UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center
8604 La Jolla Shores Drive
La Jolla, CA 92037

June 19, 2012

CRUISE INSTRUCTIONS

Ship: *R/V Ocean Starr*

Cruise Number: 1207-OS

Cruise Dates: July 2 – August 31, 2012

Cruise Title: California Current Ecosystem (CCE) Survey.

Study Area: US/Mexican border to San Francisco, with variable transect lengths.

Itinerary:

Leg 1: 2 JUL San Diego	19 JUL – Arrive San Diego, CA	18 DAS
Leg 2: 22 JUL San Diego	01 AUG - Arrive San Diego, CA	11 DAS
Leg 3: 02 AUG San Diego	16 AUG – Arrive Port Hueneme, CA	15 DAS
Leg 4: 17 AUG Port Hueneme	31 AUG – Arrive San Francisco, CA	16 DAS
Total		60 DAS

Tracklines and station positions are included at the end of this document in Appendices1, 2 & 3.

Sponsoring Institution: NOAA/NMFS, Southwest Fisheries Science Center (SWFSC) Fisheries Resources Division (FRD)

Cruise Description and Objectives:

1. To conduct continuous underway sampling of surface waters. Temperature and salinity will be automatically logged by computer with the output from the GPS navigational unit.

2. To contribute to ongoing assessment of pelagic fish stocks between San Diego and San Francisco, California

3. To collect information the size distribution and species composition of pelagic fish for acoustics ground truth information using trawling.

4. To monitor environmental conditions within the CCE survey area.

5. To record continuous acoustic targets obtained with a multi-frequency Simrad EK-60 scientific sounder.

6. To service and move three moorings on CalCOFI line 90.

7. To carry out an intensive field survey of island wakes around San Clemente and Catalina Islands, and south of San Nicolas Island, to detect hotspots of production supporting juvenile sardine and other juvenile fish.

Chief Scientist: Sam McClatchie, SWFSC (858) 546-7083, Sam.McClatchie@noaa.gov

PLAN OF OPERATIONS

1.0 OPERATIONS

The *Ocean Starr* will conduct operations from south to north along the west coast from San Diego to San Francisco, CA. The April CCE Survey was conducted as a two ship synoptic survey of the western US coast of North America. The current July survey extends the survey into the summer season, repeating most of the April transect lines of the April survey, south of San Francisco, applying the same methodologies, but incorporating time to (1) retrieve and service two oceanographic moorings, and (2) to carry out some intensive sampling of island wakes near the Catalina and San Clemente Islands, and to the south of San Nicolas Island..

During leg 1, the *Ocean Starr* will conduct standard CalCOFI operations on the basic six line/75 station grid.

During leg 2, operations will focus on collaborative mooring operations with Scripps Institution of Oceanography and intensive sampling around Catalina and San Clemente Islands, and to the south of San Nicolas Island, as mentioned above.

During leg 3, plankton stations will be limited to night hours to permit continuous acoustic running during daylight. Plankton sampling of this area, south of Point Conception, will recently have been done by the preceding CalCOFI survey. Each night time plankton station on leg 1 will comprise CTD, pairovet, bongo and manta tows at the same location.

During leg 4, north of Point Conception, full station work will be carried out in daylight and at night.

1.1.1
Standard CalCOFI station work will include the following:

1.1.1.1 CTD/Rosette - consisting of 24 10-liter hydrographic bottles will be lowered to 500 meters (depth permitting) at each station to measure physical parameters and collect water at discrete depths for analysis of salinity.

1.1.1.2 CalBOBL (CalCOFI Bongo) - standard oblique plankton tow with 300 meters of wire out, depth permitting, using paired 505 µm mesh nets with 71 cm diameter openings. The technical requirements for this tow are: Descent wire rate of 50 meters per minute and an ascent wire rate of 20 meters per minute. All tows with ascending wire angles lower than 38° or higher than 51° in the final 100 meters of wire will be repeated. Additionally, a 45° wire angle should be closely maintained during the ascent and descent of the net frame. A self-contained LOPC (Laser Optical Particle Counter) will be mounted in the port side opening during each tow only during leg I (CalCOFI stations). The port side sample will be preserved in buffered ethanol at every station.

1.1.1.3 Manta net (neuston) tow - using a 505 µm mesh net on a frame with a mouth area of 0.1333 m^2. Tows are 15 minutes in duration at a towing speed of approximately 1.5 - 2.0 knots. Wire angles should be kept between 15° and 25°.

1.1.1.4 Weather observations.

1.1.1.5 Pairovet net - will be fished from 70 meters to the surface (depth permitting) using paired 25 cm diameter 150 µm mesh nets at all stations. The technical requirements for Pairovet tows are: Descent rate of 70 meters per minute, a terminal depth time of 10 seconds and an ascent rate of 70 meters per minute. All tows with wire angles exceeding 15° during the ascent will be repeated.

1.1.1.6 PRPOOS (leg 1 only): (Planktonic Rate Processes in Oligotrophic Ocean Systems net) will be fished from 210 meters to the surface(depth permitting) using a 50 cm diameter 202 µm mesh net. The PRPOOS will be towed at all prescribed CalCOFI stations on lines 90.0 and 80.0 as well as stations out to and including station 70.0 on lines 86.7 and 83.3. These data will be used in analyses by the LTER (Long Term Ecological Research) project. Descent rate of 40 meters per minute, a terminal depth time of 20 seconds and an ascent rate of 50 meters per minute. All tows with wire angles exceeding 15° during the ascent will be repeated.

1.1.1.7 Primary productivity (leg 1 only): at about 1100 hours on each day of leg I a primary productivity CTD cast consisting of six 10-liter hydrographic bottles will be carried out. The cast arrangement will be determined by a Secchi disc observation. The purpose of the cast is to collect water from six discrete depths

for daily in situ productivity experiments. Measurements of extracted chlorophyll and phaeophytin will be obtained with a fluorometer. Primary production will be measured as C14 uptake in a six hour in situ incubation. Nutrients will be measured with an auto-analyzer. All radioisotope work areas will be given a wipe test before the departure of the SIO technical staff.

