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CRUISE REPORT

VESSEL: *Townsend Cromwell*, Cruise 92-01 (TC-169).

CRUISE PERIOD: 18 February - 9 March 1992

AREA OF OPERATION: Palmyra Atoll and surrounding waters (Fig. 1).

TYPE OF OPERATION: Personnel from the NMFS Honolulu Laboratory Fisheries Oceanography Research Program conducted biological and oceanographic sampling in waters surrounding Palmyra Atoll to assess the distribution of larval and juvenile fishes relative to the ocean environment.

ITINERARY

- February 18 - Start of cruise. On board George W. Boehlert, Bruce C. Mundy, Christopher D. Wilson, Ronald K. Yoshimoto, Christine E. Thacker, Bill Watson, Andy Yuen, Beth Flint, Derral Herbst, Ken McDermond, and Dave Woodside. Departed Snug Harbor at 0900, after MOCNESS flowmeter calibrations in Honolulu Harbor, began transit to lat. 10°N, long. 163°W.
- February 21 - Arrived at lat. 10°N, long. 163°W. Conducted ADCP, XBT, and CTD survey along long. 163°W to identify the latitudinal position of the North Equatorial Countercurrent.
- February 23 - Completed transect, arrived at Palmyra Atoll. Disembarked Yuen, Flint, Herbst, McDermond, and Woodside with field camp equipment. Commenced biological sampling and oceanographic observations.
- March 3 - Anchored outside Palmyra Lagoon. Conducted limited sampling and embarked Flint, Yuen, Herbst, McDermond, Woodside, and Ainsley Fullard-Leo.

- March 4 - Departed anchorage and conducted bongo and manta net sampling along the north shore of Palmyra. Departed later that afternoon from vicinity of Palmyra. Passed by Kingman Reef for visual inspection of the emergent land.
- March 8 - Arrived Kaunakakai Harbor, Molokai, and embarked Steve Coven, port engineer, to monitor engine room equipment in operation. Transited across Penguin Banks for ADCP calibration runs. Arrived at Snug Harbor and disembarked Boehlert, Mundy, Wilson, Yoshimoto, Thacker, Watson, Flint, Yuen, McDermond, Herbst, Woodside, and Fullard-Leo.
- March 9 - Embarked Boehlert and Mundy and ran calibration of MOCNESS flowmeter in Honolulu Harbor. Returned to Snug Harbor. Disembarked Boehlert and Mundy. End of cruise.

MISSION AND RESULTS

- A. Collect early life history stages of island-related fishes in the waters surrounding Palmyra Atoll to determine the distributional patterns relative to ocean currents, current-topography interactions, distance from the island, and vertical structure of the water column.

Three types of plankton sampling were designed to be comparable to samples and results from TC90-07. Night plankton tows using MOCNESS and MANTA gears sampled stations geographically placed around the island. Three depth intervals were routinely sampled, as follows, from deepest to shallowest: From the 22°C isotherm (approx. 100 m) to 60 m (taking in the bottom of the mixed layer); 60-30 m; and 30-0 m. An additional sample from 130-100 m (or to the 22°C isotherm) was taken at selected stations as time allowed. Each night of MOCNESS/MANTA sampling consisted of three (or optionally four) stations. Six samples were typically taken with each deployment of the MOCNESS. One 24 min deployment of the MANTA neuston net was made during each MOCNESS cast; all deck lights were turned off during the MANTA deployment. This resulted in 173 MOCNESS samples and 29 Manta net samples. A problem was encountered in the function of the conductivity sensor on the MOCNESS. Although it worked on a test deployment south of Oahu, in the warmer waters around Palmyra it registered very low salinities until reaching temperatures below 25°C, where the conductivity sensor worked again. This same problem existed with a backup sensor from the CTD, placed on the MOCNESS instrumentation. The problem was not solved by replacement of all the circuit boards in the MOCNESS underwater unit.

A nearshore daytime series of plankton hauls similar to that taken on TC 90-07 was also taken. These hauls were designed to follow the 100 m isobath of the island. Weather and sea conditions precluded deployment of the MOCNESS on the north side of the island, but three tows were made along the south side of the island and a single net of one MOCNESS deployment sampled along the western edge, but in 500 m of water. These hauls resulted in 23 0-50 m samples and three Manta net neuston samples. To sample along the northern shore, 60 cm bongo nets were deployed continuously from the stern of the *Townsend Cromwell*, sampling from 0-50 m. An additional 15 bongo samples (samples from both cod ends were combined at each station) and 4 Manta neuston hauls were conducted.

