2019-2020 CITY OF KETCHIKAN
ROCK PINNACLE REMOVAL

Marine Mammal Monitoring & Mitigation Program Final Report

National Marine Fisheries Service

Prepared for

National Marine Fisheries Service, Alaska Region
Protected Resources Division
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ACRONYMS AND ABBREVIATIONS

4MP	Marine Mammal Monitoring and Mitigation Program
BiOp	Biological Opinion
DA	Department of the Army
dB re 1 µPa	decibels referenced to one microPascal
hr	hour
IHA	Incidental Harassment Authorization
km	kilometers
L_{pk}	peak level
m	meter
min	minute
MMPA	Marine Mammal Protection Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
PM	Project manager
PSO	Protected Species Observer
PTS	Permanent Threshold Shift
QA/QC	Quality analysis and quality control
s	seconds
SEL	sound exposure level
SOP	Standard Operating Procedures
SPL	sound pressure level
USACE	United States Army Corps of Engineers

EXECUTIVE SUMMARY

J.E. McAmis contracted Fairweather Science, LLC (Fairweather Science) to implement the Marine Mammal Monitoring and Mitigation Program (4MP) during the 2019-2020 City of Ketchikan Rock Pinnacle Removal Project (hereafter, Ketchikan Rock Pinnacle Project) for blasting- and dredging-related operations within an area of approximately 0.003 square kilometers (km^2) in the Tongass Narrows, Alaska.

Marine mammal observation occurred during activities specified in the Incidental Harassment Authorization (IHA) issued by the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) on July 18, 2019, and the Department of the Army (DA) permit issued by the U.S. Army Corps of Engineers (USACE) on July 19, 2019. The DA permit includes the NOAA NMFS Biological Opinion (BiOp), dated July 16, 2019. The Ketchikan Rock Pinnacle Project commenced on December 17, 2019 and concluded on January 21, 2020.

Blasting activities occurred from December 17, 2019 to January 13, 2020; fifteen days of single-blast detonations occurred within this timeframe. Five vessels operated during blasting activities, including; one barge, two crew vessels, and two tugs. Three Protected Species Observers (PSOs) observed continuously for at least 30 minutes (min) prior to each blast, and at least 1 hour (hr) after each blast. Two PSOs were stationed on land, and one PSO observed from the barge.

Dredging activities occurred from January 13-20, 2020. Seven vessels operated during dredging activities, including; two barges, two crew vessels, and three tugs. Onsite PSOs were not required for this Project component; barge personnel received training from the Lead PSO and observed for the presence of marine mammals within 10 meters (m) of dredging activities. The Lead PSO provided remote support and marine mammal monitoring data management during dredging operations.

The total on-effort PSO monitoring time was 76.2 hr; PSOs recorded 31.2 hr of pre-blast observation time and 45 hr of post-blast observation time. A total of 33 sightings (i.e., groups) of approximately 37 individual animals were observed by PSOs from December 17, 2019 to January 13, 2020 (Table 1). Harbor seals were the most frequently observed species, followed by Steller sea lions. Per the DA permit, PSOs recorded all sightings of dead fish present in the Project area during blasting activities. A total of four sightings of six total dead fish were observed (Table 2). No marine mammals were observed during dredging operations.

Mitigation measures identified in the IHA were incorporated into PSO field protocol for implementation during the Project. Prior to the start of blasting operations, PSOs observed a series of species-specific zones (Section 2.2) for 30 min in order to request delays to blasting if a marine mammal was present in a shutdown zone. During the Ketchikan Rock Pinnacle Project, 17 marine mammal sightings were observed prior to the blast, none of which resulted in a shutdown or work delay. One marine mammal sighted prior to blast detonation was observed within its species-specific shutdown zone (Section 4.4). Sixteen marine mammal sightings were observed post-blast. Two marine mammals recorded after blast detonation were observed within their species-specific shutdown zones (Section 4.4).

As required by NMFS, monthly (two total) reports were submitted during the Project. The reports summarized completed and ongoing operations, monthly and cumulative numbers of marine mammal and dead fish sightings, and number and type of mitigation measures implemented. This report, submitted to NMFS within 90 days of the Project completion date (January 20, 2020), presents a summary of information requested in the IHA, as well as the BiOp, and/or the USACE permit for the Ketchikan Rock Pinnacle Project.

Table 1. Summary of Marine Mammal Sightings, Shutdowns, Level A Exposures, and Level B Exposures during the Ketchikan Rock Pinnacle Project.

Marine Mammal Species	No. of Sightings[1]	Estimated No. of Individuals[2]	No. of Shutdowns/ Delays	No. of Project Level A Exposures	No. of Allowable Project Level A Exposures	No. of Project Level B Exposures	No. of Allowable Project Level B Exposures
Humpback whale	1	1	0	0	0	0	Hawaii DPS – 31 Mexico DPS – 2
Gray whale	0	0	0	0	0	0	10
Minke whale	0	0	0	0	0	0	20
Killer whale	0	0	0	0	0	0	70
Harbor porpoise	0	0	0	0	25	0	50
Dall's porpoise	0	0	0	0	30	0	50
Pacific white-sided dolphin	0	0	0	0	0	0	150
Steller sea lion	11	12	0	0	0	0	500
Harbor seal	21	24	0	0	100	0	450
Other	0	0	0	0	NA	0	NA
Unidentified marine mammal	0	0	0	0	NA	0	NA
Unidentified pinniped	0	0	0	0	NA	0	NA
Total	**33**	**37**	**0**	**0**	**NA**	**0**	**NA**

[1]One sighting equals one group.

[2]Totals do not include individuals from re-sightings.

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Table 2. Summary of Dead Fish Sightings During the Ketchikan Rock Pinnacle Project.

Date	Time	Activity	No. of Dead Fish	Estimated Species
2019-12-17	12:15	POST-BLAST	3	Rockfish
2019-12-18	13:00	PRE-BLAST	1	Flounder
2019-12-18	13:30	POST-BLAST	1	Rockfish
2019-12-19	12:30	POST-BLAST	1	Salmonid
TOTAL	-	-	**6**	-

1.0 INTRODUCTION

NOAA NMFS issued an IHA to the City of Ketchikan on July 18, 2019, under the authority of Section 101(a)(5)(D) of the Marine Mammal Protection Act (MMPA) (16 U.S.C. 1361 *et seq.*) for work proposed to occur during 2019 and 2020 in Tongass Narrows, Alaska. This authorization allowed the City of Ketchikan to harass small numbers of marine mammals, by Level A and B acoustic harassment, incidental to the Ketchikan Rock Pinnacle Project that commenced on December 17, 2019 and concluded on January 21, 2020. The IHA authorized a small number of takes for the following species: gray whale (*Eschrichtius robustus*), minke whale (*Balaenoptra acutorostrata*), humpback whale (*Megaptera novaeangliae*), killer whale (*Orcinus orca*), harbor porpoise (*Phocoena phocoena*), Dall's porpoise (*Phocoenoida dalli*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), Steller sea lion (*Eumetopias jubatus*), and harbor seal (*Phoca vitulina richardsi*).

Marine mammal observation occurred during activities specified in the IHA, and the DA permit issued by the USACE on July 19, 2019. The DA permit included the NOAA NMFS BiOp, dated July 16, 2019. As specified in the DA permit, PSOs recorded all sightings of dead fish present in the Project area during blasting activities.

The Ketchikan Rock Pinnacle Project was located in the Tongass Narrows in Ketchikan, southeast Alaska (Figure 1). The blasting and dredging work occurred between Berths I and II of the Ketchikan cruise ship docks, approximately 200 m offshore. Blasting activities commenced on December 17, 2019, and the final blast was conducted on January 13, 2020; a total of 15 blasts, one per day, were detonated. Five vessels operated during Project blasting activities, including; one barge, two crew vessels, and two tugs. Dredging activities commenced on January 13, 2020 and concluded on January 20. Seven vessels operated during Project dredging activities, including; two barge vessels, two crew vessels, and three tugs.

The specific objectives of the monitoring and mitigation program, as outlined in the 4MP provide:

- the basis for real-time mitigation, as required by the various permits;
- the information needed to estimate the number of "takes" of marine mammals by harassment, which must be reported to NMFS;
- data on the occurrence, distribution, and activities of marine mammals in the areas where the permitted activity was conducted; and,
- information to compare the distances, distributions, behaviors, and movements of marine mammals relative to the permitted activities.

This report presents the final marine mammal data and findings from the Ketchikan Rock Pinnacle Project, and includes information on operations, marine mammal and dead fish monitoring and sightings, and mitigation measures implemented. Complete data fields are provided in Appendix A, and Appendix B contains effort and marine mammal sighting forms. An overview of marine mammal sighting data is provided in Appendix C. Our complete master effort and sightings dataset is available in Excel form, upon request. Appendix D contains an example marine mammal stranding report form.

