# *Pomacanthus paru* (French Angelfish)

Family: Pomacanthidae (Angelfishes)
Order: Perciformes (Perch and Cichlids)
Class: Actinopterygii (Ray-finned Fish)

**Fig. 1.** French Angelfish, *Pomacanthus paru.*

[http://www.iphotoscrap.com/scrap.view.php?q=French+Angelfish&ap=0&df=4,
Downloaded 11 November 2011]

**TRAITS.** Seen either alone or more commonly in pairs (Fig. 1), it is an inquisitive fish, often approaching divers and snorkelers. Some specimens are exceedingly tame. Fishes grow to a length of 12-15'' with deep compressed bodies, small mouths with brush-like teeth, continuous dorsal fins. Scales are small, extending onto the median fins, they also possess a prominent yellow tipped spine at corner of the preopercle. Overall colour is black with a grayish blue face, body scales black, rimmed with yellow. A yellow bar at the pectoral fin base distinguishes *P. paru* from the similar Grey Angelfish (*Pomacanthus arcuatus*). Near-adult fishes still partially show vertical yellow bands from their juvenile stage (Fig. 3), however these bands are absent in full adults. Juveniles are more commonly seen in shallow waters. Coloration quite different from

adults, juveniles are almost black in colour, with three prominent vertical yellow bars (Fig. 2). The tail fin is rounded, whereas the very similar juvenile *P. arcuatus* has a square cut tail fin.

**ECOLOGY.** Found in and around coral reefs of the tropical Western Atlantic Ocean, they are diurnal and usually seen in pairs, although they do occur solitarily. French angelfish are among the least fearful of reef fish, occurring up to depths of 100m they are quite territorial (Lieske & Myres, 1996). Feed mainly on sponges, as well as tunicates, bryozoans, zoantharians, gorgonians and algae. Extensive overlap in habitat and diet has been seen with *Holocanthus tricolor*, *P. arcuatus* and *P. paru* in the Virgin Islands, however no interspecific agnostic behavior has been observed (Hourigan et al. 1989). Juveniles act as cleaners for larger fishes such as wrasses, morays, grunts, snappers, surgeonfishes etc. feeding off ectoparasites. This service is quite important in maintaining the health of reef fish.

**SOCIAL ORGANIZATION.** Usually occur in pairs, monogamous (having one mate for life), diurnal and territorial (Lee & Dooley ,1998). A study at the Salt River Submarine Canyon, St. Croix, U.S. Virgin Islands showed that 0.21 *P. paru* per $1000m^2$ were observed in 1981 and 0.31 *P. paru* per $1000m^2$ for 1982 (Hourigan et al., 1989). Pair members are equally matched in size and spend approximately 50% of their time together (Hourigan et al., 1989). Sometimes carouselling can be observed between members of a pair. French angelfishes are monogamous and will stick with its mate until death. Unlike *Holocanthus tricolor, P. paru* are gonochoristic (females donot have the ability to change sex in the absence of males) therefore, for females, no advantage is gained by allowing other females into their territory. Likewise, males gain no advantage by allowing other males into their territory. Pairs actively defend their territories against members of the same species by chasing or charging other pairs or individuals.

They are quite active during the day, emerging at dawn from their nighttime shelters in search of food. Divers and snorkelers have no problems approaching these fish as they are quite inquisitive, often approaching observers. It was observed that *P. paru* occupied large intraspecificaly exclusive territories, often having bands of contiguous occupied regions, occurring at depths of shallow, medium and deep. No aggression is usually shown to other species of angelfish such as *Holocanthus tricolor* or *P. arcuatus*, and often interspecific territories overlap (given resources are not limiting). Breeding pairs have been known to defend territories of up to $5000m^2$ (Hourigan et al. 1989). Juveniles are not found within the home range of adult pairs, they are chased away on sight and therefore occur more commonly in shallow waters. *P. paru* is popular in the aquarium trade, mostly juvenile specimens are collected. Territoriality is increased however in a smaller tank environment, therefore individuals display aggression toward other fishes especially angelfishes in order to defend its tank territory.

**ACTIVITY.** *P. paru* are usually found in back reef, fore reef and drop-off zones, but prefer rocky bottom reefs which provide shelter. Due to their thin, disk shape they can easily manoeuvre into cracks and crevices to feed or avoid predation. They swim 1-3 m above the substratum, allowing for minimal interference with the bottom topography (Hourigan et al. 1989). Covering wide areas, they spend little time sheltering during the day, also frequenting cleaning stations where various fishes and shrimp remove ectoparasites. Juveniles tend cleaning stations, removing ectoparasites from larger fishes, however, when they come in contact with adults, juveniles are chased away. For this reason, they occur mainly in shallow, protected waters, away from adult territories.

**FORAGING BEHAVIOUR.** *P. paru* feeds on a wide variety of sponges, as well as algae, gorgonians and tunicates (to a lesser extent). Their feeding rate is approximately 2.99 bites per minute (SD. 2.0) with a large percentage of these bites concentrated on sponges, and to a lesser extent algae (Hourigan et al. 1989). Preference in the species of sponge may vary in different reefs across the Caribbean, depending on species abundance of sponges. Gorgonians are consumed to a much lesser extent, and though they may not contribute substantially to the animal's caloric intake, it is believed that they provide essential nutrients to the fish (Hourigan et al. 1989). Juveniles feed mainly on algae detritus and also ectoparasites which are cleaned off larger fish (Fig. 4).

