

Poecilia reticulata (Guppy)

Family: Poeciliidae (Livebearers)

Order: Cyprinodontiformes (Tooth-carps)

Class: Actinopterygii (Ray-finned Fish)



Fig. 1. Female guppy, *Poecilia reticulata*.

[http://www.breeding-guppies.com/images/62364260.DlmpoMRh.IMG_072801.jpg, downloaded 25 October 2011].

TRAITS. Maximum length males 3.5 cm, females 6 cm (Froese and Daniel, 2010). Elongated body shape, 30-34 scales in uninterrupted lateral series; 7-8 soft-rays on dorsal fin, larger in males; 1 pair pectoral fins with 13-14 soft-rays; 1 pair pelvic fins with 5 soft-rays; 8-10 soft-rays on anal fin, rod-shaped in males to form a gonopodium or copulatory organ (Fig. 2) (Froese and Daniel, 2010). Caudal fin vary in length and shape; first 3 rays unbranched. Mouth turned up; eyes spherical. Colour: females olive-green or grey (Fig. 1), males various combinations of brightly coloured patterns; no two males with identical pigment patterns (Meffe and Snelson, 1989). Scent glands: epidermal cells and ovaries produce pheromones.

ECOLOGY. Benthopelagic; found in habitats ranging from springs and water courses to ponds and estuaries, tolerant to wide salinity range allowing inhabitation of freshwater, brackish and the epipelagic layer of marine habitats. A popular aquarium species survival dependent on warm

temperatures (22-24°C) and calm, vegetated waters (Froese and Daniel, 2010). *P. reticulata* is omnivorous; feeding mainly on small insects, zooplanktons algae and detritus (Froese and Daniel, 2010). Guppies have also been observed eating native fishes' eggs, occasionally expressing cannibalism, also eating its own young, when kept in laboratory conditions (Shoemaker, 1944). Threatens native fishes like cyprinids and killifishes and act as a vector for parasitic nematodes and trematodes (Invasive Species Specialist Group, 2006). Outside of Trinidad and Tobago, this fish can also be found in Northern Brazil, Guyana, Venezuela, South America and other Caribbean countries with introductions in other parts of the world such as the USA, Asia and Europe (Froese and Daniel, 2010).

SOCIAL ORGANIZATION. Social, schooling, diurnal, polygynous. Extensive research is still to be done on the social organization of guppy populations. Shoals are small, 2-20 individuals allowing direct interaction between members, and come into contact every 14 seconds. Shoals composition can be entirely males, females or mixed sex; each moving in uniformity. At night guppies disperse into smaller shoals; reassembling each morning (Croft et al. 2003). Females in wild populations develop familiarity with shoal through social learning, learning behaviours and characteristics of members, which help in finding shoals, known as stable partner association. Guppies can peacefully co-exist with other species of fishes and marine organisms making them popular aquarium fishes and upon introduction to new populations can join new shoals without resistance from existing members (pers. obs). Males court and mate with several females in succession (Houde, 1997)

FORAGING BEHAVIOUR. Little published information on the feeding behaviour of guppies (Houde, 1997). Feeding accounts for 15-30% time budget in males, 45-73% in females (Dussault and Kramer, 1981). When grazing on benthic algae *P. reticulata* pecks rapidly using teeth to loosen algae in scraping motion. Body moving as a whole, the guppy approaches food in forward, downward movement with mouth closed, pecks with jaw maximally protracted, closes mouth, retracts jaw leaving the food vertically (Magurran, 2005). Dussault and Kramer (1981) discovered pecking occur at intervals of 0.55 seconds, jaw movement at 0.17 seconds and substrate contact at 0.03 seconds ingesting algae of as much as 25% of their body daily when feeding continuously. Guppies nip at insects, detritus and other fishes. In single-sex shoals, females feed to bottom of water spending less time than males finding feeding sites, usually relying on previously used sites, males move between previous and new feeding sites (Dussault and Kramer, 1981).

COMMUNICATION. Olfactory communication: release of sexual and alarm pheromones. Female produce sexual pheromones in the ovaries and release it when at maximum receptivity (Crow and Liley, 1979). Guppies have enlarged epidermal cells containing a volatile chemical which is released in the water upon injury and subsequent rupture to those cells; acting as an alarm pheromone to conspecifics (Nordell, 1998).

