Appendix 13-A Ecology of the Fish that may be affected by Nathan Dam

12-A 1.1 Movement and Migration

Table 1 Migration and movement patterns of freshwater fish known in the Fitzroy catchment (adapted from Marsden & Power 2007)

Family	*Species*	Common Name	Life History Category	Season[1]			
				Summer	Autumn	Winter	Spring
Ambassidae	*Ambassis agassizii*	Agassiz's glassfish	P	s	L	L	L
Anguillidae	*Anguilla reinhardtii*	marbled eel	C	L	L	s	L
Antherinidae	*Craterocephalus stercusmuscarum*	fly-specked hardyhead	P	s	-	s	L
Apogonidae	*Glossamia apron*	mouth almighty	P	s	s	s	s
Ariidae	*Arius graeffei*	fork-tailed catfish	A	L	L	L	L
Belonidae	*Strongylura krefftii*	freshwater longtom	A	s	s	-	?
Centropomidae	*Lates calcarifer*	barramundi	C	L	s	s	L
Clupeidae	*Nematolosa erebi*	bony bream	P	L	L	L	L
Cyprinidae	*Carassius auratus*	goldfish	P	?	?	?	?
Eleotridae	*Hypseleotris compressa*	empire gudgeon	P	L	L	L	L
	Hypseleotris klunzingeri	western carp gudgeon	P	?	?	?	?
	Hypseleotris sp. 1	Midgley's carp gudgeon	?	?	?	?	?
	Mogurnda adsepersa	purple spotted gudgeon	P	?	?	?	?
	Oxyeleotris lineolata	sleepy cod	P	?	?	?	?
	Philypnodon grandiceps	flathead gudgeon	P	?	?	?	?
Gobiidae	*Redigobius bikolanus*	speckled goby	A	?	?	?	?
Hemirhamphidae	*Arramphus sclerolepis*	snub-nosed garfish	A	?	?	?	?
Megalopidae	*Megalops cyprinoides*	oxeye herring	A	s	L	s	s
Melanotaeniidae	*Melanotaenia s. splendida*	eastern rainbowfish	P	s	s	s	L
Mugilidae	*Mugil cephalus*	striped mullet	A	L	s	L	L
Osteoglossidae	*Scleropages leichardti*	southern saratoga	P	s	?	?	s
Percichthyidae	*Macquria ambigua oriens*	golden perch (yellowbelly)	P	L	s	s	L
Plotosidae	*Neosilurus ater*	black catfish	P	L	?	?	L
	Neosilurus hyrtlii	Hyrtl's tandan	P	L	?	?	L

Family	*Species*	Common Name	Life History Category	Season[1]			
				Summer	Autumn	Winter	Spring
	Porochilus rendahli	Rendahl's catfish	P	L	?	?	L
	Tandanus tandanus	eel-tailed catfish	P	?	?	?	?
Poecillidae	*Gambusia holbrooki*	mosquitofish	P	?	?	?	?
	Poecilia reticulata	guppy	P	?	?	?	?
Pseudomugilidae	*Pseudomugil signifer*	pacific blue eye	P	?	?	?	?
Scorpaenidae	*Notesthes robusta*	bullrout	C	s	-	L	L
Synbranchidae	*Ophisternon sp.*	swamp eel	C	?	?	?	?
Terapontidae	*Amniataba percoides*	barred grunter	P	s	-	s	s
	Bidyanus bidyanus [3]	silver perch	P	L	?	?	?
	Hephaestus fuliginosus	sooty grunter	P	L	?	?	?
	Leiopotherapon unicolor	spangled perch	P	L	s	s	L
	Scortum hillii	leathery grunter	P	s	s	s	s

1 L= large number of fish migrate, s = small numbers of fish migrate, ? = information on migration patterns is limited or unknown (Marsden & Power 2007).

2 Life history category: C = Catadromous; A = Amphidromous; P = Potadromous.

3 Silver perch (*Bidyanus bidyanus*) are a native fish species translocated into the Fitzroy Basin during fish stocking programs; successful establishment is unknown (Berghuis & Long 1999).

