



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

November 30, 2005

CRUISE REPORT

VESSEL: NOAA R/V DAVID STARR JORDAN, DS 05-04

CRUISE DATES: MAY 1 - JUNE 12, 2005

PROJECT: Rockfish Recruitment Assessment,
Fisheries Oceanography Team, NOAA NMFS SWFSC

BACKGROUND:

Rockfish (*Sebastes spp.*) are an important component of both the recreational and commercial fisheries off the west coast of North America. Many adult rockfish are often unavailable to commercial fishing gears until they are 3-7 years old, so a current preview of future stocks can be valuable in modeling population growth and determining allowable harvest levels. This can be accomplished by sampling rockfish during their pelagic juvenile stage. Since 1983, personnel from the Fisheries Oceanography Team of the NOAA Fisheries Santa Cruz Laboratory (formerly the NOAA NMFS SWFSC Tiburon Laboratory) along with the NOAA Ship DAVID STARR JORDAN have conducted annual surveys off central California to assess the spawning success and future recruitment of various rockfish species.

ITINERARY:

LEG 1: May 1- May 7, 2005

The survey began in San Diego on May 1, 2002 after one day of gear and laboratory setup. The Ship departed MARFAC San Diego at 1200, May 1 and conducted sea trials for the Simrad ITI system, the net reel, the mid-water trawl, the Simrad EK500, the SCS system, and the CTD system. The night of May 1-2, three trawls and CTD casts were conducted along the San Diego transect. A hydraulic leak caused the Ship to return to homeport for repairs after the third trawl. The Ship remained in homeport for repairs to a generator and hydraulic lines, until 1230 on May 4. Beginning the night of May 4 and ending the morning of May 7 the Ship and scientists conducted mid-water trawls, CTDs, EK500 bioacoustic recordings, ADCP recordings, thermosalinometer recordings, SCUFA fluorometer recordings and bird/marine mammal observations at stations along the designated transects. 24 hours were devoted to each transect. The transects covered during the remainder of Leg 1, in chronological order, were; San Clemente, San Nicolas, and San Miguel. UC Santa Cruz researchers conducted two hoop net tows for krill on May 6 near San Miguel Island.



LEG 2: May 7 - May 14, 2005

Scientists were exchanged on May 14 at Avila Beach. Beginning the night of May 7 and ending the morning of May 14 the Ship and scientists conducted operations similar to those during Leg 1. The transects covered during Leg 2, in chronological order, were; Piedras Blancas, Monterey Bay inside, Monterey Bay outside, Davenport, Gulf of the Farallones, Pescadero, and Farallones outside. Hook and line fishing for adult rockfish was conducted near Point Sur on May 8, during daylight hours.

LEG 3: May 14 - May 22, 2005

Seven people from the Ship visited Southeast Farallon Island from 0700 – 0930. Personnel were transferred, for Leg 3, at Horseshoe Cove, Sausalito. The Ship transited back out to Southeast Farallon Island to drop off a Point Reyes Bird Observatory (PRBO) Conservation Science intern. Beginning the night of May 14 and ending the morning of May 22 the Ship and scientists conducted operations similar to those during Legs 1 and 2. The transects covered during Leg 3, in chronological order, were; Point Reyes, Fort Ross, Navarro, Delgada, Navarro, Fort Ross, and Point Reyes.

INPORT San Francisco: May 22-25

The Ship docked at Pier 32, San Francisco from May 22 until May 25.

LEG 4: May 25 – June 1, 2005

Scientists embarked the morning of May 25 and the Ship departed Pier 32 in the early afternoon. Beginning the night of May 25 and ending the morning of June 1 the Ship and scientists conducted operations similar to those during the previous legs. Hook and line sampling for adult rockfish off Davenport was conducted during the late afternoon of May 29 and near Point Sur on May 30. The transects covered during Leg 3, in chronological order, were; Farallones outside, Pescadero, Davenport, Monterey Bay inside, Point Sur, and Piedras Blancas.

LEG 5: June 1 - June 8, 2005

Scientists were exchanged the morning of May 30 at Pillar Point Harbor in Half Moon Bay. Beginning the night of June 1 and ending the morning of June 8, the Ship and scientists conducted operations similar to those during the previous legs. Hook and Line sampling for adult rockfish was conducted during the daylight hours off San Clemente Island on June 3, off San Nicolas Island on June 4, and off Santa Rosa Island on June 5. The transects covered during Leg 5, in chronological order, were; San Miguel, San Diego, San Clemente, San Nicolas, San Miguel, and Monterey Bay outside.

LEG 6: June 8 - June 12

Scientists embarked the morning of June 8 off Santa Cruz Harbor. Beginning the night of June 8 and ending the morning of June 12, the Ship and scientist conducted operations similar to those during the previous legs. The transects covered during Leg 6, in chronological order, were Davenport, Farallones outside, and Monterey Bay inside. UC Santa Cruz researchers conducted two hoop net tows for live krill on June 10 inside Monterey Bay. The Ship arrived in port, San Francisco, Pier 32, the morning of June 12, to end the survey.

OBJECTIVES:

1. To determine the distribution and abundance of juvenile rockfish between San Diego and Delgada and their relationship with oceanographic conditions (temperature, salinity, currents, chlorophyll, etc.).
2. To characterize prominent physical oceanographic features.
3. To map the distribution and abundance of krill along the California continental shelf and shelf break, and Monterey Bay.
4. To observe seabird and marine mammal distribution and abundance.
5. To collect adult rockfish species for ecological and life history characteristics, such as age, growth rates, reproductive status, and genetic analysis from various geographic regions.

PIGGYBACK PROJECTS:

1. Collect seawater samples at discrete depths for nutrient analysis in cooperation with San Francisco State University – Romberg Center.
2. Side-by side trawling gear comparisons with the Pacific Whiting Conservation Cooperative's (PWCC) F/V EXCALIBUR survey of juvenile Pacific whiting (*Merluccius productus*) and rockfish relative abundance.
3. Collect lengths and specimens of market squid (*Loligo opalescens*) for NOAA Fisheries SWFSC La Jolla Laboratory and for the University of California, Santa Cruz.
4. Collect lengths, stomachs, and statoliths of Humboldt squid (*Dosidicus gigas*) for food habitat studies by the NOAA Fisheries SWFSC Santa Cruz Laboratory
5. Collect and preserve juvenile shortbelly rockfish (*Sebastes jordani*) and bocaccio (*Sebastes paucispinis*) for RNA:DNA ratio analysis by Kevin Stierhoff, postdoctoral associate of the NOAA Santa Cruz Laboratory.

METHODS:

