

INTRODUCTION

The data in this report were collected during Cruises 9108* and 9110 of the California Cooperative Oceanic Fisheries Investigations (CalCOFI) program aboard the RV *New Horizon* of the Scripps Institution of Oceanography, University of California, San Diego and the NOAA-ship RV *David Starr Jordan*. The CalCOFI program was organized in the late 1940s to study the causes of variations in population size of fishes of importance to the State of California. It is carried out by NOAA's National Marine Fisheries Service Southwest Fisheries Science Center, the California Department of Fish and Game, and the Marine Life Research Group (MLRG) at Scripps Institution of Oceanography (SIO). MLRG contributes to this program by investigations of the physical, chemical and biological structure of the California Current. Data from CalCOFI Cruises 9108 and 9110 were collected and processed by personnel of the Marine Life Research Group and the Southwest Fisheries Science Center. Volunteers and other SIO staff members also assisted in the collection of data and chemical analyses at sea.

In addition to the usual horizontal maps of characteristics at the surface and at 200 m, vertical sections of various properties measured on CalCOFI line 90 appear in this report.

STANDARD PROCEDURES

Hydrographic and Rosette Cast Data

The hydrographic casts usually consisted of 20 three-liter plastic (PVC) bottles lowered to a maximum sampling depth of 500 meters, bottom depth permitting. A Sea-Bird Electronics, Inc. CTD and General Oceanics rosette was used successfully on 17 stations on cruise 9108 to a maximum sampling depth of 500 m, bottom depth permitting. Water samples were collected from 10 five-liter Niskin rosette bottles tripped at various depths from the maximum CTD depth to the surface on the up cast. Temperature, salinity, oxygen and nutrients were determined at sea for all depths sampled and chlorophyll-a and phaeopigments were usually determined at sea from the top 14 depths sampled on the hydrographic casts and on all 10 rosette cast bottles. Special near-bottom casts were done in the Santa Barbara and Santa Monica Basins.

Paired protected reversing thermometers read by two observers were used on the hydrographic casts to determine temperatures which were then recorded to hundredths of a degree Celsius. The temperatures are reported relative to the International Practical Temperature Scale of 1968 (IPTS-68). The new International Temperature Scale of 1990 (ITS-90) differs from the IPTS-68 by less than 0.01°C over oceanic temperature ranges, so the distinction between the two scales is of marginal significance for temperatures listed to the nearest hundredth of a degree. Most hydrographic sampling bottles used below a depth of about 75 meters were equipped with unprotected thermometers for determination of the depth of sampling, using the Saunders (1981) pressure-to-depth conversion technique. For rosette casts, pressures and temperatures were derived from the CTD at the time of the rosette bottle trip.

Salinity samples were analyzed at sea using inductive-type salinometers standardized with standard seawater. Periodic checks on the concentration of the standard were made by comparison with IAPSO Standard Seawater batch P-78. Salinity values have been calculated from the algorithms for the Practical Salinity Scale, 1978 (UNESCO, 1981a) and were reported to three decimal places, provided that accepted standards were met. If only one determination per sample was obtained, or there was doubt concerning the accuracy of the analytical results, the salinities were reported to two decimal places.

Dissolved oxygen was determined by the Winkler method, as modified by Carpenter (1965), using the equipment and procedure outlined by Anderson (1971). Percent oxygen saturation was calculated from the equations of Weiss (1970).

Silicate, phosphate, nitrate and nitrite nutrients were determined at sea using an automated analyzer. The procedures used are similar to those described in Adas *et al.* (1971).

Samples for chlorophyll-a and phaeopigments were filtered onto GF/F filters. The pigments were extracted with a cold extraction technique in 90% acetone (Venrick and Hayward, 1984), and the fluorescence determined before and after acidification with a Turner Designs fluorometer (Yentsch and Menzel, 1963; Holm-Hansen *et al.*, 1965).

*The first two digits represent the year and the last digits the month of the cruise.

Evaluation of the data involved comparisons with adjacent stations and consideration of the variation of a property as a function of density or depth and the relationships with other properties (Klein, 1973). Estimates of precision of the standard techniques are given in SIO, 1991.