12-A 1.2 Water Quality

Table 2 Fish species known in the Fitzroy Catchment and a range of water quality conditions in which they have been captured (data sourced from Pusey at al. 2004)

Family	*Species*	Common name	Water Temperature (ºC)	Dissolved Oxygen (mg/L)	pH	Conductivity (µS/cm)	Turbidity (NTU)
Ambassidae	*Ambassis agassizii*	Agassiz's glassfish	11 – 33	0.3 – 19.5	6.3 – 9.9	19.5 – 15,102	0.2 – 144
Anguillidae	*Anguilla reinhardtii*	marbled eel	8.4 – 31.7	0.6 – 16.2	5.6 – 9.1	19.5 – 2,247	
Antherinidae	*Craterocephalus stercusmuscarum* [B]	fly-specked hardyhead	22 – 28	4.8 – 11.0	6.1 – 9.1	19.5 – 5,380	0.2 – 62.3
Apogonidae	*Glossamia apron* [A]	mouth almighty	14.1 – 31.0	4.2 – 11.9	6.8 – 9.1	203.7 – 1,429	0.5 – 62.3
Ariidae	*Arius graeffei* [C]	fork-tailed catfish	20.9 - 33	9.4– 10.8	7.8 – 8.2	4 - 790	2.6 – 5.4
Belonidae	*Strongylura krefftii*[C]	freshwater longtom	30.0 – 33	8.9 – 12.1	7.99 – 8.80	394 – 790	2.76 – 5.30
Centropomidae	*Lates calcarifer*	barramundi	15.5 - 35	0 - NA	4.0 – 9.12	16 – 94 ppt salinity	Tolerant to a wide

Family	*Species*	Common name	Water Temperature (ºC)	Dissolved Oxygen (mg/L)	pH	Conductivity (µS/cm)	Turbidity (NTU)
							range water clarity
Clupeidae	*Nematolosa erebi*	bony bream	24 – 29	4.8 – 11	6.9 – 8.8	70 – 770	4 – 160
Cyprinidae	*Carassius auratus*	goldfish	NA	NA	NA	NA	NA
Eleotridae	*Hypseleotris* spp.[A]	carp gudgeons	8.4 – 31.2	0.3 – 19.5	4.4 – 8.9	51 – 4,123	0.1 – 331.4
	Mogurnda adsepersa[A]	purple spotted gudgeon	11.9 – 31.7	0.6 – 12.8	5.6 – 8.8	72.0 – 2,495	0.2 – 200.0
	Oxyeleotris lineolata[B]	sleepy cod	24.0 – 27.5	4.6 – 8.0	7.4 – 8.2	4 – 650	5 – 190 (sechi depth)
	Philypnodon grandiceps	flathead gudgeon	1.0 – 31.0	2.6 – 12.0	6.0 – 8.6	122.1 – 2,495	0.7 – 36.0
Gobiidae	*Redigobius bikolanus*[A]	speckled goby	11.7 – 27.0	4.8 – 9.2	7.4 – 8.1	249.2 – 1035.7	1.5 – 14.5
Hemirhamphidae	*Arramphus sclerolepis*	snub-nosed garfish	24 – 29	5.6 – 8.3	7.3 – 8.2	198 – 235	3.3 – 5.3
Megalopidae	*Megalops cyprinoides*	oxeye herring	22.9 – 34	1.1 – 9.7	5.3 – 9.1	2 – 200	4 – 270
Melanotaeniidae	*Melanotaenia splendida splendida*[C]	eastern rainbowfish	15 – 32.5	1.1 – 10.8	6.8 – 8.5	49 – 790	0.6-16, but up to 600 (frc pers obs)
Mugilidae	*Mugil cephalus*	striped mullet	16 – 32	NA		2 – 80 ppt	NA
Osteoglossidae	*Scleropages leichardti*	southern saratoga	22.5 - 31	3.6 – 8.3	7.2 – 8.3	NA	12 – 90 cm (SD)
Percichthyidae	*Macquaria ambigua oriens*[B]	golden perch (yellowbelly)	24 – 31	3.6 – 10.0	7.2 – 8.8	NA	4 – 40 cm (SD)
Plotosidae	*Neosilurus ater*[C]	black catfish	21.5 - 33	4.2 – 11.0	6.8 – 8.5	56 – 790	0.3 – 16
	Neosilurus hyrtlii[C]	Hyrtl's tandan	21 - 33	2.6 – 11.0	6.76 – 8.46	56 – 790	0.25 – 16.0
	Porochilus rendahli[C]	Rendahl's catfish	15 - 28	4.2 - 11	7.22 – 8.3	258 – 435	1.3 – 4.75
	Tandanus tandanus[A]	eel-tailed catfish	8.4 – 33.6	0.3 – 17.1	4.8 – 9.1	19.5 – 3,580	0.2 – 250
Poecillidae	*Gambusia holbrooki*	mosquitofish	NA	NA	NA	NA	NA
	Poecilia reticulata	guppy	18 – 28	NA	7 – 8	NA	NA
Pseudomugilidae	*Pseudomugil*	pacific blue	8.4 – 31.7	3.6 – 12.3	6.0 –	72.0 – 1,897.5	0.3 –