1. Juvenile Rockfish Survey:

In general, 5-7 midwater trawls, were conducted each night between 2100-0500 Pacific Standard Time at the stations along 16 transects within the survey area, between San Diego and Delgada. The trawl stations remained in the same location and are sampled annually in a consistent manner. There were a total of 76 standard mid-water trawl stations of fixed geographic locations. A list of the mid-water trawl and Conductivity-Temperature-Depth profiler (CTD) stations appears in Appendix A. Figures 1 and 2 show the locations of the standard trawl and CTD stations. Target headrope depths, while trawling, were achieved and maintained by a set amount of wire out for the trawl warps and a variable rate of speed through the water which maintained a SIMRAD ITI headrope sensor at the desired depth. Four SIMRAD ITI acoustic sensors (trawl-eye, depth-temp, port wing spread, starboard wing spread) are attached to the headrope and to the net wings near the center of the breast lines during deployments. The SIMRAD ITI provided real-time information on headrope depth, footrope depth, distance between spread sensors, and seawater temperature at the headrope. The SIMRAD ITI information is refreshed and recorded on a 30 second interval. The standard target headrope depth is 30 meters except in areas where the bottom is too shallow, in which case the target headrope depth is 7 meters. A target headrope depth of 100 meters was used occasionally when depth stratified tows were conducted. For a target headrope depth of 30 meters, 85 meters of warp was used. For a target headrope depth of 100 meters, 215 meters of warp was used. For a target headrope depth of 7 meters, 25 meters of warp was used. During mid-water trawl deployments (setting, fishing, retrieving), the Ship's speed was between 1.5-2.5 knots, (speed through the water). The Ship's speed and direction, during some tows, were altered to achieve the target headrope depth and for aligning of the codend directly astern of the Ship. In addition, a Vemco Temperature-Depth-Recorder (TDR) was also attached to the trawl net's headrope/bridle connection during deployments. The Vemco TDR provided retrospective data on depth and seawater temperature at the headrope. The Vemco TDR records this information every 10 seconds. The standard duration for fishing the trawl net at the target headrope depths was constant, at 15 minutes. In areas of high jellyfish concentrations, "test" trawl deployments were made with a 5 minute duration, at a target depth. The fishing at target headrope depth begins when the designated amount of warp is out, with winches braked. All aft deck lights were turned off when the net was at target depth, so that no lights were visible when the net is fishing at depth. An acceptable, standard 30 meter, target depth tow normally took 10 minutes to set and 10 minutes to retrieve. The standard tow direction was downwind with following seas astern. If both the wind and seas were calm then the tow direction was towards the next trawl station. In high cross-currents, the course was altered into or with the current.

Fish, shrimp, squid, and krill from each trawl were sorted, identified and enumerated. Juvenile rockfish, market squid, Humboldt squid stomachs and heads, selected juvenile groundfish, and juvenile salmon were frozen for laboratory analyses.

CTD casts using the port J-frame were conducted throughout the day in the vicinity of the trawl transects and at each trawl station at night. Some CTDs were excluded during daytime and night-time operations in the interests of the time needed to complete planned mid-water trawls.

A Seabird Electronics SEACAT 19+ CTD was used in conjunction with a Seabird Electronics Model 32/33 Carousel Water Sampling System. The CTD was lowered to a maximum depth of 520 m, or 10 meters from the bottom, as bottom depth allowed. Deployment rate: soak CTD for 2 minutes at 10 meters depth, then beginning at the surface, 45 m/min for the downcast, and 60 m/min for the upcast. Water samples were taken, on average, three times every 24 hours, for chlorophyll and nutrient analysis. Water samples were collected during the upcast, with the Niskin Bottles, which were attached to the Seabird carousel.

2. Survey of Prominent Physical Oceanographic Features:

An RDI Acoustic Doppler Current Profiler (ADCP) recorded data continuously while underway to determine subsurface current velocity and direction. The hull mounted ADCP recorded horizontal and vertical velocity as a function of depth by using the Doppler effect to measure the radial relative velocity between the instrument and scatterers in the ocean. The CalCOFI ue4m.exe ADCP setup configuration was used to input navigational data from the Ship's GPS and gyrocompass into the ADCP Data Acquisition Software (DAS). The ADCP transmits a ping from its transducer elements roughly once per second. Profiles were produced and displayed on a PC by range-gating the echo signal, which produces successive segments called depth bins. The noisy velocity estimates from each ping are vector averaged into ensembles.

A permanently mounted Seabird thermosalinometer continuously recorded seawater temperature and salinity while underway. The thermosalinometer measures water that is continually pumped from a seachest located in the Ship's hull at a water depth of 3 meters. This data was used for comparisons with CTD casts, and for a nearly continuous recording of surface salinity and temperature.

A Turner Designs SCUFA fluorometer was configured to record relative chlorophyll data continuously, while underway. The fluorometer was bench-mounted with a seawater flow-through system pumping seawater from the Ship's hull at a depth of 3 meters. The seawater flow rate was 1000ml/12seconds (5000ml/minute). The fluorometer data was combined with the Ship's GPS location data and with date-time information via the Ship's SCS.

3. Map the Distribution and Abundance of Krill Along the Continental Shelf and Shelf Break:

A Simrad EK500 echo sounder was used to acoustically characterize the distribution and abundance of macro-zooplankton and micro-nekton, meroplankton and zooplankton. The echo sounder was configured with down-looking 38, 120, and 200 kilohertz (kHz) transducers mounted in the hull. During the survey, the EK500 was configured to transmit pulses every 2 seconds at 1 kilowatt for 1 millisecond duration. Geographic positions were obtained from the ship's GPS and logged every 60 seconds. Ethernet communications were maintained between the EK500 and a Windows based PC, which logged the EK500 telegrams using EchoLog software. Data were displayed in the aft lab using Sonardata's EchoView software. Daytime EK500 transects, and daytime transits, with good EK500 acoustic-recording surface weather conditions, were carried out during the course of the survey. Daytime hoop net deployments near acoustic signatures were used to verify species of krill and to collect live specimens.

4. Seabird and Marine Mammal Observations:

Ornithologists from PRBO Conservation Science were aboard during Legs 1, 2 and 3. Seabirds were enumerated and identified in an arc from the bow to 90° amidships. All seabirds, which passed through this area in flight or observed sitting or foraging, were counted. Marine mammals were observed to the horizon. Distance and angle from the ship to each individual mammal or group of mammals were estimated. Data were entered as observations into a palmtop computer. Ornithologists from the H. T. Harvey & Associates Ecological Consultants were aboard during Leg 4. The ornithologists estimated the distribution and abundance of seabirds and marine mammals while underway. The ornithologists used standardized population recording techniques to survey the marine birds and marine mammals. Observers identified and counted birds/mammals continuously from the Ship's flying bridge during daylight hours while the vessel was underway at speeds of 7 knots (9 km/h) or greater. A range-finder was used to estimate the width of the survey transect and only those birds sighted within a 300 meter arc from the bow (directly ahead) to 90 ° off the side with best visibility (e.g., least glare) were logged into a field computer. Ship-following birds were recorded the first time they were detected and were ignored thereafter. The observers estimated the range to marine mammal sightings and recorded them, regardless of their perpendicular distance to the vessel.

5. Collection of Adult Rockfish Species for Ecological and Life History Characteristics:

Hook and line fishing with rod and reel for adult rockfish species was conducted during daylight hours at different locations during the survey. Nearshore fishing locations were Davenport, Point Sur, San Clemente Island, San Nicolas Island, and Santa Rosa Island. Length, gender, and reproductive condition of gonads, were recorded for all fish captured. Otoliths, ovaries, and fin clips for genetic analysis were removed from select specimens.

PIGGYBACK PROJECTS:

1. Seawater samples collections at discrete depths for nutrient analysis in cooperation with San Francisco State University – Romberg Center:

Seawater samples were collected for nutrient analyses from the Farallones and Point Reyes areas. Niskin bottles attached to the CTD Carousel were tripped during CTD casts in order to collect the seawater samples at discrete depths, normally 100m, chlorophyll maximum depth, and 5m. At select stations near Point Reyes and the Farallones, seawater was also collected at depths greater than 100m, usually 10 meters off the bottom or 520m, whichever was shallower. Seawater samples were frozen in scintillating vials and delivered frozen to San Francisco State University-Romberg Center.

2. Side-by-side (Synchronized) trawl gear comparisons with the PWCC F/V EXCALIBUR:

Similar trawl nets were used on each of the research vessels and target headrope depths were matched. Trawl gear from each vessel was deployed within 1/4 nm of one another at the same times throughout the night. Juvenile Pacific whiting and rockfish catch data were shared between the two vessels for each side-by-side trawl. Juvenile rockfish specimens caught by the F/V EXCALIBUR during the side-by-side comparison trawls were frozen and transferred to NMFS SWFSC Santa Cruz scientists for accurate identification and enumeration.

