Abstract.—Vertical distribution of euphausiids on opposite sides of Baja California, off Point Eugenia to the west (June 1961) and in the central sector of the Gulf of California to the east (May 1965), are described from day and night sets of samples. Off Point Eugenia, the thermocline was shallow (20 m) toward the coast, characteristic of upwelling in late spring. In the Gulf, the Salsipuedes Channel showed well-mixed water whereas the Guaymas Basin had a stratified profile of temperature and oxygen. Lower abundances of the larger euphausiids during day throughout the water column, compared with night, are attributed to net avoidance. When a thermocline was present, two basic migration patterns were observed: 1) species crossing the thermocline (*Nyctiphanes simplex* and most *Euphausia* spp.) and 2) species remaining at or beneath the thermocline (*Euphausia gibboides* and *Nematoscelis difficilis*). On the basis of distribution at night, the youngest larvae and adults of *N. simplex* were in the mixed layer at the coastal station off Point Eugenia; more advanced stages of development were at mid-depth, between 0 and 50 m, suggesting an upwelling-downwelling cell of circulation. Inside the Gulf, abundant metanauplii and ovigerous females of *N. difficilis* occurred only in the upper layers of Salsipuedes Channel, whereas in Guaymas Basin and Point Eugenia, the youngest larvae were within the thermocline. The decrease of oxygen with depth did not reach the critical values observed in the more tropical eastern Pacific but, in general, where values of $[O_2]$ were <1 mL/L, the abundance of euphausiids was low.

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Vertical distribution of euphausiid life stages in waters adjacent to Baja California

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Early studies of euphausiids in the California Current showed a coincidence between their vertical distribution and the vertical movement of a mid-depth layer of organisms from which sonic scattering was reflected (the deep scattering layer in Boden, 1950; Barham, 1957). Interaction of this layer with shoaling of the sea floor was described by Isaacs and Schwartzlose (1965). Vertical migration, or lack of it in certain species, has been related to daytime avoidance of nets by euphausiids off California and northern Baja California (Brinton, 1967). For a given species, variation in the extent of vertical migration, and range of nonmigrators, has been related to the depth of the thermocline and distributions of dissolved oxygen (Brinton, 1967, 1979; Youngbluth, 1976). In the margins of the eastern tropical Pacific (ca. 20–22°N), a shoaling oxygen minimum layer constrains the vertical ranges of warm-temperate euphausiid species with a replacement by tropical species tolerant of oxygen deficiency (Longhurst, 1967; Brinton, 1979). Seasonal variability in vertical migratory behavior has been also observed. In La Jolla Bight near San Diego, differences in patterns of vertical migration of *Euphausia pacifica* and the copepod *Calanus pacificus* were observed between upwelling and downwelling periods (Koslow and Ota, 1981).

These and subsequent studies dealing with vertical migration in different taxa have shown variable responses to environmental stimuli. For example, in euphausiids, the influence of light (Boden and Kampa, 1967; Bright et al., 1976), proximity of the bottom (Cochrane et al., 1994), and temperature and salinity (Wiebe and Boyd, 1978) have been described. The selective advantage of remaining at depth during the day is usually considered an adaptation for escape from predators (Zaret and Suffern, 1976; Ohman et al., 1983; Bollens et al., 1992) or an energetic benefit (McLaren, 1963, 1974; Enright, 1977).

The present study describes for the first time the vertical distribution of euphausiids in the central sector of the Gulf of California and off Point Eugenia (28°N) during spring. In the Gulf of California, deep basins, island channels, and, in particular, low $[O_2]$ within subtropical latitudes all suggest possibilities for interesting variability in vertical distribution of fauna. However, information on the subject is restricted to the vertical distribution of euphausiids and pelagic red crab, *Pleuroncodes planipes*, at the entrance of the Gulf, as part of an eastern Pacific transect (Brinton, 1979). Inside the Gulf, only the submergence of the copepod *Calanus pacificus californicus* to depths of 200–300 m during summer has been reported by Fleminger (in Brinton et al., 1986). Point Eugenia is of biogeographical interest because species of temperate, tropical, and central Pacific regions may occur together relatively near to the coast (Boden et al., 1955; Brinton 1962, a and b).

Methods

Samples used in this study were collected from a three-station transect off Point Eugenia, Pacific coast of Baja California (*Zigpac II* cruise, 12–18 June 1961), and from three stations from the central part of the Gulf of California (*El Golfo II* cruise, 15–20 May 1965) (Fig. 1). In both cruises of RV *Alexander Agassiz*, two series of tows (one during the day and one at night) were made with an opening-closing net as described by Brinton (1967). The net was 1 m in diameter, 2.35 m long, and used 0.505-mm mesh with 0.25-mm mesh in the codend bag as well as a 40-cm long section at the front of it. Off Point Eugenia, nets were hauled horizontally at discrete depths (0, 10, 25, 50, 75, 100, 150, 200, 300, 400, and 500 m) for 30 min. In the Gulf of California, hauls were oblique and nets equipped with flowmeters. In the upper 150 m, five hauls were made through strata of 30 m; below 150 m, five hauls were made through strata of 135 m.

Euphausiids were identified, counted, and grouped as adults (males and females), juveniles, and larvae. The entire sample was used except in cases of abundant *Nyctiphanes simplex* and *Euphausia recurva*, where subsamples were obtained with a Folsom splitter. Between 200 and 400 individuals per life phase were typically counted. Larvae of *Nematoscelis difficilis* and *N. simplex* were sorted by developmental stages as defined by Gopalakrishnan (1973) and Lavaniegos (1992). The biogeographic provinces of Brinton (1962a, 1979), based on affinity to water masses, were used in the classification of species.

