Chapter 3

Patterns of Flow and Plankton Distribution in the Nearshore Zone of Dockweiler State Beach, Santa Monica Bay, California

Introduction

Plankton has been investigated in the Southern California Bight (SCB) for over half a century with one of the first studies by Johnson (1939) who described the planktonic larval dispersal of the mole crab, *Emerita analoga*. By describing changes in larval crab distributions with regional flow patterns, this comprehensive study marked one of the first in southern California to fit the definition of "biological oceanography". Sverdrup *et al*. (1942) rightfully pointed out the need to understand the oceanography of a system in order to fully understand the dynamics of the plankton therein. An extensive library on southern California plankton studies has since matured, with some notable reviews conducted over the decades (Emery, 1960; Eppley, 1986; Dawson and Pieper, 1993).

The need for plankton studies was realized in California during the sardine fishery crash of the late 1940s, when state and federal fisheries managers had little information to explain the failing trend (Ricketts *et al.*, 1992). In 1949, the California Cooperative Oceanic Fisheries Investigations (CalCOFI) was formed in an effort to establish baseline information on physical water properties and plankton along the coasts of Oregon, California, and Mexico. In its 56-year existence, the CalCOFI collections have been used to generate a rich and impressive body of literature. While the spatial range of the surveys has been dramatically reduced over time, the present sampling array still includes quarterly surveys of the SCB.

No other long-term marine data set in California can compare to the CalCOFI collections, however other notable studies should be mentioned. Owing largely to the strict regulations resulting from the fomenting environmental policies of the early 1970s, intensive monitoring efforts in the region have been conducted continuously throughout southern California. These regular monitoring programs are primarily carried out by publicly owned treatment works, electric power generating stations, and the ports to remain in compliance with environmental regulations (NRC, 1990). A historic view of the monitoring programs is elaborated upon by SCCWRP (1988). Such repetitive monitoring in combination with the efforts of CalCOFI has lead the SCB to be one of the most studied water bodies in the world (Dailey et al., 1993).

Despite the focus of marine monitoring in the SCB as a whole, there is a paucity of zooplankton studies in the primary literature conducted close to shore, particularly in the nearshore zone of Santa Monica Bay (SMB). However reports produced by coastal power generating stations in compliance with environmental regulations mandated by the Federal Water Pollution Control Act of 1972, Section 316(b), include impressive plankton data sets. One of these studies was conducted in SMB by the Intersea Research Corporation (1981) for Scattergood Generating Station, owned and operated by the Los Angeles Department of Water and Power. The cooling water intake structure utilized by Scattergood is in shallow water (9 m isobath), which is typical for most coastal generating stations. In an effort to estimate plankton losses due to entrainment, IRC conducted bi-weekly surveys of plankton and gathered current data in the vicinity of the zone of influence by the intake structure over the course of one year. The ambient tidal current field on the 9 m isobath was found to approximate a high eccentricity ellipse, where the same orbits would be continuously retraced, thus exhibiting little net directional flow over long periods of time. However, when onshore winds were strong, surface waters, particularly those offshore of the intake structure, would exhibit a helical flow pattern, where longshore excursions of approximately 1.3 km were observed per tidal cycle. Mostly, these excursions would propagate in the down coast direction, but on occasion the surface waters would flow northward. IRC (1981) attributed this to the wind angle to the shore, although it is likely that these observations may be related to larger-scale patterns within SMB (Hickey *et al*., 2003).

Interpretation of the plankton results in the IRC (1981) report was limited by the scope of the study. While day and night samples were collected at three stations (at the intake structure, 3.8 km upcoast of the intake, and 2.4 km offshore of the intake) bi-weekly over the course of one year, only six target crustaceans and three larval fish species were included in the detailed analysis, although other "non-critical" taxa were reported at coarser taxonomic levels. The distribution of target taxa was found to follow density gradients with distance from shore, with *Acartia* spp., three mysid species, and *Emerita analoga* zoea generally occurring in greatest abundance consistently along the intake isobath. Only the distribution of *Cancer* spp. did not exhibit a clear pattern, which the authors attribute to the possibility that this group contained up to five related species whose larval stages could not be distinguished.

Southern California Edison (1983) conducted the only other 316(b) field effort that focused on plankton monitoring for the Redondo Beach Generating Station, located in the southern portion of SMB. As with the Scattergood 316(b) study, the scope of the report was limited to monitoring of fifteen species of larval fish, whose abundances appeared to follow seasonal trends. No planktonic invertebrates were reported in the study. The Vantuna Research Group has maintained a rich long-term data set on larval fishes in the vicinity of King Harbor, Redondo Beach and Marina Del Rey Harbor, El Segundo (Stephens *et al*., 1992; Stephens and Pondella, 2002), although these also do not include planktonic invertebrates.

Soule and Oguri (1977) conducted a one-year monitoring study of Marina Del Rey Harbor, which opens to SMB, and reported on the abundance and diversity of the different zooplankton taxa present. While this study was conducted within a confined waterway, its inherent physical connection to the nearshore zone of SMB makes it of utmost importance in understanding the distribution of zooplankton in the nearshore zone that might normally be residents of harbor waters. One compelling finding from this study was the recognition that there were differences in the plankton assemblage from the inner harbor to the outer harbor over an area of only a few kilometers. In particular, the copepod *Acartia californiensis* appeared to be confined to the inner harbor waters while *Acartia tonsa* was predominantly found in the outer channel. This strong difference between the plankton assemblages of the inner and outer harbor is likely tied to physical variables, food type and availability, and the differing degree of tidal flushing.

Marine Biological Consultants (1976) conducted a one-year 316(b) monitoring study just north of SMB in Ventura, California, in the vicinity of the Ormond Beach Generating Station seawater intake structure. This study was far more extensive than either the IRC (1981) or SCE (1983) reports, with intensive sampling carried out at multiple locations up and down coast of the intake structure, on the 10m isobath during day and night. In contrast to the studies by IRC (1981) and SCE (1983), MBC (1976) enumerated all species, with taxonomic identifications to the species level for an impressive number of organisms. This study revealed a dynamic and rich zooplankton assemblage that was dominated by the two copepods *Acartia tonsa* (43.4%) and *Paracalanus parvus* (17.4%) throughout the year. Seasonal trends in abundance were seen for many species, some of which had little information on their life histories known at the time. Despite the very narrow isobath range within which plankton collections were made, it was possible to see the influence of offshore waters to the site with the periodic collection of offshore animals.

The oceanography of the SCB is well described (Emery, 1960; Hickey, 1979; Jackson, 1986; Hickey, 1992; Hickey, 1993; Hickey *et al.*, 2003). The California Current is a well-defined eastern boundary system resulting in equatorward flow for much of the year along the west coast of North America. As a result of the changing angle of the coastline and the bottom topography of the offshore zone, the flow pattern in southern California is considerably different from that seen to the north. A large-scale counter-clockwise eddy is produced for much of the year in the SCB, which is manifested closer to shore as the poleward-moving Southern California Countercurrent (Hickey, 1979). This in turn sets up a clockwise circulation in SMB that persists much of the year (Hendricks, 1980; Hickey, 1992; Hickey *et al.*, 2003; Oram, 2004).

However, other than the study by the IRC (1981), few oceanographic studies have described the movement of water in the very nearshore zone of SMB where mixing due to tides and wind can reach the bottom. Hendricks (1980) provided one of the first descriptions of flow in SMB, but currents were averaged over months, and the "inner waters" were defined as 0-100m. Only three current meters were used for this study, with the one closest to shore set at 15m depth along the 56m isobath. Although precise coordinates were not provided, I have determined this station was approximately 8.5 km from shore. Hickey *et al.* (2003) conducted a much more detailed study of flow in SMB, building upon the work of Hickey (1992). This study included fourteen current moorings placed throughout SMB, with measurements taken at multiple depths. Two of the moorings were placed in relatively shallow water, with mooring T5 on the 32m isobath near Marina Del Rey and T8 on the 35m isobath near Malibu (Hickey *et al.*, 2003). This was an improvement from Hickey (1992), where only one current mooring was placed in shallow water along the 30m isobath. The results of both studies were summarized over periods of weeks. Averaging over long periods of time provided a much clearer picture of flow within seasons, although this excluded investigation of tidal effects. Also, the closest moorings to shore were approximately 5km from shore, thus excluding the very nearshore zone from either analysis.

A number of river and marsh discharge studies have inferred qualitatively that flow in the very nearshore zone is predominantly alongshore. One such study was conducted on the flow of storm water effluents from Ballona Creek, which demonstrated a strong alongshore component of flow that traps the runoff plumes close to shore

(Washburn *et al.*, 2003). A similar effect was observed near the Santa Ana River and Talbert Marsh mouths where pollutants are entrained and concentrated along the beach (Grant *et al.*, 2005). Both studies demonstrate the overwhelming influence of wind-driven and tidal flow in the alongshore direction as opposed to cross shelf flow in the very nearshore zone. However, in both of these studies, the plumes themselves may have influenced the pattern of accumulation since they inherently differ in their buoyant properties from the coastal ocean water in which they enter. Also, while the tracking of bacterial contaminants clearly shows a concentrating effect of these organisms, bacteria are incapable of swimming against any flow and therefore act as inert drifting particles. Bacterial distributions may therefore have little value in explaining the distribution of zooplankton in the nearshore zone, since zooplankton are capable of active swimming and can influencing their vertical position, and hence also their horizontal position as they take advantage of favorable flows (Shanks, 1986; Poulin *et al*., 2002).

Other studies of flow close to shore have been conducted in other parts of the world. For example, Csanady (1971) tracked the coastal entrapment of water discharged from a power generating station along a nearshore zone in Lake Huron. Such plumes discharged near coastlines will accumulate in the coastal boundary layer until a current reversal occurs, which forces the entrapped water offshore (Csanady, 1974). A similar phenomenon of nearshore entrainment due to the interplay of tidal currents and island topography has been described in island systems in Australia, where coral eggs are retained close to the reefs where they were spawned (Wolanski *et al.*, 1989; Wolanski, 1994; Wolanski and Spagnol, 2000). Termed "sticky water" by Wolanski (1994), coral eggs were entrapped in the coral reef nearshore zone when tidal currents were strong (spring tides) and dominated the flow field. During neap tides, when tidal currents were weak, local alongshore flow dominated, in which case coral eggs were carried away from their source. This phenomenon has recently been used to explain the nearshore retention of squid paralarvae by island tidal currents near Santa Catalina Island (Zeidberg and Hamner, 2002).

Few full-scale oceanographic studies have been undertaken close to shore due to the shallow depths and hazardously close proximity to breaking waves. One notable exception was the work of Barnett and Jahn (1987) who surveyed plankton along a line transect extending from inside the surf zone to a depth of 100m repeatedly over a year. However, such studies are uncommon. Research vessels that are adequately equipped with appropriate instrumentation are often too large to sample in shallow water. For this reason, there is little physical and biological data for the nearshore zone, which I define here as the water mass shoreward of the 40m isobath extending to the beach. Yet the dynamics of this region are of crucial importance to intertidal, nearshore subtidal, and estuarine organisms, particularly those whose life histories exhibit a benthic adult and planktonic larval stage. Also, the physical mechanism that enables harmful red tides to persist on continental shelves very close to shore are poorly known (Anderson, 1995; Horner *et al.,* 1997; Yin, 2003), despite the very extensive literature on the general subject. Along the North American west coast, the effects of toxic algal species to coastal fisheries and human health are still being uncovered (Horner *et al.*, 1997).

Despite the extensive collection efforts of CalCOFI, the innermost stations are generally located tens of kilometers from shore. For example, innermost Station 33 along CalCOFI line 87 (located at 33.89^{o}, -118.49^{o}), the only CalCOFI station located inside SMB proper, is approximately 7.1 km from the shore. Therefore, plankton strongly associated with the nearshore zone will be missed or seriously under-represented. Also, while some plankton investigations have been undertaken close to shore, many of them lack detailed physical data collections because of the above-mentioned logistical difficulties. For example, Clutter (1967) made very detailed measurements of the distribution of three mysid species inshore of the La Jolla and Scripps Canyons, and while he did suspect that nearshore circulation may have contributed to the zonation patterns he observed, he did not describe the flow field quantitatively.

The present study investigates flow in the nearshore zone in an effort to establish whether or not there is an inherent difference in the flow regimes and plankton communities between nearshore and offshore waters. The waters off Dockweiler State Beach in SMB are an ideal location for this study. All sampling took place in a distance of 200m to 10km from shore. During much of the year, a clockwise circulation persists in the upper water column of Santa Monica Bay. This large-scale eddy results from the dominant poleward flow of the southern California countercurrent, which is typically present over the much deeper Santa Monica Basin located west of the bay. Near the coast along the mid-latitudes of Santa Monica Bay, this results in an alongshore flow to the south for much of the year.

Headlands complicate flow fields and enhance the accumulation of plankton (Alldredge and Hamner, 1980). However, the nearest headlands, Palos Verdes Peninsula and Point Dume, are far enough away to impart little influence on the fine-scale flow near Dockweiler State Beach. Also the relatively straight coast and even sloping bottom result in a simple alongshore flow regime. Finally, the close proximity of Dockweiler State Beach to the Marina Del Rey Harbor entrance made for easy access to the study site.

Materials and Methods

Six surveys were conducted offshore of Dockweiler State Beach, two kilometers south of the Marina Del Rey Harbor mouth. The surveys were conducted on the following dates: May 7, 2002, July 15 and 17, 2003, February 21, September 27, and November 4, 2004. A single line transect extending perpendicular to shore from 0.2 km to 6 km from the beach was reoccupied for each survey. During the September 27, 2004 survey, the transect was extended to 8 km. For the November 4, 2004 survey, the transect was extended to 10 km (Figure 3-1). The same line transect was sampled repeatedly throughout each day.

Physical Data Collection

Physical characterization of the line transect was achieved using many instruments on each survey date. However, some tools were only available for the latter sampling dates. On all dates, alongshore water velocities were determined using drogues deployed at various depths and distances from shore along the transect. Each drifter was made from a 208-liter polyvinyl drum with more than 20 evenly spaced holes (10 cm diameter) drilled in the sides, with a 4-kg weight placed within (Figure 3-2). This allowed the drum to sink quickly upon deployment and drain easily upon retrieval. Each drum was set to depth by suspending it from a nylon line attached to a small, low profile buoy. In order to increase the visibility of the drogue, a 6.5m fiberglass pole was attached to the buoy with nylon line. The pole was suspended between two identical low profile floats and was weighted on one end, thus keeping the pole vertical in the water with at least 4m extending out of the water with a numbered flag affixed at the top. This design was used for all drogues except the innermost drogue, which did not include the flagpole or the accompanying support floats. This drogue was always placed shoreward of the 10m isobath where the onshore winds acted on the surface waters in the upper 0.5 m, in which the three buoys were immersed, thus imparting a considerable surface drag. This consistently moved the drogue towards the beach, thus making retrieval hazardous, but by eliminating the flagpole and floats, the motion of the drogue was less influenced by the wind and migrated shoreward less quickly. The innermost drogue was always placed along the 8m isobath at the start of the survey, and was tracked exclusively with the 17-ft R/V UCLA Boston Whaler. In the event that the drogue migrated shoreward of the 6m isobath, the drogue was pulled and reset back along the 8m isobath. The remaining drogues were deployed outside the 10m isobath and were tracked by the R/V Sea World UCLA.

The depth distribution and spatial arrangement of drogues varied with each cruise. On May 7, 2002, six drogues were deployed along the transect, the outer five of which were set in 1km intervals beginning on the 10m isobath (Figure 3-1). The innermost drogue was deployed on the 8m isobath and was set at a depth of 3m. Drogue 2 (on the 10m isobath) was set at 5m depth while all other offshore drogues were set at a depth of 12m. The position of each drogue was tracked in roughly 45- to 60-minute intervals by approaching each in turn and recording the time, latitude and longitude. On July 15, 2003, five drogues were used. The innermost drogue was set as before, while the remaining offshore drogues were arranged differently. Drogue 2 was positioned at a distance of 2km from the beach and was set to a depth of 5m. Drogues 3 through 5 were all deployed at 4km distance at depths of 5, 10 and 26m. On July 17, 2003 all drogues distances were set as in May 7, 2002, with the depths of all drogues set at 5m. During the February 21, 2004 cruise, six drogues were set along the transect at four locations. The first drogue was deployed on the 8m isobath at a depth of 6m, with the second positioned 2km from the beach at a depth of 10m. A pair of drogues was deployed at 3 and 4km distance. Each of the pair was set at 10 and 20m depth. On September 27, 2004, 5 drogues were used, with the first set at 5m depth along the 8m isobath. The remaining four were set at 10 and 20m depth at a distance of 2 and 4km from shore. The arrangement of drogues on November 4, 2004 was identical to that on September 27, 2004.

In addition to drogue data, velocity profiles were recorded continuously using a ship-mounted downward-viewing Acoustic Doppler Current Profiler (ADCP, RD

Instruments Workhorse Model 300). The ADCP was used for all sampling dates except for May 7, 2002. The profiles from each cruise were divided into tracks, where each track consisted of one offshore-to-onshore run. Raw data were output using WinADCP version 1.13 and VmDas version 1.42 (RD Instruments) into ASCII format and then imported into Microsoft Excel, where error correction and data reduction were performed. The data were adjusted from magnetic coordinates (North-South-East-West) into alongshore and cross-shore vectors, and then imported into Tecplot version 7.5 (Amtec Company) where each track was plotted in false color to give a two-dimensional view of the alongshore and cross shelf component of the velocity field along the transect.

Three conductivity-temperature-depth (CTD) profilers were used throughout the study. One Seabird SeaCat Profiler SBE 19 (unpumped) CTD was lowered by hand in 1km intervals over the length of the transect. This was repeated on three tracks spaced evenly throughout the day. A second Seabird SeaCat Profiler SBE 19 (unpumped) CTD was mounted in the middle of a paired plankton net (to be described below). Both Seabird profilers were used exclusively on the R/V Sea World UCLA. An Applied Microsystems™ Smart CTD, fitted with a SeaTech/WetLabs fluorometer, was used exclusively on the R/V UCLA Boston Whaler, and was submerged in a 34 L container with flow-through seawater provided by an electric pump. Seasave™ version 1.17 (Seabird Electronics) and SmartTalk™ version 1.10 (Applied Microsystems) were used to convert the raw data from the Seabird 19 profilers and Applied Microsystems™ CTD to ASCII format where further data reduction could be made using Microsoft Excel. The data were then imported into Tecplot version 7.5 (Amtec Company) where individual vertical casts along each transect were integrated into a two-dimensional temperature plot over depth and distance for each of the three transects. This was done using an inverse distance interpolation over a grid with the number of interpolation points being no more than twice the number of stations. This was done to minimize over-processing and generating a false interpolation.

For the September and November 2004 cruises, continuous surface readings of conductivity, temperature and fluorometry were recorded using a surface sampler onboard the R/V Sea World UCLA. The sampler consisted of a Seabird SeaCat Profiler SBE 19 (unpumped) CTD and a SeaTech/WetLabs fluorometer tied into the flow-through seawater system on the ship. The pump intake is located on the hull of the ship 1.8m beneath the water line. Surface temperature and chlorophyll concentration were logged at 3-second intervals to an onboard computer along with time, latitude and longitude. These data were plotted over time as a way to demarcate the presence of physical boundaries oriented parallel to shore across the transect.

A mooring was deployed to measure the propagation of internal waves along the thermocline throughout the tidal cycle during the cruises on February 21, September 27 and November 4, 2004. The mooring was placed along the transect at the 25m isobath using a 20-kg lead weight as an anchor attached with polypropylene line to a surface buoy, and was set in the early morning and retrieved at the end of each sampling day (Figure 3-3). A smaller subsurface float was also added to the line 3m below the surface to maintain vertical orientation of the array. An RBR Ltd. model XR-420 CTD was attached to the line at the thermocline and set to record every ten seconds, except for the

February 21, 2004 survey, when it was set to record in 1-minute intervals. The location of the thermocline was determined by first performing a CTD cast and examining the profile. The data were plotted over time.

Plankton Data Collection

Plankton distribution, density, diversity and species composition were determined using two collection methods. Vertical net tows were used to determine the spatial distribution of species with distance from shore along the transect on all dates except February 21, 2004. Between three and five vertical tows were spaced evenly in any given track, and three tracks were sampled throughout the day, except on May 7, 2002 when only two tracks were sampled, and July 15, 2003 when four tracks were sampled. When three tracks were sampled, the collections were set to occur roughly during the rate of greatest tidal exchange (both flood and ebb tides) as well as during slack tide. On May 7, 2002, when only two tracks were sampled, collections occurred only during flood and ebb tides. On July 15, 2003, the four tracks were spaced evenly throughout the day (2 floods, 1 slack, and 1 ebb).

The paired plankton net apparatus was designed using two 250-µm mesh 3-m long nets affixed to either side of a stainless steal frame in the shape of a figure eight (Figure 3-4). The paired nets were fastened midway between the two nets, thus eliminating the use of a bridle in front of the nets. At the back of the nets, a cross-brace joined the cod ends and was attached to the wire, thereby holding the nets extended. The nets were sunk to depth, cod-end first, by a 30 kg lead weight. A second 20 kg weight was attached to the wire 1m below the mouth of the nets. The wire went slack when the weight closest to the mouth of the nets rested on the seabed. The winch operator thus kept the mouths of the nets about 1m above the bottom, preventing sediment from fouling the nets and reducing the chance of inadvertently capturing benthic animals. On every vertical haul, the nets were lowered to the bottom and then retrieved at a steady pace. In this way, two zooplankton samples were collected at each station. A Seabird SeaCat Profiler SBE 19 (unpumped) CTD (described above) was mounted 10 cm below the mouth of the nets to gather physical information with every vertical tow.

Water volume sampled was estimated using a General Oceanics Model 2030 mechanical flowmeter mounted in the middle of the mouth of each net. These flowmeters were calibrated for distance before the field expedition began by hand towing them along a dock of a known length. Ten readings were recorded at three distances (25, 50 and 100 m), averages were taken, and a regression was made over distance. During the vertical tows, the flowmeters spun freely both on descent and ascent, and so overall distance was divided in half. During all the dates on which vertical plankton tows were performed, winds were mild, rarely exceeding 10 kn, and thus the wire angle of descent never exceeded a 10^{o} deviation from vertical.

Samples were transferred from the cod ends into 250-μm sieves to concentrate the animals, and then immediately moved into 500 ml glass containers where they were fixed in 4-5% buffered formalin and seawater. Samples remained in the fixative for one month, after which plankton volumes were estimated using the displacement method of

Kramer *et al.* (1972). Each sample was divided using a Folsom plankton splitter until roughly 1000 animals remained. This sub-sample was stored in a glass vial and kept with its parent split. The sub-samples were transferred to seawater with less than 0.5% buffered formalin and refrigerated at approximately 3^{o}C. Samples were kept in this state for three weeks before sorting. Before animals were actually identified and enumerated beneath the microscope, they were transferred into one of two containers of either 0.5% buffered formalin and seawater for gelatinous animals (cnidarians, ctenophores, salps and chaetognaths), or 70% ethanol for all other animals. All animals in the sub-sample were identified to the lowest reasonable taxonomic level and counted. A coarse visual examination of the parent sample was also conducted to ensure the proper enumeration of rare species that may have been under-represented in the sub-samples. For most zooplankton, numbers in the sub-sample split were multiplied proportionally to estimate the total abundance in the sample, and these numbers were then divided by the volume of water sampled to estimate plankton per cubic meter.

The depth distribution of plankton in the vertical hauls was estimated using the ADCP output for all sampling dates except May 7, 2002. The echo amplitude intensity (average of all four beams) was extracted and processed identically to the water velocity data. Echo amplitude intensity directly correlates to particle density in the water column, which was assumed to be a direct measure of plankton concentration. In addition, on September 27 and November 4, 2004, a graphical record was output from a Furuno color video fathometer during each vertical cast to qualitatively aid in identifying the depth of the most intense plankton patches.

Additionally, neuston tows were conducted on February 21, September 27, and November 4, 2004, aboard the R/V UCLA Boston Whaler using a pair of 250-µm mesh, 3-m long, 0.5m diameter nets deployed from 2-m long booms mounted perpendicular to the length of the boat (Figure 3-5). This design allowed for the collection of surface plankton uninterrupted by the boat wake. Ten-minute tows at a speed of approximated 2 kn were conducted parallel to the beach using a handheld global positioning satellite (GPS) unit to note starting and stopping locations and time. The depth range of the collections was between the surface and 1m. Two locations along the transect were sampled three times throughout the day for a total of six samples. The sampling location closest to shore was inshore of the 8m isobath as close to the breaking waves as safety would allow. Each nearshore sampling was immediately followed by a sample taken between 1.5 and 2.5km outside the 10m isobath along the transect. Samples were transferred to glass containers, preserved, stored, split and analyzed using the same above described method.

All plankton samples were analyzed using a multiple linear regression (MLR) model. A forward stepwise MLR approach was used to identify the minimum number of significant variables and to avoid strong multicollinearity between each physical variable. In this way, the regression of the abundance (normalized for sampling volume) of each taxonomic group on to the physical measurements provided the proportion of the variation explained by each independent variable. All of the surveys using vertical plankton tows included the following independent variables in common – (1) distance from shore, (2) surface temperature, (3) surface salinity, (4) surface density, (5) water depth, (6) approximate thermocline depth to within one meter, (7) vertical temperature change in the upper 12 m (or between the surface and bottom if shallower than 12m), and (8) horizontal temperature change over a 0.5-kilometer distance centered on each station. The latter served as a variable defining any surface discontinuity. For the September 27 and November 4, 2004 surveys, additional independent variables were added to the MLR forward step-wise model, including (1) surface chlorophyll concentration, (2) surface dissolved oxygen, and (3) horizontal change in chlorophyll concentration over a 0.5-kilometer distance centered on each station. Many of the independent variables are known to be highly correlated. However, the rationale for including them all in the model is that many of them will serve as a proxy for the distance from shore. For example, a change in temperature from onshore to offshore will necessarily be accompanied by a change in density. However, many of the sample sizes are small, and therefore explaining the variability in a species becomes more difficult. By including more independent variables, even though they may scale dependently to others, will increase the sensitivity of the test and improve the chance of detecting a significant relationship. If it was determined that two inter-related variables contributed strongly to explaining the distribution of a species, the test was run again after removing one of them to account for the synergistic effect (Rigby, *pers. comm*.).

For the neuston tow data sets, fewer independent variables were included since no vertical CTD casts were performed to complement the tows. However, surface readings were taken with the Applied Microsystems™ Smart CTD submerged in the continuously pumped seawater on the R/V UCLA Boston Whaler. The independent variables included in the analysis of the neuston tows were (1) distance from shore, (2) surface temperature, (3) surface salinity, (4) surface density, (5) surface chlorophyll concentration, and (6) surface dissolved oxygen.

Most variables were normally distributed, except in the May 7, 2002, and July 15 and 17, 2003 surveys, when one dependent variable in each of the three surveys was natural log transformed to meet the normality criteria.

Additionally, a cluster dendrogram of stations and a percent species mean coincidence table were generated for each survey in order to provide a more visual representation of station groups and species distributions. Species concentrations (number per cubic meter) were log transformed and subject to a hierarchical agglomerative clustering method determined by Euclidean distance least squares (Everitt, 1980). Coincidence tables were created by dividing the concentration of each species at a station by the average of that species over all the stations. Species were ranked based on how strongly they were skewed in their distributional weight in the offshore to onshore direction.

Results

On all sample days except February 21, 2004, the weather was mild with onshore winds in the morning at less than 3 kn, increasing to 10 kn in the afternoon. During the February 21, 2004 cruise, intermittent rain, accompanied by sustained offshore winds at 5-10 kn, persisted throughout the day. The rainstorm had not begun until the start of sampling, and hence no run-off had yet been observed from nearby Ballona Creek and the Marina Del Rey harbor mouth. Swell height rarely exceeded 0.5m, and never exceeded 1m during any survey day. Surface slicks were observed in every cruise parallel to shore, except in the post-dawn hours of November 4, 2004, when surface slicks were also seen meandering perpendicular to shore. As winds increased in the afternoon, the visibility of these surface slicks was diminished. While the location of the offshore slicks changed throughout the day, a slick located near the 10m isobath tended to remain in the same location over the course of each cruise, although it was less visible in the afternoon hours. An exception to this occurred during the February 21, 2004 cruise when the rain obscured all surface features.

While the coastline in the vicinity of the study site is more or less straight, the coast is oriented at approximately 28.5^{o} from true north (Figure 3-1). Therefore, the following description of drogue and ADCP data are done by converting the actual trajectories into their alongshore and cross shore components with respect to the direction of the coastline. In this context, for example, "movement alongshore to the north" refers to a compass heading of approximately 331^{o}, and "movement onshore" refers to a compass heading of approximately 61^{o}.

Physical Data

<u>May 7, 2002</u>

Drogues were set between 0830 and 0900 hrs, shortly after the morning high tide (0725 hrs, 3.9 ft, mean lower low water, MLLW), and continued until 1630 hrs (Figure 3-6a). In that time, drogues were tracked over ebb, low slack, and half of the following flood tide. The maximum tidal height change over the sampling period was 3.2 ft. Drogue tracks indicate there was a persistent alongshore current to the north throughout the day in the offshore portion of the transect (Figure 3-6b). This was reflected in the continual northbound trajectory of drogues 3 through 6, where the mean alongshore component of the drogue path during the morning ebb tide was 9.1 cm s^{-1} to the north (Appendix A-1), while the mean alongshore component during the afternoon flood tide was 3.2 cm s^{-1} to the north. Drogues 1 and 2 moved proportionally very little compared to the offshore drogues. Both inshore drogues exhibited a switch in the direction of the alongshore component of their respective tracks. This directional switch occurred at approximately 1100 hrs, which preceded the tidal change by 2.5 hours (1340 hr, 0.5 ft, MLLW). The mean alongshore velocity of drogues 1 and 2 was 2.5 cm s^{-1} to the north before the directional shift, and 3.1 cm s^{-1} to the south after the shift (Figure 3-6b, Appendix A-1).

In the morning, winds were variable at less than 3 kn, whereas the afternoon winds exceeded 8 kn and were persistently onshore. This pattern of wind intensity was mirrored in the onshore movement of the drogues, where the onshore component of the trajectories in the morning was negligible, but in the afternoon (after 1300 hrs) was dominated by onshore movement.

A vertical profile of temperature along the transect, generated from CTD casts, shows a strong thermocline between 7 and 8m depth in the nearshore portion of the transect, and a less well-defined, deeper thermocline in the offshore portion of the transect (Figure 3-6c). Between 2 and 2.5 km offshore of the 10m isobath, a surface temperature discontinuity is shown. This coincided with a conspicuous change in water color and clarity observed from the deck of the R/V Sea World UCLA, from a turbid green-brown in the nearshore zone to a less turbid blue-green offshore. Salinity (not shown) did not change considerably at any depth or distance along the transect.

July 15, 2003

Drogues 1 through 4 were set between 0730 and 0800 hrs, two hours after the morning low tide (0540 hrs, -1.2 ft, MLLW) (Figure 3-7a). A fifth drogue was set at 0920 hrs in the identical starting point of the offshore-most deployment location. Tracking continued through 1615 hrs, encompassing most of one flood-ebb cycle (high tide occurred at 1214 hrs, 4.1 ft, MLLW). The maximum tidal height change over the sampling period was 4.3 ft. The paths of all drogues exhibited an alongshore directional switch, although the times at which this occurred differed among each drifter (Figure 3-7b). The inner two drogues followed a northbound alongshore track and then between

1000 and 1100 hrs, their directions switched to a southbound alongshore trajectory. The average speed of the alongshore component of drogue 1 was 7.2 cm s^{-1} to the north before the switch, and was 7.2 cm s^{-1} to the south after the switch. Drogue 2 exhibited an average alongshore component speed of 8.0 cm s^{-1} to the north before it switched direction to the south at an average speed of 15.2 cm s^{-1}.

Drogues 3, 4 and 5 were all set at different depths, and all switched directions at different times. Drogue 3, set at 26m depth, traveled the least in the northbound direction compared to drogues 4 and 5. Initially, the alongshore component of the velocity of drogue 3 was to the north at 3.7 cm s^{-1}, then between 0900 and 1000 hrs, drogue 3 remained static in the alongshore direction. After 1000 hrs, drogue 3 began to drift to the south at an average speed of 9.3 cm s^{-1}. Drogue 4, set at a depth of 10m, traveled northbound with an alongshore velocity component of 11.7 cm s^{-1}, and then after 1015 hrs, it switched direction to the south at an average speed of 15.3 cm s^{-1}. Finally, drogue 5, set at a depth of 5m, drifted to the north at an average of 14.4 cm s^{-1} and then switched between 1130 and 1215 hrs to a southbound alongshore heading at an average of 26.8 cm s^{-1}. Although the sampling times before and after the directional switch were uneven, only drogue 1 exhibited similar average velocities in the northbound and southbound portions of the drogue tracks. All other drogues traveled faster and further in the southbound portion of their track (see Appendix A-2 for a summary).

Unlike the May 7, 2002, onshore winds on July 15, 2003 began to intensify earlier in the day and had already exceeded 8 kn by 1100 hrs. This was reflected in the onshore component of the drogue tracks, with the most intense effect seen in the shallower drogues.

Data from the ship-mounted ADCP are plotted in Figure 3-8 where all east and west velocities were adjusted so that all values are represented parallel and perpendicular to the shoreline. Since only the R/V Sea World UCLA was equipped with this instrument, and this ship did not venture shoreward much beyond the 10m isobath, no data were gathered to corroborate that obtained from the inner-most drogue. However, the velocity profiles shown in Figure 3-8 do generally agree with the drogue trajectories. The shift in alongshore velocity seen in the drogue data was also reflected in the ADCP data, with surface waters flowing to the north before 1200 hrs, after which, the water in the upper 20m flowed to the south. Very little motion was detected on a similar scale in the onshore-offshore axis.

A vertical profile of temperature from CTD casts along the transect shows a strong thermocline at a depth of 10m (Figure 3-9). The water column inside the 10m isobath appeared to be well mixed, with a more or less uniform temperature seen at all depths. Offshore of this zone, the water column was well stratified. By midday, a flotsam line had formed 0.5 km offshore of the 10m isobath, although it broke up in the afternoon once the winds had reached 8 kn. No conspicuous change in water color or clarity was observed to be associated with this flotsam line.

July 17, 2003

All drogues were set at 5m depth for this survey. Deployment began between 0800 and 0830 hrs, one hour after the morning low tide (0700 hrs, -0.3 ft, MLLW) (Figure 3-10a). Tracking continued through 1600 hrs, encompassing virtually all flood tide and half of ebb tide, with high tide occurring at 1341 hrs, 4.1 ft, MLLW. The maximum tidal height change over the sampling period was 4.5 ft. As in the July 15, 2003 cruise, the paths of all drogues exhibited an alongshore directional switch, however in the present cruise, the directional switch of the drogues appeared to occur within the same time period (Figure 3-10b). Also, to better observe this switch, the drogues were retrieved less than one hour before the tidal change and re-deployed at precisely the same time as the tidal change. During flood tide, all drogues had an average northbound velocity between 8.0 and 18.2 cm s^{-1}. Although the overall distance traveled by drogue 5 was the greatest, the alongshore component of that path was the smallest of all the flood tide tracks. The average northbound velocities were increasingly greater as the proximity to shore decreased, except in drogue 1 which had an average speed of 8.3 cm s^{-1}. Immediately after re-deployment, all the drogues began drifting in a southbound direction. In every case, the average southbound velocities in the afternoon exceeded the morning northbound velocities, with average velocities between 18.4 and 26.5 cm s^{-1}.

Winds on July 17, 2003 exceeded 8 kn by 1100 hrs. However, drogue movement in the cross-shore axis was most prominent in drogues 4 and 5 during flood tide, where each drifted onshore 2.9 and 3.3 km, respectively. Although drogues 1, 2 and 3 were tracked over the same time period, considerably less onshore movement was observed in those drogues. During the ebb tide tracking, all drogues migrated onshore less than during the afternoon flood tide tracking when onshore winds had peaked between 8 and 10 kn.

Data from the ship-mounted ADCP corroborate what was observed in the drogues. Alongshore northbound motion was observed in the first three transect runs, although it was confined to the surface waters (Figure 3-11). Below a depth of 6 to 8m, some southbound flow was seen in the offshore portion of the transect runs, with no observable motion in the shoreward portion of the runs. In the three passes occurring after 1100 hrs, the surface waters flowed strongly southward, with very little motion detected below a depth of 12m. In the first two transect passes, very little movement was seen in the onshore-offshore axis, however by the third run, considerable onshore movement was seen in the offshore portion of the transect, with a corresponding offshore flow in the nearshore portion of the transect, near the bottom. In run four, the surface onshore and bottom offshore movements were intensified. By run five, this pattern had relaxed, and had mostly disappeared in run six.

During four return passes throughout the day, CTD casts were performed along the transect in roughly 1 km intervals. An interpolated vertical plot of temperature, salinity and density for the four passes is shown in Figure 3-12. The depth of the thermocline varied along the transect in all passes, although it tended to persist between 9 and 14m throughout the day. No vertical casts were conducted inshore of the 10m isobath. Almost no change in salinity was observed throughout the water column. Hence, the stratification seen in the temperature plots mirror that of the density plots.

February 21, 2004

Drogue deployment occurred between 0745 and 0800 hrs, midway between the low and high tides (0340 hrs, -1.0 ft and 0944 hrs, 5.7', respectively, MLLW) (Figure 3-13a). Tracking of offshore drogues continued through 1000 hrs, while the nearshore drogue tracking continued through 1030 hrs. The drogues were then retrieved and reset between 1230 and 1245 hrs and tracked through 1545 hrs. The maximum tidal height change over the sampling period was 6.5 ft. Rather than having an onshore drift, as in all other surveys, all drogues moved offshore throughout the day as a result of the sustained offshore winds preceding the storm that brought precipitation by midday.

Only the nearshore drogue, which was set on the 8m isobath, exhibited an alongshore switch in direction (Figure 3-13b). During the morning flood tide, the alongshore component of the trajectory was southbound with an average speed of 5.8 cm s^{-1} (Appendix A-4). During ebb tide, the alongshore component of the drogue path was to the north at an average speed of 6.5 cm s^{-1}. All offshore drogues maintained a northbound trajectory throughout the day. The drogues set at 10m depth (drogues 2, 3 and 5) differed in the extent of their northbound drift (Figure 3-13b). Drogue 2 (2 km from the beach) drifted very little to the north during the morning flood tide, with an average speed of 5.9 cm s^{-1}. In the afternoon, drogue 2 traveled much faster to the north at an average speed of 15.3 cm s^{-1}. Drogue 3 (3 km from the beach) showed a similar pattern with an average northbound speed of 10.2 cm s^{-1} in the morning and 21.0 cm s^{-1} in the afternoon. There was very little difference in the average morning and afternoon speeds of drogue 5 (4 km from the beach), with the former being 17.1 cm s^{-1} and 15.0 cm s^{-1} for the latter. Drogues 4 and 6, set at 20m depth, tracked similarly to drogues 3 and 5. The northbound speeds of drogue 4 on both tides varied little, with morning flood speeds averaging 7.3 cm s^{-1} and afternoon ebb speeds averaging 8.3 cm s^{-1}. The speed of drogue 6 averaged 14.6 cm s^{-1} in the morning, but only 7.4 cm s^{-1} in the afternoon.

The persistent alongshore flow to the north observed in the drogues was also seen in the ADCP data. Due to navigational limitations in the early morning, no ADCP data were gathered shoreward of the 3 km distance along the transect until after 0930 hrs. However, the ADCP runs did extend out to 6 km along the transect, demonstrating that the northbound flow seen in the drogues extended out beyond the 4 km distance. In most of the ADCP runs, the northbound alongshore movement was seen at depths throughout the water column. No southbound alongshore flow was seen in any of the runs. In the onshore-offshore axis, flow was only seen near the surface in the offshore direction. This is likely due to wind stress resulting from the continuous offshore winds.

On each tide, a single CTD pass was conducted where five vertical casts were made between 0 and 4 km from the 10m isobath. An interpolated vertical plot of temperature, salinity and density for each pass is shown in Figure 3-15. Almost no difference could be seen between the flood and ebb CTD passes. The water column was more mixed than on past cruise dates, as evidenced by the deeper, less prominent thermocline seen at approximately 17m. Although the weather was threatening throughout the day, measurable precipitation did not fall until the afternoon. Therefore, no freshwater lens was observed in the salinity plots, which showed a more-or-less uniform salinity distribution. For this reason, the density plots exactly mirror that for temperature.

The 17m thermocline was detected in a preliminary cast 2 km offshore of the 10m isobath performed at the start of sampling. The mooring was set with the CTD suspended at the thermocline depth. Multiple patterns of oscillation were revealed in a plot of temperature over time (Figure 3-16). A first order pattern is apparent, where the morning temperature decreased sharply at 0924 hrs from an average of 13.57°C to 13.16°C. After 1130 hrs, the temperature began to gradually rise until 1345 when the temperature leveled to an average of 13.52°C, where it was maintained throughout the duration of sampling. A second order pattern was apparent throughout the day where oscillations up to 0.10°C occurred over time periods of between 7 and 11 minutes, although the variation in the amplitude of the oscillation was much smaller during the morning.

Although the CTD was kept at a fixed distance from the sea bottom, any change in the mean sea surface height appeared as a change in depth. Different scales of oscillation appear in the depth (pressure) variable (Figure 3-16). The first occurred over the duration of the sampling period, where the peak and valley (represented by a black best-fit trend line) should reasonably coincide the timing of the mean tidal height. However, in Figure 3-16 the deeper average morning reading occurring at approximately 0915 hrs precedes the actual high tide by 30 minutes, and the shallower average afternoon value occurred at roughly 1400 hrs, 2.5 hours earlier than the actual low tide. Shorter period oscillations were seen throughout the day, ranging from 16 to 23 minutes. Smaller depth changes also appeared in time periods shorter than 1 minute, likely as a result of wind surface chop and swells.

September 27, 2004

Drogues were deployed between 0700 and 0720 hrs, midway between the low and high tides (0321 hrs, -0.3 ft and 0937 hrs, 5.3', respectively, MLLW) (Figure 3-17a). Tracking was continuous throughout the day. Each drogue was retrieved at a different time, depending on its ending proximity to the shoreline or its alongshore distance traveled (Appendix A-5). Only drogue 1, in the nearshore zone at 5m depth, was repositioned after it drifted near the entrance to Marina Del Rey Harbor, and again when it migrated too close to shore in the afternoon (Figure 3-17b). Drogue 1 exhibited a conspicuous shift in alongshore movement after the first repositioning at 1100 hrs. This directional switch occurred approximately 1.5 hours after the high tide. Prior to the repositioning, the speed of the northward alongshore component averaged 13.2 cm s^{-1}, and after the repositioning, the same alongshore component was to the south at an average speed of 10.2 cm s^{-1}. Drogues 2 and 3, at 10 and 20m depth, respectively, also showed a switch in the alongshore axis, occurring approximately one hour after the tide change. The average northward component of the velocity for drogues 2 and 3 was 8.2 and 6.7 cm s^{-1}, respectively, and after the directional switch, the average velocity was to the south at 4.4 cm s^{-1} for both drogues. Drogues 4 and 5 behaved differently from the inner three. Drogue 4, set at 10m depth, traveled in the northbound alongshore direction only a small distance for the first one hour of tracking (Appendix A-5), after which it tracked to the south at an increasing speed until after 1412 hrs when it began to slow. Drogue 5, set at 20m, only traveled alongshore to the south, increasing in speed until 1315 hrs, when it began to slow. At their maximum speeds, drogues 4 and 5 reached 24.1 and 14.6 cm s^{-1}, respectively.

Shipboard ADCP data revealed similar findings as that obtained from the drogues. The northward movement that was seen in the inner three drogues earlier in the day was also seen in the first two ADCP runs (Figure 3-18). This northbound flow was most prominently seen in the waters shoreward of 3.5 km where the movement occurred at all depths. The extent of the northbound flow field was less in run 2 than in run 1, and by run 3, almost no trace of northbound flow was seen. Southbound flow became increasingly prevalent in runs 4, 5 and 6. However, unlike the earlier runs, the afternoon flow appeared to be most conspicuous in the upper waters. The onshore drift of the outer 4 drogues was seen in the first three runs, although it was most conspicuous in the upper 10m.

Three CTD passes were performed throughout the sampling period, one each during the morning flood, afternoon ebb and afternoon flood tides (Figure 3-19). Five casts were integrated in each pass, with each spaced in 1 km distances. A strong thermocline was observed during all the passes, although the depth of the thermocline was shallower in each proceeding pass. Salinity varied little throughout the water column, with slightly more saline water occurring below 30m in the outer portion of the transect. Density distribution in each pass reflected that seen in the temperature profiles.

A thermocline was observed at 18m during a preliminary cast 2 km offshore of the 10m isobath. The CTD was set at the thermocline depth on the fixed mooring. As on February 21, 2004, different scales of temperature oscillations were revealed throughout the day (Figure 3-20). Temperatures ranged from 16.2 to 19.5°C with periods of gradual change synchronized to the tides. Stronger fluctuations occurred on shorter time periods on the order of 5 to 10 minutes, most likely due to internal waves in the vicinity. A plot of depth was much more closely linked to the tidal period than was the February 21, 2004 plot, although it did not coincide exactly (Figure 3-16). The plotted peak depth preceded the morning high tide by approximately 45 minutes (Figure 3-20), while the shallower plotted afternoon depth exactly coincided with low tide.

Sea surface temperature and chlorophyll concentrations were plotted during nine onshore runs (Figure 3-21). An overall pattern of warmer temperatures shoreward of the 2-3 km distance along the transect was observed in all runs, although the temperature offshore of the 3 km distance did show a general warming trend in the afternoon runs. Also, during runs 3 and 6, the surface temperature exhibited spikes that did not appear to coincide with any surface features. Chlorophyll concentrations were also higher in the inner 2-3 km of the transect, roughly mirroring that seen in the temperature plots, particularly during runs 1, 2 and 7. The spikes noted in runs 3 and 6 were not accompanied by corresponding spikes in chlorophyll concentration.

November 4, 2004

All drogues were deployed at approximately 0700 hrs, with tracking continuing through 1545 hrs (Figure 3-22). During that time, the tidal change in sea surface height was only 0.5 ft. Since very little onshore migration of drogues was observed, no repositioning was necessary during this cruise. As before, drogue 1 was placed along the 8m isobath and set at a depth of 6m. This drogue traveled southbound in the early morning at an average speed of 7.3 cm s^{-1}, and then slowed and switched to a northbound trajectory at 1000 hrs, after which its speed averaged 7.7 cm s^{-1} (Appendix A-6). Drogues 2 and 3, set 2 km offshore of drogue 1 at 10 and 20m depths, respectively, also exhibited a directional switch between 0830 and 0930 hrs. Before this time, the average alongshore component of the drift of drogues 2 and 3 was to the south at an average speed of 6.8 and 6.0 cm s^{-1}, respectively. After 0930 hrs, the drift was to the north at an average speed of 2.7 and 4.8 cm s^{-1} for drogues 2 and 3 (Appendix A-6). Drogues 4 and 5, deployed 4 km offshore of the 10m isobath in 10 and 20m depths, did not exhibit a directional shift at any time during the day. While the flow was always to the north, the speed at which the drogues traveled did change. The northbound flow speed always increased before noon, and then decreased in the afternoon (Appendix A-6). Over the entire tracking period, the average alongshore component of the drogue velocities was 6.5 cm s^{-1} for drogue 4 and 9.7 cm s^{-1} for drogue 5. No wind was detected before noon, and onshore winds less than 4 kn occurring in the afternoon. Thus, there was very little afternoon onshore migration of the drogues.

Data from the shipboard ADCP corroborate the drogue tracks, although the spatial ranges did not precisely overlap (Figure 3-23). Ship runs along the transect were continued out to 10 km from shore, thus providing additional information about the flow further offshore than in the previous cruises. However, as with the other cruises, no ADCP data were gathered shoreward of the 10m isobath. Smooth patterns in flow were difficult to see in the ADCP data and considerable noise in the data prevented reliable estimates of the change in velocity throughout the day, although it does provide a qualitative analysis of general flow along the transect. Since the velocities calculated from the drogue tracks in the area of overlap (drogues 2, 3, 4 and 5) were always qualitatively similar to the velocities observed in the ADCP data, extending the interpretation of the nearshore zone flow with only the single inshore drogue is reasonable.

The morning southward drift seen in drogues 2 and 3 was also revealed in the ADCP data, with the water mass shoreward of 3 km flowing south, especially in the 0645 hrs run (Figure 3-23). In the 0845 and 945 hrs runs, southward flow in the same water mass was still present, but by a subsequently reduced amount. During the 1100 hrs run and all following runs, flow 2 km from shore was alongshore to the north. At all times seaward of 3 km along the transect, the dominant flow was alongshore to the north, substantiating the drift observed in drogues 4 and 5 which persisted alongshore to the north without switching direction. Negligible water movement in the onshore-offshore axis was seen in the ADCP profiles (Figure 3-23).

A series of CTD casts were performed along the transect three times during sampling. Each pass consisted of 6 integrated casts with each roughly spaced in 0.8 km intervals (Figure 3-24). A deep thermocline was observed in all profiles, although it was considerably deeper during pass 2, when it was detected at 26 m. During passes 1 and 3, the thermocline was observed at 23 m. No considerable amount of variation occurred in salinity, with a more-or-less uniform distribution throughout all depths and distances along the transect. Density profiles mirrored that seen in the temperature profiles.

A thermocline was seen at 23m depth during a preliminary cast in the morning 2.5 km offshore of the 10m isobath. A fixed mooring was deployed at that distance with a CTD set at the thermocline depth. Two obvious scales of temperature change can be seen in a plot of temperature over time (Figure 3-25). An increasing trend in temperature proceeded throughout the day, with the starting morning temperature at approximately 15.2°C. By the late afternoon, the temperature at 23m had risen to almost 17.0°C. This rise in temperature is likely the result of the deepening thermocline noted in the CTD profile passes (Figure 3-24). Smaller scale temperature fluctuations, on the order of between 7 and 15 minutes, were also observed, most likely the result of internal waves. The amplitude of the oscillations was greatest between 0900 and 0930 hrs, although no large change in the rate of tidal exchange was occurring at that time.

Sea surface temperature and chlorophyll concentrations were plotted during nine onshore runs (Figure 3-26). Runs 1 through 4 and 8 were conducted starting from 10 km offshore. Temperature was slightly warmer in the offshore portion of the transect during the first four morning runs, with a thermal break occurring at 6 km during run 1. In the subsequent three runs, the same thermal break, which was accompanied by a surface film, had migrated shoreward. By run 4, the scum line was observed just outside of the 4 km mark. In all runs to follow, no clear thermal pattern could be seen, and no scum lines were observed. Temperature spikes occurred in runs 5 and 8, although no surface features were seen to coincide with them. The temperature breaks seen in the first 4 runs were mirrored by increases in chlorophyll concentration. In addition, a second increase was also observed within 2 km of shore. In all other transects, a less dramatic increase in chlorophyll concentration occurred approaching shore.

Plankton Data

With the exception of the two cruises in July 2004, all other survey dates were separated by at least one month, with more than a year separating the first and second surveys (May 2002 to July 2003). Additionally, each season was sampled at least once, but none was sampled comprehensively. Therefore, a synoptic view of plankton population dynamics over time cannot be made with any confidence. However, general trends between the inshore and offshore zones were observed. The extent of collections varied with each cruise, and echo amplitude data provided by the ADCP are not available for the initial May 7, 2002 cruise. The results of each data set will be presented separately.

May 7, 2002

Two sets of plankton samples were collected along the transect, the first occurring at 0930 hrs and the second at 1330 hrs. Each set consisted of five vertical plankton hauls spaced evenly in 1 km intervals along the transect beginning just inside the 10m isobath (approximately 1 km from shore) and extending offshore at 2, 3, 4 and 5 km from shore. A total of 53 species were collected over all the tows with the greatest abundance and number of species generally occurring in the offshore samples (Appendix B-1).

All of the samples were dominated by the calanoid copepod *Acartia tonsa*, which comprised over 77% of the total. *A. tonsa* was somewhat more dense in the samples further offshore, although their numbers in the inshore samples were still greater than any other species. The variability in the distribution of *A. tonsa* was significantly explained by thermocline depth, density and salinity, the latter two scaling with distance from shore (Table 3-1, Appendix C-1). The second most abundant species was the appendicularian *Oikopleura* spp., which is generally associated with more oceanic waters. Its distribution was strongly skewed in the offshore stations and was significantly explained by surface temperature, horizontal temperature gradient, thermocline, and distance from shore (Table 3-1, Appendix C-1). The first two were seen in the physical data to scale with distance from shore. The next five most abundant organisms each comprised more than 1% of the overall total, including the copepods *Paracalanus parvus*, *Corycaeus anglicus*, and *Calanus pacificus*, the cladoceran *Evadne nordmanni*, and the juvenile euphausiids *Euphausia pacifica* and *Thysanoessa spinifera*. Of this group, only the distribution of *C.*

anglicus and the juvenile euphausiids (pooled) were significantly explained by the physical variables. Less abundant species, but also with significant relationships to the independent variables, are summarized in Table 3-1 and expanded in Appendix C-1.

Cluster analysis of stations showed two distinct groups, with stations shoreward of the 3 km distance as one group (T1-1 through T1-3, and T2-1 through T2-3), and the offshore two stations in both runs as a second group (T1-4, T1-5, T2-4 and T2-5) (Figure 3-27). The distribution of eight taxa appeared heavily skewed in the offshore direction (ranked as the top eight species in Figure 3-27), which could explain the clustering of the offshore stations in both transect runs. No taxa exhibited a strong distributional bias in the stations closest to shore, although pooled fish eggs did show a slight skew, but not to the extent seen for the offshore skew of the top eight species.

<u>*July 15, 2003*</u>

Four sets of plankton samples were collected along the transect, occurring at 0800, 1030, 1230, and 1430 hrs. Each set consisted of three vertical plankton hauls spaced evenly in 2 km intervals along the transect beginning just inside the 10m isobath (approximately 0.9 km from shore) and extending offshore at 3 and 5 km from shore. A total of 73 species were collected over all the tows, and while the greatest number of species generally occurring in the offshore samples, the greatest concentration of plankton did not necessarily follow that trend (Appendix B-2). In three of the sets, the offshore sample had the lowest plankton concentration. It is possible that this is the result of averaging over a deeper depth where the plankton may not be evenly distributed throughout the water column, however the echo amplitude intensity provided by the ADCP shows an even signal throughout the water column inshore of the 4 km distance (Figure 3-8). Offshore of the 5 km distance, there was an obvious different in the distribution of plankton, where two distinct layers are present. The two layers were always associated with either the surface or just beneath the thermocline. In track 7 (1545 hrs) an especially intense concentration of plankton appeared in the surface layer offshore of the 4.5 km distance. However, no samples were gathered at the time of the track 7 ADCP run.

All of the samples were again dominated by the calanoid copepod *A. tonsa*, which comprised almost 85% of the total. *A. tonsa* was always least dense in the inshore samples, with no pattern in abundance in the offshore samples. Only four other species contributed more than 1% to the overall total abundance including *E. nordmanni* (2.2%), grapsid crab zoea (1.5%), *P. parvus* (1.3%), and *C. pacificus* (1.1%). The independent measured variables had significant explanatory value for eighteen species, implying that at least 25% of all the species in all samples were distributed according to some physical factor (Table 3-2, Appendix C-2). However, a cluster analysis of stations revealed that the greatest dissimilarity occurred at Station 2 in transect run 4, where most of the species exhibited a disproportionately skewed abundance (Figure 3-28). The offshore-most station for transect runs 1 and 3 made up the second most dissimilar group, again with most species being in greater abundance than the average at this location during these two runs. Only pooled fish eggs were strong skewed towards the inshore stations, although no clear cluster appeared for inshore stations. An onshore-offshore break was less apparent across stations in this survey compared to the May 7, 2002 survey. While many species were more abundant either inshore or offshore, the clustering of stations did not reflect such a pattern.

