



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center
Fisheries Ecology Division
110 Shaffer Road
Santa Cruz, California 95060

Cruise Report

Date Submitted: October 14, 2015
Platform: *Ocean Starr*
Cruise Number: OS - 15 - 05
Project Title: Rockfish Recruitment and Ecosystem Assessment
Cruise Dates: April 30 – June 14, 2015

Prepared by: Keith M. Sakuma
Keith Sakuma
Chief Scientist
NOAA NMFS SWFSC FED

Dated: October 14, 2015

Approved by: Steve Lindley
Steve Lindley
Laboratory Director
NOAA NMFS SWFSC FED

Dated: October 16, 2015



I. OVERVIEW

Cruise Period: April 30 – June 14, 2015

Operating Area: San Diego, CA to Gold Beach, OR

Summary of Objectives

1. Sample for pelagic juvenile rockfish (*Sebastes* spp.) and other epi-pelagic micronekton.
2. Characterize prevailing ocean conditions and examine prominent hydrographic features.
3. Map the distribution and abundance of krill (Euphausiacea).
4. Observe seabird and marine mammal distribution and abundance.
5. Conduct paired trawls with NWFSC on the NOAA Ship *Bell M. Shimada* (May 27-29)
6. Collect Humboldt squid (*Dosidicus gigas*).
7. Collections for stable isotope analysis.

Participating Organizations

NOAA NMFS SWFSC FED

NOAA NMFS NWFSC

NOAA NMFS OST

Center for Stock Assessment Research (CSTAR)

University of California Santa Cruz (UCSC)

Farallon Institute for Advanced Ecosystem Research (FIAER)

Hopkins Marine Station, Stanford University

Monterey Bay Area Research Institute (MBARI)

Personnel

Leg 1 (May 1-21)

Night Shift

Keith Sakuma, Fishery Biologist, NMFS SWFSC FED (Chief Scientist)
Kristen Elsmore, Fishery Technician, NMFS SWFSC FED
John Field, Fishery Biologist, NMFS SWFSC FED (Principal Investigator) (May 1-5)
Sabrina Beyer, Fishery Technician, NMFS SWFSC FED (May 1-8)
Cythnia Carrion, Krill Biologist, UCSC (May 1-16)
Rebecca Miller, GIS Technician, NMFS SWFSC FED (May 8-21)
Stephanie Oakes, Fishery Biologist, NMFS OST (May 8-16)
Emily Tucker, Fishery Technician, NMFS SWFSC FED (May 8-16)
Rachel Zuercher, Ph.D. Student, UCSC (May 16-21)
Kim Boone, Fishery Intern, NMFS SWFSC FED (May 16-21)
Hillary Krumbholz, Krill Biologist, UCSC (May 16-21)

Day Shift

Don Pearson, Fishery Biologist, NMFS SWFSC FED
Dawn Breese, Ornithologist, FIAER (May 1-8)
Sophie Webb, Ornithologist, FIAER (May 8-21)

Leg 2 (May 23 – June 14)

Night Shift

Keith Sakuma, Fishery Biologist, NMFS SWFSC FED (Chief Scientist)
Thomas Adams, Fishery Technician, NMFS SWFSC FED
Lyndsey Lefebvre, Fishery Technician, NMFS SWFSC FED (May 23-June 8)
Cherisa Friedlander, NOAA Corp., NMFS SWFSC FED (May 23-June 1)
Cecilia Fitzgerald-Cook, Krill Biologist, UCSC (May 23-26)
Kristen Elsmore, Fishery Technician, NMFS SWFSC FED (June 1-8)
Ilysa Iglesias, Fishery Technician, NMFS SWFSC FED (June 1-8)
Cynthia Carrion, Krill Biologist, UCSC (June 1-14)
Brian Wells, Fishery Biologist, NMFS SWFSC FED (June -14)
Nick Grunloh, CSTAR, NMFS SWFSC FED (June 8-14)
Morgan Arrington, Fishery Technician, NMFS SWFSC FED (June 8-14)

Day Shift

Edward Dick, Fishery Biologist, NMFS SWFSC FED (May 23- June 1)
John Field, Fishery Biologist, NMFS SWFSC FED (Principal Investigator) (June 1-8)
Cherisa Friedlander, NOAA Corp., NMFS SWFSC FED June 8-14)

Scientist Duty Hours

Nighttime 1800-0600
Daytime 0600-1800

Administrative

Point of Contact

Keith Sakuma, Fishery Biologist,
NOAA NMFS SWFSC FED
110 Shaffer Road
Santa Cruz, CA 95060

Phone: 831-420-3945

Email: keith.sakuma@noaa.gov

Licenses and Permits

Operations within the Channel Islands National Marine Sanctuary (CINMS) were approved under permit CINMS-2012-003. Permitted activities included the use of midwater sampling gear as well as CTDs. All other activities were subject to CINMS regulations. Operations within CA state waters were approved under California Department of Fish and Wildlife (CDFW) permit ID SC12372. All attempts were made to start midwater trawl sampling outside/furthest away from CINMS and CDFW marine protected areas (MPAs) and tow away from such areas, so long as conditions allowed.

