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CRUISE REPORT[1]

VESSEL: *Oscar Elton Sette*, Cruise 06-10 (OES-46)

CRUISE PERIOD: 13-21 September 2006

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 off the Kona Coast of the Island of Hawaii using a 1.8-m wide Isaacs-Kidd (IK) trawl and morning safeboat operations to dip-net and observe billfish larvae in surface slicks. Night operations consisted of performing conductivity-temperature-depth (CTD) casts at predetermined transect positions and conducting acoustic Doppler current profiler (ADCP) transects along and off the Kona Coast. A cooperative agreement between Syd Kraul and Pacific Islands Fisheries Science Center (PIFSC) was continued in an attempt to captive rear IK collected billfish and other fish eggs for hatching and first feeding at Kraul's rearing facility on the Island of Hawaii.

ITINERARY:

13 September — Embarked Robert Humphreys, David Liittschwager, Michael Musyl, Ryan Nichols, and Anand Varma. Departed Snug Harbor, Honolulu at 1300 and transited to offshore CTD station off Keahole Point, Island of Hawaii.

14 September — Arrived off Keahole Point at 0445 and commenced first CTD cast at outermost site along the 19° 42.5' N transect line. Completed all three CTD casts along this transect line and proceeded to Kailua-Kona. Afterwards, embarked Eric Lynn and Russ Vetter from Kailua-Kona pier and transited to the south Kona Coast and began daylight IK surface tow operations for billfish eggs and larvae. At nightfall, commenced CTD casts to 150 meters depth at predetermined sampling sites along the 19° 12.5' N transect line.

[1]PIFSC Cruise Report CR-09-006
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15 September At 0634 resumed surface IK tows throughout the daylight hours. A[illegible] embarked Andrew West from Honokohau Harbor. Afterwards, conducted all remaining CTD casts (to 150 meters depth) throughout the evening and night at predetermined sampling sites off the Kona Coast.

16-17 September Launched safeboat after sunrise to observe and dip-net billfish larvae in surface slicks until noon. Shipboard surface IK tows for billfish eggs and larvae were conducted throughout the daylight hours. Drifting night-light operations from the ship were conducted to dip-net pelagic and reef-associated juvenile specimens. On September 17 at 1100, Teacher-at-Sea Jenny Holen was embarked from Honokohau Harbor. At 1700 Andrew West disembarked the cruise at Keauhou pier; West also departed with a batch of live wahoo eggs collected from IK tows that day for rearing at Syd Kraul's aquaculture facility.

18 September Surface IK tows were conducted throughout the daylight hours beginning at 0631. A series of 11 tows were conducted along a transect line (19° 28.5' N) moving progressively westward from off the Kona Coast out to a distance of some 50 nmi offshore in the vicinity of an offshore eddy. A drifting night-light station was conducted during the evening.

19 September Ten surface IK tows were conducted throughout the daylight hours within the offshore eddy beginning at 0636. After completion of the last IK tow, the ship transited back to the immediate vicinity of the Kona Coast. A drifting night-light station was conducted between Keauhou and Kealakekua Bay during the late evening.

20 September Conducted daylight surface IK tows from the ship. Ended surface tow operations at 1430 and afterwards disembarked Jenny Holen, Eric Lynn, and Russ Vetter at Kailua-Kona pier. A second and final batch of live fish eggs was transferred to Syd Kraul during this disembarkation of scientific personnel. Afterwards, a brief CTD cast was conducted for instrument calibration, thereafter; the ship began transit back to Snug Harbor, Honolulu.

21 September Disembarked Robert Humphreys, David Liittschwager, Michael Musyl, Ryan Nichols, and Anand Varma at Snug Harbor, Honolulu around 0730; end of cruise.

MISSIONS AND RESULTS:

A. Collect billfish eggs and larvae in surface waters along the Kona Coast of Hawaii.

A total of sixty 1.8-meter wide Isaacs-Kidd (IK) tows were conducted; all tows were made during daylight hours with a 10-m length, 0.5-mm mesh nylon net. Tows were conducted at distances of 2-53 nmi offshore of the Kona Coast. Ten tows were conducted in the vicinity of an offshore eddy (50-53 nmi off the Kona Coast) centered at lat. 19° 21' N, long. 156° 45' W and eleven tows were conducted along a 19° 28.5' N transect line

originating from the Kona Coast out to the offshore eddy. The remaining 39 tows were conducted in closer proximity (2-9 nmi) to the Kona coastline between Honokohau Bay (19° 42' N latitude) to the north and 19° 15' N latitude to the south. All tows were conducted for 1 h; the IK net filtered the top 1 m of surface water including the neuston layer. Tows were conducted from mid-ship and were initially deployed and retrieved by the port side J-frame. On the second day of IK tows, the deflector elbow that fitted over the forward port side A/C outflow was damaged and began producing a large foam wake across the water and forward of the net mouth. The following day (Sept. 16, starting with station 31), all IK tows were conducted along the starboard side using the CTD J-frame for deployment and retrieval.