3. Market Squid Collections:

Dorsal mantle lengths were measured for up to 30 market squid caught, per trawl. Dorsal mantle lengths were taken for the NOAA Fisheries La Jolla Laboratory and for UC Santa Cruz. In addition, up to 30 squid larger than 60 mm were preserved (frozen) from each trawl for UC Santa Cruz.

4. Humboldt Squid Collections:

Mantle lengths, stomachs, and statoliths of Humboldt squid were collected from all specimens caught by the mid-water trawl, for food habitat studies by the NOAA Fisheries SWFSC Santa Cruz Laboratory. Stomachs and heads were removed and frozen for subsequent lab analyses.

5. Shortbelly Rockfish and Bocaccio Collections for RNA:DNA Ratio Analysis:

A subsample of juvenile shortbelly rockfish and bocaccio collected with the mid-water trawl were preserved in ultra-cold conditions within the first hour of capture for RNA:DNA ratio analysis by Kevin Stierhoff, postdoctoral associate of the NOAA Santa Cruz Laboratory.

RESULTS:

1. Juvenile Rockfish Survey:

A total of 155 successful nighttime midwater trawls were completed, at 76 different stations, during the 6 Legs of the survey. Continuing the changes that were made in 2004 during survey DS0403, the total days at sea were extended and the number of trawl stations were increased both to the south and north of the usual standard central California trawl stations.

Table 1 lists the total numbers of juvenile rockfish caught during surveys since 1986. Table 2 lists the catches of juvenile rockfish and Pacific whiting from the surveys of 2004 and 2005, comparing catches north and south of Point Conception. The catch of pelagic juvenile rockfish was the lowest in the 23 years the survey has been conducted, at least in the core set of central California stations, that have been sampled continuously since 1983. This extended time period encompasses three major El Niño events (i.e., 1983, 1992, and 1998). Significantly, the catch of other juvenile groundfish, including Pacific whiting and a variety of flatfish species, was also greatly reduced.

In spite of the very low catch rates of pre-recruit rockfish off central California, the catch of rockfishes was very high south of Point Conception. For example, the average catch rate of juvenile rockfish in the southern California Bight was 238.54 fish/trawl, whereas north of Point Conception catch rates were only 0.47 fish/trawl. Thus, it would appear that conditions in 2005, while unfavorable for rockfish reproductive success in the central and northern California regions, while they were quite favorable in southern California. Of note were the high catches of shortbelly, squarespot and halfbanded rockfishes in southern California. Likewise, catches of juvenile Pacific whiting was much higher south of Point Conception, than north of Point Conception. The opposite was true during the 2004 survey for rockfishes and Pacific whiting, where catches were much higher north of Point Conception than south of Point Conception.

Table 1. Number of pelagic juvenile rockfish (*Sebastes spp.*) collected at standard stations during surveys (1986-2005*)

SPECIES	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05
Shortbelly	9104	6865	107962	1598	4479	2422	2838	2287	949	276	1848	784	69	124	2016	3403	995	206	1235	6412
Chilipepper	54	586	4418	24	66	343	90	1251	3	32	17	12	3	27	27	126	286	85	212	10
Brown	470	10	-	3	19	265	7	1226	15	5	32	2	-	2	5	117	58	95	27	2
Widow	11	424	257	13	296	623	1	101	24	25	-	49	1	81	80	193	858	227	1247	-
Squarespot	4	177	380	16	649	47	70	25	2	-	-	1	-	-	-	36	16	1	14	896
Canary	46	71	162	39	23	618	-	14	3	-	-	3	-	38	9	31	258	31	314	2
Blue	4	196	366	63	38	220	3	38	11	7	4	5	-	9	10	67	341	140	468	-
Stripetail	2	194	30	6	22	175	5	315	9	6	2	27	14	31	11	185	352	18	213	4
Bocaccio	327	106	60	22	44	114	5	26	4	3	1	7	1	15	24	51	71	2	35	96
Yellowtail	22	85	69	31	27	281	5	31	8	27	3	6	6	1	10	30	58	68	838	-
Copper complex	9	9	1	-	1	15	116	82	54	7	10	42	4	2	4	25	5	-	5	7
Halfbanded	1	9	-	2	77	8	1	5	2	-	6	68	-	1	-	96	7	-	4	1405
Pygmy	2	15	9	12	10	62	8	2	3	-	1	2	-	1	3	34	37	8	25	103
Black	1	22	19	5	4	34	-	6	2	7	7	-	1	5	1	2	29	23	294	-
Olive	-	4	2	6	18	-	-	6	1	-	-	-	-	-	-	13	5	-	7	1
Darkblotched	-	7	5	-	1	9	-	9	-	2	-	-	-	-	2	1	1	6	3	19
Cowcod	1	17	1	1	-	-	5	5	-	-	-	-	-	-	-	-	2	1	5	7
Bank	-	18	4	-	-	-	-	5	-	-	-	-	-	-	1	1	3	-	1	6
Sebastes	2	7	3	-	1	3	8	-	-	1	2	27	-	-	2	2	2	3	423	492
Splitnose	1	4	-	-	1	-	19	-	-	-	-	10	-	1	3	-	-	-	1	1
Puget Sound	-	-	-	-	-	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sharpchin	-	-	-	-	-	-	2	-	14	-	-	-	-	1	-	1	3	-	-	1
Grass	1	1	-	-	-	-	8	2	1	-	-	-	2	-	-	3	-	-	-	-
Quillback	2	1	-	-	-	6	-	-	2	-	1	-	-	-	-	-	-	-	-	-
Vermillion	-	4	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	-	-	-	-	-	-	1	-	-	-	6	-	-	-	-	-	-	-	-	-
Greenspotted	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Greenstriped	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	25
Blackgill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	62	18
Aurora	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	2	1
Calico	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Unknown	40	5	-	-	2	4	49	31	13	13	31	49	14	25	29	55	2	45	337	1627
Totals	10104	8837	113748	1841	5779	5290	3242	5467	1120	411	1971	1095	115	366	2236	4472	3394	957	5818	11113

* Catch numbers for 2005 are preliminary

Table 2. Pelagic juvenile rockfish (*Sebastes spp.*) and Pacific whiting (*Merluccius productus*) catches south and north of Point Conception during surveys of 2004 and 2005 (2005 numbers for *Sebastes spp.* are preliminary)

SPECIES	SOUTH-2004	SOUTH-2005	NORTH-2004	NORTH-2005
AURORA ROCKFISH	2	1		
SPLITNOSE ROCKFISH	2	1		
GREENSTRIPED ROCKFISH	36	25		
SQUARESPOT ROCKFISH	74	896	7	
SHORTBELLY ROCKFISH	100	6388	1135	22
COWCOD	4	7	1	
BLACKGILL ROCKFISH	63	18		
SPECKLED ROCKFISH	1			
BOCACCIO	14	96	22	
BANK ROCKFISH	4	6	1	
STRIPETAIL ROCKFISH	1	1	212	3
HALFBANDED ROCKFISH	2	1405	4	
PYGMY ROCKFISH	66	79	17	24
SHARPCHIN ROCKFISH	2			1
ROSEFISH GROUP	433	491	3	1
COPPER ROCKFISH COMPLEX	4	7	4	
BROWN ROCKFISH			27	
DARKBLOTCHED ROCKFISH			19	
WIDOW ROCKFISH			1248	
YELLOWTAIL ROCKFISH			838	
CHILIPEPPER ROCKFISH		8	212	2
BLACK ROCKFISH			294	
BLUE ROCKFISH			470	
CANARY ROCKFISH			314	2
OLIVE ROCKFISH			7	
CALICO ROCKFISH		4		
Total Catch	808	8978	4835	56

SPECIES	SOUTH-2004	SOUTH-2005	NORTH-2004	NORTH-2005
PACIFIC WHITING	636	13062	46919	91

2. Physical Oceanographic Data Collections:

266 successful CTD casts were made during the survey. Surface weather conditions were variable throughout the survey. Periods of upwelling favorable conditions were separated by calm wind conditions during the majority of the survey. Anomalous southern (downwelling favorable), gale force winds occurred on May 17 and 18 while the Ship was operating near the northern most transect. Satellite measured sea surface temperatures in the northern part of the survey region around Point Arena were very warm during May. Primary production of phytoplankton departed from the typical pattern, with little chlorophyll evident early in the survey, but with a marked increase in the latter part of May and into June. Near-surface Chlorophyll levels showed much variability with strong pulses off of Pescadero, Point Reyes and Bodega Bay, where chlorophyll concentrations were the highest. Phytoplankton showed ubiquitous mixing in the surface layers over the continental shelf during Leg 4 due to strong mixing by persistent northerly winds.

