CRUISE REPORT[1]

VESSEL: *Oscar Elton Sette*, Cruise 05-03 (OES-25)

CRUISE PERIOD: 10-17 March 2005

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

TYPE OF OPERATION: Operations conducted off the Kona coast included daytime surface net tows targeting billfish eggs and larvae 1-25 nmi off the Kona coast of the Island of Hawaii using the 1.8-m Issacs Kidd (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 consisted of conductivity-temperature-depth (CTD) casts at predetermined transect positions along and off the Kona coast.

ITINERARY:

10 March — Embarked Robert Humphreys and Michael Musyl. Departed Snug Harbor at 1000, calibrated ship's magnetic compass immediately off the south Oahu coast, then proceeded to Kailua-Kona, Island of Hawaii.

11 March — Arrived off the Kona coast at 0340 and conducted three CTD casts at pre-determined sites along the northernmost transect. At 0640, began surface IK tows for billfish egg and larvae from the ship. Ceased IK tows at around 0800 in order to embark John Hyde, Eric Lynn, and Andrew West from the Kailua-Kona pier. After embarkation, resumed billfish egg and larvae collections with surface IK tows from the ship. At mid-morning, safeboat was launched to conduct independent net tow operations using dual 0.5-m egg nets for collecting billfish eggs and larvae and dipnetting for billfish larvae. At nightfall, commenced nightly CTD casts to 150 meters depth at predetermined sampling sites.

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12-15 March Continued daily schedule of daylight surface IK tows from the ship. During this period, morning safeboat net tow and dipnet operations were conducted on only one other day (March 14). Continued nightly CTD casts to 150 meters depth at predetermined sampling sites. On March 15, fish eggs were transferred to Syd Kraul at the Honokohau Harbor; Andrew West disembarked the cruise at this time.

16 March Conducted daylight surface IK tows from the ship. At 1100, disembarked John Hyde and Eric Lynn at Kailua-Kona pier, discontinued net tow operations, and proceeded back to Snug Harbor, Honolulu.

17 March Arrived Snug Harbor, Honolulu at 0700. Disembarked Humphreys and Musyl; end of cruise.

MISSIONS AND RESULTS:

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

A total of fifty-two 1.8-meter Issacs-Kidd (IK) tows were conducted; all tows were made with a 10-m length, 0.5-mm mesh nylon net. Tows targeted coastal sea surface slicks, when present, at distances of 1-25 nmi offshore of the Kona coast between Keahole Point (19^0 43'N latitude) to the north and near Milolii (19^0 13'N latitude) to the south. Tows were conducted for 1 hr 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 ($n = 42$) except for 10 subsurface tows which filtered water at a depth of 0.5-2.0 m below the surface. 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 not visible due to unusual variable winds that originated from directions (north, west, and south) that altered the normal lee conditions typically present along the Kona coast. Due to these persistent winds, slicks were not present during the cruise except during the first two tows of the cruise. These adverse conditions limited safeboat net operations to only two mornings during the cruise.

The 1.8-meter IK net was specifically used to collect billfish eggs (finer 0.5-mm mesh and slower 2.75 to 3.0 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 resulted in the occurrence of fish eggs varying in size from about 0.7 to 3.0 mm in diameter. For most of the tows, the entire sample was examined for billfish eggs and larvae. For those tows with larger volumes, particularly larger amounts of flocculent material, the catch 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 to remove any pigmented eggs suspected to be billfish. The remainder of each tow sample was then pooled and preserved in 95% ethanol for post-cruise examination.

Based on results of previous cruises, 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 13 suspected billfish eggs were PCR tested during the cruise and yielded no positive billfish identifications. This was the second time in four previous cruises where billfish eggs were completely absent from our IK net tows. Our last cruise (OES 04-12; 17-27 September 2004) also collected no billfish eggs while the previous two cruises (OES 04-09 Leg II (20-25 July 2004) and OES 03-03 Leg II (1-8 May 2003)) successfully collected swordfish, shortbill spearfish, and blue marlin eggs. For this cruise, the multiplex PCR technique developed by John Hyde included additional markers to identify wahoo, *Acanthocybium solandri*, mahimahi, *Coryphaena hippurus*, and the pompano mahimahi, *C. equiselis*. During this cruise, none of the 13 eggs analyzed via multiplex PCR were identified to these three species either.

Net tows using the 1.8-meter IK collected only a small number of billfish larvae (n = 32) consisting of 4 swordfish and 28 istiophorid larvae. Shipboard multiplex PCR analysis of all istiophorid larvae were identified exclusively as (n = 28) shortbill spearfish.