Family	*Species*	Common name	Water Temperature (ºC)	Dissolved Oxygen (mg/L)	pH	Conductivity (µS/cm)	Turbidity (NTU)
	signifer [A]	eye			9.1		144.0
Scorpaenidae	*Notesthes robusta*	bullrout	11.7 – 27.1	4.77 – 10	6.7 – 8.95	6 – 1035	0.25 – 16
Synbranchidae	*Ophisternon* spp.	swamp eel	16.2 – 27.8	5.5 –8.0	4.4 – 8.4	19 – 563	0.4 – 18.1
Terapontidae	*Amniataba percoides* [C]	barred grunter	21 - 32	4.6 – 11.0	6.75 – 8.46	48 - 780	0.28 – 17.0
	Bidyanus bidyanus	silver perch	NA	NA	NA	NA	NA
	Hephaestus fuliginosus[C]	sooty grunter	21 – 33	4.2 – 11.0	6.7 – 8.6	56 – 790	0.25 – 16.0
	Leiopotherapon unicolor	spangled perch	5 – 41	≥ 0.4	4 – 8.6	0.2 – 35.5 ppt salinity	1.5 – 260
	Scortum hillii	leathery grunter	NA	NA	NA	NA	NA

A environmental data from captures during surveys in south-east Queensland

B environmental data from captures during surveys in the Fitzroy River system

C environmental data from captures during surveys in the Burdekin River system

NA not available

12-A 1.3 Ecology of Fishes Known or Likely to Occur in the Study Area

Agassiz's Glassfish (*Ambassis agassizii*)

Agassiz's glassfish is commonly found in rivers, creeks, ponds, reservoirs, drainage ditches and swamps from Cairns in Queensland to Lake Hiawatha in New South Wales, and in the Murray-Darling system (McDowall 1996, Allen et al 2002). This species can be found in a variety of still or slow-flowing habitats in lowland larger rivers, upland rivers and streams and small coastal streams, and occasionally in lakes, and river impoundments, particularly in areas with submerged macrophyte and bank side vegetation (Pusey et al 2004). This species has a wide temperature range of 18 – 27 °C (Merrick & Schmida 1984), although they are not tolerant of low dissolved oxygen levels (Tait & Perna 2002), and are generally found in areas of low turbidity (Pusey et al 2004). The diet of this species consists largely of small crustaceans and adult and larval insects, including mosquitoes (McDowall 1996). This species spawns and completes its lifecycle in freshwater, and during spawning deposits and fertilises demersal eggs on aquatic vegetation (Merrick & Schmida 1984). Information on the migration habits of Agassiz's glassfish are limited, however it appears that this species may undertake upstream migrations triggered by increased flow (Pusey et al 2004).

Marbled Eel (Anguilla reinhardtii)

In Australia, marbled eels have been reported from the tip of Cape York Peninsula in Queensland to Melbourne in Victoria (Pusey et al. 2004). Larger marbled eels are typically found near the mouth of the river in reaches dominated by sand, fine gravel and rock substrate, whilst smaller marbled eels are typically found further upstream in reaches dominated by cobble and rock substrate.