1.1.1.8 A light meter will be used to measure the light intensity in the euphotic zone once a day with the primary productivity cast and all daytime stations.

1.1.2 Thermosalinometer sampling – SWFSC will provide a thermosalinometer (TSG), in calibrated and working order, for continuous measurement of surface water temperature and salinity. The Scientific Computing System (SCS) will serve as the main data collection system.. All SCS data will be provided to SWFSC personnel at the completion of the cruise.

1.1.3 Acoustics – Calibration of the Simrad EK-60 echosounder will be performed at the beginning of the cruise (requiring 6-12 hours).

The EK-60 echosounder will be 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. The vessel's EQ-50, ES-60 or Skipper depth sounder may be used minimally at the discretion of the Commanding Officer, but will normally remain off while underway. The ship shall inform the Cruise Leader of any use of the vessel's sounders, as it interferes with the signals received on the scientific EK-60 that will be used continuously.

1.1.4 CUFES - The egg pump will be mounted inside the ship's hull drawing water from a depth of three meters. During the grid occupation, the pump will run continuously between stations to sample any pelagic fish eggs. Approximately 640 liters/minute is sent through a concentrator which filters all material larger than 505µm. The sieved material is then collected and identified. All fish eggs are identified to lowest taxa, counted and entered into the data acquisition software. Each sample entry is coupled with sea surface temperature, geographical position, wind speed and direction, date and time, and surface salinity. Sampling intervals will vary in length, depending on the number of fish eggs seen, from five to 30 minutes.

1.1.5 Surface trawling - During legs 3 - 4, a Nordic 264 surface trawl will be deployed between the hours of approximately 1800 and 0600 PST within the Southern California Bight and north up to San Francisco at positions determined by the acoustic data collected during daylight. The positions may be changed at the discretion of the Chief Scientist or Cruise Leader depending on information gained and occurrence of sardines, but *without compromising the specified collection of plankton samples* during the night on leg 3, and during day or night on leg 4.

SWFSC Marine Mammal Protocols, as described below, will be followed prior to, during, and following any trawl deployment. During transit to each station, for a period of at least 30 minutes, the Captain, deckhands, and all available scientists will visually scan the sea surface for marine mammals and other protected species (e.g., dolphins, seals, sea-lions, and sea turtles). If marine mammals or other protected species are sighted during this period, or upon arrival at the station, the Cruise Leader, in consultation with the Captain and other knowledgeable members of the crew and scientific staff, will determine if trawling operations can commence without likelihood of interaction between the gear and the animals sighted. This determination will be based on the species and number of animals sighted, their behavior, their position, and their vector relative to the path of the vessel, the professional judgment of the SWFSC FPC, Cruise Leader, and Captain, and other factors. If marine mammals or turtles are observed during this period and are determined to be at appreciable risk of interaction with gear, then the vessel will move away from the animals, at least 0.5 nm, to a new location within the same general area. The visual scan for marine mammals and turtles will continue during each subsequent move until it is determined by the SWFSC FPC that trawling operations can safely commence, or until the station is abandoned.

To reduce the potential of attracting marine mammals and other protected species to the vessel, trawl operations will be the first activity undertaken upon arrival at a new station. During each tow, the Captain and other designated individuals will keep a continuous watch for protected species. If animals are sighted while the net is in the water, the SWFSC FPC, in consultation with others, will determine the best strategy to avoid potential takes based on the species and number of animals sighted, their behavior, their positions, and vectors relative to the path of the vessel, and other factors. In some situations the decision may be to immediately retrieve the net and move away from the area. In other situations, the decision may be to continue towing until the animal(s) are clear of the area and away from potential contact with the gear during haulback, when the risk of entanglement is believed to be highest. Every effort will be made to deploy and retrieve the trawl net as quickly as possible (following all safety measures) to avoid possible interactions with marine mammals

Recapping, a marine mammal watch will be initiated 30 minutes before trawling. Trawling will be the first activity on arrival at a trawling station, or will be located away from a previously occupied station to avoid any mammals that may have been attracted to the vessel. The trawl is fitted with a marine mammal excluding device (MMED) to avoid any take of cetaceans, pinnipeds, or turtles. If any protected species are detected, the trawl position will be moved to a new area and the protected-species watch reinitiated.

If one or more marine mammals or sea turtles are inadvertently caught in the trawl net and brought aboard, it will be our highest priority to release the animal back into the water as soon as is safely possible. After release, the Chief Scientist will 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 size. Any mammal capture will trigger immediate telephone contact to the SWFSC leadership,

regardless of the time of day, who will take immediate action. Specifically, the SWFSC FPC will immediately notify Cisco Werner (858-334-3207; cisco.werner@noaa.gov), Kristen Koch (858-546-7081; kristen.c.koch@noaa.gov), or Russ Vetter (858-361-2361; russ.vetter@noaa.gov), via telephone and convey all the pertinent information regarding the event, via email.

Any alive, adult or juvenile salmon caught in the trawl will be immediately returned to the sea and assumed to have survived. Any incidentally killed will be frozen for genetic analyses.

Each tow will be fished for 30 minutes in duration at a towing speed of approximately 3.5 knots. The catch of each tow will be processed in the following manner: The fish will be sorted to species, if possible, and the catch weighed. Sardines collected in each trawl will be randomly sub-sampled. Standard length and body weight will be measured, fish are sexed and maturity graded, otoliths will be collected, ovaries preserved in buffered formalin and tails preserved in ethanol vials for genetics. Standard length and body weight will also be measured for Northern anchovy, Jack and Pacific mackerels, hake and other species as time permits.

