level of impact based on the magnitude, extent, and duration. These effects are primarily related to subsistence characteristics and public health and safety. **Section 4.8** summarizes the anticipated direct, indirect, and cumulative effects under each alternative for these resources.

Table 4.1-3.
Criteria for Determining Impact Level for Effects on Socio-cultural Resources.

Type of Effect	Impact Component	Impact Level			
		Negligible	Minor	Moderate	Major
Effects on subsistence	Magnitude or Intensity	No decline in production of major subsistence resources	Minor decline in production affecting few resources or limited seasons	Moderate decline in production affecting several resources or seasons	Substantial decline in production of major subsistence resources
	Geographic Extent	No measurable effects	Effects realized at few locations	Effects realized in numerous locations	Effects realized throughout the project area
	Duration or Frequency	No measurable effects	Periodic, temporary, or short-term	Moderate and frequent or long-term and intermittent	Chronic and long-term
Effects on public health and safety	Magnitude or Intensity	No measurable effects	The health and safety of < 5% of the population in the community would be affected	The health and safety of 5%-25% of the population in the community would be affected	The health and safety of >25% of the population in the community would be affected
	Geographic Extent	No measurable effects	Affects individuals in few communities	Affects individuals in half of the communities	Affects individuals throughout project area
	Duration or Frequency	No measurable effects	Periodic, temporary, or short-term	Moderately frequent or intermittent	Long-term and/or frequent

4.1.3 Steps for Identifying Cumulative Effects

To meet the requirements of NEPA, an EIS must include an analysis of the cumulative effects of a proposed action and its alternatives and consider those cumulative effects when determining environmental impacts. The CEQ guidelines for evaluating cumulative effects state that "...the most devastating environmental effects may result not from the direct effects of a particular action but from the combination of individually minor effects of multiple actions over time" (CEQ, 1997). The CEQ regulations for implementing NEPA define cumulative effects as follows:

The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

For this DEIS, assessment of cumulative effects requires an analysis of the direct and indirect effects of the proposed subsistence whaling catch limit alternatives, in combination with other past, present, or RFFAs potentially affecting bowhead whales, other biological resources, and subsistence harvest practices, and other socioeconomic resources. The intent of this analysis is to capture the total effects of many actions over time that would be missed by evaluating each action individually, and to assess the relative contribution of the proposed action and its alternatives to cumulative effects. The cumulative effects assessment then describes the additive and synergistic result of the subsistence whaling catch limit alternatives as they are reasonably likely to interact with actions external to the proposed actions. The ultimate goal of identifying cumulative effects is to provide for informed decisions that consider the total effects (direct, indirect, and cumulative) of the subsistence whaling catch limit alternatives.

The methodology used for cumulative effects analysis in this DEIS is drawn from the 2013 FEIS on the Alaska Eskimo Subsistence Hunt on Bowhead Whales and the 2008 FEIS on the Alaska Eskimo Subsistence Hunt on Bowhead Whales. This methodology includes the following steps:

- Identify issues, characteristics, and trends within the affected environment that are relevant to assessing cumulative effects of the alternatives. This information is summarized in **Section 3, "Affected Environment."**

- Describe the direct and indirect effects of the subsistence whaling catch limit alternatives. This information is presented here in **Section 4, "Environmental Consequences."**

- Define the spatial (geographic) and temporal (time) frame for the analysis. For the purposes of this DEIS, the reasonably foreseeable future has been established as the next 10 years or through 2028.

- Identify past, present, and reasonably foreseeable external actions such as other types of human activities and natural phenomena that could have additive or synergistic effects. The cumulative effects analysis uses the specific direct and indirect effects of each alternative and combines them with these identified past, present, and reasonably foreseeable effects of the identified external actions.

- Use cumulative effects tables to screen all of the direct and indirect effects, when combined with the effects of external actions, to capture those synergistic and incremental effects that are potentially cumulative in nature. Both adverse and beneficial effects of external factors are assessed and then evaluated in combination with the direct and indirect effects to determine if there are cumulative effects.

- Evaluate the impact of the reasonably likely cumulative effects using the criteria established for direct and indirect effects, and assess the relative contribution of the action alternatives to cumulative effects.

- Discuss rationale for determining the impact rating, citing evidence from the peer-reviewed literature, and quantitative information where available. The term ‘unknown’ can be used when there is not enough information to determine an impact level.

The advantages of this approach are that it closely follows 1997 CEQ guidance, employs an orderly and explicit procedure, and provides the reader with the information necessary to make an informed and independent judgment concerning the validity of the conclusions.

4.1.3.1 Relevant Past and Present Actions within the Project Area

Relevant past and present actions are those that have influenced the current condition of the resource. For the purposes of this DEIS, past and present actions include both human-controlled events, such as subsistence harvest, oil and gas exploration and development activities, and commercial fisheries, and natural events, such as predation and climate dynamics, some of which are influenced by human activity.

Extensive information about the effects of oil and gas activities on bowhead whales is discussed in several documents. The past actions applicable to the cumulative effects analysis have been either presented in **Section 3** of this document or previously reviewed in biological opinions prepared by NMFS for the following projects:

- SAExploration, Inc. (SAE) 3D OBN Open-Water Seismic exploration in the Beaufort Sea, AK (NMFS 2015a);
- Hilcorp Shallow Geohazard and Strudel Scour Surveys in Foggy Island Bay, Beaufort Sea, AK (NMFS 2015b);
- Shell Exploration Drilling Program in the Chukchi Sea, AK (NMFS 2015c);
- Lease Sale 193 Oil and Gas Exploration Activities, Chukchi Sea, Alaska (NMFS 2015d);
- SAExploration, Inc. (SAE) 3D OBN Open-Water Seismic in Colville River Delta, AK (NMFS 2014a);
- BP Exploration (BPXA) Shallow Geohazard Survey Foggy Island Bay, Beaufort Sea, AK (NMFS 2014b);
- BP Exploration (BPXA) 3D OBS Open-Water Seismic Survey Prudhoe Bay, Beaufort Sea, AK (NMFS 2014c).

The cumulative effects analysis relies on the descriptions presented in those documents. Additional past actions were identified using agency documentation, NEPA documentation, reports and resource studies, peer-reviewed literature, and best professional judgment. **Table 4.1-4** lists relevant past and present actions, and notes where descriptions of those actions can be located in this document.

4.1.3.2 Reasonably Foreseeable Future Actions (RFFAs) within the Project Area

RFFAs are those that:

- Have already been or are in the process of being funded, permitted, described in fishery management plans, oil and gas lease sale documents, or coastal zone management plans;
- Are included as priorities in government planning documents; or
- Are likely to occur or continue based on traditional or past patterns of activity.

Judgments concerning the probability of future impacts must be informed rather than based on speculation. RFFAs to be considered must also fall into the temporal and geographic scope described in **Section 4.1.3.3**.

Reasonably foreseeable future human-controlled and natural actions were screened for their relevance to the alternatives proposed in this DEIS. Due to the large geographic scope dealt with in this analysis, the identification of RFFAs was conducted on a broad scale, though specific RFFAs were considered where applicable. The following list presents the actions to be considered in the cumulative effects analysis, and **Table 4.1-4** compares those actions with past and present actions:

- **Subsistence activities**: Subsistence harvests of bowhead whales by Alaska Natives who dwell on the North Pacific Ocean or Arctic Ocean coasts of Alaska are likely to continue at present levels as described in **Section 3**. Subsistence harvests of other animals are assumed to continue at present levels.

- **Oil and gas activities**: Oil and gas leases in the Beaufort and Chukchi seas will result in continued and future offshore production facilities and pipelines, drilling activities, seismic programs, transportation and barging, staging, fixed and temporary camp operations, and ice road construction. Additional impacts from oil pollution and VLOS can occur from road runoff, bilge cleaning and ship maintenance, natural seeps, pipeline and platform spills, oil tanker spills, and offshore drilling. Other marine pollution and debris can occur due to industrial activities, waste disposal, and atmospheric deposition. Marine species may accumulate contaminants such as PCBs and polycyclic aromatic hydrocarbons (PAHs).

- **Climate variability**: Short-term changes in the ocean climate are likely to continue on a scale similar to those presently occurring. The preponderance of evidence indicates that human activities are causing some degree of global climate change due to anthropogenic warming of the atmosphere and oceans. This warming leads to shifts in global and regional weather patterns, among other effects.

- **Commercial shipping and other vessel traffic**: Trans-Arctic commercial shipping will likely increase as northern sea routes and Alaskan ports become increasingly ice-free for longer periods throughout the year, as onshore and offshore areas are developed for oil and gas, and as local communities grow.

- **Commercial fisheries**: Federal and state fisheries in the U.S. operate according to the Fishery Management Plans (FMPs). State- and Federally-regulated fisheries in the project area are administered by the North Pacific Fishery Management Council (NPFMC) and the Alaska Board of Fisheries (ABF). The NPFMC oversees management of Halibut and groundfish in the U.S. Exclusive Economic Zone (EEZ) off Alaska and ABF manages fisheries in nearshore waters as well as offshore crab fisheries.

- **Research activities**: Activities related to the scientific research of the physical and biological environment are likely to continue, including research of bowhead whales, other marine mammals, fish, birds, and marine predator-prey relationships.

- **Other development**: Coastal development within the project area, including port expansions and the construction of docks and facilities within the project area, is likely to occur as needs for marine support services and shipping capacity increase.

- **Mortality**: Disease, parasites, and predation will continue to result in mortality of marine mammals, fish, and birds. Factors such as exposure to contaminants, decreased genetic diversity, and increased stress can lead to reduced fitness, which in turn can increase susceptibility to mortality from disease and predation, as described in **Section 3**.

Table 4.1-4
Past, Present, and RFFAs Considered in the Impact Analyses

Activity	Past and Present	Reference (within this DEIS)	Reasonably Foreseeable
Human-Caused Activities			
Subsistence activities	Harvest of marine and terrestrial mammals, fish, and birds	3.2.3 3.3	Harvest of marine and terrestrial mammals, fish, and birds
Commercial harvest	Commercial whaling	3.2.2	None
Oil and gas activities, including industrial pollutants and VLOS	Seismic exploration Offshore drilling and production Industrial noise Marine spills and pollution Marine debris Contaminant bioaccumulation Human health effects	3.2.8 4.6.1 4.6.1.3 (Oil spills) 4.6.3	Seismic exploration Offshore exploration and development Construction and maintenance of oil and gas facilities Associated transportation activities (barging, pipelines, aircraft and vessel traffic) Marine spills and pollution Marine debris Contaminant bioaccumulation Human health effects Industrial noise
Commercial fisheries	Crab and pot-based fisheries (entanglement in gear) Ship strikes	3.2.6 4.6.4	Crab and pot-based fisheries (entanglement in gear) Ship strikes
Commercial shipping	Barge/vessel traffic and fuel spills Ship strikes Aircraft traffic	3.2.7 4.6.1.3 (Oil spills) 4.6.3	Barge/vessel traffic and fuel spills Ship strikes Aircraft traffic

Other development	Military activities Coastal and infrastructure development Tourism	4.6.6	Military activities Coastal and infrastructure development Tourism
Research Activities	Biological Oceanographic Geophysical/chemical (see oil and gas development)	4.6.5	Biological Oceanographic Geophysical/chemical (see oil and gas development)
Natural Systems			
Climate variability	Global warming	4.6.2	Global warming
Mortality	Predation Disease and parasites	3.2.4 3.2.5	Predation Disease and parasites

Table 4.1-5 provides a list of the RFFAs likely to occur in the project area, and identifies which resources a particular RFFA could affect.

Table 4.1-5
RFFAs Considered in the Cumulative Impact Analyses

Subsistence Activities	1, 2, 3, 4, 5, 6
Commercial Harvest	1, 2, 3, 6
Oil and Gas Activities	1, 2, 3, 4, 5, 6
Global and Industrial Pollutants	1, 2, 3, 4, 5, 6
Commercial Fisheries	1, 2, 5, 6
Commercial Shipping	1, 2, 5, 6
Other Development	1, 2, 5, 6
Scientific Research	1, 2
Climate Variability	1, 2, 3, 4, 5, 6
Mortality	1, 2, 3
1. Bowhead Whale (stock) 2. Other Wildlife 3. Alaska Eskimo Health	4. Alaska Eskimo Safety 5. Other Tribes and Aboriginals 6. General Public

4.1.3.3 Project Area and Scope for Analysis

The spatial scope of the effects analysis is the entire geographic range of the Western Arctic bowhead whale stock in the Bering, Chukchi, and Beaufort seas, including Russian Federation and Canadian waters in this range. When this spatial scope is not applicable to a given resource, a relevant geographic sub-area is defined in the analysis.

Evaluation of cumulative effects requires an analysis of the potential direct and indirect effects of the proposed alternatives, in combination with other past and present actions and RFFAs. The timeframe or temporal scope for the past and present effects analysis was defined as the period since the Western Arctic bowhead whale stock was first commercially hunted in the Bering Sea in 1848. For each resource, the timeframe for past and present effects is described in Section 3. RFFAs considered in the cumulative effects analysis consist of projects, actions, or developments that can be projected, with a reasonable degree of confidence, to occur in the foreseeable future and that are likely to affect the resources described. A common practice is to project five to 10 years forward, and in this case, the 10-year timeframe was chosen because reasonable estimates of future actions that may affect the Chukchi and Beaufort seas are available for this period.

4.2 Incomplete and Unavailable Information

The CEQ guidelines require that when an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking (40 CFR 1502.22). In the event that there is relevant information, but the overall costs of obtaining it are exorbitant or the means to obtain it are not known (40 CFR 1502.22), the regulations instruct that the following should be included:

- A statement that such information is unavailable;
- A statement of the relevance of such information to evaluate reasonably foreseeable significant adverse impacts;
- A summary of existing information that is relevant to evaluating the adverse impacts; and
- The agency's evaluation of adverse impacts based on generally accepted scientific methods.

In the analysis, this DEIS identifies those areas where information is unavailable and whether existing information can support an adequate evaluation of the environmental consequences of the alternatives. The direct, indirect, and cumulative effects analyses are based on readily available information; however, those data gaps that still exist are identified, in accordance with the above CEQ guidelines.

4.3 Resources and Characteristics of the Project Area Not Carried Forward For Analysis

Species that would not be affected directly or indirectly by bowhead whaling activities include gray whales, minke whales, killer whales, harbor porpoise, short-tailed albatross, and many terrestrial mammals. These species were not considered for further analysis because the alternatives would not affect these species.

4.4 Direct and Indirect Effects of the Alternatives on the Western Arctic Bowhead Whale in the Project Area

Five alternatives were developed for consideration in this DEIS based, in part, on the IWC-adopted strike limit, which includes takes in both Alaska and the Russian Federation. Three of the proposed alternatives assess the merits of different options in the carry forward of strikes, without suggesting a change to the existing landed limits adopted by the IWC since 1997, and as established through several decades of scientific research and calculations. One alternative contemplates a quota reduction (to zero) while another contemplates a 50 percent increase in the quota.

In the analysis of impacts under the alternatives, the risk of mortality is estimated based on the strike quota rather than the total for landed whales. The fate of struck and lost whales, and the likelihood of their mortality, is not fully known. For the purposes of assessing biological impacts, it is necessary to take a precautionary approach and assume that all struck whales represent mortalities. This is a worst-case scenario required for the analysis and not an assertion that all strikes from subsistence whaling result in mortalities.

Alternative 1 (No Action)

Alternative 1 would have NMFS take no action to establish catch limits under the WCA for subsistence take of bowhead whales, notwithstanding the IWC Schedule's requirement to establish catch limits and permit aboriginal subsistence whaling for Western Arctic bowhead whales, subject to certain limitations.

For the purpose of analysis, no bowhead whales would be taken by Alaska Natives in subsistence harvests under Alternative 1. Therefore, the magnitude, extent, and duration/frequency of direct mortality under this alternative by an AEWC hunt are considered negligible to the population of bowheads (using the method outlined in **Table 4.1-1**). Since the IWC catch limits for Western Arctic bowhead whales are shared with natives from Chukotka in the Russian Federation, NMFS' implementation of a no action alternative would make more whales available for a bowhead hunt by Russian Natives. Human activities associated with subsistence whaling by Alaska Natives would be sharply reduced under this alternative, so that the amount of noise and disturbance from subsistence whaling would also be considered negligible. Since 1978, when the IWC began to regulate the subsistence harvest, the Western Arctic bowhead stock has been growing, with an estimated yearly growth rate of 3.2% between 1984 and 2003 (see **Section 3.2.1** and **Figure 3.2.1- 1**). Without subsistence harvests, the growth rate may increase to an estimated 3.7% per year (an increase of one half of one percent), assuming Russian Natives would not increase their bowhead harvest in the absence of a bowhead hunt by Alaska Natives.

It is important to note that because the WCA requires NMFS to implement requirements of the IWC Schedule, this alternative would be contrary both to the Schedule and to U.S. law.

Alternative 2

Alternative 2 would allow NMFS to grant the AEWC the U.S. portion[25] of an annual strike limit of 67 bowheads per year, not to exceed the U.S. portion of a total of 336 landed whales over any six-year period. No carry-forward of unused strikes would be allowed.

Over any six-year period the maximum annual mortality could be 67 whales, subject to a total of 336 landed whales over any six-year period. Given the current abundance and growth trends (**Section 3.2.1**), this total annual mortality is unlikely to cause the population to decline or notably slow its rate of recovery. The magnitude, geographic extent, and duration/frequency of this level of mortality are therefore considered negligible for the bowhead population (**Table 4.1-1**). Human activities associated with subsistence whaling under Alternative 2 would vary from year to year and place to place depending on whale movements, weather, ice characteristics, and social factors. Effects of human activities are localized and timed to coincide with the presence of whales during spring and autumn migrations. The disturbance to the Western Arctic bowhead whales from subsistence whaling activities under Alternative 2 would be minor in magnitude at the population level, localized in geographic extent, and periodic, short-term in duration/frequency. The disturbance effect would be considered minor at the population level.

It is important to note that because the IWC Schedule requires unused strikes to be carried forward and added to the strike quotas of subsequent years, subject to limits, this alternative would be contrary to the Schedule and to U.S. law.

Alternative 3

Alternative 3 would allow NMFS to grant the AEWC the U.S. portion of an annual strike limit of 82 bowheads struck (67 strikes + up to 15 unused strikes carried forward from previous years) per year, not to exceed the U.S. portion of a maximum total of 336 landed whales over any six-year period. No more than 15 additional unused strikes from any prior year are added to any one year’s allocation of strikes.

This alternative would maintain the status quo for any six-year period with respect to management of the hunt. The maximum annual mortality could be 82 whales, (67 strikes + up to 15 unused strikes carried forward), subject to a maximum total of 336 landed whales over any six-year period. The direct and indirect effects of Alternative 3 on the bowhead whale population would be negligible. The magnitude, geographic extent, and duration/frequency of this level of

[25] As discussed in Section 2.0, the U.S. and Russian Federation agree annually on the total number of strikes that Alaska Natives and natives from Chukotka are each allowed to use. For purposes of this DEIS, the maximum combined mortality is analyzed.

mortality are considered negligible for the bowhead population. Effects of human activities are localized and timed to coincide with the presence of whales during spring and autumn migrations. The disturbance to the whales from subsistence whaling activities under Alternative 3 would be considered minor at the population level, and comparable to those identified under Alternative 2.

Alternative 4 (Preferred Alternative)

Alternative 4 would allow NMFS to grant the AEWC the U.S. portion of an annual strike limit of 100 bowheads (67 strikes + up to 33 unused strikes carried forward from previous years), not to exceed the U.S. portion of a total of 336 landed whales over any six-year period. Up to 33 unused strikes from previous years can be carried forward, subject to limits, and added to the annual strike quota of subsequent years, provided no more than 50 percent of the annual strike limit (33 strikes) is added for any one year. This Alternative is consistent with the IWC's 50 percent carryover principle[26].

Under this alternative, the maximum annual mortality could be 100 whales, (67 strikes plus up to 33 unused strikes carried forward), subject to a maximum total of 336 landed whales over any six-year period. This level of mortality is considered negligible in magnitude for the bowhead population (**Table 4.1-1**), in light of current abundance and growth trends (**Section 3.2.1**). The extent and duration of the effects under this alternative are the same as those for Alternative 3, so the overall impact of this alternative is also rated negligible. Human activities associated with this alternative would be identical to those associated with Alternative 3. Effects of human activities are localized and timed to coincide with the presence of whales during spring and autumn migrations. The disturbance to the whales from subsistence whaling activities under Alternative 4 would be minor in magnitude, localized in geographic extent, and periodic, short-term in duration/frequency. The disturbance effect would be considered minor at the population level.

Alternative 5

Alternative 5 would allow NMFS to grant the AEWC the U.S. portion of an annual strike limit of 150 bowheads (100 strikes + up to 50 unused strikes carried forward from previous years), not to

[26] As described in Sections 1.2.2 and 3.2.1, in 2002, the IWC adopted a "Strike Limit Algorithm" (SLA) for Western Arctic bowhead whales to calculate appropriate levels for the strike limit (IWC, 2003a, b) that would achieve IWC management goals, including stock conservation, in a very wide range of scenarios. In 2017, the IWC's Scientific Committee reiterated its previous agreement that SLAs are robust with respect to a 50 percent inter-annual variability within blocks and to the same 50 percent allowance between the last year of one block and the first year of the next (2017 IWC Scientific Committee Report at 23.)

exceed the U.S. portion of a total of 504 landed whales over any six-year period. The Bowhead SLA has not been used to assess this level of impact; however, NMFS's issuance of these catch limits would be subject to IWC requirements, which will in turn, be based on IWC Scientific Committee advice on the sustainability of these catch limits., NMFS assumes that the SLA would provide conservative management advice and meet IWC objectives for the management of stocks subject to aboriginal subsistence takes (cf. IWC, 1999).

While the Bowhead SLA has not been used to assess the harvest levels of Alternative 5, PBR can be used to assess the impacts of a harvest of up to 150 bowheads per year, not to exceed a total of 504 landed whales over any six-year period. This level of take would be below the 2016 PBR of 161 animals, and would have a minor impact.

In addition, the 2006 catch control rule Q indicates a take below Q_{low} of 155 whales per year would be considered to be a minor impact. Given that the Western Arctic bowhead whale abundance estimates have increased since the 2006 stock assessment, there is no reason to think that a current estimate of Q_{low} would be any lower today if a revised assessment were conducted.

Therefore, the direct and indirect effects of Alternative 5 on the bowhead whale population would be minor. The impact of this level of take, i.e., up to 150 whales per year, which includes the maximum carryover of unused strikes, on the Western Arctic stock of bowhead whales would be less than 1 percent of the current population estimate of 16,820 animals. The population would still likely increase in numbers, albeit at a lower rate. The magnitude, geographic extent, and duration/frequency of this level of mortality are considered minor for the bowhead population. Effects of human activities are localized and timed to coincide with the presence of whales during spring and autumn migrations. The disturbance to the whales from subsistence whaling activities under Alternative 5 would be minor in magnitude, localized in geographic extent, and periodic, short-term in duration/frequency. The disturbance effect would be considered minor at the population level.

4.5 Direct and Indirect Effects of the Alternatives on Individual Whales in the Project Area

Under the action alternatives, hunting activities associated with Alternatives have the potential to directly affect struck whales and to indirectly affect bowhead whales that are not being directly harvested. This includes noise associated with ASW hunting practices, the presence of vessels and other underwater noise. The sound of harpoon bomb detonations during a strike is audible for several kilometers. Acousticians listening to bowhead whale calls as part of the census report that calling rates decrease for a brief period after a detonation (C. W. Clark, Cornell Laboratory of Ornithology, Pers. comm.). The range at which whales may be affected is unknown and will vary with environmental conditions (e.g., depth of water, ambient noise levels, ice conditions, bottom structure) and the depth at which the bomb detonates.

According to Alaska Native Traditional Ecological Knowledge (TEK), after a harpoon bomb detonation, some whales act “skittish” and wary (E. Brower, Barrow Whaling Captain’s Association President, Pers. comm.). Whales temporarily halt their migrations, turn 180 degrees away from the disturbance (i.e., move back through the lead systems), or become highly sensitized as they continue migrating (E. Brower, Barrow Whaling Captain’s Association President, Pers. comm.). These changes in migratory behavior in response to disturbance are short-term, as several whales are often landed at whaling villages such as Utqiaġvik (Barrow) in a single day (George, 1996).

In this respect, the indirect disturbance effects on individual whales will be negligible in magnitude, extent, and duration/frequency under Alternative 1, since under this alternative no subsistence whaling by Alaska Natives would occur. Under Alternatives 2, 3, 4, and 5, subsistence whaling would occur with negligible mortality and minor disturbance effects at the population level, as described in **Section 4.4**. With respect to disturbance effects to individual bowhead whales, the magnitude, extent, and duration of the associated disturbance effects would also be minor.

4.6 Cumulative Effects of Other Activities in or near the Project Area on the Western Arctic Bowhead Whale Stock

Cumulative effects are the effects on the environment which result from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions (RFFAs) regardless of what agency (federal or non-federal) or person undertakes such other actions (40 CFR 1508.7). Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time. The ultimate goal of identifying cumulative effects is to provide for informed decisions that consider the total effects (direct, indirect, and cumulative) of the proposed action to provide for a multi-year block catch limit for the subsistence harvest of bowhead whales.

In the following section, past, present, and reasonably foreseeable future actions occurring in or near the project area that cumulatively affect bowhead whales are discussed. Subsequent sections address the direct, indirect and cumulative effects of the alternatives on other wildlife (**Section 4.8 and Section 4.9**), and direct, indirect and cumulative effects of the alternatives on the sociocultural environment (**Section 4.10**).

4.6.1 Effects of Offshore Oil and Gas Activities in the Project Area

4.6.1.1 Past and Present Offshore Oil and Gas Activities in the Project Area

Past and present oil and gas activities considered in the cumulative case include the following: any historical actions related to exploration, development, or production that have ongoing effects on the DEIS project area; construction and ongoing maintenance of present infrastructure support facilities and transportation systems; and any other oil and gas activities that affect the DEIS project area and are currently underway. These activities include projects or actions that may occur in a broader geographic area than the DEIS project area, in any stage of development.

Onshore oil development has been the main agent of industrial change on the North Slope and throughout the Arctic Outer Continental Shelf (OCS) in the twentieth and twenty-first centuries. Although Iñupiat people used oil from seepages as fuel prior to Western contact, the U.S. Navy and the U.S. Geological Survey (USGS) conducted the first modern program of oil and gas exploration on the North Slope during the 1940s and 1950s. Oil production started at Prudhoe Bay in 1977, and has occurred for over 40 years in the region. It presently spans from Alpine in the west to Point Thomson in the east. Associated industrial development has included the creation of industry-supported community airfields at Deadhorse and Kuparuk, and an interconnected industrial infrastructure that includes roadways, pipelines, production and processing facilities, gravel mines, and docks (BOEM 2017, page 5-3).

Federal leasing on the North Slope, which began in 1958, led to several industry-sponsored exploration programs. The discovery of oil at Prudhoe Bay in 1968, followed by discoveries at Kuparuk, West Sak, and Milne Point in 1969, marked the beginning of commercial oil development in the region (National Research Council [NRC], 2003). Completion of the Trans-Alaska Pipeline System (TAPS) in 1977 allowed year-round transport of North Slope oil to the marine terminal in Valdez and efficient shipment to market. Leasing of state and federal offshore continental shelf areas began in 1979, and offshore discoveries were made at Endicott, Sag Delta, Point McIntyre, Niakuk, and Northstar (NRC, 2003).

The Point McIntyre and Niakuk pools are located mostly in the offshore area, but their production facilities are located onshore (MMS, 2008). Endicott Island, built in 1987, was the first continuously producing offshore oil field in the Arctic. The Northstar offshore island for oil production was constructed in 1999-2000. Northstar, Nikaitchuq and Ooguruk developments currently operate in nearshore areas of the Beaufort Sea, and is expected to continue operating in the future. Construction of the artificial island to facilitate the offshore Liberty project is planned to commence in 2018.

TAPS throughput peaked in 1988 at nearly 2.1 million barrels per day. Although the overall trend has been one of declining throughput (down to 540,000 barrels per day in 2017), however production did increased in 2016 and 2017 (Alaska Oil and Gas Association, 2018).

For additional information on past, present, and future oil and gas exploration and development in the Beaufort and Chukchi seas, please refer to following:

- Environmental Assessment – Shell Offshore Inc. [Shell], Beaufort Sea Exploration Plan, 2007-2009 (MMS, 2007b).
- Draft Environmental Impact Statement – Beaufort and Chukchi Sea Planning Areas Oil and Gas Lease Sales 209, 212, 217, and 221 (MMS, 2008) (hereafter "Arctic Multiple-Sale Draft EIS").
- Environmental Assessment – For the Issuance of Incidental Harassment Authorizations to Take Marine Mammals by Harassment Incidental to Conducting Open Water Seismic and Marine Surveys in the Beaufort and Chukchi Seas. July 2010. (NMFS, 2010).
- Final Supplemental Environmental Impact Statement – Chukchi Sea Planning Area, Oil and Gas Lease Sale 193 (Bureau of Ocean Energy Management, Regulation and Enforcement [BOEMRE], 2011a).
- Draft Environmental Impact Statement – Effects of Oil and Gas Activities in the Arctic Ocean (NMFS, 2011).
- Point Thomson Project Draft Environmental Impact Statement. (U.S. Army Corps of Engineers [USACE], 2011).
- Statoil Shallow Hazard Surveys in the Chukchi Sea, Alaska (2011)
- Final Environmental Impact Statement – Outer Continental Shelf Oil and Gas Leasing Program: 2012- 2017 (Bureau of Ocean Energy Management [BOEM], 2011).
- Seismic exploration by BP in Simpson Lagoon, Beaufort Sea, Alaska (2012)
- Shell Exploration Drilling Program in the Chukchi Sea, AK (2012)
- TGS 2D Seismic Survey in the Chukchi Sea (2013)

- Shell Geophysical Surveys, Equipment Recovery, and Maintenance Activities in the Chukchi Sea, Alaska (2013)
- SAExploration, Inc. (SAE) 3D OBN Open-Water Seismic in Colville River Delta, AK (2014)
- BP Exploration (BPXA) Shallow Geohazard Survey Foggy Island Bay, Beaufort Sea, AK (2014)
- BP Exploration (BPXA) 3D OBS Open-Water Seismic Survey Prudhoe Bay, Beaufort Sea, AK (2014)
- SAExploration, Inc. (SAE) 3D OBN Open-Water Seismic Beaufort Sea, AK (2015)
- Hilcorp Shallow Geohazard and Strudel Scour Surveys in Foggy Island Bay, Beaufort Sea, AK (2015)
- Shell Exploration Drilling Program in the Chukchi Sea, AK (2015)
- Shell Ice Overflight Surveys in the Beaufort and Chukchi Seas, AK (2015)

Lease Sales. Ten federal lease sales for the Outer Continental Shelf (OCS) have been held in the Beaufort Sea planning area since 1979. Active federal leases include seven leases from Sale 186 (15,217 hectares), 83 leases from Sale 195 (170,464 hectares), and 89 leases from Sale 202 (196,276 hectares) in the Beaufort Sea.

Three federal lease sales for the OCS have been held in the Chukchi Sea planning area between 1979 and 2017. Six exploration wells were drilled in the Chukchi Sea between 1989 and 2017, but no commercial production has occurred in the Chukchi Sea planning area.

Chukchi Sea Lease Sale 193, held in February 2008, resulted in the sale of 487 leases totaling approximately 2.8 million acres in the Chukchi Sea Planning Area (BOEMRE, 2011a). As is the case elsewhere, development on leased areas is subject to conditions to mitigate operational and environmental risks, including: protection of biological resources; orientation programs to familiarize personnel with environmental, social, and cultural issues; environmental requirements regarding the placement of pipelines; precautionary action to mitigate potential oil spill impacts; and measures to minimize the effects to threatened and endangered species. BOEM has also required specific mitigation measures for the corridor of leases closest to the coastline, including a corridor 83.6 km (52 mi.) from the shore in which no lease activity will take place, site-specific monitoring programs to assess behavioral effects on marine mammals, and conflict avoidance mechanisms to protect subsistence harvesting activities (BOEMRE, 2011a).

Seismic Survey and Site Clearance Activities. Seismic work in the Arctic has traditionally been conducted in ice-free months (July through November), although surveys utilizing an icebreaker could potentially continue through mid-December. Seismic surveys are also conducted on-ice in areas where there is bottom-fast ice in the winter. These surveys generally occur from January through May. Each survey takes between 30 and 90 days, depending on many factors, including ice conditions, weather, equipment operations, size of area to be surveyed, and the timing of subsistence hunts.

Site clearance and shallow hazards surveys are usually of lesser concern regarding impacts to cetaceans than deep two-dimensional (2-D)/three-dimensional (3-D) surveys (NMFS, 2010) because they typically use smaller sized air gun arrays. The potential for cumulative adverse impacts to marine mammals from seismic surveys and site clearance activities can be mitigated by implementing well-designed monitoring plans and carefully constructed mitigation measures. Since 1986, the AEWC has collaborated with developers in crafting Conflict Avoidance Agreements (CAA), whereby parties jointly develop mitigation measures intended to reduce adverse impacts to subsistence hunting opportunities, as well as direct and cumulative impacts to bowhead whales and bowhead whale habitat.

Seismic surveys for exploration purposes in state waters are authorized under Geophysical Exploration Permits subject to 11 Alaska Administrative Code (AAC) 96.010 through 96.250, Miscellaneous Land Use Regulations, and the attached stipulations. However, seismic surveys conducted for other purposes, such as shallow hazard assessments, do not require permits unless they are not conducted from the ice and/or involve contact with the seafloor (MMS, 2006b).

Offshore oil and gas exploration programs have operated in the Alaskan Chukchi Sea since the 1950s, although the extent of these activities has been significantly less than that in the Beaufort Sea, and has seen much variation among years (MMS, 2006b; Shell, 2011). MMS-permitted seismic surveys have been conducted in the Chukchi and Beaufort seas since the late 1960s/early 1970s.

As previously indicated, in 2015, SAExploration, Inc. conducted 3D OBN Seismic exploration in the Beaufort Sea and Hilcorp conducted a shallow hazard and strudel scour survey in Foggy Island Bay in the Beaufort Sea in 2015. In 2014, BP Exploration Alaska, Inc. (BPXA) completed a 3D Ocean Bottom Node (OBN) Seismic Survey in the North Prudhoe Bay area and SAExploration, Inc. completed an on-ice 3-D Seismic Survey extending from onshore Alaska across nearshore State waters into the Beaufort Sea OCS. In 2012, Ion Geophysical Corporation completed a 2-D Seismic Survey across a large swath of the Beaufort Sea OCS and extending into the Chukchi Sea OCS. Other less recent Beaufort Sea OCS surveys include one 3-D survey each by Shell and BPXA in 2008 and three surveys by Shell in 2007 (one 3-D marine seismic, one 3-D on-ice seismic, and one high resolution shallow seismic survey.)

More recent seismic exploration activities were conducted by industry in the Alaskan Chukchi Sea in 2006–2010. The total number of miles of vessel track line associated with seismic survey activities in the Chukchi Sea was greatest in 2006 (Funk et al., 2010). Similar amounts of seismic survey activities occurred in the Chukchi Sea from 2006-2010 compared to what occurred from 1980-1991.