3. Map the Distribution and Abundance of Krill Along the Continental Shelf Break Between Point Reyes and Monterey Bay:

Acoustic data from the Simrad EK500 were collected continuously throughout the survey. Acoustic data are being used for various studies cooperatively between the NOAA NMFS Santa Cruz Lab and the University of California at Santa Cruz, which include acoustic target identification/differentiation, and krill abundance/distribution. Data collected during the daylight hours under relatively low swell and sea wave height conditions, being the most valuable for the krill research.

4. Seabird and Marine Mammal Observations:

PRBO Conservation Science conducted observations of marine birds and mammals from the flying bridge during daylight hours, during legs 1-3, from 4-22 May (and briefly on 1 May). Observations were conducted by Cornelia Oedekoven and Sophie Webb using standard techniques. Data were entered as observations into a Husky Fex21 palmtop computer using the FLK program (courtesy George Hunt). Observations of the most numerous species for the period are summarized in Table 3 and Table 4. Total numbers of both seabirds (12,909) and mammals (937) were lower than counts from 2004 (16,355 and 2,227 respectively). For seabirds, this difference can mostly be explained by the fewer number of Sooty Shearwaters observed. Interestingly, only 1 Northern Fulmar was observed for the entire period. While total number observed of many mammal species was lower than the previous year, both Northern Fur Seals and California Sea Lion numbers were greater during the study period.

Over the course of 8 days (Leg 4), David Ainley and Ian Gaffney conducted surveys of marine birds and mammals from the flying bridge of *David Starr Jordan*. The area included the waters between Fanny Shoal and Morro Bay. All birds and pinnipeds were tallied of those that came within 300 m, and all cetaceans within 800 m, of the side of the vessel having the least glare. Overall, 508 nautical miles of survey track was censused. In this area, 21 species of seabirds (17,438 individuals), 7 species of cetaceans (761), 4 species of pinnipeds (103) and the sea otter (3) were encountered. Waters over the shelf were somewhat devoid of top-trophic predators, but along the shelf break and in waters seaward of it, numbers were higher than expected. It seemed that the entire seabird community had shifted from waters of the shelf to those of the slope.

Compared to observations and results from rockfish assessment surveys since 1985, the composition of the avifauna was not unusual for early June, except for far higher than ‘normal’ numbers of pink-footed shearwaters and the presence of black-vented shearwaters. Likely, the anomalously warm water had something to do with this. Sooty shearwater, common murre, western gull and pink-footed shearwater dominated the community. The high number of sightings of Pacific white-sided dolphins, in small groups (41 groups), was unusual; as were three sightings of killer whales. There appeared to be nothing unusual about the number and occurrence pattern evident in humpback whales (17 in 9 sightings within our survey strip).

**Table 3. Observations of seabirds on legs 1-3 (1, 4-22 May)
(PRBO Conservation Science, unpublished data)**

<u>May 2005 Survey</u>		
<u>Top 20 Seabird Species</u>	<u>Total Observed</u>	<u>% Of Total Seabirds Observed</u>
Sooty Shearwater	4,983	38.6%
Common Murre	2,819	21.8%
Western Gull	1,240	9.6%
Red Phalarope	761	5.9%
Red-necked Phalarope	612	4.7%
Pink-footed Shearwater	557	4.3%
Brandt's Cormorant	474	3.7%
Cassin's Auklet	401	3.1%
California Gull	302	2.3%
Rhinoceros Auklet	140	1.1%
Sabine's Gull	135	1.0%
Black-footed Albatross	130	1.0%
Unidentified Gull	69	0.5%
Brown Pelican	44	0.3%
Ashy Storm-Petrel	43	0.3%
Arctic Tern	36	0.3%
Black Storm-Petrel	24	0.2%
Pacific Loon	24	0.2%
Pomarine Jaeger	16	0.1%
Leach's Storm-Petrel	13	0.1%
Total Seabirds Observed*	12,909	

**Table 4. Marine mammals on legs 1-3 (1, 4-22 May)
(PRBO Conservation Science, unpublished data)**

<u>May 2005 Survey</u>		
Top 5 Mammal Species	Total Observed	% Of Total Mammals Observed
Pacific White-sided Dolphin	245	26.1%
California Sea Lion	220	23.5%
Northern Right Whale Dolphin	121	12.9%
Risso's Dolphin	75	8.0%
Northern Fur Seal	61	6.5%
Total Mammals Observed*	937	

5. Collection of Adult Rockfish for Ecological, Natural History, and Genetic Characteristics: A total of six afternoons were spent hook and line fishing for adult rockfish in support of the Central California Groundfish Ecology Survey program and the Santa Cruz Rockfish Genetic research projects. A total of five areas were visited: Davenport, Monterey Bay, Point Sur (twice), Santa Rosa Island, and San Clemente Island. A total of 475 fish were caught from fifteen different species. Of particular interest to the genetics group were 32 rosy rockfish, 7 honeycomb rockfish, 29 vermilion rockfish and 11 olive rockfish. A total of 55 gopher rockfish were collected which will be extremely valuable in our ongoing study of area-specific age and length studies for this species.

PIGGYBACK PROJECTS:

1. Seawater samples at discrete depths for nutrient analysis in cooperation with San Francisco State University – Romberg Center:

Several hundred seawater samples were collected, frozen, and delivered to San Francisco State University for nutrient analyses. More samples were taken near the Gulf of the Farallones and Point Reyes than at any other transects, although water samples were collected consistently throughout the survey whenever daytime CTD casts were made.

2. Synchronized trawl gear comparisons with the PWCC R/V EXCALIBUR:

Between May 27 and May 29, two nights of synchronized trawls were conducted with a total of 11 comparable trawls deployed at 10 standard trawl stations. The transects covered during the 2 nights were Davenport and Monterey Bay outside. Catches from the 11 synchronized trawls conducted during the survey in late May, for the salient juvenile species on the DS JORDAN (EXCALIBUR) are listed in Table 5.

Table 5. Synchronized mid-water trawl pelagic juvenile catches - JORDAN (EXCALIBUR)

Year	Pacific Whiting	Rockfish
2001	415 (773)	332 (150)
2002	1118 (355)	165 (72)
2003	20 (40)	131 (75)
2004	6609 (4167)	544 (443)
2005	2 (4)	8 (5)

3. Market Squid Collections:

A total of 2526 Market Squid were caught during the survey. Table 6 lists the total catch numbers for market squid during the surveys since 1987, which was the first year that market squid were identified and enumerated. The number of market squid caught in the midwater trawls was relatively low compared to previous surveys. In comparison to last year, half as many market squid were caught. This year was the fourth lowest year for market squid catch, since 1987. Frozen specimens were delivered to UC Santa Cruz at the conclusion of the survey.