Abundance at a particular depth is expressed as individuals (ind)/m^3, and total abundance in the water column as ind/m^2 of ocean surface. In horizontal hauls, the depth of tow was taken as the middle depth of the layer. In oblique hauls, the thickness of the layer was the difference between depths of opening and closing of net. Statistical comparisons were not made because of absence of replicate tows. Data on temperature, salinity, and dissolved oxygen were obtained from standard Nansen-bottle casts and processed by California Cooperative Oceanic Fisheries Investigations. Data from the Gulf of California are published (SIO Data Report[1]).

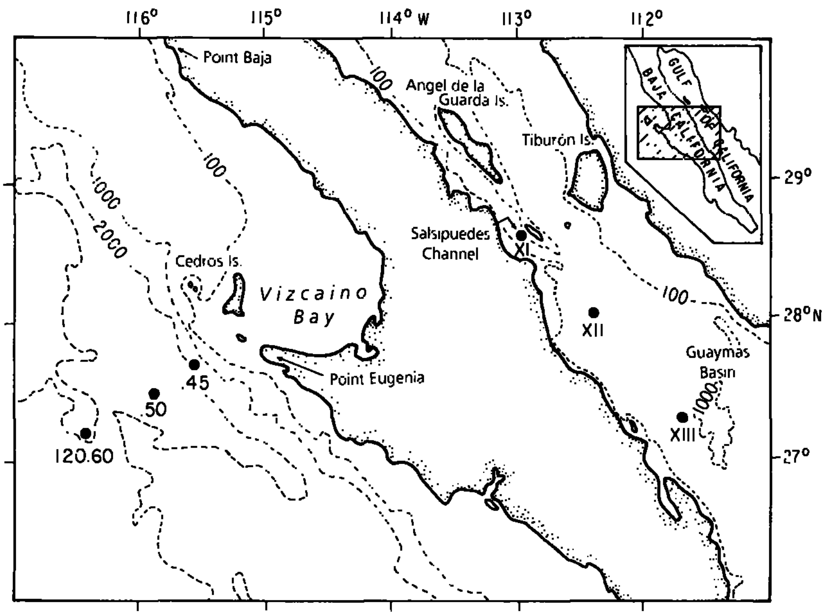

Figure 1
Sampling stations (•) off Point Eugenia, Pacific Coast of Baja California. Isobaths are in fathoms.

Results

Hydrographic vertical profiles

In the outer coast of Baja California, physical conditions in June 1961 were typical for late spring (Reid et al., 1958; Hickey, 1979; Huyer, 1983). Near the coast (station [st.] 120.45), the mixed layer was 20 m (Fig. 2). The station most distant from the coast (st. 120.60) showed a thicker mixed layer (50–60 m) and warmer temperatures between depths of 20–150 m than did the other stations. Salinity in the surface layer showed low values (33.5–33.8 ppt), influenced by more northern California Current water. Near the coast (st. 120.45), a shallow oxycline and values of salinity >34.0 ppt at 75–100 m depth resulted from the influence of Intermediate Equatorial water.

The Gulf of California is influenced by northerly winds during spring and summer. However, tides,

1 SIO Data Report. 1967. Physical and chemical data report: CalCOFI Cruise 6505 (*El Golfo* II). SIO Reference 67-16. Scripps Institution of Oceanography, La Jolla, CA, 92093.

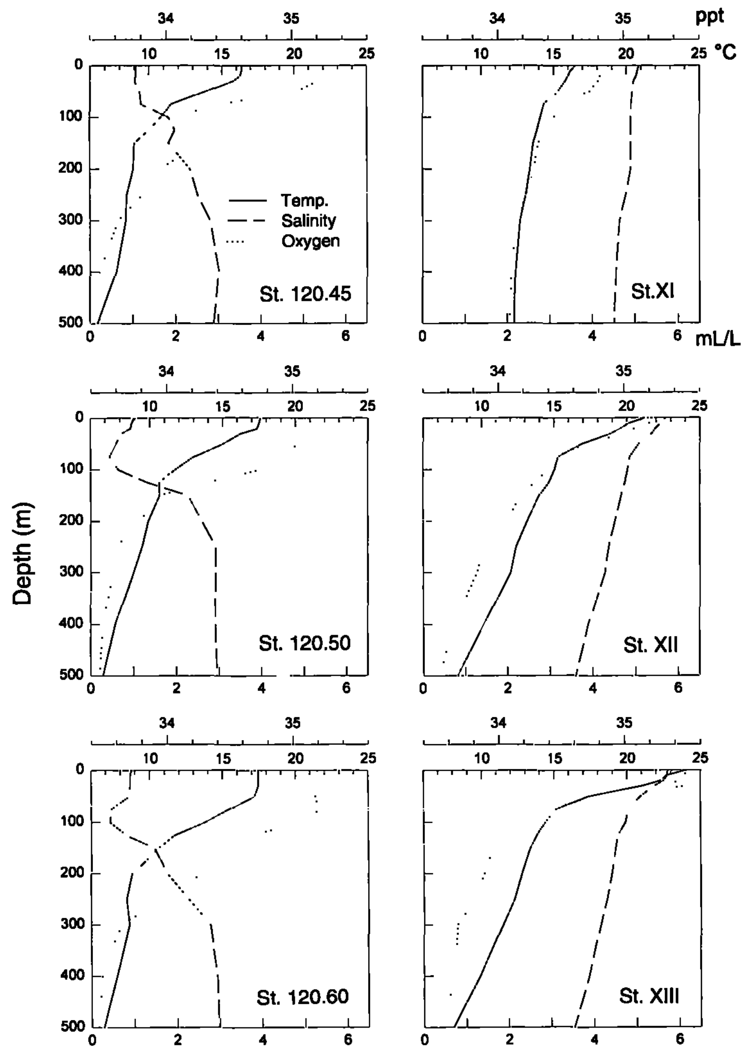

Figure 2

Depth profiles of temperature (°C), salinity (ppt), and dissolved oxygen (mL/L) for Point Eugenia (left) and the Gulf of California (right) stations.