In the 1980s, five high-resolution site-clearance surveys were conducted in the Chukchi Sea OCS prior to five exploration wells being drilled. Between 1970 and 1975, 12 MMS G&G (geological and geophysical) permits were issued for Chukchi Sea 2-D marine seismic surveys, but none between 1976 and 1979.

Site Clearance Survey Activities. High-resolution site-clearance surveys in the Beaufort and Chukchi Sea OCS precede the drilling of exploration wells. Additional site-clearance surveys may have been conducted for other activities as well (e.g., island or dock construction).

Oil and Gas Exploration and Development. Since the discovery and development of the Prudhoe Bay and Kuparuk oil fields, more nearshore oil fields have been tapped from terrestrial sites. Notable exceptions include Northstar, Endicott, and Lisburne fields. Endicott Field was developed using causeways whereas the Lisburne Field was developed using directional drilling from shore. The Ooguruk Field, developed by Pioneer Natural Resources Alaska in nearshore waters off of Oliktok Point, uses horizontal drilling to access oil in several different areas from a single location on the surface. The Ooguruk field began production in 2008.

Similarly, oil production began at the Nikaitchuq field in February 2011. The Nikaitchuq field is located in the nearshore waters of the Beaufort Sea northwest of Prudhoe Bay in approximately 3 meters of water. Field development at the Nikaitchuq field started in 2008. Eni (an Italian multinational oil and gas company) plans to drill one-third of the wells from shore and the remainder from an artificial island to be constructed about 2.8 mi. from shore in Phase 2 of the field's development. A 6.1 km-long (3.8 mi.-long) under seabed pipeline bundle, which is the heaviest bundle ever installed in the Arctic, connects the offshore facility to the onshore facilities.

Five exploration wells were drilled in OCS waters of the Chukchi Sea in the 1980s, and an additional well was drilled in 2015. There are currently no operating oil or gas facilities in the

Chukchi Sea Planning Area.

<u>Drilling</u>. There are 38 past and present U.S. Arctic Oil and Gas fields and satellite fields in Alaska (BOEM 2017, page 5-4). Recent exploration drilling has occurred in both the Beaufort and Chukchi Sea OCS, as well as in the nearshore state waters of Smith Bay in the Beaufort Sea. In 2012, Shell Offshore, Inc. proposed exploration of two new prospects in Camden Bay, the Sivulliq and Torpedo prospects. Though four wells were permitted, only one well was drilled. The well targeted the Sivulliq prospect BOEM Liberty Development and Production Plan Draft EIS Cumulative Effects 5-5 approximately 16 miles offshore. Prior to penetrating potentially oil-bearing zones, Shell ceased drilling, and the well was temporarily abandoned and the exploration program was terminated.

In 2012, Shell Gulf of Mexico, Inc. also attempted exploration of the Burger prospect approximately 60 miles from shore in the Chukchi Sea OCS. As with the Sivulliq well, Shell ceased drilling, temporarily abandoned the well, and terminated the exploration program prior to penetrating the potentially oil-bearing Burger prospect. Shell returned to the Burger prospect in 2015 to drill a new exploration well, this time reaching the Burger prospect and confirming a lack of economically producible oil. The well was plugged and abandoned and Shell later relinquished all Chukchi Sea OCS leases. After relinquishments by other Chukchi Sea OCS lessees, there are currently no remaining Chukchi Sea leases issued in Lease Sale 193.

In 2016, Caelus Energy Alaska, LLC (Caelus) drilled two exploration wells into the Tulimaniq prospect on nearshore State of Alaska leases in Smith Bay approximately 59 miles southeast of Utqiaġvik (Barrow) in the Beaufort Sea. By October 2016, Caelus announced it has made an oil discovery estimated at 200,000 barrels per day of light, highly mobile oil. The recovery rates, if correct, would put the field's estimated oil potential between 1.8 billion barrels and 4 billion barrels. By way of comparison, Prudhoe Bay oil field was originally estimated to have 25 billion barrels. Additional well testing would tell more about potential production rates.

<u>Noise</u>. In both the Beaufort and Chukchi seas lease areas, bowhead whales can be affected by combined effects of noise and activity from all of these sources in nearshore waters, including seismic activity, site-clearance seismic surveys, drilling, and other oil and gas development activity. As a result, whales may exhibit avoidance behavior resulting in short-term displacement from traditional migration routes, thereby making it harder for subsistence hunters to hunt, and to retrieve harvested whales.

The spring season appears to be a particularly critical period in the bowheads' annual cycle. This is the time most, if not all, of the population migrates through areas covered by dense ice where migration routes are constrained and most likely to be affected by elevated sound sources

(Richardson et al., 1995a,b). Studies have defined anthropogenic impact as a function of the extent that industrial activities coincide with the bowhead whales' seasonal occupation of certain regions and the whales' tolerance level of the impacts (Richardson and Malme, 1993; Bratton et al., 1993). Exposure to anthropogenic sound and contaminants may produce short and long-term effects (Richardson and Malme, 1993; Bratton et al., 1993). However, Richardson and Malme (1993) state that data are not available to assess long-term impacts. Further, research in 1996 through 1998 showed that some seismic noise can deflect autumn migration of bowheads to farther offshore (Miller et al., 1999; Richardson, 1999; Richardson et al., 1999). Residents of the Arctic have expressed concern regarding the cumulative and long-term effects of anthropogenic noises on Western Arctic bowhead whales (Ahmaogak, 1985; 1989).

> *Our observations, proven correct time and again by scientific research, are that bowhead whales change their behavior when industrial activity is taking place in their usual habitat. Because of these changes in behavior, the whales become less available or completely unavailable to our hunters during the time the activity is occurring, due both to noise disturbance and to pollution in the water. We also are very concerned that some habitats might be abandoned altogether if industrial activity increases or if it is undertaken in a way that creates ongoing disturbance.* -- Harry Brower, representing the AEWC, in written comments on NMFS (2011) dated April 9, 2010.

As noted in **Section 3.2.8** of this DEIS, the effects of oil and gas activities on bowhead whales are discussed at length in several documents: NMFS (2013), BOEMRE (2011), BOEM (2015, 2016), NMFS (2015a, b) with additional information presented on the BOEM Alaska OCS Region website: https://www.boem.gov/Alaska-Region/. NMFS (2006) concluded that the effects from an encounter with aircraft generally are brief and whales should resume their normal activities within minutes (Patenaude et al., 2002). Bowheads may exhibit temporary avoidance behavior to vessels at distances of 1 to 4 km. Many earlier studies indicate that most bowheads exhibit avoidance behavior when exposed to sounds from seismic activity. Bowheads also exhibited tendencies for reduced surfacing and dive duration, fewer blows per surfacing, and longer intervals between successive blows. Alaska Native whalers have stated that noise from seismic surveys and some other activities at least temporarily displaces whales farther offshore, especially if the operations are conducted in the main migration corridor (MMS, 2006b).

Mitigation measures developed through this process have increased hunter safety from industry vessel traffic through the establishment of industry-funded communications centers and mitigated adverse impacts to the availability of bowhead whales for subsistence hunting. Measures to reduce both direct and cumulative adverse impacts to bowhead whales and bowhead whale habitat have been implemented. In a March 1997 workshop on seismic-survey effects conducted by MMS (now BOEM) in Utqiaġvik (Barrow), Alaska, with subsistence hunters from the communities of Utqiaġvik (Barrow), Nuiqsut, and Kaktovik, hunters agreed on the following statement concerning the “zone of influence” from seismic-survey noise:

> *Factual experience of subsistence whalers testify that pods of migrating bowhead whales will begin to divert from their migratory path at distances of 35 miles from an active seismic operation and are displaced from their normal migratory path by as much as 30 miles* (MMS, 2008).

Monitoring studies of 3-D seismic exploration in the nearshore Beaufort Sea during 1996-1998 demonstrated that nearly all bowhead whales will avoid an area within 20 km of an active seismic source (Richardson et al., 1999). Using airgun arrays with 6 to 16 airguns and total volumes ranging from 9.2 liters to 24.6 liters (560 to 15000 cubic inches), sound levels received by bowhead whales ranged from 117 - 135 dB re 1 μPa (rms) at 20 km, and from 107-126 dB re 1 μPa (rms) at 30 km from the source (Richardson et al., 1999). Data from monitoring seismic operations from 1996 through 1998 suggested that the offshore displacement may have begun roughly 35 km (19 n. mi. or 22 statute miles [st. mi.]) east of the activity and may have persisted more than 30 km to the west (Richardson et al., 1999). Bowheads reoccupied the area within 12-24 hours after seismic surveys ended (Richardson et al., 1999). It should be noted that the sound levels received by bowhead whales at a given distance from a sound source would depend upon multiple factors, including the source level, frequency, and duration of the sound, all of which may be influenced by the volume and configuration of a particular airgun array. Environmental factors such as water depth, temperature, and seafloor composition would also influence the propagation characteristics of sound through the nearshore Beaufort Sea.

Richardson et al. (1986b) observed feeding bowheads start to turn away from a 30-airgun array with a source level of 248 dB re 1 μPa at a distance of 7.5 km (4.7 mi.) and swim away when the vessel was within about 2 km (1.2 mi.) while other whales in the area continued feeding. More recent studies have similarly shown greater tolerance of feeding bowhead whales to higher sound levels than migrating whales (Miller et al., 2005; Harris et al., 2007). Data from an aerial monitoring program in the Alaskan Beaufort Sea during 2006 to 2008 also indicate that bowheads feeding during late summer and autumn did not exhibit large-scale distribution changes in relation to seismic operations (Funk et al., 2010). This apparent tolerance, however, should not be interpreted to mean that bowheads are unaffected by the noise. Feeding bowheads may be so highly motivated to stay in a productive feeding area that they remain in an area with noise levels that may cause adverse effects (NMFS, 2010). They could be suffering increased stress by staying in a location with very loud noise (MMS, 2008).

Bowheads have been sighted within 0.2 - 5 km of drill ships, although bowheads change their migration speed and swimming direction to avoid close approach to noise-producing activities, vehicles and structures. During autumn migration, bowheads may avoid drill ships and their support vessels at 20 - 30 km. It has been predicted that roughly half of the bowheads would respond at a distance of 4.6 - 20 km when the signal-to-noise ratio is 30 dB (Richardson et al., 1995a). These types of observations have been reported by subsistence whalers. As indicated by Thomas Brower, Sr. on October 1, 2008 in the Arctic Multiple Sale document (MMS, 2008):

> *The whales are very sensitive to noise and water pollution. In the spring whale hunt, the whaling crews are very careful about noise. In my crew, and in other crews I observe, the actual spring whaling is done by rowing small boats, usually made from bearded sealskins. We keep our snow machines well away from the edge of the ice so that the machine sound will not scare the whales. In the fall, we have to go as much as 65 miles out to sea to look for whales. I have adapted my boat's motor to have the absolute minimum amount of noise, but I still observe that whales are panicked by the sound when I am as much as 3 miles away from them. I observe that in the fall migration, the bowheads travel in pods of 60 to 120 whales. When they hear the sound of the motor, the whales scatter in groups of 8 to 10, and they scatter in every direction.*

Available scientific information, however, does not indicate that oil and gas-related activity (or any recent activity) has had detectable long-term adverse population-level effects on the health, status, or recovery of the bowhead population (MMS, 2006b). Potential impacts of individual activities associated with oil and gas exploration on bowhead whales would represent disturbance effects are mostly of moderate intensity (i.e., noticeable change in localized distribution), minor duration (i.e., periodic, temporary, or short-term) and moderate frequency (i.e. moderately frequent or intermittent), and minor to moderate geographic extent (i.e., effect limited to one or several locations) (**Table 4.1-1**). Taking these ratings of the three impact components together, and with consideration given to reduced adverse impacts through the implementation of mitigation measures, the overall impact to bowhead whales is likely to be minor to moderate (NMFS, 2011). Data indicate that the bowhead whale population has continued to increase over the timeframe that oil and gas activities have occurred and that there is no evidence of long-term displacement from habitat (MMS, 2006b).

4.6.1.2 Reasonably Foreseeable Future Offshore Oil and Gas Activities

Reasonably foreseeable oil and gas activities are discussed in detail in BOEM's recent Liberty Draft EIS (BOEM 2017), and include the following projects: Point Thompson, Greater Prudhoe Bay/Kuparuk/State Offshore Areas, Alpine CD-5, Greater Mooses Tooth, Smith Bay, Pikka Unit and Nanushuk. Pipeline construction projects which are reasonably foreseeable include the Alaska LNG project and the Alaska Stand Alone Gas Pipeline. Both of these pipeline projects would transport gas from the North Slope to Southcentral Alaska (BOEM 2017).

<u>Lease Sales</u>. In their current lease sale plan, BOEM plans to hold Beaufort Sea oil and gas lease sales in 2019, 2021, and 2023, and Chukchi Sea oil and gas lease sales in 2020, 2022, and 2024. A Hope Basin lease sale, covering OCS waters between Point Hope and Wales, Alaska, is planned for 2023, as is a Norton Basin lease sale, covering OCS waters from Point Hope south to 63^{o} N latitude.

<u>Seismic Survey and Site Clearance Activities</u>. Future seismic surveys and site clearance activities in the Beaufort and Chukchi Seas are reasonably foreseeable, and include a planned 3-D survey of the Barrow Arch region.

<u>Noise</u>. Anthropogenic industrial activities during bowhead whale migration could add to the small amounts of noise and disturbance incurred by subsistence hunting activities. Such industrial activities could affect bowhead distribution and habitat use (MMS, 2006c). In addition, impacts to subsistence hunting practices may result from the presence of industrial noise, water pollution, and other stressors that may disturb/deflect whales and other subsistence resources.

Whales disturbed by noise and activity from all sources in nearshore waters could experience short-term displacement from migration routes to areas farther offshore. The available data on reaction to noise and disturbance do not indicate any lasting population–level effect on bowheads, based on the level of activity in the Beaufort and Chukchi since the 1970s (NMFS, 2006). However, the cumulative effects of these future- noise-generating activities are less certain. As sea ice retreats due to climate change, drill ships and seismic exploration vessels will have access to areas where they were previously excluded at certain times of the year, which may contribute to an increased exposure of bowheads to future offshore oil and gas activities. However, it is not clear whether such potential changes in the distribution of seismic efforts, site-clearance activities, or development activities would coincide with potential changes in the distribution or migratory movements of bowheads due to climate change.

Overall, bowheads exposed to noise producing activities, including subsistence hunting, marine and aircraft traffic, and oil and gas activities, most likely would experience temporary, nonlethal behavioral effects, such as avoidance behavior. Effects could potentially be longer term, if sufficient oil and gas activity were to occur in a localized area such that whales were excluded from preferred habitat. However, long-term displacement of bowhead whales as a result of human activity has not been demonstrated (MMS, 2007a). Cumulative effects of disturbance from noise are currently considered minor at the population or stock level. Detailed discussions of the contribution of effects of oil and gas activity to the overall cumulative effects on bowhead whales are presented in the 2013 Arctic Region Biological Opinion for Oil and Gas Activity in the Beaufort and Chukchi Sea (NMFS, 2013), the 2007 Chukchi Oil and Gas Lease Sale 193

Final EIS (MMS, 2007a), along with both of the supplemental EISs for this project (BOEMRE, 2011, BOEM 2015). Analyses of the effects of noise on bowhead whales, including the effects of noise from seismic exploration and descriptions of mitigation and monitoring measures for protecting marine mammals and the availability of marine mammals for subsistence uses, are presented in the Environmental Impact Statement - Outer Continental Shelf Oil and Gas Leasing Program: 2017 - 2022 (BOEM, 2016).

Oil and Gas Exploration and Development. Activities on new and existing leases in the Beaufort Sea are expected to continue in the near future. There are no known exploration or development operations planned in the Chukchi Sea. Exploration and development activities may include drilling, the construction and installation of islands and pipelines from offshore production facilities, and expansion of existing offshore and shore-based facilities to accommodate natural gas production.

Eni US intends to drill four exploration wells into the federal submerged lands of the Beaufort Sea from its Spy Island Drillsite, a pre-existing facility located in Alaska state waters (https://www.boem.gov/press07122017/, accessed March 11, 2018). TGS (a geoscience data company) plans to conduct seismic explorations off the Colville Delta in the Beaufort Sea Barrow Arch region, Alaska as early as summer 2018 and 2019.

***Liberty*:** The Liberty Project is located on the eastern end of the Prudhoe Bay area, in nearshore waters of Prudhoe Bay. The project will be a self-contained offshore drilling and production facility located on a 9.3 acre artificial gravel island to be called the Liberty Development and Production Island (LDPI), with a pipeline to shore. Once the LDPI is constructed, multiple production and disposal wells are expected to be drilled from that island during subsequent years. Associated onshore facilities and activities to support the Liberty Project would include ice road construction, construction of gravel pads to support the pipeline tie-in location and Badami ice road crossing, ice pad construction, construction of a hovercraft shelter and small boat dock, and development of a gravel mine site west of the Kadleroshilik River.

***Point Thomson*:** ExxonMobil has completed the initial phase of developing this field on the eastern North Slope. Point Thomson is a gas condensate field that is currently producing condensate and shipping it via a 22-mile oil pipeline to Pump Station 1 on the TAPS. Current estimated recoverable condensate resources are 200 million bbl. First oil production from Point Thomson began in May 2016. Peak production from the first stage of development at this facility is estimated at 10,000 barrels per day (bpd). The drillsite and production facilities are located on state onshore lands just west of the Alaska National Wildlife Refuge with long-reach wellbores drilled more than 1.5 miles into the nearshore waters of the Beaufort Sea. The project includes production pads, process facilities, an infield road system, a pipeline, infield gathering lines, and an airstrip. To avoid offshore development and potential impacts on the marine environment, onshore drilling pads were selected to enable directional drilling to offshore locations.

***Greater Prudhoe Bay/Kuparuk/State Offshore Areas*:** This main producing part of the Alaska North Slope is expected to have numerous small developments as smaller reserves of oil are discovered and can be produced using existing infrastructure. Product from these developments would flow from existing facilities into Pump Station 1 of TAPS. The timing of these developments would be scattered over the next 10 years.

In 2012, ConocoPhillips Alaska, Inc. (COPA) drilled a successful appraisal well into an undeveloped section of the Kuparuk formation on the southwest flank of the Kuparuk field and began construction of a new drill site in 2014. Named Drill Site 2S, this was the first new drill site in Kuparuk in 12 years. Construction was completed in 2015 and first production flowed in October 2015. Estimated peak production from Drill Site 2S is 8,000 bpd. COPA extended the Kuparuk fields existing Drill Site 1H consisting of five production wells, thirteen injection wells, and associated surface equipment. COPA began production from the 1H-NEWS extension in November, 2017.

To the west of Kuparuk River Unit lies the Mustang oil field, part of the Southern Miluveach Unit now owned by Brooks Range Petroleum Corporation (Brooks Range Petroleum). After construction of a gravel road and drillsite and drilling several development wells starting in early 2015, Brooks Range Petroleum announced the delay of first oil production after encountering mechanical and reservoir problems while drilling. Originally anticipated in 2016, first oil production has been delayed repeatedly, and production was most recently projected to begin in early 2019. The estimated 1,292 barrel per day peak flow field is equipped with a standalone production facility and pipeline on a gravel pad and road, which connects to existing infrastructure at Kuparuk.

***Alpine CD-5*:** COPA began construction of the newest Alpine field satellite development drill site named CD-5 in 2014, with plans for 14 production wells and an exploration well. This new drill site is located on Alaska Native village corporation lands near Nuiqsut and is the first commercial oil production from within the National Petroleum Reserve in Alaska (NPR-A). As a satellite to Alpine Central Processing Facility (CPF), CD-5 has only minimal on-site processing facilities but required six miles of gravel road, four bridges, and 32 miles of pipelines including completion of a gravel road and natural gas pipeline from Alpine CPF into Nuiqsut. First production flowed from CD-5 to Alpine CPF in October 2015. It is exceeding its projected peak flow rate of 16,000 bpd, and is currently producing 37,000 bpd.

***Greater Mooses Tooth*:** In October 2015, COPA received approval for construction of the

Greater Mooses Tooth-1 (GMT-1) project, the first commercial development on Federal lands in the NPR-A. Initially targeting the Lookout oil pool with a total of nine wells, the GMT-1 drill site would host 24 additional wells slots for eventual development of two other oil and gas pools in the Federally-managed Greater Mooses Tooth Unit. The 7.7-mile long GMT-1 road, two bridges, and pipelines would connect to Alpine CPF through the existing CD-5 road and pipeline extension. First oil production is expected in late 2018, with peak flow projections of 30,000 bpd.

In August 2015, COPA announced submission of applications for construction of the Greater Mooses Tooth-2 (GMT-2) project on Federal lands in the NPR-A. If approved, GMT-2 would target the Spark oil pool with as many as 48 wells drilled from a 14-acre drill site 8 miles to the southwest of GMT-1. The proposed 8.6 mile gravel road and pipeline would connect through GMT-1 and on to Alpine CPF through the existing CD-5 extension. Production estimates are yet to be published but COPA anticipates first oil production by the end of 2020 if permits are approved on schedule.

***Smith Bay Development*:** In 2016, Caelus Energy Alaska (Caelus), made a significant light oil discovery on its Smith Bay state leases on the North Slope of Alaska. Caelus estimates the amount of oil in place to be approximately 6 billion barrels with an additional 10 billion barrels of oil in place when the adjoining acreage is included. Caelus expects to achieve recovery factors in the range of 30-40% due to the favorable fluids contained in the reservoir. According to Caelus, the Smith Bay development has the potential to provide 200,000 barrels per day of light, highly mobile oil that would both increase TAPS volumes and reduce the average viscosity of oil in the pipeline, extending its long-term viability. If developed, this may require constructing a new pipeline. Caelus is currently planning an appraisal program that would include drilling an additional appraisal well and acquiring a new 3D seismic survey additional acreage. The appraisal program would enable Caelus to confirm reservoir continuity, optimize future drilling locations, and ultimately increase reserves. Caelus is also studying and planning the development of facilities to process and transport the oil to TAPS.

***Pikka Unit and Nanushuk Development*:** The Pikka Unit was approved in 2015 to accommodate Repsol and Armstrong Energy's exploration leases. Wells, referred to as Horseshoe-1 and 1A were drilled on State land during the 2016-2017 winter season in a section of the Pikka Unit known as the Nanushuk Prospect. In 2017, Repsol and Armstrong Energy reported they had discovered the largest U.S. onshore oil discovery in 30 years between the Colville River Unit, the Oooguruk Unit and the Placer Unit in the central North Slope. The Horseshoe discovery wells are located approximately 12 miles south of Nuiqsut and extend the Nanushuk Prospect by 20 miles (32 kilometers).

The Pikka Unit (including the Nanushuk Development) and the Horseshoe discovery apparently contain at least 1.2 billion barrels of recoverable light oil combined. First production for the Pikka Unit from the Nanushuk Development could occur as early as 2021, with a potential rate approaching 120,000 barrels of oil per day. Armstrong Energy, proposing to develop Nanushuk, would target oil deposits in the Alpine C and Nanushuk reservoirs. The project is southeast of the East Channel of the Colville River, located approximately 52 miles west of Deadhorse and about 6.5 miles from Nuiqsut (at the southernmost location of the Nanushuk Project). The project would include construction of the Nanushuk Pad comprised of Drill Site 1 and a Central Processing Facility, Drill Site 2, Drill Site 3, an operations center pad, infield pipelines, the export/import Nanushuk Pipeline, infield roads, and an access road.

***Alaska (AK) LNG Project*:** The project, still in preliminary engineering and design stages and under environmental review, is a proposal originally put forth by a consortium comprised of major North Slope oil and gas producers ExxonMobil, BPXA, and COPA, along with partners TransCanada and the State of Alaska. The development would include a gas treatment plant at Prudhoe Bay to remove carbon dioxide and other impurities from the gas stream, a 42-inch-diameter, high-pressure, 800-mi (1,287 km) pipeline and eight compressor stations to move the gas to a proposed liquefaction plant at Nikiski, on the Kenai Peninsula. The Nikiski site would include LNG storage tanks and a marine shipping terminal for gas exports. Up to five take-off points for in-state gas delivery are also planned upstream of the Nikiski LNG plant.

The pipeline would be designed to accommodate 3 billion to 3.5 billion cubic feet of gas per day, with an initial mix of gas from the Prudhoe Bay and Point Thomson fields, and room to accommodate other gas fields in the decades ahead. The permitting process is currently projected to extend into 2020. Project financing remains uncertain.

***Alaska Stand Alone Gas Pipeline*:** A second partnership, the Alaska Stand Alone Gas Pipeline (ASAP) project, was originally planned as a 24-in diameter natural gas pipeline with a natural gas flow rate of 500 million ft3 per day at peak capacity of consumer grade, “lean gas.” This is to be a reliable, affordable energy source to Alaskan communities. The Alaska Gasline Development Corporation in partnership with TransCanada Corp. has led the planning effort for ASAP. Production from this pipeline would emphasize in-State distribution, although surplus gas would also likely be condensed and exported. According to the USACE, the 727-mile, low pressure ASAP pipeline route would generally parallel the TAPS and Dalton Highway corridor to near Livengood, northwest of Fairbanks. At Livengood, the mainline route would continue south, to the west of Fairbanks and Nenana. The pipeline would bypass Denali National Park and Preserve to the east and would then generally parallel the Parks Highway corridor to Willow, continuing south to its connection into ENSTAR's distribution system at MP 39 of the Beluga Pipeline southwest of Big Lake. The Fairbanks 30-mile Lateral tie-in would be located approximately 2.5 miles south of the Chatanika River crossing at MP 440 of the mainline. From the mainline tie-in point, the Fairbanks Lateral pipeline would traverse east over Murphy Dome, following the Murphy Dome and Old Murphy Dome Roads, and then extend southeast into Fairbanks.

The project is expected to include an underground pipeline with elevated bridge stream crossings, compressor stations, possible fault crossings, pigging facilities, and off-take valve locations. Either pipeline would be designed to transport a highly conditioned natural gas product, and would follow the same general route. A gas conditioning facility would need to be constructed near Prudhoe Bay and would likely require one or more large equipment modules to be off-loaded at the West Dock loading facility. Shipments to West Dock would likely require improvements to the dock facilities and dredging would be needed to deepen the navigational channel to the dockhead. Project proponents are currently seeking authorizations to begin construction of facilities and infrastructure at West Dock near the northern extent of the pipeline in the Prudhoe Bay area.

4.6.1.3 Oil Spills

Oil spills can occur during seismic exploration, exploratory drilling, construction and operation of offshore platforms, and from subsea pipelines. Oil spills are broken down into three general spill-size categories: (1) small spills, those less than 1,000 barrels (bbl); (2) large spills, those greater than or equal to 1,000 bbl, meaning that 1,000 bbl is the threshold size; and (3) very large spills, those greater than or equal to 150,000 bbl (MMS, 2009). This section contains a discussion of the potential environmental effects of a low-probability, high impact event, a hypothetical very large oil spill (VLOS) in the Chukchi Sea or in the Beaufort Sea. The probability of a VLOS is considered to be remote during exploration, but was assessed due to the pronounced effects it might have on bowheads and the potentially higher probabilities of occurrence associated with development and production phases (NMFS, 2006). The analysis of a VLOS also allows NMFS and BOEM to understand possible effects of spills of smaller sizes as well.

In the unlikely event that a VLOS were to occur in the Chukchi Sea, the potential for significant effects on a variety of resource categories would be high. Marine mammal species could be affected depending on the location, timing, duration, sea and climatic conditions, and response to spill events. As described in BOEM Lease Sale 193 Final Second SEIS, the potential physiological effects associated with a VLOS that could lead to reduced marine mammal fitness include:

(1) Irritation, inflammation, or necrosis of skin; chemical burns of skin, eyes, mucous

membranes; inhalation of toxic fumes with potential short- and long-term respiratory effects (e.g., inflammation, pulmonary emphysema, infection);

(2) Partial or extensive coating of pelts with oil for polar bears would reduce insulation and could result in hypothermia and ingestion of oil during grooming; either could result in mortalities;

(3) Ingestion of oil (and dispersants) directly or via contaminated prey, leading to inflammation, ulcers, bleeding, damage to liver, kidney, and brain tissues.

(4) Disturbance from beach cleanup crews, vessels and aircraft during spill response and cleanup; and

(5) Oil coating baleen in *mysticetes* whales which could adversely affect baleen functionality in sieving food from sea water.

Complications of the above may lead to reduced fitness, injury and mortalities.

Existing onshore and offshore oil and gas development and production facilities and their associated pipelines have the potential to release industrial chemicals, or to spill oil. Oil spills from offshore production activities are of concern because as additional offshore oil exploration and production – such as the Liberty, Ooguruk, and Nikaitchuq projects – occurs, the potential for large spills in the marine environment increases. In addition to potential oil spills from industry infrastructure, the potential also exists for oil/fuel spills to occur from associated support vessels, fuel barges, and even aircraft (NMFS, 2010). Impacts to marine mammals most likely would include temporary displacement from the area of the spill, and short-term effects on health from the ingestion of contaminated prey (MMS, 2007a). Drilling for oil and gas in the Arctic generally occurs from natural and artificial islands, caissons, bottom-founded platforms, and ships. With varying degrees, these operations produce low-frequency sounds with strong tonal components (NMFS, 2010).

The 2012 - 2017 OCS Oil and Gas Leasing Program Draft Programmatic EIS (BOEM, 2011) includes an assessment of the impacts of a VLOS in the Beaufort Sea. Summaries of relevant information from this document are provided in the discussion below. As allowed for by CEQ regulations in §1502.21, NMFS has incorporated the information presented in the BOEM Draft Programmatic EIS (2011) into this DEIS by reference.

Likewise, the BOEMRE Final Supplemental EIS for the Chukchi Sea Oil and Gas Lease Sale 193 (BOEMRE, 2011a) and the 2012-2017 OCS Oil and Gas Leasing Program Draft

Programmatic EIS (BOEM, 2011) contain the best information available for assessing the impacts of a VLOS in the Chukchi Sea. The hypothetical VLOS scenario for the Chukchi Sea described in the Lease Sale 193 Final SEIS considers a loss of well control during exploration drilling, which leads to a blowout and an ongoing, high volume release of crude oil and gas that continues for up to 74 days. The total volume of the oil is nearly 2.2 million barrels and the volume of the gas is 1.8 billion cubic feet (Bcf) (BOEMRE, 2011a). Summaries of relevant information from the BOEM documents are provided in the discussion below. As allowed for by CEQ regulations in §1502.21, NMFS has incorporated the information presented in the BOEM documents (BOEMRE, 2011a; BOEM, 2011) into this EIS by reference.

The magnitude and severity of effects of a VLOS on bowhead whales and subsistence harvest practices would depend upon the location, size, and timing of the spill, the type of product spilled, weather conditions, and the environmental conditions at the time of the spill (BOEM, 2011). Bowhead whales may be exposed to spilled oil by direct contact, inhalation, or ingestion of oil or contaminated prey species. In addition, the effects of a VLOS could interact with the effects of other impact-producing factors, such as climate change (**Section 4.6.2.2**), increases in vessel and aircraft traffic (**Section 4.6.3.2**), research activities (**Section 4.6.4.2**), and other development (**Section 4.6.5.2**), potentially resulting in additive or synergistic adverse impacts.

Depending on the timing of the spill, bowhead whales could experience contact with fresh oil during summer and/or fall feeding aggregations and migration in the Chukchi Sea and western Beaufort Sea. Contact with oil could cause irritation and various skin and eye disorders. Exposure of aggregations of bowheads to fresh oil, especially if calves are present, could result in mortality. Surface feeding bowheads could ingest oil with their prey, which might or might not be contaminated with oil components. Bowheads could also ingest oil that might be incorporated into bottom sediments during near-bottom feeding. Ingestion of oil could result in temporary and permanent damage to bowhead endocrine function and reproductive system function, as well as feeding due to baleen fouling (NRC, 2003). If sufficient amounts of oil are ingested, mortality of individuals may also occur. Population level effects are unlikely, but could potentially result from a very low probability, high impact circumstance where large numbers of whales experience prolonged exposure or ingest large amounts of oil (BOEM, 2011).

A winter spill could result in hydrocarbons trapped in and under ice, then released during the bowhead calving and migration period in spring. Some ingestion of surface and near-surface oil fractions could occur during feeding, and could affect endocrine and reproductive performance in adult and juvenile whales. Likewise, an oil spill into ice leads or polynyas in the spring could have devastating effects, trapping bowhead whales where they would be likely to encounter fresh crude oil. Calves would be more vulnerable than adults because they need to surface more often to breathe (BOEM, 2011). In this low probability situation, recovery from the exposure of a substantial portion of a bowhead age class cohort could take decades. Population level impacts to bowheads (as well as other species) are also possible if a VLOS event co-occurred with feeding aggregations during the open water season.

Based on criteria established in **Section 4.1.2.2**, the level of impact to bowhead whales resulting from a VLOS could be major. The duration of effects could range from temporary (e.g., skin irritations or short-term displacement) to permanent (e.g., endocrine impairment or reduced reproduction) and would depend on the length of exposure and means of exposure (direct or indirect ingestion). Effects of direct ingestion of oil is a function of its chemical composition, the quantity ingested, and the degree of weathering prior to ingestion, and other factors that include the health, age, and reproductive status of exposed animals. Displacement of bowheads from areas impacted by the spill due to increased human activity would be likely. If the area is an important bowhead feeding area, such as off Utqiaġvik (Barrow) or Camden Bay, or along the migratory corridor, the magnitude of the effects could be major. The impact of a VLOS on bowhead whales could extend throughout the population and its range.

Human activities associated with oil spill response and cleanup could include vessel and aircraft traffic, icebreaking, wildlife hazing, booming and skimming operations, in-situ burning, dispersant application, drilling of a relief well, research, and monitoring. These activities would likely result in temporary, non-lethal effects to bowheads. Diversion of bowhead whales away from aggregated prey sources could occur, resulting in the loss of important feeding opportunities relative to annual energy and nutrition requirements. Lost feeding opportunities could result in reduced body condition and reproductive performance, increased reproductive interval, loss or abandonment of nursing calves, decreased in vivo and neonatal calf survival, and increased age of sexual maturation in some bowheads. Activities associated with spill response, clean-up, and remediation would not be expected to result in population level effects. Bowheads may avoid vessels at distances of several kilometers depending on the noise energy produced by the vessel. Migrating whales would be expected to divert up to 20 - 30 km around relief well drilling operations. Cetacean protection actions such as hazing would likely be deployed as required, and would be modified to meet the needs of the response effort.

A VLOS in either the Beaufort Sea or the Chukchi Sea could affect subsistence harvest practices by oiling, fouling, and other contamination of subsistence resources, and by the presence of response equipment and personnel. The duration of impacts of a VLOS on subsistence harvests could be long-term to permanent, and the perception that food is tainted and/or contaminated could be long lasting or permanent among Iñupiat communities. As observed after the Exxon Valdez oil spill, the interruption of two to three years of training youth in subsistence harvest practices changed the balance of the subsistence economy for a period persisting well beyond the spill itself.