1.1.6 IKMT net sampling for juvenile fishes – During leg 2, an Isaacs-Kidd Mid-water Trawl (IKMT) will be deployed between the hours of approximately 1800 and 0600 PST at locations around Catalina and San Clemente Islands, and to the south of San Nicolas Island in the Southern California Bight at positions determined by prevailing oceanographic conditions just prior to the cruise. These conditions will be assessed based on the most recent available 1-km remote sensing imagery and line 90 spray glider data just prior to the cruise. The positions may be changed at the discretion of the Chief Scientist or Cruise Leader

1.1.7 Bird Observations – During daylight hours on legs 1 & 4, a bird observer will be posted on the flying bridge to identify and count birds while the ship is underway during cruise transects.

1.1.8 Acoustic hydrophone – During transit between most daylight stations on leg I (CalCOFI), an acoustic hydrophone array will be towed from the stern at a distance of 300 meters with a deck loaded winch to record sounds from marine mammals. The winch is 440V 3-phase with a deck pattern of 4.5 by 4.5 feet. Upon approaching a station, a sonobuoy will be deployed one nautical mile prior to stopping for station work.

1.1.9 Mooring operations – During **the last three days of leg 2**, the ship will occupy two locations (indicated in leg 2 of appendix 2) to service pre-existing and deploy new mooring arrays.

1.1.10 Island wakes survey (leg 2) – The effects of (1) currents flowing over variable topography and (2) winds on the ocean in the lee of the hills on islands creates different kinds of eddies due to currents, and to stratification of the water column due to shelter

from prevailing winds. Current wakes increase mixing and enhance production, while wind wakes produce patches of warmer water. Both increased production and warmer water may be favorable to the growth and survival of larval and juvenile fishes.

The purpose of the high resolution island wakes survey is to **test the hypothesis** that both wind and current wakes provide hotspots for the survival of larval and juvenile fishes. We predict that (1) density of larval and juvenile fishes will be higher in the wakes, (2) the size distributions of larval and juvenile fishes will be relatively larger in the wakes, and (3) that the condition of juvenile fishes will be higher in the wakes.

Over the period of one week we will conduct high resolution CTD, CUFES, multi-frequency acoustic, plankton (bongo, pairovet, manta) and IKMT sampling on either side of, and within, current and wind wakes off Catalina and San Clemente Islands, and to the south of San Nicolas Island, as time permits. Exact sampling locations will be based on the best remote sensing and glider information prior to the cruise, as well as upon the predicted locations of the wind and current wakes based on previous studies in the literature. As a result, the survey design will be flexible and cannot be detailed in advance here. The general area of operations is shown in Figure 1, and a satellite image of the wakes is shown in Figure 1B.

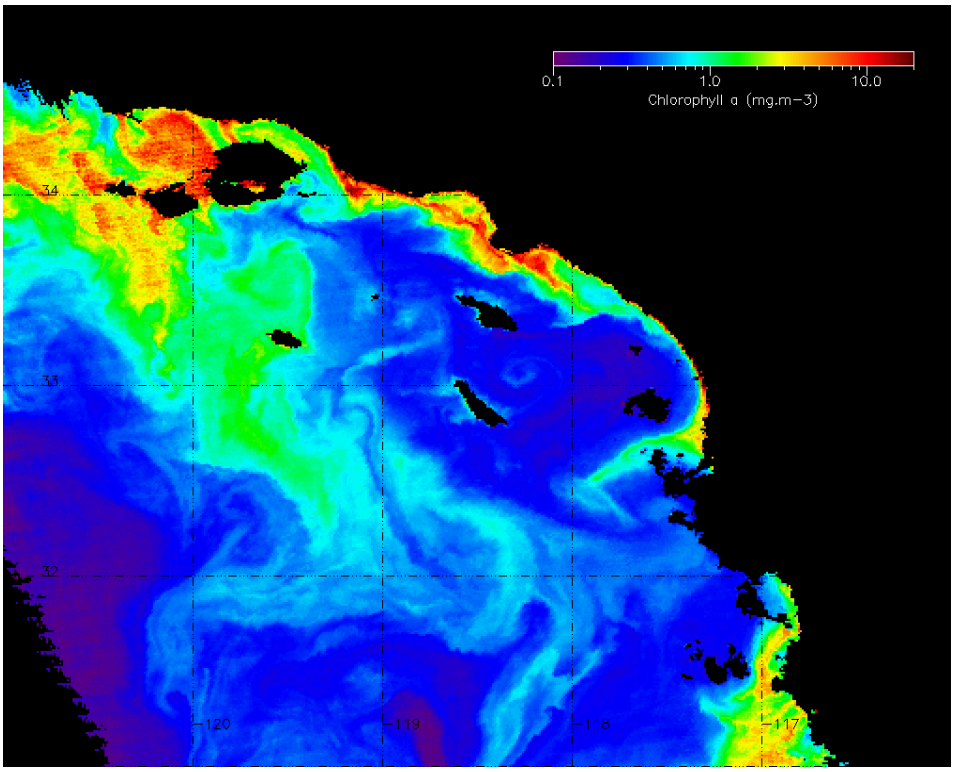


Figure 1B: 1-km resolution satellite imagery from the MODIS Aqua satellite sensor on July 15, 2010 showing pigment enrichment in island wakes to the south of San Nicolas Is, and to the west and north of San Clemente Is.

The primary species focus of this study is small pelagic fish, rockfishes, and squids. However, the full ichthyoplankton community will be counted according to usual protocols, and all species from the IKMT will be identified, counted and preserved. Acoustic backscatter data will be interpreted using catches from bongo nets and IKMT and predicted frequency-dependent scattering. CUFES data will be enumerated and samples preserved according to normal protocols.

The focus of the island wakes study is on juvenile fishes, ichthyoplankton and zooplankton, so there will be no sampling for adult fishes using the Nordic trawl on leg 2, to permit adequate time for IKMT and other samples to be collected.

2.0 SCIENTIFIC PERSONNEL

2.1 Chief Scientist - The Chief Scientist is Sam McClatchie, SWFSC, at phone (858) 546-7083.
Cruise leader - The Cruise Leader is Amy Hays, SWFSC, at phone (858) 546-7130.

