Annual Report under Section 101(a)(5)(A) of the MMPA
for Fisheries and Ecosystem Research Activities Conducted by Southwest Fisheries Science Center
during October 30, 2015 – December 31, 2016

On October 30, 2015, the Southwest Fisheries Science Center (SWFSC) received Letters of Authorization (LOA) under section 101(a)(5)(A) of the Marine Mammal Protection Act (MMPA; 16 U.S.C 1371(a)(5)) to take marine mammals incidental to fishery and ecosystem research activities in the California Current Ecosystem (CCE), the Eastern Tropical Pacific (ETP), and the Antarctic Marine Living Resources Ecosystem (AMLR). Take of marine mammals incidental to SWFSC fishery and ecosystem research activities are subject to the provisions of the MMPA and the regulations governing this take as described in 50 CFR Part 219, Subpart A (CCE), 50 CFR Part 219, Subpart B (ETP), and 50 CFR Part 219, Subpart C (AMLR). These authorizations are valid through October 29, 2020.

In accordance with these authorizations, the SWFSC is required to provide annual reports. The following report will cover the period from October 30, 2015 – December 31, 2016 and only two of the research areas: CCE & AMLR – the ETP will not be included because the center did not conduct any research in the ETP during the reporting period.

The report will be organized into the following sections:

I. Overview of SWFSC's required mitigation measures.
II. Line-kilometers surveyed during which EK60/80, ME70, SX90 were predominant & pro-rated estimates of actual Level B acoustic take
III. Information regarding use of all longline and trawl gear
IV. Accounts of all incidents of marine mammal interactions
    a. California Current Ecosystem
    b. AMLR - Information related to on-ice disturbance of pinnipeds[1]
V. Evaluation of effectiveness of SWFSC mitigation strategies
VI. Final outcome of serious injury determinations[2]
VII. Updates on development / implementation of MMEDs and analysis of bycatch patterns[3]
VIII. Training provided to SWFSC staff

In each section, a summary for each research area will be described in relation to the reporting period.

I.

Overview of SWFSC's mitigation measures

With the issuance of the SWFSC's MMPA LOA's a set of prescribed mitigation measures were outlined for the Center to follow on all surveys in order to attempt to minimize the likelihood or severity of incidental gear interactions with marine mammals and other protected species. These measures vary slightly depending on the gear type and survey but are mainly comprised of dedicated marine mammal / protected species watches, an associated exclusion zone and move-on rule if protected species are seen during watch, and standard operating procedures by gear type. Below are gear specific descriptions of these conservation measures.

Trawl

30 minute pre-set watch

During all SWFSC trawl surveys, a dedicated observer must initiate a 30 minute pre-set watch (visual observation) prior to deploying trawl gear. The surrounding waters are scanned with the naked eye and range finding sighting instruments during the day and at night are conducted using the naked eye and available vessel lighting.

Move-on rule

If a marine mammal or other protected species is seen during the pre-set watch within 1 nautical mile (n mi) of the set location (i.e., exclusion zone), the move-on rule must be implemented: before starting the haul, the ship must move-on to ensure that the observed marine mammal is 1 n mi away from the set location. If, after moving-on, the marine mammal remains in the exclusion zone (within that 1 n mi radius the set location) the ship must move again or skip the station.

Active gear monitoring

Once trawl net deployment begins, an active gear watch (visual monitoring during gear deployment, fishing, and retrieval) must be conducted by a dedicated observer. If a marine mammal is seen during the active gear watch, the most appropriate action to avoid an interaction will be determined through the use of professional judgment. If professional judgment is employed it will be recorded. Professional judgment is only to be used in circumstances when the gear is already deployed - that is, if a marine mammal is seen during the pre-set watch, the move-on rule must be implemented, but if it is seen when the net is fishing, then professional judgment will be used to determine the best course of action to avoid an interaction.

Marine mammal excluder device (MMED)

On the Nordic 264 trawl net, a marine mammal excluder device is used at all times. This device was developed to allow marine mammals to escape from the net without losing target species catch.

Acoustic deterrent devices

On all SWFSC trawl nets, 2-4 acoustic deterrent devices, or pingers, are placed along the head rope and footrope to deter marine mammals from entering the net.

Other standard trawl survey protocols

The SWFSC also employs several standard survey protocols to attempt to minimize impacts to protected species: 1) the gear will be emptied as quickly as possible upon retrieval in order to determine whether to nor protected species are present and 2) care will be taken when

emptying the trawl to avoid damage to protected species that may be caught but not visible during retrieval.

If a marine mammal or other protected species is seen during the pre-set watch within 1 nautical mile (n mi) of the set location, the move-on rule must be implemented: before starting the haul, the ship must move-on to ensure that the observed marine mammal is 1 n mi away from the set location. If, after moving-on, the marine mammal remains within that 1 n mi radius the ship must move again or skip the station. If a marine mammal is seen during the active gear watch, the most appropriate action to avoid an interaction will be determined through the use of professional judgment. In addition to the watches, the SWFSC deploys 2-4 acoustic deterrent devices, or pingers, on trawl nets and a MMED on the Nordic 264 trawl.

Longline

30 minute pre-set watch

Similarly to SWFSC trawl surveys, during all longline research efforts, a dedicated observer must initiate a 30 minute pre-set watch (visual observation) prior to deploying longline gear. The watch during longline surveys is conducted in the same manner as on trawl surveys - the surrounding waters are scanned with the naked eye and range finding sighting instruments during the day and at night are conducted using the naked eye and available vessel lighting.

Move-on rule

If a marine mammal or other protected species is seen during the pre-set watch within 1 nautical mile (n mi) of the set location (i.e., exclusion zone), the move-on rule must be implemented: before starting the haul, the ship must move-on to ensure that the observed marine mammal is 1 n mi away from the set location. If, after moving-on, the marine mammal remains in the exclusion zone (within that 1 n mi radius the set location) the ship must move again or skip the station. For longline surveys there is an exception to the move-on rule: the vessel does not have to move on if there are five or fewer California sea lions within the 1 n mi exclusion zone.

Active gear monitoring

The active gear monitoring watch for longlines varies slightly from that for trawling: a watch is conducted during gear deployment and retrieval, but because longline sets can last multiple hours, the 'active fishing' watch starts only 30 minutes prior to haul back of gear and is completed by a dedicated observer. Similarly to the trawl surveys, if a marine mammal is seen during the active gear watch, the most appropriate action to avoid an interaction will be determined through the use of professional judgment and recorded. Professional judgment is only to be used in circumstances when the gear is already deployed (with the exception to CA sea lions)- that is, if a marine mammal is seen during the pre-set watch, the move-on rule must be implemented, but if it is seen when the net is fishing, then professional judgment will be used to determine the best course of action to avoid an interaction.