Overall, the combined probability of a spill occurring and contacting bowhead habitat during periods when whales are present is low. If such an event were to occur, the fraction of the bowhead whale stock affected would vary widely, depending upon the timing and location of the spill and subsequent response. The North Slope Borough (NSB) believes there are some scenarios, such as an oil spill in a spring lead system near Utqiaġvik (Barrow), which could affect a large portion of the population (J. C. George, NSB, Pers. comm., December 20, 2007).

Offshore oil and gas development would not likely cause bowhead mortality, except in the case of a VLOS. Ship strikes and entanglement in commercial fishing gear may contribute to mortality and could affect whales throughout their range. Evidence from harvested whales indicates that entanglement is common (perhaps 10%) but probably temporary for most whales; serious injuries are thought to be relatively rare. The estimated mortality incidental to U.S. commercial fisheries is 0.2 w hales per year (Allen and Angliss, 2011). The incidence of ship strikes and entanglement could increase in the future depending on the extent to which climate change and sea ice reduction allow for the expansion of fisheries and marine vessel traffic in the Arctic. Considering the aggregated impacts and interactions of past, present, and reasonably foreseeable future actions, the very low level of bowhead mortality from anthropogenic sources other than subsistence whaling efforts (less than one whale per year) is unlikely to cause the population to decline or slow its rate of recovery. The magnitude, geographic extent, and duration of this level of mortality are therefore considered negligible for the bowhead population (**Table 4.1-1**).

The magnitude, geographic extent, duration, and population-level effects of VLOS-caused bowhead mortality are difficult to predict, but could range from negligible to major (**Table 4.1-1**).

4.6.2 Effects of Climate Change in the Project Area

Over the past few decades, evidence of climate change has been reported in a variety of geophysical, biological, oceanographic, and atmospheric parameters (e.g., IPCC 2014, Richter-Menge et al. 2017). Scientific evidence indicates that average air, land, and sea temperatures are increasing, and the rate of that increase is accelerating. The climate is changing faster in the Arctic than any other region in the world (NOAA, 2014a). Geophysical, biological, oceanographic, atmospheric, and anthropogenic sources provide overwhelming evidence of climate-driven changes in the Arctic in recent decades and it is well established that climate change in the Arctic is occurring two to three times faster than at lower latitudes (Arctic Council 2005; Intergovernmental Panel on Climate Change [IPCC] 2007; USGS 2011, IPCC 2014). Arctic regions have experienced some of the largest climate-driven changes, with major implications for the marine environment and coastal communities.

4.6.2.1 Past and Present Effects of Climate Change in the Project Area

Climate change in the Arctic is causing warmer air and ocean temperatures, decreased duration, extent and thickness of seasonal sea ice, reduced volumes of multi-year sea ice, and changes in the timing and duration of phytoplankton blooms in the Beaufort Sea (USGS 2011; BOEMRE 2011a,b; Druckenmiller et al. 2017). These changes have been attributed to rising CO_2 levels in the atmosphere and corresponding increases in concentrations of CO_2 dissolved in seawater (i.e., ocean acidification).

According to the 2017 Arctic Report Card (Richter-Menge et al. 2017), the second warmest surface air temperature anomaly (+1.6° C relative to 1981-2010) north of 60° N since the year 1900 was observed between October 2016 and September 2017. The warmest surface air anomaly occurred during 2016. Further, on 7 March 2017, satellites observed the lowest winter maximum in sea ice on record (1979-present), while the second lowest winter maximum sea ice extent on record occurred during winter 2017/2018 (National Snow and Ice Data Center 2018). The March, 2017 record low maximum sea ice extent was 8 percent lower and the September, 2017 minimum sea ice extent was 25% lower than the 1981-2010 average. The sea ice cover continues to be relatively young and thin with multiyear ice (more than 1 year old) comprising only 21 percent of ice cover in 2017 compared to 45 percent in 1985. With respect to sea surface temperatures, the Chukchi Sea has experienced the largest warming trend on the planet: ~0.7° C per decade since 1982. In August 2017, the Barents and Chukchi seas experienced surface temperatures up to 4° C warmer than the 1982-2010 average. The most pronounced increasing trends in ocean primary productivity during the 2003-2017 period were observed in the Barents Sea and Eurasian Arctic regions. Long-term records suggest that years with elevated ocean productivity levels are often associated with earlier sea ice breakup during the spring/summer transition.

With respect to terrestrial ice mass and snow cover, the 2017 Arctic Report Card highlighted the downward trend in total ice mass of the Greenland ice sheet averaged over the last 15 years is estimated at 264-270 Gt/yr. The spatial extent of melt for the period June, July and August 2017 reached a maximum of 32.9%, marking the lowest maximum extent since 1996. Further, spring snow cover extent over Eurasia in May 2017 was the second highest recorded by satellite observations dating back to 1967. May and June snow cover extent anomalies over the Eurasian Arctic mark the first positive anomalies observed since 2005 and 2004, respectively. Tundra greenness has increased substantially throughout the Arctic during 2015 and 2016 (the most recent year with a complete data set) following 3-4 years of continuous declines. Peak tundra greenness for 2016 ranks fourth (entire Arctic), 9th (Eurasian Arctic), and third (North American

Arctic) in the context of the 35-year satellite record. Permafrost temperatures in 2016 (the most recent set of complete observations) at many observation sites around the Arctic were among the highest on record (as long as 1978-present, but duration of records vary). Increases in permafrost temperature, since 2000, have been greatest in cold permafrost of the Alaskan Arctic, Canadian high Arctic, and Svalbard.

One of the most dramatic changes in the Arctic during the last few decades has been the significant decrease of sea ice during the summer. Thinner sea ice melts faster than thicker ice, so the average thickness of Arctic ice is expected to decrease further, particularly with respect to the extent of the summer ice. The reduction in sea ice has had a significant effect on bowhead whale distribution (Druckenmiller et al. 2017). Bowhead whales are associated with and well adapted to ice-covered seas with leads, polynyas, open water areas, or thin ice that the whales can break through to breathe. Although Arctic coastal peoples have hunted bowheads for thousands of years, historical effects of climate changes and sea ice dynamics on the distribution of bowheads and the efficacy of subsistence harvest practices are not certain. It has been postulated that a cold period 500 years ago resulted in less ice-free water near Greenland, forcing bowheads to abandon the range, and that this led to the disappearance of the Thule culture (McGhee 1984; Aagaard and Carmack 1994; as cited in Tynan and DeMaster 1997). Inversely, it is possible that larger expanses and longer periods of ice-free water would be beneficial to bowhead populations and subsistence harvest practices (e.g., Robards et al. 2017). While large changes to the timing of the bowhead whale spring migration are not expected, the increased open-water period will likely result in delayed arrival to wintering areas in the Bering Sea (Druckenmiller et al. 2017). These changes have also affected many terrestrial, freshwater and marine species that have shifted their geographic ranges, seasonal activities, migration patterns, abundances and species interactions in response to ongoing climate change (IPCC 2014).

4.6.2.2 Reasonably Foreseeable Future Effects of Climate Change in the Project Area

Atmosphere-ocean global climate models (AOGCMs) driven by different greenhouse-gas emission scenarios are the main tools used to predict future climate conditions in the Arctic (USGS 2011). Climate projections for the next 50–100 years produced by global climate models consistently show a pronounced warming over the Arctic, accelerated sea-ice loss, and continued permafrost degradation (IPCC 2007, 2014; USGS 2011, Richter-Menge et al. 2017). Of all areas on Earth, the Arctic has the greatest sensitivity to changes in greenhouse gases, primarily due to albedo-temperature feedback. The ability of Arctic regions to absorb heat energy from solar radiation increases as reflective snow and ice cover declines. As the extent and duration of snow and ice cover declines, a positive feedback loop is established whereby the resulting temperature increases further exacerbate declines in snow and ice cover, which, in turn, further exacerbates temperature increases. Within the Arctic, some of the largest changes are expected to occur in the Bering, Beaufort, and Chukchi seas (Chapman and Walsh 2007; Walsh 2008). Projected climate changes will likely result in selection pressures that could lead to considerable changes in the structure and function of biological systems in the EIS project area.

Given the projections of warming in the Arctic, it is plausible that the Arctic Ocean will become largely ice-free during the summer in the near future. Recent model projections suggest as much as a 60-day reduction in sea-ice duration by the middle of the 21st century (Wang et al. 2017). Overland et al. (2018) note that "model projections show that future temperatures in the Chukchi and Beaufort seas continue to warm at a rate greater than the global rate, reaching a change of +4°C by 2040 relative to the 1981–2010 mean. Offshore at 74°N, climate models project the open water duration season to increase from a current average of three months to five months by 2040." Sea surface temperature anomalies in the North Pacific have been show to enhance these rates. Additionally, temperature increases may compromise the integrity of ice cellars traditionally used to store subsistence foods after they are harvested, an effect that has already been reported by subsistence users in northern and western Alaska. Overland et al. (2018) concluded, "…the ecological and societal consequences of such changes show a radical departure from the current Arctic environment."

Climate change effects are difficult to predict, as are the effects of climate-driven changes on bowheads.. Bowhead movement patterns and behavior may change relative to changes in sea ice distribution and zooplankton populations. The effects of climate changes will also depend on the ability of bowheads to locate sufficient concentrations of planktonic crustaceans to allow efficient foraging (Druckenmiller et al. 2017). Since phytoplankton blooms may occur earlier or at different times of the season, or in different locations, the timing of zooplankton availability may also change from past patterns (Arrigo and van Dijken 2004, Ardyna et al. 2014). Hence, the ability of bowheads to use these food sources may depend on their flexibility to adjust the timing of their own movements and to find food sources in different places (Druckenmiller et al. 2017).

While the retreat of sea ice due to climate change may enable bowheads to expand their range, it may also increase predator pressure as killer whales expand their range into increasingly ice-free waters. Human sources of disturbance could serve to inhibit the use of some areas by bowheads, The potential for increased commercial shipping and other vessel activity in the Arctic with continued sea ice retreat and longer ice-free periods could contribute to noise disturbance effects on bowhead whales and an increased incidence of vessel avoidance behaviors. Whether this will add markedly to the overall level of disturbance noted above is uncertain.

The effects of climate change on subsistence harvest of bowheads are uncertain (ACIA 2004; Moore and Huntington 2008). There will be more open water and longer ice-free seasons in the arctic seas, which may allow bowheads to expand their range offshore as the population continues to recover from commercial whaling and as ice-free waters to the north become increasingly available. If changes in the abundance and distribution of ice result in bowhead migration occurring further offshore, safe access to whales by subsistence hunters may be reduced. Changes in the migration routes of the whales can affect the ability of whaling communities to hunt successfully.

Subsistence hunters in the project area have already noted such changes:

> *We realize the ecosystem we are in is very healthy and productive. However, the access, due to changing patterns in ice and weather, has affected our ability to access resources. The changes aren't all bad, because in 1990 Savoonga and Gambell started harvesting bowheads in the dead of winter. Consequently, 40 percent of our harvests are now occurring in winter (November/December timeframe). We have begun to take steps to conduct spring whaling activities earlier so we can adjust to the changes that are now occurring in migration patterns of marine mammals, specifically the bowhead whales. –* George Noongwook, AEWC Vice Chair and representing Savoonga/St Lawrence March 2011 - Open Water Meeting, Anchorage, AK.

In addition, changes in ice conditions have influenced the spring bowhead hunt in communities along the Chukchi Sea coast. Due to dynamic ice conditions that are considered too dangerous and difficult for captains and their crews during the spring season, whaling crews from Wainwright, Point Hope and Point Lay have recently been conducting fall hunts to provide for their communities (Comstock 2011). Since the early 2000's, bowheads have been feeding more frequently in ice-free waters northeast of Utqiaġvik (Barrow), leading to increased hunting success for Utqiaġvik (Barrow) crews in the fall (Treacy 2002; Bodenhorn 2003 as cited in Moore and Laidre 2006; Ashjian et al. 2010). This observed pattern of new feeding patterns for bowheads comports with models predicting increases in prey availability for bowheads driven by the retreat of the ice edge relative to the underwater shelf break, which facilitates wind-driven upwelling of zooplankton-rich waters, as well as greater primary productivity in ice-free waters (Moore and Laidre 2006). Evidence suggests that bowhead whales feed on concentrations of zooplankton throughout their range. Likely or confirmed feeding areas include Amundsen Gulf; Utqiaġvik (Barrow); Wrangel Island; the coast of Chukotka, between Wrangel Island and the Bering Strait; the western Bering Sea; and the Alaskan Beaufort Sea (Quakenbush et al. 2010a,b; Lowry et al. 2004; Clarke and Ferguson 2010a; Ashjian et al.,2010; Okkonen et al. 2011, Shelden et al. 2017). Bowheads have also been observed feeding during the summer in the northeastern Chukchi Sea (Clarke and Ferguson 2010b). Another indication of bowhead whale responses to decreased sea ice is the steady population increase during roughly two decades of sea-ice loss in the western Beaufort Sea (Givens et al. 2016; Figure 3.2.1-1). the bowhead population trend suggests that sea-ice loss is not currently hindering recovery, however, sea ice loss has also opened the Arctic to potential competitors and predators such as humpback whales, fin whales, and killer whales (Clarke et al. 2015, Crance et al. 2015, Moore 2016), as well as bowhead whales from other stocks (Heide-Jørgensen et al. 2012).

4.6.3 Effects of Vessel and Aircraft Traffic in the Project Area

Bowheads may be affected by vessel and aircraft traffic due primarily to acoustic impacts and vessel strikes. The majority of vessel traffic within the proposed action area is in support of international commercial shipping, oil and gas development, and operations at the Red Dog mine. Other vessel activity within bowhead habitat derives from commercial fishing, barges and cargo vessels used to supply coastal villages, smaller vessels used for hunting and local transportation during the open water period, military vessels, research vessels, commercial recreational vessels (e.g., cruise ships), a few private recreational watercraft, and ice breakers used in support of any of these activities. Aircraft use in the area includes commercial aviation transport, private personnel transport (e.g., within oil fields), small fixed wing aircraft, and helicopters in support of oil and gas development, other natural resource development, and natural resource management and research. Military aircraft also use this area. Impacts to bowhead whales may occur from noise due to vessel and aircraft operations, and from vessel strikes.

4.6.3.1 Past and Present Effects of Vessel and Aircraft Traffic in the Project Area

The Northern Sea Route, predominately along the northern coast of Russia, linking Europe, North America, and Asia is being used with increasing frequency by cargo ships and fuel tankers. Between 2015 and 2025, use of this route is projected to increase five-fold (Azzara et al. 2015). In addition, new classes of vessels are using the Northern Sea Route, with some ice hardened vessels with a beam of 50 m and draft of 11.8 m capable of operating in frigid temperatures and travelling through ice up to 2.1 m thick (Gosnell, 2018). Bowhead whales may be affected by vessel-produced noise, ship strikes, and commercial fishing gear interactions.

Vessel Noise. Underwater noise from ships may temporarily disturb or mask communication of marine mammals. Shipping sounds are often at source levels of 150-190 dB re 1 µPa at 1m (BOEM 2011a). Shipping traffic is mostly at frequencies from 20-300 Hz (Greene 1995). Sound produced by smaller boats typically is at a higher frequency, around 300 Hz (Greene 1995). In shallow water, vessels more than 10 km (6.2 mi) away from a receiver generally contribute only to background-sound levels (Greene and Moore 1995). Icebreaking vessels that are used in the Arctic in support of research and oil and gas activities produce louder but also more variable sounds than those associated with other vessels of similar power and size (Greene and Moore

1995). The greatest sound generated during ice-breaking operations is produced by cavitation of the propeller as opposed to the engines or the ice on the hull; extremely variable increases in broadband (10-10,000 Hz) noise levels of 5-10 dB are caused by propeller cavitation (Greene and Moore 1995). Greene and Moore (1995) reported estimated source levels for icebreakers to range from 177-191 dB re 1 μPa-m. Even with rapid attenuation of sound in heavy ice conditions, the elevation in noise levels attributed to icebreaking can be substantial out to at least 5 km (3 mi) (Greene and Moore 1995). In some instances, icebreaking sounds are detectable from more than 50 m (31 mi) away.

Behavioral reactions from vessels can vary depending on the type and speed of the vessel, the spatial relationship between the animal and the vessel, the species, and the behavior of the animal prior to the disturbance from the vessel. Response also varies between individuals of the same species exposed to the same sound. Individual whales' experiences with vessels appear to be important in determining individual whale response to acoustic disturbance and vessel presence (Shell 2011). Vessels moving at slow speeds and avoiding rapid changes in direction or engine RPM may be tolerated by some species and individuals. Others may deflect around vessels and continue on their migratory path. Humpback whale reactions to approaching vessels are variable, ranging from approach to avoidance (Payne 1978, Salden 1993). Whales have been known to tolerate slow-moving vessels within several hundred meters, especially when the vessel is not directed toward the animal and when there are no sudden changes in direction or engine speed (Wartzok et al. 1989, Richardson et al. 1995, Heide-Jorgensen et al. 2003). Animals exposed to vessel noise may exhibit deflection from the noise source, engage in low level avoidance behavior, exhibit short-term vigilance behavior, or experience and respond to short-term acoustic masking behavior, but these behaviors are not likely to result in biologically significant disruption of normal behavioral patterns.

Ship Strikes. Vessel activity may result in mortality of bowhead whales through ship strikes. Increased ship traffic may increase the risk of ships striking bowhead whales. Subsistence harvest data suggests that ship-strike injuries are currently uncommon among bowhead whales in Alaska (George et al., 2017b). Only 10 whales harvested between 1990 and 2012 (~2% of the total sample) showed clear evidence of scarring from ship propeller injuries (see section 3.2.7).

Bowheads that may be killed by ship strikes are not part of the subsistence harvest-derived estimate of bowhead ship strikes, because these individuals are not included in that estimate. Therefore, the subsistence harvest-derived estimate of proportion of bowheads that have been struck by vessels should be considered a minimum estimate. However, given the increasing trend in the Western Arctic bowhead population, the contribution of ship strikes to cumulative effects on bowhead populations is likely to be negligible at the present time. This may change if notable increases in Arctic shipping occur.

Aircraft Noise. Aircraft noise that may affect bowheads is most likely to derive from non-commercial aircraft in the area because these aircraft are more likely to fly at low altitudes over habitat used by bowheads. Helicopters and fixed wing aircraft are used to support routine activities within the EIS project area, and fly over near shore and offshore bowhead habitat. The majority of air travel and freight hauling between Arctic coastal communities involves small commuter-type aircraft, and government agencies and researchers often charter small aircraft for travel and research purposes. Aircraft are also used in support of oil and gas activities and scientific research. These activities are expected to continue, and the level of aircraft traffic within the project area may increase as a result of climate change, research, and/or increased industrial activity and community development.

Aircraft sounds are dominated by tonal harmonics of engine/turbine and blade rates and are largely within the frequency range of cetacean hearing. Due to the reflective properties of the air-water interface on sound, transmission of aircraft noise to the water column is generally limited to a 13^{o} cone beneath the aircraft, although surface roughness of the water can affect the size of this sound transmission cone. The level of aircraft noise reaching the sea surface and transmitting into the water depends on the acoustic source level, atmospheric sound transmission characteristics, and flight altitude. In some cases, the combination of audible and visual (aircraft and shadow) stimuli may produce higher levels of response than would the noise alone (Richardson et al., 1995a), although visual stimuli of aircraft on Bowheads is expected to be negligible. Because aircraft travel at high speeds, and transmission into the water column is limited to a narrow cone beneath the aircraft, the duration of aircraft noise events is on the order of a few seconds to a few tens of seconds (Patenaude et al., 2002). For example, an aircraft travelling at an altitude of 500 feet at 120 miles per hour will transmit sound to a point within its sound transmission cone for less than 1.5 seconds. However, aircraft involved in certain duties may hover, circle, or remain in limited areas, and thereby produce more prolonged noise exposures to marine mammals than would straight-line flight paths.

Underwater sound levels produced by aircraft have been measured by several researchers. Patenaude et al. (2002) report measurements of sound levels and responses of belugas and bowheads to noise from a Bell 212 helicopter and de Havilland Twin Otter fixed-wing aircraft from four seasons of research. Both of these aircraft types are likely to be used for personnel transfers and/or research purposes within the EIS project area. The measurements summarized by Patenaude et al. (2002) were made in springtime during bowhead and beluga migration periods in 34 meter (m) and 170 m water depths, with hydrophones at 3 m and 18 m depths below surface. Various aircraft flight altitudes and airspeeds were monitored. The primary results of the sound level measurements are presented in **Figure 4.6.3-1**. These results indicate that the Bell 212 helicopter noise levels are on average higher than the Twin Otter levels, but the Twin

Otter levels reach similar maxima for the same overflight altitudes. The helicopter levels reached 125 dB re 1 µPa SPL at the lowest overflight altitude of 80 m. The Twin Otter levels reached 120 dB re 1 µPa at 150 m flight altitude. Above 400 m altitude, both aircraft produced underwater SPL below 115 dB re 1 µPa.

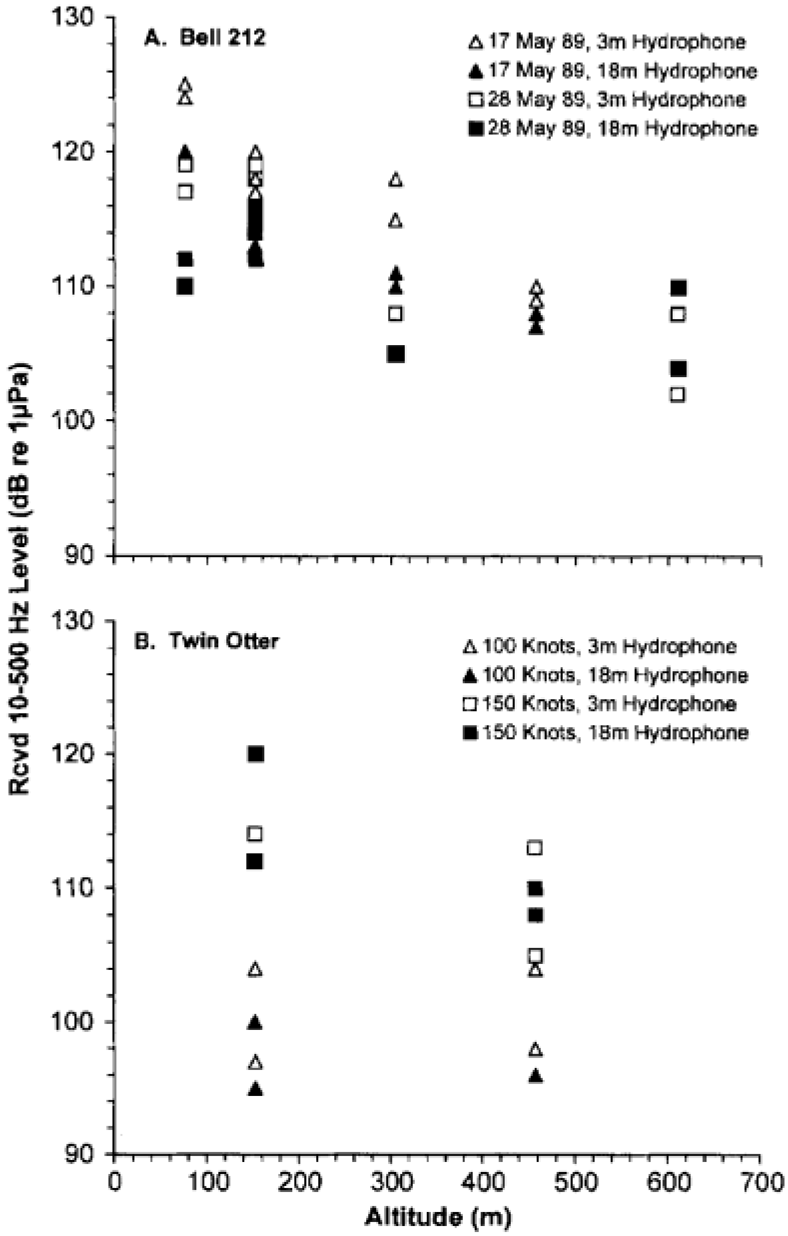

Figure 4.6.3-1. Received levels of underwater sound from (A) Bell 212 helicopter and (B) Twin Otter fixed-wing aircraft flying directly overhead vs. aircraft altitude, hydrophone depth, and (for Twin Otter) airspeed. Open and filled symbols show paired measurements at 3 m and 18 m hydrophone depths, respectively. Bandwidth 10-500 Hz; averaging time 0.75 sec. Source:

Patenaude et al., 2002.

Corresponding observations of marine mammal reactions were made by biologists aboard the aircraft or on ice. **Table 4.6.3-1** summarizes the results of these observations in terms of percentage of groups that reacted for overflights below and above threshold altitudes (150 m for the Bell 212 and 182 m for the Twin Otter), and within or beyond a lateral distance threshold of 250 m.

Table 4.6.3-1

Percentage occurrence of observed reactions by spring-migrating bowhead and beluga whales to helicopter and fixed-wing aircraft, overall and by aircraft altitude and lateral distance

	Percent of groups seen to react						
		Altitude			Lateral distance		
	Overall	≤150 m	>150 m	P	≤250 m	>250 m	P
Bell 212 helicopter							
Bowhead							
Heli. flying	15	15[b]	13[c]	0.66	24	10[d]	0.17
Heli. on ice	13[c]				–	0[c]	–
Beluga							
Heli. flying	31	40[b]	10[c]	0.12[e]	53	0[c]	0.004
Heli. on ice	50[c]				42[c]	–	–
Twin Otter Fixed-Wing							
Bowhead	2.2	3.7[b]	1.0	0.063	Infrequent	Rare	–
Beluga	3.2	5.4[b]	1.4	0.009	Infrequent	Rare	–

Source: Table 6 in **Patenaude et al. (2002)**.

a "–" means n <7.

b Probably an underestimate because of brevity of observations, especially for Twin Otter.

c Percentages based on 7-14 groups of whales (otherwise >14).

d Probably an overestimate

e Statistical power low

f Not calculable because lateral distances from Twin Otter were not recorded for some groups that did not react.

The findings of Patenaude et al. (2002), as summarized in Table 4.6.3-1, suggest that approximately 15percent of bowheads reacted to helicopter overflights. Based on the Bell 212 sound measurements of Figure 4.6.3-1, these whales were likely exposed to maximum helicopter noise levels between 110 and 125 dB re 1 µPa. Fewer reactions occurred for flight paths beyond 250 m lateral range from the whales, but the number of observations was not high enough to confirm significance of that difference. Beluga reactions to the helicopter were greater, with approximately 31percent of animals reacting. There were significantly fewer (zero) reactions observed at lateral distances greater than 250 m from the flight path.

The fixed wing Twin Otter aircraft produced smaller percentages of observable reactions by both bowheads and belugas than did the helicopter, even though the sound measurements indicate that the Bell 212 noise levels were not substantially greater. The Twin Otter sounds have lower broadband non-tonal noise than the Bell 212, and that could be a possible reason for reduced reactions, although this is largely conjecture. For both aircraft, the reactions consisted of abrupt dives, tail slapping, breaching, turns, and unusually brief surfacing. No long-term reactions were noted, and the overall impact of these temporary behavior modifications is likely to be minor.

In summary, vessel and aircraft noise have the potential to cause behavioral disruption of bowheads, but these disruptions are not expected to result in significant disruptions to behavioral patterns.

4.6.3.2 Reasonably Foreseeable Future Effects of Vessel and Aircraft Traffic in the Project Area

Changes in the distribution of sea ice, longer open-water periods, and increasing interest in studying and viewing Arctic wildlife and habitats may support increases in vessel traffic in the proposed action area, regardless of oil and gas activity (AMSA, 2009). To help manage this projected increase in shipping traffic (**Fig 3.2.7-1**), the United States and Russian Federation have proposed a system of voluntary two-way routes for all domestic and international ships to follow in the Bering Strait and Bering Sea (IMO 2017) (**Fig 3.2.7-2**).

Increased vessel traffic in the Beaufort and Chukchi Seas may result in greater incidents of pollutant discharges, and an increase in the risk of disturbance effects such as ship noise and ship strikes on migrating and foraging bowheads (AMSA, 2009). Observed and predicted decreases in the summer extent of the ice pack could also lead to a substantial increase in commercial shipping in the Arctic, especially if the Northwest Passage becomes reliably navigable (ACIA, 2004). Vessel traffic through the Bering Strait has risen steadily over recent years according to U. S. Coast Guard (USCG) estimates, and Russian efforts to promote a Northern Seas Route for shipping may lead to continued increases in vessel traffic adjacent to the western portion of the EIS project area. The Northern Seas Route has become an opportunity for Russia and China to bring services and commodities transported on large vessels escorted by icebreakers (including petroleum products via ice strengthened super tankers) to Asian markets (Whitney, 2012). Development of new classes of vessels may render the need for icebreaker accompaniment obsolete. Increased ship traffic may also be associated with offshore seismic exploration and exploratory drilling for oil and gas. Potential offshore development in the Beaufort and Chukchi seas would increase the numbers of support and supply ships transiting the region. The service vessels to support offshore oil and gas exploration activities can be categorized as supply, crew, and utility vessels (seismic and icebreaking). Exploratory drilling programs would be expected to use several support vessels, including spill response vessels and vessels for ice management. In 2012, Shell Oil Co. launched a 360-foot tug supply vessel the M/V Aiviq, which is an anchor-handling icebreaker. This vessel is classified as a Polar Class 3 ship that according to international shipping standards will allow it to operate year round in second year ice.

The western Arctic stock of bowhead whales seasonally migrates through the Bering Strait, Chukchi and Beaufort seas. In the Bering Strait, bowheads are constrained to a relatively small corridor, exposing them to increased interactions with vessels transiting this area. Bowhead whale migration could be affected by icebreakers operating in this area. Whales could move further offshore following the open leads created by icebreaking vessels, possibly putting them out of reach of coastal whaling communities (AMSA, 2009).

It is highly plausible there would be greater marine access and longer seasons of navigation, but not necessarily easier ice conditions for marine operations (AMSA, 2009). Increased vessel traffic in the Beaufort and Chukchi seas may interact additively or synergistically with other stressors such as climate change and seismic exploration, affecting foraging bowheads and their prey, or increasing the incidence of ship strikes. Most severe and lethal ship strikes of whales involve relatively large ships (e.g., 80 m or longer) traveling at speeds of 14 knots or faster (Laist et al., 2001). Because the probability of a vessel striking a whale increases as the speed of the vessel increases, it follows that the hazard posed by ships is at least partly a function of their speed (Laist et al. 2001; Vanderlaan and Taggart, 2007). Thus, management actions may focus on reducing vessel speeds to below 14 knots in areas where cetaceans are known to occur. As climate and sea ice conditions continue to change, the timing and location of bowhead activity may also change, making predictions of the potential interactions between shipping and bowheads increasingly complex (AMSA, 2009).

4.6.4 Effects of Commercial Fishing in the Project Area

Bowheads may interact with commercial fishing operations. Most commercial fishing activity in the Bering Sea occurs south of the range of bowhead whales. Citta et al. (2014) found that the distribution of satellite-tagged bowhead whales in the Bering Sea overlapped spatially, but not temporally, with some areas where commercial pot fisheries occurred, noting the potential risk of whales becoming entangled in derelict gear.

4.6.4.1 Past and Present Effects of Commercial Fishing in the Project Area

The North Pacific Groundfish Observer Program places observers on many of the large commercial fishing vessels that operate in the northern Bering Sea, but there are no observer records of fishery interactions with bowheads either through entanglements in fishing gear or ship strikes (Angliss and Outlaw, 2005). There are also no self-reported interactions from vessels without observers. However, based on multi-year photo mark-recapture data and other data from subsistence-harvested bowheads, the probability of a bowhead acquiring an entanglement injury was estimated at 2.4% per year (Givens et al. 2017, IWC SC/67a 2017 page 63). About 50% of large (≥17m) subsistence-harvested bowheads bore entanglement scars (George et al. 2017). Most entanglement injuries occurred on the peduncle and were rarely observed on smaller subadult and juvenile whales (<10 m). These estimates of entanglement, primarily with derelict commercial pot-fishing gear, should be considered minimum estimates of entanglement rates, as they do not include those whales that may have become anchored in place by pot gear, or that died because of entanglement and were not among the animals available for subsistence harvest.

Other interactions with bowhead whales and commercial fisheries are not expected in U.S. waters. To date, no large commercial fisheries have developed in the U.S. Beaufort and Chukchi Seas, and no commercial fishing occurs in the U.S. Arctic except for several small fisheries that occur in state waters managed by the State of Alaska. These include a small commercial set net fishery for chum salmon in the Kotzebue Sound region, and a very small commercial fishery for whitefish in the delta waters of the Colville River (NPFMC, 2009). These commercial fisheries in the Beaufort and Chukchi seas are expected to make negligible contributions to cumulative impacts on bowhead whale populations due to the timing, locations, and limited spatial extent of fishery activities.

4.6.4.2 Reasonably Foreseeable Future Effects of Commercial Fishing in the Project Area

The Arctic Management Area, including all marine waters in the U.S. EEZ of the Chukchi and Beaufort seas north of the Bering Strait from 3 nautical miles offshore the coast of Alaska or its baseline to 200 nautical miles offshore, is closed to commercial fishing until such time in the future that sufficient information is available with which to initiate a planning process for commercial fishery development (NPFMC, 2009). However, considering warming trends in ocean temperatures and changes in seasonal sea ice conditions, it is conceivable that the Alaska Arctic EEZ could offer commercial fishing opportunities in the future (Newton, 2005). Longer ice-free seasons coupled with warming waters and fish range expansion could together create conditions that lead to commercial fishery development. Although several species of finfish and shellfish occur in these waters that may support future commercial fisheries, there are no such fisheries in the U.S. Arctic Management Area at this time (NPFMC, 2009). Commercial fishing activities in the Bering Sea, as well as several small fisheries that occur solely in state waters, are likely to continue in the future, but potential changes in fishing effort relative to the range of the bowhead are unknown. The North Pacific Fishery Management Council established the Northern Bering Sea Research Area (NBSRA) in 2008 and prohibited bottom trawling in the northern part of the Bering Sea. This area includes nearly all of the Bering Sea waters north of 61^{o} N Latitude. Bottom trawling within U.S waters has little spatial overlap with the range of bowheads, and northern extension of bottom trawling effort further north into the bowheads' range is not expected in the foreseeable future. In addition, interactions between bottom trawling and bowheads have not been reported.

Some commercially exploited fish stocks may expand in both abundance and range as a result of climate warming while other stocks are predicted to decline (ACIA, 2004). However, due to the North Pacific Fishery Management Council moratorium on commercial fishing in the Arctic Management Area, and the prohibition of bottom trawling in the Northern Bering Sea Research Area, the potential contribution of commercial fishing to cumulative impacts within the range of the bowhead is likely to remain small. The notable exception to this is the effects of derelict pot fishing gear on entanglement rates of bowhead whales. Barring regulatory action from NOAA, which would require additional analysis of impacts to bowhead whales and subsistence harvest practices, substantial changes in commercial fishing effort in the DEIS project area are unlikely to occur in the foreseeable future. Likewise, entanglement rates caused by derelict fishing gear is unlikely to change barring changes to how northern Bering Sea pot fisheries are conducted.