The 1.8-meter IK net was specifically used to collect billfish eggs (finer 0.5-mm mesh and slower ~3.0 knots towing speed) and retain fish eggs >0.5 mm in diameter. Net tows retained fish eggs varying in size from about 0.7 to 2.5 mm in diameter. For the majority of the tows (except for the last 7 tows conducted on Sept. 20), the entire sample was sorted for billfish eggs and larvae. The contents of each tow were concentrated and examined under dissecting microscopes for the presence of billfish eggs and larvae. Billfish larvae and suspected eggs were removed for photography and further identification. Based on the results of previous cruises, we felt capable of visually distinguishing swordfish from istiophorid larvae. However, istiophorid larvae and all suspected billfish and mahimahi eggs were identified via the multiplex-PCR assay. Wahoo eggs were also initially run but their distinguishing small size and pigment pattern allowed us to visually identify these eggs afterwards. The remainder of the contents, and any portion of the tow catch that could not be examined, were preserved together in 95% undenatured ethanol. These ethanol-preserved tow samples were saved for future laboratory examination.

During this cruise, identified eggs were recorded for the following species; wahoo (n = 61 from 5 tows), pompano mahimahi, *Coryphaena equiselis* (n = 2 from 2 tows), and mahimahi *C. hippurus* (n = 1 from 1 tow). Virtually all of the wahoo eggs were collected adjacent to the coastline within the area between Kailua-Kona and Kealakekua Bay. No swordfish or istiophorid eggs were detected during the cruise.

Net tows using the same 1.8-meter IK net also collected larval stages of billfish (n = 5) consisting of blue marlin (n = 3 from 2 tows), 1 swordfish, and 1 unidentified istiophorid larva. Overall, catches of billfish early life stages (eggs and larvae combined) during this cruise was the lowest of any previous Kona cruise.

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

Suspected billfish, mahimahi (both *Coryphaena* species), and initially several wahoo eggs including 3 of 4 istiophorid larvae were run using the at-sea multiplex-PCR assay to confirm their respective species identities. Prior to initial DNA extraction, all eggs to be multiplex-PCR tested were first digitally photographed under a dissecting microscope 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 the right-side

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 (3-h processing), ease of use, and shipboard adaptability which would have allowed billfish egg collection efforts to quickly adapt sampling schemes if these eggs had been captured during the cruise.

C. Conduct nightly CTD casts at predetermined sites off the Kona Coast.

Oceanographic sampling via 15 Seabird CTD casts were conducted off the Kona Coast to acquire physical data on the upper 150 m of the water column. The CTD stations were conducted along four latitudinal transects out from the coastline at the following locations:

Along the 19° 42.5' N latitude transect at:
156° 15' W 156° 10' W 156° 05' W

Along the 19° 32.5' N latitude transect at:
156° 15' W 156° 10' W 156° 05' W 156° 00' W

Along the 19° 22.5' N latitude transect at:
156° 15' W 156° 10' W 156° 05' W 156° 00' W

Along the 19° 12.5' N latitude transect at:
156° 15' W 156° 10' W 156° 05' W 156° 00' W

The thermosalinograph data indicated that sea surface temperature (SST) ranged from 26.4°C to 27.3°C along the Kona Coast while sea surface salinity (SSS) varied from 34.6 to 34.9 psu. The mixed layer was between 60 and 90 meters deep as recorded from the CTD profiles.

During past cruises off the Kona Coast, surface current directionality as recorded by the shipboard ADCP typically indicated a slow (0.1-0.2 m/s) southerly current immediately adjacent to the Kona coastline. However, during this cruise the near-shore current displayed a weak easterly or northerly flow. Further off the Kona Coast, the current showed a strong northerly flow of 0.4-0.5m/s starting at about 5-10 nmi offshore. The typical cyclonic "pin-wheel" flow of water off the Kona Coast was not apparently present during this cruise.

