



**U.S. DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
**NATIONAL MARINE FISHERIES SERVICE**  
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## CRUISE REPORT

**VESSEL:** *Townsend Cromwell*, Cruise 01-04 (TC-267)

**CRUISE PERIOD:** April 20 to May 4, 2001

**AREA OF OPERATION:** Waters south of the Hawaiian Archipelago, particularly in the vicinity of the BIGEYE oceanographic mooring at latitude 20°36.0'N, longitude 161°24.2'W and along latitude 158°W between latitudes 7°N and 12°N (Fig. 1).

**TYPE OF OPERATION:** Personnel from the Southwest Fisheries Science Center (SWFSC) Honolulu Laboratory (HL) and the University of Hawaii Department of Oceanography (UH) conducted a series of conductivity-temperature-depth (CTD) casts and discrete depth water sampling for extracted chlorophyll and nutrients determinations along transects to support ongoing studies characterizing the physical and biological oceanographic properties associated with waters in the vicinity of the BIGEYE mooring site and through areas frequented by commercial longline fishing vessels. 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.

### ITINERARY:

20 April - Departed Snug Harbor, Honolulu, at 1615. On board were Andrea Messer, Victoria Rechtenwald, Michael P. Seki and Happy A. Williams. Proceeded to first station at latitude 22°N, longitude 162°33'W.



- 21 April - Arrived at 22°N, 162°33'W. Commenced conducting a series of 1,000-m CTD casts spaced approximately 30 nmi apart along the NW-SE BIGEYE sampling transect.
- 26 April - Arrived at 12°N, 158°09.6'W and completed the last scheduled station on the BIGEYE transect. Proceeded to 12°N, 158°W and commenced conducting a series of 500-m CTD casts spaced 15 nmi apart running southward along the 158°W meridian to sample through the North Equatorial Current (NEC).
- 27 April - Suspended oceanographic sampling at 11°15'N, 158°W due to adverse weather and sea conditions. Began transit to the end of the projected sampling line at 7°N, 158°W.
- 28 April - Arrived at 7°N, 158°W and resumed operations with 500-m CTD casts spaced 30 nmi apart transiting northward along the 158°W meridian.
- 30 April - Arrived at 11°30'N, 158°W and completed the last scheduled station on the NEC transect.
- 1 May - Conducted a single experimental midwater trawl tow with a 2.7 m Isaacs-Kidd Midwater Trawl (IKMT) equipped with a SeaBird SBE-39 temperature-pressure recorder rigged to collect and display data in real time. The trawling effort (depth of the net) targeted the sonic scattering layer monitored with the recently acquired Simrad ES-50 echo-sounder. Upon completion, proceeded to Snug Harbor.
- 4 May - Arrived Snug Harbor, Honolulu. Disembarked Messer, Rechtenwald, Seki and Williams. End of cruise.

## MISSIONS AND RESULTS:

- A. Describe the physical oceanographic environment in the vicinity of (1) the BIGEYE mooring site (20°36.0'N, 161°24.2'W) and (2) the NEC through CTD casts and continuous ADCP and TSG measurements.

A total of 35 CTD casts were conducted with a SBE 9/11+ CTD system along two discrete sampling transects over the duration of the cruise (Fig. 1). Twenty-one of the CTDs composed the NW-SE BIGEYE transect that followed a path similarly occupied by the TOPEX/POSEIDON satellite overpass. Vertical sections reveal that through the water column, depressed isotherms characterized the region between latitudes 13°N and 20°N (Fig. 2). These observations are consistent with the presence of an anticyclonic meander evidenced in satellite altimetry (Fig. 1). These data together with continuous observations obtained from the ship-mounted ADCP indicate a traversing of the NEC just south of latitude 14°N. For the NEC sampling line, 14 CTD casts to 500 m depth were made at 30

nmi intervals along longitude 158°W heading due south. Well mixed thermohaline properties characterized the upper 100 m in this region (Fig. 2).

