



U. S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
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CRUISE REPORT

VESSEL: *Townsend Cromwell*, Cruise TC-96-02 (TC-205)

CRUISE PERIOD: February 3-March 2, 1996

AREA OF OPERATION: Within an area 480-780 miles north of the Island of Oahu, Hawaii (Fig. 1)

TYPE OF OPERATION: Longline fishing operations were conducted using monofilament longline gear in conjunction with hook timers and time-depth recorders (TDRs) to study the habitat utilization, hooked longevity, and vulnerability to fishing gear of broadbill swordfish (*Xiphias gladius*). Physical oceanography was monitored with expendable bathythermographs (XBTs), conductivity-temperature depth (CTD) casts, thermosalinograph (TSG) and acoustic Doppler current profile (ADCP) transects.

ITINERARY:

3 February - Embarked scientists. Departed Snug Harbor at 2000, and proceeded towards the first fishing station about 580 nmi northwest of Oahu.

4 February - At 110 nmi northwest of Oahu, tested and adjusted setting rates of the longline shooter and retrieval speeds of the longline reel. Checked the frequency and strength of radio buoys. Adjusted winch speed for CTD operation and re-terminated the connection to the CTD.

6-7 February - Diverted, by the U.S. Coast Guard (USCG), to assist the distressed fishing vessel *Red October*. Arrived at the scene 550 nmi northeast of Oahu on 7 February. *Townsend Cromwell* personnel inspected conditions on the fishing vessel, transferred two incapacitated fishermen suffering from hypothermia to the *Townsend Cromwell*, treated them, and kept the USCG apprised of the situation.



- 8 February - At 1600, two fishermen were transferred back to the *Red October*, and the vessel was inspected and deemed seaworthy. Proceeded to the first fishing station, set 200 hooks, and deployed a CTD cast.
- 9 February - Retrieved the longline at 0200 and at 0800. Repaired gear, and proceeded south 1° to the location of set 2 (Fig. 1) and set 400 hooks after sunset. The CTD was deployed at 15° intervals of latitude en route to the next fishing station.
- 10 February - Retrieved longline at 0200 and at 0800. At set 3, 400 hooks were deployed followed by a CTD cast. The CTD cable was jammed outside the block and the damaged cable was repaired the next day.
- 11 February - Severe weather conditions canceled the haul at 0200 and a main engine failure delayed the pickup to 0900. By the afternoon, the ship had run over the main line twice, fouling the propellor shaft and causing the port engine to shut down. Sea conditions were too rough to deploy divers to free the shaft. It was decided to abandon the remaining gear in the water (approximately 88 hooks, 66 floats, and 1 temperature-depth recorder), and head south for better conditions before sending divers over the side.
- 12-13 February - Removed monofilament longline tangled on both propeller shafts. The port engine still indicated a load on the shaft. Conducted a night light station. The port shaft was freed the next day. Proceeded to the next fishing station.
- 14 February - At longline set 4, set 150 hooks at 0100 and retrieved at 0800. The ship was then maneuvered in a hove-to position to repair the controller system for the CTD winch. The problem was not resolved. Proceeded to the next fishing station and dropped an XBT en route.
- 15 February - At the next fishing station (set 5) set 150 hooks at 0100 and retrieved at 0800. Continued repairs to winch controller system for the rest of the day. At the end of the day, a winch failure destroyed the CTD. Used XBTs for the remainder of the cruise.

- 16 February - Set 150 hooks at 0230 at longline set 6. Severe weather and sea conditions delayed retrieval to 1430. Decided to abandon proposed fishing grid and move southwest for better working conditions and better fishing.
- 17-20 February - Established start of new fishing grid. For longline sets 7-10, 400 hooks were set at 1930, followed by an XBT, and longline retrieval was conducted at 0200 and 0800. An XBT cast was scheduled midway between fishing stations.
- 21 February - After the 0800 haul, the ship proceeded to the next fishing station with one engine until repairs to the port engine were completed. A 150-hook set was made at 2300 at longline set 11.
- 22-27 February - For longline sets 12-18, continued the established pattern of hauling at 0200 and 0800, conducting an XBT station between fishing stations and setting at 1930, followed by an XBT deployment.
- 28 February - Hauled 200 hooks at 0200, and proceeded to Snug Harbor.
- 2 March - Arrived at Snug Harbor about 0930. End of cruise. Proceeded to off-load selected gear, specimens, and records.

