



**U.S. DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
**NATIONAL MARINE FISHERIES SERVICE**  
Southwest Fisheries Center Honolulu Laboratory  
2570 Dole St. • Honolulu, Hawaii 96822-2396

March 15, 1990

CRUISE REPORT

VESSEL: *Townsend Cromwell*, cruise 90-01 (TC-149)

CRUISE

PERIOD: Leg I: January 10-25, 1990  
Leg II: January 30-February 15, 1990

AREA OF

OPERATION: Waters of the main Hawaiian Islands

TYPE OF

OPERATION: Personnel from the Southwest Fisheries Center (SWFC) Honolulu Laboratory (HL) conducted fishing operations for bigeye tuna, *Thunnus obesus*, using monofilament longline gear in conjunction with hook timers and time-depth-temperature recorders (TDR's). Physical oceanography was monitored through expendable bathy-thermograph (XBT), conductivity-temperature-depth (CTD) Niskin bottle casts, acoustic Doppler current profiler (ADCP) recordings, and echo sounder observations.

ITINERARY: Leg I

- January 10 - Embarked scientists Christofer H. Boggs, Randolph K. C. Chang, Heidi Dewar, Peter Fields, Apisai Sesawa, Robert A. Skillman, James H. Uchiyama, and Shigeru Yano. Departed Snug Harbor at 1500 and began transit to area near Jagger Seamount.
- 11-12 - Conducted repeated (2 days) longline operations (stations 1, 3) and CTD-Niskin bottle casts (stations 2, 4) near Jagger and Perret Seamounts (Fig. 1), 60 nmi west of Kailua-Kona, Hawaii. Began transit to area near Shepherd Seamount.
- 13-14 - Conducted repeated (2 days) longline operations (stations 5, 7) and CTD-Niskin bottle casts (stations 6, 8) west of Shepherd Seamount and 120 nmi southeast of Hawaii. Began transit southeast to latitude 14°N.
- 15 - In transit to latitude 14°N.



- 16-18 - Arrived at latitude 14°N. Conducted repeated (3 days) longline operations (stations 9, 11, 14) and CTD-Niskin bottle casts (stations 10, 12, 16) starting at 14°9'N, 150°48'W, moving west 30-40 nmi each night. Manta tows (stations 13, 15) were conducted 17-18 January.
- January 19 - In transit back to area near Shepherd Seamount. Conducted XBT drops every 30 minutes of latitude.
- 20 - Conducted longlining operations (station 17) west of Shepherd Seamount. Conducted CTD-Niskin bottle casts (station 18). Transited to Wood Seamount.
- 21 - Conducted longlining operations (station 19) over summit of Wood Seamount located 90 nmi south of Hawaii. Conducted CTD-Niskin cast (station 20) and three Manta tows (stations 21, 22, 23) at 90, 70, and 50 nmi from Ka Lae (South Point), Hawaii. Broke the Manta frame. Transited to area near Jagger and Perret Seamounts, 40-60 nmi west of Kona, Hawaii.
- 22-24 - Conducted repeated (3 days) longline operations (stations 24, 26, 28) and CTD-Niskin bottle casts (stations 25, 27, 29), all in the vicinity of Jagger and Perret Seamounts. Departed for Honolulu.
- 25 - Arrived at Snug Harbor, Pier 45, and disembarked Boggs, Chang, Dewar, Fields, Sesawa, Skillman, Uchiyama, and Yano to conclude Leg I, cruise 90-01 (TC-149).

ITINERARY: Leg II

- January 30 - Embarked scientists Christofer H. Boggs, Randolph K. C. Chang, Chris M. Hayashi, Russell Y. Ito, Thomas M. Moser, and James H. Uchiyama. Departed Snug Harbor at 1800 to area near Jagger and Perret Seamounts.
- 31 - Conducted longline operations (station 30) near Jagger and Perret Seamounts. Rough weather, high winds, and crosscurrent damaged gear. Transited into lee of Kona, Hawaii, to repair fishing gear.

