

April 26, 1996

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## CRUISE REPORT

**VESSEL:** *Townsend Cromwell*, Cruise 96-04 (TC-207)

**CRUISE PERIOD:** **Leg I:** 17 March to 1 April 1996  
**Leg II:** 5-8 April 1996

**AREA OF OPERATION:** North central Pacific between latitudes 28-31°N and longitudes 166-178°W on Leg I (Figure 1), and an area between the islands of Maui, Molokai, and Lanai on Leg II (Figure 2)

**TYPE OF OPERATION:** On Leg I, longline fishing for swordfish (*Xiphias gladius*) was conducted in the proximity of strong sea surface temperature gradients and a seamount. Physical oceanographic features were monitored, in transit, using the thermosalinograph (TSG) and surveyed along longitude 166°W between latitudes 28-31°N with the TSG, conductivity-temperature-depth (CTD) casts, and the acoustic Doppler current profiler (ADCP). Time-depth-temperature recorders (TDR) were attached to the mainline of the longline to monitor its depth. On Leg II, moored current meters were located and retrieved, 7 drifters were deployed, and dive training was conducted.

### ITINERARY: **Leg I**

- 16 March - Scientific Field Party embarked the *Townsend Cromwell* at Midway Island.
- 17-24 March - Departed Midway Island for the western edge of the survey area at latitude 31°N, longitude 166°W. Fishing operations were conducted when steep sea surface temperature gradients were encountered on the way to the survey area and off

a seamount at latitude  $28^{\circ}\text{N}$ , longitude  $171^{\circ}\text{W}$  (Figure 1).

- 24-25 March - Arrived at survey area. Made two CTD casts before setting longline at latitude  $31^{\circ}\text{N}$ , longitude  $166^{\circ}\text{W}$ . At the start of retrieval, encountered problem with ship's controlled propeller propulsion (CPP) system. Hauled in with one engine.
- 26-27 March - Continued on transect making CTD casts every 15' latitude, down longitude  $166^{\circ}\text{W}$  to latitude  $28^{\circ}\text{N}$  while various attempts to repair CPP were made. Exhausting everything that could be tried at sea, the decision to return to Honolulu was made.
- 28-31 March - In transit on one engine. Made two CTD casts along the way.
- 1 April - Arrived at Snug Harbor. Scientific field party disembarked.

### Leg II

- 5 April - Embark Scientific field party. Depart for operations area near Maui (Figure 2).
- 6-7 April - Searched, located, and retrieved moored current meters, deployed drifters, and conducted dive training.
- 8 April - Arrived at Snug Harbor. Scientific field party disembarked. End of cruise.

### MISSIONS AND RESULTS:

#### Leg I

- A. Collect environmental data in association with the swordfish longline fishing operation: temperature- and salinity-depth profiles (CTD casts), horizontal sea surface temperature and salinity distribution (TSG), and the occurrence of surface (longline drift) and subsurface currents (ADCP).
1. Temperature- and salinity-depth profiles down to 1,000 m were obtained at five of six longline stations. One thousand meter CTD casts were also made every 15' latitude between latitudes  $28-31^{\circ}\text{N}$  along longitude  $166^{\circ}\text{W}$ , completing one transect of the survey area. Two additional 500 m CTD casts were made at latitudes  $27^{\circ}$  and  $26^{\circ}\text{N}$ , in transit, to Honolulu.

2. Sea surface temperature and salinity were recorded by the TSG throughout the cruise. The salinity sensor malfunctioned in transit between longitudes 170-166°W when the *Townsend Cromwell* was pounding into the sea.
3. The ship's track during the setting and retrieval of the longline was plotted by Seaplot, which can be used to measure surface current. Subsurface currents were recorded by the ADCP throughout the cruise.

- B. Collect swordfish catch-per-unit-effort data relative to steep sea surface temperature gradients and other physical features.

Four sets were made across steep sea surface temperature gradients and a set off a seamount at approximately latitude 28°N, longitude 172°W. The sixth longline set was to be the first set of a series of 12 sets in the survey area. When a problem with the ship's propulsion system developed, further fishing operation was suspended. Swordfish was caught on only 1 set across a temperature gradient. Loss of bait was extensive on the warm side of the temperature gradient, as up to 94% of the hooks came up bare on retrieval. Whole bait were retrieved on the cold side of the gradients.

- C. Experiment with the longline fishing operation and other capture methods to quantify factors which increase the number and condition of viable swordfish for tagging.

Due to the lack of swordfish and the need to transit east to the survey area, experimental and alternative methods of catching live swordfish for tagging were not conducted. Swordfish hauled in about 2 h after the establishment of one longline set were already dead, whereas two of the three swordfish hauled in at the regular time after sunrise were alive.