For swordfish larvae, positive tows occurred both in the northern and southern regions sampled along the Kona coast. There appeared to be no association with time of tow and sampling depth. Catches of shortbill spearfish larvae peaked in the morning (0600-0930; n = 12) and mid to late afternoon (1500-1730; n = 13). Percent positive tows for both surface and subsurface tows differed for swordfish (5% *versus* 20%, respectively) but were similar for shortbill spearfish (29% *versus* 30%, respectively). The larvae of both species were predominantly >10 mm in total length. Post-cruise processing of net tow samples will undoubtedly yield more billfish larvae that were overlooked during our initial at-sea processing.

B. Conduct DNA based procedures for the identification of billfish eggs and larvae using a PCR (polymerase chain reaction) protocol.

This was the fourth cruise (preceded by OES cruises 03-03 Leg 2, 04-09, and 04-12) where trials were conducted of the multiplex PCR species identification protocols to identify billfish larvae and eggs at sea in near-real time. Prior to this cruise, John Hyde (Scripps Institute of Oceanography) added an additional set of three unique markers to detect wahoo, mahimahi, and pompano mahimahi in addition to the markers developed to differentiate all six species of Indo-Pacific billfishes. This technique uses a multiplex species-specific PCR designed to produce unique gel band patterns for each of the six species of Indo-Pacific billfishes in

addition to wahoo, mahimahi, and pompano mahimahi. Processing time for this assay is now 3 hours. The lab bench space needed to conduct these PCR assays on the ship has been substantially reduced, and all related equipment is transportable within a single suitcase.

Prior to initial DNA extraction, all eggs to be tested were first photographed and then placed in individual microcentrifuge tubes of Chelex solution for DNA extraction. The entire egg was consumed during these procedures while for larvae, only one eyeball was extracted. Egg and tissue standards from known billfish species were periodically run with unknown egg and larvae samples to confirm results. The multiplex PCR technique provides rapid identifications, ease of use, and shipboard adaptability which will allow future billfish egg surveys to quickly adapt sampling schemes during the cruise.

C. 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 temperature ranged from 24.8°C to 25.4°C along the Kona coast while sea surface salinity varied from 34.42 to 34.63 psu. The mixed layer was deep, extending beyond 150 meters at all of the CTD stations.

D. Miscellaneous field and oceanographic observations.

Unusually low volumes of plankton were collected throughout this cruise. This also translated to low numbers of fish eggs and larvae collected in tows. Winds coming out of the north, west, and south throughout the cruise did not allow for a lee effect to occur and surface slicks could not manifest themselves under these wind conditions. The mixing and dispersal undergone at the surface is thought to have eliminated the persistence of any aggregated patches of fish eggs and larvae. The low catches of billfish larvae are thought to be a direct effect of these unusual wind conditions. Further dispersal of these rarely encountered larvae may well explain the low catches of fish larvae in general, and billfish larvae specifically. Data acquired over past larval billfish cruises has established that highest catches of both swordfish and shortbill spearfish larvae have coincided with sea surface temperatures (24.8° to 25.8°C) and sea surface salinities (34.40 to 34.60 psu); similar to that encountered during this cruise. The most noticeable difference between those past cruises and this particular cruise was the absence of surface slicks and persistent windy conditions throughout the cruise; the latter condition causing the absence of surface slicks and producing wind swells and chop not encountered during previous cruises off Kona.

A small batch of fish eggs collected during both safeboat and *Sette* tows on March 15 were transported to Syd Kraul at Honokohau Harbor. Although no billfish eggs were present in this sample, Mr. Kraul was able to successfully transport these eggs back to his rearing facility and successfully hatch these eggs. Newly hatched larvae appeared to be from unidentified eel and flatfish species. This trial run seems to indicate that our plans to transport and hatch billfish eggs (thought to be more hearty than these other species of eggs) are feasible.

DATA COLLECTED:

The following forms, logs, charts, and data records were kept and given to the Pacific Islands Fisheries Science Center 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.