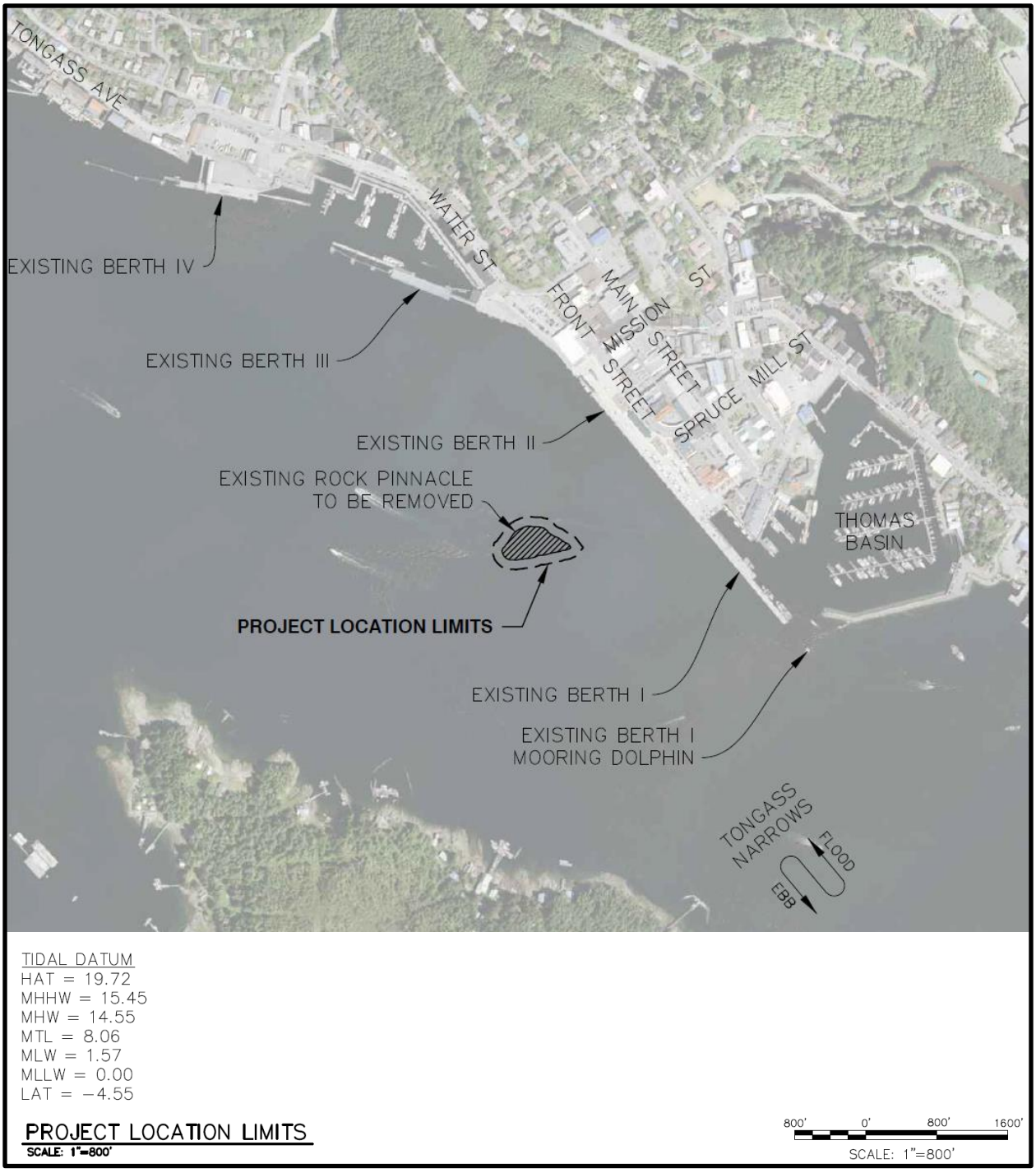

Figure 1. Ketchikan Rock Pinnacle Project area (source: DA permit No. POA-1922-00022-M26).

1.1 DESCRIPTION OF ACTIVITIES

The City of Ketchikan performed blasting and dredging operations to remove an existing rock outcrop (i.e., rock pinnacle), in close proximity to Berth II of the Ketchikan cruise ship dock to expand the area of safe navigation depths for cruise ships that presently visit Berths I and II. The Project site was located at Latitude 55.3392º N, Longitude 131.6494º W. The rock pinnacle measured approximately 97.5 m by 45.7 m by 1.2 m.

A general outline of the Project's timeline is provided in Table 3. Prior to the Project start, a kickoff meeting was held on December 12, 2019 in Ketchikan, Alaska, that was attended by representatives from Moffatt & Nichol, the City of Ketchikan, J.E. McAmis, B.E. Consultants, Contract Drilling and Blasting, Fairweather Science, Olson Marine, and Northwest Hydro. On December 12 and 13, the Fairweather Science Project Manager (PM) and Lead PSO held pre-Project meetings with the PSO team to distribute field gear, address any remaining questions regarding Project permits and the 4MP, and review marine mammal identification and sighting cues.

The Ketchikan Rock Pinnacle Project commenced on December 17, 2019 with blasting operations, during which three PSOs monitored the Project area. One test blast was conducted per day between December 17-20 for a total of four blasts during the month of December 2019. One partial-strength blast was conducted on December 17, and the first full-strength blast was performed on December 18. Additional full-strength blasts occurred on December 19 and 20. The Project team and PSOs demobilized for a holiday break which lasted from December 21, 2019 to January 2, 2020. Production blasting operations recommenced on January 3, 2020 and continued through January 13. One full-strength production blast was conducted per day for a total of 11 blasts during the month of January 2020. After the final production blast was conducted on January 13, the PSOs demobilized for the remainder of the Project. The Lead PSO maintained contact with J.E. McAmis personnel for marine mammal data management purposes, and distributed weekly marine mammal data updates. The Fairweather Science PM continued attendance of weekly teleconferences to provide marine mammal sightings updates. Dredging operations occurred from January 13-20, 2020, and removed a total of 4,410 cubic meters (m^3) of material from the Project area. The final bathymetric survey of the area was taken on January 21; upon removal of the rock pinnacle the ocean bottom depth in the Project area was reduced to approximately -12.8 m.

Table 3. General Timeline of Events During the Ketchikan Rock Pinnacle Project.

Date	Activity
December 12, 2019	Kickoff meeting in Ketchikan, AK.
December 17-20, 2019	Project commenced. Test and production blasts conducted.
December 21, 2019 – January 2, 2020	Holiday break.
January 3-13, 2020	Production blasts conducted
January 13, 2020	PSOs demobilized, Lead PSO provided remote data support for rest of Project.
January 13-20, 2020	Dredging operations.
January 21, 2020	Final bathymetry, Project conclusion.

1.1.1 Vessels

Five Project vessels operated during blasting; one barge conducted production blasting in the Project area, two crew vessels were on site during the 30-min pre-blast marine mammal clearing period to provide general vessel clearance and pre-blast notification for other vessels in the area, and; two tugs were on site to move the work barge into position. Additionally, a sixth vessel was onsite during blasting operations between December 17-20; this survey vessel collected sound information from the test blasts for analysis. Seven Project vessels operated during dredging; two barge vessels (one drill barge and one dredge scow) supported dredging operations; two crew vessels provided general area clearance, and; three tugs were onsite to move the barge vessels into position.

2.0 MARINE MAMMAL MONITORING AND MITIGATION PROGRAM

The IHA authorized small numbers of takes (Table 1), by Level A and Level B harassment, for 9 NMFS-managed marine mammal species. Other species of marine mammals were recorded, if observed. As specified in the DA permit, PSOs recorded all sightings of dead fish present in the Project area during blasting activities.

The Ketchikan Rock Pinnacle Project utilized vessel and land-based PSOs for marine mammal monitoring and mitigation, and dead fish observation, during blasting. The PSO team had two primary objectives:

1. **Monitoring**: Record numbers, behaviors, and proximity to blast zone for marine mammal sightings during monitoring. Document animal reactions (when applicable), and environmental variables that may affect the ability to sight marine mammals.
2. **Mitigation**: Initiate necessary communication and mitigation protocols, including work shut down or request additional zone clearing time, for marine mammals within, or about to enter, the applicable zones.

PSOs were not required during dredging activities; the Lead PSO provided J.E. McAmis personnel basic training in basic marine mammal observation and data collection for the purpose of documenting marine mammal sightings within the shutdown zone (Section 2.1.1).

2.1 VISUAL OBSERVATIONS

During blasting operations, three PSOs monitored for marine mammals and dead fish during daylight hours in accordance with all permits and the blasting schedule. Two PSOs were stationed on land (Figure 2); one PSO was stationed at a "North Dock" location (Figure 3), at the end of Berth IV at the Ketchikan cruise ship dock, approximately 600 m southwest of the blast zone; the second PSO was stationed at a "South Dock" location (Figure 4), at the end of Berth I of the Ketchikan cruise ship dock, approximately 400 m southeast of the blast zone. The land-based PSOs were stationed approximately 1,000 m apart to capture the full visible range required to monitor the largest shutdown zone (1,500-m radius, Section 2.2). The Lead PSO was stationed on the barge (Figure 5) from which blasting operations occurred. All necessary security clearance measures were completed prior to the Lead PSO boarding the barge.

All three PSOs were equipped with 7x50 Fujinon reticle binoculars, a Bushnell rangefinder, a Canon Powershot camera, Garmin GPS, and a clipboard with rite-in-the-rain datasheets. PSOs remained in contact with each other and the barge personnel at all times via marine radios.

PSOs observed the Project area with the naked eye and binoculars. Observers scanned the area in a systematic manner, searching from left to right and included both far and near fields of view. The barge-based PSO monitored from the best possible vantage points on the vessel, which primarily included the control room situated above the barge deck. PSOs were not on watch for more than a four hr period.

During dredging operations, the barge crew watched for marine mammals within 10 m of the barge (Section 2.2). The Lead PSO remained on remote standby during dredging operations to answer any questions concerning marine mammal sightings.