**COMMUNICATION.** Adults display aggression in defending their territories from interspecific competition. Chasing and charging are the two main forms of territorial aggression. Neighbouring pairs are kept in check by being chased away if they encroach on another's home ground. Wandering bachelors and bachelorettes are also chased away as they pose a threat to pairs. If a member of the pair wanders off for a long period of time, upon return to its partner, a carouselling behavior is often observed, where couples circle each other in a rapid manner. This activity is said to increase bonding within a pair (OCEANA 2011).

Juveniles are not located in vicinity of adults, if they manage to find themselves within an adult territory, they are vigorously chased away upon sighting. They set up cleaning stations at prominent locations, making it easy for clients to spot. Before a cleaning event, juveniles swim in a fluttering motion indicating that they are available for cleaning (Humann & de Loach, 2002). During the session they brush their pelvic fins against the client, as a form of saying "I'm still working".

**SEXUAL BEHAVIOUR.** Some species of fish display monandric protogyny, where all males start off as females. In this strategy, a male controls a harem of females, all smaller in size, if the male disappears however, it would be advantageous for the largest female to turn into a male and control the harem (Hourigan et al. 1989). French angelfishes however are gonochoristic (don't change sex) and therefore members of a pair are the same size. A mating pair would stay together until separated by death, readily defending their territory from neighboring *P. paru.* Sexual maturity is achieved at a length of approximately10 inches (Florida Museum of Natural History 2011).

Mating season occurs during the months of April to September, peaking in July. Due to the strong bonding between the mating pair, no courtship is necessary for spawning events to take place. Other French angelfish that approach the mating pair are chased away. Mating events usually take place at dusk, during which a pair would rise together in the water column forming a shallow arc after a short chase, bringing their vents close together until they release both sperm and eggs. Approximately 25,000 to 75,000 eggs are released during each spawning event. The eggs are pelagic in nature, with a diameter of 0.9mm. Approximately 15 – 20 hours after fertilization, eggs hatch into larvae which live among plankton. When larvae reach 15mm in length they settle onto reefs (Florida Museum of Natural History 2011).

**JUVENILE BEHAVIOUR.** As noted, juveniles differ greatly from adults in terms of color. Post larval stages settle on various coral reefs or rocky outcroppings in sea grass beds. They set up cleaning stations in various parts of the reef such as large sponges, rocky outcroppings or depressions which can be easily located by clients. When available for cleaning, juveniles wiggle their brightly colored bodies like a flag, in order to attract client fish. Fishes that desire to be

cleaned hover over the area or lie on the substrate opening their mouths and gills for cleaning, the juvenile would then remove and eat parasites from these areas while keeping their ventral fins in contact with the client's body (Fig. 4), indicating that cleaning is in progress (Florida Museum of Natural History 2011).

**ANTIPREDATOR BEHAVIOUR.** Adult *P. paru* are among the largest fishes on the reef, and are ignored by all but the largest predators like sharks and groupers. Their thin, disk shape bodies allow them to turn with ease and fit into various narrow caves and crevices for shelter, also making them far too wide for most predators to swallow. French angelfish are largely territorial and will team up with their mates to defend territories, to a lesser extent for resources but mainly against wandering bachelors or bachelorettes who threaten to break up the pair. When other French Angelfish intrude on the territory they are driven away either by chasing or charging.

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**Fig. 2** Coloration of juvenile French angelfish.

[http://www.ourfishytales.com/images/Curacao/Diving/Vertibrates/Juvenile-French-Angelfish.jpg, downloaded 11 November 2011]

**Fig. 3.** Coloration of near-adult French angelfish.

[http://2.bp.blogspot.com/_IP5qFiSSE0k/S9Xx6RMdKQI/AAAAAAAAAv4/gJus6KCUcNg/s1600/12.+Juvenile+French+Angelfish.jpg, downloaded 11 November 2011]

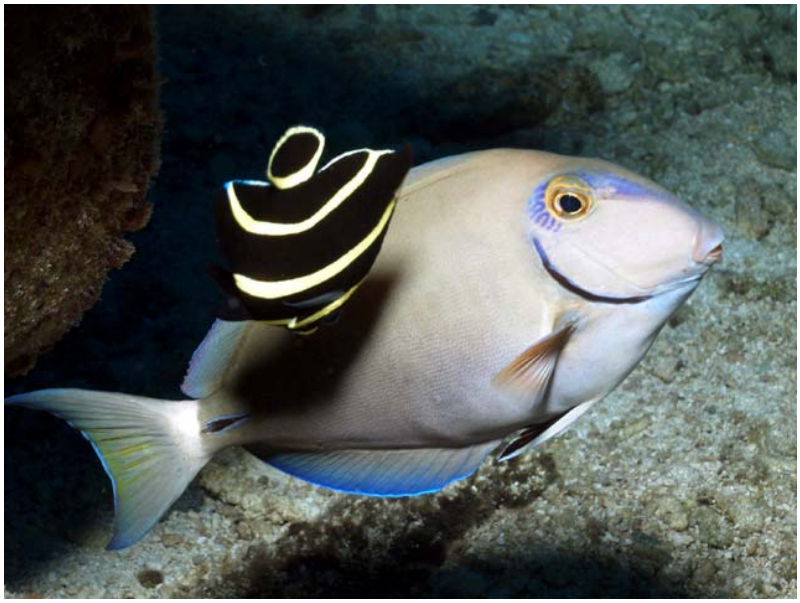

**Fig. 4.** Juvenile French angelfish cleaning surgeonfish.

[http://chemistry.csudh.edu/faculty/jim/Cozapr07/cleaning.jpg, downloaded 11 November 2011]