Visual communication: change in body orientation and staring, lateral body-arching and gliding, jumping, open and closed fin displays, stiff quivers, tail lashing, gonopodial thrusting and changing colour pattern. Most of *P. reticulata*'s visual displays are used in a sexual context; except the first mentioned. Changing the body's orientation towards a predator and watching its movement is effective in signalling the predator that their presence is know. Body arching and gliding are displayed in females to express their receptivity to males without frightening them

and used in with a combination of other sexual displays to court a female. Males changing colour patterns, intensifying his black pigment to accentuate the coloured spots and to appear more attractive to females (Houde, 1997).

SEXUAL BEHAVIOUR. Lecithotrophic ovoviviparity is practiced; young develop in eggs, nourished by the yolk and retained by female until hatching time. Thirty or more young per litter at 2-3 generations a year is the norm (Reznick *et al.* 2001). Female reproductive cycle lasts 25-30 days; fertile only 2-3 days reproducing throughout the year being able to be impregnated 1 week after giving birth (Houde, 1997).

A courting male will follow a female waiting until in she stops or slows. When in her view he arches laterally in S-shape (Fig. 3) quivering stiffly for a short time with caudal fins closed or a long, slow display with spread fins along a vertical axis of a few millimetres or may jump away (Magurran, 2005). Male darken black spots and horizontal lines changing colour patterns and may attempt to lead female away to a less crowded area. Responsive female turn towards male, glides smoothly to him moving fins only and may arch her body laterally. The male intensifies his display, spread fins and begin circling the female with her turning with him. The gonopodium is swung forward from below behind the female (Fig. 4) (Houde, 1997). The pair spins quickly around each other upon successful insertion with the male breaking away violently after insemination. He jerks his entire body forward and up decreasing the frequency then guards her for a few minutes; resuming sigmoidal display after 1 hour. Males court females in continuity with only 10% of encountered females being receptive (Houde, 1997). Farr (1975) observed approximately 13 displays and 3 gonopodial thrusts for a courting male in 5 minutes. Males may also attempt stealing copulations (Fig. 4) when a female is not looking, distracted by another male or swims away before copulation. Watching from in front, he follows her then approaches from behind attempting sneak copulation by gonopodial thrusting (Magurran, 2005).

JUVENILE BEHAVIOUR. Juveniles are born in an advanced stage of development of a relatively large size. Feeding begins immediately after birth, mostly algal diet at first, high growth rates of 0.1-0.5 mm day⁻¹ (Meffe and Snelson, 1989). They form and stay in shoals with individuals of the same brood. They stay close to the water's surface; migrating downward with age. Females mature about at 3 months, males mature much quicker; developing their gonopodium. Juveniles show predator inspection behaviour and organize evasive strategies like quick dashes or flash expansion manoeuvre (Magurran, 2005). They also 'practice' their strategies in a playful manner by chasing each other and adults then dashing back to their shoals (pers. obs.).

ANTIPREDATOR BEHAVIOUR. When aerial predators are detected, guppies quickly migrate to deeper waters or closer to the bottom of the water to hide by rocks, vegetation or debris (Meffe and Snelson, 1989). When other predators are detected, they school closely together, orient their bodies in the direction of the predator and display inspection behaviour; involving close watching and monitoring of the behaviour the predator (Houde, 1997). According to Houde (1997) this functions to acknowledge the predator's presence and evaluate the level of threat it might be to the shoal. Magurran *et al.* (1992) observed that guppies from high-predation populations tend to stay a further distance away than those of low-predation population to display inspection behaviour. It was also observed that guppies were familiar to the common predators in their population; avoiding venturing into close proximity to them and avoiding their mouths to a great extent; however, being less cautious around uncommon

predators. When predators drew closer, guppies dashed away quickly, paused to assess the predator's behaviour and dashed off again if the predator persisted (pers. obs.). Guppies are relatively fast swimmers and can change direction suddenly to evade their predator. Several predacious fish work together to isolate and group shoals of guppies to capture them.

AGGRESSIVE BEHAVIOUR. Aggression is rarely expressed in guppies except in the presence of defendable resources or male-biased sex ratio population. Tail lashing was used by males wishing to mate with a female, already being courted, to attempt to avert the other while moving closer to the female (Houde, 1997). With 2 males, females or juveniles or adult and juvenile one individual may dart to the other and nip at it. The victim jumps away with closed fins. Females become very aggressive and continuously attack males when the pair lives without other guppies. Lateral displays occur between 2 males or 2 females; pairs line up parallel or anti-parallel, spread dorsal and caudal fins and quiver; males fight after lateral display while females sometimes fight immediately without displaying. Darkening of colour patterns occur; being more intense in males (Houde, 1997).

