August 25, 2000 F/SWC2:CHB:JLB
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CRUISE REPORT

VESSEL: *Townsend Cromwell*, Cruise 92-08 (TC-176)

CRUISE PERIOD: 31 August-29 September 1992

AREA OF OPERATION: The vicinity of Oahu, Maui, Kahoolawe, and Hawaii at a distance of 3-150 miles from the shoreline of these islands (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 blue marlin (*Makaira mazara*), yellowfin tuna (*Thunnus albacares*), and associated species. Physical oceanography was monitored with expendable bathythermographs (XBTs), conductivity-temperature-depth (CTD) casts with Niskin bottles for dissolved oxygen (DO) measurements, and with the acoustic Doppler current profiler (ADCP).

ITINERARY: **Leg I**

31 August: Embarked scientists (except Curran, Dollar, Humphreys, and Time) and departed at 1100. Conducted trial set 30 nmi south of Oahu from 1450-1730. Experienced hydraulic problems and departed for Honolulu at 1800. Arrived at Snug Harbor at 2100.

1 September: Contractor repaired longline reel control valve by 1000. Departed at 1030. Conducted longline

operations from 1400-1730, 30 nmi south of Oahu (station 1) and departed for next station.

2-4 September — Conducted longline operations from 0530 to 1900 or 2100 each day (1 set per day) ca. 70 nmi west of Hawaii at locations near Jagger Seamount (stations 2 and 3), and Pensacola Seamount (station 4). Conducted CTD and Niskin bottle casts (1 per day, no DO measurements) at ca. 0930 each day.

5-7 September — Conducted longline operations and CTD casts from 0530- 2000 or 2200 each day ca. 40 nmi from shore south of Ka Lae (station 5), south of Puna (station 6), and east of Hilo (station 7).

8-9 September — Conducted longline operations and CTD casts (similar schedules as above) ca. 15-20 nmi from shore northeast of Hamakua (station 8) and northeast of West Maui (station 9).

10 September — Arrived at Snug Harbor ca. 0700 to end Leg I. Disembarked Bigelow, Jones, and Raring, and embarked Curran, Humphreys, and Time.

Leg II

10 September — Departed from Snug Harbor at 1830 for intended station 20 nmi west of Kona.

11 September — Encountered abrupt rise in wind speed, (gusting to 45 kn) at 0440 shortly before longline operations were scheduled to commence. Canceled longline operations west of Kona and took shelter from Hurricane Iniki in the lee of the Hamakua coast. Spent the day repairing fishing lines and testing radio beacons. That evening at 2100 the Coast Guard vessel *Kiska* arrived (with helicopter) to investigate a report of a drifting foreign fishing vessel matching the description of the *Townsend Cromwell*.

12-13 September — Conducted longline operations, CTD and Niskin bottle casts (with DO measurements) on a similar schedule on Leg I. Stations were located ca. 40 nmi from shore east of Hilo (station 10) and south of Puna (station 11). Departed for area west of Hawaii in an attempt to avoid Tropical Storm Orlene.

14 September — Conducted longline operations 15 nmi from shore off South Kona (station 12). After the set and

before haulback (ca. 1300) Tropical Disturbance Orlene intersected with the operation and the longline gear was temporarily lost. Haulback was completed by 1940.

15-18 September — Conducted longline operations, CTD and Niskin bottle casts, and an XBT transect in the area of 16.4-18.0 north latitude ca. 70-150 nmi south of Hawaii (stations 13-16).

19-20 September — Conducted longline operations, CTD and Niskin bottle casts at locations near McCall Seamount 70 nmi west of Hawaii (station 17) and 90 nmi south of Oahu (station 18) en route back to Oahu.

21 September — Arrived at Snug Harbor ca. 0700 to end Leg II. Disembarked Hawn and Humphreys, and embarked Bigelow and Dollar.

Leg III

21 September — Departed Snug Harbor at 1830 for fishing area near Kahoolawe.

22 September — Conducted longline operations (no CTD or bottle casts) from 0530-1330 at a location ca. 3 nmi northwest of Kahoolawe (station 19). Departed for next station at 1330.

23-25 September — Conducted 3 longline operations (stations 20, 22, and 23), 4 CTD and Niskin Bottle casts (stations 20-23) and an XBT transect in the area of 17.5-18.0 north latitude ca. 80-110 nmi south southwest of Hawaii. Longline operations conducted according to normal schedule (starting at 0530, finishing at 1900-2200).

26 September — The approach of Tropical Storm Roslyn required a move northward away from intended area of fishing. Longline, CTD and bottle cast operations conducted ca. 40 nmi south of Puna (station 24).