Throughout the cruise we were supplied with sea surface height (SSH) and SST imagery through the PIFSC's Coast Watch Program. The imagery indicated that an anticyclonic (cold-core) eddy was centered some 50 nmi west at lat. 19° 21' N, long. 156° 44' W. Since previous days catches of billfish egg and larvae were negligible from tows conducted adjacent to the Kona Coast, we transited to the offshore eddy to sample within a different oceanographic environment. Of the 10 IK tows conducted within the eddy only 1 istiophorid larva and no billfish eggs were captured. However, compared to waters adjacent to the Kona Coast, IK tows within the offshore eddy collected higher numbers of incidental species. These included pelagic juvenile stage reef fishes, a much greater

quantity of plastic debris and associated fish such as *Psenes cyanophrys*, and a higher abundance of oceanic neuston invertebrates, primarily *Porpita*, *Glaucus*, *Halobates*, and *Parapeneus*.

D. Cooperative arrangement between Syd Kraul and PIFSC to rear billfish eggs in captivity.

Due to the absence of billfish eggs collected during this cruise and after consulting with Syd Kraul via telephone, it was decided to instead transfer wahoo eggs caught in the surface IK tows for shoreside rearing. Two transfers of wahoo eggs were conducted (September 17 and 20); eggs were placed in small plastic bottles half-filled with seawater and floated within an aquarium tank. Once received, Kraul transferred these eggs into separate 200-liter rearing tanks at his shoreside facility at Keahole Point. On Sept 20, a batch of unknown large eggs (2-3 mm in diameter) was also transferred to Syd Kraul. The hatchlings of these large unknown eggs turned out to be primarily unidentified species of deep-sea eels which survived for up to 9 days. The hardiest of the wahoo eggs (the Sept 20th batch) survived (2 individuals) up to 14 days post-hatch. Kraul reported that the wahoo hatchlings fed on live copepods but did not feed on the larger artemia. Wahoo larvae showed no evidence of cannibalism in captivity. Wahoo post-hatchlings were periodically sacrificed and preserved in 95% ethanol for future study.

D. Miscellaneous activities and observations.

During this cruise, David Liittschwager and Anand Varma, two photographers on assignment for National Geographic, continued there photographic efforts to record natural images of neustonic invertebrates and fishes in order to produce a pictorial story on the surface microfauna off the Kona Coast. David Liittschwager photographed pristine specimens of larval fish and invertebrates collected from our surface IK tows, and dip-netting from both surface slicks and during drifting night-light operations. A portion of the desktop space adjacent to the CTD/ADCP lab space was set aside to provide an indoor and secured site for the setup of their photographic equipment. Their pictorials (all photos taken during *Sette* cruises 06-05 and 06-10) subsequently appeared in the November 2007 issue of National Geographic.

NOAA selected Teacher-at-Sea Jenny Holen from West Hawaii Explorations Academy, a charter public school located at Keahole Point on the Island of Hawaii, participated during a five-day portion of this cruise. She was fully integrated into the scientific operations, participating in CTD casts and IK tow deployments, retrievals, and the sorting of catch using dissecting microscopes. She also brought to the ship a microscope specifically equipped for photography which allowed her to take numerous photos of various invertebrates and fish larvae shortly after being retrieved from the IK tows. Her experiences during the cruise were reported in an article that appeared in the Kona-based newspaper *West Hawaii Today*; the article is appended to this cruise report.

Russ Vetter and Eric Lynn (SWFSC, La Jolla) continued their efforts to measure oxygen consumption of viable billfish eggs using a microrespirometer system developed by Anders Bang and Peter Grønkjær of the Institute of Biological Sciences, University of

Aarhus, Denmark and Unisense S/A, Aarhus, Denmark. The use of oxygen consumption for the study of eggs and yolk sac larvae has been limited by the technical limits of polarographic oxygen electrodes and the simple difficulties of manipulating tiny, rapidly developing, organisms in small chambers. Since billfish eggs were not available, wahoo eggs were instead tested.

A rare catch of a large adult butterfly fish *Chaetodon lineatus* was made during a daylight surface IK tow (station 36) off the coast from Keauhou. Remarkably, this tow was conducted some 1-2 nmi from the nearest coastal reef habitat. The capture of this fish did not appear to be associated with any large floating piece of debris. This is the first instance in which a large adult reef fish has been captured from an IK surface tow over the course of the 12+ Kona larval billfish cruises conducted since 1997.

