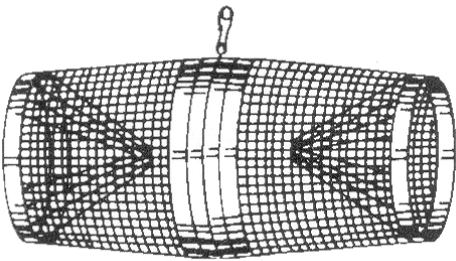


## Studying mudfishes

First, catch your mudfish! The scientific study of mudfish species has been greatly impeded both by misconceptions as to their rarity, and by perceived difficulties in capturing these shy nocturnal fishes. Their habitats restrict the use of normal fishing equipment such as set nets or electric fishing machines. However, in recent years, the use of fine-mesh Gee minnow traps has proved to be extremely successful. These traps are double-ended wire baskets that clip together as shown below.



**Figure 10** Gee minnow trap



**Figure 11** Minnow traps set in a wetland

The traps should be set with the openings of the entry cones just below the water surface; the rationale is that, when the fish are feeding at the water surface at night, they are directed into the trap. Setting the trap at this level also provides an air space to allow the trapped fish to gulp air at the surface. If an air space is not provided, the fish will drown if the water oxygen concentration is too low, as is often the case in swampy environments. Traps do not need to be baited. While some researchers swear by the use of vegemite or bread as bait, unbaited traps catch just as many fish.

Other traps can be used to catch mudfish but they should have a small entrance hole to prevent escape and be set in the same manner.

## Keeping mudfishes

Permission to keep mudfish in captivity should be obtained from the local Department of Conservation office. A permit is required to transport any native fish from one area to another and to keep native fish in captivity. Many mudfish habitats are on land administered by the Department and a permit is also required to catch fish and, in some cases, even to allow access to these sites.

### *Aquaria*

Mudfish are relatively undemanding as aquarium subjects but also unspectacular since they will spend most of the daylight hours hiding. They prefer a low pH, soft water, and of course plenty of places to hide. Suitable hiding places can be provided with waterlogged driftwood or rocks, or even cut lengths of opaque plastic pipe. Care should be taken in the choice of a substrate. Aquarium gravel is suitable so long as it is not of a type that will cause the water to become alkaline. Other suitable substrates are peat or dried sphagnum moss. These will help keep the water slightly acidic and the fish will burrow into them.

Mudfish do not require a period of aestivation each year and will happily live in almost any permanent water body so long as they do not have to compete with, or face predation by, other fish species. Some captive populations have been maintained under such conditions for at least fifteen years.

### *Feeding*

Mudfish will readily accept dead food such as frozen bloodworms. These are available from most aquarium suppliers. More aquarium fish die from overfeeding than from any other single cause. Mudfish should only be fed

every three or four days, and then only as much as they will readily eat in about 15 minutes. Any uneaten food should be siphoned from the aquarium. Some substrates such as sphagnum make this difficult and therefore care should be taken not to overfeed in the first place.

### *Temperature*

Mudfish cannot tolerate high temperatures, which can present problems keeping them over the summer months. The fish will suffer if the water temperature exceeds about 22°C. The aquarium should be situated out of direct sunlight where it can remain as cool as possible.

### *Water*

Tapwater is suitable for use but only if it is completely chlorine-free. This can be achieved by using commercial chlorine removers that contain sodium thiosulphate, or by aerating the water for at least 24 hours to drive off the chlorine. The pH of the water can be adjusted to be slightly acidic using commercially available aquarium products designed for acid-loving fishes such as discus.

### *Transporting mudfish*

Mudfish can be transported in water or in air. In either case, the primary consideration is to avoid overheating. This can be achieved by keeping transport containers in a cooler. Fish transported in water should have minimal water and plenty of airspace or aeration. Fish transported in air can be wrapped loosely in wet sphagnum moss. In experimental studies of aestivation, mudfish have been kept successfully for several weeks wrapped in wet sphagnum.

# Mudfish identification

Most mudfish species are easily identified simply by their allopatric (non-overlapping) distributions. For instance, any mudfish caught on the West Coast or in the Wairarapa would undoubtedly be a brown mudfish. However, the distributions of the Northland and black mudfishes are sympatric (overlapping). The following key gives combinations of characters that will unequivocally identify individual species. Most characters can be identified easily using a hand-held magnifying lens.

## Key to species

- |          |  |          |
|----------|--|----------|
| <b>1</b> | Pelvic (ventral) fins present .....  | <b>2</b> |
|          | Pelvic (ventral) fins absent .....   | <b>3</b> |
| <b>2</b> | Pelvic fins with 6 or 7 rays; pelvic fins long, more than 1/3 distance from pelvic fin base to origin of anal fin .....  |          |
|          | ..... species of the genus <i>Galaxias</i>   |          |
|          | Pelvic fins with 4 or 5 rays; pelvic fins short, less than 1/3 distance from Pelvic fin base to origin of anal fin .....   |          |
|          | ..... <i>Neochanna burrowsius</i> <b>Canterbury mudfish</b>  |          |
| <b>3</b> | Mouth short, extending only as far as the anterior edge of the eye; eye diameter greater than 15% of head length; dorsal fin with 10 to 14 rays; anal fin with 12 to 17 rays; head not bulbous behind eyes ..... |          |
|          | ..... <i>Neochanna diversus</i> <b>black mudfish</b>   |          |
|          | Mouth long, extending to the middle or posterior edge of the eye; eye diameter less than 15% of head length; head bulbous behind eyes .....  | <b>4</b> |
| <b>4</b> | Caudal fin with less than 13 principal fin rays; caudal peduncle depth equal to or less than length; dorsal fin with 12 to 16 rays .....   |          |
|          | ..... <i>Neochanna heleioides</i> <b>Northland mudfish</b>   |          |
|          | Caudal fin with more than 14 principal fin rays; caudal peduncle depth 1.5 to 2 times length; dorsal fin with 16 to 19 rays .....  |          |
|          | ..... <i>Neochanna apoda</i> <b>brown mudfish</b>  |          |

