

Diel Vertical Migration of Life History Stages of *Euphausia pacifica*



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INTRODUCTION:

Euphausia pacifica is the dominant euphausiid in the California Current System along the coast of Oregon. Euphausiids are known to exhibit diel vertical migration (DVM) as a predator avoidance mechanism. DVM may also serve as a mechanism to avoid advection off the shelf during upwelling. Depending on the particular current patterns of a productive upwelling zone, individuals may alter the amount of time they spend in surface waters or deeper strata as a retention mechanism. *Euphausia pacifica* develops through 16 life history stages (Egg, 2 Nauplius stages, a Metanauplius, 3 Calyptopis stages, 7 Furcilia stages, Juvenile, and Adult). Knowing which strata of the water column these different life stages occupy through time will facilitate our understanding of euphausiid behavior, possible retention mechanisms, and the role euphausiids play in the diets of predators. Presented here are data that were collected during the Mesoscale/Process cruises of the US GLOBEC NEP program in July/August 2000.

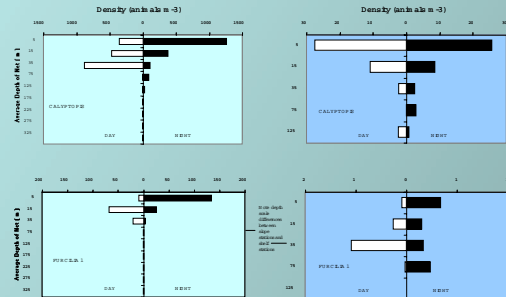
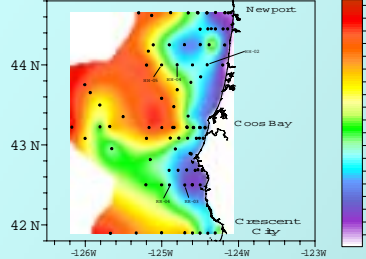
Densities of individual stages of *E. pacifica* in MOCNESS nets.

Densities are averages from multiple stations.

Slope stations are in 500 – 1000 meters of water depth.
Slope stations (HH-05 and RR-04)

Shelf stations are in 100 – 200 meters of water depth.
Shelf stations (HH-02, HH-04, and RR03)

Station locations for the Mesoscale 2000 cruise. Stations that were sampled both during the day and the night are labeled.

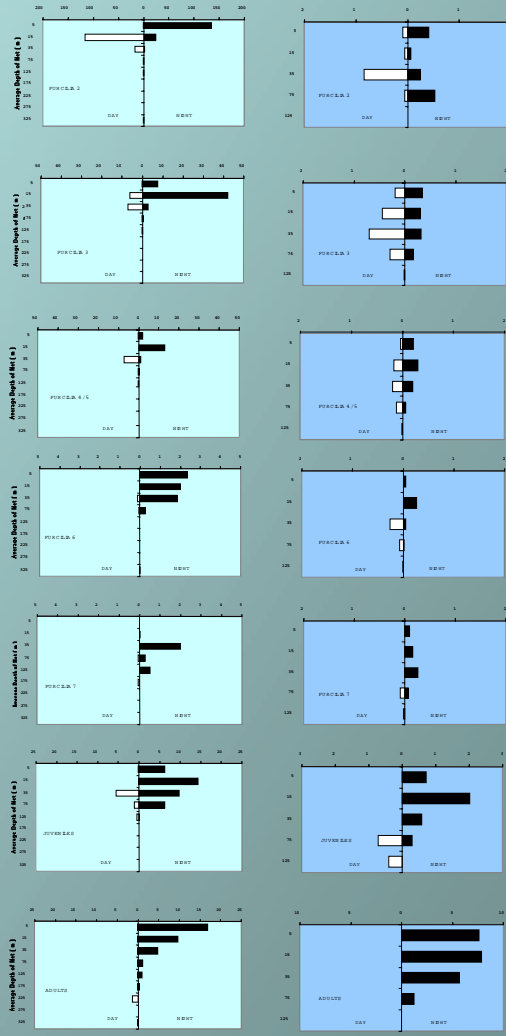
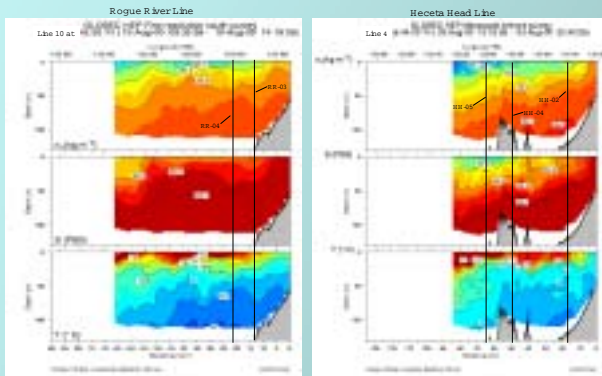