air-sea fluxes, and propagation of internal waves enhance mixing of the water (Roden and Groves, 1959; Badan-Dangon et al., 1985; Bray and Robles, 1991). Strongest tidal currents have been recorded in the Ballenas Channel (west of Angel de la Guarda Island) and Salsipuedes Channel (Fig. 1). Here the water column is well mixed above 500 m during spring tides (Bray and Robles, 1991) as observed in May 1965 (st. XI, Fig. 2). In contrast, the Guaymas Basin profiles (sts. XII and XIII) showed gradients of temperature and oxygen that were particularly strong above 100 m. Temperature in the top 50 m showed differences of 2–4°C among the three sampling stations. Surface salinity showed values >35.0 ppt, characteristic of the Gulf water mass, produced in the northern gulf and flowing and mixing rapidly southward.

Vertical distribution of euphausiids

Off Point Eugenia, the greatest number of species was of the Central Pacific group. These, however, had relatively low abundances, <10 ind/m^2 per species, excepting *Euphausia recurva* and, at one station, *E. hemigibba* (Table 1). This group was absent in the Gulf of California.

The most abundant species in both study regions was *Nyctiphanes simplex* (Tables 1 and 2). This spe-

Table 1

Abundance integrated to surface (ind/m^2) per species off Point Eugenia. (METP = marginal of the eastern tropical Pacific (sensu Brinton 1962a, 1979).

Biogeographic group	Species	St. 120.60 Night	St. 120.60 Day	St. 120.50 Night	St. 120.50 Day	St. 120.45 Night	St. 120.45 Day
Transition zone	*Euphausia gibboides*	26	19	123	6	12	4
	Nematoscelis difficilis	1	3	98	10	60	23
	Nyctiphanes simplex	5	1	674	79	836	588
	Thysanoessa gregaria	<1	1	4	3	9	4
METP	*Euphausia eximia*	2	10	13	13	8	3
	Nematobrachion flexipes	1	<1	<1	1	1	<1
	Stylocheiron affine	1	1	2	<1	5	<1
Subarctic	*Euphausia pacifica*	—	—	73	18	20	21
Equatorial	*Nematoscelis gracilis*	<1	—	—	—	—	<1
Central epipelagic	*Euphausia hemigibba*	9	1	1	—	<1	1
	Euphausia mutica	2	—	1	—	<1	—
	Euphausia recurva	33	30	64	1	33	4
	Nematoscelis atlantica	<1	—	<1	—	—	—
	Stylocheiron suhmii	—	<1	—	—	—	—
	Thysanopoda astylata	<1	<1	<1	—	—	<1
Central mesopelagic	*Nematobrachion boopis*	—	<1	—	—	—	—
	Nematoscelis tenella	<1	<1	<1	—	<1	—
	Stylocheiron elongatum	<1	—	<1	<1	—	—
	Stylocheiron longicorne	1	1	2	1	3	1
	Stylocheiron maximum	<1	<1	<1	<1	<1	<1
	Thysanopoda orientalis	<1	—	<1	<1	<1	<1
	Total	79	66	1,054	132	987	650

Table 2

Abundance integrated to surface (ind/m^2) per species in the central sector of the Gulf of California. (METP = marginal of the eastern tropical Pacific, ETP = eastern tropical Pacific (sensu Brinton 1962a,1979).

Biogeographic group	Species	St. XI Night	St. XI Day	St. XII Night	St. XII Day	St. XIII Night	St. XIII Day
Transition zone	*Nematoscelis difficilis*	324	217	604	178	344	163
	Nyctiphanes simplex	274	619	1,778	1,314	11,082	585
METP	*Euphausia eximia*	—	—	2	—	10	2
	Nematobrachion flexipes	—	—	<1	—	—	—
ETP	*Euphausia distinguenda*	—	—	<1	1	—	1
	Euphausia lamelligera	—	—	<1	1	1	21
	Total	598	836	2,385	1,494	11,437	772

cies is a warm-temperate endemic, occurring typically in nearshore waters of the southern part of the California Current (Brinton, 1962a) and in the Gulf of California (Brinton and Townsend, 1980). Other abundant species of the group identified as the "California Current's transition zone" was *Nematoscelis difficilis*, which was even more abundant in the Gulf than at the California Current stations. *Euphausia gibboides*, *Thysanoessa gregaria* (transition zone), and the subarctic-warm temperate *E. pacifica* were not observed in the Gulf.

Tropical species were scarce along both coasts of the peninsula, as expected during the time of sampling (Brinton, 1979; Brinton and Townsend, 1980). In this group, *E. eximia* and *Nematobrachion flexipes* were common off Point Eugenia and in Guaymas Basin. *Euphausia lamelligera* and *E. distinguenda* were observed in Guaymas Basin only. The tropical-subtropical *Stylocheiron affine* was taken only at Point Eugenia.