Other longline survey protocols

Chumming is prohibited during all SWFSC longline surveys to prevent attracting marine mammals while gear is being set.

II.

Line-kilometers surveyed during which the EK60/EK80, ME70, and SX90 were predominant during the reporting period and pro-rated estimates of actual take

Table 1. Total line-kilometers (kms) surveyed during the reporting period for which the EK60/EK80, ME70, or SX90 echosounder was the predominant acoustic source in the CCE compared to the totals calculated in the SWFSC's MMPA LOA application (Appendix C of SWFSC's National Environmental Policy Act Programmatic Environmental Assessment).

California Current Ecosystem				
Echosounder	EA Estimated summed dominant line-kms/source (0-200 m)	**Summed line-kms of reporting period / source (0-200 m)**	EA Estimated summed dominant line-kms/source (>200 m)	**Summed line-kms of reporting period / source (>200 m)**
SX90	33,880	**8,417**	33,880	**8,417**
EK60/EK80	79,912	**22,610**	99,640	**49,574**
ME70	19,728	**26,414**	0	**0**

Table 2. Total line-kilometers (kms) surveyed during the reporting period for which the EK60 echosounder was the predominant acoustic source in the Scotia Sea / AMLR compared to the total calculated in the SWFSC's MMPA LOA application (Appendix C of SWFSC's National Environmental Policy Act Programmatic Environmental Assessment).

Scotia Sea / Antarctic Ecosystem				
Echosounder	SWFSC EA - Summed line-kms / source (0-200 m)	**Summed line-kms of reporting period / source (0-200 m)**	SWFSC EA - Summed line-kms / source (>200 m)	**Summed line-kms of reporting period / source (>200 m)**
EK60	20,486	**5,200**	20,486	**5,200**

Table 3. SWFSC's annual Level B harassment by acoustic sources by sound type for each marine mammal species in the CCE. For each species and predominant source, the cross sectional area for the relevant depth strata (Table 6.5 of SWFSC's EA Appendix C) was multiplied by the actual line-km for each respective strata (Table 1) and the volumetric density (shown here) to assess Level B harassment for the reporting period.

Common name	Volumetric Density (#/km^3)	Typical vertical habitat		SWFSC Reporting Period Acoustic Takes (# of animals)			**Reporting Period Total Takes**	EA Estimated Annual Takes
		0-200 m	>200 m	EK60/EK80	ME70	SX90		
CCE Cetaceans								
Harbor porpoise	0.188725	X		56	65	21	**142**	682
Dall's porpoise	0.37765	X		112	130	42	**284**	1365
Pacific white-sided dolphin	0.10465	X		31	36	12	**79**	378
Risso's dolphin	0.0523	X		15	18	6	**39**	189
Bottlenose dolphin	0.0089	X		3	3	1	**7**	32
Striped dolphin	0.08335	X		25	29	9	**63**	301
Short-beaked common dolphin	1.54675	X		457	534	170	**1161**	5591
Long-beaked common dolphin	0.0962	X		28	33	11	**72**	348
Northern right-whale dolphin	0.04875	X		14	17	5	**37**	176
Killer whale	0.00355	X		1	1	0	**3**	13
Short-finned pilot whale	0.00062		X	4	2	1	**7**	12
Baird's beaked whale	0.00176		X	12	5	2	**19**	34
Mesoplodont beaked whales	0.00206		X	14	6	2	**22**	39
Cuvier's beaked whale	0.00764		X	51	23	9	**83**	146
Pygmy sperm whale	0.00218		X	15	7	2	**24**	42
Dwarf sperm whale	0.00218		X	15	7	2	**24**	42
Sperm whale	0.0034		X	23	10	4	**37**	65
Humpback whale	0.00415	X		1	1	0	**3**	15
Blue whale	0.0068	X		2	2	1	**5**	25
Fin whale	0.0092	X		3	3	1	**7**	33
Sei whale	0.00045	X		0	0	0	**0**	2
Common Minke whale	0.0036	X		1	1	0	**3**	13
Gray whale	0.09565	X		28	33	11	**72**	346
CCE Pinnipeds								
California sea lion	1.19	X		352	411	131	**894**	4302
Steller sea lion, eastern subspecies	0.29165	X		86	101	32	**219**	1054
Guadalupe fur seal	0.03705	X		11	13	4	**28**	134
Northern fur seal	1.68275	X		497	581	185	**1264**	6083
Harbor seal	0.252	X		74	87	28	**189**	911
Northern elephant seal	0.248		X	1665	759	283	**2707**	4744

Table 4. SWFSC's annual Level B harassment by acoustic sources by sound type for each marine mammal species in the AMLR. For each species and predominant sound source, the cross sectional area for the relevant depth strata (Table 6.5 of SWFSC's EA Appendix C) was multiplied by the actual line-km for each respective strata (Table 1) and the volumetric density (shown here) to assess Level B harassment for the reporting period.

Common name	Volumetric Density (#/km^3)	Typical vertical habitat		SWFSC Reporting Period Acoustic Takes (# of animals)			**Reporting Period Total Takes***	EA Estimated Annual Takes
		0-200 m	>200 m	EK60/EK80	ME70	SX90		
Antarctic Cetaceans								
Spectacled porpoise	0.043	X		2.9	0	0	**3**	12
Hourglass dolphin	0.043	X		2.9	0	0	**3**	12
Killer whale	0.0385	X		2.6	0	0	**3**	11
Sperm whale	0.0013		X	0.1	0	0	**< 1**	3
Arnoux's beaked whale	0.013		X	0.9	0	0	**1**	37
Southern bottlenose whale	0.013		X	0.9	0	0	**1**	37
Long-finned pilot whale	0.0152		X	1	0	0	**1**	43
Antarctic minke whale	0.0215	X		1.5	0	0	**1**	6
Southern right whale	0.004	X		0.3	0	0	**< 1**	1
Fin whale	0.4195	X		28.5	0	0	**29**	114
Humpback whale	0.338	X		23	0	0	**23**	92
Antarctic Pinnipeds								
Antarctic fur seal	0.4998	X		34	0	0	**34**	136
Southern elephant seal	0.0012		X	0.8	0	0	**1**	3
Crabeater seal	0.0065	X		0.4	0	0	**< 1**	2
Weddell seal	0.0035	X		0.2	0	0	**< 1**	1
Leopard seal	0.0045	X		0.3	0	0	**< 1**	1

* Estimated harassment labeled < 1, was non-zero i.e., < 0.5

III.

