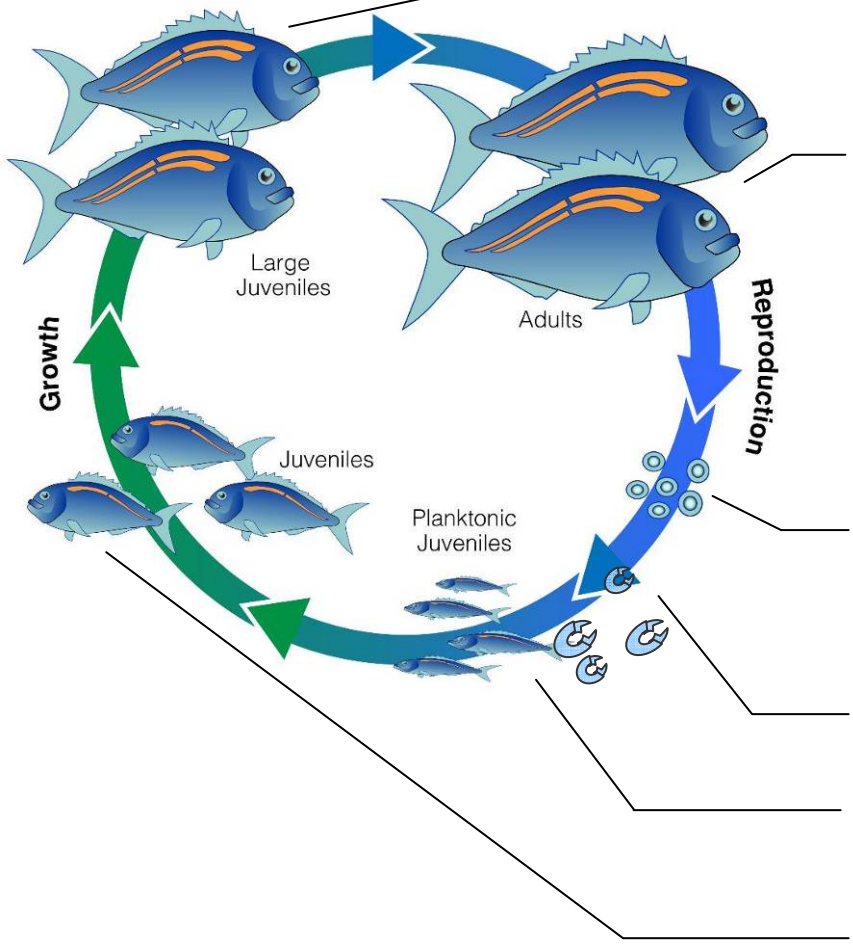
Fish Habitat Basics

Fish differ in appearance, size, eating quality and fighting ability, however they do have one characteristic in common - they all rely on habitat and what habitat they need may change at different times in their life cycle.

So what is the fish life cycle and what's needed in terms of habitat at each stage?



Large juveniles
Suitable water (pH, salinity, temperature, dissolved oxygen)
Places to shelter from predators / strong currents
Places to obtain food

Adults
Suitable water (pH, salinity, temperature, dissolved oxygen, quantity and timing of flow)
Places to shelter from predators / adverse conditions
Places to obtain food
Place to set up territory and territorial markers
Places to find mates
Places to spawn

Fertilised eggs
Suitable water (pH, salinity, dissolved oxygen, temperature)
Places to be attached to (for some species)

Larvae / planktonic juveniles
Suitable water (pH, salinity, temperature, dissolved oxygen)
Water flow (freshwater) or currents (saltwater)
Food source

Small juveniles
Suitable water (pH, salinity, temperature, dissolved oxygen)
Places to shelter from predators / strong currents
Places to obtain food

What is ‘fish habitat’?

Habitat is where fish live.