Table 6. Total number of market squid (*Loligo opalescens*) catches (1987-2005)

YEAR	TOTAL CATCH
1987	33906
1988	14082
1989	7929
1990	5242
1991	74719
1992	45308
1993	9396
1994	4460
1995	11684
1996	4014
1997	6055
1998	240
1999	1140
2000	5199
2001	26407
2002	8721
2003	2002
2004	5248
2005	2526

4. Humboldt Squid Collections:

For the first time in the 23 year history of the survey, Humboldt squid were caught within the central California region's standard stations. Mantle lengths, stomachs, and heads of Humboldt squid were collected from all 20 specimens caught by the mid-water trawl at station 133, of the Pescadero transect. There were also an anomalous high abundance of Humboldt squid (*Dosidicus gigas*) within the survey region in the months prior to the survey. Historically, the presence of Humboldt squid in central and northern California waters is coincident with warm water events.

5. Shortbelly Rockfish and Bocaccio Collections for RNA:DNA Ratio Analysis:

A subsample of approximately 328 juvenile shortbelly rockfish were used by Kevin Stierhoff, for RNA:DNA ratio analysis.

DISPOSITION OF DATA:

1. Juvenile rockfish specimens, midwater trawl catch data, CTD, SIMRAD EK500, chlorophyll, thermosalinometer, ADCP, data - Keith Sakuma, NOAA NMFS, 110 Shaffer Road, Santa Cruz CA 95060.
2. Adult rockfish data – Don Pearson, NOAA NMFS, 110 Shaffer Road, Santa Cruz CA 95060.
3. Adult rockfish genetic data – Carlos Garza, NOAA NMFS, 110 Shaffer Road, Santa Cruz CA 95060.
4. Seabird and marine mammal data - Bill Sydeman, Point Reyes Bird Observatory, 4990 Shoreline Hwy, Stinson Beach, CA 94970.

SCIENTIFIC PERSONNEL:

Leg 1 (May 1 - May 7)

Ken Baltz, Oceanographer, NMFS-Santa Cruz, CA – Cruise Leader
Keith Sakuma, Fisheries Biologist, NMFS-Santa Cruz, CA – Chief Scientist
Don Pearson, Fisheries Biologist, NMFS-Santa Cruz, CA
Heidi Fish, Fisheries Biologist, NMFS-Santa Cruz, CA
Edward Dick, Fisheries Biologist, NMFS-Santa Cruz, CA
Kevin Stierhoff, Post-Doc, UCSC and NMFS, Santa Cruz, CA
Baldo Marinovic, Krill Biologist, UC Santa Cruz, Santa Cruz, CA
Kit Clark, Krill Biologist, UC Santa Cruz, Santa Cruz, CA
Cornelia Oedekoven, PRBO Conservation Science, Stinson Beach, CA
Sophie Webb, PRBO Conservation Science, Stinson Beach, CA

Leg 2 (May 7 - May 14)

Ken Baltz, Oceanographer, NMFS-Santa Cruz, CA – Cruise leader
Keith Sakuma, Fisheries Biologist, NMFS-Santa Cruz, CA – Chief Scientist
Don Pearson, Fisheries Biologist, NMFS-Santa Cruz, CA
John Field, Fisheries Biologist, NMFS-Santa Cruz, CA

Heidi Fish, Fisheries Biologist, NMFS-Santa Cruz, CA
Asila Ghoul, Krill Biologist, UC Santa Cruz, Santa Cruz, CA
Joy Featherstone, Krill Biologist, UC Santa Cruz, Santa Cruz, CA
Cornelia Oedekoven, PRBO Conservation Science, Stinson Beach, CA
Sophie Webb, PRBO Conservation Science, Stinson Beach, CA

Leg 3 (May 14 - May 22)

Ken Baltz, Oceanographer, NMFS-Santa Cruz, CA – Cruise leader
Keith Sakuma, Fisheries Biologist, NMFS-Santa Cruz, CA – Chief scientist
Don Pearson, Fisheries Biologist, NMFS-Santa Cruz, CA
Eric Bjorkstedt, Fisheries Biologist, NMFS-Santa Cruz, CA
Jessica Miller, University Of Oregon, Charleston, OR
Alex Parker, San Francisco State Univ. – Romberg Center, Tiburon, CA
Ann Vassilieva, Krill Biologist, UC Santa Cruz, Santa Cruz, CA
Nancy Gong, Krill Biologist, UC Santa Cruz, Santa Cruz, CA
Cornelia Oedekoven, PRBO Conservation Science, Stinson Beach, CA
Sophie Webb, PRBO Conservation Science, Stinson Beach, CA

Leg 4 (May 25 – June 1)

Ken Baltz, Oceanographer, NMFS-Santa Cruz, CA – Cruise leader
Keith Sakuma, Fisheries Biologist, NMFS-Santa Cruz, CA - Chief Scientist
Don Pearson, Fisheries Biologist, NMFS-Santa Cruz, CA
Eric Bjorkstedt, Fisheries Biologist, NMFS-Santa Cruz, CA
Christine Peterson, Post-Doc, NMFS-Santa Cruz, CA
Walter Heady, Krill Biologist, UC Santa Cruz, Santa Cruz, CA
Nancy Gong, Krill Biologist, UC Santa Cruz, Santa Cruz, CA
David Ainley, Ornithologist, H. T. Harvey & Associates
Ian Gaffney, Ornithologist, H. T. Harvey & Associates

Leg 5 (June 1 - June 8)

Ken Baltz, Oceanographer, NMFS-Santa Cruz, CA – Cruise Leader
Keith Sakuma, Fisheries Biologist, NMFS-Santa Cruz, CA – Chief Scientist
Don Pearson, Fisheries Biologist, NMFS-Santa Cruz, CA
Christine Peterson, Post-Doc, NMFS-Santa Cruz, CA
Kevin O’Conner, JIMO, UC Santa Cruz, Santa Cruz, CA
Lisa Wertz, CA Dept. of Fish and Game, Monterey, CA
Ann Vassilieva, Krill Biologist, UC Santa Cruz, Santa Cruz, CA
Asila Ghoul, Krill Biologist, UC Santa Cruz, Santa Cruz, CA

Leg 6 (June 8 - June 12)

Ken Baltz, Oceanographer, NMFS-Santa Cruz, CA – Cruise leader
Keith Sakuma, Fisheries Biologist, NMFS-Santa Cruz, CA – Chief Scientist
Don Pearson, Fisheries Biologist, NMFS-Santa Cruz, CA
Kevin O’Conner, JIMO, UC Santa Cruz, Santa Cruz, CA
Yasmin Lucero, NOAA Fellowship, UC Santa Cruz, Santa Cruz, CA
Dana Wingfield, Krill Biologist, UC Santa Cruz, Santa Cruz, CA
Baldo Marinovic, Krill Biologist, UC Santa Cruz, Santa Cruz, CA

