

**Annual Report under Section 101(a)(5)(A) of the MMPA for Fisheries and Ecosystem Research
Activities Conducted by Southwest Fisheries Science Center during
January 1, 2021 – December 31, 2021**

On January 15, 2021, 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), 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 in the CCE and AMLR. These authorizations are valid through January 14, 2026.

In accordance with these authorizations, the SWFSC is required to provide annual reports. The following report will cover the period from January 1, 2021 - December 31, 2021 in the CCE. Research conducted in AMLR was conducted under a directed research permit, and therefore will not be included in this report.

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 and SX90 Were Predominant and Pro-Rated Estimates of Actual Level B Acoustic Take
- III. SWFSC Gear Metadata for All Fisheries and Ecosystem Surveys in the CCE During the Reporting Period
- IV. Accounts of All Incidents of Marine Mammal Interactions in the CCE
- V. Final Outcome of Serious Injury Determinations
- VI. Evaluation of Effectiveness of SWFSC Mitigation Strategies
- VII. Updates on Mitigation Strategy Development
- VIII. Training Provided to SWFSC Staff and Cooperative Agencies

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

I. Overview of SWFSC's Required Mitigation Measures

Prescribed mitigation measures are outlined in the newly issued MMPA LOAs for the Center to follow during surveys to minimize the likelihood or severity of incidental gear interactions with marine mammals and other protected species. Specific measures are described for each covered gear type, and consist of dedicated marine mammal/ protected species watches, a move-on rule if protected species are seen during watch within the exclusionary zone, and standard operating procedures.

Below are gear specific descriptions of these conservation measures in trawl, hook and line and purse seine-based surveys:

- **15-minute pre-set watch**

During SWFSC trawl, purse seine and hook and line surveys, a dedicated observer must initiate a 15 minute pre-set watch (visual observation) prior to deploying 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. If two sequential stations are

more than 15 minutes apart (assuming cruise speed of approximately 10 knots), then the watch will be conducted during the final 15 minutes of transit. If transit time is less than 15 minutes, then a marine mammal watch is conducted for the duration of the transit. A pre-set watch will be conducted during pre-set activities once the vessel has arrived on station.

- **Move-on rule**

For surveys using a trawl net, If a marine mammal (excluding baleen whales) 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 the 1 n mi radius of the set location) the ship must move again or skip the station. If baleen whales are in the vicinity of the station, professional judgement is used.

For surveys using a purse seine net, when one or more killer whales, small cetaceans or five or more pinnipeds are observed within 500 meters (m) of the planned sampling location, the vessel must remain on-site or move to another sampling location. If remaining onsite, the set will be delayed until the animals depart the vicinity or no longer appear to be at risk, at which point an additional 15 minute watch will be conducted to ensure the animals have moved out of the vicinity or no longer appear to be at risk of an interaction. If after moving on, the animals remain at risk of interaction, then the vessel must move again or skip the station. Marine mammals sighted beyond the 500 m exclusionary zone will be monitored to determine position and movement in relation to the vessel. Professional judgement is used to determine the best course of action to minimize risk of an interaction.

- **Active gear monitoring**

Once 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 judgement. When professional judgment is used, it will be recorded, and only to be used in circumstances when the gear is already deployed. Further defined, if a marine mammal is seen during the pre-set watch, the move-on rule must be implemented, but if it is seen during deployment of the net, active fishing or haul back, then professional judgment is used to determine the best course of action to avoid an interaction.

If a marine mammal is sighted in the purse seine net, the net will be immediately opened to free the animal.

- **Marine mammal excluder device (MMED)**

SWFSC's marine mammal excluder device was developed to allow marine mammals to escape from the Nordic 264 trawl net without losing target catch. The modified Cobb trawl is not equipped with a MMED.

- **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. Operational status is checked prior to deploying the net.

- **Other standard trawl survey protocols**

The SWFSC also employs several standard survey protocols to minimize impacts to protected species: 1) research operations are conducted as soon as practicable upon arrival at the sampling station; 2) the gear will be emptied as quickly as possible upon retrieval in order to determine whether to or not protected species are present, and; 3) care will be taken when emptying the trawl to avoid damage to protected species that may be caught, but not visible during retrieval of the net.

II. Line-Kilometers Surveyed During Which EK60/EK80, ME70, and SX90 Were Predominant and Pro-Rated Estimates of Actual Level B Acoustic Take

Three trawl-based surveys were conducted in the CCE during the reporting period: Spring Coastal Pelagic Species (CPS) Survey (RL2102), Rockfish Recruitment and Ecosystem Assessment (RREA) Survey (RL2103) and the CCE Survey (RL2104). Acoustic systems used during 2021 trawl-based surveys include: Simrad EK60 and EK80 narrow beam echosounders, Simrad ME70 multibeam echosounder and Simrad SX90 narrow beam sonar. The Nearshore CPS Survey, a purse seine-based survey was conducted aboard two fishing vessels (F/V): F/V Long Beach Carnage for the southern aspect of the survey, and F/V Lisa Marie for the northern portion of the survey. The EK60 was the sole acoustic system used during the Nearshore CPS Survey. California Cooperative Oceanic Fisheries Operations (CaCOFI) surveys (RL2101 and 2105SH), which incorporate the EK60/80 and ME70 acoustic systems are included in Table 1 below.