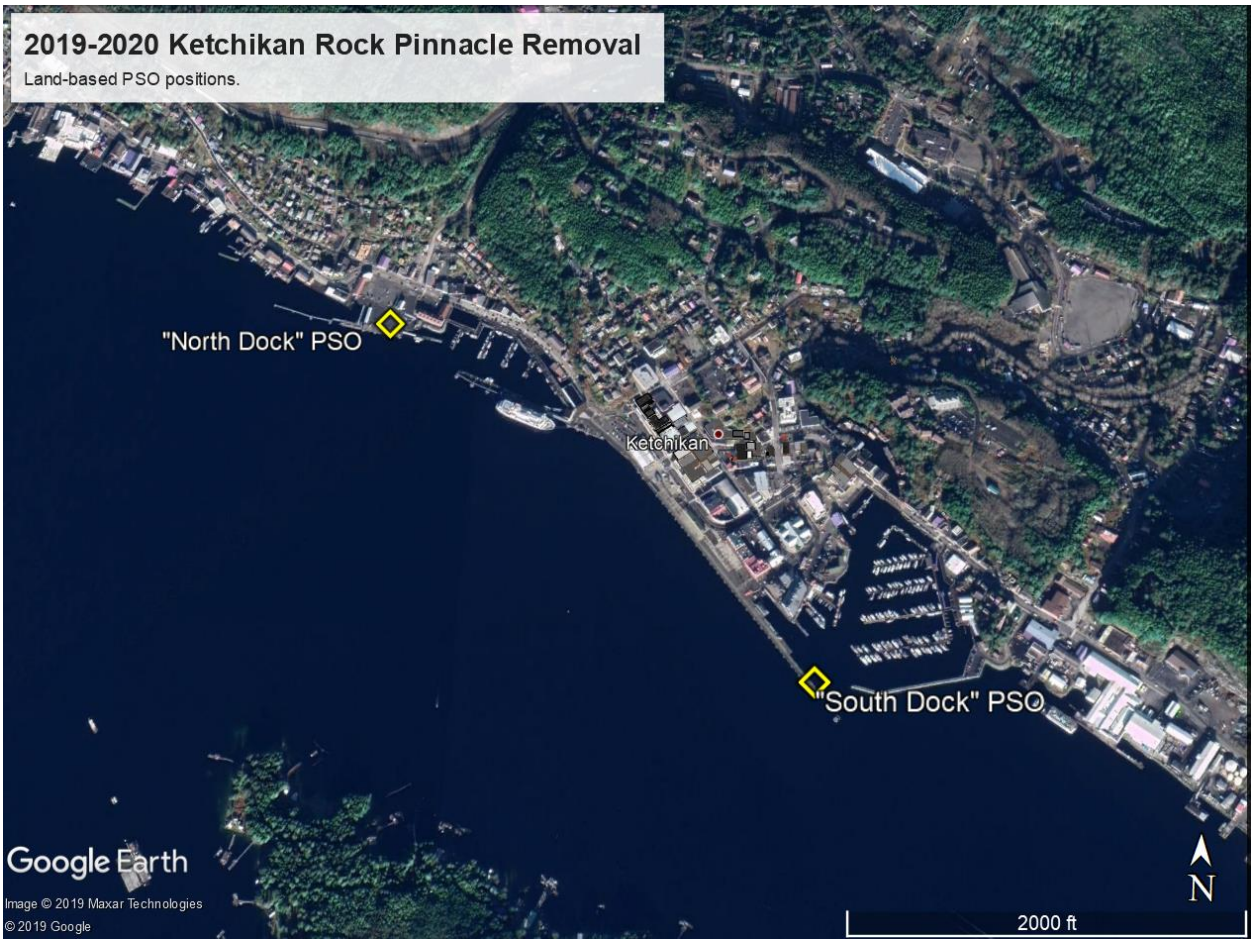

Figure 2. Land-based PSO stations ("North Dock" and "South Dock") for the 2019-2020 Ketchikan Rock Pinnacle Removal Project.

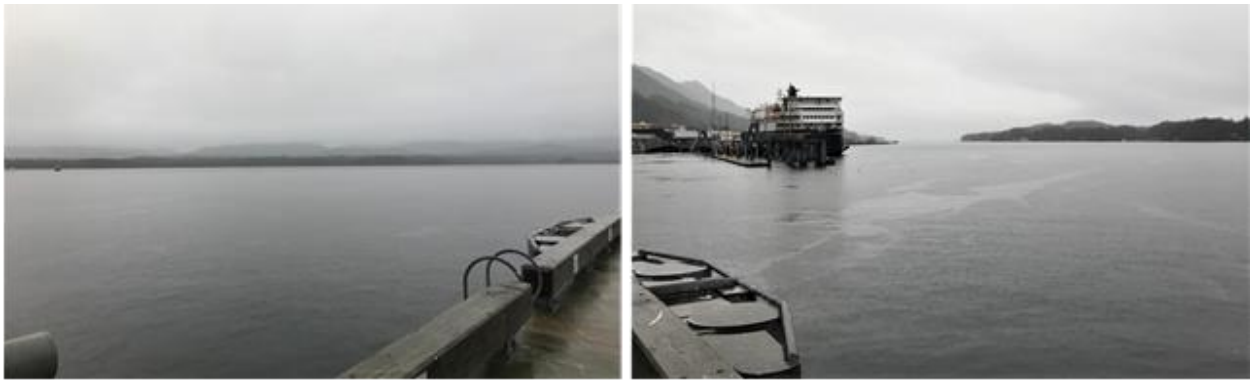

Figure 3. View from "North Dock" PSO observing location on Berth IV of the Ketchikan cruise ship dock: left) view to the southwest, right) view of the blasting area, north.

Figure 4. View from "South Dock" PSO observing location on Berth I of the Ketchikan cruise ship dock: left) view to the southeast, right) view of the blasting area, northwest.

Figure 5. View from the barge PSO observing location: left) view of Berth I to the southeast, right) view of Berth II to the northeast.

2.1.1 Data collection

PSOs collected effort and sightings data to provide a comprehensive account of marine mammal observations (and dead fish sightings, when applicable) in the context of Project activities. Data sheets (Appendix B) printed on Rite-in-the-Rain© paper were used to document all records. This method of data recording was selected due to the expected low frequency of sightings and the lack of shelter or surfaces at the outdoor observing locations.

Each PSO recorded effort data every half hour and upon any change in Project activity or environmental conditions. Marine mammal sightings were recorded immediately upon observation. Confirmed re-sightings of the same individual(s) were recorded using the ID number assigned to the original sighting and with descriptive notes detailing the re-sight. All effort and sighting data fields, units, and descriptions are provided in Appendix A.

Records of dead fish sightings were captured in the notes section in the PSO effort data; see Table 2 for a list of all dead fish sightings observed during the Project. Dead fish sightings were identified to the lowest possible taxonomic group. Fork length was not measured because PSOs could not access the dead fish sightings in a safe or feasible manner.

After the end of each watch period, the Lead PSO transcribed all effort and sightings data into a master Excel database housed on Google Docs. All entries were Quality Assurance/Quality Controlled (QA/QCed) by the Lead PSO and the Fairweather Science PM. The Lead PSO distributed a daily marine mammal and dead fish sightings summary to J.E. McAmis personnel via email, and distributed the up-to-date master database on a weekly basis.

PSOs recorded the initial and secondary behaviors (as applicable) of each marine mammal sighting. The initial behavior was defined as the first behavior that observers noticed upon detecting the marine mammal. Secondary behaviors were additional behaviors observed over the duration of the sighting. Marine mammals were observed until they were no longer in view. PSOs also recorded any potential reactions that marine mammals may have had in response to Project vessels and operations. If the animal did not appear to acknowledge the vessel or ongoing activity, the reaction was coded as no reaction (none). For sightings comprised of more than one animal, the most common behavior of the group was recorded. Effort-specific data, including vessel activity was also recorded at the time of the sighting.

On January 13, prior to dredging operations, the Lead PSO provided J.E. McAmis personnel an overview of marine mammal monitoring methods (e.g., basic ID and sighting cues) for data collection during dredging. J.E. McAmis personnel were instructed to generate a record for all marine mammal sightings within the shutdown zone of dredging operations, and additionally record marine mammal species, location, and any mitigation measures executed. Sighting forms were distributed and remained on board the barge during dredging operations. Each completed sighting form was to be emailed to the Lead PSO at the end of each day by the superintendent for marine mammal data management. The Lead PSO continued to distribute the most current version of the marine mammal database on a weekly basis, via email.

The PSOs and Fairweather Science management team were trained to follow protocol for reporting dead or injured marine mammals as outlined in the IHA (stipulation 6[d]). An example Level A Stranding Report form is provided in Appendix D.

2.2 MITIGATION MEASURES

As outlined in the IHA and BiOp, PSOs established monitoring zones and shutdown zones around the blasting area (Table 4). The zones represented species-specific estimated 160-dB disturbance harassment thresholds for marine mammals, as defined by NMFS. PSOs cleared the zones for 30 min prior to each blast. If any marine mammals were observed within the zones, blasting did not occur until the marine mammal was visually confirmed to have exited the shutdown zone or was not observed for an additional 30 min. The blasting crew sounded alarms 30 min and 15 min prior to each blast, and a 10-second (s) countdown was issued via radio; blasts could be aborted up to 3 s prior to detonation. PSOs observed the Project area for 60 min after the blast; blasting did not occur later than one hour prior to sunset to accommodate post-blast monitoring. All marine mammals observed within the Project area were documented. Additionally, a shutdown zone of 10 m around dredging activities was observed by dredging operators and support crew.

Table 4. Ketchikan Rock Pinnacle Project Marine Mammal Monitoring Zones.

Description	Low frequency cetacean	Mid frequency cetacean, otariid	High frequency cetacean, sea otter	Phocid
Monitoring zone (blasting)	2,500 m	500 m	5,000 m	1,500 m
Shutdown zone (blasting)	1,000 m	100 m	1,500 m	250 m
Shutdown zone (dredging)	10 m	10 m	10 m	10 m

3.0 MARINE MAMMAL MITIGATION AND MONITORING ANALYSIS

This section describes analysis methods for data collected during IHA-specified blasting activities subsequent to the Ketchikan Rock Pinnacle Project. Terminology and definitions used in this section are defined in Table 5. Marine mammal data analysis methods are not described for dredging activity because PSOs were not required for this component of the Project, during which marine mammals were sighted.

Table 5. Definitions of Data Collection and Analysis Terminology.

Pre-blast effort	Periods during which PSOs were on watch prior to blast detonation.
Post-blast effort	Periods when PSOs were on watch subsequent to blast detonation.
Sighting	An observation of one of more marine mammals. One sighting equals one group.
Platform	Type of location where PSOs were stationed, e.g., land, barge.
Group (i.e., sighting)	One or more individuals in close proximity and behaving in a similar manner (e.g., coordinated surfacing, orientation, etc.)
Actual effort	Actual run time (hr:min) during which PSOs were on-watch, accounts for duplication.
Total effort	Total on-watch effort (hr:min); sum of independent watch periods of three PSOs.
Sighting rate	The number of marine mammal groups (or individuals) recorded per hour of observation effort. Sighting rates are calculated during pre- and post-blast effort.

3.1 MONITORING EFFORT AND ENVIRONMENTAL CONDITIONS

Monitoring effort was based on PSO observation effort records and calculated for pre- and post-blast watch periods. Effort by environmental conditions includes the Beaufort sea state and visibility. Beaufort sea state is presented by ranking on a 0-9 scale, and effort by visibility is presented at distances of 0-1.0 km, 1.1-4.0 km, 4.1-7.0 km, and 7.1-10.0 km. Precipitation is displayed as relative frequency. All environmental analyses using effort data were calculated using total PSO effort.

