

F. Nearshore Acoustic and Purse Seine Sampling-Central and Southern CA (F/V *Long Beach Carnage*)

Overview

During summer 2022, NOAA Ship *Lasker* will be used by Southwest Fisheries Science Center (SWFSC) Fisheries Resources Division (FRD) to survey the distributions and abundances of coastal pelagic fish species (CPS), their prey, and their biotic and abiotic environments in the California Current between Cape Flattery and Baja California. Routinely, *Lasker* will only survey in water depths greater than ~ 20 to 30 m, and therefore may potentially under-sample any CPS aggregations in the shallower, *nearshore area*. Therefore, to extend the CPS sampling closer to shore, Fishing Vessel *Long Beach Carnage* (LBC) will be used to conduct echosounder and purse-seine sampling as close to shore as safely navigable, from Bodega Bay to San Diego, CA. The principle components of the nearshore sampling include: Advanced Survey Technology Program's (AST's) four Simrad EK60 General Purpose Transceivers (GPT), operating at 38, 70, 120 and 200 kHz, connected to AST's four-transducer array (MTA-4) pole-mounted on the port side of *Long Beach Carnage* (Fig. F1).

ITINERARY – F/V *Long Beach Carnage*

Event	Location	Date(s)	Sea days
Calibration	SWFSC (Tech Tank)	TBD	
Mobilization	Long Beach, CA	TBD	
Departure	Long Beach, CA	27 July	
Leg 1		29 July–8 Aug.	10
Leg 2		12–29 Aug.	10
Arrival	Long Beach, CA	29 Aug.	
Demobilization	Long Beach, CA	TBD	

The echosounder system will be used to sample acoustic backscatter from CPS along transects between the 5 and 60-m isobaths, spaced 5 nmi apart (Fig. F2). *Long Beach Carnage* will also sample CPS using purse-seine sets in the nearshore area. Joel Van Noord, a biologist from the California Wetfish Producers Association (CWPA), will be aboard *Long Beach Carnage* to log EK60 data; direct the purse-seine sampling of CPS; sample the catches, and maintain a log of all observations and sampling activities. To ensure that the samplings from *Lasker* and *Long Beach Carnage* are contemporaneous, the acoustician aboard *Lasker* will communicate and coordinate with Joel Van Noord throughout the survey. Following the survey, biologists from the California Department of Fish and Wildlife (CDFW) will process the samples from the purse seine catches to obtain information about the proportions of species in the area, their lengths, weights, and ages (estimated from otoliths).

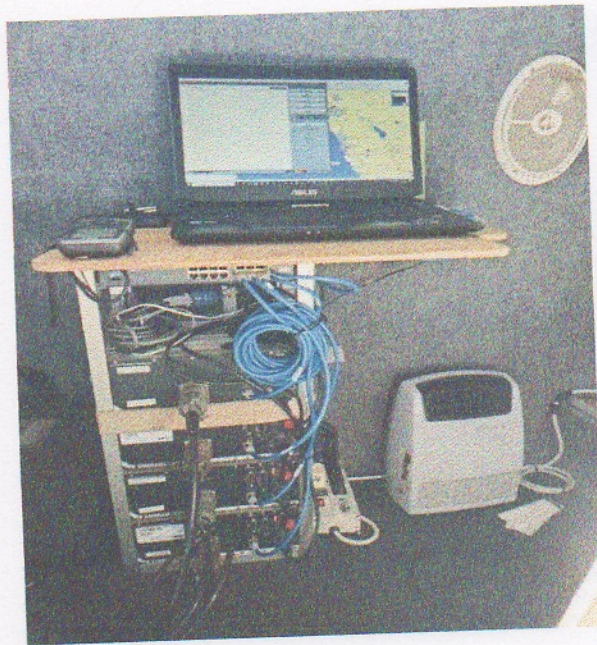


Figure F1. A four-frequency scientific echosounder system installed aboard F/V *Long Beach Carnage*, consisting of four Simrad EK60 General Purpose Transceivers (GPTs), a system control and data logging laptop computer, an Ethernet switch, and a GPS receiver, (left); and a retractable multi-transducer array (MTA-4) mounted on the port-side (right).