July 17, 2003

Three sets of plankton samples were collected along the transect, occurring at 1000, 1330 and 1530 hrs. Each set consisted of three vertical plankton hauls spaced evenly in 2 km intervals along the transect beginning just inside the 10m isobath (approximately 0.9 km from shore) and extending offshore at 3 and 5 km from shore. A total of 80 species were collected over all the tows, and while the greatest number of species generally occurred at the 2 and 4 km stations, again the greatest concentration of plankton did not necessarily follow that trend (Appendix B-3). All three plankton sets had the lowest plankton concentration occurring in the offshore sample. For this survey, it is possible that this is the result of averaging over a deeper depth in the offshore samples. Only slight differences were seen in comparing the echo amplitude intensity from the ADCP inshore of the 4 km distance (Figure 3-11). However, smaller high-density surface patches of plankton did appear inshore of the 2.5 km distance in the afternoon tracks, which could have contributed to the higher concentration seen in the second and third sample sets. As in the July 15 survey, two distinct layers were always associated with either the surface or just beneath the thermocline.

The samples were represented mostly by *A. tonsa*, which comprised almost 76% of the total. *A. tonsa* was least dense in the inshore samples of the first and second sets, however in the third set, the concentration of *A. tonsa* in the offshore sample was considerably less than in any other sample. This apparently anomalous result is likely why the distribution of *A. tonsa* showed no significant relationship with any independent variables. Five other species contributed more than 1% to the overall total abundance including *E. nordmanni* (7.7%), *C. pacificus* (2.0%), *Sagitta* sp. (1.8%), grapsid crab zoea (1.2%), and *Oikopleura* spp. (1.0%). The independent measured variables had significant explanatory value for twelve species, implying that at least 15% of all the species were distributed according to some physical factor (Table 3-3, Appendix C-3). As in the July 15, 2003 survey, a cluster analysis across all stations was not as conclusive as the May 7, 2002 survey for identifying an onshore-offshore boundary (Figure 3-29). The most dissimilar station was T2-2, however this cluster was weak and very close in dissimilarity to the subsequent two breaks. Many species did tend to be skewed in their distribution most strongly at middle Station 2 during all three transects, however no cluster was formed.

February 21, 2004

Due to logistical and safety concerns with the rain, no vertical plankton tows were conducted during this survey. However, six neuston tows were carried out parallel to shore at two distances. Three 10-minute tows were done at 0630, 0930 and 1400 hrs as close to the surf zone as safety would allow. Each was immediately followed by a 10-minute tow approximately 1.7 km from shore. A total of 37 species was collected over all the tows, and no pattern could be discerned from the plankton concentrations (Appendix B-4). Concentrations were generally an order of magnitude lower than in the previous surveys, although this may be related to the difference in the method of collection. Only a single layer of plankton was seen in the ADCP echo amplitude intensity, which in some cases extended below the thermocline (Figure 3-14). Peculiar patterns were seen in the offshore portion of the tracks, where there appeared to be a dynamic nature to the lower edge of the surface plankton concentration. In track 1, a surface patch located offshore of the 4 km distance was accompanied by a concentration of plankton beneath it extending to the bottom. A similar pattern was seen in track 2, although it was less intense and did not extend to the bottom. In track 5, inshore of the 4 km distance, the concentration of plankton was intense from the surface to the bottom, which differed greatly from that seen offshore. Unfortunately, tracks 1, 2 and 5 did not extend into the shallows where the neuston samples were gathered. However, tracks 3 and 6 did coincide with the second and third neuston sets collected at the 1.7 km distance. No especially intense patches were seen at the surface in the nearshore portion of either track.

The samples were again dominated by *A. tonsa*, which comprised 82% of the total. Only three other species contributed more than 1% to the overall total abundance including the harpacticoid copepod *Harpacticus* sp. (8.4%), the cyclopoid copepod *Oncaea* sp. (4.9%), and the barnacle cyprid *Balanus* sp. (1.1%). *Harpacticus* sp. was not collected on any other survey. Since no other samples were collected in winter or during rainy weather, it is possible that these two factors may be related to the presence of *Harpacticus* sp. in the surface waters, although this premise is not tested here. The independent measured variables had significant explanatory value for eight species, implying that at least 22% of all the species were distributed according to some physical factor (Table 3-4, Appendix C-4).

A cluster analysis of stations revealed a prominent onshore-offshore boundary existed somewhere between the inshore and offshore tows (Figure 3-30). Two station clusters are demonstrated, with all inshore tows in one group and all offshore tows in a second group. Virtually all species were heavily weighted in their distribution, with the top six taxa in Figure 3-30 exhibiting an offshore skew, while the bottom seven taxa exhibited an onshore skew. Only the middle four species in Figure 3-30 appeared to not be skewed either onshore or offshore in their distribution.

September 27, 2004

Three sets of vertical plankton samples and three sets of neuston samples were collected along the transect. Each vertical plankton set consisted of four hauls spaced evenly in 1 km intervals along the transect beginning at 1 km and ending at 5 km from shore. Each neuston set consisted of a collection just outside the surf zone and a collection 1.5 km from shore. The vertical plankton sets were collected at 0930, 1230 and 1530 hrs while the neuston sets were collected at 0830, 1230 and 1600 hrs. A total of

70 species were collected over all the vertical tows, with the lowest number of species occurring in the innermost station (Appendix B-5). Thirty-eight species were collected in the neuston tows (Appendix B-6). No pattern of abundance was seen with distance from shore. Echo amplitude intensity from the ADCP was generally less intense overall compared to previous surveys, although a clear pattern was present along the transect. As in the July 2003 surveys, two layers of higher density plankton were observed at the surface and beneath the thermocline (Figure 3-18). The surface layer was thinner than during past surveys, although a dense patch was seen during the first two tracks between 4.5 and 5.5 km distance. Despite this, the furthest offshore station of the first plankton set had the lowest concentration of organisms (Appendix B-5). Since the collection of plankton at this station likely passed directly through the most intense surface concentration, it is possible that averaging over the entire depth is unnecessarily conservative. The sub-thermocline layer was generally thin in the morning tracks and thicker and more intense in the afternoon tracks. Since the thermocline was considerably deeper compared to past surveys, the sub-thermocline plankton layer was not present inshore of the 4 km distance.

The species assemblage in the vertical plankton tows differed considerably from all previous surveys. The dominant species was *Evadne nordmanni*, which comprised 33% of the total (Appendix B-5). Ten other species contributed more than 1% to the overall total, including one species, the cladoceran *Penilia avirostris*, which was not collected previously. The ten dominant species after *E. nordmanni* were the copepod *Clausocalanus* sp. (19.6%), an unidentified bryozoan cyphonautes (9.0%), *Oikopleura* spp. (5.2%), *Sagitta* sp. (4.8%), all hydromedusae (3.6%), *P. parvus* (3.6%), *P. avirostris* (3.3%), *A. tonsa* (2.8%), *C. pacificus* (1.5%), *C. anglicus* (1.5%), and all fish eggs (1.4%). The independent measured variables had significant explanatory value for sixteen taxa (with several being pooled related species – e.g. hydromedusae, siphonophora, fish eggs, and motile ichthyoplankton), implying that at least 26% of all the species were distributed according to some physical factor (Table 3-5, Appendix C-5).

The species assemblage seen in the neuston tows was similar to that seen in the vertical tows. The cladoceran *E. nordmanni* was dominant, comprising over 70% of the total (Appendix B-6). Six other species contributed more than 1% to the total, including *A. tonsa* (12.9%), all fish eggs (4.6%), *Clausocalanus* sp. (4.1%), *Oikopleura* spp. (2.3%), all motile ichthyoplankton (1.3%), and *C. anglicus* (1.3%). The independent measured variables had significant explanatory value for eight taxa (with several being pooled as related species – e.g. siphonophores, fish eggs, and motile ichthyoplankton), implying that at least 23% of all the species were distributed according to some physical factor (Table 3-6, Appendix C-6).

Station cluster analysis was conducted on both data sets (Figures 3-31 and 3-32). As in the July 15 and 17, 2003 surveys, the vertical tow stations did not show a strong onshore-offshore break over all stations, but rather the most dissimilar station was T3-2, the middle tow along transect run 3 (Figure 3-31). Species did tend to be skewed in the inshore or offshore stations, but this did not result in an onshore-offshore boundary being revealed across stations. However, unlike the previous surveys with vertical tows, one species in this survey, *Acartia tonsa*, showed strong distributional skewing in the nearshore stations. A much clearer onshore-offshore boundary was seen in the cluster analysis of stations in the neuston tows (Figure 3-32). Two station clusters are revealed with all inshore tows in one group and all offshore tows in a second group. Pooled fish eggs was the only taxon that did not demonstrate a clear skew across stations. All species listed above it in Figure 3-32 were heavily weighted in their distribution offshore, while taxa listed below pooled fish eggs were weighted nearshore in their distribution.

November 4, 2004

Three sets of vertical plankton samples and three sets of neuston samples were collected along the transect. Each vertical plankton set consisted of four hauls spaced evenly in 1 km intervals along the transect beginning at 1 km and ending at 5 km from shore. Neuston samples were not gathered in sets, but rather were done at different distances from shore throughout the day. The distance from shore and times were 0.2 km (0800 hrs), 0.6 km (0930 hrs), 0.5 km (1100 hrs), 2.4 km (1230 hrs), 2.3 km (1400 hrs), and 2.5 km (1530 hrs). The vertical plankton sets were collected at 0730, 1200 and 1445 hrs. A total of 60 species were collected over all the vertical tows, with the lowest number of species occurring in the innermost station (Appendix B-7). Thirty-six species were collected in the neuston tows (Appendix B-8). Plankton concentrations in the first five neuston tows were similar, however the concentration of plankton in the sixth tow (collected at the end of the day) was more than twice that any other neuston sample. A higher overall intensity of plankton was observed in the echo amplitude intensity from the ADCP as compared to the September 27, 2004 survey (Figure 3-23). The surface layer of plankton was thick extending down between 12-20m, which was near the thermocline depth. In the two afternoon tracks, this layer extended even deeper to between 40 and 50m, well below the thermocline depth. A second layer of higher density plankton was seen in the morning tracks, although its depth, between 30 and 40m, was well below the thermocline. By the afternoon tracks, the second layer had disappeared as the deepening surface layer overtook it.

The distribution of species in the vertical plankton tows tended to be more skewed than in other surveys (Figure 3-33). An exception was the dominant species, *A. tonsa*, which exhibited a more even distribution across stations. *A. tonsa* comprised almost 38% of the total (Appendix B-7). Ten other species contributed more than 1% to the overall total, including *E. nordmanni* (12.1%), *Paracalanus parvus* (11.1%), an unidentified bryozoan cyphonautes (10.4%), all hydromedusae (3.2%), *Oikopleura* spp. (2.9%), *Sagitta* sp. (2.6%), *Balanus* sp. cyprid (2.6%), *Clausocalanus* sp. (2.6%), *C. anglicus* (1.4%), and all fish eggs (1.3%). The independent measured variables had significant explanatory value for twenty-three taxa (with several being pooled related species – e.g. hydromedusae, siphonophores, fish eggs, and motile ichthyoplankton), implying that at least 43% of all the species were distributed according to some physical factor, the highest percentage of any survey (Table 3-7, Appendix C-7).

The dominant species in the neuston tows was *A. tonsa*, comprising 65% of the total (Appendix B-8). Nine other species contributed more than 1% to the total, including

Clausocalanus sp. (9.6%), *Balanus* sp. cyprid (4.5%), *E. nordmanni* (4.0%), an unidentified bryozoan cyphonautes (3.8%), the cladoceran *Podon polyphemoides* (2.4%), a veneroid bivalve veliger (1.9%), all gastropod veligers (1.8%), the cyclopoid copepod *Oithona helgolandica*, and *C. anglicus* (1.2%). The independent measured variables had significant explanatory value for eleven taxa (with several being pooled as related species – e.g. gastropod veligers), implying that at least 31% of all the species were distributed according to some physical factor, the highest percentage of all neuston sets in all surveys (Table 3-8, Appendix C-8).

The cluster analyses for both data sets were striking, with clear onshore-offshore boundaries seen in both station dendrograms. In the vertical tows, the inner two stations for all three transect runs clustered in one group, while the outer two stations for all three transects formed a second group cluster (Figure 3-33). The distribution of most taxa in the three transect runs exhibited some onshore-offshore bias. The top fifteen species (Figure 3-33) exhibited a pronounced skew weighted in the offshore stations, while the bottom eleven species appeared skewed towards the inshore stations. The middle thirteen species did not show any obvious pattern of skewing across the stations. The onshore-offshore break seen in the clustering of the vertical tow stations was also seen in the neuston tow stations, where the three tows less than 0.6 km from shore formed one cluster and the three tows greater than 2.3 km from shore formed a second cluster (Figure 3-34). The top eight species listed in Figure 3-34 exhibited a distributional skew in the offshore tows, while the bottom five species were skewed in the tows closest to nearshore. The distribution of the middle eight species did not show a clear bias in any neuston tows.

Discussion

The physical data gathered offshore of Dockweiler State Beach, SMB, identify two areas of differing flow characteristics. As determined by drogue, ADCP, CTD casts, and a fixed mooring, the waters shoreward of the 10-20m isobath (approximately 2-3 km from shore) follow an alongshore tidal periodicity with almost no net directional flow, and offshore of this zone, the waters travel alongshore to the south or north, likely in accordance with the dominant SMB eddy flow regime. The plankton data corroborate this finding by revealing conspicuous discontinuities in the distribution of many species with distance from shore. Oceanic species are absent or far less abundant inshore of the 10-20m isobath than they are offshore, and neritic species are mostly confined to the inner waters, with some exceptions discussed below. The extent to which physical factors or plankton behavior contributed to the distribution of species was not determined.

This study involved an intensive field sampling effort carried out over six days utilizing a number of instruments for *in situ* measurement of physical data and the collection of plankton samples. The rationale behind such an effort was based on the apriori assumption that the nearshore zone had highly variable flow, and that large sets of data would therefore have to be gathered to discern patterns, particularly in the distribution of plankton close to shore. Two surveys were thus conducted in summer and two in fall, while winter and spring were each represented by only one sampling effort. Ship tracks only extended out 8 km for the collection of physical data, except on November 4, 2004 when some tracks extend to 10 km from shore. Plankton collections extended on the transect line no further than 5 km from shore. This limits interpretation of the data to the nearshore zone. Despite these temporal and spatial constraints, clear conclusions can be drawn from the results.

The drogue and ADCP data from all six surveys reveal a region of variable flow close to shore. Hendricks (1980) suggested that a clockwise flow might be present in SMB. This was later confirmed by Hickey (1992) who also noted that during certain times of the year, changes in the direction of flow will occur briefly before returning to the more typical clockwise flow. Using empirical orthogonal functional decomposition (EOF) (after Kundu and Allen, 1976), Hickey *et al.* (2003) describe the variability of the current field within SMB and identified two general modes of flow. The first mode occurs when intensified local wind stress forces water in the bay northward in the same direction as the larger California Counter Current. Termed "unidirectional", the surface flow over the SMB slope and the inner shelf waters of SMB move in the same direction. The second more common mode, termed "countercurrent", occurs when flow over the SMB slope and the inner shelf waters are in reverse direction to one another. This results in a counter clockwise eddy within the bay much of the year. Hickey *et al.* (2003) also identified intermediate patterns of flow that persist for only a few days as the overall flow stabilizes to either the unidirectional or countercurrent modes. Oram (2004) used a similar approach applied to his ROMS model data, and he arrived at a similar result identifying both modes of flow and calculating the average flushing time for SMB. When the flow field was in the more common countercurrent mode, the average residence time within the bay was 18 days, while the residence time in the unidirectional mode was 13.5 days.

Irrespective of whether the overall flow field is in the unidirectional or countercurrent mode, there can be a highly variable localized flow field closer to shore (Hickey, 1992: Hickey *et al.*, 2003). It is possible therefore that the offshore drogues along the transect in my investigations were responding to the larger mean flow field within the bay. According to Hickey (2003), one would therefore predict that during the summer, fall and early winter surveys, the outer drogues would travel on average in a southbound alongshore direction, while during late winter and spring the offshore drogues would travel on average in the northbound alongshore direction. However, this pattern did not always occur. Also, while the offshore drogues always exhibited a net directional flow, there was often a component to their motion that appeared to coincide with the tidal period. Current measurements by Hickey (1992) and Hickey *et al.* (2003) were collected every 10-15 minutes, but were averaged over longer time periods (weeks), precluding her from addressing the influence of tides on time scales less than one day.

During the July 15 and 17, 2003 and September 27, 2004 surveys, a varying degree of tidal influence was observed in the offshore drogues, although they did exhibit a net directional flow alongshore to the south. This was determined by adding the alongshore component of the velocity of the drogue tracks throughout the day (Appendix

A). Since these offshore drogues were at a distance from shore comparable to the current mooring of Hickey (1992) and Hickey *et al.* (2003), it is reasonable to assume that the patterns described by Hickey (1992), Hickey *et al.* (2003), and Oram (2004) may account for the movements seen in these drogues. In the July 15, 2003 survey, drogues 2 through 5 all flowed initially to the north, likely influenced by the tide, and then flowed south at a faster net velocity (Figure 3-7). Drogues 3 and 4 were set deeper than drogue 5 and hence exhibited proportionally less initial northbound flow. Setting all the drogues at a depth of 5 m during the July 17, 2003 survey likely allowed for the local wind stress acting on the surface layer to have a larger influence on the overall flow, even though the winds never exceeded 10 kn on that day (Figure 3-10). Nonetheless, drogues 4 and 5 displayed a net directional flow to the south. During the September 27, 2004 cruise, an even more pronounced net flow to the south was observed in the offshore drogues (Figure 3-17).

While the movement of offshore drogues in the July 15 and 17, 2003 and September 27, 2004 surveys generally followed the countercurrent mode (Hickey *et al.*, 2003), the pattern of movement of the November 4, 2004 offshore drogues did not. Rather, drogues 4 and 5 flowed only northbound (Figure 3-22), which is inconsistent with the general seasonality of the two flow regimes (Hickey, 1992; Hickey *et al.*, 2003; Oram 2004). It is possible that some other forcing is responsible for this pattern, wind stress being the most likely.

The offshore drogues in the May 7, 2002 and February 21, 2004 surveys moved northward as predicted by Hickey *et al.* (2003), however the actual mechanism controlling the drogues in each survey are likely different. In the May survey, drogues 3 through 6 all traveled northbound (Figure 3-6), yet three hours after the tidal change, the drogues slowed down considerably. Unfortunately, the study was ended before it could be determined whether or not the drogues would have switched direction. During the February survey, drogues 2 through 6 all moved in an offshore and northbound direction (Figure 3-13). This was undoubtedly due to the stronger sustained offshore easterly wind that accompanied the rainstorm throughout the day. It is possible that as the drogues moved offshore, they veered to the right (north) influenced by the Coriolis acceleration.

In spite of the variability in flow observed in the offshore drogues, the inshore drogues in all surveys (placed shoreward of the 10m isobath) always exhibited a tidal periodicity to their motion, a phenomenon that has been described near the study site (IRC, 1981). In most cases, net directional flow was almost zero, with the average velocity alongshore in one direction canceling that measured in the opposite direction. This was true of all six surveys, with a caveat. In all surveys except February 21, 2004, the inshore drogues traveled north during flood tide and south during ebb tide. However, in the February survey, the tidal periodicity observed in the inshore drogue was opposite of the other surveys with northward flow occurring during ebb tide and southward flow seen during flood tide (Figure 3-13). No obvious mechanism could be discerned from the data to explain this apparent anomaly. However, the fact that the winds in the February survey were strong and sustained in the offshore direction, whereas it was onshore during all other surveys, suggests that there may be a strongly coupled connection between tides and wind controlling the movement of the nearshore zone water mass (IRC, 1981).

The strength of the tidal currents may also be a factor influencing how far from shore one will see a separation in flow behavior between the nearshore and offshore zones. One might predict that during spring tides, when the influence of tidal currents would be greatest, that the drogues would be retained within some boundary zone more readily than during neap tides, when tidal currents are weak and prevailing coastal currents would dominate. This would be consistent with the sticky water phenomenon (Wolanski *et al.*, 1989; Wolanski, 1994; Wolanski and Spagnol, 2000), although it has never been used to explain retention of water along continental coastlines. In the last three surveys, the CT mooring recorded internal wave propagation along the thermocline, with the greatest temperature oscillations generally occurring close in time to when the greatest tidal exchange was occurring (Figures 3-16, 3-20 and 3-25). The most regular oscillations were expanded out in the latter two figures revealing the nature of the timing of the wave oscillations with respect to the measured tidal period, which rarely matched the predicted tides precisely. This confirms that the influence of internal waves and tides are strong within my study site, and that the conditions do exist very close to shore for the sticky water phenomenon to occur.

However, the drogue paths in my investigation did not clearly reflect a pattern consistent with sticky water in the nearshore zone. During the September 27 and November 4, 2004 surveys the deployment of drogues was carried out identically so as to test the sticky water hypothesis. These two dates were chosen specifically to take advantage of the different tidal ranges, and hence tidal current strengths (Figures 3-17 and 3-22). On September 27, 2004, a maximum tidal height change of 4.6 ft occurred over the sampling period, while a maximum of only 0.5 ft occurred during sampling on November 4, 2004. The strong reversing tidal periodicity of the inner drogues and the dominant northerly flow of the outer drogues during both of these surveys have already been described. However, the middle drogues 2 and 3 in both surveys also exhibited a strong tidal periodicity. On September 27, 2004, drogues 2 and 3 exhibited a directional switch during the tide change, and although the net directional flow was to the north (as was the inner drogue to a small degree), they behaved very differently from offshore drogues 4 and 5. Likewise, drogues 2 and 3 in the November 4, 2004 survey behaved more like the inner drogue than the outer drogues. Surprisingly, drogues 1 through 3 in the November 4, 2004 (neap tide) survey exhibited as strong a tidal periodicity as did those observed during the September 27, 2004 (spring tide) survey. These results are inconsistent with a sticky water paradigm, where the opposite result would have been predicted. However, it is also possible that, since the drogue data gathered to specifically test for a sticky water pattern came from only two days of drogue observations, too few observations were made to see a real pattern. Although the more likely explanation is that flow in the study site is more complicated, and one phenomenon alone is inadequate to explain the observed pattern. In either case, the addition of more observations in the future will help clarify the relevance of sticky water in explaining the pattern of flow in the study site.

The drogue data clearly show that the waters shoreward of the 10-20 m isobath behave differently than the offshore waters. This is consistent with initial observations of the surface along these isobaths where surface slicks demarcated a region of water shoreward of which was generally turbid with a murky tan-green hue, and offshore of which was usually less turbid with a blue-green hue. By calculating a mixing parameter, such as in Beers (1983), it is possible to roughly estimate over what depth a tidal front should be formed, given a certain average velocity of flow throughout the water column. The equation is given as:

$$\text{Mixing Parameter} = \log \frac{(h)}{(u)^3} \qquad \text{Equation 3-1}$$

where the mixing parameter (MP) equals the log of the ratio of the depth (*h*) to the water velocity (*u*) cubed. Small MP values indicate vertically well-mixed water. This general equation explains mixing best for straight coastlines with a gradually sloping bottom where waves approaches the beach perpendicular to shore, as is the case in my study site. A small-scale tidal mixing front along Dockweiler State Beach would enhance the separation of the inshore and offshore waters since the shallower inshore waters would be well mixed, and the deeper offshore waters would remain stratified. This would set up a density gradient, inhibiting horizontal mixing. Beers (1983) proposed an MP value of 2 as coinciding with regions of the English Channel where tidal fronts are typically observed, however the water velocities present in the English Channel are generally faster than that seen in SMB (Capon, 2003). For those surveys in which the change in tidal height exceeded 2 ft, the velocities throughout the water column rarely exceeded 25 cm s^{-1}. Using this as a theoretical sustainable maximum flow in a depth range of 10 to 20 m (where surface slicks are commonly observed in the study area), the MP is 2.8 along the 10m isobath and 3.1 along the 20m isobath, both values being much greater than the threshold value of 2 (Beers, 1983). Since vertical mixing in the vicinity of Dockweiler State Beach has not been investigated in this way in past studies, it is difficult to know whether the MP values above are reasonable. Compared to SMB, the English Channel has much higher average wind speeds, with sustained winds commonly up to 30 kn (Capon, 2003) and greater tidal stream velocities of 60-130 cm s^{-1} (Pingree *et al*., 1975). It is therefore likely that the threshold value utilized by Beers (1983) may be inappropriate for describing mixing in the nearshore zone along Dockweiler State Beach.

Unfortunately, the shallower depths shoreward of the 10m isobath were usually too shallow for the R/V Sea World UCLA to maneuver safely, and accordingly, no corroborating ADCP information could be gathered. There was always good agreement between the outer drogue velocity vectors and the velocity vectors detected by ADCP, but only on rare occasion could the ship venture as close as 1 km from shore because of the proximity to the breaking waves. Exceptions to this occurred on September 27 and November 4, 2004 during calm seas when strong tidal periodicity was observed in drogues 2 and 3, initially deployed on the 20m isobath approximately 2.5 km from shore. The ADCP tracks of these two surveys, recorded shear zones at approximately 3.5 km from shore (Figures 3-18 and 3-23). This zone of transition was seen in the sea surface temperature plots of September 27, 2004, and in the plots of chlorophyll concentration (Figures 3-21 and 3-26). The water inshore of the 3 km distance was warmer than offshore and had a slightly higher concentration of chlorophyll (Figure 3-21), but the pattern was not consistent in all the runs. The transitional zone in the November 4, 2004 survey was not seen in the temperature or chlorophyll concentration plots (Figure 3-26). Rather, these plots revealed the presence of a thermal front between the 6 and 7 km distance in the first four runs, which disappeared as the day progressed.

Zooplankton data also demonstrate a distinctive skewing in the distribution of many species, but not in all. I identified between 53 and 80 species in the vertical tows and between 36 and 37 species in the neuston tows of each survey, many of which are common residents of the SCB (MBC 1976; Soule and Oguri, 1977; IRC 1981; Barnett and Jahn, 1987; Dawson and Pieper, 1993). None of the collections occurred more than 5 km offshore, yet certain species still exhibited either an offshore or onshore distributional bias. The assemblage of organisms associated with offshore oceanic waters was usually present only at the offshore collection stations, while species common to bays, estuaries and littoral zones were generally captured in the nearshore vertical and neuston tows. Oddly enough, this trend was most apparent in the neuston tows, which were confined to an even smaller sampling range (less than 2.5 km from shore) than the vertical plankton tows (Figures 3-30, 3-32 and 3-34). Within the vertical tows, the onshore-offshore skewing of plankton was most clearly demonstrated during the November 4, 2004 survey, when very little tidally induced motion should theoretically have been observed (Figure 3-33). Identification of water masses by its plankton composition has been practiced for many decades (Cassie, 1963; Steele, 1977; Mackas *et al.*, 1985; Mauchline, 1998). However, many of these studies examine greater spatial scales than in the present study, as in cross-shelf changes in copepod fauna near Cape Hatteras (Bowman, 1971; Malone *et al.,* 1983), in the Bearing Sea (Smith and Vidal, 1984), Nova Scotia (Reiss *et al.,* 2003), and many others. Locally, plankton species have been used to identify water masses in southern California, particularly when offshore oceanic waters tend to migrate cross shelf towards shore (MBC, 1976; EQA MBC, 1978; IRC, 1981; Barnett and Jahn, 1987).

In analyzing the MLR model results for the different species, all possible physical measurements were included as independent variables in the model. Most of these variables were interrelated with each other, particularly with distance from shore (e.g. depth, surface temperature, salinity, density, chlorophyll concentration, vertical temperature gradient, etc.). Every attempt was made to obtain adequate sample sizes, however even the greater number of stations sampled during the July 15, 2003, September 27, and November 4, 2004 surveys (where N=12) were only marginally sufficient for statistically detecting patterns in distribution. Therefore, including as many independent physical variables as possible in the MLR model, even though many were interrelated, would increase the chances of revealing patterns. However, discussing whether or not, for example, temperature or density contributed more to explaining the distribution of a species would be of little value in this investigation, and perhaps might even distract from the overall goal of assessing distributional differences with distance from shore. Therefore, in discussing the MLR results for each species below, I refer to the interrelated measured variables as a complex of physical variables that all relate to distance from shore. This allows for a more holistic look at the influence of the physical variables as a whole on plankton distribution. The details of the MLR model components for each species whose distribution was statistically significantly explained by at least one independent physical variable are provided in Appendix C and summarized in Tables 3-1 through 3-8. In some cases the p-value of all explanatory variables, collectively, for a species may be greater than 0.05, but will be included in Appendix C and the tables if at least one of the variables contributes significantly (e.g. Appendix C-1 and Table 3-1 summary for *Acartia tonsa* and *Tortanus discaudatus*).

The initial assumption after preliminary observations of drogues in the study site was that tides must play an important role in the dynamics of the nearshore zone along with local wind forcing, and that this should be related to the intensity of tidal currents. Since winds were variable for most surveys and rarely exceeded 10 kn (except during the February 21, 2004 survey), more attention was given to tides in explaining the variation in flow between the nearshore and offshore waters. While the first four surveys covered a reasonable range of tidal height change (3.2 ft to 6.5 ft), the dates for the September 27 and November 4, 2004 surveys were selected specifically to observe whether or not tidal current intensity affected horizontal stratification in the physical variables and plankton assemblage. Both surveys were conducted in a similar fashion, with tidal current intensity varying between the two days. The tidal height change during sampling was 4.6 ft on September 27, 2004 (spring tide) and 0.5 ft on November 4, 2004 (neap tide). All other surveys had tidal height changes in between that of the last two surveys, except the February 21, 2004 survey, which had a tidal height change of 6.5 ft. However, only neuston tows were collected for this survey, and a storm front was present during much of the sample.

The MLR results showed that the measured physical variables did a better job of explaining the distribution of more species in the November 4, 2004 vertical tows (Table 3-7) and neuston tows (Table 3-8) than in any other survey. The distribution of 23 species in the vertical tows and 11 species in the neuston tows were significantly explained by at least one of the independent variables on November 4, 2004 (Tables 3-7 and 3-8), whereas the distribution of 16 species in the vertical tows and 7 species in the neuston tows were significantly explained (Tables 3-5 and 3-6). An obvious distributional pattern in many plankton species was observed in the cluster analyses of stations and the two-way coincidence table of species for November 4, 2004 (Figures 3-33 and 3-34). A distributional pattern was less evident in the cluster analysis of stations and the two-way coincidence table of species in the vertical tows on September 27, 2004, although the neuston tows did show a strong pattern (Figures 3-31 and 3-32).

The top fifteen species listed in Figure 3-33 were strongly associated with the offshore vertical tows. As would be predicted, the gelatinous animals were all in this category, represented by siphonophores, *Sagitta* sp., *Salpa* sp., hydromedusae and *Oikopleura* spp. Likewise, most of the crustaceans in the upper 15 taxa are generally oceanic, as for *Rhincalanus nasutus*, *Calanus pacificus* and euphausiid juveniles. A similar pattern was revealed in the neuston tows with the top 10 species listed in Figure 3-34 being strongly associated with the offshore waters. *Sagitta* sp. and *Oikopleura* spp. in particular were present in all surveys, with the former present only in vertical tows and the latter present in both vertical and neuston tows. The distribution of both of these species was significantly explained by at least one physical variable in at least half of the surveys.

The higher abundance of *Penilia avirostris* in offshore waters and low numbers close to shore in the November 4, 2004 vertical tows, was unusual since it is known to be a common inhabitant of harbors (Soule and Oguri, 1977; EQA and MBC, 1978) (Figure 3-34). *P. avirostris* only occurred in the September 27 and November 4, 2004 surveys, and other than the November vertical tows, it was more common in the nearshore tows (Figures 3-31, 3-32 and 3-33). This species likely aggregates near the surface where their abundance would be emphasized in neuston tows. Also, the distance range was very different between the two collection methods, with the offshore-most neuston tows occurring midway between the second and third vertical tow positions. In the September neuston tows and the November vertical tows, the distribution of this species was explained significantly by at least one physical variable (Tables 3-6 and 3-7; Appendix C). This species has been increasing recently in areas where it had not been common, perhaps as a result of rising seawater temperatures (Johns *et al.,* 2005).

While the neuston tows of September 27 and November 4, 2004 both resulted in strong dissimilarities between onshore and offshore tows, some obvious differences are apparent. Most species that were more abundant offshore are known to be oceanic, for example *Calanus pacificus* and *Oikopleura* spp., which appeared highly skewed in both surveys. The cladoceran *Evadne nordmanni* is generally considered a ubiquitous surface dwelling species found over the coastal shelf (Bainbridge, 1958; Onbe and Ikeda, 1995), yet in the neuston samples, it was in greatest abundance offshore with proportionally small numbers nearshore. This pattern did not occur as strongly in the February 21, 2004 survey, the only other survey when neuston collections were made, nor in any of the vertical tow samples. Nonetheless, this species was found during all surveys, and its distribution was explained by at least one physical variable in more than half of the surveys.

The distributional pattern of bryozoan cyphonautes in the last two surveys was peculiar. In the September neuston tows, this taxon was found almost exclusively in the offshore samples, although this was not the case for the vertical tows, implying that bryozoan cyphonautes offshore were likely in the surface waters. However the opposite was found in the November survey, where a distributional pattern was seen for this taxon in the vertical tows, but not in the neuston tows. It is possible that this was due to the different sampling techniques, although this is unlikely. The sampling method was identical between the two surveys, and one would expect a sampling bias to be consistent in one net type versus another, which was not the case. It is more likely that this may be a manifestation of a behavioral character. Bryozoan cyphonautes do actively respond to shear forces (Abelson, 1997), and they are capable of swimming speeds up to 5 cm s^{-1} in controlled laboratory experiments (Crisp, 1955), although others have questioned how likely this is in nature (Mullineaux and Butman, 1991). However, the physical cues to which bryozoan cyphonautes might be responding in the study site remains unclear. The February 21, 2004 survey had the greatest change in tidal height (6.5 ft), and therefore theoretically the greatest dissipation of tidal energy in the study site. Bryozoan cyphonautes was also heavily skewed in its distribution in the neuston tows from this survey, although the distributional weighting of this species in the offshore of the November 4, 2004 vertical tows diminishes the explanation that tidal forces are responsible. Bryozoan cyphonautes larvae were abundant in all of the surveys, and in six of the eight data sets, the distribution was explained by at least one physical variable (Tables 3-2 through 3-7, Appendix C). Identifying bryozoan cyphonautes to the species level is difficult, and while I was not confident in assigning a species name to those found in my samples, they are most likely members of the genus *Membranipora* (Rafferty, 2001). Bryozoa adults generally live on hard substrates, which implies that the source of the larvae in my samples is likely Marina Del Rey Harbor where there is ample rocky substrate. This does raise a question about the larval behavior of this species since no cyphonautes were captured in the inshore samples near the harbor mouth. It is possible that, close to shore, bryozoan cyphonautes remain near the bottom where shear forces are greatest, and they can better search for suitable habitat (Abelson, 1997). Such a behavior would exclude this species from capture by the vertical nets tows which always sampled no less than 1m from the seabed.

Consisting mostly of meroplankton and copepods known to be neritic, the bottom 11 species listed in Figure 3-33 were more abundant in the nearshore vertical tows. The presence of large numbers of *Balanus* sp. cyprid larvae close to shore is notable. This species passes through multiple naupliar stages over the course of 2-4 weeks after which it molts to the cyprid stage whereupon it must find substrate on which to settle within the following few weeks (Pfeiffer-Hoyt and McManus, 2005). The fact that the cyprid stage of this species was found in such abundance in the nearshore tows but not in the offshore tows in either the vertical or neuston samples implies a strong behavioral response by the species to migrate to a layer (most likely the surface during the daytime) that will enhance their aggregation in the nearshore waters. Also of interest was the difference in distribution of gastropod veligers in the vertical and neuston tows on November 4, 2004. This taxon was likely represented by multiple species that could not be differentiated. It is possible that the concentration of gastropod veligers in the nearshore, measured by neuston tows, and the higher abundance offshore, measured by vertical tows, is the result of behavioral swimming differences in different species (Lough and Gonor, 1971; Chia *et al*., 1984). Likewise, this could simply be a consequence of using two different sampling approaches. Gastropod veligers were significantly explained by at least one measured physical variables during the May 7, 2002, and in both the vertical and neuston tows on November 4, 2004 (Tables 3-1, 3-7 and 3-8). Comparing the vertical tows only, these two surveys produced the strongest separation between the nearshore and offshore stations, as was depicted in the station cluster diagrams (Figures 3-27 and 3-33).

Copepods were the most abundant species group in all of the surveys, which is consistent with other local studies (MBC, 1976; IRC, 1981; Barnett and Jahn, 1987; Dawson and Pieper, 1993). Fourteen copepod species were found to have a statistically significant relationship with at least one physical variable (Appendix C). Of these, the distribution of three copepod species was significantly explained in over half the surveys. *Acartia tonsa*, the most ubiquitous species in my samples, has also been locally dominant in many past studies in the SCB (MBC, 1976; IRC, 1981; Barnett and Jahn, 1987; Dawson and Pieper, 1993). *A. tonsa* was the most abundant species in all the surveys except September 27, 2004, yet even in this survey, its distribution was significantly related to multiple independent variables (Appendix C). On the other hand, on July 17, 2003, *A. tonsa* was highly abundant in all samples taken, but no statistical relationship was revealed. In three surveys, *A. tonsa* exhibited a distributional bias and had a significant relationship with at least one physical variable, but the skewing was not consistent. During the July 15, 2003 survey, the distribution of *A. tonsa* exhibited the strongest bias toward the offshore stations of any species even though no dissimilarity was detected between onshore and offshore stations (Figure 3-28). In contrast, in the vertical and neuston tows on September 27, 2004, *A. tonsa* was most highly abundant in the nearshore samples (Figures 3-31 and 3-32). Exactly what structured the distribution of this species in all surveys is unresolved. Possibly, the scale on which all of surveys were conducted is too small to resolve these patterns.

The calanoid copepod *Calanus pacificus* and the cyclopoid *Corycaeus anglicus* were also common in all surveys, and their distributions were significantly explained in over half the surveys (see all table summaries except 3-4; Appendix C). These species are generally observed in the offshore waters (MBC, 1976; Barnett and Jahn, 1987; Dawson and Pieper, 1993), however in this study, distributional patterns were only obvious during the last two surveys, and for *C. anglicus*, the patterns were not always consistent between the two sampling methods. In general, these species were numerically more abundant offshore, but the two-way coincidence tables only revealed strong skewing in the September 27 and November 4, 2004 surveys. In the neuston tows for both surveys, both species were distributed proportionally greater in the offshore waters (Figures 3-32 and 3-34). However, in the vertical tows on both dates, *C. pacificus* was strongly skewed in the offshore direction while *C. anglicus* was skewed in the onshore direction (Figures 3-31 and 3-33). This discrepancy is likely related to the inability to see real spatial differences in *C. anglicus* due to the small scale on which this study was conducted.

Only one copepod species, the cyclopoid *Oithona oculata*, appeared to exhibit a bias towards the nearshore zone. This species, most often associated with harbors, lagoons and estuaries (Olsen, 1949; MBC 1976), was captured exclusively in the neuston tows. However, it was only abundant in the September 27 and November 4, 2004 samples, and hence its distribution was only explained significantly in those two surveys (Tables 3-6 and 3-8). The skewing pattern in the nearshore waters was evident in the two-way coincidence tables (Figures 3-32 and 3-34). It is likely that the Marina Del Rey harbor mouth is the source for this species.

The distribution of eggs of northern anchovy, *Engraulis mordax,* and all other assorted fish eggs were significantly related to at least one physical variable in half of the surveys (Appendix C). *E. mordax* actively schools in coastal waters and releases eggs offshore year round (Moser, 1996; Moser and Pommeranz, 1999). In those samples where *E. mordax* eggs were present, they tended to have a slight offshore distribution. Despite the strong association with the physical variables, *E. mordax* eggs were never abundant enough to be included in any of the two-way coincidence tables. The other fish eggs consisted of at least five unidentified taxa. Collectively, the distribution of fish eggs was skewed in the inshore direction, particularly in the samples taken by vertical tow.

All of the two-way coincidence tables for the vertical tow samples revealed this strong association with the nearshore zone, although less so for the September 27, 2004 survey (Figures 3-29 through 3-34). Since the nearshore samples were generally collected near the 10m isobath, and surface slicks were often seen parallel to shore along the 10m isobath, it is possible that the higher abundance may be the result of accumulation or inshore trapping by a tidal front (Le Fevre, 1986).

Conclusion

From the physical and plankton data gathered during the six surveys, there is an obvious hydrographic discontinuity approximately 2–3 km from shore, roughly coinciding with the 10–20m isobaths. This discontinuity varied little with distance from shore in each survey, except on November 4, 2004 when it extended out past the middle-distance drogues. The inshore waters always had a strong tidal periodicity to the flow with almost no net directional flow in any survey. The offshore waters generally did exhibit a net directional flow, even when some tidal periodicity was observed. However, this alongshore directional flow did not always travel as predicted by the seasonal flow patterns in SMB. The forces responsible for generating the difference in offshore flow remains inconclusive, although the prevailing local winds likely plays a critical role based on the northbound travel of the drogues during the February 21, 2004 survey when atypical sustained easterly winds were present.

Other studies have observed the concentration of plumes within a narrow band near to shore (e.g. Csanady, 1971; Washburn *et al.,* 2003; Grant *et al.,* 2005). Still others have noted an increase in local abundance of zooplankton when the exchange of water is limited. This is true for zooplankton in general (Chalkia and Pitta, 2003) and for planktonic larvae of benthic invertebrates (e.g. Sponaugle *et al*., 2002). In SMB, a number of species were found to be associated with either the nearshore or offshore waters, as demonstrated in the two-way coincidence tables, however it is unclear whether or not this is due to passive accumulation by differing flows in the nearshore and offshore waters, or if it is due to plankton behavior. Nonetheless, if the latter is true, a shear boundary could further enhance a behavioral propensity for nearshore or offshore waters. Many of the species that exhibited distributional skews are known to migrate vertically. While this would be of little benefit in the classical sense in my study site, where samples were never collected in waters deeper than 45m, it would enable a species to select for a favorable horizontal flow. Nearshore zones are inherently dynamic, where even in the absence of tidal effects onshore winds can move surface waters towards the beach. While some of this flow will refract in the alongshore direction, some of it will re-circulate as offshore-flowing bottom water. By utilizing this conveyer belt effect, competent swimming zooplankton can affect their horizontal distribution. The significance of behavior in determining the spatial distribution of plankton species is underscored in the studies described in Chapters 1 and 2 of this dissertation, where the observed distributions of a number of zooplankton species were not consistent with what would have been predicted by passive convergent flow alone near a front in Monterey

Bay. The fact that the distribution of many zooplankton species near Dockweiler State Beach were highly skewed in either the nearshore or offshore waters, suggests that behavior may also be an important factor in maintaining the onshore-offshore pattern of zooplankton close to shore.

Clearly, further research will be required to better resolve the nature of this inshore hydrographic zone. Because this region is highly dynamic over short time periods, continuous monitoring of currents using upward-looking ADCP moorings in an array would be a great benefit. Also conducting further drogue exercises further from shore may help to establish the extent to which the SMB eddy truly influences flow closer to shore.

Tables

Table 3-1. Forward step-wise multiple linear regression summary statistics for each significant zooplankton taxa in the study site on May 7, 2002. Reported p-values are cumulative for all significant independent explanatory variables and may not collectively reflect a significant result. In such a case, the species will still be included if at least one independent variable contributes to explaining the species distributional variability. Details are presented in Appendix C-1.

	F	Adjusted R^2	p-value	Independent explanatory variable
Holoplankton				
Acartia tonsa	$F_{(3,6)}=4.5132$	0.5394	0.0555	Surface Sal., Surface Dens., Thermocline
Tortanus discaudatus	$F_{(2,7)}=3.4281$	0.3505	0.0916	Thermocline, Horiz. ΔT °C
Corycaeus anglicus	$F_{(7,2)}=1543.4$	0.9992	0.0007	Depth, Distance, Surface Sal., Thermocline, Vert. ΔT °C, Horiz. ΔT °C
Rhincalanus nasutus	$F_{(5,4)}=33.292$	0.9472	0.0024	Depth, Distance, Surface Temp., Thermocline, Horiz. ΔT °C
Eucalanus californica	$F_{(6,3)}=18.956$	0.9229	0.0175	Depth, Distance, Surface Sal., Surface Dens., Vert. ΔT °C
Euphausiid juveniles	$F_{(2,7)}=35.900$	0.8858	0.0002	Distance, Surface Temp.
Muggiaea sp.	$F_{(2,7)}=4.8823$	0.4632	0.0470	Distance, Surface Temp.
Sagitta sp.	$F_{(6,3)}=23.982$	0.9387	0.0125	Depth, Distance, Surface Temp., Thermocline, Vert. ΔT °C
Oikopleura spp.	$F_{(4,5)}=60.017$	0.9633	0.0002	Distance, Surface Temp., Thermocline, Horiz. ΔT °C
Meroplankton				
Fish eggs var.	$F_{(4,5)}=11.054$	0.8171	0.0107	Distance, Surface Temp., Surface Dens.
Gastropoda veligers	$F_{(4,5)}=4.8594$	0.6317	0.0566	Surface Temp., Surface Dens., Thermocline, Horiz. ΔT °C
Porcellanidae zoea	$F_{(4,5)}=4.0062$	0.5719	0.0801	Depth, Surface Temp., Surface Sal., Vert. ΔT °C
Sample Summaries				
Plankton conc. (ml L^{-1})	$F_{(7,2)}=144.23$	0.9193	0.0069	Depth, Distance, Surface Temp., Surface Dens., Vert. ΔT °C, Horiz. ΔT °C
Diversity (H')	$F_{(7,2)}=144.23$	0.9911	0.0069	Surface Temp., Surface Sal., Surface Dens., Thermocline, Vert. ΔT °C, Horiz. ΔT °C

Table 3-2. Forward step-wise multiple linear regression summary statistics for each significant zooplankton taxa in the study site on July 15, 2003. Reported p-values are cumulative for all significant independent explanatory variables and may not collectively reflect a significant result. In such a case, the species will still be included if at least one independent variable contributes to explaining the species distributional variability. Details are presented in Appendix C-2.

	F	Adjusted R^2	p-value	Independent explanatory variable
Holoplankton				
Acartia tonsa	$F_{(6,5)}=66.415$	0.9727	0.0001	Depth, Distance, Surface Temp., Thermocline, Horiz. ΔT ^{o}C
Calanus pacificus	$F_{(4,7)}=7.3532$	0.6979	0.0119	Depth, Surface Temp., Surface Dens., Thermocline
Paracalanus parvus	$F_{(4,7)}=6.6971$	0.6744	0.0153	Depth, Surface Temp., Surface Dens., Thermocline
Tortanus discaudatus	$F_{(3,8)}=6.6132$	0.6049	0.0147	Depth, Surface Temp., Thermocline
Calocalanus styliremis	$F_{(7,4)}=5.5524$	0.7434	0.0585	Depth, Distance, Surface Temp., Surface Sal., Surface Dens., Thermocline, Vert. ΔT ^{o}C
Corycaeus anglicus	$F_{(3,8)}=4.4043$	0.4814	0.0416	Depth, Surface Temp., Thermocline
Rhincalanus nasutus	$F_{(7,4)}=14.225$	0.8938	0.0110	Depth, Distance, Surface Temp., Surface Sal., Thermocline, Vert. ΔT ^{o}C
Hydromedusae (pooled)	$F_{(2,9)}=7.5855$	0.5449	0.0117	Depth, Distance
Oikopleura spp.	$F_{(8,3)}=33.317$	0.9592	0.0076	Depth, Distance, Surface Sal., Surface Dens., Thermocline, Vert. ΔT ^{o}C, Horiz. ΔT ^{o}C
Sagitta sp.	$F_{(2,9)}=7.6964$	0.5490	0.0113	Depth, Vert. ΔT ^{o}C
Meroplankton				
Cancridae zoea	$F_{(1,10)}=5.6763$	0.2983	0.0385	Distance
Hippolytidae zoea	$F_{(1,10)}=6.6775$	0.3404	0.0272	Distance
Neotrypaea californica zoea	$F_{(3,8)}=2.9273$	0.3445	0.0998	Surface Dens., Thermocline, Vert. ΔT ^{o}C
Gastropoda veligers	$F_{(4,7)}=10.420$	0.7740	0.0045	Surface Temp., Surface Sal., Thermocline, Vert. ΔT ^{o}C
Bryozoa cyphonautes	$F_{(5,6)}=4.1451$	0.5884	0.0564	Surface Temp., Surface Sal., Surface Dens., Thermocline, Horiz. ΔT ^{o}C
Typhloscolex sp.	$F_{(5,6)}=10.551$	0.8128	0.0062	Surface Dens., Thermocline, Vert. ΔT ^{o}C, Horiz. ΔT ^{o}C
Fish eggs var.	$F_{(4,7)}=18.255$	0.8625	0.0008	Distance, Surface Sal., Horiz. ΔT ^{o}C
Engraulis mordax eggs	$F_{(8,3)}=100.71$	0.9864	0.0015	Depth, Distance, Surface Temp., Surface Sal., Thermocline, Vert. ΔT ^{o}C, Horiz. ΔT ^{o}C
Sample Summaries				
Number of individuals	$F_{(5,6)}=73.717$	0.9706	0.0000	Distance, Surface Temp., Thermocline, Vert. ΔT ^{o}C, Horiz. ΔT ^{o}C
Number of species	$F_{(3,8)}=22.181$	0.8524	0.0003	Distance, Thermocline, Horiz. ΔT ^{o}C
Diversity (H')	$F_{(7,4)}=13.253$	0.8863	0.0126	Depth, Distance, Surface Sal., Surface Dens., Thermocline, Vert. ΔT ^{o}C, Horiz. ΔT ^{o}C
Plankton concentration (ml L^{-1})	$F_{(3,8)}=5.6231$	0.5577	0.0227	Surface Temp., Surface Dens., Horiz. ΔT ^{o}C
Plankton volume (ml)	$F_{(2,9)}=7.1894$	0.5295	0.0136	Depth, Distance, Surface Temp., Surface Sal., Surface Dens., Thermocline, Vert. ΔT ^{o}C, Horiz. ΔT ^{o}C

Table 3-3. Forward step-wise multiple linear regression summary statistics for each significant zooplankton taxa in the study site on July 17, 2003. Reported p-values are cumulative for all significant independent explanatory variables and may not collectively reflect a significant result. In such a case, the species will still be included if at least one independent variable contributes to explaining the species distributional variability. Details are presented in Appendix C-3.

	F	Adjusted R^2	p-value	Independent explanatory variable
Holoplankton				
Calanus pacificus	$F_{(1,7)}$=17.977	0.6797	0.0038	Surface Dens.
Rhincalanus nasutus	$F_{(2,6)}$=5.7012	0.5403	0.0410	Surface Sal., Surface Dens.
Euphausiacea juveniles	$F_{(1,7)}$=24.795	0.7484	0.0016	Surface Dens.
Muggiaea sp.	$F_{(2,6)}$=3.1321	0.3477	0.1171	Surface Temp., Surface Sal.
Oikopleura spp.	$F_{(3,5)}$=9.3935	0.7589	0.0170	Distance, Surface Sal., Surface Dens.
Fritillaria sp.	$F_{(2,6)}$=5.1353	0.5083	0.0502	Surface Sal., Surface Dens.
Meroplankton				
Cancridae zoea	$F_{(3,5)}$=6.0433	0.6541	0.0407	Surface Temp., Surface Sal., Vert. ΔT °C
Grapsidae zoea	$F_{(2,6)}$=6.3468	0.5720	0.0331	Surface Sal., Thermocline
Neotrypaea californica zoea	$F_{(1,7)}$=21.839	0.7226	0.0023	Surface Temp.
Bryozoa cyphonautes	$F_{(5,3)}$=741.68	0.9978	0.0001	Depth, Distance, Surface Temp., Surface Sal.
Fish eggs var.	$F_{(4,4)}$=66.624	0.9704	0.0007	Depth, Distance, Surface Temp., Surface Sal.
Engraulis mordax eggs	$F_{(2,6)}$=14.948	0.7771	0.0047	Surface Sal., Surface Dens.
Sample Summaries				
Number of individuals	$F_{(3,5)}$=12.967	0.8178	0.0086	Depth, Distance
Diversity (H')	$F_{(1,7)}$=3.1165	0.2092	0.1209	Distance
Plankton concentration (ml L^{-1})	$F_{(2,6)}$=9.6716	0.6843	0.0133	Depth, Vert. ΔT °C
Plankton volume (ml)	$F_{(2,6)}$=8.4239	0.6499	0.0181	Distance, Vert. ΔT °C

Table 3-4. Forward step-wise multiple linear regression summary statistics for each significant zooplankton taxa in neuston tows from the study site on February 21, 2004. Reported p-values are cumulative for all significant independent explanatory variables and may not collectively reflect a significant result. In such a case, the species will still be included if at least one independent variable contributes to explaining the species distributional variability. Details are presented in Appendix C-4.

	F	Adjusted R^2	p-value	Independent explanatory variable
Holoplankton				
Acartia tonsa	$F_{(2,3)}$=2.3129	0.3443	0.2468	Depth, Surface Temp.
Oithona helgolandica	$F_{(2,3)}$=37.400	0.9357	0.0076	Depth, Distance
Podon polyphemoides	$F_{(1,4)}$=66.487	0.9291	0.0012	Depth
Oikopleura spp.	$F_{(3,2)}$=152.93	0.9891	0.0065	Depth, Distance, Surface Sal.
Meroplankton				
Crangonidae zoea	$F_{(4,1)}$=500.05	0.9975	0.0335	Depth, Distance, Surface Temp., Surface Sal.
Paguridae zoea	$F_{(1,4)}$=16.826	0.7599	0.0148	Distance
Cirripedia nauplius (balanomorphan)	$F_{(1,4)}$=38.817	0.8832	0.0034	Distance
Bryozoa cyphonautes	$F_{(4,1)}$=1087.3	0.9989	0.0227	Distance, Surface Temp., Surface Sal., Surface Dens.
Sample Summaries				
Number of species	$F_{(3,2)}$=363.45	0.9954	0.0028	Depth, Distance, Surface Dens.
Diversity (H')	$F_{(3,2)}$=198.01	0.9916	0.0050	Depth, Distance, Surface Dens.

Table 3-5. Forward step-wise multiple linear regression summary statistics for each significant zooplankton taxa in vertical tows from the study site on September 27, 2004. Reported p-values are cumulative for all significant independent explanatory variables and may not collectively reflect a significant result. In such a case, the species will still be included if at least one independent variable contributes to explaining the species distributional variability. Details are presented in Appendix C-5.