## Mudfish conservation

All of our mudfish species face an uncertain future, although none of them can be considered endangered in the same way as kakapo or the giant panda. These latter species are endangered because there are only very few individuals left. But even our rarest mudfish, the Northland mudfish, can be very abundant at the few sites where it is found.



**Figure 12** Mudfish can be locally abundant – a single night's catch of Northland mudfish from 15 minnow traps.

By far the greatest threat facing all New Zealand's mudfish species is the continuing destruction of appropriate habitat. Many people regard swamps as either wasteland or potentially valuable pasture. Many remaining habitats are such fragmented or tiny remnants of once larger wetland areas that their future is very uncertain.

One of the most important environmental factors affecting mudfish is the availability of water. The rapid fluctuations in water level that occur in small swamps are prevented in larger wetlands, which act like giant sponges, smoothing out these hydrodynamic oscillations into a more predictable seasonal pattern.



Where wetlands are surrounded by pasture, they often receive run-off loaded with sediment and nutrients causing increases in turbidity and a state of gradual eutrophication. Management of remaining mudfish habitats should aim to reduce such impacts on wetlands and try to retain large wetland reserves. Larger habitats also help to maintain greater genetic diversity in fish populations, whereas small or fragmented habitats act as genetic bottlenecks. Without sufficient genetic diversity, animals do not have the range of genetic variation required to adapt to changing environments.

In some areas such as the Waikato, where wetlands have been drained for pasture, quite significant mudfish populations still exist in drains. Although less than ideal, mudfish seem to cope well in such habitats so long as they are left relatively undisturbed. Fish require plenty of emergent vegetation to provide food and shelter. Regular clearing of drains degrades this habitat for fish and eventually leads to their elimination.



**Figure 13** Good mudfish habitat  
– an unmanaged drain

Bad mudfish habitat  
– a “managed” drain

Another threat to mudfish, especially in the North Island, is predation by the introduced mosquitofish, *Gambusia affinis*. Mosquitofish are small, aggressive fish, native to south-eastern parts of the United States, and were introduced to many countries during the early part of the twentieth century in the mistaken belief that they were effective in controlling mosquitoes. They have been implicated in the decline or extinction of native species of aquatic invertebrates, fishes and amphibians, in many of the countries where they were introduced.

Mosquitofish were introduced to New Zealand in the 1930s. From their original site of release at the Auckland Botanical Gardens, they have been spread throughout most of the North Island and were recently discovered near Nelson in the South Island. Mosquitofish eat mudfish fry and will also attack adults, although the nocturnal habits of the latter will help to protect them from attack by the day-active mosquitofish. Mosquitofish can tolerate a wide range of temperatures and salinities, and thrive in swampy shallow lake margins and drains. Although they cannot survive in mudfish habitats that completely dry out over summer, they can re-invade wetlands from adjacent permanent water bodies during winter when mudfish fry are present.

Mosquitofish are now classified as unwanted organisms in New Zealand, meaning that it is illegal to release, spread, breed or sell them.



**Figure 14** Mosquitofish, *Gambusia affinis* – 50 mm adult female (left) and 30 mm adult male (right)

## Glossary

<b>aestivation</b>	a period of torpor or inactivity during a dry or summer season – summer equivalent of hibernation
<b>anal fin</b>	a central unpaired ventral fin posterior to the anus but before the tail
<b>caudal fin</b>	the tail fin
<b>caudal peduncle</b>	the slender posterior end of the body supporting the caudal fin – bordered by fleshy edges in most galaxiids
<b>dorsal fin</b>	any central unpaired fin on the back
<b>eutrophic</b>	aquatic habitats that are nutrient enriched
<b>gley soils</b>	soils saturated with water for prolonged periods and with pale greyish subsoils.
<b>oligotrophic</b>	aquatic habitats that are nutrient poor
<b>organic soils</b>	soils formed from the partly decomposed remains of wetland peat or thick forest litter
<b>pectoral fins</b>	paired fins occurring either side of the fish immediately behind the gills
<b>pelvic fins</b>	paired fins occurring on the belly of the fish between the gills and anus
<b>podzols</b>	strongly acid soils with a hard accumulated substratum of iron, aluminium and silicon rich materials leached from surface layers
<b>principal fin ray count</b>	the number of all branched and segmented fin rays in the caudal fin plus the two longest unbranched rays being the ray immediately above and below the branched rays



## Further Reading

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Dr Nick Ling is a senior lecturer in the Department of Biological Sciences at the University of Waikato, and teaches in the areas of animal physiology and comparative zoology. He has been interested in fish since an early age and has spent nearly twenty years researching aspects of their physiology and ecology. Mudfish are perhaps our least well-known and most cryptic freshwater fishes. Nick has spent the past eight years studying the black mudfish in swamps of the northern North Island, and was involved in the discovery of the Northland mudfish in 1998.