An Analysis of the Environmental Factors which Influence Gametogenesis, Spawning, and Nutrient Storage in the Sea Anemone *Anthopleura elegantissima* (Brandt, 1835)

By

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AN ANALYSIS OF THE ENVIRONMENTAL FACTORS WHICH INFLUENCE GAMETOGENESIS, SPAWNING, AND NUTRIENT STORAGE IN THE SEA ANEMONE ANTHOPLEURA ELEGANTISSIMA (BRANDT, 1835).

Abstract

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The reproductive biology of the sea anemone Anthopleura elegantissima (Brandt, 1835) was studied for three years at four sites in central California, including the thermal discharge canal of the Pacific Gas and Electric Company's power plant at Morro Bay, San Luis Obispo County, an adjacent control, and two areas at Bodega Bay, Sonoma County.

Histological analysis showed that oogonia arise in the mesenteries of females in the fall. Oogonia are present throughout the year at all sites, showing a peak at the onset of gametogenesis and a decline before spawning. Oocytes grow in the mesoglea through the winter and spring and are spawned in the late summer to early fall each year. Vitellogenesis involves a trophonema. Oocytes do not undergo final maturation divisions until after spawning. Local populations spawn synchronously.

Spermatogenesis proceeds in a manner similar to that described for other anemones, with spermatogonia arising in the endoderm of the male mesenteries, migrating into the mesoglea, and undergoing mitotic divisions. Eventually, spermatocytes are differentiated towards the center of the vesicular lumina, and tailed sperm develop. Although spermatogenesis may take less than a month, mature sperm may be maintained for

more than four months before spawning. The spermatogenic cycle is delayed and compressed in anemones from the thermal outfall site, possibly as a result of the higher temperatures found there.

Large solitary A. elegantissima in the outfall spawn at the same time as the smaller cloning forms; oocytes are of the same size in both types of anemone. Evidence suggests that these large solitary anemones are members of the same reproductive population as the smaller clonal forms. Anemones of both sexes at all sites spawned after the water temperatures had reached their summer maxima.

A. elegantissima stores lipids, as analyzed gravimetrically after ether-extraction, both to provide energy for vitellogenesis and nourishment of sperm, and possibly also to maintain the adults during winter periods of inactivity. There were no differences in lipid storage attributable to size or sex in populations at Morro Bay. The maintenance of lipid levels in A. elegantissima appears to be temperature-dependent.

It is suggested that temperature may be responsible both for cueing spawning and as a factor controlling the amount of lipid deposition, and thus reproductive effort. Variations in annual reproductive output do exist, probably as a result of fluctuations in food availability, or other local events. Photoperiod changes did not affect either lipid storage levels or gamete maturation in laboratory experiments.