The first thing that springs to mind is water, but the water has to be the right type (freshwater, estuarine or saltwater), temperature, quantity (depth and flow) and quality. Fish habitat is more than just the water.

According to the NSW Fisheries Management Act 1994 fish habitat means: any area occupied, or periodically or occasionally occupied, by fish or marine vegetation (or both), and includes any biotic (living) or abiotic (non-living) component.

Other things that make up fish habitat include the:

- materials that provide the underlying structure: e.g. rocks, coral, gravel, sand and mud

- types of vegetation present: e.g. overhanging vegetation, reeds, water plants, algae, dead wood (snags), seaweeds, seagrasses, mangroves and saltmarsh

- shape and nature of the habitat: e.g. pools and riffles, billabongs and reefs

- connections to other waterways and ecosystems: e.g. wetlands, streams, estuaries, floodplains lakes and beaches.

At each stage of the life cycle each type of fish requires a particular habitat to survive and thrive. Only by maintaining this range of habitats can we make sure we have healthy fish populations into the future.

Spawning

Different fish species reach sexual maturity at different ages. Sexual maturity is one of the factors used to determine legal size catch limits.

Fish found in NSW spawn in one of two ways:

1. External fertilisation of eggs.

   This is the most common method and involves either:

   - males and females simultaneously releasing eggs and sperm into the water, or
   - the female laying eggs onto a surface (gravel or snag etc) which the male then fertilises.

   In these circumstances fertilisation of the egg is left up to chance. Some species however exhibit strong parental care. The male and female freshwater catfish (*Tandanus tandanus*) work together to build nests and guard their eggs to ensure the highest possible chance of survival for their offspring.

2. Internal fertilisation of the eggs.

   Cartilaginous fishes such as sharks and rays use this method and lay eggs or give birth to live young. Introduced species such as mosquito fish (*Gambusia holbrooki*) are the only other species in Australian waters to use this method.

Yellowtail kingfish (Seriola lalandi) generally reach sexual maturity at less than a year old. The current minimum legal length of 65 cm therefore allows three years breeding before a fish can legally be taken.

Illustration: Pat Tully, I&I NSW

A catfish (Tandanus tandanus) on its nest.

Image: I&I NSW

Spawning habitats vary greatly. Fresh and saltwater fish move within and between waters to seek out mates and suitable habitat to spawn. The Australian bass (*Macquaria novemaculeata*) is a popular recreational fish that uses estuaries for spawning. The saltwater and estuarine species most fishers are familiar with spawn outside the estuary, usually in in-shore areas.

Contrary to popular belief, most popular coastal recreational fish do not spawn in estuaries!

Freshwater fish such as the crimson-spotted rainbowfish (*Melanotaenia duboulayi*) lay sticky eggs which attach to fringing vegetation; others such as Murray cod (*Maccullochella peelii*) seek out clean surfaces of hollow logs upon which to lay their eggs. Australia bass are different: they lay planktonic (tiny floating) eggs in brackish tidal reaches and estuaries that are carried with the tides and currents out to sea.

Murray cod eggs laid on an artificial breeding chamber. Where available, these fish lay their eggs on and in hollow logs.
Photo: Stephan Thurston, I&I NSW.

Murray cod larvae at about 5 days old.
Photo: Stephan Thurston, I&I NSW.

Uniquely, freshwater catfish make nests from gravel and guard their eggs, keeping them free from sediment till they hatch, often returning to the same nest year after year.
Photo: C. Jenkins, I&I NSW.

There are some fish that demonstrate more extreme parental care and nurse their developing young in their mouths. One such 'mouth-brooder' is aptly named mouth almighty (Glossamia aprion).
Photo © Gunther Schmida.

Lutjanus spp. (snapper) larva at 10 days old. This larva is just 5mm long.
Photo: Benjamin Victor (www.coralreeffish.com/).

