Pest fish profiles
Trichogaster trichopterus – Three spot gourami

Common names:
Gourami. Also known as three spot gourami or blue gourami.

Synonyms:
Labrus trichopterus (Pallas 1770
Trichogaster trichopterus (Bloch & Schneider 1801)
Trichopodus trichopterus (Lacepede 1801)
Trichopodus trichopterus (Cuvier & Valenciennes 1831)
Trichopus sepat (Bleeker 1845)
Osphromenus siamensis (Günther 1861)
Osphromenus trichopterus (Bleeker 1865)
Osphromenus trichopterus var. koelreuteri (Günther)
Osphromenus trichopterus var. cantori s (Günther)
Trichopus siamensis (Sauvage 1881)
Trichopus cantoris (Sauvage 1884)
Trichopodus maculatus (Vipulya 1923)
Osphronemus saigonensis (Borodin 1930)

Classification:
Order Perciformes
Suborder Anabantoidei
Family Osphronemidae
Subfamily Luciocephalinae
Genus *Trichogaster*
Species *trichopterus*

Taxonomic description:
The dorsal fin (VI-VIII, 7-10) is small and the anal fin (IX-XII, 30-38) is elongate, while the caudal fin is slightly emarginate or truncate (Froese & Pauly 2007).

Appearance & Size:
T. trichopterus is elongate, moderately compressed laterally and grows to about 15-20 cm TL (but common at 11cm in the wild). Ventral pelvic fins form a pair of long thin sensory filaments. Adult males tend to be larger with a more elongate dorsal fin than females. Both male and female are uniform blue with a pale olive ground colour and two characteristic dark spots of varying intensity on the mid lateral flank and on the caudal peduncle. Dorsal, anal and caudal fins have a series of whitish spots forming parallel bands.

The Three-spot or Blue gourami, *Trichogaster trichopterus*, is a member of the anabantoid group of air-breathing fishes consisting of three families, 19 genera and about 120 species, all occurring in freshwater and indigenous to Africa and southern Asia (Nelson 2006). *T. trichopterus* was assigned to the family Belontiidae, subfamily Tricogastrinae, with other gouramis (Nelson 1994), but has recently been placed with the osphronemids (including the Giant gourami, Siamese fighting fishes and Paradisefishes) in the subfamily Luciocephalinae, which consists of six genera and about 20 species (Nelson 2006).

It has a very small, dorsally directed mouth, with a vertical, somewhat protractile upper jaw and prominent lower jaw. The species has scales that are moderate in size and irregularly arranged with a curved, irregular lateral line. The dorsal fin (VI-VIII, 7-10) is small and the anal fin (IX-XII, 30-38) is elongate, while the caudal fin is slightly emarginate or truncate (Froese & Pauly 2007). The paired ventral pelvic fins are filamentous in which the first ray is elongated and the remainder are vestigial. The fins have a sensory function; they are well endowed with tactile and chemo-receptors and play a role in feeding, courtship and mating, and aggressive activities (Scharrer *et al.* 1947; Picciolo 1964; Pollak *et al.* 1978a & 1978b; Bisazza *et al.* 2001).

In the wild, the Three-spot gourami occurs in two main colour morphs: brown and blue, with several variants, many produced through commercial selective breeding. The blue-coloured gourami occurs in two morphs: the "Sumatran" form (present in northern Queensland) which is a relatively uniform blue with two characteristic dark spots of varying intensity on the mid lateral flank and on the caudal peduncle; and the "Cosby" form with a distinct dark shading pattern on the dorsal flank region which tend to obscure the pair of dark "eyespots" (Frankel 1992).

Diet:
The species is omnivorous but feeds mainly on zooplankton, (eg. copepods, cladocerans, ostracods), macroinvertebrates (insect larvae), detritus and occasionally terrestrial macrophytes (Conlu 1986; Chung et al. 1994; Rainboth 1996; Talde et al. 2004), and occasionally on detritus (Talde et al. 2004).

Habitat:
The species typically occurs in heavily vegetated, shallow, sluggish or standing water and in seasonally flooded habitats.

