CRUISE REPORT

VESSEL: Townsend Cromwell, Cruise TC-94-05 (TC-191)

CRUISE PERIOD:
Leg I: 16-25 June 1994
Leg II: 30 June-8 July 1994

AREA OF OPERATION: Within a radius of 200 miles of the Island of Hawaii (Figs. 1 and 2)

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 blue marlin (Makaira mazara), yellowfin tuna (Thunnus albacares), and associated species. At each fishing station, physical oceanography was monitored with expendable bathythermographs (XBTs), conductivity-temperature depth (CTD) casts and the acoustic Doppler current profiler (ADCP). A hydrographic transect was conducted in the vicinity of Cross Seamount to assess the dissolved oxygen regime at the summit and in the surrounding waters.

ITINERARY:

LEG I

16 June - Embarked scientists and departed Snug Harbor at 1000. Conducted a short longline set and CTD cast south of Oahu to test the gear and familiarize all personnel with fishing and oceanographic operations.

17-18 June - Conducted longline operations each day within a 150-nmi radius of the Island of Hawaii at Dutton and Cross Seamounts. A CTD cast was performed on each fishing day (Sta. 1-2).

19-20 June - Conducted CTD bottles, XBT, ADCP, and hydroacoustic transects along predetermined grids in the vicinity of Cross Seamount (Sta. 3-13).
21-24 June - Continued longline operations, working south to Finch Seamount and an unnamed seamount at lat. 16°22.9'N and long. 156°59.8'W, then back north to Daly and Clark Seamounts (Sta. 14-17).

25 June - Returned to Snug Harbor at 0800, disembarked scientists, and prepared ship for generator repairs.

Leg II

30 June - Completed repairs to the generators and embark scientists. Departed 1930 to conduct longline operations within 50 miles of the island chain.

1-7 July - Conducted longline operations north of Maui, and off Hilo, Kalapana, and Ka Lae on the Island of Hawaii. A CTD and XBT cast was deployed at each fishing station (Sta. 18-24).

8 July - Return to Snug Harbor at 1730, and transferred live fish to the Waikiki Aquarium. End of Leg II, and end of cruise. Proceed to off-load equipment, supplies, and specimens.

MISSIONS AND RESULTS:

A. Measure the fishing depth of the longline hooks using TDRs and measure the time at which blue marlin, yellowfin tuna, and associated species of fish are captured using hook timers.

1. The depth of the main line at points 0.5 of the line length between serial floats, (the deepest points) was recorded with TDRs on 11-16 baskets in each of the 13 sets. (A basket is one interval of gear between two floats; ca. 30-54 baskets were used in each full-scale set). The depth of the mainline at an intermediate position (0.2 to 0.3 of the distance between two floats) was also recorded with TDRs on 2-3 baskets per set. TDR records of fishing depths indicated that the deepest part of the mainline was typically 100-300 m. TDR failures were due to watertight integrity (1 failure) and unexplained malfunctions in the microprocessors. However, 4 TDRs were separated from the main line. All snap attachments were examined and, where necessary replaced on Leg II to try and prevent further losses. No TDRs were lost on Leg II, however, another microprocessor failed for unknown reasons.
2. Almost every hook set was equipped with a hook timer. Hook timers indicated that fish were caught throughout the period while the longline was in the water but predominately while the longline was at its settled depth rather than while it was sinking during deployment or rising during haulback. Hook timers indicated that tuna survived for many hours after being captured (yellowfin up to 10 h).

B. Collect fish catch and effort data to index relative gear efficiency as a function of gear configuration and fishing depth.

1. A total of 13 sets were made including 9 full-scale 600+ hook sets. Four short sets and 1 practice set made without bait were made at the beginning of Leg I. Effort totaled over 7,700 hooks set, and 226 fish caught. The fishing sea days lost to the generator repairs were to a great degree compensated for by increased work hours, more hooks set, and a high catch rate on Leg II. Rather than repeat the oceanographic transect at Cross Seamount Leg II, all days were devoted to fishing operations. Compared to previous cruises, the catch was less diverse, and included a very large proportion of albacore (*Thunnus alalunga*). Nontarget species caught included 23 lancetfish (*Alepisaurus ferox*), 36 mahimahi (*Coryphaena hippurus*), and 17 (4 species) sharks and pelagic stingrays. Billfish (30 caught, 4 species) were less numerous than tuna (104 caught, 4 species). The catch-per-unit-effort (CPUE) for the target species was 1.94 yellowfin tuna per thousand hooks and 1.16 blue marlin per thousand hooks. The size of yellowfin tuna averaged much larger than on previous cruises, and provided more definitive data on the depth distribution of mature fish.

2. Depth information on the catch has yet to be compiled, but bigeye (*Thunnus obesus*) and albacore tunas tended to be caught on the deeper hooks and on sets that reached 140 m or deeper. Yellowfin tuna and billfish were mostly caught on shallower hooks.