3.2 METHODS FOR CALCULATING EFFORT HOURS

Observation effort hours were calculated on a daily basis and added to a cumulative total. Daily pre- and post-blast observation time was recorded and summed for actual daily effort. The sum was multiplied by three to capture the total PSO effort.

3.3 METHODS FOR CALCULATING SIGHTINGS AND SIGHTING RATES

Marine mammal observations are presented per species as number of sightings (i.e., one sighting equals one group), and estimated number of individuals. Rates were calculated for pre-blast, post-blast, and cumulative time periods. Actual observation effort was used to calculate all sighting rates.

3.4 MARINE MAMMAL BEHAVIOR

Marine mammal movement relative to Project activities, initial and secondary behavior states, and observable reactions were recorded for each marine mammal sighting. These data fields and associated values were consistent with those presented in other marine mammal monitoring and mitigation reports (e.g., Aerts et al. 2008; Blees et al. 2010; Lomac-MacNair et al. 2014).

3.5 NUMBER OF EXPOSURES

Under the MMPA, NMFS defined levels of harassment for marine mammals. Level A harassment is defined as "…any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild." Level B harassment is defined as "…any act of pursuit, torment, or annoyance which 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."

For Level A, the NOAA Technical Memorandum NMFS-OPR provides guidelines for assessing the onset of permanent threshold shifts (PTS) from anthropogenic sound. Under this guideline, marine mammals were separated into five functional hearing groups; source types are separated into impulsive and non-impulsive and require analyses of the distance to the peak received sound pressure level (SPL, L_{pk}) and 24-hr cumulative sound exposure level (SEL_{24h}). Monitoring and shutdown zones (Table 4) were established based on these hearing thresholds and Project sound sources.

3.5.1 Implemented Mitigation Measures

The PSO team developed a Standard Operating Procedures (SOP) document prior to the commencement of the Ketchikan Rock Pinnacle Project. The purpose of the SOP was to provide a brief summary of IHA requirements, marine mammal monitoring zones, and mitigation protocols. The PSO team also created a one-page guide that outlined PSO communication processes and shutdown zones. The documents were distributed to relevant vessel personnel so that all parties maintained a clear understanding of marine mammal-related monitoring and mitigation procedures throughout the duration of the Project.

4.0 RESULTS

The results below provide a summary of data collected while PSOs were on watch, during blasting operations that occurred from December 17, 2019 to January 13, 2020. PSOs were not required for dredging operations that occurred from January 13 to January 20, and marine mammals were not observed during this time; therefore, all results pertain only to PSO effort, marine mammal and dead fish sightings, and environmental conditions recorded during blasting.

4.1 EFFORT AND ENVIRONMENTAL CONDITIONS

4.1.1 Total Monitoring Effort

The total PSO monitoring effort associated with the Ketchikan Rock Pinnacle Project was 76.2 hr, which included 31.2 hr of pre-blast effort and 45.0 hr of post-blast effort (Table 6). Fifteen blasts were detonated during the Project. One partial strength blast and three full-strength blasts were detonated for a total of four blasts in December 2019, and 11 full-strength blasts were detonated in January 2020.

PSO watch periods during December 2019 generally commenced between 11:15 AM and 12:30 PM, and ended between 1:00 PM and 2:05 PM.; PSO watch periods during January 2020 began between 8:08 AM and 12:45 PM, and ended between 9:50 AM and 2:22 PM.

Blast detonation commenced in a productive manner with no delays due to marine mammal presence in the shutdown zones.

Table 6. Total PSO Observation Hours Relative to Blast Detonation.

PSO Watch Relative to Blast	Actual Effort (HH:MM:SS)	Total Effort (HH:MM:SS)
Pre-blast	10:24:00	31:12:00
Post-blast	15:00:00	45:00:00
TOTAL	**25:24:00**	**76:12:00**

4.1.2 Monitoring Effort by Environmental Conditions

The environmental conditions in the Project area were conducive to consistent and successful monitoring efforts. Beaufort sea states ranged from 0-4, and were documented as 3 or less for 97% of the total monitoring effort (Figure 6). Sightability ranged from “Fair” to “Excellent”, and “Good” or “Excellent” was recorded for 76% of the total monitoring effort. Visibility ranged from 0.8-10 km, and a visibility of 3 km or more was recorded approximately 93% of the time (Figure 7). Precipitation occurred during 48% of effort hours (Figure 8) and included primarily snow (24% effort) followed by light rain (12% effort) and drizzle (8% effort).

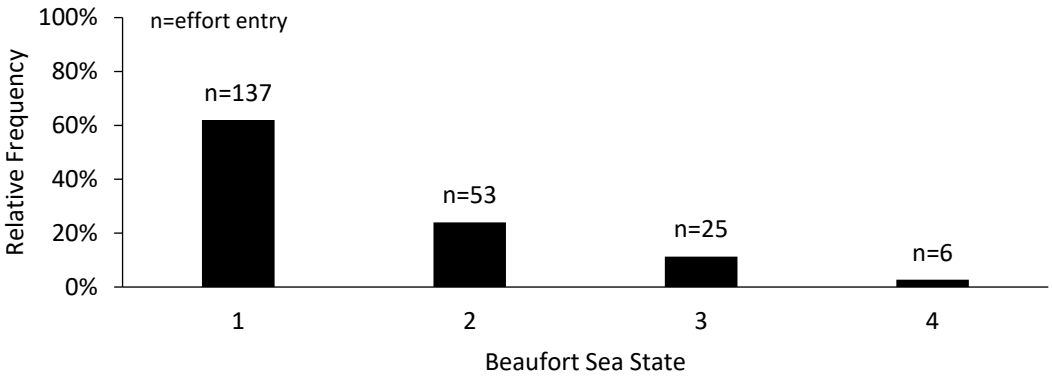

Figure 6. Relative frequencies of Beaufort sea state ratings during the Project.

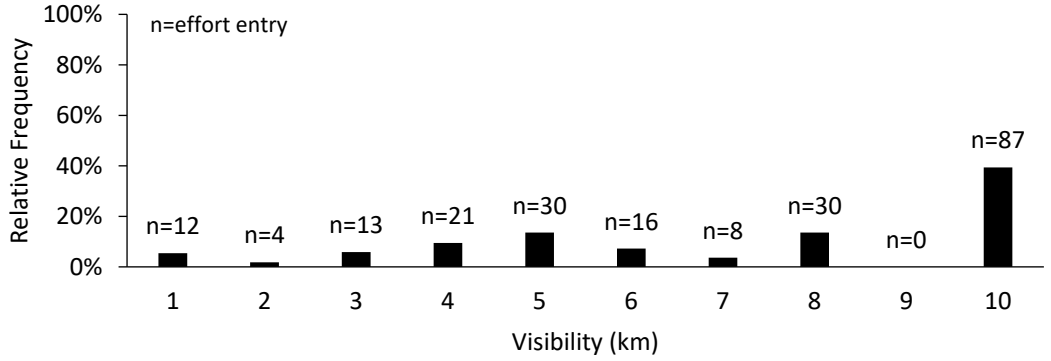

Figure 7. Relative frequencies of visibility distances recorded during the Project.

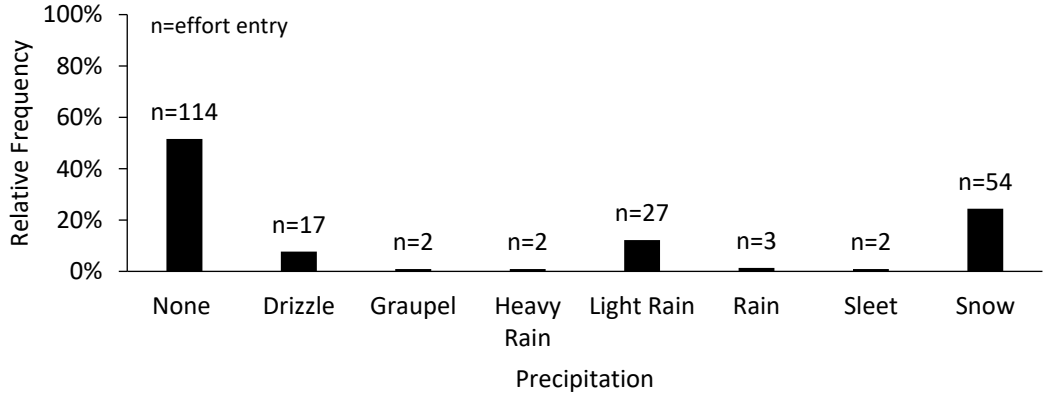

Figure 8. Relative frequencies of precipitation types during the Project.

4.2 MARINE MAMMAL VISUAL OBSERVATIONS

4.2.1 Marine Mammal Sightings

During the Ketchikan Rock Pinnacle Project, PSOs recorded a total of 33 independent marine mammal sightings comprised of 37 individuals (Table 7).

Table 7. Marine Mammal Sightings, Estimated Number of Individuals Observed, and Initial Behaviors Recorded During the Project.

Marine Mammal Species	No. of Sightings[1]	Estimated No. of Individuals[2]	Initial Behaviors
Humpback whale	1	1	Swim
Gray whale	0	0	-
Minke whale	0	0	-
Killer whale	0	0	-
Harbor porpoise	0	0	-
Dall's porpoise	0	0	-
Pacific white-sided dolphin	0	0	-
Steller sea lion	11	12	Look, Snorkle, Swim
Harbor seal	21	24	Look, Mill, Swim
Other	0	0	-
Unidentified marine mammal	0	0	-
Unidentified pinniped	0	0	-
Total	**33**	**37**	**-**

[1]One sighting equals one group.

[2]Totals do not include re-sightings.

Table 8 presents the total marine mammal sightings sighted per platform. Ninety-four percent (94%; n=33) of marine mammal sightings were recorded by PSOs stationed on land, while 6% of sightings were recorded by the PSO stationed on the barge. The majority of sightings occurred in Thomas Basin harbor and Casey Moran City harbor, which were visible from the land-based stations but obscured from the barge field of view.

