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CRUISE REPORT

VESSEL: *Townsend Cromwell*, Cruise 97-04 (TC-219)

CRUISE PERIOD: 25 April to 19 May 1997

AREA OF OPERATION: Waters north of the Hawaiian Archipelago in the vicinity of the Subtropical Front (Fig. 1)

TYPE OF OPERATION: Personnel from the Southwest Fisheries Science Center (SWFSC) Honolulu Laboratory (HL) conducted a series of conductivity-temperature-depth (CTD) casts and 2m² ring net and Isaacs-Kidd midwater trawl (IKMT) tows along transects collecting data to support ongoing studies characterizing the physical and biological oceanographic properties associated with the Subtropical Front. The station sites on each transect line were spaced 15 nmi apart. Estimates of in situ ocean currents' direction and velocities were also obtained along the cruise track with a shipboard acoustic Doppler current profiler (ADCP). Underway measurements of sea surface temperature and salinity with a hull-mounted thermosalinograph (TSG) were also used to help conduct the near real time synoptic assessment of the oceanography. Fishing operations with an experimental squid driftline and video camera with nightlight were conducted to continue evaluating the potential of the technologies as future resource assessment tools.

ITINERARY:

25 April - Departed Snug Harbor, Honolulu, at 1800. On board Colleen Allen, Bruce C. Mundy, James Palmer, Michael P. Seki, Daneka Spencer, Greg Spencer, and Happy A. Williams.

- 27 April - Arrived Tern Island, French Frigate Shoals. Unloaded 2 55-gal drums of gasoline for Protected Species Investigation field operations. Conducted seas trials of the CTD and 2m² ring net gears and calibrated the time-depth-recorders (TDR) in waters to the lee of French Frigate Shoals. Proceeded towards first scheduled oceanographic sampling site at 26°N latitude, 172°W longitude.
- 29 April - Arrived at lat. 26°N, long. 172°W. Commenced conducting a series of 500 m CTD casts spaced 15 nmi apart (0.25° longitude) and continued northward along the 172°W meridian to 34°N latitude. The 172°W hydrographic transect replicates the spatial and temporal sampling conducted on the companion cruise conducted in 1996.
- 4 May - Arrived at lat. 34°N, long. 172°W completing the hydrographic section. Commenced fishing operations at selected stations adjacent to oceanographic frontal features along the 172°W longitude identified by the hydrographic section. Sampling protocols included oblique 2m² ring net tows and 1.8 m (6 ft) IKMT tows targeting 200 m and experimental squid driftline sets.
- 9 May - Arrived at lat. 29°N, long. 172°W. Commenced 24-h CTD time series at 1.5 h temporal resolution.
- 10 May - Completed the 24-h time series and began second transect consisting of a series of 500 m CTD casts spaced 15 nmi apart transiting eastward along the 29°N latitude to the 167°30'W meridian. Squidlines were fished at locations occupied at 2000 each night.
- 12 May - Completed the 29°N trackline with the station at 167°30'W. Began sampling on third hydrographic section running south along the 167°30'W meridian to 24°N latitude. CTD and squidline operations as above for second transect.
- 14 May - Completed 167°30'W longitude sampling with the operations at the 24°N latitude station; proceeded to starting site of fourth transect line at 23°14'N lat., 160°15'W long.

- 17 May - Arrived at lat. 23°14'N, long. 160°15'W and resumed operations on transect across Kauai Channel with 500 m CTD casts conducted every 15 nmi.
- 18 May - Completed sampling at the last scheduled station at 21°32'N lat., 158°39.5'W long; proceeded for Snug Harbor.
- 24 May - Arrived Snug Harbor, Honolulu. Disembarked Allen, Mundy, Palmer, Seki, D. Spencer, G. Spencer and Williams. End of cruise.

MISSIONS AND RESULTS:

- A. Describe the oceanographic features characterizing the Subtropical Frontal region through routine CTD and XBT casts and continuous ADCP and TSG measurements.

A total of 99 CTD casts with a SBE 9/11+ CTD system were conducted along four sampling transects over the duration of the cruise. These data together with continuous observations obtained from the ship-mounted ADCP and TSG were used to characterize hydrographic conditions associated with the Subtropical Front and with other mesoscale oceanographic features in the vicinity identified through remotely sensed sea level height data from the altimeter aboard the TOPEX/Poseidon satellite. Uplifting (and depression) of isotherms, isohalines and isopycnals responding to the divergent (and convergent) dynamics associated with frontal regions at these features are illustrated in the vertical sections of the sampled parameters along the tracklines (e.g., Fig. 2).

- B. Assess the influence of the physical dynamics associated with the frontal region on biological productivity through CTD-mounted fluorometer measurements, discrete depth water collections with Niskin bottles on a rosette sampler, and zooplankton and micronekton collections at selected sampling sites.

In vivo chlorophyll determinations were made with CTD mounted fluorometer measurements at all 99 CTD stations. In addition, discrete depth-filtered chlorophyll and unfiltered nutrient determinations were acquired at the 15 nmi resolution for sampling on the 172°W transect (33 stations) and at 1.5-h resolution for the 24-h time series conducted at 29°N lat., 172°W long. For the 167°30' W transect and Kauai Channel transect sampling, only nutrients were collected at 30 nmi resolution (30 stations). For discrete depth chlorophyll analysis, 1-L of seawater acquired from 200 m, 150 m, 125 m, 100 m, 80 m, 65 m, 50 m, 35 m, 20 m, and at the surface were vacuum filtered through 47 mm

diameter, 0.7 μm glass fiber filters. Water samples (120 ml) for nutrients (nitrate + nitrite, orthophosphate and silicate) determinations were collected at 500 m, 400 m, 300 m, 200 m, 150 m, 125 m, 100 m, 80 m, 50 m, 35 m and at the surface; all samples were frozen and returned to the Lab for analysis.

Preliminary analysis indicate increased phytoplankton biomass primarily in the regions of the deep chlorophyll maximum at convergences adjacent to upwelling (e.g., Fig. 2d). Observed patterns are consistent with that expected with input of nutrients into the euphotic surface waters with upwelled water and the subsequent advection and accumulation of phytoplankton at adjacent frontal convergences.

Zooplankton collections included oblique tows through the water column with a 2m² ring net (505 μm Nitex mesh); micronekton sampling employed a 1.8 m (6 ft) IKMT also towed in an oblique fashion targeting a maximum depth of 200 m. A total of 22 2m² ring net tows and 20 IKMTs were made, all conducted in the vicinity of the Subtropical Front. Each deployment was equipped with a Wildlife Computers time-depth-recorder (TDR) to help determine actual depths fished.

- C. Conduct trial deployments of the experimental squid driftline and video camera deployment with nightlights and evaluate the potential of the gear as an instrument for future resource assessment.

Ten deployments of the experimental squid driftline were made each with about 40 droppers (jigs) set per deployment and each accompanied by the simultaneous deployment of the nightlight video camera. A total of 6 *Ommastrephes bartramii*, including 2 females (49.0 and 55.0 cm dorsal mantle length (DML)) and 4 males (33.1 and 36.5 cm DML) were caught; all sexually mature.

**SCIENTIFIC
PERSONNEL:**

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