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

*All data files together on the same (1) DVD-R

SCIENTIFIC PERSONNEL:

Robert L. Humphreys, Jr., Chief Scientist, National Marine Fisheries Service (NMFS), Pacific Islands Fisheries Science Center (PIFSC)
John Hyde, Cooperating Scientist, Scripps Institute of Oceanography
Eric Lynn, Fishery Biologist, NMFS, Southwest Fisheries Science Center, La Jolla
Michael Musyl, Cooperating Scientist, Joint Institute for Marine and Atmospheric Research, University of Hawaii
Andrew West, Cooperating Scientist, University of Technology, Sydney, Australia

(/s/Robert L. Humphreys, Jr.)
Submitted by: _____
Robert L. Humphreys, Jr.
Chief Scientist

(/s/Samuel G. Pooley)
Approved by: _____
Samuel G. Pooley
Science Center Director
Pacific Islands Fisheries Science Center

Attachments

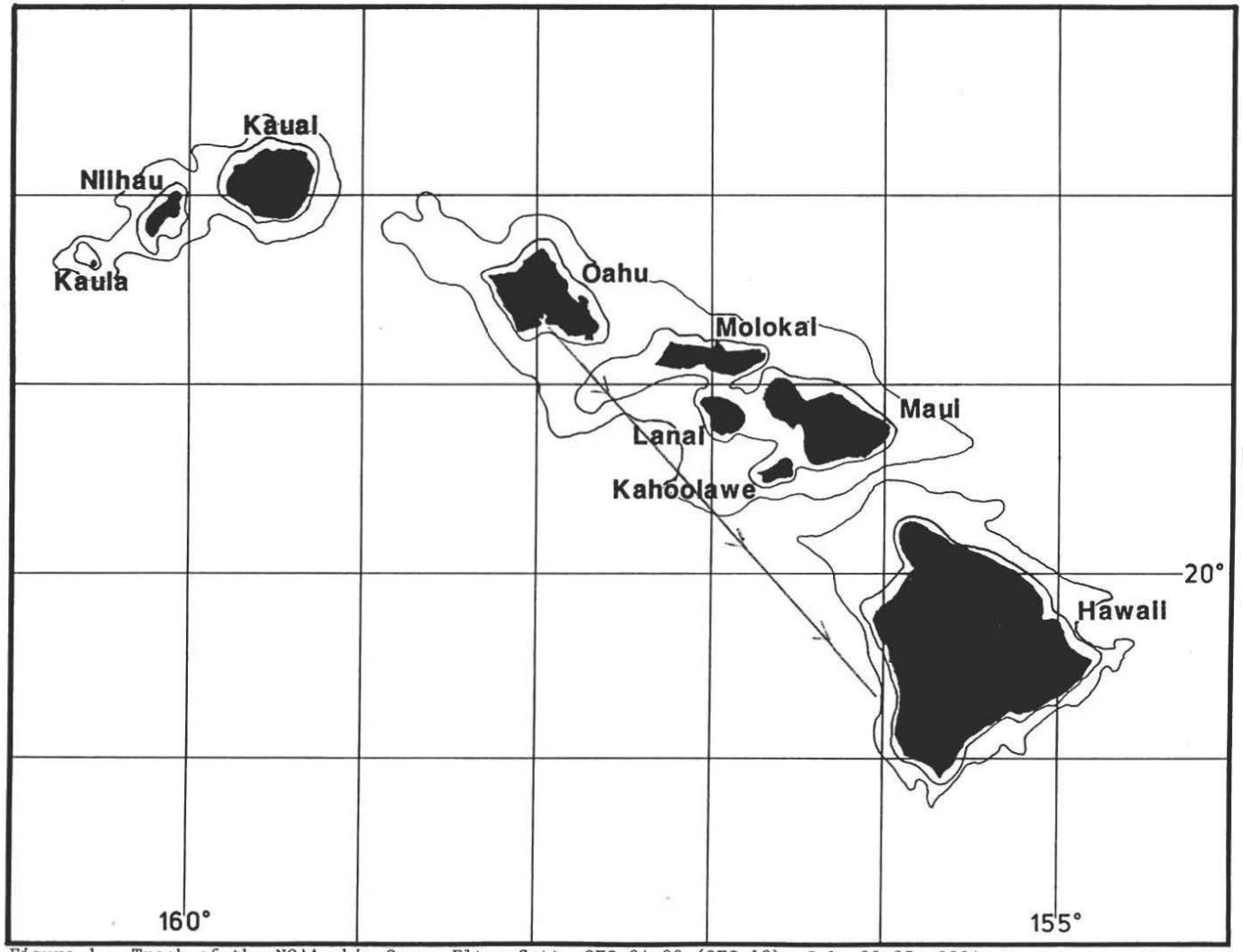

Figure 1.--Track of the NOAA ship Oscar Elton Sette OES-04-09 (OES-18), July 20-25, 2004.