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 ping data files on DVD-R*
CTD Station Data Log Sheet
Seabird CTD data files on DVD-R*
Marine Operations Log
Deck Log-Weather Observation Sheet
Plankton, Eggs and Larvae #1
SCS data files (raw & compressed) on DVD-R*
Scientist's Log
Metadata files on DVD-R*
COM, Customer Satisfaction Survey NOAA OMAO
Station Locations for CTD Casts
ast SheetDeck WX Log for CTD C

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

SCIENTIFIC PERSONNEL:

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David Liittschwager, Photographer, Independent
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Attachments

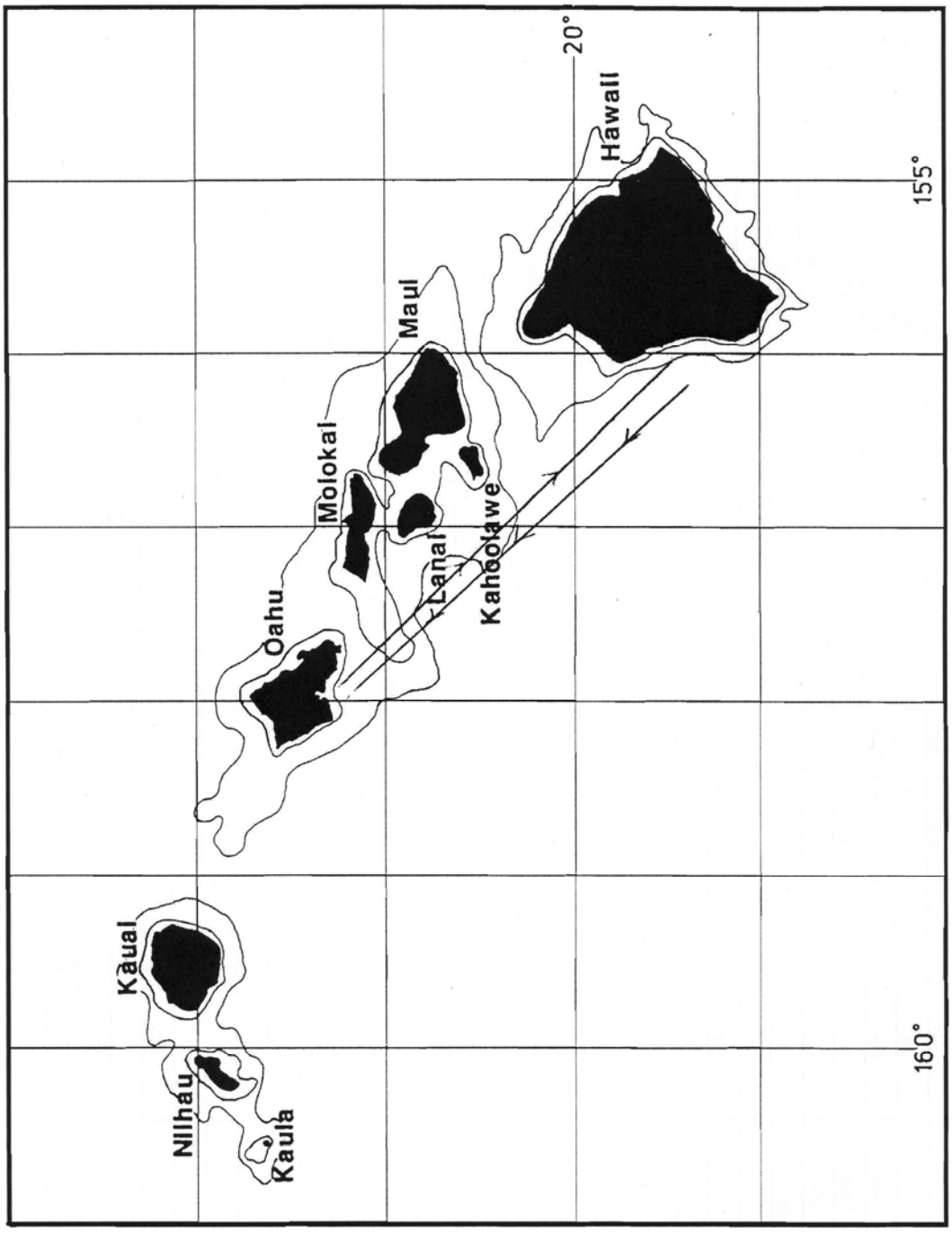

Figure 1.—Track of the NOAA Ship *Oscar Elton Sette* cruise OES-06-10 (OES-46), September 13-21, 2006.