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Posted online: 2011



Fig. 2. Gonopodium structure of male guppy.

[<http://www.fishforums.net/index.php?/topic/200028-hybrids-of-mine-gambusia-affinis-x-poecilia-recticulata>, downloaded 14 November 2011]



Fig. 3. Courtship display in male guppies (sigmoidal display).

[<http://www.justbajan.com/pets/fish/species/guppy/index.htm>, downloaded 14 November 2011]

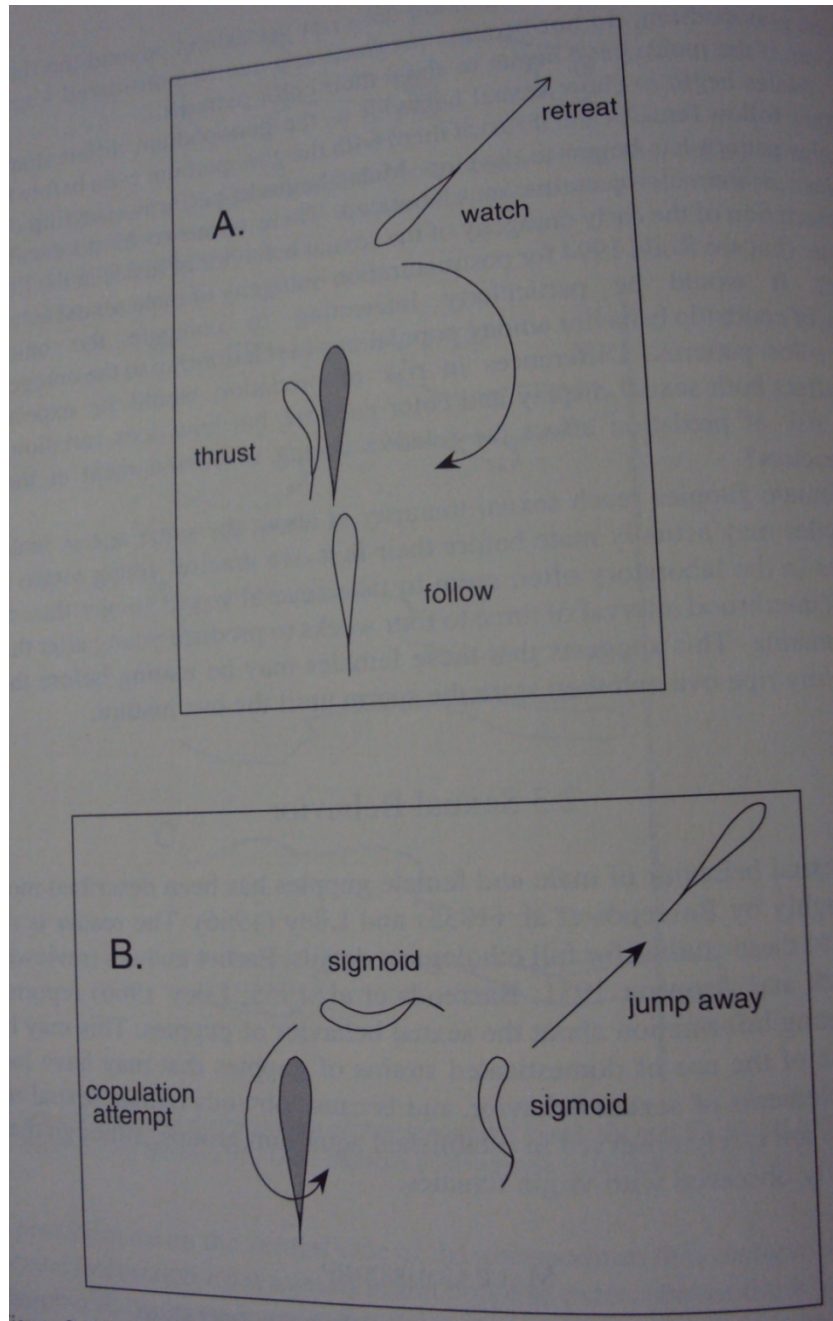


Fig. 4. Males and female (dark) displaying gonopodial trust (above) and copulation display (below).

[Fig. 2.6 of Houde (1997)]