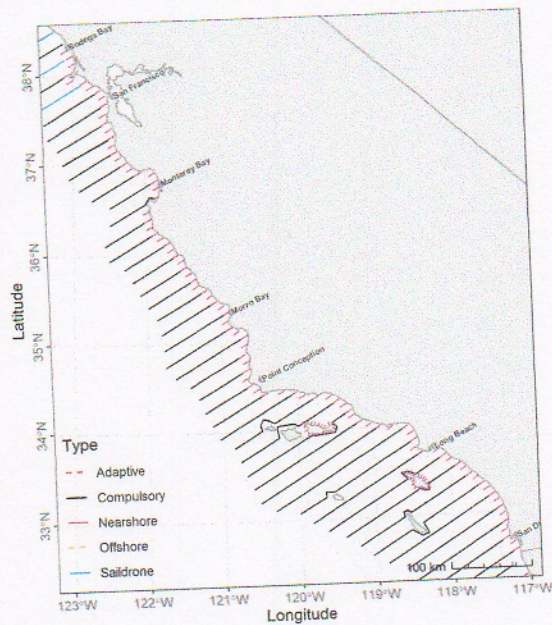


Figure F2. *Long Beach Carnage's* nearshore transects (magenta lines) and compulsory, adaptive, and unmanned surface vehicle (USV) transects (gray lines). The waypoints for the nearshore transects are in **Table F2**. All vessels will run the transects as close to shore as safely navigable.

Methods

[Date TBD], [AST-TBD] will install, test, and calibrate the EK60 recording system (principally the four GPTs and the MTA-4, a GPS receiver, and control and logging laptop PC). [Date TBD], Captain Richie Ashley and Joel Van Noord, while communicating with [AST-TBD], will test the echosounder system's function and evaluate any crosstalk between the vessel's sonar and the echosounder.

On July 27, *Long Beach Carnage* will depart Long Beach, CA and transit to the first planned transect off San Diego, CA near the U.S.-Mexico border. Between 29 July and 29 August, *Long Beach Carnage* will conduct acoustic transects and purse-seine sets on transects spanning the nearshore region from San Diego to Bodega Bay and around Santa Catalina and Santa Cruz Islands.

Long Beach Carnage will conduct the nearshore survey (~1200 nmi total transect distance; ~1700 nmi total distance, including transits before and after the survey) transiting at nominally 8 kn, running transects at 7 kn, and purse-seine sampling at least **once per transect** following the provisional schedule in **Table F1**, which includes transit days, port calls, and sampling days.

Upon completion of the planned transects or on 29 August, whichever comes first, the vessel will transit to San Diego, CA where demobilization will occur.

Following the survey, the catch samples will be processed ashore by CDFW biologists (TBD).

Table F1. Provisional schedule for F/V *Long Beach Carnage*.

Date	First Transect	Last Transect	Date	First Transect	Last Transect
July 27, 2022	In port	Transit	August 12, 2022	177	175
July 28, 2022	Transit	Transit	August 13, 2022	174	172
July 29, 2022	224	220	August 14, 2022	171	169
July 30, 2022	219	215	August 15, 2022	Santa Cruz	Santa Cruz
July 31, 2022	214	210	August 16, 2022	Santa Cruz	Santa Cruz
August 1, 2022	209	206	August 17, 2022	168	166
August 2, 2022	205	201	August 18, 2022	165	163
August 3, 2022	200	196	August 19, 2022	162	159
August 4, 2022	195	192	August 20, 2022	158	156
August 5, 2022	191	187	August 21, 2022	155	153
August 6, 2022	186	182	August 22, 2022	Santa Catalina	Santa Catalina
August 7, 2022	181	178	August 23, 2022	Santa Catalina	Santa Catalina
August 8, 2022	In port	In port	August 24, 2022	152	150
August 9, 2022	In port	In port	August 25, 2022	149	147
August 10, 2022	In port	In port	August 26, 2022	146	144
August 11, 2022	In port	In port	August 27, 2022	143	141
			August 28, 2022	140	138
			August 29, 2022	Transit	In port