Expected trends of low abundances during daytime were observed and are believed to be due to net avoidance during the hours of light. High abundance was usually accounted for by larvae of epipelagic species when most of the population was in the upper 100 m at night. Larvae of *N. simplex* accounted for 90% or more of the euphausiids in the richest samples. Off Point Eugenia their distribution was greater toward the coast and in the upper 50 m (Fig. 3). Night occurrences of calyptopes and early furcilias (C–F_3 in Fig. 3) were almost exclusively at st. 120.45, with most at the surface; the oldest furcilias (F_4–F_6) and juveniles were well represented at st. 120.50, down to 50 m. The old larvae descended to 200 m during daytime. The occurrence of mature adults at the surface at the nearshore station may be associated with nearshore grouping to mate and spawn. Inside the Gulf few larvae of *N. simplex* occurred at Salsipuedes Channel (st. XI, Fig. 4). Moreover, all larval stages were found at Guaymas Basin, where furcilias at st. XII were restricted to the first 30 m during night; the larval calyptopes were dispersed in the upper 100 m. Adults were more abundant at st. XIII, peaking at 30–60 m (there was no sample for 0–30 m) during night and at 135–270 m in the light hours.

Vertical distribution of *Nematoscelis difficilis* larvae off Point Eugenia, as with *Nyctiphanes simplex*, was restricted to coastal stations, with a shallower range nearshore (st. 120.45) than at st. 120.50 (Fig. 5). In contrast to *N. simplex*, *N. difficilis* larvae avoided the upper layer, and juveniles and adults peaked at 100 m depth during nighttime (Fig. 5). Mating and spawning may have occurred in and below the thermocline near the coast, because most of the females with spermatophore attached or carrying external eggs were found between 75 and 200 m during the night (st. 120.45). In the Guaymas Basin, a more extended vertical range, from 55 to 420 m, was observed for adults of this species (Fig. 6). Interestingly, in Salsipuedes Channel, certain of the adults were near the surface, particularly gravid females. These may have been shedding newly hatched metanauplii in the upper layer, where many were found. A progression toward more advanced larval stages from north to south was observed.

Larvae of other species were found only off Point Eugenia. These were of the four most abundant species of *Euphausia* (Fig. 7). Three (*E. gibboides*, *E. recurva*, and *E. eximia*) included larval calyptopes

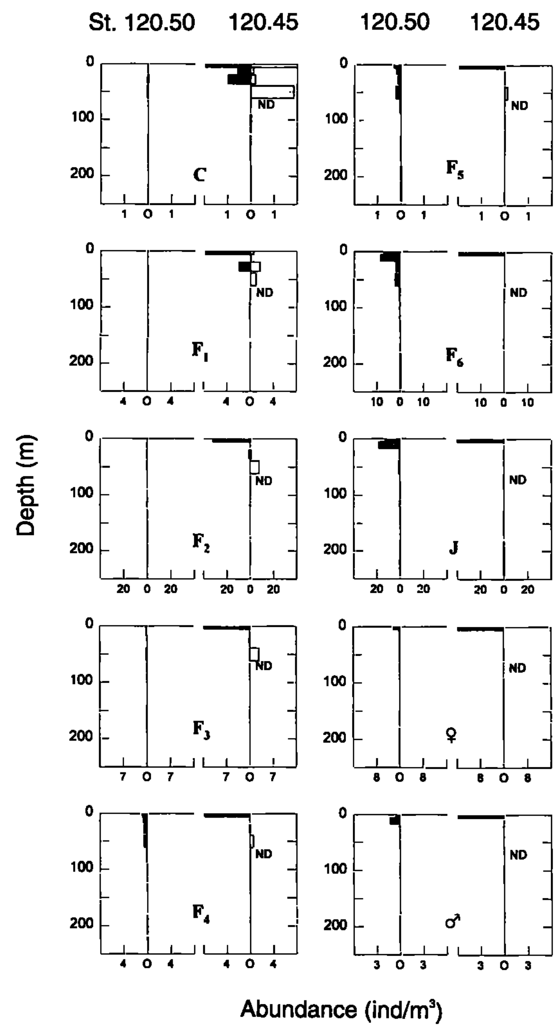

Figure 3

Vertical distribution of life stages of *Nyctiphanes simplex* off Point Eugenia at night (solid bars) and day (open bars). C = calyptopes; F_1–F_6 = furcilia stages; J = juveniles; ND = no data. Note the different scales used for abundance among stages.