SWFSC's Gear Meta Data for All Fisheries and Ecosystem Surveys in the CCE and AMLR During the Reporting Period

Table 5. SWFSC trawl survey meta data for the reporting period by trawl net and research area.

Research Area	Trawl Net	Total # tows	Fishing Depth Range (m)	Average Tow Duration of active fishing (minutes)
California Current Ecosystem	Modified cobb	137	10-54	5-15
	Nordic 264	273	0-16	30-45
Scotia Sea / Antarctic Marine Living Resources Ecosystem	Tucker	106	170	20-30

In the CCE, the modified Cobb net was used during the Rockfish Recruitment survey (RL-16-03) and the Nordic 264 net was used for the Spring Coastal Pelagic Species (CPS) survey (1604RL), the California Current Ecosystem survey (1607RL), and the Ocean Salmon Survey (OS1601). The tucker trawl was used during the 2016 Austral Winter Krill and Ecosystem Survey in the AMLR.

Table 6. SWFSC's reporting period longline and hook & line meta data in the CCE.

Gear Type	Survey	Total # sets	# Hooks	Total hook hours	Hook type	Fishing depth range (m)
Longline	Juvenile Thresher	68	6800	17527	13/0 offset circle	6-9
Hook & Line	Rockfish Recruitment	5	128	12.5	shrimp fly	30-119
	Rockfish Tagging & Release Device Testing	-	-	1143	J hook	42-152

During the reporting period, the Center conducted one longline survey in the CCE, the Juvenile Thresher Shark Survey (LL-JT-0030). Hook hours for this survey are calculated from the time the first hook enters the water until the last hook is hauled back in order to conservatively provide the maximum fishing time per set. The SWFSC also conducted hook & line work for two different projects, both targeting rockfish:

1) during daytime hours on the Rockfish Recruitment survey (RL-16-03), hook and line work was conducted to collect genetic samples of adult rockfish. During each of the 5 sets, 6 to 8 anglers were set with a total of 4 hooks per angler and

2) the Rockfish Tagging & Release Device Testing project is conducted to look at post-release survival of rockfish following field recompression by using electronic tags. This survey is conducted on chartered recreational fishing boats and where effort is only recorded as number of hook hours.

IV.

Marine Mammal Interactions

The following section will detail the SWFSC Level A marine mammal interaction events in the CCE and Level B on-ice disturbance in AMLR for the reporting period.

California Current Ecosystem

Table 7. SWFSC's take table from the MMPA LOA for the CCE (Table 1 in the authorization) displays the takes issued to the Center by gear type in that ecosystem over the five year authorization period (Oct 2015 - Oct 2020).

Species		Authorized Take		
		M/SI + Level A[1]		Level B[2]
		Trawl	Longline	
Gray whale (*Eschrichtius robustus*)		-	-	346
Humpback whale (*Megaptera novaeangliae*)		-	-	14
Minke whale (*Balaenoptera acutorostrata*)		-	-	13
Sei whale (*Balaenoptera borealis*)		-	-	1
Fin whale (*Balaenoptera physalus*)		-	-	33
Blue whale (*Balaenoptera musculus*)		-	-	24
Sperm whale (*Physeter macrocephalus*)		-	-	65
Pygmy or dwarf sperm whale (*Kogia* spp.)		-	1	42
Cuvier's beaked whale (*Ziphius cavirostris*)		-	-	146
Baird's beaked whale (*Berardius bairdii*)		-	-	34
Hubbs', Blainville's, ginkgo-toothed, Perrin's, lesser, or Stejneger's beaked whales (*Mesoplodon* spp.)		-	-	40
Bottlenose dolphin (*Tursiops truncatus*)	CA/OR/WA stock	8	1	32
	CA coastal stock	3		
Striped dolphin (*Stenella coeruleoalba*)		11	1	301
Long-beaked common dolphin (*Delphinis capensis*)		11	1	348
Short-beaked common dolphin (*Delphinis delphis*)		11	1	5,592
Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)		35	-	378
Northern right whale dolphin (*Lissodelphis borealis*)		10	-	176
Risso's dolphin (*Grampus griseus*)		11	1	188
Killer whale (*Orcinus orca*)		-	-	13
Short-finned pilot whale (*Globicephala macrorhynchus*)		-	1	12
Harbor porpoise (*Phocoena phocoena*)		5	-	682
Dall's porpoise (*Phocoenoides dalli*)		5	-	1,365
Guadalupe fur seal (*Arctocephalus philippii townsendi*)		-	-	134
Northern fur seal (*Callorhinus ursinus*)	California stock	5	-	236
	Pribilof Islands/ Eastern Pacific stock			11,555
California sea lion (*Zalophus californianus*)		20	5	4,302
Steller sea lion (*Eumetopias jubatus*)		9	1	1,055
Harbor seal (*Phoca vitulina*)		9	-	910
Northern elephant seal (*Mirounga angustirostris*)		5	-	4,743
Unidentified cetacean (Family Delphinidae or Family Phocoenidae)		1	-	-
Unidentified pinniped		1	1	-

[1] These takes may be by mortality or any lesser intensity, including serious injury and Level A harassment, and are apportioned by gear type. The number represents the total authorization over five years.

[2] These takes may be by Level B harassment only. The number represents the annual take authorization for five years.

Table 8. SWFSC's Level A take in trawl gear (modified Cobb and Nordic 264 nets) for the reporting period and the remaining takes left for trawl surveys during the authorization period:

Authorized Trawl Species	**# of Level A (M/SI) authorized incidental takes (2015-2020)**	**SWFSC Trawl Takes for the reporting period**	**Remaining Takes**
Bottlenose dolphin (*Tursiops truncatus*) CA/OR/WA offshore	8	0	8
Bottlenose dolphin (*Tursiops truncatus*) CA coastal	3	0	3
Striped dolphin (*Stenella coeruleoalba*)	11	0	11
Short-beaked common dolphin (*Delphinis delphis*)	11	0	11
Long-beaked common dolphin (*Delphinis capensis*)	11	0	11
Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)	35	9	26
Northern right whale dolphin (*Lissodelphis borealis*)	10	0	10
Risso's dolphin (*Grampus griseus*)	11	0	11
Harbor porpoise (*Phocoena phocoena*)	5	0	5
Dall's porpoise (*Phocoenoides dalli*)	5	0	5
Northern fur seal (*Callorhinus ursinus*) – California Stock & Pribilof Islands/ Eastern Pacific stock	5	0	5
California sea lion (*Zalophus californianus*)	20	0	20
Steller sea lion (*Eumetopias jubatus*)	9	0	9
Harbor seal (*Phoca vitulina*)	9	0	9
Northern elephant seal (*Mirounga angustirostris*)	5	0	5
Unidentified pinniped	1	0	1
Unidentified cetacean (Family Delphinidae or Family Phocoenidae)	1	0	1

The SWFSC had no incidental interactions with longline gear and marine mammals during the reporting period and therefore remaining take levels equal those issued as displayed in Table 7.