The Cruise Leader or Chief Scientist is authorized to alter the scientific portion of this cruise plan with the concurrence of the Commanding Officer, provided that the proposed changes will not: (1) jeopardize the safety of personnel or the ship, (2) exceed the time allotted for the cruise, (3) result in undue additional expense, or (4) change the general intent of the project.

2.2 Participating Scientists
Please see Appendix 3.

3.0 EQUIPMENT

3.1 Supplied by scientific party:

1. 37% Formalin (SWFSC)
2. Ethanol (SWFSC)
3. Tris buffer (SWFSC)
4. Sodium borate (SWFSC)
5. 30 cc and 50 cc syringes (SWFSC)
6. Canulas (SWFSC)
7. Pint, quart and gallon jars (SWFSC)
8. Jars for ovaries (SWFSC)
9. Inside and outside labels (SWFSC)
10. CalCOFI net tow data sheets (SWFSC)
11. 71 cm CalCOFI Bongo frames (SWFSC)
12. 71 cm CalCOFI 505 µm mesh nets (SWFSC)
13. CalCOFI 150 µm Calvet nets and codends (SWFSC)
14. CalCOFI Pairovet frames (SWFSC)
15. 333 µm mesh codends (SWFSC)
16. PRPOOS frames (SIO)
17. PRPOOS nets (SIO)
18. Inclinometer for bongo tows (SWFSC)
19. Digital flowmeters (SWFSC)
20. 75 lb Bongo weight (SWFSC)
21. 100 lb hydro weights (SWFSC)
22. 170 lb hydro weight (SIO)
23. CalCOFI Manta net frames (SWFSC)
24. 60 cm CalCOFI 505 µm mesh Manta nets (SWFSC)
25. Standard CalCOFI tool boxes (SWFSC)
26. Bucket thermometers and holders (SWFSC)

27. Hand held inclinometer for Pairovet tows(SWFSC)
28. LOPC (Laser Optical Partical Counter)(SIO)
29. Guildline Portasal (SIO)
30. Salinity bottles (SIO)
31. Standard sea water (SIO)
32. Data sheets for scheduled hydrographic work (SIO)
33. Weather observation sheets (SIO)
34. CTD and rosette (Leg I only))(SIO)
35. CTD without rosette (SWFSC)
36. 10 liter hydrographic bottles (SIO)
37. Primary Productivity incubation rack
38. Simrad EK-60 GPTs and software (SWFSC)
39. Dissecting microscopes (SWFSC)
40. Nordic 264 rope trawl (SWFSC)
41. Trawl rigging (SWFSC)
42. 3.0 m² XL-Lite foam core trawl doors (SWFSC)
43. Motion compensated balances (SWFSC)
44. Fish measuring boards (SWFSC)
45. Dissection equipment (SWFSC)
46. Fish baskets (SWFSC)
47. IKMT trawl (SWFSC)
48. SBE TSG (SWFSC)
49. Observer chairs on the flying bridge to be used by bird and/or mammal observers.
50. Isotope van (SIO)
51. Winch for deploying marine mammal acoustic array (SIO)

3.2 Supplied by ship - We request the following systems and their associated support services, sufficient consumables, back-up units, and on-site spares. All measurement instruments are assumed to have current calibrations and we request that all pertinent calibration information be included in the data package.

1. Starboard hydro winch with ¼" cable for standard Bongo, Pairovet and Manta tows.
2. Port winch with .375" conductive cable
3. Port and starboard combo trawl winch with ∈" trawl cable
4. Port and starboard gantries with trawl blocks for ∈" trawl cable
5. Net reel to accommodate Nordic 264 trawl
6. J-frame w/block to accommodate .375" cable
7. Constant temperature room set at $22^{o}C \pm 1^{o}C$ ($71.5^{o}F \pm 2^{o}F$)
8. Winch monitoring system
9. Knudsen 12 kHz depth recorder or comparable
10. Multifrequency transducers providing 38, 70, 120, 200 kHz frequencies for the EK-60

3.3 Installation and Maintenance - Prior to departure from San Diego the Cruise Leader or Chief Scientist and members of the scientific party may board the vessel, with permission of the ship's Captain, to test survey equipment and environmental sensors. It is also requested that the constant temperature room be set at $22^{o}C \pm 1^{o}C$ ($71.5^{o}F \pm 2^{o}F$) prior to departure.

3.4 Hazardous Materials - The Cruise Leader or Chief Scientist shall be responsible for complying with NC Instruction 6280a, Hazardous Materials and Hazardous Waste; policy, guidance, and training, dated February 4, 1991, paragraph 7.g and paragraph 9. By Federal Law, the ship may not sail without a complete inventory of Material Safety Data Sheets (MSDS's) and appropriating neutralizing agents, buffers, and/or absorbents in amounts adequate to address spills of a size equal to the amount of chemicals brought on board. The Cruise Leader or Chief Scientist will provide the Commanding Officer with a copy of all MSDS's prior to the cruise.

4.0 DATA RESPONSIBILITIES

4.1 Collection of Data - The Chief Scientist will receive all original data related to the project. The Chief Scientist will in turn furnish the Commanding Officer with a complete inventory listing of all data gathered by the scientific party, detailing types of operations and quantities of data prior to departing the ship. All data gathered by the vessel's personnel that are desired by the Chief Scientist will be released to him, including supplementary data specimens and photos gathered by the scientific crew.

4.2 Dissemination of Data - The Cruise Leader or Chief Scientist is responsible for the quality assurance, disposition and archiving of data and specimens collected aboard the ship. The Chief Scientist is also responsible for the dissemination of copies of these data to cruise participants and to any other requesters. The SWFSC cruise report will be submitted according to SWFSC procedures to appropriate persons and groups.

4.3 Evaluation Form - The Cruise Leader or Chief Scientist will complete the Ship Operations Evaluation Form and forward it to the Office of Marine and Aviation Operations. The Commanding Officer will provide this form.