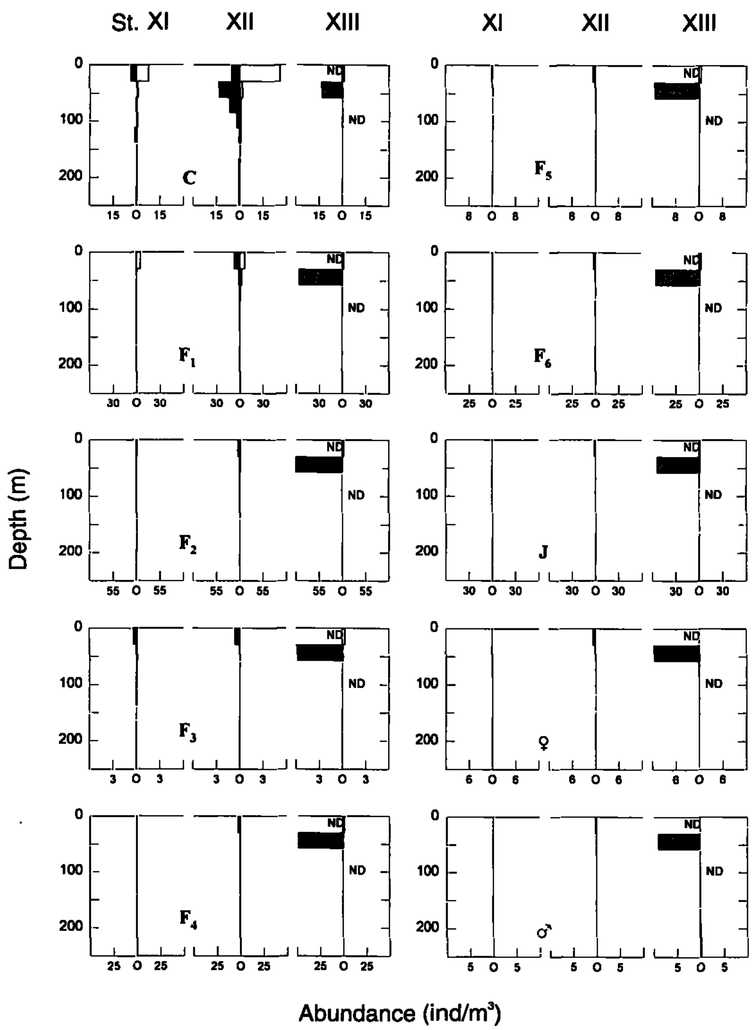

Figure 4

Vertical distribution of life phases of *Nyctiphanes simplex* in the Gulf of California. C = calyptopes; F_1–F_6 = furcilia stages; J = juveniles; ND = no data.

whereas *E. pacifica* larvae were advanced furcilias. Though the larvae of nighttime epipelagic species (*E. recurva*, *E. eximia*, and *E. pacifica*) occupied upper strata during both day and night, larvae of *E. gibboides* showed the same tendency as *N. difficilis* in avoiding the surface layer.

Few postlarvae (juveniles and adults) of epipelagic species were caught during daytime, particularly of *E. gibboides*, making it difficult to compare day and night vertical distributions. However, the other *Euphausia* species (Fig. 7) may have been migrating daily, on the basis of specimens found between 200 and 400 m during daytime, compared with their nighttime presence near the surface (Tables 3 and 4). *Thysanoessa gregaria* and *Stylocheiron affine* did not appear to migrate; they were not present in the upper 100 m during day and night (Fig 8).

The main part of the population of the three mesopelagic species did not occur above 100 m (Fig. 8). Larvae of *Stylocheiron longicorne* and *S. maximum* were at 100 m (except at st. 120.60 during the day) and of *Thysanopoda orientalis* at 200 m (Table 3). Off Point Eugenia and in Guaymas Basin virtually no euphausiids were found below 400 m depth. At those depths, dissolved oxygen was <1 mL/L at both locations (Fig. 2). In Salsipuedes Channel, oxygen values below 400 m was >2 mL/L, and some postlarvae of *N. difficilis* were found as deep as 700–800 m.

Discussion

The vertical distribution of the six most abundant species of euphausiids off Point Eugenia, June 1961, showed differences between day and night. Three of them (*Nyctiphanes simplex*, *Nematoscelis difficilis*, and *Euphausia eximia*) were important species in the central Gulf of California in May 1965. In both regions, when a thermocline was present, two basic kinds of distribution were apparent: 1) species found above and below the thermocline (*Nyctiphanes simplex* and most *Euphausia* species); and 2) species that remain in or below the thermocline (*E. gibboides* and *Nematoscelis difficilis*). In the absence of confirming replicated tows, the differences could also be interpreted as local patchiness. Similar patterns, however, were found during January–February of 1964 (Brinton, 1967) off Pt. Banda (32°N), Dana Pt. (34°N), and Pt. Reyes (38°N). During winter, upwelling is weak and the difference in depth of the thermocline between offshore and onshore stations is less than in summer. Though transects of winter 1964 extended farther offshore than in the present study, the trend of migrating species to be concentrated into depth ranges that were narrower nearshore was observed in both studies. A more northern study, off Cape Mendocino (40°N) and Cape Blanco (43°N) during July–August 1970, also showed this trend (Youngbluth, 1976).

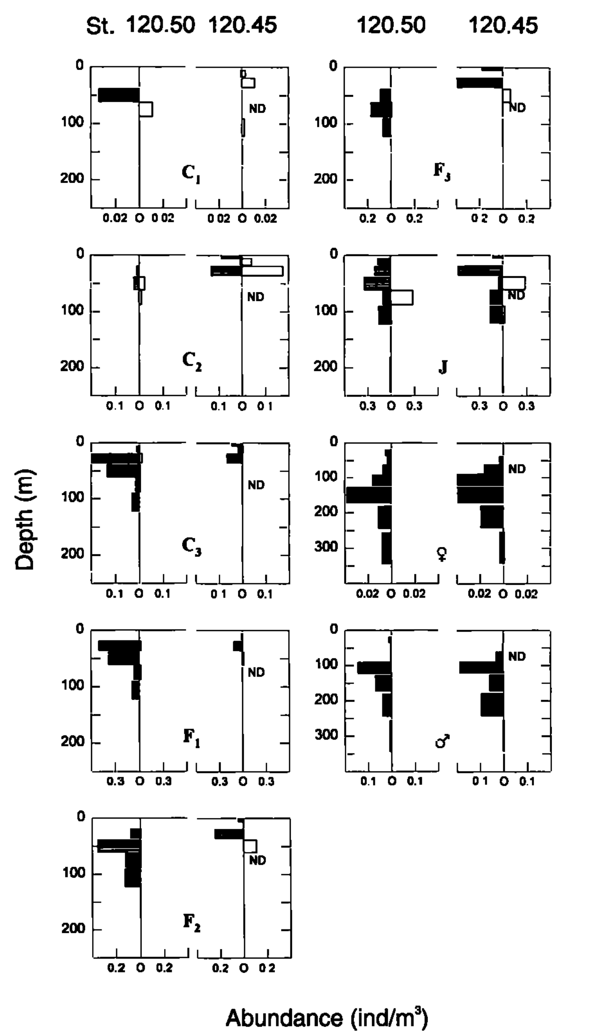

Figure 5

Vertical distribution of life stages of *Nematoscelis difficilis* off Point Eugenia. C_1–C_3 = calyptopis stages; F_1–F_3 = furcilia stages; J = juveniles; ND = no data.