	F	Adjusted R^2	p-value	Independent explanatory variable
Holoplankton				
Acartia tonsa	$F_{(4,7)}=5.8910$	0.6401	0.0213	Depth, Distance, DO, Vert. ΔChlor.
Calanus pacificus	$F_{(5,6)}=8.8482$	0.7811	0.0097	Distance, Surface Chlor., DO, Vert. ΔT °C, Horiz. ΔT °C
Corycaeus anglicus	$F_{(8,3)}=9.6480$	0.8628	0.0444	Depth, Distance, Surface Temp., Surface Sal., Surface Chlor., Vert. ΔChlor., Horiz. ΔT °C
Evadne nordmanni	$F_{(3,8)}=3.2154$	0.3766	0.0829	Surface Sal., Thermocline, Vert. ΔT °C
Evadne spinifera	$F_{(3,8)}=4.2609$	0.4707	0.0449	Distance, Surface Sal., Vert. ΔT °C
Podon polyphemoides	$F_{(3,8)}=6.6903$	0.6081	0.0143	Surface Dens., DO, Vert. ΔChlor.
Sagitta sp.	$F_{(5,6)}=10.345$	0.8094	0.0065	Distance, Surface Sal., Surface Chlor., Vert. ΔChlor., Vert. ΔT °C
Oikopleura spp.	$F_{(6,5)}=61.763$	0.9707	0.0002	Depth, Distance, Surface Dens., Surface Chlor., Vert. ΔChlor., Horiz. ΔT °C
Salpa sp.	$F_{(9,2)}=33.613$	0.9639	0.0292	Depth, Distance, Surface Sal., Thermocline, Surface Chlor., DO, Vert. ΔT °C, Horiz. ΔT °C
Hydromedusae (pooled)	$F_{(4,7)}=4.2851$	0.5443	0.0458	Depth, Distance, Surface Sal., Surface Chlor.
Siphonophora (pooled)	$F_{(7,4)}=7.4332$	0.8037	0.0356	Depth, Distance, Surface Sal., Surface Chlor., DO, Vert. ΔChlor., Vert. ΔT °C
Meroplankton				
Bryozoa cyphonautes	$F_{(4,7)}=3.8482$	0.5088	0.0582	Depth, Distance, Vert. ΔChlor., Horiz. ΔT °C
Fish eggs var.	$F_{(3,8)}=14.768$	0.7897	0.0013	Surface Temp., Surface Dens., Vert. ΔChlor.
Engraulis mordax eggs	$F_{(4,7)}=3.8906$	0.5125	0.0568	Distance, Surface Sal., Vert. ΔT °C, Horiz. ΔT °C
Ichthyoplankton (pooled)	$F_{(3,8)}=5.2131$	0.5347	0.0276	Surface Sal., Surface Dens. Vert. ΔT °C
Cirripedia nauplii (balanomorphan)	$F_{(3,8)}=8.7360$	0.6784	0.0066	Surface Sal., Thermocline, Horiz. ΔT °C
Sample Summaries				
Number of individuals	$F_{(6,5)}=9.7760$	0.8272	0.0121	Depth, Distance, Surface Sal., Surface Dens., Surface Chlor.
Number of species	$F_{(5,6)}=85.644$	0.9747	0.0000	Distance, Surface Temp., Surface Sal., Thermocline, Horiz. ΔT °C
Plankton volume (ml)	$F_{(6,5)}=18.435$	0.9049	0.0029	Distance, Surface Temp., Surface Sal., Surface Chlor., Vert. ΔChlor., Horiz. ΔT °C
Plankton concentration (ml L^{-1})	$F_{(7,4)}=11.589$	0.8708	0.0161	Depth, Distance, Surface Sal., Surface Chlor., Vert. ΔChlor., Vert. ΔT °C, Horiz. ΔT °C
Diversity (H')	$F_{(9,2)}=3535.8$	0.9997	0.0003	Depth, Distance, Surface Sal., Surface Dens., Thermocline, Vert. ΔChlor., Vert. ΔT °C, Horiz. ΔT °C

Table 3-6. Forward step-wise multiple linear regression summary statistics for each significant zooplankton taxa in neuston tows from the study site on September 27, 2004. Reported p-values are cumulative for all significant independent explanatory variables and may not collectively reflect a significant result. In such a case, the species will still be included if at least one independent variable contributes to explaining the species distributional variability. Details are presented in Appendix C-6.

	F	Adjusted R^2	p-value	Independent explanatory variable
Holoplankton				
Acartia tonsa	$F_{(3,2)}=168.09$	0.9901	0.0059	Depth, Surface Temp., Surface Chlor.
Corycaeus anglicus	$F_{(1,4)}=19.212$	0.7846	0.0119	Surface Chlor.
Oithona oculata	$F_{(4,1)}=30212$	0.9999	0.0043	Depth, Surface Temp., Surface Dens., Surface Chlor.
Evadne nordmanni	$F_{(1,4)}=42.610$	0.8927	0.0028	Surface Sal.
Penilia avirostris	$F_{(3,2)}=228.10$	0.9927	0.0044	Depth, Surface Temp., Surface Chlor.
Meroplankton				
Bryozoa cyphonautes	$F_{(1,4)}=34.535$	0.8702	0.0042	Distance
Engraulis mordax eggs	$F_{(1,4)}=33.052$	0.8651	0.0045	Surface Sal.
Sample Summaries				
Number of species	$F_{(2,3)}=52.591$	0.9538	0.0046	Distance, Surface Sal.
Diversity (H')	$F_{(2,3)}=18.875$	0.8773	0.0200	Depth, Surface Dens.

Table 3-7. Forward step-wise multiple linear regression summary statistics for each significant zooplankton taxa in vertical tows from the study site on November 4, 2004. Reported p-values are cumulative for all significant independent explanatory variables and may not collectively reflect a significant result. In such a case, the species will still be included if at least one independent variable contributes to explaining the species distributional variability. Details are presented in Appendix C-7.

	F	Adjusted R^2	p-value	Independent explanatory variable
Holoplankton				
Acartia tonsa	$F_{(5,6)}$=4.6388	0.6232	0.0444	Surface Temp., Thermocline, Surface Chlor., Vert. ΔT °C, Horiz. ΔT °C
Paracalanus parvus	$F_{(7,4)}$=83.089	0.9812	0.0004	Depth, Distance, Surface Temp., Thermocline, Surface Chlor., DO, Vert. ΔT °C
Corycaeus anglicus	$F_{(4,7)}$=16.145	0.8463	0.0012	Distance, Surface Temp., Thermocline, Vert. ΔChlor.
Calanus pacificus	$F_{(5,6)}$=13.338	0.8487	0.0034	Depth, Distance, Thermocline, Horiz. ΔT °C
Pontella sp.	$F_{(7,4)}$=81.976	0.9810	0.0004	Distance, Surface Dens., Thermocline, Vert. ΔChlor., Vert. ΔT °C, Horiz. ΔT °C
Clausocalanus sp.	$F_{(4,7)}$=4.2286	0.5400	0.0472	Surface Temp., Surface Chlor., DO, Horiz. ΔT °C
Labidocera trispinosa	$F_{(4,7)}$=13.007	0.8137	0.0024	Distance, Surface Dens., Vert. ΔChlor., Horiz. ΔT °C
Evadne nordmanni	$F_{(8,3)}$=22.365	0.9395	0.0135	Depth, Distance, Surface Temp., Thermocline, Vert. ΔChlor., Vert. ΔT °C, Horiz. ΔT °C
Evadne spinifera	$F_{(3,8)}$=6.5224	0.6010	0.0153	DO, Vert. ΔChlor., Vert. ΔT °C
Penilia avirostris	$F_{(5,6)}$=48.462	0.9557	0.0001	Depth, Distance, Thermocline, Vert. ΔT °C, Horiz. ΔT °C
Podon polyphemoides	$F_{(3,8)}$=6.1617	0.5847	0.0178	Distance, Surface Temp., Vert. ΔT °C
Sagitta sp.	$F_{(8,3)}$=30.247	0.9551	0.0087	Depth, Distance, Surface Temp., Thermocline, Vert. ΔChlor., Vert. ΔT °C, Horiz. ΔT °C
Hydromedusae (pooled)	$F_{(4,7)}$=11.103	0.7860	0.0038	Depth, Distance, Surface Temp., DO
Siphonophora (pooled)	$F_{(5,6)}$=14.674	0.8614	0.0026	Distance, Surface Sal., Surface Dens., Thermocline, Vert. ΔT °C
Salpa sp.	$F_{(9,2)}$=134.98	0.9910	0.0074	Depth, Distance, Surface Temp., Thermocline, Surface Chlor., Vert. ΔChlor., Vert. ΔT °C, Horiz. ΔT °C
Oikopleura spp.	$F_{(9,2)}$=103.07	0.9882	0.0096	Depth, Distance, Surface Temp., Surface Sal., Surface Dens., Thermocline, Surface Chlor., Vert. ΔChlor., Vert. ΔT °C, Horiz. ΔT °C
Meroplankton				
Cancridae zoea	$F_{(2,9)}$=19.473	0.7706	0.0005	Surface Sal., Thermocline
Hippolytidae zoea	$F_{(6,5)}$=6.8723	0.7621	0.0258	Distance, Surface Sal., Thermocline, Vert. ΔChlor., Vert. ΔT °C, Horiz. ΔT °C
Balanus sp. cyprid	$F_{(4,7)}$=24.803	0.8964	0.0003	Distance, Surface Temp., Vert. ΔChlor., Horiz. ΔT °C
Gastropoda veligers	$F_{(6,5)}$=33.666	0.9469	0.0007	Surface Sal., Thermocline, Surface Chlor., DO, Vert. ΔT °C, Horiz. ΔT °C
Bryozoa cyphonautes	$F_{(3,8)}$=15.497	0.7981	0.0011	Distance, Surface Temp., Vert. ΔChlor.
Ophiuroidea ophiopluteus	$F_{(5,6)}$=4.7869	0.6325	0.0414	Distance, Surface Temp., Thermocline, Vert. ΔT °C, Horiz. ΔT °C
Fish eggs var.	$F_{(9,2)}$=22.995	0.9474	0.0424	Depth, Distance, Surface Dens., Thermocline, Surface Chlor., DO, Vert. ΔT °C, Horiz. ΔT °C
Sample Summaries				
Number of individuals	$F_{(4,7)}$=12.053	0.8008	0.0029	Depth, Thermocline, Surface Chlor., DO
Number of species	$F_{(6,5)}$=22.294	0.9207	0.0018	Distance, Thermocline, Surface Chlor., Vert. ΔChlor., Vert. ΔT °C, Horiz. ΔT °C
Diversity (H')	$F_{(7,4)}$=17.279	0.9120	0.0077	Distance, Surface Temp., Thermocline, Vert. ΔChlor., Vert. ΔT °C, Horiz. ΔT °C
Plankton volume (ml)	$F_{(4,7)}$=12.554	0.8078	0.0026	Distance, Surface Dens., Vert. ΔChlor., Vert. ΔT °C

Table 3-8 Forward step-wise multiple linear regression summary statistics for each significant zooplankton taxa in neuston tows from the study site on November 4, 2004. Reported p-values are cumulative for all significant independent explanatory variables and may not collectively reflect a significant result. In such a case, the species will still be included if at least one independent variable contributes to explaining the species distributional variability. Details are presented in Appendix C-8.

	F	Adjusted R^2	p-value	Independent explanatory variable
Holoplankton				
Calanus pacificus	$F_{(1,4)}=41.544$	0.8902	0.0030	Surface Sal.
Clausocalanus sp.	$F_{(1,4)}=8.4036$	0.5969	0.0442	Surface Temp.
Oithona oculata	$F_{(1,4)}=125.75$	0.9615	0.0442	Surface Chlor.
Oncaea sp.	$F_{(2,3)}=60.996$	0.9600	0.0037	Depth, Surface Sal.
Evadne nordmanni	$F_{(1,4)}=11.298$	0.6731	0.0283	Depth
Evadne spinifera	$F_{(1,4)}=91.417$	0.9476	0.0007	Surface Temp.
Podon polyphemoides	$F_{(2,3)}=15.004$	0.8485	0.0274	Depth, Distance
Sagitta sp.	$F_{(2,3)}=29.774$	0.9201	0.0105	Depth, Surface Dens.
Salpa sp.	$F_{(2,3)}=27.590$	0.9141	0.0117	Depth, Surface Dens.
Meroplankton				
Balanus sp. cyprid	$F_{(2,3)}=112.85$	0.9781	0.0015	Surface Temp., Surface Sal.
Gastropoda veligers	$F_{(2,3)}=92.424$	0.9734	0.0020	Distance, Surface Sal.
Sample Summaries				
Number of individuals	$F_{(2,3)}=13.865$	0.8373	0.0305	Depth, Surface Sal.
Number of species	$F_{(2,3)}=5.6432$	0.6500	0.0962	Distance, Surface Dens.
Plankton volume	$F_{(3,2)}=19.959$	0.9192	0.0481	Depth, Surface Dens., Surface Chlor.

Figures

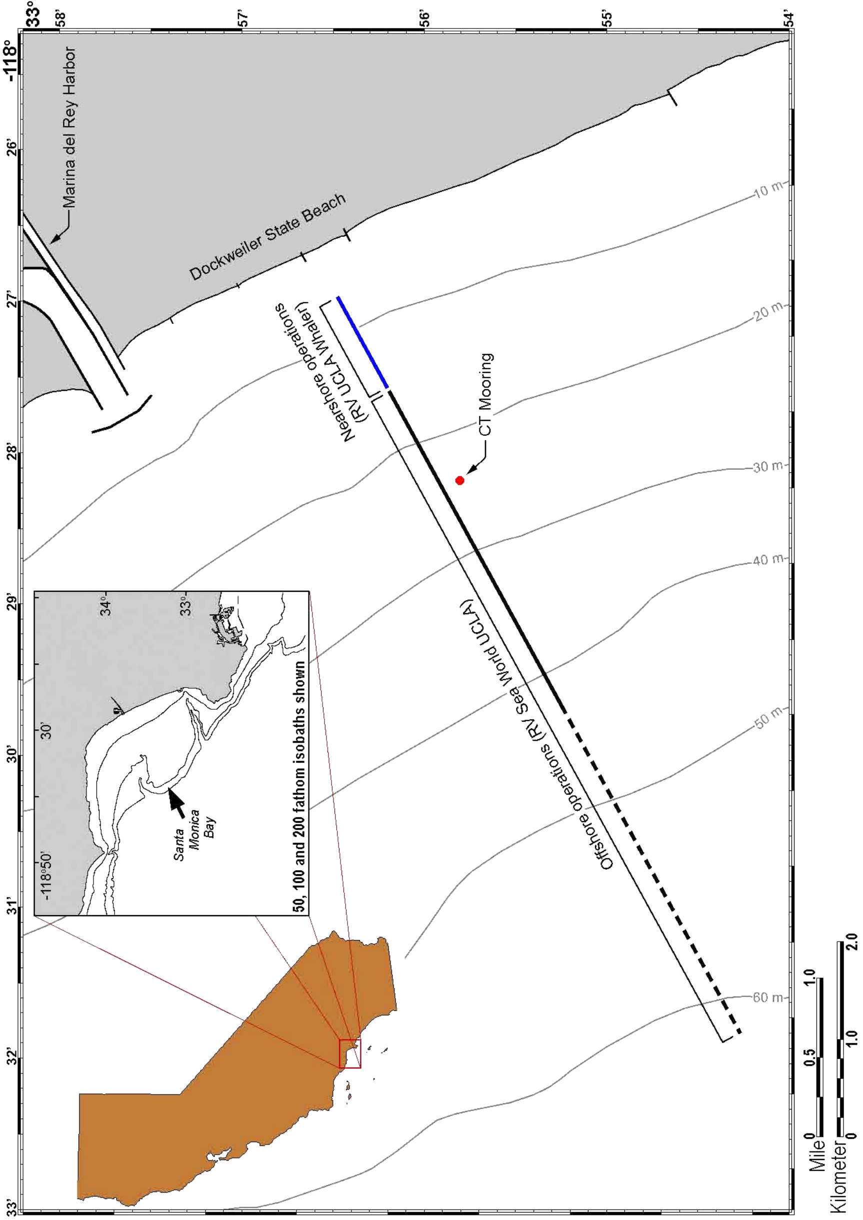

Figure 3-1. Line transect offshore of Dockweiler State Beach, Santa Monica Bay, California. Operations were conducted on the RV Sea World UCLA (black line), and the RV UCLA Whaler (blue line). Tracks extended from the 10m isobath out 5km (solid line), except on Sept. 27, 2004, when tracks extended to 8km, and on Nov. 4, 2004, when tracks extended to 10km (dotted line). A conductivity-temperature (CT) mooring was set at the 25m isobath during the Feb. 21, Sept. 27 and Nov. 4, 2004 cruises.

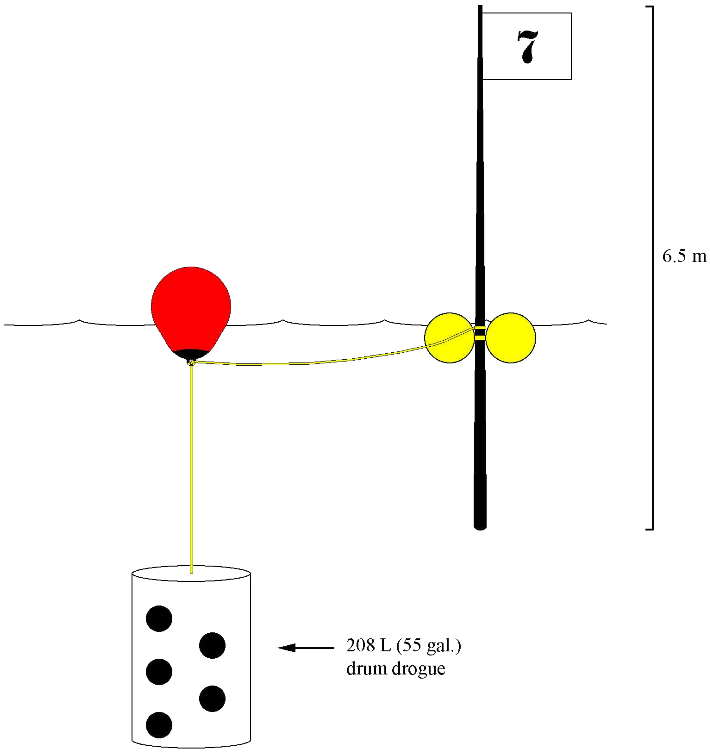

Figure 3-2. Diagram of drifter assembly. A 208 L perforated drum is suspended to a pre-designated depth via a line attached to a buoy. To increase visibility of the drogue, the buoy was secured to a 6.5 m fiberglass flagpole and two supporting floats. Drifters deployed shoreward of the 10 m isobath consisted only of the drum and buoy, and were not attached to a flagpole.

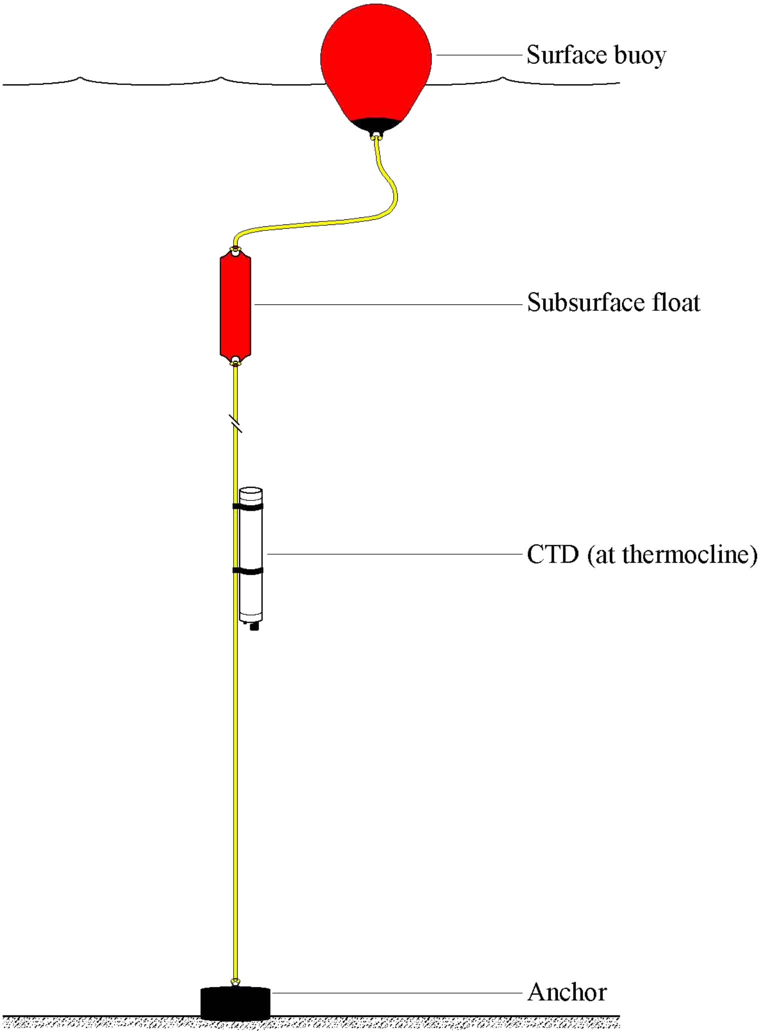

Figure 3-3. Diagram of mooring assembly. Deployment occurred along the 25m isobath. A subsurface float was used to keep the line taut while a surface buoy marked the location. An RBR Ltd. model XR-420 CTD was attached to the line at the thermocline. The depth of the thermocline was determined by performing a CTD cast and immediately inspecting the profile upon retrieval.

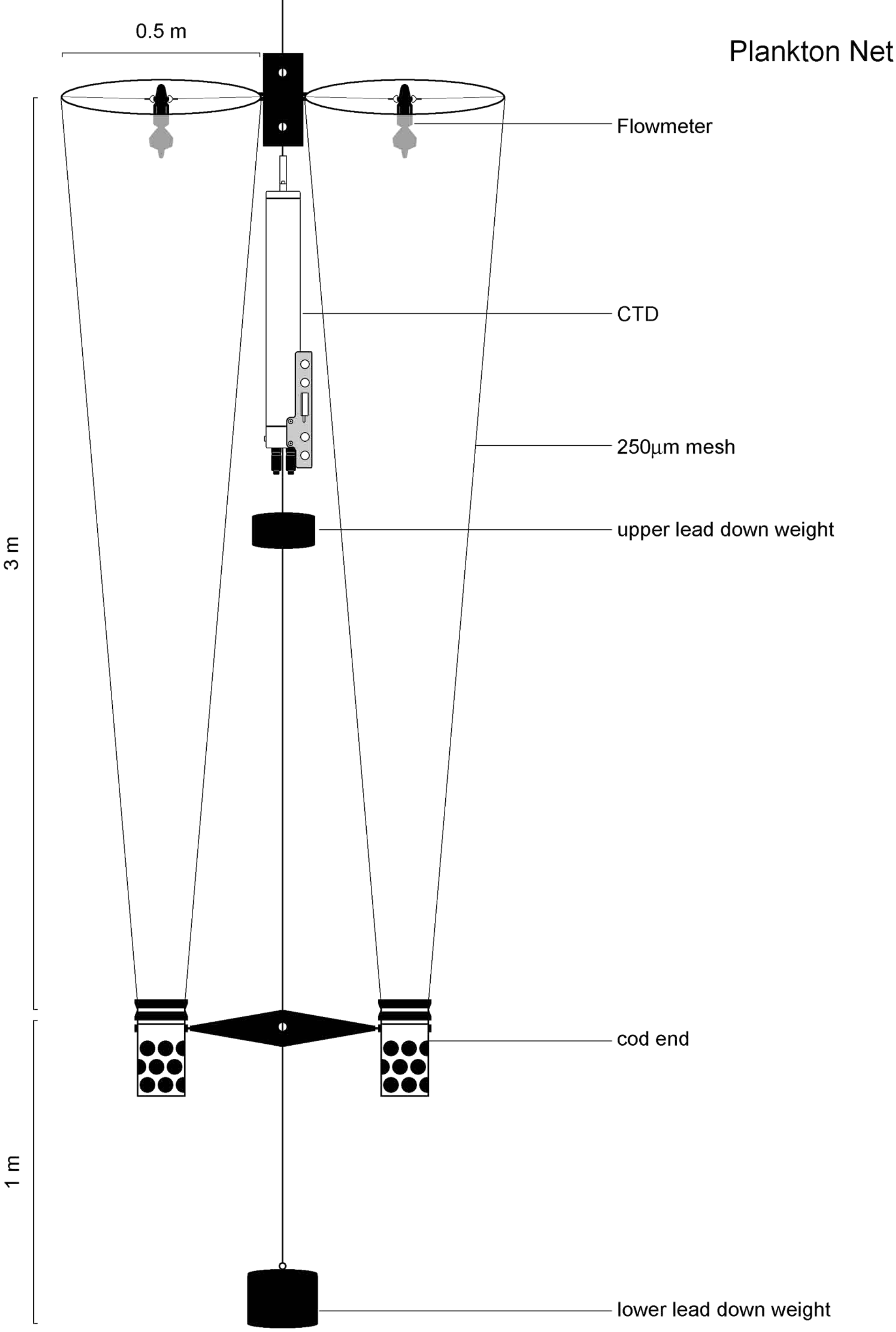

Figure 3-4. Illustration and dimensions of the towed vertical plankton net with center-mounted Seabird SeaCat Profiler SBE 19 (unpumped) CTD.

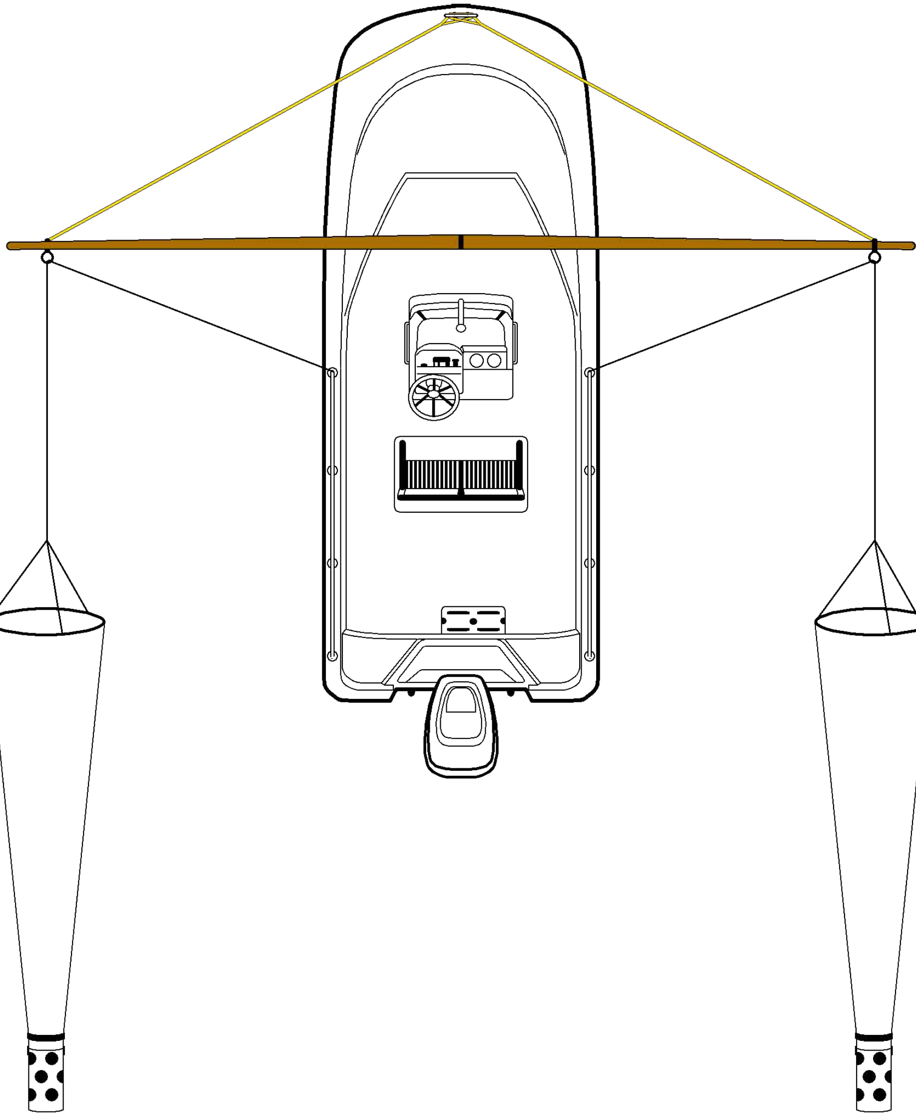

Figure 3-5. Top-view diagram of paired neuston tow arrangement. Two plankton nets (250mm mesh, 0.5m diameter, 3m length) were fitted to a cross beam mounted on the bow of the RV UCLA Whaler, a 17 ft Montauk Boston Whaler. When idling forward at a speed of 2 kn, the nets remained just beneath the surface and outside of the boat wake.

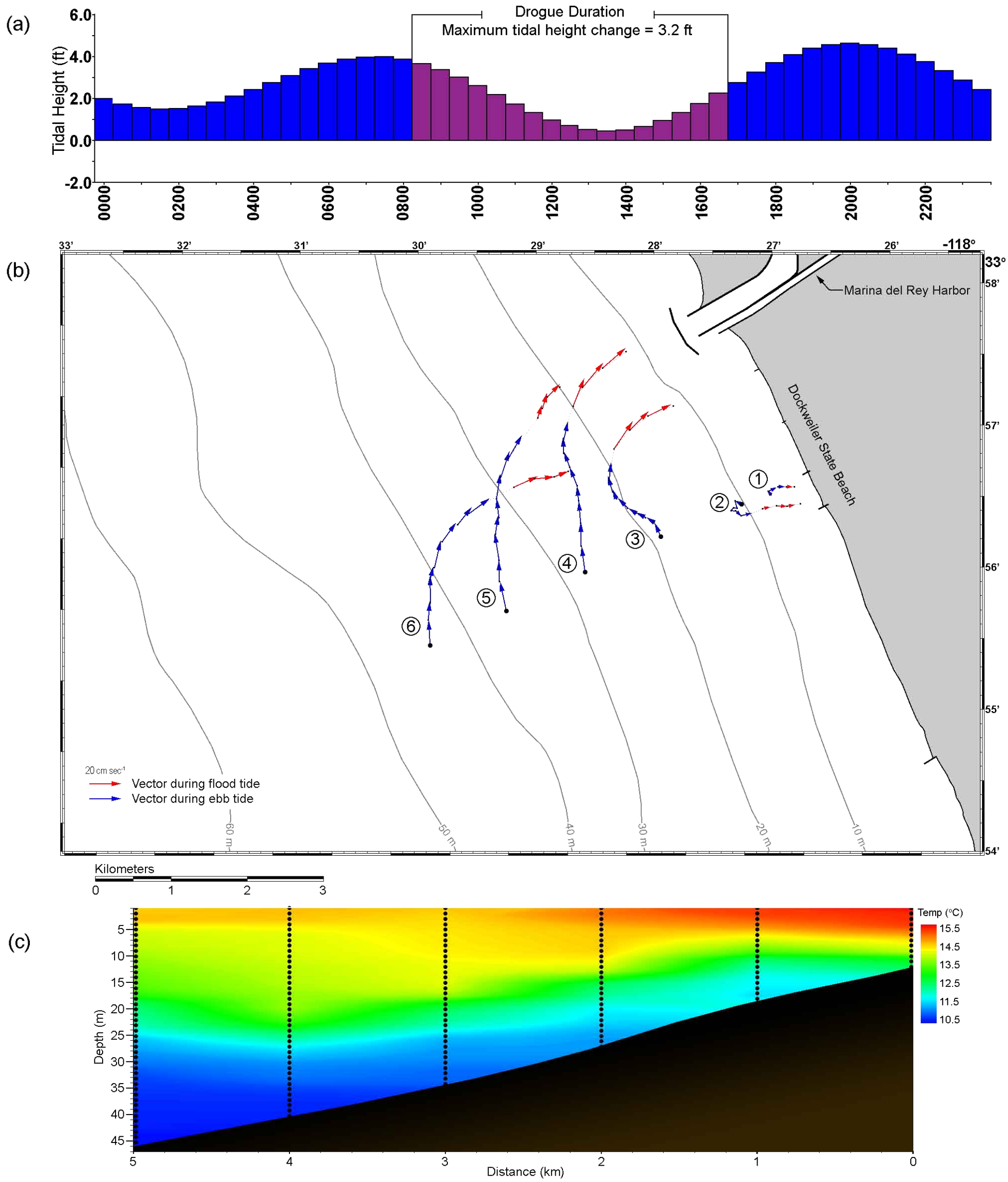

Figure 3-6. May 7, 2002, data summary. (a) Tidal graph with overlaid sampling time. (b) Drogue tracks. Drogue 1 was set at 3m depth on the 8m isobath. Drogue 2 was set at 5m depth on the 10m isobath. Drogues 3, 4, 5 and 6 were set in 1km intervals offshore of drogue 2, and were all set at 12m depth. Raw data are provided in Appendix A-1. (c) Vertical temperature profile showing a thermocline in the nearshore between 7 and 8m depth. In the offshore portion, the thermocline is deeper and less pronounced. Also, a surface temperature break is evident between 2 and 2.5 km offshore.

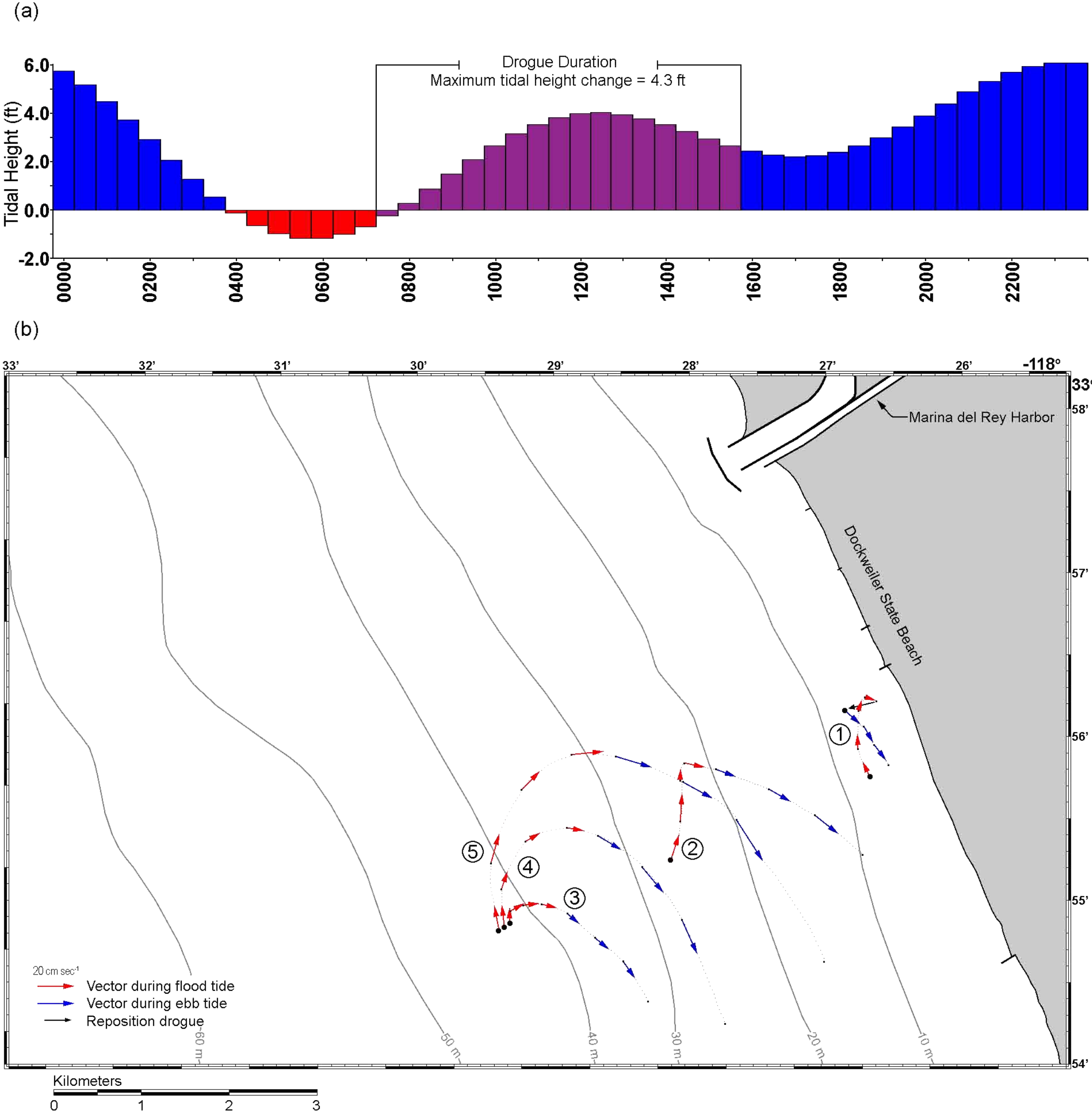

Figure 3-7. Drogue vectors, July 15, 2003, Santa Monica Bay, California. Drogue 1 was set at 5m depth inshore of the 10m isobath. Immediately after slack tide, drogue 1 was relocated back out to the same starting distance from shore. Drogue 2 was set at 5m depth, 2km offshore of drogue 1. Drogues 3, 4 and 5 were deployed 4 km offshore of drogue 1, at 26, 10 and 5m depth, respectively. Raw data are provided in Appendix A.

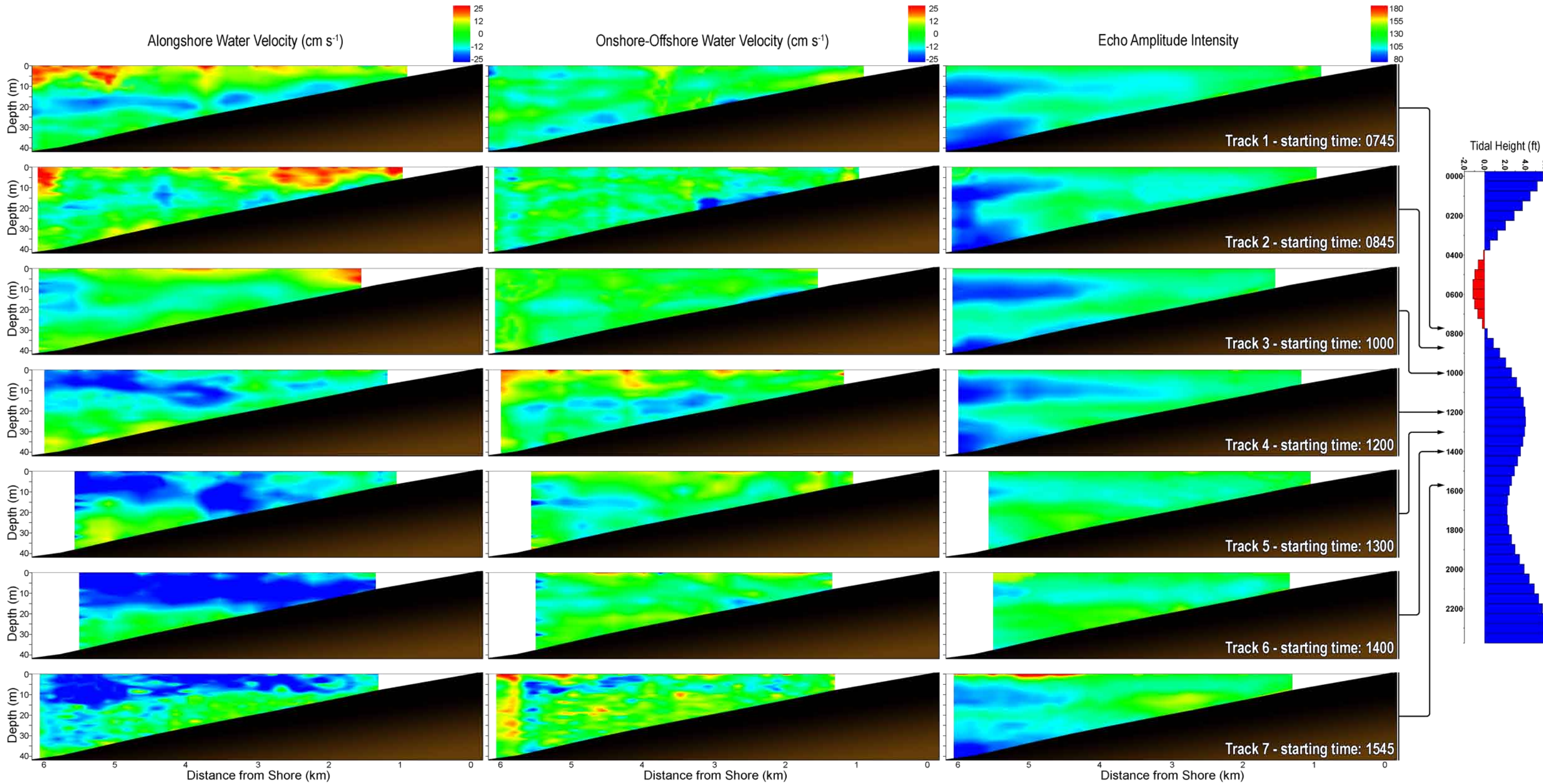

Figure 3-8. ADCP transect profiles on July 15, 2003. Alongshore and onshore-offshore velocities and echo amplitude intensity are shown for seven runs. In the alongshore velocity plots, red indicates northward flow and blue indicates southward flow. In the onshore-offshore velocity plots, red indicates flow onshore and blue indicates offshore flow. Echo amplitude intensity plots give a direct measure of larger suspended particles in the water column, which are interpreted as representing plankton densities. Red indicates a high concentration of plankton while blue indicates a thin distribution of plankton.

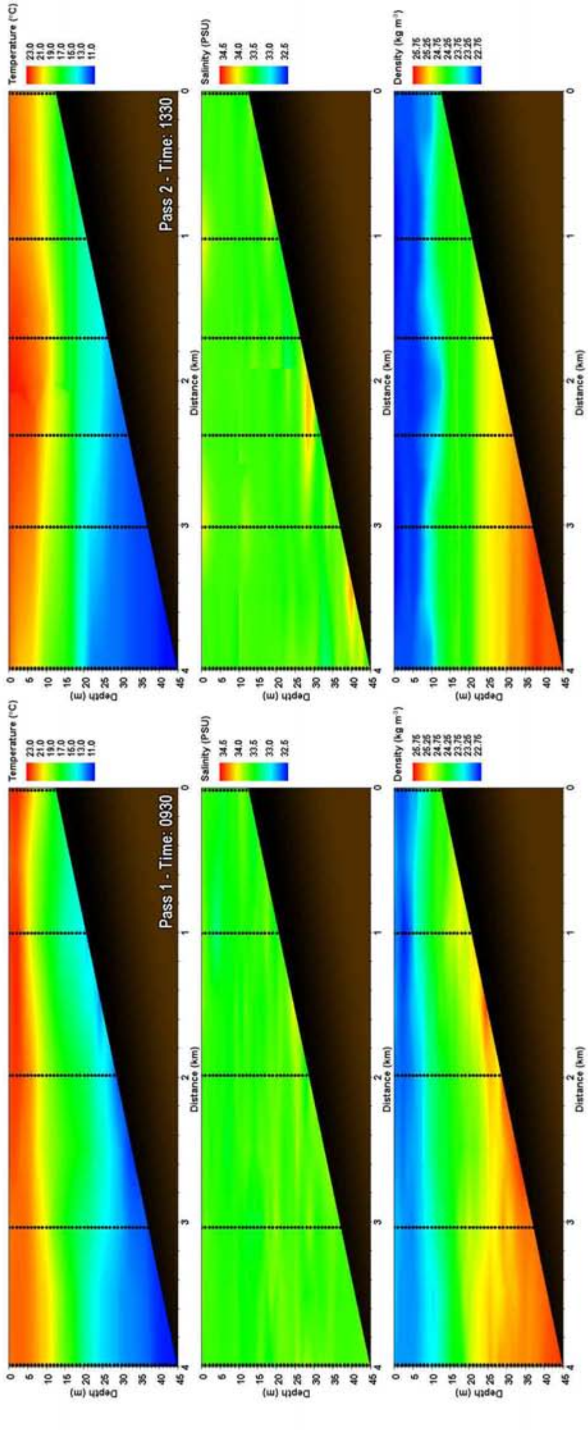

Figure 3-9. Interpolated transect vertical profiles of temperature, salinity and density during two passes on July 15, 2003. Cast locations are shown as vertical dotted lines where each dot represents a 1-meter bin.

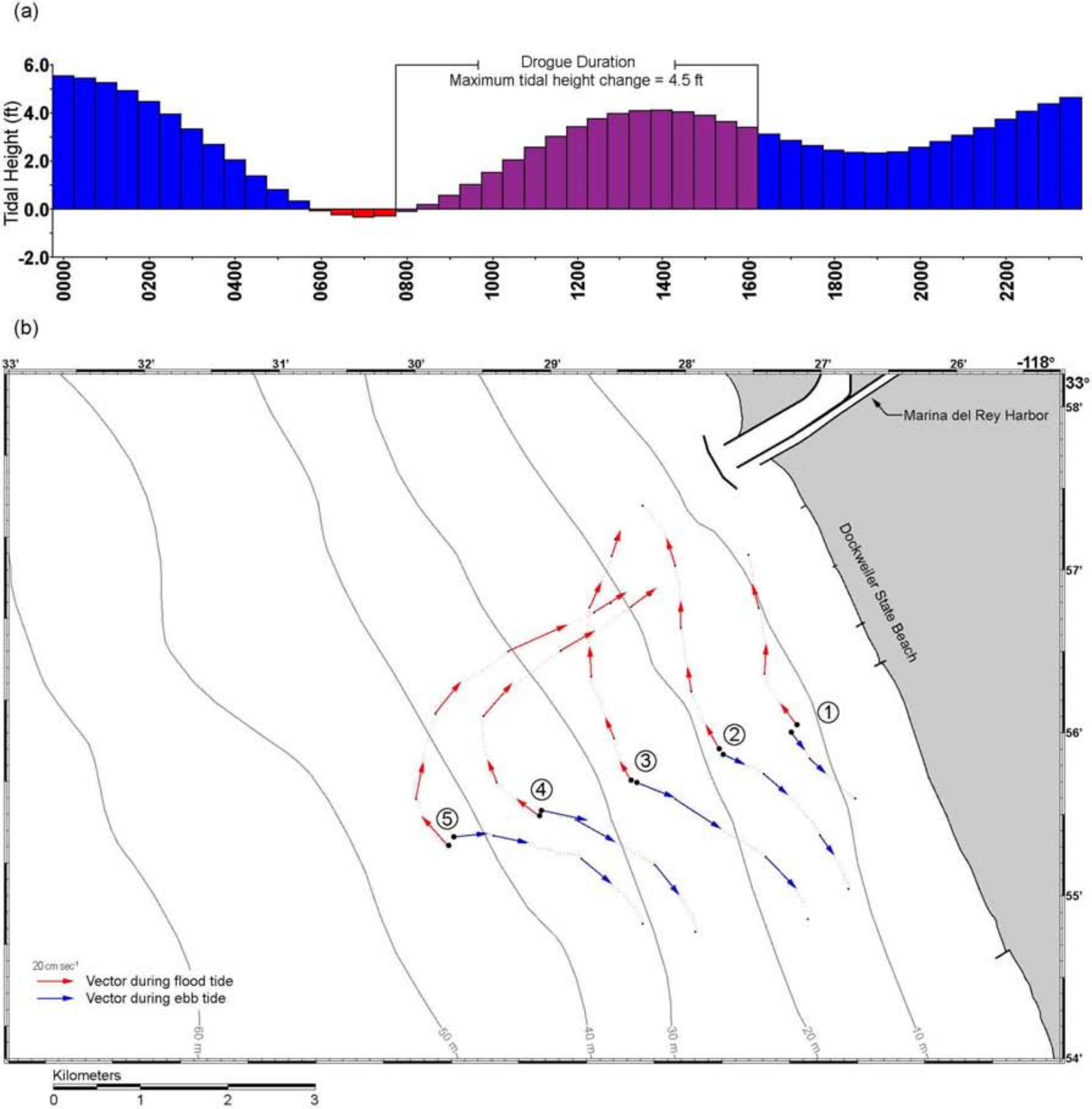

Figure 3-10. Drogue vectors, July 17, 2003, Santa Monica Bay, California. Drogue 1 was set immediately outside the 10m isobath. Drogues 2-5 were deployed in 1km intervals offshore of drogue 1. All drogues were set at 5m depth. Raw data are provided in Appendix A.

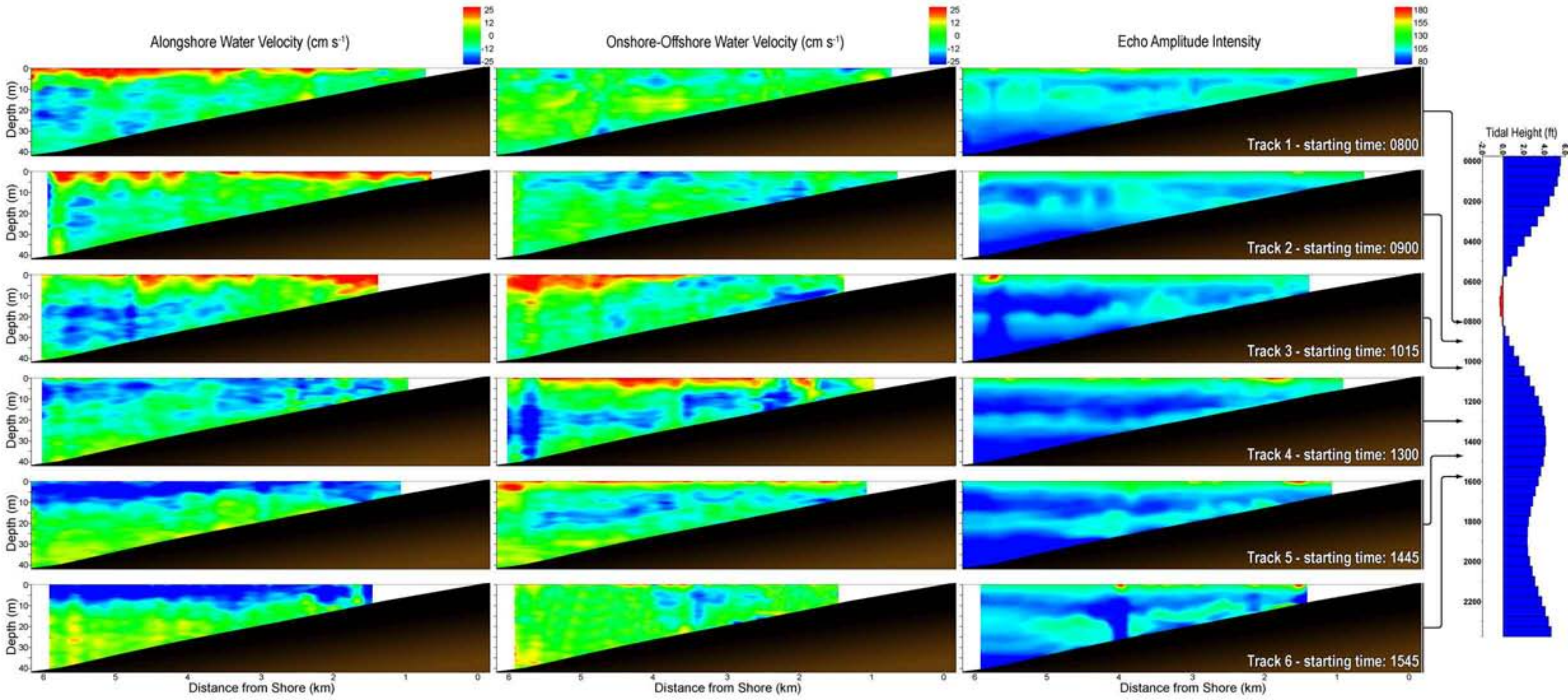

Figure 3-11. ADCP transect profiles on July 17, 2003. Alongshore and onshore-offshore velocities and echo amplitude intensity are shown for six runs. In the alongshore velocity plots, red indicates northward flow and blue indicates southward flow. In the onshore-offshore velocity plots, red indicates flow onshore and blue indicates offshore flow. Echo amplitude intensity plots give a direct measure of larger suspended particles in the water column, which are interpreted as representing plankton densities. Red indicates a high concentration of plankton while blue indicates a thin distribution of plankton.

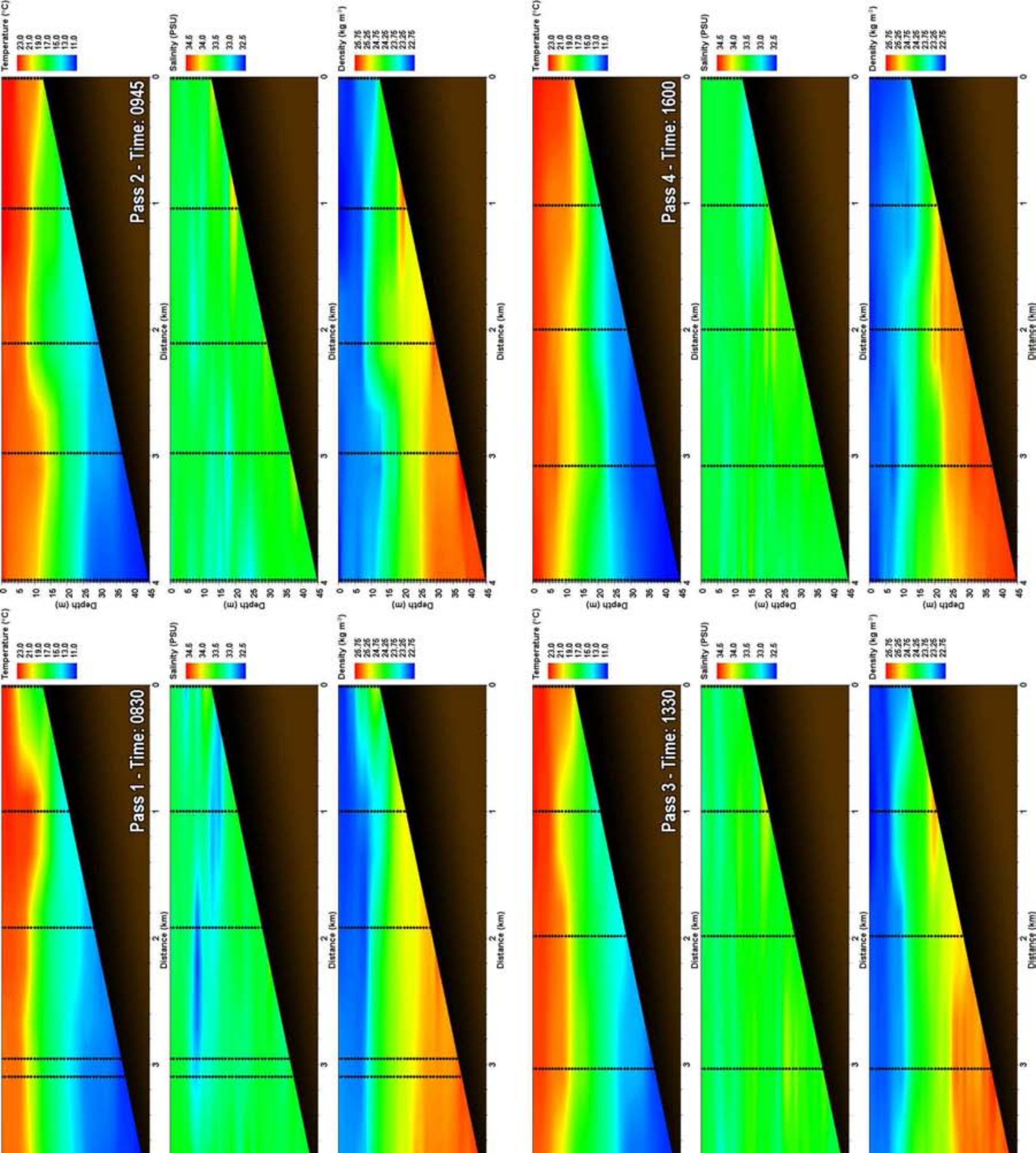

Figure 3-12. Interpolated transect vertical profiles of temperature, salinity and density during four passes on July 17, 2003. Cast locations are shown as vertical dotted lines where each dot represents a 1-meter bin.

