December 7, 2004 F/PIC:RLH:FLF
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CRUISE REPORT

VESSEL: *Oscar Elton Sette*, Cruise 04-12 (OES-21)

CRUISE PERIOD: 17-27 September 2004

AREA OF OPERATION: Kona coast off the Island of Hawaii (Fig. 1)

TYPE OF OPERATION: Operations off the Kona coast of the Island of Hawaii during 18-20 September were conducted to calibrate the Simrad EK60 echosounder by the placement of metallic calibration spheres at various depths and locations underneath the ship's transducer by shipboard NOAA-certified divers. Night operations consisted of net performance trials using the dual warp Cobb (Stauffer) trawl and simultaneous monitoring of net performance using the Netmind system. Other night operations during 18-20 September included trial deployments of the Thomas drop net system, subsurface tows targeting tuna larvae using a 1.8-meter Issacs-Kidd (IK) trawl net (net entirely 0.5 mm mesh) towed from midship, and a grid transect of shallow conductivity-temperature-depth (CTD) casts at predetermined locations off Kona.

Operations conducted off the Kona coast during 22-26 September consisted of daytime surface net tows targeting billfish eggs and larvae 2-25 nmi off the Kona coast of the Island of Hawaii using the 1.8-m IK trawl. During the mornings, safeboat operations independent of the ship included tows of dual 0.5-m egg nets (with 0.5 mm mesh) and dipnetting of billfish larvae within surface slicks. Night operations off the Kona coast included subsurface IK tows targeting tuna larvae, additional trials of the Thomas drop net system, and further CTD casts at predetermined locations off Kona.

ITINERARY:

17 September	Embarked Robert Humphreys, Lara Asato, Ray Boland, Reka Domokos, Marc Lammers, Michael Musyl, Derek Needham, Melissa Paine, Michael Seki, Allen Shimada, and Kent Thomas. Depart Snug Harbor at 1300 and begin transit to Kailua-Kona, Island of Hawaii.
18 September	Begin operations inside Kealakekua Bay to conduct calibration of Simrad EK-60. Upon completion of calibration, transited to Kailua-Kona and disembarked Boland, Domokos, and Lammers that afternoon. In the evening, completed all four CTD casts along the northernmost transect line.
19 September	Subsurface IK tows for tuna larvae were conducted in the morning followed by an early afternoon test of the Thomas drop-net system for collecting midwater micronekton. Afterwards, subsurface IK tows for tuna larvae were resumed. In the evening, a test trial of the Cobb trawl and associated Netmind system was conducted.
20 September	During daylight hours conducted subsurface IK tows for tuna larvae, a trial deployment of the Thomas drop-net system, and a test trial of the Cobb trawl and associated Netmind system. In the evening, conducted CTD casts and another test deployment of the Thomas drop-net system.
21 September	Anchored off Kailua-Kona. Disembarked Asato, Needham, and Seki in the morning and embarked John Hyde, Eric Lynn, and Andrew West on the cruise. Departed anchorage in the evening and conducted CTD casts.
22-25 September	Commenced daytime schedule of 1-hour surface tows targeting billfish eggs and larvae using a 1.8-m Isaacs-Kidd (IK) trawl and, during morning hours, independently conducting dual 0.5-m dual ring net tows and dip-net operations from the ship's safeboat. Night operations consisted of subsurface IK tows for tuna larvae and CTD casts at predetermined locations. Additional trial deployments of the Thomas drop-net system at the surface and midwater depths were conducted on the nights of September 23 and 24, respectively. Disembarked West from the cruise at the Kailua-Kona pier on the afternoon of September 25.
26 September	Conducted daylight surface IK tow operations until mid-afternoon; disembarked Hyde and Lynn from the cruise at the Kailua-Kona pier, then departed Kona for Snug Harbor, Honolulu.
27 September	Arrived Snug Harbor, Honolulu at 0730 and disembarked Humphreys, Musyl, Paine, Shimada, and Thomas. End of cruise.