Table 1. Line-kilometers (kms) surveyed during the reporting period for which the SX90, EK60/EK80, or ME70 systems were the predominant acoustic sources in the CCRA compared to the totals calculated in the SWFSC’s MMPA LOA application (Appendix B of SWFSC’s National Environmental Policy Act (NEPA) Supplemental Programmatic Environmental Assessment (SPEA). Included in the ‘EK60/EK80 - Summed line-kms of reporting period/source (0-200 m)’ column are a fraction of Sairdrone line-kms, which operated with an EK80 WBT mini echosounder. The acoustic output for this source operates with less power at 38 kHz (500W), less frequent intervals (~2 seconds) and a wider bandwidth (18 degrees) than that of the echosounder on the ship. To calculate the difference in acoustic output between the WBT Mini echosounder vs. the ship’s EK60/80 echosounder, the following equation was used: (Total Sairdrone kms) * (Change in beamwidth 7/18) * (Change in power 500/2000) for operation at 38 kHz. The resulting number obtained was approximately 10% of the total Sairdrone line-kms, which was added to the total line kms reported for the ship, and subsequently analyzed.

California Current Ecosystem						
Echosounder	SPEA Estimated summed dominant line kms/source (0-200 m)	Summed line-kms of reporting period / source (0-200 m)	Pro-rated predominant acoustic line-kms of reporting period/source (0-200 m)	SPEA Estimated summed dominant line-kms/source (>200 m)	Summed line-kms of reporting period / source (>200 m)	Pro-rated predominant acoustic line-kms of reporting period/source (>200 m)
SX90	33,880	6412	1603	33,880	21,876	5,469
EK60/EK80	79,912	16,267	9,760	99,640	36,176	27,132
ME70	19,728	6,412	962	0	21,876	0 ¹

¹The ME70 has negligible effects >200 m and is therefore pro-rated to 0.

Table 2. 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 PEA Appendix C) was multiplied by the pro-rated acoustic 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	SPEA Estimated Annual Takes
		0-200 m	>200 m	EK60/EK80	ME70	SX90		
<i>CCE Cetaceans</i>								
Harbor porpoise	0.17057	X		22	3	18	43	675
Dall’s porpoise	0.23154	X		30	4	24	58	916
Pacific white-sided dolphin	0.1042	X		13	2	11	26	412
Risso’s dolphin	0.05283	X		7	1	6	13	209
Bottlenose dolphin	0.01565	X		2	0	2	4	62
Striped dolphin	0.22321	X		28	4	23	56	883
Short-beaked common dolphin	3.64808	X		465	64	382	911	14,430
Long-beaked common dolphin	0.36033	X		46	6	38	90	1,425
Northern right-whale dolphin	0.15534	X		20	3	16	39	614
Killer whale	0.00318	X		0	0	0	1	13
Short-finned pilot whale	0.00068		X	2	0	1	3	30
Baird’s beaked whale	0.00523		X	19	0	5	24	72
Mesoplodon beaked whales	0.00612		X	22	0	5	28	84
Cuvier’s beaked whale	0.01167		X	43	0	10	53	160
Pygmy sperm whale	0.01548		X	57	0	14	71	213
Dwarf sperm whale	0.01548		X	57	0	14	71	213
Sperm whale	0.00699		X	26	0	6	32	96
Humpback whale	0.00747	X		1	0	1	2	23
Blue whale	0.00449	X		1	0	0	1	18
Fin whale	0.03144	X		4	1	3	8	124
Sei whale	0.00185	X		0	0	0	0	10
Common Minke whale	0.0048	X		1	0	1	1	19
Gray whale	0.13483	X		17	2	14	34	533
<i>CCE Pinnipeds</i>								
California sea lion	1.28803	X		164	23	135	322	5,095

Steller sea lion, eastern subspecies	0.31306	X		40	5	33	78	914
Guadalupe fur seal	0.07915	X		10	1	8	20	313
Northern fur seal	3.18399	X		406	56	333	795	12,595
Harbor seal	0.28167	X		36	5	29	70	1,114
Northern elephant seal	0.358		X	1315	0	320	1,635	4,916

III. SWFSC Gear Metadata for All Fisheries and Ecosystem Surveys in the CCE During the Reporting Period

Table 3. SWFSC gear metadata for the reporting period by trawl net, purse seine, hook and line in the CCRA.