Table 1.--Cruise summary of 60 surface Isaacs-Kidd (IK) tow hauls for billfish eggs and larvae off the Kona Coast of the Island of Hawaii.

Sta. No.	Date (2006)	Local time (start)	Local time (end)	Start location	End location	Gear	Tow depth/Surface slick targeted
04	Sept 14	1044	1145	19 15.2'N 155 55.0'W	19 17.5'N 155 55.8'W	1.8-m IK,0.5 mm mesh	Surface / no
05	Sept 14	1159	1259	19 17.6'N 155 56.2'W	19 17.7'N 155 59.4'W	1.8-m IK,0.5 mm mesh	Surface / no
06	Sept 14	1423	1523	19 18.1'N 156 00.8'W	19 20.7'N 156 03.0'W	1.8-m IK,0.5 mm mesh	Surface / yes
07	Sept 14	1542	1642	19 20.0'N 156 03.2'W	19 18.1'N 156 01.9'W	1.8-m IK,0.5 mm mesh	Surface / yes
08	Sept 14	1648	1748	19 17.9'N 156 01.9'W	19 15.9'N 155 59.5'W	1.8-m IK,0.5 mm mesh	Surface / yes
09	Sept 14	1755	1855	19 15.7'N 155 59.2'W	19 14.0'N 155 56.9'W	1.8-m IK,0.5 mm mesh	Surface / yes
14	Sept 15	0634	0734	19 20.3'N 155 57.5'W	19 22.9'N 155 56.2'W	1.8-m IK,0.5 mm mesh	Surface / no
15	Sept 15	0744	0844	19 23.2'N 155 56.3'W	19 25.7'N 155 58.5'W	1.8-m IK,0.5 mm mesh	Surface / no
16	Sept 15	0852	0952	19 26.0'N 155 58.4'W	19 28.7'N 156 00.4'W	1.8-m IK,0.5 mm mesh	Surface / no
17	Sept 15	1000	1100	19 29.0'N 156 00.4'W	19 31.6'N 155 58.6'W	1.8-m IK,0.5 mm mesh	Surface / no
18	Sept 15	1109	1212	19 31.9'N 155 58.8'W	19 34.4'N 156 00.7'W	1.8-m IK,0.5 mm mesh	Surface / no
19	Sept 15	1218	1318	19 34.6'N 156 00.8'W	19 37.1'N 156 02.5'W	1.8-m IK,0.5 mm mesh	Surface / no
20	Sept 15	1339	1439	19 37.2'N 156 03.4'W	19 37.2'N 156 06.7'W	1.8-m IK,0.5 mm mesh	Surface / no
21	Sep 15	1450	1550	19 37.5'N 156 06.5'W	19 39.2'N 156 03.9'W	1.8-m IK,0.5 mm mesh	Surface / no
31	Sept 16	0722	0822	19 22.8'N 156 00.3'W	19 23.2'N 156 03.7'W	1.8-m IK,0.5 mm mesh	Surface / no
32	Sept 16	0834	0934	19 23.4'N 156 03.6'W	19 25.5'N 156 01.5'W	1.8-m IK,0.5 mm mesh	Surface / no
33	Sept 16	0942	1042	19 25.7'N 156 01.4'W	19 27.7'N 155 59.2'W	1.8-m IK,0.5 mm mesh	Surface / no
34	Sept 16	1122	1222	19 28.0'N 155 59.1'W	19 30.6'N 156 01.1'W	1.8-m IK,0.5 mm mesh	Surface / no
35	Sept 16	1230	1330	19 30.8'N 156 01.0'W	19 33.3'N 155 59.2'W	1.8-m IK,0.5 mm mesh	Surface / no
36	Sept 16	1340	1440	19 33.6'N 155 59.3'W	19 36.0'N 156 01.1'W	1.8-m IK,0.5 mm mesh	Surface / no
37	Sept 16	1449	1549	19 36.1'N 156 01.8'W	19 36.0'N 156 04.7'W	1.8-m IK,0.5 mm mesh	Surface / no
38	Sept 16	1558	1658	19 36.2'N 156 04.7'W	19 38.5'N 156 02.3'W	1.8-m IK,0.5 mm mesh	Surface / no
39	Sept 16	1709	1809	19 38.4'N 156 02.1'W	19 36.1'N 155 59.9'W	1.8-m IK,0.5 mm mesh	Surface / no
42	Sept 17	0632	0732	19 40.6'N 156 03.4'W	19 42.7'N 156 06.0'W	1.8-m IK,0.5 mm mesh	Surface / yes
44	Sept 17	0852	0952	19 37.1'N 156 02.5'W	19 34.3'N 156 03.5'W	1.8-m IK,0.5 mm mesh	Surface / yes
45	Sept 17	1009	1029	19 34.1'N 156 03.4'W	19 34.1'N 156 02.3'W	1.8-m IK,0.5 mm mesh	Surface / no
46	Sept 17	1050	1150	19 34.0'N 156 02.2'W	19 31.0'N 156 02.3'W	1.8-m IK,0.5 mm mesh	Surface / no
47	Sept 17	1219	1319	19 31.1'N 156 02.6'W	19 33.8'N 156 03.4'W	1.8-m IK,0.5 mm mesh	Surface / no
48	Sept 17	1326	1426	19 34.0'N 156 03.4'W	19 36.8'N 156 02.5'W	1.8-m IK,0.5 mm mesh	Surface / no
49	Sept 17	1447	1547	19 36.8'N 156 02.3'W	19 34.6'N 156 00.1'W	1.8-m IK,0.5 mm mesh	Surface / no
50	Sept 17	1553	1653	19 34.4'N 156 00.0'W	19 33.4'N 155 58.5'W	1.8-m IK,0.5 mm mesh	Surface / no

