

November 14, 1994 F/SWC2:JHU:FLF  
CR9410-1.JHU

## CRUISE REPORT

**VESSEL:** *Townsend Cromwell*, Cruise 94-10 (TC-196) (Fig. 1)

**CRUISE PERIOD:** 3-28 October 1994

**AREA OF OPERATION:** Along long. 165°W from 14°N to the equator in waters of the North Equatorial Current (NEC), the North Equatorial Counter Current (NECC), and the South Equatorial Current (SEC).

**TYPE OF OPERATION:** As part of the ongoing investigation of the life history and distribution of swordfish, *Xiphias gladius*, in the central North Pacific, the habitat of subadult swordfish was investigated in the swordfish spawning and nursery grounds, which apparently occur south of Hawaii. Specimens were collected to support mtDNA genetic, age and growth, and other ongoing biological studies. Fishing operations were conducted with monofilament longline gear deployed at dusk and retrieved at dawn or earlier, but bait and gear modifications were employed to target small, subadult swordfish. Acoustic Doppler current profiler (ADCP) transects, CTD casts, satellite imagery, and data on depth of the longline from time-depth recorders (TDRs) were collected to describe the habitat of young swordfish.

### ITINERARY:

- 3 October - Embarked scientists, departed for offshore trial setting and hauling of the gear. Returned to Honolulu Harbor Pier 40 to repair the motor on the spooler.
- 4 October - Departed for deep water outside of harbor to wait out the tsunami alert. Returned to Snug Harbor to reinstall the repaired motor. Departed at 1700

and traveled to operating area, deploying drifter buoys along the way.

- 7 October - Began CTD transect with cast made every 30' latitude between 14°N and the equator along long. 165°W. Longline stations and night-light stations were occupied every degree between 12°N and the equator.
- 21 October - After completion of the longline station, the vessel set course for Honolulu.
- 23 October - Conducted a longline station in the transition zone between the NECC and the SEC. Visited Palmyra Atoll in the afternoon before continuing on to Honolulu.
- 28 October - Arrived at Snug Harbor, Honolulu. End of cruise. Scientists disembarked.

#### **MISSIONS AND RESULTS:**

- A. Conduct longline sets within apparent spawning-nursery grounds and in association with selected oceanographic features (e.g., edges of currents) and water masses.
  - 1. The longline was set 13 times with about 400 hooks at every degree latitude from 12°N to the equator. Three sets were made in the NEC, 5 in the NECC, and 5 in the SEC. Subadult swordfish were caught in all three water masses, but were not caught at the northern and southern transition zones of the NECC. The smallest swordfish were caught at 1°N where the catch was greatest (Table 1). The smallest swordfish was 47 cm eye-fork length and appeared to have recently metamorphosed to adult-like form from the large-scale postlarval stage.
  - 2. A set was made at 5°34'N, 20 nmi from Palmyra Atoll to see if island effects would increase the catch rate of swordfish in the NECC. No swordfish were caught here as the set may have been made in the southern transition zone of the NECC.
- B. Collect environmental data in association with the swordfish longline operations: temperature and salinity depth profiles (CTD casts), surface temperature and salinity (thermosalinograph), and satellite imagery as well as the occurrence of currents (plots of longline drift, ADCP).
  - 1. Temperature-salinity-oxygen-depth profiles were obtained from 300 m CTD casts made every 30' latitude

between 14°N and the equator. A CTD cast was also made after the longline was set at 5°34'N.

2. Sea surface temperature and salinity data were collected by the TSG throughout the cruise.
  3. The ADCP data were recorded throughout the cruise.
  4. Plots of ship's track during the setting and retrieval of the longline were prepared for all sets.
- C. Collect fish catch and effort data for the longline fishing operation.
1. Fishing effort for all sets was about 400 hooks. However, data will have to be reexamined for effective effort. It seems that the bait was often consumed by nontarget species, and we may have been frequently fishing with bare hooks. Near Palmyra, the longline was retrieved about 2 h after setting. Much of the saury bait was gone at retrieval. The catch has been summarized in Table 1.
- D. Collect biological samples from swordfish (tissues appropriate for mtDNA analysis, otoliths, dorsal and anal fins, gonads (of mature sized swordfish), and stomach contents).
1. Muscle tissue samples for mtDNA analysis were collected from 57 swordfish for Dr. Barbara Block of Hopkins Marine Station and Dr. Seinen Chow of the Far Seas Laboratory. Five samples were collected from the NECC, 8 from the NEC, and 44 from the SEC.
  2. Skulls containing otoliths, dorsal and anal fins, and gonads were collected from 48 swordfish for life history studies at the Honolulu Laboratory.
  3. All stomach contents from swordfish, sharks, tunas, wahoo, and the alepisauris were examined and sorted. All items were identified at sea.
- E. Take and record biological measurements and determinations (fork length, various morphometric measures, tissue weights, somatic weight, fin ray counts, sex) from longline-caught swordfish; fork or pre-caudal length of other fishes will be recorded.
1. Morphometric measurements were taken on 48 swordfish. Fin ray counts which ranged from 35 to 45 in the first dorsal fin and 11-12 in the first anal fin were made for 30 swordfish. Morphometric measurements were made

on 14 sharks (4 blue sharks, *Prionace glauca*; 4 pelagic white tip sharks, *Carcharhinus longimanus*; 4 silky sharks, *Carcharhinus falciformus*; 1 dusky, *Carcharhinus obscurus*; and 1 black tip, *Carcharhinus limbatus*).