Research Area	Gear Type	Total # tows/sets	Fishing Depth Range (m)	Average Tow Duration of active fishing (minutes)
<i>California Current Ecosystem</i>	Modified cobb trawl net	140	3-50	5-15
	Nordic 264 trawl net	177	0-15	45
	Purse seine	58	0-15	N/A
	Hook and line	N/A	73-182 (40-100 fathoms)	330

In the CCE, the modified Cobb net was used during RL2103. The Nordic 264 net was used for RL2102 and RL2104.

A purse seine net was used by cooperative agencies, Washington Department of Fish and Wildlife (WDFW) and California Wetfish Producers Association (CWPA) for northern and southern aspects of the Nearshore CPS Survey.

Hook and line gear was used in the Genetics Physiology and Aquaculture (GPA) Project. During fishing efforts, an attempt is made to mimic the recreational fishing fleet, and therefore gear restrictions other than established sport fishing regulations, are not imposed. Hook type varied from approximately 50% J hook and 50% circle hooks which varied from 5/0 to 10/0 in size. Fishing line mostly consisted of spectra fishing line with a monofilament leader.

Longline gear was not used during the reporting period.

IV. Accounts of All Incidents of Marine Mammal Interactions in the CCE

The following section will detail SWFSC Level A interaction events in the CCE.

Table 4. SWFSC’s take table from the MMPA LOA for the CCE displays the takes issued to the Center by gear type in that ecosystem over the five year authorization period (January 2021 - January 2026).

Species	Authorized Take				
	M/SI + Level A ¹			Level B ²	
	Trawl	Purse Seine	Hook & Line		
Gray whale (<i>Eschrichtius robustus</i>)	-	-	-	533	
Humpback whale (<i>Megaptera novaeangliae</i>)	-	-	-	23	
Minke whale (<i>Balaenoptera acutorostrata</i>)	-	-	-	19	
Sei whale (<i>Balaenoptera borealis</i>)	-	-	-	10	
Fin whale (<i>Balaenoptera physalus</i>)	-	-	-	124	
Blue whale (<i>Balaenoptera musculus</i>)	-	-	-	18	
Sperm whale (<i>Physeter macrocephalus</i>)	-	-	-	96	
Pygmy or dwarf sperm whale (<i>Kogia</i> spp.)	-	-	2	213	
Cuvier’s beaked whale (<i>Ziphius cavirostris</i>)	-	-	-	160	
Baird’s beaked whale (<i>Berardius bairdii</i>)	-	-	-	72	
Hubbs’, Blainville’s, ginkgo-toothed, Perrin’s, lesser, or Stejneger’s beaked whales (<i>Mesoplodon</i> spp.)	-	-	-	84	
Bottlenose dolphin (<i>Tursiops truncatus</i>)	CA/OR/WA stock	8	-	1	62
	CA coastal stock	3	-	-	
Striped dolphin (<i>Stenella coeruleoalba</i>)	11	1	2	883	
Long-beaked common dolphin (<i>Delphinis capensis</i>)	11	1	2	1,425	
Short-beaked common dolphin (<i>Delphinis delphis</i>)	11	1	2	14,430	
Pacific white-sided dolphin (<i>Lagenorhynchus obliquidens</i>)	40	1	-	412	
Northern right whale dolphin (<i>Lissodelphis borealis</i>)	10	1	-	614	
Risso’s dolphin (<i>Grampus griseus</i>)	11	1	2	209	
Killer whale (<i>Orcinus orca</i>)	-	-	-	13	
Short-finned pilot whale (<i>Globicephala macrorhynchus</i>)	-	-	2	30	
Harbor porpoise (<i>Phocoena phocoena</i>)	5	1	-	675	
Dall’s porpoise (<i>Phocoenoides dalli</i>)	5	1	-	916	
Guadalupe fur seal (<i>Arctocephalus philippii townsendi</i>)	-	-	-	313	
Northern fur seal (<i>Callorhinus ursinus</i>)	California stock	5	-	-	12,595
	Pribilof Islands/ Eastern Pacific stock				

California sea lion (<i>Zalophus californianus</i>)	20	5	5	5,095
Steller sea lion (<i>Eumetopias jubatus</i>)	9	-	1	914
Harbor seal (<i>Phoca vitulina</i>)	9	5	-	1,114
Northern elephant seal (<i>Mirounga angustirostris</i>)	5	-	-	4,916
Unidentified cetacean (Family Delphinidae or Family Phocoenidae)	1	-	-	-
Unidentified pinniped	1	1	1	-

¹ 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 Takes may be by Level B harassment only. The number represents the annual take authorization for five years.

