Diadema antillarum (Long-spined Black Urchin)

Order: Diadematoida (Hollow-spined Sea Urchins)
Class: Echinoidea (Sea Urchins)
Phylum: Echinodermata (Starfish, Sea Urchins and Sea Cucumbers)

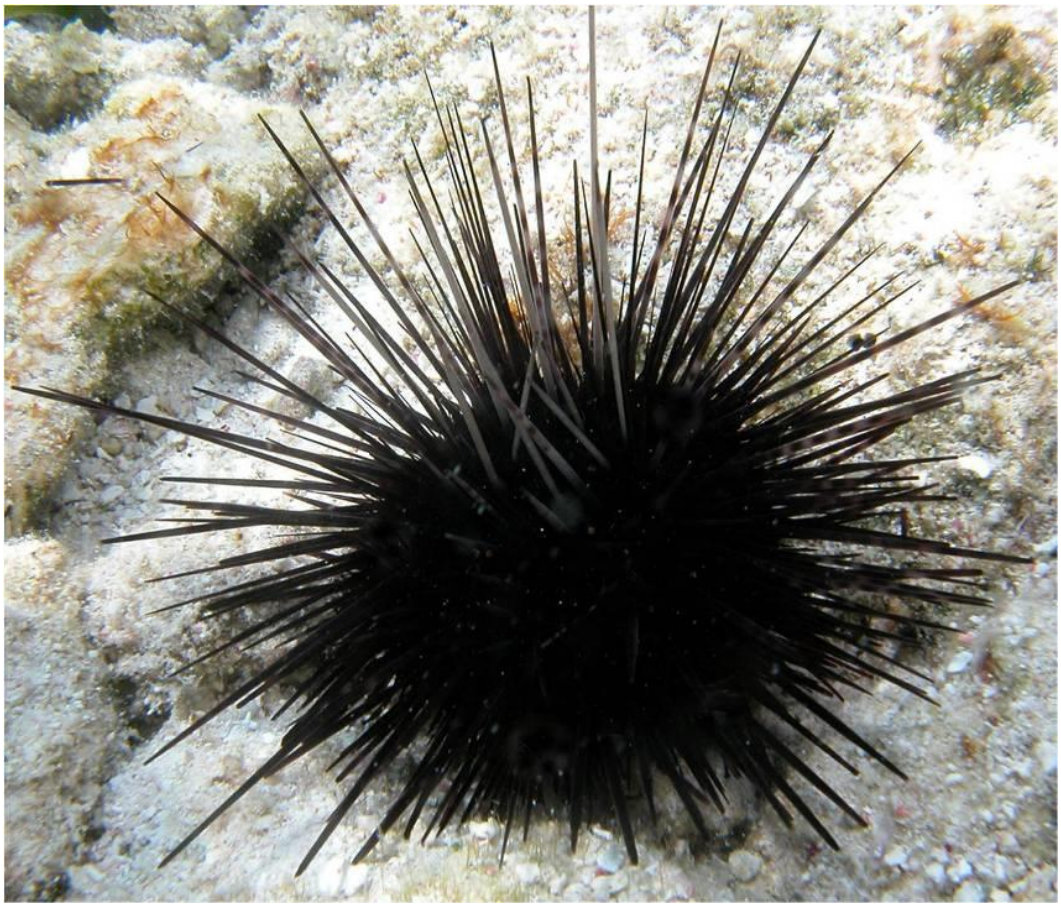

Fig. 1. Long-spined black urchin, *Diadema antillarum*.

[http://blogs.haverford.edu/hkwlab/files/2012/07/Diadema-antillarum.jpg, downloaded 3 March 2016]

TRAITS. The body of the sea urchin is round in shape, and illustrates a pentameric type of radial symmetry (five-fold arrangement). Possesses a rigid internal body skeleton called a test, covered with long movable spines. Adults can reach up to 5cm in diameter, with long, needle-sharp, thin spines that are easily broken and are up to 30cm in length (Nicole and Cookie, 1971) (Fig. 1). The spines of adults are dark coloured, whereas those of juveniles are checkered having alternating white and purple bands. The body is also covered with tube feet for feeding, mucous production, locomotion and breathing (Randall et al., 1961).

