

## *Panulirus argus* (Caribbean Spiny Lobster)

Order: Decapoda (Shrimps, Lobsters and Crabs)

Class: Malacostraca (Crustaceans: Shrimps, Sand-hoppers and Woodlice)

Phylum: Arthropoda (Arthropods)



**Fig. 1.** Caribbean spiny lobster, *Panulirus argus*.

[<http://www.bbc.co.uk/nature/13780718>, downloaded 18 March 2015]

**TRAITS.** *Panulirus argus* has a carapace of a sub-cylindrical shape which has numerous long front-facing spines, and rostral horns point forward over the stalked compound eyes located at the front of the head (Crawford and De Smidt, 1922) (Fig. 1). Their characteristic whip-like antennae project from the head and are lined with setae (hairs) and spines, and the antennules are approximately two thirds of the carapace length. The abdomen has notches along the lateral margins but the rest is smooth and flat (Holthuis, 1991). The body colour can range from tan or grey, spotted with brown, black, green, red or purple spots (Crawford and De Smidt, 1922). The legs are striped in a dull blue colour, they have orange or black pleopods (swimming legs) (Calinski and Lyons, 1983). In juveniles, a wide white line follows the middle of the purplish body (Eldred et al., 1972; Kanciruk, 1980). Adult lobsters have white, yellow or brown stripes on the tail fans (Seudeal, 2013). Spiny lobsters are sexually dimorphic (Marx and Herrnkind, 1986). Males tend to have longer carapaces; the sternum is broader than in females and it has less to none of the striations found on females (Marx and Herrnkind, 1986). Males have raised genital openings on the base of the abdomen and females have gonopores (Marx and Herrnkind, 1986).

**DISTRIBUTION.** *Panulirus argus* live in coastal marine environments in the western Atlantic tropical and sub tropical waters from North Carolina, USA (including Bermuda) to Rio de

Janiero, Brazil and their abundance is also seen in the Gulf of Mexico, the West Indies and the Caribbean (Williams, 1984) (Fig. 2). They are native to Trinidad and Tobago (Butler et al., 2013).

**HABITAT AND ACTIVITY.** *Panulirus argus* inhabits marine ecosystems in undisturbed, shallow tropical and sub-tropical waters up to 90m in depth (Seudeal, 2013). They have nocturnal habits in foraging hence they stay hidden during the day (Cox et al., 1997). They hide in protective reef recesses, overhangs, ledges, reef crevices and generally any breaks in hard substrates in undisturbed areas (Fig. 3) (Marx and Herrnkind, 1986). Different life stages are habitat specific. Phyllosome larvae are the oceanic planktonic phase that inhabits the photic (sunlit) zone of open water (Marx and Herrnkind, 1986). The puerulus post-larval stage inhabits near-shore estuarine habitats but prefers to settle in plant-covered substrate like sea grasses (Marx and Herrnkind, 1986). Red alga *Laurencia* species are important to them (Seudeal, 2013). The early benthic stages utilize mangrove creeks and vegetated shallow water (Marx and Herrnkind, 1986). The older juveniles utilize sea grass and oyster reefs and sub-adults migrate to shallow banks and near-shore waters, adults utilize hard-bottom patch reefs and coral reefs and they use soft-bottom sea grasses when migrating (Marx and Herrnkind, 1986, Herrnkind, 1980).

**FOOD AND FEEDING.** They are nocturnal foragers and are omnivorous (Cox et al., 1997). They feed on carrion from fish, molluscs, echinoderms, marine invertebrate, detritus, marine and aquatic worms, aquatic crustaceans and macro algae (Seudeal, 2013). Feeding involves using the front legs to move the food to the mandibles where the food is crushed (Seudeal, 2013). The larval stages prefer planktonic marine organisms as food. Spiny lobsters have a complex nervous system which allows them to differentiate and identify food odours (Olsen et al., 1975). The antennules are studded with chemoreceptive setae and the legs, mouthparts and second antennae assist in food acquisition (Seudeal, 2013).