Table 5. SWFSC’s Level A takes in trawl gear (Nordic 264 and modified Cobb 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 (2021-2026)	SWFSC Trawl Takes for the reporting period	Remaining Takes
Bottlenose dolphin (<i>Tursiops truncatus</i>) CA/OR/WA offshore	8	0	8
Bottlenose dolphin (<i>Tursiops truncatus</i>) CA coastal	3	0	3
Striped dolphin (<i>Stenella coeruleoalba</i>)	11	0	11
Short-beaked common dolphin (<i>Delphinus delphis</i>)	11	0	11
Long-beaked common dolphin (<i>Delphinus capensis</i>)	11	0	11
Pacific white-sided dolphin (<i>Lagenorhynchus obliquidens</i>)	40	3	37
Northern right whale dolphin (<i>Lissodelphis borealis</i>)	10	0	10
Risso’s dolphin (<i>Grampus griseus</i>)	11	0	11
Harbor porpoise (<i>Phocoena phocoena</i>)	5	0	5
Dall’s porpoise (<i>Phocoenoides dalli</i>)	5	0	5
Northern fur seal (<i>Callorhinus ursinus</i>) – California Stock & Pribilof Islands/ Eastern Pacific stock	5	0	5
California sea lion (<i>Zalophus californianus</i>)	20	2	18
Steller sea lion (<i>Eumetopias jubatus</i>)	9	0	9
Harbor seal (<i>Phoca vitulina</i>)	9	0	9
Northern elephant seal (<i>Mirounga angustirostris</i>)	5	0	5

Unidentified pinniped	1	0	1
Unidentified cetacean (Family Delphinidae or Family Phocoenidae)	1	0	1

Table 6. SWFSC’s Level A takes in purse seine gear for the reporting period and the remaining takes left for purse seine surveys during the authorization period.

Authorized Purse Seine Species	# of Level A (M/SI) authorized incidental takes (2021-2026)	SWFSC Trawl Takes for the reporting period	Remaining Takes
Striped dolphin (<i>Stenella coeruleoalba</i>)	1	0	1
Long-beaked common dolphin (<i>Delphinus capensis</i>)	1	0	1
Short-beaked common dolphin (<i>Delphinus delphis</i>)	1	0	1
Pacific white-sided dolphin (<i>Lagenorhynchus obliquidens</i>)	1	0	1
Northern right whale dolphin (<i>Lissodelphis borealis</i>)	1	0	1
Risso’s dolphin (<i>Grampus griseus</i>)	1	0	1
Harbor porpoise (<i>Phocoena phocoena</i>)	1	0	1
Dall’s porpoise (<i>Phocoenoides dalli</i>)	1	0	1
California sea lion (<i>Zalophus californianus</i>)	5	0	5
Harbor seal (<i>Phoca vitulina</i>)	5	0	5
Unidentified pinniped	1	0	1

Table 7. SWFSC’s Level A takes in hook and line gear for the reporting period and the remaining takes during the authorization period.

Authorized Purse Seine Species	# of Level A (M/SI) authorized incidental takes (2021-2026)	SWFSC Trawl Takes for the reporting period	Remaining Takes
Pygmy or dwarf sperm whale (<i>Kogia</i> spp.)	2	0	2
Bottlenose dolphin (<i>Tursiops truncatus</i>) (CA/WA/OR Stock)	1	0	1
Striped dolphin (<i>Stenella coeruleoalba</i>)	2	0	2
Long-beaked common dolphin (<i>Delphinus capensis</i>)	2	0	2
Short-beaked common dolphin (<i>Delphinus delphis</i>)	2	0	2
Risso’s dolphin (<i>Grampus griseus</i>)	2	0	2
Short-finned pilot whale (<i>Globicephala macrorhynchus</i>)	2	0	2
California sea lion (<i>Zalophus californianus</i>)	5	0	5
Steller sea lion (<i>Eumetopias jubatus</i>)	1	0	1
Unidentified Pinniped	1	0	1

Level A Marine Mammal Interactions

During the reporting period, SWFSC had 4 separate interaction events with marine mammals that resulted in incidental takes of 3 Pacific white-sided dolphins (*Lagenorhynchus obliquidens*) and 2 California sea lions (*Zalophus californianus*). All interactions occurred on the NOAA Reuben Lasker fisheries research vessel (FSV) during nighttime trawl operations. All required mitigation measures were followed. Pingers were tested for functionality, dedicated observer(s) performed the pre-set, gear deployment, active fishing, and gear retrieval watch. Watch logs and anecdotal narratives indicate that no protected species were seen during the pre-set, gear deployment, and active fishing watches. 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. Photographs and morphometric measurements were taken prior to freezing the carcasses. All incidental takes occurred during the RL2102 survey.