Table 8. Total Marine Mammal Sightings and Estimated Individual Counts per PSO Platform.

	North Dock		South Dock		Barge		Total	
Species	**No. of Sightings[1]**	**Estimated No. of Individuals[2]**	**No. of Sightings[1]**	**Estimated No. of Individuals[2]**	**No. of Sightings[1]**	**Estimated No. of Individuals[2]**	**No. of Sightings[1]**	**No. of Individuals[1]**
Humpback whale	1	1	0	0	0	0	1	1
Gray whale	0	0	0	0	0	0	0	0
Minke whale	0	0	0	0	0	0	0	0
Killer whale	0	0	0	0	0	0	0	0
Harbor porpoise	0	0	0	0	0	0	0	0
Dall's porpoise	0	0	0	0	0	0	0	0
Pacific white-sided dolphin	0	0	0	0	0	0	0	0
Steller sea lion	4	5	7	7	0	0	11	12
Harbor seal	10	11	9	11	2	2	21	24
Other	0	0	0	0	0	0	0	0
Unidentified marine mammal	0	0	0	0	0	0	0	0
Unidentified pinniped	0	0	0	0	0	0	0	0
Total	15	17	16	18	2	2	**33**	**37**

[1]One sighting equals one group.

[2]Totals do not include individuals from re-sightings.

4.2.1.1 Cetaceans

One sighting of one individual humpback whale was observed during the Project. The whale was observed 47 min post-blast, approximately 75 m from the North Dock PSO location (~600 m from the blast zone) with the naked eye. The PSO indicated that the whale's body was the visual sighting cue, and that the animal was swimming at a slow pace upon initial detection. The animal dove soon after detection and was not sighted again. PSOs reported that the humpback whale did not demonstrate any observable reaction to Project vessel presence.

4.2.1.2 Pinnipeds

Pinnipeds were about equally detected using binoculars and the naked eye. Collectively, pinniped species were sighted between 20 m and 370 m from the PSO platforms, with an average sighting distance of ~154 m, and were sighted between 50 m and 900 m from the blasting zone, with an average of 473 m from the blast zone. Pinnipeds were observed in groups of 1-3 individuals, but sightings were solitary 90% (n=32) of the time. Sighting cues included head and body.

4.2.1.2.1 Behavior

Pinniped initial behaviors recorded during the Ketchikan Rock Pinnacle Project included snorkel, look, swim, and mill (Table 9), with look as the most commonly recorded initial behavior. Secondary behaviors observed included; dive, mill, sink, and swim.

Table 9. Pinniped Sighting Initial Behaviors.

Pinniped Initial Behavior	Percent of Sightings (%)	Number of Sightings
Snorkel	9	3
Look	66	21
Swim	22	7
Mill	3	1
Total	**100**	**32**

Steller Sea Lion

Steller sea lions were detected by the presence of a head (91%; n=11) or body (9%), and look was the most commonly recorded initial behavior (45%). Behaviors were performed at slow to moderate paces. All sightings were solitary with the exception of one group of two animals. Forty-five percent (45%) of Steller sea lion sightings were observed prior to the blast detonation, and 55% of sightings were recorded post-blast. No sightings occurred simultaneously with the blast. A reaction was recorded for one Steller sea lion that was sighted post-blast. The animal was observed approximately 30 m from the barge and 50 m away from the blast zone approximately 6 minutes after the blast was detonated; it looked at the barge and dove in apparent response to patrol boat movement. No mitigation measures were required or implemented.

Harbor Seal

Harbor seal sightings were detected by the presence of a head (100%; n=21), and look was the most commonly recorded initial behavior (76%). Most behaviors occurred at a slow pace (81%).

Most (90%) of sightings were solitary animals, and no juveniles were observed. Fifty-seven percent (57%) of sightings were observed prior to blast detonations, and 43% of sightings were recorded post-blast. No sightings occurred simultaneously to the blast. A reaction was recorded for one harbor seal that was sighted 16 min post-blast. The animal was observed approximately 150 m away from the blast zone; it looked in the direction of the barge then proceeded to swim and resurface in an observably normal manner. No mitigation measures were required or implemented.

4.2.2 Dead Fish Sightings

Per the DA permit, PSOs recorded all sightings of dead fish present in the Project area prior to, during, and after blasting operations. A total of four dead fish sightings (comprised of 6 total fish) were observed during the Ketchikan Rock Pinnacle Project (Table 2), and all sightings occurred in December 2019. Dead fish sightings were identified to the lowest possible taxonomic group, and fork length was not measured because PSOs could not access the dead fish sightings in a safe or feasible manner.

4.2.3 Marine Mammal Sighting Rates

Table 10 presents overall marine mammal sighting and individual animal observation rates, and Table 11 shows sightings per hour and individuals observed per hour for pre- and post-blast effort.

Harbor seal sightings and individual animals were observed at the highest overall rates, followed by Steller sea lions and humpback whales (Table 10). Harbor seals and Steller sea lions were observed at higher rates during pre-blast effort than post blast (Table 11). This, however, may have been influenced by a number of confounding variables such as; occurrence of the blast detonation at varying times of day, weather conditions, and low sample size.

Table 10. Marine Mammal Sighting Rates.

Species	No. of Sightings[1]	Estimated No. Individuals[2]	Sightings/hour	Individuals/Hour
Humpback whale	1	1	0.04	0.04
Gray whale	0	0	0.00	0.00
Minke whale	0	0	0.00	0.00
Killer whale	0	0	0.00	0.00
Harbor porpoise	0	0	0.00	0.00
Dall's porpoise	0	0	0.00	0.00
Pacific white-sided dolphin	0	0	0.00	0.00
Steller sea lion	11	12	0.43	0.47
Harbor seal	21	24	0.83	0.94
Other	0	0	0.00	0.00
Unidentified marine mammal	0	0	0.00	0.00
Unidentified pinniped	0	0	0.00	0.00
Total	**33**	**37**	NA	NA

[1]One sighting equals one group.

[2]Totals do not include individuals from re-sightings.

Table 11. Marine Mammal Sighting Rates During Pre- and Post-blast Effort.

	Pre-blast				Post-blast			
Species[1]	**No. of Sightings[2]**	**Estimated No. Individuals[3]**	**No. of Sightings/hour**	**No. of Individuals/Hour**	**No. of Sightings[2]**	**Estimated No. Individuals[3]**	**No. of Sightings/Hour**	**No. of Individuals/Hour**
Humpback whale	0	0	0.00	0.00	1	1	0.07	0.07
Steller sea lion	5	6	0.48	0.58	6	6	0.40	0.40
Harbor seal	12	13	1.15	1.25	9	11	0.60	0.73
Total	17	19	-	-	16	18	-	-

[1]Includes observed species only. See Table 10 for a complete list of species and overall rates.

[2]One sighting equals one group.

[3]Totals do not include individuals from re-sightings.

While no marine mammals were observed simultaneously to blast detonations, 20 sightings of 23 individual animals were observed within their species-specific Level B zones prior to and following some blasts. Table 12 shows the total daily sighting rates for individual marine mammals observed in Level B zones, by month. Eleven sightings of 12 harbor seals were observed prior to blasts within their species-specific Level B zone (Table 4); these sightings ranged in distances of 360 m to 800 m from the blast area, were recorded between 7 min and 32 min prior to the blast, and were not observed during a blast. One sighting of one individual humpback whale and eight sightings of 10 individual harbor seals were observed in their species-specific Level B zones following blasts. The humpback whale was observed briefly, 55 min post-blast, approximately 75 m away from the North Dock PSO. The harbor seal sightings recorded subsequent to blasts were observed between six and 51 min after blast detonation, between 400 m and 900 m from the blast area.

Table 12. Daily Individual Sighting Rates for Marine Mammals Observed in Level B Zones, by Month.

	December Individuals[1] in the Level B zone[2]	December[3] Level B Zone Individuals/Day	January Individuals[1] in the Level B Zone[2]	January[3] Level B Zone Individuals/Day
Harbor seal	1	0.25	21	1.91
Humpback whale	1	0.25	0	0.00

[1]Includes observed species only. See Table 10 for a complete list of species and overall rates.

[2]Species-specific Level B Zone, see Table 4.

[3]Exercise caution when comparing rates between months due to low sample size, and difference in number of blasting days between months (4 days in December, 11 days in January)

4.3 MARINE MAMMAL EXPOSURES

No marine mammal sightings were recorded simultaneoulsy with blasting operations associated with the Ketchikan Rock Pinnacle Project.

4.4 SUMMARY OF MITIGATION MEASURES

No shutdowns were implemented during the Ketchikan Rock Pinnacle Project, and sightings did not result in delays to operations (Table 13). All marine mammals observed prior to blast detonation were visually confirmed beyond species-specific shutdown zones prior to blast detonation, or 30 min had passed without subsequent detection of the marine mammal within the species-specific shutdown zone. One harbor seal was observed within its species-specific shutdown zone (Table 4) prior to blasting. The animal was last sighted by PSOs at 9:02 AM, and the blast was detonated at 9:50 AM, 48 min later. Two marine mammals were observed within their species-specific shutdown zones subsequent to blast detonation. One harbor seal was observed approximately 150 m from the blast zone 16 min post-blast and remained in the visible area for 44 min, until the PSO observation period had concluded. The second marine mammal was a Steller sea lion that was observed 6 min post-blast, approximately 50 m from the blast zone; the animal milled in the area visible to PSOs for 20 min. Appendix C contains a record of all sighting species, their proximities to the blast zone, and the time of sighting.

Table 13. Number of Mitigation Measures Implemented Per Species for all Marine Mammal Sightings.

Species	Mitigation Measure[1]			
	Shut down	**Delay[2]**	**None**	**Total**
Humpback whale	0	0	1	**1**
Grey whale	0	0	0	**0**
Minke whale	0	0	0	**0**
Killer whale	0	0	0	**0**
Harbor porpoise	0	0	0	**0**
Dall's porpoise	0	0	0	**0**
Steller sea lion	0	0	11	**11**
Harbor seal	0	0	21	**21**
Pacific white-sided dolphin	0	0	0	**0**
Other	0	0	0	**0**
Unidentified marine mammal	0	0	0	**0**
Unidentified pinniped	0	0	0	**0**
Total	**0**	**0**	**33**	**33**

[1]Count refers to sightings, not individuals.