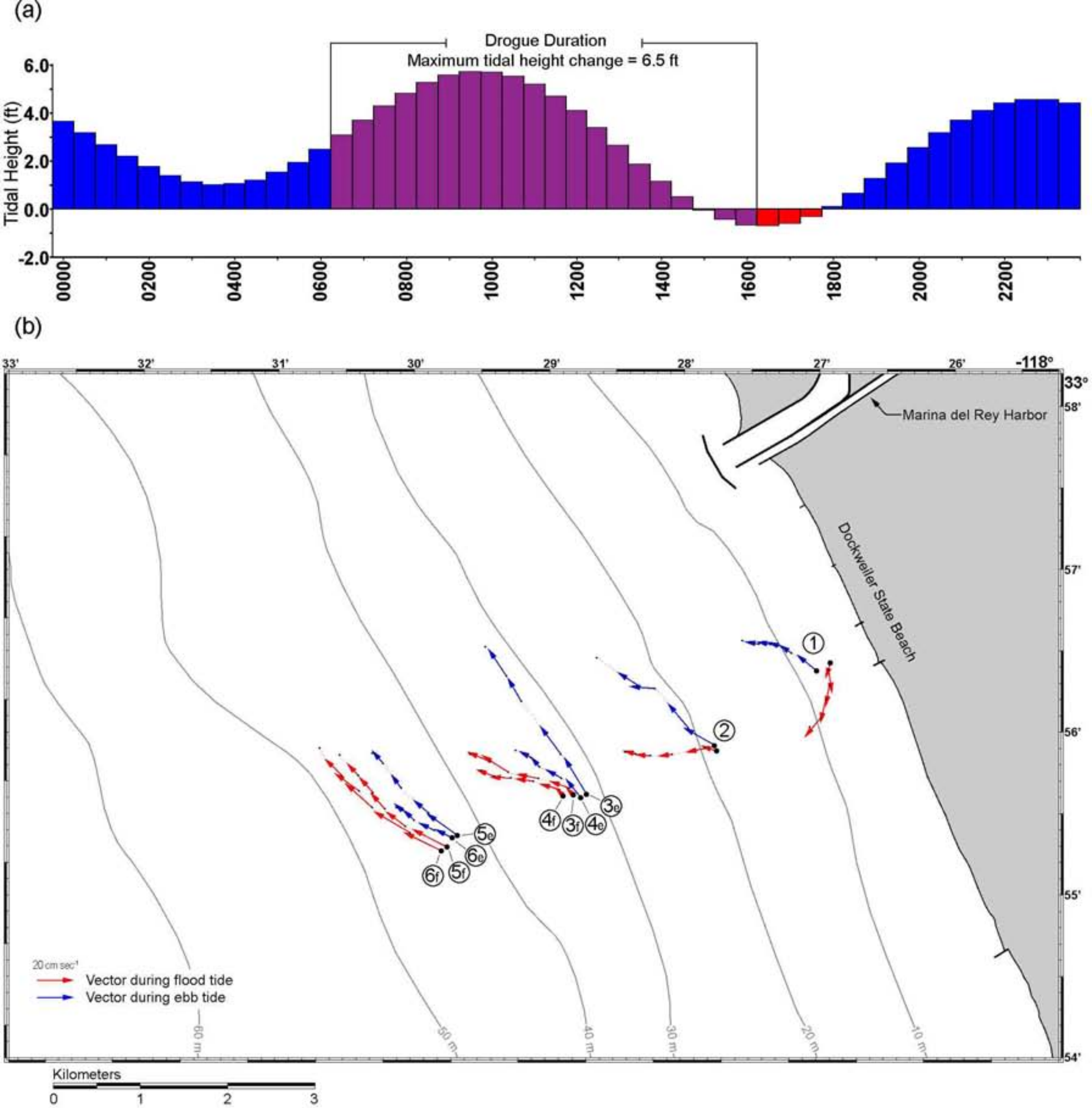

Figure 3-13. Drogue vectors, Feb. 21, 2004, Santa Monica Bay, California. Drogue 1 was set at 5m depth inshore of the 10m isobath. Drogue 2 was set at 10m depth, 1km offshore of the 10m isobath. Drogues 3 and 4 were deployed 2.5km offshore of the 10m isoabth, at 10 and 20m depth, respectively. Drogues 5 and 6 were deployed 4km offshore of the 10m isoabth, at 10 and 20m depth, respectively. At slack tide, all drogues were re-deployed at their starting position. Raw data are provided in Appendix A.

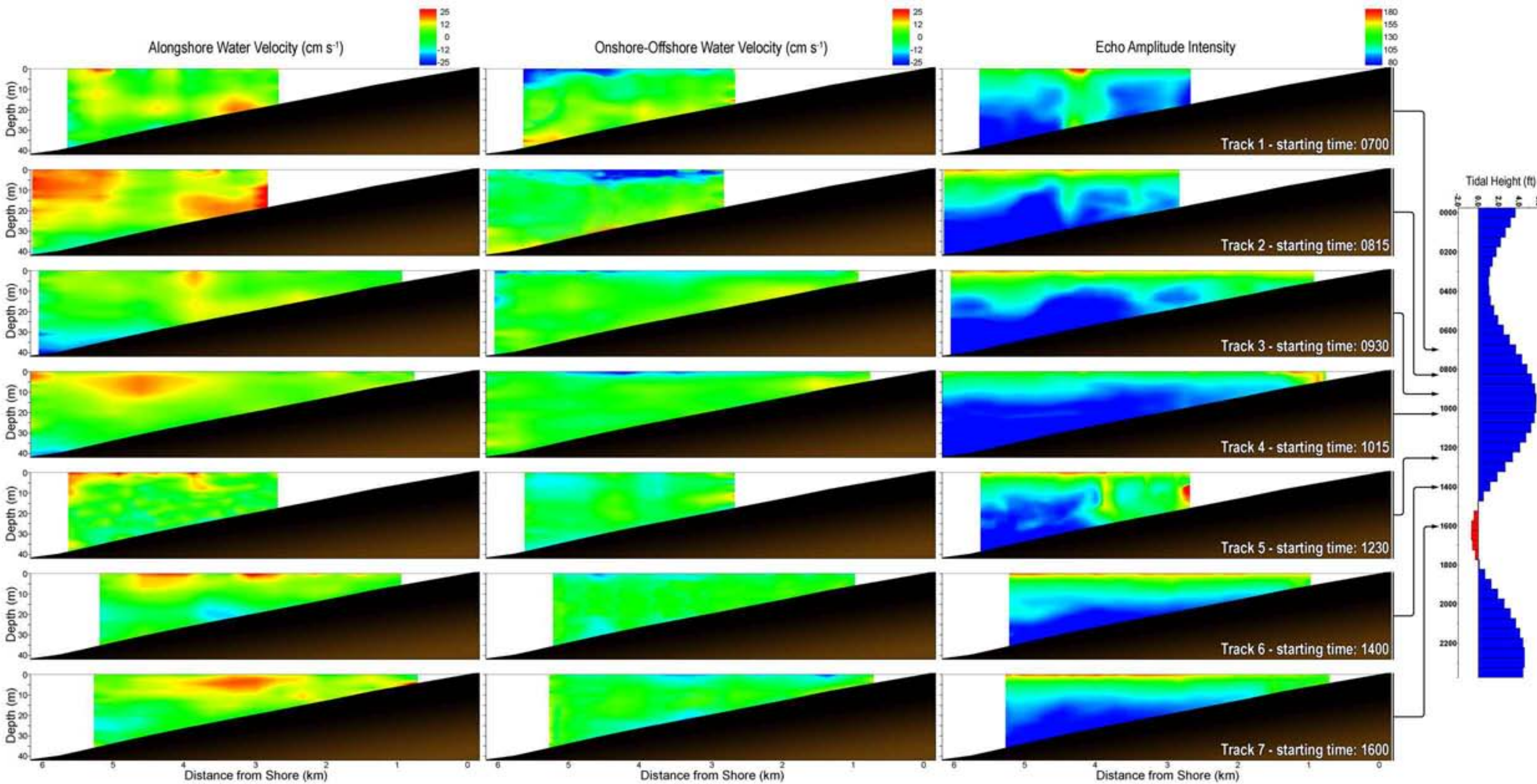

Figure 3-14. ADCP transect profiles on February 21, 2004. Alongshore and onshore-offshore velocities and echo amplitude intensity are shown for seven runs. In the alongshore velocity plots, red indicates northward flow and blue indicates southward flow. In the onshore-offshore velocity plots, red indicates flow onshore and blue indicates offshore flow. Echo amplitude intensity plots give a direct measure of larger suspended particles in the water column, which are interpreted as representing plankton densities. Red indicates a high concentration of plankton while blue indicates a thin distribution of plankton.

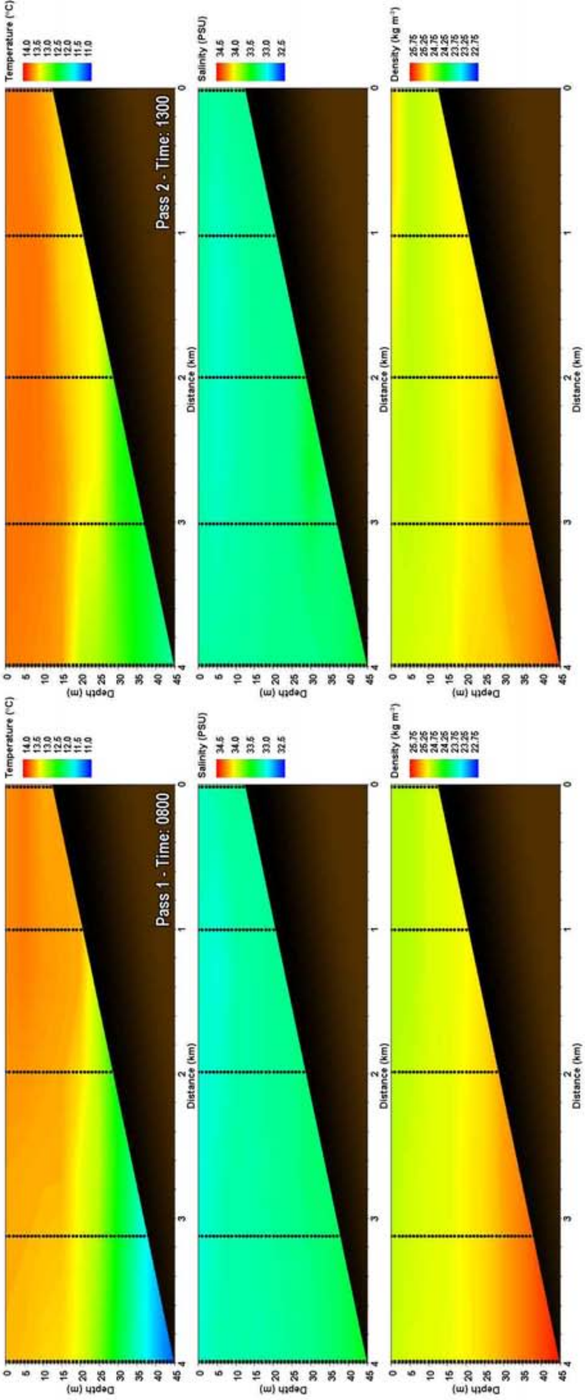

Figure 3-15. Interpolated transect vertical profiles of temperature, salinity and density during two passes on February 21, 2004. Cast locations are shown as vertical dotted lines where each dot represents a 1-meter bin.

Figure 3-16. Plots of temperature and depth over time at the thermocline located approximately 2.5 km from shore, February 21, 2004. The mooring was set on the 25m isobath with the CTD affixed at the thermocline (approximately 17m). The temperature plot suggests multiple scales of oscillation as a result of many forces, including internal tides, internal waves, and wind forcing. Since the CTD was fixed in place, the harmonic mean plot (blue line) illustrates the change in mean tidal height as the depth of water above the CTD throughout the day. This line does not exactly follow the predicted tidal height. The deeper morning average depth (17.4m) precedes the 0930 hrs high tide by approximately 40 minutes, and the shallower afternoon depth (16.1m) appears at 1400 hrs, 2.5 hours before low tide. At approximately 0917 hrs, a temperature drop of almost 0.5°C was observed as the thermocline was elevated with the rising tide, overtaking the fixed CTD position. As the day progressed, the average temperature gradually increased as the tidal height decreased until approximately 1345 when it appears the thermocline had descended below the CTD position, as indicated by the 0.25°C increase. However, the temperature range over the sampling period was small compared to that observed in subsequent surveys, and the shorter period oscillations generally ranged by less than 0.1°C.

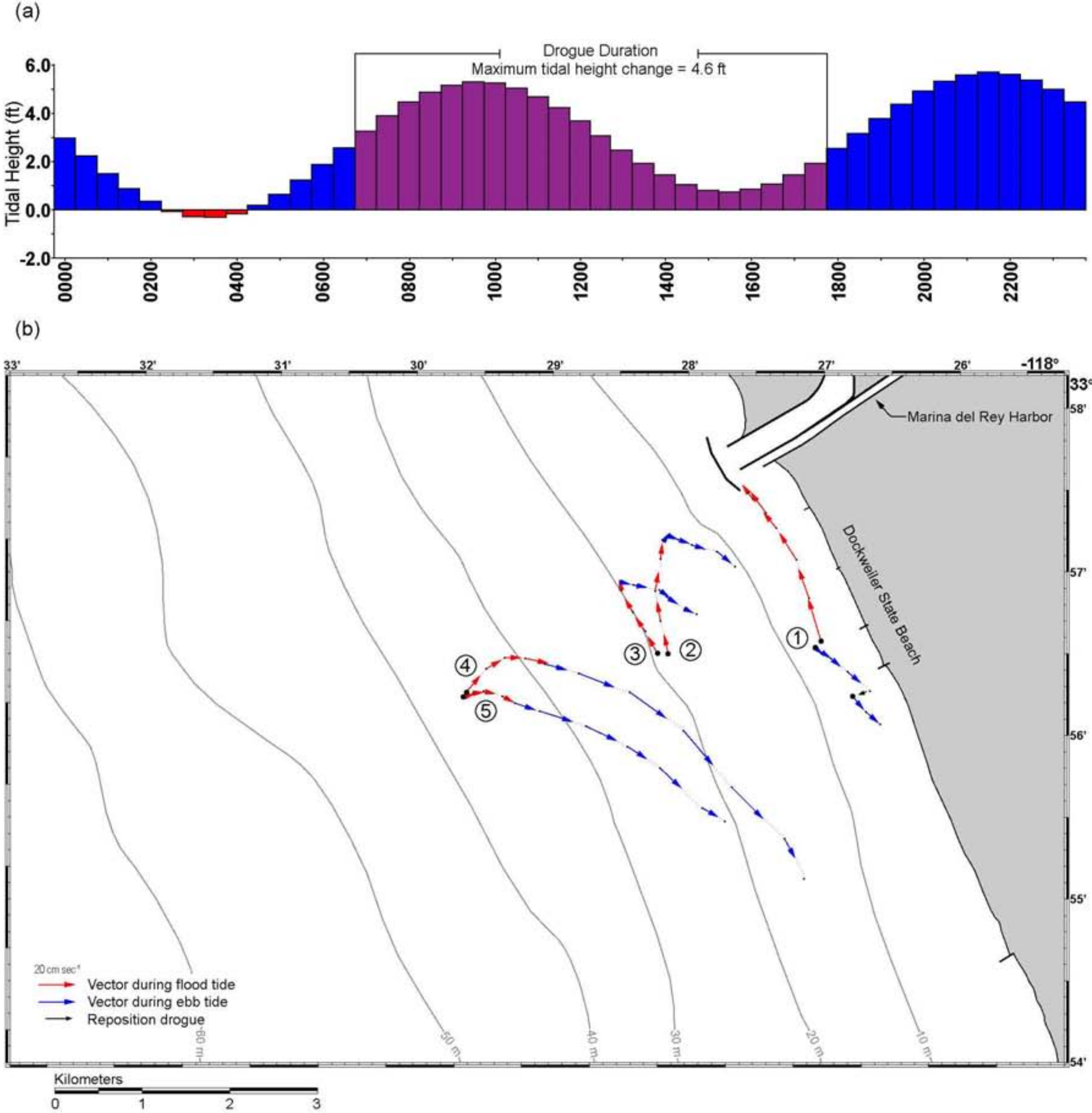

Figure 3-17. Drogue vectors, Sept. 27, 2004, Santa Monica Bay, California. Drogue 1 was set at 5m depth inshore of the 10m isobath. At 0930 hrs, drogue 1 was re-deployed at its initial starting position. Once during ebb tide, drogue 1 was pulled offshore to prevent beaching. Drogues 2 and 3 were set at 10 and 20m depth, respectively, 2km offshore of the 10m isobath. Drogues 4 and 5 were set at 10 and 20m depth, respectively, 4km offshore of the 10m isobath. Raw data are provided in Appendix A.

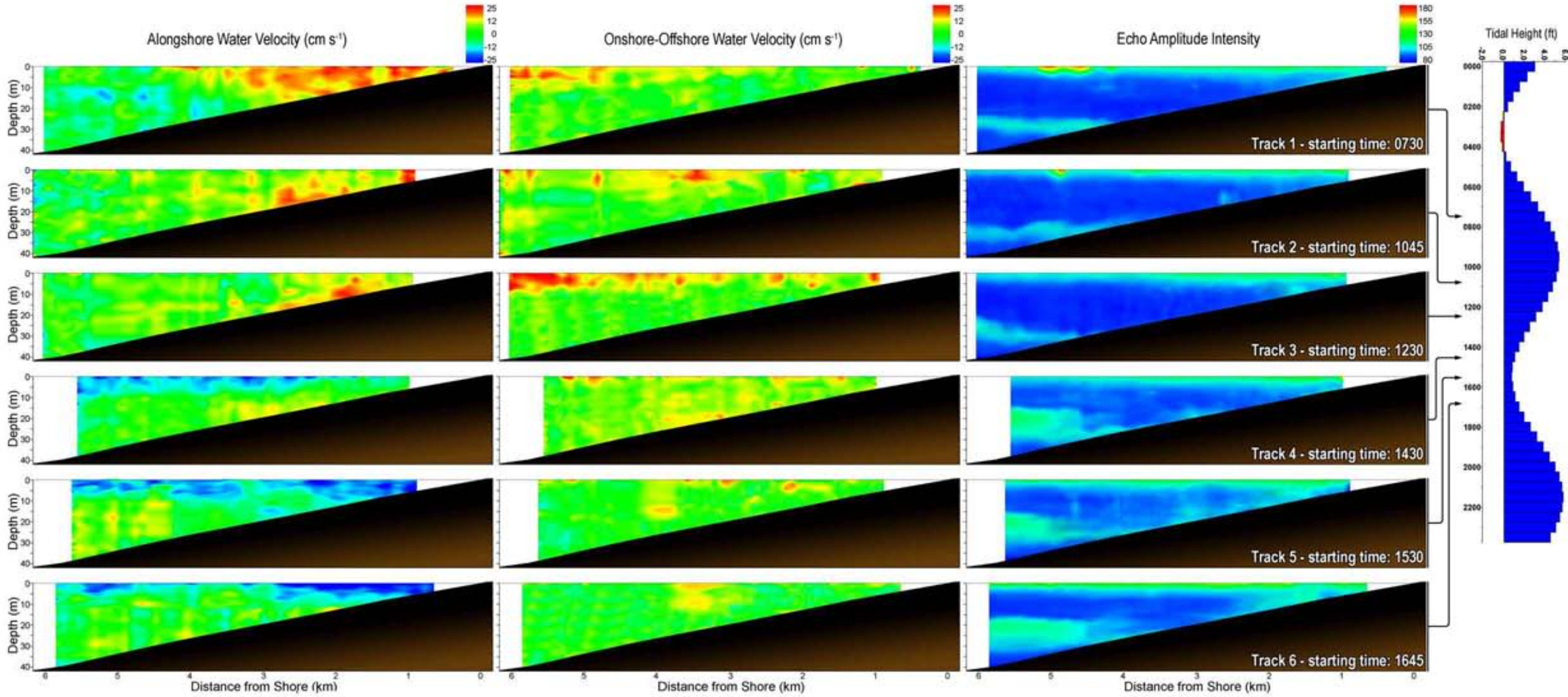

Figure 3-18. ADCP transect profiles on September 27, 2004. Alongshore and onshore-offshore velocities and echo amplitude intensity are shown for six runs. In the alongshore velocity plots, red indicates northward flow and blue indicates southward flow. In the onshore-offshore velocity plots, red indicates flow onshore and blue indicates offshore flow. Echo amplitude intensity plots give a direct measure of larger suspended particles in the water column, which are interpreted as representing plankton densities. Red indicates a high concentration of plankton while blue indicates a thin distribution of plankton.

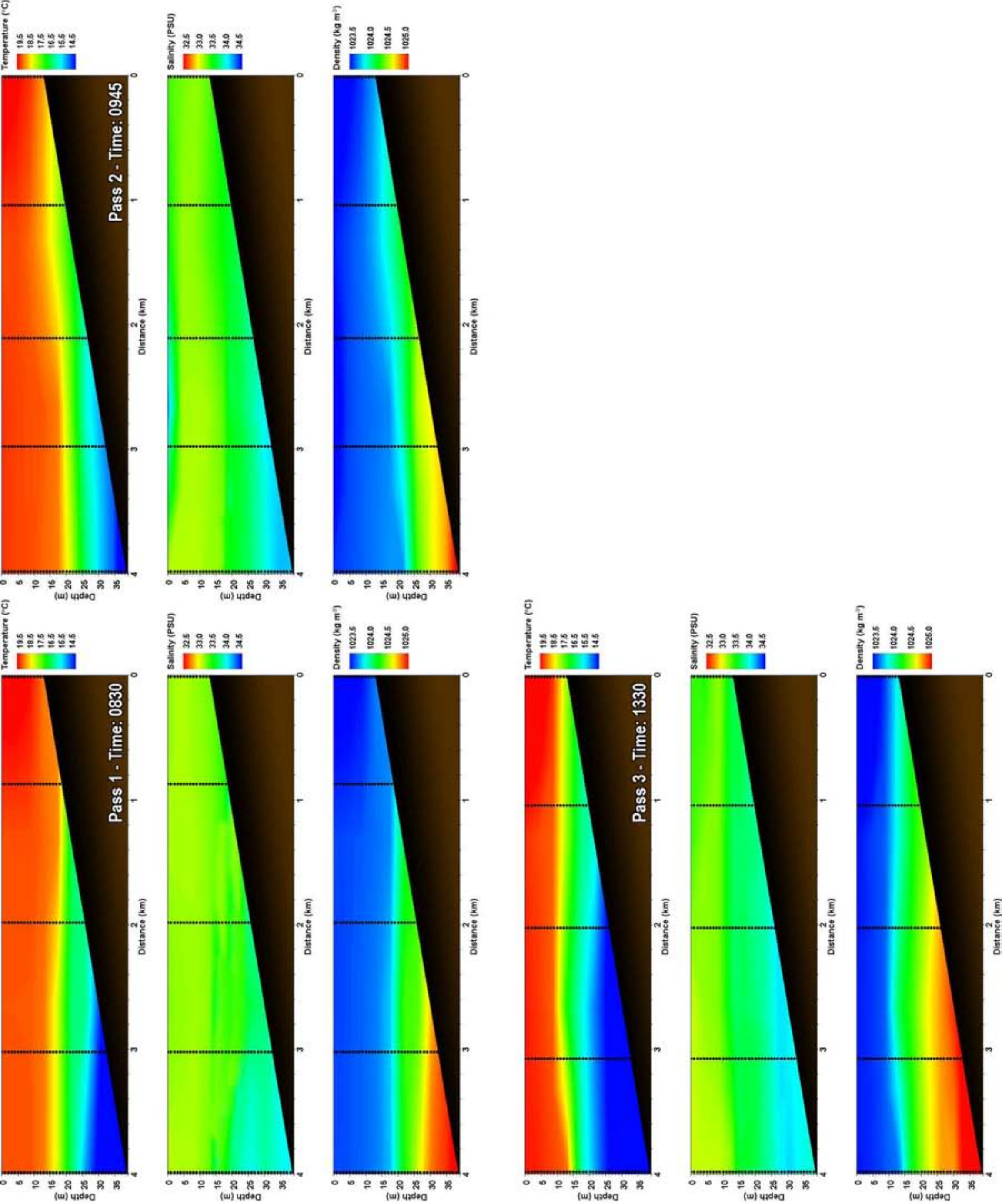

Figure 3-19. Interpolated transect vertical profiles of temperature, salinity and density during three passes on September 27, 2004. Cast locations are shown as vertical dotted lines where each dot represents a 1-meter bin.

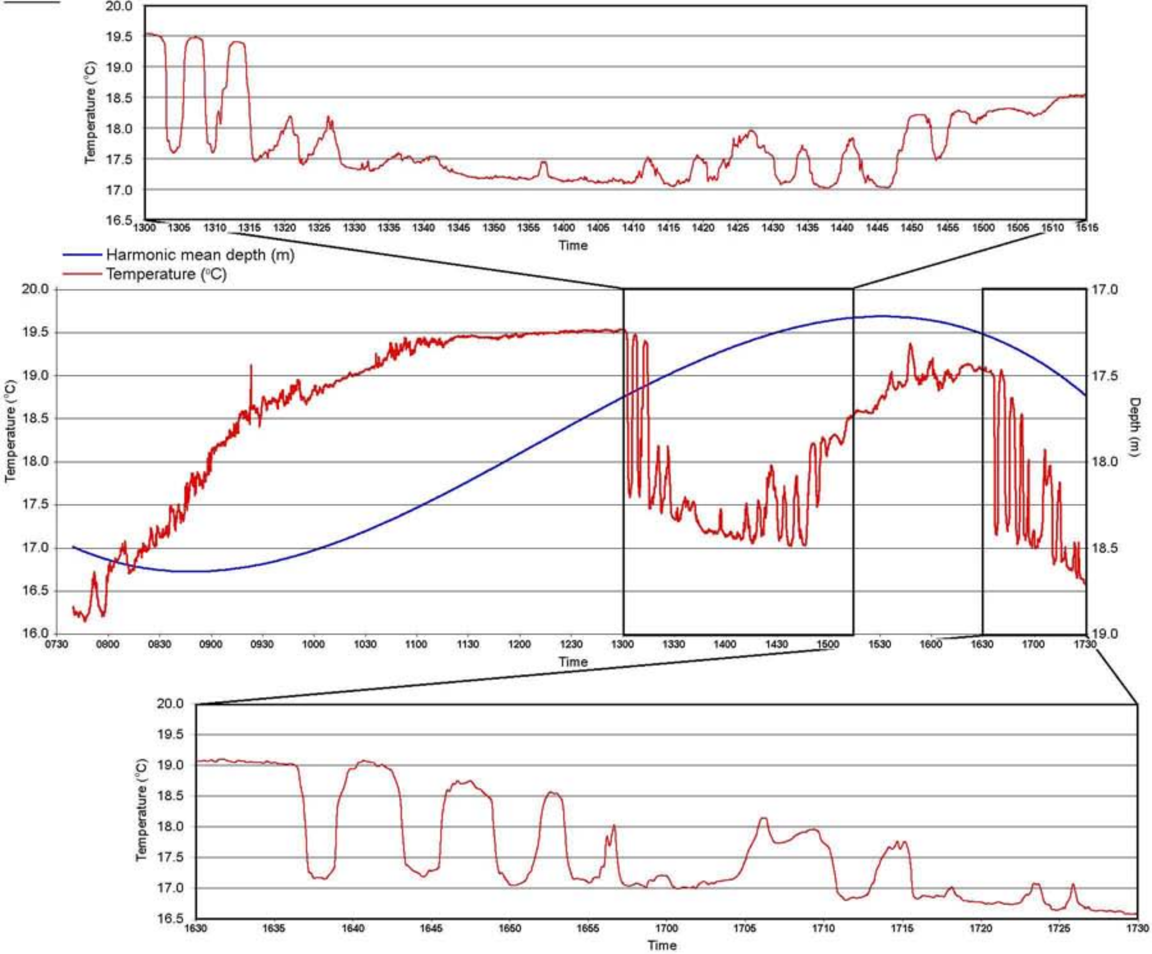

Figure 3-20. Plots of temperature and depth over time at the thermocline located approximately 2.5 km from shore, September 27, 2004. The mooring was set on the 25m isobath with the CTD affixed at the thermocline (approximately 18m). The middle temperature plot suggests multiple scales of oscillation as a result of many forces, including internal tides, internal waves, and wind forcing. Since the CTD was fixed in place, the harmonic mean plot (blue line) illustrates the change in mean tidal height as the depth of water above the CTD throughout the day. This line does not exactly follow the tidal prediction. The deeper morning average depth (18.6m) precedes the 0937 hrs high tide by approximately 45 minutes, however the shallower afternoon depth (17.2m) appears at 1530 hrs, precisely coinciding with the low tide. Before and after the afternoon low tide, internal waves were observed propagating through the study site. These are expanded in plots above and below the middle graphic, showing temperature changes up to 2°C over 5-10 minute intervals.

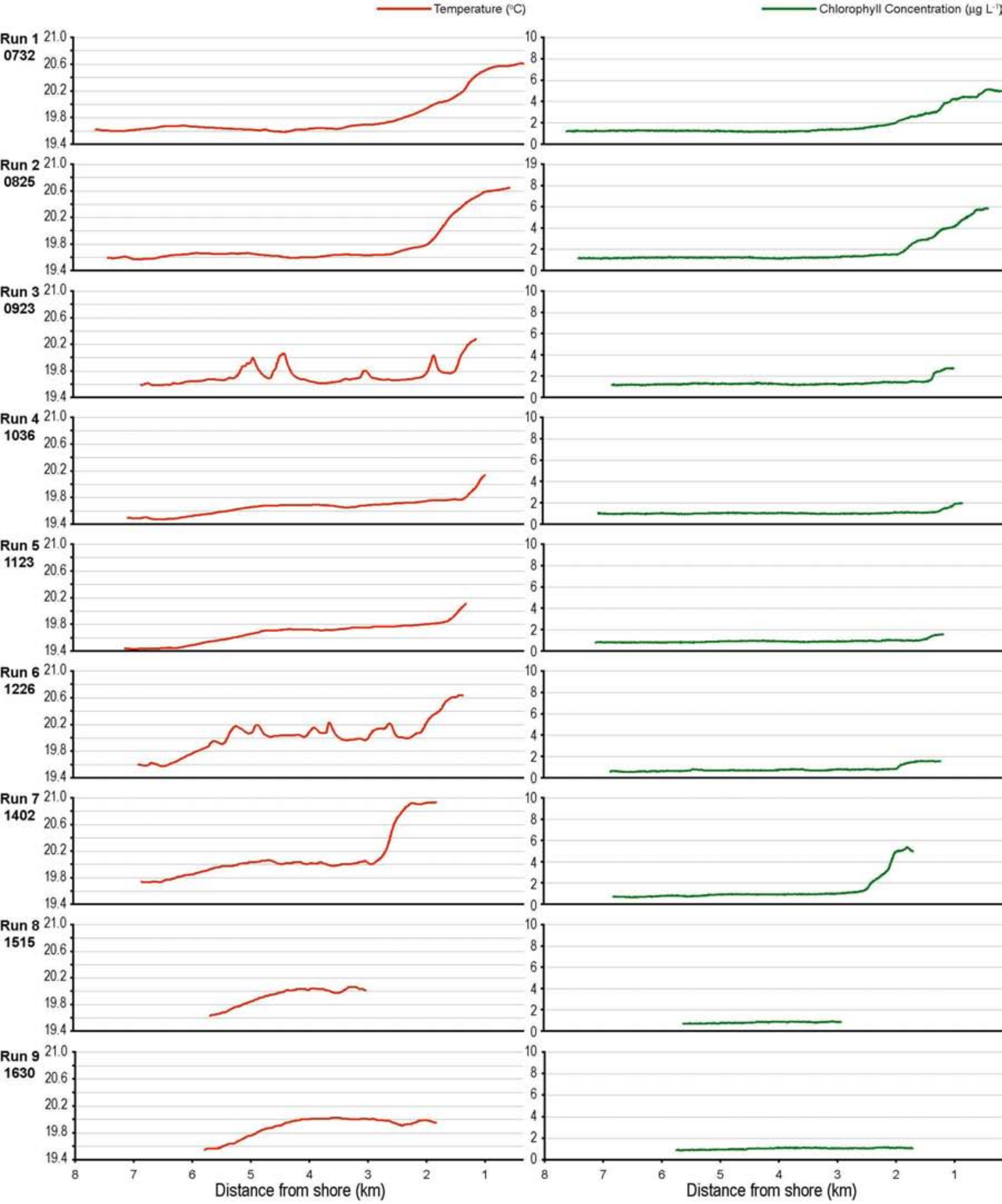

Figure 3-21. Sea surface temperature and chlorophyll concentration along nine onshore runs, September 27, 2004.

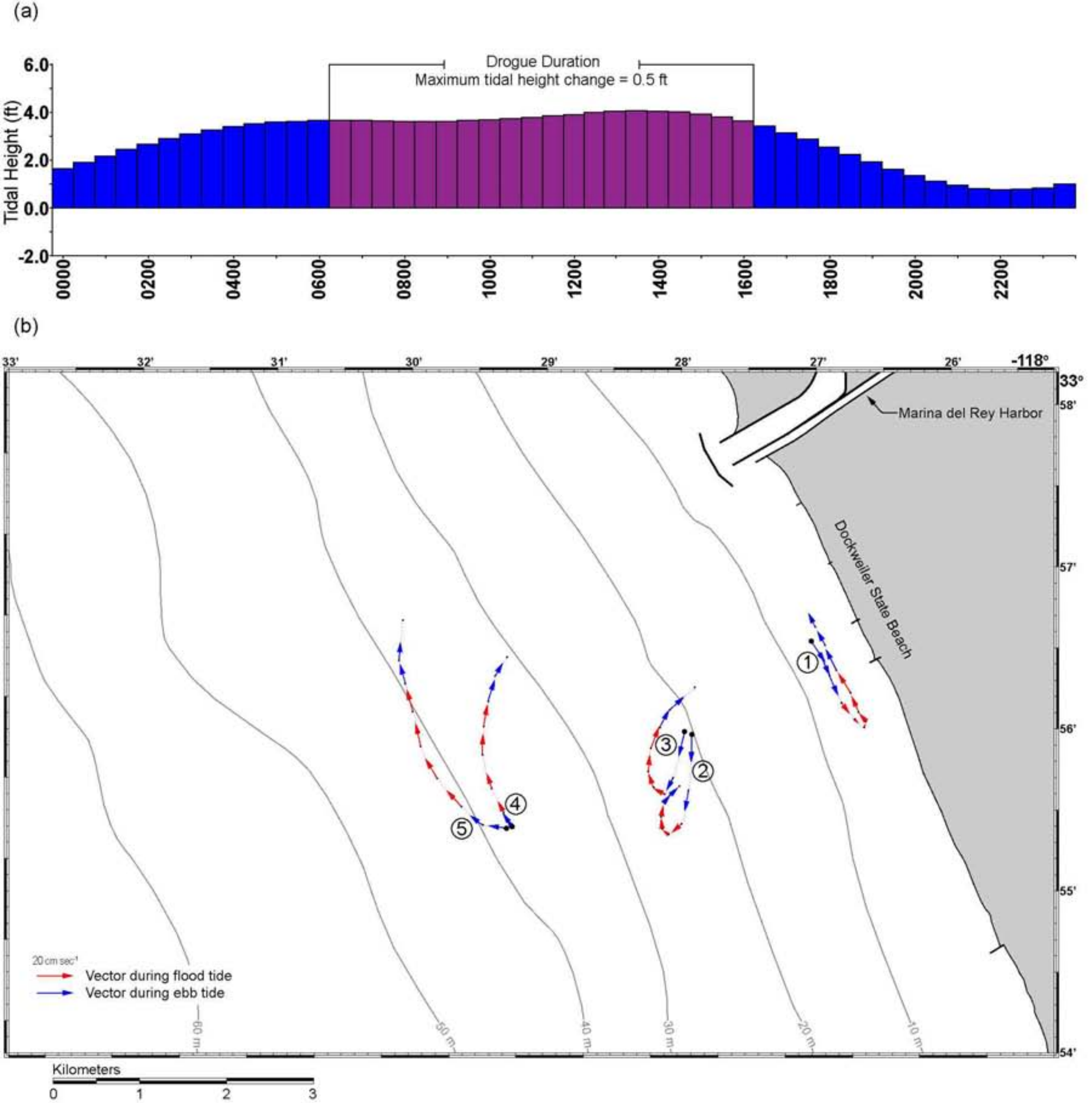

Figure 3-22. Drogue vectors, Nov. 4, 2004, Santa Monica Bay, California. Drogue 1 was set at 6m depth on the 8m isobath. Drogues 2 and 3 were set at depths of 10 and 20m, 2km offshore of the 10m isobath. Drogues 4 and 5 were set at depths of 10 and 20m, 4km offshore of the 10m isobath. Raw data are provided in Appendix A.

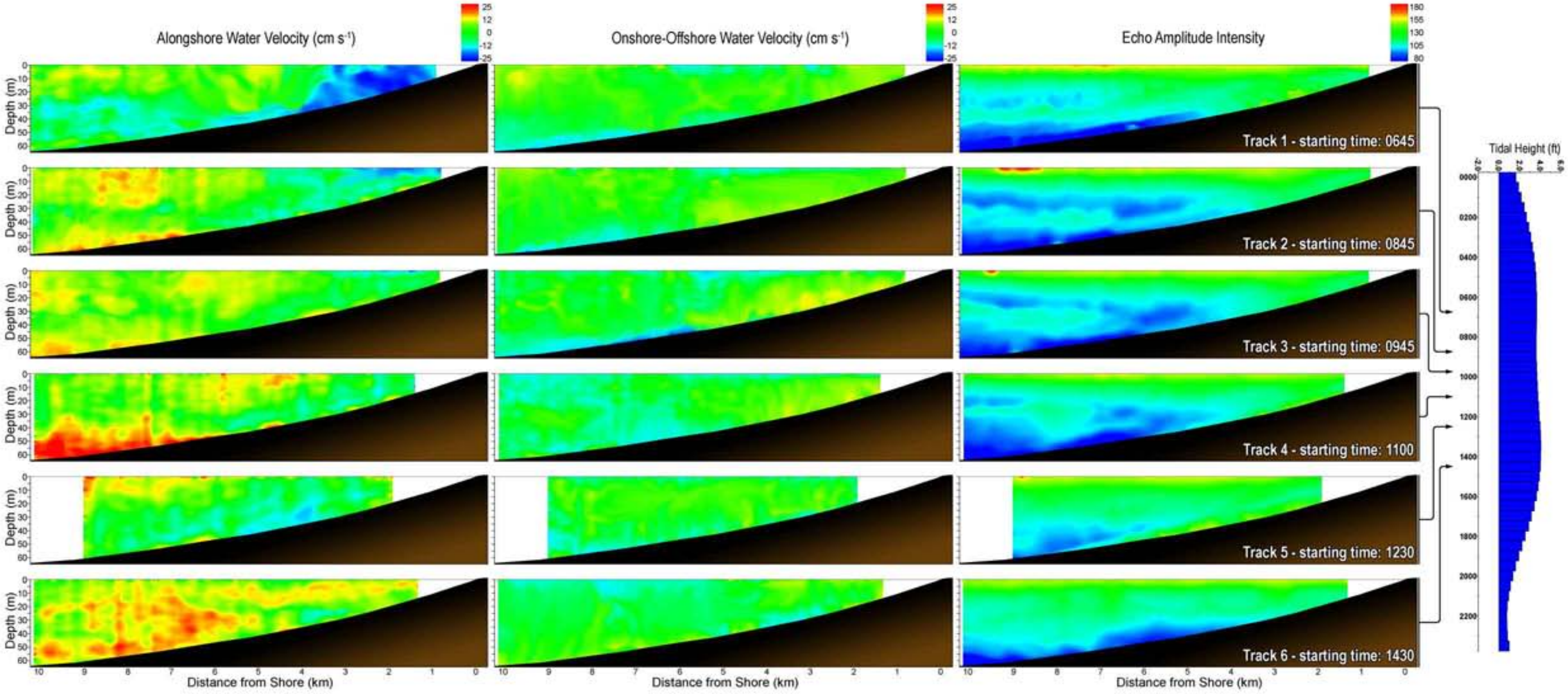

Figure 3-23. ADCP transect profiles on November 4, 2004. Alongshore and onshore-offshore velocities and echo amplitude intensity are shown for six runs. In the alongshore velocity plots, red indicates northward flow and blue indicates southward flow. In the onshore-offshore velocity plots, red indicates flow onshore and blue indicates offshore flow. Echo amplitude intensity plots give a direct measure of larger suspended particles in the water column, which are interpreted as representing plankton densities. Red indicates a high concentration of plankton while blue indicates a thin distribution of plankton.

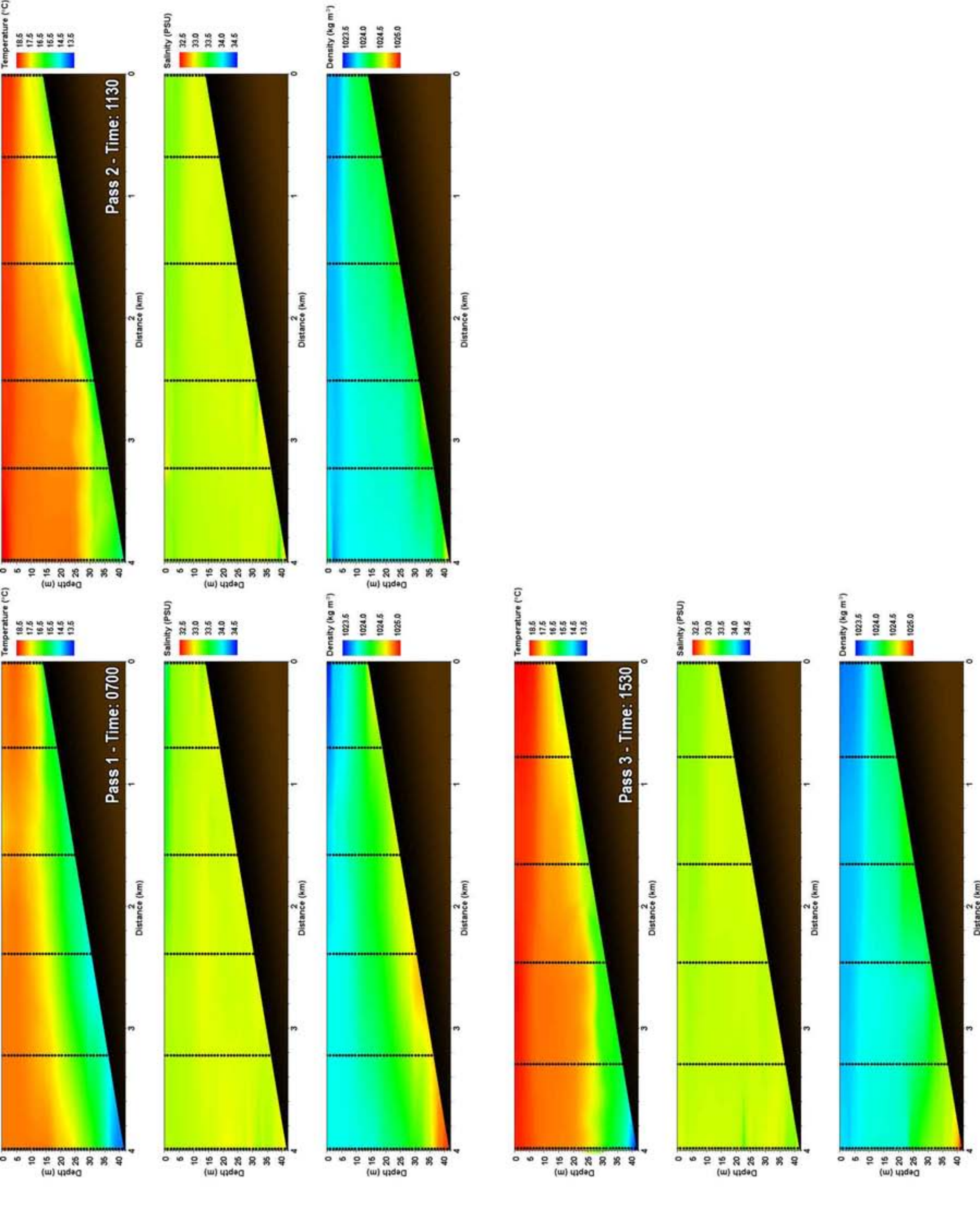

Figure 3-24. Interpolated transect vertical profiles of temperature, salinity and density during three passes on November 4, 2004. Cast locations are shown as vertical dotted lines where each dot represents a 1-meter bin.

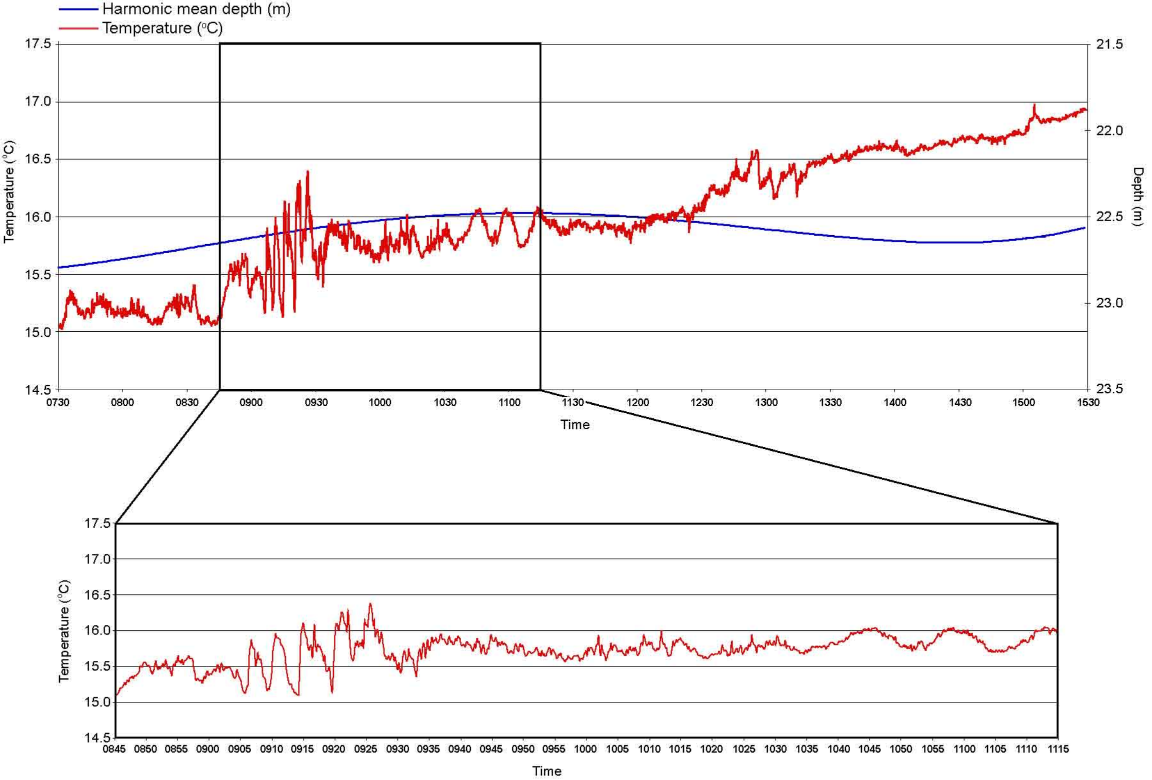

Figure 3-25. Plots of temperature and depth over time at the thermocline located approximately 2.5 km from shore, November 4, 2004. The mooring was set on the 25m isobath with the CTD affixed at the thermocline (approximately 22.5m). The top temperature plot suggests multiple scales of oscillation as a result of many forces, including internal tides, internal waves, and wind forcing. A general trend of increasing temperature over time reflects the deepening thermocline detected also in the CTD profile passes. Since the CTD was fixed in place, the harmonic mean plot (blue line) illustrates the change in mean tidal height as the depth of water above the CTD throughout the day. This line closely follows the predicted tidal height, but not precisely. The shallowest depth occurred at approximately 1100 hrs, 2.5 hours after the actual low tide. Since the absolute range in sea surface height only varied by 0.5 ft during the entire sampling period, and the difference between the predicted tidal height at 0830 and 1100 hrs was only 0.2 ft, the discrepancy is likely a result of the detection limitation of the CTD in discerning real change from stochasticity. Internal waves were observed propagating through the study site over most of the sampling period, however they were most intense between 0845 and 0930 hrs with temperature oscillations over 5-10 minute intervals of up to 1.2°C. After this period, the temperature oscillations decreased to 0.3°C. This is depicted in the lower graphic.

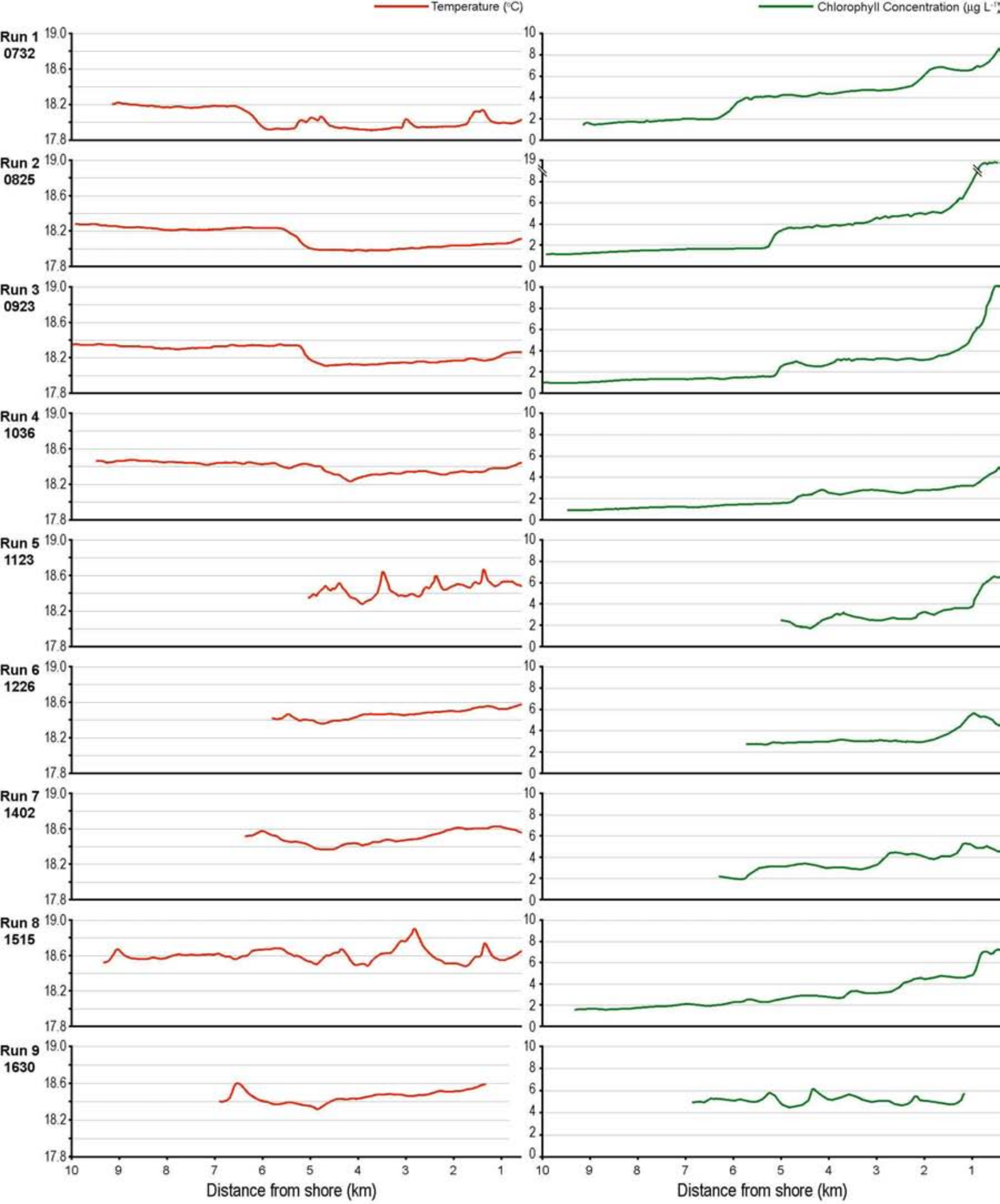

Figure 3-26. Sea surface temperature and chlorophyll concentration along nine onshore runs, November 4, 2004.

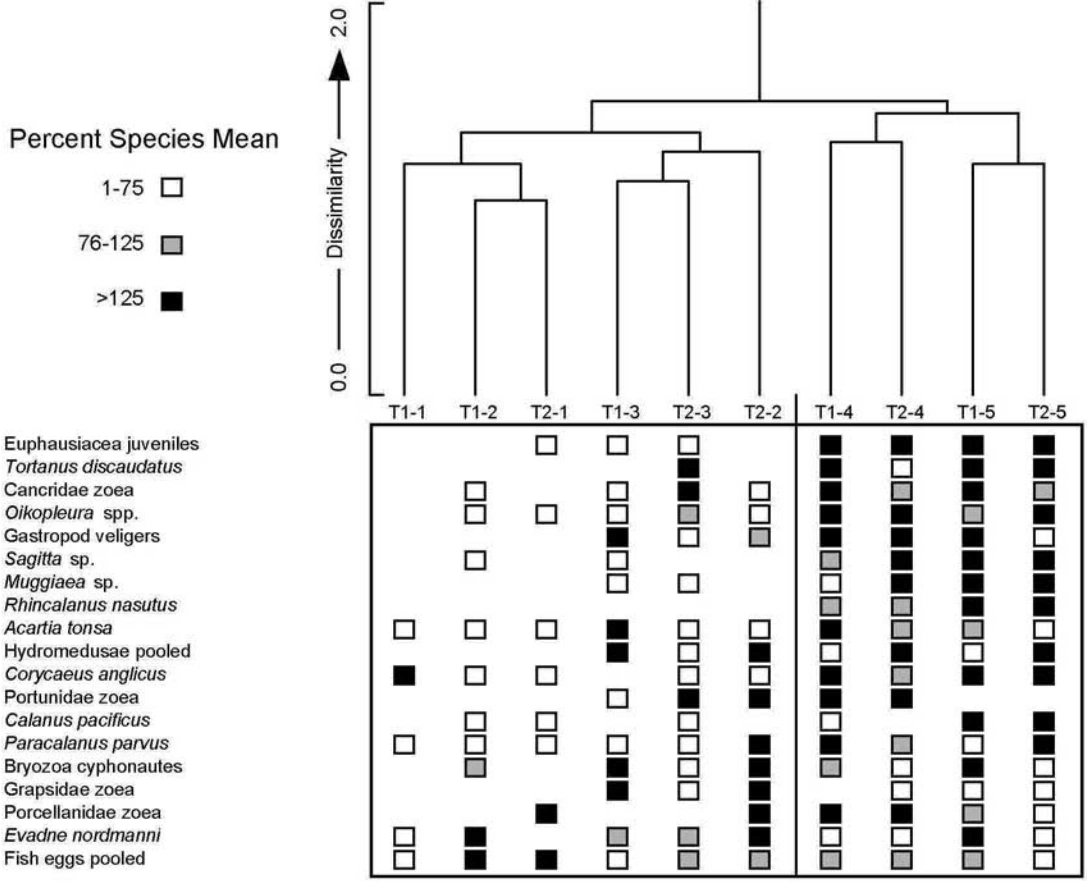

Figure 3-27. Station clustering dendrogram and percent species mean coincidence table for vertical plankton tows, May 7, 2002. The abundance data were log transformed and subject to hierarchical agglomerative clustering (Everitt, 1980). A vertical line was drawn to illustrate the most dissimilar station groupings. The species-station coincidence table symbols provide a visual representation of whether or not a species is skewed in its distribution across all stations. This was determined by dividing the concentration of each species at a station by the average over all the stations. Values between 75 and 125 percent (gray squares) contribute less to skewing whereas values greater than or less than this range contribute more to skewing - low values (white squares) are under-represented and high values (black squares) are over-represented. Species are arranged based on their degree of skew offshore (top species) or onshore (bottom species). Only species that contributed more than 0.1% to the overall abundance are shown.

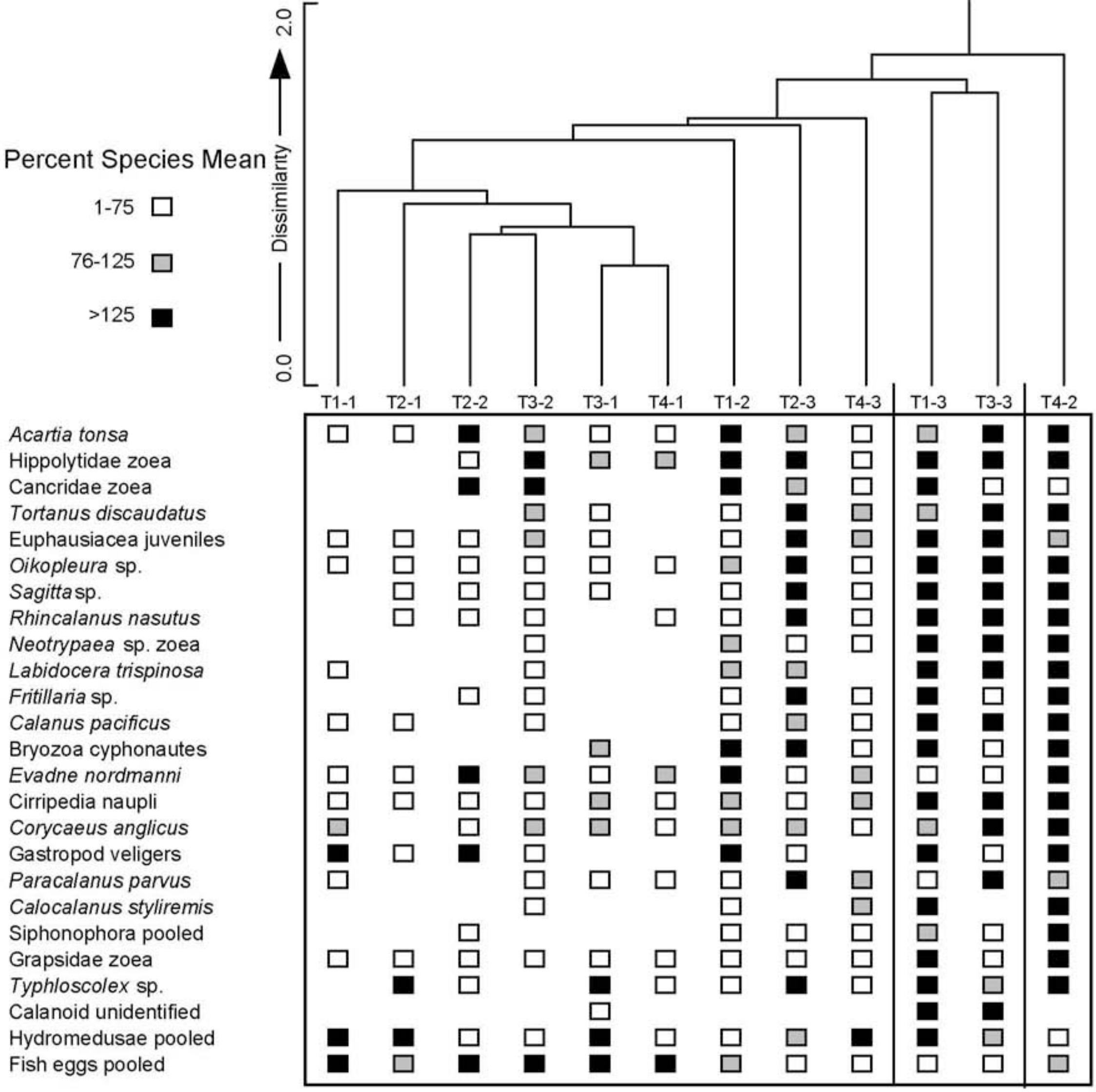

Figure 3-28. Station clustering dendrogram and percent species mean coincidence table for vertical plankton tows, July 15, 2003. Interpretation details are provided in the Figure 3-27 caption.