In the Gulf of California, wind-driven upwelling occurs along the mainland coast in winter and on the peninsular coast in summer (Roden and Groves, 1959; Badan-Dangon et al., 1985). However, tides dominate the circulation of water near the midriff islands (Angel de la Guarda and Tiburón), including the Salsipuedes Channel, where currents up to six knots (2.76 m/s) have been measured (Alvarez et al., 1984; Bray and Robles, 1991). In this well-mixed area, the water column is cold, relatively rich in oxygen, and the vertical distribution of *Nematoscelis difficilis* was unique in that many adults were present in the upper 100 m at night. A migratory behavior to mate or shed the hatching metanauplii could be occurring, but an absence of a thermocline, acting as a barrier, could promote this behavior. In the earlier (1964) California Current study, near the coast the juveniles and adults of *N. difficilis* showed a bimodal vertical distribution (a peak near the surface and another in or below the thermocline), whereas offshore, the nocturnal distribution showed only the deep mode (Brinton, 1967). *N. difficilis* was therefore considered a vertical migrant, although a capability of daytime net avoidance was noted. In the congener *N. megalops*, from the northwestern Atlantic, differences between day and night were explained as due to daytime net avoidance (Wiebe and Boyd, 1978; Wiebe et al., 1982). Unfortunately, no replicate data for the Salsipuedes Channel station are available. This appeared to be an important area for reproduction of this species in May 1965; many metanauplii and first larval calyptopes were found in the upper layer, coincident with ovigerous females.

Though larvae of many species were found off Point Eugenia, most were late furcilias. Only the transition-zone group *N. simplex*, *N. difficilis*, and *E. gibboides*; the more tropical *E. eximia*; and the central Pacific *E. recurva* showed evidence of local reproductive activity, as suggested by the abundance of younger larval stages. Of these, differences in vertical distribution were between species with stage

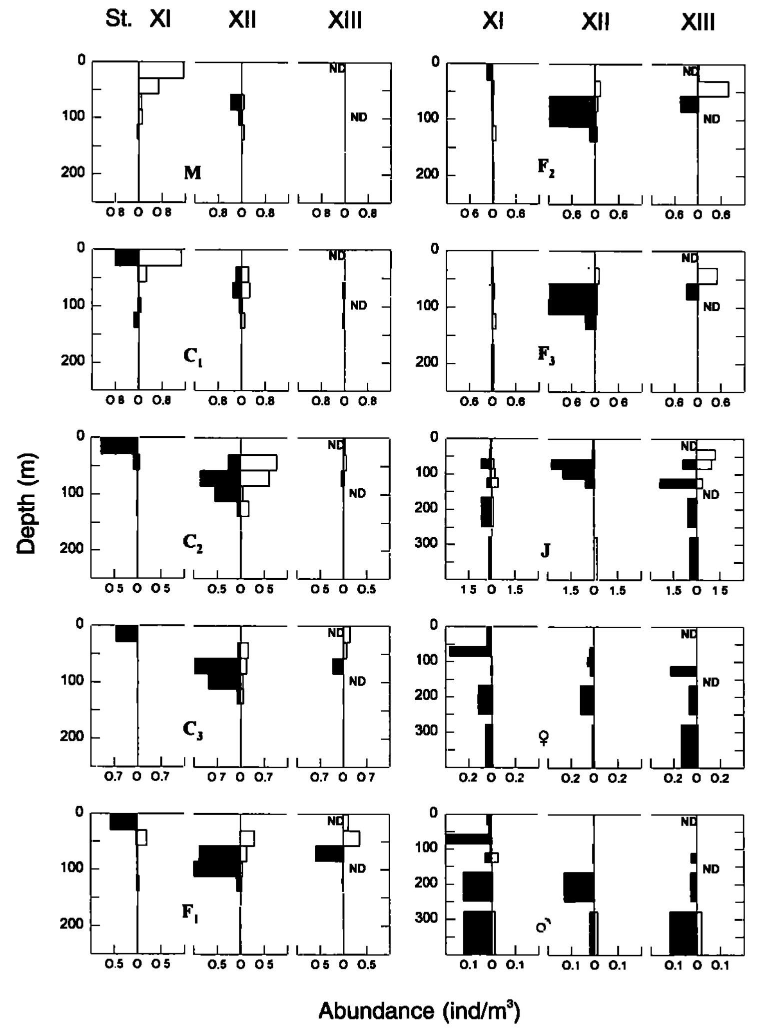

Figure 6

Vertical distribution of life stages of *Nematoscelis calyptopis* stages; M = metanauplii, C_1–C_2 = calyptopis stages; F_1–F_3 = furcilia stages; J = juveniles; ND = no data.

C_1 in the thermocline (*E. gibboides* and *N. difficilis*) and those with C_1 in the mixed layer (*N. simplex*, *E. eximia*, and *E. recurva*). These positions may be near the level of liberation of youngest larvae in species protecting eggs in maternal ovisacs such as done by *N. simplex* and *N. difficilis* (Brinton, 1966; Mauchline and Fisher, 1969). One day or even hours would have elapsed before moulting from metanauplius into C_1 stage. For *Nyctiphanes couchii* in the Celtic Sea, the liberation of mature metanauplii occurred within the euphotic zone, and moulting into calyptopis stage 1 (C_1) occurred in a matter of hours (Williams and Fragopoulu, 1985).