Level A interactions in CCE

During the reporting period, the SWFSC had two separate interaction events with marine mammals that resulted in a total of nine Pacific white-sided (*Lagenorhynchus obliquidens*) dolphins being taken. Both interaction events occurred on the NOAA Reuben Lasker fisheries research vessel (FSV) during nighttime trawl operations.

The first of these two interaction events happened on SWFSC's Rockfish Recruitment survey (RL-16-03) using the midwater modified Cobb trawl net to sample for pelagic juvenile rockfish (*Sebastes* spp.) and other epi-pelagic micronekton. This survey began on April 26, 2016 and ended June 12, 2016. The take occurred about halfway through the survey on May 15, 2016 off of Central California at 36.3359°N, 122.01246°W. See Appendix A for Map 1 depicting location of SWFSC marine mammal and sea turtle take events from reporting period.

All required mitigation measures were followed during the haul that led to the take event – protected species watches (30 minute pre-set and active gear), use of pingers, and standard survey protocols. A dedicated observer preformed the pre-set watch and active gear watches. The watch logs and anecdotal narratives of this event indicate that no protected species were seen during these watches. Therefore, the move-on rule was not implemented and no professional judgment decisions were made. The modified Cobb net was deployed with two STM Products DDD-03 dolphin pingers on the mouth and both pingers were tested to ensure proper function before net was deployed. There is no requirement for the modified Cobb to use a Marine Mammal Excluder Device (MMED), and to date SWFSC has not developed or tested a MMED for this gear type.

Table 9. FSV Reuben Lasker automatic event logger for RL-16-03 haul that resulted in incidental take of Pacific white-sided dolphin

Net Activity	**Time**
Net in Water	22:43:53
Shoot doors	22:55:20
Net Fishing	22:58:35
Haul back	23:03:37
Doors on deck	23:05:10
Net on deck	23:27:33

The time indicated at 'net fishing' represents the time at which the net mouth is fully opened and at fishing depth, and the mouth stays fully open until the time at 'haul back' where the net mouth collapses and the net is no longer fishing. As Table 9 shows, the net was actively fishing at target depth for approximately five minutes.

When the net was hauled on board the dolphin was found in the codend. The dolphin was removed from the net and was determined to be deceased. Under 50 CFR 216.22, the scientists collected all pertinent information and froze the animal for later transfer to SWFSC's La Jolla lab for later necropsy and evaluation. The scientists followed SWFSC's *Detailed Sampling Protocol for Marine Mammal and Sea Turtle Incidental Takes During SWFSC Research Cruises* (PSIT-002.02) to determine species ID and sex, and they took photographs and measurements prior to freezing the carcass. The

animal was female and 189 cm in length. The animal was frozen in the Lasker's scientific freezer until the survey ended in San Diego and was then transferred to the NOAA NMFS Southwest Region stranding team at the SWFSC for later necropsy and evaluation.

The second marine mammal interaction event the Center had in during the reporting period occurred during the CCE (1607RL – June 28, 2016 – September 23, 2016)) survey on July 18, 2016. This take occurred offshore of Washington State at 47.0753°N, 124.6853°W. During the CCE survey, nighttime tows using the Nordic 264 trawl net are conducted to sample for coastal pelagic species (CPS; sardine, mackerel, anchovy, etc.). This event resulted in the taking of eight Pacific white-sided dolphins. See Appendix A for Map 1 depicting location of SWFSC marine mammal and sea turtle take events from reporting period.

All required mitigation measures were followed during the haul that lead to the take event – protected species watches (30 minute pre-set and active gear), use of pingers, and standard survey protocols. A dedicated observer preformed the pre-set watch and active gear watches. The watch logs and anecdotal narratives of this event indicate that no protected species were seen during these watches, therefore the move-on rule was not implemented and no professional judgment decisions were made. The observer did notice that just before the entire net was brought aboard, dolphins were swimming aft of ship outside of the codend of the net. The Nordic 264 was deployed with 4 Future Ocean pingers equally located along the length of the footrope: two 70kHz dolphin pingers placed on each end and a 10kHz porpoise and 3kHz whale pinger equidistant between them. Three of the four Future Ocean pingers can be confirmed active through visual observation if they light up when removed from the water – these three were confirmed active when net was brought onboard. The fourth pinger function must be confirmed with audio inspection and observer was too far away to hear whether or not it was working. The Nordic 264 was also equipped with the MMED.

Table 10. FSV Reuben Lasker automatic event logger for 1607RL haul that resulted in incidental take of 8 Pacific white-sided dolphins.

Net Activity	**Time**
Net in Water	23:27:02
Shoot Doors	23:40:56
Begin Fishing (EQ)	23:48:17
Haul Back	0:33:18
Doors UP	0:37:34
Net on Deck	1:22:11

As described above for Table 9, the time indicated at 'net fishing' represents the time at which the net mouth is fully opened, and the mouth stays fully open until the time at 'haul back' where the net mouth collapses and the net is no longer fishing. Therefore, Table 10 shows, the net was actively fishing at target depth for approximately for 45 minutes during this take event.

As the net began to come back aboard, the first dolphin was noticed entangled in mesh – the mesh was cut to remove the dolphin. As haul back continued, 3 more dolphins were found to be entangled in the trawl mesh about 3-5 meters apart and cut out of the mesh as well. As the excluder device was brought on deck 1 dolphin was pressed lengthwise against the grate and 2 others

dolphins were found lying on the individual against the grate. A total of seven dolphins were brought up in the net and all were deceased upon their arrival on deck. In addition to those in the net, it is known that another dolphin escaped through the excluder device. During the CCE survey, GoPro® cameras are deployed in the Nordic 264 trawl net at random intervals to help understand how the MMED is affecting target catch. During this take event, the GoPro® video camera happened to be active. Upon review of the GoPro® video, it became apparent that the total take for this event was eight Pacific white-sided dolphins. The dolphin appeared to be alive at the time it was excluded from the net; however, further analysis will be done to make a formal serious injury determination. The video also showed that the dolphin that was pressed against the MMED grate was alive when it first appeared in the video and encountered the grate, but was swimming slowly / lethargically and possibly got stuck in the grate by its fluke. The other two dolphins that were found near the grate are already deceased when they appear in the video.