- B. Assess the influence of the physical dynamics on biological productivity by collecting CTD mounted fluorometer measurements and discrete depth water samples with Niskin bottles for extracted phytoplankton and nutrients assessment and export production sampling.

In situ total chlorophyll was estimated with CTD mounted fluorometer measurements at all 35 CTD stations. In addition, water samples from discrete depths were collected for determination of extracted chlorophyll (fluorescence) and pigments (high performance liquid chromatography, HPLC) and unfiltered nutrients concentrations. For discrete depth extracted phytoplankton analyses, seawater was acquired from depths of 200 m, 150 m, 125 m, 100 m, 80 m, 65 m, 50 m, 35 m, 20 m, and at the surface. Water samples of volumes 1-L for fluorescence and 2-L for HPLC were vacuum filtered through 47 mm diameter, 0.7  $\mu\text{m}$  Gelman TCLP glass fiber filters. Measurements of fluorescence to yield total chlorophyll, chl-*a*, and phaeophytin concentration were made at sea on a Turner 10-AU fluorometer after 24-h extraction in acetone. Filters containing pigments for HPLC were frozen in liquid nitrogen and returned to the UH for analysis. Unfiltered water samples (120 ml) for nutrients (inorganic nitrate + nitrite, orthophosphate, and silicate) determinations were collected at 500 m, 300 m, 150 m, 125 m, 100 m, 80 m, 65 m, 50 m, 35 m and at the surface; all samples were frozen and returned to the HL for analysis. At selected stations, 2-L water samples were also collected from depths 150 m and shallower for determination of  $^{234}\text{Th}$  scavenging and estimates of export production.

Very low chlorophyll concentrations in the upper water column characterized the upper 100 m in waters sampled along the BIGEYE transect line. In contrast, uniform high chlorophyll levels of 0.2-0.4  $\text{mg m}^{-3}$  were observed through the upper water column in waters to the south along the NEC transect (Fig. 2). The twofold increase in surface chlorophyll corroborates concurrent measurements of surface chlorophyll made by satellite remote sensing of ocean color (SeaWiFS).

- C. Conduct trial deployments of the IKMT equipped with real-time pressure monitoring capability and concurrent shipboard echo-sounders to assess the feasibility of the technology to qualitatively and quantitatively sample the SSL.

A single deployment of the IKMT was made at 14°08.6'N, 157°58.7'W. For the first time, real-time monitoring of actual net towing depth was made possible by rigging the trawl with a Seabird SBE-39 temperature-pressure sensor and a serial data feed through the electromechanical conducting cable. Concurrent monitoring of acoustic backscatter was attempted with the recently acquired Simrad ES-50 echo-sounder; however, poor performance of the instrument limited the effectiveness of the tool. The 1-h tow through

the SSL principally yielded a collection of coelenterates and pelagic tunicates (salps and pyrosomes).

**SCIENTIFIC  
PERSONNEL:**

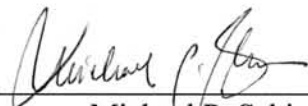
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Victoria Rechtenwald, Cooperating Scientist, UH Department of Oceanography.

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Submitted by:



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Approved by:



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Attachments

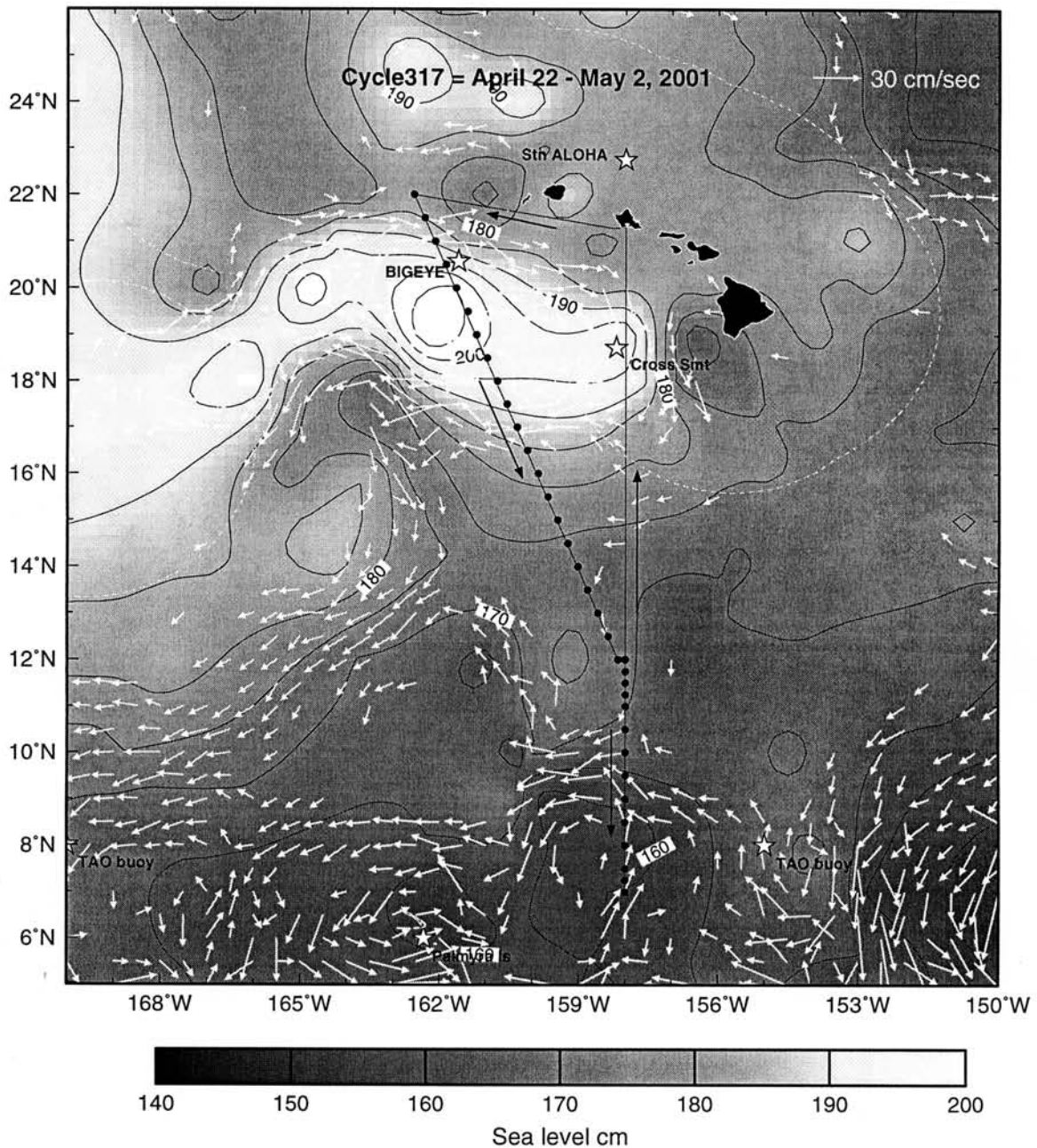


Figure 1. Trackline of the Townsend Cromwell cruise 01-04, 20 April-4 May 2001 and concurrent sea level height (with the Levitus long term mean dynamic height at 1000 m added) from the altimeter aboard TOPEX/POSEIDON for cycle 207, 22 April-2 May 2001. Greyscale shading and 5 cm contours represent altimetry gridded at  $0.1^\circ$  resolution and a smoothing radius of  $6.5^\circ$ . Corresponding geostrophic current velocities (vectors) are presented for  $0.5^\circ$  spatial resolution; only velocities  $>30 \text{ cm s}^{-1}$  are shown. Black dots represent CTD-water sampling stations.