These authors observed in summer a stratified distribution of *N. couchii* during hours of light, with larger euphausiids at greater depths than smaller euphausiids. Similarly, in the northern Benguela Current, during winter, the larval calyptopes of *Nyctiphanes capensis* showed a shallower range of vertical distribution than furcilia (Barange and Pillar, 1992). In the present study the occurrence of older furcilias (F_4–F_6) of *N. simplex* at 200 m off Point Eugenia (Fig. 3) during daytime could indicate, as with *N. couchii* and *N. capensis*, an active daily migration. The restriction of early stages (C_1–F_3) of *N. simplex* to the nearshore station (32 km), exclusively in the surface layers, whereas late furciliar and postlarval stages extended to 64 km from the coast (from the surface into the layer below) may be explained by offshore flows, produced by coastal upwelling. As

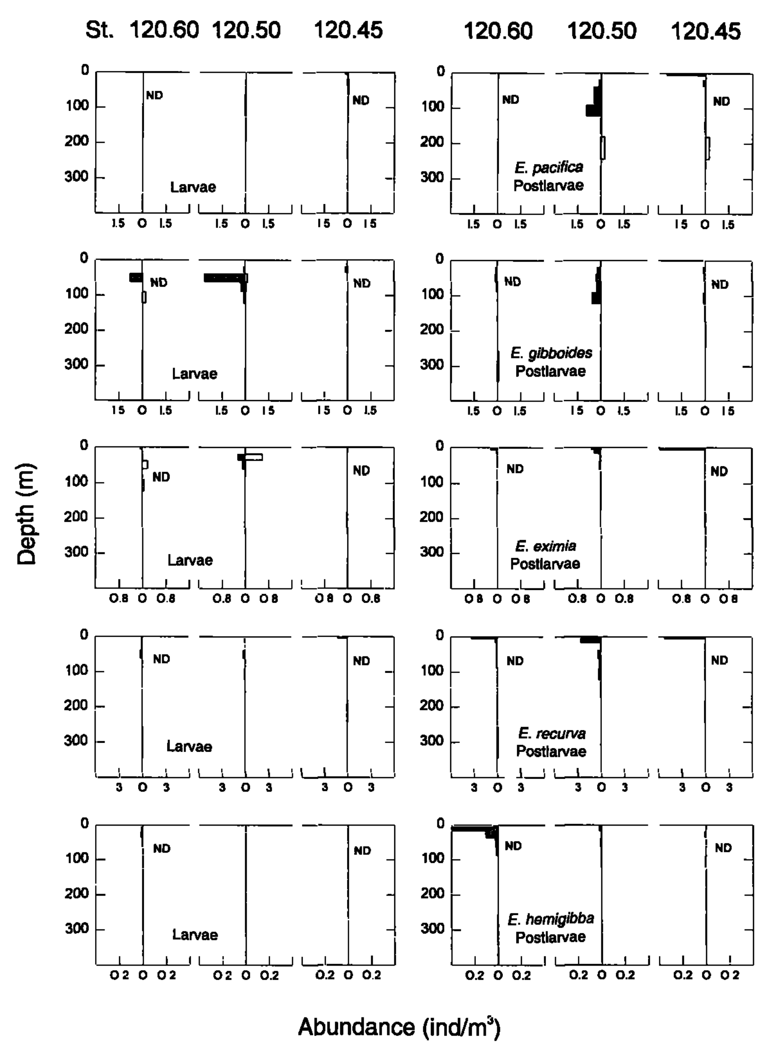

Figure 7

Vertical distribution of *Euphausia* species off Point Eugenia. Note the different scales used for abundance among species. ND = no data.

the larvae grow, they are carried offshore within the surface layers toward a convergence or frontal zone but eventually return to shore at depth by means of onshore flows. A cell of circulation of this kind conforms with the observations of a negative wind stress "curl" or Ekman convergence near the coast between Point Baja and Point Eugenia (Bakun and Nelson, 1977). Evidence for offshore flow in the surface, and onshore flow at 57 m, was found by Walsh et al. (1977) in the adjacent coastal shelf of Point San Hipolito (27°N). Similar conditions, within 28 km from the coast for early larval stages (nauplii and calyptopes) of *N. capensis*, and within 65 km for furcilias, were observed in Möwe Point (Benguela) (Barange and Pillar, 1992). These authors proposed a two-cell cross-shelf circulation to explain the maintenance of *N. capensis* near the coast.

From the same set of samples used in the present study, and from in situ observations in the Santa Barbara Basin (33°N), dense aggregations of stage-V copepodites of *Calanus pacificus californicus* were found (Alldredge et al., 1984). The presence of great abundances of resting copepodites of this species had been previously recorded along southern Baja California in oxygen-deficient water (Longhurst, 1967). Off Point Eugenia the species occupied a stratum near 300 m in offshore stations (120.60 and 120.50) but was found at 0–75 m in the nearshore station 120.45, both day and night. These differences were explained as population diapauses, at depth during