4.6.5 Effects of Research Activities in the Project Area

Research activities occurring in the project area have the potential to affect bowhead whales, both incidentally and intentionally. Considerable scientific research effort conducted by government, industry, and educational organizations occurs every year in the EIS project area.

4.6.5.1 Past and Present Effects of Research Activities in the Project Area

The programs conducted by government, industry, and educational organizations have generally included marine environmental baseline studies, deployment of oceanographic equipment for collecting water and sediment samples, and use of nets and trawls for collection of phytoplankton, zooplankton, benthic and pelagic invertebrates, and fish. Moorings, buoys, and acoustic wave and current meters are also deployed for studies of physical oceanography and climate.

The Western Arctic Shelf Basin Interactions (SBI) project was a 10-year (1999-2009) interdisciplinary program investigating the impacts of climate change on biological, physical, and geological processes in the Western Arctic Ocean (Grebmeier et al. 2009). Funded by the National Science Foundation (NSF) and Office of Naval Research (ONR), the project was conducted from the U.S. Coast Guard HEALY and POLAR STAR icebreakers. Underwater noise generated by icebreakers may be a substantial source of impact within the EIS project area. Although radiated noise levels for these ships have not been measured, estimated source levels for icebreakers of similar size range from 177-191 dB re 1 μPa at 1 m (Richardson et al., 1995a: Table 6.5). Increases in noise level (197dB to 201dB) during ice breaking are caused by propeller cavitation, are broadband (10- 10,000 Hz), and are extremely variable over the period of pushing ice. Noise from research activities aboard the icebreakers or from ice camps may also be audible underwater, but source levels from these activities would be expected to be much lower than that of a ship breaking ice. It should be noted that ambient sea-ice noise is also extremely variable, with source levels of 124-137 dB re 1 μPa at 1 m for 4 and 8 Hz tones measured for ice deformation noises at pressure ridges (Richardson et al., 1995a).

Based on previous studies of bowhead response to noise, ice-breaking noise could result in temporary displacement of whales from the area where the icebreakers were operating and could potentially cause temporary deflection of the migration corridor (see Section 4.6.1 for further discussion of noise disturbance).

Research specifically on bowhead whales has been conducted since the early 1980s. The early focus of research was to understand the species' biology and ecology, particularly abundance, distribution, and habitat use (e.g., Burns et al. 1993). The Bureau of Ocean Energy Management (BOEM), collaborating with NOAA, NSF, ONR, USFWS, NSB, NPRB, ADF&G and others, has partially or fully funded research focused on population growth, habitat use, genetics, body condition, and response to anthropogenic sources, particularly because bowheads use habitat near oil and gas developments (e.g., Citta et al. 2015, Kuletz et al. 2015, Clark et al. 2015, George et al. 2015, Citta et al. 2017, Shelden et al. 2017, see also Chapter 3). An ecosystem approach to studying habitats occupied by high Arctic species has resulted in several special issues of peer-reviewed journals describing physical, chemical, and biological characteristics of bowhead whale habitat (e.g., Dunton et al. 2014, Moore and Stabeno 2015, Dunton et al. 2017, Mueter et al. 2017).These types of studies include research platforms on land, small to large vessels, moorings, and aircraft (both manned and unmanned). Depending on the project, bowhead whales could be temporarily deflected from feeding and migratory areas due noise or close approaches. Researchers work closely with the Native communities to ensure sampling and survey methods will have minimal, if any, effects on species used for subsistence (e.g., Konar et al. 2017, Robards et al. 2018).

4.6.5.2 Reasonably Foreseeable Future Effects of Research Activities in the Project Area

Research activities similar to those discussed above are expected to continue for the reasonably foreseeable future (e.g., SOAR Phase II: https://www.pmel.noaa.gov/soar/soar-phase-2). Increased noise from vessel and aerial surveys may result in temporary disturbance and temporary displacement of whales, or temporary deflection of bowhead migration. However, there is presently no evidence to indicate that current noise levels result in long-term adverse behavioral or physiological effects on the Western Arctic bowhead stock. Continued cooperation with Native communities of the North Slope will be essential to minimize disturbance during the hunting seasons.

4.6.6 Effects of Other Development in the Project Area

Other activities that may possibly contribute to the cumulative effects on bowhead whales include military activities, other industrial development, and tourism.

4.6.6.1 Past and Present Effects of Other Development in the Project Area

Military Activities. Prior to 2013, the surface and airspace of the Chukchi and Beaufort seas were not extensively used for testing or training of military aircraft, vessels, weapon systems, and personnel. Historically, military vessels or aircraft have not been stationed in the Beaufort or Chukchi seas. As of 2018, none of the airspace over the Beaufort and Chukchi seas is classified as ‘special use airspace’ for the military by the Federal Aviation Administration (https://sua.faa.gov/sua/siteFrame.app). However, shortly after the National Strategy for the Arctic was released, the Department of Defense released its 2013 Arctic Strategy that identified its objectives to ensure security, support safety, and promote defense cooperation and to prepare for a wide range of challenges and contingencies. This strategy was updated in 2016 to sharpen its focus on homeland defense in light of changes to the international security environment. To supplement the national-level guidance, the Navy released its Arctic strategy in a document called the Arctic Roadmap (Kendall 2014). The Arctic Roadmap identifies four strategic objectives:

- Ensuring sovereignty of the United States’ Arctic region;
- Providing ready naval forces to respond to crises and contingencies;
- Preserving freedom of navigation; and
- Promoting partnerships within the U.S. government and with its international allies and partners.

The U.S. Navy regularly and routinely operates and conducts undersea and on-ice exercises in the Arctic Ocean, and collaborates and cooperates with other Arctic nations by participating in multinational exercises, including Ice Exercises “ICEX” held every two years (https://en.wikipedia.org/wiki/ICEX:_US_Navy_Mission_in_Arctic). Submarines are often used for oceanic research or military activities in the area, particularly for use of passive and active acoustic technologies. Information about the response of bowhead whales to submarines is not available. Passive acoustics would not introduce noise to the environment and would likely result in no impact to bowhead whales.

Past military activities in the area were associated with the Distant Early Warning system, an integrated chain of radar and communications sites across Alaska, northern Canada, and Greenland. This system was discontinued in 1963 and replaced with short- and long-range radar (https://en.wikipedia.org/wiki/North_Warning_System). As of 2018, only three stations in Alaska remain active: Barrow, Oliktok, and Barter Island, along the north coast (western Beaufort Sea). The U.S. Department of Defense is in the process of dismantling the abandoned sites.

Beginning in 2009, during the open water months, Operation Arctic Crossroads has been conducted in an effort to integrate local knowledge of the region with military expertise to meet the challenges of Arctic operations. This operation involves USCG, U.S. Air Force, Army National Guard, Air National Guard, and U.S. Public Health Services personnel. This program aims to build Arctic domain awareness, involves USCG cutter operations (including icebreaking, buoy tenders and cutters), deployments to villages, community engagement, and search and rescue exercises. The USCG cutter Hamilton entered Arctic waters for the first time in 2009 to conduct search and rescue drills. Use of cutters in the Arctic is a challenge as the hulls of these vessels are not ice reinforced. The USCG had indicated that the current infrastructure and small boats and short range helicopters was not effective for long distance search and rescue operations in the Arctic and limit response capabilities for emergencies and response to potential oil spills. In 2017, the USCG through the programs Arctic Shield and Operation Arctic Guardian increased its presence in the Arctic, conducting oil spill response drills and training, outreach at multiple Native communities, search and rescue operations, and transiting the Northwest Passage with the first non-icebreaking cutter since 1967 (USCG 2017, http://www.pacificarea.uscg.mil/Our-Organization/District-17/Arctic-Shield/)

Other Industrial Development. On the Chukchi Sea, the major industrial developments are associated with the Red Dog Mine and Delong Mountain Terminal. Red Dog Mine is the largest producer of zinc concentrate in the world. Mining operations have reserves for over 40 years. The Delong Mountain Terminal receives ore concentrate from the Red Dog Mine and stores it until the area is free of ice. Approximately 250 barge trips per year transfer 1.5 million tons of concentrate to about 27 bulk cargo ships, which are anchored 9.7 km (6 mi.) offshore (MMS, 2006b).

Tourism. Tourism activities have typically been concentrated, on land but lack of sea ice has opened areas to marine vessels (such as small cruise ships). The U.S. Coast Guard District 17 (Alaska) noted 485 Bering Strait transits in 2016, down slightly from 540 in 2015, but up significantly from 220 transits in 2008. Vessel traffic includes merchant vessels such as cargo ships, tankers, bulk carriers, and tugs, but also research vessels, cruise ships, and even private adventurers on sailing and motor vessels. In 2016 there were 290 vessels that passed within the District 17 Arctic Area of Interest (extending northward from the Bering Strait to the North Pole), a massive rise from the 120 vessels noted in 2008 (Gosnell 2018).

The effects of vessels are related to ship strikes and anthropogenic noise. The effects of ship strikes are discussed in Section 4.6.3 and the effects of anthropogenic noise on bowheads are discussed in Section 4.6.1.

4.6.6.2 Reasonably Foreseeable Future Effects of Other Development in the Project Area

Military Activities. Military activity in the Arctic has increased in recent years, and it is reasonable to expect that military activity will continue to increase in the foreseeable future. Military activities in the proposed action area include the transit of military vessels through area waters, as well as submarine activity, aircraft overflights, icebreaking activity, and related maneuvers. In routine operations, submarines use passive sonar, which is not likely to disturb bowhead whales. The use of submarines as research platforms is likely to continue, resulting in potential disturbance to bowheads.

Other Industrial Development. Future development associated with the Red Dog Mine facility includes onshore developments, such as roads and/or infrastructure, which would have no impact on bowhead whales. The Red Dog Mine port site could also become the port facility for expanded mining operations for metallic minerals and/or coal in Northwest Alaska. However, a major expansion of the Red Dog Port and/or Delong Mountain Terminal would involve substantial capital expense, and such an expansion does not appear economically viable. The Red Dog Mine will continue to depend on marine transport systems, and it is plausible that the summer, ice-free season for support to the Red Dog Mine could be extended as Arctic sea ice continues to retreat in the Chukchi Sea (AMSA, 2009). Current projections are that the Red Dog Mine will remain in operation until 2030 (SRK 2016). In addition, coal mining prospecting proposals for the Brooks Range have been submitted to Alaska Department of Natural Resources, Division of Mining, Land and Water for approval. Past, present and reasonably foreseeable future activities related to mining are summarized in **Table 4.6.6-1**.

Table 4.6.6-1
Past, Present, and Reasonably Foreseeable Future Actions Related to Mining in the Project Area

Category	Area	Action / Project	Past	Present	Future
Mining	Red Dog Mine	Zinc Mine	X	X	X
	Red Dog Port	Minerals Export	X	X	X
		Coal Export			X
	Brooks Range	Coal Mining			X

Also associated with industrial development are chemical contaminants, Chemical contaminants are introduced to Arctic ecosystems through a variety of endogenic and exogenic sources. Certain organic pollutants tend to accumulate and persist in cold climates due to decreased mobility and slower degradation rates at lower temperatures. Organic pollutants and other contaminants, such as heavy metals, may be deposited in Arctic environments as a result of both long-range transport processes and local activities. The deposition and accumulation of contaminants are expected to continue over the reasonably foreseeable future, and must be considered in combination with actions that may lead to cumulative impacts in the proposed action area.

Tourism. Tourism activities are also likely to increase in the area, resulting in potential ship strikes and increased noise. The effects of ship strikes are discussed in **Section 4.6.3** and the anthropogenic noise on bowheads are discussed in **Section 4.6.1**.

4.7 Cumulative Effects of the Alternatives and Other Activities in the Project Area on the Western Arctic Bowhead Whale Stock

The intent of this section is to assess the contribution of the alternatives to the overall cumulative effects of other activities in the project area on bowheads. See **Table 4.11-1** for a summary of the direct, indirect, and cumulative effects of the alternatives and other activities on the Western Arctic bowhead whale stock.

It is important to frame this section by describing the status of the Western Arctic stock of bowhead whales. The Western Arctic stock bowhead whales currently appears resilient to the level of human- caused mortality and disturbance that has occurred within its range since commercial whaling ended. Since bowhead whales can live over 100 years (George et al., 1999), many individuals in this population have likely been exposed to numerous disturbance events during their lifetimes. Despite that exposure, this stock of bowhead whales has been steadily increasing at an estimated 3.4% per year (George et al., 2004a) and may even be approaching carrying capacity (Brandon and Wade, 2006). There is currently no indication that the combined effects of past or present noise and disturbance-causing factors or mortality levels since commercial whaling ended are hindering population growth.

Offshore Oil and Gas Activities. As described above, offshore petroleum exploration and development, shipping, aircraft, and research activities all contribute marine noise and activities that may disturb bowheads to the point of altering their movement patterns and behavior. These activities take place across the range of the Western Arctic stock of bowheads and are likely to continue or to expand in the future. Long-term and localized sources of noise, such as offshore petroleum facilities, can be regulated to mitigate the effects on bowheads during the times when they are present, but nonetheless may lead to bowheads avoiding those areas, resulting in loss of available habitat. Mobile sources of noise such as marine vessels tend to be short-term and inconsistent in time and place. Whales may avoid these sources when they encounter them, but are not likely to abandon a particular area of their range unless the disturbance is more consistent and prolonged.

The cumulative effects of the alternatives and offshore oil and gas activities, with the exception of the possibility of a very large oil spill (VLOS), would be minor. Alternative 1 would contribute no mortality and disturbance to the cumulative effects on bowheads, so the cumulative effects of human activities other than subsistence whaling are rated negligible to minor, as described in the preceding sections. Alternatives 2, 3, 4, and 5 would make minor contributions to the cumulative effects of disturbance to bowhead populations from all activities in the project area

Oil Spills. The potential effects of a VLOS (**Section 4.6.1.3**) could result in major cumulative effects of disturbance, injury, and mortality. A VLOS is a low probability, high consequence event and the duration of effects from a VLOS on individual bowhead whales could range from temporary (e.g., skin irritations or short-term displacement) to permanent (e.g., endocrine impairment, reduced reproduction, or mortality). Displacement from areas affected by a spill is likely due to response activities. If the area affected were an important feeding area, or along a migratory corridor, the effects might be of higher magnitude. Population level effects are possible if a VLOS coincided with and affected large feeding aggregations of bowhead whales, particularly if calves were present.

Alternative 1 would contribute no mortality and disturbance to the cumulative effects on bowheads, so the cumulative effects of human activities other than subsistence whaling are rated negligible to minor, as described in the preceding sections. A VLOS would influence the context and contribution of Alternatives 2, 3, 4, and 5 to cumulative effects on bowhead whales. If the timing and location of a VLOS resulted in significant injury or mortality, the added contribution of Alternatives 2, 3, 4, and 5 to cumulative effects could result in impact levels at the population level of minor for mortality, and minor to moderate for disturbance.

Climate Change. Also important for assessing cumulative effects on bowhead whales are the current and projected effects due to climate change. Although the current state of knowledge is limited, bowhead whales may be sensitive to current and ongoing effects of climate change in the Arctic. The loss of sea ice may be opening new habitat and the possibility of genetic exchange between Atlantic and Pacific populations that were previously separated by sea ice. Satellite-tagged bowhead whales from both Alaska and West Greenland recently entered the Northwest Passage from opposite directions and spent roughly ten days in the same general area. This is the first documented overlap of these two populations (Heide-Jørgensen et al., 2011). Sea ice loss is also allowing for range expansions of seasonally migrant sub-Arctic and temperate whale species (e.g., fin and humpback whales) into the Beaufort and Chukchi seas (Clarke et al., 2011; Hashagen et al., 2009). Range expansion of these more temperate species could lead to competition for resources with Arctic species, such as bowhead whales (ACIA, 2005).

Alternative 1 would contribute no mortality and disturbance to the cumulative effects on bowheads, so the cumulative effects of human activities other than subsistence whaling are rated negligible to minor, as described in the preceding sections. Although current knowledge on the cumulative effects of climate change on bowhead whales is limited, it is likely that subsistence harvesting under Alternatives 2, 3, 4, and 5 would make only a minor contribution to these cumulative effects.

Vessel and Aircraft Traffic. The majority of vessel traffic within the proposed action area is in support of international commercial shipping, domestic shipping to coastal villages, oil and gas development, and operations at the Red Dog mine. Other vessel activity within bowhead habitat derives from commercial fishing, , smaller vessels used for hunting and local transportation during the open water period, military vessel traffic, vessels conducting scientific research, commercial recreational vessels (e.g., cruise ships) a few private recreational watercraft, and ice breakers used in support of any of these activities. Aircraft use in the area includes commercial aviation transport, private personnel transport (e.g., within oil fields) and small fixed wing and helicopters in support of oil and gas development, other natural resource development, and natural resource management and research. Military aircraft also use this area. Impacts to bowhead whales may occur from noise due to vessel and aircraft operations, and from vessel strikes.

Alternative 1 would contribute no mortality and disturbance to the cumulative effects on bowheads, so the cumulative effects of human activities other than subsistence whaling are rated negligible to minor, as described in the preceding sections. It is likely that subsistence harvesting under Alternatives 2, 3, 4, and 5 would make only a minor contribution to the cumulative effects of vessel and aircraft traffic activities on the bowhead whale stock.

Commercial Fishing. Commercial fishing vessels may strike a small proportion of bowhead whales, with injuries from vessels observed in about two percent of subsistence-harvested bowheads. While the lack of spatio-temporal overlap between commercial fishing vessels and bowheads suggests that vessel noise and ship strikes are not expected to result as a result of fishing, a notable proportion (12 percent) of bowheads bear signs of entanglement with gear, most likely derelict commercial pot gear, with some bowhead mortality having been reported due to entanglement with derelict commercial crab gear. While commercial pot fishing gear remains a threat to individual bowheads, it is unknown whether this is having population-level effects. The continued growth of the bowhead population, however, indicates that commercial fisheries interactions are not precluding the recovery of this endangered species. Nevertheless, the effects of commercial fishing likely have a minor to moderate effect on the bowhead whale population through entanglement in derelict gear.

Alternative 1 would contribute no mortality and disturbance to the cumulative effects on bowheads, so the cumulative effects of human activities other than subsistence whaling are rated negligible to minor, as described in the preceding sections. It is likely that subsistence harvesting under Alternatives 2, 3, 4, and 5 would make only a minor contribution to the cumulative effects of commercial fishing activities on the bowhead whale stock.

Research Activities. Research activities occurring in the project area have the potential to affect bowhead whales, both incidentally and intentionally. Considerable scientific research effort conducted by government, industry, and educational organizations occurs every year in the DEIS project area.

Alternative 1 would contribute no mortality and disturbance to the cumulative effects on bowheads, so the cumulative effects of human activities other than subsistence whaling are rated negligible to minor, as described in the preceding sections. It is likely that subsistence harvesting under Alternatives 2, 3, 4, and 5 would make only a minor contribution to the cumulative effects of research activities on the bowhead whale stock.

Other Development. Other activities that may possibly contribute to the cumulative effects on bowhead whales include military activities, other industrial development, and tourism. Alternative 1 would contribute no mortality and disturbance to the cumulative effects on bowheads, so the cumulative effects of human activities other than subsistence whaling are rated negligible to minor, as described in the preceding sections. It is likely that subsistence harvesting under Alternatives 2, 3, 4, and 5 would make only a minor contribution to the cumulative effects of other development activities on the bowhead whale stock.

In summary, considering the aggregated impacts and interactions of past, present, and reasonably foreseeable future actions, the cumulative effect of disturbance on bowheads is minor in magnitude, since the distribution of the bowhead population is unlikely to be changed. The geographic extent of disturbance effects discussed in this section is primarily localized, but disturbances may occur in numerous locations, particularly with respect to commercial fishing throughout the Bering Sea, for an aggregate rating of moderate. The duration of these effects is primarily short-term, although effects from oil spills, oil spill response and derelict fishing gear can span across years. Therefore, the aggregate rating for the duration of these effects is considered to be moderate. The overall effects of disturbance from sources other than subsistence whaling are unlikely to limit bowhead population growth, because bowheads have continued to show population growth in the presence of these effects. Therefore, we consider these effects to be minor (**Table 4.1-1**).

4.8 Direct and Indirect Effects of the Alternatives on Other Wildlife in the Project Area

Alternative 1 would not provide federal authorization for subsistence whaling. In itself, this would have no direct impact on other wildlife species. However, as an indirect effect, it is likely that hunting pressure on other species (especially seals, walrus, and caribou) would increase substantially to compensate in part for the loss of the whale harvest. Although this increased effort on other species is unlikely to replace the whale harvest, it could lead to moderate and possibly major reductions in the populations of popular subsistence-harvested species around the whaling communities. Hunting pressure on these species might increase a small amount with minor effects on populations. Increased hunting activity would also increase noise and disturbance to subsistence-harvested species and other wildlife. Since the loss of whaling would affect a number of communities, increased hunting disturbance would affect populations of subsistence-harvested species in numerous locations, but not range-wide for any species. For species that often congregate in numbers, like walrus and caribou, disturbance could affect numerous animals for each hunting event and the effects would be considered moderate. For species that are dispersed, like seals and polar bears, few animals would be disturbed and the effects would be considered minor. The duration of effects would depend on the duration of a whaling moratorium but the frequency of disturbance on other wildlife would likely vary from minor to moderate.

Alternatives 2, 3, 4 and 5 are not expected to have more than negligible or minor effects on other wildlife species. Just as individual whales may be indirectly affected by hunting activities, (e.g., vessel noise) (**Section 4.5**), other wildlife such as seals or polar bears may also be disturbed by these activities. Moreover, the Native villages and communities that currently harvest bowhead whales would be likely to alter their harvest patterns of other subsistence foods depending on the number of bowhead whales harvested. This currently occurs, as other species may be sought out when bowheads cannot be hunted due to weather/ice or whenever a village's hunting is only partially successful. At these times, it is possible that subsistence hunters may increase their harvest of other animals, such as seals, ducks, fish, caribou, bears, walrus, beluga whales, Dall sheep, or freshwater and marine fish. It is not possible to quantify this effect, as each subsistence food has its own individual value and place within the Alaska Native diet. A pound of bowhead whale *maktak* is not necessarily replaceable by a pound of caribou or whitefish, even if direct substitution were possible. In magnitude, extent, and duration, these effects are considered negligible to minor.

The U.S. Fish and Wildlife Service (USFWS) was consulted regarding potential effects of the bowhead subsistence harvests on ESA listed species, ESA candidate species, and designated critical habitat under USFWS jurisdiction. In its May 2018 consultation letter, USFWS reviewed potential impacts to three species listed as threatened: Steller's eider, spectacled eider, and polar bear (see **Appendix 8.4.1**). Potential impacts to designated critical habitat for polar bear and spectacled eider were also reviewed. USFWS concluded that the proposed annual quotas for bowhead subsistence harvests are unlikely to adversely affect listed species or designated critical habitat under USFWS's jurisdiction.

4.9 Cumulative Effects of the Alternatives and Other Activities on Other Wildlife in the Project Area

Chapter 3 describes a number of marine and terrestrial wildlife species that are present in the Alaskan coastal areas considered in this DEIS. Some of these bird and mammal species are affected directly or indirectly by bowhead whaling activities associated with Alternatives 2, 3, 4, and 5:

- Disturbance (marine species);
- Mortality associated with supplying whaling crews with food (seals, caribou);
- Mortality associated with whaling equipment (bearded seal, walrus, furbearers);
- Personal defense mortality of polar bears attracted to hunting camps and butchering sites;
- Mortality associated with subsistence harvests for community celebrations (waterfowl, caribou, seals); and
- Mortality associated with subsistence harvests of alternative food sources when whaling is not successful (marine and terrestrial species).

Other species (gray whales, minke whales, killer whales, harbor porpoise, short-tailed albatross, and many terrestrial mammals) would incur no or negligible indirect effects from potential vessel or land-based disturbance associated with subsistence activities; these species will not be considered further in this DEIS. We evaluated the direct and indirect impact of the alternatives on other species and determined them to be either so minor as to be negligible or so unlikely as to be discountable. We have therefore determined that there will be no measurable cumulative impacts to assess. There are no incremental or synergistic effects of the alternatives that will add to or interact with the effects of other cumulative actions. The effects of past and present activities within the project area have been considered in **Section 3**, the description of the Affected Environment. Further consideration is given to species listed as endangered or threatened under the Endangered Species Act by USFWS in the Project Area, including: Steller's eider (*Polysticta stelleri*) (threatened), Spectacled eider (*Somateria fischeri*) (threatened), Short-tailed albatross (*Phoebastria albatrus*) (endangered), Polar bear (*Ursus maritimus*) (threatened), Eskimo curlew (*Numenius borealis*) (endangered), for which the alternatives could contribute to cumulative effects.

Section 3, Affected Environment, summarizes the major natural and human-influenced factors that affect different wildlife species in the Arctic. For most of these species, reasonable population estimates and trends are not available, so it is difficult to establish the relative importance of natural and human influenced factors to population level effects. Some of the major human influenced factors that contribute to cumulative effects on these species include:

- Subsistence and sport hunting;
- Noise and disturbance from motorized vehicles, aircraft, and vessels;
- Environmental contamination (air, water, and land) from distant industrial and agricultural sources;
- Oil and gas development on land and in marine waters;
- Oil spills and other discharges from marine traffic;
- Noise and pollution from oil and gas development;
- Environmental changes due to global warming; and
- Commercial fishery interactions.

All of the human activities and factors described above that have contributed to effects on other wildlife in the past are likely to continue in the future. The relative importance of various factors and intensity of effects on different species is likely to change over time, especially as environmental (climate) changes become more pronounced. Although extensive modeling efforts are underway to help predict changes in the physical environment (ACIA, 2004; IPCC, 2007), the synergistic responses of animals and humans to future environmental conditions are very difficult to predict.

As described above for bowhead whales, there is a remote chance of a VLOS occurring during offshore drilling operations. A VLOS could contribute substantially to cumulative effects of injury and mortality. Impact levels may vary by species and depend on timing and location of a spill and subsequent clean-up efforts, species abundance and distribution in the area, and their relative vulnerability or resilience. Ice seals can purge their bodies of hydrocarbons through renal and biliary pathways and, like walrus, are not dependent on fur for insulation, leaving them less susceptible to thermoregulatory effects of oiling. Although ice seals can get lesions on their eyes and some internal organs from contacting crude oil, many of the physiological effects self-correct if the duration of exposure is not too great (Engelhardt et al., 1977; Engelhardt, 1982; 1983; 1985; Smith and Geraci, 1975; Geraci and Smith, 1976a,b; St. Aubin, 1990). It is not clear whether walrus are able to metabolize small amounts of oil as has been demonstrated with ringed and bearded seals, but they have a similar physiology, so tissue damage may be temporary unless they are exposed to chronic contamination (Kooyman et al., 1976). Chronic exposure may result in mortality or long term sub-lethal effects that reduce overall fitness and survival. Polar bears are susceptible to oil spill-induced injury and death through lost insulation value of their fur and ingestion of oil through grooming or contaminated prey (Hurst and Oritsland, 1982; Neff, 1990). Polar bears are curious about new things in their environment and may not avoid oil spill areas or contaminated prey or carcasses (St. Aubin, 1990; Derocher and Stirling, 1991).

A VLOS could also contribute substantially to the cumulative effects of disturbance on ice seals, walrus, and polar bears. Activities associated with spill response and cleanup, such as vessel and aircraft traffic, booming and skimming operations, drilling a relief well, research, and monitoring, could continue for several months post-incident and cause disturbance and displacement throughout the response area. Walrus are particularly sensitive when hauled out on land, where disturbance from vessels and low-flying aircraft could cause stampedes and trampling events.

In the unlikely event that a VLOS were to occur during offshore drilling operations, marine and ice-obligate species would be particularly vulnerable. Such an event could result in negligible to major cumulative effects of disturbance, injury, and mortality. The contribution of Alternative 1 to cumulative effects with a VLOS scenario could be minor to moderate, since in the absence of bowhead whaling, subsistence hunting pressure on other species would increase. Alternatives 2, 3, and 4 would reauthorize the existing level of bowhead harvest, so existing levels of subsistence harvest of other species would continue. Alternative 5 would authorize 100 strikes per year, subject to a six-year landed limit of 504 whales, so existing levels of subsistence harvest of other species would likely continue. However, if a VLOS were to result in reduced bowhead abundance requiring restrictions on whaling, then subsistence hunting directed to other species would increase. If other marine species were also adversely affected by a VLOS, then new hunting activity might represent an additive effect of moderate to major magnitude. As a result, it is possible that hunting might be limited or suspended in areas impacted by a VLOS.

Timing and location of such an incident would largely determine cumulative effects.

Major conservation concerns in the Arctic include substantial reductions in sea ice and ice pack habitat (ACIA, 2004). Ice-obligate species (e.g., walrus, ringed seals, bearded seals, and polar bears) are intricately tied to and heavily dependent upon sea ice for feeding, breeding, pupping, and resting, making them particularly vulnerable to climate-driven changes to sea ice conditions (Moore and Huntington, 2008). Concern over habitat degradation and loss due to climate change prompted petitions to list these four species as either threatened or endangered under the ESA. Following extensive litigation, polar bears, the Beringia and Okhotsk subspecies of bearded seals, and the Arctic, Okhotsk, and Baltic subspecies of ringed seals are now listed as threatened (73 FR 28212; 77 FR 76706, 77 FR 76740).

Recent shifts in distribution and habitat use by polar bears and walrus are attributed to loss of sea ice habitat. In the past, most denning female polar bears in Alaska chose den sites on the pack ice (Amstrup and Gardner, 1994), but the majority now den on l and, which is a trend that is expected to continue into the future (Fischbach et al., 2007). Delayed formation of sea ice in the fall is causing more bears to remain longer on land where they are more susceptible to starvation and interactions with people, resulting in an increased chance of being killed in defense of life or property (Amstrup, 2000). The recent use of coastal haulouts by aggregations of walrus along the northwestern Alaska coast was attributed to the loss of sea ice over the Chukchi Sea continental shelf (Clarke et al., 2011; Allen and Angliss, 2011; Fischbach et al., 2009). Use of shore-based haul outs may leave walrus, particularly calves and juveniles, vulnerable to disturbance-related stampedes and trampling mortalities (Fischbach et al., 2009).

While ice-obligate species experience habitat loss as sea ice retreats, ranges of some sub-Arctic and temperate species, such as fin and humpback whales, are expanding into the Chukchi and Beaufort seas (Clarke et al., 2011; Hashagen et al., 2009).

As described in previous sections, under Alternative 1, it is likely that hunting pressure and associated disturbance on other wildlife species (especially seals, walrus, and caribou) would increase substantially to compensate in part for the loss of the whale harvest. This might result in minor to moderate reductions in game populations around the whaling communities. Depending on the species, these populations are managed for sustainable harvests by the Alaska Department of Fish and Game (ADF&G), the Federal Subsistence Board, and jointly by federal agencies and Alaska Native Organizations under co-management agreements. For ice-obligate species, cumulative effects are likely to be dominated by the effects of climate change, as detailed above. The contribution of Alternative 1 would be minor to moderate based on increased harvest and associated disturbance of ice-obligate marine mammals (e.g., ice seal and walrus populations), at least near whaling communities. Increased harvest of terrestrial game species might add to the complexity of managing game populations, especially with the uncertainty of how climate change will affect different terrestrial species. For other species, including threatened and endangered species, cumulative effects are likely to be dominated by conservation issues independent of whaling activities, as outlined above. The contribution of Alternative 1 to the cumulative effects on these species, due to increased hunting effort, would be moderate for important game species (e.g., caribou) and minor for other species.

Alternatives 2, 3, and 4 would result in similar amounts of whaling activity and harvest over a six-year period, although total take levels could vary slightly between these alternatives, due to differing provisions concerning carry-forward of unused strikes. Alternative 5 would result in an increase in whaling activity and harvest over a six-year period. Based on low magnitude, limited geographic extent, and short-term duration, the direct and indirect effects of these alternatives are considered to be negligible to minor for other wildlife, depending on the species. For ice-obligate species (ice seals, walrus, and polar bears), cumulative effects are likely to be dominated by the effects of climate change, as described above, and the contribution of the alternatives is considered negligible, since bowhead harvests would continue, and other resources would continue to play their current role in the subsistence harvest annual round. For other species, including threatened and endangered species, cumulative effects are likely to be dominated by conservation issues independent of whaling activities, as outlined above. The contribution of the alternatives to the cumulative effects on these species is considered negligible.

4.10 Direct, Indirect, and Cumulative Effects of the Alternatives and Other Activities in the Project Area on the Sociocultural Environment

4.10.1 Effects on Subsistence Patterns

The past, present, and future importance of the bowhead whale in these Alaska Native villages cannot be overemphasized. The AEWC has stated that, "…whaling, more than any other activity, fundamentally underlies the total lifeway of these communities" (AEWC, undated). Alaska Natives have hunted the bowhead whale for over 2,000 years, and the hunt remains the dominant aspect of their culture. Subsistence whaling is a year-round activity in these villages, beginning each winter with: preparation of skin boats; caribou hunting for meat supplies for the crews and sinew for sewing the bearded seals skins used for *umiaks*; preparation of ice cellars; and outfitting the camps with supplies. Spring whale hunting involves shared labor in harvesting followed by widespread distribution of bowhead whale food and cultural events celebrating the harvest. By summer time, whalers are hunting for bearded seals for use in building *umiaks* for the following year's spring bowhead hunt, followed by autumn whaling in Utqiaġvik (Barrow), Nuiqsut, Kaktovik, Wainwright, Gambell and Savoonga.

Bowhead whale meat, *maktak*, and oil have long provided, and continue to provide, important contributions to the Inuit diet. *Maktak* and oil are especially valuable in supplying high-calorie protein in a cold and harsh climate. Subsistence foods are highly nutritious and contain heart-healthy fats (Nobmann [1997] in MMS, 2006d). A study found that Alaska Natives with higher levels of polyunsaturated fats, found in fish oils and marine mammals, had lower heart disease mortality (McLaughlin et al., 2005). A permanent loss of whale meat could precipitate the physical, psychological, and cultural trauma that often accompanies drastic and forced dietary changes (Michie, 1979). The sale of bowhead whale meat is prohibited, however, edible portions are shared throughout the communities of Alaska's North Slope and beyond. Bowhead whales also provide raw materials for the creation of Native handicrafts, which may be legally sold.

In 1997, the AEWC documented a level of 280 landed whales over a five-year period as necessary to provide for the nutritional and cultural needs of these communities. The 2012 need statement of the AEWC (**Appendix 8.1**) considers the 2010 U.S. Census results for the 11 participating AEWC communities and documents a continuing need of 57 landed bowhead whales per year. Any alternative that would provide fewer whales would be expected to have some level of adverse impact to socioeconomic and cultural needs of these villages. It is not likely that the nutritional or cultural void created would or could be filled with substitute foods. Imported foods cannot readily take the place of whale and other marine mammals, which are central to the cultural identity and diets of Alaska Natives (Michie 1979).

An updated need statement will be developed by the AEWC and submitted to the IWC for review in advance of its 67th meeting in September 2018. This updated need statement will be considered in the Final EIS for this proposed action.