Anguillids migrate from freshwater to oceanic spawning grounds in the Coral Sea and the young migrate back to freshwaters to complete their lifecycle (Pusey et al. 2004). The downstream migration can occur over an extended period, but generally peaks during summer and autumn (December to May) (Cotterell 1998). It is believed that the adults die after spawning. Oceanic currents carry the larvae to the coast where they develop and return to freshwater environments. The upstream movement of juveniles is concentrated during the wet spring and summer months (September to March) (Cotterell 1998). The migration of juvenile eels into rivers has been correlated with river discharge, which may guide the eels towards the rivers (Martin 1995, cited in Brizga et al. 2003).

Although eels are known for their ability to overcome obstacles, the swimming ability of juvenile eels may be below that needed to pass beyond fishways. Juvenile marbled eels have a maximum sustained and burst swimming speed of 0.32 and 0.75 m/s (Langdon & Collins 2000 as cited in Pusey et al. 2004). Therefore, it is recommended that the mean and maximum velocities through fishways should not exceed 0.30 and 0.75 m/s.

The marbled eel is a carnivorous species, consuming small sized food items as juveniles and switching to larger diet items and a more diverse array of food types with growth (Pusey et al. 2004). Aquatic insects (89%) dominate the diet of smaller marbled eels (<200 mm TL) with micro-crustaceans, terrestrial invertebrates, and fish consumed in a smaller proportion. Adults consume fish (28%), macro-crustaceans (21%), and aquatic insects (30%) comprise the larger portion of the diet, whilst they also consume terrestrial vertebrates, aquatic algae, terrestrial vegetation, and terrestrial invertebrates. The marbled eel occurs across a range of water quality conditions throughout south eastern Queensland. Anguillids are known to be a hardy group of fish and are able to survive out of water for a long period of time by absorbing oxygen from the atmosphere through the skin or by gulping air (FRC Coastal Resources and Environmental 1999; McDowall 1994, cited in Pusey et al. 2004).

Fly-specked Hardyhead (Craterocephalus stercusmuscarum)

The fly-specked hardyhead is a very widespread species found in coastal and inland drainages of eastern and northern Australia, south to the Queensland border (Pusey et al 2004). This species is common and widely distributed in central Queensland, and is known to occur in the Fitzroy Basin (Burghuis & Long 1999; Pusey et al 2004). The species can be found in a variety of habitat types including rivers, streams, lakes, water impoundments and in brackish river estuaries, with moderate to fast water flows (Pusey et al 2004). This species is likely to migrate year round, migrating upstream to spawn (Marsden & Power 2007), although only low numbers have been found in fishways in the Fitzroy Basin (Pusey et al 2004).

This tropical species is moderately tolerant of a wide range of temperatures, dissolved oxygen, pH and conductivity levels, however appears to be intolerant to high turbidity levels (>100 NTU) (Pusey et al 2004 and references within). This species is a microphagic carnivore consuming aquatic insects and microcrustaceans and to a lesser extent aquatic algae and macrophytes (Pusey et al 2004 and references cited within).

Mouth Almighty (*Glossamia aprion*)

The mouth almighty is widely distributed across northern Australia from the Kimberley region to coastal northern NSW and inhabits floodplain lagoons and streams with a variety of substrate types (Pusey et al 2004). This species may tolerate a wide range of different environmental conditions, including moderate hypoxia, although it generally prefers less turbid waters as it is a visual predator (Pusey et al 2004). This species is unlikely to migrate over substantial distances (Pusey et al 2004).

Fork-Tailed Catfish (*Arius graeffei*)

The fork tailed catfish (*Arius graeffei*) is a widespread species found in a wide variety of habitats including marine, estuarine and freshwaters (Merrick & Schmida 1984). Often found swimming in large aggregations, and commonly associated with the bottom, the fork tailed catfish prefers open water habitat (Herbert & Peeters 1995), although it is also commonly associated with the open-water fringe of dense aquatic macrophyte beds (pers. obs.).