During the time planned for sampling with the MOCNESS on the north shore of the island, an additional four MOCNESS deployments were made to determine the relationship of larval abundance to water column stratification. Given the very distinct thermocline around Palmyra, the following strata were fished, based largely on isotherm depths:

15-20°C thermocline
20-23°C thermocline
23-26°C thermocline
26°C plus 15 meters up from that isotherm depth into the mixed layer.

Twelve minute hauls were made. In the 15-20°, 20-23°, and 26°+ strata, the net was fished by slowly moving the net up and down during the cast until encountering the thermal limits. The 23-26° band was vertically so narrow that it was difficult to maintain the net within these isotherms and the net was simply positioned to stay within the zone. Eight samples were taken in each of three shallowest strata and four in the deepest.

A series of dropnet samples was planned during anchorage of the *Townsend Cromwell* in Palmyra Lagoon late in the cruise. Because of wind and ocean conditions, we were unable to enter the lagoon and instead anchored outside during embarkation of the USFWS field party. Consequently, less time was available for this work. The scientific party used the ship's Boston Whaler to sample larval fishes. Ten dropnet samples were taken between 2000 and 2400 hrs. A towed 40 cm ringnet and light traps were deployed later.

Midwater trawling was conducted to target discrete scattering layers as well as for distributional studies

of fishes. Three Cobb trawls were made in daylight hours and three IKMT hauls were made, one at night, one at dawn, and one in the early evening.

- B. Collect oceanographic data to determine the current patterns and vertical structure of the water column for the evaluation of distribution of fish larvae and juveniles.

An oceanographic transect was conducted as the first operation of the cruise along 163°W using CTD, XBT, and ADCP instrumentation. This transect was from 10°N to 4.5°N. CTD stations were conducted at 10°, 9°, 8°, 7°, 6°, 5°, and 4.5°N. Additionally, 11 XBT (T-7) drops were made at 20' intervals (40', 20') between CTD stations. The objective of this transect was to define the main axis of the north equatorial countercurrent at the latitude of Palmyra.

The ADCP was kept running virtually at all times to collect current velocity data as a function of depth. Vector plots of absolute current velocities, based on the ADCP, were generated in near real-time throughout the cruise. There was also a synoptic hydrographic survey on 1-2 March, during which 12 CTD and 9 XBTs were cast.

- C. To collect larval and juvenile stages of tunas to determine the abundance as a function of distance from the island.

Analysis of the samples described above under objective A will determine the success of this objective.

- D. Evaluate the effects of sound scattering layer behavior near topography on the performance of the ADCP.

Acoustic surveys near Palmyra Island were conducted to determine if a relatively dense sound scattering layer (SSL) was present near the island. (On TC 90-07 a dense SSL was present from about 100-130 m depths within 5 km of the 100 m isobath for several hours after sunrise.) Animals that compose the SSL may maintain position with respect to the island and thus bias ADCP estimates of velocity.

Five deployments of an S4 current meter were made in areas of notable scattering. The ship maintained position over the SSL (and with respect to the island) while the current meter and a 410 lb. weight were lowered on the oceanographic winch cable through the SSL. The

current meter was held at particular depths for 5-15 min during each profile. One depth was above the SSL, two depths were within the SSL, and another was below the SSL.

Acoustic data were collected concurrently from the ADCP as well as the 38 kHz SIMRAD echosounder during acoustic surveys to locate dense SSLs, as well as during current meter profiling. The current meter was detected acoustically (i.e., 38 kHz) during the casts, making positioning of the meter at particular depths easier. Scattering layers were documented both with the SIMRAD paper trace and with photographs of the SRC chromoscope.

E. General observations and miscellaneous activities.

1. Bird flock, fish school, and marine mammal sightings were recorded by the ship's officers and crew during daylight hours when possible.

2. Standard weather observations were made at 0000, 0600, 1200, and 1800 (GMT) during transit.

3. A field party of U.S. Fish and Wildlife Service staff were disembarked to conduct ecological surveys on the several islands comprising Palmyra. Their efforts will result in a report useful for consideration of future development activities at that island.

SCIENTIFIC PERSONNEL

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Attachment