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Reproduction:
The Blue gourami is similar to other anabantids and has a promiscuous mating system. It is capable of year round spawning in its native or introduced range depending on prevailing conditions, with temperature and day length being the two main reproductive cues (Hails and Abdullah 1982). The species can breed at temperatures between 18 and 29°C (Axelrod and Shaw 1967) with spawning enhanced in acidic water with a pH range between 5.5 and 6.5 (Reyes-Bustamente and Ortega-Salas 2002).

Blue gouramis, particularly males, exhibit complex behaviours, both innate and learned, associated with establishment and defence of reproductive territories (Tooker and Miller 1980; Hollis 1999; Hollis *et al.* 1984,1989, 1995, 1997). Reproductive behaviours (e.g. emission of pheromones and gonadal development) are modulated by visual and chemical cues from both males and females. Studies have shown that female maturation can be effected either by pheromones released by territorial males (chemical stimulus) or in response to male nest-building and courtship displays (visual stimuli) (Pollak *et al.* 1978, 1981; Lee and Ingersoll 1978; Becker *et al.* 1992; Degani and Boker 1992a,1992b; Degani 1993; Degani and Schreibman 1993; Jackson *et al.* 1994). Cheal and Davies (1974) also demonstrated that female pheromonal cues stimulated nest-building activity in males and facilitated mating success. Studies have shown that male gouramis detect chemical cues via chemoreceptors on the long thread-like ventral pelvic fins (Pollak *et al.* 1978).

Sexually dimorphic, polygynous, bubble nest spawner. Male *T. trichopterus* are territorial and bubble nest builders. Air is gulped in at the surface, then mucus-lined bubbles are expelled which adhere to each other at the water surface, usually among floating or emergent vegetation. Peak nest building and reproductive behaviour occur under low light conditions (opaque water or darkness) (Degani 1989). The nest is the focus of the territory and serves as a protective, oxygen-rich environment for fertilised eggs after spawning. The male exhibits aggressive behaviour to intruders, which is manifested by an intensification or darkening of colouration, erection of median fins and lateral display involving undulations of the body and tail beating. This may escalate to include physical contact (butting and biting) when an intruder is not deterred. A male that is ready to spawn will usually allow a receptive female to enter the territory, or he will guide a female into the territory and under the nest. This typically involves non-agonistic displays with slow movements around the female and frequent parallel alignment, usually with depressed fins (Picciolo 1964). The nest may also advertise the reproductive fitness of the male. Degani (1989) found a correlation between both parental body size and nest size and number of larvae and concluded that the female lays her eggs according to the size of the nest.

Spawning occurs with the male initially stroking the ventral side of the female with his dorsal fin then wrapping his body round the female to exert pressure on her to expel her eggs, which he then fertilises. The eggs are mostly lighter than water and float upwards into the nest, or the male will retrieve those that sink in his mouth, or those that have floated outside the nest and expel them into the nest with numerous bubbles. This procedure is repeated until all eggs have been released by the female. The male then tends the brood for several days and retrieves eggs and fry that drift from the nest (Hodges and Behre 1953; Miller 1964; Picciolo 1964). During the post spawning and nursing phase, the male becomes highly aggressive towards other conspecifics including the recently-spawned female. After the young fish leave the nest, the male ceases care, but usually continues to maintain the nest and during this period will court and spawn with other ripe females (Hodges and Behre 1953; Miller 1964; Pollak *et al.* 1981).

The specialised nesting and parental behaviour enhances early fry survival and recruitment. Fecundity varies with female size with reports of between about 300 for smaller females and 2000 to 4000 from larger females (Zukal 1983; Richter 1988; Pethiyagoda 1991). However, a study by Reyes-Bustamante and Ortega-Salas (2002) under experimental conditions, reported a mean absolute fecundity (number of ripe ova) of 8,021 and a maximum value of 9,104. Combined with multiple spawnings, this enables rapid population growth with a doubling time estimated at less than 15 months (Froese & Pauly 2007).

Ecological tolerances:
T. trichopterus is an extremely hardy fish, and can tolerate wide ranges of several water parameters including hardness, pH, temperature, salinity and dissolved oxygen conditions. Priest (2002) reported that *T. trichopterus* can survive in a wide range of environmental conditions. They will survive in water with hardness anywhere from 5° to 35° dGH, a pH anywhere between 6.0 to 8.8, and a temperature ranging from 21°C to 31°C. They have even been reported to tolerate brackish waters although its upper tolerance limit has not been documented.