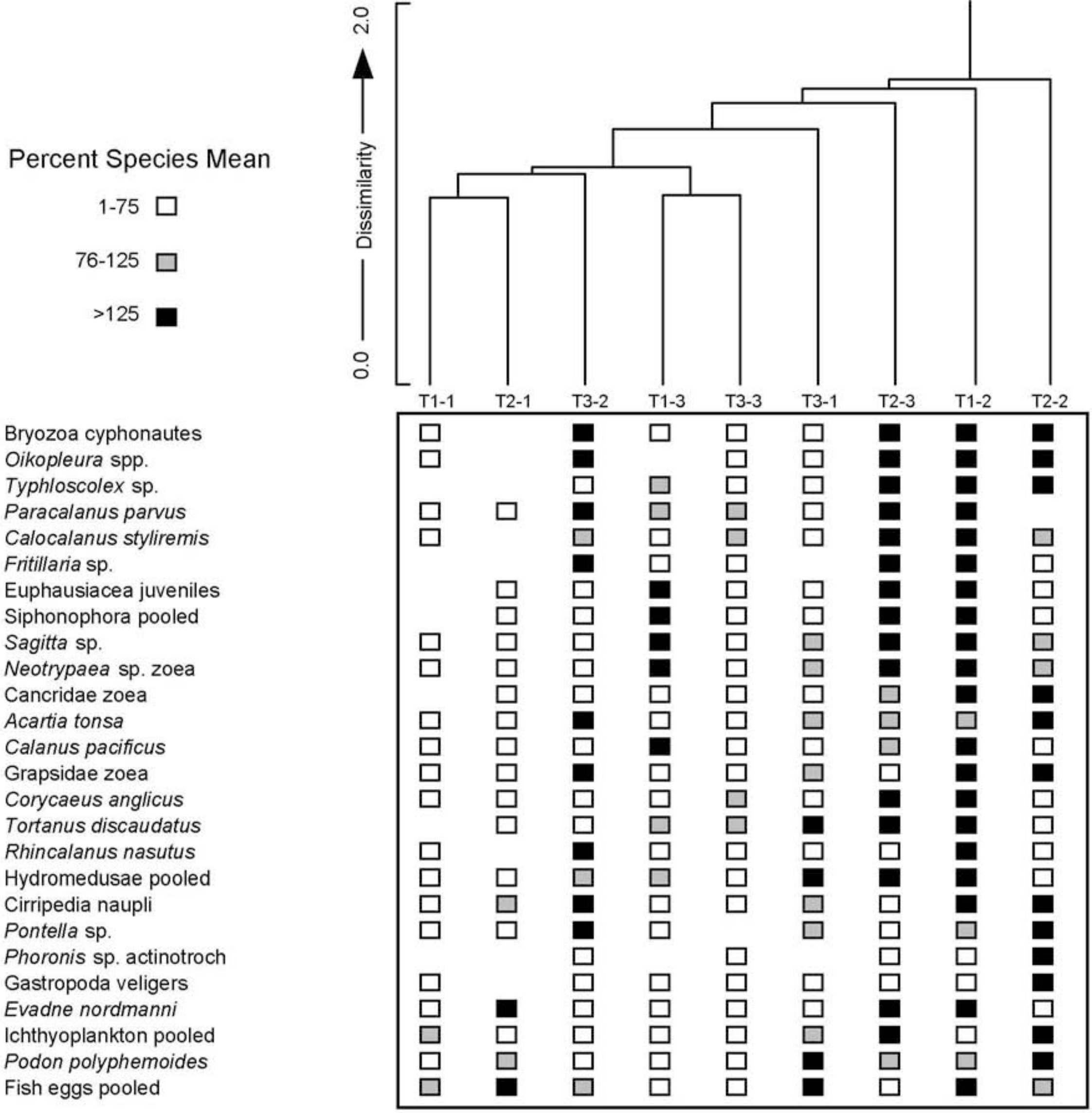

Figure 3-29. Station clustering dendrogram and percent species mean coincidence table for vertical plankton tows, July 17, 2003. Interpretation details are provided in the Figure 3-27 caption.

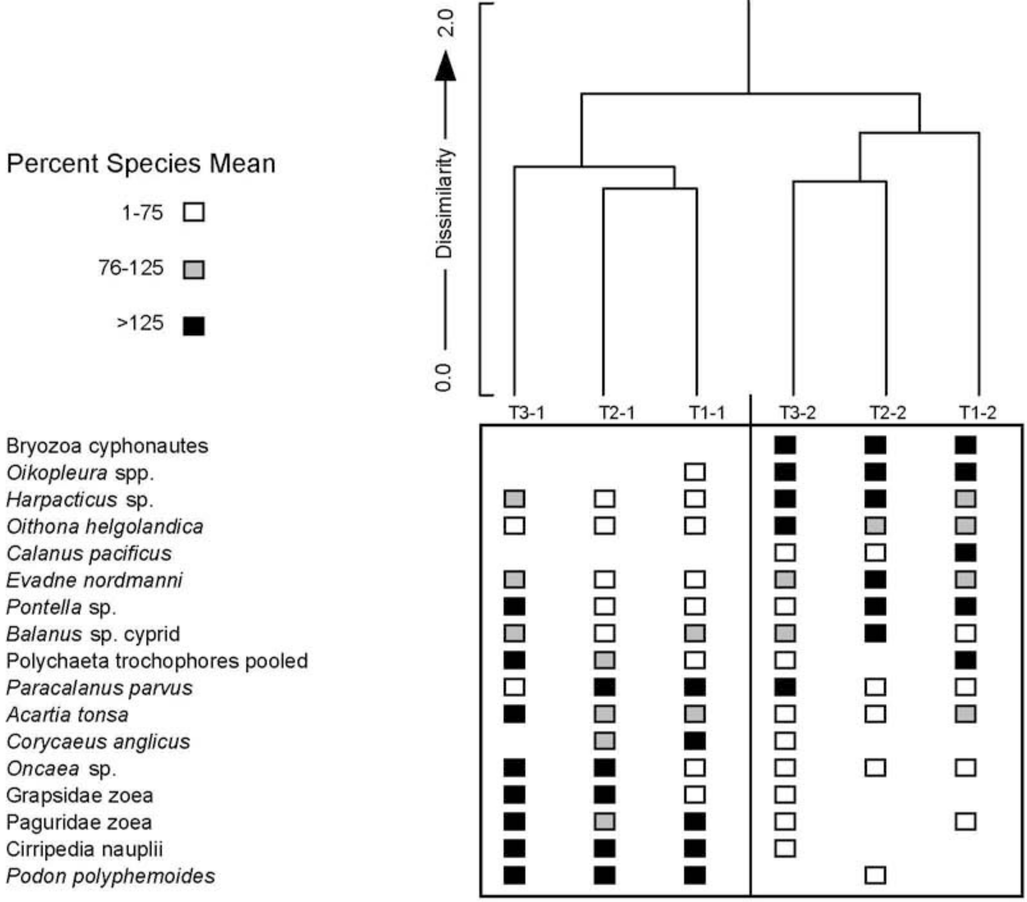

Figure 3-30. Station clustering dendrogram and percent species mean coincidence table for neuston plankton tows, February 21, 2004. Interpretation details are provided in the Figure 3-27 caption.

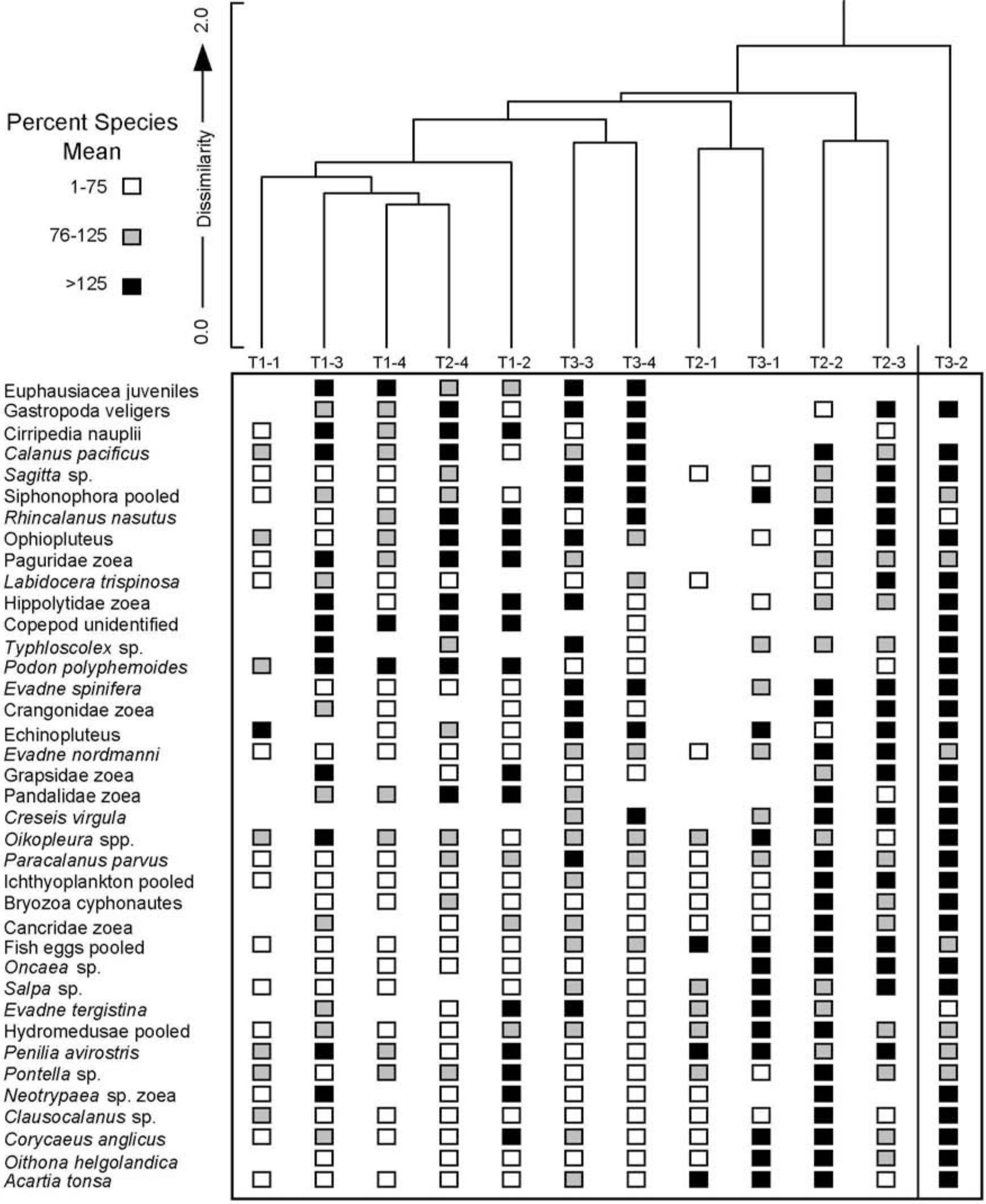

Figure 3-31. Station clustering dendrogram and percent species mean coincidence table for vertical plankton tows, September 27, 2004. Interpretation details are provided in the Figure 3-27 caption.

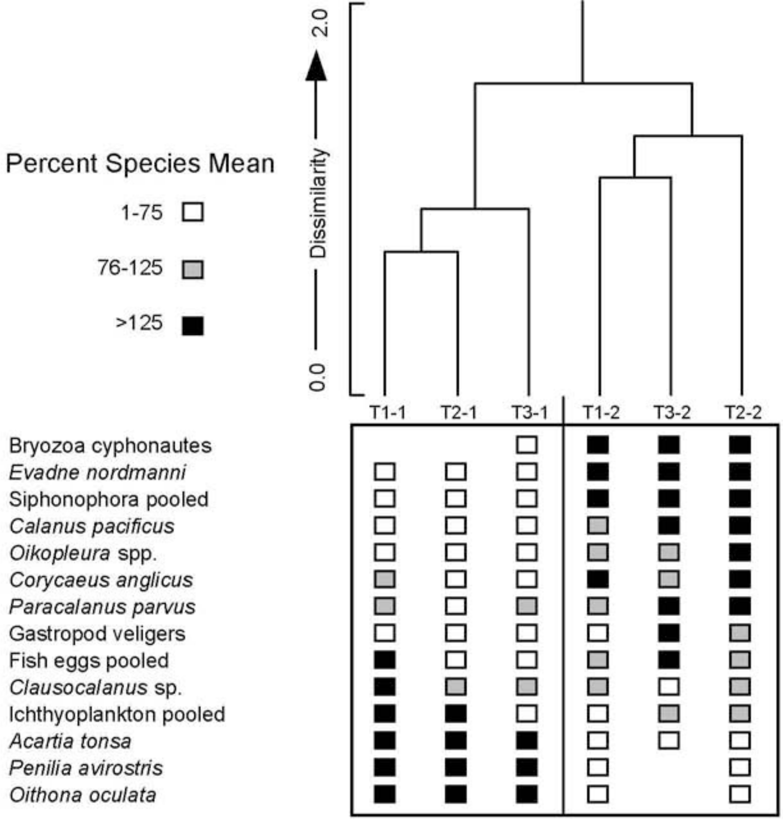

Figure 3-32. Station clustering dendrogram and percent species mean coincidence table for neuston plankton tows, September 27, 2004. Interpretation details are provided in the Figure 3-27 caption.

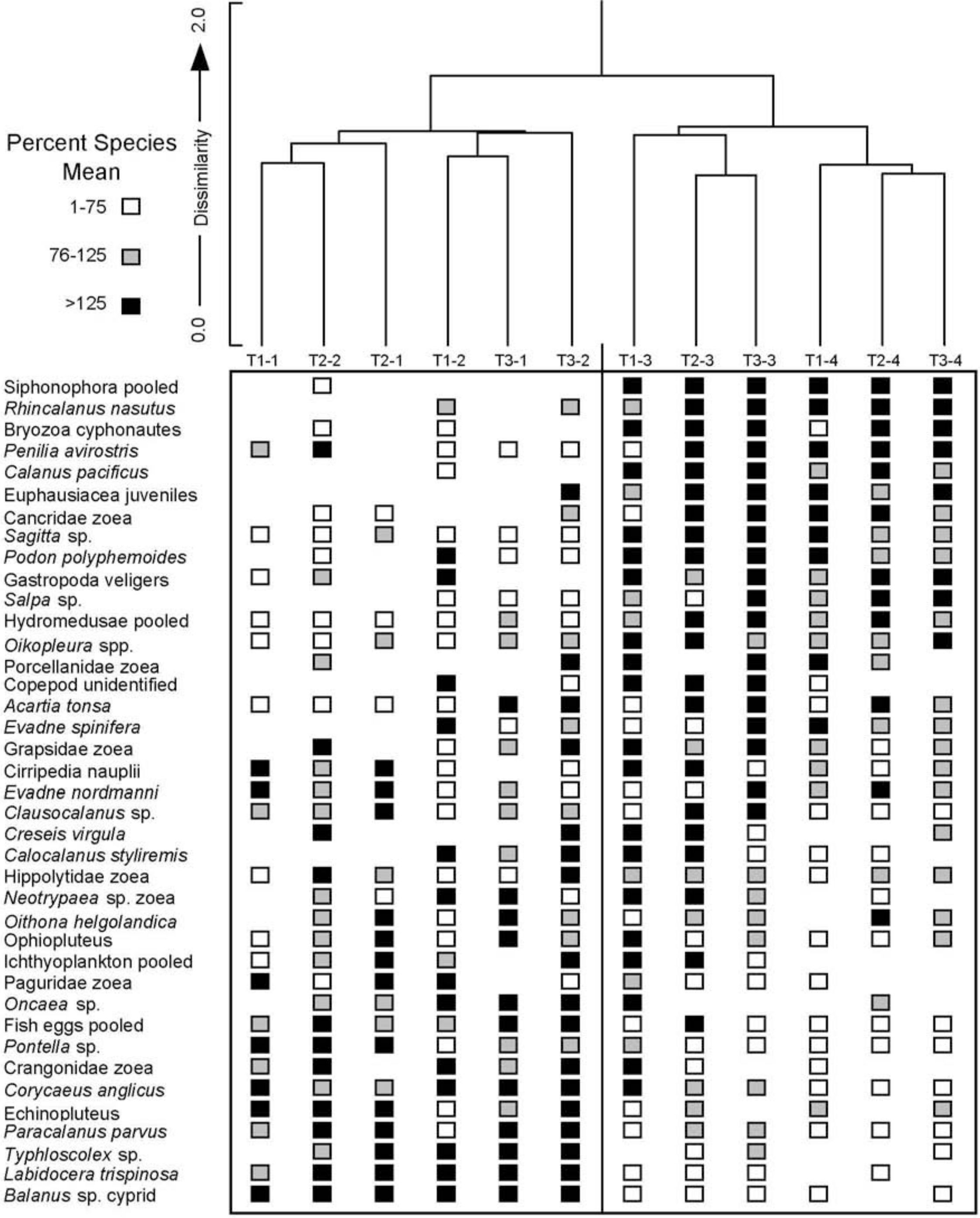

Figure 3-33. Station clustering dendrogram and percent species mean coincidence table for vertical plankton tows, November 4, 2004. Interpretation details are provided in the Figure 3-27 caption.

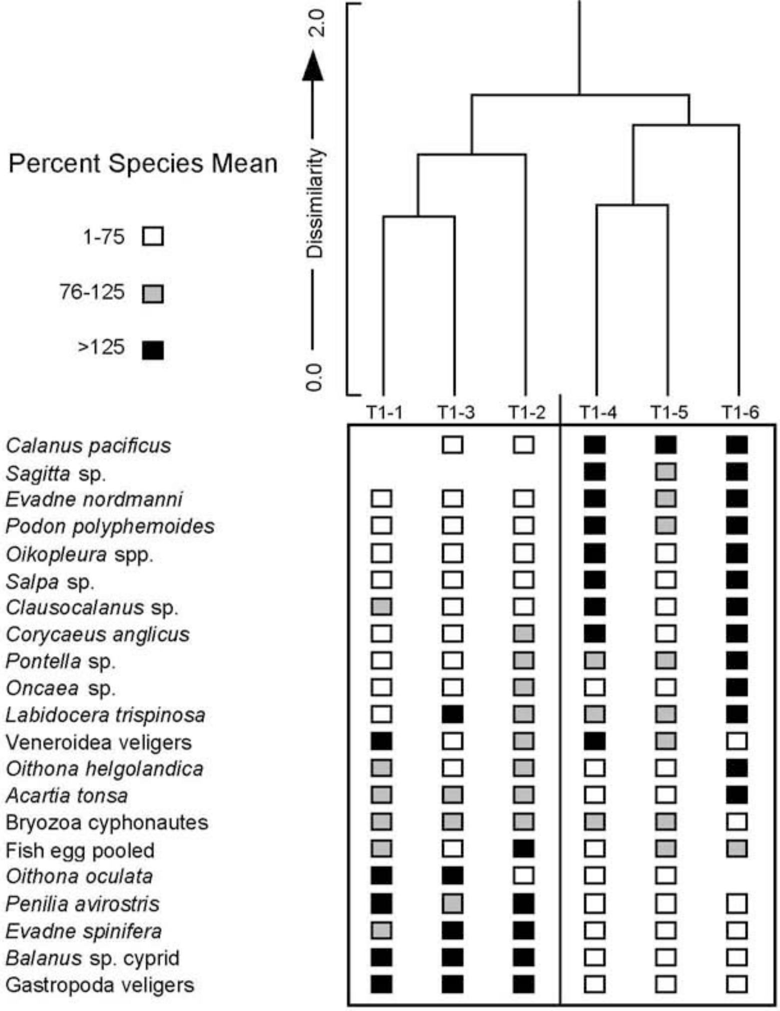

Figure 3-34. Station clustering dendrogram and percent species mean coincidence table for neuston plankton tows, November 4, 2004. Interpretation details are provided in the Figure 3-27 caption.

Appendices

Appendix A-1. Drogue data from May 7, 2002, including time and position. From this, distance and vector data were calculated and then split into onshore-offshore and longshore components. The angle of the coastline along the study site was assumed to be straight and at an angle of -28.5° from true north.

							Rotated relative to coastline (-28.5°)			
					Vector Velocity	Vector Angle	Distance (m)		Velocity (cm s^{-1})	
Drogue	Time	Longitude	Latitude	Distance (m)	cm s^{-1}	(true degree)	x (onshore)	y (longshore)	u (onshore)	v (longshore)
1	909	-118.451	33.942	0.0	3.2	335.9	7.0	76.8	0.3	3.2
	949	-118.451	33.943	77.1	1.3	75.3	25.3	14.4	1.1	0.7
	1026	-118.451	33.943	29.1	2.6	61.9	53.5	8.9	2.5	0.4
	1101	-118.451	33.943	54.2	1.9	82.2	43.1	-7.2	1.8	-0.3
	1140	-118.450	33.943	43.7	2.7	82.0	61.2	-27.2	2.5	-1.1
	1221	-118.450	33.943	66.9	4.6	55.6	89.5	-40.7	4.1	-1.9
	1257	-118.449	33.944	98.3	6.6	124.3	105.9	-52.9	5.9	-2.9
	1327	-118.448	33.943	118.4	2.2	103.1	62.1	-75.9	1.4	-1.7
	1442	-118.447	33.943	98.1						
2	859	-118.454	33.941	0.0	4.3	305.8	-43.4	93.1	-1.8	3.9
	939	-118.455	33.941	102.7	5.0	314.3	-47.4	100.7	-2.1	4.5
	1016	-118.456	33.942	111.3	6.4	286.9	-98.5	90.3	-4.7	4.3
	1051	-118.457	33.942	133.6	4.2	294.4	-69.0	69.0	-3.0	3.0
	1130	-118.458	33.943	97.6	2.4	235.6	-58.0	-6.4	-2.4	-0.3
	1211	-118.458	33.942	58.4	2.6	146.6	19.6	-53.8	0.9	-2.5
	1247	-118.458	33.942	57.2	16.4	92.7	259.1	-140.6	14.4	-7.8
	1317	-118.455	33.942	294.8	5.7	90.3	222.4	-129.7	4.9	-2.9
	1432	-118.453	33.942	257.4	10.4	91.2	155.7	-93.4	8.9	-5.4
	1501	-118.451	33.942	181.5		95.0	190.8	-92.3	9.6	-4.7
	1534	-118.449	33.942	211.9						
3	855	-118.466	33.937	0.0	9.4	321.6	-14.1	226.3	-0.6	9.4
	935	-118.467	33.939	226.8	6.3	304.7	-83.8	111.8	-3.8	5.0
	1012	-118.468	33.939	139.7	7.8	294.6	-103.8	133.4	-4.8	6.2
	1048	-118.469	33.940	169.1	6.5	290.3	-87.6	114.5	-3.9	5.2
	1125	-118.471	33.940	144.1	8.1	304.7	-91.3	176.0	-3.7	7.2
	1206	-118.472	33.941	198.3	6.3	324.1	-15.5	131.7	-0.7	6.3
	1241	-118.473	33.942	132.6	8.5	331.9	17.6	152.3	1.0	8.5
	1311	-118.473	33.944	153.3	9.5	16.3	234.1	344.7	5.3	7.9
	1424	-118.472	33.947	416.7	20.0	43.1	314.5	147.2	18.1	8.5
	1453	-118.470	33.950	347.2	18.2	57.3	338.0	90.1	17.6	4.7
	1525	-118.468	33.951	349.9	18.4	72.4	397.3	-28.4	18.4	-1.3
	1601	-118.464	33.952	398.3						
4	851	-118.476	33.933	0.0	14.5	350.4	98.9	342.9	4.0	13.9
	932	-118.477	33.936	356.8	12.1	356.8	103.9	248.1	4.7	11.2
	1009	-118.477	33.938	268.9	12.6	354.9	92.8	255.1	4.3	11.8
	1045	-118.477	33.941	271.5	9.6	353.2	77.4	204.0	3.4	8.9
	1123	-118.478	33.943	218.2	11.9	332.9	13.9	284.6	0.6	11.9
	1203	-118.479	33.945	284.9	9.6	335.7	13.3	206.8	0.6	9.6
	1239	-118.480	33.947	207.2	9.0	1.3	60.6	145.4	3.5	8.4
	1308	-118.480	33.948	157.5	10.7	16.1	301.7	358.2	6.9	8.2
	1421	-118.478	33.952	468.3	13.2	35.5	238.8	196.7	10.2	8.4
	1450	-118.477	33.955	309.4	19.4	49.4	349.0	131.7	18.2	6.9
	1522	-118.474	33.957	373.0	20.7	60.4	426.7	82.4	20.3	3.9
	1557	-118.471	33.959	434.6						

Appendix A-1. (Continued).

							Rotated relative to coastline (-28.5°)			
					Vector Velocity	Vector Angle	Distance (m)		Velocity (cm s^{-1})	
Drogue	Time	Longitude	Latitude	Distance (m)	cm s^{-1}	(true degree)	x (onshore)	y (longshore)	u (onshore)	v (longshore)
5	847	-118.488	33.928	0.0	16.1	338.6	76.4	388.4	3.1	15.8
	928	-118.489	33.932	395.8	11.5	5.0	101.8	233.5	4.6	10.5
	1005	-118.489	33.934	254.7	15.7	345.8	105.7	323.2	4.9	15.0
	1041	-118.489	33.937	340.0	11.4	17.8	152.9	211.1	6.7	9.3
	1119	-118.489	33.939	260.6	10.7	349.5	79.4	251.5	3.2	10.2
	1200	-118.489	33.942	263.7	13.3	17.4	160.6	228.6	7.6	10.9
	1235	-118.488	33.944	279.4	15.1	25.3	199.0	186.2	11.1	10.3
	1305	-118.487	33.946	272.6	15.7	42.6	603.3	349.6	13.6	7.9
	1419	-118.483	33.951	697.3	9.2	19.7	123.0	101.3	7.1	5.8
	1448	-118.483	33.952	159.3	8.5	36.9	117.0	105.3	6.3	5.7
	1519	-118.482	33.953	157.4	11.9	53.3	226.8	63.8	11.5	3.2
	1552	-118.480	33.955	235.6						
6	841	-118.498	33.924	0.0	13.0	355.2	120.9	311.9	4.7	12.1
	924	-118.499	33.927	334.5	10.1	5.2	119.4	188.5	5.4	8.5
	1001	-118.499	33.929	223.2	14.3	2.7	125.8	283.0	5.8	13.1
	1037	-118.498	33.932	309.6	7.7	17.9	116.8	130.5	5.1	5.7
	1115	-118.498	33.934	175.1	14.4	23.5	237.1	262.0	9.6	10.7
	1156	-118.497	33.937	353.3	13.7	47.5	276.8	125.8	12.5	5.7
	1233	-118.495	33.938	304.1	15.0	50.8	240.3	100.8	13.8	5.8
	1302	-118.493	33.940	260.6	17.6	64.2	776.8	89.6	17.5	2.0
	1416	-118.487	33.943	781.9	18.6	74.9	312.6	-6.8	18.6	-0.4
	1444	-118.484	33.944	312.7	16.7	80.4	291.7	-104.7	15.7	-5.6
	1515	-118.481	33.944	309.9	11.9	74.5	220.0	-21.3	11.8	-1.1
	1546	-118.479	33.945	221.1						

Appendix A-2. Drogue data from July 15, 2003, including time and position. From this, distance and vector data were calculated and then split into onshore-offshore and longshore components. The angle of the coastline along the study site was assumed to be straight and at an angle of -28.5^{o} from true north.

							Rotated relative to coastline (-28.5^{o})			
					Vector Velocity	Vector Angle	Distance (m)		Velocity (cm s^{-1})	
Drogue	Time	Longitude	Latitude	Distance (m)	cm s^{-1}	(true degree)	x (onshore)	y (longshore)	u (onshore)	v (longshore)
1	742	-118.445	33.929	0.0	0.0	333.2	12.9	348.5	0.4	10.0
	840	-118.446	33.932	348.7	7.2	1.2	184.5	388.1	3.8	8.0
	1001	-118.446	33.936	429.8	12.3	23.7	150.5	129.0	4.3	3.7
	1059	-118.445	33.937	198.2	8.9	109.9	119.2	-111.8	5.4	-5.0
	1136	-118.444	33.937	163.4						
reset	1145	-118.448	33.936	0.0	0.0	120.7	129.4	-279.2	3.0	-6.4
	1258	-118.445	33.935	307.7	9.3	154.6	32.4	-239.7	1.0	-7.3
	1353	-118.444	33.933	241.9	7.8	136.9	65.0	-310.4	2.1	-9.9
	1452	-118.442	33.930	317.1						
2	753	-118.469	33.921	0.0	0.0	16.6	294.5	353.4	8.6	10.3
	850	-118.468	33.925	460.0	9.7	0.5	187.0	411.4	3.9	8.7
	1009	-118.468	33.929	451.9	13.2	22.3	128.1	166.6	3.7	4.9
	1106	-118.467	33.931	210.1	6.1	96.8	340.7	-232.0	10.0	-6.8
	1203	-118.464	33.930	412.2	11.3	108.3	550.2	-550.2	15.0	-15.0
	1304	-118.457	33.928	778.1	24.5	115.0	403.7	-550.5	12.7	-17.3
	1357	-118.451	33.925	682.7	21.1	124.9	350.4	-700.8	10.8	-21.6
	1451	-118.446	33.921	783.5						
3	802	-118.489	33.914	0.0	0.0	354.5	63.2	132.7	1.8	3.7
	901	-118.489	33.916	147.0	3.1	72.7	180.4	0.0	3.8	0.0
	1021	-118.487	33.916	180.4	6.1	85.6	234.4	-90.7	8.0	-3.1
	1110	-118.485	33.916	251.3	6.8	106.5	271.9	-256.8	7.3	-6.9
	1212	-118.482	33.915	374.0	10.1	126.2	196.7	-414.5	5.3	-11.1
	1314	-118.478	33.913	458.8	14.7	124.1	205.3	-417.7	6.6	-13.4
	1406	-118.475	33.911	465.4	10.1	144.4	80.1	-554.1	1.7	-12.0
	1523	-118.472	33.906	559.9						
4	803	-118.489	33.914	0.0	0.0	353.5	157.9	414.5	4.0	10.5
	909	-118.490	33.918	443.6	14.5	31.2	489.2	396.7	16.0	13.0
	1018	-118.487	33.923	629.8	19.1	74.5	586.0	-68.5	17.8	-2.1
	1113	-118.482	33.924	590.0	17.9	103.1	341.5	-279.4	10.3	-8.5
	1208	-118.478	33.923	441.2	12.3	119.7	358.7	-600.2	10.0	-16.7
	1308	-118.472	33.920	699.2	22.4	137.8	177.8	-779.8	5.7	-25.0
	1400	-118.468	33.915	799.8	14.6	153.9	-40.3	-1317.2	-0.7	-24.1
	1531	-118.462	33.904	1317.8						
5	920	-118.491	33.914	0.0	0.0	356.3	244.1	732.4	6.6	19.7
	1022	-118.491	33.920	772.1	22.6	27.3	681.4	647.7	19.9	18.9
	1119	-118.487	33.928	940.1	27.5	59.8	777.4	154.0	22.7	4.5
	1216	-118.481	33.932	792.5	21.3	93.4	527.7	-263.8	14.2	-7.1
	1318	-118.476	33.931	590.0	18.2	105.9	691.5	-683.8	21.3	-21.1
	1412	-118.467	33.929	972.5	30.0	116.6	381.6	-640.3	11.8	-19.8
	1513	-118.461	33.926	745.4	21.1	144.1	275.6	-2096.1	7.8	-59.2
	1612	-118.450	33.910	2114.2						

Appendix A-3. Drogue data from July 17, 2003, including time and position. From this, distance and vector data were calculated and then split into onshore-offshore and longshore components. The angle of the coastline along the study site was assumed to be straight and at an angle of -28.5° from true north.

							Rotated relative to coastline (-28.5°)			
					Vector Velocity	Vector Angle	Distance (m)		Velocity (cm s^{-1})	
Drogue	Time	Longitude	Latitude	Distance (m)	cm s^{-1}	(true degree)	x (onshore)	y (longshore)	u (onshore)	v (longshore)
5	827	-118.496	33.922	0.0	0.0	319.3	-81.1	668.8	-2.3	18.9
	926	-118.500	33.927	673.7	16.0	15.2	666.7	758.2	15.9	18.1
	1036	-118.497	33.935	1009.6	27.1	54.1	1189.1	261.0	32.0	7.0
	1138	-118.489	33.942	1217.4	36.2	70.0	1267.4	-99.9	37.7	-3.0
	1234	-118.478	33.946	1271.4	141.3	65.3	230.3	-6.8	25.6	-0.8
	1249	-118.476	33.947	230.4						
reset	1321	-118.495	33.923	0.0	0.0	88.8	470.9	-250.7	23.1	-12.3
	1355	-118.490	33.923	533.5	13.5	102.4	896.4	-835.1	22.6	-21.1
	1501	-118.480	33.920	1225.1	35.2	130.8	291.3	-1087.0	8.4	-31.2
	1559	-118.472	33.914	1125.3						
4	823	-118.485	33.925	0.0	0.0	304.3	-276.9	617.8	-7.8	17.5
	922	-118.490	33.928	677.0	15.7	344.9	236.2	748.0	5.5	17.3
	1034	-118.492	33.935	784.4	21.1	55.0	1240.8	263.8	33.4	7.1
	1136	-118.482	33.942	1268.5	37.8	62.9	1095.7	75.0	32.6	2.2
	1232	-118.473	33.946	1098.3	91.5	62.1	292.5	21.9	24.4	1.8
	1252	-118.471	33.947	293.4						
reset	1317	-118.484	33.926	0.0	0.0	103.8	347.3	-332.2	17.5	-16.8
	1350	-118.480	33.925	480.7	12.0	115.5	634.2	-1014.7	15.8	-25.2
	1457	-118.471	33.920	1196.6	34.4	143.8	47.7	-940.4	1.4	-27.0
	1555	-118.466	33.913	941.6						
3	0818	-118.474	33.929	0.0	0.0	334.8	58.6	514.5	1.7	14.5
	0917	-118.476	33.933	517.8	12.0	335.8	112.9	763.4	2.6	17.7
	1029	-118.478	33.939	771.7	20.4	359.2	358.1	690.6	9.5	18.3
	1132	-118.478	33.946	777.9	22.7	27.4	525.9	411.3	15.4	12.0
	1229	-118.476	33.951	667.6	69.5	13.9	123.2	147.9	12.8	15.4
	1245	-118.475	33.953	192.5						
reset	1312	-118.473	33.928	0.0	0.0	107.3	341.1	-437.5	16.7	-21.4
	1346	-118.468	33.927	554.7	14.0	117.7	680.2	-1219.9	17.2	-30.8
	1452	-118.457	33.921	1396.7	41.6	141.7	97.0	-914.9	2.9	-27.2
	1548	-118.452	33.914	920.1						
2	814	-118.463	33.932	0.0	0.0	329.6	32.5	734.0	0.9	21.1
	912	-118.466	33.938	734.7	17.2	349.8	248.1	698.7	5.8	16.4
	1023	-118.467	33.944	741.4	19.3	353.5	276.7	650.0	7.2	16.9
	1127	-118.468	33.950	706.5	15.9	327.6	6.8	824.5	0.2	18.6
	1241	-118.472	33.957	824.5						
reset	1307	-118.462	33.931	0.0	0.0	109.8	348.4	-481.8	17.1	-23.6
	1341	-118.457	33.929	594.6	14.6	133.0	252.8	-997.1	6.2	-24.4
	1449	-118.450	33.923	1028.6	30.6	147.4	6.7	-721.3	0.2	-21.5
	1545	-118.447	33.917	721.3						
1	809	-118.453	33.934	0.0	0.0	321.5	-54.1	717.3	-1.5	20.3
	908	-118.457	33.939	719.4	16.9	354.0	304.2	692.6	7.1	16.3
	1019	-118.458	33.946	756.5	20.0	345.7	189.1	593.3	5.0	15.7
	1122	-118.459	33.952	622.7						
reset	1304	-118.454	33.933	0.0	0.0	139.4	54.2	-385.9	2.7	-18.9
	1338	-118.451	33.931	389.7	9.7	126.6	271.4	-721.4	6.8	-17.9
	1445	-118.446	33.927	770.8						

Appendix A-4. Drogue data from February 21, 2004, including time and position. From this, distance and vector data were calculated and then split into onshore-offshore and longshore components. The angle of the coastline along the study site was assumed to be straight and at an angle of -28.5° from true north.

							Rotated relative to coastline (-28.5°)			
					Vector Velocity	Vector Angle	Distance (m)		Velocity (cm s^{-1})	
Drogue	Time	Longitude	Latitude	Distance (m)	cm s^{-1}	(true degree)	x (onshore)	y (longshore)	u (onshore)	v (longshore)
1	657	-118.449	33.940	0.0	4.7	198.0	-56.3	-62.0	-3.1	-3.4
	727	-118.449	33.940	83.8	8.8	169.9	-68.2	-155.0	-3.6	-8.1
	759	-118.449	33.938	169.3	10.1	202.9	-127.9	-127.9	-7.1	-7.1
	829	-118.449	33.937	180.9	10.7	194.0	-142.8	-148.7	-7.4	-7.7
	901	-118.450	33.935	206.2	11.4	238.4	-192.4	-46.2	-11.1	-2.7
	930	-118.451	33.934	197.9	15.7	253.8	-286.7	51.5	-15.4	2.8
	1001	-118.454	33.933	291.3	8.3	251.8	-118.1	13.9	-8.2	1.0
	1025	-118.455	33.933	118.9						
reset	1229	-118.450	33.940	0.0	9.5	301.0	-184.6	361.9	-4.3	8.5
	1340	-118.454	33.941	406.2	8.8	296.1	-100.5	160.8	-4.7	7.4
	1416	-118.455	33.942	189.7	6.4	274.2	-80.2	60.2	-5.1	3.9
	1442	-118.456	33.942	100.3	8.9	271.8	-157.1	91.0	-7.7	4.5
	1516	-118.458	33.942	181.6	12.7	283.1	-170.1	140.5	-9.8	8.1
	1545	-118.460	33.943	220.6						
2	645	-118.463	33.931	0.0	6.7	281.1	-119.5	112.5	-4.9	4.6
	726	-118.464	33.932	164.2	11.5	260.3	-442.5	139.7	-11.0	3.5
	833	-118.468	33.931	464.0	12.6	266.9	-242.5	124.7	-11.2	5.8
	909	-118.471	33.931	272.6	13.9	276.9	-178.8	121.9	-11.5	7.8
	935	-118.473	33.931	216.4	12.9	279.5	-96.8	77.4	-10.1	8.1
	951	-118.474	33.931	123.9						
reset	1227	-118.463	33.932	0.0	17.8	299.0	-201.2	365.2	-8.6	15.6
	1306	-118.466	33.934	417.0	14.4	315.0	-133.4	625.0	-3.0	14.1
	1420	-118.470	33.938	639.1	24.4	278.1	-190.5	160.0	-18.7	15.7
	1437	-118.473	33.938	248.8	17.8	299.5	-300.9	565.1	-8.4	15.7
	1537	-118.478	33.941	640.2						
3	651	-118.481	33.927	0.0	4.3	324.6	-18.8	100.5	-0.8	4.2
	731	-118.481	33.928	102.3	12.6	282.3	-292.7	307.7	-8.7	9.2
	827	-118.485	33.929	424.7	21.2	281.5	-321.7	269.3	-16.2	13.6
	900	-118.488	33.929	419.5	15.1	294.6	-139.2	222.8	-8.0	12.8
	929	-118.491	33.930	262.7	15.6	288.2	-197.9	212.6	-10.6	11.4
	1000	-118.493	33.931	290.5						
reset	1234	-118.479	33.927	0.0	25.6	322.1	-48.5	582.6	-2.1	25.6
	1312	-118.482	33.931	584.6	21.6	318.4	-116.4	794.4	-3.1	21.4
	1414	-118.487	33.937	802.8	17.7	324.0	-20.2	349.5	-1.0	17.7
	1447	-118.489	33.939	350.1	19.8	319.8	-62.1	434.5	-2.8	19.6
	1524	-118.491	33.942	438.9						
4	652	-118.481	33.927	0.0	3.9	320.8	-6.5	90.6	-0.3	3.9
	731	-118.481	33.928	90.8	11.3	285.9	-264.4	272.0	-7.9	8.1
	827	-118.485	33.929	379.3	15.9	277.4	-252.5	189.4	-12.8	9.6
	900	-118.488	33.929	315.6	13.0	273.8	-189.5	123.9	-10.9	7.1
	929	-118.490	33.929	226.4	10.0	290.0	-108.3	135.4	-6.2	7.8
	958	-118.491	33.930	173.4						
reset	1234	-118.480	33.927	0.0	13.7	311.1	-98.3	314.5	-4.1	13.1
	1314	-118.482	33.929	329.5	10.3	296.3	-200.3	288.4	-5.9	8.4
	1411	-118.485	33.930	351.2	6.0	333.0	-28.9	110.6	-1.5	5.8
	1443	-118.485	33.931	114.3	7.6	293.5	-132.0	173.7	-4.6	6.0
	1531	-118.487	33.932	218.1						

Appendix A-4. (Continued).

Drogue	Time	Longitude	Latitude	Distance (m)	Vector Velocity cm s^{-1}	Vector Angle (true degree)	Rotated relative to coastline (-28.5°) Distance (m) x (onshore)	y (longshore)	Velocity (cm s^{-1}) u (onshore)	v (longshore)
5	658	-118.495	33.922	0.0	22.5	287.5	-330.2	460.9	-13.1	18.3
	740	-118.500	33.923	567.0	23.6	299.4	-215.6	539.0	-8.8	21.9
	821	-118.505	33.926	580.5	14.3	316.5	-50.6	253.1	-2.8	14.1
	851	-118.507	33.928	258.1	15.7	306.2	-65.6	284.1	-3.5	15.3
	922	-118.509	33.929	291.5	16.5	315.2	-116.7	431.0	-4.3	16.0
	1007	-118.511	33.932	446.6						
reset	1240	-118.495	33.922	0.0	19.1	303.1	-200.5	438.1	-8.0	17.4
	1322	-118.499	33.925	481.8	18.3	308.0	-150.9	425.3	-6.1	17.3
	1403	-118.502	33.927	451.2	12.6	317.9	-62.5	381.7	-2.0	12.5
	1454	-118.504	33.930	386.8	13.5	307.8	-58.3	168.4	-4.4	12.8
	1516	-118.506	33.931	178.2						
6	659	-118.496	33.922	0.0	23.1	294.9	-298.4	482.8	-12.1	19.6
	740	-118.501	33.924	567.6	14.5	303.6	-172.1	321.5	-6.8	12.8
	822	-118.504	33.926	364.7	14.0	316.2	-45.3	239.4	-2.6	13.8
	851	-118.505	33.927	243.6	15.1	314.2	-107.6	248.8	-6.0	13.8
	921	-118.507	33.929	271.1	13.2	313.3	-60.9	343.1	-2.3	13.0
	1005	-118.509	33.931	348.5						
reset	1240	-118.496	33.922	0.0	11.3	287.8	-172.0	211.1	-7.2	8.8
	1320	-118.498	33.923	272.3	11.7	292.1	-178.7	253.2	-6.8	9.6
	1404	-118.501	33.924	309.9	6.3	306.5	-78.9	179.4	-2.5	5.7
	1456	-118.502	33.925	195.9	7.5	284.0	-51.1	56.8	-5.0	5.6
	1513	-118.503	33.925	76.4						

Appendix A-5. Drogue data from September 27, 2004, including time and position. From this, distance and vector data were calculated and then split into onshore-offshore and longshore components. The angle of the coastline along the study site was assumed to be straight and at an angle of -28.5° from true north.

							Rotated relative to coastline (-28.5°)			
					Vector Velocity	Vector Angle	Distance (m)		Velocity (cm s^{-1})	
Drogue	Time	Longitude	Latitude	Distance (m)	cm s^{-1}	(true degree)	x (onshore)	y (longshore)	u (onshore)	v (longshore)
1	0710	-118.450	33.943	0.0	20.3	341.9	116.6	499.0	4.6	19.8
	0752	-118.452	33.947	512.5	16.2	337.6	91.5	457.6	3.2	15.9
	0840	-118.453	33.951	466.7	16.5	322.3	-35.2	464.7	-1.2	16.5
	0927	-118.456	33.954	466.0	9.8	319.1	-19.3	205.5	-0.9	9.8
	0952	-118.457	33.956	206.4	10.9	312.4	-66.5	226.1	-3.1	10.5
	1028	-118.459	33.957	235.7	7.1	321.7	-13.4	100.6	-0.9	7.0
	1052	-118.459	33.958	101.5						
reset	1110	-118.451	33.942	0.0	5.2	122.3	43.9	-94.1	2.2	-4.8
	1143	-118.450	33.942	103.9	8.5	121.6	67.1	-126.8	4.0	-7.5
	1211	-118.449	33.941	143.5	14.6	122.8	106.8	-249.2	5.7	-13.4
	1242	-118.447	33.940	271.1	12.5	127.4	127.7	-336.1	4.4	-11.7
	1330	-118.445	33.938	359.6						
reset	1331	-118.447	33.937	0.0	13.9	132.8	52.6	-236.7	3.0	-13.6
	1400	-118.445	33.936	242.4	10.7	127.9	92.3	-246.2	3.8	-10.0
	1441	-118.443	33.934	262.9						
2	0709	-118.469	33.942	0.0	11.0	343.4	106.0	361.6	3.1	10.6
	0806	-118.470	33.945	376.8	10.1	349.3	111.0	320.6	3.3	9.5
	0902	-118.471	33.948	339.3	8.6	10.1	228.4	291.8	5.3	6.8
	1014	-118.470	33.951	370.6	7.5	10.5	129.8	168.7	4.6	6.0
	1101	-118.470	33.953	212.9	2.5	57.6	86.9	23.2	2.4	0.6
	1202	-118.469	33.954	89.9	2.4	103.2	79.2	-92.4	1.6	-1.8
	1327	-118.468	33.953	121.7	9.8	106.2	134.3	-156.6	6.4	-7.5
	1402	-118.466	33.953	206.3	10.3	104.0	261.1	-246.2	7.5	-7.1
	1500	-118.463	33.952	358.9	6.6	126.9	113.3	-266.6	2.6	-6.1
	1613	-118.461	33.950	289.7						
3	0711	-118.470	33.942	0.0	8.9	325.6	-6.8	298.4	-0.2	8.9
	0807	-118.472	33.944	298.5	8.2	321.5	-20.9	278.6	-0.6	8.1
	0904	-118.474	33.946	279.4	6.6	326.3	13.3	286.8	0.3	6.5
	1017	-118.475	33.948	287.1	3.4	355.6	40.8	87.5	1.4	3.1
	1104	-118.475	33.949	96.6	4.8	99.2	130.4	-115.9	3.6	-3.2
	1205	-118.474	33.949	174.5	9.3	99.9	273.8	-229.4	7.1	-6.0
	1309	-118.470	33.948	357.1	3.1	124.0	41.2	-94.1	1.2	-2.8
	1405	-118.470	33.948	102.7	8.9	119.3	144.8	-274.3	4.2	-7.9
	1503	-118.467	33.946	310.1	3.4	113.5	88.0	-125.8	1.9	-2.8
	1619	-118.466	33.946	153.5	6.1	138.1	164.1	-136.8	4.7	-3.9
	1717	-118.465	33.944	213.6						
4	0720	-118.494	33.938	0.0	11.8	45.8	352.6	148.1	10.9	4.6
	0814	-118.491	33.940	382.4	8.3	59.5	276.9	14.2	8.2	0.4
	0910	-118.489	33.941	277.3	6.7	91.8	253.8	-138.4	5.9	-3.2
	1022	-118.487	33.941	289.1	9.5	108.4	186.4	-186.4	6.8	-6.8
	1108	-118.484	33.941	263.5	12.9	100.7	342.3	-334.7	9.2	-9.0
	1210	-118.480	33.940	478.7	18.8	106.9	487.3	-548.2	12.5	-14.1
	1315	-118.474	33.938	733.5	24.9	120.5	378.7	-764.6	11.1	-22.4
	1412	-118.467	33.934	853.3	24.7	134.8	197.7	-896.7	5.3	-24.1
	1514	-118.461	33.928	918.3	20.1	128.8	271.5	-863.3	6.0	-19.2
	1629	-118.455	33.923	905.0	14.5	150.2	20.8	-547.9	0.6	-14.5
	1732	-118.453	33.919	548.3						

Appendix A-5. (Continued).

							Rotated relative to coastline (-28.5°)			
					Vector Velocity	Vector Angle	Distance (m)		Velocity (cm s^{-1})	
Drogue	Time	Longitude	Latitude	Distance (m)	cm s^{-1}	(true degree)	x (onshore)	y (longshore)	u (onshore)	v (longshore)
5	0721	-118.494	33.937	0.0	4.1	101.2	132.5	-19.9	4.1	-0.6
	0815	-118.493	33.937	134.0	5.0	61.5	159.1	-61.9	4.7	-1.8
	0912	-118.492	33.938	170.7	5.3	103.7	160.4	-160.4	3.7	-3.7
	1024	-118.490	33.937	226.8	7.7	109.4	119.0	-182.5	4.2	-6.5
	1111	-118.488	33.937	217.9	9.2	104.0	226.7	-248.0	6.2	-6.8
	1212	-118.485	33.936	336.0	17.1	106.7	458.6	-481.6	11.8	-12.3
	1317	-118.479	33.934	665.0	17.9	111.7	352.8	-499.8	10.3	-14.6
	1414	-118.474	33.932	611.8	15.1	119.4	246.3	-441.8	7.3	-13.1
	1510	-118.470	33.930	505.8	13.2	120.0	210.9	-632.8	4.2	-12.6
	1634	-118.465	33.927	667.0	10.3	129.9	128.9	-386.8	3.3	-9.8
	1740	-118.462	33.925	407.7						

Appendix A-6. Drogue data from November 4, 2004, including time and position. From this, distance and vector data were calculated and then split into onshore-offshore and longshore components. The angle of the coastline along the study site was assumed to be straight and at an angle of -28.5° from true north.

							Rotated relative to coastline (-28.5°)			
					Vector Velocity	Vector Angle	Distance (m)		Velocity (cm s^{-1})	
Drogue	Time	Longitude	Latitude	Distance (m)	cm s^{-1}	(true degree)	x (onshore)	y (longshore)	u (onshore)	v (longshore)
1	0658	-118.449	33.941	0.0	10.9	154.8	32.9	-284.8	1.2	-10.8
	0742	-118.448	33.939	286.6	10.4	149.9	-32.8	-360.3	-0.9	-10.4
	0840	-118.447	33.936	361.8	9.2	139.8	-24.8	-263.0	-0.9	-9.1
	0928	-118.445	33.934	264.2	5.1	111.9	24.9	-131.4	0.9	-5.0
	1012	-118.444	33.934	133.8	1.2	45.0	11.9	-29.1	0.5	-1.1
	1056	-118.444	33.934	31.4	1.7	301.0	28.9	32.1	1.1	1.3
	1138	-118.444	33.934	43.2	4.7	324.9	-24.1	126.7	-0.9	4.6
	1224	-118.445	33.935	129.0	7.5	335.1	31.2	230.7	1.0	7.4
	1316	-118.446	33.937	232.8	12.0	324.3	-26.3	322.7	-1.0	12.0
	1401	-118.447	33.939	323.8	11.7	332.1	25.7	315.4	1.0	11.7
	1446	-118.449	33.942	316.5	8.7	326.2	13.8	255.9	0.5	8.7
	1535	-118.450	33.944	256.3	8.1	328.6	5.6	77.9	0.6	8.1
	1551	-118.450	33.944	78.1						
2	0657	-118.467	33.933	0.0	13.7	186.2	-346.9	-549.9	-7.3	-11.6
	0816	-118.468	33.927	650.2	10.0	194.9	-257.1	-302.1	-6.5	-7.6
	0922	-118.469	33.924	396.7	5.1	232.3	-200.2	-48.3	-5.0	-1.2
	1029	-118.470	33.922	206.0	2.8	305.9	-36.1	101.2	-0.9	2.6
	1133	-118.471	33.923	107.4	4.6	348.0	55.9	130.5	1.8	4.2
	1225	-118.471	33.924	142.0	6.0	14.7	100.5	125.6	3.7	4.7
	1310	-118.471	33.926	160.8	4.4	45.0	110.4	48.3	4.0	1.7
	1356	-118.470	33.926	120.5	1.2	51.3	56.9	16.6	1.1	0.3
	1520	-118.470	33.927	59.3						
3	0656	-118.466	33.933	0.0	11.8	194.0	-378.5	-411.7	-8.0	-8.7
	0815	-118.468	33.928	559.2	5.7	214.2	-182.2	-130.2	-4.6	-3.3
	0921	-118.469	33.927	224.0	4.7	284.3	-90.3	164.1	-2.3	4.1
	1027	-118.470	33.927	187.3	5.9	347.1	28.7	222.3	0.8	5.9
	1130	-118.471	33.929	224.2	8.7	9.1	157.0	219.8	5.0	7.0
	1222	-118.470	33.931	270.1	9.9	26.9	208.6	158.0	7.9	6.0
	1306	-118.469	33.934	261.7	9.1	34.3	204.1	138.3	7.6	5.1
	1351	-118.468	33.935	246.6	8.7	54.1	428.1	36.9	8.7	0.8
	1513	-118.465	33.938	429.7						
4	0706	-118.488	33.924	0.0	1.1	340.9	-10.7	49.8	-0.2	1.1
	0823	-118.488	33.923	51.0	5.1	328.9	23.5	199.7	0.6	5.0
	0929	-118.489	33.925	201.1	7.8	329.1	6.6	317.2	0.2	7.8
	1037	-118.490	33.927	317.3	10.5	342.3	94.6	391.1	2.5	10.2
	1141	-118.491	33.931	402.4	10.5	2.6	167.9	279.8	5.4	9.0
	1233	-118.491	33.934	326.3	11.1	11.8	187.5	232.8	6.9	8.6
	1318	-118.491	33.936	298.9	11.2	18.2	211.3	224.1	7.7	8.1
	1404	-118.490	33.939	308.1	5.0	36.7	228.7	130.7	4.4	2.5
	1531	-118.488	33.941	263.4						
5	0705	-118.488	33.924	0.0	8.7	265.3	-322.6	254.1	-6.8	5.4
	0824	-118.491	33.923	410.6	8.8	306.5	-130.6	329.9	-3.2	8.2
	0931	-118.494	33.925	354.9	11.5	312.3	-110.9	457.4	-2.7	11.2
	1039	-118.497	33.928	470.7	11.3	328.6	6.9	440.5	0.2	11.3
	1144	-118.499	33.932	440.5	12.9	345.9	112.3	386.9	3.6	12.4
	1236	-118.500	33.935	402.9	12.4	341.7	82.8	331.2	3.0	12.0
	1322	-118.501	33.938	341.4	9.9	340.6	69.1	270.1	2.5	9.6
	1409	-118.502	33.940	278.8	8.7	6.3	264.9	387.7	4.9	7.2
	1539	-118.501	33.945	469.6						

Appendix B-1. Species list and individuals per cubic meter by station. All organisms were identified to the lowest reasonable taxonomic level. Station summaries are provided below the species list. Santa Monica Bay Nearshore Zone, vertical plankton tows, May 7, 2002.