Alternative 1 (No Action)

Under Alternative 1, there would be no federal authorization of subsistence bowhead whaling for 2019 and beyond. With no subsistence whaling, the direct effects of this alternative would include the loss of tens of thousands of pounds of highly nutritious and highly valued food, attenuation of the social cohesion occasioned by the shared work among whaling crews and other cooperators in the year-round work of preparation for whaling, disruption in the bonds established through food sharing, and diminished opportunities for young people to continue to learn the knowledge, practice, and beliefs associated with this central cultural institution (Worl 1979). The indirect effect of Alternative 1 would be likely to result in redirection of subsistence harvest effort to other subsistence resources, but it is unlikely that the volume of food produced in whaling could be recreated. Instead, local residents would be more likely to increase their use of imported foods; and, given the high costs of imported foods, especially for frozen and fresh foods, it is likely that the increase would be in imported foods of lower nutritional value.

Inuit leaders and institutions would likely contest the elimination of subsistence bowhead whaling, as they did in 1977 at the time of the IWC moratorium (Langdon, 1984). This might involve litigation, and highly charged efforts to petition federal agencies and the Congressional delegation seeking relief. Alternative 1 would likely be viewed by the AEWC as a failure by the U.S. government to uphold rights of Alaska Natives. Since the MMPA and ESA expressly provide for the right for Alaska Native subsistence hunting, and since there is no conservation-based rationale for denying the subsistence whaling quota, elimination of a quota would not comport with NMFS's objective to accommodate federal trust responsibilities to the fullest extent possible consistent with applicable law. Alternative 1 could also result in confrontation between the AEWC and NMFS. Cooperative research and management efforts between the AEWC and NMFS that benefit marine mammals could be jeopardized.

The loss of such an important subsistence food resource would be an adverse impact of major magnitude. Since all AEWC communities would be similarly affected, this impact would be major in geographic extent. The duration of such an effect would be uncertain, since NMFS might revisit such a decision in a subsequent year, or it could last for the five year or six year period of the current IWC authorizations for aboriginal subsistence whaling. In all, the direct, indirect, and cumulative effects of Alternative 1 on subsistence patterns would be adverse and major (**Table 4.1-3**). Cumulative effects on subsistence harvest patterns from the oil and gas activities and climate change, described in **Sections 4.6.1 and 4.6.2**, would be minor to moderate, except that a VLOS could have major effects. The contribution of Alternative 1 to cumulative effects on subsistence harvest patterns would be adverse and major, in that the near-term effects of discontinuing bowhead whaling would be far greater than the other impacts of oil and gas activity, or climate change. In summary, the direct, indirect, and cumulative effects of Alternative 1 on subsistence harvests would be major and adverse.

Alternative 2

Alternative 2 would provide for continued subsistence bowhead whaling at a level that would, under ideal hunting conditions, address the identified Alaska Native cultural and nutritional subsistence needs. However, Alternative 2 provides for no carry-forward of unused strikes. The direct effects would include continuation of the subsistence food contribution of bowhead whales, the cooperative work and food sharing practices, and crucial cultural learning opportunities for young people. Indirect effects would include continuation of the current levels of diversity in subsistence resource uses, and continuing levels of reliance on subsistence foods, supplemented by purchased foods.

Alternative 2 would avoid the adverse reaction to no subsistence whaling quota predicted under

Alternative 1. However, with no carry-forward of unused strikes, Alternative 2 would not provide the flexibility that whaling captains have required for many years. Indeed, in prior years, when adverse weather conditions hindered hunting activities late in a year, whaling captains had confidence that unused strikes would be available in a subsequent year, although these have actually been used infrequently (i.e., twice in the period 1998 - 2010, as shown in **Figure 3.2.12**). The availability of these unused strikes and the flexibility they afford also help to alleviate a sense of pressure among hunters to take all strikes when they are available. This sense of pressure can have an adverse effect on hunting efficiency, as hunters feel the need to try to take whales under less than favorable conditions. The lack of flexibility provided by the carry-forward can also foster a tendency toward competition. A competitive pressure was introduced into this hunt during the years of lower IWC catch limits, but has been alleviated in more recent years with the increase in catch limits to a level consistent with need, and the flexibility afforded by the carry-forward of unused strikes. The introduction of competitive pressure in this hunt undermines the socially valuable characteristics of cooperation and sharing that the hunt itself has fostered historically in the AEWC communities and helps to preserve today. The lack of this flexibility is an adverse effect in subsistence patterns, although relative to Alternative 1, overall the direct and indirect sociocultural effects of Alternative 2 are considered beneficial, and of major magnitude, extent, and duration.

The contribution to cumulative effects on subsistence harvest practices from Alternative 2 would be major and beneficial, and would help to offset the cumulative effects of disturbance and displacement of subsistence activities due to oil and gas activities, including noise and oil spills, and ecosystem impacts from climate change as outlined in **Section 4.6.1** and **Section 4.6.2**. With oil and gas activities, whales may adjust migration routes around areas of high noise, or in the event of an oil spill, alter feeding activities to avoid contaminated waters. While temporary and local in nature, these disruptions might make subsistence whaling more time-consuming and, in periods of rough seas, more dangerous. These disruptions could also result in bowhead whales being unavailable to some of the communities if the whales move too far offshore to avoid noise or contamination. The authorization of bowhead whaling gives this activity standing and profile before the regulatory agencies and industry, and may contribute to the pressure to identify effective mitigation measures required by the BOEM and NMFS from industry. To minimize disturbances, the Open Water Season Conflict Avoidance Agreement (CAA) negotiated between industry and the AEWC (MMS, 2006d), includes provisions for quiet periods when industry activity in specific areas ceases before and during the active hunt, and onboard marine mammal observers and vessel speed and distance restrictions to reduce the possibility of ship strikes.

Disturbances from an oil spill, especially a VLOS, have the potential to affect bowhead harvest activities if the spill occurs during the bowhead whaling season and if it occurs in bowhead habitat. This concern was voiced by Donald Long, a resident of Utqiaġvik (Barrow), at the public hearing for the Beaufort Sea Planning Area Oil and Gas Lease Sale 124 in April of 1990:

- Any disruption, whether it be oil spill or noise, would only disturb the normal migration, and a frightened or a tense whale is next to impossible to hunt.

- At the same meeting in Utqiaġvik (Barrow), Marie Adams also voiced concern that an oil spill would significantly impact bowhead whale migration routes through the ice:

- An oil spill in the fragile ecosystem of the Arctic could devastate the bowhead whale. These animals migrate through narrow open lead systems which could be the preferred path of an oil spill.

- The magnitude of effects of a VLOS on subsistence harvest patterns depends on seasonal and other factors.

Generally, spring whaling occurs before seismic activities are underway, and mitigation measures and the CAA create exclusion zones to avoid seismic activities in specified areas before and during the fall hunts of specific communities when whales are nearby. Cumulative effects on spring whaling would be rated as minor. For fall whaling, the likelihood of impacts is less certain, because it turns on the effectiveness of mitigation measures. The NSB and the AEWC have expressed concern about the potential for growing levels of seismic exploration to deflect bowhead whales further offshore and for longer periods away from the traditional harvest areas. This impact would increase the displacement of traditional subsistence whaling practices, requiring greater travel distances, time and cost. On the basis of current knowledge, this analysis concludes that there are deflection effects of noise associated with oil and gas activity, though those effects are not completely known, and that the potential for disturbance to the whales and to subsistence whalers would result in cumulative sociocultural effects that can be considered moderate in magnitude, and generally minor in duration. The impact of a VLOS could be adverse and major on bowhead populations as noted in **Section 4.6.6.1**, and could result in reduced subsistence whaling opportunities. The contribution of Alternative 2 to cumulative effects on subsistence patterns would be positive and would in part offset any adverse effects of other activities on subsistence practices. In the case of a VLOS, the magnitude of adverse cumulative effect on subsistence resources may be such that subsistence bowhead whaling harvest, and potentially the allocation, might be limited or eliminated, based on, at least, the advice of the IWC's Scientific Committee, removing the beneficial effect.

Alternative 3

Under Alternative 3, the direct and indirect effects on subsistence harvest practices would be nearly identical to Alternative 2 (**Section 4.8.1.2**) but would provide for the longstanding flexibility to carry-forward up to 15 unused strikes into subsequent years. In contrast to Alternative 2, the carry-forward feature of Alternative 3 would provide whaling captains with the continuing confidence that if adverse weather prevents a safe hunt late in the season, they may recoup the opportunity in following years through the carry-forward of up to 15 unused strikes per year. Direct, indirect, and cumulative effects would be the same described for Alternative 2. In total, the contribution of Alternative 3 to cumulative effects on subsistence patterns would be beneficial, and major in magnitude, extent, and duration. Bowhead whaling with authorization under Alternative 3 would offset in part the adverse effects of other activities on subsistence practices. In the case of a VLOS, the magnitude of adverse cumulative effect on subsistence resources may be such that subsistence bowhead whaling harvest, and potentially the allocation, might be limited or eliminated, based on, at least, the advice of the IWC's Scientific Committee, removing the beneficial effect.

Alternative 4 (Preferred Alternative)

Alternative 4 would provide for the same continuity in subsistence harvests and related social and cultural benefits as Alternative 3. However, Alternative 4 would provide for additional flexibility to carry-forward up to 33 unused strikes into subsequent years. Direct, indirect, and cumulative effects would be the same described for Alternative 3. In total, the contribution of Alternative 4 to cumulative effects on subsistence patterns would be beneficial, and major in magnitude, extent, and duration. Bowhead whaling with authorization under Alternative 4 would offset in part the adverse effects of other activities on subsistence practices. In the case of a VLOS, the magnitude of adverse cumulative effect on subsistence resources may be such that subsistence bowhead whaling harvest, and potentially the allocation, might be limited or eliminated, based on, at least, the advice of the IWC's Scientific Committee, removing the beneficial effect.

Alternative 5

Under Alternative 5, the direct and indirect effects on subsistence harvest practices would be nearly the same as Alternative 4, though with increased harvest levels over any six-year period. Overall the direct and indirect sociocultural effects of Alternative 5 are considered beneficial, and of major magnitude, extent, and duration. The contribution of Alternative 5 to cumulative effects on subsistence patterns would be beneficial and major in magnitude, extent, and duration, and this would in part offset any adverse effects of other activities on subsistence practices. In the case of a VLOS, the magnitude of adverse cumulative effect on subsistence resources may be such that subsistence bowhead whaling harvest, and potentially the allocation, might be limited or eliminated, based on, at least, the advice of the IWC's Scientific Committee, removing the beneficial effect.

4.10.2 Effects on Inuit Health: Nutritional Benefits and Risks

In addition to the food volume produced through subsistence bowhead whaling, nutritional benefits and risks can be assessed, at least in qualitative terms. As a result of industrial pollution, long distance vectors for transport and deposition in Arctic environments, and high rates of persistence, many contaminants are found in Arctic subsistence resources. As described in **Section 3.2.6**, bowhead whale subsistence foods have been analyzed for their levels of contaminants, including PCBs, dichlorodiphenyltrichloroethanes (DDTs), organochlorines (OCs), chlordanes, and heavy metals. These contaminant levels varied with gender, length/age, and season, but were generally relatively low compared to other marine mammals. Reports by the Arctic Monitoring and Assessment Programme (AMAP) identified levels of contamination meriting closer public health attention in some parts of the Arctic, through generally not in Alaska (AMAP, 2009a,b).

At the same time, public health officials recognize that the loss of subsistence foods would have far-reaching consequences throughout the sociocultural system of small, predominantly indigenous communities. A report from the Alaska Division of Public Health, Section of Epidemiology in 1998 observed that:

- Changes in diet, lifestyle, and the social and cultural disruption that follows the cessation of subsistence may contribute to a wide array of changes in communities from increases in obesity and diabetes, to increases in violence, alcoholism and drug abuse (Egeland et al., 1998:9).

Moreover, highly nutritious subsistence foods are generally replaced by nutritionally inferior purchased foods. The report further stated:

- The market foods that often replace locally harvested wildlife are high in saturated fat and vegetable oils and carbohydrates and often lower in nutrient value. In addition, dietary changes are complex in nature, often coinciding with a number of other lifestyle changes that also contribute to increases in chronic diseases such as heart disease, diabetes, and cancer (Egeland et al., 1998:9).

In a 2004 update on risk and benefits of traditional foods, the Alaska Section of Epidemiology studied mercury contaminant levels in fish and marine mammals, including data on hum an uptake (i.e., biomonitoring through hair samples). This study reiterated the findings of the 1998 report and continued to recommend, "…unrestricted consumption of fish and marine mammals from Alaska waters as part of a balanced diet…" (Arnold and Middaugh, 2004:2). Another indication of the positive benefits of subsistence foods is found in a study of blood samples from Alaska Native mothers which concluded that Iñupiat mothers with subsistence diets high in land mammals and bowhead whale have lower levels of organochlorines and metals in comparison to Yupik mothers, who consume greater amounts of pacific salmon and seals (AMAP, 2009b).

In short, documented contaminant levels in bowhead whales in Alaska do not represent a threat to the health of subsistence users at current levels. Given the low levels of risk, public health officials conclude that the nutritional decline from loss of subsistence foods, like bowhead whale meat and blubber, would be far more adverse.

Alternative 1 (No Action)

Under Alternative 1, there would be no federal authorization of subsistence bowhead whaling for 2019 and beyond. The direct effects of this alternative, assuming no unauthorized whaling, would be to eliminate the nutritional benefits of bowhead whale consumption, and to eliminate exposure to the low contaminant levels in bowhead whale meat and blubber. Indirect effects would include consumption of a different mix of subsistence foods, as hunters redirect their harvest efforts to species not prohibited to them. However, it is unlikely that redirected subsistence hunting effort could replace the exceptional volume of bowhead whale food for most of the affected communities. Instead, it is likely that purchased food of inferior nutritional value would become a larger portion of total food consumption, with deleterious health effects. As noted above, the loss of a central subsistence harvest activity may also contribute to behavioral health problems. The AEWC considers it very important to recognize the adverse nutritional and behavioral health effects that would likely follow if bowhead subsistence whaling were prohibited (AEWC, undated). In their view, this category of impacts has not previously been given sufficient attention.

Because it would affect a large portion of all of the AEWC communities, the effects of Alternative 1 would be adverse and major in magnitude and geographic extent. The duration of these effects is unknown, since the NMFS could revisit its decision in a subsequent year, or the decision to deny a subsistence whaling quota could continue from the period 2019 and beyond. In all, the effects of Alternative 1 on the nutrition and health would be adverse and major (**Table 4.1-3**).

Alternative 2

Alternative 2 would reauthorize subsistence bowhead whaling at a level sufficient to address the identified Alaska Native cultural and nutritional subsistence needs, with no provision for carry-forward of unused strikes into a subsequent year. The direct effect of this alternative would be to continue the significant positive contributions of bowhead whale foods to the nutritional level of subsistence users. Concurrently, subsistence users would continue their low levels of exposure to contaminants in bowhead meat and blubber. Few indirect or cumulative effects would be expected, as this alternative provides for continuity in bowhead harvest levels, rather than redirection to other subsistence resources or purchased foods. The lack of provisions for carry-forward of unused strikes may make a very small difference in harvest levels. Carry-forward provisions provide flexibility to whaling captains late in the season. While they have rarely been used, as noted under the discussion of socio-cultural impacts, their availability has positive psychological and socio-cultural benefits, and may have a positive effect on struck and lost ratios in this hunt. Since this alternative does reauthorize the subsistence hunt, the effects of Alternative 2 on nutrition and health would be beneficial and major in magnitude, extent, and duration, securing a substantial subsistence harvest opportunity for all AEWC communities for any six-year period.

Alternative 3

Under Alternative 3, the direct and indirect effects on the nutritional level of subsistence users would be nearly identical to Alternative 2, would increase the longstanding flexibility to carry-forward up to 15 unused strikes into a subsequent year. The additional flexibility provided by the opportunity to carry-forward unused strikes into a subsequent year is expected to have a small, but positive, effect on harvest levels. Although this flexibility has rarely been used, carry-forward of unused strikes could increase the take in a year following one in which adverse weather prevented optimal hunting success. Because this alternative reauthorizes the subsistence hunt, the effects of Alternative 3 on nutrition and health would be beneficial and major in magnitude, extent, and duration, securing a substantial subsistence harvest opportunity for all AEWC communities for any six-year period.

Alternative 4 (Preferred Alternative)

Alternative 4 would provide for continuity in subsistence harvests and related social and cultural benefits under the same harvest authorization for landed whales that has been in place since 1997. Alternative 4 would increase the longstanding flexibility to carry-forward from up to 15 unused strikes into a subsequent year to up to 33 unused strikes. The direct, indirect, and cumulative effects of Alternative 4 on health and nutrition are greater than those in Alternative 3, given the opportunity to carry-forward more unused strikes from previous years. The additional flexibility provided by the opportunity to carry-forward unused strikes into a subsequent year is expected to have a small, but positive, effect on harvest levels. Although this flexibility has rarely been used, carry-forward of unused strikes could increase the take in a year following one in which adverse weather prevented optimal hunting success. Because this alternative reauthorizes the subsistence hunt, the effects of Alternative 4 on nutrition and health would be beneficial and major in magnitude, extent, and duration, securing a major subsistence harvest opportunity for all AEWC communities for any six-year period.

Alternative 5

Under Alternative 5, the direct and indirect effects on the nutritional level of subsistence users would be nearly the same as Alternative 4, although with increased harvest levels over any six-year period. As a result, the effects of Alternative 5 on nutrition and health would be beneficial and major in magnitude, extent, and duration, securing a major subsistence harvest opportunity for all AEWC communities for any six-year period.

4.10.3 Effects on Inuit Public Safety

Subsistence whaling carries a range of inherent risks, including the dangers of using small, open boats in Arctic waters, shore ice breaking off and isolating whaling camps, and accidents on the ice as snow machines travel from the village to ice edge whaling camps. Iñupiat and Siberian Yupik whalers have long expressed a profound concern for safety. A rich body of oral history includes episodes of hunters thrust into life threatening situations, as lessons for survival. Cumulative traditional knowledge and ongoing close-grained observations of weather and ice conditions are topics of constant discussion, as whaling captains and crews assess safety and risks arising from these conditions (George et al., 2004b).

Another class of safety risks arises from the incorporation of new technologies into whaling, ranging from the historic adoption of the harpoon bombs in the 19th Century Yankee whaling era, to more recent use of heavy equipment and steel cables to haul massive bowhead whales up onto the ice. The AEWC has implemented a program to promote hunter safety and efficiency, including the use of newer penthrite projectiles.

Several past episodes are representative of the risks involved in whaling. In a tragic accident in 2005, a skin-covered whaling boat from Gambell capsized while helping to tow a bowhead back to the community overnight in eight-foot swells. The mayor of Gambell, his two children, and another adult drowned, while two crewmembers survived (Spero News, 2005; Siku Circumpolar News Service, 2005). In the mid-1990s, a Nuiqsut whaling boat capsized while on a resupply run in rough seas during the fall hunt; one hunter died. In a report to the IWC, the AEWC referred to an accident during a hunt in Utqiaġvik (Barrow), in which "one of the most experienced harpooners in the Arctic was killed when his boat capsized while towing a whale; he was trapped under it [the boat]" (AEWC, 2006). In the early 1980s, six whale hunters from Savoonga survived a capsizing accident just after harpooning a large bowhead whale (Alaska Magazine, 1982).

Two major episodes of sudden break-off of the ice are recounted in George et al., (2004b). In a famous episode of onshore ice thrust, known in Iñupiat as *ivu*, in 1957, the breakup of shorefast ice was so sudden and abrupt that whaling camps and equipment were abandoned and dog teams cut loose, as whalers scrambled for shore. No lives were lost, but the event became famous as a warning about setting camp on flat pans of multi-year ice, referred to as *piqaluyak*. It took many years for whaling crews to recover and obtain new equipment. In 1997, 12 whaling camps and 142 people were carried off as the shorefast ice broke off, an event referred to as *uisauniq*. Although captains recognized some signs of unstable ice, this particular episode arose suddenly, without time to retreat to shore. Fortunately, many whalers had GPS equipment and radios, and the Utqiaġvik (Barrow) Search and Rescue helicopters were able to retrieve all hunters with no loss of life (George et al., 2004b). In another example of risks attributable to changes in ice quality, NSB officials cite recent instances of hunters falling through ice while traveling on snow machines from the community to the camps (R. Suydam, NSB, Pers. comm.).

Injuries involving accidental discharge of harpoon bombs have occurred. In 1940, an anthropologist working in Point Hope reported four accidental explosions of the shoulder guns, resulting in one death and one injury (Rainey, 1940). Three members of a Utqiaġvik (Barrow) whaling crew sustained injuries, serious in one case, when a bomb exploded in the whale gun in May 1968 (Naval Arctic Research Laboratory, 1968). Another accident involving equipment failure was reported in Utqiaġvik (Barrow) in 1992, when the block and tackle gear used to haul the whale up on the ice broke and flying cables killed two women (R. Suydam, NSB, Pers. comm.). A hunter lost three fingers on his left hand when an explosive charge in a darting gun detonated during a bowhead whale hunt off Point Hope on April 21, 2018.

From the perspective of cumulative effects, the trends of several of these dangers associated with whaling interact with the effects of climate change, as the shorefast ice environment becomes more unstable and less predictable. In addition, changes in open water lead patterns oblige whaling crews to pursue bowhead whales for greater distances. Weather conditions may be less predictable and therefore more dangerous to whaling crews. Declines in the thickness of shorefast ice due to global warming increase the dangers of breakoffs, in which camps are separated from land, with substantial dangers to the whaling crews (George et al., 2004b).

Alternative 1 (No Action)

Under Alternative 1 (No Action), there would be no federal authorization of subsistence bowhead whaling for 2019 and beyond. The direct effect of this moratorium would be to avoid exposure to the risks associated with whaling. However, as an indirect effect, subsistence efforts would be redirected to other resources and these involve risks as well. Harvest of other marine mammal species, such as seals and walrus, may involve similar risks, though in lesser degree. In the cumulative case, the effects of climate change are increasing the risks associated with less predictable weather, dangerous open water conditions, and unstable ice. The contribution of Alternative 1 to cumulative effects on public safety would be beneficial and would serve to moderate the safety risks associated with climate change. The contribution to cumulative effects on public safety are unclear. Subsistence harvest effort redirected to other resources would involve similar risks on the ice and open water, though not through the use of harpoon guns and large block and tackle equipment. Since the effects of this alternative would reach all AEWC communities they would be rated major in geographic extent. The duration of such an effect would be uncertain, since NMFS might revisit such a decision in a subsequent year, or it could last for the years 2019 and beyond. In all, the direct, indirect, and cumulative effects of Alternative 1 on subsistence patterns would be adverse and major (Table 4.1-3). As discussed in section 4.8.1.1, Alaska Native leaders would likely contest the decision not to issue a federal authorization, and confrontation between NMFS and Alaska Native hunters could result. In addition, the loss of this important cultural activity could result in the breakdown of social systems, leading to increases in substance abuse and incidents of violence toward self and others, potentially offsetting the minor beneficial effects on public safety from Alternative 1.

Alternative 2

Alternative 2 would provide for subsistence bowhead whaling at a level that would address the identified Alaska Native cultural and nutritional subsistence needs. However, Alternative 2 provides for no carry-forward of unused strikes. Direct and indirect public safety effects of this alternative would be continuing exposure to the current levels of risk inherent in bowhead whaling, and other subsistence pursuits. The public safety incidents are very infrequent, and so are rated minor in duration and frequency. The provisions regarding carry-forward of unused strikes would not appreciably change the effects of this alternative. The cumulative effects would be dominated by the effects of climate change on the public safety of marine subsistence activities, as noted in the assessment for Alternative 1. The contribution of Alternative 2 to cumulative effects on public safety would be minor in relation to the large-scale effects of climate change.

Alternative 3

Under Alternative 3, the direct and indirect effects on the public safety would be nearly identical to Alternative 2 but would provide for flexibility to carry-forward up to 15 unused strikes per year into subsequent years. Since the annual harvest rate and levels of risk inherent in bowhead whaling are expected to remain the same under Alternative 3, this extension would have no additional impact on public safety. As a result, the effects of Alternative 3 on public safety would be minor in duration and frequency with the provision regarding carry-forward of unused strikes not appreciably affecting impacts.

Alternative 4 (Preferred Alternative)

Alternative 4 would provide for the same continuity in subsistence harvests and related social and cultural benefits as Alternative 3. The only difference is that Alternative 4 would provide for additional flexibility to carry-forward up to 33 unused strikes per year into subsequent years. This would have the beneficial effect of providing flexibility so that whaling captains could avoid bad weather with confidence that the opportunities they forego would be carried over to a later season. The direct, indirect, and cumulative effects would be the same as those noted for Alternative 3.

Alternative 5

Under Alternative 5, the direct and indirect effects on public safety would be nearly identical to Alternatives 3 and 4. Given that the annual harvest rate and levels of risk inherent in bowhead whaling would increase slightly under this Alternative, the contribution of Alternative 5 to the cumulative effects on public safety would be minor.

4.10.4 Effects on Other Tribes and Aboriginals

The IWC provided for aboriginal groups to hunt whales in the original Schedule adopted in 1946. The Commission began regulating aboriginal subsistence hunts when it first set catch limits for bowhead whales in 1977. Revision of bowhead catch limits, in furtherance of subsistence hunts by Alaska Natives and Chukotkan aboriginal people, sets no new precedent that could increase commercial or subsistence hunts.

The media has reported that Canadian Aboriginal First Nations have also conducted subsistence hunts. Canada is not a member of the IWC, and the U.S. government opposes any hunts by Canadian aboriginal people unless Canada rejoins the IWC and conducts such hunts in compliance with the IWC Schedule. Nonetheless, since 1991, Canada has allowed its aboriginal people to take bowhead whales regularly from the Davis Strait and Hudson Bay stocks of bowhead whales. Infrequently, Canadian Inuvialuit have taken Western Arctic bowhead whales in the eastern Beaufort Sea at the Mackenzie Delta. As noted in Section 3.2.4, the successful harvest of a single whale was reported for 1991 and 1996, respectively.

Alternative 1 (No Action)

Under Alternative 1, there would be no NMFS authorization of subsistence bowhead whaling for the years 2019 and beyond. As described in the No Action sections above, this alternative would result in major adverse effects for the Alaska Native communities. If the Russian Federation did the same, the Chukotkan aboriginal people would also be denied a subsistence hunt. This would represent the loss to the Chukotkan aboriginal people of the food value of up to five bowhead whales authorized per year, although average harvests as described in Section 3.2.4 are closer to one bowhead whale per year. Since the Canadian government has withdrawn from the IWC, the very limited harvest of Western Arctic stock bowheads would continue in the Mackenzie Delta area. As an indirect effect of Alternative 1, working relationships with other tribes might be adversely affected since the tribes might view NMFS's action under this alternative as a breach of faith by the U.S. government in upholding Native subsistence rights. Most Native tribes throughout the U.S. would likely view Alternative 1 as a failure on the part of NMFS to exercise its trust responsibility with respect to Alaska Natives, and possibly to Native Americans in general. In light of the potential for political action by Alaska Natives to defend the bowhead subsistence hunt, described in Section 4.8.1.1 above, the potential impact on other tribes might be moderate to major, depending on the extent to which this would emerge as a national issue among Native American tribes.

Alternative 2

Alternative 2 would provide for a continuing level of subsistence bowhead whaling and would promote cultural diversity and recognize the importance of maintaining traditions for the coherence of Alaska Native groups. This alternative would also make it possible for the AEWC to carry on subsistence hunts authorized by the IWC Schedule. Official recognition that traditional subsistence activities, such as whale hunts, are culturally valuable will be reassuring to Native Americans in general. Thus, Alternative 2 would avoid the adverse, indirect effects of deterioration in working relations between NMFS and other tribes. Alternative 2 does not provide flexibility to the bowhead subsistence whalers in the form of carry-forward of unused strikes into a subsequent year, but this is not likely to affect the working relations of NMFS with other tribes. The effects of Alternative 2 on other tribes would be negligible.

Alternative 3

Alternative 3 would provide for continuation of the subsistence hunts authorized by the IWC Schedule at the current level of flexibility with carry-forward of unused strikes, in that up to 15 can be carried into any subsequent year. Since the annual bowhead harvest rate is expected to remain the same under Alternative 3, this extension would allow AEWC communities to carry on subsistence hunts and would avoid deterioration of working relationships between NMFS and the other tribes. The effects of Alternative 3 on other tribes would be negligible.

Alternative 4 (Preferred Alternative)

Alternative 4 would provide for continuation of the subsistence hunts authorized by the IWC Schedule, with additional flexibility to carry-forward up to 33 unused strikes per year into subsequent years. The direct and indirect effects of this alternative on relations with other tribes are the same as those of Alternative 3. The effects of Alternative 4 on other tribes would be negligible.

Alternative 5

Under Alternative 5, the direct, indirect, and cumulative effects on Alaska Native groups would be nearly identical to Alternatives 3 and 4. This Alternative would allow AEWC communities to carry on subsistence hunts and would avoid deterioration of working relationships between NMFS and the tribes. The effects of Alternative 5 on other tribes would be negligible.

4.10.5 Effects on the General Public

There is a segment of the U.S. population that is opposed to whaling, though this opposition is often focused on commercial whaling (according to letters and environmental group communications to the U.S. government). However, other citizens and non-governmental groups understand and appreciate the cultural and nutritional needs of Alaska Natives to harvest bowhead whales in a subsistence hunt. Some citizens and groups oppose all whaling, no matter the situation.

Alternative 1 (No Action)

Under Alternative 1, there would be no federal authorization of subsistence bowhead whaling for 2019 and beyond. This alternative may be supported by citizens opposed to all whaling. However, as noted above Alternative 1 is likely to result in political action by Alaska Native whalers, appealing for support to the general public. Citizens who support a limited opportunity for aboriginal whaling may be sympathetic to the claims of the Alaska Native whalers that their needs have been sacrificed for ideological reasons. The effects of Alternative 1 on the general public may be seen as mixed, with countervailing tendencies, depending on the position of support or opposition to subsistence whaling held by a particular portion of the general public.

The overall result is a moderate impact for the subset of citizens who follow marine mammal management issues, beneficial in the eyes of the anti-whaling public and adverse for those who support indigenous whaling rights, and would be moved by the objections of the Alaska Native whalers to closure of the subsistence whaling opportunity.

Alternative 2

Alternative 2 provides for an ongoing subsistence hunt for bowheads at a level that meets the nutritional and cultural needs. However, this alternative would not provide any flexibility for carry-forward of unused strikes. Citizens who support aboriginal whaling would support this allocation, and would be relieved that confrontations between the subsistence whaling communities and the government agencies have been avoided. Citizens who oppose aboriginal whaling would not support this alternative. The specifics of the provisions on carry-forward of unused strikes are not likely to be consequential to the general public. The effects of Alternative 2 on the general public may be seen as mixed, with countervailing tendencies, depending on the position of support or opposition to subsistence whaling held by a particular portion of the general public. The overall result is a minor impact.

Alternative 3

Under Alternative 3, the direct and indirect effects on the general public would be nearly identical to Alternative 2 but would provide flexibility to whaling captains in that up to 15 unused strikes per year can be carried-forward and added to the strike quota of any subsequent year. The support and opposition to this alterative among the general public would be the same at that described for Alternative 2. The effects of Alternative 3 on the general public may be seen as mixed, with countervailing tendencies, depending on the position of support or opposition to subsistence whaling held by a particular portion of the general public. The overall result is a minor impact.

Alternative 4 (Preferred Alternative)

Alternative 4 provides for the ongoing subsistence whaling allocation at a level that meets the identified need, with additional flexibility to carry forward up to 33 unused strikes per year into any subsequent year. The support and opposition to this alterative among the general public would be the same at that described for Alternative 3. The effects of Alternative 4 on the general public may be seen as mixed, with countervailing tendencies, depending on the position of support or opposition to subsistence whaling held by a particular portion of the general public. The overall result is a minor impact.

Alternative 5

Alternative 5 provides for increased harvest levels over any six-year period. The support and opposition to this alterative among the general public would be the same at that described for Alternatives 3 and 4. The effects of Alternative 5 on the general public may be seen as mixed, with countervailing tendencies, depending on the position of support or opposition to subsistence whaling held by a particular portion of the general public. The overall result is a minor impact.

4.10.6 Environmental Justice

In February 1994, President Clinton issued EO 12898 on Environmental Justice (1994), which requires the federal government to promote fair treatment of people of all races, so no person or group of people bear a disproportionate share of the negative environmental effects from the country's domestic and foreign programs. Fair treatment means that no population, due to lack of political or economic power, is forced to shoulder the negative human health and environmental impacts of pollution or other environmental hazards. Environmental justice means avoiding, to the extent possible, disproportionate adverse environmental impacts on low- income populations and minority communities.

A minority is any individual classified as American Indian, Alaska Native, Asian or Pacific Islander, African American, or Hispanic. A low-income person is a person with a household income at or below the U.S. Department of Health and Human Services poverty guidelines. A minority population and low-income population are defined as any readily identifiable group of minority or low-income persons who live in geographic proximity, and if circumstances warrant, geographically dispersed/transient persons (such as migrant workers or Native Americans) who would be similarly affected by a proposed program, policy, or activity.

Potentially affected populations are identified below in **Section 4.8.5.1**. The analysis of beneficial and adverse effects on minority and low-income populations is presented in **Section 4.8.5.2**.

4.10.6.1 Affected Populations

The communities affected by the proposed action are the 11 member communities of the AEWC. As discussed in Chapter 3, Section 4, “Socioeconomic Environment,” these are small, predominantly Alaska Native villages, with the exception that Utqiaġvik (Barrow), as a regional service center, is larger and more diverse. In 2010, the 11 AEWC communities counted a total 8,258 residents, of whom 6,674 or 80.8 percent are Alaska Native or part Alaska Native (Table 3.4-1). Utqiaġvik (Barrow) accounts for just over half of the total population, and is more diverse, with Alaska Native residents making up 68.6 percent of the community. The most recent population estimates are in the 2012-2016 American Community Survey 5-Year Estimate. Comparing this dataset with the information from the 2010 U.S. Census, five AEWC communities have experienced a decrease in population, while the six other AEWC communities have experience population growth. The most current information concerning income and poverty levels is the 2012-2016 American Communities Survey 5-Year Estimate. While it is the best information available, there is a significant margin of error for each estimate and the data should be taken with caution. Table 3.4-2 shows that, using the federally defined poverty level, two of the AEWC communities have low levels (less than 10% of residents), while three communities have intermediate rates (10% - 18% of residents). The remaining six communities have higher rates, ranging from 23.7% through 52.7% of residents living below the poverty level. The available data suggests that population declines may be based on decreased economic activity for these communities. All but two of these communities exceed the average rate of Alaska residents living below the poverty level, which is 10.1%, and in many cases these rates are two and three times the Alaska average.

For the purposes of the environmental justice analysis, all of the AEWC communities qualify as predominantly minority, based on the high percentages of Alaska Native residents. The majority of these communities would qualify as having significant proportions of residents living below the poverty level, particularly when compared to the Alaska average.