MISSIONS AND RESULTS:

A. Calibrate the Simrad EK60 echosounder.

After a brief survey of the bathymetry inside Kealakekua Bay, this site was chosen to perform the calibration. The ship's bow and stern anchor lines were deployed to maintain stable positioning throughout the calibration. The EK-60 transducers are located approximately midship underneath the hull. These transducers were to be calibrated using a steel ball at a fixed distance and angle setting in relation to the transducers. Positioning of the calibration ball was accomplished using three electric reel guide poles set out near mid-ship; two poles on the port side and one on the starboard side. These poles provided three-point positioning for the small steel ball used for calibration. Three NOAA-certified divers were placed in the water before the calibration testing in order to pinpoint the exact location of the EK-60 transducer under the hull. With the transducer's position under the hull located, the guide poles were then adjusted to allow for the steel ball to be placed directly under the transducer. Calibration tests were conducted at various depths, and the steel ball was also repositioned at various angles away from the transducer to calibrate the decline in acoustic target strength with changes in distance and angle. The entire calibration effort was successfully completed in 8 hours.

B. Conduct net trials using the dual warp Cobb (Stauffer) trawl and simultaneous monitoring of net performance using the Netmind system.

During the first night operational set of the Cobb trawl, the net was set very deep in order to pay out most of the cable on each of the trawl winches, thereby allowing the trawl cables to be rewound under pressure onto their winch drums during retrieval. The net performance monitoring system (Netmind) worked well except for the net mouth opening sensor that did not appear to be functioning properly during the trawl set. The problem was thought to be a misalignment of the receiving sensor on the footrope. As in previous cruises, trouble was again encountered with the ship's hydraulic system. Hydraulic temperature rose to a point where the system automatically shutdown. After allowing sufficient time for the hydraulic system to cool, the net was further deployed deeper and towed prior to retrieval. Upon retrieval, the catch from this haul consisted of a tub full of mesopelagic fishes and crustaceans; some of these fishes were rather large specimens. The success of this tow confirmed that the trawl was properly fishing. A second net operation of the Cobb trawl was conducted during the day and at a shallower depth (50 m). No overheating of the hydraulic system occurred during this operation. The trawl catch was light consisting primarily of baitfish (nehu), a few carangid juveniles, and one *Thynnus* juvenile.

C. Conduct trial deployments of the Thomas Dropnet system.

Sea trials were conducted of the Thomas dropnet system, a net gear designed specifically to collect live specimens with minimal damage. This net system was designed to sample in two modes; the first a surface sampler in association with a night-light and secondly, as a deeper midwater sampler of micronekton. In both modes, when the net is triggered, the top ring drops through the water and then twists closed, trapping the catch within a cylinder of fine mesh netting. An underwater cable system (100-m length) supplying a video camera and an underwater light was used to monitor net performance. During the cruise, two trial sets were

made in the midwater sampling mode and three trial sets in the surface sampling mode. During the first test of the midwater sampling mode, the dropnet was deployed off the port side of the fantail. The net was lowered to a depth of 50 m; however, the trigger lines were unable to properly release the closure trigger on the net while at depth. In a second test of the dropnet in the midwater sampling mode, the trigger cord lines again fouled around the gear and the trigger release could not be actuated. Failure was due to both current taking the net away from the ship and fouling of the trigger cord lines around the top of the net frame. It would appear that in order to rectify this problem, the net closure triggers need to be changed from a mechanical to an electrical or acoustic release system. Two persistent problems were encountered during tests of the dropnet in the surface sampling mode. First, the small braided line used as the trigger release lines was not capable of releasing the net in other than a straight up-and-down orientation. This will present a considerable problem if one desires to have these gears deployed at some distance from the ship rather than immediately adjacent to the ship. The other problem occurred when the dropnet remained attached to the ship's crane immediately adjacent to the ship. Even a small amount of sea swell caused the dropnet to periodically surge up and down, sometimes slamming violently back down against the sea surface. During the third trial in the surface sampling mode, the dropnet did release; however, the dropnet would not twist closed at the bottom and remained open after the net had dropped down. In both sampling modes, the trigger release lines proved to be the cause for the dropnet's failure to trigger and properly close thereby not allowing samples to be collected.