- February 1 - Repaired gear in the lee at Kona, Hawaii. Transited to Shepherd Seamount area.
- 2-3 - Conducted repeated (2 days) longline operations (stations 31, 32) and CTD-Niskin bottle casts (stations 32, 34) starting 30 nmi west of the summit of Shepherd Seamount and directly over the summit on the following day. Began transit to 14°N (North Equatorial Current area).
- February 4 - In transit to 14°N (North Equatorial Current area).
- 5-6 - Conducted repeated (2 days) longline operations (stations 35, 37) and CTD-Niskin bottle casts (stations 36, 38), starting at 14°15'N, 150°39'W on 5 February, moving east 40 nmi overnight. Only two of the four planned sets were made because the brake on the hydraulic longline reel failed, forcing a repair attempt at sea.
- 7 - Repair attempt was unsuccessful; began transit to Kailua-Kona, Hawaii, for repairs. Conducted XBT drops every 30 minutes of latitude.
- 8 - In transit to Kailua-Kona.
- 9 - Anchored in Kailua-Kona at 1530. Disembarked Hayashi, because of seasickness. Repairs were completed by 1700. (Damage to brake was due to large quantities of seawater in the hydraulic system.) Began transit to area near Jagger and Perret Seamounts.
- 10-13 - Conducted repeated (4 days) longline operations (stations 39, 41, 43, 45) and CTD-Niskin bottle casts (stations 40, 42, 44), starting in the vicinity of Jagger and Perret Seamounts on the first day, moving 60 nmi west on the second day, and returning to the summit of an unnamed seamount between Jagger and Perret for the last 2 days. No CTD-Niskin bottle casts were made on 13 February. The fishing was very poor in all these sets, and all were characterized by current shear observed on the ADCP. Began transit to Brigham Seamount.

- 14 - Conducted longline operations (station 46) and CTD-Niskin bottle cast (station 47) over the summit of Brigham Seamount. No current shear was found, and the fishing was excellent. Began transit to Honolulu.
- 15 - Arrived Snug Harbor, Pier 45, and disembarked Boggs, Chang, Ito, Moser, and Uchiyama. End of Leg II and end of cruise.

MISSION  
AND

- RESULTS: 1. To ascertain what aspects of the interaction between longline fishing gear, currents, and the vertical stratification of the physical habitat affect the vulnerability of tunas and billfishes to longline fishing gear. To observe exactly when and where fish are caught by the gear, by using hook timers to determine when (in relation to gear motion, as well as absolute time) the fish bite, and by using TDR's to determine where the line is at each point in time.

On cruise TC-89-01, rubber bands were used to hold hook timer magnets in place, but they sometimes caused the magnets to bind and stick or sometimes they were too loose. As a consequence, some large fish were caught without setting off the hook timers; and many timers were retrieved with clocks running when no fish had been hooked. On cruise TC-90-01, we successfully overcame these problems: Thread with a measured breaking strength of 4-5 kg was used to bridge the loop in the dropper, and the magnets were held in place by a weaker thread that was not pulled at all until the bridging thread was broken. This worked very well. Timer clocks were always running when a large fish was caught. Fish smaller than 10 kg tended not to set off the timer clocks, but this was desirable because small fish sometimes become bait for larger fish. If a small fish had started a timer clock, a false reading could have resulted if a larger fish was caught on the same hook by striking the smaller fish.

A total of 22 longline sets were made during the cruise, one more than was originally planned. The extra sets were made possible by early starts on transits that were originally planned to take all day. Most sets were made with 400-600 hooks, and the gear was retrieved about 8-10 hours after setting. A total of 393 fishes were caught on the longline and 7 mahimahi were caught by the trolling gear, making a cruise total of 400 fishes including 44 bigeye tuna, *T. obesus*; 13 yellowfin tuna, *T. albacares*; 2 skipjack tuna, *Katsuwonus pelamis*; 37 striped marlin, *Tetrapturus audax*; 21 shortbill spearfish, *T. angustirostris*; 2 unidentified billfishes, Istiophoridae; 2 blue marlin, *Makaira mazara*; 2 broadbill swordfish, *Xiphias gladius*; 88 mahimahi, *Coryphaena hippurus*; 51 sharks (at least 5 spp.); 103 long-nosed lancetfish, *Alepisaurus*

*ferox*; 17 pomfrets, *Taractichthys steindachneri*, *Taractes rubescens*, and *Eumegistis illustris*; 7 brown rays, *Dasyatis violacea*; and 4 ribbonfish, *Trachipterus* sp.

The analysis of catch and hook timer data has just begun. All that can be said now is that the disparate condition of the catch noted by commercial fishermen--that is, fish either very fresh or long dead--is not due to fish striking while the gear is being set or retrieved. Very seldom did the hook timers show that a fish was caught while the gear was being set, although it was common for timers to indicate that *C. hippurus* was caught while the gear was being retrieved. Sometimes a tuna or a billfish was caught with a timer clock reading less than 1 hour, but most timers indicated that tuna and billfish were caught 2-8 hours before the gear was retrieved. Surprisingly, most of these fish were still alive, even those caught up to 6 hours before the gear was retrieved!

2. To use TDR's to measure how the fishing depth of hooks is affected by the deployment of the new monofilament longline fishing gear. To control fishing depth by using a line thrower to deploy the line faster than the speed of the vessel by a varying amount.