5.0 ADDITIONAL INVESTIGATIONS AND PROJECTS

5.1 Ancillary Projects - Ancillary projects are secondary to the objectives of the cruise, should be treated as additional investigations, do not have representation aboard, and are accomplished by the ship's force. Ancillary tasks will be accomplished in accordance with the NOAA Fleet Standing Ancillary Instructions. Any additional work will be conducted so as not to interfere with operations as outlined in these instructions. The Cruise Leader or Chief Scientist will be responsible for determining the priority of additional work relative to the primary project with approval from the Commanding Officer.

6.0 COMMUNICATIONS

6.1 Radios - The Cruise Leader or designee may request, from the Commanding Officer, the use of radio transceivers aboard the ship to communicate with other vessels and aircraft, if necessary.

6.2 Telephone - The Cruise Leader or designee may require access to the ship's INMARSAT or cellular telephone systems with permission from the Commanding Officer. The Commanding Officer will provide the Cruise Leader with a log of all INMARSAT calls made from the ship for SWFSC business at the end of each leg. In accordance with the Communications Reimbursement Policy, SWFSC will pay these charges via a transfer of funds from SWFSC to the ship.

6.3 Electronic Mail - All members of the scientific party will have access to e-mail for communications with persons not aboard the ship. The amount of such communication traffic will be determined by the Cruise Leader or Chief Scientist.

7.0 MISCELLANEOUS

7.1 Pre-cruise Meeting - A pre-cruise meeting between the Cruise Leader or Chief Scientist and the ship's Captain (and his staff) will be held prior to the start of the cruise to identify operational requirements (i.e., overtime, modifications, repairs or procurement). The date and time for this meeting is yet to be scheduled.

7.2 Underway Meetings - Meetings between the ship's Captain (and other mates) and the Cruise Leader should occur at the beginning and end of each leg to discuss and solve any problems or changes that may arise. Additional meetings should occur as needed.

7.4 Time and Attendance - Time and Attendance will be filled out by the SWFSC timekeeper while the ship is at sea, based on information transmitted by the Cruise Leader to the Chief Scientist. Scheduled overtime is authorized for Saturdays, Sundays, holidays and any hours over a standard eight hour week day. Irregular overtime will be authorized by the Cruise Leader as required. SWFSC personnel are authorized per diem at the rate of $5.00 per day to be paid via a travel voucher at the termination of the cruise. Task Number K8LEF28-P15 will pay for per diem and overtime for any SWFSC permanent, term or temporary employees.

7.5 Navigation - Primary control will be GPS, also dead reckoning based on visual bearings and radar ranges when possible.

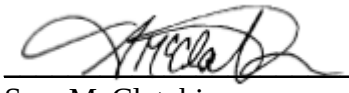
7.6 Scientific Spaces - The Cruise Leader shall be responsible for the proper upkeep and cleaning of all spaces assigned to the scientific party, both laboratory and living spaces,

throughout the cruise. The Cruise Leader or Chief Scientist will make berthing assignments for scientific personnel on a per-leg basis, with approval of the ship's Captain.

For further information contact:

Sam McClatchie, Southwest Fisheries Science Center, National Marine Fisheries Service, NOAA, 8604 La Jolla Shores Drive, La Jolla, CA 92037; Sam.McClatchie@noaa.gov, Phone (858) 546-7083.

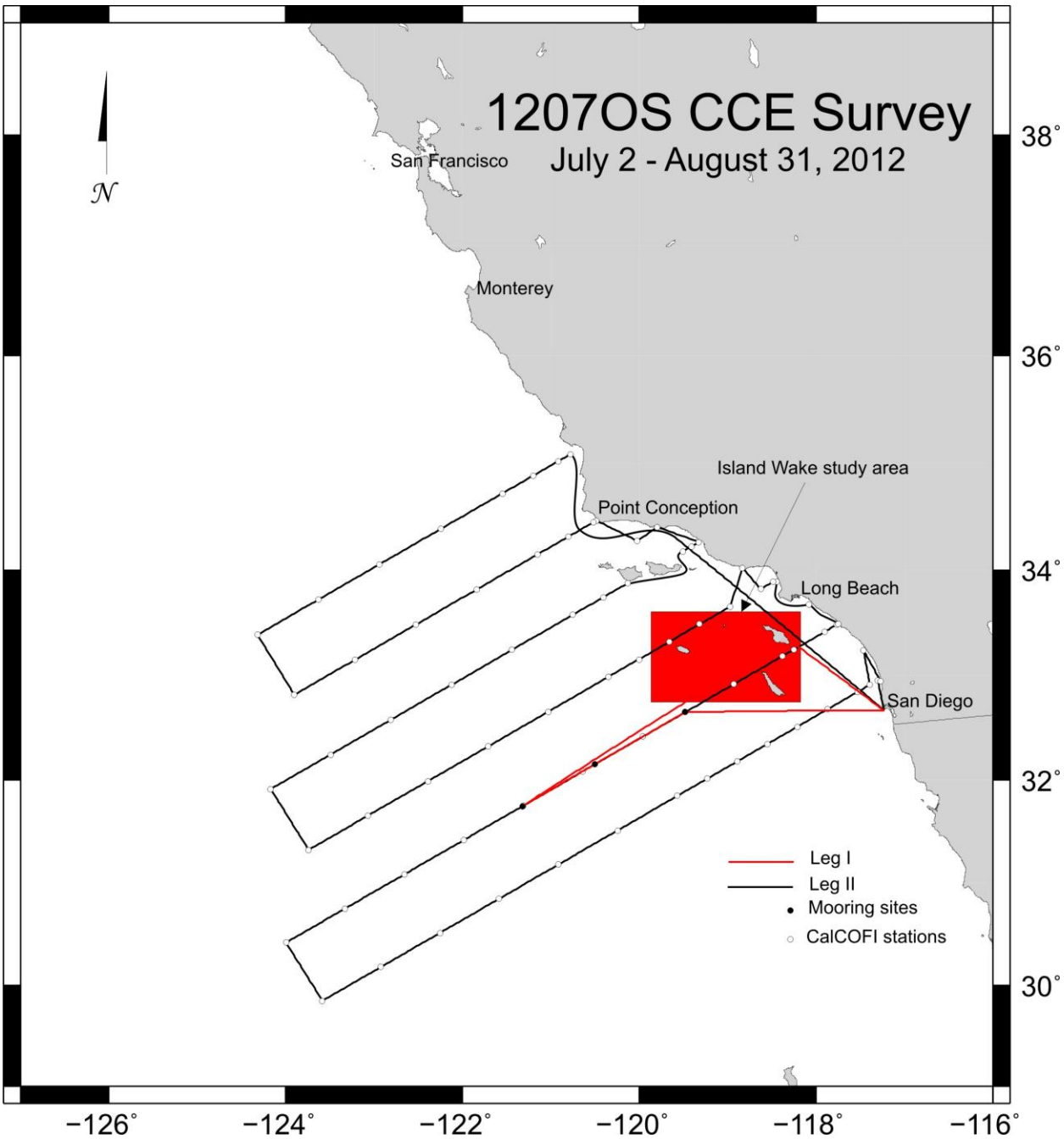
Amy Hays, Southwest Fisheries Science Center, National Marine Fisheries Service, NOAA, 8604 La Jolla Shores Drive, La Jolla, CA 92037; Amy.Hays@noaa.gov, Phone (858) 546-7130.