[2]Sightings that result in a delay of operations.

5.0 REFERENCES

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Blees, M.K., K.G. Hartin, D.S. Ireland, and D. Hannay. 2010. Marine mammal monitoring and mitigation during open water seismic exploration by Statoil USA E&P Inc. in the Chukchi Sea, August-October 2010: 90-day Report. LGL Report P1119. Prepared by LGL Alaska Research Associates Inc., LGL Ltd., and JASCO Research Ltd. for by Statoil USA E&P Inc., National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 102 pp., plus appendices.

Lomac-MacNair, K., M.A. Smultea and G. Campbell. 2014. Draft NMFS 90-Day Report for Marine Mammal Monitoring and Mitigation during Apache's Cook Inlet 2014 Seismic Survey, 2 April – 27 June 2014. Prepared for Apache Alaska Corporation, 510 L Street #310, Anchorage AK 99501. Prepared by Smultea Environmental Sciences (SES), P.O. Box 256, Preston, WA 98050.

APPENDIX A. EFFORT AND SIGHTINGS DATA FIELDS

EFFORT		
Field	**Code**	**Definition**
Date	YYYY-MM-DD	Date of entry.
Time	HH:MM	Auto-populated. Time of entry using 24-hr clock.
Latitude	DD.DDDD	Decimal degrees. Location of observer.
Longitude	-DDD.DDDD	Decimal degrees. Location of observer.
PSO	XX	Initials of the PSO recording the data
Location	SD	“South Dock” observing location
	ND	“North Dock” observing location
	BB	“Blasting Barge” observing location
Activity	PRE	PSOs are conducting at least 30 minutes of pre-blast clearing of the shutdown zones.
	POST	PSOs are observing for 1 hour following blast detonation
Effort ID	XX####	Unique effort ID per effort segment, composed of two letters the refer to the PSO location, and consecutive numerals.
Beaufort	0	Sea surface is calm and smooth like a mirror
	1	Scaly ripples, no foam crests
	2	Small wavelets, glassy crests, no breaking waves, cats paw
	3	Large wavelets, crests begin to break, scattered whitecaps
	4	Small waves 1-4 ft becoming longer, numerous whitecaps
	5	Moderate waves 4-8 ft taking longer form, many whitecaps, chance of spray
	6	Larger waves 8-13 ft, white foam crests everywhere, probably spray
	7	Sea heaps up, waves 13-19 ft, white foam streaks off breakers. Sightings are rare in a Bf ≥7 and monitoring is typically suspended.
Visibility (km)	#	Number of kilometers visible to the horizon. Maximum value is 10 km. Use decimals when visibility is less than 1 km (500 m = 0.5 km).
Glare	None	No glare present.
	Light	There is a small amount of glare but a marine mammal would still be visible in the glare.

	Moderate	There is a moderate amount of glare and it would be difficult to detect a marine mammal in the glare.
	Severe	The glare is strong and marine mammal in the glare would not be visible.
Glare from	Clock face #	Where the glare starts. Glare is captured as hours on the clock face. 12 o'clock is directly in front of the vessel. Move in a clockwise direction, e.g. **Glare from** 0700 and **Glare to** 0930.
	X	Enter "X" when there is no glare.
	Variable	Enter "Variable" when the position of the glare is changing frequently due to the movement of the vessel (e.g. vessel is circling).
Glare to	Clock face #	Where the glare stops. Glare is captured as hours on the clock face. 12 o'clock is directly in front of the vessel. Move in a clockwise direction, e.g. Glare from 0700 and Glare to 0930.
	X	Enter "X" when there is no glare.
	Forward	When "Variable" has been entered in the Glare from field, enter "Forward" if the glare is primarily in front of the vessel between 0900 and 0300.
	Aft	When "Variable" has been entered in the Glare from field, enter "Aft" if the glare is primarily toward the stern of the vessel.
Cloud Cover	#	Percent range of cloud cover: 0-10, 10-50, 50-90, 90-100%.
Precip	None	No precipitation present
	Drizzle	Very fine drops of misty rain falling intermittently
	Light rain	Small drops of rain falling steadily and possibly obscuring visibility
	Heavy rain	Larger drops of rain falling steadily and likely obscuring visibility
	Light fog	Patchy, intermittent, gauzy fog
	Heavy fog	Dense fog obscuring visibility
	Graupel	Pellets of snow or soft hail
	Hail	Small balls or lumps of ice and compact snow
	Snow	Ice crystals falling in flakes
	Multiple	Enter when more than one type of precipitation is occurring and describe in the "Notes". For example, light rain and light fog are present.
Sightability	-	*Sightability is an overall assessment of how the environmental conditions as a whole impact your ability to detect a marine mammal.*

	Excellent	Ideal conditions for detecting a marine mammal (e.g. low sea state, 10 km visibility, daylight, no glare, no precipitation).
	Good	Favorable conditions for detecting a marine mammal (e.g. sea state 1-3, 7-10 km visibility, daylight, minimal glare, no/limited precipitation).
	Fair	Marginal conditions for detecting a marine mammal (e.g. sea state 3-4, visibility ≤ 5km, daylight/twilight, moderate glare, precipitation present).
	Poor	Conditions make it unlikely to detect a marine mammal (e.g. sea state ≥ 5, visibility ≤ 3km, twilight/dark, severe glare, heavy precipitation).
Notes	Text	Additional notes or descriptions not otherwise captured by the above fields, denote the number and species of dead fish observed during effort.

SIGHTINGS		
Field	**Code**	**Definition**
Date	YYYY-MM-DD	Date of entry.
Sighting ID	XX####	Unique ID per sighting, composed of two letters the refer to the PSO location, and consecutive numerals.
Time	HH:MM:SS	Time of entry using 24-hr clock.
PSO	XX	Initials of the PSO recording the data
Latitude	DD.DDDD	Decimal degrees. Location of observer.
Longitude	-DDD.DDDD	Decimal degrees. Location of observer.
Location	SD	"South Dock" observing location
	ND	"North Dock" observing location
	BB	"Blasting Barge" observing location
Species	XX	Letter code for marine mammal observed.
End time	HH:MM	Time at which the sighting was no longer visible.
Confidence	%	Confidence level in species identification – 100%, 75%, or 50%
Group Size	#	Total number of individuals observed in the group, including juveniles and calves/pups. If animals are more than **FIVE** body lengths apart, enter as a separate sighting.
Juveniles	#	Number of juveniles observed.
MM Distance to Observer	#	Distance in meters from the observer to the marine mammal.
MM Distance to Blast Zone	#	Distance in meters from the marine mammal to the blast zone.
Optics	Naked eye	Enter if the distance was estimated by eye.
	7x50	Enter if the distance was determined by using the reticles in the handheld 7x50 binoculars.
MM Heading	Direction	N, NE, E, SE, S, SW, W
Sighting Cue		*Initial visual cue that the PSO saw and resulted in a marine mammal sighting.*
	Birds	Group of birds on water surface or hovering over a particular area, possibly feeding.
	Body	Part of the body visible.

	Blow	Exhalation visible.
	Dorsal	Dorsal fin visible above the water surface.
	Fluke	Fluke visible above the water surface.
	Footprint	Wake on water surface from animal swimming.
	Head	Part of the head visible.
	Other	Describe in Notes.
	Splash	Splash from marine mammal movement visible.
Behavior 1 & Behavior 2	Avoid Predation	Engaged in activity to avoid a predator. Moving with speed and/or abrupt changes in direction.
	Blow	Visible exhalation from a cetacean species.
	Bowride/ Wakeride	Small toothed cetaceans riding the waves associated with the movement of the vessel at the bow or stern.
	Breach	Cetacean jumping out of the water.
	Bubbles	Underwater exhalation creating bubbles. Not the bubbles associated with an animal exhaling as it comes to the surface to breathe.
	Calving	Actively giving birth. Animal may exhibit strange body posturing, blood may be visible, group size increases by one.
	Change Direction	Animal was traveling in one direction and then changed course.
	Dead	Carcass is found. Describe condition in Notes. Complete stranding report.
	Decrease Speed	Animal was traveling at a certain speed and then reduced speed.
	Dive	Animal dives below the water surface and is not seen again for an extended period of time.
	Feed	Animal is feeding or prey is observed in combination with characteristic feeding movement/behavior.
	Flipper Slap	Cetacean slapped the water surface with the pectoral fin and produced a splash.
	Fluke	Cetacean raises tail before completing a forward dive.
	Haulout	Pinniped(s) resting on land or ice.
	Increase Speed	Animal was traveling at a certain speed and then increased speed.
	Interact with gear	Animal is interacting with gear in the water. This could be seismic survey equipment or gear from another vessel.

	Lobtail	Cetacean slapped the water surface with fluke vigorously and produced a splash.
	Logging	Animal resting at the water surface. Drifting and not otherwise moving.
	Look	Animal looked in any direction above the water surface.
	Mate	Animals are suspected to be mating. Determined by body positioning, movement, and the penis is may be visible.
	Mill	Animals are moving about while remaining in the same general area.
	Other	Behavior not otherwise captured by the options listed in the drop-down. Describe in the Notes.
	Porpoising	Rapid travel at the water surface. Low, arching leaps above the water surface.
	Rafting	Group of animals motionless at the surface. Typical for sea otters.
	Rest	Animal is motionless at the water surface or on land/ice.
	Rush	Rapid movement into the water from the land/ice.
	Side scan	Cetacean swimming at the surface with the side of the body visible. Usually at a slow speed and may be followed by a quick pursuit of prey.
	Sink	Pinniped sinks below the water surface in an upright/vertical position.
	Splash	Animal moves quickly/vigorously and creates a splash.
	Snorkel	Shallow surfacing to breathe. Low profile with only a small portion of the head/body visible.
	Socialize	Interaction between individuals in a group. Indicated by milling, bubbling, physical contact, vocalizations, etc.
	Spyhop	Cetacean raises head in a vertical position with eyes above the water surface.
	Startle	Rapidly changing behavior, dispersement, or travel that suggests a response to an external event.
	Surface active	Several behaviors observed at the surface, including splashing, breaching, lobtailing, etc.
	Swim	Animal swimming at the water surface. May include several short shallow dives.
	Tail wave	Vertical body position with tail held out of the water. Tail may be moving slowly but slapping/splashing does not occur.
	Travel	Steady swimming in one direction.
	Unknown	Unable to determine behavior. Enter this in second behavior, if none is observed.