II. OPERATIONS

1. Sample for pelagic juvenile rockfish and other epi-pelagic micronekton

Four to seven midwater trawls of 15 minute duration were conducted each night along a transect. A modified-Cobb midwater trawl with a 26 m (86') headrope and a 9.5 mm (3/8") codend liner was used. Trawling operations commenced just after dusk and concluded just before dawn. Target headrope depths was 30 m except in areas with shallow bottom depths, in which case the target headrope depth was 10 m,. Wire out was initially 25 and 85 m with adjustments made if target depths were not obtained, as determined from depth recordings collected from TDRs and the ship's acoustic trawl net monitoring system. The TDR and acoustic sensors were attached to the net during each tow. Target ship speed during trawling was ~2.0 knots with speed adjusted while trawling to maintain target headrope depth (using the acoustic trawl net monitoring system) and the amount of wire out also adjusted when necessary. Two STM Products Dolphin Dissuasive Device (DDD 03) acoustic pingers were attached to the trawl to mitigate encounters with marine mammals. Fish and select invertebrates from each trawl were sorted, identified and enumerated. Length measurements were taken on adult and pelagic juvenile northern anchovy (*Engraulis mordax*), Pacific sardine (*Sardinops sagax*), Pacific herring (*Clupea pallasii*) Pacific sanddab (*Citharichthys sordidus*), Pacific whiting (*Merluccius productus*), and salmon (*Oncorhynchus* spp.) as well as pelagic juvenile lingcod (*Ophiodon elongatus*), speckled sanddab (*Citharichthys stigmaeus*), and sablefish (*Anaplopoma fimbria*). Mantle lengths were recorded

on select squids including Humboldt squid, market squid (*Doryteuthis opalescens*, blacktip squid (*Abraliopsis felis*), armhook squids (*Gonatus* spp.), boreal clubhook squid (*Onychoteuthis borealijaponica*), and robust clubhook squid (*Onykia robusta*). Length measurements were also taken on a subsample of mesopelagic fishes including California headlightfish (*Diaphus theta*), *Nannobranchium* spp., California lanternfish (*Symbolophorus californiensis*), northern lampfish (*Stenobranchius leucopsarus*), blue lanternfish (*Tarletonbeania crenularis*), California smoothtongue (*Leuroglossus stilbius*), and blacksmelts (Bathylagidae). In addition, gobies (Gobiidae), medusafish (*Icichthys lockingtoni*), plainfin midshipman (*Porichthys notatus*), and king-of-the-salmon (*Trachipterus altivelis*) were measured. Size information was also recorded for *Chrysaora* spp., *Aurelia* spp., *Pyrosoma* spp., *Thetys* spp., and *Carinaria* spp. All pelagic juvenile rockfish were frozen for later laboratory analyses.

2. Characterize prevailing ocean conditions and examine prominent hydrographic features

CTD casts were conducted throughout the day at pre-determined stations in the vicinity of the trawl transects and at each trawl station at night. A Seabird Electronics CTD and water sampling system with conductivity, temperature, depth, fluorometer, transmissometer, photosynthetically active radiation (PAR), and dissolved oxygen sensors was used. The CTD was lowered to a maximum depth of 520 meters, as bottom depth allowed. Deployment rate: soak for 2 minutes at 10 meters depth, then beginning at the surface - 45 meters/minute on the downcast, and 60 meters/minute for the upcast. Water samples were taken during the upcast for chlorophyll samples. Sea surface temperature and salinity were also collected while underway by a SeaBird thermosalinometer. .

3. Map the distribution and abundance of krill

A series of daytime transects were run, during which the Simrad EK60 echosounder was used to record and geo-reference the presence and abundance of krill. The EK-60 operated at 38, 70, 120 and 200 kHz and interfaced to a data acquisition system to estimate small pelagic and krill biomass between 10 and a maximum of 750 m. Particular areas of interest were Monterey Bay, Ascension Canyon (off Davenport), Pioneer Canyon (between Pescadero and the Farallones), and Point Sal. Seabird and marine mammal observations were recorded concurrently along set transect lines in these areas (see Appendix I and II). Prior to the first midwater trawl of the night and after the last midwater trawl in the morning, a vertical tow using a paironet was conducted. The net was lowered to a depth of 70 meters at a rate of 70 meters per minute (or as fast as possible if less than that). At depth it was allowed to rest for 10 seconds and retrieved at a rate of 70 meters per minute (or as fast as possible if less than that). The sample from one cod end was preserved in 10% buffered formalin/seawater and the other in 95% alcohol. Bongo tows were conducted at Monterey Bay and Gulf of Farallones stations prior to midwater trawl operations. The bongo net was lowered to a depth of either 10 or 30 m (depending upon bottom depth) and towed for a period of 15 minutes. Samples were preserved in 10% buffered formalin/seawater.

4. Observe Seabird and marine mammal distribution and abundance

Ornithologists/marine mammal biologists from the Farallon Institute for Advanced Ecosystem Research visually surveyed and estimated abundance and distribution of seabirds and marine mammals from the Ship's flying bridge during daylight hours while underway. If species of particular interest were encountered, the Ship was asked to alter course accordingly.

5. Conduct paired trawls with NWFSC on the NOAA Ship *Bell M. Shimada* (May 27-29)

Working with the personnel from the NWFSC onboard the NOAA Ship *Bell M. Shimada*, paired trawls (side-by-side operations, distance between ships to be determined based on discussions with respective ship captains and weather conditions) were planned in order to estimate real or potential ship effects on catchability of juvenile rockfish and/or other micronekton. This paired trawling was scheduled to take place on the Flint Rock Head, Brookings, and Gold Beach transect lines, but was subject to change based on relative catch rates in these areas (a range of variable, but generally high, catch rates would provide the best information for making comparisons). CTD casts and other activities would be suspended during paired trawling operations at night in order to maximize the number of trawls conducted. Daytime CTD operations would then revisit the fixed stations that were sampled the previous night to obtain hydrographic data for that area.