Growing out

The juvenile to adulthood phase of a fish's life cycle is an important and challenging one. The growing fish faces predation, disease, hunger and the risk of drying out (particularly in inland waterways). The more suitable habitat there is available, the more juveniles will survive to breeding age.

The things fish eat include plants, macroalgae (seaweed), plankton (microscopic animals and plants), invertebrates (mosquito larvae, dragonflies, shrimp) or other fish. Each of these also needs particular habitat conditions.

It is important to remember that our aquatic environments are very complex. Even the most unassuming components, such as leaves, are crucial to the overall balance of the system. Changes to habitat might not affect the fish directly but might affect their food source. This, in turn, means that the fish can no longer survive in that habitat or competition for food might increase.

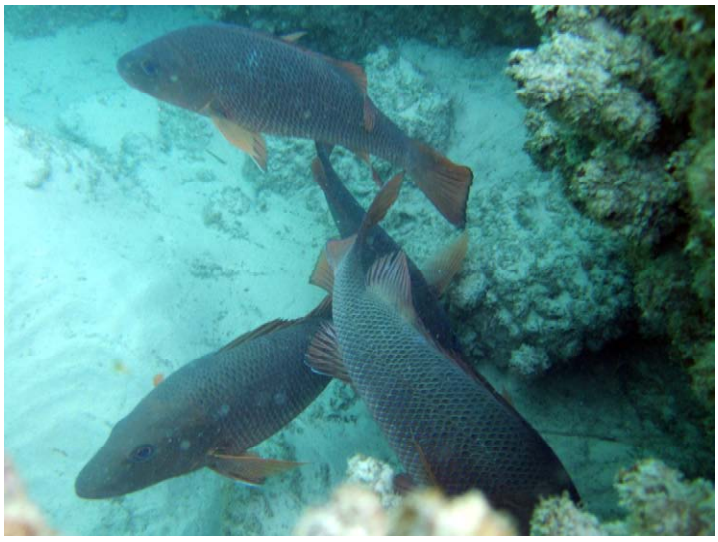
Estuaries are complex aquatic environments which support diverse and productive fisheries. Juvenile fish species including flathead, leather jacket, bream, mangrove jack and whiting utilise specific areas of estuaries and rivers differently and at different stages of their life cycle. Habitat features such as sand and mudflats, seagrass beds, floodplain wetlands, saltmarsh and mangrove forests are important nurseries areas.

Australian bass are voracious carnivores and get close to half their summer diet from the insects that fall from river bank vegetation.

Image: D. Peace

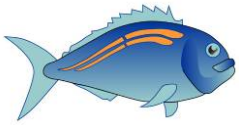
Image: C. Carruthers, I&I NSW

Harris, J.H. (1985) Diet of Australian bass, *Macquaria novemaculeata* (Perciformes: Percichthyidae) in the Sydney Basin. Australian *Journal of Marine and Freshwater Research* 36: 219–34.



The mangrove jack is well regarded as an excellent sports fish within our estuaries and around offshore reefs. Adult mangrove jack spawn offshore and juveniles then re-enter estuaries in the following months where they spend the next 3-11 years of their life. Mangrove jack have been recorded over 100 km upstream from the ocean, well and truly into freshwater habitat. Image: James Sakker

In Botany Bay for example, many of our common recreational fish species utilise several different habitats such as Zostera and Posidonia (seagrasses), sandy and muddy bottom areas, mangroves and rocky reefs.