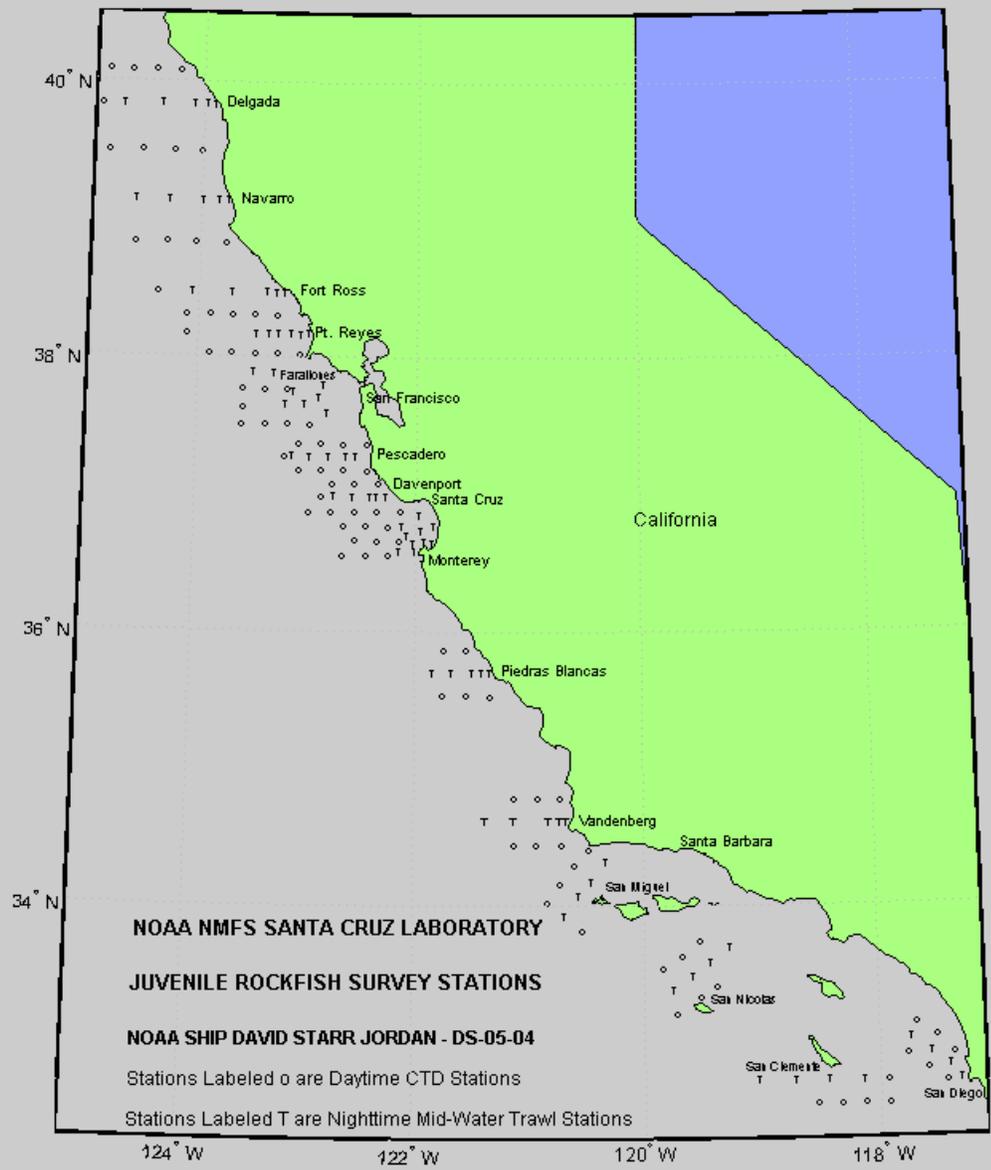


Figure 1. Trawl and CTD stations along all transects of the survey

Standard Trawl and CTD Station Locations

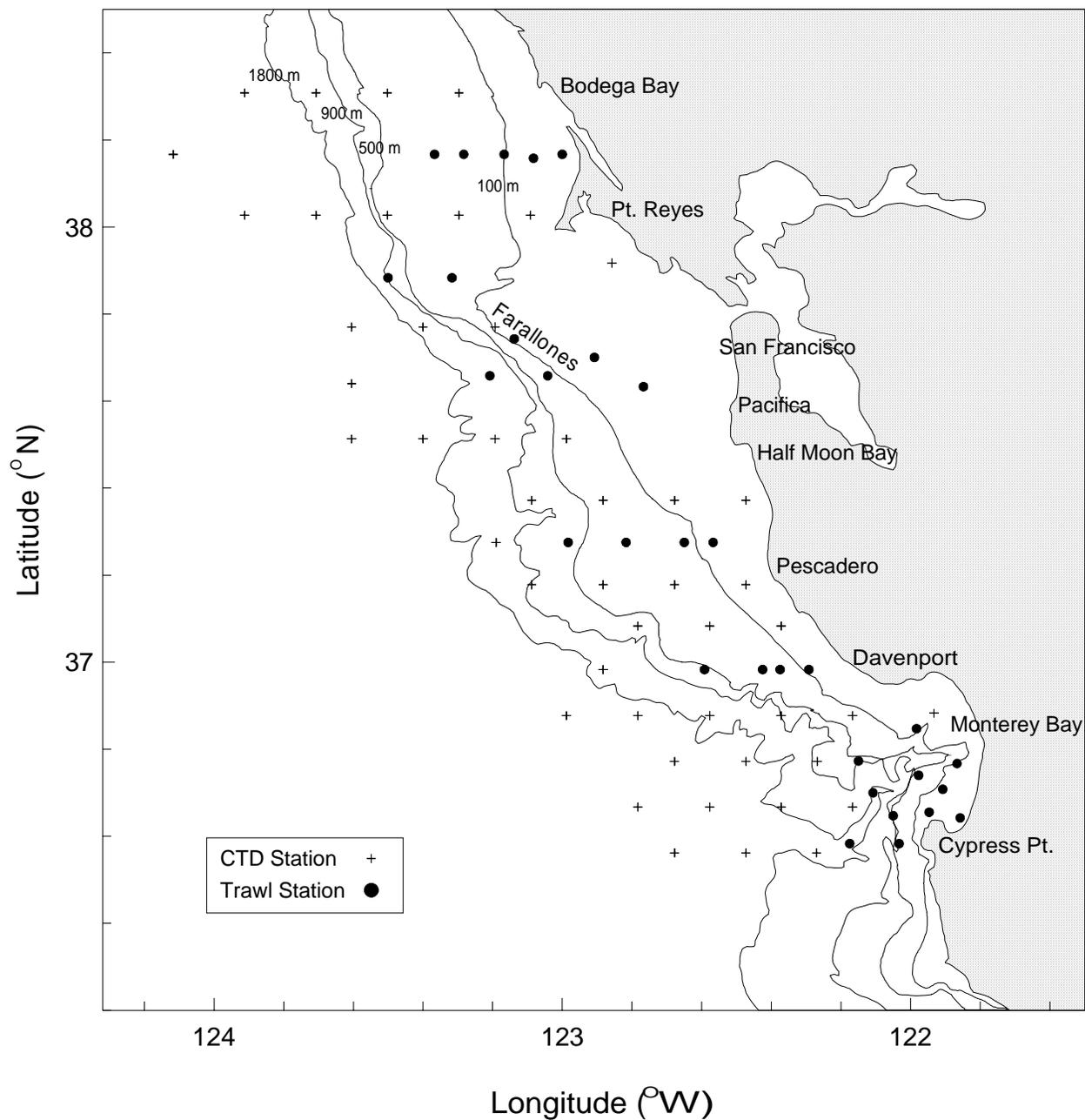


Figure 2. Standard sampling stations for trawls and CTDs off central CA

APPENDIX A

Juvenile Rockfish Survey Trawl and CTD Stations at each Transect

DAY: CTD - SAN DIEGO TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	32° 42.5'	117° 27'	350	340	4041
CTD	32° 47.9'	117° 37'	1020	520	4042
CTD	32° 54.5'	117° 46.7'	1040	520	4043
CTD	33° 08'	117° 42'	810	520	4045
CTD	33° 02'	117° 32.3'	700	520	4046
CTD	32° 54.4'	117° 23'	550	520	4047

NIGHT: TRAWL & CTD - SAN DIEGO TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	33° 01'	117° 45'	750	520	481
trawl	33° 01'	117° 45'	750	85	481
trawl	32° 55'	117° 35'	850	85	482
CTD	32° 55'	117° 35'	850	520	482
CTD	32° 49'	117° 25.3'	700	520	483
trawl	32° 49'	117° 25'	700	85	483
trawl	32° 42.5'	117° 20'	100	85	484
CTD	32° 42.5'	117° 20'	100	90	484

DAY: CTD - SAN CLEMENTE TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	32° 43'	117° 57'	520	500	4048
CTD	32° 33'	117° 57'	963	520	4049
CTD	32° 33'	118° 09'	1900	520	4050
CTD	32° 33'	118° 21'	1385	520	4051
CTD	32° 33'	118° 33'	1111	520	4052