Phylum	Station										Numerical	Percent
Species	T1-1	T1-2	T1-3	T1-4	T1-5	T2-1	T2-2	T2-3	T2-4	T2-5	Total	Total *
Cnidaria												
Hydromedusa - *Eutonina* sp.	-	-	0.7	-	0.5	-	-	0.2	0.9	0.2	16	0.07
Hydromedusa - *Obelia* sp.	-	-	3.1	1.8	1.4	-	5.7	0.9	6.6	4.8	142	0.64
Hydromedusa - unidentified	-	-	-	0.2	-	-	-	-	-	0.5	5	0.02
Scyphomedusa - ephyra	-	-	-	-	-	-	-	-	-	0.1	1	0.00
Siphonophora - *Muggiaea* sp.	-	-	0.2	0.3	2.0	-	-	0.2	4.9	2.0	71	0.32
Annelida												
Polychaeta - Polynoidae	-	1.2	0.2	0.2	-	-	-	-	0.1	-	6	0.03
Polychaeta - Spionidae	-	-	-	0.2	-	-	-	-	-	-	1	0.00
Polychaeta - *Typhloscolex* sp.	-	-	-	0.2	-	-	0.4	-	-	-	2	0.01
Polychaeta - trochophore unidentified	-	2.0	-	-	-	-	-	-	-	-	5	0.02
Arthropoda												
Amphipoda - Gammaridea	-	-	-	-	-	-	-	-	0.1	-	1	0.00
Anomura - *Emerita analoga* zoea (II-III)	-	-	-	-	0.1	-	-	-	-	-	1	0.00
Anomura - *Lepidopa myops* zoea	-	-	0.2	0.2	-	-	-	-	0.1	0.1	4	0.02
Anomura - Majidae zoea	-	-	-	0.3	-	-	-	-	-	-	2	0.01
Anomura - Paguridae zoea	-	-	-	-	-	-	1.1	-	-	-	3	0.01
Anomura - Porcellanidae zoea	-	-	-	1.7	0.5	0.8	0.8	-	1.3	0.1	28	0.13
Brachyura - Cancridae zoea	-	0.4	0.2	2.8	2.4	-	0.4	2.8	1.2	0.9	70	0.32
Brachyura - Grapsidae zoea	-	-	4.9	-	1.2	-	21.5	0.2	0.7	0.2	97	0.44
Brachyura - Portunidae zoea	-	-	0.2	1.1	-	-	1.1	0.7	1.2	-	22	0.10
Brachyura - *Randallia ornata* zoea	-	-	0.2	-	-	-	-	-	-	-	1	0.00
Caridea - Crangonidae zoea	-	0.4	-	-	0.1	-	0.4	-	0.3	0.2	7	0.03
Caridea - Hippolytidae zoea	-	-	1.3	0.2	-	-	0.8	0.7	-	-	12	0.05
Cirripedia - nauplii (balanomorphan)	-	-	-	-	0.2	-	-	-	0.1	0.1	4	0.02
Cladocera - *Evadne nordmanni*	0.9	35.3	14.1	7.1	14.5	-	26.8	8.7	4.2	4.5	502	2.28
Cladocera - *Podon polyphemoides*	0.9	-	-	0.2	-	-	0.4	-	-	0.1	4	0.02
Copepoda - *Acartia tonsa*	11.4	27.4	795.5	989.7	225.8	61.1	170.9	149.5	365.0	154.8	17030	77.30
Copepoda - *Calanus minor*	-	-	-	0.2	0.1	-	-	-	-	-	2	0.01
Copepoda - *Calanus pacificus*	-	0.4	-	0.3	6.0	0.8	-	0.4	-	28.3	301	1.37
Copepoda - *Clausocalanus* sp.	-	-	-	-	0.1	-	-	0.2	-	0.7	8	0.04
Copepoda - *Corycaeus anglicus*	8.8	0.8	-	7.1	12.9	3.1	0.8	0.4	6.0	11.9	318	1.44
Copepoda - *Eucalanus californica*	2.6	-	0.4	0.3	0.7	-	-	-	-	0.3	16	0.07
Copepoda - *Labidocera trispinosa*	-	-	-	0.3	0.2	-	1.1	0.2	0.3	-	10	0.05
Copepoda - *Oncaea* sp.	-	-	-	-	0.1	-	-	-	-	0.2	3	0.01

Appendix B-1. (Continued).

Phylum / Species	Station										Numerical	Percent
	T1-1	T1-2	T1-3	T1-4	T1-5	T2-1	T2-2	T2-3	T2-4	T2-5	Total	Total *
Arthropoda (Continued)												
Copepoda - *Paracalanus parvus*	0.9	9.4	12.6	47.9	11.4	3.9	52.4	13.2	20.4	28.4	1076	4.88
Copepoda - *Rhincalanus nasutus*	-	-	-	0.3	1.3	-	-	-	0.3	0.8	22	0.10
Copepoda - *Scolecithricella* sp.	-	-	-	-	0.6	-	-	-	-	0.8	12	0.05
Copepoda - *Tortanus discaudatus*	-	-	-	6.9	2.7	-	-	6.3	1.5	3.8	140	0.64
Copepoda - unidentified	5.3	-	-	1.7	-	2.4	-	-	-	-	20	0.09
Euphausiacea juveniles (*E. pacifica*, *T. spinifera*)	-	-	0.4	8.9	14.9	0.8	-	3.0	19.6	10.7	424	1.92
Ostracoda - *Conchoecia* sp.	2.6	0.4	0.2	-	-	-	-	-	0.1	-	6	0.03
Thalassinidea - *Neotrypaea* sp. zoea	-	-	-	0.2	-	-	-	-	-	0.1	2	0.01
Mollusca												
Gastropoda veliger - echinospiral	-	-	0.7	-	-	-	0.8	0.2	-	-	6	0.03
Gastropoda veliger - unidentified	-	-	0.7	3.4	1.2	-	-	0.2	1.9	0.3	52	0.24
Phoronida												
Phoronis sp. actinotroch	-	-	0.2	0.5	-	-	0.4	-	0.6	0.1	10	0.05
Bryozoa												
Bryozoa - cyphonautes	-	1.6	4.0	1.2	2.1	-	3.0	0.9	0.9	0.8	73	0.33
Bryozoa - lingulid larva	-	-	-	-	-	-	-	-	0.1	-	1	0.00
Echinodermata												
Dendraster excentricus echinopluteus	-	-	-	-	-	-	-	0.4	-	0.3	5	0.02
echinopluteus larvae	-	-	-	-	0.1	-	-	0.2	-	0.2	4	0.02
Chaetognatha												
Sagitta sp.	-	1.2	0.7	1.5	3.7	-	-	-	2.5	7.1	125	0.57
Chordata												
Appendicularia - *Oikopleura* spp.	-	9.8	6.6	48.9	22.2	2.4	9.8	18.6	43.1	26.9	1196	5.43
Fish egg - *Engraulis mordax*	-	-	0.2	-	0.7	-	0.8	0.7	-	0.8	19	0.09
Fish egg - unidentified I	0.9	4.7	1.5	3.7	2.5	3.1	1.1	2.0	4.0	0.5	112	0.51
Fish egg - unidentified II	-	0.8	0.2	-	0.4	2.4	1.9	1.5	-	0.1	22	0.10
Motile Ichthyoplankton - Gobiidae post-flexon	-	2.0	0.2	-	-	1.6	0.4	-	-	-	9	0.04

Appendix B-1. (Continued).

Phylum	Station										Numerical	Percent
Species	T1-1	T1-2	T1-3	T1-4	T1-5	T2-1	T2-2	T2-3	T2-4	T2-5	Total	Total *
Number of individuals	39	249	3853	7403	2820	105	802	980	3262	2518	22031	
Number of species	9	16	26	32	31	11	23	25	28	35	53	
Diversity (H')	1.77	1.82	0.38	0.65	1.43	1.13	1.50	1.26	1.12	1.77	1.10	
Water depth sampled (m)	5.8	13.0	23.1	33.1	43.2	6.5	13.5	23.5	34.0	43.9		
Water volume sampled (m^3)	1.14	2.55	4.54	6.50	8.48	1.28	2.65	4.61	6.68	8.62		
Plankton sample volume (ml)	0.8	1.2	3.2	6.8	6.0	1.1	2.8	3.9	5.2	5.8		
Plankton concentration (ml m^{-3})	0.70	0.47	0.71	1.05	0.71	0.86	1.06	0.85	0.78	0.67		
Distance from shore (km)	0.12	1.12	2.08	3.10	4.08	0.12	1.12	2.07	3.10	4.10		
Surface temperature (°C)	15.95	15.62	15.66	15.26	15.01	15.94	15.64	15.58	15.13	15.25		
Surface salinity (PSU)	33.05	33.35	33.38	33.11	33.41	32.29	33.37	33.57	33.26	33.43		
Surface density (σ_T)	24.26	24.57	24.58	24.46	24.75	23.68	24.57	24.03	24.60	24.23		
Approximate thermocline depth (m)	6.9	6.0	10.2	9.8	8.4	7.0	6.2	10.5	9.5	8.0		
ΔT (°C) vertical (12 m)**	0.95	1.42	0.34	0.55	0.62	0.77	0.88	0.43	0.64	0.60		
ΔT (°C) horizontal (0.5 km)	0.09	0.14	1.30	0.37	0.24	0.07	0.10	1.11	0.20	0.17		

*** 0.00 < 0.005**

**** Where depth <12m, ΔT (°C) vertical is from surface to bottom**

Appendix B-2. Species list and individuals per cubic meter by station. All organisms were identified to the lowest reasonable taxonomic level. Station summaries are provided below the species list. Santa Monica Bay Nearshore Zone, vertical plankton tows, July 15, 2003.

Phylum	Station												Numerical	Percent
Species	T1-1	T1-2	T1-3	T2-1	T2-2	T2-3	T3-1	T3-2	T3-3	T4-1	T4-2	T4-3	Total	Total *
Cnidaria														
Hydromedusa - *Eutonina* sp.	18.3	0.6	-	20.0	-	1.2	-	1.6	2.0	5.4	2.2	0.3	132	0.19
Hydromedusa - *Obelia* sp.	-	0.4	17.5	-	1.4	7.5	13.9	4.6	7.8	1.1	2.2	16.4	502	0.71
Hydromedusa - *Stomatoca atra*	0.6	-	-	1.1	-	-	-	0.2	-	-	-	-	4	0.01
Siphonophora - *Diphyes* sp.	-	-	0.8	-	-	-	-	-	-	-	-	-	7	0.01
Siphonophora - *Muggiaea* sp.	-	-	4.7	-	0.2	-	-	-	1.6	-	2.2	0.5	72	0.10
Siphonophora - *Physonectes* sp. (nectophore)	-	-	2.8	-	0.5	0.6	-	-	0.1	-	86.7	0.6	517	0.73
Siphonophora - *Rhizophysa* sp.	-	-	0.1	-	-	-	-	-	-	-	-	-	1	0.00
Siphonophora - *Sphaeronectes* sp.	-	-	0.5	-	0.5	-	-	-	-	-	7.9	0.5	54	0.08
Siphonophora - unidentified	-	0.2	-	-	-	-	-	-	-	-	-	-	1	0.00
Ctenophora														
Pleurobrachia bachei	-	-	-	-	-	-	-	-	-	-	0.4	-	2	0.00
Annelida														
Polychaeta - *Magelona* sp.	0.6	0.4	0.1	-	0.2	-	-	-	-	-	-	-	5	0.01
Polychaeta - Phyllodocidae	-	-	-	-	-	-	-	0.2	-	-	-	-	1	0.00
Polychaeta - Polynoidae	1.1	0.6	0.2	-	-	-	0.5	0.2	-	-	-	-	9	0.01
Polychaeta - Spionidae	-	-	0.1	-	-	-	-	-	-	-	0.7	-	5	0.01
Polychaeta - *Autolytus* sp.	-	-	-	-	-	-	-	-	0.1	-	-	-	1	0.00
Polychaeta - *Typhloscolex* sp.	-	0.4	3.2	1.7	0.2	1.5	2.6	-	1.2	0.5	1.4	0.8	78	0.11
Polychaeta - trochophore unidentified	1.1	0.2	-	-	-	-	-	-	0.1	0.5	-	-	5	0.01
Arthropoda														
Anomura - *Blepharipoda occidentalis* zoea	-	-	-	-	-	0.1	-	-	0.1	-	0.4	-	4	0.01
Anomura - *Emerita analoga* zoea (I)	-	0.4	-	-	-	0.1	-	-	0.3	-	-	1.0	15	0.02
Anomura - *Lepidopa myops* zoea	-	-	0.1	-	-	-	-	-	0.1	-	-	0.2	4	0.01
Anomura - Majidae zoea	-	-	-	-	-	-	-	-	-	-	0.2	-	1	0.00
Anomura - Porcellanidae zoea	-	0.4	0.1	-	-	-	-	-	0.2	-	-	0.2	7	0.01
Brachyura - Cancridae zoea	-	4.5	4.1	-	2.1	1.5	-	1.6	0.5	-	0.7	0.5	99	0.14
Brachyura - Grapsidae zoea	8.6	7.9	32.2	3.4	0.2	6.3	2.1	5.5	10.2	1.6	90.3	2.3	1039	1.46
Brachyura - megalopa	-	-	-	-	-	-	-	-	-	-	-	0.2	2	0.00
Brachyura - *Randallia ornata* zoea	-	-	-	-	-	-	-	-	-	-	0.2	-	1	0.00
Caridea - Crangonidae zoea	-	0.2	1.3	-	-	-	-	0.2	0.5	-	-	-	17	0.02
Caridea - Hippolytidae zoea	-	1.4	2.0	-	0.7	1.5	1.0	1.8	1.5	1.1	2.2	0.6	83	0.12
Caridea - Paguridae zoea	-	0.2	0.7	-	0.2	1.9	-	0.4	-	-	-	0.1	27	0.04
Caridea - Pandalidae zoea	-	-	-	-	0.2	1.5	-	-	0.9	-	-	-	21	0.03
Cirripedia - nauplii (balanomorphan)	1.1	2.0	5.6	0.6	0.5	1.5	2.6	0.4	5.1	1.1	3.6	2.2	168	0.24

Appendix B-2. (Continued).

Phylum / Species	Station												Numerical Total	Percent Total *
	T1-1	T1-2	T1-3	T2-1	T2-2	T2-3	T3-1	T3-2	T3-3	T4-1	T4-2	T4-3		
Arthropoda (Continued)														
Cladocera - *Evadne nordmanni*	12.6	57.9	6.4	13.7	63.4	2.9	18.0	31.7	5.1	19.8	64.3	22.5	1533	2.16
Cladocera - *Podon polyphemoides*	-	3.9	0.6	-	0.7	-	1.0	1.1	0.1	-	0.7	0.1	41	0.06
Copepoda - *Acartia tonsa*	406.9	1829.4	911.2	265.5	1192.2	886.2	237.7	910.9	1599.9	147.4	1147.9	393.0	60301	84.81
Copepoda - *Calanus pacificus*	1.1	2.9	12.5	2.9	-	7.8	-	4.1	46.2	-	21.7	5.4	792	1.11
Copepoda - *Calocalanus styliremis*	-	1.2	13.2	-	-	-	-	0.4	-	-	28.9	3.6	314	0.44
Copepoda - *Clausocalanus* sp.	-	2.6	0.5	-	-	-	-	-	-	-	2.2	0.9	37	0.05
Copepoda - *Corycaeus anglicus*	4.0	3.1	3.7	-	0.5	4.4	3.1	3.0	14.5	1.1	9.4	0.9	305	0.43
Copepoda - *Eucalanus californica*	-	-	-	-	-	-	-	-	0.6	-	-	0.9	13	0.02
Copepoda - *Labidocera trispinosa*	0.6	0.6	4.1	-	-	1.0	-	0.2	1.9	-	1.3	-	72	0.10
Copepoda - *Lucicutia flavicornis*	-	0.2	0.7	-	-	-	-	0.2	-	-	-	-	8	0.01
Copepoda - *Metridia lucens*	-	-	-	-	-	0.2	-	-	-	-	-	-	2	0.00
Copepoda - nauplius	0.6	0.2	0.7	-	-	0.1	-	-	-	-	-	-	9	0.01
Copepoda - *Oithona helgolandica*	-	-	-	-	-	-	-	-	-	-	-	1.6	14	0.02
Copepoda - *Oithona plumifera*	-	-	-	-	-	-	-	-	-	-	-	0.2	2	0.00
Copepoda - *Oithona spinirostris*	-	-	-	-	-	-	-	-	-	-	-	0.1	1	0.00
Copepoda - *Oncaea* sp.	-	0.4	-	-	-	-	-	0.4	-	-	0.5	0.1	8	0.01
Copepoda - *Paracalanus parvus*	4.0	0.8	3.5	-	-	14.1	0.5	3.2	67.9	1.6	10.5	7.2	901	1.27
Copepoda - *Pontella* sp.	-	0.2	-	-	-	-	-	0.4	0.1	-	2.2	-	16	0.02
Copepoda - *Rhincalanus nasutus*	-	0.8	2.1	0.6	0.5	3.4	-	0.4	3.3	0.5	3.4	0.5	108	0.15
Copepoda - *Tortanus discaudatus*	-	2.0	4.4	-	-	9.2	0.5	4.6	15.4	-	11.6	3.6	383	0.54
Copepoda - unidentified	-	-	6.0	-	-	-	0.5	-	4.5	-	-	-	93	0.13
Euphausiacea juveniles (*E. pacifica*, *T. spinifera*)	0.6	4.9	12.2	1.1	3.9	11.6	2.6	7.3	22.4	-	6.5	7.6	592	0.83
Ostracoda - *Conchoecia* sp.	-	-	-	-	-	-	-	-	0.1	-	-	-	1	0.00
Palinurida - *Panulirus interruptus* phyllosoma	-	0.2	-	-	-	-	-	-	0.2	-	-	-	3	0.00
Thalassinidea - *Neotrypaea* sp. zoea	-	1.8	6.7	-	-	1.0	-	0.2	4.5	-	10.1	0.6	177	0.25
Mollusca														
Gastropoda veliger - unidentified	1.7	2.6	2.4	0.6	1.4	0.6	-	0.4	0.6	-	2.2	-	68	0.10
Sipunculida														
Sipunculida trochophore	-	-	2.1	-	-	-	-	-	-	-	0.7	-	22	0.03
Phoronida														
Phoronis sp. actinotroch	1.1	1.6	-	-	1.4	-	-	0.2	-	-	-	0.1	18	0.03
Bryozoa														
Bryozoa - cyphonautes	-	3.3	1.9	-	-	3.9	1.0	-	0.5	-	1.4	0.2	80	0.11

Appendix B-2. (Continued).

Phylum / Species	Station T1-1	T1-2	T1-3	T2-1	T2-2	T2-3	T3-1	T3-2	T3-3	T4-1	T4-2	T4-3	Numerical Total	Percent Total *
Echinodermata														
Brachiolaria larvae	-	-	-	-	-	-	-	-	0.1	-	-	-	1	0.00
Echinopluteus larvae	-	-	0.7	-	-	1.0	-	-	0.1	-	-	-	15	0.02
seastar - pre-recruit	-	-	-	-	-	-	-	-	0.2	-	-	-	2	0.00
Chaetognatha														
Sagitta sp.	-	2.9	31.3	1.7	2.5	13.6	2.6	3.7	11.5	-	11.7	1.9	620	0.87
Chordata														
Appendicularia - *Fritillaria* sp.	-	1.0	45.6	-	0.5	14.6	-	0.7	4.6	-	13.7	5.2	688	0.97
Appendicularia - *Oikopleura* spp.	4.0	4.9	9.6	2.3	1.6	10.7	3.6	1.1	18.6	1.1	12.3	2.3	480	0.68
Enteropneusta - unidentified tornaria	-	-	-	0.6	-	-	-	-	-	-	-	-	1	0.00
Fish egg - *Engraulis mordax*	-	3.5	0.9	-	4.6	1.9	1.5	5.2	0.8	1.6	4.3	0.1	128	0.18
Fish egg - unidentified (various)	16.0	9.2	3.2	9.2	8.6	1.5	19.5	9.3	0.7	17.2	5.8	1.0	335	0.47
Motile Ichthyoplankton - unidentified I	-	-	-	-	0.5	-	-	-	-	-	0.7	-	6	0.01
Motile Ichthyoplankton - unidentified II	-	1.2	-	2.3	0.2	-	0.5	0.2	0.1	1.6	1.1	-	23	0.03
Motile Ichthyoplankton - unidentified III	-	-	-	-	-	0.1	-	-	-	-	-	-	1	0.00
Thaliacea - *Salpa maxima*	-	0.2	-	-	-	-	-	-	-	-	-	-	1	0.00
Number of individuals	847	9638	10039	572	5570	8368	613	5644	16407	379	8728	4294	71099	
Number of species	19	43	43	16	27	33	20	34	44	16	40	39	73	
Diversity (H')	0.79	0.42	1.15	0.85	0.38	0.75	1.10	0.54	0.72	1.10	1.29	1.00	0.90	
Water depth sampled (m)	8.9	25	44	8.9	22	42	9.9	28.6	45	9.5	28.2	45		
Water volume sampled (m^3)	1.75	4.91	8.64	1.75	4.32	8.25	1.94	5.62	8.84	1.87	5.54	8.84		
Plankton sample volume (ml)	1.30	4.00	8.00	1.10	4.00	3.00	2.00	4.50	3.00	2.00	7.00	3.00		
Plankton concentration (ml m^{-3})	0.74	0.81	0.93	0.63	0.93	0.36	1.03	0.80	0.34	1.07	1.26	0.34		
Distance from shore (km)	0.17	2.15	4.15	0.18	2.17	4.21	0.18	2.18	4.18	0.18	2.17	4.17		
Surface temperature (°C)	24.29	23.91	23.34	24.42	24.04	23.06	23.90	24.03	23.65	24.56	24.14	23.00		
Surface salinity (PSU)	32.55	32.44	32.33	32.58	32.45	32.21	32.46	32.46	32.36	32.54	32.48	32.24		
Surface density (σ_T)	22.57	22.97	22.99	22.73	22.97	22.94	22.70	22.79	22.71	22.70	23.06	23.00		
Approximate thermocline depth (m)	7	8	10	8	11	9	9	12	8	9	9	10		
ΔT (°C) vertical (12 m)**	1.14	0.14	2.99	2.01	2.24	2.07	1.44	1.45	2.43	2.24	1.99	1.16		
ΔT (°C) horizontal (0.5 km)	0.19	0.28	0.23	0.19	0.49	0.29	0.06	0.19	0.17	0.21	0.57	0.40		

*** 0.00 < 0.005**

**** Where depth <12m, ΔT (°C) vertical is from surface to bottom**

Appendix B-3. Species list and individuals per cubic meter by station. All organisms were identified to the lowest reasonable taxonomic level. Station summaries are provided below the species list. Santa Monica Bay Nearshore Zone, vertical plankton tows, July 17, 2003.

Phylum	Station									Numerical	Percent
Species	T1-1	T1-2	T1-3	T2-1	T2-2	T2-3	T3-1	T3-2	T3-3	Total	Total *
Cnidaria											
Hydromedusa - *Eutonina* sp.	-	1.1	0.2	-	-	2.4	1.1	0.7	1.6	49	0.07
Hydromedusa - *Obelia* sp.	2.0	10.5	6.7	2.5	1.6	3.2	14.3	5.8	0.1	218	0.31
Hydromedusa - *Stomatoca atra*	-	1.5	2.5	-	0.2	3.1	1.6	0.2	1.7	77	0.11
Hydromedusa - unidentified	-	3.5	0.2	-	0.4	5.7	1.6	2.2	0.3	90	0.13
Siphonophora - *Muggiaea* sp.	-	8.9	4.7	1.0	-	2.8	0.5	1.5	0.7	131	0.19
Siphonophora - *Physonectes* sp. (nectophore frag)	-	-	-	-	-	8.8	-	-	-	76	0.11
Siphonophora - *Rhizophysa* sp.	-	-	-	-	-	0.3	0.5	-	-	4	0.01
Siphonophora - *Sphaeronectes* sp.	-	-	-	-	-	0.1	-	-	0.1	2	0.00
Siphonophora - unidentified	-	-	-	-	0.2	-	0.5	-	-	2	0.00
Ctenophora											
Pleurobrachia bachei	-	0.2	0.1	-	-	-	-	-	0.1	3	0.00
Annelida											
Polychaeta - *Magelona* sp.	-	-	-	-	1.3	0.5	-	0.2	0.2	14	0.02
Polychaeta - Polynoidae	-	0.2	-	0.5	1.5	0.1	-	0.4	0.2	15	0.02
Polychaeta - Spionidae	-	-	-	-	0.2	0.5	0.5	-	-	6	0.01
Polychaeta - *Autolytus* sp.	-	-	0.2	-	-	0.1	0.5	-	-	4	0.01
Polychaeta - *Typhloscolex* sp.	-	3.3	2.2	-	7.6	4.5	0.5	1.5	0.9	135	0.19
Polychaeta - trochophore unidentified	-	0.2	-	0.5	0.7	0.2	-	-	0.2	10	0.01
Arthropoda											
Amphipoda - *Caprella* sp.	-	-	-	-	-	-	0.5	-	0.1	2	0.00
Amphipoda - Gammaridea unidentified	-	-	-	-	-	0.1	-	-	-	1	0.00
Anomura - *Blepharipoda occidentalis* zoea	-	0.2	0.7	-	-	0.1	-	-	-	8	0.01
Anomura - *Emerita analoga* zoea (I)	-	2.5	0.2	0.5	0.4	1.9	0.5	-	-	36	0.05
Anomura - *Lepidopa myops* zoea	-	-	0.1	-	0.2	-	-	-	-	2	0.00
Anomura - Majidae zoea	-	1.5	-	-	-	-	-	-	0.1	9	0.01
Anomura - Porcellanidae zoea	-	0.5	-	-	1.1	1.0	-	1.3	0.1	26	0.04
Brachyura - Cancridae zoea	-	6.9	1.3	1.5	4.9	1.7	1.6	1.3	0.2	106	0.15
Brachyura - Grapsidae zoea	3.6	24.7	0.8	6.0	55.7	1.2	14.3	62.4	0.6	846	1.20
Brachyura - megalopa	-	0.4	-	-	-	-	-	0.5	-	5	0.01
Brachyura - *Randallia ornata* zoea	-	-	-	-	0.2	-	-	-	-	1	0.00
Brachyura - unknown zoea	-	0.5	-	-	-	-	-	-	-	3	0.00
Caridea - Hippolytidae zoea	-	2.2	0.9	1.0	2.4	1.2	0.5	0.7	0.2	52	0.07
Caridea - Paguridae zoea	0.5	0.5	-	1.0	2.7	1.2	1.1	0.4	0.1	35	0.05
Caridea - Pandalidae zoea	-	-	-	-	-	-	2.1	0.2	0.1	6	0.01

Appendix B-3. (Continued).

Phylum	Station									Numerical	Percent
Species	T1-1	T1-2	T1-3	T2-1	T2-2	T2-3	T3-1	T3-2	T3-3	Total	Total *
Arthropoda (Continued)											
Caridea - Sergestidae	-	-	-	-	-	-	-	-	0.1	1	0.00
Caridea - unknown zoea	0.5	0.2	-	-	0.4	-	0.5	-	0.2	6	0.01
Cirripedia - nauplii (balanomorphan)	2.0	9.5	1.7	8.0	16.7	2.0	8.5	15.8	1.2	306	0.43
Cirripedia - nauplii (lepadomorphan)	-	-	0.2	-	3.8	1.0	-	0.4	0.3	37	0.05
Cladocera - *Evadne nordmanni*	5.1	219.9	60.4	148.8	68.2	265.8	73.7	40.0	39.5	5408	7.66
Cladocera - *Evadne spinifera*	-	0.4	-	-	-	0.5	-	0.4	0.1	9	0.01
Cladocera - *Podon polyphemoides*	1.0	6.4	1.4	8.0	21.1	6.9	17.5	3.5	5.4	339	0.48
Copepoda - *Acartia tonsa*	397.8	993.7	772.3	619.1	2991.7	967.7	1237.7	2402.8	114.8	54740	77.55
Copepoda - *Calanus pacificus*	1.0	39.1	92.7	0.5	8.7	23.6	3.7	5.8	11.5	1410	2.00
Copepoda - *Calocalanus styliremis*	1.0	20.7	1.6	-	5.8	17.6	2.1	8.2	7.2	425	0.60
Copepoda - *Clausocalanus* sp.	-	2.9	0.1	1.5	-	2.3	1.1	0.7	0.6	51	0.07
Copepoda - *Corycaeus anglicus*	2.0	37.1	6.4	3.0	4.4	23.6	5.8	6.7	12.7	653	0.93
Copepoda - *Eucalanus californica*	-	-	1.7	-	-	0.9	-	-	0.5	27	0.04
Copepoda - *Labidocera trispinosa*	-	2.4	0.3	-	2.0	2.0	3.7	0.2	0.2	54	0.08
Copepoda - *Lucicutia flavicornis*	0.5	-	-	-	-	0.1	-	-	-	1	0.00
Copepoda - nauplius	1.0	4.9	-	-	0.2	0.3	-	0.2	0.7	38	0.05
Copepoda - *Oithona helgolandica*	0.5	0.5	0.2	-	-	0.2	-	0.4	0.3	12	0.02
Copepoda - *Oithona plumifera*	-	-	0.2	-	-	0.1	-	0.2	0.3	7	0.01
Copepoda - *Oncaea* sp.	-	-	-	-	0.2	0.9	-	-	0.1	10	0.01
Copepoda - *Paracalanus parvus*	1.5	22.7	8.0	1.0	-	11.9	1.1	16.9	6.5	451	0.64
Copepoda - *Pontella* sp.	0.5	3.8	0.3	2.0	13.8	0.8	3.7	4.0	-	140	0.20
Copepoda - *Rhincalanus nasutus*	1.5	14.6	2.1	-	2.2	1.7	0.5	5.1	0.8	161	0.23
Copepoda - *Tortanus discaudatus*	-	9.8	5.6	2.0	2.9	13.0	14.9	3.8	5.1	328	0.46
Copepoda - unidentified	-	4.9	0.2	-	-	-	-	0.5	-	32	0.05
Euphausiacea juveniles (*E. pacifica*, *T. spinifera*)	-	13.1	18.9	1.5	4.0	9.7	2.7	1.8	3.1	386	0.55
Ostracoda - *Conchoecia* sp.	-	0.2	-	-	-	-	-	0.2	-	2	0.00
Ostracoda - *Cypridina* sp.	-	-	-	-	0.2	-	-	-	-	1	0.00
Palinurida - *Panulirus interruptus* phyllosoma	-	-	-	-	-	0.9	0.5	-	0.2	11	0.02
Thalassinidea - *Neotrypaea* sp. zoea	1.0	12.7	10.9	1.5	4.9	14.2	4.8	2.2	2.2	357	0.51
Mollusca											
Gastropoda veliger - unidentified	0.5	0.7	0.9	-	24.2	1.0	0.5	1.6	1.4	176	0.25
Gastropoda - Thecosomata unidentified	-	-	-	-	1.6	-	1.1	-	-	11	0.02
Sipunculida											
Sipunculida trochophore	1.0	-	-	-	0.4	-	0.5	-	-	3	0.00

Appendix B-3. (Continued).

Phylum Species	Station T1-1	T1-2	T1-3	T2-1	T2-2	T2-3	T3-1	T3-2	T3-3	Numerical Total	Percent Total *
Phoronida											
Phoronis sp. actinotroch	-	0.4	-	-	14.9	0.5	-	0.2	0.1	90	0.13
Bryozoa											
Bryozoa - cyphonautes	0.5	5.3	1.0	-	4.7	5.1	0.5	5.1	1.0	146	0.21
Echinodermata											
Brachiolaria larvae	-	-	0.1	-	-	0.1	-	-	-	2	0.00
Echinopluteus larvae	-	2.5	-	-	-	3.6	-	0.4	0.6	52	0.07
Ophiopluteus larvae	-	-	-	-	-	0.5	-	-	-	4	0.01
seastar - pre-recruit	-	0.2	-	-	-	-	-	-	-	1	0.00
Chaetognatha											
Sagitta sp.	1.5	61.1	31.3	6.0	17.3	36.1	28.1	11.3	11.4	1241	1.76
Chordata											
Appendicularia - *Fritillaria* sp.	-	8.2	0.3	-	0.5	2.8	-	2.5	0.8	96	0.14
Appendicularia - *Oikopleura* spp.	2.5	26.7	-	-	26.9	21.8	1.1	34.2	3.5	704	1.00
Enteropneusta - unidentified tornaria	-	-	-	-	-	-	0.5	-	-	1	0.00
Fish egg - *Engraulis mordax*	0.5	11.3	1.9	4.0	4.7	2.8	1.6	8.9	0.9	196	0.28
Fish egg - unidentified (various)	16.3	14.4	3.4	33.5	9.1	3.8	25.5	10.0	0.8	368	0.52
Motile Ichthyoplankton - *Hypsoblennius* sp.	-	-	-	-	0.2	-	-	-	-	1	0.00
Motile Ichthyoplankton - unidentified I	1.0	0.2	0.1	-	1.1	3.1	0.5	0.5	0.1	40	0.06
Motile Ichthyoplankton - unidentified II	1.5	0.7	-	1.5	6.4	2.4	2.1	0.2	0.5	72	0.10
Motile Ichthyoplankton - unidentified III	0.5	-	-	-	0.4	-	0.5	0.2	0.1	5	0.01
Thaliacea - *Salpa maxima*	-	0.2	-	-	-	-	-	-	-	1	0.00

Appendix B-3. (Continued).

Phylum	Station									Numerical	Percent
Species	T1-1	T1-2	T1-3	T2-1	T2-2	T2-3	T3-1	T3-2	T3-3	Total	Total *
Number of individuals	882	8910	9032	1715	18389	12892	2804	14701	2144	70587	
Number of species	28	53	42	25	49	59	46	49	55	80	
Diversity (H')	0.66	1.70	1.16	1.02	0.64	1.45	0.94	0.53	2.09	1.15	
Water depth sampled (m)	10	28	44	10.2	28	44	9.6	28	45		
Water volume sampled (m^3)	1.96	5.50	8.64	2.00	5.50	8.64	1.88	5.50	8.84		
Plankton sample volume (ml)	1.3	4.0	3.1	1.6	5.2	4.0	2.4	3.1	3.0		
Plankton concentration (ml m^{-3})	0.66	0.73	0.36	0.80	0.95	0.46	1.27	0.56	0.34		
Distance from shore (km)	0.16	2.15	4.12	0.17	2.19	4.20	0.17	2.18	4.20		
Surface temperature (°C)	22.74	22.15	21.84	22.67	22.30	21.94	22.86	22.59	22.79		
Surface salinity (PSU)	33.52	33.44	33.66	33.52	33.49	33.58	33.57	33.44	33.56		
Surface density (σ_T)	22.89	23.00	23.25	22.91	22.99	23.16	22.89	22.88	22.91		
Approximate thermocline depth (m)	5.1	10.4	10.9	-	12.2	8.1	-	9.9	8.9		
ΔT (°C) vertical (12 m)**	2.89	0.17	0.05	0.44	0.15	0.95	0.25	1.08	1.72		
ΔT (°C) horizontal (0.5 km)	0.30	0.15	0.23	0.18	0.18	0.16	0.13	0.10	0.11		

*** 0.00 < 0.005**

**** Where depth <12m, ΔT (°C) vertical is from surface to bottom**

Appendix B-4. Species list and individuals per cubic meter by station. All organisms were identified to the lowest reasonable taxonomic level. Station summaries are provided below the species list. Santa Monica Bay Nearshore Zone, neuston tows, February 21, 2004.

Phylum	Station						Numerical	Percent
Species	T1-1	T1-2	T2-1	T2-2	T3-1	T3-2	Total	Total*
Cnidaria								
Hydromedusa - *Obelia* sp.	-	0.14	-	0.03	-	-	19	0.01
Hydromedusa - unidentified	-	-	-	-	0.29	0.05	37	0.03
Siphonophora - *Rhizophysa* sp.	-	-	-	0.01	-	-	1	0.00
Platyhelminthes								
Turbellaria unidentified	0.03	0.20	0.07	0.06	-	0.17	59	0.04
Annelida								
Polychaeta - trochophore unidentified	0.10	1.36	0.58	-	0.64	0.21	328	0.23
Arthropoda								
Amphipoda - Gammaridea	-	-	0.22	0.01	-	-	25	0.02
Amphipoda - *Metacaprella* sp.	-	0.02	-	-	-	0.01	3	0.00
Anomura - Paguridae zoea	0.53	0.10	0.29	-	0.64	0.04	174	0.12
Anomura - Porcellanidae zoea	0.01	0.01	-	-	-	-	2	0.00
Brachyura - Cancridae zoea	-	-	-	0.02	-	-	2	0.00
Brachyura - Grapsidae zoea	0.65	-	1.75	-	4.85	0.03	805	0.57
Brachyura - Pinnotheridae zoea	-	0.20	-	0.24	-	0.06	59	0.04
Caridea - Crangonidae zoea	-	0.44	0.07	0.28	0.14	0.08	117	0.08
Caridea - Hippolytidae zoea	-	0.14	-	-	-	0.05	21	0.01
Caridea - *Pandalus* sp.	0.19	0.58	-	-	-	0.20	107	0.08
Cirripedia - *Balanus* sp. cyprid	2.88	0.82	1.09	4.30	2.71	2.16	1545	1.09
Cirripedia - nauplii (balanomorphan)	1.10	-	0.66	-	1.07	0.03	307	0.22
Cladocera - *Evadne nordmanni*	0.35	0.54	0.22	0.81	0.57	0.54	338	0.24
Cladocera - *Podon polyphemoides*	0.35	-	0.44	0.11	0.36	-	136	0.10
Copepoda - *Acartia tonsa*	153.78	151.63	159.67	98.81	395.49	86.53	116008	82.02
Copepoda - *Calanus pacificus*	-	1.90	-	0.07	-	0.26	259	0.18
Copepoda - *Clausocalanus* sp.	0.06	0.19	0.34	0.20	0.01	0.28	119	0.08
Copepoda - *Corycaeus anglicus*	2.21	-	0.36	-	-	0.04	267	0.19
Copepoda - *Harpacticus* sp.	3.44	19.02	8.45	29.28	17.11	29.25	11923	8.43
Copepoda - *Labidocera jollae*	0.03	-	-	0.01	0.02	0.01	7	0.00
Copepoda - *Labidocera trispinosa*	0.05	0.12	0.15	0.07	0.02	-	45	0.03
Copepoda - *Oithona helgolandica*	0.63	0.74	0.07	1.01	0.22	2.50	560	0.40
Copepoda - *Oithona oculata*	0.04	-	0.20	-	0.29	-	58	0.04
Copepoda - *Oncaea* sp.	5.82	0.27	15.15	0.20	40.78	0.32	6919	4.89
Copepoda - *Paracalanus parvus*	0.63	0.02	0.80	0.20	0.19	0.76	277	0.20
Copepoda - *Pontella* sp.	0.24	0.68	0.29	0.81	0.71	0.32	345	0.24

Appendix B-4. (Continued).

Phylum	Station						Numerical	Percent
Species	T1-1	T1-2	T2-1	T2-2	T3-1	T3-2	Total	Total*
Bryozoa								
Bryozoa - cyphonautes	-	1.09	-	0.54	-	0.71	265	0.19
Echinodermata								
Ophiopluteus larvae	-	-	-	0.03	-	-	4	0.00
Chordata								
Appendicularia - *Oikopleura* spp.	0.06	0.54	-	0.54	-	0.85	221	0.16
Fish egg - unidentified (various)	-	0.14	-	0.25	-	0.15	61	0.04
Motile Ichthyoplankton - Gobiidae	-	0.03	-	-	-	0.01	4	0.00
Motile Ichthyoplankton - unidentified I	-	-	0.02	0.01	0.04	0.02	10	0.01
Number of individuals	17556	21303	20964	16425	52312	12877	141437	
Number of species	22	25	21	25	20	28	37	
Diversity (H')	0.592	0.697	0.716	0.902	0.627	0.983	0.790	
Water depth (m)	4.9	20.1	4.2	20.1	4.0	21.5		
Distance sampled, 10 minute tow (m)	516.3	599.8	559.3	606.8	571.6	522.0		
Water volume sampled (m^3)	101.38	117.76	109.83	119.14	112.22	102.50		
Plankton sample volume (ml)	3.3	3.1	2.9	2.5	6.3	3.1		
Plankton concentration (ml m^{-3})	0.033	0.026	0.026	0.021	0.056	0.030		
Distance from shore (km)	0.13	1.74	0.09	1.72	0.10	1.76		
Surface temperature (°C)	13.75	13.29	13.68	13.49	13.63	13.47		
Surface salinity (PSU)	33.13	33.21	33.08	33.20	33.09	33.17		
Surface density (σ_T)	24.80	24.95	24.77	24.90	24.79	24.88		
Approximate thermocline depth (m)	-	8.9	-	9.2	-	8.5		

*** 0.00 < 0.005**

Appendix B-5. Species list and individuals per cubic meter by station. All organisms were identified to the lowest reasonable taxonomic level. Station summaries are provided below the species list. Santa Monica Bay Nearshore Zone, vertical plankton tows, September 27, 2004.

Phylum	Station												Numerical	Percent
Species	T1-1	T1-2	T1-3	T1-4	T2-1	T2-2	T2-3	T2-4	T3-1	T3-2	T3-3	T3-4	Total	Total*
Cnidaria														
Hydromedusa - *Aegina citrea*	0.4	1.5	0.7	1.6	11.5	5.6	3.1	1.1	6.8	4.1	3.8	5.0	185	0.92
Hydromedusa - *Clytia gregaria*	2.0	5.3	5.4	3.5	1.3	7.6	5.1	1.9	1.7	1.8	1.1	1.1	184	0.91
Hydromedusa - *Euphysa* sp.	-	-	-	-	-	-	-	-	-	-	0.4	-	2	0.01
Hydromedusa - *Obelia* sp.	0.8	0.7	0.5	0.7	-	0.5	0.7	0.3	-	2.0	1.8	2.3	55	0.27
Hydromedusa - *Sarsia* sp.	-	-	-	-	-	-	-	-	-	-	1.1	-	6	0.03
Hydromedusa - unknown	5.9	7.5	7.7	4.2	2.1	8.4	6.4	3.2	13.2	6.1	3.6	1.1	300	1.49
Siphonophora - *Dyphes* sp.	0.4	1.0	1.4	0.7	-	1.0	1.3	0.4	3.0	0.8	0.7	1.0	53	0.26
Siphonophora - *Muggiaea* sp.	-	-	-	-	-	0.3	1.5	0.7	-	0.5	1.3	1.1	31	0.15
Polychaeta														
Polychaeta - Polynoidae	-	-	-	-	-	-	0.5	-	-	-	-	-	3	0.01
Polychaeta - trochophore unidentified I	-	-	-	-	0.4	-	-	-	0.4	-	-	-	2	0.01
Polychaeta - trochophore unidentified II	-	0.5	-	0.1	0.8	-	0.2	-	0.4	0.8	-	0.4	13	0.06
Polychaeta - *Typhloscolex* sp.	-	-	1.6	-	-	0.5	0.5	0.4	0.4	1.0	0.9	0.3	29	0.14
Nemertea														
Nemertea - pilidium	-	-	-	-	-	-	-	-	-	-	0.2	-	1	0.00
Sipunculida														
Sipunculidae trochophore	-	-	0.2	1.1	-	-	0.4	-	-	0.5	-	0.3	15	0.07
Arthropoda														
Amphipoda - Gammaridea	-	-	-	-	-	0.3	-	-	-	-	-	-	1	0.00
Anomura - *Belpharipoda occidentalis* zoea	-	-	-	-	-	-	0.2	-	-	-	-	-	1	0.00
Anomura - Majidae zoea	-	-	-	-	-	-	-	-	-	0.3	-	-	1	0.00
Anomura - Paguridae zoea	0.4	1.5	3.5	0.9	-	0.8	0.7	1.8	-	1.0	0.7	-	62	0.31
Anomura - Porcellanidae zoea	-	-	0.2	-	-	-	-	-	-	0.8	-	-	4	0.02
Brachyura - Cancridae zoea	-	1.0	1.1	-	0.8	2.3	1.5	0.6	0.8	5.1	1.5	0.8	69	0.34
Brachyura - Grapsidae zoea	-	3.2	2.1	-	-	1.5	3.6	0.3	-	4.1	0.4	0.4	74	0.37
Brachyura - Pinnotheridae zoea	-	-	-	-	-	-	-	-	-	0.8	-	-	3	0.01
Brachyura - Randallia ornata zoea	-	-	-	-	-	-	0.2	-	-	1.8	-	-	8	0.04
Brachyura - Xanthidae zoea	-	-	-	-	-	0.8	0.5	-	-	1.0	0.5	0.1	14	0.07
Caridea - Crangonidae zoea	-	0.2	0.4	0.1	-	0.8	0.5	-	-	1.0	0.9	0.1	20	0.10
Caridea - Hippolytidae zoea	-	1.9	2.8	0.1	-	1.5	1.1	1.8	0.4	3.3	2.5	0.3	80	0.40
Caridea - Pandalidae zoea	-	1.2	0.5	0.5	-	1.3	0.4	1.2	-	1.3	0.5	-	36	0.18
Cirripedia - *Balanus* sp. cyprid	-	-	-	-	-	-	-	-	0.4	-	-	0.1	2	0.01
Cirripedia - nauplii (balanomorphan)	0.8	3.9	3.7	1.5	-	-	0.4	5.6	-	-	0.7	2.3	113	0.56

Appendix B-5. (Continued).

Phylum / Species	Station												Numerical Total	Percent Total*
	T1-1	T1-2	T1-3	T1-4	T2-1	T2-2	T2-3	T2-4	T3-1	T3-2	T3-3	T3-4		
Arthropoda (Continued)														
Cirripedia - nauplii (lepadomorphan)	-	-	0.5	0.3	-	-	-	1.0	-	-	-	0.4	15	0.07
Cladocera - *Evadne nordmanni*	79.1	76.4	72.4	48.9	89.1	306.6	228.1	57.1	137.5	104.4	145.7	110.3	6692	33.27
Cladocera - *Evadne spinifera*	-	0.2	0.9	0.7	-	7.9	4.0	0.6	3.0	4.1	5.3	3.8	147	0.73
Cladocera - *Evadne tergistina*	-	1.0	0.4	-	0.4	0.5	-	0.1	1.7	0.3	0.5	0.3	20	0.10
Cladocera - *Penilia avirostris*	14.9	16.7	16.0	9.6	18.2	12.0	15.8	8.9	16.1	13.0	2.9	5.1	653	3.25
Cladocera - *Podon polyphemoides*	1.6	6.5	2.8	2.8	-	-	0.7	3.3	-	2.5	0.4	0.8	114	0.57
Copepoda - *Acartia tonsa*	4.7	5.3	3.5	1.6	41.2	31.1	0.5	1.0	33.1	23.7	10.2	5.7	562	2.79
Copepoda - calanoid copepod unidentified	-	1.2	1.6	1.6	-	-	-	0.8	-	1.5	-	0.3	40	0.20
Copepoda - *Calanus pacificus*	3.5	1.9	6.1	3.8	-	6.9	4.9	6.1	-	8.1	4.9	8.8	299	1.49
Copepoda - *Clausocalanus* sp.	75.2	45.6	20.9	18.4	57.7	174.9	58.4	36.8	51.4	334.1	44.4	30.1	3937	19.58
Copepoda - *Corycaeus anglicus*	1.2	9.9	6.7	3.6	2.5	6.9	4.5	2.5	10.6	10.7	5.5	1.6	293	1.46
Copepoda - *Eucalanus californica*	-	1.5	-	1.2	-	-	0.2	-	-	-	-	0.3	18	0.09
Copepoda - *Labidocera jollae*	-	-	-	0.3	0.4	-	-	-	-	-	-	-	3	0.01
Copepoda - *Labidocera trispinosa*	0.4	-	1.4	0.8	0.8	1.0	2.7	1.1	-	7.9	0.9	1.1	88	0.44
Copepoda - *Lucicutia flavicornis*	-	-	0.4	-	-	-	0.5	0.1	-	0.8	-	1.3	18	0.09
Copepoda - *Oithona helgolandica*	-	0.5	0.9	-	0.8	5.6	1.5	0.3	3.4	2.0	0.2	0.7	63	0.31
Copepoda - *Oithona plumifera*	-	-	0.2	-	0.8	0.8	0.2	-	0.8	1.0	-	-	13	0.06
Copepoda - *Oithona spinirostris*	-	0.5	-	-	0.4	-	-	-	-	-	-	-	3	0.01
Copepoda - *Oncaea* sp.	-	0.2	0.2	0.3	-	2.0	4.4	0.4	2.1	4.1	0.5	0.6	67	0.33
Copepoda - *Paracalanus parvus*	7.1	11.6	7.6	6.2	8.5	28.5	11.3	9.8	10.2	20.4	16.4	14.6	717	3.57
Copepoda - *Pontella* sp.	1.2	3.2	0.7	1.2	1.7	4.8	1.3	1.8	0.4	1.5	0.4	0.6	85	0.42
Copepoda - *Rhincalanus nasutus*	-	0.7	0.2	0.5	-	0.8	1.6	0.8	-	0.3	0.4	1.4	39	0.19
Copepoda - *Tortanus discaudatus*	-	-	-	-	-	-	-	-	-	1.5	-	-	6	0.03
Euphausiacea juveniles (*E. pacifica*, *T. spinifera*)	-	0.7	1.2	1.3	-	-	-	1.1	-	-	3.5	3.4	71	0.35
Mysidacea - *Neomysis kadiakensis*	-	-	-	-	-	-	-	-	-	0.3	-	-	1	0.00
Ostracoda - *Conchoecia* sp.	-	-	-	-	-	-	-	-	-	-	0.4	0.1	3	0.01
Thalassinidea - *Neotrypaea* sp. zoea	0.8	6.3	1.9	-	0.4	2.5	-	0.4	-	1.8	0.2	0.7	66	0.33
Mollusca														
Gastropoda veliger - unidentified I	-	0.5	1.1	1.1	-	0.3	2.0	1.9	-	0.3	1.8	2.0	67	0.33
Gastropoda veliger - unidentified II	-	0.2	0.7	1.2	-	0.3	0.7	1.0	-	3.3	2.2	1.8	64	0.32
Thecosomata - *Creseis virgula*	-	-	-	-	-	1.3	2.0	-	0.4	0.8	0.4	0.6	26	0.13
Bryozoa														
Bryozoa - cyphonautes	-	16.7	18.3	12.2	5.5	100.3	32.4	30.3	5.9	155.1	13.3	6.5	1811	9.00

Appendix B-5. (Continued).

Phylum	Station												Numerical	Percent
Species	T1-1	T1-2	T1-3	T1-4	T2-1	T2-2	T2-3	T2-4	T3-1	T3-2	T3-3	T3-4	Total	Total*
Echinodermata														
Echinopluteus larvae	1.6	0.2	-	0.3	-	0.5	2.2	1.0	2.5	2.8	2.4	1.7	70	0.35
Ophiopluteus larvae	1.2	1.9	0.5	1.7	-	1.0	2.9	2.3	0.8	2.0	1.8	1.1	92	0.46
Chaetognatha														
Chaetognatha - *Sagitta* sp.	2.7	-	9.7	6.4	1.3	16.6	49.1	12.0	2.1	20.1	30.6	25.6	968	4.81
Chordata														
Appendicularia - *Fritillaria* sp.	-	-	-	-	-	-	-	-	-	-	-	0.6	4	0.02
Appendicularia - *Oikopleura* spp.	13.7	7.8	29.7	17.6	16.1	18.3	9.6	14.0	31.0	26.7	16.4	19.1	1035	5.15
Fish egg - *Engraulis mordax*	0.4	1.5	1.2	1.2	0.4	4.3	3.8	-	0.8	1.8	2.7	2.1	101	0.50
Fish egg - unidentified (various)	1.6	1.5	1.8	1.1	9.8	5.3	5.8	0.3	10.2	3.8	3.3	3.1	185	0.92
Motile Ichthyoplankton - unidentified I	0.8	0.5	0.5	0.4	1.7	6.4	3.5	0.7	1.3	5.6	2.4	1.1	109	0.54
Motile Ichthyoplankton - unidentified II	-	-	-	-	-	1.0	1.1	0.1	0.4	0.3	0.2	-	14	0.07
Thaliacea - *Salpa* sp.	0.8	1.9	1.8	0.3	3.4	3.1	8.7	-	8.1	6.4	3.6	1.7	166	0.83
Number of individuals	569	1040	1385	1205	656	3081	2712	1575	852	3184	1903	1950	20112	
Number of species	26	42	46	41	27	44	50	43	33	54	49	51	70	
Diversity (H')	0.88	0.74	0.53	0.41	0.93	0.63	0.47	0.42	0.96	0.60	0.49	0.41	1.62	
Water depth sampled (m)	13	21	29	38	12	20	28	37	12	20	28	36		
Water volume sampled (m^3)	2.55	4.12	5.69	7.46	2.36	3.93	5.50	7.26	2.36	3.93	5.50	7.07		
Plankton sample volume (ml)	1.5	2.0	2.0	1.5	1.0	3.0	4.5	4.0	1.0	3.0	3.0	4.0		
Plankton concentration (ml m^{-3})	0.59	0.49	0.35	0.20	0.42	0.76	0.82	0.55	0.42	0.76	0.55	0.57		
Distance from shore (km)	0.94	2.22	3.60	5.02	0.86	2.26	3.50	4.99	0.91	2.30	3.59	4.97		
Surface temperature (°C)	20.26	19.60	19.56	19.59	20.30	19.67	19.78	19.74	20.81	19.81	19.89	19.92		
Surface salinity (PSU)	33.33	33.33	33.31	33.34	33.29	33.28	33.19	33.34	33.28	33.31	33.35	33.35		
Surface density (σ_T)	23.43	23.60	23.59	23.61	23.38	23.54	23.44	23.57	23.24	23.53	23.54	23.53		
Surface chlorophyll concentration (μg/L)	1.44	1.25	1.22	1.23	0.82	0.69	0.70	0.62	2.29	0.97	0.93	0.84		
Surface dissolved oxygen (mg l^{-1})	7.41567	7.50755	7.51372	7.50907	7.41265	7.50067	7.48891	7.48742	7.34332	7.47997	7.46603	7.46251		
Approximate thermocline depth (m)	-	17.5	17.0	16.5	11.0	16.5	17.5	18.0	-	13.0	12.0	14.0		
ΔT (°C) vertical (12 m)**	0.86	0.10	0.15	0.23	0.61	0.87	0.25	0.32	1.31	2.13	2.79	0.68		
ΔT (°C) horizontal (0.5 km)	0.53	0.02	0.39	0.07	0.24	0.06	0.06	0.32	0.80	0.26	0.01	0.38		
ΔChlorophyll (μg/L) horizontal (0.5 km)	3.26	1.73	0.11	0.04	0.94	0.03	0.10	0.18	4.02	0.04	0.04	0.21		

*** 0.00 < 0.005**

**** Where depth <12m, ΔT (°C) vertical is from surface to bottom**

Appendix B-6. Species list and individuals per cubic meter by station. All organisms were identified to the lowest reasonable taxonomic level. Station summaries are provided below the species list. Santa Monica Bay Nearshore Zone, neuston tows, September 27, 2004.