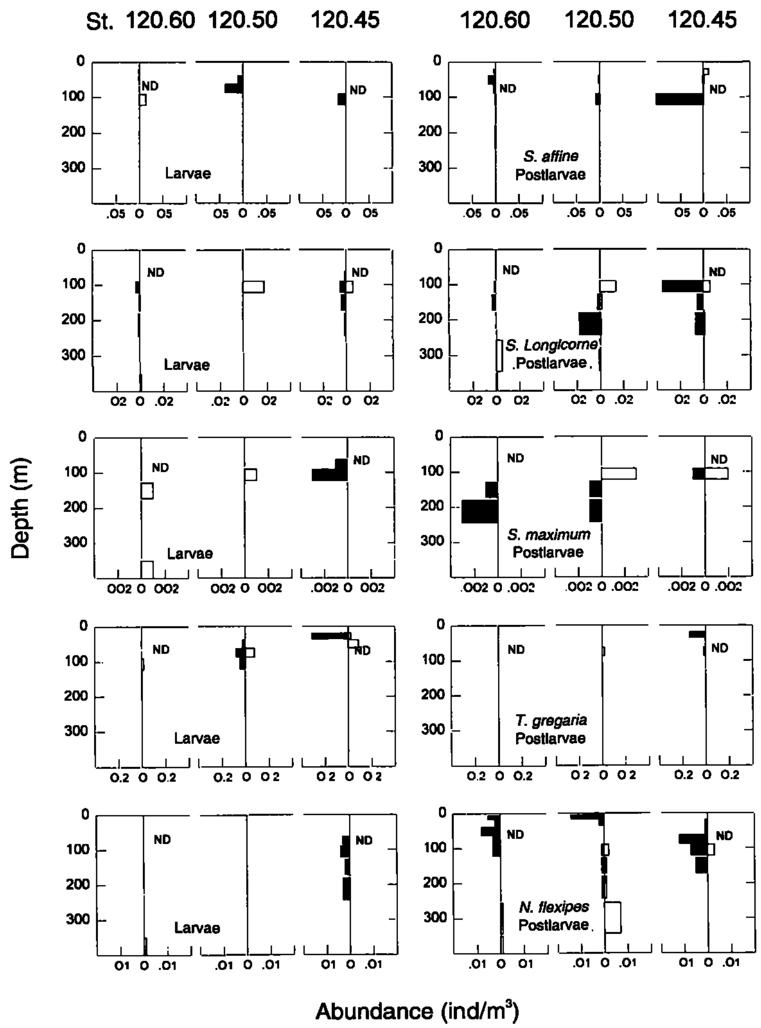

Figure 8

Vertical distribution of *Stylocheiron affine*, *S. longicorne*, *S. maximum*, *Thysanoessa gregaria*, and *Nematobrachion flexipes* off Point Eugenia. ND = no data.

periods of weak upwelling, with descent even to depths lacking oxygen (i.e. Santa Barbara Basin, Alldredge et al., 1984). In the present study, no aggregations of euphausiids analogous to copepods in diapause were found. For some euphausiid species, a low concentration of oxygen might limit migration at depth during daytime. This case apparently occurs in Saanich Inlet (British Columbia), where dense aggregations of *Euphausia pacifica* were observed directly above the anoxic layers (100–150 m) (Mackie and Mills, 1983). Near this site, in the temperate fjord of Dabbob Bay (Washington), a seasonal variation in the vertical migratory range of *E. pacifica* was recorded (Bollens et al., 1992). During the day, larvae of this species occurred deeper in the water column in late summer and fall than in spring. However, they were always above the depth levels of juveniles and adults (50–125 m) during the day, the entire population migrating to the surface at night (Bollens et al., 1992).

The relation between vertical distribution of euphausiids and low oxygen concentration has been discussed for the eastern tropical Pacific (ETP) (Brinton, 1979; Sameoto et al., 1987). In ETP the layer of strongly depleted oxygen (<0.1 mL/L) is present beneath the thermocline, to depths of 300–400 m. The vertically migrating species in the ETP group (*Euphausia lamelligera*, *E. distinguenda*, *E. diomedeae*, and *Nematoscelis gracilis*) tolerate intense O_2-deficiency at their daytime depths and enter the oxygenated mixed layer at night (Brinton,

Table 3

Depth (m) of maximal relative abundance of euphausiid postlarvae (juveniles and adults) of rare species off Point Eugenia, Baja California.

Species		St. 120.60		St. 120.50		St. 120.45	
		Depth	%	Depth	%	Depth	%
Nematoscelis gracilis	Night	200	75	—		—	
	Day	—		—		400	100
Euphausia mutica	Night	0	99	10	47	0	92
	Day	—		—		—	
Nematoscelis atlantica	Night	10	100	25	100	—	
	Day	—		—		—	
Stylocheiron suhmii	Night	—		—		—	
	Day	100	100	—		—	
Thysanopoda astylata	Night	10	100	500	100	—	
	Day	400	100	—		300	100
Nematobrachion boopis	Night	—		—		—	
	Day	400	100	—		—	
Nematoscelis tenella	Night	100	60	400	72	75	100
	Day	400	100	—		—	
Stylocheiron elongatum	Night	200	100	200	100	—	
	Day	—		200	100	—	
Thysanopoda orientalis	Night	—		—		—	
	Day	—		300	100	300	100

Table 4

Layer (m) of maximal relative abundance of euphausiid postlarvae (juveniles and adults) of tropical species in the Guaymas Basin, Gulf of California.

Species		St. XII		St. XIII	
		Layer	%	Layer	%
Euphausia ditinguenda	Night	0–30	50	—	
	Day	285–420	100	30–60	30
Euphausia eximia	Night	0–30	95	30–60	52
	Day	—		150–285	73
Euphausia lamelligera	Night	0–30	68	60–90	30
	Day	285–420	100	285–420	97
Nematobrachion flexipes	Night	285–420	100	—	
	Day	—		—	

1979). In one station in the Costa Rica Dome (9°N, 89.5°W), only *N. gracilis* and *Stylocheiron* spp. were found in water with oxygen below 0.1 mL/L (Sameoto et al., 1987). Off both coasts of central Baja California, the depletion of oxygen is not so strong as in the ETP and therefore it is not restrictive for vertical ranging of the dominant temperate species (*N. simplex* and *N. difficilis*). The relation between the thermocline and vertical migration was more important.

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