6. Collect Humboldt squid

As time and weather conditions allowed, hook and line fishing for Humboldt squid was conducted within the survey area at depths down to 300 meters during nighttime CTD deployments. Large weighted squid jigs were used as lures, and gaffs were available to bring the squid aboard. Whole specimens would be frozen for later processing.

7. Collections for stable isotope analysis

Samples of zooplankton, krill and other micronekton were collected to provide baseline samples at multiple trophic levels to explore the potential for developing an "isoscape" analysis of the California Current. This included saving samples (frozen) from one cod-end for each of the bongo tows (ideally with 333 um mesh) conducted and tissue samples/whole organisms from krill, market squid (ideally in 50 to 100 mm size range, with larger preferred over smaller), adult northern anchovy, Pacific sardine, Pacific hake, shortbelly rockfish, Pacific sanddab, and also northern lampfish and California headlightfish. Opportunistic samples from jellyfish (*Chrysaora* spp.) and salps (*Thetys* spp.) would be collected several times over the course of the survey. The overall idealized objective was to collect net and krill samples from each station, and up to five individuals or tissue samples of each species at each station. For larger fish, samples were taken from muscle tissue and combined in a single bag (as five individual pieces), smaller individuals were frozen whole.

Mitigating interaction with marine mammals

The captain, deckhands, and scientists visually scanned the area for marine mammals for a period of no less than 30 minutes before setting the trawl gear. If marine mammals were observed within one nautical mile of the planned set location during the initial visual scan and determined to be at risk of interaction, then the vessel relocated to a distance no less than one nautical mile away and another visual scan was conducted. If marine mammals were still observed after the vessel moved from the original station location, then trawl operations for that particular station were cancelled and the vessel proceeded to the next planned trawl station.

Whenever the trawl was in the water, the captain/ship operator, the chief scientist and/or scientists and crew standing watch continued to monitor the waters around the vessel and maintain a lookout for marine mammal presence as far away as environmental conditions allowed. The chief scientist was notified if any marine mammals were observed by the captain, deckhands, and scientists. If the midwater trawl was deployed (but not yet fishing) after an “all clear” visual scan, and marine mammals were then observed by the captain, deckhands, or scientists during the trawl deployment, the gear was immediately retrieved to avoid further interaction with the animals. The vessel would then be relocated to a distance no less than one nautical mile away and followed the visual scanning protocols noted in the previous paragraph. If the midwater trawl was fishing and marine mammals were observed, then the appropriate action was taken based upon the individual circumstances with consultation between the scientists and captain (in some cases the net would be immediately retrieved, while in others it might be kept at depth to avoid marine mammals at the surface).

Every effort was made to deploy and retrieve the trawl net as quickly as possible (following all safety measures) to avoid possible interactions with marine mammals, which tend to aggregate at the surface.

If a marine mammal were to be captured in the trawl net, it would be of the highest priority to release the animal back into the water as soon as is safely possible. The chief scientist would be responsible for recording the event in the data books, noting the status of the animal (e.g. healthy and alive, injured slightly, etc.), the species, and if possible other details such as sex and relative size. If a marine mammal was captured in the midwater trawl net, the chief scientist would immediately notify a NOAA NMFS SWFSC representative on shore via telephone or email and convey all the pertinent information regarding the event.

A further measure to mitigate marine mammal encounters was to install acoustic pingers on the midwater trawl net. Two STM Products Dolphin Dissuasive Device (DDD 03) acoustic pingers were attached to the trawl net whenever it was deployed to mitigate marine mammal encounters.

III. RESULTS AND DISPOSITION OF DATA

1. Sampling for pelagic juvenile rockfish and other epi-pelagic micronekton

The daily sampling schedule is shown in Appendix I and the sampling locations shown in Appendix II. A total of 168 midwater trawls were completed. Several days of bad weather were encountered during Leg 1, but conditions were much improved for Leg 2. Two nights of sampling were lost due to emergency

evacuation of personnel (one during Leg 1 for an infected finger and the other at the beginning of Leg 2 for seasickness).

Catches of pelagic juvenile rockfish in the core area (Monterey Bay to Point Reyes) were the highest observed in the history of the survey (Appendix III). Catches north of the core area were also the highest observed since expanded area sampling began in 2004, while catches south of the core area were the second highest observed. Pelagic juvenile rockfish varied greatly in size with many more smaller fish (< 30 mm SL) collected compared to the previous two years. Smaller rockfish were particularly dominant in Southern California. Shortbelly rockfish (*S. jordani*) was the dominant species comprising 73% of the total rockfish catch, while the other top five species included (in descending order), rosy rockfish complex (*Sebastes* spp.), squarespot rockfish (*S. hopkinsi*), halfbanded rockfish (*S. semicinctus*), and chilipepper (*S. goodei*). While it would appear that southern species were dominant in 2015 it should be noted that widow rockfish (*S. entomelas*), which is a northern species, was the 6th most abundant species encountered. Note that in 2011 due to vessel, weather, and logistic constraints only two stations were sampled south of the core area in 2011 (the two nearshore Piedras Blancas stations) and in 2012 none of the expanded survey area stations north of Point Reyes were sampled.

Catches of pelagic juvenile Pacific hake were higher in the core and north areas relative to the past two years, while catches in the south were relatively low (Appendix III). Catches of pelagic juvenile Pacific sanddabs in the north were the highest ever observed and catches in the core area were the second highest (Appendix III). Pacific sanddab catches in the south were lower than 2014, but still quite high relative to previous years. Market squid catches were the second highest in the core and north, but lower in the south compared to the past several years (Appendix III). Adult Pacific sardine and northern anchovy catches remained low in all areas as in prior years, but catches of larvae and pelagic juveniles were the highest ever in the core and north and still relatively high in the south (Appendix III). Myctophid and krill abundances declined compared to the past couple of years (Appendix III).