	Small juveniles 	Large juveniles 	Adults 	Spawning 
Dusky flathead  *Image James Sakker*	*Zostera* Mangroves Shallow mud	Deep mud	Seagrass (s) (w) Deep mud (w)	*Zostera*
Sand whiting  *Image David Harasti*	*Zostera* Shallow sand		Shallow sand	Inshore surf zone
Tailor  *Image I&I NSW*	*Zostera* Shallow sand	*Zostera* Deep sand (s) Deep mud (w)	*Zostera* Shallow sand (s) Deep mud (w)	Offshore
Yellowfin bream  *Image David Harasti*	Mangroves *Zostera* Shallow mud	Shallow sand (s) Deep mud (w)	Shallow sand (s) *Zostera* Deep sand(w) Rocky reef (w)	Inshore
Tarwhine  *Image I&I NSW*	*Zostera*	Deep sand (s) Deep mud (w)	Offshore reefs	Inshore
Luderick  *Image David Harasti*	*Zostera*	*Zostera* (s) *Posidonia* (s) Mangroves (w)	*Zostera* *Posidonia* Rocky reefs	Inshore

(s) summer feeding grounds, (w) winter feeding grounds, Source: SPCC (1981)

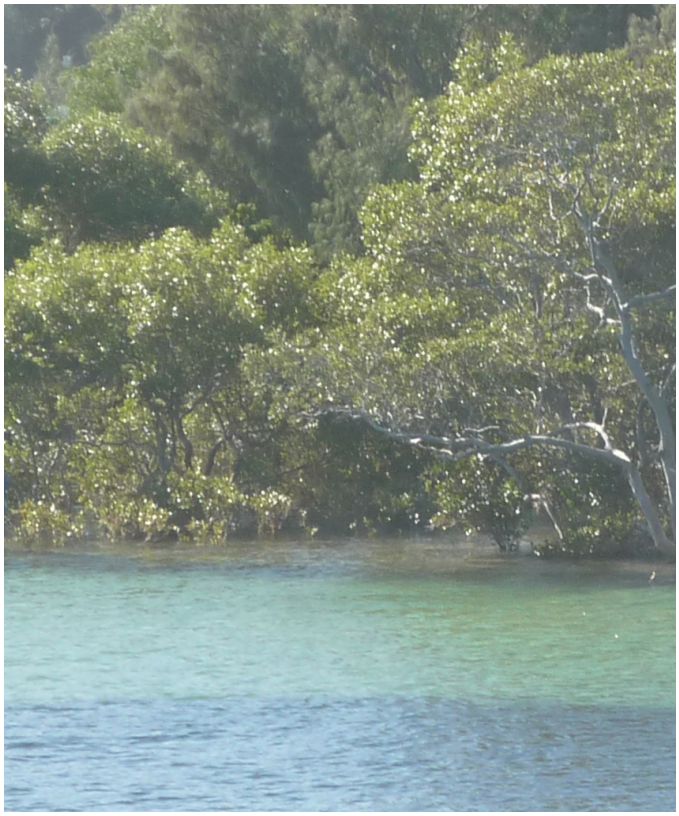
Fish also need to be able to hide from predators and shelter from extreme conditions, such as floods and harsh sunlight. If these features are removed from fish habitat, then both juvenile and adult fish become vulnerable to predators.

In freshwater, instream structure, such as rocks, submerged logs and branches (snags), vegetation and deep pools or undercut banks, provides fish with places to shelter. In estuaries, seagrasses and mangrove forests provide shelter for juvenile fish from predators.

Some native freshwater fish prefer areas with at least 80 % coverage of instream structure. Murray cod and trout cod use snags. Murray cod often prefer snags closer to the river bank whilst trout cod prefer snags in the middle of a river. Around 80 % of Murray cod are found within 1 metre of a snag they can use for shelter.

Image Luke Pearce, I&I NSW

Koehn, J. and Nicol, S. (1998). Habitat and movement requirements of fish. In proc. 1998 *Riverine Environmental Forum* (Eds. R.J. Banens and R. Lehane) pp. 1-6. October 1998, Brisbane, Queensland. Murray-Darling Basin Commission.



In estuaries, areas where there are mangroves, seagrass beds and sand in close proximity provide habitat for the juveniles of many species.

