

Lytechinus variegatus (Variegated Sea Urchin)

Order: Camarodonta (Globular Sea Urchins)

Class: Echinoidea (Sea Urchins)

Phylum: Echinodermata (Starfish, Sea Urchins and Sea Cucumbers)



Fig. 1. Variegated sea urchin, *Lytechinus variegatus*.

[http://www.sms.si.edu/irlspec/Lytech_varieg.htm, downloaded 9 March 2016]

TRAITS. Globe-shaped and with five-fold radial symmetry, the variegated sea urchin can exist in different colour morphs such as white, green, purple or red, or as a mixture of those colours. Typically, an adult is 5-8cm in diameter. The exoskeleton is an inflexible theca that is composed of plates that surround the central mouth on the lower (oral) side. The rigid theca encloses and protects the inner organs (Nichols, 1962). The mouth has unique five pyramid-shaped teeth enclosed in a bony structure, called Aristotle's lantern. Short green spines cover the entire surface of the theca (Fig. 1). The hemispherical upper (aboral) side of the theca is copiously covered with small, cup-like tubercles (Hendler et al., 1995). Tube feet emanate from pores in the five ambulacral plates of the theca (Nichols, 1962).

DISTRIBUTION. Common inhabitant of shallow marine water of the Atlantic coast from North Carolina to Brazil, including the Caribbean and Gulf of Mexico (Hammer et al., 2013).

HABITAT AND ACTIVITY. It is a tropical species that inhabits calm, clear and shallow waters. *L. variegatus* is intolerant of polluted and sedimented water. It is not typically found in water deeper than 50m. Commonly found on seagrass or algae beds, sandy or reef sea bottoms and sometimes rock. It is often covered with pieces of debris, which protects the organism from high light intensities of the tropical sun and UV radiation, as well as camouflages it from predators (Sharp and Grey, 1962). A combination of the short spines and tube feet are used for locomotion. Tube feet continuously adhere and release on the substratum to move, and the jointed spines rotate and push against surfaces, aiding the tube feet. The variegated sea urchin performs a range of activities such as digging for protection, moving to find food, and using spines to create water currents (Nichols, 1962). Poisonous pedicellariae (minute pincer-like organs) are used to scare off predators and to paralyse prey.

FOOD AND FEEDING. The species is an omnivore. The variegated sea urchin commonly feeds on large chunks of food that are blade-shaped and flat (Klinger, 1982). It chiefly feeds on marine seagrass such as *Thalassia* sp. and algae. It also feeds on suspended particles such as phytoplankton in water, which are caught by the spines and tube feet (Moore, 1963). The specialised, strong jointed and toothed Aristotle's lantern is used to scrape out algae growing on hard substrates such as rock and to graze on seagrass. The lantern is constantly moving to take in seawater and its suspended food particles (Klinger, 1984). Sharp-toothed and poisonous pedicellariae are used to capture and paralyse prey to enable smooth feeding. The food particles travel into the mouth, down the esophagus and the centre of the lantern and into the elongated intestine (Nichols, 1962).

POPULATION ECOLOGY. The species usually occurs in high densities ranging up to 40/m², uncommonly in even larger densities of 250-600/m² which are referred to as urchin fronts (Hammer et al., 2013). Extrinsic biotic and abiotic factors such as nutrient content and availability, competition, temperature, osmotic condition of marine water and habitat affect the population density of the species. A greater population density is usually found in the seagrass meadows of the tropical marine waters and it is significantly higher in *Thalassia testudinum* seagrass beds than in sand. The high-density urchin fronts can have substantial effects on the seagrass community. The formation of a grazing front can denude thousands of square metres of seagrass. Examples of population densities in the Caribbean include southwest Puerto Rico with a mean density of 18/m², Kingston, Jamaica with a mean density of 20/m² and Brazil showing a mean density of 0.6 m² (Marcia, 2000). Densities of subpopulations of the variegated sea urchin fluctuate with seasons. The small populations found in sandy habitats were associated with low food sources on the sea floor. Large aggregations of immatures are found in all sites, whereas juveniles are usually in the company of adults (Beddingfield, 1997). This species of sea urchin is predated by many species of fish, shorebirds and herring gulls (Randall, 1967).