Problems were experienced in controlling the depth of the sets due to difficulty in estimating the ship's speed through the water and shear current documented on the ADCP, which operated successfully throughout the cruise. Shear current of more than 1 kn was noted frequently in the lee sides of the main Hawaiian Islands when over 100 nmi from land. However, in most situations, there was some correlation between the intended depth of the set and the outcome as recorded on TDR's.

The decision to repeat the sampling pattern of the first leg was due the lack of control of fishing depth, which necessitated the collection of more replicate data in each area.

3. To support growth rate validation studies in the eventuality that oxytetracycline-injected fish are recaptured.

The catch of live fish in excellent condition provided many opportunities for tagging. A total of 52 fishes were tagged and released, including 29 billfishes, 21 tunas, 1 *Carcharhinus longimanus*, and 1 *Coryphaena hippurus*. Injections of oxytetracycline were given to 28 billfishes. Tagging and injection were performed from the deck of the ship without removing the fish from the water, by using long poles to hold the syringes and tags. Live mahimahi (total of six) were returned to the HL's Kewalo Research Facility and used for metabolic rate experiments (the first ever conducted on mahimahi).

SCIENTIFIC  
PERSONNEL:

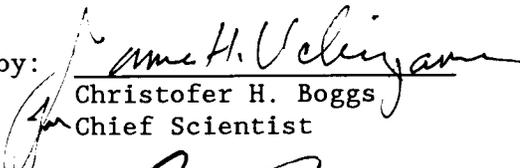
Leg I: (10-25 January 1990)

Christofer H. Boggs, Chief Scientist, NMFS, SWFC, HL  
 Randolph K. C. Chang, Fishery Biologist, NMFS, SWFC, HL  
 Heidi Dewar, Graduate Student, Scripps Institution of  
 Oceanography (SIO)  
 Peter Fields, Graduate Student, SIO  
 Apisai Sesawa, Fishery Biologist, Fiji Fisheries Division  
 Robert A. Skillman, Fishery Biologist, NMFS, SWFC, HL  
 James H. Uchiyama, Fishery Biologist, NMFS, SWFC, HL  
 Shigeru Yano, Research Lab Mechanic, NMFS, SWFC, HL

Leg II: (30 January-15 February 1990)

Christofer H. Boggs, Chief Scientist, NMFS, SWFC, HL  
 Randolph K. C. Chang, Fishery Biologist, NMFS, SWFC, HL  
 Chris M. Hayashi, High School Senior and NMFS Volunteer  
 Russell Y. Ito, Research Assistant, NMFS, SWFC, HL  
 Thomas M. Moser, Research Assistant, NMFS, SWFC, HL  
 James H. Uchiyama, Fishery Biologist, NMFS, SWFC, HL

Submitted by:

  
 Christofer H. Boggs  
 Chief Scientist

Approved by:

  
 George W. Boehlert  
 Director, Honolulu Laboratory

Attachment

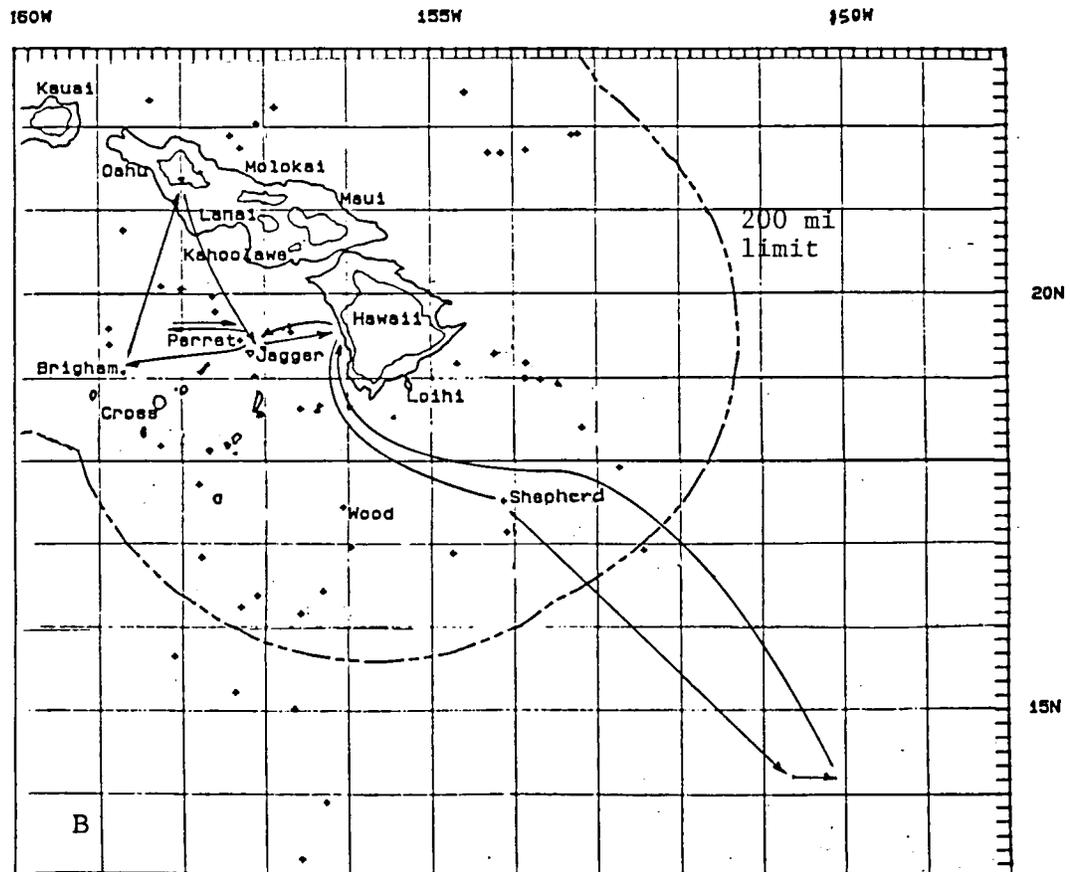
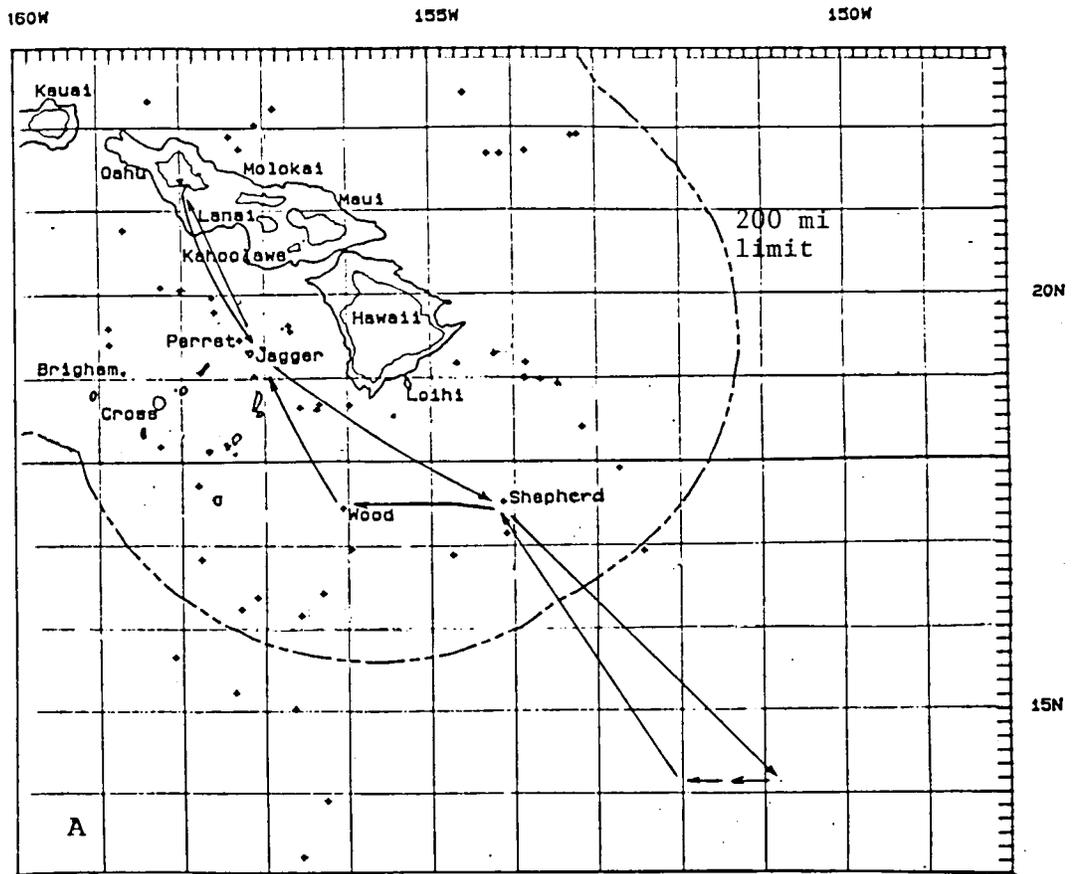


Figure 1.--Track of Townsend Cromwell cruise 90-01 (TC-149). A. Leg I, January 10-25, 1990. B. Leg II, January 30-February 15, 1990. The 1,000 fathom contour is shown along with seamounts >2,000 fathoms deep (crosses).