In addition to a wide salinity tolerance, the fork tailed catfish is able to tolerate a wide range of temperatures (juveniles can withstand temperatures of 11 – 37.5°C) (Merrick & Schmida 1984). The species is often found schooling and feeding in waters that are highly turbid, nutrient enriched, low in dissolved oxygen and subject to urban and industrial runoff (e.g. frc environmental 2003).

Freshwater Longtom (*Strongylura krefftii*)

The freshwater longtom is a widely distributed tropical species found across northern Australia, in a range of habitat types. In lagoon habitats, this species is commonly found associated with submerged macrophytes and under overhanging vegetation and tree roots. Habitats with submerged vegetation are thought to be important spawning sites for this species (Pusey et al 2004 and references cited within).

Data on the environmental tolerance of this species is limited, however it has been found in a wide range of water temperatures (22.9 – 38°C) and pH values, and within moderately well oxygenated, high clarity and low conductivity waters (Pusey et al 2004).

There is limited information on the life history characteristics or migration patterns of this species (Pusey et al 2004). This species can be found in fishways and aggregating downstream of impoundment structures, and may undertake seasonal spawning migrations during the wet season (Marsden & Power 2007). Freshwater longtoms may not move easily between river basins, as they have not been found in marine environments, which has important consequences for populations affected by drought, disease or human disturbance (Pusey et al 2004).

Bony Bream (Nematalosa erebi)

Bony bream are abundant detritivores / algivores that form the basis of the food chain for a number of higher order consumers including larger fishes and birds such as cormorants and pelicans (Pusey et al. 2004).

Bony bream commonly occur in the shallows of still or slow-flowing streams, particularly in turbid conditions such as those of the region (Allen et al. 2002). Within the Fitzroy River system, bony bream have been recorded from water temperatures between 24 – 29 °C (Pusey et al. 2004). They have a wide pH (4.8 – 8.6) tolerance and have been recorded from waters with salinity levels approaching those of the seawater (Ruello 1976). High salinity tolerance is undoubtedly one of the factors influencing the widespread distribution of bony bream throughout Australia's freshwater habitats. However, they cannot tolerate low dissolved oxygen levels (Allen et al. 2002) and are the first species to perish when ephemeral habitats start to dry up (Allen et al. 2002).

Carp Gudgeons (*Hypseleotris* spp.)

There is considerable taxonomic uncertainty surrounding the systematics of this genus (especially in juveniles), with some species capable of hybridising. However ecologically, the species are probably very similar (Pusey et al 2004). Carp gudgeons (*Hypseleotris* spp.) are common in coastal drainage basins of eastern Australia, from the northern section of the Murray-Darling Basin and parts of coastal NSW to north Queensland. Some species such as empire

gudgeons (*Hypseleotris compressa*) have broader distributions extending across northern Australia (Pusey et al 2004). Gudgeons are often shelter around aquatic vegetation and under logs and tree roots, commonly in slow moving water in streams, ponds, swamps and drains (Allen et al 2002; Marsden & Power 2007). Adult carp and firetail gudgeons are known to feed on invertebrates, such as mosquito larvae (Diptera: Culicidae), and small crustacea such as cladocerans and ostracods (Merrick & Schmida 1984, Allen et al 2002). These species are quite tolerant to changes in water quality, and under ideal conditions can rapidly increase in numbers (Merrick & Schmida 1984). Most *Hypseleotris* species undertake upstream spawning migrations in low to high water flow, however, the timing of migration and spawning can vary among the different species (Marsden & Power 2007).

Purple Spotted Gudgeon (*Mogurnda adsepersa)*

Purple spotted gudgeons are relatively common and distributed from the Cape York in Queensland to the Clarence River in New South Wales and in the Murray-Darling Basin.

Purple spotted gudgeons are relatively tolerant of low dissolved oxygen and high turbidity, but appear to prefer less turbid waters. They feed primarily on insects, both aquatic and terrestrial, but also eat fish, molluscs, and macro- and microcrustaceans. Spawning occurs in summer months and females spawn repeatedly, between 7 and 10 times per season. Purple spotted gudgeons probably undergo substantial migrations during their early life history as many eleotrids do, moving upstream during periods of flow (Pusey et al. 2004).

