



Photo credit: © John Hoover.



Figure 1. Three siphon holes of *Lingula reevii* in sand. Photo credit: © Fred Farrell.

Current Status:

KEY INFORMATION

Areas of Concern
Kaneohe Bay, Hawaii.

Year Identified as “Species of Concern”
2004

Factors for Decline

- Habitat degradation and alteration
- Overexploitation
- Pollution
- Sedimentation
- Vulnerable life history
- Limited distribution

Conservation Designations

IUCN: Not Evaluated
Species of Greatest Conservation Need: HI

Demographic and Genetic Diversity Concerns:

The species is rare and is only known to occur in shallow, sandy reef flats in Kaneohe Bay, Oahu, Hawaii, with a few reports from other areas within the bay (Emig 1978). The species has declined in density from 500 per square meter in the 1960s (Worcester 1969) to 100 per square meter (Emig 1981). Recent work shows continuing decline in density to a maximum of 4 *Lingula* per m² (Cindy Hunter, personal communication). Because they are sessile and reproduction involves broadcast spawning, individuals must maintain a sufficient density to ensure successful fertilization of gametes.

Existing Protections and Conservation Actions:

Currently there are no existing protections. Existing conservation actions include developing necessary husbandry techniques to maintain collected specimens at the Waikiki Aquarium (University of Hawaii, Manoa) alive and growing, and eventually determine how to breed captive specimens.

Factors for Decline:

The continued decline may be attributed to decreased organic enrichment from sewage discharge more than two decades ago, as well as the more recent reduction of suitable habitat by the invasion of mat-forming alien algae species.



Species of Concern

NOAA National Marine Fisheries Service

Status Reviews/Research Underway:

In August 2006, NMFS Pacific Islands Regional Office held a workshop in Honolulu for species of concern in the region to gather pertinent information on the species and conservation ideas. These efforts will ultimately lead to the development of a conservation action plan for the species.

Brief Species Description:

Brachiopods (lamp shells) are common as marine fossils and also include about 352 extant species. *Lingula* represents one of the oldest extant genera on Earth. It was once widely distributed, but today exists only in a small area of the Pacific. Members of this genus are found mostly in shallow marine or brackish waters from the intertidal zone to about 66 feet (20 m) depth. Hammen and Lum (1977) found that they can survive a week or more in 18 ppt salinity. Their phylum is included as one of three lophophorate phyla because of its feeding structure, a filtering lophophore; however, it also resembles a bivalve mollusc in possessing a mantle and a calcareous shell with two valves. *Lingula* is an inarticulated brachiopod (its bilaterally symmetrical shell is held together only by muscles and not teeth) that lives within a burrow and feeds on plankton. Davidson's (1888) description of *L. reevii* is as follows: "Shell oblong oval, broadest about the middle, longer than wide, rather narrow; sides very gently curved outwardly, front rounded; posterior edge obtusely acuminate [tapering to a sharp point]; valves moderately convex. Surface smooth, blue-green or emerald and verdigris-green, especially along the middle; peduncle thick, much longer than the length of the shell." The lophophore consists of a fold of the body wall that possesses a crown of ciliated tentacles surrounding the mouth. The lateral cilia create a water current and fine plankton are transported down the tentacles to the brachial groove and into the mouth. They burrow vertically in sand, leaving a three-hole siphonal opening at the surface (Figure 1). When disturbed, a rapid contraction of the pedicle pulls the animal below the surface and these siphonal openings are reduced to a slit (Emig 1987). Emig (1981) found that this species is capable of upward burrowing through a sediment layer, even if the animal has to autotomize (detach) the pedicle (a new one then regenerates).

Lingula has separate sexes, and gametes are shed into the water column for external fertilization. Embryos develop into a free swimming larva that looks like a tiny adult; they develop a shell while planktonic. As additional shell material is laid down, the animal becomes heavy, sinks to the bottom, and takes up its adult existence. There is no metamorphosis in *Lingula*. The lifespan of *Lingula* spp. is estimated to be five to eight years (Emig 1997).



Photo credit: © Fred Farrell.

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