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CRUISE REPORT

VESSEL: *Townsend Cromwell*, Cruise TC-97-03 (TC-218)

CRUISE PERIOD: March 20-April 18, 1997

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 conductivity-temperature depth (CTD) casts, thermosalinograph (TSG), and acoustic Doppler current profile (ADCP) transects.

ITINERARY:

- 20 March - Embarked scientists, departed Snug Harbor and proceeded to the first fishing station about 580 nmi northeast of Oahu.
- 21 March - 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, reterminated the connection to the CTD, and calibrated TDRs.
- 22-23 March - Initiated series of CTD casts at intervals of 15' working north beginning at lat. 26°N, long. 156°W.
- 24 March - Terminated CTD casts at lat. 30°15'N, long. 156°W, and set and retrieved longline gear.

- 25 March-5 April - Followed a routine of two 150-hook longline sets each day. The first set was at 0300 and haulback was at 0800. The second set was either before or after dusk, followed by a CTD cast, and the set retrieved after soaking for 5 hours.
- 6-7 April - Retrieved previous evening 150-hook set, and completed 0300 set. Began a series of CTD casts every 15' from lat. 29°45'N to 26°N at long. 152°W.
- 8-9 April - Continued transit to Kailua-Kona.
- 10 April - Arrived Kailua-Kona, disembarked P. Shiota and delivered specimens to Keahole airport for air shipment.
- 11 April - Disembarked C. Demarke, embarked R. Humphreys and departed for South Point off the Kona coast.
- 12-13 April - Conducted simultaneous night light stations at 60- and 200-meter depths from moonset to dawn. Deployed 1-hour Isaacs Kidd midwater trawl (IKMT) or Neuston trawl at the surface from sunrise through sunset.
- 14-16 April - Deployed IKMT at the surface from sunrise through sunset along the Kona coast.
- 17 April - Deployed IKMT in the lee of Lanai from sunrise through sunset. Proceed to Snug Harbor.
- 18 April - Arrived at Snug Harbor, 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. The experimental design will test the hypotheses that: (1) hooked periods conducted at night and of a shorter duration (measured with hook timers) will result in better viability than longer hooked periods or periods conducted during the day (deep diving and greater injuries from the shallow-set gear may occur during the day), (2) circle hooks reduce gut hooking and increase jaw hooking (and thus, viability) without reducing overall hooking rates, and (3) hooked periods at lower temperatures improve capture condition.

A total of 3,520 hooks were set over 24 longline fishing stations (Fig. 1). Three sets were initiated before sunset

to accommodate the birdpole line observations. All other hooks were either set in the evening and retrieved about 5 hours later or set at 0300 and retrieved at 0800. Hooks retrieved before sunrise numbered 1,712, and hooks retrieved during the day numbered 1,808. Of the 12 broadbill caught, only 2 were determined to be marginally strong enough to be tagged and released. Of the remaining fish, all were either dead or near dead and all 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. Four fish were identified to be caught with circle hooks and 8 with J-hooks. Both hooks seemed equally effective in catching fish, however, more damage to the gill arches and to the pericardial cavity was experienced with J-hooks. Fish caught earlier in the cruise were also more viable than those caught toward the end of the cruise due to the possible correlation of sea surface temperature warming from 16-21°C.

- B. To develop and test procedures to better retrieve and handle live swordfish for upcoming tracking and archival tagging experiments. Controlled and slower recovery speeds will be used to carefully lift the gear during recovery to reduce the dragging of fish through the water. Vigorous fish will be tethered with time-depth recorders to measure night versus day dive behavior of hooked fish that may be related to hooking mortality and to determine the utility of this method of holding fish until the haulback is complete (for use in future tracking work).

A lack of strong vigorous fish and a higher priority to collect fresh fish samples prevented the implementation of tagging experiments.

- C. To test the hypothesis that swordfish catchability is increased in the vicinity of surface thermal fronts visible in satellite imagery or TSG transects, and that these surface fronts are associated with subsurface features. Environmental data in and between the area of fishing stations will be collected by 500m CTD casts with fluorometer, dissolved oxygen meter, Niskin bottle samples for calibration, TSG, CoastWatch satellite imagery, and ADCP. Data on swordfish catch rates by the *Townsend Cromwell* will be amplified later by using commercial fishery data, which should be highly active in the area of the cruise.

Although inconclusive, thermal fronts did not seem to affect the availability of broadbill swordfish.

- D. To tag and mark swordfish and other viable fish for movement studies.

Fifteen blue shark (*Prionace glauca*) were tagged and released.

- E. Collect fish catch, effort, depth, and time of capture data for the longline fishing operation using hook timers and time-depth recorders to test the hypothesis that efficiency of the fishing gear depends on the depth at which it is deployed in relation to both the depth of the thermocline and the time of capture.

Hook timers, time-depth recorders, and CTD casts were made in conjunction with each of the 24 longline sets. The times of retrieval and hook timers were recorded on the longline retrieval log.