Length and weight were measured on 122 fishes.

- F. Tether viable swordfish and attach a TDR to the hook dropper.
1. This mission was not conducted due to lack of both time and viable swordfish. At the longline set off Palmyra Atoll, the soak time was shortened by hauling in the longline about 2 h after the set. It was hoped that freshly hooked swordfish would be available and that a technique to handle live swordfish could be developed. However, no swordfish were caught at this station.
- G. Night-light for 1 h after the longline is set.
1. A night-light station was occupied after every longline station for at least 1 h except off Palmyra Atoll. At the longline station near Palmyra Atoll, the night-light was in the water during the CTD cast. Attraction to the light was best at 3-4°N where productivity appeared highest. Two tuna juveniles ca 3 cm long were caught with the dip net as were 2 Coryphaenid juveniles.
- H. Troll for surface predators.
1. Trolling was poor along the transect. Few bird flocks and fish schools were sighted. Three bigeye tuna, *Thunnus obesus*, and 2 wahoos, *Acanthocybium solandri* were caught on trolling lines. Their stomachs were examined for juvenile swordfish and other billfishes, but none were found.
- I. Tag, mark, and release viable swordfish and selected other pelagic species.
1. A swordfish and a Pacific blue marlin, *Makaira mazara*, were injected with oxytetracycline, tagged and released. Also tagged and released were 4 bigeye tuna, and a yellowfin tuna, *T. albacares*.
  2. A problem tagging large bigeye tuna in the NECC occurred when their hearts appeared to burst at the surface. First, a little puff of blood would appear from behind the operculum; then a few seconds later, a large cloud of blood came out. Dissection revealed that the ventricle (of their hearts) had burst open.

- J. Conduct 3 vertical plankton tows from 150 m depth from the three water masses to be surveyed.
1. Vertical plankton tows from 150 m depth were collected in the NEC and the NECC for Dr. Marcia Gowing of the University of California at Santa Cruz. Depth of net and water temperature were documented by a TDR attached to the net. The net and a TDR were lost making the third haul in the SEC.
- K. Miscellaneous observations and activities.
1. Ten drifter buoys were deployed every 15' latitude between 20°14.999'N 158°55.569'W and 17°59.995'N 161°09.030'W for Dr. Pierre Flament of the University of Hawaii, Manoa.
  2. An olive ridley, *Lepidochelys olivacea*, was caught on a fish hook (8/0 Mustad) at 2°N 165°W. The fish hook was removed from the throat. Then, the turtle was measured, weighed, tagged, and released. A second olive ridley was sighted swimming near the longline at 0°165°W. It was about the same size as the one caught on the longline. George Balazs verified the species from photographs.
  3. At a night-light station (2300, October 13) in the NECC (7°N 164° 38.6'W), a green turtle, *Chelonia mydas*, was attracted to the ship. According to Unai Marcaida who had the best view, the turtle had tumors on the fore flippers and on its head near the eyes.
  4. A brown stingray, *Dasyatis violacea*, captured in the SEC, gave birth on deck.
  5. Two pelagic white tip sharks, and 3 silky sharks, were brought back live from the SEC for the Waikiki Aquarium. Hooks were left in the mouths of these sharks. During the 10 days of transit, only one hook came off.
  6. Heart muscle tissues from 18 bigeye tuna, 2 swordfish, 3 yellowfin tuna, a skipjack tuna, *Katsuwonus pelamis*, and possibly a hybrid bigeye-yellowfin tuna were collected for John Graves of the Virginia Institute of Marine Science.

**SCIENTIFIC  
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Attachments

Table 1. Longline catch along longitude 165°W on TC-94-10.

Species	Latitude (Degrees)													
	12	11	10	9	8	7	6	5.5	5	4	3	2	1	0
<i>Thunnus albacares</i>		1	1			1	1	4						
<i>T. obesus</i>	1		1		1	6	3	1	3				2	2
<i>Makaira mazara</i>						1								
<i>Xiphius gladius</i>	3	6			3	2	1			2	2	7	25	14
<i>Elagatis bipinnulata</i>						2								
<i>Sphyræna baracuda</i>												1		
<i>Alepisauris ferox</i>	1	1	1	1			1						2	
<i>Carcharinus falciformis</i>						1		11	3	2		3	3	5
<i>C. longimanus</i>	5		8	4	2	2	2	2	1	0	5	6	6	4
<i>C. melanopterus</i>									1					
<i>C. obscurus</i>	1						1		2		2	1		
<i>C. sp.</i>	1	2												
<i>Isurus oxyrinchus</i>				1										
<i>Prionace glauca</i>	5	7	5	1	1	3								
<i>Dasyatus violacea</i>						2	2		1	2	4	2	5	6

Note: Catch includes parts of fish such as heads, shark eaten carcasses, and a couple of fish which came off the hook but should have been landed.