**POPULATION ECOLOGY.** Spiny lobsters are usually the top carnivores in their benthic community (Kanciruk, 1980, Marx and Herrnkind, 1986). They are gregarious and migratory in nature (Cruz et al., 2007). Their life cycles consist of 5 phases associated with size and not necessarily age (Olsen et al., 1975). Lobsters begin to migrate at the size of 70-80mm when they are at sexual maturity; when migrating, more females than males participate and select deeper waters (Marx and Herrnkind, 1986). They show den sharing behaviour and aggregate together to ward off predators (Frisch, 2008). Mating is polygynandrous (Seudeal, 2013). The larval and post-hatch stages live solitarily and independently in sea grass beds but juvenile to adult stages aggregate as groups in dens on harder substrates (Marx and Herrnkind, 1986). Males show no dominance based on size and individual size does not play a part in den inhabiting (Williams, 1984). They are widespread and abundant in their habitat (Marx and Herrnkind, 1986). The lobsters can range in weights from 0.5-4.5kg and can grow up to sizes of 45cm in length with a population average of 20cm (Seudeal, 2013). In the wild they can live for up to 20 years (long lived) with an average age of 12 years and both sexes reach sexual maturity post hatch in approximately 2 years (Seudeal, 2013). The female gestation period is 1 month (Seudeal, 2013). They moult their exoskeleton to permit growth, moulting is based on their locality and generally decreases in frequency as they age (Marx and Herrnkind, 1986). They are preyed upon by a wide range of predators including triggerfish, nurse sharks, rays, sea turtles and humans (Seudeal, 2013).

**REPRODUCTION.** Courtship involves signals given by both sexes, after which mating/copulation occurs (Marx and Herrnkind, 1986). Mating is seasonal, influenced by the location of the population (Seudeal, 2013). The male holds the female in sternum-sternum contact and releases the spermatophore which remains attached to the female sternum until spawning where the female extrudes eggs on its abdomen (Lipcius et al., 1983, Seudeal, 2013). The female scratches the spermatophore for external fertilization of the extruded eggs (oviparous) (Lipcius et al., 1983). One male can mate with many females in the season (polygynandrous) while females mate with one male in one or more reproductive events (Lipcius et al., 1983, Seudeal, 2013). Females can produce 500,000-2,000,000 eggs once or twice each season (Seudeal, 2013). Fecundity is based on female body size (Williams, 1984). Males do not exhibit any parental care and females provide protection in pre-fertilization and pre-hatching stages but from the larval stages the young are independent (Seudeal, 2013, Marx and Herrnkind, 1986). The larvae hatch as leaf shaped phyllosoma that and undergo 11 distinct stage changes by metamorphosis into pueruli which resemble adults but are colourless and possess no calcified exoskeleton and after 6 months they metamorphose into juveniles (Marx and Herrnkind, 1985).

**BEHAVIOUR.** They use their antennae and antennules to detect olfactory cues as chemical signals (Ache et al., 1976). Most of the sensory activity is done using the long setae-studded antennae for migration, mating, socializing, hunting and defence (Ache et al., 1976; Hallberg et al., 1997). Their compound eyes can sense light, colour and movement (Seudeal, 2013). When migrating they can sense magnetic fields to locate other lobsters and familiar places (Seudeal, 2013). When threatened by predators screeching sounds are made by scraping the antennae against the plates around the bottom of the eyes (Roach, 2004). They can also upturn their tails to change direction and move rapidly in open areas (Seudeal, 2013). They form long lines when migrating to ward off predators and form rings to defend against attack using their spines to create a phalanx (Figs 4 and 5) (Seudeal, 2013). Juveniles exhibit group behaviours in shelter and foraging similar to adults (Childress and Herrnkind, 1996). The younger stages are more solitary and independent due to the absence of parental care (Childress and Herrnkind, 1996).