The seven remaining carcasses were collected and frozen for later transfer to SWFSC's La Jolla lab for later necropsy and evaluation. The scientists followed SWFSC's *Detailed Sampling Protocol for Marine Mammal and Sea Turtle Incidental Takes During SWFSC Research Cruises* (PSIT-002.02) to determine species ID and sex, and they took photographs and measurements prior to freezing the carcass. The scientists, NOAA Corps Officers, and NOAA NMFS Southwest Region stranding team coordinated to have the frozen carcasses removed from the vessel at an in-port in Newport, OR and transferred to SWFSC's La Jolla lab so the stranding team could perform later necropsy and evaluation.

On-ice Disturbance data (Level B Interactions) in the Antarctic Marine Living Resources Ecosystem

Table 11. Annual authorized Level B takes for on-ice disturbance of marine mammals in the AMLR under SWFSC's MMPA LOA (Oct 2015 - Oct 2020) compared to actual takes from reporting period.

Species	**Authorized take[1]**	**Actual Reporting Period Takes**
Southern right whale (*Eubalaena australis*)	0	-
Humpback whale (*Megaptera novaeangliae*)	0	-
Antarctic minke whale (*Balaenoptera bonaerensis*)	0	-
Fin whale (*Balaenoptera physalus*)	0	-
Sperm whale (*Physeter macrocephalus*)	0	-
Arnoux' beaked whale (*Berardius arnuxii*)	0	-
Southern bottlenose whale (*Hyperoodon planifrons*)	0	-
Hourglass dolphin (*Lagenorhynchus cruciger*)	0	-
Killer whale (*Orcinus orca*)	0	-
Long-finned pilot whale (*Globicephala melas*)	0	-
Spectacled porpoise (*Phocoena dioptrica*)	0	-
Antarctic fur seal (*Arctocephalus philippii townsendi*)	417	113
Southern elephant seal (*Mirounga leonina*)	3	-
Crabeater seal (*Lobodon carcinophaga*)	5	93
Weddell seal (*Leptonychotes weddellii*)	3	-
Leopard seal (*Hydrurga leptonyx*)	4	1

[1] These takes may be by Level B harassment only. The number represents the annual take authorization for five years.

The 2016 Austral Winter Krill and Ecosystem Survey was conducted by the Antarctic Ecosystem Research Division from 3 August to 31 August 2016. Summary information related to on-ice disturbance of marine mammals (Antarctic seals) was collected during daylight hours and is summarized in Table 12. Four species of seals were observed in the survey area. These species included the Antarctic fur seals (*Arctocephauls gazellae*), Crabeater seals (*Lobodon carcinophaga*), Leopard seals (*Hydrurga leptonyx*) and Weddell seals (*Leptonychotes weddellii*).

Table 12. Summary of disturbance data of four species of seals present during the 2016 austral summer survey of the South Shetland Islands conducted by the US AMLR Program, 3 August to 31 August 2016

		Effect			
Species	**Distance (m)**	**no movement**	**alert**	**movement**	**fleeing**
Crabeater Seals (*Lobodon carcinophaga*)	0-100	1	15	41	34
	100-300	8	30	8	9
	300-500	13	19	1	-
Total		22	64	50	43
Antarctic Fur Seals (*Arctocephalus philippii townsendi*)	0-100	11	19	16	64
	100-300	25	29	12	16
	300-500	25	30	2	3
Total		61	78	30	83
Leopard Seals (*Hydrurga leptonyx*)	0-100	-	1	-	-
	100-300	1	5	1	-
	300-500	-	1	-	-
Total		1	7	1	-
Weddell Seals (*Leptonychotes weddellii*)	0-100	1	1	-	-
	100-300	-	-	-	-
	300-500	-	1	-	-
Total		1	2	-	-

In Table 12 the distance bins represent unique approaches to the specified pinniped species i.e., there is no overlap between the distance bins, so each animal is only counted once. Furthermore, each vessel approach was binned according to the ship's closest approach to the animal.

Table 13. Total Level B takes in SWFSC's AMLR research activities for the reporting period (on-ice disturbance + acoustic) compared to estimated annual takes from AMLR MMPA LOA.

Common Name	On-ice Disturbance Takes	Acoustic Takes	**Reporting Period Level B Takes**	Estimated Annual Takes
Spectacled porpoise	0	2.9	**2.9**	12
Hourglass dolphin	0	2.9	**2.9**	12
Killer whale	0	2.6	**2.6**	11
Sperm whale	0	0.1	**0.1**	3
Arnoux's beaked whale	0	0.9	**0.9**	37
Southern bottlenose whale	0	0.9	**0.9**	37
Long-finned pilot whale	0	1.0	**1**	43
Antarctic minke whale	0	1.5	**1.5**	6
Southern right whale	0	0.3	**0.3**	1
Fin whale	0	28.5	**28.5**	114
Humpback whale	0	23.0	**23**	92
Antarctic fur seal	113	34.0	**147.0**	553
Southern elephant seal	0	0.8	**0.8**	6
Crabeater seal	93	0.4	**93.4**	7
Weddell seal	0	0.2	**0.2**	4
Leopard seal	1	0.3	**1.3**	5

It should be noted that SWFSC exceeded the authorized take of Crabeater seals during the reporting period (2016 survey). The Center cannot definitively explain why this would have occurred. However, it can be noted that the survey was conducted over the same area, during the same months, and for the same duration as previous years. This Austral Winter Krill and Ecosystem survey was originally conducted in 2012 and the 2016 survey was the first year these data were required to be collected, as well as the last year this survey will be conducted (i.e., for the duration of the authorization period there are no plans / funding to conduct another Winter survey in AMLR). During the 2016 survey, according to SWFSC scientists' anecdotal accounts, there was nothing obviously out of the ordinary to suggest why they would have encountered a greater number of Crabeater seals. It is more likely that there is very little historical data on the Center's observations of these species during this surveys (that there has been so few of) and therefore with a smaller data set, consistent variability in number of animals encountered each year, should be expected.

V.

Evaluation of SWFSC Mitigation Strategies

An evaluation of the mitigation measures employed by the SWFSC to reduce potential impacts to marine mammals is outlined below for both trawl and longline gear types. For detailed mitigation measure descriptions, please see Section 1 of this report.

Trawl Marine Mammal Mitigation Measures

The SWFSC uses two types of trawl nets that require the implementation of mitigation measures, the Nordic 264 surface trawl, and the Modified Cobb midwater trawl net. During use of any of these nets, the following mitigation protocols must be observed: protected species watches (30 minute and active gear), move-on rule, use of pingers, use of a MMED on Nordic 264 net only, use of professional judgment, and standard survey protocols (all described in detail in Section 1).