Primary Productivity Casts

Primary productivity casts were taken each day shortly before local apparent noon (LAN). Primary production was estimated from C uptake using a simulated *in situ* technique. Light penetration was estimated from the Secchi depth (assuming that the 1% light level is three times the Secchi depth). The depths, with ambient light intensities corresponding to light levels simulated by the on-deck incubators, were identified and sampled with five-liter Niskin bottles attached to the hydrowire on cruise 9108. The Niskin bottles were equipped with epoxy-coated springs and silicone-rubber O-rings. Where the productivity casts occurred at non-standard CalCOFI sampling locations on 9108, additional hydrographic bottles were added to extend the observations to 200 m. On cruise 9110 the Niskin bottles were tripped on the rosette cast. Pressures and temperatures reported in the 9110 productivity data were derived from the CID at the time of the Niskin bottle trip. Triplicate samples (two light and one dark control) were drawn from each productivity sample depth into 250 ml polycarbonate incubation bottles. Samples were inoculated with 10 nCi of $CasNaHCO_3$, (200 μ l of 50 nCi/ml stock) prepared in a 0.3 g/liter solution of sodium carbonate (Fitzwater *et al.*, 1982). Samples were incubated from LAN to civil twilight in seawater-cooled incubators with neutral-density screens which simulate *in situ* light levels. At the end of the incubation, the samples were filtered onto Millipore HA filters and placed in scintillation vials. One half ml of 10% HCl was added to each sample. The sample was then allowed to sit, without a cap, at room temperature for 12 hours (after Lean and Bumison, 1979). Following this, 10 ml of scintillation fluor were added to each sample and the samples were returned to SIO where the radioactivity was determined with a scintillation counter. Temperature, salinity, oxygen, nutrients, chlorophyll-a, and phaeopigments were determined for all depths.

Macrozooplankton Net Tows

Macrozooplankton was sampled with a 71 cm mouth diameter paired net (bongo net) equipped with 0.505 mm plankton mesh. Bottom depth permitting, the nets were towed obliquely from 210 m to the surface. The tow time for a standard tow was 21.5 minutes. Volumes filtered were determined from flowmeter readings and the mouth area of the net. Only one sample of each pair was retained and preserved. The biomass, as wet displacement volume, after removal of large (>5 ml) organisms, was determined in the laboratory ashore. These procedures are summarized in greater detail in Kramer *et al.* (1972).

TABULATED DATA

Hydrographic and Rosette Cast Data

On cruise 9108, CTD/Rosette cast data are included with the hydrographic cast data. The time reported is Coordinated Universal Time (UTQ). For CTD/Rosette casts the time reported is the time of the first bottle trip on the up cast, for wire casts it is the time of the messenger release. Bottom depths, determined acoustically, have been corrected using British Admiralty Tables (Carter, 1980) and are reported in meters. Weather conditions have been coded using WMO code 4501. Secchi depths, taken on most daylight stations, are also reported.

Observed and interpolated standard depth data from hydrographic casts have been interspersed and are presented together sequentially by depth. Interpolated or extrapolated standard level data are noted by the footnote "ISL" printed after the depth. No interpretations were done on the rosette casts taken on cruise 9108. Density-related parameters have been calculated from the International Equation of State of Seawater 1980 (UNESCO, 1981, b). Computed values of potential temperature, sigma-theta, specific volume anomaly (SVA), dynamic height or geopotential anomaly, and pressure are included with both observed and interpolated standard depth levels.

Primary Productivity Casts

In addition to the normal hydrographic data, the tabulated data include: the *in situ* light levels at which the samples were collected, the uptake from each of the replicate light bottles (uptake 1 and uptake 2) which have been corrected for dark uptake by subtracting the dark value, the mean of the two uptake values, the dark uptake, chlorophyll-a and phaeopigments. The uptake values are totals for the incubation period. Also shown are the times

of L A N , civil twilight, and the value of the mean uptake integrated from the surface to the deepest sample, assuming that the shallowest v;alue continues to the surface and that negative values (when dark uptake exceeds light uptake) are zero. The uptake data have been presented to two significant digits (values <1.00) or one decimal (values >1.00). The higher production values may not warrant all of the digits presented. Incubation time, L A N , and civil twilight are given in local Pacific: Standard Time (PST); to convert to UTC, add eight hours to the PST time. Incubation light intensities are listed in a footnote at the bottom of each page.

Macrozooplankton Data

3 3

Macrozooplankton biomass volumes are tabulated as total biomass volume (cm /1000 m strained) and as the total volume minus the volume of larger organisms under the heading "Small." Tow times are given in local PST (+8) time.

FOOTNOTES

In addition to footnotes, special notations are used without footnotes because the meaning is always the same.

ISL: After a depth value indicates that this is an interpolated or extrapolated standard level.

P: After a depth value indicates that the bottle pretripped.

U: Uncertain value. Values which are not used in interpolation because they seem to be in error without apparent reason.

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