Sta. No.	Date (2006)	Local time (start)	Local time (end)	Start location	End location	Gear	Tow depth/Surface slick targeted
51	Sept 17	1753	1853	19 33.3'N 155 59.3'W	19 33.3'N 156 03.3'W	1.8-m IK,0.5 mm mesh	Surface / no
54	Sept 18	0631	0731	19 28.1'N 155 58.5'W	19 28.3'N 156 01.8'W	1.8-m IK,0.5 mm mesh	Surface / no
55	Sept 18	0738	0838	19 23.4'N 156.02.1'W	19 28.7'N 156 05.5'W	1.8-m IK,0.5 mm mesh	Surface / no
56	Sept 18	0849	0949	19 28.8'N 156 06.0'W	19 28.7'N 156 09.4'W	1.8-m IK,0.5 mm mesh	Surface / no
57	Sept 18	0959	1059	19 28.7'N 156 09.9'W	19 28.6'N 156 13.5'W	1.8-m IK,0.5 mm mesh	Surface / no
58	Sept 18	1106	1206	19 28.6'N 156 13.8'W	19 28.7'N 156 17.1'W	1.8-m IK,0.5 mm mesh	Surface / no
59	Sept 18	1211	1311	19 28.8'N 156 17.3'W	19 28.7'N 156 20.3'W	1.8-m IK,0.5 mm mesh	Surface / no
60	Sept 18	1316	1416	19 28.7'N 156 20.5'W	19 28.7'N 156 23.7'W	1.8-m IK,0.5 mm mesh	Surface / no
61	Sept 18	1422	1522	19 28.7'N 156 23.8'W	19 28.6'N 156 27.0'W	1.8-m IK,0.5 mm mesh	Surface / no
62	Sept 18	1531	1631	19 28.6'N 156 27.5'W	19 28.5'N 156 31.8'W	1.8-m IK,0.5 mm mesh	Surface / no
63	Sept 18	1636	1736	19 28.5'N 156 32.1'W	19 28.3'N 156 36.6'W	1.8-m IK,0.5 mm mesh	Surface / no
64	Sept 18	1741	1841	19 28.3'N 156 36.9'W	19 28.1'N 156 41.2'W	1.8-m IK,0.5 mm mesh	Surface / no
66	Sept 19	0636	0736	19 24.1'N 156 44.4'W	19 20.9'N 156 44.1'W	1.8-m IK,0.5 mm mesh	Surface / no
67	Sept 19	0744	0844	19 20.7'N 156 44.2'W	19 17.7'N 156 44.0'W	1.8-m IK,0.5 mm mesh	Surface / no
68	Sept 19	0900	1000	19 17.9'N 156 42.9'W	19 21.0'N 156 42.5'W	1.8-m IK,0.5 mm mesh	Surface / no
69	Sept 19	1006	1106	19 21.3'N 156 42.5'W	19 24.4'N 156 42.8'W	1.8-m IK,0.5 mm mesh	Surface / no
70	Sept 19	1115	1215	19 24.3'N 156 42.9'W	19 21.5'N 156 43.8'W	1.8-m IK,0.5 mm mesh	Surface / no
71	Sept 19	1224	1324	19 21.3'N 156 43.3'W	19 18.4'N 156 43.9'W	1.8-m IK,0.5 mm mesh	Surface / no
72	Sept 19	1333	1433	19 18.6'N 156 43.9'W	19 21.4'N 156 43.2'W	1.8-m IK,0.5 mm mesh	Surface / no
73	Sept 19	1437	1537	19 21.6'N 156 43.1'W	19 24.2'N 156 42.2'W	1.8-m IK,0.5 mm mesh	Surface / no
74	Sept 19	1544	1644	19 24.2'N 156 42.1'W	19 27.2'N 156 41.6'W	1.8-m IK,0.5 mm mesh	Surface / no
75	Sept 19	1648	1748	19 27.4'N 156 41.5'W	19 30.4'N 156 41.3'W	1.8-m IK,0.5 mm mesh	Surface / no
78	Sept 20	0634	0734	19 28.1'N 155 57.1'W	19 28.3'N 156 00.4'W	1.8-m IK,0.5 mm mesh	Surface / no
79	Sept 20	0744	0844	19 28.6'N 156 00.4'W	19 31.3'N 155 58.8'W	1.8-m IK,0.5 mm mesh	Surface / no
80	Sept 20	0858	0958	19 32.0'N 155 58.6'W	19 28.9'N 155 57.5'W	1.8-m IK,0.5 mm mesh	Surface / yes
81	Sept 20	1007	1107	19 28.8'N 155 57.7'W	19 29.4'N 156 00.8'W	1.8-m IK,0.5 mm mesh	Surface / no
82	Sept 20	1115	1215	19 29.8'N 156 01.3'W	19 33.0'N 156 01.9'W	1.8-m IK,0.5 mm mesh	Surface / yes
83	Sept 20	1225	1325	19 33.3'N 156 01.8'W	19 35.3'N 156 59.6'W	1.8-m IK,0.5 mm mesh	Surface / no
84	Sept 20	1334	1434	19 35.5'N 155 59.5'W	19 37.8'N 156 01.5'W	1.8-m IK,0.5 mm mesh	Surface / yes