To ensure compliance with these regulations, the Center has implemented the use of boiler plate language in all cruise / project instructions for trawl surveys that use the Nordic 264 or modified Cobb nets. The boiler plate language provides detail and instruction on the required mitigation measures and other standard trawl protocols. In addition to this, the Center has started collecting data in watch logs during each survey to record whether or not marine mammals or other protected species were seen during required watches, and if they were, what actions were implemented to mitigate potential interactions (e.g., move-on rule or professional judgment decisions).

Over the reporting period, our watch logs showed that during nighttime surveys we are often able to see or hear animals near the ship and implement the move-on rule in order to avoid interactions. Through anecdotal descriptions, we know that these sightings typically occur in good conditions i.e., no clouds, moonlight, low sea state (beaufort), etc. and most importantly, when the animals are near the ship. However, once the net is out fishing it is very far away from the ship and therefore, even in good nighttime conditions, it is nearly impossible to see if there are marine mammals close by the net while it is actively fishing. This is evidenced by the fact that on the two trawls that took marine mammals during this reporting period, no marine mammals were seen during the pre-set or active gear watches, but the net came up with the animals deceased in it.

The watch logs from the reporting period also show that the required 30 minute pre-set watch, active gear watches, and move on rule was implemented with 100% compliance on all of our trawl surveys.

Table 14. Implementation and effect of Marine Mammal (MM) Watches and move-on rule on SWFSC Trawl surveys during the reporting period.

Trawl Survey	Total # tows	Move-on implemented	% total tows that had to move-on	Trawl aborted due to MM	% of tows cancelled due to MM	Interaction events w/ MM
Nordic 264 Net						
Ocean Salmon Survey – OS1601	68	1	1.5%	1	1.5%	0
Spring CPS - 1604RL	43	3	7%	0	0	0
Summer CPS – CCE 1607RL	121	5	4%	1	1%	1
Modified Cobb Net						
Rockfish Recruitment - RL-1603	131	8	6%	13	10%	1

Table 14 displays impacts of the marine mammal watches (pre-set and active gear) and associated move-on rule to SWFSC's trawl surveys. The table is divided into surveys that use the Nordic 264 net versus the modified Cobb net and shows the total number of hauls for each survey that specified net was used. It should also be noted that all surveys listed in Table 14 trawl during nighttime hours except the Ocean Salmon Survey (OS1601).

The column labeled 'move-on implemented' represents the number of hauls where marine mammals were seen within 1 n mi of the set location during the pre-set watch, and the ship had to move to exclude them from the restricted radius. The percent of total tows where the ship had to move-on represents the times where the ship moved to exclude marine mammals – in some of these instances the move-on was successful and the net was set, but in others the haul was cancelled because the marine mammals remained in the restricted 1 n mi radius. Additionally, tow cancellation could have been a result of marine mammals being sighted when the net was already set, but before the doors were deployed and the mouth of the net was opened (start of active fishing), so a professional judgment call was made and the net was immediately hauled back to avoid interaction (trawl aborted). There were no instances where marine mammals were seen within the exclusions zone prior to deploying gear where the move-on rule was not enacted – i.e., the move-on rule was followed at all times.

According to SWFSC's watch logs from the trawl surveys listed above, there were several occasions where during net deployment (active gear watch) dolphins were seen around the ship, so a professional judgment decision was made to halt net deployment to avoid potential interaction. In accordance with our LOA, because trawl operations were suspended due to the presence of marine mammals, the net deployment could not begin again until the dolphins were at least 1 n mi away from the set location. The scientists / ship tried to move 1 n mi away from the animals, but they followed and so those sets had to be cancelled. It is policy of some groups that if a marine mammal is seen before the net is fully deployed, to haul back immediately (as was done in the cases described above) to minimize risk of interaction. It can also be noted from the watch logs that, there were many occasions that California Sea Lions and dolphins were seen during the haul back portion of the active gear watch. These animals were typically seen swimming around the hull of the ship or the codend of the net as it is towed back into brought aboard the ship. In all of these instances when marine mammals were seen, haul back continued as usual i.e., no alternative action was taken, and none of these instances resulted in a marine mammal take. In one instance on the Summer CPS survey, it was recorded that after the doors of the trawl net had already been hauled out of the water (this effectively closes the mouth of the net), 20-25 pacific white sided dolphins were seen swimming around the ship – haul back continued as normal and the pingers were checked and determined to be functioning properly when brought aboard. Interestingly, during one SWFSC survey there are a couple recorded instances where dolphins were seen bow-riding during the pre-set watch on transit to station and scientists decided to slow vessel speed to see if dolphins would lose interest in following this ship. On both occasions this tactic worked – the dolphins did lose interest and left the area, so the scientists were able to successfully set once arriving on station.

For three quarters of SWFSC surveys, the required evasion of marine mammals only caused loss of 1.5% or less of trawling effort. However, for the Rockfish Recruitment survey, the move-on rule caused a loss of 10% of their trawl effort. To understand this loss, it is key to note that the rockfish survey conducts trawls at some stations that are very close together (less than 2-3 n mi apart), so if the move-on action is executed and the marine mammals follow the ship, conducting the move-on

rule a second time would put the ship at the next station which would effectively mean skipping the current station. This occurrence was compounded in 2016 by the necessity for the ship to also avoid an abundance of commercial crab pots during trawl tows. The commercial crab season was opened later in the year than normal, pushing that fishing season into the same time frame as the rockfish survey. Because the crab fishing season was more limited than usual, it also meant that there were more crab pots at deeper depths and therefore a higher abundance in areas where our scientists' stations exist. During the day the ship would scout for a clear track through the crab pots so they could successfully conduct nighttime tows without disrupting / destroying the industry's gear. However, when marine mammals were seen during pre-set watch, in these areas of extremely constrained tow space due to high density crab pots, the station automatically had to be skipped because there was not alternative tow route through the commercial fishing gear. Additionally, to achieve the full 30 minutes for the pre-set watch, the ship slowed transit speed in between set locations for stations that were less than 5 n mi apart in order to perform the pre-set watch (detailed description in section 1 of this report) as prescribed by SWFSC's LOA. Although our survey was able to successfully complete the watches, the slowed transit times between stations resulted in scientists altering their standardized data collection methods. The diversion from the normal scientific methods included instances of cancelling ecosystem sampling (e.g., performing CTD casts) at stations or significantly shortening trawl times (from 15 down to 5 minutes) for all tows in order to accommodate the 30 minute watch. All sampling on this survey must be conducted at nighttime (when there is complete darkness), thus there is a very limited amount of time to fit all crucial activities in to collect the data necessary to inform stock assessments for commercially valuable rockfish each night. For future field seasons, SWFSC has determined that in order to achieve both its scientific research goals and mitigate its impact on marine mammals to the fullest possible extent, it will perform a pre-set watch for either 30 minutes, or if the travel distance between two stations is less than 30 minutes, to conduct the watch for the entire transit time. This would still ensure that a watch is conducted for the total possible period leading up to the trawl set, but would allow for the completion of all scientific tows in a night because the transit speed will not have to be slowed.