	Vocalize	Animal is heard making sounds.
Behavioral Pace	Stationary	Animal is not moving. Also use for carcasses.
	Slow	Animal is moving slowly. Behaviors look relaxed.
	Moderate	Animal is moving at a medium pace.
	Vigorous	Animal is moving at a rapid pace that suggests it is agitated.
	Unknown	Cannot determine the pace of movement/behavior.
Behavioral Reaction	None	No reaction observed. The animal continues to behave in same way and at same pace as when first encountered.
	Avoidance	Animal maneuvers away from Project activities.
	Approach	Animal approaches Project vessels or equipment.
	Paralleling	Animal travels parallel to the Project vessel.
	Increase Speed	Animal was traveling at a certain speed and then increased speed, likely in response to Project activities.
	Decrease Speed	Animal was traveling at a certain speed and then reduced speed, likely in response to Project activities.
	Change Direction	Animal was traveling in one direction and then changed course, likely in response to Project activities.
	Look	Pinniped appears to look at the vessel.
	Rush	Rapid movement into the water from the land/ice, likely in response to Project activities.
	Splash	Animal moves vigorously and creates a splash, likely in response to Project activities.
	Startle	Animal exhibits a sudden shock or alarmed behavior, likely in response to Project activities.
	Dive	Animal dives below the water surface and is not seen again for an extended period of time, likely in response to Project activities.
	Bowride/ Wakeride	Small toothed cetaceans riding the waves associated with the movement of the vessel at the bow or stern.
	Interact with gear	Animal is interacting with seismic gear in the water.
	Unknown	Unknown if behavior is a reaction to Project activities.
	None	No mitigation action implemented.

Mitigation Action	Delay Start-Up	Blasting is delayed because a marine mammal has entered the shutdown while the PSO was clearing the area.
	Shut Down	Blasting or dredging operations have been shut down for a marine mammal sighting.

APPENDIX B. EFFORT AND MARINE MAMMAL SIGHTING FORMS

Ketchikan Rock Pinnicle Removal Marine Mammal
Effort Form

Location		Latitude	
PSO		Longitude	

Page_____ of_____

Effort ID	Date	Time	Activity	Water Depth	Sea State	Visibility	Glare	Glare From	Glare To	% Cloud Cover	Precip	Sightability	Notes

Ketchikan Rock Pinnicle Removal Marine Mammal
Sighting Form

Sighting ID	Date	Location	Latitude	Longitude	PSO	Sighting Time	End Time
Species	Confidence	Total Group Size	Juveniles	MM dist from observer	MM dist from blast zone	Optics	MM Heading
Sighting Cue	Behavior 1	Behavior 2	Pace	Reaction to project activity	Mitigation Measure		

Notes

Sighting ID	Date	Location	Latitude	Longitude	PSO	Sighting Time	End Time
Species	Confidence	Total Group Size	Juveniles	MM dist from observer	MM dist from blast zone	Optics	MM Heading
Sighting Cue	Behavior 1	Behavior 2	Pace	Reaction to project activity	Mitigation Measure		

Notes

APPENDIX C. MARINE MAMMAL SIGHTINGS DATA

Date	Location	Latitude	Longitude	Sighting time	Species	Total Group Size	MM Distance to Observer	MM Distance to blast zone	Optics	MM Heading	Sighting Cue	Behavior 1	Reaction to Activity	Mitigation Measure
2019-12-17	ND	55.344	131.6557	13:04	HW	1	75	600	NAKED EYE	E	BODY	SWIM	NONE	NONE
2019-12-18	SD	55.3382	131.6435	13:09	SSL	1	20	620	NAKED EYE	SE	BODY	SNORKLE	NONE	NONE
2019-12-19	SD	55.3382	131.6435	12:08	HS	1	270	900	7X50	S	HEAD	LOOK	NONE	NONE
2020-1-3	SD	55.3382	131.6435	8:34	HS	1	50	650	NAKED EYE	NE	HEAD	LOOK	NONE	NONE
2020-1-3	ND	55.344	131.6557	9:06	HS	1	50	550	NAKED EYE	SE	HEAD	LOOK	NONE	NONE
2020-1-4	SD	55.3382	131.6435	11:13	HS	1	70	520	NAKED EYE	E	HEAD	LOOK	NONE	NONE
2020-1-4	ND	55.344	131.6557	10:54	SSL	2	180	450	NAKED EYE	E	HEAD	LOOK	NONE	NONE
2020-1-4	ND	55.344	131.6557	12:11	HS	1	30	600	NAKED EYE	SW	HEAD	SWIM	NONE	NONE

Date	Location	Latitude	Longitude	Sighting time	Species	Total Group Size	MM Distance to Observer	MM Distance to blast zone	Optics	MM Heading	Sighting Cue	Behavior 1	Reaction to Activity	Mitigation Measure
2020-1-5	SD	55.3382	131.6435	9:43	HS	1	300	750	10X42	SE	HEAD	SWIM	NONE	NONE
2020-1-5	ND	55.344	131.6557	9:52	SSL	1	250	350	7X50	W	HEAD	SWIM	NONE	NONE
2020-1-5	BB	55.339	131.649	8:59	HS	1	150	150	NAKED EYE	SE	HEAD	SWIM	NONE	NONE
2020-1-6	SD	55.3382	131.6435	12:53	HS	1	100	550	NAKED EYE	SE	HEAD	MILL	NONE	NONE
2020-1-6	SD	55.3382	131.6435	13:36	HS	1	300	150	10X42	W	HEAD	LOOK	LOOK	NONE
2020-1-6	ND	55.344	131.6557	12:55	HS	1	150	450	7X50	W	HEAD	LOOK	NONE	NONE
2020-1-6	ND	55.344	131.6557	13:12	SSL	1	150	450	7X50	E	HEAD	LOOK	NONE	NONE
2020-1-6	ND	55.344	131.6557	13:53	HS	1	75	425	7X50	S	HEAD	LOOK	NONE	NONE

Date	Location	Latitude	Longitude	Sighting time	Species	Total Group Size	MM Distance to Observer	MM Distance to blast zone	Optics	MM Heading	Sighting Cue	Behavior 1	Reaction to Activity	Mitigation Measure
2020-1-6	BB	55.3391	131.6485	13:37	HS*	1	50	75	NAKED EYE	NE	HEAD	LOOK	NONE	NONE
2020-1-7	SD	55.3382	131.6435	14:13	HS	3	120	570	NAKED EYE	E	HEAD	LOOK	NONE	NONE
2020-1-7	ND	55.344	131.6557	12:55	SSL	1	250	450	7x50	E	HEAD	LOOK	NONE	NONE
2020-1-8	SD	55.3382	131.6435	11:02	HS	1	55	505	NAKED EYE	E	HEAD	LOOK	NONE	NONE
2020-1-8	ND	55.344	131.6557	10:28	HS	1	200	800	7x50	W	HEAD	LOOK	NONE	NONE
2020-1-8	BB	55.339	131.6487	10:18	HS	1	350	360	7x50	SE	HEAD	SWIM	NONE	NONE
2020-1-9	SD	55.3382	131.6435	10:14	SSL	1	300	350	10X42	NW	HEAD	SNORKLE	NONE	NONE
2020-1-9	SD	55.3382	131.6435	10:42	SSL	1	25	450	NAKED EYE	S	HEAD	SWIM	NONE	NONE

Date	Location	Latitude	Longitude	Sighting time	Species	Total Group Size	MM Distance to Observer	MM Distance to blast zone	Optics	MM Heading	Sighting Cue	Behavior 1	Reaction to Activity	Mitigation Measure
2020-1-9	ND	55.344	131.6557	10:06	HS	1	175	450	7X50	SE	HEAD	LOOK	NONE	NONE
2020-1-9	ND	55.344	131.6557	10:13	HS	1	150	400	7X50	E	HEAD	LOOK	NONE	NONE
2020-1-10	SD	55.3382	131.6435	8:56	SSL	1	140	300	10X42	NW	HEAD	LOOK	NONE	NONE
2020-1-10	SD	55.3382	131.6435	9:27	SSL	1	90	540	10X42	SE	HEAD	SWIM	NONE	NONE
2020-1-10	ND	55.344	131.6557	9:05	SSL*	1	120	475	7X50	W	HEAD	LOOK	NONE	NONE
2020-1-10	ND	55.344	131.6557	9:45	HS	1	200	400	7X50	SE	HEAD	LOOK	NONE	NONE
2020-1-10	BB	55.339	131.648	8:59	SSL*	1	175	200	NAKED EYE	NW	BODY	SWIM	NONE	NONE
2020-1-11	SD	55.3382	131.6435	8:14	SSL	1	35	490	NAKED EYE	E	HEAD	SNORKLE	NONE	NONE

Date	Location	Latitude	Longitude	Sighting time	Species	Total Group Size	MM Distance to Observer	MM Distance to blast zone	Optics	MM Heading	Sighting Cue	Behavior 1	Reaction to Activity	Mitigation Measure
2020-1-11	SD	55.3382	131.6435	8:56	SSL	1	370	50	10X42	NW	HEAD	LOOK	LOOK	NONE
2020-1-11	ND	55.344	131.6557	8:36	HS	1	150	450	7X50	NW	HEAD	LOOK	NONE	NONE
2020-1-11	ND	55.344	131.6557	9:29	SSL*	1	200	400	7X50	E	HEAD	LOOK	NONE	NONE
2020-1-13	SD	55.3382	131.6435	9:07	HS	1	75	525	10X42	E	HEAD	LOOK	NONE	NONE
2020-1-13	ND	55.344	131.6557	8:38	HS	2	100	500	7X50	W	HEAD	LOOK	NONE	NONE