Several species were collected in 2015 that had never before been observed in the history of the survey. These included the greater Argonaut (*Argonauta argo*), slender snipefish (*Macroramphosus gracilis*), pelagic juvenile Pacific bonito (*Sarda chiliensis*), and pelagic stingray (*Dasyatis violacea*). In addition, the ribbon fish king-of-the-salmon (*Trachipterus altivelis*) was collected in record numbers in the core and south and large catches of pelagic red crabs (*Pleuroncodes planipes*) were observed in Southern California and were even collected in the core area (Appendix III).

Jellyfish catches (core area) were the lowest since 2006 (combined species catch) (Appendix IV). Catches of other gelatinous organisms was up in all three areas compared to 2014 (Appendix IV). Catches of salps in the north were the highest observed and catches in the core and south were the second highest ever. In addition to the salps, pyrosomes were dominant in the trawl catches with the highest numbers ever observed in all three areas. *Thetys* spp. catches were also quite high in all three areas in 2015. Note that enumeration at sea of gelatinous organisms was discontinued after 2001. However, the decision was made to resume enumerating select gelatinous organisms in 2012 due to the abnormally large densities observed that year.

2. Characterize prevailing ocean conditions and examine prominent hydrographic features

A total of 246 CTD casts were completed (see Appendix II for locations). At the start of the cruise there were some issues with the port winch that resulted in problems with the real-time data acquisition. However, these were resolved after a couple of days (in the interim the CTD was deployed in standalone mode). All continuous flow-through data were collected and archived for future examination.

3. Map the distribution and abundance of krill

Acoustic transects were run each day between CTD stations and discrete transect grids were run in the vicinity of Point Sal, Monterey Bay, and Pioneer Canyon (see Appendix I and II for dates and locations) with concurrent seabird and marine mammal observations. All acoustic data were archived to external hard drives. Although windy conditions during much of Leg 1 were problematic for plankton tows a total of 59 bongo tows and 57 pairovets were still completed..

4. Observe seabird and marine mammal distribution and abundance

A summary of survey effort is shown in Appendix V. Bad weather and poor visibility hampered observations on several days. Within the core area sooty shearwaters (*Puffinus griseus*) were by far the most numerous seabird observed, which is similar to last year. The other seabirds in the top five in order were the common murre (*Uria aalge*), western gull (*Larus occidentalis*), elegant tern (*Sterna elegans*), and pink-footed shearwater (*P. creatopus*). These top five most numerous species were also the most frequently encountered. Outside of the core area the top five most numerous seabirds were the sooty shearwater, common murre, red-necked phalarope (*Phalaropus lobatus*), western gull, and black-footed albatross (*Phoebastria nigripes*). The most frequently encountered species outside the core area were sooty shearwater, common murre, western gull, black-footed albatross, and pink-footed shearwater. The top five most numerous marine mammals observed in the core area in order were the short-beaked common dolphin (*Delphinus delphis*), long-beaked common dolphin (*D. capensis*), California sea lion (*Zalophus californianus*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), and blue whale (*Balaenoptera musculus*). The most frequently encountered species in the core area were California sea lion, short-beaked common dolphin, humpback whale (*Megaptera novaeangliae*), Baird's beaked whale (*Berardius bairdii*), and fin whale (*B. physalus*). Outside the core area the five most numerous marine mammals were northern right whale dolphin (*Lissodelphis borealis*), California sea lion, Pacific white-sided dolphin, humpback whale, and fin whale. The most frequently encountered species outside the core area were humpback whale, California sea lion, Pacific white-sided dolphin, northern right whale dolphin, and fin whale.

5. Conduct paired trawls with NWFSC on the NOAA Ship *Bell M. Shimada* (May 27-29)

Due to the NOAA Ship *Bell M. Shimada* having some personnel issues which delayed the start of the NWFSC survey the paired trawling was cancelled.

6. Collect Humboldt squid

Hook and line jigging was conducted at night at several stations. However, no Humboldt squid were encountered during the survey.

7. Collections for stable isotope analysis.

Several hundred samples were frozen from the bongo tows and midwater trawls conducted throughout the survey area.

Disposition of data

Requests and questions regarding the seabird and marine mammal data should be sent to the Farallon Institute for Advanced Ecosystem Research, William Sydeman 707-981-8033 wsydeman@comcast.net.

Requests and questions regarding the stable isotope data should be sent to Hopkins Marine Station, Stanford University, Steven Litvin 831-655-6241 litvin@stanford.edu.