Sleepy Cod (Oxyeleotris lineolata)

Sleepy cod are common and widespread in northern Australia between the Ord River on the west coast and Noosa on the east coast (Allen et al 2002). They are a hardy species inhabit rivers, creeks and billabongs, usually in quiet or slow-flowing water among vegetation, around woody debris or beneath undercut banks (Merrick & Schmida 1984, Allen et al 2002). This species is a sluggish bottom dwelling carnivore that feeds on insects, small fishes and crustaceans (Merrick & Schmida 1984, Allen et al 2002). Sleepy cod appear to have a lower thermal limit of 15 °C and Northern Territory populations can withstand temperatures to 32 °C (Merrick & Schmida 1984). Sleepy cod generally do not undertake substantial migrations, with spawning usually occurring between October and February (Allen et al 2002), when water temperatures reach 24 °C. The nest is located on a solid surface (usually rock, tree roots or submerged log) and the male guards the nest for the incubation period of 5 – 7 days (Merrick & Schmida 1984, Allen et al 2002).

Flathead Gudgeon (Philypnodon grandiceps)

Flathead gudgeons are widespread and common within their range, which includes coastal and inland drainages of eastern and southern Australia. This predominantly freshwater species occurs in a wide variety of habitats including streams, rivers, wetlands and billabongs, and can sometimes be found in brackish and estuarine waters (Pusey et al 2004 and references within). This species may be tolerant of poor water quality typical of degraded habitats, however, data is limited to make a full assessment of the levels of tolerance for this species (Pusey et al 2004). This species may undergo spawning and dispersal migrations in freshwater habitats, commonly associated with high water flows (Pusey et al 2004).

Speckled Goby (Redigobius bikolanus)

The speckled goby is widely distributed in tropical areas. In Australia, this species is found in northern Australian coastal regions from Shark Bay in Western Australia, to the Queensland-New South Wales Border (Allen et al 2002). In Central Queensland it is patchily distributed and uncommon in the Fitzroy River (Johnson & Johnson 1984 cited in Pusey et al

2004). This species is commonly found in brackish estuaries and streams close to river mouths (Marsden & Power 2007), and occupies a wide variety of habitat types, with a wide array of sediment types particularly in reaches with fine particle-sized sediments (Pusey et al 2004). There is limited information on the environmental tolerance of this species, however it is believed to be intolerant to very low levels dissolved oxygen and high sediment loads (Pusey et al 2004). This species is a microphagous carnivore that primarily consumes aquatic insect larvae (chironomid midge larvae and trichopteran nymphs) and small amounts of vegetation (Pusey et al 2004).

Reproduction is thought to be entirely in freshwater, however given the distribution in brackish estuaries may have a larval interval in marine or estuarine habitats. Few individuals have been found above weirs and barrages and this species is unlikely to undertake large dispersive of spawning migrations, although more information is required to determine the extent of migratory behaviour for this species.

Wager and Jackson (1993) list this species as Non-Threatened, however, more information about the taxonomy, systematics and life history characteristics of this species may assist understanding of the species ecology and inform further management decisions about this species.

Snub-Nosed Garfish (Arrhamphus sclerolepis)

Two sub-species of snub-nosed garfish are found within Australia. *A. sclerolepis sclerolepis* occurs in the tropical north from Gascoyne River in Western Australia to the Pioneer River in Queensland (Allen et al. 2002). *A. sclerolepis kreffti* occurs along the east coast of Australia between Rockhampton and Sydney (Johnson et al. 1981, Hollaway & Hamlyn 2001, Simpson 1994, cited in Pusey et al. 2004).

A. s. kreffti inhabits estuaries, rivers and the near-shore environment of south east Queensland. Snub-nosed garfish can complete their entire lifecycle in freshwater, but are usually found in the lower reaches of rivers and in estuaries. They migrate into freshwater and breed in macrophyte beds (Cotterell 1998). Snub-nosed garfish reach sexual maturity sizes at about 12 months of age and spawning occurs in late spring-early summer (October–January) (Hughes & Stewart 2006).