4.10.6.2 Environmental Justice Effects Analysis

The analysis of environmental justice examines whether disproportionate, adverse human health or environmental impacts would affect minority and low income communities. As shown in Section 4.8.5.1, all of the AEWC communities affected by the proposed action would qualify as minority and in most cases low-income communities. For the purposes of this EIS, major impacts on bowhead whale populations or major impacts on subsistence whaling patterns would raise Environmental Justice concerns, as these would have a disproportionate adverse impact.

Under Alternative 1, no catch limit for subsistence bowhead whaling would be provided. As noted in Section 4.8.1, this would have major adverse direct, indirect, and cumulative effects upon the communities. Disruption of the bowhead harvest would eliminate a substantial food resource, disrupt cooperative labor and sharing practices, disrupt the learning process for young hunters, and disrupt highly valued cultural ceremonial events, particularly *Nalukatak*, the spring whaling festival. As a result of these disproportionately adverse effects, Alternative 1 would raise Environmental Justice concerns.

Alternatives 2, 3, and 4 would provide for an ongoing bowhead subsistence whaling quota, with variations in the provisions for carry-forward of unused strikes into subsequent years. Alternative 5 would provide for an ongoing bowhead subsistence whaling quota at increased harvest levels. Because these alternatives provide for continuity of subsistence whaling, the communities would not be affected by adverse direct or indirect effects. Concerning cumulative effects, **Section 4.6** concluded that none of the alternatives, when ongoing mitigation measures are taken into consideration, would result in major adverse impacts on the bowhead whale population. Therefore, Alternatives 2, 3, 4, and 5 would provide beneficial effects for the AEWC communities and do not raise environmental justice concerns that a minority population may be disproportionately adversely affected.

4.11 Summary of Effects

As presented in Chapter 2, "Alternatives, Including the Proposed Action," five alternatives are analyzed in this DEIS. Under Alternative 1, NMFS would not issue the AEWC a subsistence whaling catch limit for cultural and nutritional purposes, notwithstanding the IWC Schedule's requirement to establish catch limits and permit aboriginal subsistence whaling for Western Arctic bowhead whales, subject to certain limitations. This alternative would be contrary to the IWC Schedule, and because the WCA requires NMFS to implement requirements of the IWC Schedule, this alternative would also be contrary to U.S. law.

Under Alternative 2, NMFS would grant the AEWC the U.S. portion of an annual strike quota of 67 bowhead whales, not to exceed the U.S. portion of a total of 336 landed whales over any 6-year period. Under this alternative, no unused strikes from a previous year would be added to the strike quota for a subsequent year, notwithstanding the IWC's requirement to "carryover" or "carry forward" unused strikes in the bowhead subsistence catch limits. Because the IWC Schedule requires unused strikes to be carried forward and added to the strike quotas of subsequent years, subject to limits, this alternative would be contrary to the IWC Schedule. As the WCA requires NMFS to implement requirements of the IWC Schedule, this alternative would also be contrary to the WCA.

Under Alternative 3, NMFS would grant the AEWC the U.S. portion of an annual strike quota of 67 bowhead whales (plus up to 15 previously unused strikes as carry-forward), not to exceed the U.S. portion of a total of 336 landed whales over any 6-year period. This alternative differs from Alternatives 1 and 2 by allowing the AEWC to carry forward unused strikes from previous years, and add up to 15 of those unused strikes per year to the catch limits for any subsequent years, consistent with the current IWC Schedule. A carry-forward allows for variability in hunting conditions from one year to the next within limits that conserve the Western Arctic bowhead stock and is a long-standing feature of this quota structure.

Under Alternative 4, NMFS would grant the AEWC the U.S. portion of an annual strike quota of 67 bowhead whales (plus up to 33 previously unused strikes as carry-forward), not to exceed the U.S. portion of a total of 336 landed whales over any 6-year period. This alternative differs from Alternative 3 by allowing the AEWC to carry forward unused strikes from previous years, provided that no more than 50 percent of the annual strike limit is added for any one year, consistent with the IWC's 50 percent carryover principle. A carry-forward allows for variability in hunting conditions from one year to the next within limits that conserve the Western Arctic bowhead stock and, as noted, is a long-standing feature of this quota structure.

Under Alternative 5, NMFS would grant the AEWC the U.S. portion of an annual strike quota of 100 bowhead whales (plus carry-forward), not to exceed the U.S. portion of a total of 504 landed whales over any 6-year period. This alternative differs from Alternatives 1 through 4 by increasing the harvest levels by 50 percent, and differs from Alternatives 1 through 3 by employing the IWC's 50 percent carryover principle. A carry-forward allows for variability in hunting conditions from one year to the next within limits that conserve the Western Arctic bowhead stock and, as noted, is a long-standing feature of this quota structure.

The following tables (**Tables 4.11-1 through 4.11-3**) summarize the direct, indirect, and cumulative effects of each alternative for all resources where environmental consequences were evaluated and found to be possible. More detailed discussions of direct, indirect, and cumulative effects can be found in **Sections 4.4** through **Section 4.8.**

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Table 4.11-1
Summary of Direct, Indirect, and Cumulative Effects of the Alternatives and Other Activities in the Project Area on Bowhead Whales

Effect		Alternative 1 Do not grant AEWC a catch limit.	Alternative 2 Annual strike quota of 67 bowhead whales.	Alternative 3 Annual strike quota of 67 bowhead whales, plus up to 15 previously unused strikes as carry-forward.	Alternative 4 Annual strike quota of 67 bowhead whales, plus up to 33 (50% of annual strike quota) previously unused strikes as carry-forward.	Alternative 5 Annual strike quota of 100 bowhead whales, plus up to 50 (50% of annual strike quota) previously unused strikes as carry-forward.
Direct and Indirect Effects	**Mortality**	No direct or indirect effects of Alternative, as the Alternative would not contribute to mortality.	Negligible effects on mortality of Western Arctic bowhead whale population.	Same as Alternative 2.	Same as Alternative 2.	Minor adverse effects on mortality of Western Arctic bowhead whale population.
	Disturbance	No direct or indirect effects of Alternative, as the Alternative would not contribute to disturbance.	Minor effects of disturbance in magnitude, extent, and duration/frequency.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
Cumulative Effects		Cumulative effects to mortality would be negligible in magnitude, extent, and duration/frequency. Cumulative effects to disturbance would be negligible in magnitude, extent, and	Cumulative effects due to mortality would be negligible in magnitude, extent, and duration/frequency. Cumulative effects to disturbance would be moderate in magnitude, extent, and	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.

	duration/frequency. A VLOS could have major adverse effects in terms of magnitude, extent, and duration/frequency if the spill occurred during a time when bowheads were present.	duration/frequency. A VLOS could have major adverse effects in terms of magnitude, extent, and frequency if the spill occurred during a time when bowheads were present.			

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Table 4.11-2

Summary of Direct, Indirect, and Cumulative Effects of the Alternatives and Other Activities in the Project Area on Other Wildlife

Effect		Alternative 1 Do not grant AEWC a catch limit.	Alternative 2 Annual strike quota of 67 bowhead whales.	Alternative 3 Annual strike quota of 67 bowhead whales, plus up to 15 previously unused strikes as carry-forward.	Alternative 4 Annual strike quota of 67 bowhead whales, plus up to 33 (50% of annual strike quota) previously unused strikes as carry-forward.	Alternative 5 Annual strike quota of 100 bowhead whales, plus up to 50 (50% of annual strike quota) previously unused strikes as carry-forward.
Direct and Indirect Effects	**Mortality**	Minor to moderate effects in magnitude, extent, and duration/frequency.	Negligible to minor direct and indirect effects on mortality.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
	Disturbance	Minor to moderate effects in magnitude, extent, and duration/frequency.	Negligible to minor direct and indirect effects on disturbance.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
Cumulative Effects		Cumulative effects would be moderate for important game species (e.g. caribou) and minor for other species.	Negligible cumulative effects.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.

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Table 4.11-3
Summary of Direct, Indirect, and Cumulative Effects of the Alternatives and Other Activities in the Project Area on the Sociocultural Environment

Effect		Alternative 1 Do not grant AEWC a catch limit.	Alternative 2 Annual strike quota of 67 bowhead whales.	Alternative 3 Annual strike quota of 67 bowhead whales, plus up to 15 previously unused strikes as carry-forward.	Alternative 4 Annual strike quota of 67 bowhead whales, plus up to 33 (50% of annual strike quota) previously unused strikes as carry-forward.	Alternative 5 Annual strike quota of 100 bowhead whales, plus up to 50 (50% of annual strike quota) previously unused strikes as carry-forward.
Direct and Indirect Effects	**Subsistence**	Adverse effects and major in magnitude, extent, and duration/frequency.	Beneficial effects and major in magnitude, extent, and duration/frequency.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
	Public Health and Safety	Adverse effects and major in magnitude, extent, but unknown duration/frequency. The effects on safety are complex, with positive net effects to hunter safety that count be countervailed by adverse nutritional, psychological, and social consequences.	Beneficial effects that are major for public health, but effects on safety would be adverse and minor due to the inherent risks of whaling.	Substantially similar to Alternative 2, but with additional temporal flexibility as a result of carry-forward that would increase the beneficial effects to public safety.	Substantially similar to Alternative 2, but with additional temporal flexibility as a result of carry-forward that would increase the beneficial effects to public safety.	Substantially similar to Alternative 2, but with additional temporal flexibility as a result of additional strikes and carry-forward that would increase the beneficial effects to public safety.
Cumulative Effects		Cumulative effects on subsistence practices, nutrition, and health	The contribution of Alternative 2 to the cumulative effects on	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.

	would be adverse and major in magnitude, extent, and duration. Cumulative effects on public safety are unknown.	subsistence harvest practices would be beneficial and major in magnitude, extent, and duration. Cumulative effects on subsistence harvest practices would be adverse and minor to moderate, depending on the timing and location of oil and gas activities, and the efficacy of measure intended to mitigate impacts. In the case of a VLOS, the cumulative effects on subsistence practices could be major in magnitude, extent, and duration, and could countervail any beneficial effects.			

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5.0 LIST OF PREPARERS AND PERSONS CONSULTED

5.1 Bowhead DEIS Steering Committee

John Henderschedt	Director, Office of International Affairs and Seafood Inspection, NOAA Fisheries, Silver Spring, Maryland
Jon Kurland	Assistant Regional Administrator, Protected Resources Division, Alaska Regional Office, Juneau, Alaska
Dr. Doug DeMaster	Director, Science and Research, Alaska Fisheries Science Center, NOAA Fisheries, Seattle, Washington
Ryan Wulff	Assistant Regional Administrator and U.S. Deputy Commissioner to IWC, Sustainable Fisheries Division, West Coast Regional Office, NOAA Fisheries, Sacramento, California
Dr. Robyn Angliss	Deputy Director, National Marine Mammal Laboratory, Alaska Fisheries Science Center, NOAA Fisheries, Seattle, Washington
Greg Balogh	Field Office Supervisor, Protected Resources Division, Alaska Regional Office, NOAA Fisheries, Anchorage, Alaska
Roger Eckert	Attorney Advisor, Office of General Counsel, Headquarters, NOAA, Silver Spring, Maryland
Jessica Lefevre	Counsel, Alaska Eskimo Whaling Commission, Alexandria, Virginia
Jordan Carduner	Permits and Conservation Division, Office of Protected Resources, NOAA Fisheries, Silver Spring, Maryland
Carolyn Doherty	Foreign Affairs Officers and IWC Coordinator, Office of International Affairs, Headquarters, NOAA Fisheries, Silver Spring, Maryland

5.2 Principal Authors

Carolyn Doherty, Foreign Affairs Specialist, Office of International Affairs and Seafood Inspection, NMFS, Silver Spring, Maryland. Ms. Doherty oversaw the compilation, organization, and review of this document. In addition to being the project coordinator, she contributed to the development of Sections 3 and 4. Ms. Doherty is the Coordinator for the U.S. delegation to the International Whaling Commission. *M.E.M in Coastal Environmental Management, Duke University, Durham, North Carolina.*

Greg Balogh, Supervisory Biologist, NMFS Alaska Region Protected Resources Division, Anchorage, Alaska. Greg provided input on Sections 3 and 4 of this document. He has 29 years of experience working with Federal Natural Resource Management agencies in Alaska, and over 20 years of experience working with Alaska's threatened and endangered species. He is the NMFS liaison to the Alaska Eskimo Whaling Commission. *B.S in Wildlife Management, M.S. in Environmental Biology, and M.S. in Zoology from The Ohio State University.*

Kim Shelden, Marine Biologist, National Marine Mammal Laboratory, Alaska Fisheries Science Center, NMFS, Seattle, Washington. Her expertise on this document included providing information on the affected environment, bowhead whales, and other wildlife, results of recent hunts, and monitoring and enforcement of hunting regulations. She has over 27 years of experience with the federal government working with marine mammal conservation in Alaska. *M.M.A. in Marine Policy/Conservation Biology, University of Washington, Seattle, Washington.*

5.3 Contributors

Dr. Robert Suydam, Wildlife Biologist, North Slope Borough Department of Wildlife Management, Utqiaġvik (Barrow), Alaska. Provided information regarding borough research on bowhead whales, Iñupiat harvest practices, and safety incidents. He has over 25 years of experience in bowhead whale biology. *Ph.D. in Aquatic and Fisheries Science, University of Washington, Seattle, Washington.*

Dr. John Craighead "Craig" George, Wildlife Biologist, North Slope Borough Department of Wildlife Management, Utqiaġvik (Barrow), Alaska. Provided information regarding borough research on bowhead whales and Iñupiat harvest practices. He has over 35 years of experience in bowhead whale biology. *Ph.D. University of Alaska, Fairbanks, Alaska.*

Dr. Geof H. Givens, Ph.D., Director of Givens Statistical Solutions LLC and Emeritus Associate Professor of Statistics, Colorado State University, has broad expertise in statistics, data analysis, modeling and conservation biology. He has been U.S. Delegate to the Scientific Committee of the International Whaling Commission for 25 years, and was co-designer of the computer model used by the IWC since 2003 to establish safe indigenous harvest levels for bowhead whales. With a substantial record of scientific publications, he has also authored

Computational Statistics, an advanced textbook used widely in North American universities and in nearly 30 countries.

Gina Ylitalo, Supervisory Research Chemist, Environmental and Fisheries Sciences Division, Northwest Fisheries Science Center, NMFS, Seattle, Washington. Her expertise on this document included providing information on the chemical contaminant concentrations determined in bowhead whale tissues. She has 30 years of experience with the federal government assessing links between exposure to chemical contaminants and potential health effects to marine mammals and fish, as well as developing methods to analyze new contaminants of concern and other chemical tracers in marine biota.

Dr. Raphaela Stimmelmayr, Veterinary Surgeon, MSc, PhD., is the wildlife veterinarian and research biologist for the North Slope Borough's Department of Wildlife Management and leads the Marine Mammal Health Research Program. Her expertise on this document included providing health information on the BCB bowhead whales. She has worked on wildlife health and subsistence issues in the Arctic, subarctic, and subtropics. She holds a Research Scientist position with the Institute of Arctic Biology, University of Alaska Fairbanks and is the onsite coordinator for the 2011 Alaska Pinniped Unusual Mortality Event.

Grace Ferrara, Foreign Affairs Fellow, Office of International Affairs and Seafood Inspection, NMFS, Silver Spring, MD. Her contribution to this document included compiling information on the affected socioeconomic environment and providing editorial support. She is conducting a NOAA Sea Grant Knauss Marine Policy Fellowship with the NMFS Office of International Affairs and Seafood Inspection after completing her master's degree, for which she studied marine mammal subsistence in Alaska in the face of climate change. *M.M.A. in Marine Policy, University of Washington, Seattle, Washington.*

Diane Daly, Fisheries Regulation Specialist, Office of Sustainable Fisheries, NMFS, Silver Spring Maryland. Her expertise on this document includes NEPA technical editing. She has more than 8 years Federal government regulatory and environmental protection experience for both NOAA and the U.S. Coast Guard. *M.A in Education Leadership, University of Notre Dame of Maryland, Baltimore Maryland*

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6.0 COOPERATION AND CONSULTATION

NEPA requires federal agencies to reduce delay in the NEPA process by cooperating with other affected agencies before an EA or EIS is prepared. Cooperative planning is encouraged when more than one agency (federal, state, tribal, or local) is involved in the project or program. Alaska Native subsistence hunting, include that taking of bowhead whales, is exempt from the Marine Mammal Protection Act and the ESA. However, consultation under Section 7 of the ESA is required.

NMFS consulted with the USFWS regarding potential effects of the bowhead subsistence harvests on ESA listed species, ESA candidate species, and designated critical habitat under USFWS jurisdiction. In the May 2018 consultation letter, the USFWS concluded that the proposed annual quotas for bowhead subsistence harvests are unlikely to adversely affect listed species or designated critical habitat under USFWS's jurisdiction (see **Appendix 8.4.1**).

A NMFS Biological Opinion concerning the proposed action to issue annual catch limits to the AEWC to allow continuation of its subsistence hunt for bowhead whales from the Western Arctic stock from 2019 onward, subject to IWC-set catch limits, will be prepared. This will conclude the consultation with NMFS concerning ESA listed species.

NMFS consulted with the AEWC during the scoping process and the development of alternatives. Additionally, although NMFS is the lead agency in this process and the agency with expertise on the biological aspects of bowhead whales, the AEWC was consulted about the social, economic, and cultural impacts of various alternatives. The AEWC also had an opportunity to comment on the Draft EIS document.

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8.0 APPENDICES

8.1 Quantification of Subsistence and Cultural Need for Bowhead Whales by Alaska Eskimos (2012)

QUANTIFICATION OF SUBSISTENCE AND CULTURAL NEED FOR BOWHEAD WHALES BY ALASKA ESKIMOS

2012 Update Based on 2010 U.S. Census Data

Prepared by:
Stephen R. Braund & Associates
P.O. Box 1480
Anchorage, AK 99510
(907) 276-8222
srba@alaska.net

Prepared for the Alaska Eskimo Whaling Commission
Barrow, Alaska

May 2012

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LIST OF ACRONYMS

AEWC	Alaska Eskimo Whaling Commission
IWC	International Whaling Commission
SRB&A	Stephen R. Braund & Associates

Stephen R. Braund & Associates
P.O. Box 1480
Anchorage, AK 99510
(907) 276-8222
srba@alaska.net

QUANTIFICATION OF SUBSISTENCE AND CULTURAL NEED FOR BOWHEAD WHALES BY ALASKA ESKIMOS

2012 Update Based on 2010 U.S. Census Data

INTRODUCTION

This document is similar to the previously prepared *2007 Update Based on 2000 U.S. Census Data* (Stephen R. Braund & Associates [SRB&A] 2007) and is submitted at this time to provide a current (2012) subsistence and cultural need statement. This needs assessment relies on the 2010 U.S. Census. Thus, the quantification of subsistence and cultural need for bowhead whales by Alaska Eskimos has been updated with 2010 population information.

In previous subsistence and cultural needs assessments submitted to the International Whaling Commission (IWC) for years between the decennial U.S. Census, including the 2007 report, the calculation depended on the most current Alaska Department of Labor Data population estimates for the communities multiplied by the percent Native from the 1980 and 1990 U.S. Census. However, the most reliable information for assessing subsistence and cultural need using the IWC accepted method is to rely on the U. S. Census. Thus, the 2012 needs assessment is based on the 2010 U.S. Census.

Like the 2002 and 2007 reports, this document is intended to be an addendum to the *Quantification of Subsistence and Cultural Need for Bowhead Whales by Alaska Eskimos - 1997 Update Based on 1997 Alaska Department of Labor Data* (SRB&A 1997). The 1997 report should be read in conjunction with this document as the former report provides relevant discussion and references for the historic context of this report. That discussion is not repeated in this brief report. In addition, for full discussion of the research on historical whaling and human population data that formed the basis of the calculation of subsistence and cultural need, see Braund, Stoker and Kruse (1988).

This report provides the eighth calculation of subsistence and cultural need for bowhead whales by Alaska Eskimos and is based on the same methodology used in the previous seven "needs" assessments. The first calculation of subsistence and cultural need submitted to the IWC was undertaken in 1983 (U.S. Government 1983). The second calculation was submitted to the IWC in 1988 (Braund, Stoker and Kruse 1988) when more extensive research provided additional historical whaling and human population data. The 1988 study used the most recent Eskimo population data available at that time, ranging from 1983 to 1987, to calculate current need. The third calculation of need, performed in 1992, was based on 1990 U.S. Census population data. This update was presented to the Alaska Eskimo Whaling Commission (AEWC), but not to the IWC (SRB&A 1992). The fourth calculation of need was conducted in 1994 based on July 1, 1992 population data generated by the State of Alaska, Department of Labor (SRB&A 1994). The fifth calculation (fourth presented to the IWC) was based on July 1, 1997 population data generated by the State of Alaska, Department of Labor (SRB&A 1997). The sixth calculation of need conducted in 2002 (SRB&A 2002) and the seventh calculation of need conducted in 2007 (SRB&A 2007) relied on 2000 U.S. Census data. This 2012 report, that uses the 2010 U.S. Census data, is the fourth time since 1983 that U.S. Census data have been used for the Alaska Eskimo needs calculation. All of the calculations of need since 1988 utilize the same method that was accepted by the IWC in 1986.

2012 UPDATE BASED ON 2010 U.S. CENSUS DATA

In preparation for the June/July 2012 IWC meeting, the AEWC requested an update of cultural and subsistence need for bowhead whales. Because the most reliable population information is from the U.S. census, this update is based on the 2010 U.S. Census data for the 11 Alaska bowhead whaling communities. Since the previous needs assessment, Point Lay has been added as an Alaska bowhead whaling community (SRB&A 2008). The 2010 U.S. Census has race information, and the Alaska Native population in each of the whaling communities is reported. For this reason, the 2010 U.S. Census is used for the 2012 needs update, rather than more current Alaska State Demographer population estimates that require an additional estimate of the percent American Indian of the state estimates.

Applying the IWC accepted method of calculating need (see Braund, Stoker and Kruse 1988), SRB&A updated need based on 2010 U.S. Census data. Other than the additional communities (i.e., Little Diomede and Point Lay), the only variable that has changed since 1988 for this calculation is the Alaska Native population for the 11 whaling communities. Only the Native population of each community is considered. The 2010 U.S. Census Alaska Native population data represent "American Indian or Alaska Native alone or in combination with one or more other races."

Based on 2010 U.S. Census data, the number of bowheads needed by each community and by the region as a whole (all 11 communities) is derived by multiplying the mean number of whales landed per capita over the base time period (1910-1969) by the 2010 Alaska Native population for each community and for the region as a whole. Using this method, the need for each community is shown on Table 1. Based on the 2010 census data, the cultural and subsistence need in the 11 Alaska Eskimo communities is 55 landed bowhead whales (58 if rounded up and summed for each community). In 1997 the need was 54 landed bowheads (56 rounded up), and in 2002 and 2007, it was 56 landed bowheads (56 and 58 landed bowheads rounded up respectively). Applying the mean of .008515 bowhead landed per capita for all 11 communities for the historical period (1910-1969) to the 2010 regional Native population of 6,674 results in a 2010 **regional** cultural and subsistence need of 57 landed bowhead whales. In 1997, this regional calculation was 56 landed bowhead whales and in 2002 and 2007, it was 57 landed bowhead whales.

Table 1: Eleven Alaska Eskimo Whaling Villages' Subsistence & Cultural Need For Landed Bowhead Whales, 2010[1]

Community	Number of Observations[2]	Total Eskimo Population for ea. yr. of a Bowhead Observation[3]	Number of Bowheads Landed 1910-1969[4]	Mean Landed Per Capita 1910-1969[5]	2010 Alaska Native Population[6]	2010 Bowhead Need (Landed)[7]	2010 Need (Landed) Rounded[8]
Gambell	39	11,883	68	0.005722	654	3.7	4
Savoonga[9]	0	----	----	0.005722	637	3.6	4
Wales	42	6,907	5	0.000724	136	0.1	1
Diomede[10]	30	3,250	11	0.003678	110	0.4	1
Kivalina	7	926	3	0.003240	366	1.2	1
Point Hope	50	12,467	209	0.016764	629	10.5	11
Point Lay	34	2,080	8	0.003846	168	0.6	1
Wainwright	49	10,723	108	0.010072	510	5.1	5
Barrow	60	44,687	379	0.008481	2889	24.5	25
Nuiqsut[9]	0	----	----	0.008481	360	3.1	3
Kaktovik	3	327	3	0.009174	215	2.0	2
Totals	314	93,250	794		6,674	54.9	58
Region[11]	314	93,250	794	0.008515	6,674	56.8	57

[1] Subsistence and cultural need is based on historic per capita harvest per community multiplied by the 2010 Alaska Native population of each community.

[2] The number of observations represents the number of years for which data on landed whales were available for each community (See Appendices 1 & 2 of Braund, Stoker & Kruse 1988, Table 1 of Stephen R. Braund & Assoc. 1991, and Table 17 of Stephen R. Braund & Assoc. 2008).

[3] Total Eskimo population represents the sum of the Eskimo population for each year there was an observation of a landed bowhead whale (only includes the 1910-1969 "Base Period;" see Braund, Stoker & Kruse 1988).

[4] Number of bowheads landed represents the sum of the observed bowheads landed between 1910 and 1969.

[5] The mean landed bowhead whales per capita is based on the total number of whales landed between 1910 and 1969 for each community divided by the sum of the total Eskimo population for each village for each year landed whale data existed between 1910 and 1969 (See Appendices 1 & 2 in Braund, Stoker & Kruse 1988, Tables 1 and 3 in Stephen R. Braund & Assoc. 1991, and Tables 2 and 17 in Stephen R. Braund & Assoc. 2008). The sum of the total Eskimo population was calculated by adding the Population estimates for each community for each year that there was a
landed whale observation. For example, Barrow's 379 landed whales from 1910-1969 was divided by the total Eskimo population sum of 44,687 for this 60 Year period (i.e., 379 divided by 44,687 = .008481).

[6] 2010 Alaska Native population data for each community are from the 2010 U. S. Census. They represent the category "American Indian or Alaska Native alone or in combination with one or more other races."

[7] The number of bowheads needed is derived by multiplying the mean per capita landed whales (1910-1969) by the
2010 Alaska Native population for each community. The true column total of 54.9 is shown and is less than the sum of its parts because of their being rounded up.

[8] The number of bowhead whales needed per individual community is rounded to the nearest whole number unless the product was less than .5; such cases were rounded up to one.

[9] Because there are no landed bowhead data for either Savoonga or Nuiqsut between 1910-1969, the mean per capita landed whales for Gambell was used for Savoonga and the mean for Barrow was used for Nuiqsut.

[10] Due to uncertainties in the landed whale data for Little Diomede Island, four different calculations of subsistence and cultural need, ranging from .4 to 1.0 bowheads, were presented (see Table 4 Stephen R. Braund & Assoc. 1991). The Little Diomede mean landed whale per capita (1910-1969) in this table represents the mean of these four calculations.

[11] The mean per capita landed whales for the region represents the total number of whales landed for all 11 communities between 1910 and 1969 divided by the sum of the total Native population for all communities for each year landed whale data existed between 1910 and 1969 (i.e., 794 whales divided by 93,250 = .008515).

Stephen R. Braund & Associates, 2012.

AEWC11_Need_May 2012 4 SRB&A 5/23/12

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IWC/64/ASW 3
Agenda item 6.1.2

QUANTIFICATION OF SUBSISTENCE AND CULTURAL NEED FOR BOWHEAD WHALES BY ALASKA ESKIMOS

1997 Update Based on 1997 Alaska Department of Labor Data

Prepared by:
Stephen R. Braund & Associates
P.O. Box 1480
Anchorage, AK 99510
(907) 276-8222
srba@alaska.net

Prepared for the Alaska Eskimo Whaling Commission
Barrow, Alaska

13 October 1997

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QUANTIFICATION OF SUBSISTENCE AND CULTURAL NEED FOR BOWHEAD WHALES BY ALASKA ESKIMOS

1997 Update Based on 1997 Alaska Department of Labor Data

INTRODUCTION

Inupiat and Yup'ik Eskimos of Alaska have hunted bowhead whales for over 2,000 years as the whales migrate near the communities in the spring and fall. Hunting bowhead whales in Alaska remains a communal activity that supplies important meat and maktak for the entire community as well as for feasts and ceremonies. Formalized patterns of hunting, sharing, and consumption characterize the modern bowhead harvests. Of all subsistence activities in these communities, bowhead whaling represents one of the greatest concentrations of effort, time, money, group symbolism, and significance. In addition to providing a major source of food, bowhead whaling is a large part of these communities' cultural tradition and their modern cultural identity (Braund and Moorehead 1995).

Since the early 1980s, the International Whaling Commission (IWC) has determined the quota for Alaska Eskimo bowhead whale harvests in part by considering the subsistence and cultural need for bowhead whales by Alaska Eskimos. In 1986, the IWC adopted the only method used to date to calculate subsistence and cultural need. This method incorporates the historic and current size of the Eskimo population residing in Alaskan whaling villages and the number of bowhead whales historically landed by each community. Because bowhead whaling is a community-wide activity, it is appropriate to consider the community population in association with the historic harvest levels. Besides abundance of bowhead whales, community population levels are a critical factor that influences harvests because the community population dictates the number and size of whaling crews and the amount of meat and maktak needed to feed the community, share with others, and provide for ceremonial feasts.

The first calculation of subsistence and cultural need submitted to the IWC was undertaken in 1983 (U.S. Government 1983). The second calculation was submitted to the IWC in 1988 (Braund, Stoker and Kruse 1988) when more extensive research provided additional historical whaling and human population data. The 1988 study used the most recent Eskimo population data available at that time, ranging from 1983 to 1987, to calculate current need. The third calculation of need, performed in 1992, was based on 1990 U.S. Census population data; this update was presented to the Alaska Eskimo Whaling Commission (AEWC), but not to the IWC (Stephen R. Braund & Associates [SRB&A] 1992). The fourth calculation of need was conducted in 1994 based on July 1, 1992 population data generated by the State of Alaska, Department of Labor (SRB&A 1994). This, the fifth calculation (and fourth presented to the IWC) utilizes the same method accepted by the IWC in 1988 for calculating need, presenting revised calculations based on July 1, 1997 population data generated by the State of Alaska, Department of Labor.

REVIEW OF THE 1988 STUDY

The objective of the 1988 study was to quantify the cultural and subsistence need for bowhead whales by Alaska Eskimos (Braund, Stoker and Kruse 1988). We viewed cultural and subsistence need as independent of any biological assessment of bowhead populations and as only one of two parts of any quota request the U.S. government made to the International Whaling Commission (the second part being the biological assessment). Prior to 1988, the estimation of cultural need for bowhead whales by Alaska Eskimos had been based on the historic relationship between the size of the Eskimo population residing in Alaskan whaling villages and both the number of bowhead whales historically landed and the number of crews engaged in whaling (U.S. Government 1983). Based on data available in 1983, the cultural need for bowhead whales was established at 26 bowheads landed per year for the nine Alaska bowhead whaling communities. Assuming 75 percent efficiency, 26 landed converted to 35 strikes requested by the U.S. government at the 1983 IWC meeting. At that time, we knew the historical data on bowhead landings and Eskimo population were incomplete. Furthermore, the Alaska Eskimo whaling community believed that the cultural need for bowheads had been seriously underestimated.

NEW SOURCES OF DATA FOR THE 1988 STUDY

The new sources of data for the 1988 analysis included additional landed bowhead data and Eskimo population data.

Bowheads Landed

The study team began with the lists of landed bowheads in Marquette and Bockstoce (1980) that provided, by location, the number of crews, bowheads landed, struck and lost, killed but lost, and total bowheads killed. Additional research to make this list more complete included hiring Bockstoce and Marquette to make additions they had learned about since 1980, performing additional archival research based on both published and unpublished information (whale ship logs, teacher reports, diaries, magazines, newspapers, books, reports, etc.), researching in libraries and archives throughout the U.S., and performing fieldwork in Wainwright, Wales, Gambell and Savoonga in November and December 1987.

This research resulted in a new, longer list of bowhead landed data for 21 different locations in Alaska representing 1) historic but not current human settlements, 2) traditional whaling sites occupied seasonally, and 3) existing communities (Braund, Marquette and Bockstoce 1988). The bowhead harvest data were presented by each specific location where the activity took place from pre-1900 to 1977. The Scientific Committee reviewed and accepted the new landed data in 1988 (IWC 1989:49).

Next, we consolidated the whale harvest data from the 21 locations within the nine Alaska Eskimo communities that currently participate in bowhead whaling (e.g., whales harvested at Icy Cape, Point Belcher and Point Franklin were attributed to Wainwright, whales harvested at Cape Halkett and Cross Island/Prudhoe Bay were consolidated with Barrow). Hence, eight of the 21 locations were reassigned or consolidated with these nine communities. The last five locations (Little Diomede, King Island, Point Lay, Shaktoolik, and "unlocated") were not included in the analysis.

The reasons for consolidation included 1) the centralization into larger communities such that most of the people who lived and whaled at the smaller sites became residents of the nearby larger villages, and 2) residents of the nine active communities traditionally traveled to many smaller sites on a seasonal basis to hunt bowheads.

Next, the study team linked human population by consolidated location to whale hunting activity from 1910 to 1969. Thus, the human population per year by consolidated location (i.e., the nine whaling villages) was linked to whale hunting activity from 1910 to 1969. In this way, we were able to examine the relation between human population and bowhead harvest data.

Eskimo Population

The second source of new data for the 1988 analysis was more detailed information on the Eskimo population. The 1983 calculation of cultural need for bowheads was based on available decennial census population counts. In order to formally examine the relationship between bowhead landings and human population, however, it was necessary to have annual human population counts which could be compared to the number of bowheads landed on a village basis. Instead of simply assuming a uniform rate of change in population between census counts or assuming a continuation of present growth rates, the study team constructed a human population model incorporating data on 1) age and sex distributions; 2) birth rates; and 3) death rates.

1988 RESULTS: RECALCULATION OF CULTURAL NEED FOR BOWHEAD WHALES

Revision of Historical Base Period

As mentioned above, the 1983 calculation of cultural need was constrained by lack of data. The starting point for the base period used in 1983 varied by village from 1940 to 1950. The end point was uniformly 1970. Additional data gathered for this study and study team members' knowledge of the prevalent living conditions between 1940 and 1970 led the study team to conclude that the most appropriate base period was the 60 year period from 1910 to 1969.

The beginning year of 1910 was selected because data prior to 1900 becomes increasingly sporadic and unreliable related to both bowhead landed and human population, and commercial whaling had an effect on the number of whales landed at certain villages (especially Gambell, Point Hope, and Barrow). Commercial whaling ceased in 1909 so 1910 begins a period free of commercial influence.

The two or three decades after the end of commercial whaling represent a significant period of heavy reliance on subsistence for the northern Alaska Eskimo. Conditions changed dramatically in the 1940s as military activities and government programs exerted strong influences on local lifestyles. The period 1940 to 1969 can be characterized as a time of increased local employment that conflicted with subsistence activities and of religious and government pressures to abandon traditional lifestyles. Despite these influences, the Eskimo continued to demonstrate an active interest in subsistence whaling. The year 1969 was chosen as the end of the base period because the period from 1970 to 1977 was a time of considerable economic change and cultural revival in the villages. These years (1970 to 1977) represent a time of increase in bowhead whaling effort, in the number of whales taken, and the number of whales struck and lost (Marquette and Bockstoce 1980). Hence, to avoid the influence of this increased harvest period, the study team chose to end the base period in 1969.