MISSIONS AND RESULTS:

- A. To measure factors affecting the capture condition (alive, moribund, dead) and viability for release of swordfish (and other species) caught on longline gear, and the efficiency of fishing gear as related to the thermocline. The experimental design will compare fish caught during day and night periods, the length of time the fish remained on the hook, the effectiveness of circle hooks to increase viability, and the effect of lower temperatures to improve captured condition.

A total of 5,600 hooks were set over 18 longline fishing stations (Fig. 1). All hooks were set in the evening after dusk. Hooks retrieved before sunrise numbered 2,575 and hooks retrieved during the day numbered 3,025. Of the 15 broadbill caught, only 1 was determined to be strong enough to be tagged and released. Of the remaining fish, all were either dead or near dead and 11 were brought aboard to be sampled. Five fish were retrieved during the daylight haul but those with operating timers were all hooked in the early morning before first light. Seven fish were identified to be caught with circle hooks and 4 with J-hooks. Both hooks

seemed equally effective in catching fish. Of interest, all broadbill swordfish caught with circle hooks were jaw-hooked, except one which was tail-hooked. Several circle hooks retrieved were straightened out. Preliminary results indicate that on average, hooks soaked for 3.9 h, broadbill swordfish were hooked at approximately 0100 and had remained hooked for 5.2 h before being retrieved. CTD and XBT casts and TDRs confirm that all sets were within the mixed layer.

- B. To test the hypothesis that swordfish catchability is increased in the vicinity of surface thermal fronts.

Longline sets 7-18 were divided north and south of a frontal zone detected between 28°N and 29°N. Sets 1-6 were north of this zone. Although the data are too few to be conclusive, proximity to the frontal zone did not seem to affect the catch rate for broadbill swordfish.

- C. To develop and test procedures to better retrieve and handle live swordfish for future tracking and archival tagging experiments.

High seas and inclement weather, a lack of viable fish and a very tight schedule prevented the implementation of tagging experiments.

- D. To tag and mark swordfish with tetracycline for movement studies and to measure the rate of deposits on otoliths, and to tag and release other viable fish for movement studies. Also, to compare the application and retention of different tag designs.

Suitable swordfish did not present themselves for tetracycline marking. One blue marlin (*Makaira mazara*) and two broadbill swordfish were sampled with various tag attachment designs. Preliminary results indicate that an inflexible head with a larger surface area would produce more desirable results. Frozen sections of a blue marlin and a broadbill swordfish were returned for further tag attachment tests. Thirteen fish, 1 broadbill swordfish, and 12 albacore tunas were tagged with National Marine Fisheries Service (NMFS), Southwest Fisheries Service Center (SWFSC) tags.

- E. Collect biological samples (tissues appropriate for mtDNA analysis, stock heterogeneity studies, growth rate estimation, diet studies, and sex and fecundity determinations).

Muscle samples from 1 blue marlin and 10 broadbill swordfish were collected for DNA determination by Barbara Block of Stanford University and Seinan Chow of the Research Institute of Far Seas Fisheries, Shizuoka, Japan.

Gonads, stomach contents, otoliths and anal fins from 10 broadbill swordfish and fins from 7 blue sharks were collected for Fish Biology and Ecology Investigation personnel.

- F. Collect and record biological measurements and determinations (fork length, various morphometric measures, tissue weight, somatic weight, fin ray counts, sex, etc.).

The fork length, weight and sex was collected from 15 albacore tuna (*Thunnus alalunga*), 6 bigeye tuna (*Thunnus obesus*), 5 longnose lancet fish (*Alepisaurus ferox*), 2 escolar (*Lepidocybium flavobrunneum*), 1 yellowfin tuna (*Thunnus albacares*), 1 snake mackerel (*Gempylus serpens*), 1 cookie cutter shark (*Isistius brasiliensis*), and 1 blue marlin.

In addition, extensive morphometric data were collected from 9 blue sharks (*Prionace glauca*) on the Pelagic Shark Biological Form and from 11 broadbill swordfish for the Life History Program.

- G. Search and rescue operation.

The ship's complement is to be commended for the outstanding and professional manner in which it came to the aid of the fishing vessel *Red October*. The officers and crew provided an accurate description of the situation to the U.S. Coast Guard, treated two fishermen, transferred ship's stores to the disabled boat, helped correct the flooding problem and before departing the scene, inspected the vessel and deemed it seaworthy. Operations were conducted under less than ideal conditions of heavy rain, 30-40 kt wind and choppy 12 ft seas.