Incidental take of one Pacific white-sided dolphin (*Lagenorhynchus obliquidens*) occurred on March 27, 2021 off the coast of Southern California (33.018611, -119.768889) during RL2102 (haul 19) between the time period of 02:19, the start of active fishing and 03:36, the completion of active fishing. Marine mammals were not seen in the previous 24 hours, or during the full 15 minute pre-set watch. The watch continued during gear deployment, active fishing (tow speed: 3.2 knots) and gear retrieval in which no marine mammals were seen until the animal was visualized as the codend was being brought on board. The animal was spotted and entangled approximately 4 m anterior of the MMED. The net had twisted during active fishing and as a result was hauled back. One deceased female Pacific white-sided dolphin (RL210327.001, curvilinear length: 216 cm) was discovered entangled via pectoral fins and facing forward toward the mouth of the net in 4 inch (in) mesh. Photographs were taken, and reported to the Protected Species Incidental Take (PSIT) database. Superficial lacerations were present on the melon, mandible and right pectoral fin, which appeared to be as a result of entanglement. Net impressions were visible on the left pectoral fin. Visibility was reported as good with clear skies. Wind speed was 10 knots and sea conditions were recorded as moderate. Species composition of the catch was composed mostly of Northern anchovy. Four pingers attached to the trawl net (3-70 kHz and 1-10 kHz) were confirmed to be operating properly by the scientific crew and the survey technician prior to net deployment. The animals were stored frozen and subsequently transferred to the Marine Mammal and Turtle Division at SWFSC for necropsy and further analysis.

Incidental take of two California Sea Lions (*Zalophus californianus*) occurred on March 30, 2021 off the coast of Southern California (34.15, -119.366667) during RL2102 (haul 27) between the time period of 00:21, the start of active fishing, and 02:11, the completion of active fishing. Prior to arriving at the station, a 15 minute protected species watch was conducted, and no marine mammals or other protected species were observed. Similarly, the protected species watch was continued during gear deployment, active fishing (depth: 0, tow speed: 3.2) and during gear retrieval. Dolphins were observed during a pre-set watch approximately 4 hours prior to the incidental take. The move-on rule was implemented and the ship moved on approximately 4.5 miles, after which no marine mammals were seen. Visibility was reported as clear with no cloud cover. Wind speed was 12 knots and Beaufort Sea state was recorded as 4. Two deceased sea lions (RL210330.001 straight length 101.6 cm; and RL210330.002, straight length 133.5 cm) were deceased and discovered close to one another. The head of RL210330.001 was slightly entangled in 5 inch mesh, although it is unclear whether the head entanglement was an effect of gear retrieval aboard the ship. RL210330.002 was found entangled in 4 inch mesh closer in proximity to the MMED. Front and rear flippers did not appear entangled in the net upon retrieval of the animals. Both animals were facing forward toward the mouth of the net. Species composition of the catch was composed of a very small amount of market squid. Four pingers attached to the trawl net (3-70 kHz and 1-10 kHz) were confirmed to be operating properly by the scientific crew and the survey technician prior to net deployment. The animals were stored frozen and subsequently transferred to the Marine Mammal and Turtle Division at SWFSC for necropsy and further analysis

A second Pacific white-sided dolphin (*Lagenorhynchus obliquidens*) was incidentally taken on April 5, 2021 off the coast of Southern California (35.113, -121.208) during RL2102 (haul 43) between the time period 23:53, the commencement of active fishing and 00:42, the completion of active fishing. Prior to arriving at the station, a 15 minute protected species watch was conducted, and no marine mammals were observed. Similarly, the protected species watch was continued during gear deployment, active fishing (depth: 0, tow speed: 3.9 knots) and during gear retrieval. No marine mammals were observed during active fishing or during gear retrieval. Marine mammals were not observed for 24 hours prior to the incidental take. Sky condition at the time of the incidental take was cloudy, and visibility was reduced due to fog. Wind speed was 13 knots, and sea conditions were moderate to rough. Beaufort Sea state was

recorded as 4. One deceased female Pacific white-sided dolphin (RL210405.001 straight length: 189 cm, girth: 118 cm) was entangled in the 5 inch mesh portion of the net, and was first visualized as gear retrieval was underway. The animal was not lactating at the time of capture and no major abrasions were present. Species composition was composed of mostly Northern anchovy. Four pingers attached to the trawl net (3-70 kHz and 1-10 kHz) were confirmed to be operating properly by the scientific crew and the survey technician prior to net deployment. The animals were stored frozen and subsequently transferred to the Marine Mammal and Turtle Division at SWFSC for necropsy and further analysis.

A third Pacific white-sided dolphin was (*Lagenorhynchus obliquidens*) was incidentally taken on April 9, 2021 off the coast of Central California (36.5352, -122.3348) during RL2102 (haul 50) between the time period of 03:51, the commencement of active fishing and 04:36, the completion of active fishing. Prior to arriving at the station, a 15 minute protected species watch was conducted, and no marine mammals were observed. Similarly, the protected species watch was continued during gear deployment, active fishing (depth: 0, tow speed: 4.1 knots) and during gear retrieval. No marine mammals were observed during active fishing or during gear retrieval. There were several instances of marine mammal sightings during dedicated watches in the preceding 24 hours. Approximately 6 hours prior during haul 48, a professional judgement decision was made to abort trawl operations due to the presence of 8 dolphins. Two scientists conducted the protected species watch for haul 49, which began at 21:44, however operations could not commence until 23:56, just over 2 hours later, due multiple sightings of dolphins on both the starboard and port side. This resulted in the vessel moving on 6 times, and moved the station location 3 miles after the last dolphin sighting. These multiple marine mammal sightings and move-on implementations occurred approximately 4 hours prior to the incidental take during haul 50. Visibility was recorded as clear and sky conditions were also recorded as clear. Wind speed was 19 knots, and sea wave height was 5-8 foot swell. Beaufort Sea state was recorded as 5. One deceased female Pacific white-sided dolphin (RL210409.001, total length: 181.3 cm, max girth: 115 cm) was first spotted from the bridge to be entangled in the 16 inch mesh portion of the net. The animal's pectoral fins were entangled, and minor abrasions were present along the pectoral fins and fluke. The animal was not lactating at the time of death. Species composition in the net was a small amount of Northern anchovy and few myctophids. Four pingers attached to the trawl net (3-70kHz and 1-10kHz) were confirmed to be operating properly by the scientific crew and the survey technician prior to net deployment. The animals were stored frozen and subsequently transferred to the Marine Mammal and Turtle Division at SWFSC for necropsy and further analysis.