METHODS:

We used a 1 m², 335 µm mesh, MOCNESS (Multiple Opening and Closing Net Environmental Sensing System) equipped with 10 nets to sample stations HH-2, 4, and 5 and RR-3 and 4 during the day and night. Day/Night sample pairs were collected within 10 hours of each other. We fished the net 10 m from the seafloor to a maximum of 350 m at about 2.5 knots. Samples were preserved in 5% buffered formalin. These samples were sorted for all euphausiid species and life stages as well as other zooplankton groups not represented here.

The data from the three "shelf stations" (HH-02, HH-04, and RR-03, water depths of 100 – 200 m) were combined and compared to the data from the two "slope stations" (HH-05 and RR-04, water depths of 500 – 1000 m).

SeaSoar profiles of the Rogue River and the Heceta Head transects with Day/Night station positions labeled. The SeaSoar instrument package was towed behind the R/V *Weconia* as another component of the Mesoscale/Process cruises. The figures show the patterns of water density, salinity, and temperature.



RESULTS / DISCUSSION:

- There is evidence of diel vertical migration of *E. pacifica* as early as the calyptopis stage.

Taki (1998) and Iguchi (1995) also reported DVM by early furcilia stages in the NW Pacific and the Sea of Japan. The magnitude of migration in younger stages is generally only 10-20 meters.

As the animals age, the magnitude of migration increases; adults often move 100-200 m.

The fact that daytime tows often contain no adults suggest that the animals might migrate to below 350 m (the maximum depth of our tows).

When examined individually, 4 stations out of 5 show evidence of DVM by Furcilia 2, 3 out of 5 for Furcilia 1, and 2 out of 5 for Calyptopis.

- For animals older than Furcilia 3, densities were lower during daylight hours than at night.

The lower numbers of animals collected during the day could be due to net avoidance.

These differences could also be partly due to the fact that the older animals have the ability to migrate down out of the range of our collections.

- Our data indicate decreasing densities with increasing age.

This is the standard life history pattern of broadcast spawning marine crustaceans.

When the animals reach the longer-lived stages of juvenile and adult, the densities increase again.

ACKNOWLEDGEMENTS:

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We would like to thank the scientists and crew of the R/V *New Horizon* for sample collection.

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Naoki Iguchi - 1995. Spring Diel Migration of a Euphausiid *Euphausia pacifica* in Toyama Bay, Southern Japan Sea. Bulletin of the Japan Sea National Fisheries Research Institute. No. 45. 59-68.
Kenji Taki - 1998. Horizontal Distribution and Diel Vertical Migrations of *Euphausia pacifica* in Summer in and around a Warm-Core Ring off Sanriku, Northwestern Pacific. Bulletin of Tohoku National Fisheries Research Institute. No. 60. 49-61.

FUTURE STUDIES:

Analyze the effects of life history stage, current velocities, and water depth on DVM magnitude and range.

Work up DVM profiles for other species (*Thysanoessa spinifera*, *T. inspinata*)

Examine other Day / Night sample pairs.