3. Actual calculations of the efficiency of different gear configurations will require further analysis. Data collected from the target species and albacore should be sufficient to provide meaningful efficiency estimates.

C. Collect environmental data and physically locate longline gear to test hypothesis regarding the distribution of fish in relation to oceanographic features.
1. Thirteen CTD and Niskin bottle casts were made at the 13 fishing stations. Salinity samples were collected from each cast. Thermosalinograph, depth and current profiles were also recorded.

D. Tag, mark with injection of oxytetracycline, and release blue marlin and other billfish captured alive. Tag and release yellowfin tuna and other pelagic species captured alive.

1. A total of 31 fish were tagged and released. These included 1 bigeye tuna, 13 albacore tuna, 4 blue marlin, 6 shortnose spearfish (Tetrapterus angustirostris), 4 striped marlin (Tetrapterus audax), 2 opah (Lampris guttatus), and 1 broadbill (Xiphias gladius). Most of the billfish tagged and released were injected with oxytetracycline.

E. Tether live yellowfin or bigeye tuna to test method of recovering tethered fish for ultrasonic tracking after the longline operation is completed.

1. No fish were tethered on this cruise.

F. Record measurements (fork length, morphometric measurements, organ and body weights), determine sex, and photograph dead fish. Collect and preserve various tissue samples.

1. Of the 226 fish caught, length, weight, and sex (if possible) data were recorded; biological samples were collected from 129 fish. Other fish were released or escaped while fighting on the branch line alongside the vessel. Very few dead fish dropped off the line or were partially eaten and could not be sampled (ca. <7 fish).

2. Otoliths, vertebrae and selected spines were collected from 21 albacore were collected for use in comparison and age determination studies.

3. Parasitic copepods were collected from 20 large (>90 cm FL) albacore in the area of the anal vent. The information is used to determine an association of large albacore and ectoparasitic copepods.

4. Gonadal samples were collected from 4 yellowfin tuna. Samples will be used to compare histological techniques used to determine spawning frequency.

G. Conducted CTD, XBT, ADCP, and hydroacoustic transects along predetermined sampling grids in the vicinity of Cross Seamount to evaluate the dissolved oxygen regimes with respect to the seamount and its adjacent waters. Two days
were spent on and about Cross Seamount on fine scale oceanographic sampling transects. A total of 11 CTDs and 23 XBTs were cast along predetermined grids. Water samples were collected at various depths to determine dissolved oxygen, salinity, nutrient analysis, and temperature to confirm CTD readings.

H. Participation in the "Teacher at Sea" program and with volunteers.

The five teachers and six volunteers participated in all phases of the cruise. This included the setting and hauling of the longline gear, collecting and recording catch data, and monitoring CTD operations. Time spent to train volunteers to download and store CTD and TDR data allowed them to be more computer literate and kept the scientific staff current on the status of fishing conditions. The teachers used their hands-on experiences and exposure to the operation of a research vessel to develop lesson plans and returned with samples of data collected from the cruise and samples of fishing gear for their classrooms. Much of this information and operational procedures are unique to a research longline cruise, and was unselfishly shared by the ship's and scientific personnel.

SCIENTIFIC PERSONNEL:

Leg I:

Randolph K. C. Chang, Chief Scientist, National Marine Fisheries Service (NMFS), Southwest Fisheries Science Center (SWFSC), Honolulu Laboratory (HL).
Kurt Gunderson, volunteer, University of Hawaii (UH), Manoa.
Douglas Henion, Volunteer, UH, Hilo.
Ardi Kvevin, Teacher at Sea Program, NMFS, Seattle.
Patricia Mann, Teacher at Sea Program, NMFS, Seattle.
Tammy Wenham, Volunteer, UH, Hilo.
Michael P. Seki, Fishery Biologist, NMFS, SWFSC, HL.

Leg II:

Christofer H. Boggs, Chief Scientist, NMFS, SWFSC, HL.
Richard W. Brill, Fishery Biologist, NMFS, SWFSC, HL.
Sue Brooks, Teacher at Sea Program, NMFS, Seattle
Daniel S. Curran, Volunteer, UH, Manoa.
Thomas Fenske, Volunteer, UH, Waikiki Aquarium.
Bill Mahn, Teacher at Sea Program, NMFS, Seattle.
Peggy Marconi, Teacher at Sea Program, NMFS, Seattle.
Tammy Wenham, Volunteer, UH, Hilo.
Figure 1.--TC-94-05, (TC-191): Longline operation stations. The dotted line indicates the 1000 fm contour, and the dashed line indicates the 200-mi Exclusive Economic Zone.
Figure 2. Oceanographic operations conducted in the vicinity of Cross Seamount on Townsend Cromwell cruise 94-05(I). CTD casts to 1000 m were conducted at locations denoted by filled circles; hatch marks designate XBT casts (450 m). Bathymetric and ADCP measurements were collected along four track lines dissecting the seamount octamerously. [map adapted from Malahoff 1985, Noble and Mullineaux 1989].