During the reporting period, SWFSC had no Level A marine mammal interactions with purse seine nets.

During the reporting period, SWFSC had no Level A marine mammal interactions with hook and line gear.

All accounts of Level A incidental take were reported to the Protected Species Incidental Take (PSIT) database within 48 hours. Notifications were then administered to appropriate parties. See Appendix A for Map 1 depicting location of SWFSC marine mammal incidental takes from the reporting period.

V. Final Outcome of Serious Injury Determinations

No serious injury determinations were made during the reporting period. However, there were five instances of final outcome determination, fatal incidental take, as described in Section 4. A total of 5 Pacific white-sided dolphins and one long-beaked common dolphin were taken incidentally in RL2102 trawl activities. Photographs were taken immediately after the incidental take events and are available on PSIT.

VI. Evaluation of Effectiveness of SWFSC Mitigation Strategies

Mitigation measures are continually evaluated by SWFSC to further reduce potential impacts to marine mammals. 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. During use of these nets, the following mitigation protocols must be observed: protected species watches (15 minute pre-set, gear deployment, active fishing and gear retrieval), move-on rule, use of 2-4 acoustic pingers, use of professional judgement, and standard survey protocols (all described in detail in Section 1).

Over the reporting period, watch logs showed that during nighttime surveys, animals were often able to be heard or seen in close proximity to the ship, resulting in implementation of the move-on rule in order to reduce risk of an interaction. Through anecdotal descriptions, we have determined these sightings typically occur in good conditions, i.e., minimal cloud cover, moonlight, low Beaufort Sea state, etc. and most often, when the animals are in close proximity and made visible by available ship lighting. However, once the net has been deployed and is actively fishing, it is located a significant distance from the ship and therefore, even in good conditions, it is nearly impossible to see if marine mammals are in the vicinity of the net. This is evidenced by the fact that of all interaction events that incidentally captured marine mammals during the reporting period, no marine mammals were seen during the pre-set, gear deployment, and active fishing. However, there were a number of hauls on all three surveys where marine mammals were seen during visual observations. On several occasions dolphins were seen following the vessel while in transit to the station. An effective measure used to deter dolphins from following the ship and/or bow riding was stopping the vessel for approximately 20-30 minutes. A number of marine mammals (both cetaceans and pinnipeds) were seen during haulback, and positioned between the incoming net and vessel. No animals were captured during these instances, however discussion of the animals' behavior ultimately led to modifying protected species handling protocols for when a pinniped voluntarily hauls out on the ship or is brought aboard via the net. During RL2104, there were a couple observations of sea lions jumping on and off of the codend as the net was being hauled in. No sea lions were incidentally captured upon observing this behavior. This is the first time this behavior has been recorded during SWFSC trawl surveys.

During the RL2102 survey professional judgement was practiced in one instance when a pair of dolphins were observed approximately 21 minutes into active fishing. The trawl was immediately aborted and the net hauled back. During the RL2103 survey, professional judgement was used on several occasions, once when a sea lion was observed during the 15 minute pre-set watch. The vessel implemented the move-on rule and set the net. Approximately 10 minutes into active fishing, a Pacific white-sided dolphin was observed and the decision was made to abort the trawl. During haulback, an estimated 4-5 additional dolphins were observed. A final professional judgement decision was made after 1 dolphin was observed during haulback as the doors were up and crossed near the stern. The haulback was paused for several minutes to deter interactions. The deterrence did not work as once haulback was resumed, two dolphins were observed approximately 5 feet from the net. In another situation where 2 dolphins were observed during haulback, the net was already collapsed at the surface, and the decision was made to haul back faster. There were no incidental takes which occurred during either event.