The Three-spot gourami has a remarkable tolerance to hypoxia and can exist in waters with extremely low oxygen levels with high BOD, eg., densely vegetated habitat. Like other anabantoids, the species possesses an auxiliary respiratory structure, the labyrinth organ associated with the gills, that enables a rapid switch between water-breathing and air-breathing depending on available oxygen in the water (Das 1928; Burggren 1979; Heisler 1993; Berra 2001).

The labyrinth apparatus is a bony structure, and is a modified extension of the epibranchial segment of the first gill arch, contained within a supra-branchial chamber. The bones of the skull and operculum form the roof and walls, and muscles of the jaw compose its floor. Valves at chamber apertures largely isolate the chamber from the adjacent buccal and pharyngeal cavities. Both the walls of the chamber and the labyrinth are covered with a highly vascularised respiratory tissue. During air-breathing at the surface, the fish engulfs air bubbles into the suprabranchial chamber and gas-exchange occurs (Peters 1978, Yan 1998).

The species is characterised by both a low oxygen carrying capacity and low blood-O_2 affinity indicating a highly obligate air-breathing trait, particularly during periods of hypoxic stress. During such periods, the species is also able to adjust its breathold limits and maintain a deeper position in the water column to minimise surface exposure and predation risk (Herbert and Wells 2001).

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World distribution:

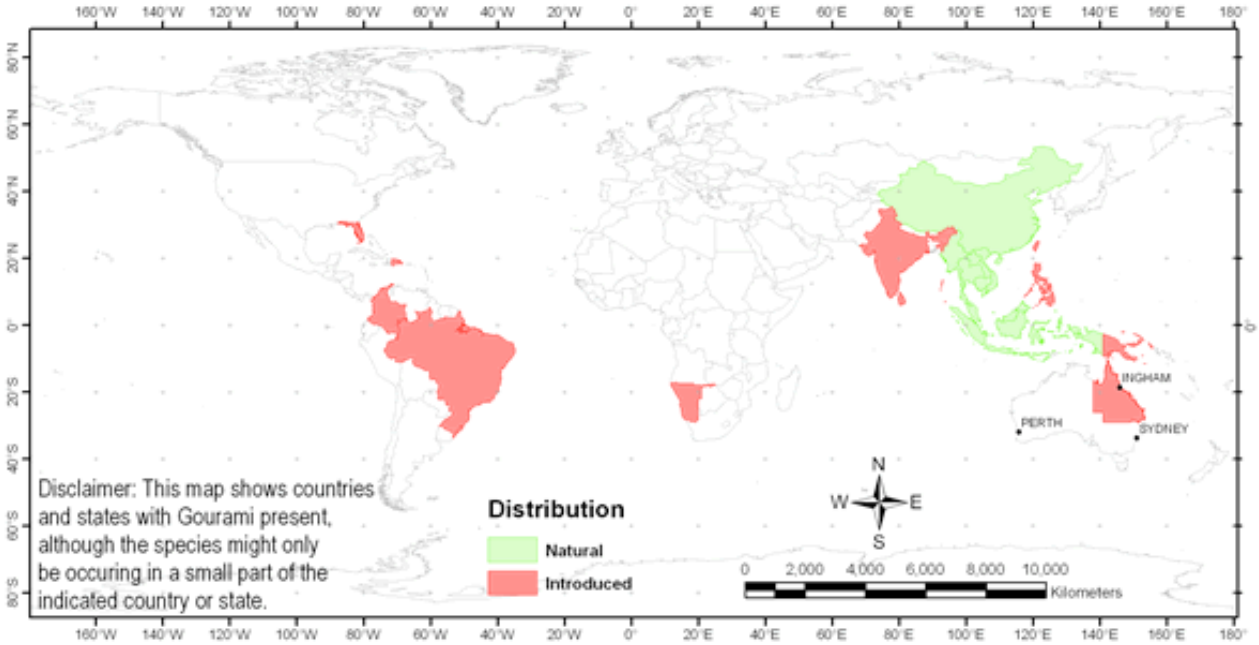

Figure 1: World wide distribution of Oscar.