This provisional schedule assumes transits to and from the Channel Islands will occur at night and not impact daytime (approximately 11 h sunrise to sunset) acoustic and purse-seine sampling times.

a) Acoustic Sampling

Long Beach Carnage is expected to begin sampling the nearshore area off Bodega Bay and continue sampling nearshore transects south to San Diego and around Santa Cruz and Santa Catalina Islands (**Fig. F2**). Transects off the mainland are 5 nmi-apart and consistently 5 nmi-long. Transects may be shortened to 3 nmi-long to allow for an average of one purse-seine sample per transect, maintain progress with *Lasker*, or both. Transects off the Channel Islands are nominally 2 nmi-long and spaced 2.5 nmi-apart. There are 87 mainland transects, or 3-5 per sampling day (9 hours per day). This leaves between **3.5 and 5 hours of daylight** for 3-5 purse seine samples per day. Each day off the Channel Islands will have more than 6 hours for purse seine sampling, and it may be possible to sample each island in a single day, rather than the two proposed in the schedule above.

Acoustic sampling of each nominally east-west transect is expected to occur on a straight line between the inshore and offshore waypoints (**Table F2**). Deviations from these transect lines should be minimized.

b) Purse Seine Sampling

Each day, after one or more transects have been surveyed, *Long Beach Carnage* will collect CPS samples by fishing a purse-seine net on randomly selected CPS schools observed in echograms. The samples will be used to determine the species composition of CPS schools and to obtain biological information including weight, length, maturity, and age (using extracted otoliths).

The 200-m-long and 27-m-deep net has mostly 17-mm-wide mesh. A small section on the backend of the net is 25-mm-wide mesh. *Long Beach Carnage* will set the net at least an average of once per transect (~ 1 h per set), to collect at least 95 sets (an average of one per each of the 87 transects plus average of 4 per island) over the course of the survey. The seine will generally be set only during daytime. However, in areas where an abundance of schools is observed, daytime sets are not successful, or both, a set may be made at night.

To the extent possible, and to the best ability of the captain and crew, the date, time, location, and species composition of all putative CPS schools observed (acoustically and visually) shall be logged. Each day, the CWPA biologist will use these observations to direct the purse seine sampling effort such that the catches are proportional to the species composition of the schools observed acoustically that day.

The duration of the survey and the lack of space on the F/V *Long Beach Carnage* prevents CDFW staff from processing samples onboard, so the initial sample collection will be done by fishermen and the CWPA biologist, and final processing will be conducted ashore by CDFW staff.

The following protocols will be followed for the processing of catch from each set:

CWPA Biologist at sea

- For every set, collect three (3) dip net samples, separated spatially as much as possible in the seine net
- Each dip net sample will be put in a bag and tagged with a date, time of capture, lat/lon, transect line #, school and dip net numbers, and estimated tonnage of entire school
- For each dip net sample, sort the Pacific Sardine, Northern Anchovy, Pacific Mackerel, and Jack Mackerel and record the number of fish and combined weight of each species
- Each dip net sample will then be combined and as many as 50 fish of each species will be chosen randomly throughout the combined sample Freeze sample bags onboard and coordinate a delivery of samples with CDFW

CDFW Biologists ashore

- Each species sample will be processed with:
 - total sample weight recorded to the nearest gram
 - individual fish weight recorded to the nearest gram
 - individual fish length recorded using standard length for Pacific Sardine and Northern Anchovy, and fork length for mackerels
 - maturity stage
 - otoliths extracted for aging
 - because fish are frozen, no female gonads can be collected or weighed
- Catch and biological data will be shared with SWFSC for analysis

The visual monitoring watches (from 15 min prior to set through gear retrieval) and any data gathered during these watches will be recorded in the watch logs provided for each survey. The net will not be opened if only pinnipeds enter it. If any dolphins or porpoises are seen within 500 m of the vessel, the move-on rule is applied. If killer whales are seen at any distance, the move-on rule is applied. If any cetaceans are seen within the net it is opened immediately.

c) Coordination and Data Exchange

Conditions permitting, *Long Beach Carnage* and *Lasker* will communicate daily with the acousticians aboard *Lasker* to exchange information and maintain temporal and spatial coherence of the samples. If daily encounters are not possible, or even if a larger than 3-day mismatch occurs between *Long Beach Carnage* and *Lasker*, *Long Beach Carnage* will continue the sampling protocol independently of *Lasker*, at a rate of approximately 6-7 transects per day for the remaining available time.