Table 7. 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 total tows cancelled due to MM
<i>Modified Cobb Net</i>					
Rockfish Recruitment and Ecosystem Assessment - RL2103	140	8	5.2%	7	4.6%
<i>Nordic 264 Net</i>					
Spring CPS - RL2102	50	9	17%	5	5.2%
Summer CCE - RL2104	127	3	2.3%	1	2.3%

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, resulting in the ship moving on to exclude them from the restricted radius. The column labeled ‘% of total tows that had to move on’ represents the percentage of total tows that the ship moved to exclude marine mammals. The column labeled ‘Trawl aborted due to MM’ reflects the number of times that a station was skipped due to the prolonged presence of marine mammals within the 1 n mi radius, and the associated percentage in the column to the right labeled ‘% of total tows cancelled due to MM.’

Purse Seine Marine Mammal Mitigation Measures

The SWFSC conducts collaborative research with WDFW and CWPA and contracted F/V Lisa Marie and F/V Long Beach Carnage to complete Nearshore CPS Survey research objectives. The vessels use a purse seine net and require implementation of mitigation measures. During the use of these nets, the following mitigation protocols must be observed: protected species watches (15 minute pre-set, gear deployment, active fishing and gear retrieval), move on rule (specific to purse seine operations), use of professional judgement and standard survey protocols, including opening of the net if cetaceans are observed within. Mitigation measure descriptions can be found in Section 1.

Over the reporting period, watch logs showed that there was a single instance in which a sea lion was jumping in and out of the net. There were, however, several occasions when sea lions were seen swimming outside of the net, and it was not obvious if direct interaction with the net and/or depredation occurred below the surface. Professional judgement was used when whales were spotted during the 15 minute watch. The vessel waited at the set location and set the net once the animals were out of the vicinity. The animals reappeared during gear retrieval but were moving away from the vessel.

Hook and Line Marine Mammal Mitigation Measures

Two hook and line surveys are covered under the MMPA LOA, in which visual monitoring must occur prior to deployment of gear, active fishing and gear retrieval. Surveys typically conducted are the GPA Project and Life History and Reproductive Ecology Investigations of Rockfish. The latter did not occur this season. Mitigation measure descriptions for hook and line gear can be found in Section 1.

Over the reporting period, the watch log for the GPA survey indicated that occasionally sea lions would swim in the vicinity of the line, but did not investigate or interact with the gear.

To ensure compliance with these regulations, SWFSC implements the use of boilerplate language in all project instructions for surveys that use trawl nets. Project instructions, which detailed required environmental compliance and other standard trawl protocols, were provided to the crew of R/V Reuben Lasker for all trawl surveys discussed in this report.

VII. Mitigation Strategy Updates

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 aim to develop a more informed view of the efficacy of our mitigation strategies.

An effort is underway to analyze environmental factors that may play a role in Level A incidental takes. Historical data collected from trawl surveys between 2008 through 2019 and watch logs includes whether marine mammals were observed within the vicinity of the net or escaping through the MMED, and a number of environmental factors including moon phase, visibility, sky conditions, sea surface temperature, salinity, wind speed, etc. Pending the results of the analysis, the goal is to create a risk analysis for scientists to use at sea.

A preliminary effort is underway to incorporate video technology in future surveys to evaluate marine mammal trawl interactions during active fishing. Objectives may include evaluating behavior of animals entering the trawl, interactions with and efficiency of the MMED, and evaluation of areas forward of the MMED, including the 8 inch nylon mesh where animals have historically become entangled. The goal is to use video to better understand fisheries interactions between marine mammals and trawls, particularly the Nordic 264 net, and incorporate practical measures which may help to reduce incidental take. However, with the circumstances surrounding the COVID-19 pandemic, this coordinated effort has been halted until operations return to normal.

VIII. Training Provided to SWFSC Staff and Cooperative Agencies

The SWFSC is required to conduct annual training for chief scientists and other personnel 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 judgement to avoid marine mammal interactions to gain an understanding of successful versus unsuccessful decisions.

Quarterly meetings are held between Environmental Compliance Coordinators on the West coast (SWFSC, NWFSC, AFSC and PIFSC) to discuss various topics, including protocols and authorization renewals. A

meeting to specifically address training consistency related to handling procedures and data collection in the CCRA was held between the SWFSC and NWFSC was held on February 25, 2021.

Annual training occurred on March 2, 2021 at SWFSC in La Jolla, CA for the Fisheries Resources Division and Cooperative Agencies (Washington Department of Fish and Wildlife and California Wetfish Producers Association), and on April 8, 2021 for the Fisheries Ecology Division. Both trainings included the following topics: overview and background of statutory requirements, SWFSC's incidental take history, development of the Center's mitigation measures, scope of coverage for the Center's authorized takes and implementation of the authorization conditions (mitigation measures, reporting requirements, data collection, etc.), discussion of the use of professional judgement in interactions/avoidance practices with protected species, and review of handling and sampling methodologies for marine mammal and sea turtles (in coordination with the SWFSC Marine Mammal and Turtle Division). In addition to the annual training, refresher environmental compliance training sessions were offered to participants of the Summer CCE Survey as well as to cooperative agencies partnering with SWFSC to conduct the Nearshore CPS Survey. Refresher training occurred on June 9 and June 29th, respectively. Protected Species Handling Training was provided to the R/V Reuben Lasker crew on April 21, 2021. All training sessions were provided virtually due to circumstances surrounding the COVID-19 pandemic.