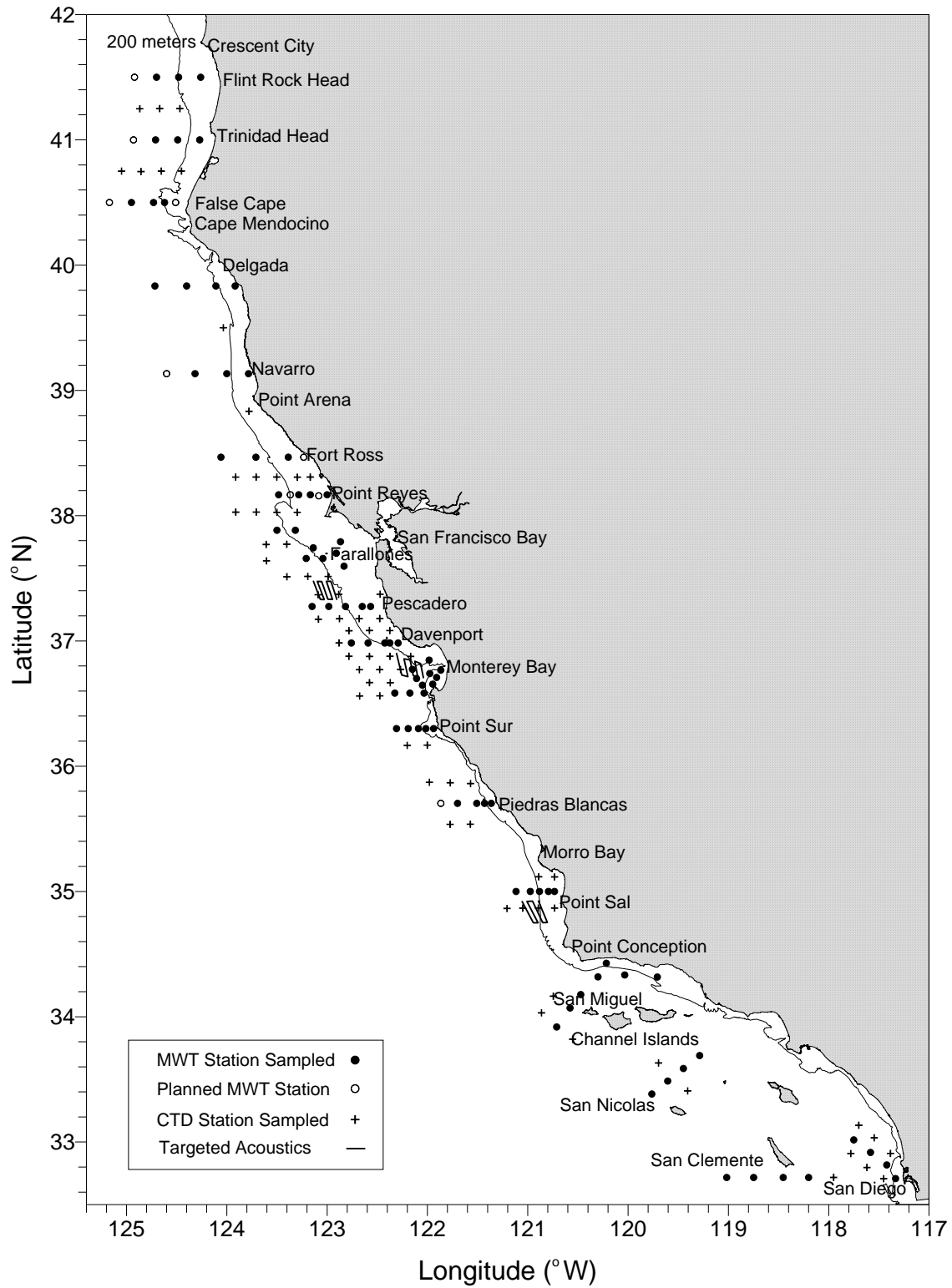
All other data requests should be sent to NOAA NMFS SWFSC FED, Keith Sakuma 831-420-3945 keith.sakuma@noaa.gov.

APPENDIX I: DAILY SCHEDULE (TENTATIVE)