NIGHT: TRAWL & CTD - SAN CLEMENTE TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	32° 43'	118° 09.3'	1000	520	401
trawl	32° 43'	118° 09'	1000	85	401
trawl	32° 43'	118° 27.2'	270	85	402
CTD	32° 43'	118° 27.2'	270	260	402
CTD	32° 43'	118° 44.9'	1284	520	403
trawl	32° 43'	118° 44.9'	1284	85	403
trawl	32° 43'	119° 03'	500	85	404
CTD	32° 43'	119° 03'	500	490	404

DAY: CTD - SAN NICOLAS TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	33° 24.4'	119° 24.2'	963	520	4002
CTD	33° 20.2'	119° 32.5'	85	75	4003
CTD	33° 12.62'	119° 44.3'	460	450	4004
CTD	33° 32.5'	119° 51.4'	330	320	4006
CTD	33° 37.8'	119° 41.6'	1366	520	4007
CTD	33° 44.6'	119° 32.5'	1930	520	4008

NIGHT: TRAWL & CTD - SAN NICOLAS TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	33° 41.4'	119° 17.2'	886	520	411
trawl	33° 41.4'	119° 17.2'	886	85	411
trawl	33° 35.2'	119° 26.9'	1874	85	412
CTD	33° 35.2'	119° 26.9'	1874	520	412
CTD	33° 29.2'	119° 36.3'	769	520	413
trawl	33° 29.2'	119° 36.3'	769	85	413
trawl	33° 23'	119° 45.8'	107	85	414
CTD	33° 23'	119° 45.8'	107	97	414

DAY: CTD - SAN MIGUEL TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	33° 49.3'	120° 33.1'	1819	520	4010
CTD	34° 01.8'	120° 51.6'	948	520	4011
CTD	34° 09.8'	120° 44.6'	738	450	4012

NIGHT: TRAWL & CTD - SAN MIGUEL TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	34° 18.9'	120° 18'	355	345	422
trawl	34° 18.9'	120° 18'	355	85	422
CTD	34° 10.6'	120° 28.3'	149	140	423
trawl	34° 10.6'	120° 28.3'	149	140	423
trawl	34° 04.2'	120° 34.7'	159	85	424
CTD	34° 04.2'	120° 34.7'	159	150	424
trawl	33° 55.1'	120° 42.7'	1848	85	425
CTD	33° 55.1'	120° 42.7'	1848	520	425

DAY: CTD - VANDENBERG TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	34° 26.8'	120° 44.3'	493	483	4015
CTD	34° 26.8'	120° 57'	900	520	4016
CTD	34° 26.8'	121° 09'	1413	520	4017
CTD	34° 47.1'	121° 08.9'	566	520	4020
CTD	34° 47.1'	120° 56.6'	304	294	4021
CTD	34° 47.1'	120° 44.5'	77	70	4022

NIGHT: TRAWL & CTD - VANDENBERG TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	34° 37'	120° 42.5'	60	50	431
trawl	34° 37'	120° 42.5'	60	85	431
trawl	34° 37'	120° 45.8'	92	85	432
CTD	34° 37'	120° 45.8'	92	85	432
CTD	34° 37'	120° 51.8'	308	300	433
trawl	34° 37'	120° 51.8'	308	85	433
trawl	34° 37'	121° 10'	154	85	434
CTD	34° 37'	121° 10'	154	145	434
trawl	34° 37'	121° 25'	1140	85	435
CTD	34° 37'	121° 25'	1140	520	435

DAY: CTD - PIEDRAS BLANCAS TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	35° 32.1'	121° 21.8'	516	506	4023
CTD	35° 32.1'	121° 34.1'	848	520	4024
CTD	35° 32.1'	121° 46.3'	1007	520	4025
CTD	35° 52'	121° 46.4'	968	520	4028
CTD	35° 52'	121° 34'	510	500	4029

NIGHT: TRAWL & CTD - PIEDRAS BLANCAS TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	35° 42.2'	121° 21.8'	60	50	441
trawl	35° 42.2'	121° 21.8'	60	85	441
trawl	35° 42.2'	121° 25.8'	167	85	442
CTD	35° 42.2'	121° 25.8'	167	85	442
CTD	35° 42.2'	121° 30.5'	557	520	443
trawl	35° 42.2'	121° 30.5'	557	85	443
trawl	35° 42.2'	121° 42'	885	85	444
CTD	35° 42.2'	121° 42'	885	520	444
trawl	35° 42.2'	121° 52'	1040	85	445
CTD	35° 42.2'	121° 52'	1040	520	445

NIGHT: TRAWL & CTD - MONTEREY BAY INSIDE TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	36° 50.8'	121° 59'	91	81	119
trawl	36° 50.8'	121° 59'	91	85	119
trawl	36° 46'	121° 52'	73	85	114
CTD	36° 46'	121° 52'	73	63	114
CTD	36° 44.4'	121° 58.6'	238	228	116
trawl	36° 44.4'	121° 58.6'	238	85	116
trawl	36° 42.5'	121° 54.5'	91	85	115
CTD	36° 42.5'	121° 54.5'	91	81	115
CTD	36° 38.5'	121° 51.5'	37	30	111
trawl	36° 38.5'	121° 51.5'	37	25	111
trawl	36° 39.3'	121° 56.8'	73	85	112
CTD	36° 39.3'	121° 56.8'	73	63	112

DAY: CTD - MONTEREY BAY OUTSIDE TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	36° 40'	122° 10'	1134	520	1002
CTD	36° 46.3'	122° 16.1'	823	520	1003
CTD	36° 46.3'	122° 28.4'	2100	520	1004
CTD	36° 40'	122° 22.3'	1737	520	1005
CTD	36° 33.7'	122° 16.2'	2560	520	1006
CTD	36° 33.7'	122° 28.4'	2743	520	1007
CTD	36° 40'	122° 34.6'	2377	520	1008
CTD	36° 46.3'	122° 40.7'	2148	520	1009
CTD	36° 33.7'	122° 40.7'	2740	520	1010

NIGHT: TRAWL & CTD - MONTEREY BAY OUTSIDE TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	36° 35'	122° 10.5'	2323	520	110
trawl	36° 35'	122° 10.5'	2323	25	110
trawl	36° 35'	122° 10.5'	2323	85	110
trawl	36° 35'	122° 10.5'	2323	215	110
CTD	36° 35'	122° 2'	530	510	109
trawl	36° 35'	122° 2'	530	85	109
trawl	36° 38.8'	122° 3'	914	85	113
CTD	36° 38.8'	122° 3'	914	520	113
CTD	36° 42'	122° 6.5'	1920	520	117
trawl	36° 42'	122° 6.5'	1920	85	117
trawl	36° 46.4'	122° 9'	914	85	118
CTD	36° 46.4'	122° 9'	914	520	118

DAY: CTD - DAVENPORT TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	36° 52.6'	122° 10'	91	81	1011
CTD	36° 52.6'	122° 22.3'	823	520	1012
CTD	36° 52.6'	122° 34.6'	1600	520	1013
CTD	36° 52.6'	122° 47'	2286	520	1014
CTD	36° 52.6'	122° 59.3'	2697	520	1015
CTD	36° 59'	122° 53'	1372	520	1016
CTD	37° 5'	122° 47'	686	520	1017
CTD	37° 5'	122° 34.6'	119	110	1018
CTD	37° 5'	122° 22.3'	59	50	1019

NIGHT: TRAWL & CTD - DAVENPORT TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	36° 59'	122° 17.5'	82	72	123
trawl	36° 59'	122° 17.5'	82	85	123
trawl	36° 59'	122° 22.5'	128	85	124
CTD	36° 59'	122° 22.5'	128	118	124
CTD	36° 59'	122° 25.5'	457	445	125
trawl	36° 59'	122° 25.5'	457	85	125
CTD	36° 59'	122° 35.5'	402	390	126
trawl	36° 59'	122° 35.5'	402	85	126
trawl	36° 59'	122° 45.5'	1085	85	127
CTD	36° 59'	122° 45.5'	1085	520	127