REPRODUCTION. The species has separate males and females, which release their gametes into the water, where external fertilization occurs. The reproductive cycle is seasonal at higher latitudes (Hammer et al., 2013), the breeding season is between May and July, and spawning occurs throughout summer (Moore, 1963). The fertilised eggs develop into free swimming larvae, morphologically different from the adult and have to undergo metamorphosis. Before spawning,

the gonads increase in size and there is a marked increase in nutrient storage. Reproductive processes such as gonad size, gamete production and reproductive success is highly correlated to nutrient availability. Due to egg laying and external fertilization, there is no parental care (Hammer et al., 2013).

BEHAVIOUR. Larvae are planktonic feeders that swim in search of a substratum to undergo metamorphosis. The substratum is usually determined by chemical stimuli. The larva metamorphoses into a small urchin, which will reach adult size within 1-3 years (Hammer et al., 2013). Adult sea urchins have a covering behaviour (Fig. 2). The urchins cover their aboral theca with debris, seagrass, or dig into sediment due to photosensitivity. The objects protect the body from strong light intensities and UV radiation (Millott, 1956).

APPLIED ECOLOGY. The eggs of *L. variegatus* are used to study the functions of chemicals and proteins in external fertilization (Bachman and McClay, 1995). Due to its rapid growth, the species is used in small-scale aquaculture as a source of food. The gonads are eaten and thus, urchins with large gonads and high quality are cultured (Hammer et al., 2013). This species has not yet been assessed for the IUCN Red List.

REFERENCES

- Bachman, E., McClay, D. (1995). Characterization of moesin in the sea urchin *Lytechinus variegatus*: redistribution to the plasma membrane following fertilization is inhibited by cytochalasin B. *J. of Cell Sci.* **108**:161.
- Beddingfield, S. D. (1997). The nutrition, growth, reproduction and population dynamics of *Lytechinus variegatus* (Lamarck) from contrasting habitats in St. Joseph's bay, Florida. *ProQuest Dissertations and Theses.* 187-187.
- Hammer, H., Powell, M., and Watts, S. (2013). Species Profile: Sea Urchins of the Southern Region, <http://fisheries.tamu.edu/files/2013/09/SRAC-Publication-No.-7211-Species-Profile-Sea-Urchins-of-the-Southern-Region>, downloaded 9 March 2016.
- Hendler, G., Kier, P.M., Miller, J.E., Pawson, D.L. (1995). *Sea Stars, Sea Urchins, and Allies: Echinoderms of Florida and the Caribbean*. Washington: Smithsonian Institution Press.
- Klinger, T.S. (1984). Feeding of a marine generalist grazer: *Lytechinus variegatus* (Lamarck) (Echinodermata: Echinoidea). Unpublished PhD thesis, University of South Florida, Tampa.
- Klinger, T.S. (1982). Feeding rates of *Lytechinus variegatus* Lamarck (Echinodermata: Echinoidea) on differing physiognomies of an artificial food of uniform composition. In: Lawrence, J.M., editor. *Echinoderms: Proceedings of the International Conference, Tampa Bay, Netherlands: A.A. Balkema* p 29-32.
- Marcia, S. M. (2000). The role of the sea urchin *Lytechinus variegatus* in the community ecology of seagrass beds. *ProQuest Dissertations and Theses.* 129-129.
- Millott, N. (1956). The covering reaction of sea urchins. 1. A preliminary account of covering in the tropical echinoid *Lytechinus variegatus* (Lamarck), and its relation to light. *J. Exp. Biol.* **33**:508
- Moore, H.B., Jutare, T., Bauer, J.C., Jones, J.A. (1963). The biology of *Lytechinus variegatus*. *Marine Sci.* **13**:23-53.
- Nichols, D. (1962). *Echinoderms*. London: Hutchinson & CO LTD.
- Randall JE. (1967). Food habits of reef fishes of the West Indies. *Inst. Mar. Sci. Univ. Miami. Studies in Tropical Oceanog.* **5**: 665-847.
- Sharp, D. T., & Gray, I. E.. (1962). Studies on Factors Affecting the Local Distribution of Two Sea Urchins, *Arbacia Punctulata* and *Lytechinus Variegatus*. *Ecology.* **43**:309-313.

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Posted online: 2016



Fig. 2. *Lytechinus variegatus* covering itself with fragments of algae and other debris.

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