DISTRIBUTION. Found in the western Atlantic from Florida, the Gulf of Mexico extending to the Yucatan Peninsula, the West Indies, along the north coast of South America to Suriname. It is also present in Bermuda, the Azores, the Canaries, Cape Verde Islands, Madeira, and the Gulf of Guinea in the eastern Atlantic (Ogden and Carpenter, 1987).

HABITAT AND ACTIVITY. They inhabit coral reefs, at a depth range of 0-400m and are herbivorous. Juveniles reside beneath rocks and crevices. Their diet mainly comprises of algae that are in a competitive interaction with the corals. They aid in coral settlement and expansion by cleaning up the surface of the coral, decreasing competition with macroalgae (seaweed) for site settlement (Keller, 2016). There is an inverse correlation between *D. antillarum* and macroalgae; in the absence of *D. antillarum*, there is a replacement of encrusting algae by macroalgae, which are not eaten by other herbivores. Those which live at the margins of reefs travel at night into the surrounding beds of seagrass and produce bare "halos" next to reefs by eating algae and seagrasses. Juvenile reef fish and juvenile spiny lobsters take shelter in the spines. Two uncharacterized species of palaemonid shrimps are present among the spines, living as commensals. They are mostly active during the night. During the day, they may hide in crevices within the reef (Fig. 2) or occur in large aggregations in clear areas. They are able to predict the level of protection that a crevice can provide against predators. Low-quality crevices are vacated more quickly than high-quality crevices. In the evening, activity and foraging begins and continues until dawn. In areas, where predators are scarce, they are observed to be active during the day (Ogden and Carpenter, 1987).

FOOD AND FEEDING. They are grazers (Fig. 3) and spend most of their time in the removal of the reef's hard surface and the ingestion of plants combined with coral rock; 5kg of carbonate sediments per square meter per year is produced by an average population of $10/m^2$; equivalent to about 1cm of reef erosion per year. Individuals return to the normal place of protection during the day after nightly feeding attempts. The areas near home crevices that have been grazed the previous night are not grazed. In this manner, their food intake is maximized in relation to algal production (Ogden and Carpenter, 1987).

POPULATION ECOLOGY. Beginning in Panama in 1983 and moving throughout the Caribbean, there has been a 90% reduction in the population of *D. antillarum* as a result of a type of mass mortality. The mortality advanced rapidly through the types of surface currents to Cayman, Jamaica, Mexico, Bermuda and Florida. Deaths were recorded throughout South America's north coast and Lesser Antilles; mortality due to pathogen (Ogden and Carpenter, 1987). *D. antillarum* is currently recovering in Jamaica, one of the few places in the Caribbean, which may be as a consequence of the overfishing of predatory species of fish at the Jamaican reefs. In the Florida Keys, the species has a low density because of high fish populations (Keller, 2016). The high predation pressures demands the sea urchins obtain daytime hiding areas, and thus a habitat factor is introduced into the control of the population sizes of *D. antillarum* (Ogden and Carpenter, 1987).

REPRODUCTION. Certain populations of *D. antillarum* demonstrates congregation during the breeding period. The lunar calendar dictates the time of breeding; eggs and sperm are discharged per lunar month. Breeding season relies on temperature, thus breeding may take place at different times in different hemispheres depending on the occurrence of the warm season. Eggs and sperm are discharged into the water where fertilization occurs and formation of larval echinoplutas. Eggs become the largest during the months that breeding occurs (Puckett, 2002).

BEHAVIOUR. In the appearance of a shadow, the spines of the urchin are waved in the shadow's direction and it moves away from the shadow, to an area more suitable for protection.

D. antillarum can sense the presence of predators. It is unknown how they are able to communicate with each other in order to aggregate (Fig. 4) when a predator is present (Encyclopedia of life, 2016).

APPLIED ECOLOGY. The major threat to *D. antillarum* is uncontrolled sedimentation coming from cleared lands or dredging; more tolerant than corals, but will disappear from heavy areas of sedimentation. Abrasion, smothering and cutting off light necessary for algal growth are caused by sedimentation. The death of *D. antillarum* affects the marine life biodiversity of the coral reefs, thus affecting tourism in many small countries. Action: Research on the growth of urchins in the lab and their relocation. Conservation of the coral reefs stimulates *D. antillarum* repopulation.

