

## Two Sea Urchins Found inside the Air Bladder of the Bull Kelp (*Nereocystis luetkeana*)

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WHILE I WAS a scientific observer for the United States aboard a Japanese fishing vessel in the North Pacific Ocean, I observed two sea urchins living within the cavity of the air bladder of the bull kelp, *Nereocystis luetkeana* (Mertens). The sea urchins were identified as *Allocentrotus fragilis* (Jackson) by David Pawson of the Smithsonian Institution (personal communication). The kelp was taken in an otter trawl of the Japanese factory ship stern trawler "Taka-chiho Maru" on April 23, 1965, off Fox Islands in the Aleutians (53°26'N, 166°01'W). I witnessed the discovery of the urchins when a worker cut into the air bladder after picking the kelp from the landing bin. The kelp was intact, and the urchins were dark red and glistened with moisture. No sea water was in the bladder. I acquired the kelp with the urchins still inside and examined the bulb for openings other than the cut made by the worker. No other openings were visible, although some of the top of the kelp bulb broke after the initial cut was made (Fig. 1). The cavity of the bulb did not extend into the stipe, and the opening made by the worker had to be enlarged to remove the urchins.

The urchins were positioned with their oral-aboral axes coincident and perpendicular to the longitudinal axis of the bladder. They were alive and appeared to be in excellent condition. All of the spines were intact and erect, and no spine fragments were found in the cavity of the bulb. It is unlikely that the vessel's crew was playing a trick on me because the sea urchins could not have been placed inside the bulb without a few of the spines breaking off—none were broken until I removed the urchins from the cavity (Fig. 1). The diameters of the tests of the urchins found in the kelp were 65 and 70 mm; the lengths of the spines were about 20 mm. The cavity in the bulb was about 105 by

125 mm, and the thickness of its wall varied from approximately 5 mm on the top (near the blades) to 15 mm at the sides to 20 mm on the bottom (near the stipe).

I assume that the plant bearing the urchins was floating near the surface after having become detached in shallow water and was captured when the net was being set or raised, because the net was fished at approximately 290 m—far below the reported depth range of the kelp. Bull kelp attaches to rocky substrates at depths of 5 to 25 m (Setchell and Gardner, 1925: 624), and is reported from the Shumagin Islands, off the Alaska Peninsula, to Santa Barbara, California. The sea urchin *A. fragilis* is reported from offshore waters along the west coast of the United States at depths of 50 to 1150 m (David Pawson, personal communication), and its test attains a diameter of over 100 mm (Booolootian, Giese, Tucker, and Farmanfarmanian, 1959:370).

The occurrence of the sea urchins inside the kelp air bladder poses some contradictions with published accounts of the life history of the kelp. The kelp sporophyte is thought to be an annual that occurs from February to December (Setchell, 1908:129). If this is true, and the growth rate of *A. fragilis* is similar to that of sea urchins of the genus *Strongylocentrotus*, which are less than 30 mm in diameter at 1 year of age (Kawamura, 1965:23; Kawamura, 1966:7; Ebert, 1967:557), the sea urchins would have entered the bulb sometime after the age of 1 year. On the other hand, if *Nereocystis luetkeana* is a biennial as suggested by Frye (1906:144) or if *Allocentrotus fragilis* could attain a diameter of 60 to 70 mm within a year inside the kelp's bladder, it is possible that the urchins entered through a small opening when they were juveniles—probably when the plant was also a juvenile.

I have been unable to find other accounts of the occurrence of living organisms within the air bladders of kelp, but conditions there may

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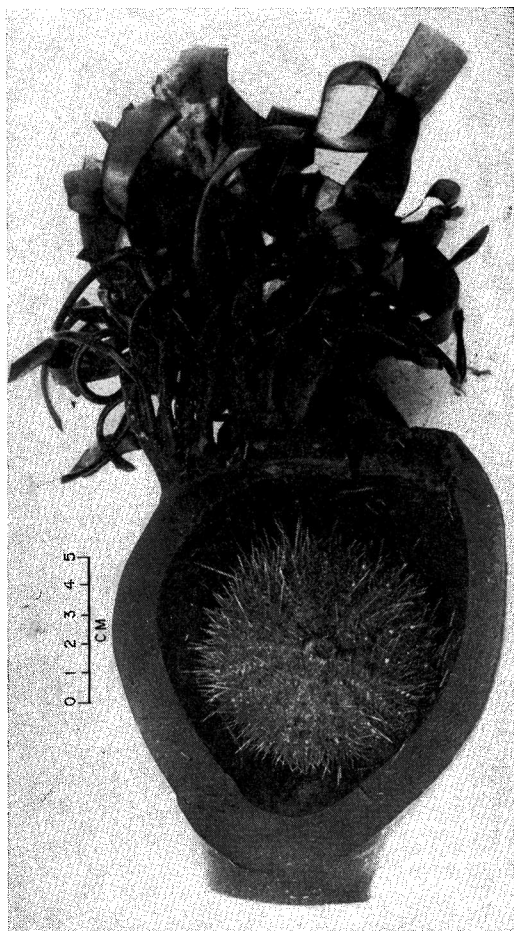


FIG. 1. Longitudinal view of the cavity of the air bladder of *Nereocystis luetkeana*, showing one of two *Allocentrotus fragilis* found inside. The pieces of spines visible in the bladder cavity were broken when the sea urchins were first removed.

not be hostile to sea urchins. Rigg and Henry (1934:364), who examined specimens of *Nereocystis luetkeana*, found the air bladders to be devoid of microorganisms. Langdon (1916:243) found 14.4 to 22.9 percent by volume of oxygen in the bulbs, but he also found 0.4 to 12.2 percent by volume of carbon monoxide. Food was presumably present for the urchins in the form of the inner wall of the bulb—a possible explanation of the bulb's thin wall below its fronds (Fig. 1). Giese (1961:143)

reported that *Allocentrotus fragilis* ingested organic particles, including algal fragments.

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