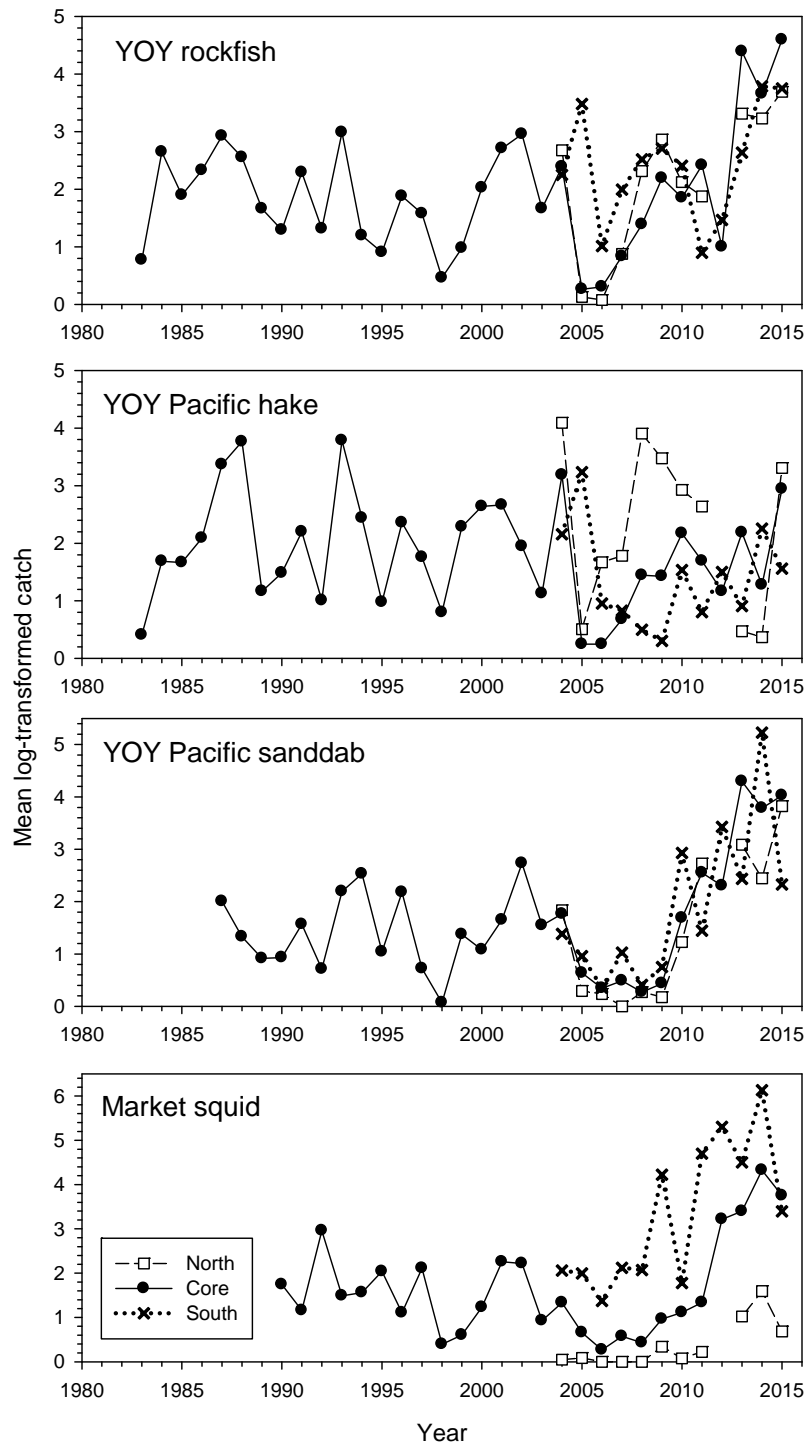
Date	Transect Location	# Sampled	Notes
30-Apr	S.F. Port		Load and Set Up Gear
1-May	Gulf of Farallones	1	Depart S.F., CA, Begin Leg 1
2-May	Fort Ross	.8	Saturday
3-May	Navarro	.8	Sunday-Bad Weather
4-May	Delgada	.8	Bad Weather
5-May			Drop off John Field in S.F.-Bad Weather
6-May	Monterey Inside	.8	Bad Weather
7-May	Davenport	.8	Bad Weather
8-May	Pescadero	1	Skiff Transfer Santa Cruz, CA
9-May	Monterey Outside	.8	Saturday-Monterey Acoustic Transect
10-May	Piedras Blancas	.4	Sunday-Bad Weather
11-May	San Miguel	.3	Bad Weather
12-May	San Clemente	1	
13-May	San Diego	1	
14-May	San Nicolas	1	
15-May	San Miguel	1	Bad Weather
16-May	Point Sal	1	Saturday-Skiff Transfer Avila, CA
17-May	Piedras Blancas	1.2	Sunday-Point Sal Acoustic Transect
18-May	Monterey Outside	1.6	
19-May	Pescadero	2	
20-May	Outside Farallones	.8	Pioneer Acoustic Transect
21-May	End Leg 1		
22-May	S.F. Port		In Port S.F., CA
23-May	Gulf of Farallones	2	Saturday-Depart S.F., CA, Begin Leg 2- Bad Weather
24-May	Fort Ross	1.3	Sunday-Bad Weather
25-May	Delgada	1.5	Memorial Day
26-May	False Cape	1	Drop off UCSC Krill Biologist in Eureka
27-May	Flint Rock Head	1	Paired Trawling with NWFSC Cancelled.
28-May	Trinidad Head	1	
29-May	Navarro	1.5	
30-May	Point Reyes	.7	Saturday
31-May	Outside Farallones	1.6	Sunday
1-Jun	Davenport	1.6	Skiff Transfer-Half Moon Bay, CA
2-Jun	Monterey Inside	1.8	
3-Jun	Piedras Blancas	1.8	Bad Weather
4-Jun	San Miguel	1.8	
5-Jun	San Clemente	1.8	
6-Jun	San Diego	1.5	Saturday
7-Jun	San Nicolas	2	Sunday
8-Jun	San Miguel	2.5	Skiff Transfer-Santa Barbara, CA
9-Jun	Point Sal	1.8	
10-Jun	Point Sur	1	
11-Jun	Monterey Outside	2.4	
12-Jun	Pescadero	3	
13-Jun	Outside Farallones	2.8	Saturday
14-Jun	Cruise Ends		Sunday-Dock S.F., CA