27 September — Conducted longline, CTD and bottle cast operations 10 nmi off the coast of Hamakua.

28 September — Conducted early longline set (starting at 0400) using some light sticks at a location ca. 70 nmi northeast of Maui (station 26). Also conducted CTD and bottle cast.

29 September	Arrived at Snug Harbor at ca. 0800. End of Leg III and end of cruise.

MISSIONS AND RESULTS:

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

1. The depth the main line at points 0.5 of the line length between serial floats (the deepest points) was recorded with TDRs on 10-12 baskets in each of 23 full-scale sets. (A "basket" is one interval of gear between two floats, ca. 30-60 baskets were used in each full-scale set.) The depth of the main line at an intermediate position (0.25 of the way between two floats) was also recorded with TDRs on 3-4 baskets per set. Altogether, over 300 TDR records of fishing depth were collected, indicating that the deepest part of the main line was typically at 150-300 m. Watertight integrity was maintained by all TDRs, but two were lost when a section of mainline was lost. The loss occurred on 9/24, after dark, when an unlighted portion of the main line broke loose and could not be found.)

2. The increased number of TDRs used (compared with previous cruises) resulted in a number of incidences of fish being caught immediately adjacent to a TDR. These records provided data on the behavior (with respect to depth) of captured fish and confirmed (through abrupt changes in depth) the time of capture indicated by hook timers.

3. 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 predominantly while the longline was at its settled depth rather than while it was sinking during deployment or rising during haulback. Compared with previous cruises, haulback caused the line to rise much farther in advance of its actual retrieval (up to many hours before retrieval). The proportion of fish caught while the gear was rising was therefore more than on previous cruises. Hook timers indicated that fish survived for many hours after being captured, with tuna tending to survive longer than billfish. Blue marlin tended to be less hardy (had shorter survival times) than striped marlin (*Tetrapterus audax*) based on striped marlin data from previous cruises.

4. When haulback lasted into the evening hours, hook timers indicated that fish were not caught after dark.

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 25 sets were made including 23 full-scale sets and 2 short sets made on 9/1 and 9/22 (1 set was made at each station except station 21). Effort totaled over 13,000 hooks, and 384 fish (21 species) were caught. The catch was extremely diverse and composed mostly of non-target species such as lancetfish (*Alepisaurus ferox*, 100 caught) mahimahi (*Coryphaena hippurus*, 73 caught) and sharks (58 caught). Billfish (59 caught, 4 species) were more numerous than tuna (49 caught, 4 species). Blue marlin (*Makaira mazara*, 32 caught) was the most common billfish. Due to the lateness of the season (the cruise was originally scheduled for the summer) yellowfin tuna (*Thunnus albacares*, 12 caught) were less numerous than bigeye tuna (*T. obesus*, 18 caught) or albacore (*T. alalunga*, 15 caught). The CPUE was very low for both target species (0.9 yellowfin per thousand hooks, 2.5 blue marlin per thousand hooks).

2. Depth information on the catch has yet to be compiled, but tuna (mostly bigeye and albacore) tended to be caught on the deeper hooks and on sets that reached 200 m or deeper. Billfish were mostly caught on shallow hooks close to the floats.

3. Actual calculations of the efficiency of different gear configurations will require further analysis, but the data for blue marlin should be sufficient to provide meaningful estimates (like those published for bigeye tuna and striped marlin based on previous cruises). In contrast the yellowfin data may be too sparse to provide meaningful efficiency estimates. Hopefully the yellowfin catch will be better next year when the cruise is scheduled earlier in the year.

C. Collect environmental data and physically locate longline gear to test hypotheses regarding the distribution of fish in relation to mesoscale eddies, eddy boundaries, the thermocline and the oxycline using daily satellite imagery from CoastWatch, thermosalinograph data, temperature (XBT), salinity (CTD) and oxygen (Niskin bottle) depth profiles, and current profiles (ADCP).

1. CTD and Niskin bottle casts were made at 24 stations, and DO determinations were made from the bottle casts at 16 of those stations (the DO probe did not work properly on the first leg). Thermosalinograph, depth, and current

profiles were also recorded. One satellite image was provided through the new Coastwatch Node.

2. Surface temperature differences were not clearly related to observed differences in CPUE, but a subsurface oceanographic feature was found to have an influence on CPUE for bigeye tuna. On Leg II a transition was found in the depth of the thermocline (18 degree isotherm) and oxycline (2 mg/L isoline) between 16.5 and 17.0 north latitude with the thermocline rising 40 m and the oxycline rising 100 m on the south side of the transitional area. Bigeye tuna were abundant along the north edge of this transition. The same (or similar) feature was found on Leg III between 17.5N and 18N, and again bigeye tuna were abundant on the north edge.

