Perna viridis (Asian Green Mussel)

Order: Mytiloida (Mussels)
Class: Bivalvia (Clams, Oysters and Mussels)
Phylum: Mollusca (Molluscs)

Fig. 1. Asian green mussel, *Perna viridis*.

[http://www.jaxshells.org/n6948.htm, downloaded 3 April 2015]

TRAITS. *Perna viridis* is a large species of mussel which ranges from 8-16 cm in length. There is no sexual dimorphism as regards their size or other external traits. The shell is smooth and elongated with concentric growth lines. The shell tapers in size as it extends to the anterior (Rajagopal et al., 2006). The ventral margin (hinge) of the shell is long and concave. The periostracum, a thin outer layer, covers the shell. In juveniles, the periostracum has a bright green colour. As the mussel matures to adulthood, the periostracum fades to a dark brown colour with green margins (Fig. 1). The inner surface of the shell is smooth with an iridescent blue sheen (McGuire and Stevely, 2015). The posterior adductor muscle scar is kidney shaped. There are interlocking teeth at the beak. The left valve has two teeth while the right valve has one tooth. The foot is long and flat and specially adapted for vertical movement. The ligamental ridge (hinge) is finely pitted (Sidall, 1980).

DISTRIBUTION. They originated in the Indo-Pacific region, mainly dispersed across the Indian and southern Asian coastal regions (Rajagopal et al., 2006). It is an invasive species that has been introduced in the coastal regions of North and South America, Australia, Japan, southern United States and the Caribbean, including Trinidad and Tobago (Fig. 2). Distribution occurs via the sea currents and ballast tanks of ships carrying larvae, or adults attached to the hull of ships (Gobin et al., 2013).

HABITAT AND ACTIVITY. They are found in coastal regions at depths less than 10m. They are commonly found in intertidal, subtidal and estuarine habitats. It thrives in areas of salinity ranging from about 18-33 ppt (parts per thousand) and temperature ranging from 10-42°C. They anchor themselves to rocky surfaces, bridges, ships and other hard substrata by producing attachment fibers called byssus threads (McGuire and Stevely, 2015). They settle in areas of high water flow and can withstand turbid waters. They actively draw in and pump out water through their siphons. They are nocturnal as they are mostly active at night (Robson et al., 2010).

FOOD AND FEEDING. They are sessile bivalve filter feeders. Its diet consists of mainly microscopic phytoplankton, zooplankton and suspended organic detritus in the water. The mussel uses gills and ciliary-mucus mechanisms to feed on suspended food in the water. Securely attached to a hard substrata, the mussel uses its inhalent siphon to actively draw in water. The water is pumped through the gill filaments. The appropriately sized organic food particles in the food-laden water are filtered out and entrapped by cilia. The water and sediment particles are discharged through the exhalent siphon. The cilia transfers the organic food particles to the labial palps. The labial palps manage how much food enters the mouth and reject excess food particles as psuedofaeces (Rajagopal et al., 2006). The rapid consumption of phytoplankton through active suspension feeding increases the clarity of the water. Their diet is influenced by fluctuations in temperature, light intensity, concentration and composition of their food supply and wave action. To deal with these changes, various coping mechanisms have been developed such as the production of psuedofaeces and the regulation of the rate of feeding and enzymatic activity (Wong and Cheung, 2003).

POPULATION ECOLOGY. They grow rapidly in dense colonies. They form dense populations on a range of hard substrata such as ships, buoys and pipes in midlittoral and sublittoral regions. The population densities as great as 39,500 individuals per square metre have been recorded. The population density is influenced by the availability of food, environmental conditions and presence of other species. The exact number varies depending on location. In Tampa Bay, the population density varied from approximately 3,600-4,100 individuals per meter square according to location. They may grow in layers of mussels as was observed in the Little Manatee River where the population density ranged from 9,000-12,000 individuals per square metre (Rajagopal et al., 2006). In many areas, including Trinidad and Tobago the population density pattern is described as isolated and patchy along the coast (Gobin et al., 2013). Because of its range of tolerance to pollution and environmental conditions, it is common species and has a lifespan of approximately 2-3 years (Gobin et al., 2013).

REPRODUCTION. They are a dioecious species and have separate sexes, but males and females cannot be distinguished based on their external features. Occasional hermaphroditism occurs in less than 0.1% of the population (Lee, 1988). The males have white gonads while females have bright red gonads. Fertilization occurs externally. During spawning, streams of female and male gametes are released into the water. Many eggs are produced, but few are fertilized. Several sperm surround the egg but only one fertilizes it, forming a circular shaped zygote. A free swimming larva is formed 7-8 hours after fertilization. Many eggs and larvae are lost due to predation. The shell begins to form enclosing the soft tissue after 16-19 hours. The larva remains in the water for up to 10-12 days, after which it undergoes metamorphosis where it changes to a juvenile and

attaches to a hard substrate. They achieve sexual maturity at about 2-3 months old (Rajagopal et al., 2006).

Either sex may induce spawning. Spawning may also be initiated due to a decrease in the salinity level of the water or spawning by other organisms. Environmental factors such as the availability of food, salinity and water temperature influence the duration and timing of the breeding periods. Generally, there are two main spawning periods, one during the early months of spring and the other during the late months of autumn. This is because water temperatures and plankton population increase while salinity decreases during these months. In tropical areas however, the environmental conditions remain relatively constant and so breeding periods remain consistent throughout the year (Rajagopal et al., 2006).

BEHAVIOUR. They increase the thickness of their shells in the presence of predators such as crabs and whelks to prevent them from reaching their soft inner tissue. The adductor muscle increases in size to close tightly to prevent against predators. They also increase the production of byssus threads to firmly anchor itself to a surface, preventing predators from detaching or removing them (Wong and Cheung, 2003). They have sensors that detect chemical changes in the water. They are sensitive touch and temperature. They tightly close their shell if they are disturbed (Wong and Cheung, 2003).

APPLIED ECOLOGY. *Perna viridis* has not been assessed for the IUCN Red List. It is an invasive species that has impacted negatively the native species in the environment. It grows rapidly and out-competes native species for food and space, modifying ecosystems. This negatively affects the fishing industry. In Australia, it is deemed a pest as its rapid growth causes biofouling on ships, industrial plants and other man made structures and can cause clogging of pipes and intakes (Fig. 3). In the Indo-west Pacific region, it is harvested as a source of food. Human consumption is discouraged however as they bioaccumulate toxic substances which can cause serious health issues in humans (McGuire and Stevely, 2015)

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Fig. 2. Asian green mussel geographic distribution.

[http://www.cabi.org/isc/datasheet/70090, downloaded 18 January 2015]

Fig. 3. Fouling of a power plant filter by Asian green mussels.

[http://edis.ifas.ufl.edu/LyraEDISServlet?command=getImageDetail&image_soid=FIGURE%201&document_soid=SG094&document_version=40189, downloaded 3 April 2015]

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