D. Collect egg and larval billfish specimens in surface waters along the Kona coast of Hawaii.

Forty-five 1.8-meter Isaacs-Kidd (IK) tows were conducted targeting billfish eggs and larvae; all tows were made with an 0.5-mm mesh nylon net. Tows targeted coastal sea surface slicks when present, at distances of 2-25 nmi offshore of the Kona coast between Keahole Point (lat. 19° 45'N) to the north and below Milolii (lat 19° 04'N) to the south. Tows were conducted for 1 h alongside the ship off the port side J-frame. The IK net filtered the top 1-1.25 m of surface water including the neuston layer during surface tows except for eight subsurface tows which filtered water at a depth of 0.5-2.0 m and one tow at 6-8 m depth. The safeboat worked independently of the ship and equipped with a 12-ft. angle iron crosspiece, allowed dual 0.5-m egg nets (nets with 0.5-mm mesh) to be towed simultaneously for 30 min per tow. When not towing nets, dipnetting from the safeboat was conducted while operating in surface slicks. Safeboat operations were limited to the morning daylight hours (0700-1130). Surface slicks are normally present only during the morning periods since offshore breezes produced by thermal release over the island typically disrupt slick occurrence by early afternoon. During much of this cruise, surface slicks were present by midmorning, dissipated by the afternoon, and sometimes reappeared in the late afternoon-early evening prior to sunset.

The 1.8-meter IK net was specifically used to collect billfish eggs and the smallest sized (<10 mm TL) larvae (finer 0.5-mm mesh and slower 2.5 knot towing speed). This contrasts with previous Kona cruises prior to 2003 where billfish larvae were targeted with 1.8-meter IK surface tows using nets with a substantially larger mesh size (front 4/5 of net 5-mm mesh, remainder 0.5-mm mesh, allowing a faster 4.0-knot towing speed). Use of the 1.8-meter IK net with 0.5-mm mesh during the last cruise off Kona (OES cruise 04-09 in July 2004) resulted in

the occurrence of a large number of eggs varying in size from about 1.0 to 3.0 mm in diameter. As during this last cruise, each tow sample during this cruise was first qualitatively sorted for egg size by pouring the entire tow contents through a column of graded sieves of 2.8-mm and 1.0-mm mesh. The contents that passed through the top 2.8-mm sieve and accumulated on the 1.0-mm sieve were immediately examined under magnification in seawater to remove any pigmented eggs and larvae suspected to be billfish. The sorted catch from each tow sample was then pooled and preserved in 95% ethanol for post-cruise examination.

Based on our experiences during the previous cruise (OES 04-09 in July 2004), we initially felt capable of visually identifying swordfish and shortbill spearfish eggs based on their larger sizes and distinct pigment patterns but were uncertain what blue marlin eggs might look like. Therefore, all pigmented eggs 1-2 mm in diameter were measured and photographed prior to subsequent destructive sampling via shipboard multiplex polymerase chain reaction (PCR) identification. A total of 36 suspected billfish eggs were PCR-tested during the cruise and yielded no positive billfish identifications. This was the first egg- collecting cruise conducted in the month of September, the third cruise specifically targeting the capture of billfish eggs, and the first cruise to not capture a single billfish egg. PCR testing of suspected billfish eggs did identify three eggs of wahoo, *Acathocybium solandri*, and seven eggs of the pompano dolphinfish, *Coryphaena eqiselis*. For this and the previous cruise (OES 04-09), the multiplex PCR technique was expanded by John Hyde to include markers to identify wahoo, *Acanthocybium solandri*, mahimahi, *Coryphaena hippurus*, and the pompano mahimahi, *C. equiselis*. With respect to fish eggs, IK tows yielded very few specimens (typically $\leq$10 eggs per tow), especially compared to the two previous Kona cruises where individual tows typically collected an order of magnitude greater number of fish eggs.