Native and introduced distribution:
The species is native to the Mekong Basin, South-east Asia in Laos (Roberts 1993; Kottelat 1998; Kottelat 2001a), China (Yunnan) (Hwang *et al.* 1998), Cambodia (Rainboth 1996; Kottelat 1985, 1998), Thailand (Vidthayanan *et al.* 1997) and Vietnam (Kottelat 1998; Kottelat 2001b), as well as Malaysia (Ang *et al.* 1989), Myanmar (Kottelat 1985) and Indonesia (Bali, Sumatra, Java, and Kalimantan/Borneo) (Kottelat *et al.* 1993). The species has been introduced into eleven countries as ornamental fish and have established feral populations in USA (Florida) (Courtenay *et al.* 1984), Colombia (Welcomme 1988), Brazil (Magalhaes *et al.* 2002), Dominican Republic (Lever 1996), Namibia (FAO 1997), Papua New Guinea (West and Glucksman 1976; Allen 1991), Philippines (Juliano *et al.* 1989), Sri Lanka (Welcomme 1988), India (Daniels and Rajagopal 2004), Taiwan (Liao and Liu 1989) and Australia (Queensland) (Webb 2003). The only form reported to date from Australian open waters is the blue sumatran morph.

In Australia, the species was first reported in 1998 from a sugar-cane irrigation channel and subsequently from freshwater lagoons associated with Sheep Station Creek in the lower Burdekin region, northern Queensland (C. Perna, ACTFR, *pers. comm.).* Specimens were also collected by Webb (2003) from Aplin Weir, Ross River, Townsville. The species has now been reported in 2007 from the Barattas system adjacent to Sheep Station Creek (Vern Veitch, ACTFR, *pers. comm* .)

Ecological impacts:
There is virtually no information on the ecological impacts of the Three-spot gourami in its introduced range. The species is an opportunistic carnivore and is territorial and aggressive. According to Liao and Liu (1989) the species was strongly suspected -as a resource competitor- to have caused declines in populations of the endangered Chinese barb, Puntius semifasciolata.

Glossary

Anal	(Fin) beneath the body, behind anal opening.
Auxiliary	Acting as support or assistance.
Buccal	Related to the cheeks or cavity of the mouth
Caudal	Towards the tail.
Caudal peduncle	Part of the body between the base of the anal fin and the base of the tail fin
Conspecifics	Members of the same species.
Dimorphic	Sexual differences in size.
Dorsal	Situated near to or on the back.
Emarginate	Notched; having a slight, shallow notch at the tip
Epibranchial	Bone or cartilage forming the upper part of the gill arch, immediately above the angle of the arch.
Fecundity	Fertility
Filaments	Hairlike fleshy projections on gills or other internal organs, used for creating currents or for screening particles
Filamentous	**Long, cylindrical and thread-like**
Gonadal	Related to the organ in animals that produces gametes, especially a testis or ovary
Hypoxia	An inadequate supply of oxygen to the tissues.
Lateral	Situated at or extending to the side.
Median	One of the fins located on the sagittal plane of the body, the dorsal, caudal and anal fins.
Obligate	Restricted to a particular host, environmental conditions, substratum or mode of nutrition.
Omnivorous	Eating both plant and animal matter.
Opercular	Situated near or related to the gill cover.
Pelvic	Related to the pelvis, or lower middle of the fish.
Pharyngeal	Related to or coming from the pharynx: the part of the neck and throat situated immediately posterior to the mouth and nasal cavity.
Polygynous	Multiple partner
Protractile	Able to be extended
Truncate	Square or broad at the end; not tapered.
Undulation	Smooth wave-like movement of the torso, front to back or side to side.
Ventral	Towards the belly or underside of the body, the opposite of dorsal
Vestigial	Small or degenerate. Part of an animal (organ or bone) that is no longer used by the species and has therefore become smaller or less developed

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Other information sheets available:

Spotted tilapia – *Tilapia mariae*
Oscar – *Astronotus ocellatus*
Burton's haplochromis – *Haplochromis burtoni*
Mosquitofish – *Gambusia holbrooki*
Guppy – *Poecilia reticulates*
Swordtail – *Xiphophorus helleri*
Platy – *Xiphophorus maculates*
Three-spotted gourami – *Thrichogaster trichopterus*