The pre-set and active gear watches were implemented with 100% of the time during the reporting period, and any time the move-on rule was implemented and a trawl followed, there was no interaction with marine mammals. However, the two interaction events that SWFSC had in 2016 occurred when no marine mammals were seen during pre-set or active gear watches.

Pingers were deployed on every tow for both nets in throughout the reporting period, and were functioning properly during the two take events. However no additional data was collected on sets that had no interactions with marine mammals. For all 2017 trawl surveys, pinger function will be added to the watch logs and data collection will occur on every set during all trawl surveys.

Longline Marine Mammal Mitigation Measures

During the reporting period, the Center only conducted daytime longline sets. In addition to the pre-set watch and active gear watch, the line is checked throughout the soak to look for target catch species and to make sure the line has not been ensnared or tangled.

SWFSC also developed boiler plate language detailing the required longline mitigation measures to include in all longline cruise / project instructions. Likewise to trawl surveys, data is collected on all longline surveys in watch logs on whether or not marine mammals or other protected species were

seen during required watches and if they were, what actions were implemented to mitigate potential interactions (e.g., move-on rule or professional judgment decisions).

The watch logs from the reporting period show that the required 30 minute pre-set watch, active gear watches, and move on rule was implemented with 100% compliance on our longline survey which occurred in late summer of 2016 – Juvenile Thresher Shark Survey (LL-JT-0030)

Table 15. Implementation and effect of marine mammal (MM) watches and move-on rule on SWFSC longline surveys during the reporting period.

Longline Survey	Total # sets	Move-on implemented	Set aborted	# Sets: 30-min pre-set MM seen but didn't move-on	# Sets: 30-min pre-retreival MM seen but no action taken	# Sets MM seen during soak	% of sets that had to move on	% of sets cancelled due to MM	Interactions events w/ Marine Mammals
Juvenile Thresher Shark - LLJT0030	68	0	0	12	7	23	0	0	0

During the 2016 longline survey, 68 pelagic longline sets were completed and all pre-set watches and active gear watches were fulfilled. As shown by the table, during 12 of the 68 sets, marine mammals were seen during the pre-set watch, but no move-on rule was implemented because of the exception to the rule for longlines when five or fewer California sea lions are present in the area. Additionally of note, active gear watches (deployment, soaking, retreival) there were 23 instances where marine mammals were seen swimming in the set area – these instances were monitored and recorded, however no alternative action was taken during these sightings and the survey had zero marine mammal interactions. In 7 of those 23 instances, the marine mammals were seen during the required the 30 minute pre-retrieval watch. All of those situations were monitored closely, but the final duration of the soak and gear retrieval proceeded normally with no alternative action taken. California sea lions, harbor seals, humpback whales, dolphins, and sea otters made up the species seen during those watches – none of the sightings during those watches resulted in incidental interaction with any of these species.

AERD marine mammal mitigation measures

In the AMLR, SWFSC fisheries and ecosystem research activities were conducted in a manner consistent with all mitigation measures. Visual watches were conducted while the vessel was underway, prior to and during gear deployment, and during sampling. No protected species interactions with sampling gear occurred. Use of active acoustic systems was tracked and is reported in Table 2. Table 5 summarizes trawl gear use in the ARA. Table 13 summarizes the behavioral responses / disturbance of hauled out pinnipeds incidental to the ship while on predetermined survey tracklines. Because no interactions occurred between trawl gear and marine mammals in the ARA we have no basis on which to evaluate the efficacy of the mitigation strategies in this research area.

VI.

Outcome of Serious injury determinations

One serious injury determination will need to be made for the Pacific white-sided dolphin that was excluded from the MMED during the take event on the summer CCE survey (1607RL). However, serious injury determination reports for any given year are not completed until the end of the following calendar year so at this time SWFSC cannot provide a specific report for this event. The SWFSC will provide an update to this report once SI determination has been made.

VII.

Updates on development / implementation of MMEDs and analysis of bycatch patterns

During the reporting period, the Ocean Salmon Survey used tested an alternative configuration of the MMED on the Nordic 264 trawl net to limit loss of target catch species. The MMED escape hole and cover flap was faced downwards (towards sea floor) instead of up (towards sea surface) – see Appendix A for further description.

There are currently no updates or analysis of SWFSC's bycatch patterns. However, a major part of implementing EC / ITA compliance throughout the Center has been devoted to data collection to aid in the understanding of the practical impacts of our mitigation measures on limiting survey impacts to protected species. With additional years of data collection we hope to be able to develop a more informed view of the efficacy of our mitigation strategies.

VIII.

Training provided to SWFSC staff

The SWFSC is required to conduct annual training for all chief scientists and other personnel who may be responsible for implementing mitigation measures, data collection, and reporting requirements. A portion of the training must be dedicated to discussion on the use of best professional judgment to avoid marine mammal interactions to gain an understanding of successful versus unsuccessful decisions.

The first training SWFSC provided to seagoing personnel was conducted in 2015 just prior to receiving final authorizations – although the Center did not have its completed incidental take statements or letters of authorizations in hand, by working closely with NMFS OPR and WCR the Center had participated in the development and was aware of all mitigation measures. Therefore, it was possible to develop a training for seagoing staff on the new requirements and start implementation discussions. Krista Catelani and Jeremy Rusin developed, *Training on Incidental Take Authorization and Environmental Compliance Process for SWFSC Fisheries and Ecosystem Research* – the training was put on for SWFSC's Fisheries and Ecosystem Division (FED) in Santa Cruz, CA August 4, 2015 and for SWFSC's Fisheries Resources Division (FRD) in La Jolla, CA on September 9, 2015. These trainings occurred over one full work day and divisions determined who from seagoing staff would participate – chief scientists relayed all relevant information to those folks who could not make the training.