Prepared by:  Date: 6/18/2012
Sam McClatchie
Chief Scientist, SWFSC

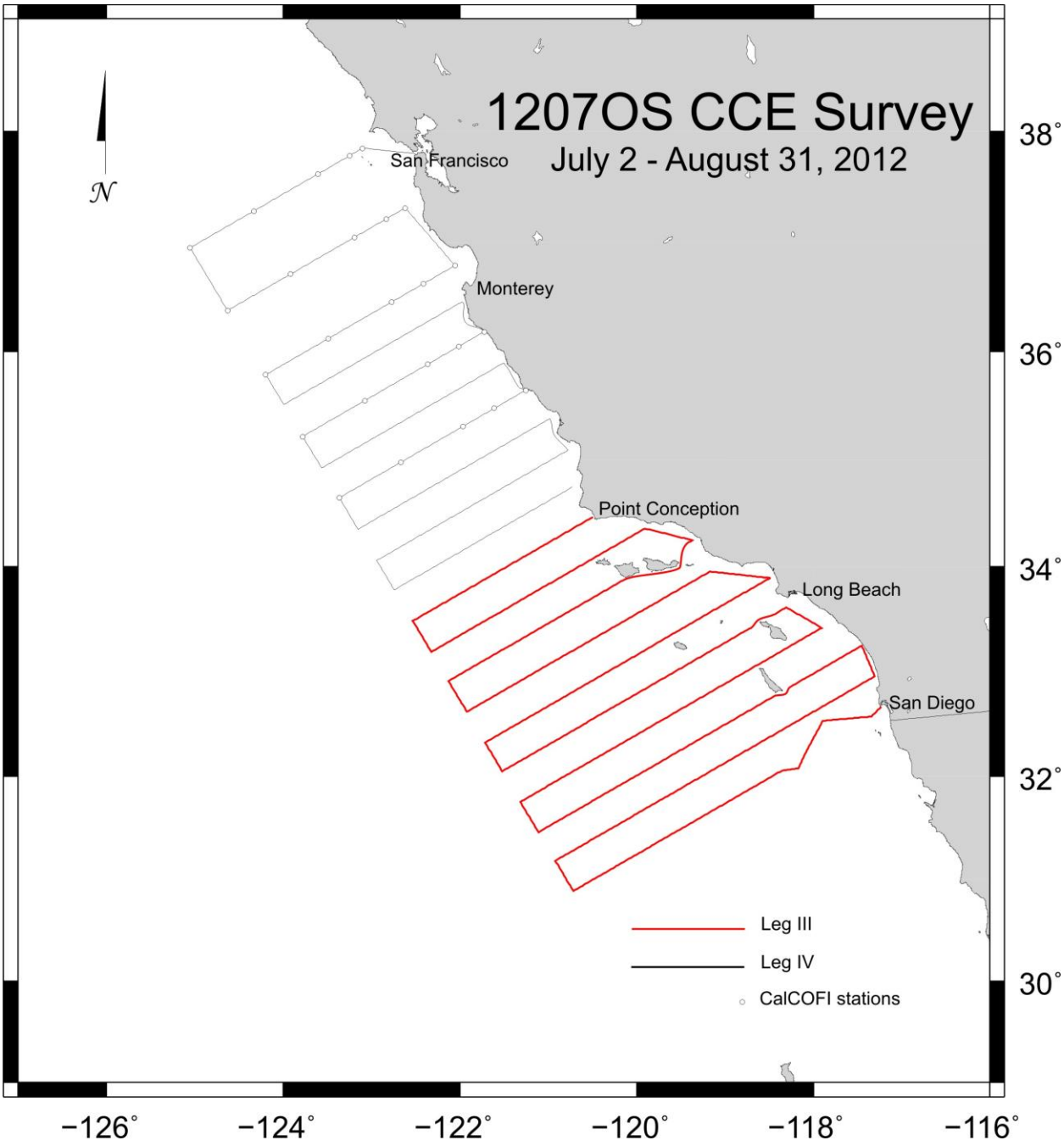
Approved by: _____ Date: _____
Russ Vetter
Director, FRD, SWFSC

Approved by: _____ Date: _____
Cisco Werner, PhD.
Science & Research Director
Southwest Region

Appendix 1. The vessel R/V *Ocean Starr* track lines for 1207OS Legs 1 and II.