Table 2.--Cruise summary of SeaBird CTD station casts.

Station	Cast	Date (2006)	Cast depth (m)	Start location
01	1	Sept 14	150	19 42.5'N 156 15.0'W
02	2	Sept 14	150	19 42.5'N 156 10.1'W
03	3	Sept 14	150	19 42.5'N 156 05.0'W
10	4	Sept 14	150	19 12.5'N 156 00.0'W
11	5	Sept 14	150	19 12.5'N 156 05.0'W
12	6	Sept 14	150	19 12.4'N 156 10.0'W
13	7	Sept 14	150	19 12.5'N 156 15.1'W
22	8	Sept 15	150	19 32.5'N 156 00.0'W
23	9	Sept 15	150	19 32.5'N 156 04.9'W
24	10	Sept 15	150	19 32.5'N 156 10.0'W
25	11	Sept 15	150	19 32.5'N 156 15.0'W
26	12	Sept 16	150	19 22.5'N 156 15.0'W
27	13	Sept 16	150	19 22.5'N 156 10.0'W
28	14	Sept 16	150	19 22.5'N 156 05.0'W
29	15	Sept 16	150	19 22.5'N 156 00.0'W

Teacher at Sea

Marine biology and art teacher from West Hawaii Explorations Academy was selected to be on the research vessel Oscar Elton Sette to study billfish spawning

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It is not everyone's ideal five-day cruise. Swells coming from both directions. Performing plankton tows from 6 a.m. to 7 p.m. among the coastal slicks. Looking through a microscope at moving plankton in a petri dish on a rolling ship.

But Jenny Holen could not wait.