After completion of the field season, a SWFSC Fisheries & Ecosystem Environmental Compliance Forum was held on November 18, 2021. This forum served as a 2021 field season debrief. A survey was designed, and distributed to sea-going staff during the field season.

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

- 1) Overview of current mitigation measures and effect on data collection
- 2) Need / want for improvements of required EC/ITA measures
- 3) Recommendations for additional mitigation efforts

All suggestions for environmental compliance-related topics are taken into consideration for subsequent field seasons to improve and streamline environmental compliance protocols overall.

Appendix A

Marine Mammal Incidental Take for Reporting Period January 1, 2021- December 31, 2021

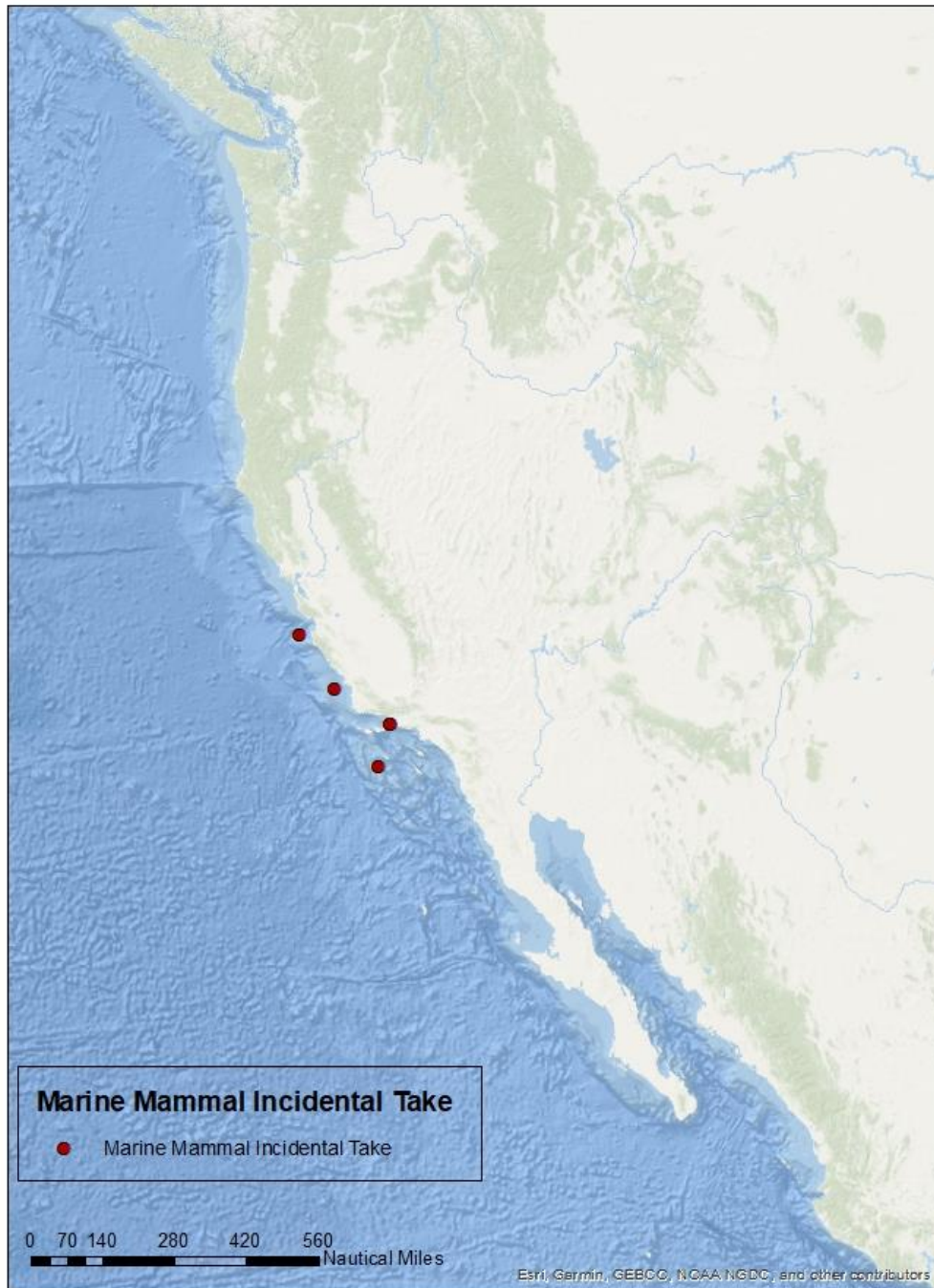


Figure 1. Map of SWFSC's incidental take of marine mammal species protected under the MMPA over the reporting period.