Appendix 2. . The vessel R/V *Ocean Starr* track lines for 1207OS Legs III and IV. Stations on leg III will be determined by the ship's distance covered during daylight hours:



Leg I :

Schedule_Order	Line	Station	Dlatitude	Dlongitude	
1	94.7229717	27.9871951	32.667	117.232997	San Diego
2	93.3	26.7	32.9563724	117.305381	
3	93.4	26.4	32.9490519	117.273565	
4	91.7	26.4	33.2435006	117.465417	
5	93.3	28	32.9130391	117.394382	
6	93.3	30	32.8463724	117.531221	
7	93.3	35	32.6797058	117.872864	
8	93.3	40	32.5130391	118.213865	
9	93.3	45	32.3463724	118.554228	
10	93.3	50	32.1797058	118.893958	
11	93.3	55	32.0130391	119.233061	
12	93.3	60	31.8463724	119.571542	
13	93.3	70	31.5130391	120.246658	
14	93.3	80	31.1797058	120.919346	
15	93.3	90	30.8463724	121.589647	
16	93.3	100	30.5130391	122.257599	
17	93.3	110	30.1797058	122.923242	
18	93.3	120	29.8463724	123.586614	
19	90	120	30.4179492	123.998933	
20	90	110	30.7512825	123.331643	
21	90	100	31.0846159	122.662016	
22	90	90	31.4179492	121.990013	
23	90	80	31.7512825	121.315594	
24	90	70	32.0846159	120.638718	
25	90	60	32.4179492	119.959345	
26	90	53	32.6512825	119.482276	
27	90	45	32.9179492	118.935511	
28	90	37	33.1846159	118.387081	
29	90	35	33.2512825	118.249711	
30	90	30	33.4179492	117.905821	
31	90	28	33.4846159	117.768079	
32	90	27.7	33.4946159	117.747408	
33	88.5	30.1	33.6744235	118.083693	
34	86.8	32.5	33.8888721	118.444235	
35	86.7	33	33.889526	118.490334	
36	86.7	35	33.8228593	118.628732	
37	85.4	35.8	34.0213592	118.834131	
38	86.7	40	33.6561926	118.974252	

39	86.7	45	33.489526	119.319096	
40	86.7	50	33.3228593	119.663272	
41	86.7	55	33.1561926	120.006783	
42	86.7	60	32.989526	120.349637	
43	86.7	70	32.6561926	121.03339	
44	86.7	80	32.3228593	121.714573	
45	86.7	90	31.989526	122.39323	
46	86.7	100	31.6561926	123.069401	
47	86.7	110	31.3228593	123.743126	
48	83.3	110	31.9117566	124.170395	
49	83.3	100	32.2450899	123.492322	
50	83.3	90	32.5784232	122.811732	
51	83.3	80	32.9117566	122.128582	
52	83.3	70	33.2450899	121.442831	
53	83.3	60	33.5784232	120.754434	
54	83.3	55	33.7450899	120.40923	
55	83.3	51	33.8784232	120.132579	
56	83.3	42	34.1784232	119.508513	
57	83.3	40.6	34.2250899	119.411235	
58	83.3	39.4	34.2650899	119.327811	
59	81.7	43.5	34.4055514	119.80037	
60	81.8	46.9	34.2748975	120.025237	
61	80	50.5	34.4666667	120.489055	
62	80	51	34.45	120.523905	
63	80	55	34.3166667	120.802448	
64	80	60	34.15	121.15	
65	80	70	33.8166667	121.843035	
66	80	80	33.4833333	122.533349	
67	80	90	33.15	123.220987	
68	80	100	32.8166667	123.905992	
69	76.7	100	33.3882434	124.322891	
70	76.7	90	33.7215768	123.633345	
71	76.7	80	34.0549101	122.941091	
72	76.7	70	34.3882434	122.246083	
73	76.7	60	34.7215768	121.548277	
74	76.7	55	34.8882434	121.19831	
75	76.7	51	35.0215768	120.917821	
76	76.7	49	35.0882434	120.777403	
77	94.7229717	27.9871951	32.667	117.232997	San Diego

Leg II :

Schedule_Order	Line	Station	Dlatitude	Dlongitude	
1	94.723	27.9872	32.6670005	117.232997	San Diego
2	90	53	32.6512825	119.482276	CORC 3
3	90	68	32.1512825	120.503045	CORC 1-2
4	90	80.1	31.7479492	121.32235	CORC 4
5	89.4	35.1	33.3518722	118.32534	Avalon, Catalina Is.
6	94.723	27.9872	32.6670005	117.232997	San Diego

Leg III and IV:

Schedule_Order	Line	Station	Station_Type	Dlatitude	Dlongitude
1	94.7229717	27.9871951	0	32.667	117.232997
2	94.9	29.9	0	32.5725776	117.34352
3	93.9	36.3	0	32.5324494	117.893193
4	94.8	40.6	0	32.2332315	118.08304
5	95.3	42.7	0	32.0766289	118.168352
6	95	45	0	32.0519238	118.358686
7	95	50	0	31.8852571	118.697312
8	95	55	0	31.7185905	119.035319
9	95	60	0	31.5519238	119.372713
10	95	70	0	31.2185905	120.045683
11	95	80	0	30.8852571	120.71626
12	91.7	80	0	31.4568339	121.11113
13	91.7	70	0	31.7901672	120.436426
14	91.7	60	0	32.1235006	119.759261
15	91.7	55	0	32.2901672	119.419743
16	91.7	50	0	32.4568339	119.079594
17	91.7	45	0	32.6235006	118.738809
18	91.7	40	0	32.7901672	118.397383
19	91.7	35	0	32.9568339	118.05531
20	91.7	30	0	33.1235006	117.712585
21	88.3	33	0	33.6123978	118.306741
22	88.3	35	0	33.5457312	118.444689
23	88.3	40	0	33.3790645	118.789089
24	88.3	45	0	33.2123978	119.132824
25	88.3	50	0	33.0457312	119.475899
26	88.3	55	0	32.8790645	119.818319
27	88.3	60	0	32.7123978	120.160089
28	88.3	70	0	32.3790645	120.841703
29	88.3	80	0	32.0457312	121.520783