The marine biology and art teacher at West Hawaii Explorations Academy was selected to be on the research vessel Oscar Elton Sette to study billfish spawning about 50 miles off the Kona coast, as part of the National Oceanic and Atmospheric Administration's Teacher at Sea program.

Founded in 1990, the program gives teachers a greater insight into the ocean, marine research and maritime work. Participants live and work side-by-side with those who contribute to the world's body of scientific knowledge.

Armed with newfound enthusiasm and understanding, Holen has already developed eight science and art lessons, which can be used in middle and high schools. By sharing her experience, she hopes to inspire students who dread their biology and chemistry classes.

Holen had previously applied for the Teacher at Sea program and was turned down. More than 200 teachers from around the nation applied this summer, and only a handful were picked.

Holen later spent four days training with the Southeast Phytoplankton Monitoring

Network in South Carolina. Established by NOAA's Marine Biotoxins Program, SPMN taught Holen and a woman from the island of St. Thomas how to monitor the marine phytoplankton community for harmful algae species. The data will give scientists a better consensus of what plankton do in the ocean. It also helps identify general trends and areas prone to algal blooms. Holen said no one monitors for toxicity or algal blooms in Hawaii. She is the self-proclaimed "guinea pig."

Robert Humphreys, chief scientist of the NOAA Pacific Islands Fisheries Science Center, invited Curtis Muraoka, WHEA co-director, to come aboard Oscar Elton Sette, where scientists were trying to determine whether adult billfish migrate between Hawaii -- a nursery ground -- and South America, where there may be better nutrients.

"The importance behind obtaining this knowledge is to help conserve the declining population due to commercial and sport fisheries," Holen wrote. "If we knew where the mothers primarily spawn and if there are resident verses transient populations, then we could gain a better grasp of their overall ecology, life cycle and habitat range."

Muraoka declined because of his tendency to get seasick and instead recommended Holen, who became one of the more than 460 teachers in Teacher at Sea. Only seven Hawaii teachers have been selected to date, according to NOAA. Two are from WHEA.

Around 11 a.m. Sept. 17, Holen was picked up at the Honokohau Harbor fuel dock. On seeing the four-story Oscar Elton Sette on the horizon, she compared it to a giant cruise ship. Functioning like a miniature city, the vessel is equipped with a gym, gift shop, cafeteria, laboratories, medical treatment room and crew quarters. Accompanying Holen were four commission officers, one medical officer, three licensed engineers, 13 crew members and five scientists, including the author of the critcally acclaimed book "Archipelago."

Every hour from sunrise to sunset, Holen dropped a fine-meshed sampling net into the ocean, where it was towed and collected plankton. She then reeled the net in, scanned the sample for billfish eggs and larvae, and took some microscopic photographs.

"In a jar, surface plankton simply resembles muck from the bottom of your toilet," Holen wrote. "Up close, however, the characteristics, colors and movements planktonic organism portray immediately demand the respect of awe and wonder.

Are they microscopic aliens floating around silently in the vast ocean realm?"

The most exciting discovery was a thin, flat, transparent crab larva with feathers attached to each leg joint for swimming. Scientists onboard had never seen this Muppet-like creature before, Holen said.

Holen's biggest challenge was battling sea sickness, which surprised her since she used to work on the 118-foot schooner Spirit of Dana Point.

While boring, the monotony of the job was needed to solve the project's mystery. Holen became more appreciative of famous explorers, who not only bore the elements, but "had to literally draw each organism with only a magnifying glass as an aid." For fun, the crew threw a bright light overboard at night with the hopes of attracting strange

phototactic organisms.

Holen also answered questions and kept a daily long of her adventure, which is chronicled online at teacheratsea.noaa.gov/2006/holen/index.html.

Working with well-known scientists who possessed doctorates and have published many scientific journal articles allowed Holen to take them off the pedestal. Instead, she began to admire them on a more personal level as down-to-earth "regular Joes."

"Anyone into conservation can accomplish great feats," Holen said. "All you need is dedication and drive from within. It's still possible to be great explorers, be the next Jacques Cousteau or Charles Darwin. There's so much work still to be done and to be discovered."

Next month, Holen, along with her students, plans to survey the different plankton, in particular diatoms and dinoflagelate populations, found along the West Hawaii coastline. Once a week at Kailua Pier and Honokohau Harbor, they will drop screen squares in the ocean, examine the catch samples and send specimens to SPMN for verification of classification. Their goal is to publish about book on Hawaii plankton.