The training was designed to introduce staff who had not played a major role in acquiring environmental compliance and incidental take authorizations (EC/ ITA) to the process and new regulatory requirements that would have to be implemented on their surveys. Throughout the training two way communication was promoted between staff and presenters to ensure that a thorough and complete understanding or all new requirements was translated. First, an overview and background were provided to give a general understanding of statutory requirements, SWFSC's incidental take history, and development of the Center's mitigation measures. After that, the main objective of the training was to introduce 1) the scope (research areas, gear types, authorized take species, etc.) of what the Center's authorizations would cover, and 2) the implementation of the authorization conditions (mitigation measures, reporting requirements, data collection, etc.). The next portion of the training was focused on the circumstances in which professional judgment decisions can be used (detailed below) and what decisions are frequently made when dealing with specific gear types and interactions / avoidance practices with protected species. The marine mammal and sea turtle handling and sampling portion of the trainings were developed in coordination with SWFSC's Marine Mammal and Turtle Division.

After the initial training in 2015, smaller meetings were held in 2016 whenever a seagoing group felt it necessary to go over EC / ITA requirements before going out to sea. These meetings were conducted on a smaller scale at division program levels or with a few seagoing folks at a time. They focused on mitigation measure and data collection specific to the gear type that would be used on the survey and the handling and reporting protocols that would follow an incidental take.

On December 14, 2016, Krista Catelani and Jeremy Rusin held a *SWFSC Fisheries & Ecosystem Environmental Compliance* Forum with seagoing staff affected by the new EC / ITA authorizations to discuss implementation of the new requirements over the previous year. The idea is that an annual training session is useful to prepare seagoing staff immediately prior to their field season, and a forum is useful to debrief implementing mitigation, reporting and collecting data during the past season while memories are still fresh. Several NOAA Corps Officers from the FSV Reuben Lasker were also invited and attended the forum. A survey was designed and sent out to all staff listed on

2016 cruise / project instructions prior to the forum to help guide the discussions on SWFSC's current fisheries and EC / ITA practices. The survey results were extremely informative in developing topics to guide the meeting discussions on how the 2016 EC / ITA efforts went both at sea (scientists) and among Center leadership. Through the forum we were able to streamline and standardize many of our EC / ITA implementation protocols.

The survey results highlighted the following key topics that were covered in forum discussions:

1) Required mitigation measures effect on scientific data collection
2) Need / want for improvements on communication of required EC/ITA measures
3) New / additional mitigation measures
4) Professional judgement

The first of these four topics were described in detail in Section 4 -- Evaluation of SWFSC Mitigation Strategies. Through both the survey and forum discussions it was apparent that some of SWFSC's surveys were being negatively affected by the required 30 minute pre-set watch. As discussed previously, the impacts of the watch resulted from the commitment of scientists to adhere to the letter of the mitigation requirement (i.e., a 30-minute watch) even when stations are less than 30 minutes apart. SWFSC determined it is not practical to have the ship slow down transit speeds to conduct a 30 minute watch when the transit times between stations is less than that due to the risk of losing significant scientific sampling opportunities. However, in order to continue to mitigate potential impacts to marine mammals, SWFSC will still conduct a dedicated watch for the entire duration of transit between stations that are less than 30 minutes apart. A dedicated observer will be scanning the sea surface for marine mammals and other protected species during transit leading up to the setting of the trawl so the move-on rule can be implemented if necessary prior to setting gear.

The second main topic discussed during the forum was the need and want for improvements on the communication of required measures and how to perform them. Seagoing staff requested more explanation on how to properly conduct watches and subsequent updates to pre-set and active gear watch text included in cruise instructions. It was agreed upon that all watches should be conducted without distraction e.g., no headphones, music, phones, etc. should be used while conducting watches. Scientists also shared experience that it is helpful to keep bridge windows open, when weather permits, during watches and employ active listening for the occurrence of marine mammals and other protected species. Use of active listening is now part of SWFSC's boiler plate language and watch protocols.

In addition to the how to conduct the watches, there was much confusion during the 2016 survey season when an incidental take occurred on what was to be done with the resulting marine mammal carcasses. Although SWFSC had developed protocols for reporting and sampling incidentally caught mammals, those instructions and requirements had not been relayed to the FSV Officers. In order to combat this lack of communication and understanding between the science center staff and the FSV Reuben Lasker officers and crew, the Officers were invited to the EC / ITA Forum and Krista Catelani provided a training to the ship's officers and crew in early 2017 on all SWFSC EC / ITA requirements and protocols. Supplementary to the trainings, the scientific staff and ship officers thought it would be helpful to create a brief handout on EC / ITA requirements to be provided during the welcome aboard meetings on the ship which occur at the start of each survey leg as a refresher for all seagoing staff. Although SWFSC has made great headway in developing data collection, monitoring, reporting and sampling protocols, during the reporting period we

discovered we need to invest more in communicating requirements and our protocols from the Chief Scientist to each Cruise Leader and ensuring all relevant staff are knowledgeable regarding environmental compliance measures and their roles in implementing them.

The next common theme that ran through both the survey answers and forum discussions was the interest in developing and implementing new and better mitigation measures for nighttime surveys since detection of marine mammals and other species during nighttime hours can be very difficult depending on lighting conditions, weather, and sea state. Many ideas on alternative mitigation measures were discussed, including the use of infrared detection, passive acoustic detection, live video feed, use of night vision sighting instruments, etc. The biggest constraint on all of these is funding to develop and test them and the need to prioritize this work relative to other Center activities.

Lastly, the use of professional judgment during survey operations was discussed. To date, no group has compulsory actions they take when gear is in the water and they see a marine mammal. The decisions made are dependent on species and gear state. On daytime trawls, if the net is being deployed, but is not yet actively fishing (the mouth is still closed) and dolphins are seen generally the practice is to immediately haul back. For both day and night time surveys if marine mammals are seen while the net is actively fishing, general practice is to continue fishing in hopes that if the marine mammals entered the net, they will either be excluded through the MMED or swim back out of the mouth. If the net were to instead be hauled back immediately in this situation, the net would collapse onto the animals entrapping them. All scientists, especially those who conduct nighttime surveys would really like to develop a best professional judgement guide, but at this point we don't have enough information to be able to do so. Until then, we are focusing on collecting data and archiving information on different decision points and considerations in order to inform "best practices."

These pre-field season training sessions and the post-season forums to discuss how everything went seem to be a good complement and approach to disseminating and collecting information from seagoing fisheries and ecosystem research staff. SWFSC expects that this investment in communication with its staff will ensure SWFSC research meets its requirements and also yield important data and observations that will inform development of future mitigation strategies.

Appendix A

Map 1 – This map displays SWFSC's take of protected species protected under the MMPA and Endangered Species Act (ESA) over the reporting period.