Daytime 1.8-meter IK net tows collected 214 larval billfish consisting of 1 swordfish and 213 istiophorid larvae. Istiophorid larvae are notoriously difficult to identify to species, particularly if damaged. One hundred twenty-six of these istiophorid larvae collected during the cruise were PCR-tested at sea and identified as blue marlin. No other species of istiophorid larvae were detected, and it would appear that the overwhelming majority of the 213 istiophorid larvae collected will turn out to be blue marlin.

The istiophorid larvae collected were virtually all $\leq$10 mm total length (TL) and most were smaller ($\leq$5 mm TL). Ninety-three percent of the istiophorid larvae collected were taken in IK tows that did not target surface slicks. Although only seven subsurface IK tows (net mouth at 0.5-2.0 m or 6-8 m depth) were conducted during the cruise, these tows yielded 70 (33%) of the 213 istiophorid larvae collected. Surface tows targeting surface slicks were much less successful in collecting istiophorid larvae compared to non-slick tows. Post-cruise processing of these net samples for billfish eggs and larvae has begun and will undoubtedly yield more billfish larvae that were overlooked during our initial at-sea processing.

E. Collect tuna larvae in subsurface waters along the Kona coast of Hawaii.

Forty 1.8-meter IK tows using the 0.5-mm mesh net were conducted at night by Melissa Paine of VIMS to collect tuna larvae for her ongoing graduate studies of tuna genetics. Tows were

conducted for 1-h at 2.5 knots speed and primarily targeted tow depths of 10-14 m. Samples collected large amounts of crustaceans that vertically migrate up into the surface waters off Kona during the night. Cursory processing during the cruise and incomplete post-processing have already yielded some 500 scombrid larvae; based on the samples that still need to be processed back at VIMS, a total of some 1,000 scombrid larvae may have been collected. The proportion of these scombrid larvae that will be identified as tuna and to species is unknown and will require detailed morphological and genetic analysis. All of these tow samples were preserved in 95% undenatured ethanol.

F. Conduct nightly CTD casts at predetermined sites off the Kona coast.

A sampling grid of 15 Seabird CTD casts were conducted along four latitudinal transects off the Kona coast to acquire environmental data on the upper 150 m of the water column. Initial examination of the raw data indicated that sea surface temperatures were the highest ever encountered during a Kona cruise (27.5˚C to 28.3°C) while the sea surface salinity along the Kona coast was low (34.6 to 34.7 psu). The mixed layer was deep (~100 meters) at most of the CTD stations. The ADCP unit was not operational during the entire cruise, so data on current direction and speed with depth were not collected.

G. Miscellaneous oceanographic observations.

Although fish eggs were rarely encountered during daytime IK tows, each tow collected thousands of non-fish eggs, of what appear to be from an unknown invertebrate species. These eggs were 0.7 to 0.8 mm in diameter. The abundance of these eggs appeared to decline in tows conducted farther offshore; however, thousands of these eggs were collected in each tow throughout the area sampled along the Kona coast. Due to the lack of available billfish eggs, the cooperative arrangement between the Pacific Islands Fisheries Science Center (PIFSC) and Black Pearls, Inc. at Keahole Point to undertake efforts to raise net-collected billfish eggs to hatching and first feeding at the latter's rearing facility did not occur. We anticipate that this cooperative effort will go forward during future cruises when billfish eggs are again collected in our net tow operations.

DATA COLLECTED:

The following forms, logs, charts, and data records were kept and given to the PIFSC upon termination of the cruise. These include all data captured onto computer storage media during the cruise. All the records are filed there unless indicated otherwise in parentheses.