Phylum	Station						Numerical	Percent
Species	T1-1	T1-2	T2-1	T2-2	T3-1	T3-2	Total	Total *
Cnidaria								
Siphonophora - *Dyphes* sp.	0.06	9.16	-	9.42	0.46	7.06	3125	0.33
Siphonophora - *Muggiaea* sp.	0.03	2.77	0.16	1.93	0.04	3.52	1054	0.11
Annelida								
Polychaeta - *Typhloscolex* sp.	-	0.03	-	0.34	-	0.07	50	0.01
Arthropoda								
Amphipoda - Gammaridea	-	-	0.01	0.01	-	-	2	0.00
Anomura - Paguridae zoea	-	0.08	-	0.05	-	-	14	0.00
Anomura - Porcellanidae zoea	-	0.28	-	1.03	0.01	-	144	0.02
Brachyura - Cancridae zoea	0.03	0.42	0.01	1.12	0.06	0.21	209	0.02
Brachyura - Grapsidae zoea	0.01	0.05	0.03	0.05	0.05	-	20	0.00
Brachyura - *Pachygrapsus crassipes* megalopa	-	0.04	0.04	0.03	0.05	-	17	0.00
Brachyura - Pinnotheridae zoea	-	0.02	-	0.07	0.09	-	19	0.00
Brachyura - Xanthidae zoea	-	0.36	-	0.29	-	0.06	80	0.01
Caridea - Crangonidae zoea	0.02	0.04	-	0.15	-	-	22	0.00
Caridea - Hippolytidae zoea	0.11	0.14	0.03	0.18	0.06	-	55	0.01
Caridea - Pandalidae zoea	0.70	0.34	0.29	0.28	0.25	0.01	189	0.02
Cladocera - *Evadne nordmanni*	85.82	1738.30	52.86	2308.39	33.02	1413.88	666899	70.48
Cladocera - *Penilia avirostris*	13.86	0.03	10.36	0.11	18.32	-	4211	0.45
Cladocera - *Podon polyphemoides*	-	1.15	0.03	0.83	0.06	0.56	309	0.03
Copepoda - *Acartia tonsa*	406.35	21.57	297.85	14.13	487.43	5.28	122013	12.90
Copepoda - calanoid copepod unidentified	-	0.13	0.03	1.84	-	-	217	0.02
Copepoda - *Calanus pacificus*	5.53	7.86	4.75	10.15	3.67	14.10	5387	0.57
Copepoda - *Clausocalanus* sp.	77.63	61.44	66.33	63.53	53.26	37.06	38378	4.06
Copepoda - *Corycaeus anglicus*	13.01	21.92	9.31	30.10	9.70	20.66	11842	1.25
Copepoda - *Labidocera jollae*	0.02	0.22	0.03	0.37	0.15	0.48	156	0.02
Copepoda - *Labidocera trispinosa*	0.41	0.52	0.48	0.65	0.25	0.52	316	0.03
Copepoda - *Lucicutia flavicornis*	0.03	0.04	-	0.15	0.02	0.05	33	0.00
Copepoda - *Oithona helgolandica*	0.83	1.39	0.72	2.21	0.53	0.90	729	0.08
Copepoda - *Oithona oculata*	3.74	0.14	4.55	0.22	4.50	-	1300	0.14
Copepoda - *Oncaea* sp.	0.02	0.22	0.02	0.85	-	0.34	171	0.02
Copepoda - *Paracalanus parvus*	9.70	14.21	4.05	16.49	11.39	15.89	8158	0.86
Copepoda - *Pontella* sp.	0.31	0.59	0.22	0.55	0.65	0.54	322	0.03
Copepoda - *Rhincalanus nasutus*	-	0.08	0.01	0.34	0.03	0.03	54	0.01

Appendix B-6. (Continued).

Phylum / Species	Station						Numerical	Percent
	T1-1	T1-2	T2-1	T2-2	T3-1	T3-2	Total	Total *
Mollusca								
Gastropoda veliger - unidentified I	-	1.39	0.04	0.94	0.28	2.65	675	0.07
Gastropoda veliger - unidentified II	0.41	0.70	0.03	1.88	0.06	13.41	2274	0.24
Bryozoa								
Bryozoa - cyphonautes	-	15.00	-	16.49	0.36	8.83	4787	0.51
Echinodermata								
Echinopluteus larvae	-	0.02	0.01	0.06	-	-	9	0.00
Chordata								
Appendicularia - *Oikopleura* spp.	2.77	24.95	4.60	110.71	8.72	37.07	21809	2.30
Fish egg - *Engraulis mordax*	-	14.31	-	11.77	0.03	21.18	5954	0.63
Fish egg - unidentified (various)	85.94	53.75	44.49	63.60	29.94	61.78	37310	3.94
Motile Ichthyoplankton - unidentified I	12.48	4.12	9.10	14.13	3.78	5.30	5207	0.55
Motile Ichthyoplankton - unidentified II	18.02	2.07	15.15	7.07	6.68	14.12	6899	0.73
Number of individuals	68126.0	222313.0	51963.0	291353.0	69521.0	242912.0	946190	
Number of species	24	36	29	37	30	25	37	
Diversity (H')	0.066	0.048	0.062	0.050	0.056	0.040	1.183	
Water depth (m)	6.1	18.2	6.4	17.8	6.8	17.9		
Distance sampled, 10 minute tow (m)	470.3	569.6	503.7	553.5	525.8	738.6		
Water volume sampled (m^3)	92.34	111.83	98.89	108.68	103.24	145.03		
Plankton sample volume (ml)	43	57	48	63	52	50		
Plankton concentration (ml m^{-3})	0.466	0.510	0.485	0.580	0.504	0.345		
Distance from shore (km)	0.20	1.69	0.22	1.49	0.24	1.51		
Surface temperature (°C)	21.02	19.41	21.42	19.44	21.48	19.36		
Surface salinity (PSU)	33.30	33.33	33.30	33.33	33.30	33.33		
Surface density (σ_T)	23.24	23.64	23.14	23.54	23.07	23.51		
Surface chlorophyll concentration (μg/L)	5.36	0.66	5.59	0.67	6.32	0.66		
Surface dissolved oxygen (mg l^{-1})	7.34	7.52	7.28	7.51	7.22	7.54		

*** 0.00 < 0.005**

Appendix B-7. Species list and individuals per cubic meter by station. All organisms were identified to the lowest reasonable taxonomic level. Station summaries are provided below the species list. Santa Monica Bay Nearshore Zone, vertical plankton tows, November 4, 2004.

Phylum	Station												Numerical	Percent
Species	T1-1	T1-2	T1-3	T1-4	T2-1	T2-2	T2-3	T2-4	T3-1	T3-2	T3-3	T3-4	Total	Total
Cnidaria														
Hydromedusa - *Aegina citrea*	-	0.2	0.5	0.5	-	-	1.8	1.7	1.6	0.5	3.8	1.4	66	0.44
Hydromedusa - *Clytia gregaria*	-	-	0.7	0.5	-	-	2.6	1.5	0.4	-	1.1	0.7	44	0.29
Hydromedusa - *Euphysa* sp.	-	-	-	0.1	-	-	-	0.1	-	-	-	-	2	0.01
Hydromedusa - *Obelia* sp.	2.8	1.7	0.4	0.7	1.6	0.3	0.8	0.7	2.4	1.3	0.7	0.3	52	0.34
Hydromedusa - unknown	1.6	2.9	7.6	5.0	2.4	2.3	7.7	6.3	3.2	3.7	9.2	6.7	317	2.10
Siphonophora - *Dyphes* sp.	-	-	3.3	1.6	-	0.3	0.6	0.8	-	-	0.7	1.0	51	0.34
Siphonophora - *Muggiaea* sp.	-	-	0.4	0.3	-	0.5	1.2	2.2	-	-	1.1	1.2	43	0.28
Polychaeta														
Polychaeta - Polynoidae	-	0.2	-	-	-	-	-	-	0.4	-	-	-	2	0.01
Polychaeta - trochophore unidentified I	0.8	0.2	0.2	-	-	0.3	-	-	0.4	-	-	-	6	0.04
Polychaeta - *Typhloscolex* sp.	-	2.2	-	-	1.2	0.8	0.4	-	0.8	1.3	0.7	0.1	29	0.19
Arthropoda														
Anomura - *Belpharipoda occidentalis* zoea	-	-	-	-	-	-	0.2	0.1	-	-	0.2	-	3	0.02
Anomura - Majidae zoea	-	-	0.4	0.1	-	0.3	-	0.6	-	-	0.2	-	9	0.06
Anomura - Paguridae zoea	2.8	4.8	1.1	0.1	5.3	1.0	0.6	-	-	1.1	0.7	-	62	0.41
Anomura - Porcellanidae zoea	-	-	0.5	0.4	-	0.3	-	0.3	-	1.1	0.4	-	15	0.10
Brachyura - Cancridae zoea	-	-	0.9	2.5	0.4	0.8	3.8	3.9	-	1.8	2.5	1.8	109	0.72
Brachyura - Grapsidae zoea	-	0.5	2.7	1.3	-	2.1	1.0	0.8	1.2	1.6	2.5	1.0	76	0.50
Brachyura - Pinnotheridae zoea	-	-	0.4	-	-	0.3	-	-	-	-	0.4	0.1	6	0.04
Brachyura - Xanthidae zoea	-	-	-	0.5	-	-	0.2	0.1	-	-	0.2	-	7	0.05
Caridea - Crangonidae zoea	0.4	0.7	1.1	0.3	-	0.5	0.2	-	0.4	1.1	-	-	20	0.13
Caridea - Hippolytidae zoea	0.4	1.0	1.3	1.1	1.2	2.3	1.8	1.1	0.8	3.9	1.8	1.1	84	0.56
Caridea - Pandalidae zoea	-	0.2	-	0.4	-	0.5	0.4	-	-	-	0.2	-	9	0.06
Cirripedia - *Balanus* sp. cyprid	14.7	19.4	3.6	0.3	16.7	14.2	5.0	-	26.5	13.7	1.8	0.1	391	2.59
Cirripedia - nauplii (balanomorphan)	2.4	0.5	1.8	1.5	3.3	1.6	2.4	0.8	-	0.8	0.2	1.2	74	0.49
Cladocera - *Evadne nordmanni*	40.6	18.2	20.9	27.6	51.3	39.3	18.0	48.3	26.1	18.6	39.7	34.8	1828	12.12
Cladocera - *Evadne spinifera*	-	1.4	0.7	3.8	-	-	0.8	0.8	0.8	1.3	2.2	1.1	76	0.50
Cladocera - *Evadne tergistina*	-	-	0.7	0.3	-	-	0.2	0.3	-	-	0.5	-	12	0.08
Cladocera - *Penilia avirostris*	2.0	0.5	1.1	2.8	-	2.8	3.8	4.5	1.6	1.1	3.3	2.7	142	0.94
Cladocera - *Podon polyphemoides*	-	3.8	3.8	3.3	-	1.0	2.4	2.1	0.4	0.5	2.7	1.8	124	0.82
Copepoda - *Acartia tonsa*	48.1	49.3	40.6	17.0	29.3	8.0	243.0	136.1	159.5	147.0	168.3	107.1	5661	37.52
Copepoda - calanoid copepod unidentified	-	1.2	0.5	0.3	-	-	0.6	-	-	0.3	1.4	-	22	0.15
Copepoda - *Calanus pacificus*	-	0.2	1.6	1.1	-	-	4.2	2.0	-	-	4.3	1.0	84	0.56
Copepoda - *Clausocalanus* sp.	5.6	2.9	3.3	2.5	11.0	8.3	13.5	1.8	8.3	6.3	23.7	1.6	391	2.59
Copepoda - *Calocalanus styliremis*	-	0.5	0.7	0.1	-	-	1.0	0.1	0.4	0.8	0.2	-	18	0.12

Appendix B-7. (Continued).

Phylum	Station												Numerical	Percent
Species	T1-1	T1-2	T1-3	T1-4	T2-1	T2-2	T2-3	T2-4	T3-1	T3-2	T3-3	T3-4	Total	Total
Arthropoda (Continued)														
Copepoda - *Corycaeus anglicus*	8.4	5.7	5.8	0.7	3.7	4.1	4.4	1.3	5.9	7.1	5.1	1.0	215	1.42
Copepoda - *Eucalanus californica*	-	0.5	0.4	-	-	-	0.2	-	0.4	-	0.5	-	9	0.06
Copepoda - *Labidocera jollae*	-	0.2	-	-	0.8	-	-	0.1	-	-	-	-	4	0.03
Copepoda - *Labidocera trispinosa*	2.0	3.3	0.2	-	6.9	3.6	1.0	0.3	3.2	5.3	1.1	-	92	0.61
Copepoda - *Lucicutia flavicornis*	-	-	-	0.1	-	-	0.4	-	-	-	0.5	0.4	9	0.06
Copepoda - *Oithona helgolandica*	-	0.5	0.4	-	2.0	1.0	1.2	1.8	2.8	0.8	0.9	0.8	53	0.35
Copepoda - *Oithona plumifera*	-	-	-	-	-	-	-	0.4	-	-	-	0.3	5	0.03
Copepoda - *Oithona spinirostris*	-	-	-	-	-	-	-	-	-	-	-	0.1	1	0.01
Copepoda - *Oncaea* sp.	-	1.2	1.4	-	0.4	0.5	-	0.6	1.6	0.8	-	-	27	0.18
Copepoda - *Paracalanus parvus*	38.6	24.9	15.7	14.4	74.6	47.1	32.9	10.9	80.5	47.5	34.7	12.0	1671	11.08
Copepoda - *Pontella* sp.	2.4	0.7	1.6	0.3	7.3	3.1	0.8	0.8	2.0	2.1	0.4	0.7	80	0.53
Copepoda - *Rhincalanus nasutus*	-	0.5	0.5	0.8	-	-	1.4	0.7	-	0.5	0.7	0.7	34	0.23
Copepoda - *Tortanus discaudatus*	-	0.2	-	-	-	0.5	-	-	-	0.8	0.2	-	7	0.05
Euphausiacea juveniles (*E. pacifica*, *T. spinifera*)	-	-	0.5	0.8	-	-	1.4	0.4	-	0.8	1.6	1.2	40	0.27
Thalassinidea - *Neotrypaea* sp. zoea	-	1.2	2.2	-	0.4	0.5	0.8	0.1	1.2	0.3	0.7	-	33	0.22
Mollusca														
Gastropoda veliger - unidentified	0.4	1.7	1.6	1.5	-	1.0	1.2	1.7	-	-	2.9	3.0	88	0.58
Thecosomata - *Creseis virgula*	-	-	0.4	-	-	0.5	1.0	-	-	0.8	0.2	0.3	15	0.10
Bryozoa														
Bryozoa - cyphonautes	-	3.8	38.5	15.3	-	1.8	56.9	30.9	-	-	50.0	59.1	1569	10.40
Echinodermata														
Echinopluteus	1.6	0.2	0.4	0.9	4.1	1.6	1.2	-	1.2	1.6	-	1.4	55	0.36
Ophiopluteus	1.2	0.2	2.2	0.3	2.9	1.8	0.2	0.3	6.3	1.8	1.6	2.1	82	0.54
Chaetognatha														
Chaetognatha - *Sagitta* sp.	0.8	1.2	9.8	8.8	4.9	2.1	12.3	5.7	4.3	3.4	12.5	7.4	398	2.64
Chordata														
Appendicularia - *Oikopleura* spp.	5.2	4.1	11.2	5.8	9.0	3.6	11.7	7.4	5.5	6.0	8.5	10.4	444	2.94
Fish egg - *Engraulis mordax*	1.6	1.9	0.4	-	-	3.6	3.8	0.4	5.1	1.8	1.4	0.5	82	0.54
Fish egg - unidentified (various)	2.8	2.9	0.9	0.5	3.7	3.1	1.6	1.5	4.3	3.7	1.4	0.8	107	0.71
Motile Ichthyoplankton - unidentified I	-	0.5	0.9	-	0.8	-	0.6	-	-	1.8	-	-	19	0.13
Motile Ichthyoplankton - unidentified II	0.4	-	0.4	-	-	0.5	0.4	-	-	0.5	0.2	-	10	0.07
Thaliacea - *Salpa* sp.	-	0.7	1.6	1.6	-	-	1.0	2.7	0.4	0.8	4.3	3.8	104	0.69

Appendix B-7. (Continued).

Phylum	Station												Numerical	Percent
Species	T1-1	T1-2	T1-3	T1-4	T2-1	T2-2	T2-3	T2-4	T3-1	T3-2	T3-3	T3-4	Total	Total
Number of individuals	482	715	1098	969	618	665	2297	2043	934	1146	2253	1999	15088	
Number of species	24	43	49	42	25	40	49	43	33	40	50	39	60	
Diversity (H')	1.07	0.80	0.53	0.44	1.08	0.81	0.51	0.42	0.94	0.75	0.52	0.35	1.72	
Water depth sampled (m)	13	21	28	39	13	20	26	36	13	19	28	37		
Water volume sampled (m^3)	2.51	4.18	5.54	7.58	2.45	3.87	5.05	7.15	2.53	3.81	5.54	7.30		
Plankton sample volume (ml)	1.4	2.1	1.4	1.2	4.1	3.8	3.1	3.2	1.7	3.1	1.9	2.7		
Plankton concentration (ml m^{-3})	0.56	0.50	0.25	0.16	1.67	0.98	0.61	0.45	0.67	0.81	0.34	0.37		
Distance from shore (km)	0.97	2.10	3.52	5.17	0.96	2.16	3.51	5.09	1.01	2.09	3.58	5.07		
Surface temperature (°C)	17.9073	17.6636	17.9033	17.9106	18.2886	18.261	18.2224	18.6384	18.4846	18.2571	18.5112	18.3372		
Surface salinity (PSU)	32.5662	32.5762	33.018	33.0082	32.9406	32.9233	33.0203	33.5606	32.9203	32.9391	33.0783	33.0776		
Surface density (σ_T)	23.4325	23.4987	23.7792	23.7699	23.626	23.6195	23.7031	24.0134	23.5621	23.6325	23.6763	23.7188		
Surface chlorophyll concentration (μg/L)	6.43	5.21	2.12	1.87	4.25	2.76	1.81	0.97	6.40	4.21	2.18	1.97		
Surface dissolved oxygen (mg l^{-1})	7.79132	7.82753	7.77083	7.77021	7.71724	7.72212	7.72333	7.63772	7.6894	7.72196	7.67825	7.70378		
Approximate thermocline depth (m)	-	14.2	19.7	20.5	-	17.2	22.6	22.8	-	16.9	22.5	21.8		
ΔT (°C) vertical (12 m)*	1.08	0.66	0.55	0.01	1.22	0.72	0.34	0.71	1.05	0.54	0.53	0.40		
ΔT (°C) horizontal (0.5 km)	0.13	0.12	0.22	0.08	0.18	0.11	0.19	0.09	0.15	0.14	0.18	0.12		
ΔChlorophyll (μg/L) horizontal (0.5 km)	6.93	6.88	4.89	4.30	4.25	3.17	3.03	2.94	7.37	4.77	3.36	2.91		

*** Where depth <12m, ΔT (°C) vertical is from surface to bottom**

Appendix B-8. Species list and individuals per cubic meter by station. All organisms were identified to the lowest reasonable taxonomic level. Station summaries are provided below the species list. Santa Monica Bay Nearshore Zone, neuston tows, November 4, 2004.

Phylum	Station						Numerical	Percent
Species	T1-1	T1-2	T1-3	T1-4	T1-5	T1-6	Total	Total *
Ctenophora								
Pleurobrachia bachei	-	-	-	-	-	0.02	2	0.00
Platyhelminthes								
Turbellaria unidentified	0.32	0.48	0.64	0.34	0.28	0.56	196	0.06
Annelida								
Polychaeta - Spionidae	0.02	0.26	0.16	0.04	0.15	0.93	127	0.04
Arthropoda								
Anomura - *Emerita analoga* zoea (V)	-	-	-	0.04	0.01	-	4	0.00
Anomura - Porcellanidae zoea	-	-	-	0.19	0.01	-	17	0.01
Brachyura - *Pachygrapsus crassipes* megalopa	0.04	-	0.05	-	-	-	6	0.00
Brachyura - Cancridae zoea	-	-	-	-	0.03	-	3	0.00
Brachyura - Xanthidae zoea	-	0.02	-	-	0.01	-	2	0.00
Caridea - Crangonidae zoea	-	0.02	-	-	-	-	1	0.00
Caridea - Hippolytidae zoea	-	-	-	-	0.01	-	1	0.00
Cirripedia - *Balanus* sp. cyprid	59.26	73.64	89.41	0.32	0.60	0.97	14085	4.53
Cladocera - *Evadne nordmanni*	2.94	7.02	4.53	59.17	21.31	52.16	12535	4.03
Cladocera - *Evadne spinifera*	2.34	4.89	4.72	0.19	0.10	0.12	781	0.25
Cladocera - *Penilia avirostris*	8.03	20.13	6.82	0.53	1.08	0.47	2240	0.72
Cladocera - *Podon polyphemoides*	0.58	8.25	3.14	24.81	11.19	41.16	7536	2.42
Copepoda - *Acartia tonsa*	436.51	385.00	458.57	237.15	293.94	839.13	201948	64.92
Copepoda - *Calanus pacificus*	-	0.26	0.08	3.07	1.98	1.68	615	0.20
Copepoda - *Clausocalanus* sp.	52.22	43.39	30.27	92.55	43.87	115.48	29795	9.58
Copepoda - *Corycaeus anglicus*	0.48	8.25	0.67	11.84	3.55	22.35	3857	1.24
Copepoda - *Labidocera jollae*	0.11	0.53	0.18	0.19	0.22	0.19	102	0.03
Copepoda - *Labidocera trispinosa*	0.60	1.52	2.45	1.42	1.60	3.72	899	0.29
Copepoda - *Oithona helgolandica*	12.32	11.00	4.72	5.11	6.21	21.23	4559	1.47
Copepoda - *Oithona oculata*	12.74	2.60	8.08	0.04	0.05	-	1464	0.47
Copepoda - *Oncaea* sp.	1.76	2.75	0.92	0.36	1.78	8.01	1231	0.40
Copepoda - *Pontella* sp.	0.88	2.44	1.63	2.52	2.66	3.35	1064	0.34
Euphausiacea - *Thysanoessa gregaria*	0.05	0.05	-	-	-	-	6	0.00
Mysidacea - *Neomysis* sp.	-	0.02	-	-	-	-	1	0.00

Appendix B-8. (Continued).

Phylum	Station						Numerical	Percent
Species	T1-1	T1-2	T1-3	T1-4	T1-5	T1-6	Total	Total *
Mollusca								
Gastropoda veliger - unidentified I	30.80	24.14	30.35	0.23	0.22	1.31	5441	1.75
Gastropoda veliger - unidentified II	0.16	0.13	0.04	0.02	-	-	21	0.01
Bivalvia veliger - Veneroidea	21.42	16.19	8.23	22.57	12.26	2.28	5957	1.92
Bryozoa								
Bryozoa - cyphonautes	32.26	33.60	24.66	31.49	25.39	15.46	11887	3.82
Chaetognatha								
Sagitta sp.	-	-	-	3.17	1.90	6.15	995	0.32
Chordata								
Appendicularia - *Oikopleura* spp.	0.21	0.38	0.56	8.06	2.62	11.54	2032	0.65
Thaliacea - *Salpa* sp.	0.11	1.15	0.16	2.62	1.25	5.78	936	0.30
Fish egg - unidentified (various)	1.76	2.44	0.82	1.07	1.78	1.68	700	0.23
Motile Ichthyoplankton - unidentified I	0.02	-	0.03	0.01	-	-	4	0.00
Number of individuals	38516	35486	49808	42908	40920	103412	311050	
Number of species	26	28	26	28	29	24	36	
Diversity (H')	0.096	0.103	0.076	0.073	0.063	0.063	1.494	
Water depth (m)	4.3	9.1	7.3	19.5	20.1	24.4		
Distance sampled, 10 minute tow (m)	289.4	277.8	372.0	429.2	477.9	455.7		
Water volume sampled (m^3)	56.81	54.55	73.04	84.28	93.84	89.48		
Plankton sample volume (ml)	24.0	22.9	29.9	28.4	29.4	78.1		
Plankton concentration (ml m^{-3})	0.422	0.420	0.409	0.337	0.313	0.873		
Distance from shore (km)	0.168	0.609	0.487	2.412	2.267	2.481		
Surface temperature ($^{\circ}C$)	18.50	18.34	18.32	18.69	18.64	18.75		
Surface salinity (PSU)	32.95	33.08	33.07	33.56	33.56	33.36		
Surface density (σ_T)	23.58	23.72	23.71	24.00	24.01	23.83		
Surface chlorophyll concentration (μg/L)	11.52	6.27	8.77	3.01	4.33	4.05		
Surface dissolved oxygen (mg l^{-1})	7.68	7.70	7.31	7.49	7.54	7.53		

*** 0.00 < 0.005**

Appendix C-1. Forward step-wise multiple linear regression detailed summary statistics for each taxa comprising greater than 0.25% of the overall abundance and significant plankton sample summaries from May 7, 2002 vertical plankton tows. Non-significant variables were omitted. All variables were regressed against (1) depth, (2) distance from shore, (3) surface temperature, (4) surface salinity, (5) surface density, (6) thermocline depth, (7) temperature change in the upper 12m, and (8) 0.5 km horizontal change in surface temperature centered on each station.

HOLOPLANKTON

Acartia tonsa

R= 0.83242570 R²= 0.69293254 Adjusted R²= 0.53939882
F(3,6)=4.5132 p<0.05553 SE of estimate: 226.87

	Beta	SE of Beta	B	SE of B	t(6)	p-level
Intercept			-286.21	7330.20	-0.04	0.9701
Thermocline (m	0.799	0.243	158.47	48.22	3.29	0.0167
Density (σ_T)	0.648	0.299	665.77	306.79	2.17	0.0730
Salinity	-0.552	0.314	-510.29	290.85	-1.75	0.1299

Tortanus discaudatus

R= 0.70343052 R²= 0.49481450 Adjusted R²= 0.35047578
F(2,7)=3.4281 p<0.09164 SE of estimate: 2.1916

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			-9.92	4.84	-2.05	0.0796
Thermocline (m	0.985	0.411	1.59	0.66	2.40	0.0476
Horiz. ΔT °C	-0.463	0.411	-2.82	2.50	-1.13	0.2973

Corycaeus anglicus

R= 0.99990745 R²= 0.99981491 Adjusted R²= 0.99916712
F(7,2)=1543.4 p<0.00065 SE of estimate: 0.14084

	Beta	SE of Beta	B	SE of B	t(2)	p-level
Intercept			-154.81	8.23	-18.82	0.0028
Depth (m)	-7.895	0.454	-2.71	0.16	-17.39	0.0033
Vertical ΔT °C	-0.125	0.025	-1.98	0.40	-4.92	0.0389
Salinity	0.413	0.018	5.58	0.25	22.43	0.0020
Distance (m)	9.502	0.472	31.36	1.56	20.13	0.0025
Horiz. ΔT °C	-0.388	0.026	-4.25	0.28	-15.02	0.0044
Thermocline (m	-0.064	0.025	-0.19	0.07	-2.53	0.1270

Eucalanus californica

R= 0.98706690 R²= 0.97430106 Adjusted R²= 0.92290317
F(6,3)=18.956 p<0.01747 SE of estimate: 0.22444

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			-79.60	14.34	-5.55	0.0115
Distance (m)	-2.785	0.412214	-1.33	0.20	-6.76	0.0066
Salinity	0.9233	0.161697	2.07	0.36	5.71	0.0107
Density (σ_T)	0.3128	0.162236	0.78	0.40	1.93	0.1494
Depth (m)	-12.36	4.966676	-0.70	0.28	-2.49	0.0886
Vertical ΔT °C	-0.176	0.123053	-0.46	0.32	-1.43	0.2484

Euphausiid juveniles

R= 0.95455047 R²= 0.91116660 Adjusted R²= 0.88578563
F(2,7)=35.900 p<0.00021 SE of estimate: 2.4397

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			438.32	57.10	7.68	0.0001
Surface T °C	-1.236	0.16	-27.34	3.55	-7.70	0.0001
Distance (m)	-0.483	0.16	-2.07	0.69	-3.01	0.0197

Siphonophora - *Muggiaea* sp.

R= 0.76318656 R²= 0.58245372 Adjusted R²= 0.46315479
F(2,7)=4.8823 p<0.04704 SE of estimate: 1.1762

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			77.88	27.53	2.83	0.0254
Surface T °C	-0.989	0.35	-4.86	1.71	-2.84	0.0250
Distance (m)	-0.387	0.35	-0.37	0.33	-1.11	0.3032

***Sagitta* sp.**

R= 0.98973572 R²= 0.97957679 Adjusted R²= 0.93873037
F(6,3)=23.982 p<0.01246 SE of estimate: .56188

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			-139.58	36.23	-3.85	0.0309
Depth (m)	8.998	3.77	1.44	0.60	2.39	0.0968
Thermocline (r	-0.233	0.18	-0.31	0.25	-1.27	0.2950
Surface T °C	1.175	0.31	8.17	2.14	3.82	0.0316
Vertical ΔT °C	0.524	0.22	3.85	1.60	2.41	0.0947
Distance (m)	-6.978	3.91	-10.71	6.01	-1.78	0.1726

Rhincalanus nasutus

R= 0.98819734 R²= 0.97653397 Adjusted R²= 0.94720144
F(5,4)=33.292 p<0.00235 SE of estimate: 0.10241

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			32.67	9.02	3.62	0.0224
Depth (m)	0.700	0.268	0.02	0.01	2.62	0.0591
Thermocline (r	-1.188	0.229	-0.31	0.06	-5.19	0.0066
Distance (m)	-1.013	0.196	-0.27	0.05	-5.17	0.0067
Horiz. ΔT °C	1.017	0.263	1.02	0.26	3.87	0.0180
Surface T °C	-1.398	0.399	-1.91	0.54	-3.50	0.0248

Appendix C-1. (Continued).

HOLOPLANKTON (Continued)

***Oikopleura* spp.**

R= 0.98974622 R^2= 0.97959758 Adjusted R^2= 0.96327564
F(4,5)=60.017 p<0.00021 SE of estimate: 3.2015

	Beta	SE of Beta	B	SE of B	t(5)	p-level
Intercept			-581.11	167.78	-3.46	0.0180
Surface T °C	0.569	0.19	29.14	9.78	2.98	0.0308
Thermocline (m	1.655	0.19	16.41	1.86	8.82	0.0003
Horiz. ΔT °C	-1.628	0.20	-60.97	7.55	-8.08	0.0005
Distance (m)	0.865	0.15	8.57	1.50	5.73	0.0023

MEROPLANKTON

Fish egg - unidentified (various)

R= 0.94784177 R^2= 0.89840403 Adjusted R^2= 0.81712725
F(4,5)=11.054 p<0.01068 SE of estimate: .65481

	Beta	SE of Beta	B	SE of B	t(5)	p-level
Intercept			204.77	53.06	3.86	0.0119
Distance (m)	-2.602	0.484	-2.69	0.50	-5.37	0.0030
Surface T °C	-2.003	0.500	-9.40	2.34	-4.01	0.0102
Density (σ_T)	-0.476	0.213	-2.24	1.00	-2.23	0.0758

Gastropoda veligers

R= 0.89185056 R^2= 0.79539742 Adjusted R^2= 0.63171536
F(4,5)=4.8594 p<0.05659 SE of estimate: 0.67877

	Beta	SE of Beta	B	SE of B	t(5)	p-level
Intercept			-65.82	45.25	-1.45	0.2056
Surface T °C	0.349	0.411	1.19	1.41	0.85	0.4355
Thermocline (r	1.567	0.514	1.04	0.34	3.05	0.0284
Horiz. ΔT °C	-1.175	0.454	-2.95	1.14	-2.59	0.0490
Density (σ_T)	0.485	0.297	1.67	1.02	1.63	0.1637

Porcellanidae zoea

R= 0.87303335 R^2= 0.76218723 Adjusted R^2= 0.57193702
F(4,5)=4.0062 p<0.08013 SE of estimate: 0.40403

	Beta	SE of Beta	B	SE of B	t(5)	p-level
Intercept			104.38	27.20	3.84	0.0122
Surface T °C	-2.279	0.745	-4.31	1.41	-3.06	0.0281
Salinity	-0.606	0.255	-1.04	0.44	-2.38	0.0634
Depth (m)	-1.846	0.836	-0.08	0.04	-2.21	0.0781
Vertical ΔT °C	-0.487	0.306	-0.97	0.61	-1.59	0.1725

Appendix C-1. (Continued).

SIGNIFICANT PLANKTON SAMPLE SUMMARIES

Diversity (H')

R= 0.99901102 R²= 0.99802301 Adjusted R²= 0.99110355
F(7,2)=144.23 p<0.00690 SE of estimate: 0.04543

	Beta	SE of Beta	B	SE of B	t(2)	p-level
Intercept			-12.35	4.55	-2.71	0.1132
Thermocline (m	-0.599	0.105	-0.17	0.03	-5.68	0.0296
Salinity	1.156	0.060	1.54	0.08	19.17	0.0027
Density (s_T)	-0.598	0.050	-0.89	0.07	-12.01	0.0069
Horiz. ΔT °C	-0.107	0.113	-0.12	0.12	-0.94	0.4452
Surface T °C	-0.612	0.108	-0.90	0.16	-5.66	0.0298
Vertical ΔT °C	0.335	0.068	0.52	0.11	4.94	0.0386

Plankton concentration (ml L^{-1})

R= 0.98645230 R²= 0.97308813 Adjusted R²= 0.91926440
F(6,3)=18.079 p<0.01870 SE of estimate: 0.05071

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			16.82	4.81	3.50	0.0396
Vertical ΔT °C	-2.215	0.226	-1.28	0.13	-9.82	0.0022
Horiz. ΔT °C	-1.541	0.215	-0.62	0.09	-7.17	0.0056
Depth (m)	-19.428	2.814	-0.24	0.04	-6.90	0.0062
Distance (m)	17.946	2.867	2.17	0.35	6.26	0.0082
Density (σ_T)	-0.520	0.168	-0.29	0.09	-3.10	0.0531
Surface T °C	-0.782	0.405	-0.43	0.22	-1.93	0.1492

NON-SIGNIFICANT, BUT SUGGESTIVE SPECIES

Evadne nordmanni

R= 0.99925394 R²= 0.99850844 Adjusted R²= 0.98657593
F(8,1)=83.680 p<0.08436 SE of estimate: 1.3314

	Beta	SE of Beta	B	SE of B	t(1)	p-level
Intercept			786.79	146.45	5.37	0.1172
Vertical ΔT °C	0.239	0.166	1.63	1.13	1.44	0.3857
Depth (m)	-6.042	1.829	-4.89	1.48	-3.30	0.1871
Thermocline (m	-1.120	0.137	-7.64	0.94	-8.16	0.0776
Horiz. ΔT °C	0.912	0.146	23.49	3.75	6.26	0.1008
Surface T °C	-0.973	0.215	-34.24	7.58	-4.52	0.1386
Distance (m)	5.482	1.918	42.60	14.91	2.86	0.2143
Salinity	-0.164	0.074	-5.22	2.35	-2.22	0.2695

Cancridae zoea

R= 0.76919574 R²= 0.59166208 Adjusted R²= 0.47499411
F(2,7)=5.0713 p<0.04351 SE of estimate: 0.82173

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			23.84	15.00	1.59	0.1559
Surface T °C	-0.468	0.266	-1.63	0.92	-1.76	0.1217
Thermocline (r	0.446	0.266	0.30	0.18	1.68	0.1376

Appendix C-2. Forward step-wise multiple linear regression detailed summary statistics for each taxa comprising greater than 0.25% of the remaining abundance and significant plankton sample summaries from July 15, 2003 vertical plankton tows. Non-significant variables were omitted. All variables were regressed against (1) depth, (2) distance from shore, (3) surface temperature, (4) surface salinity, (5) surface density, (6) thermocline depth, (7) temperature change in the upper 12m, and (8) 0.5 km horizontal change in surface temperature centered on each station.

HOLOPLANKTON

Acartia tonsa

R= 0.99378475 R²= 0.98760812 Adjusted R²= 0.97273787

F(6,5)=66.415 p<0.00013 SE of estimate: 91.056

	Beta	SE of Beta	B	SE of B	t(5)	p-level
Intercept			-13741.0	3142.87	-4.37	0.0072
Distance (m)	-0.540	0.061	-212.10	23.78	-8.92	0.0003
Thermocline (m)	0.545	0.121	591.90	131.17	4.51	0.0063
Surface T ºC	-0.469	0.069	-1559.40	230.51	-6.76	0.0011
Horiz. ΔT ºC	-1.603	0.433	-59.30	16.01	-3.70	0.0139
Depth (m)	1.331	0.505	430.30	163.36	2.63	0.0463

Calanus pacificus

R= 0.89875486 R²= 0.80776029 Adjusted R²= 0.69790903

F(4,7)=7.3532 p<0.01192 SE of estimate: 7.3598

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			-97.49	468.13	-0.21	0.8410
Depth (m)	1.706	0.343	1.53	0.31	4.98	0.0016
Surface T ºC	0.993	0.323	26.21	8.52	3.08	0.0179
Thermocline (m)	-0.370	0.184	-3.53	1.76	-2.01	0.0845
Density (σ_T)	-0.277	0.218	-23.09	18.17	-1.27	0.2446

Paracalanus parvus

R= 0.89040904 R²= 0.79282826 Adjusted R²= 0.67444440

F(4,7)=6.6971 p<0.01528 SE of estimate: 10.803

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			934.12	687.13	1.36	0.2162
Depth (m)	1.553	0.356	1.97	0.45	4.37	0.0033
Density (σ_T)	-0.580	0.226	-68.32	26.68	-2.56	0.0375
Surface T ºC	0.700	0.335	26.13	12.50	2.09	0.0750
Thermocline (m)	-0.318	0.191	-4.29	2.58	-1.66	0.1402

Tortanus discaudatus

R= 0.84417999 R²= 0.71263986 Adjusted R²= 0.60487980

F(3,8)=6.6132 p<0.01472 SE of estimate: 3.2490

	Beta	SE of Beta	B	SE of B	t(8)	p-level
Intercept			-179.29	92.30	-1.94	0.0880
Depth (m)	1.433	0.376	0.50	0.13	3.81	0.0052
Surface T ºC	0.745	0.368	7.59	3.75	2.02	0.0779
Thermocline (m)	-0.314	0.199	-1.16	0.73	-1.58	0.1538

Corycaeus anglicus

R= 0.78922096 R²= 0.62286973 Adjusted R²= 0.48144587

F(3,8)=4.4043 p<0.04156 SE of estimate: 2.9815

	Beta	SE of Beta	B	SE of B	t(8)	p-level
Intercept			-174.82	84.70	-2.06	0.0729
Depth (m)	1.39	0.431171	0.39	0.12	3.22	0.0122
Surface T ºC	0.935	0.422144	7.63	3.45	2.22	0.0576
Thermocline (m)	-0.502	0.228145	-1.48	0.67	-2.20	0.0591

Rhincalanus nasutus

R= 0.98050064 R²= 0.96138151 Adjusted R²= 0.89379916

F(7,4)=14.225 p<0.01101 SE of estimate: 0.44499

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			652.92	191.57	3.41	0.0271
Depth (m)	3.254	0.948685	0.30	0.09	3.43	0.0265
Thermocline (m)	-1.02	0.161515	-0.99	0.16	-6.32	0.0032
Vertical ΔT ºC	0.962	0.180651	1.75	0.33	5.32	0.0060
Distance (m)	-5.385	1.424775	-4.31	1.14	-3.78	0.0194
Salinity	-1.859	0.580121	-21.45	6.70	-3.20	0.0328
Surface T ºC	0.654	0.549696	1.76	1.48	1.19	0.3000

Hydromedusa (pooled)

R= 0.79224531 R²= 0.62765264 Adjusted R²= 0.54490878

F(2,9)=7.5855 p<0.01173 SE of estimate: 4.7399

	Beta	SE of Beta	B	SE of B	t(9)	p-level
Intercept			31.10	5.83	5.33	0.0005
Distance (m)	-1.490	0.384	-21.26	5.48	-3.88	0.0037
Depth (m)	1.199	0.384	0.57	0.18	3.12	0.0122

***Oikopleura* spp.**

R= 0.99441928 R²= 0.98886970 Adjusted R²= 0.95918892

F(8,3)=33.317 p<0.00755 SE of estimate: 1.1207

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			1887.79	454.14	4.16	0.0253
Depth (m)	3.066	0.600	1.14	0.22	5.11	0.0145
Thermocline (m)	-1.156	0.102	-4.57	0.40	-11.32	0.0015
Vertical ΔT ºC	0.942	0.110	6.95	0.81	8.57	0.0033
Distance (m)	-5.106	0.912	-16.61	2.97	-5.60	0.0112
Horiz. ΔT ºC	-0.170	0.106	-5.69	3.54	-1.61	0.2059
Salinity	-1.075	0.262	-50.39	12.28	-4.11	0.0262
Density (σ_T)	-0.324	0.135	-11.18	4.65	-2.40	0.0957

Appendix C-2. (Continued).

HOLOPLANKTON (Continued)

Calocalanus styliremis

R= 0.95220144 R^2= 0.90668758 Adjusted R^2= 0.74339084

F(7,4)=5.5524 p<0.05846 SE of estimate: 4.4200

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			88.70	1694.36	0.05	0.9608
Density (σ_T)	0.857	0.275828	46.54	14.99	3.11	0.0360
Salinity	-0.488	0.640638	-35.98	47.25	-0.76	0.4887
Depth (m)	5.488	1.474975	3.21	0.86	3.72	0.0205
Distance (m)	-7.243	2.260562	-37.05	11.56	-3.20	0.0328
Vertical ΔT °C	0.695	0.27519	8.07	3.19	2.53	0.0650
Thermocline (m)	-0.618	0.254198	-3.84	1.58	-2.43	0.0718

***Sagitta* sp.**

R= 0.79437966 R^2= 0.63103904 Adjusted R^2= 0.54904772

F(2,9)=7.6964 p<0.01126 SE of estimate: 6.0523

	Beta	SE of Beta	B	SE of B	t(9)	p-level
Intercept			-11.60	5.15	-2.25	0.0507
Depth (m)	0.522	0.209	0.32	0.13	2.49	0.0343
Vertical ΔT °C	0.480	0.209	5.76	2.51	2.29	0.0475

MEROPLANKTON

Cancridae zoea

R= 0.60174247 R^2= 0.36209400 Adjusted R^2= 0.29830340

F(1,10)=5.6763 p<0.03845 SE of estimate: 1.3110

	Beta	SE of Beta	B	SE of B	t(10)	p-level
Intercept			-1.91	1.39	-1.38	0.1990
Distance (m)	0.602	0.253	1.91	0.80	2.38	0.0384

Hippolytidae zoea

R= 0.63276312 R^2= 0.40038916 Adjusted R^2= 0.34042808

F(1,10)=6.6775 p<0.02722 SE of estimate: 0.57873

	Beta	SE of Beta	B	SE of B	t(10)	p-level
Intercept			-0.39	0.61	-0.64	0.5389
Distance (m)	0.633	0.245	0.92	0.35	2.58	0.0272

Gastropoda veligers

R= 0.92531143 R^2= 0.85620125 Adjusted R^2= 0.77403054

F(4,7)=10.420 p<0.00451 SE of estimate: 1.0651

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			-831.89	381.62	-2.18	0.0657
Thermocline (m)	-0.496	0.154	-0.79	0.25	-3.23	0.0145
Vertical ΔT °C	-0.379	0.150	-1.13	0.45	-2.52	0.0397
Salinity	1.596	0.743	30.22	14.08	2.15	0.0690
Surface T °C	-1.299	0.734	-5.74	3.24	-1.77	0.1200

***Neotrypaea* sp. zoea**

R= 0.72339475 R^2= 0.52329997 Adjusted R^2= 0.34453746

F(3,8)=2.9273 p<0.09977 SE of estimate: 2.6833

	Beta	SE of Beta	B	SE of B	t(8)	p-level
Intercept			-307.89	125.17	-2.46	0.0393
Density (σ_T)	0.670	0.270	13.83	5.58	2.48	0.0382
Vertical ΔT °C	0.435	0.251	1.92	1.11	1.74	0.1207
Thermocline (m)	-0.437	0.277	-1.03	0.65	-1.58	0.1534

Fish egg - unidentified (various)

R= 0.95525983 R^2= 0.91252134 Adjusted R^2= 0.86253354

F(4,7)=18.255 p<0.00083 SE of estimate: 2.3892

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			751.56	490.08	1.53	0.1690
Distance (m)	-1.524	0.410	-5.76	1.55	-3.72	0.0075
Salinity	-0.417	0.277	-22.71	15.10	-1.50	0.1763
Horiz. ΔT °C	-0.237	0.148	-9.20	5.73	-1.60	0.1527

***Typhloscolex* sp.**

R= 0.94756724 R^2= 0.89788368 Adjusted R^2= 0.81278675

F(5,6)=10.551 p<0.00620 SE of estimate: 0.44140

	Beta	SE of Beta	B	SE of B	t(6)	p-level
Intercept			-189.21	35.98	-5.26	0.0019
Vertical ΔT °C	0.610	0.134	0.83	0.18	4.54	0.0039
Horiz. ΔT °C	-1.030	0.194	-6.34	1.19	-5.31	0.0018
Density (σ_T)	1.338	0.253	8.50	1.61	5.29	0.0018
Thermocline (m)	-0.355	0.155	-0.26	0.11	-2.29	0.0618

Appendix C-2. (Continued).

MEROPLANKTON (Continued)

Bryozoa cyphonautes

R= 0.88062189 R^2= 0.77549491 Adjusted R^2= 0.58840734

F(5,6)=4.1451 p<0.05637 SE of estimate: 0.86987

	Beta	SE of Beta	B	SE of B	t(6)	p-level
Intercept			317.59	315.49	1.01	0.3530
Salinity	-1.818	1.045	-20.84	11.98	-1.74	0.1326
Thermocline (m)	-0.631	0.223	-0.61	0.22	-2.83	0.0301
Density (σ_T)	1.327	0.409	11.21	3.46	3.24	0.0176
Horiz. ΔT °C	-0.857	0.346	-7.01	2.83	-2.48	0.0479
Surface T °C	1.734	1.080	4.63	2.89	1.61	0.1595

***Engraulis mordax* eggs**

R= 0.99814333 R^2= 0.99629010 Adjusted R^2= 0.98639705

F(8,3)=100.71 p<0.00147 SE of estimate: 0.21971

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			725.07	95.05	7.63	0.0047
Thermocline (m)	-0.013	0.059	-0.02	0.08	-0.22	0.8432
Surface T °C	0.884	0.197	3.28	0.73	4.48	0.0207
Distance (m)	-3.512	0.510	-3.88	0.56	-6.89	0.0063
Salinity	-1.573	0.209	-25.05	3.32	-7.54	0.0048
Vertical ΔT °C	0.333	0.066	0.83	0.17	5.06	0.0149
Horiz. ΔT °C	-0.206	0.050	-2.33	0.57	-4.11	0.0261
Depth (m)	0.735	0.343	0.09	0.04	2.15	0.1212

SIGNIFICANT PLANKTON SAMPLE SUMMARIES

Number of individuals

R= 0.99195879 R^2= 0.98398225 Adjusted R^2= 0.97063412

F(5,6)=73.717 p<0.00003 SE of estimate: 849.58

	Beta	SE of Beta	B	SE of B	t(6)	p-level
Intercept			-71973.1	17816.9	-4.04	0.0068
Distance (m)	1.513	0.097	15229.7	976.9	15.59	0.0000
Thermocline (m)	-0.589	0.061	-2080.6	216.7	-9.60	0.0001
Vertical ΔT °C	0.307	0.053	2025.4	351.8	5.76	0.0012
Horiz. ΔT °C	-0.457	0.070	-13670.0	2078.0	-6.58	0.0006
Surface T °C	0.307	0.073	2999.3	716.5	4.19	0.0058

Number of species

R= 0.94481780 R^2= 0.89268067 Adjusted R^2= 0.85243593

F(3,8)=22.181 p<0.00031 SE of estimate: 4.2298

	Beta	SE of Beta	B	SE of B	t(8)	p-level
Intercept			14.27	8.43	1.69	0.1289
Distance (m)	1.180	0.157	26.39	3.52	7.50	0.0001
Thermocline (m)	-0.316	0.132	-2.48	1.04	-2.39	0.0439
Horiz. ΔT °C	-0.250	0.142	-16.59	9.43	-1.76	0.1167

Plankton volume (ml)

R= 0.78424175 R^2= 0.61503512 Adjusted R^2= 0.52948737

F(2,9)=7.1894 p<0.01363 SE of estimate: 1.4592

	Beta	SE of Beta	B	SE of B	t(9)	p-level
Intercept			-213.62	62.62	-3.41	0.0077
Density (σ_T)	0.713	0.207	9.44	2.74	3.44	0.0074
Horiz. ΔT °C	0.293	0.207	0.83	0.59	1.42	0.1907

Diversity (H')

R= 0.97911411 R^2= 0.95866444 Adjusted R^2= 0.88632721

F(7,4)=13.253 p<0.01255 SE of estimate: 0.10011

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			36.11	38.38	0.94	0.4000
Vertical ΔT °C	0.629	0.183	0.25	0.07	3.44	0.0264
Distance (m)	0.793	0.184	1.47	0.34	4.32	0.0125
Density (σ_T)	6.322	0.982	0.13	0.02	6.44	0.0030
Depth (m)	-7.367	1.505	-1.28	0.26	-4.90	0.0081
Thermocline (m)	-0.384	0.169	-0.08	0.04	-2.27	0.0859
Salinity	-0.843	0.426	-2.12	1.07	-1.98	0.1192

Plankton concentration (ml L^{-1})

R= 0.82360153 R^2= 0.67831948 Adjusted R^2= 0.55768928

F(3,8)=5.6231 p<0.02270 SE of estimate: 0.20155

	Beta	SE of Beta	B	SE of B	t(8)	p-level
Intercept			-59.03	19.33	-3.05	0.0157
Surface T °C	1.081	0.266	0.65	0.16	4.07	0.0036
Density (σ_T)	1.036	0.389	1.95	0.73	2.66	0.0287
Horiz. ΔT °C	-0.524	0.334	-0.96	0.61	-1.57	0.1556

Appendix C-2. (Continued).

NON-SIGNIFICANT, BUT SUGGESTIVE SPECIES

Euphausiacea juveniles

R= 0.96487328 R^2= 0.93098044 Adjusted R^2= 0.84815697

F(6,5)=11.241 p<0.00891 SE of estimate: 2.4739

	Beta	SE of Beta	B	SE of B	t(5)	p-level
Intercept			-84.33	262.10	-0.32	0.7606
Depth (m)	0.391	1.01629	0.17	0.43	0.38	0.7166
Density (σ_T)	-0.138	0.242022	-5.46	9.57	-0.57	0.5932
Surface T °C	0.704	0.288191	8.81	3.61	2.44	0.0584
Horiz. ΔT °C	-0.341	0.218116	-13.05	8.35	-1.56	0.1789
Distance (m)	1.306	1.104215	4.86	4.11	1.18	0.2902
Thermocline (m)	-0.147	0.132563	-0.66	0.60	-1.11	0.3187

Evadne nordmanni

R= 0.96745514 R^2= 0.93596944 Adjusted R^2= 0.85913278

F(6,5)=12.181 p<0.00744 SE of estimate: 8.5523

	Beta	SE of Beta	B	SE of B	t(5)	p-level
Intercept			-1122.91	1247.85	-0.90	0.4094
Horiz. ΔT °C	0.24	0.205992	32.97	28.30	1.16	0.2967
Vertical ΔT °C	-0.111	0.168262	-3.35	5.10	-0.66	0.5403
Surface T °C	0.072	0.423719	3.25	19.03	0.17	0.8710
Density (σ_T)	0.315	0.285699	44.63	40.54	1.10	0.3211
Distance (m)	1.133	0.465031	52.43	21.52	2.44	0.0589

Appendix C-3. Forward step-wise multiple linear regression detailed summary statistics for each taxa comprising greater than 0.25% of the overall abundance and significant plankton sample summaries from July 17, 2003 vertical plankton tows. Non-significant variables were omitted. All variables were regressed against (1) depth, (2) distance from shore, (3) surface temperature, (4) surface salinity, (5) surface density, (6) thermocline depth, (7) temperature change in the upper 12m, and (8) 0.5 km horizontal change in surface temperature centered on each station.

HOLOPLANKTON

Calanus pacificus

R= 0.84837371 R^2= 0.71973796 Adjusted R^2= 0.67970052

F(1,7)=17.977 p<0.00384 SE of estimate: 16.820

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			-4336.7	1027.74	-4.22	0.0039
Density (σ_T)	0.848	0.200	189.59	44.72	4.24	0.0038

Rhincalanus nasutus

R= 0.80945714 R^2= 0.65522085 Adjusted R^2= 0.54029447

F(2,6)=5.7012 p<0.04098 SE of estimate: 3.0587

	Beta	SE of Beta	B	SE of B	t(6)	p-level
Intercept			1698.80	545.82	3.11	0.0208
Salinity	-1.034	0.307	-66.58	19.74	-3.37	0.0150
Density (σ_T)	0.688	0.307	23.35	10.40	2.24	0.0660

Euphausiacea juveniles

R= 0.88308523 R^2= 0.77983952 Adjusted R^2= 0.74838802

F(1,7)=24.795 p<0.00160 SE of estimate: 3.2086

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			-970.18	196.06	-4.95	0.0017
Density (σ_T)	0.883	0.177	42.48	8.53	4.98	0.0016

***Muggiaea* sp.**

R= 0.71468514 R^2= 0.51077485 Adjusted R^2= 0.34769980

F(2,6)=3.1321 p<0.11709 SE of estimate: 2.3658

	Beta	SE of Beta	B	SE of B	t(6)	p-level
Intercept			593.11	435.67	1.36	0.2223
Surface T ºC	-0.736	0.298	-5.63	2.28	-2.47	0.0486
Salinity	-0.332	0.298	-13.86	12.47	-1.11	0.3089

***Oikopleura* spp.**

R= 0.92157983 R^2= 0.84930939 Adjusted R^2= 0.75889503

F(3,5)=9.3935 p<0.01696 SE of estimate: 6.9189

	Beta	SE of Beta	B	SE of B	t(5)	p-level
Intercept			5003.93	1314.85	3.81	0.0126
Salinity	-0.858	0.262	-172.54	52.78	-3.27	0.0222
Distance (m)	0.426	0.237	12.01	6.68	1.80	0.1322
Density (σ_T)	0.318	0.303	33.67	32.11	1.05	0.3423

***Fritillaria* sp.**

R= 0.79450318 R^2= 0.63123530 Adjusted R^2= 0.50831374

F(2,6)=5.1353 p<0.05015 SE of estimate: 1.8650

	Beta	SE of Beta	B	SE of B	t(6)	p-level
Intercept			938.31	332.80	2.82	0.0304
Salinity	-1.005	0.317	-38.15	12.04	-3.17	0.0193
Density (σ_T)	0.745	0.317	14.91	6.34	2.35	0.0571

MEROPLANKTON

Cancridae zoea

R= 0.88534215 R^2= 0.78383073 Adjusted R^2= 0.65412917

F(3,5)=6.0433 p<0.04069 SE of estimate: 1.3325

	Beta	SE of Beta	B	SE of B	t(5)	p-level
Intercept			776.38	246.98	3.14	0.0256
Vertical ΔT ºC	-0.473	0.235	-1.14	0.56	-2.01	0.1002
Salinity	-0.666	0.218	-21.53	7.04	-3.06	0.0281
Surface T ºC	-0.388	0.244	-2.29	1.44	-1.59	0.1732

***Neotrypaea* sp. zoea**

R= 0.87021641 R^2= 0.75727659 Adjusted R^2= 0.72260182

F(1,7)=21.839 p<0.00228 SE of estimate: 2.7249

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			269.38	56.36	4.78	0.0020
Surface T ºC	-0.870	0.186	-11.74	2.51	-4.67	0.0023

Bryozoa cyphonautes

R= 0.99959576 R^2= 0.99919168 Adjusted R^2= 0.99784447

F(5,3)=741.68 p<0.00008 SE of estimate: 0.10945

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			945.05	47.14	20.05	0.0003
Depth (m)	1.394	0.085	6.57	0.40	16.38	0.0005
Distance (m)	-20.739	0.854	-3.28	0.14	-24.30	0.0002
Salinity	-0.786	0.040	-26.45	1.34	-19.68	0.0003
Surface T ºC	-0.259	0.026	-1.59	0.16	-10.06	0.0021

Appendix C-3. (Continued).