3. ADCP data was examined in real time and was very useful for predicting the longline drift, which was invariably in the direction of the upper layer of water, and often against the prevailing wind. Also, when the ADCP indicated current shear (an interface between layers of water with different vectors) with magnitude >0.5 knots it was hard to set the gear much deeper than 50 m below the depth of the shear. Shear currents were most common on the lee side of Hawaii and near the coastline.

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. Attempt videographic measurement of released fish and collect (for John Lucy, VIMS) measurements on dead fish for use in estimating weight from videographic measurements.

1. A total of 51 fish were tagged and released. These were 6 yellowfin tuna, 1 tuna that was either a yellowfin or a bigeye tuna (identification uncertain), 8 bigeye tuna, 4 albacore, 22 blue marlin, 3 shortbill spearfish (*Tetrapterus angustirostris*), 1 sailfish (*Istiophorus platypterus*) and 6 opah (moonfish, *Lampris guttatus*). Most of the billfish tagged and released were also injected with oxytetracycline.

2. A video camera was not available for this cruise, one being repaired and the other in use. Still photographs were taken of some fish during tagging and release, but these are much less useful than video for estimating fish size. Length, weight, and truss measurements were collected from 10 blue marlin and 6 striped marlin that were dead when recovered. Photographs, rather than videos of these fish will be provided for use in John Lucy's VIMS study.

E. Tether live, vigorous blue marlin or yellowfin tuna to test method of recovering tethered fish for sonic tracking after the longline operation is completed. Conduct sonic tracking experiments if tethering works for fish much larger than any tracked before (e.g., >70 kg yellowfin tuna).

1. Seven tuna that were recovered alive on the longline were tethered (2 yellowfin tuna of 50-100 lb size, 1 tuna that was either a yellowfin or a bigeye tuna (identification uncertain), and 4 bigeye tuna of 40-130 lb size). Hook timer data indicated that these fish had been captured 2-8 hr before the time they were tethered. A 200-m line was attached to the branch line, followed by a radio beacon and/or strobe light and/or radar reflector, and the tethered fish were left behind while haulback was completed. Five of the seven tethered fish (all but 2 bigeye) were brought back from their tethers alive up to 10 hr after their initial capture. One bigeye was dead and another came off the tether as it was retrieved (condition uncertain).

2. The tracking equipment was tested on deck and in the baitwell and twice in the sea using a transmitter attached to a buoy. The equipment generally functioned properly, until the time came to try tracking a tethered fish. Each time the system was tested before an intended tracking experiment, the hydrophones failed to send a usable signal. Two attempts at tracking failed for this reason. The problem seems to be in the connector between the hydrophone-bearing "wing" paravane and the receiver. This underwater connection is poorly designed to resist leaking under the buffeting given it while being towed. After the first failure drying the connection overnight and reconnecting it remedied the problem. However, this remedy was not successful when the drying time was reduced to a few minutes (isopropyl alcohol rinse) while a fish was held on the tether. Generally the paravane design is not good for use on the *Townsend Cromwell*. A pole-mounted hydrophone that could be rotated would be much better, and the design and implementation of such an arrangement is recommended.

F. Record measurements (fork length, morphometric measurements, organ and body weights) determine sex, and photograph dead fish.

1. Of the 384 fish caught, data on length, weight, sex (if possible) were recorded and samples were collected from 207 fish. The 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. 10 fish). Excellent

photographs were obtained of most of the species collected. The only morphometric measurements collected were the marlin truss measurements mentioned above (D.2.). Gonad weights of mahimahi and billfish were recorded.

G. Conduct study of shrinkage of morphometric measurements during storage in ice (yellowfin and bigeye tunas).

1. This objective was abandoned before the cruise, but after the final cruise instructions were written.

H. Collect biological samples from dead fish (heart tissue) for studies of population structure by Ed Heist and John Graves, VIMS.

1. Heart and muscle samples were collected from 23 elasmobranchs (4 oceanic white tip sharks, *Carcharhinus longimanus*; 2 Galapagos sharks, *C. galapgensis*; 2 silky sharks, *C. falciformis*; 7 blue sharks, *Prionace glauca*; 1 thresher shark, *Alopias superciliosus*; and 2 brown rays, *Dasyatis violacea*) for studies of populations structure by Ed Heist (VIMS). Similar samples were also collected from 54 teleosts (11 albacore, 9 bigeye tuna, 7 ono, *Acanthocybium solandri*, 10 blue marlin, 6 striped marlin, 7 shortbill spearfish, and 4 sailfish) for studies of populations structure by John Graves (VIMS). Mahimahi and billfish ovaries were preserved in formalin for Jimmy Uchiyama. Lancetfish, billfish, tuna, and brown ray stomachs were frozen for Robert Humphreys. Lenses (eyes) were collected from 14 species of teleost and frozen in ringers solution for Rich Brill.

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Attachments