Image left: Liz Baker, I&I NSW
Image below: Mark Stewart, I&I NSW

Migrating

Many native fish respond to environmental cues that trigger spawning events such as rises in water level and flow velocity, changes in water temperature and salinity, day length and night length. These adaptations have evolved over thousands of years with naturally changing river conditions and climate. Some fish migrate locally while others will travel a great distance between where they live and where they reproduce.

Did you know …

Even mud crabs migrate… the female mud crab migrates up to 50 km off-shore after her eggs are fertilised to spawn.

Of the 83 species of freshwater fish in south eastern Australia, over half migrate at least once as part of their life cycle. Golden perch have a recorded migration of up to 2,300km – that's like swimming from Sydney to New Zealand!

Image © Gunther Schmida

Sixty six species of freshwater fish endemic to south eastern Australian migrate to some extent. Many of these species migrate upstream to spawn and fish larvae are then dispersed downstream.

Restricting natural migration patterns of fish through the construction of dams, flood levees, weirs and road crossings can have severe impacts on native fish populations. Even small structures such as low lying causeways with small changes in water level (10 cm drop) can block the passage of the less agile or energetic native fish.

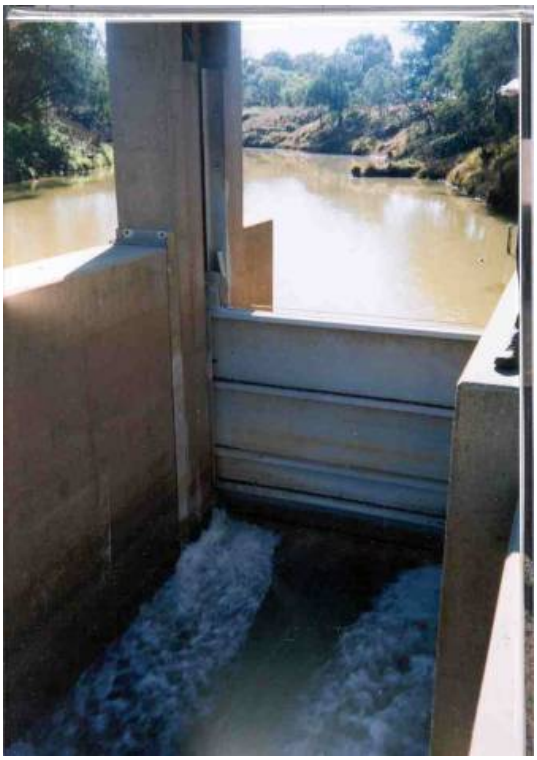
There's not much these migrating mullet can do about this floodgate – it's an impassable barrier preventing them from moving upstream. Image I&I NSW

Recent research[1] has highlighted that the large number of weirs on our rivers not only block upstream migration but also severely impact on the survival of fish in their larval stage.

Studies on two iconic species in the Murray Darling Basin (Murray cod and golden perch) indicate that up to 95 % of golden perch and 52 % of Murray cod larvae are killed when flowing through undershot weirs.

Undershot weirs release water from the bottom, the amount of water released is controlled by a sluice gate. It is believed that a combination of factors lead to such high mortality rates including stress, sudden changes in water pressure, shear stress and injury. The findings of this research have been presented to the authorities operating undershot weirs.

Further research is underway to determine appropriate migratory measures. This research will guide management to ensure long term sustainability of wild populations.



Undershot weir. Image I&I NSW

Overshot weir. Image I&I NSW

This Factsheet was prepared by Amy Kalatzis and Liz Baker, as part of the Recreational Fishers' Education Project, a partnership between Industry and Investment NSW and Southern Cross University, and funded by the NSW Government through its Environmental Trust. This factsheet can be used and distributed for education purposes.

[1] Baumgartner, L.J., Reynoldson, N. and Gilligan, D.M., 2006. Mortality of larval Murray cod (*Maccullochella peelii peelii*) and golden perch (*Macquaria ambigua*) associated with passage through two types of low-head weirs. *Marine & Freshwater Research*, 57: 187-191.