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CRUISE REPORT

VESSEL: *Townsend Cromwell*, cruise TC-93-03 Leg I (TC-181)

CRUISE PERIOD: March 12-April 8, 1993

AREA OF OPERATION: North of Oahu, Hawaii from the boundary of the exclusive economic zone to latitude 30°N (Fig. 1).

TYPE OF OPERATION: Swordfish (*Xiphias gladius*) longline fishing and habitat study, using the surface thermosalinograph (TSG), conductivity-temperature-depth (CTD) profiler, and the acoustic Doppler current profiler (ADCP).

ITINERARY:

12 March Embarked Keith A. Bigelow, Sandra G. Blake, Daniel S. Curran, Donald R. Hawn, Unai Marcaida, and James H. Uchiyama. Departed Oahu and performed trial set. Pulled in line and proceeded to operation area, monitoring sea surface temperature and salinity along the way.

13-17 March Arrived at initial sampling site and commenced the setting of longline gear at dark. Retrieved gear in the morning. Moved north and repeated operation which included a CTD cast.

18-23 March Returned to Honolulu to repair the ship's port generator motor.

24 March Departed Honolulu after repairs. Headed north to resume operation.

- 25 March-
6 April Resumed routine setting of longline gear at darkness, conducting a CTD cast, and retrieving the longline gear in the morning. Headed north each day until conducting a station at 30°N. Then headed south, conducting operations in westwardly and eastwardly flowing currents and at a region of very steep sea surface temperature and salinity gradients.
- 7 April En route home. Tested the net sonde and calibrated the time-depth recorder (TDR) using the CTD.
- 8 April Arrived at Snug Harbor, Honolulu. Disembarked scientists. End of cruise.

MISSIONS AND RESULTS:

- A. Collect environmental data in association with the swordfish longline fishing operation.
1. Thirteen CTD casts were made either before or after setting the longline gear to obtain a temperature and salinity depth profile for the location. A cast for station 1 was not made because of heavy sea conditions.
 2. The TSG logged data continuously throughout the cruise. Daily plots of sea surface temperature and salinity were plotted as the cruise proceeded.
 3. The ADCP data were also logged throughout the cruise. The ADCP display was monitored periodically, when the vessel was on a north or south transit, to immediately obtain information of water flow.
- B. Determine the depth of the longline and the depth at which swordfish take the baited hooks.

TDR were placed at different positions along the longline to obtain an estimate in the depth variation of the main line. Hook timer data obtained on fish caught and TDR data will be used to estimate depth at which swordfish were caught. Two TDRs located next to droppers that caught fish will reveal vertical movement of fish after capture.

- C. Collect fish catch and effort data for the longline fishing operations.

Some environmental data and the catch rates (catch per 100 hooks) of swordfish and blue sharks (*Prionace glauca*) are

shown in Table 1. Differences in maximum and minimum surface temperature observed during a longline station indicate some of the sharp surface temperature gradients encountered. Longline drifts with two opposite directions separated by a hyphen indicate a rotational drift. Species of fish caught by the longline gear are listed in Table 2 by station.

- D. Tag, mark, and release viable swordfish, and selected other pelagic species.

Nine swordfish, ranging in size from an estimated 10 to 180 kg, were injected with oxytetracycline, tagged, and released. Five striped marlin (*Tetrapterus audax*) (ca. 45-55 kg) were also marked, tagged, and released. Most of these fish were not injured nor bleeding because of a technique developed on this cruise. Postmortem examination of earlier specimens that failed to survive the marking and tagging process showed severe damage to major arteries and other injuries. These injuries were caused by the hook and monofilament leader as the fish tried to fight the line. So it was decided to slacken the leader and let the fish circle under the vessel so the swordfish or striped marlin could rest and calm down. When the fish appeared to be calm, it was slowly brought to the surface for injection and tagging. Although this procedure was time-consuming, injury to the fish was avoided. Swordfish and striped marlin, unlike tunas and sharks, do not dive.

- E. Collect biological samples.

Swordfish otoliths, anal and dorsal fin spines, ovaries, and caudal peduncles were collected for research at the Honolulu Laboratory. Tissue samples from the hearts, liver, white muscle tissue, the first three precaudal vertebrae, and stomach samples from swordfish were collected for researchers at CICESE, Ensenada, Mexico. Fresh heater organs from 6 swordfish were collected for Barbara Block, University of Chicago; 44 swordfish bills for Francis Carey, Woods Hole Oceanographic Institute; and 42 heart tissues for Edward Graves, Virginia Institute of Marine Studies. A couple of swordfish eye lens were collected for Joe Horowitz of the Julius Stein Eye Institute, University of California at Los Angeles. Fins from 13 blue sharks and 3 shortfin mako (*Isurus oxyrinchus*) were measured and weighed fresh, then dried and reweighed for utilization estimates.

- F. Take and record biological measurements and determinations from swordfish and major transition zone species; record only fork length and weight for other species.

Morphometric measurements and various weights were taken on 42 swordfish, 13 blue sharks and 3 shortfin mako. Fork lengths and weights were obtained for 22 other fishes including 6 lancet fish (*Alepisaurus ferox*), 3 bigeye tuna (*Thunnus obesus*), 10 mahimahi (*Coryphaena hippurus*), 3 snake mackerel (*Thyrstitoides marleyi*), and an escolar, (*Lepidocybium flavobrunneum*).

- G. Conduct an oceanographic transect into the subarctic-subtropical transition zone.

The oceanographic transect was not conducted because of time lost for generator repairs.

- H. Conduct surface trolling during the oceanographic transect. Surface trolling was not conducted because suitable environment was not found.

- I. Observations on protected species interaction.

Although up to 12 black-footed and Laysan albatrosses were observed at the beginning of a longline set and up to 50 albatrosses were seen during retrieval, no interaction was observed. At station 15, three swordfish heads and a pectoral girdle were retrieved. The fish had been eaten up to where the swordfish had been hooked, leaving only the head or pectoral girdle around the hook. The main line was tangled near these heads and pectoral girdle, indicating a chase and struggle. Some who examined the remains closely noticed large teeth marks, but unlike a shark bite. False killer whale(s) are believed to have eaten these swordfish.

**SCIENTIFIC
PERSONNEL:**

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Attachments