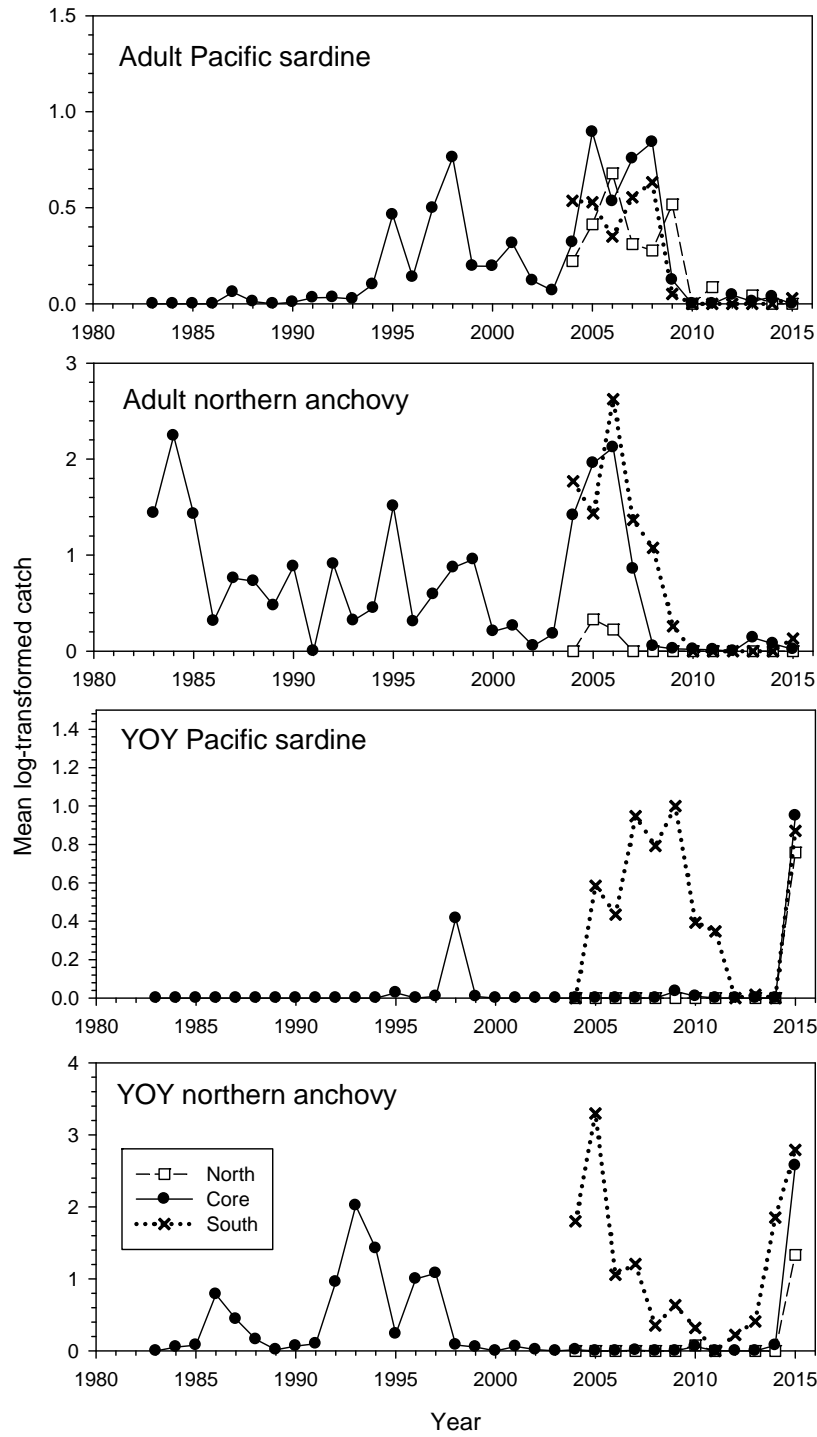
APPENDIX II: STATION LOCATIONS

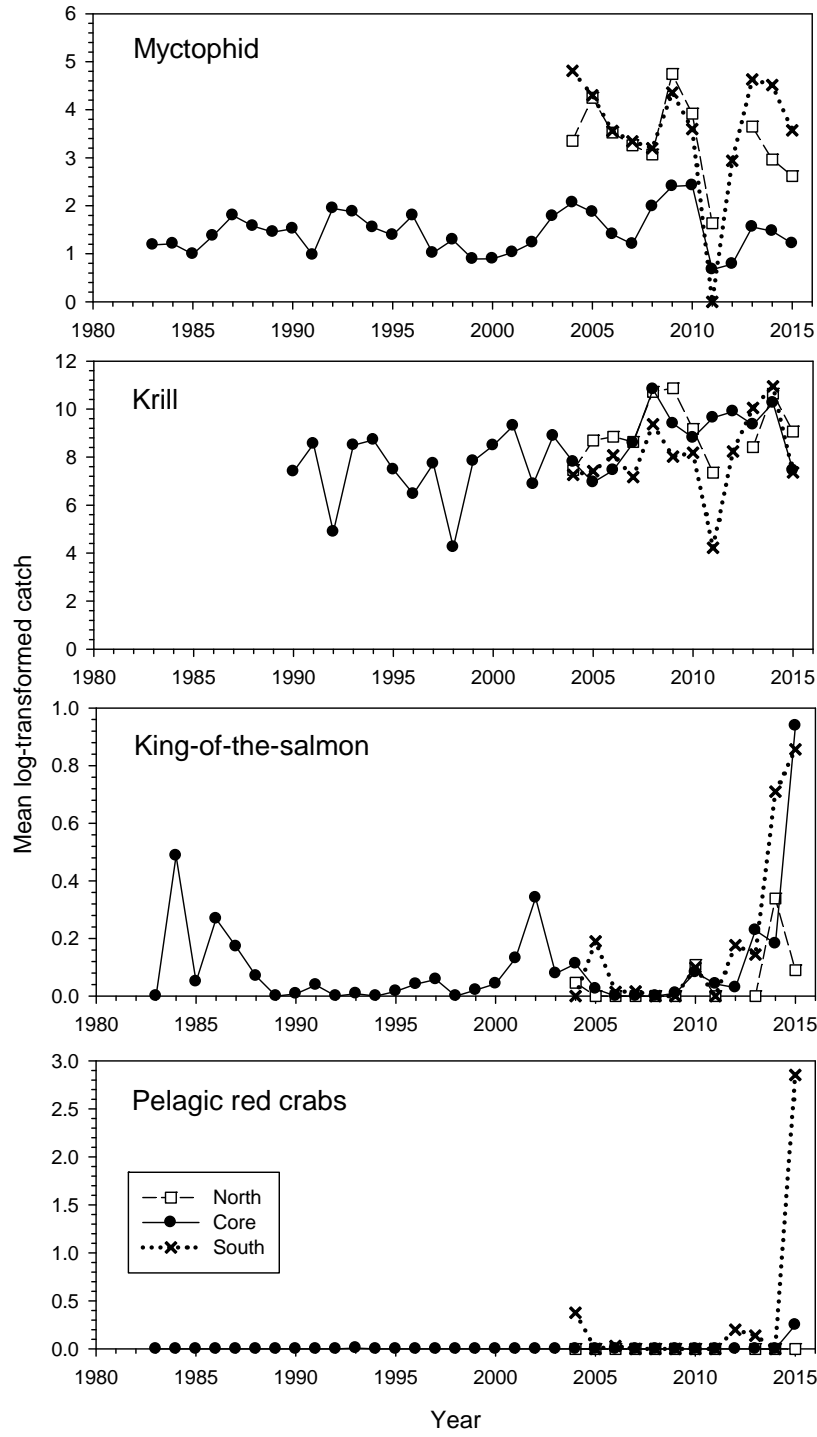
SWFSC Stations



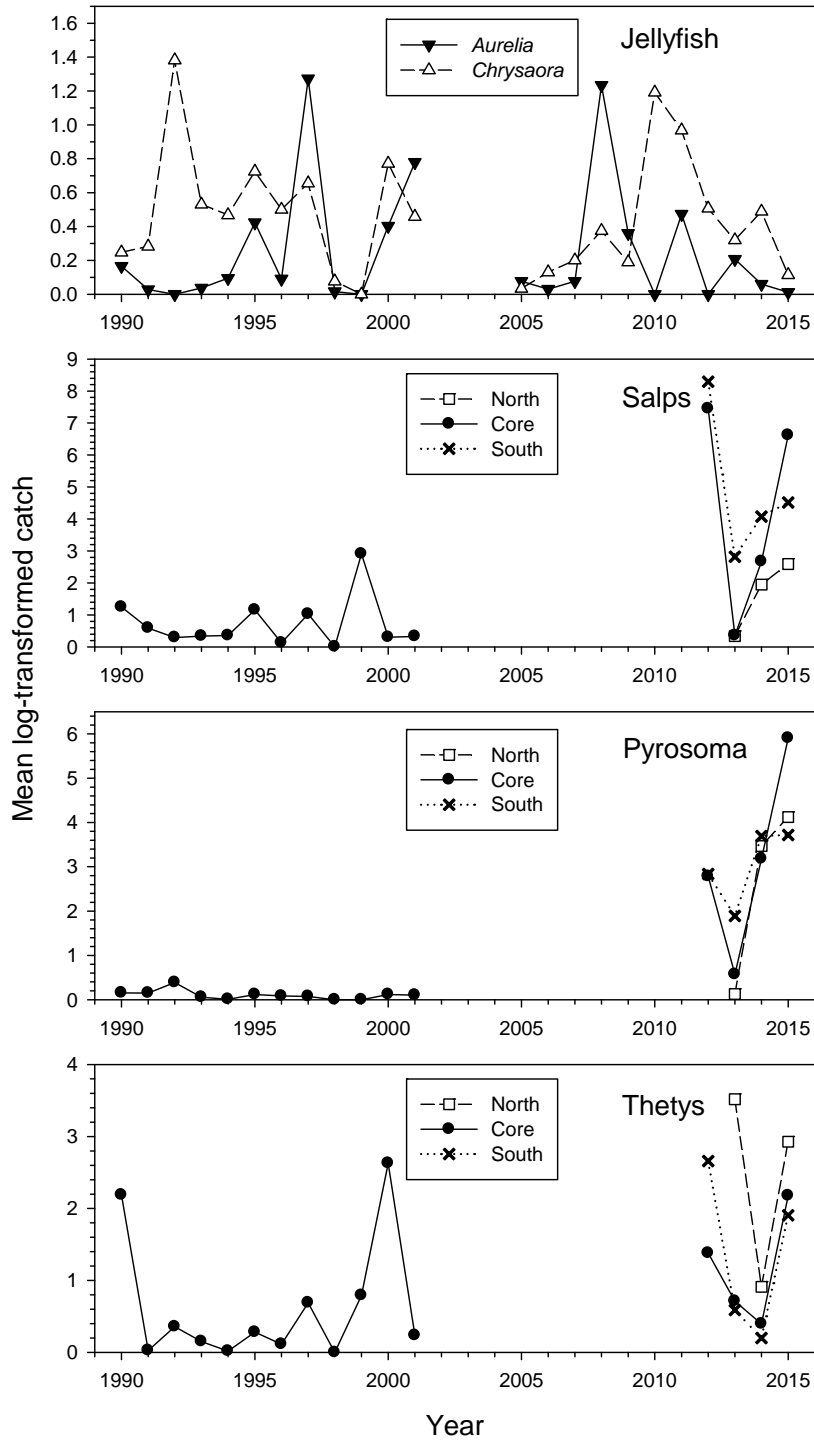
APPENDIX III: ANNUAL CATCH SUMMARIES FOR SELECT SPECIES







APPENDIX IV: ANNUAL CATCH SUMMARIES FOR GELATINOUS ORGANISMS



APPENDIX V: SEABIRD AND MARINE MAMMAL SURVEY EFFORT

Annual Survey Summary	Core region	Extended region	Total
Survey Vessel	R/V Ocean Starr	R/V Ocean Starr	R/V Ocean Starr
Start Date	5/9/2015	5/9/2015	5/9/2015
End Date	5/20/2015	5/20/2015	5/20/2015
Survey Days	7	7	12
Distance Surveyed (km)	805	794	1599
Area Surveyed (birds; km ²)	242	238	480
Number of Bird Species Obs.	32	26	40
Overall Bird Density (per km ²)	25.585	12.554	19.117
Total Birds Observed	6179	2988	9167
Number of Mammal Species	12	11	16
Overall Mammal Encounter Rate (per 100 km surveyed)	0.482	0.730	0.579
Total Mammals Observed	830	9	839