1988 Estimation of Cultural Need Based on the Relationship Between Bowheads Landed and Eskimo Population

Table 1 presents the recalculated cultural need for bowhead whales based on the IWC accepted method. The data base included 250 observations matching the Eskimo population with bowhead landed at the community level. As shown in the table, substantial landed whale data were compiled for the 60 year period (1910 to 1969) for Gambell (39 years), Point Hope (50 years), Wainwright (49 years), and for Barrow (60 years).

In Table 1, the number of bowheads needed by each community and by the region as a whole was derived by multiplying the mean number of whales landed per capita over the time period selected (1910 to 1969) by the best estimate of current human population for these communities and the region. "Current" population data was the most recent data available at the time, ranging from 1983 data for three villages, 1985 data for one village, 1986 data for two villages, to 1987

Table 1: Alaska Eskimo Whaling Communities' Subsistence and Cultural Need For Landed Bowhead Whales, 1988.\1

Community	Number of Observations\2	Total Eskimo Population for ea. yr. of a Bowhead Observation\3	Number of Bowheads Landed 1910-1969\4	Mean Landed Per Capita 1910-1969\5	1983-87 Eskimo Population\6	1987 Bowhead Need (Landed)\7	1987 Need (Landed) (Rounded)\8
Gambell	39	11,883	68	0.005722	495	2.8	3
Savoonga \9	0	----	----	0.005722	485	2.8	3
Wales	42	6,907	5	0.000724	154	0.1	1
Kivalina	7	926	3	0.003240	275	0.9	1
Point Hope	50	12,467	209	0.016764	534	9.0	9
Wainwright	49	10,723	108	0.010072	445	4.5	5
Barrow	60	44,687	379	0.008481	1,823	15.5	16
Nuiqsut \9	0	----	----	0.008481	227	1.9	2
Kaktovik	3	327	3	0.009174	154	1.4	1
Totals	250	87,920	775		4,592	38.8	41
Region\10	250	87,920	775	0.008815	4,592	40.5	41

\1 Subsistence and cultural need is based on historic per capita harvest per community multiplied by present village population.

\2 The number of observations represents the number of years for which data on landed whales were available for each community (See Appendices 1 and 2 in Braund, Stoker and Kruse 1988).

\3 Total Eskimo population represents the sum of the Eskimo population for each year there was an observation of a landed bowhead whale.

\4 Number of bowheads landed represents the sum of the observed bowheads landed between 1910 and 1969.

\5 The mean landed bowhead whales per capita is based on the total number of whales landed between 1910 and 1969 for each community divided by the sum of the total Eskimo population for each village for each year landed whale data existed between 1910 and 1969 (See Appendices 1 and 2 in Braund, Stoker and Kruse 1988). The sum of the total Eskimo population was calculated by adding the population estimates for each village for each year that there was a landed whale observation. For example, Barrow's 379 landed whales from 1910-1969 were divided by the total Eskimo population sum of 44,687 for this 60 year period (i.e., 379 divided by 44,687 = .008481).

\6 See Table 7 (in Braund, Stoker and Kruse 1988) for the source of Eskimo population data for each community.

\7 The number of bowheads needed is derived by multiplying the mean per capita landed whales (1910-1969) by the most current Eskimo population figure available for each community.

\8 The number of bowhead whales needed per individual community is rounded to the nearest whole number unless the product was less than .5; such cases were rounded up to one.

\9 Because there are no landed bowhead data for neither Nuiqsut nor Savoonga between 1910-1969, the mean per capita landed whales for Gambell was used for Savoonga and the mean for Barrow was used for Nuiqsut.

\10 The mean per capita landed whales for the region represents the total number of whales landed for all communities between 1910 and 1969 divided by the sum of the total Eskimo population for all communities for each year landed whale data existed between 1910 and 1969 (i.e., 775 whales divided by 87,920 = .008815).

Source: Stephen R. Braund & Associates, 1988.

Stephen R. Braund & Associates, 1997.

population data for three villages. The mean number of whales landed per capita over the time period was calculated from the total number of whales landed between 1910 and 1969 for each community (and for the region as a whole) divided by the total human population, by community and region, summed over all the years for which landed whale data exist between 1910 and 1969. In other words, the total human population by village and region is the sum of all village population estimates for years in which whales were landed. This sum was divided into the total landed whales in each community. Based on a mean of .008815 bowhead landed per capita from 1910 to 1969, the 1988 cultural need was 41 landed bowhead whales.

1992 UPDATE BASED ON 1990 U. S. CENSUS

In 1992, the Alaska Eskimo Whaling Commission (AEWC) asked Stephen R. Braund and Associates (SRB&A) to update the cultural and subsistence need for bowhead whales by nine Alaska Eskimo whaling communities based on more current human population data for the communities. Applying the same IWC accepted method of calculating need as used in the 1988 report (Braund, Stoker and Kruse 1988), SRB&A updated need based on 1990 U.S. Census data (see Stephen R. Braund & Associates 1992). The only variable that had changed for this calculation was the Alaska Native population for the nine whaling communities. The 1988 report was written between U.S. decennial census counts and current U.S. census data were not available. For the 1992 update, the 1990 U.S. Census data for each community was used (Alaska Department of Labor 1991). Only the Native population of each community was considered. Based on the 1990 census data, the cultural and subsistence need in the nine Alaska Eskimo communities was 47 landed bowheads (excluding Little Diomede; for a discussion of Little Diomede Island bowhead whaling, see Stephen R. Braund & Associates 1991).

1994 UPDATE BASED ON 1992 ALASKA DEPARTMENT OF LABOR DATA

In 1994, the Alaska Eskimo Whaling Commission again requested an update of cultural and subsistence need for bowhead whales, as the 1990 U.S. Census data were nearly four years old. Because the next U.S. census would not be conducted until the year 2000, the study team reviewed the available sources for current population data.

The Alaska Department of Labor (ADOL) makes annual population estimates for each incorporated community in Alaska for purposes of municipal planning. For 1992, ADOL made these estimates based on the relationship of the 1990 U.S. Census data to the 1990 Alaska Permanent Fund applications for each community. Using this relationship as the base period, ADOL estimated the 1992 community population by knowing the number of 1992 Permanent Fund applications and solving for the 1992 population (Personal communication, J. Gregory Williams April 28, 1994). In addition, the ADOL reviewed other information to ensure the accuracy and consistency of their population estimates. These additional analyses included a similar computation for each community using school enrollment information and a careful review of rural public health nurse records in each community.

The study team reviewed these population data for the 10 Alaska bowhead whaling communities recognized by the AEWC (Alaska Dept. of Labor, Research Analysis 1994).[1] Because these data were not broken down by race, they represented the total population (Alaska Native and other races) for each location. The method accepted by the IWC for calculating need depends on having population data on Alaska Natives only. In order to disaggregate the population data by race, the study team relied on the Alaska State Demographer who provided information on the percentage of Natives in each of the ten communities based on both school enrollment and the 1990 U.S. Census (SRB&A 1994 Table 2). As suggested by the Alaska State Demographer, the study team used the 1990 percent Native American figures and applied these percentages to the 1992 population estimates to arrive at the Native population for the communities.

Using the 1992 total population estimates provided by the Alaska Department of Labor and applying the percentage Native from the 1990 U.S. Census resulted in a 1992 cultural and subsistence need of 51 landed bowhead whales for the 10 communities (SRB&A 1994, Table 3).

1997 UPDATE BASED ON 1997 ALASKA DEPARTMENT OF LABOR DATA

In preparation for the 1997 IWC meeting, the Alaska Eskimo Whaling Commission requested an

[1] This analysis includes population data for the village of Little Diomede. For a discussion of Little Diomede Island bowhead whaling, see Stephen R. Braund & Associates 1991.

update of cultural and subsistence need for bowhead whales. By 1997, the 1994 update was based on the five year old 1992 population information. The Alaska State Demographer (ADOL 1997a) provided population estimates for each year from the 1990 U.S. Census (Table 2). These updates are prepared annually and include the total population (Native and other) in each of the communities. To arrive at the Native population only, the percent Native American from the 1990 U.S. Census was applied to the annual population data (Table 3). This resulted in an estimated Native population for the ten Alaska bowhead whaling communities.

Using the 7/1/97 total population estimates provided by the Alaska Department of Labor and applying the percentage Native from the 1990 U.S. Census, Table 4 presents the 1997 cultural and subsistence need for bowhead whales in the ten Alaska Eskimo communities. The number of bowheads needed by each community and by the region as a whole (all ten communities) is derived by multiplying the mean number of whales landed per capita over the base time period (1910-1969) by the estimated 1997 Alaska Native population for each community and for the region as a whole. Using this method, the need for each community is shown on Table 4. Applying the mean of .008621 bowhead landed per capita for all ten communities for the historical period (1910-1969) to the estimated 1997 regional Native population of 6,472 results in a 1997 regional cultural and subsistence need of 56 landed bowhead whales.

Table 5 compares the ten Eskimo whaling communities' need in the mid-1980s (i.e., based on 1983-87 Alaska Native population estimates in each community) with the need in 1990, 1992, and 1997. The landed need increased from 41 landed in the mid-1980s (not including Little Diomede Island) to a need of 48 landed based on the 1990 U.S. Census data to 51 landed in 1992 and 56 landed in 1997. The 1990, 1992 and 1997 landed need figures include Little Diomede Island.

Table 6 compares the mid-1980s Alaska Native population for each community with Native population of 1990, 1992 and 1997 (the four years when new population data were gathered to

Table: 2 Total Estimated Population of Ten Alaska Eskimo Bowhead Whaling Communities.\1,2

Community\3,4	4/1/90	7/1/91	7/1/92	7/1/93	7/1/95	7/1/95	7/1/96	7/1/97
Gambell	525	551	579	586	616	622	636	653
Savoonga	519	543	562	573	571	603	612	622
Wales	161	158	152	156	162	174	166	162
Diomede\5	178	175	181	177	170	154	171	174
Kivalina	317	331	370	366	376	348	353	357
Point Hope	639	668	685	676	709	719	756	749
Wainwright	492	497	531	536	537	535	560	550
Barrow	3,469	3,609	3,778	3,897	4,055	4,197	4,257	4,380
Nuiqsut	354	387	422	403	411	412	427	435
Kaktovik	224	218	215	211	208	212	221	222
Totals	6,878	7,137	7,475	7,581	7,815	7,976	8,159	8,304

\1 Population numbers represent total community population.
\2 The 1992 population data presented in this table reflect minor differences with the 1992 population data presented to the IWC in 1994 (IWC/46/AS6) due to revisions in national and state populations by the U.S. Census Bureau. The demographer's annual update to the Alaska population data results in minor readjustments to previous years' population data back to 1990. Thus, there are minor differences in the 1992 population data as reported in 1994 compared to the 1992 data reported in 1997. These differences do not change the outcome of the needs calculation.
\3 1990 population data from the 1990 U.S. Census.
\4 1991-1997 population data are from the Alaska Department of Labor, Research & Analysis Section, 1997a.
\5 Little Diomede Island was granted membership into the AEWC in 1988.

Table: 3 Estimated Native Population of Ten Alaska Eskimo Bowhead Whaling Communities, 1997.\1,2

Community	Percent Native American\3	4/1/90	7/1/91	7/1/92	7/1/93	7/1/94	7/1/95	7/1/96	7/1/97
Gambell	96.19%	505	530	557	564	593	598	612	628
Savoonga	95.18%	494	517	535	545	543	574	583	592
Wales	88.82%	143	140	135	139	144	155	147	144
Diomede	93.82%	167	164	170	166	159	144	160	163
Kivalina	97.48%	309	323	361	357	367	339	344	348
Point Hope	91.86%	587	614	629	621	651	660	694	688
Wainwright	94.31%	464	469	501	506	506	505	528	519
Barrow	63.91%	2,217	2,307	2,415	2,491	2,592	2,682	2,721	2,799
Nuiqsut	92.66%	328	359	391	373	381	382	396	403
Kaktovik	84.38%	189	184	181	178	176	179	186	187
Totals		5,403	5,605	5,874	5,939	6,112	6,218	6,372	6,472

\1 The 1992 population data presented in this table reflect minor differences with the 1992 population data presented to the IWC in 1994 (IWC/46/AS6) due to revisions in national and state populations by the U.S. Census Bureau. The demographer's annual update to the Alaska population data results in minor readjustments to previous years' population data back to 1990. Thus, there are minor differences in the 1992 population data as reported in 1994 compared to the 1992 data reported in 1997. These differences do not change the outcome of the needs calculation.
\2 Based on Percent Native American from the 1990 U.S. Census.
\3 From 1990 U.S. Census data.

Stephen R. Braund & Associates, 1997.

Table 4: Ten Alaska Eskimo Whaling Villages' Subsistence and Cultural Need For Landed Bowhead Whales, 1997.\1

Community	Number of Observations\2	Total Eskimo Population for ea. yr. of a Bowhead Observation\3	Number of Bowheads Landed 1910-1969\4	Mean Landed Per Capita 1910-1969\5	1997 Alaska Native Population\6	1997 Bowhead Need (Landed)\7	1997 Need (Landed) (Rounded)\8
Gambell	39	11,883	68	0.005722	628	3.6	4
Savoonga \9	0	----	----	0.005722	592	3.4	3
Wales	42	6,907	5	0.000724	144	0.1	1
Diomede \10	30	3,250	11	0.003678	163	0.6	1
Kivalina	7	926	3	0.003240	348	1.1	1
Point Hope	50	12,467	209	0.016764	688	11.5	12
Wainwright	49	10,723	108	0.010072	519	5.2	5
Barrow	60	44,687	379	0.008481	2,799	23.7	24
Nuiqsut \9	0	----	----	0.008481	403	3.4	3
Kaktovik	3	327	3	0.009174	187	1.7	2
Totals	280	91,170	786		6,472	54.4	56
Region\11	280	91,170	786	0.008621	6,472	55.8	56

\1 Subsistence and cultural need is based on historic per capita harvest per community multiplied by the 1997 Alaska Native population of each community.

\2 The number of observations represents the number of years for which data on landed whales were available for each community (See Appendices 1 & 2 of Braund, Stoker & Kruse 1988 & Table 1 of Stephen R. Braund & Assoc. 1991).

\3 Total Eskimo population represents the sum of the Eskimo population for each year there was an observation of a landed bowhead whale.

\4 Number of bowheads landed represents the sum of the observed bowheads landed between 1910 and 1969.

\5 The mean landed bowhead whales per capita is based on the total number of whales landed between 1910 and 1969 for each community divided by the sum of the total Eskimo population for each village for each year landed whale data existed between 1910 and 1969 (See Appendices 1 & 2 in Braund, Stoker & Kruse 1988 and Tables 1 and 3 in Stephen R. Braund & Assoc. 1991). The sum of the total Eskimo population was calculated by adding the population estimates for each community for each year that there was a landed whale observation. For example, Barrow's 379 landed whales from 1910-1969 was divided by the total Eskimo population sum of 44,687 for this 60 year period (i.e., 379 divided by 44,687 = .008481).

\6 1997 Alaska Native population data for each community are from the Alaska Department of Labor, Research & Analysis Section (1997a) 7/1/97 population estimates of these 10 communities multiplied by the percent Native American in each community from the 1990 U.S. Census. J. Gregory Williams, State Demographer, 10/6/97 and 1990 U.S. Census.

\7 The number of bowheads needed is derived by multiplying the mean per capita landed whales (1910-1969) by the 1997 Alaska Native population for each community.

\8 The number of bowhead whales needed per individual community is rounded to the nearest whole number unless the product was less than .5; such cases were rounded up to one.

\9 Because there are no landed bowhead data for either Savoonga or Nuiqsut between 1910-1969, the mean per capita landed whales for Gambell was used for Savoonga and the mean for Barrow was used for Nuiqsut.

\10 Due to uncertainties in the landed whale data for Little Diomede Island, four different calculations of subsistence and cultural need, ranging from .4 to 1.0 bowheads, were presented (see Table 4 Stephen R. Braund & Assoc. 1991). The Little Diomede mean landed whale per capita (1910-1969) in this table represents the mean of these four calculations.

\11 The mean per capita landed whales for the region represents the total number of whales landed for all ten communities between 1910 and 1969 divided by the sum of the total Native population for all communities for each year landed whale data existed between 1910 and 1969 (i.e., 786 whales divided by 91,170 = .008621).

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Table 5: Comparison of Ten Alaska Eskimo Whaling Communities' mid-1980s Subsistence and Cultural Need for Landed Bowhead Whales with 1990, 1992, and 1997 Need.\1

	Mean	Mid-1980s Calculation Data				1990 Calculation Data			1992 Calculation Data			1997 Calculation Data		
Community	Landed Per Capita 1910-1969\2	Est. 1983-87 AK Na. Pop.\3	Date of Pop. Est\3	1987 Bowhead Need (Lnded)\4	1987 Need (Landed) (Rnded)\5	1990 AK Native Pop.\6	1990 Bowhead Need (Lnded)\7	1990 Need (Landed) (Rnded)\5	Est. 1992 AK Native Pop.\8	1992 Bowhead Need (Lnded)\9	1992 Need (Landed) (Rnded)\6	Est. 1997 AK Native Pop.\10	1997 Bowhead Need (Lnded)\11	1997 Need (Landed) (Rnded)\6
Gambell	0.005722	495	1987	2.8	3	505	2.9	3	530	3.0	3	628	3.6	4
Savoonga	0.005722	485	1985	2.8	3	494	2.8	3	515	2.9	3	592	3.4	3
Wales	0.000724	154	1987	0.1	1	143	0.1	1	129	0.1	1	144	0.1	1
Diomede Is	0.003678	N/A	N/A	N/A	N/A	167	0.6	1	169	0.6	1	163	0.6	1
Kivalina	0.003240	275	1987	0.9	1	309	1.0	1	356	1.2	1	348	1.1	1
Point Hope	0.016764	534	1986	9.0	9	587	9.8	10	629	10.5	11	688	11.5	12
Wainwright	0.010072	445	1983	4.5	5	464	4.7	5	505	5.1	5	519	5.2	5
Barrow	0.008481	1,823	1986	15.5	16	2,217	18.8	19	2,532	21.47	21	2,799	23.7	24
Nuiqsut	0.008481	227	1983	1.9	2	328	2.8	3	364	3.1	3	403	3.4	3
Kaktovik	0.009174	154	1983	1.4	1	189	1.7	2	183	1.7	2	187	1.7	2
Totals		4,592		38.8	41	5,403	45.3	48	5,912	49.7	51	6,472	54.4	56
Region w/o Dio	0.008815	4,592		40.5	41									
Region w/ Dio	0.008621					5,403	46.6	48	5,912	51.0	51	6,472	55.8	56

\1 Subsistence and cultural need is based on historic per capita harvest per community multiplied by the Alaska Native population of each community.
\2 See Table 1, footnote \5 for explanation of mean landed bowheads per capita.
\3 See Braund, Stoker & Kruse (1988) Table 7 for source of mid-1980s Alaska Native population data.
\4 The number of bowheads needed in 1987 was derived by multiplying the mean per capita landed whales (1910-1969) by the most current Alaska Native population data available for each community in 1988.
\5 The number of bowheads needed per individual community is rounded to the nearest whole number unless the product was less than .5; such cases were rounded up to one.
\6 1990 Alaska Native population data for each community are from the 1990 U.S. Census.
\7 The number of bowheads needed in 1990 is derived by multiplying the mean per capita landed whales (1910-1969) by the 1990 Alaska Native population for each community.
\8 1992 Alaska Native population data for each community are from the Alaska Department of Labor, Research & Analysis Section, Demographics Unit. J. Gregory Williams, State Demographer, 3/15/94.
\9 The number of bowheads needed in 1992 is derived by multiplying the mean per capita landed whales (1910-1969) by the estimated 1992 Alaska Native population for each community.
\10 1997 Alaska Native population data for each community are from the Alaska Department of Labor, Research & Analysis Section (1997a) 7/1/97 population estimates multiplied by the percent Native American in each community from the 1990 U.S. Census.
\11 The number of bowheads needed in 1997 is derived by multiplying the mean per capita landed whales (1910-1969) by the estimated 1997 Alaska Native population for each community.

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update the calculation of subsistence and cultural need for bowhead whales). Between the mid-1980s and 1990, the Alaska Native population in these communities grew at an annual rate of a low of -2.4 percent in Wales to a high of 6.4 percent in Nuiqsut. Because the beginning population data year varied (e.g., from 1983 to 1987), it is not possible to calculate the percent change for all of the communities combined. From 1990 to 1992, the Alaska Native population in these 10 communities grew at an annual rate of a low of -4.9 percent in Wales to 7.1 percent and 7.6 percent in Barrow and Kivalina respectively. The average annual growth rate for all ten communities was 4.7 percent during this two year period. Between the mid-1980s and 1997, the annual rate of increase in the communities ranged from -.7 percent in Wales to 4.9 percent and 5.5 percent in Barrow and Nuiqsut respectively. Between 1992 and 1997, the annual growth rate ranged from a low of -.7 percent in Diomede to a high of 3.7 percent in Gambell. The annual rate of growth for the ten communities combined during the past five years is 1.9 percent per year. This compares with an annual growth rate for the State of Alaska from 6/30/90 to 6/30/96 of 1.65 percent (Alaska Department of Labor 1997c). In addition, the 1.9 percent annual rate of growth between 1992 and 1997 for these 10 communities is substantially lower than the 4.7 percent annual rate of growth between 1990 and 1992.

In an effort to understand the growth rates in these communities, the study team collected data on the births and deaths in the communities from 1991 to 1996, the latest year for which these data are available (Table 7). These data indicate that approximately 77 percent of the regional growth from 1990 to 1996 was due to natural increase (births less deaths) and approximately 23 percent was due to migration. The annual birth rate per 1,000 persons was 26.7 while the annual death rate per 1,000 persons was 5.7. This compares with an average annual birth per 1,000 persons of 18.8 and average annual deaths per 1,000 persons of 4.0 for the State of Alaska from 1990 to 1996 (ibid.).

Table 6: Comparison of Ten Alaska Eskimo Whaling Communities' Native Population: mid-1980s, 1990, 1992, and 1997.

		1983-87 to 1990				1990 to 1992		1992 to 1997		1983-87 to 1997	
Community	Date of 1983-87 Pop. Est\1	Est. 1983-87 AK Na Pop.\1	Yrs fr 1983-87 to 1990\2	1990 AK Na Pop.\3	% Change Per Yr fr 1983-87 to 1990\4	Est. 1992 AK Na Pop.\5	% Change Per Year 1990 to to 1992\6,7	Est. 1997 AK Na Pop.\8	% Change Per Year 1992 to to 1997\7,9	Yrs fr 1983-87 to 1997\10	% Change Per Year 1983-87 to 1997\11
Gambell	1987	495	3	505	0.7%	530	2.5%	626	3.7%	10	2.7%
Savoonga	1985	485	5	494	0.4%	515	2.1%	592	3.0%	12	1.8%
Wales	1987	154	3	143	-2.4%	129	-4.9%	144	2.3%	10	-0.7%
Diomede Is	N/A	N/A	N/A	167	N/A	169	0.6%	163	-0.7%	N/A	N/A
Kivalina	1987	275	3	309	4.1%	356	7.6%	348	-0.4%	10	2.7%
Point Hope	1986	534	4	587	2.5%	629	3.6%	688	1.9%	11	2.6%
Wainwright	1983	445	7	464	0.6%	505	4.4%	519	0.5%	14	1.2%
Barrow	1986	1,823	4	2,217	5.4%	2,532	7.1%	2,799	2.1%	11	4.9%
Nuiqsut	1983	227	7	328	6.4%	364	5.5%	403	2.1%	14	5.5%
Kaktovik	1983	154	7	189	3.2%	183	-1.6%	187	0.5%	14	1.5%
Totals		4,592		5,403		5,912		6,472			
Region							4.7%		1.9%		

\1 See Braund, Stoker & Kruse (1988) Table 7 for source of mid-1980s Alaska Native population data.
\2 Number of years between the 1990 U.S. Census and the 1983-87 population figures for each community.
\3 1990 Alaska Native population data for each community are from the 1990 U.S. Census.
\4 1990 Alaska Native population minus 1983-87 population divided by 1987-83 population divided by the number of years from 1983-87 to 1990.
\5 1992 Alaska Native population data for each community are from the Alaska Department of Labor, Research & Analysis Section, Demographics Unit. J. Gregory Williams, State Demographer, 3/15/94.
\6 1992 Alaska Native population minus 1990 population divided by 1990 population divided by two years (the number of years from 1990 to 1992).
\7 The percent change per year for all communities (i.e., Region) does not represent a sum of community percents, but rather the percent change per year for the total population of all ten communities (i.e., region) between the designated years.
\8 1997 Alaska Native population data for each community are from the Alaska Department of Labor, Research & Analysis Section (1997a) 7/1/97 population estimates multiplied by the percent Native American in each community from the 1990 U.S. Census.
\9 1997 Alaska Native population minus 1992 population divided by 1992 population divided by five years (the number of years from 1992 to 1997).
\10 Number of years between the 1997 estimated Alaska Native population figures for each community and the 1983-87 population estimates.
\11 1997 Alaska Native population minus 1983-87 population divided by 1983-87 population divided by the number of years from 1983 to 1997.

Stephen R. Braund & Associates, 1997.

Table 7: Residential Births and Deaths in Ten Alaska Eskimo Whaling Communities, 1991-96.\1

Community\2	Native American Population 4/1/90	Native American Population 7/1/96	Pop. Change 1990-96\3	Births\4 1991-96\5	Births: Annual Rate/1000 Mid Period Population\6	Deaths\4 1991-96\5	Deaths: Annual Rate/1000 Mid Period Population\7	Natural Increase (Births-Deaths) 1991-96\5	Net Migrants	% of Pop. Change Due to Natural Increase\8,9	% of Pop. Change Due to Migration\9
Gambell	505	612	107	102	30.2	17	5.0	85	22	79%	21%
Savoonga	494	583	89	102	31.2	19	5.8	83	6	93%	7%
Wales	143	147	4	20	24.1	9	10.8	11	-7	N/A	N/A
Diomede Is	167	160	-7	4	4.0	4	4.0	0	-7	0%	100%
Kivalina	309	344	35	62	29.0	6	2.8	56	-21	N/A	N/A
Point Hope	587	694	107	97	26.0	21	5.6	76	31	71%	29%
Wainwright	464	528	64	71	23.4	19	6.3	52	12	81%	19%
Barrow	2,217	2,721	504	414	27.7	91	6.1	323	181	64%	36%
Nuiqsut	328	396	68	55	24.5	13	5.8	42	26	62%	38%
Kaktovik	189	186	-3	24	22.5	4	3.7	20	-23	N/A	N/A
Totals	5,403	6,371	968	951		203		748	220		
Region\10					26.7		5.7			77%	23%

\1 Population, birth and death data are for Alaska Natives only.
\2 Refers to community of mother's residence and community of decedent's residence.
\3 1996 Alaska Native population in each community minus 1990 population.
\4 Birth and death data from the Alaska Department of Health and Social Services, Bureau of Vital Statistics (1997).
\5 1996 data are provisional and subject to change.
\6 Annual Rate/1000 is calculated by dividing the total births from 1991-96 by 6 years for an average annual number of births. This number is then divided by the 7/1/93 population (the mid period population from 4/1/90 to 7/1/96) multiplied by 1,000 to determine the rate/1000 people.
\7 Annual Rate/1000 is calculated by dividing the total deaths from 1991-96 by 6 years for an average annual number of deaths. This number is then divided by the 7/1/93 population (the mid period population from 4/1/90 to 7/1/96) multiplied by 1,000 to determine the rate/1000 people.
\8 Net natural increase (e.g., births minus deaths) in each community divided by total population change between 1990 and 1996.
\9 The percent of the population change due to natural increase and migration is not applicable when the population change is less than natural increase.

Stephen R. Braund & Associates, 1997.

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8.2 National Oceanic and Atmospheric Administration-Alaska Eskimo Whaling Commission Cooperative Agreement (as amended in 2017)

COOPERATIVE AGREEMENT
between the
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
and the
ALASKA ESKIMO WHALING COMMISSION
as amended
2013

1. PURPOSES

The purposes of this agreement are to protect the bowhead whale and the Eskimo culture, to promote scientific investigation of the bowhead whale, and to effectuate the other purposes of the Marine Mammal Protection Act, the Whaling Convention Act, and the Endangered Species Act as these acts relate to aboriginal subsistence whaling.

In order to achieve these purposes, this agreement provides for:

(a) Cooperation between members of the Alaska Eskimo Whaling Commission (AEWC) and the National Oceanic and Atmospheric Administration (NOAA) in management of the bowhead whale hunt through 2018; and

(b) an exclusive enforcement mechanism that shall apply during the term of this agreement to any violation by whaling captains (or their crews) who are registered members of the AEWC of any provisions of the Marine Mammal Protection Act, the Endangered Species Act, or the Whaling Convention Act, as these acts may relate to aboriginal subsistence whaling; of the International Convention for the Regulation of Whaling, 1946; of regulations of the International Whaling Commission; of the AEWC Management Plan; or of this agreement.

2. RESPONSIBILITIES

NOAA has primary responsibility within the United States Government for management and enforcement of programs concerning bowhead whales. The AEWC is an association governing Alaskan Eskimo whalers who hunt for bowhead whales. The AEWC adopted a Management Plan on March 4, 1981, to govern hunting for bowhead whales by Alaskan Eskimos. The AEWC and NOAA have cooperatively managed the bowhead hunts since 1981. Under this Cooperative Agreement, the AEWC will, in continued cooperation with NOAA, manage the bowhead whale hunts through 2018. The authority and responsibilities of the AEWC are contained in and limited by this agreement and the Management Plan, as amended from time to time, to the extent the Management Plan is not inconsistent with this agreement. If the AEWC fails to carry out its enforcement responsibilities or meet the conditions of this agreement or of the Management Plan, as amended from time to time, NOAA may assert its federal management and enforcement authority and will regulate the bowhead whale hunt in a manner consistent with federal law, this agreement, and the Management Plan to the extent necessary to carry out the responsibilities that are not carried out by the AEWC. Such assertion of federal authority will be preceded by notice to the AEWC of intent to regulate the bowhead whale hunt to the extent necessary to carry out those responsibilities and conditions, and will not be effected until the AEWC or its members have been given an opportunity to present their views on the need for such assertion in a public forum: provided, however, that in cases where NOAA determines that irreparable harm to the bowhead whale resource might result, the assertion of federal authority may be effected immediately after notice, in which cases the public forum on the need for such assertion will be conducted as soon as practicable thereafter.

3. INSPECTION AND REPORTING

NOAA personnel shall monitor the hunt and the AEWC shall assist such personnel with such monitoring. The AEWC shall report to NOAA regarding the number of strikes and landings. The AEWC shall also inform all whaling captains who are engaged in whaling activities of the number of whales struck or landed at all times. On the first of each month during the spring and fall whaling seasons, the AEWC shall inform NOAA of the number of bowhead whales struck during the previous month. The AEWC shall also provide a report to NOAA within 30 days after the conclusion of the spring hunt, and within 30 days after the fall hunt but no later than March 31, containing at least the following information:

(1) The date and exact, to the extent practicable, location of strike for each whale struck or landed, including, at a minimum, the estimated distance and bearing from the village or whaling camp;

(2) The length (as measured from the point of the upper jaw to the notch between the tail flukes) and the sex of the whales landed;

(3) The length and sex of a fetus, if present, in a landed whale; and

(4) An explanation of circumstances associated with the striking of any whale not landed, and an estimate of whether a harpoon or bomb emplacement caused a wound which might be fatal to the animal (e.g., the harpoon entered a major organ of the body cavity and the bomb exploded).

NOAA shall provide technical assistance in collection of the above information. The AEWC shall assist appropriate persons in collection of specimens from landed whales. The AEWC shall encourage whaling captains to make such specimens available to researchers upon written request to the AEWC. NOAA personnel cooperating with the AEWC shall work closely with the AEWC Commissioner in each whaling village to facilitate the accurate monitoring of the hunt.

4. MANAGEMENT

(1) No more than seventy-five (75) bowhead whales shall be struck in 2013. The AEWC and NOAA shall determine the total number of bowhead whales that may be struck in each year from 2014 through 2018, and any applicable number of bowhead whales that may be landed, through annual negotiations during the first quarter of the year for which the quota is applicable: provided, however, that the Under Secretary or his designee may, in consultation with the AEWC, reconsider and revise the term of this paragraph if he deems it necessary on the basis of public comments received pursuant to the Federal Register notice of the allocations.

(2) Registered whaling captains shall hunt under the provisions of the AEWC Management Plan, and will use all practical means to improve hunting efficiency.

(3) The AEWC shall determine the allocation of these permitted strikes among the whaling villages.

(4) The AEWC Management Plan will provide that the meat and edible products of bowhead whales taken in the subsistence hunt must be used exclusively for native consumption and may not be sold or offered for sale.

5. ENFORCEMENT

(1) The AEWC agrees that registered whaling captains may be subject to civil monetary assessments for whales struck over the annual strike limit as set forth in this Agreement and whales landed over any landing limit that is prescribed in this

agreement and the Management Plan as they may be amended from time to time. The AEWC will collect the assessments from the whaling captains. In the event of a dispute between NOAA and the AEWC over the number of whales landed or struck or the amount of the assessment, or other factual matters, NOAA will consult with the AEWC about the matter. If the dispute cannot be resolved, it will be referred to an administrative law judge for determination under a trial-type administrative proceeding of the facts and the amount of assessment. The procedures contained in 15 CFR sections 904.200-904.273 will control these proceedings. The decision of the administrative law judge may be appealed to the Administrator of NOAA. Whaling captains may also be liable for civil assessments for other violations of the Management Plan as determined by the AEWC or by an administrative law judge under the procedures described above.

(2) In consideration of the AEWC's agreement hereunder, the Government of the United States agrees that the enforcement procedure described in paragraph (1) of this section shall be the exclusive enforcement mechanism that shall apply during the term of this agreement to any violation by whaling captains or their crew who are registered members of the AEWC of any provisions of the Marine Mammal Protection Act, the Endangered Species Act, or the Whaling Convention Act, as these Acts may relate to aboriginal subsistence whaling; of the International Convention for the Regulation of Whaling, 1946; of any regulations of the International Whaling Commission; of the Management Plan; or of this agreement.

(3) The AEWC shall maintain a list containing the names of all registered whaling

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captains and shall make this list available to NOAA upon request.

6. AUTHORITIES

This Cooperative Agreement is concluded under the authorities governing management of living marine resources, including but not limited to the Marine Mammal Protection Act of 1972 and the Whaling Convention Act of 1949.

7. DURATION

This Agreement will become effective upon the signature of the approving officials of both the AEWC and NOAA, and will remain in effect through March 31, 2019.