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Fig. 2. *D. antillarum* seen hiding in crevices within the reef during the day.
[http://www.ericjsimon.com/belize/index_files/image055.jpg, downloaded 5 March 2016]

Fig. 3. *D. antillarum* grazing the surface of a coral reef.
[https://www.google.tt/search?q=diadema+antillarum+feeding, downloaded 5 March 2016]

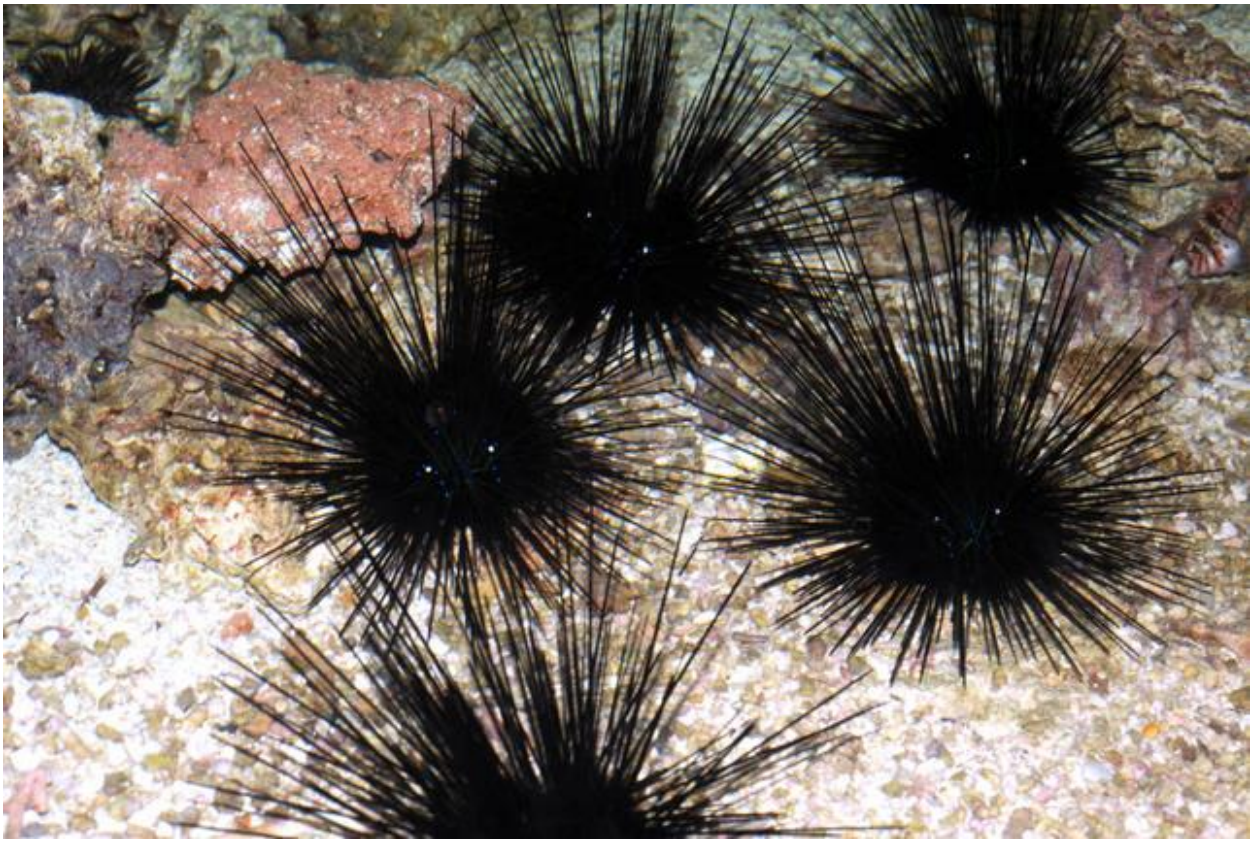

Fig. 4. Antipredator behaviour of *D. antillarum.*

[https://www.google.tt/search?q=diadema+antillarum+feeding, downloaded 5 March 2016]