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

The larger of the two live swordfish was injected with oxytetracycline, tagged and measured before release. The smaller swordfish looked weak after being measured, so it was brought on deck and sampled.

- E. Collect biological samples of otoliths, fin rays, gonads, somatic muscle tissues, and stomach contents from swordfish and other species.

Samples of brain cases containing otoliths, the first anal fin, gonads, somatic muscle tissues, and stomach contents were obtained from three swordfish. Somatic muscle tissues

for mtDNA analysis were collected for Dr. Barbara Block of Stanford University and for Dr. Seinan Chow of the Research Institute of Far Seas Fisheries, Japan. Fins from two blue shark (*Prionace glauca*) were weighed and frozen for drying later at the laboratory.

- F. Take and record biological measurements and determinations of fork length, various morphometric measures, tissue weights, somatic weight, sex, and fin ray counts from swordfish. Take various length and morphometric measurements, sex, and pup counts of shark. Record fork length, somatic weight, and sex of other species.

Fork length, various morphometric measurements, somatic weight, tissue weights, gonad volume, sex, and first dorsal and first anal fin ray counts were obtained from three swordfish. Length and morphometric measurements, somatic weight, and the sum of fin weights were obtained from two blue shark. Pups from the female blue shark were counted and measured.

- G. When swordfish and other important pelagic species with well developed ovaries are caught, conduct plankton tows in area of longline set to verify the spawning activity.

None of the swordfish or albacore tuna (*Thunnus alalunga*) caught had developed ovaries to warrant a plankton tow.

- H. Obtain environmental data near fronts and other physical features by conducting an additional oceanographic survey at a designated seamount (latitude 28°N, longitude 171°W), and in the immediate area of thermal fronts which are detected, in transit, on the TSG or by up-to-date satellite imagery of the sea surface.

When a steep sea surface temperature gradient (3°C) was encountered in transit, a small transect pattern was conducted in the vicinity of the gradient to better define the gradient so that the longline could be set across it. These transects were conducted in less than 4 h and the patterns varied from station to station. Only two of the transects provided sufficient coverage to contour. The sea surface salinity also showed changes when the steep sea surface temperature gradients were encountered. These gradients appeared to run north-south and be about a degree longitude apart at latitudes 28.5-29°N.

- I. Miscellaneous observation and request.

1. We made good use of the newest version of the Scientific Computer System, SCS 6.0, installed on the ship before

the cruise. We were able to access real time data, and found SCS 6.0 user friendly.

2. Transported used formaldehyde (hazardous waste) from Midway Island to Honolulu for the Protected Species task.

### Leg II

- A. To retrieve two current meters.

Successfully located and retrieved two current meters using divers.

- B. Miscellaneous activities.

1. Deployed 7 satellite-tracked drifters for measuring surface currents.
2. As time allowed, a dive training session was conducted to familiarize two staff members of the Honolulu Laboratory with dive sled operations to be used in an upcoming cruise.

### RECORDS:

The following forms, logs, charts, and data records were kept and given to the Honolulu Laboratory upon termination of the cruise. All the records are filed there unless indicated otherwise in parentheses.

### Leg I

ADCP data on a 100 Mb Zip cartridge  
 CTD log, data on a 100 Mb Zip cartridge, and profile graphs  
 Deck Log-weather (15)  
 Fish Sampling Log (2)  
 Fish Tagging Record (1)  
 Longline haul-in worksheet (54)  
 Longline set worksheet (54)  
 Longline station charts (6)  
 Marine Operations Log (4)  
 Occurrence of Birds, Aquatic Mammals and Fish Schools Log (15)  
 Protected Species Interaction Observation (1)  
 Scientist's Log  
 Shark Morphometric Forms (2)  
 Station charts [Seaplot] (6)  
 Swordfish Morphometric Data (1)  
 TDR data on 100 Mb Zip cartridge  
 Thermosalinograph (TSG) Traces (16) and Data (SCS data)  
 SCS data on 250 Mb Jumbo backup tape (1) [tape also contained data from TC9603]

**Leg II**

ADCP data on a 100 Mb Zip cartridge  
Deck Log-weather  
Marine Operations Log

**SCIENTIFIC  
PERSONNEL:**

**Leg I**

James H. Uchiyama, Chief Scientist, National Marine Fisheries  
Service (NMFS), Southwest Fisheries Science Center (SWFSC),  
Honolulu Laboratory (HL)  
Daniel S. Curran, Fishery Biologist, Joint Institute for Marine  
and Atmospheric Research (JIMAR), University of Hawaii (UH)  
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**Leg II**

Claude R. Lumpkin, Chief Scientist, Department of Oceanography,  
UH  
Denise Ellis, Cooperating Scientist, JIMAR, UH  
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Attachments