8. CONSULTATION

NOAA and the AEWC shall consult during the operation of this Agreement concerning the matters addressed herein as well as all other matters related to bowhead whales which either party believes are suitable for such consultation. Specifically, NOAA shall consult with the AEWC on any action undertaken or any action proposed to be undertaken by any agency or department of the Federal Government that may affect the bowhead whale and/or subsistence whaling and shall use its best efforts to have such agency or department participate in such consultation with the AEWC.

9. LIMITATION OF USE

Nothing in the Agreement shall be construed to support or contradict the position of either party regarding the jurisdiction of the International Convention for the Regulation of

Whaling, 1946, or the Whaling Convention Act of 1949 with respect to aboriginal subsistence whaling by Alaskan Eskimos.

10. AMENDMENT

This Agreement may be amended from time to time by mutual written consent of the parties. Such amendments may be approved, on behalf of NOAA, by the United States Deputy Commissioner to the International Whaling Commission, or his designee.

Dated: 2.6.2013

Dated: 2-20-13

George Noongwook
Chairman, Alaska Eskimo
Whaling Commission

Samuel D. Rauch III
Deputy Assistant Administrator Regulatory Programs, performing the functions and duties of the Assistant Administrator for Fisheries

7

2018 AMENDMENT
to the
COOPERATIVE AGREEMENT
between the
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
and the
ALASKA ESKIMO WHALING COMMISSION

The Alaska Eskimo Whaling Commission (AEWC) and the National Oceanic and Atmospheric Administration (NOAA) hereby agree to amend their Cooperative Agreement as follows:

Article 4, Paragraph (1) is amended to read as follows:

"No more than 75 bowhead whales shall be struck in 2018."

John Hopson, Jr.
Chairman, Alaska Eskimo
Whaling Commission

Date: 12/13/17

Ryan Wulff
Acting U.S. Commissioner to the
International Whaling Commission

Date: 12/14/17

8.3 Alaska Eskimo Whaling Commission Management Plan

ALASKA ESKIMO WHALING COMMISSION
MANAGEMENT PLAN

AS AMENDED ON:

FEBRUARY 15, 2991

FEBRUARY 14, 1992

FEBRUARY 15, 1995

FEBRUARY 14, 2003

FEBRUARY 4, 2005

FEBRUARY 5, 2016

SUBPART A

INTRODUCTION

SUBSECTION 100.1 PURPOSE OF REGULATIONS

It is the purpose of the regulations contained herein to:

(a) Insure safe and efficient subsistence harvest of bowhead whales;

(b) Provide a means within the Alaska Eskimo customs and institutions of protecting the habitat of the bowhead whale and limiting the bowhead whale harvest in order to prevent the extinction of such species; and

(c) Provide for Eskimo regulation of all whaling activities by Eskimos who are members of the Alaska Eskimo Whaling Commission.

SUBSECTION 100.2 SCOPE OF REGULATIONS

The regulations contained herein apply to the subsistence hunting of whales by Eskimos who are members of the Alaska Eskimo Whaling Commission.

SUBPART B

ALASKA ESKIMO WHALING COMMISSION

SUBSECTION 100.11 POWERS

(a) The Alaska Eskimo Whaling Commission (hereafter AEWC) is empowered to administer the regulations contained herein to insure that the purposes in Subsection 100.1 of these regulations are attained.

(b) The AEWC is empowered to enforce the regulations by:

(1) denying any whaling captain or crew member who violates these regulations the right to participate in hunting bowhead whales

(2) making civil assessments

(3) acting as an enforcement agent for any government entity authorized to enforce thee regulations.

(c) The AEWC is empowered to promulgate interim regulations that are in addition to, but not inconsistent with regulations contained herein.

SUBSECTION 100.12 DUTIES

(a) The AEWC shall administer and enforce the regulations contained herein (including any interim regulations).

(b) The AEWC shall conduct village education programs to facilitate compliance with these regulations, including training programs for whaling captains and crew.

(c) The AEWC shall initiate research for improvement of the accuracy and reliability of weapons.

SUBPART C

REGULATIONS

SUBSECTION 100.21 DEFINITIONS

(a) "bowhead whale" means a whale whose scientific name is baleana mysticetus and which mitigates past whaling villages in Alaska.

(b) "captain" means the person in charge of a registered whaling crew.

(c) "harvest" means to kill and bring to shore or butchering area.

(d) "non-traditional weapons" means any instrument that could be used to harvest a bowhead whale that is not a traditional weapon.

(e) "traditional weapon" means a harpoon with line attached, darting gun, should gun, lance or any other weapon approved by the AEWC as such a weapon in order to improve the efficiency of the bowhead whale harvest.

(1) "harpoon with line attached" means a harpoon with a rotating head which is attached to a line and float and which has no explosive charge. (See figure 7 and 8 of Appendix E of the FEIS on the International Whaling Commission's Deletion of Native Exemptions for the Subsistence Harvest of Bowhead Whales. (October 1977) (hereinafter FEIS).

(2) "darting gun harpoon" means a harpoon with an explosive charge and with a line and float attached. (See Appendix E of FEIS of Figure 4).

(3) "shoulder gun" means a whaling gun, adapted from the era of commercial whaling in the 19th century, which shoots an explosive charge.

(4) "lance" means a non-explosive sharply pointed weapon without a harpoon head.

(5) "explosive charge" as used in subparagraph (2) of this paragraph includes, in addition to a black powder projectile, a penthrite-based explosive charge developed, approved, and issued to a whaling captain by the AEWC, unless such explosive charge has not been issued or is not compatible with the darting gun harpoon.

(f) "whaling crew" means those registered persons who participate directly in the harvest of attempted harvest of the bowhead whale and are under the supervision of a registered captain.

(g) "whaling village" means the Alaska Eskimo Whaling village in which resides a whaling captain and crew which participates in the harvest of bowhead whales and which is represented by a Commissioner of the AEWC.

(h) "whaling season" means customary period of time during which the bowhead whale is harvested, either in the Spring or Fall.

(i) "garbage" means anything that the whaling captains and crew brings out to the ice that is not biodegradable.

(j) "habitat" means the water and associated land and ice environment used by the bowhead whale.

SUBSECTION 100.22 **REGISTRATION**

(a) Every year, prior to participating in the bowhead subsistence hunt, each captain shall register himself, each of his crew members, and each of his boats with the AEWC on forms provided by the AEWC for that purpose, which discloses his name, address and qualifications as a captain and his willingness to abide by the regulations of the AEWC and to require his crew to abide by those regulations. If a captain registers for the spring hunt but then wishes to use a different boat or additional boats of different or additional crew members during the fall hunt, those boats and crew members must be registered before the fall hunt.

(b) The AEWC shall take into account any reading or language difficulties in developing procedures and forms for registration.

SUBSECTION 100.23 REPORTS

(a) Each whaling captain shall be responsible for keeping a written record of the number of whales:

(1) attempted to be harvested by using traditional weapons but not harvested.

(2) Harvested by the captain or his crew, and

(3) Sighted by the captain and his crew.

(b) Each whaling captain shall report the date, place, and time of any striking not resulting in harvesting and shall describe:

(1) the size and type of bowhead whale,

(2) any known latter attempted harvest or actual harvest of said whale,

(3) the reason for the captain or crew not harvesting the whale, i.e., environmental factors, the failure of traditional weapons; or other reasons, and

(4) the conditions of the whale that was not harvested.

(c) Each whaling captain shall make other reports as the AEWC requires in order to accomplish the purposes of the regulations herein or in order to advance the scientific knowledge of the bowhead whale.

SUBSECTION 100.24 PERMISSIBLE HARVESTING METHODS

(a) No whaling captain or crew shall harvest or attempt to harvest the bowhead whale in any manner other than the traditional harvesting manner

(b) "traditional harvesting manner" means:

(1) only traditional weapons shall be used as defined in Subsection 100.21(e).

(2) the bowhead whale shall first be struck with a harpoon or darting gun with line and float attached.

(3) the shoulder gun may be used:

(I) after a line has been secured to the bowhead whale, or
(II) when pursuing a wounded bowhead whale with a float attaché to it.

(4) the lance may be used after a line has been secured to the bowhead whale.

(5) no whaling captain or crew shall attempt to harvest a calf or a cow accompanied by a calf.

(c) No whaling captain or crew shall attempt to harvest a calf or a cow accompanied by a calf.

(d) No whaling captain or crew shall engage in whaling in a wasteful manner, including the processing, storage, or use of the ordi.

SUBSECTION 100.25 TRADITIONAL PROPRIETARY CLAIM

The bowhead whale shall belong to the captain and crew which first strikes the bowhead whale in the manner described in Subsection 100.24.

SUBSECTION 100.26 LEVEL OF HARVEST

(a) The AEWC shall establish the levels of harvest or attempted harvest for each whaling village during each season or seasons.

(b) In establishing the levels of harvest or attempted harvest, the AEWC shall consult each whaling village.

SUBSECTION 100.27 REGULATIONS TO PROJECT THE BOWHEAD WHALE HABITAT

(a) All whaling crews shall bring their garbage back to land and dispose of it in a proper manner.

SUBSECTION 100.28 NATIVE CONSUMPTION

The meat and products, except for traditional native handcrafts, of whales taken in the subsistence hunt must be exclusively for native consumption and may not be sold or offered for sale.

SUBSECTION 100.29 PROCEDURES FOR ADDRESSING MANAGEMENT PLAN VIOLATIONS

(a) For any village having a local Whaling Captains' Association (WCA) Dispute Panel recognized by the AEWC, a hearing by the local WCA Dispute Panel shall be triggered if a whiling captain submits a written complaint to the President of the WCA identifying a Management Plan violation by a fellow whaling captain. If such a written complaint is received, the WCA Dispute Panel shall:

(1) determine whether a violation of the AEWC Management Plan did occur and if so, what the circumstances of that violation were;

(2) if it is found that a violation of the AEWC Management Plan did occur, determine a recommended penalty consistent with the Subsection _____ below.

(3) forward to the AEWC Board of Commissioners:

i. a written description of the violation and the findings made by the Dispute Panel; and

ii. the Dispute Panel's recommendations regarding the imposition of a penalty.

(b) For any village not having a local WCA Dispute Panel recognized by the AEWC, or that otherwise wishes to seek the assistance of the AEWC in addressing a possible violation, the President and/or Commissioner of the local WCA regarding a possible violation of the Management Plan shall be submitted to the AEWC Board of Commissioners through the AEWC Office.

SUBSECTION 100.30 AEWC BOARD OF COMMISSIONERS REVIEW AND HEARING PROCEDURES

(a) Upon receipt of a notice of determination made under Subsection 100.29(a), the AEWC Board of Commissioners shall review all documentation related to the incident of violation and the recommended penalty. If for any reason, the Commissioners disagree with the determination of the local WCA or the proposed penalty, the matter shall be returned to the local WCA with recommendations for further action.

(b) In all cases, the AEWC Board of Commissioners retains the authority to impose a penalty for violation beyond the recommendations of a local WCA.

(c) Upon receipt of a notice of possible violation made under Subsection 100.29(b), the AEWC staff shall gather the following information:

(1) the names of the captain and all crew members involved in the incident, and the names of all the other crews and community members who witnessed the incident;

(2) the captain's completed harvest report.

(3) If eyewitness testimony is to be provided to the Board of Commissioners by witnesses who will be unable to testify at the Board of Commissioners' hearing, staff shall gather sworn affidavits prepared by those individuals.

(4) If the possible violation involved a whale thought to be a calf, the captain and crew shall provide the AEWC staff with one full piece of baleen from the tip to the upper jawbone taken from the middle of the rack. The baleen shall be sent with a sworn statement from the Officers of the local WCA attesting that it is from the whale in question that is thought to be a calf.

(d) For incidents occurring during the spring harvest, the review of the local WCA determination or the hearing, when necessary, shall be held during the same year at the Second Quarterly meeting of the AEWC Board of Commissioners. For incidents occurring during the fall harvest, a review of determination or hearing shall be held at the following year's First Quarterly meeting of the AEWC Board of Commissioners.

(e) The Board of Commissioners may schedule an emergency hearing if deemed necessary based on the nature of any reported violation.

(f) Testimonial evidence considered during a hearing shall be provided by the captain in-person; testimony of crew members and other witnesses shall be by teleconference or sworn affidavit.

(g) Upon final determination of a violation and imposition of penalty, the AEWC shall issue a certified letter to the whaling captain, with copies to the local WCA President and Commissioner, identifying the penalty and outlining the imposition of penalties.

SUBSECTION 100.31 IMPOSITION OF PENALTIES

(a) Whaling captains and crew members whom the AEWC Board of Commissioners determines have violated the regulations contained in Subsections 100.24(a)-(d) and/or 100.26, after opportunity for a hearing as set forth in Subsection 100.29, shall be subject to the following penalties:

(1) Denial of participation in the harvest for a period of not less than one year and not more than five years, and a fine of not less than $2500 and not more than $10,000;

(2) For repeat offenses, any offense found to have been intentional, or any offense involving negligent disregard for these management regulations or the management authority of the AEWC, denial of participation in the harvest of not less than [5 years] and a fine of not less than [$10,000];

(3) For a any offense otherwise involving gross disregard for these management regulations or the management authority of the AEWC, a lifetime ban on registration as an AEWC whaling captain.

(4) The take of a fall calf found by the AEWC Board of Commissioners to be unintentional shall not be subject to penalty.

SUBSECTION 100.32 APPEAL OF AEWC DECISIONS

(a) Any captain subject to the imposition of penalties under this Management Plan may appeal the finding to the AEWC Board of Commissioners.

(b) A notice of request for appeal shall be submitted to the AEWC office in writing and shall set forth an explanation of the bases of the appeal.

(c) A decision of the AEWC Board of Commissioners on an appeal shall be final and not subject to further appeal.

It is the responsibility of the whaling captains/crew to report to the Commissioner of their village on a daily basis when they are whaling. The Commissioners then reports to the AEWC Central Office in Barrow. The AEWC office takes a report, which they pass on to the National Marine Fisheries Service (NMFS) office in Anchorage. Following completion of the season, the AEWC office then submits a final report to the U.S. Department of Commerce in Washington, D.C.

ALASKA ESKIMO WHALING COMMISSION
BOWHEAD WHALE HUNT
MANAGEMENT REPORTING PROCEDURES

VILLAGE WHALING CAPTAINS
REPORT TO THE

VILLAGE AEWC COMMISSIONER
WHO REPORTS TO THE

AEWC OFFICE IN BARROW
WHO REPORTS TO THE

NATIONAL MARINE FISHERIES SERVICE
(Anchorage, Alaska)
WHO REPORTS TO THE

UNITED STATES DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
(Washington, D.C.)

8.4 Endangered Species Consultation Letters

8.4.1 U.S. Fish & Wildlife

United States Department of the Interior
U.S. FISH AND WILDLIFE SERVICE
Fairbanks Fish and Wildlife Field Office
101 12th Avenue, Room 110
Fairbanks, Alaska 99701
May 14, 2018

Carolyn Doherty
Foreign Affairs Specialist
NOAA Fisheries
U.S. Department of Commerce

Re: Section 7 Endangered Species Act determination for Draft EIS for issuing annual catch limits to the Alaska Eskimo Whaling Commission for a subsistence hunt on bowhead whales for the years 2019 – 2025.

Dear Ms. Doherty:

Thank you for inquiring about endangered and threatened species and critical habitats pursuant to section 7 of the Endangered Species Act of 1973 (ESA), as amended.

THE PROPOSED ACTION

The National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) proposes to issue annual catch limits to the Alaska Eskimo Whaling Commission (AEWC) to allow continuation of subsistence harvest of bowhead whales from the Western Arctic stock from 2019 – 2025, under the Whaling Convention Act (WCA) and the Cooperative Agreement with the Alaska Eskimo Whaling Commission (AEWC), and subject to International Whaling Commission (IWC)-set catch limits. Eleven Alaskan Native coastal villages along this migratory route participate in traditional subsistence hunts of these whales: Gambell, Savoonga, Little Diomede, and Wales (on the Bering Sea coast); Kivalina, Point Hope, Point Lay, Wainwright, and Utqiaġvik (on the coast of the Chukchi Sea); and Nuiqsut and Kaktovik (on the coast of the Beaufort Sea).

The purpose of this action is twofold: (1) to manage the conservation and sustainable subsistence utilization of the Western Arctic stock of bowhead whales (as required under the International Convention for the Regulation of Whaling (ICRW), the Whaling Convention Act (WCA), the Marine Mammal Protection Act, and other applicable laws), and (2) to fulfill the Federal Government's trust responsibility to recognize the cultural and subsistence needs of Alaska Natives.

NMFS proposes to permit the AEWC an annual strike limit of 67 bowhead whales, not to exceed a total of 336 landed whales over any 6-year period, with unused strikes from

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previous years carried forward and added to the annual strike quota of subsequent years (subject to limits), provided that no more than 50 percent of the annual strike limit is added for any one year. This alternative would maintain the status quo for any 6-year period with respect to management of the hunt for landed whales and employ the Commission's agreed-upon 50 percent carryover principle.

THE ACTION AREA

The action area includes the communities of Gambell, Savoonga, Little Diomede, and Wales (on the Bering Sea coast); Kivalina, Point Hope, Point Lay, Wainwright, and Utqiaġvik (on the coast of the Chukchi Sea); and Nuiqsut and Kaktovik (on the coast of the Beaufort Sea), and the hunting areas the vessels utilize within the Beaufort, Bering and Chukchi seas (Figures 1 – 3).

EFFECTS OF THE ACTION

Effects to eiders

The bowhead whale hunt occurs as spectacled and Steller's eiders are migrating north and east in spring leads, and also during fall migration as birds migrate west and south along the coast. Subsistence whaling activities may disturb migrating or marine-feeding listed eiders, but any disturbance by boats or hunting camps will be temporary, as individual birds are unlikely to spend Jong periods of time in the area, and activities will cease once whales are harvested. We recognize that subsistence bird harvest can occur during the whale hunt, and listed and candidate species, which are closed to harvest under the Migratory Bird Treaty Act, are sometimes inadvertently or intentionally taken during these hunts. However, we have no evidence that whaling activities would increase the total amount of take of listed species above that which would occur in the absence of whaling. Additionally, take of listed avian species is considered in a separate Biological Opinion on the Migratory Bird Subsistence Harvest Regulations annually promulgated by the U.S. Fish and Wildlife Service (Service).

In summary, we expect that subsistence whaling activities under the proposed quota would have, at most, an insignificant *additional* effect on listed and candidate avian species.

Spectacled eider designated critical habitat

Whaling may occur in portions of spectacled eider wintering critical habitat south of St. Lawrence Island. We do not expect whaling activities to cause physical changes to the primary constituent elements (PCEs), namely the biota of the water column and benthic substrate. While most of the spectacled eiders will have left the wintering area by the time whaling commences, whaling activities may affect the ability of any remaining spectacled eiders to access PCEs in portions of the critical habitat because the presence of vessels may temporarily deter eiders from using localized areas; however, this effect would be minor and temporary. Therefore, we expect that the activities would have, at most, an insignificant effect on designated critical habitat.

Polar bear

On May 15, 2008, the polar bear was listed as threatened (73 FR 28212). The proposed activities could temporarily disrupt the normal behavior of polar bears encountering such activities. It is possible that polar bears would be encountered by hunting crews in boats or on land or sea ice camps during whaling activities, particularly in the spring, as polar bears use open water leads for foraging. Polar bears are occasionally harvested in conjunction with whaling activities; however, separate subsistence polar bear hunts are conducted in several Native communities, and we have no evidence to suggest that polar bear harvest increases as a result of the whale hunt.

Polar bears disturbed on land or sea ice by boats or hunters on foot may run and/or enter the water and start swimming; this temporary change in behavior may cause a limited amount of stress. Evidence that bears can be re-sighted during repeated surveys in one fall season indicates that most of these disturbances are likely to be temporary (e.g., likely lasting a few moments up to five minutes; T. Evans 2011, MMM, pers. comm.); thus, we expect that polar bears would resume previous behaviors once the source of disturbance leaves the area. Polar bears first encountered while swimming will likely continue to swim with minimal effects from passing boats. Due to the temporary nature of the disturbance, we expect that whale hunting activities would have, at most, an insignificant effect on polar bears.

Polar bear critical habitat

The Service designated critical habitat for polar bears on November 24, 2010 (75 FR 76086). Proposed activities may occur within the no-disturbance zone of barrier island habitat (Unit 3) and on the sea ice (Unit 1). Subsistence whaling activities are unlikely to affect the Primary Constituent Elements (PCEs) and associated features that make designated critical habitat valuable to polar bears, but the activities may affect polar bear critical habitat either by causing disturbance or disrupting movements of polar bears, thereby interfering with the capacity of the critical habitat areas to provide their intended function. Noise and human activity resulting from subsistence whale harvest and associated camping may temporarily deflect polar bears from natural paths of travel. Areas with these disturbances may be temporarily unavailable to polar bears, but these impacts would be short term over a small spatial scale. The whale hunt does not occur during the denning season; therefore disturbance would not affect the ability of bears to use critical habitat for denning. Thus, disturbance from the proposed action is expected to have a minor effect, if any, on the capability of bears to use critical habitat and disturbance effects on the value of critical habitat are expected to be minimal. We believe that the proposed action would have, at most, an insignificant effect on critical habitat.

Short-tailed albatross

The short-tailed albatross is listed under the Endangered Species Act as Endangered throughout its range (65 FR 46643) on July 31, 2000. Short-tailed albatrosses forage widely across the temperate and subarctic North Pacific, and can occur in the Bering Sea in June. When feeding, albatrosses alight on the ocean surface and seize their prey, including squid, fish, and shrimp. If, in the unlikely event a foraging short-tailed albatross were to encounter whaling vessels, we expect the albatross would easily avoid the vessel. Additionally, this species does not breed in the proposed project area; therefore, we expect the proposed action would not affect short-tailed albatross.

Summary

We conclude that the proposed action is not likely to adversely affect listed species or designated critical habitat under the Service's jurisdiction. Thank you for your cooperation in meeting our joint responsibilities under the Act. If you need further assistance, please contact Amal Ajmi at (907) 456-0324.

Sincerely,

Ted Swem
Endangered Species Coordinator

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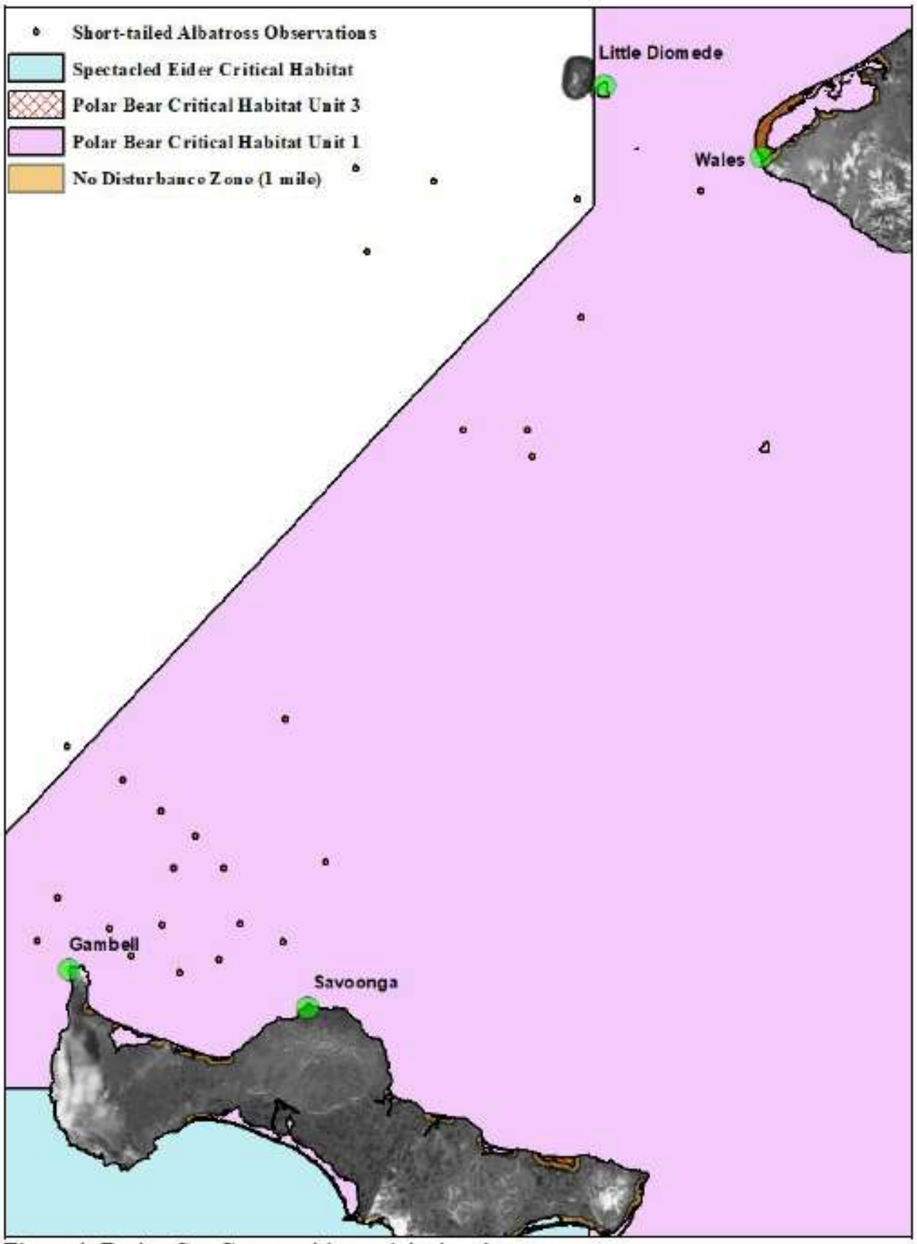

Figure 1. Bering Sea Communities and Action Area.

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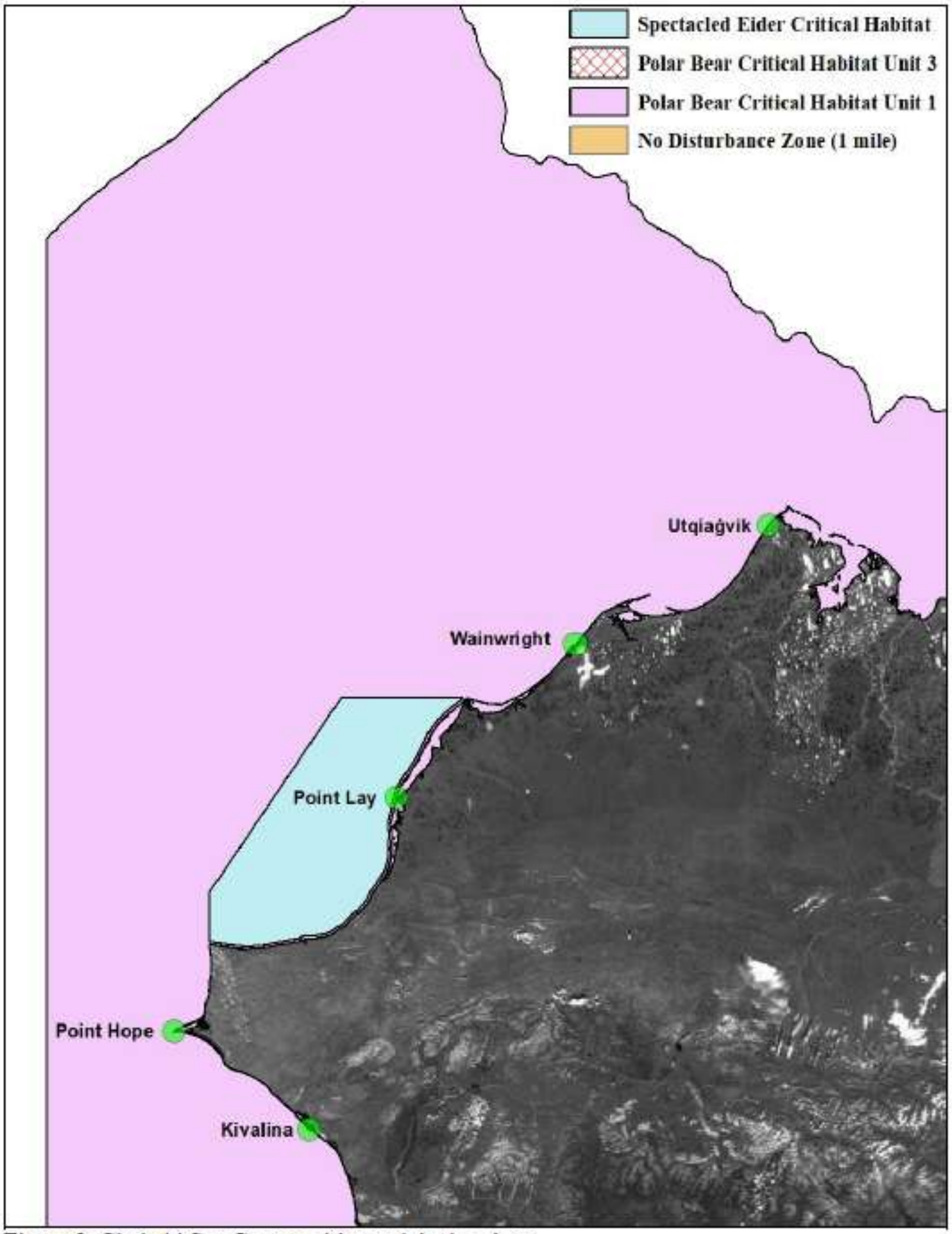

Figure 2. Chukchi Sea Communities and Action Area.

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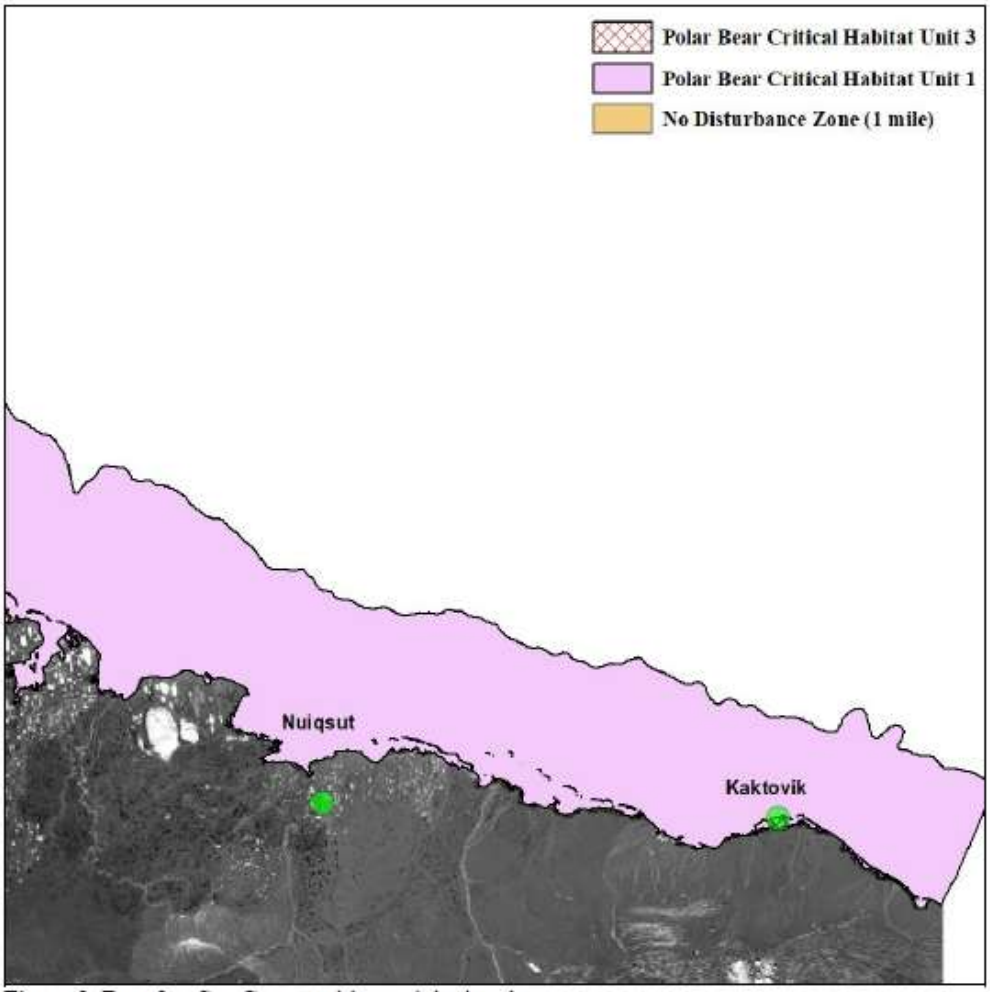

Figure 3. Beaufort Sea Communities and Action Area.

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8.5 Mailing List

8.5.1 U.S. Congress Members

Senator Lisa Murkowski
Senator Dan Sullivan
Representative Don Young

8.5.2 Government Agencies

U.S. Environmental Protection Agency, Region 10

Jennifer Curtis, Alaska Operations Office

U.S. Fish and Wildlife Service

Robert J. Henszey, Ph.D., Branch Chief, Planning and Consultation
Amal Ajmi, Fish & Wildlife Biologist, Planning and Consultation
Ted Swem, Endangered Species Coordinator, Fairbanks Fish and Wildlife Field Office

Alaska Department of Fish & Game

Lori Quakenbush, Arctic Marine Mammal Program

Marine Mammal Commission

Peter Thomas, Executive Director

National Oceanic and Atmospheric Administration (NOAA)

Roger Eckert, Fisheries and Protected Resources Section, NOAA Office of the General Counsel

NOAA Fisheries / National Marine Fisheries Service (NMFS)

Dr. Doug DeMaster, Science and Research Director, Alaska Region
Ryan Wulff, Assistant Regional Administrator and Acting U.S. Commissioner to the IWC, Sustainable Fisheries Division, West Coast Region

Carolyn Doherty, Office of International Affairs and Seafood Inspection
Kim Shelden, Marine Mammal Laboratory, Alaska Fisheries Science Center
Greg Balogh, Alaska Region Protected Resources Division
Dr. Shannon Bettridge, Marine Mammal and Sea Turtle Conservation Division Office of Protected Resources
Dr. Robyn Angliss, Marine Mammal Laboratory, Alaska Fisheries Science Center
Jon Kurland, Alaska Region Protected Resources Division

U.S. Department of State

Elizabeth Phelps, Office of Ocean and Polar Affairs, Bureau of Oceans and International Environmental and Scientific Affairs

8.5.3 North Slope Borough

Mayor Harry K. Brower, Jr.
Taqulik Hepa, Director, Department of Wildlife Management

8.5.4 Tribal and Native Organizations

George Edwardson, President, Inupiat Community of the Arctic Slope
Josiah B. Patkotak, Vice President, Inupiat Community of the Arctic Slope

8.5.5 Other Native Groups

Alaska Eskimo Whaling Commission

Arnold Brower, Executive Secretary
Jessica S. Lefevre, Counsel

Alaska Beluga Whale Committee

Willie Goodwin, Chairman
Robert Suydam, North Slope Borough Department of Wildlife Management

8.5.6 Non-Governmental Organizations

Animal Welfare Institute

D.J. Schubert, Wildlife Biologist

Whale and Dolphin Conservation Society

Sue Fisher, Policy Director, WDCS North America

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9.0 INDEX

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