CTD Station Data Log Sheet
Seabird CTD data files on CD-ROM*
Digital camera photos (JPG file format) on CD-ROM*
Marine Operations Log
Deck Log
Plankton, Eggs and Larvae #1 (all net tows)
SCS data files (raw & compressed) on CD-ROM*
XBT (SEAS) data files on CD-ROM*

*All data files together on the same (1) CD-ROM

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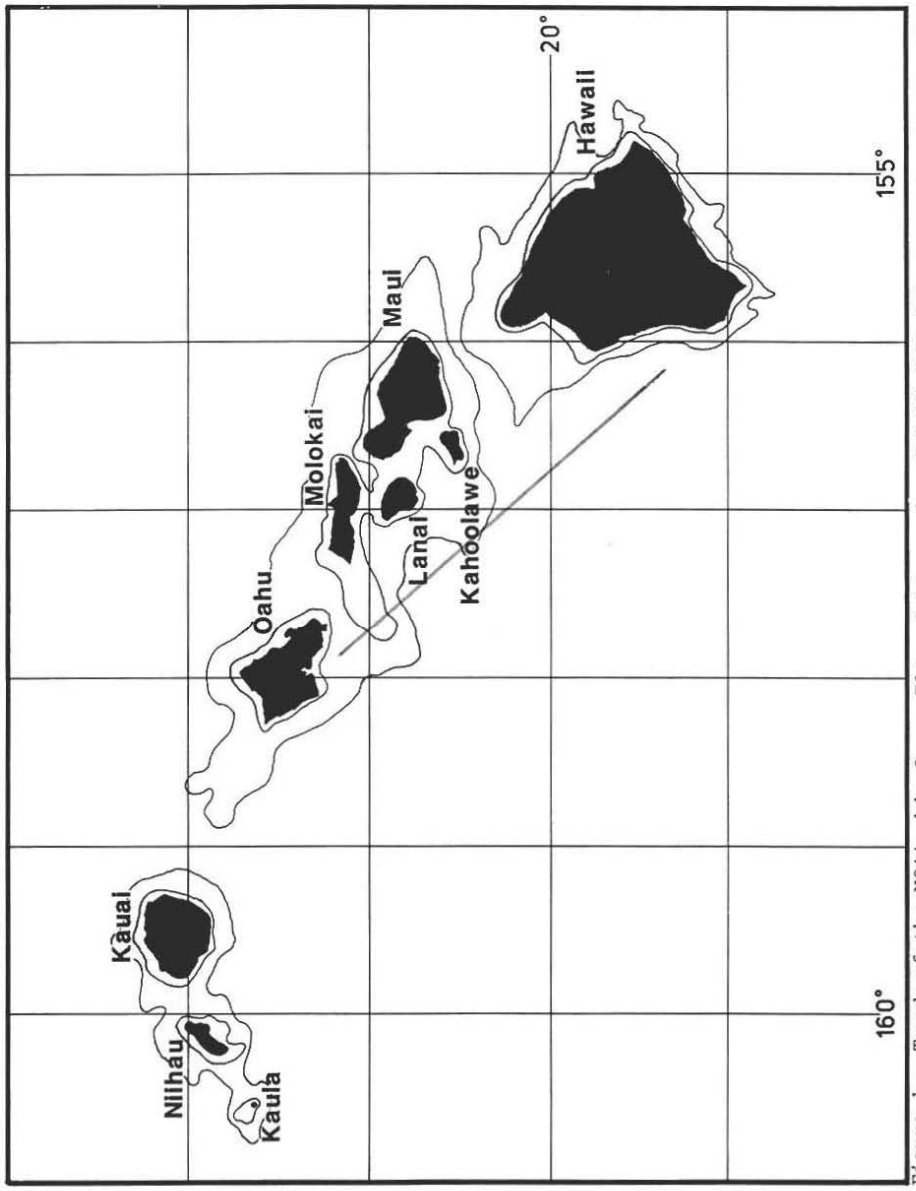

Figure 1.--Track of the NOAA ship Oscar Elton Sette cruise OES-12 (OES-21), September 17-27, 2004.