DAY: CTD - PESCADERO TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	37° 10.7'	122° 28.4'	68	58	1020
CTD	37° 10.7'	122° 40.7'	110	100	1021
CTD	37° 10.7'	122° 53'	421	410	1022
CTD	37° 10.7'	123° 5.3'	869	520	1023
CTD	37° 16.5'	123° 11.4'	1189	520	1024
CTD	37° 22.3'	123° 5.3'	823	520	1025
CTD	37° 22.3'	122° 53'	201	190	1026
CTD	37° 22.3'	122° 40.7'	88	78	1027
CTD	37° 22.3'	122° 28.4'	27	20	1028

NIGHT: TRAWL & CTD - PESCADERO TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	37° 16.5'	122° 34'	82	75	131
trawl	37° 16.5'	122° 34'	82	85	131
trawl	37° 16.5'	122° 39'	95	85	132
CTD	37° 16.5'	122° 39'	95	85	132
CTD	37° 16.5'	122° 49'	165	155	133
trawl	37° 16.5'	122° 49'	165	85	133
CTD	37° 16.5'	122° 59'	550	520	134
trawl	37° 16.5'	122° 59'	550	85	134
trawl	37° 16.5'	123° 09'	1006	85	135
CTD	37° 16.5'	123° 09'	1006	520	135

DAY: CTD - FARALLONES OUTSIDE TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	37° 30.8'	122° 59.3'	229	220	1029
CTD	37° 30.8'	123° 11.6'	1280	520	1030
CTD	37° 30.8'	123° 24'	2377	520	1031
CTD	37° 30.8'	123° 36.3'	2652	520	1032
CTD	37° 38.4'	123° 36.3'	3338	520	1033
CTD	37° 46.2'	123° 36.3'	2697	520	1034
CTD	37° 46.2'	123° 24'	1509	520	1035
CTD	37° 46.2'	123° 11.6'	128	118	1036

NIGHT: TRAWL & CTD - FARALLONES OUTSIDE TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	37° 39.5'	123° 2.5'	119	109	152
trawl	37° 39.5'	123° 2.5'	119	85	152
trawl	37° 39.5'	123° 12.5'	1244	85	154
CTD	37° 39.5'	123° 12.5'	1244	520	154
CTD	37° 44.6'	123° 8.3'	91	81	156
trawl	37° 44.6'	123° 8.3'	91	85	156
CTD	37° 53'	123° 19'	91	81	160
trawl	37° 53'	123° 19'	91	85	160
trawl	37° 53'	123° 30'	1463	85	162
CTD	37° 53'	123° 30'	1463	520	162

NIGHT: TRAWL & CTD - GULF OF THE FARALLONES TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	37° 47.5'	122° 52'	55	45	139
trawl	37° 47.5'	122° 52'	55	25	139
trawl	37° 42'	122° 54.5'	55	25	138
CTD	37° 42'	122° 54.5'	55	45	138
CTD	37° 35.8'	122° 49.9'	55	45	237
trawl	37° 35.8'	122° 49.9'	55	25	237

DAY: CTD - POINT REYES TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	38° 1.6'	123° 5.5'	64	54	1046
CTD	38° 1.6'	123° 17.8'	120	110	1045
CTD	38° 1.6'	123° 30.1'	137	127	1037
CTD	38° 1.6'	123° 42.4'	2560	520	1038
CTD	38° 1.6'	123° 54.7'	3475	520	1039
CTD	38° 10'	124° 07'	3658	520	1040

NIGHT: TRAWL & CTD - POINT REYES TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	38° 10'	123° 29'	411	400	171
trawl	38° 10'	123° 29'	411	85	171
trawl	38° 10'	123° 22'	183	85	170
CTD	38° 10'	123° 22'	183	173	170
CTD	38° 10'	123° 17'	128	118	168
trawl	38° 10'	123° 17'	128	85	168
trawl	38° 10'	123° 10'	91	85	167
CTD	38° 10'	123° 10'	91	81	167
CTD	38° 9.5'	123° 5'	73	63	166
trawl	38° 9.5'	123° 5'	73	85	166
trawl	38° 10'	123° 0'	55	25	165
CTD	38° 10'	123° 0'	55	45	165

DAY: CTD - FORT ROSS TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	38° 18.5'	123° 10'	83	73	1048
CTD	38° 18.5'	123° 17.8'	110	100	1044
CTD	38° 18.5'	123° 30.1'	274	264	1043
CTD	38° 18.5'	123° 42.4'	1463	520	1042
CTD	38° 18.5'	123° 54.7'	2835	520	1041
CTD	38° 18.5'	124° 07.7'	3600	520	4030
CTD	38° 28'	124° 24'	3500	520	4031

NIGHT: TRAWL & CTD - FORT ROSS TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	38° 28'	123° 14'	53	43	183
trawl	38° 28'	123° 14'	53	85	183
trawl	38° 28'	123° 18.5'	92	85	452
CTD	38° 28'	123° 18.5'	92	82	452
CTD	38° 28'	123° 23.2'	115	105	453
trawl	38° 28'	123° 23.2'	115	85	453
trawl	38° 28'	123° 42.6'	910	85	454
CTD	38° 28'	123° 42.6'	910	520	454
trawl	38° 28'	124° 05'	3350	85	455
CTD	38° 28'	123° 05'	3350	520	455

DAY: CTD - NAVARRO TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	38° 50'	123° 47'	111	520	4032
CTD	38° 50'	124° 04'	1805	520	4033
CTD	38° 50'	124° 20'	3300	520	4034
CTD	38° 50'	124° 37'	3500	520	4035

NIGHT: TRAWL & CTD - NAVARRO TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	39° 08'	123° 45.8'	50	40	461
trawl	39° 08'	123° 45.8'	50	85	461
trawl	39° 08'	123° 51'	100	85	462
CTD	39° 08'	123° 51'	100	90	462
CTD	39° 08'	124° 00'	500	490	463
trawl	39° 08'	124° 00'	500	85	463
trawl	39° 08'	124° 19'	2000	85	464
CTD	39° 08'	124° 19'	2000	520	464
trawl	39° 08'	124° 37'	3300	85	465
CTD	39° 08'	123° 37'	3300	520	465

DAY: CTD - DELGADA TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	39° 30'	124° 02'	630	520	4036
CTD	39° 30'	124° 17'	1800	520	4037
CTD	39° 30'	124° 35'	2300	520	4038
CTD	39° 30'	124° 53'	2807	520	4039
CTD	39° 50'	124° 58'	1830	520	4059
CTD	40° 05'	124° 15.2'	160	150	4055
CTD	40° 05'	124° 28.3'	678	520	4056
CTD	40° 05'	124° 41.3'	1000	520	4057
CTD	40° 05'	124° 54.3'	1200	520	4058

NIGHT: TRAWL & CTD - DELGADA TRANSECT

<i>OPS</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Depth(m)</i>	<i>Wire Out(m)</i>	<i>Station</i>
CTD	39° 50'	123° 55'	60	50	471
trawl	39° 50'	123° 55'	60	85	471
trawl	39° 50'	123° 58.8'	120	85	472
CTD	39° 50'	123° 58.8'	120	110	472
CTD	39° 50'	124° 06.5'	300	290	473
trawl	39° 50'	124° 06.5'	300	85	473
trawl	39° 50'	124° 24'	1500	85	474
CTD	39° 50'	124° 24'	1500	520	474
trawl	39° 50'	124° 45'	1300	85	475
CTD	39° 50'	123° 45'	1300	520	475