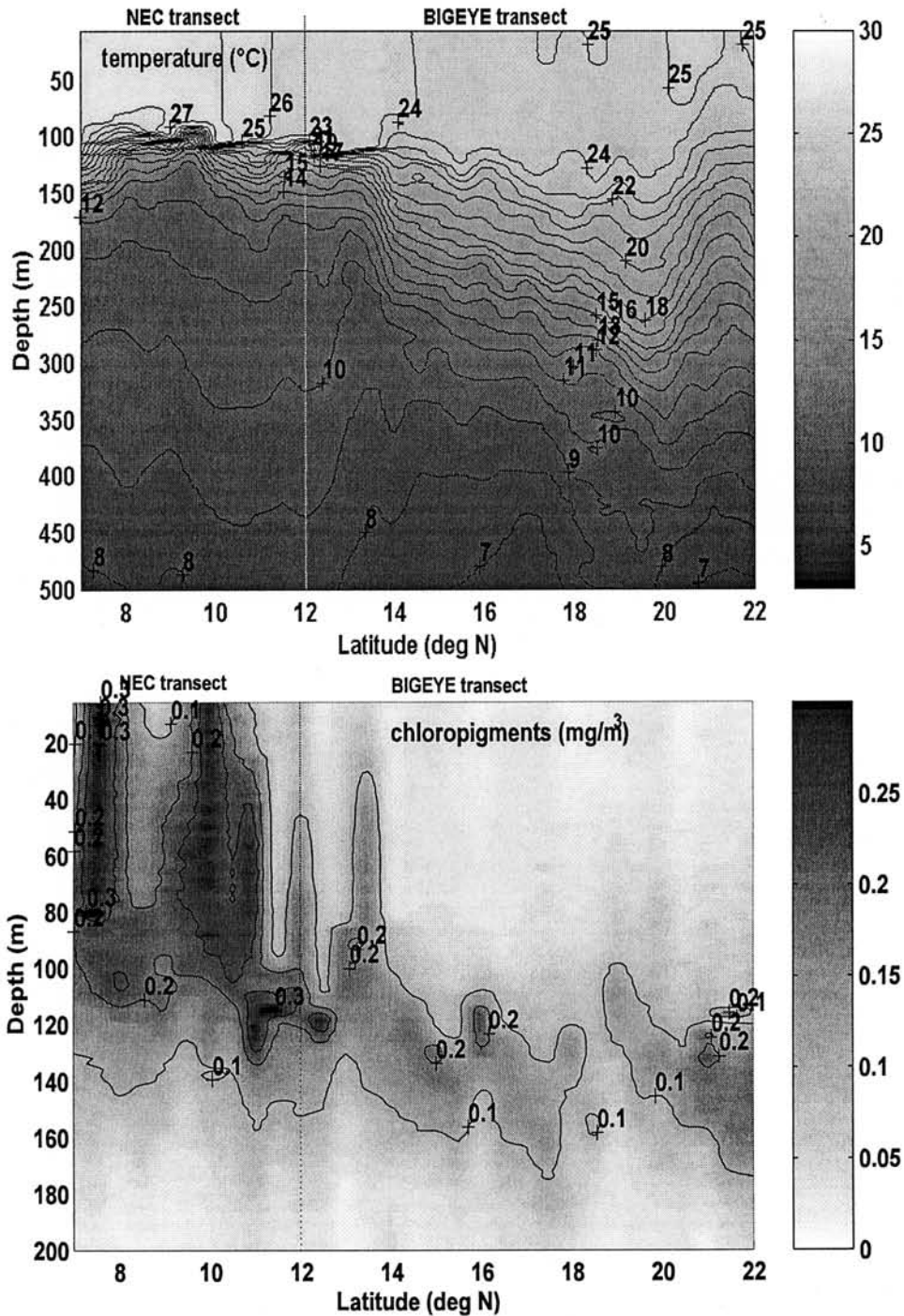


Figure 2. Vertical sections of temperature ( $^{\circ}\text{C}$ ) (top) and in situ chlorophyll ( $\text{mg m}^{-3}$ ) (bottom) along transects occupied during Townsend Cromwell (TC) cruise 01-04, 21-30 April 2001. The vertical line at  $12^{\circ}\text{N}$  latitude schematically depicts the shift between the BIGEYE and NEC transects.