*Indicates re-sight

APPENDIX D. EXAMPLE MARINE MAMMAL STRANDING FORM

MARINE MAMMAL STRANDING REPORT - LEVEL A DATA

FIELD #:_____ **NMFS REGIONAL #:**_____ **NATIONAL DATABASE#:** _____
(NMFS USE) (NMFS USE)

COMMON NAME:_____ **GENUS:**_____ **SPECIES:** _____

EXAMINER Name:_____ Affiliation: _____

Address:_____ Phone: _____

Stranding Agreement or Authority: _____

CONFIDENCE CODE (Check ONE): ☐ Unconfirmed - Low ☐ Confirmed - Minimum ☐ Confirmed - Medium ☐ Confirmed – High

INITIAL OBSERVATION

☐ Same Information for Level A Examination

DATE: Year:_____Month:_____Day: _____
First Observed: ☐ Beach/Land/Ice ☐ Floating ☐ Swimming

LOCATION: State:_____ County:_____City:_____
Body of Water:_____
Locality Details:_____
Lat (DD):_____._____N
Long (DD):_____._____W
☐ Actual ☐ Estimated

How Determined: (check ONE)
☐ GPS ☐ Map ☐ Internet/Software ☐ Other_____

CONDITION AT INITIAL OBSERVATION (Check ONE)
☐ 1. Alive
☐ 2. Fresh Dead
☐ 3. Moderate Decomposition
☐ 4. Advanced Decomposition
☐ 5. Mummified/Skeletal
☐ 6. Condition Unknown

LEVEL A EXAMINATION

Examined? ☐ YES ☐ NO

DATE: Year:_____Month:_____Day: _____
First Examined: ☐ Beach/Land/Ice ☐ Floating ☐ Swimming

LOCATION: State:_____ County:_____City:_____
Body of Water:_____
Locality Details:_____
Lat (DD):_____._____N
Long (DD):_____._____W
☐ Actual ☐ Estimated

How Determined: (check ONE)
☐ GPS ☐ Map ☐ Internet/Software ☐ Other_____

CONDITION AT EXAMINATION (Check ONE)
☐ 1. Alive
☐ 2. Fresh Dead
☐ 3. Moderate Decomposition
☐ 4. Advanced Decomposition
☐ 5. Mummified/Skeletal

LIVE ANIMAL INFORMATION

INITIAL LIVE ANIMAL DISPOSITION (Check one or more)
☐ 1. Left at Site
☐ 2. Immediate Release at Site
☐ 3. Relocated and Released
☐ 4. Disentangled
  ☐ a. Partially
  ☐ b. Completely
☐ 5. Died at Site
☐ 6. Died During Transport
☐ 7. Euthanized
☐ 8. Transferred to Rehabilitation:
  Date: Year: _____Month: _____Day:_____
  Facility:_____
☐ 9. Other:_____

CONDITION/DETERMINATION (Check one or more)
☐ 1. Sick
☐ 2. Injured
☐ 3. Out of Habitat
☐ 4. Deemed Releasable
☐ 5. Abandoned/Orphaned
☐ 6. Inaccessible
☐ 7. Location Hazardous
  ☐ a. To animal
  ☐ b. To public
☐ 8. Unknown/CBD
☐ 9. No Rehabilitation Options
☐ 10. Other: _____

DEAD ANIMAL INFORMATION

CARCASS STATUS (Check one or more)
☐ 1. Frozen for Later Examination/Necropsy Pending
☐ 2. Left at Site ☐ 5. Landfill ☐ 8. Towed: Lat_____Long_____
☐ 3. Buried ☐ 6. Incinerated ☐ 9. Sunk: Lat_____Long_____
☐ 4. Rendered ☐ 7. Composted ☐ 10. Unknown/Other_____

NECROPSIED ☐ YES ☐ NO ☐ Limited ☐ Complete
☐ Carcass Fresh ☐ Carcass Frozen/Thawed

CARCASS CODE AT NECROPSY ☐ Code 2 ☐ Code 3 ☐ Code 4

NECROPSIED BY: _____
Date: Year:_____**Month:**_____**Day:**_____

PHOTOS/VIDEOS TAKEN: ☐ YES ☐ NO

Photo/Video Disposition: _____

MORPHOLOGICAL INFORMATION

SEX (Check ONE)
☐ 1. Male
☐ 2. Female
☐ 3. Unknown

ESTIMATED AGE CLASS (Check ONE)
☐ 1. Adult
☐ 2. Subadult
☐ 3. Yearling
☐ 4. Pup/Calf
☐ 5. Unknown

☐ Whole Animal ☐ Partial Animal
Straight Length:_____ ☐ cm ☐ in
☐ Actual ☐ Estimated ☐ Not Measured

Weight:_____ ☐ kg ☐ lb
☐ Actual ☐ Estimated ☐ Not Weighed

SAMPLES COLLECTED (Check one or more)
☐ 1. Histology ☐ 2. Other Diagnostics ☐ 3. Life History
☐ 4. Skeletal ☐ 5. Other _____

PARTS TRACKING (Check one or more)
☐ 1. Scientific Collection ☐ 2. Educational Collection
☐ 3. Other:
_____

OCCURRENCE DETAILS

☐ Restrand GE# _____ (NMFS Use)

Group Event: ☐ YES ☐ NO
If Yes, Type: ☐ Cow/Calf Pair ☐ Mass Stranding ☐ UME # Animals:_____ ☐ Actual ☐ Estimated

Was the Marine Mammal Human Interaction Report completed? ☐ YES ☐ NO

Findings of Human Interaction: ☐ YES ☐ NO ☐ Could Not Be Determined (CBD)
If YES evidence of: 1. Vessel Interaction ☐ YES ☐ NO ☐ CBD
2. Shot ☐ YES ☐ NO ☐ CBD
3. Fishery Interaction ☐ YES ☐ NO ☐ CBD
4. Other Human Interaction: _____

If YES, what was the likelihood that the human interaction contributed to the stranding event?
☐ Uncertain (CBD) ☐ Improbable ☐ Suspect ☐ Probable

Gear/HI Items Collected? ☐ YES ☐ NO Gear Disposition: _____
Other Findings Upon Level A: ☐ YES ☐ NO ☐ Could Not Be Determined (CBD)
If Yes, Choose one or more: ☐ 1. Illness ☐ 2. Injury ☐ 3. Pregnant ☐ 4.Other: _____
How Determined (Check one or more): ☐ External Exam ☐ Internal Exam ☐ Necropsy
☐ Other: _____

TAG DATA		ID#	Color	Type	Placement* (Circle ONE)	Applied	Present	Removed
Tags Were:								
Present at Time of Stranding (Pre-existing):	☐ YES ☐ NO				D DF L R LF LR RF RR	☐	☐	☐
Applied during Stranding Response/Release:	☐ YES ☐ NO							
Applied during Rehabilitation/Release:	☐ YES ☐ NO				D DF L R LF LR RF RR	☐	☐	☐
Absent but Suspect Prior Tag:	☐ YES ☐ NO							
					D DF L R LF LR RF RR	☐	☐	☐

* D= Dorsal; DF= Dorsal Fin; L= Left Lateral Body R= Right Lateral Body LF= Left Front; LR= Left Rear; RF= Right Front; RR= Right Rear

ADDITIONAL IDENTIFIER: _____ (If animal is restranded, please indicate any previous field numbers here)

ADDITIONAL REMARKS:

DISCLAIMER

THESE DATA SHOULD NOT BE USED OUT OF CONTEXT OR WITHOUT VERIFICATION. THIS SHOULD BE STRICTLY ENFORCED WHEN REPORTING SIGNS OF HUMAN INTERACTION DATA.

DATA ACCESS FOR LEVEL A DATA

UPON WRITTEN REQUEST, CERTAIN FIELDS OF THE LEVEL A DATA SHEET WILL BE RELEASED TO THE REQUESTOR PROVIDED THAT THE REQUESTOR CREDIT THE STRANDING NETWORK AND THE NATIONAL MARINE FISHERIES SERVICE. THE NATIONAL MARINE FISHERIES SERVICE WILL NOTIFY THE CONTRIBUTING STRANDING NETWORK MEMBERS THAT THESE DATA HAVE BEEN REQUESTED AND THE INTENT OF USE. ALL OTHER DATA WILL BE RELEASED TO THE REQUESTOR PROVIDED THAT THE REQUESTOR OBTAIN PERMISSION FROM THE CONTRIBUTING STRANDING NETWORK AND THE NATIONAL MARINE FISHERIES SERVICE.

PAPERWORK REDUCTION ACT INFORMATION

PUBLIC REPORTING BURDEN FOR THE COLLECTION OF INFORMATION IS ESTIMATED TO AVERAGE 30 MINUTES PER RESPONSE, INCLUDING THE TIME FOR REVIEWING INSTRUCTIONS, SEARCHING EXISTING DATA SOURCES, GATHERING AND MAINTAINING THE DATA NEEDED, AND COMPLETING AND REVIEWING THE COLLECTION OF INFORMATION. SEND COMMENTS REGARDING THIS BURDEN ESTIMATE OR ANY OTHER ASPECT OF THE COLLECTION INFORMATION, INCLUDING SUGGESTIONS FOR REDUCING THE BURDEN TO: CHIEF, MARINE MAMMAL AND SEA TURTLE CONSERVATION DIVISION, OFFICE OF PROTECTED RESOURCES, NOAA FISHERIES, 1315 EAST-WEST HIGHWAY, SILVER SPRING, MARYLAND 20910. NOT WITHSTANDING ANY OTHER PROVISION OF THE LAW, NO PERSON IS REQUIRED TO RESPOND, NOR SHALL ANY PERSON BE SUBJECTED TO A PENALTY FOR FAILURE TO COMPLY WITH, A COLLECTION OF INFORMATION SUBJECT TO THE REQUIREMENTS OF THE PAPERWORK REDUCTION ACT, UNLESS THE COLLECTION OF INFORMATION DISPLAYS A CURRENTLY VALID OFFICE OF MANAGEMENT AND BUDGET (OMB) CONTROL NUMBER.