MEROPLANKTON (Continued)

Fish egg - unidentified (various)

R= 0.99257867 R²= 0.98521241 Adjusted R²= 0.97042483
F(4,4)=66.624 p<0.00065 SE of estimate: 1.8612

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			3570.96	837.21	4.27	0.0130
Depth (m)	0.787	0.345	0.57	0.25	2.28	0.0851
Vertical ΔT °C	-0.560	0.084	-6.43	0.96	-6.68	0.0026
Distance (m)	-1.714	0.332	-37.10	7.18	-5.16	0.0067
Salinity	-0.677	0.161	-104.58	24.82	-4.21	0.0135

Grapsidae zoea

R= 0.82403477 R²= 0.67903330 Adjusted R²= 0.57204440
F(2,6)=6.3468 p<0.03307 SE of estimate: 15.818

	Beta	SE of Beta	B	SE of B	t(6)	p-level
Intercept			7660.51	2684.51	2.85	0.0290
Salinity	-0.665	0.232	-229.42	80.01	-2.87	0.0285
Thermocline (m)	0.442	0.232	5.31	2.79	1.91	0.1054

***Engraulis mordax* eggs**

R= 0.91260469 R²= 0.83284731 Adjusted R²= 0.77712975
F(2,6)=14.948 p<0.00467 SE of estimate: 1.7606

	Beta	SE of Beta	B	SE of B	t(6)	p-level
Intercept			1674.22	314.17	5.33	0.0018
Salinity	-1.160	0.214	-61.74	11.36	-5.43	0.0016
Density (σ_T)	0.621	0.214	17.40	5.99	2.91	0.0271

SIGNIFICANT PLANKTON SAMPLE SUMMARIES

Number of individuals

R= 0.94133154 R²= 0.88610507 Adjusted R²= 0.81776811
F(3,5)=12.967 p<0.00855 SE of estimate: 2741.2

	Beta	SE of Beta	B	SE of B	t(5)	p-level
Intercept			49608.0	21927.0	2.26	0.0731
Distance (m)	2.660	0.509	34161.9	6530.8	5.23	0.0034
Depth (m)	-22.059	7.226	-9503.3	3112.9	-3.05	0.0283

Diversity (H')

R= 0.55503152 R²= 0.30805999 Adjusted R²= 0.20921142
F(1,7)=3.1165 p<0.12085 SE of estimate: 0.46157

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			0.77	0.26	3.03	0.0191
Distance (m)	0.555	0.314	0.17	0.09	1.77	0.1209

Plankton concentration (ml L^{-1})

R= 0.87364164 R²= 0.76324972 Adjusted R²= 0.68433296
F(2,6)=9.6716 p<0.01327 SE of estimate: 0.16843

	Beta	SE of Beta	B	SE of B	t(6)	p-level
Intercept			1.25	0.14	8.86	0.0001
Depth (m)	-0.816	0.200	-0.02	0.00	-4.07	0.0066
Vertical ΔT °C	-0.438	0.200	-0.14	0.06	-2.19	0.0715

Plankton volume (ml)

R= 0.85871583 R²= 0.73739287 Adjusted R²= 0.64985717
F(2,6)=8.4239 p<0.01811 SE of estimate: 0.72519

	Beta	SE of Beta	B	SE of B	t(6)	p-level
Intercept			0.50	1.01	0.50	0.6365
Distance (m)	0.717	0.217	1.76	0.53	3.30	0.0164
Vertical ΔT °C	-0.318	0.217	-0.41	0.28	-1.46	0.1940

Appendix C-4. Forward step-wise multiple linear regression detailed summary statistics for each taxa comprising greater than 0.25% of the overall abundance and significant plankton sample summaries from February 21, 2004 neuston tows. Non-significant variables were omitted. All variables were regressed against (1) depth, (2) distance from shore, (3) surface temperature, (4) surface salinity, and (5) surface density.

HOLOPLANKTON

Acartia tonsa

R= 0.77884216 R^2= 0.60659511 Adjusted R^2= 0.34432519
F(2,3)=2.3129 p<0.24675 SE of estimate: 91.236

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			8901.01	6752.31	1.32	0.2790
Depth (m)	-1.433	0.728	-18.16	9.22	-1.97	0.1435
Surface T ºC	-0.930	0.728	-627.26	490.88	-1.28	0.2912

Oithona helgolandica

R= 0.98053002 R^2= 0.96143911 Adjusted R^2= 0.93573185
F(2,3)=37.400 p<0.00757 SE of estimate: .22088

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			-4.10	0.73	-5.60	0.0113
Depth (m)	13.424	2.234	1.32	0.22	6.01	0.0092
Distance (m)	-12.702	2.234	-12.36	2.17	-5.69	0.0108

Podon polyphemoides

R= 0.97121164 R^2= 0.94325205 Adjusted R^2= 0.92906506
F(1,4)=66.487 p<0.00123 SE of estimate: .05187

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			0.47	0.04	12.19	0.0003
Depth (m)	-0.971	0.119	-0.02	0.00	-8.15	0.0012

***Oikopleura* spp.**

R= 0.99782748 R^2= 0.99565968 Adjusted R^2= 0.98914921
F(3,2)=152.93 p<0.00650 SE of estimate: .03752

	Beta	SE of Beta	B	SE of B	t(2)	p-level
Intercept			38.92	26.55	1.47	0.2804
Depth (m)	5.286	0.960	0.21	0.04	5.51	0.0314
Distance (m)	-4.163	0.998	-1.67	0.40	-4.17	0.0529
Salinity	-0.180	0.120	-1.20	0.80	-1.50	0.2735

MEROPLANKTON

Bryozoa cyphonautes

R= 0.99988506 R^2= 0.99977013 Adjusted R^2= 0.99885067
F(4,1)=1087.3 p<0.02274 SE of estimate: .01566

	Beta	SE of Beta	B	SE of B	t(1)	p-level
Intercept			64.89	14.52	4.47	0.1401
Surface T ºC	-5.680	0.444	-15.71	1.23	-12.79	0.0497
Salinity	6.776	0.582	57.85	4.96	11.65	0.0545
Density (σ_T)	-11.113	0.990	-71.21	6.34	-11.22	0.0566
Distance (m)	0.255	0.051	0.22	0.04	5.02	0.1251

Cirripedia nauplius (balanomorp

R= 0.95214494 R^2= 0.90657998 Adjusted R^2= 0.88322498
F(1,4)=38.817 p<0.00338 SE of estimate: .18290

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			1.00	0.11	8.89	0.0009
Distance (m)	-0.952	0.153	-0.57	0.09	-6.23	0.0034

Crangonidae zoea

R= 0.99975012 R^2= 0.99950030 Adjusted R^2= 0.99750149
F(4,1)=500.05 p<0.03353 SE of estimate: .00814

	Beta	SE of Beta	B	SE of B	t(1)	p-level
Intercept			-18.10	5.82	-3.11	0.1980
Surface T ºC	-0.660	0.065	-0.64	0.06	-10.22	0.0621
Depth (m)	-9.850	0.622	-0.18	0.01	-15.83	0.0402
Distance (m)	9.643	0.685	1.75	0.12	14.08	0.0451
Salinity	0.277	0.060	0.83	0.18	4.61	0.1361

Paguridae zoea

R= 0.89884816 R^2= 0.80792801 Adjusted R^2= 0.75991001
F(1,4)=16.826 p<0.01483 SE of estimate: .13184

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			0.93	0.17	5.46	0.0055
Distance (m)	-0.899	0.219	-0.44	0.11	-4.10	0.0148

Appendix C-4. (Continued).

SIGNIFICANT PLANKTON SAMPLE SUMMARIES

Number of species

R= 0.99908413 R^2= 0.99816909 Adjusted R^2= 0.99542273

F(3,2)=363.45 p<0.00275 SE of estimate: .20409

	Beta	SE of Beta	B	SE of B	t(2)	p-level
Intercept			-161.09	136.26	-1.18	0.3586
Depth (m)	8.604	0.813	2.92	0.28	10.59	0.0088
Distance (m)	-7.836	0.901	-26.40	3.04	-8.70	0.0130
Density (σ_T)	0.166	0.131	6.95	5.47	1.27	0.3321

Diversity (H')

R= 0.99832083 R^2= 0.99664448 Adjusted R^2= 0.99161121

F(3,2)=198.01 p<0.00503 SE of estimate: .01446

	Beta	SE of Beta	B	SE of B	t(2)	p-level
Intercept			114.47	8.02	14.27	0.0049
Depth (m)	-0.328	0.707	-0.01	0.01	-0.46	0.6886
Density (σ_T)	-2.114	0.150	-4.63	0.33	-14.10	0.0050
Distance (m)	3.089	0.787	0.89	0.23	3.93	0.0592

NON-SIGNIFICANT, BUT SUGGESTIVE SPECIES

***Harpacticus* sp.**

R= 0.92093050 R^2= 0.84811298 Adjusted R^2= 0.74685497

F(2,3)=8.3758 p<0.05919 SE of estimate: 5.3167

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			6210.46	3592.30	1.73	0.1823
Distance (m)	1.713	0.556	20.21	6.56	3.08	0.0541
Salinity	-0.960	0.556	-187.39	108.54	-1.73	0.1827

Appendix C-5. Forward step-wise multiple linear regression detailed summary statistics for each taxa comprising greater than 0.25% of the overall abundance and significant plankton sample summaries from September 27, 2004 vertical plankton tows Non-significant variables were omitted. All variables were regressed against (1) depth, (2) distance from shore, (3) surface temperature, (4) surface salinity, (5) surface density, (6) surface dissolved oxygen, (7) thermocline depth, (8) temperature and (9) chlorophyll concentration change in the upper 12m, and (10) change in surface temperature in a 0.5km distance centered on each station.

HOLOPLANKTON

Acartia tonsa

R= 0.87805067 R²= 0.77097298 Adjusted R²= 0.64010040
F(4,7)=5.8910 p<0.02126 SE of estimate: 8.7588

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			1371.01	850.37	1.61	0.1509
Depth (m)	-2.034	4.334	-3.09	6.59	-0.47	0.6532
Distance (m)	1.185	4.348	10.91	40.03	0.27	0.7931
Vertical ΔChl.	-0.794	0.425	-8.35	4.47	-1.87	0.1039
Surface D.O.	-0.612	0.411	-174.97	117.58	-1.49	0.1803

Calanus pacificus

R= 0.93838968 R²= 0.88057519 Adjusted R²= 0.78105452
F(5,6)=8.8482 p<0.00971 SE of estimate: 1.3469

	Beta	SE of Beta	B	SE of B	t(6)	p-level
Intercept			-250.75	189.55	-1.32	0.2340
Distance (m)	0.493	0.359	3.14	2.29	1.37	0.2193
Horiz. ΔT ºC	0.953	0.252	11.38	3.01	3.78	0.0091
Surface Chl.	-0.599	0.202	-3.75	1.26	-2.97	0.0250
Vertical ΔT ºC	0.384	0.184	1.32	0.63	2.09	0.0820
Surface D.O.	0.594	0.456	33.46	25.72	1.30	0.2410

Corycaeus anglicus

R= 0.98111463 R²= 0.96258593 Adjusted R²= 0.86281506
F(8,3)=9.6480 p<0.04438 SE of estimate: 1.2863

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			-1050.8	562.47	-1.87	0.1585
Surface Chl.	0.263	0.337	1.99	2.55	0.78	0.4927
Distance (m)	3.388	0.874	26.02	6.72	3.87	0.0304
Depth (m)	16.420	7.542	5.94	2.73	2.18	0.1177
Surface T ºC	2.384	0.921	22.21	8.58	2.59	0.0812
Vertical ΔChl.	-1.015	0.411	-2.54	1.03	-2.47	0.0902
Horiz. ΔT ºC	0.481	0.275	6.93	3.96	1.75	0.1787
Salinity	0.211	0.162	16.17	12.43	1.30	0.2841

Evadne nordmanni

R= 0.73935394 R²= 0.54664424 Adjusted R²= 0.37663584
F(3,8)=3.2154 p<0.08286 SE of estimate: 60.028

	Beta	SE of Beta	B	SE of B	t(8)	p-level
Intercept			37618.1	13526.7	2.78	0.0239
Salinity	-0.673	0.242	-1131.6	406.1	-2.79	0.0237
Vertical ΔT ºC	0.527	0.322	47.8	29.2	1.64	0.1405
Thermocline (m)	0.346	0.320	10.2	9.5	1.08	0.3114

Evadne spinifera

R= 0.78425916 R²= 0.61506242 Adjusted R²= 0.47071083
F(3,8)=4.2609 p<0.04491 SE of estimate: 1.8465

	Beta	SE of Beta	B	SE of B	t(8)	p-level
Intercept			836.85	418.62	2.00	0.0806
Vertical ΔT ºC	0.615	0.223	1.86	0.67	2.76	0.0248
Distance (m)	0.446	0.221	2.50	1.24	2.01	0.0787
Salinity	-0.450	0.224	-25.23	12.58	-2.01	0.0798

Podon polyphemoides

R= 0.84558117 R²= 0.71500751 Adjusted R²= 0.60813533
F(3,8)=6.6903 p<0.01426 SE of estimate: 1.2130

	Beta	SE of Beta	B	SE of B	t(8)	p-level
Intercept			-473.30	115.85	-4.09	0.0035
Density (σ_T)	0.712	0.537	12.72	9.59	1.33	0.2213
Vertical ΔChl.	0.953	0.310	1.33	0.43	3.07	0.0153
Surface D.O.	0.618	0.612	23.46	23.21	1.01	0.3418

***Sagitta* sp.**

R= 0.94660254 R²= 0.89605637 Adjusted R²= 0.80943668
F(5,6)=10.345 p<0.00653 SE of estimate: 6.4292

	Beta	SE of Beta	B	SE of B	t(6)	p-level
Intercept			8543.21	1633.70	5.23	0.0020
Vertical ΔChl.	0.465	0.331	4.93	3.51	1.41	0.2096
Salinity	-0.788	0.151	-256.62	49.16	-5.22	0.0020
Vertical ΔT ºC	0.598	0.149	10.49	2.62	4.01	0.0071
Distance (m)	0.859	0.227	7.98	2.11	3.79	0.0091
Surface Chl.	-0.515	0.257	-16.51	8.23	-2.01	0.0917

Appendix C-5. (Continued).

HOLOPLANKTON (Continued)

***Oikopleura* spp.**

R= 0.99332132 R^2= 0.98668724 Adjusted R^2= 0.97071192
F(6,5)=61.763 p<0.00016 SE of estimate: 1.2602

	Beta	SE of Beta	B	SE of B	t(5)	p-level
Intercept			-245.79	154.10	-1.60	0.1716
Horiz. ΔT °C	0.902	0.092	27.56	2.80	9.85	0.0002
Vertical ΔChl.	-1.725	0.143	-9.14	0.76	-12.03	0.0001
Surface Chl.	1.171	0.101	18.77	1.61	11.64	0.0001
Depth (m)	-3.082	1.163	-2.37	0.89	-2.65	0.0455
Distance (m)	2.500	1.171	11.61	5.44	2.13	0.0859
Density (σ_T)	0.169	0.098	11.43	6.67	1.71	0.1472

***Salpa* sp.**

R= 0.99671071 R^2= 0.99343224 Adjusted R^2= 0.96387732
F(9,2)=33.613 p<0.02922 SE of estimate: .55850

	Beta	SE of Beta	B	SE of B	t(2)	p-level
Intercept			2469.24	215.56	11.45	0.0075
Salinity	-0.845	0.078	-54.90	5.05	-10.87	0.0084
Vertical ΔT °C	-0.044	0.135	-0.15	0.47	-0.32	0.7763
Surface Chl.	-0.252	0.203	-1.61	1.30	-1.24	0.3405
Distance (m)	2.377	0.554	15.44	3.60	4.29	0.0503
Surface D.O.	-1.562	0.411	-89.87	23.67	-3.80	0.0629
Thermocline (m)	-0.747	0.220	-0.85	0.25	-3.39	0.0771
Depth (m)	11.098	4.236	3.40	1.30	2.62	0.1200
Horiz. ΔT °C	0.344	0.169	4.20	2.06	2.03	0.1790

Hydromedusa (pooled)

R= 0.84263295 R^2= 0.71003029 Adjusted R^2= 0.54433332
F(4,7)=4.2851 p<0.04576 SE of estimate: 3.2226

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			1511.05	772.27	1.96	0.0913
Depth (m)	-0.808	0.336	-0.40	0.17	-2.41	0.0471
Salinity	-0.428	0.220	-45.17	23.22	-1.95	0.0928
Distance (m)	0.692	0.344	7.31	3.63	2.01	0.0839
Surface Chl.	0.384	0.250	3.99	2.60	1.54	0.1684

Siphonophora (pooled)

R= 0.96364560 R^2= 0.92861284 Adjusted R^2= 0.80368531
F(7,4)=7.4332 p<0.03555 SE of estimate: .39920

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			453.21	106.67	4.25	0.0132
Salinity	-0.679	0.162	-13.53	3.23	-4.19	0.0138
Vertical ΔT °C	0.183	0.215	0.20	0.23	0.85	0.4414
Distance (m)	8.958	3.278	5.09	1.86	2.73	0.0523
Vertical ΔChl.	0.741	0.386	0.48	0.25	1.92	0.1272
Depth (m)	-8.265	3.340	-0.78	0.31	-2.47	0.0686
Surface Chl.	0.365	0.276	0.72	0.54	1.32	0.2570

Appendix C-5. (Continued).

MEROPLANKTON

Cirripedia nauplii (balanomorphan)

$R= 0.87529203$ $R^2= 0.76613615$ Adjusted $R^2= 0.67843720$

$F(3,8)=8.7360$ $p<0.00664$ SE of estimate: 1.0753

	Beta	SE of Beta	B	SE of B	t(8)	p-level
Intercept			-782.21	240.99	-3.25	0.0118
Thermocline (m)	0.809	0.187	0.60	0.14	4.32	0.0026
Salinity	0.554	0.172	23.25	7.23	3.22	0.0123
Horiz. ΔT °C	0.252	0.186	1.98	1.46	1.35	0.2129

Bryozoa cyphonautes

$R= 0.82909516$ $R^2= 0.68739878$ Adjusted $R^2= 0.50876952$

$F(4,7)=3.8482$ $p<0.05817$ SE of estimate: 32.756

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			-22.02	77.34	-0.28	0.7841
Vertical ΔChl.	-0.745	0.411	-25.05	13.82	-1.81	0.1128
Depth (m)	-1.236	0.362	-6.02	1.76	-3.42	0.0112
Distance (m)	1.088	0.441	112.43	45.60	2.47	0.0431
Horiz. ΔT °C	0.556	0.333	107.80	64.54	1.67	0.1388

Ichthyoplankton (poole

$R= 0.81337571$ $R^2= 0.66158004$ Adjusted $R^2= 0.53467256$

$F(3,8)=5.2131$ $p<0.02755$ SE of estimate: 1.5960

	Beta	SE of Beta	B	SE of B	t(8)	p-level
Intercept			1219.61	369.93	3.30	0.0109
Salinity	-0.840	0.242	-43.48	12.52	-3.47	0.0084
Vertical ΔT °C	0.622	0.220	1.73	0.61	2.82	0.0224
Density (σ_T)	0.453	0.244	9.76	5.25	1.86	0.1001

Fish egg - unidentified (various)

$R= 0.92035248$ $R^2= 0.84704868$ Adjusted $R^2= 0.78969193$

$F(3,8)=14.768$ $p<0.00126$ SE of estimate: 1.4142

	Beta	SE of Beta	B	SE of B	t(8)	p-level
Intercept			1467.58	371.88	3.95	0.0043
Density (σ_T)	-1.961	0.443	-55.73	12.60	-4.42	0.0022
Vertical ΔChl.	-0.447	0.228	-0.99	0.51	-1.96	0.0860
Surface T °C	-0.931	0.503	-7.71	4.16	-1.85	0.1013

***Engraulis mordax* eggs**

$R= 0.83050993$ $R^2= 0.68974674$ Adjusted $R^2= 0.51245916$

$F(4,7)=3.8906$ $p<0.05679$ SE of estimate: .94446

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			570.42	217.31	2.62	0.0342
Horiz. ΔT °C	-0.239	0.283	-1.34	1.59	-0.85	0.4256
Salinity	-0.573	0.219	-17.15	6.54	-2.62	0.0343
Distance (m)	0.430	0.285	1.29	0.85	1.51	0.1748
Vertical ΔT °C	0.316	0.214	0.51	0.35	1.47	0.1838

Appendix C-5. (Continued).

SIGNIFICANT PLANKTON SAMPLE SUMM

Number of individuals

R= 0.95992335 R^2= 0.92145285 Adjusted R^2= 0.82719626

F(6,5)=9.7760 p<0.01214 SE of estimate: 378.78

	Beta	SE of Beta	B	SE of B	t(6)	p-level
Intercept			299258	114627	2.61	0.0476
Distance (m)	0.073	0.690	146.80	1389.30	0.11	0.9199
Density (σ_T)	0.964	0.820	8097.30	6881.20	1.18	0.2923
Depth (m)	-13.726	5.351	-1303.3	508.10	-2.56	0.0503
Surface Chl.	0.176	0.286	349.20	567.80	0.61	0.5655
Salinity	-0.714	0.364	-14393	7341.50	-1.96	0.1072

Number of species

R= 0.99306705 R^2= 0.98618217 Adjusted R^2= 0.97466731

F(5,6)=85.644 p<0.00002 SE of estimate: 1.3564

	Beta	SE of Beta	B	SE of B	t(6)	p-level
Intercept			1864.73	408.59	4.56	0.0038
Distance (m)	1.551	0.104	29.23	1.95	14.96	0.0000
Surface T °C	0.098	0.161	2.23	3.67	0.61	0.5654
Thermocline (m)	-0.522	0.090	-1.73	0.30	-5.81	0.0011
Salinity	-0.302	0.058	-56.90	10.98	-5.18	0.0021
Horiz. ΔT °C	0.333	0.086	11.78	3.05	3.86	0.0083

Diversity (H')

R= 0.99996858 R^2= 0.99993715 Adjusted R^2= 0.99965435

F(9,2)=3535.8 p<0.00028 SE of estimate: .00387

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			-47.10	1.85	-25.51	0.0015
Distance (m)	-4.453	0.264	-0.58	0.03	-16.90	0.0035
Vertical ΔChl.	-0.262	0.025	-0.04	0.00	-10.44	0.0091
Salinity	0.597	0.024	2.74	0.11	25.17	0.0016
Vertical ΔT °C	-0.258	0.013	-0.06	0.00	-19.91	0.0025
Density (σ_T)	-0.979	0.045	-1.88	0.09	-21.59	0.0021
Depth (m)	3.392	0.252	0.07	0.01	13.45	0.0055
Horiz. ΔT °C	-0.047	0.011	-0.04	0.01	-4.29	0.0503
Thermocline (m)	0.052	0.021	0.00	0.00	2.43	0.1357

Plankton volume (ml)

R= 0.97813705 R^2= 0.95675208 Adjusted R^2= 0.90485458

F(6,5)=18.435 p<0.00288 SE of estimate: .37467

	Beta	SE of Beta	B	SE of B	t(5)	p-level
Intercept			128.65	92.48	1.39	0.2229
Surface Chl.	-1.151	0.190	-3.05	0.50	-6.05	0.0018
Distance (m)	1.564	0.232	4.20	0.62	6.74	0.0011
Surface T °C	0.747	0.236	2.43	0.77	3.16	0.0250
Vertical ΔChl.	0.741	0.246	0.65	0.21	3.02	0.0295
Horiz. ΔT °C	0.386	0.157	1.94	0.79	2.46	0.0575
Salinity	-0.201	0.098	-5.40	2.63	-2.05	0.0955

Plankton concentration (ml L^{-1})

R= 0.97622175 R^2= 0.95300890 Adjusted R^2= 0.87077447

F(7,4)=11.589 p<0.01606 SE of estimate: .06514

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			67.63	16.78	4.03	0.0157
Salinity	-0.505	0.126	-2.02	0.51	-4.01	0.0160
Surface Chl.	-1.371	0.226	-0.54	0.09	-6.07	0.0037
Vertical ΔT °C	0.441	0.128	0.10	0.03	3.46	0.0259
Vertical ΔChl.	1.255	0.314	0.16	0.04	3.99	0.0162
Distance (m)	1.094	0.240	0.44	0.10	4.55	0.0104
Horiz. ΔT °C	0.466	0.181	0.35	0.14	2.58	0.0613
Depth (m)	-0.359	0.224	-0.01	0.00	-1.60	0.1839

Appendix C-6. Forward step-wise multiple linear regression detailed summary statistics for each taxa comprising greater than 0.25% of the overall abundance and significant plankton sample summaries from September 27, 2004 neuston tows. Non-significant variables were omitted. All variables were regressed against (1) depth, (2) distance from shore, (3) surface temperature, (4) surface salinity, (5) surface density, and (6) surface chlorophyll concentration.

HOLOPLANKTON

Acartia tonsa

R= 0.99802285 R^2= 0.99604961 Adjusted R^2= 0.99012401

F(3,2)=168.09 p<0.00592 SE of estimate: 21.722

	Beta	SE of Beta	B	SE of B	t(2)	p-level
Intercept			7637.26	1789.09	4.27	0.0507
Surface Chl.	3.522	0.558	274.21	43.41	6.32	0.0242
Surface T °C	-2.024	0.452	-419.50	93.58	-4.48	0.0463
Depth (m)	0.538	0.299	18.60	10.35	1.80	0.2141

Corycaeus anglicus

R= 0.90976796 R^2= 0.82767774 Adjusted R^2= 0.78459718

F(1,4)=19.212 p<0.01185 SE of estimate: 3.8064

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			25.98	2.49	10.43	0.0005
Surface Chl.	-0.910	0.208	-2.66	0.61	-4.38	0.0118

Oithona oculata

R= 0.99999586 R^2= 0.99999173 Adjusted R^2= 0.99994863

F(4,1)=30212. p<0.00431 SE of estimate: .01472

	Beta	SE of Beta	B	SE of B	t(1)	p-level
Intercept			-51.40	3.87	-13.29	0.0478
Surface T °C	1.060	0.031	2.30	0.07	34.34	0.0185
Depth (m)	-0.205	0.021	-0.07	0.01	-9.95	0.0638
Surface Chl.	-0.227	0.038	-0.19	0.03	-6.03	0.1046
Density (σ_T)	0.037	0.014	0.35	0.14	2.61	0.2328

Evadne nordmanni

R= 0.95612844 R^2= 0.91418159 Adjusted R^2= 0.89272699

F(1,4)=42.610 p<0.00284 SE of estimate: 329.93

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			-2.2E+06	3.35E+05	-6.52	0.0028
Salinity	0.956	0.146	65611.00	10051.20	6.53	0.0028

Penilia avirostris

R= 0.99854185 R^2= 0.99708583 Adjusted R^2= 0.99271459

F(3,2)=228.10 p<0.00437 SE of estimate: .69498

	Beta	SE of Beta	B	SE of B	t(2)	p-level
Intercept			270.19	57.24	4.72	0.0421
Surface Chl.	3.840	0.479	11.13	1.39	8.02	0.0152
Surface T °C	-1.991	0.388	-15.37	2.99	-5.13	0.0359
Depth (m)	0.896	0.257	1.15	0.33	3.49	0.0734

Siphonophora (pooled)

R= 0.99949651 R^2= 0.99899328 Adjusted R^2= 0.99748319

F(3,2)=661.55 p<0.00151 SE of estimate: .30413

	Beta	SE of Beta	B	SE of B	t(2)	p-level
Intercept			-181.60	79.83	-2.27	0.1507
Depth (m)	1.030	0.125	0.99	0.12	8.24	0.0144
Density (σ_T)	0.242	0.105	6.17	2.69	2.29	0.1488
Surface T °C	0.266	0.178	1.53	1.02	1.50	0.2729

Appendix C-6. (Continued).

MEROPLANKTON

Bryozoa cyphonautes

R= 0.94667710 R²= 0.89619753 Adjusted R²= 0.87024692

F(1,4)=34.535 p<0.00419 SE of estimate: 2.7867

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			-2.06	1.89	-1.09	0.3369
Distance (m)	0.947	0.161	9.91	1.69	5.88	0.0042

***Engraulis mordax* eggs**

R= 0.94448088 R²= 0.89204414 Adjusted R²= 0.86505518

F(1,4)=33.052 p<0.00454 SE of estimate: 3.3635

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			-19618.3	3413.77	-5.75	0.0045
Salinity	0.944	0.164	589.10	102.47	5.75	0.0045

SIGNIFICANT PLANKTON SAMPLE SUMMARIES

Number of species

R= 0.98603710 R²= 0.97226916 Adjusted R²= 0.95378194

F(2,3)=52.591 p<0.00462 SE of estimate: 22808.

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			-6.1E+08	2.43E+08	-2.53	0.0854
Salinity	2.550	1.008	1.84E+07	7.28E+06	2.53	0.0854
Distance (m)	-1.582	1.008	-2.3E+05	1.45E+05	-1.57	0.2144

Diversity (H')

R= 0.96248564 R²= 0.92637860 Adjusted R²= 0.87729767

F(2,3)=18.875 p<0.01998 SE of estimate: .00336

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			-1.00	0.47	-2.14	0.1219
Depth (m)	-1.993	0.505	0.00	0.00	-3.94	0.0291
Density (σ_T)	1.157	0.505	0.05	0.02	2.29	0.1060

Appendix C-7. Forward step-wise multiple linear regression detailed summary statistics for each taxa comprising greater than 0.25% of the overall abundance and significant plankton sample summaries from November 4, 2004 vertical plankton tows Non-significant variables were omitted. All variables were regressed against (1) depth, (2) distance from shore, (3) surface temperature, (4) surface salinity, (5) surface density, (6) surface dissolved oxygen, (7) thermocline depth, (8) temperature and (9) chlorophyll concentration change in the upper 12m, and (10) change in surface temperature in a 0.5km distance centered on each station.

HOLOPLANKTON

Acartia tonsa

R= 0.89133443 R^2= 0.79447706 Adjusted R^2= 0.62320794

F(5,6)=4.6388 p<0.04436 SE of estimate: 45.770

	Beta	SE of Beta	B	SE of B	t(6)	p-level
Intercept			-3164.49	1175.58	-2.69	0.0360
Surface T ºC	0.561	0.285	142.47	72.37	1.97	0.0965
Horiz. ΔT ºC	0.329	0.200	572.48	348.79	1.64	0.1518
Vertical ΔT ºC	-0.262	0.433	-57.50	95.13	-0.60	0.5677
Surface Chl.	1.415	0.479	55.92	18.92	2.96	0.0254
Thermocline (m)	1.341	0.668	24.21	12.06	2.01	0.0914

Paracalanus parvus

R= 0.99657899 R^2= 0.99316968 Adjusted R^2= 0.98121661

F(7,4)=83.089 p<0.00036 SE of estimate: 3.1873

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			-4826.09	3110.02	-1.55	0.1957
Depth (m)	-1.037	0.124	-2.52	0.30	-8.39	0.0011
Surface T ºC	1.605	0.626	127.07	49.58	2.56	0.0624
Thermocline (m)	-1.733	0.208	-9.76	1.17	-8.34	0.0011
Vertical ΔT ºC	-0.816	0.106	-55.85	7.27	-7.68	0.0015
Distance (m)	0.653	0.127	29.08	5.64	5.15	0.0067
Surface Chl.	-0.573	0.146	-7.06	1.80	-3.93	0.0171
Surface D.O.	0.820	0.648	362.71	286.78	1.26	0.2746

Corycaeus anglicus

R= 0.94984536 R^2= 0.90220621 Adjusted R^2= 0.84632404

F(4,7)=16.145 p<0.00122 SE of estimate: .95747

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			25.00	22.01	1.14	0.2933
Distance (m)	-1.660	0.290	-2.51	0.44	-5.72	0.0007
Thermocline (m)	1.474	0.345	0.87	0.20	4.27	0.0037
Vertical ΔChl.	0.617	0.209	0.91	0.31	2.95	0.0214
Surface T ºC	-0.219	0.142	-1.82	1.18	-1.54	0.1678

Labidocera trispinosa

R= 0.93883686 R^2= 0.88141466 Adjusted R^2= 0.81365161

F(4,7)=13.007 p<0.00235 SE of estimate: .97467

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			-73.21	80.44	-0.91	0.3931
Distance (m)	-1.265	0.211	-5.47	0.91	-6.00	0.0005
Vertical ΔChl.	-0.346	0.184	-0.47	0.25	-1.88	0.1020
Horiz. ΔT ºC	0.303	0.137	15.95	7.23	2.21	0.0631
Density (σ_T)	0.234	0.225	3.53	3.40	1.04	0.3339

Evadne nordmanni

R= 0.99172042 R^2= 0.98350938 Adjusted R^2= 0.93953441

F(8,3)=22.365 p<0.01349 SE of estimate: 2.9422

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			-36.69	90.86	-0.40	0.7135
Surface T ºC	0.088	0.125	3.57	5.10	0.70	0.5347
Vertical ΔT ºC	0.940	0.187	33.10	6.57	5.04	0.0151
Depth (m)	5.234	1.367	6.55	1.71	3.83	0.0314
Vertical ΔChl.	-1.148	0.159	-8.28	1.15	-7.23	0.0055
Horiz. ΔT ºC	-1.007	0.172	-281.33	48.08	-5.85	0.0099
Distance (m)	2.228	0.418	51.05	9.58	5.33	0.0129
Thermocline (m)	-0.398	0.361	-1.15	1.05	-1.10	0.3506

Evadne spinifera

R= 0.84249577 R^2= 0.70979912 Adjusted R^2= 0.60097379

F(3,8)=6.5224 p<0.01529 SE of estimate: .68024

	Beta	SE of Beta	B	SE of B	t(8)	p-level
Intercept			48.39	41.02	1.18	0.2720
Vertical ΔT ºC	-1.047	0.245	-3.32	0.78	-4.27	0.0027
Vertical ΔChl.	0.557	0.295	0.36	0.19	1.89	0.0961
Surface D.O.	-0.296	0.261	-6.06	5.35	-1.13	0.2907

Appendix C-7. (Continued).

HOLOPLANKTON (Continued)

Calanus pacificus

R= 0.95783940 R^2= 0.91745632 Adjusted R^2= 0.84866992
F(5,6)=13.338 p<0.00335 SE of estimate: .61569

	Beta	SE of Beta	B	SE of B	t(6)	p-level
Intercept			-10.11	3.44	-2.94	0.0259
Thermocline (m)	1.521	0.436	0.58	0.17	3.49	0.0130
Distance (m)	-4.234	2.285	-4.14	2.24	-1.85	0.1134
Horiz. ΔT °C	-0.335	0.251	-12.37	9.28	-1.33	0.2308
Depth (m)	1.942	1.787	0.32	0.30	1.09	0.3189

***Pontella* sp.**

R= 0.99653278 R^2= 0.99307758 Adjusted R^2= 0.98096334
F(7,4)=81.976 p<0.00037 SE of estimate: .26822

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			-88.04	27.67	-3.18	0.0335
Vertical ΔT °C	-0.071	0.100	-0.41	0.57	-0.71	0.5159
Vertical ΔChl.	-1.151	0.083	-1.35	0.10	-13.92	0.0002
Thermocline (m)	-2.060	0.169	-0.97	0.08	-12.17	0.0003
Distance (m)	0.612	0.218	2.28	0.81	2.81	0.0484
Horiz. ΔT °C	0.125	0.094	5.65	4.27	1.33	0.2557
Density (s_T)	0.361	0.092	4.69	1.20	3.91	0.0174

***Salpa* sp.**

R= 0.99917786 R^2= 0.99835640 Adjusted R^2= 0.99096019
F(9,2)=134.98 p<0.00737 SE of estimate: .14073

	Beta	SE of Beta	B	SE of B	t(2)	p-level
Intercept			-45.19	4.46	-10.14	0.0096
Thermocline (m)	1.350	0.142	0.48	0.05	9.48	0.0109
Surface Chl.	1.723	0.150	1.35	0.12	11.49	0.0075
Depth (m)	7.735	0.529	1.20	0.08	14.62	0.0046
Vertical ΔT °C	0.418	0.074	1.82	0.32	5.67	0.0297
Distance (m)	-7.279	0.667	-6.66	0.61	-10.91	0.0083
Vertical ΔChl.	-0.853	0.101	-0.76	0.09	-8.42	0.0138
Horiz. ΔT °C	0.240	0.070	8.30	2.43	3.41	0.0763
Surface T °C	0.249	0.051	1.25	0.26	4.84	0.0401

Penilia avirostris

R= 0.98784451 R^2= 0.97583677 Adjusted R^2= 0.95570074
F(5,6)=48.462 p<0.00009 SE of estimate: .28776

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			0.17	1.10	0.16	0.8802
Thermocline (m)	1.324	0.176	0.44	0.06	7.54	0.0003
Horiz. ΔT °C	-1.047	0.121	-33.43	3.85	-8.69	0.0001
Depth (m)	-1.848	0.277	-0.26	0.04	-6.67	0.0005
Distance (m)	1.257	0.262	3.29	0.68	4.81	0.0030
Vertical ΔT °C	0.136	0.116	0.55	0.47	1.17	0.2851

Podon polyphemoides

R= 0.83542955 R^2= 0.69794254 Adjusted R^2= 0.58467099
F(3,8)=6.1617 p<0.01783 SE of estimate: .91619

	Beta	SE of Beta	B	SE of B	t(8)	p-level
Intercept			42.16	18.62	2.26	0.0533
Vertical ΔT °C	-0.203	0.302	-0.85	1.26	-0.67	0.5208
Surface T °C	-0.479	0.221	-2.32	1.07	-2.17	0.0621
Distance (m)	0.582	0.303	1.58	0.83	1.92	0.0915

Hydromedusa (pooled)

R= 0.92943178 R^2= 0.86384344 Adjusted R^2= 0.78603969
F(4,7)=11.103 p<0.00375 SE of estimate: 1.7221

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			-1808.14	1245.63	-1.45	0.1899
Distance (m)	1.407	0.296	10.03	2.11	4.76	0.0021
Depth (m)	-0.444	0.327	-0.17	0.13	-1.36	0.2175
Surface T °C	2.443	1.573	30.96	19.94	1.55	0.1644
Surface D.O.	2.269	1.611	160.63	114.09	1.41	0.2020

***Clausocalanus* sp.**

R= 0.84100513 R^2= 0.70728963 Adjusted R^2= 0.54002657
F(4,7)=4.2286 p<0.04716 SE of estimate: 4.3201

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			-9097.68	3431.76	-2.65	0.0329
Horiz. ΔT °C	0.405	0.208	60.31	31.01	1.94	0.0929
Surface T °C	6.887	2.497	149.32	54.14	2.76	0.0282
Surface D.O.	6.823	2.621	826.52	317.47	2.60	0.0352
Surface Chl.	-0.844	0.414	-2.85	1.40	-2.04	0.0808

Appendix C-7. (Continued).

HOLOPLANKTON (Continued)

Siphonophora (pooled)

R= 0.96145859 R²= 0.92440263 Adjusted R²= 0.86140482

F(5,6)=14.674 p<0.00260 SE of estimate: .48661

	Beta	SE of Beta	B	SE of B	t(6)	p-level
Intercept			-85.91	38.46	-2.23	0.0669
Distance (m)	0.523	0.314	1.31	0.79	1.66	0.1470
Density (σ_T)	1.211	0.477	10.57	4.16	2.54	0.0440
Salinity	-0.990	0.501	-5.12	2.59	-1.98	0.0954
Vertical ΔT ºC	0.442	0.252	1.70	0.97	1.76	0.1295
Thermocline (m)	0.466	0.437	0.15	0.14	1.07	0.3276

***Sagitta* sp.**

R= 0.99385800 R²= 0.98775372 Adjusted R²= 0.95509697

F(8,3)=30.247 p<0.00870 SE of estimate: .86102

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			-86.06	26.59	-3.24	0.0480
Distance (m)	1.785	0.360	13.89	2.80	4.96	0.0158
Horiz. DT ºC	0.093	0.148	8.80	14.07	0.63	0.5759
Vertical DT ºC	-0.747	0.161	-8.93	1.92	-4.65	0.0188
Surface T ºC	0.376	0.108	5.20	1.49	3.48	0.0400
Thermocline (m)	-0.558	0.311	-0.55	0.31	-1.79	0.1706
Vertical ΔChl.	-0.267	0.137	-0.65	0.34	-1.95	0.1459
Depth (m)	1.254	1.178	0.53	0.50	1.06	0.3651

***Oikopleura* spp.**

R= 0.99892373 R²= 0.99784863 Adjusted R²= 0.98816745

F(9,2)=103.07 p<0.00964 SE of estimate: .30018

	Beta	SE of Beta	B	SE of B	t(2)	p-level
Intercept			38.12	9.51	4.01	0.0570
Distance (m)	-0.248	0.186	-1.31	0.98	-1.34	0.3132
Horiz. ΔT ºC	1.142	0.081	73.60	5.19	14.17	0.0049
Vertical ΔChl.	-0.749	0.116	-1.25	0.19	-6.46	0.0231
Thermocline (m)	-0.827	0.163	-0.55	0.11	-5.08	0.0367
Surface Chl.	1.160	0.172	1.70	0.25	6.76	0.0212
Depth (m)	-4.652	0.605	-1.34	0.17	-7.69	0.0165
Surface T ºC	-0.192	0.059	-1.80	0.55	-3.26	0.0826
Vertical ΔT ºC	0.203	0.084	1.65	0.68	2.41	0.1375

MEROPLANKTON

Cancridae zoea

R= 0.90127078 R²= 0.81228901 Adjusted R²= 0.77057546

F(2,9)=19.473 p<0.00054 SE of estimate: .67816

	Beta	SE of Beta	B	SE of B	t(9)	p-level
Intercept			-54.66	37.29	-1.47	0.1768
Thermocline (m)	0.678	0.207	0.23	0.07	3.28	0.0096
Salinity	0.282	0.207	1.58	1.16	1.36	0.2065

***Balanus* sp. cyprid**

R= 0.96648481 R²= 0.93409288 Adjusted R²= 0.89643167

F(4,7)=24.803 p<0.00031 SE of estimate: 2.8799

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			-80.16	64.79	-1.24	0.2559
Distance (m)	-0.732	0.128	-12.55	2.19	-5.74	0.0007
Vertical ΔChl.	0.374	0.142	2.02	0.77	2.62	0.0342
Surface T ºC	0.172	0.113	5.24	3.43	1.53	0.1701
Horiz. ΔT ºC	0.134	0.098	28.08	20.53	1.37	0.2138

Appendix C-7. (Continued).

MEROPLANKTON (Continued)

Hippolytidae zoea

R= 0.94438002 R^2= 0.89185362 Adjusted R^2= 0.76207797

F(6,5)=6.8723 p<0.02581 SE of estimate: .45209

	Beta	SE of Beta	B	SE of B	t(5)	p-level
Intercept			-64.75	33.82	-1.91	0.1137
Vertical ΔChl.	-0.100	0.285	-0.06	0.16	-0.35	0.7405
Distance (m)	-2.214	0.424	-3.93	0.75	-5.22	0.0034
Thermocline (m)	1.027	0.632	0.23	0.14	1.63	0.1650
Horiz. ΔT °C	0.580	0.174	12.55	3.77	3.33	0.0208
Vertical ΔT °C	-0.915	0.316	-2.50	0.86	-2.90	0.0338
Salinity	0.563	0.288	2.06	1.06	1.96	0.1079

Fish eggs (pooled)

R= 0.99520279 R^2= 0.99042859 Adjusted R^2= 0.94735726

F(9,2)=22.995 p<0.04236 SE of estimate: .13776

	Beta	SE of Beta	B	SE of B	t(2)	p-level
Intercept			49.43	27.08	1.83	0.2094
Distance (m)	-0.012	0.384	-0.01	0.44	-0.03	0.9785
Thermocline (m)	2.592	0.367	0.38	0.05	7.05	0.0195
Vertical ΔT °C	0.701	0.184	1.24	0.32	3.82	0.0623
Horiz. ΔT °C	-1.003	0.174	-14.06	2.44	-5.77	0.0287
Density (σ_T)	-0.414	0.202	-1.66	0.81	-2.05	0.1767
Depth (m)	4.686	1.274	0.29	0.08	3.68	0.0666
Surface Chl.	-0.420	0.249	-0.13	0.08	-1.68	0.2342
Surface D.O.	-0.145	0.138	-1.65	1.57	-1.05	0.4033

Bryozoa cyphonautes

R= 0.92368187 R^2= 0.85318820 Adjusted R^2= 0.79813378

F(3,8)=15.497 p<0.00107 SE of estimate: 23.907

	Beta	SE of Beta	B	SE of B	t(8)	p-level
Intercept			-1497.76	537.75	-2.79	0.0237
Distance (m)	-0.639	0.176	-65.09	17.94	-3.63	0.0067
Surface T °C	0.477	0.157	86.49	28.44	3.04	0.0160
Vertical ΔChl.	0.436	0.198	13.98	6.34	2.21	0.0584

Gastropoda veligers

R= 0.98784847 R^2= 0.97584461 Adjusted R^2= 0.94685813

F(6,5)=33.666 p<0.00069 SE of estimate: .60723

	Beta	SE of Beta	B	SE of B	t(5)	p-level
Intercept			-10.86	136.52	-0.08	0.9397
Surface Chl.	0.801	0.229	1.12	0.32	3.49	0.0174
Salinity	0.569	0.225	5.93	2.34	2.53	0.0525
Horiz. ΔT °C	0.341	0.078	20.98	4.81	4.37	0.0073
Thermocline (m)	-1.216	0.250	-0.78	0.16	-4.87	0.0046
Vertical ΔT °C	-0.723	0.165	-5.61	1.28	-4.38	0.0072
Surface D.O.	-0.443	0.172	-22.18	8.64	-2.57	0.0501

Ophiuroidea ophiopluteus

R= 0.89418342 R^2= 0.79956398 Adjusted R^2= 0.63253397

F(5,6)=4.7869 p<0.04142 SE of estimate: 1.0559

	Beta	SE of Beta	B	SE of B	t(6)	p-level
Intercept			-103.82	28.37	-3.66	0.0106
Vertical ΔT °C	-0.823	0.430	-4.22	2.21	-1.91	0.1041
Surface T °C	1.101	0.296	6.53	1.75	3.72	0.0098
Thermocline (m)	-2.168	0.703	-0.92	0.30	-3.09	0.0215
Horiz. ΔT °C	0.331	0.203	13.48	8.25	1.63	0.1532
Distance (m)	0.798	0.504	2.66	1.68	1.58	0.1643

Appendix C-7. (Continued).

SIGNIFICANT PLANKTON SAMPLE SUMMARIES

Number of individuals

R= 0.93445936 R^2= 0.87321430 Adjusted R^2= 0.80076533
F(4,7)=12.053 p<0.00294 SE of estimate: 218.21

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			30680.0	11611.74	2.64	0.0333
Surface D.O.	-0.460	0.160	-4274.40	1485.67	-2.88	0.0238
Thermocline (m)	1.618	0.400	191.56	47.40	4.04	0.0049
Surface Chl.	0.821	0.356	212.75	92.21	2.31	0.0544
Depth (m)	-0.433	0.297	-22.13	15.20	-1.46	0.1888

Number of species

R= 0.98181848 R^2= 0.96396753 Adjusted R^2= 0.92072856
F(6,5)=22.294 p<0.00184 SE of estimate: 2.1853

	Beta	SE of Beta	B	SE of B	t(5)	p-level
Intercept			-3.60	12.66	-0.28	0.7876
Thermocline (m)	1.699	0.342	3.19	0.64	4.97	0.0042
Horiz. ΔT °C	0.531	0.094	96.25	16.98	5.67	0.0024
Vertical ΔT °C	-0.268	0.152	-6.13	3.47	-1.76	0.1380
Distance (m)	-1.501	0.278	-22.31	4.14	-5.40	0.0030
Vertical ΔChl.	1.293	0.265	6.05	1.24	4.88	0.0046
Surface Chl.	-1.320	0.361	-5.43	1.49	-3.65	0.0147

Diversity (H')

R= 0.98386400 R^2= 0.96798837 Adjusted R^2= 0.91196801
F(7,4)=17.279 p<0.00765 SE of estimate: .04498

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			3.45	1.27	2.72	0.0531
Distance (m)	-1.596	0.507	-0.15	0.05	-3.15	0.0345
Thermocline (m)	-0.451	0.420	-0.02	0.02	-1.07	0.3432
Horiz. ΔT °C	-0.336	0.195	-1.19	0.69	-1.72	0.1607
Vertical ΔChl.	-0.255	0.179	-0.02	0.02	-1.43	0.2269
Surface T °C	-0.254	0.146	-0.13	0.08	-1.74	0.1573
Vertical ΔT °C	0.226	0.225	0.10	0.10	1.01	0.3716

Plankton volume (ml)

R= 0.93683493 R^2= 0.87765968 Adjusted R^2= 0.80775092
F(4,7)=12.554 p<0.00261 SE of estimate: .43370

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			-28.65	34.91	-0.82	0.4388
Vertical ΔChl.	-1.054	0.189	-0.63	0.11	-5.59	0.0008
Distance (m)	-0.919	0.254	-1.74	0.48	-3.62	0.0086
Vertical ΔT °C	0.218	0.189	0.64	0.55	1.16	0.2853
Density (σ_T)	0.232	0.225	1.53	1.49	1.03	0.3374

Plankton concentration (ml L^{-1})

R= 0.97493765 R^2= 0.95050341 Adjusted R^2= 0.92221965
F(4,7)=33.606 p<0.00012 SE of estimate: .11312

	Beta	SE of Beta	B	SE of B	t(7)	p-level
Intercept			-12.74	9.28	-1.37	0.2123
Depth (m)	-0.547	0.189	-0.02	0.01	-2.89	0.0232
Vertical ΔChl.	-1.057	0.147	-0.26	0.04	-7.17	0.0002
Thermocline (m)	-1.140	0.223	-0.11	0.02	-5.11	0.0014
Density (σ_T)	0.267	0.145	0.72	0.39	1.84	0.1089

Appendix C-8. Forward step-wise multiple linear regression detailed summary statistics for each taxa comprising greater than 0.25% of the overall abundance and significant plankton sample summaries from November 4, 2004 neuston tows. Non-significant variables were omitted. All variables were regressed against (1) depth, (2) distance from shore, (3) surface temperature, (4) surface salinity, (5) surface density, and (6) surface chlorophyll concentration.

HOLOPLANKTON

Calanus pacificus

R= 0.95507742 R^2= 0.91217287 Adjusted R^2= 0.89021609
F(1,4)=41.544 p<0.00298 SE of estimate:0.41711

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			-148.32	23.19	-6.39	0.0031
Salinity	0.955	0.148	4.49	0.70	6.45	0.0030

***Clausocalanus* sp.**

R= 0.82311231 R^2= 0.67751388 Adjusted R^2= 0.59689234
F(1,4)=8.4036 p<0.04417 SE of estimate: 21.182

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			-2741.05	967.31	-2.83	0.0472
Surface T ºC	0.823	0.284	151.24	52.17	2.90	0.0442

Oithona oculata

R= 0.98446474 R^2= 0.96917083 Adjusted R^2= 0.96146354
F(1,4)=125.75 p<0.00036 SE of estimate: 1.0472

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			-6.28	1.00	-6.25	0.0033
Surface Chl.	0.984	0.088	1.61	0.14	11.21	0.0004

***Oncaea* sp.**

R= 0.98792626 R^2= 0.97599829 Adjusted R^2= 0.95999714
F(2,3)=60.996 p<0.00372 SE of estimate: .55551

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			624.78	65.73	9.51	0.0025
Depth (m)	2.125	0.193	0.72	0.07	11.03	0.0016
Salinity	-1.831	0.193	-19.01	2.00	-9.50	0.0025

***Salpa* sp.**

R= 0.97387707 R^2= 0.94843654 Adjusted R^2= 0.91406090
F(2,3)=27.590 p<0.01171 SE of estimate: .62541

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			-3.19	0.75	-4.26	0.0237
Depth (m)	4.473	0.951	1.16	0.25	4.70	0.0182
Distance (m)	-3.677	0.951	-10.27	2.66	-3.87	0.0306

Evadne nordmanni

R= 0.85937151 R^2= 0.73851940 Adjusted R^2= 0.67314925
F(1,4)=11.298 p<0.02827 SE of estimate: 14.341

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			-12.48	12.47	-1.00	0.3735
Depth (m)	0.859	0.256	2.62	0.78	3.36	0.0283

Evadne spinifera

R= 0.97881501 R^2= 0.95807883 Adjusted R^2= 0.94759854
F(1,4)=91.417 p<0.00067 SE of estimate: .52517

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			231.36	23.98	9.65	0.0006
Surface T ºC	-0.979	0.102	-12.37	1.29	-9.56	0.0007

Podon polyphemoides

R= 0.95347525 R^2= 0.90911505 Adjusted R^2= 0.84852509
F(2,3)=15.004 p<0.02740 SE of estimate: 6.0025

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			-19.09	7.19	-2.65	0.0767
Depth (m)	3.602	1.262	6.75	2.37	2.85	0.0649
Distance (m)	-2.754	1.262	-55.62	25.50	-2.18	0.1172

***Sagitta* sp.**

R= 0.97572406 R^2= 0.95203745 Adjusted R^2= 0.92006242
F(2,3)=29.774 p<0.01050 SE of estimate: .69793

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			222.94	75.98	2.93	0.0608
Depth (m)	1.453	0.225	0.44	0.07	6.45	0.0076
Density (σ_T)	-0.667	0.225	-9.54	3.22	-2.96	0.0595

Appendix C-8. (Continued).

MEROPLANKTON

***Balanus* sp. cyprid**

R= 0.99341927 R^2= 0.98688185 Adjusted R^2= 0.97813642
F(2,3)=112.85 p<0.00150 SE of estimate: 6.1157

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			4822.36	341.27	14.13	0.0008
Surface T °C	-0.675	0.103	-153.81	23.50	-6.55	0.0073
Salinity	-0.376	0.103	-58.12	15.95	-3.64	0.0356

Gastropoda veligers

R= 0.99198268 R^2= 0.98402963 Adjusted R^2= 0.97338272
F(2,3)=92.424 p<0.00202 SE of estimate: 2.5275

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			536.21	411.19	1.30	0.2833
Distance (m)	-0.741	0.216	-15.04	4.38	-3.43	0.0414
Salinity	-0.262	0.216	-15.18	12.50	-1.21	0.3113

SIGNIFICANT PLANKTON SAMPLE SUMMARIES

Number of individuals

R= 0.94993419 R^2= 0.90237497 Adjusted R^2= 0.83729162
F(2,3)=13.865 p<0.03050 SE of estimate: 10375.

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			4997733	1227588	4.07	0.0267
Depth (m)	2.001	0.389	6256.00	1215.00	5.15	0.0142
Salinity	-1.574	0.389	-151347	37362.0	-4.05	0.0271

Number of species

R= 0.88882513 R^2= 0.79001012 Adjusted R^2= 0.65001687
F(2,3)=5.6432 p<0.09623 SE of estimate: 1.0855

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			-471.84	149.21	-3.16	0.0508
Density (σ_T)	1.987	0.595	21.13	6.33	3.34	0.0444
Distance (m)	-1.685	0.595	-4.05	1.43	-2.83	0.0660

Plankton volume

R= 0.98370609 R^2= 0.96767767 Adjusted R^2= 0.91919418
F(3,2)=19.959 p<0.04809 SE of estimate: 5.9962

	Beta	SE of Beta	B	SE of B	t(2)	p-level
Intercept			3431.23	818.15	4.19	0.0524
Depth (m)	2.229	0.321	5.71	0.82	6.94	0.0201
Salinity	-1.332	0.311	-105.04	24.54	-4.28	0.0505
Surface Chl.	0.427	0.332	2.77	2.15	1.29	0.3269

NON-SIGNIFICANT, BUT SUGGESTIVE SPECIES

Penilia avirostris

R= 0.80310929 R^2= 0.64498453 Adjusted R^2= 0.55623066
F(1,4)=7.2671 p<0.05433 SE of estimate: 5.0641

	Beta	SE of Beta	B	SE of B	t(4)	p-level
Intercept			629.58	231.26	2.72	0.0529
Surface T °C	-0.803	0.298	-33.62	12.47	-2.70	0.0543

***Oikopleura* spp.**

R= 0.91821063 R^2= 0.84311077 Adjusted R^2= 0.73851794
F(2,3)=8.0609 p<0.06214 SE of estimate: 2.4466

	Beta	SE of Beta	B	SE of B	t(3)	p-level
Intercept			364.00	266.35	1.37	0.2651
Depth (m)	1.327	0.407	0.77	0.24	3.26	0.0472
Density (σ_T)	-0.562	0.407	-15.58	11.30	-1.38	0.2618

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