30	85	80	0	32.6173079	121.9212
31	85	70	0	32.9506413	121.237749
32	85	60	0	33.2839746	120.551691
33	85	55	0	33.4506413	120.207671
34	85	50	0	33.6173079	119.862982
35	85	45	0	33.7839746	119.517621
36	85	40	0	33.9506413	119.17158
37	81.7	45	0	34.3555514	119.90482
38	81.7	50	0	34.1888847	120.252534
39	81.7	55	0	34.022218	120.599556
40	81.7	60	0	33.8555514	120.94589
41	81.7	70	0	33.522218	121.636519
42	81.7	80	0	33.1888847	122.324467
43	78.3	80	0	33.777782	122.743021
44	78.3	70	0	34.1111153	122.050306
45	78.3	60	0	34.4444486	121.35483
46	78.3	55	0	34.6111153	121.006042
47	78.3	51	0	34.7444486	120.726503
48	75	49	0	35.3826921	120.980849
49	75	51	0	35.3160254	121.121782
50	75	55	0	35.1826921	121.403296
51	75	60	0	35.0160254	121.754534
52	75	70	0	34.6826921	122.45485
53	75	80	0	34.3493587	123.152327
54	73.3	80	1	34.6438074	123.364388
55	73.3	70	1	34.9771407	122.664405
56	73.3	60	1	35.310474	121.961541
57	73.3	55	1	35.4771407	121.609013
58	73.3	50	1	35.6438074	121.255748
59	70	51	1	36.1820508	121.725864
60	70	55	1	36.0487175	122.010478
61	70	60	1	35.8820508	122.365563
62	70	70	1	35.5487175	123.073478
63	70	80	1	35.2153841	123.778431
64	66.7	80	1	35.7869609	124.195712
65	66.7	75	1	35.9536276	123.841058
66	66.7	70	1	36.1202942	123.485649
67	66.7	65	1	36.2869609	123.129477
68	66.7	60	1	36.4536276	122.772537
69	66.7	55	1	36.6202942	122.414823
70	66.7	50	1	36.7869609	122.056327
71	63.3	52	1	37.3091915	122.617831

72	63.3	55	1	37.2091915	122.834518
73	63.3	60	1	37.0425248	123.195021
74	63.3	70	1	36.7091915	123.913642
75	63.3	80	1	36.3758582	124.629124
76	60	80	1	36.9474349	125.053269
77	60	70	1	37.2807683	124.332375
78	60	60	1	37.6141016	123.608253
79	60	53	1	37.8474349	123.099418

Appendix 3. Personnel for the 1207OS CCE Survey

Ocean Starr Leg I (CalCOFI):
2 JUL – Depart San Diego 19 JUL - Arrive San Diego CA 18 DAS

Position	Name	Affiliation	Citizenship
Cruise Leader	Amy Hays	SWFSC	USA
Biologist	Dave Griffith	SWFSC	USA
Biologist	Bryan Overcash	OAI	USA
Oceanographer	Dave Faber	SIO	USA
Oceanographer	Jennifer Rodgers-Wolgast	SIO	USA
Oceanographer	Jim Wilkinson	SIO	USA
Oceanographer	Ralph Jiorle	SIO	USA
Oceanographer	Melissa Miller	SIO	USA
LTER	Shonna Dovel	SIO	USA
Volunteer	Adam Glick	private	USA
Volunteer	Liz Lam	private	USA
Volunteer	Michael Wang	private	USA
Birder	Dawn Breese	private	USA
Marine mammal	Lauren Roche	SIO	USA
Marine mammal	Katherine Whitaker	private	USA
Marine mammal	Andrea Bendin	private	USA
Acoustician	Josiah Renfree	SWFSC	USA

Ocean Starr Leg II (Island Wake/ Moorings):
22 JUL – Depart San Diego, CA 1 AUG - Arrive San Diego, CA 11 DAS

Position	Name	Affiliation	Citizenship
Cruise Leader	Dave Griffith	SWFSC	USA
Chief Scientist	Sam McClatchie	SWFSC	USA
Biologist	Amy Hays	SWFSC	USA
Biologist	Helena Afyafar	SWFSC	USA
Biologist	TBD	SWFSC	USA
Mooring	Uwe Send	SIO	USA
Mooring	Matt Moldovan	SIO	USA
Mooring	Christian Begler	SIO	USA
Mooring	Taylor Semingson	SIO	USA
Mooring	Romain Heux	SIO	USA
Mooring	Gabriela Chavez	SIO	USA
Mooring	SungHyun Nam	SIO	USA
Mooring	Sam Wilson	SIO	USA
Acoustician	Kyle Byers	SWFSC	USA

Ocean Starr Leg III (CPS):
2 AUG – Depart San Diego, CA 16 AUG - Arrive Port Hueneme, CA 15 DAS

Position	Name	Affiliation	Citizenship
Cruise Leader	Dave Griffith	SWFSC	USA
Biologist	Amy Hays	SWFSC	USA
Biologist	Andrew Thompson	SWFSC	USA
Biologist	Elaine Acuna	SWFSC	USA
Biologist	Lauren Shiosaka	Volunteer	USA
Biologist	Colleen Grant	Volunteer	USA
Biologist	Lian Guo	Volunteer	USA
Acoustician	Josiah Renfree	SWFSC	USA
Volunteer	John Condon	private	USA

Ocean Starr Leg IV (CPS):
17 AUG – Depart Port Hueneme, CA 31 AUG - Arrive San Francisco, CA 15 DAS

Position	Name	Affiliation	Citizenship
Cruise Leader	Dave Griffith	SWFSC	USA
Biologist	Amy Hays	SWFSC	USA
Biologist	Bill Watson	SWFSC	USA
Biologist	Ed Weber	SWFSC	USA
Biologist	Bryan Overcash	SWFSC	USA
Acoustician	Josiah Renfree	SWFSC	USA
Birder	Scott Mills	private	USA
Volunteer	John Condon	private	USA
Volunteer	Sara Kazarnowicz	private	USA