**APPLIED ECOLOGY.** *Panulirus argus* is listed by the IUCN under the list of threatened species where it is categorized as data deficient but it has a recognized as having a decreasing population in its distribution (Butler et al., 2013). It is harvested as a food source throughout its geographic range and is over-exploited. It is also under threat from PAV1 disease which affects an estimated 1 in 4. In order to conserve the species, there is a size limit in harvesting, a harvesting season and a prohibition in taking berried females (with eggs) (Butler et al., 2013).

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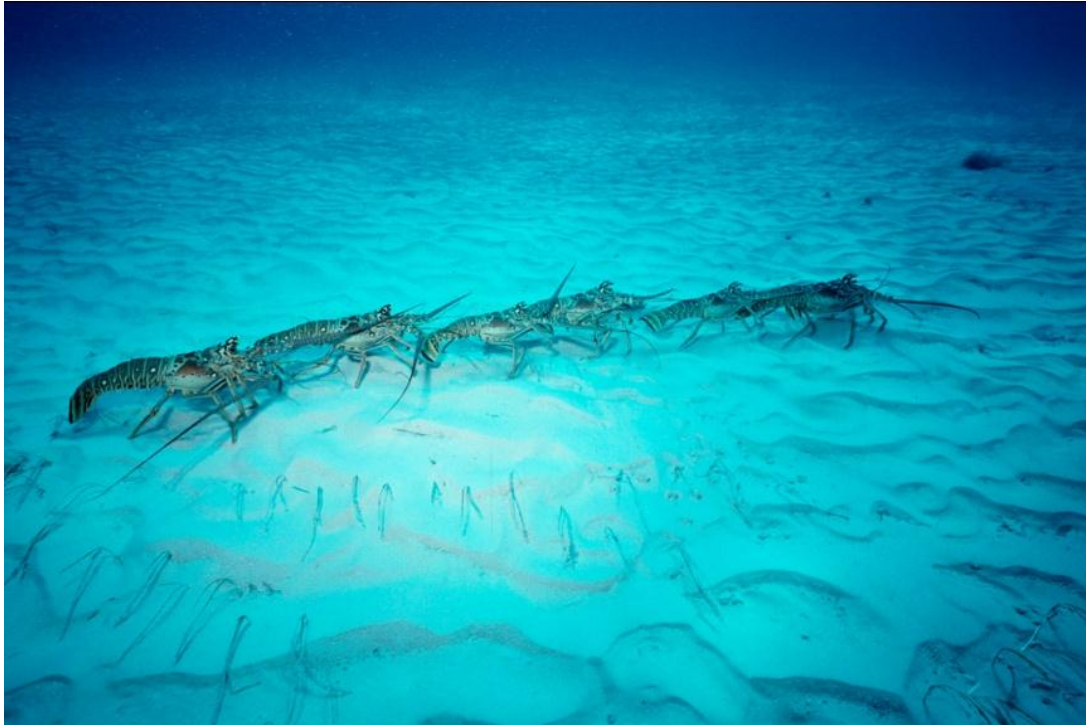
**Fig. 2.** Geographic range of *Panulirus argus*.

[<http://www.iucnredlist.org/details/full/169976/0>, downloaded 27 March 2015]



**Fig. 3.** Migration line and defensive ring behaviour.

[<http://arthropoda.southernfriedscience.com/?p=2231>, downloaded 27 March 2015]



**Fig. 4.** Migratory line behaviour using antennae to maintain formation.

[[http://www.norbertwu.com/nwp/subjects/spinylobsters\\_web/gallery-01.html](http://www.norbertwu.com/nwp/subjects/spinylobsters_web/gallery-01.html), downloaded 27 March 2015]



**Fig. 5.** Spiny lobsters aggregated in a hidden den.

[<http://www.ashleyhauck.com/blog/catalina-dive-sites-two-harbors/>, downloaded 27 March 2015]