At the conclusion of the nearshore survey aboard *Long Beach Carnage*, CWPA biologist Joel Van Noord will disembark *Long Beach Carnage* at San Diego, CA. There, AST members will remove the scientific echosounder system, including GPTs, GPS, pole-mount, and MTA-4. The acoustic data and log book will be provided to the AST for data processing. Joel Van Noord will transfer the biological samples and a copy of the log book to the CDFW biologists for processing. Finally, the results of the sample processing will be provided by the CDFW biologists to the AST to estimate and report the nearshore CPS biomasses and distributions.

d) Echosounder equipment
 (1) EK60 System

The EK60 system is comprised of four GPTs operating at 38, 70, 120, and 200 kHz, four pole-mounted split-beam transducer (Simrad ES38-12, ES70-7C, ES120-7C, and ES200-7C), AC or DC power, a connection to the ship's ground, synchronization with other sounders and

sonars, and an Ethernet connection to a laptop PC running Simrad ER60 control and data logging software. In this installation, the temperature sensor, event input, motion sensor, new line, and remote on/off inputs will not be used.

(2) Transducers

The four-transducer array (MTA-4) is mounted on a pole on the port side of *Long Beach Carnage*, is connected to the GPTs using four cables, each with an 11-pin Amphenol connector.

(3) Power

The GPTs may be powered by either 110 AC or 12 VDC/7A. To reduce noise in the echosounder data, use a power strip with line filter.

(4) Ground

The GPT chassis must be connected to the ship's ground using a cable that is as short as possible.

(5) ER60 Computer

The EK60s will be controlled, and their data will be logged, using a laptop PC running Simrad EK80 software. Data will be backed-up to USB hard disk drives (HDDs). The EK60 GPTs and controlling and data-logging laptop will be located on the bridge of *Long Beach Carnage*. The laptop will be connected directly to the EK60 GPTs via an Ethernet cable; and to a handheld GPS receiver via a USB-to-serial adapter.

(6) Ethernet

The GPTs and laptop are connected using "straight through" Ethernet cables and an Ethernet switch.

(7) GPS Data

NMEA 0183 data from a GPS receiver must be input to the laptop via a USB-serial adapter. The communication parameters are 4800 bps, 8 data bits, no parity, and one stop bit. The GPS's serial output signal (Tx, pin 3) and ground (pin 5) wires must be connected to the laptop's serial input signal (Rx, pin 2) and ground (pin 5) wires using a maximum cable length of 10 m.

A GPS receiver will be installed with an antenna running outside and on top of the cabin, or affixed to the inside of the port-side bridge window.

(8) EK60 System Calibration and Configuration

Prior to installation aboard *Long Beach Carnage*, the EK60 system will be calibrated in the SWFSC Technology Development Tank. Gain values will be determined relative to a sphere made from tungsten carbide with 6% cobalt binder material, suspended directly beneath the transducer. The local seawater temperature and salinity will be measured from *Lasker* to adjust the estimates for sound speed and absorption coefficients.

The EK60 system will be configured for operation with a transmit power of 2000 W, pulse length of 1024 μ s, and the ping rate will be optimized using EK Adaptive Logging (EAL) software. With the EAL, the nominal transmit interval will be 0.5 Hz.

(9) Cross-talk Interference

Prior to the survey, noise in the EK60 data, originating from operation of *Long Beach Carnage's* depth sounder and fishing sonar, must be evaluated and mitigated. To evaluate crosstalk noise from the depth sounder and sonar and depth sounder, the EK60 GPT will be set in passive mode and noise measurements will be collected with the depth sounder turned on and then off, and then the sonar turned on and then off.

To avoid interference during the survey transects, *Long Beach Carnage's* depth sounder and fishing sonar must be secured. However, during transits and fishing operations, the depth sounder and fishing sonar may be used to observe near-surface fish schools.

e) Contact list

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