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CRUISE REPORT

VESSEL: *Townsend Cromwell*, Cruise 96-06 (TC-209)

CRUISE PERIOD: 4-24 May 1996

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 bongo net tows along meridional transect lines collecting data to support ongoing studies characterizing the physical and biological oceanographic properties associated with the Subtropical Front. The station sites on each meridional 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 were conducted to evaluate the potential of the technology as a future resource assessment tool.

ITINERARY:

- 4 May - Departed Snug Harbor, Honolulu, at 1800. On board Robert L. Humphreys, Jr., Donald R. Kobayashi, Bruce C. Mundy, Miguel Santos, Michael P. Seki, and Robert A. Skillman.
- 5 May - Enroute to first scheduled at latitude 26°N, longitude 172°W. Conducted seas trials of the CTD and bongo net gears and calibrated the time-depth-recorders (TDRs) in waters just north of Kauai.

- 8 May - Arrived at latitude 26°N, longitude 172°W. Commenced oceanographic and fishing operations and continued northward along the longitude 172°W meridian. Sampling protocols included 500 m CTD casts spaced 15 nmi apart (0.25° longitude), oblique bongo tows targeting 200 m at stations 30 nmi apart (0.5° longitude) and experimental squid driftline sets as time permitted.
- 12 May - Completed sampling along the 172°W longitude transect line at the 32°N latitude station and transited east to the first station on the 168°W line.
- 13 May - Arrived at latitude 32°N, longitude 168°W and resumed operations as above, heading southwards along the trackline.
- 16 May - Completed longitude 168°W sampling with the operations at the latitude 27°30'N station; proceeded towards the first station on the 164°W longitude sampling line.
- 17 May - Arrived at latitude 27°30'N, longitude 164°W and resumed operations heading north along the trackline. Oceanographic operations restricted to 500 m CTD casts conducted every 15 nmi.
- 19 May - Ended the longitude 164°W sampling at latitude 31°N and proceeded east towards the 160°W longitude meridian. Conducted one squid driftline at latitude 31°N, longitude 162°21'W.
- 20 May - Arrived at latitude 31°N, longitude 160°W and began running a course south along the 160°W longitude conducting expendable bathythermograph (XBT) casts every 15 nmi.
- 22 May - Arrived at latitude 26°N, longitude 160°W completing the oceanographic survey; proceeded for Snug Harbor.
- 24 May - Arrived Snug Harbor, Honolulu. Disembarked Humphreys, Kobayashi, Mundy, Santos, Seki, and Skillman. 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.

Sixty-one CTD (30 with the SBE 9/11+ CTD system, 31 with a SBE-19 SEACAT profiler) and 23 XBT (Sippican T-4) casts were conducted along the sampling grid over the duration of the cruise. These data together with continuous observations obtained from the ship-mounted ADCP and TSG were used to develop a synoptic characterization of the prevailing oceanographic conditions over the region bound to the north and south by the 32°N and 26°N parallels of latitude, respectively, and to the west and east by the 172°W and 160°W longitude meridians, respectively. The horizontal, composite assemblage of the sea-surface temperature and salinity observations depict the presence of a convoluted, large scale frontal feature across the sampled region between latitudes 29°N and 30°N (Fig. 2). In the water column, uplifting of isotherms, isohalines, and isopycnals associated with the frontal regions are illustrated in the vertical sections of the sampled parameters along the tracklines (e.g., Fig. 3).

- B. Assess the influence of the physical dynamics associated with the frontal region on biological productivity through CTD-mounted fluorometer measurements, and zooplankton collections coupled with ADCP backscatter information.

Zooplankton collections were made with 70 cm bongo nets towed in an oblique fashion targeting a maximum depth of 200 m. Each deployment was equipped with a Wildlife Computer's time-depth-recorder (TDR) to help determine actual depths fished. Twenty-three bongo tows, each spaced 30 nmi apart, were conducted along the 172°W and 168°W longitude transect lines. Fluorometer measurements were obtained along only the 172°W and part of the 168°W longitude tracklines before the SBE 9/11+ CTD system became disabled. For the 172°W longitude trackline, indicators of primary production (chlorophyll *a* concentrations) and zooplankton biomass (from bongo tows) generally tended to exhibit peaks coincident with the observed frontal regions (Fig. 4).

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

Seven deployments of the experimental squid driftline were made with 15-20 droppers (jigs) set per deployment. Eight *Ommastrephes bartramii* and 1 *Eucleoteuthis luminosa* were caught. The eight *O. bartramii* included six females, 47.0-48.9 cm dorsal mantle length (ML) and two males, 31.8 and 32.9 cm ML; all sexually mature. The single *E. luminosa* was a 22.0 cm ML mature male.

**SCIENTIFIC
PERSONNEL:**

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Figure 1.--Track of the *Townsend Cromwell* cruise 96-06 (TC-209), 4-24 May 1996.

Figure 2.--Composite horizontal schematic representation of sea-surface temperature (above) and salinity (below) on *Townsend Cromwell* cruise 96-06 (TC-209), 4-24 May 1996.

Figure 3.--Vertical section of temperature (above) and salinity (below) along the 172°W longitude trackline on *Townsend Cromwell* cruise 96-06 (TC-209), 8-12 May 1996.

Figure 4.--Biological parameters along the 172°W longitude trackline on Townsend Cromwell cruise 96-06 (TC-209), 8-12 May 1996: (A) chlorophyll a concentration ($\mu\text{g}\cdot\text{l}^{-1}$) with respect to pressure (dbars), (B) integrated (over 300 m) chlorophyll a ($\mu\text{g}\cdot\text{l}^{-1}$), and (C) integrated (over 200 m) zooplankton biomass

$(\text{ml}\cdot\text{m}^{-2})$.