- F. Collect biological samples appropriate for mtDNA analysis, stock heterogeneity studies, growth rate estimation, diet studies, sex and fecundity determinations. A special effort will be made to collect swordfish eye muscle for electron microscopy and vascular corrosion casting, and to collect serum and plasma samples for monoclonal antibody development.

The fork length, weight and sex was collected from 12 broadbill swordfish, 3 blue shark, 16 mahimahi (*Coryphaena hippurus*), 15 longnose lancetfish (*Alepisaurus ferox*), 1 albacore tuna (*Thunnus alalunga*), and 1 snake mackerel (*Gempylus serpens*).

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.

Of 12 broadbill swordfish sampled, plasma samples were collected from 9 fish, and eyes were collected for eye muscle and heater tissue from 4 fish.

Collected 11 broadbill swordfish bills and muscle samples to compare isotope ratios from different areas.

Collected 16 mahimahi (*Coryphaena hippurus*) DNA samples for population studies.

- G. Collect and record biological measurements and determinations (fork length, fin ray counts, sex, etc.).

In addition, extensive morphometric data were collected from 3 blue sharks on the Pelagic Shark Biological Form and from 12 broadbill swordfish for the Life History Program.

- H. Collect larval and juvenile swordfish and preserve samples for age and growth studies. High speed Neuston trawls or 1-meter plankton tows will be conducted during the day. Night light stations will be carried out simultaneously at 35m and 250m depths.

A total of 46 Isaacs Kidd midwater trawls (IKMT) and 3 neuston trawls collected 30 broadbill swordfish larvae and 6 unidentified billfish larvae.

- I. Test the viability and effectiveness of awa (*Chanos chanos*) as live bait for swordfish longline fishing, and develop handling and carrying procedures for the bait while at sea.

A total of 8 longline sets included 50 live awa. The bait was moved from the forward baitwells to the stern just prior to setting operations. The transfer was accomplished with a minimum of effort and time. The live bait caught as much as the traditional bait. Preliminary results indicate a potential exists and the work should be replicated.

- J. Test the effectiveness of bird pole line for reducing the bird bycatch during longline fishing.

The bird pole line is a device designed to keep birds away from the stern of the ship and dissuade birds from preying on baited hooks. A line with suspended streamers extended about 20 meters past the the stern. A paucity of birds and an absence of any observed bird interactions with the longline gear, when the bird pole line was tested, prevented any conclusions regarding effectiveness of the bird pole.

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Attachments

**File Contains Data for
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Table 1 TC97-03 Catch results by longline set

Set	Hooks	Species	Tag	Release	Sample	Total
1	102	blue shark (<i>Prionace glauca</i>) Totals	2 2			2 2
2	152	blue shark mahimahi (<i>Coryphaena hippurus</i>) Totals	3 3	1 1	1 1	4 5
3	143	blue shark broadbill swordfish (<i>Xiphias gladius</i>) Totals	1 1		1 1	1 2
4	144	blue shark mahimahi Totals		1 1	1 2	2 3
5	144	blue shark broadbill swordfish Totals		1 1	1 1	1 2
6	158	blue shark broadbill swordfish longsnout lancetfish (<i>Alepisaurus ferox</i>) albacore tuna (<i>Thunnus alalunga</i>) Totals		2 2	1 1 1 3	2 1 1 5
7	154	broadbill swordfish Totals			2 2	2 2
8	153	broadbill swordfish longsnout lancetfish Totals			1 3 4	1 3 4
9	146	blue shark broadbill swordfish snake mackerel (<i>Gempylus serpens</i>) Totals	3 3	2 2	2 1 3	5 2 1 8
10	143	blue shark mahimahi longsnout lancetfish Totals	1 1	1 2	2 1 3	2 2 2 6
11	142	Totals				
12	141	broadbill swordfish Totals			1 1	1 1
13	142	Totals				
14	144	blue shark mahimahi longsnout lancetfish Totals		1 1 2	1 1 2	1 2 1 1.4
15	142	blue shark broadbill swordfish Totals			1 1 2	1 1 2
1 6	143	blue shark longsnout lancetfish Totals	2 2		2 2	2 2 4

Table 1 TC97-03 Catch results by longline set

Set	Hooks	Species	Tag	Release	Sample	Total
1 7	172	Totals				
1 8	143	Totals				
1 9	144	broadbill swordfish mahimahi Totals			1 1 2	1 1 2
2 0	175	mahimahi longsnout lancetfish Totals			3 2 5	3 2 5
2 1	138	Totals				
2 2	169	blue shark mahimahi longsnout lancetfish Totals	1 1	2 2	5 5 10	7 5 13
23	143	blue shark Totals	1 1			1 1
24	143	blue shark broadbill swordfish mahimahi Totals	1 1		1 3 4	1 3 5
		blue shark broadbill swordfish mahimahi longsnout lancetfish albacore tuna snake mackerel	15	8 4 1	3 12 16 15 1 1	26 12 20 16 1 1
	350 7	TOTAL FISH	15	13	48	76