SCIENTIFIC PERSONNEL:

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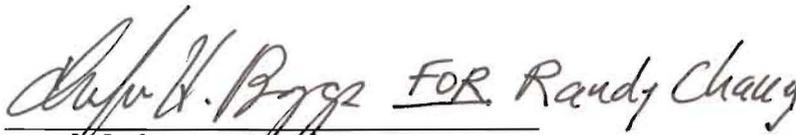
Robert B. Moffit, Fishery Biologist, NMFS, SWFSC, HL

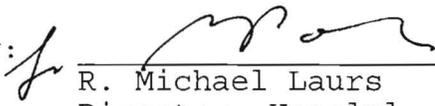
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Attachment

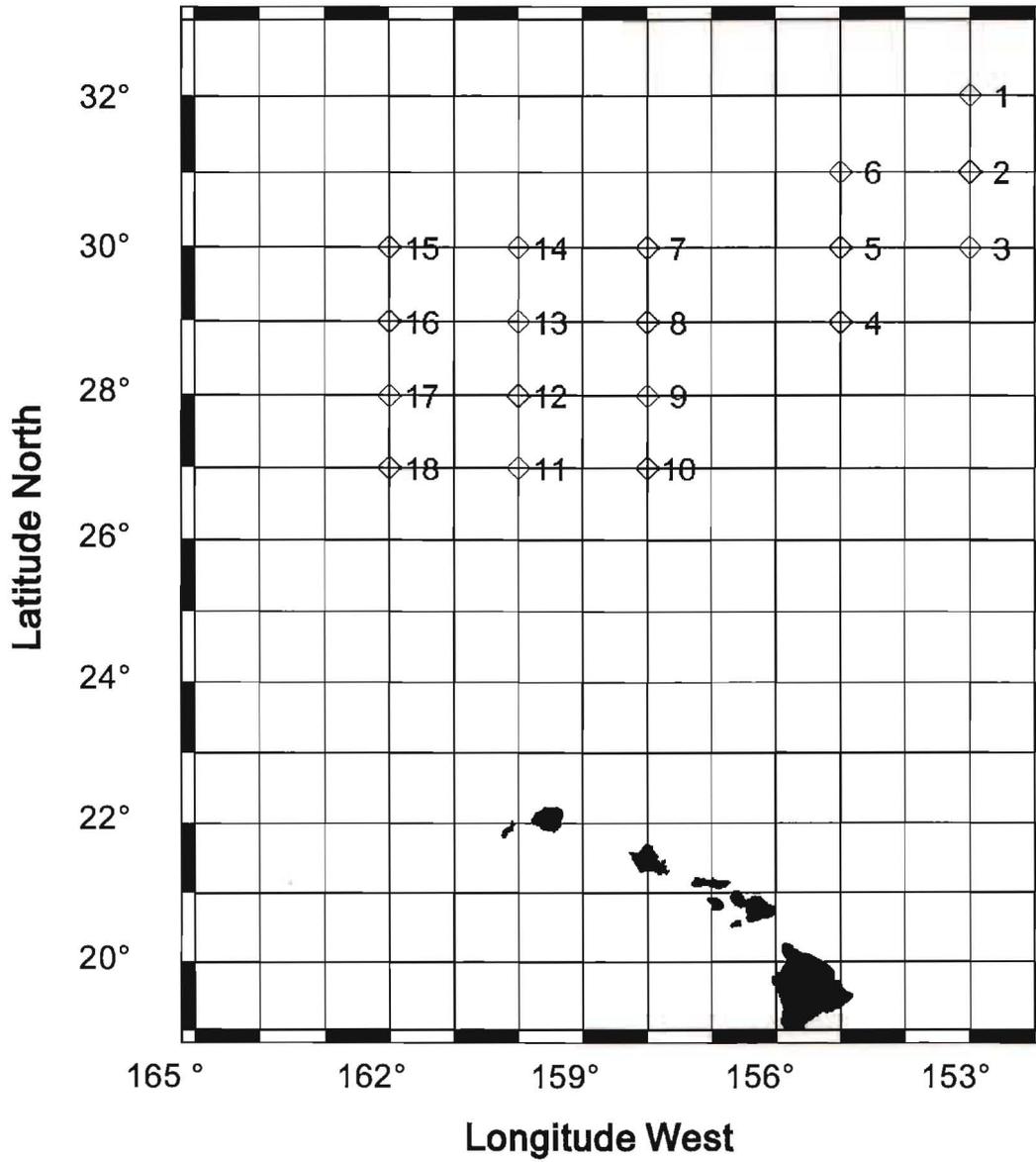


Figure 1.--Area of operation and position of longline sets.