As adults, snub-nosed garfish are known to feed on seagrass material in natural wetlands and at night, as they feed on seagrass, crustacean prey is also ingested (Waltham & Connolly 2006). Freshwater juvenile snub-nosed garfish were found to be carnivores, and then switched to being omnivores for a short period before reaching the adult trophic habit of herbivory (Tibbetts & Carseldine 2004). The ontogenetic shift in diet might mean their ability to use plant material is restricted by their capacity to either ingest it or process it efficiently at a smaller size (Tibbetts & Carseldine 2004).

Eastern Rainbowfish (Melanotaenia s. splendida)

The eastern rainbowfish is the common rainbowfish to many parts of north-eastern and central Australia, and is usually abundant wherever it occurs (Allen et al 2002). Where found, this species usually prefers areas of sluggish water flow, and can be found a variety of habitats including streams, wetlands, floodplains and lowland rivers (Pusey et al 2004). This tropical species is tolerant of a wide range of environmental conditions, however is not often found in highly degraded streams (Marsden & Power 2007). This species spawns all year round, although spawning peaks immediately before and during flood periods (Merrick & Schmida 1984). Adults migrate upstream to spawn during the wet season from (November to April) when water flows are high and juveniles disperse from the spawning grounds (Merrick & Schmida 1984).

Southern Saratoga (Scleropages leichardti)

Southern Saratoga are surface dwelling predators that are endemic to the Fitzroy Basin and commonly found in slow flowing rivers and billabongs that have abundant structure and overhanging vegetation (Marsden & Powers 2007). This species spawns after a period of courtship between September and November, with the females retaining eggs in their buccal cavity (Pusey et al 2004). It is unlikely that this species undergoes substantial migrations, however this species has been found below weirs during high summer flow events (Marsden & Power 2007).

Golden Perch (Macquaria ambigua oriens)

Golden perch are large piscivorous predatory fish that are sought after by anglers. Golden perch inhabit numerous water bodies east of the Great Dividing Range, due to transplanting and stocking, however, the Fitzroy Basin is the only drainage (east of the Great Dividing Range) where they naturally occur as the subspecies *Macquaria ambigua oriens.* Golden perch can tolerate extremes in temperature (4 – 35 °C) (Allen et al 2002) although in the Fitzroy River they have been recorded in waters ranging from 24 – 31 °C (Midgeley 1942, cited in Pusey et al 2004). Golden perch are very tolerant of high turbidity (Gehrke et al 1993), and may move long distances upstream during floods (Allen et al 2002).

Black Catfish (*Neosilurus ater*)

Black catfish are a bottom dwelling species, common to northern Australia, that occupies a variety of fast and slow moving waters of streams and rivers (Marsden & Power 2007). This freshwater species is generally tolerant of high water temperatures and a wide range of dissolved oxygen and pH levels (Pusey et al 2004). This species is a nocturnal predator with a general diet consisting of crustaceans, worms, molluscs and insects (Marsden & Power 2007). This species undertakes spawning migrations upstream during peak flooding periods, where it builds nests to brood eggs. Adults and juveniles then disperse back downstream (Marsden & Power 2007).

Hyrtl's Tandan (Neosilurus hyrtlii)

This species is very common and widespread in coastal drainages of northern Australia, as far south as Mary River on the east coast and the Pilbara on the west coast (Allen et al 2002). It also occurs widely throughout central Australia (Allen et al 2002) and is known to occur in the Fitzroy River (Merrick & Schmida 1984). Hyrtl's tandan is a shoaling species that occupies a diverse range of habitats including still or flowing waters, pools and billabongs (Allen et al 2002). This species feeds on insects, molluscs, small crustaceans and worms (Allen et al 2002). The spawning behaviours of interior populations are unknown; however, northern populations breed at the beginning of the wet season in shallow, sandy areas in the upper reaches of streams (Allen et al 2002). Further research is required as this species may actually represent more than one species (Allen et al 2002).

Rendahl's Catfish (*Porochilus rendahli*)

This benthic fish species has a patchy and uncommon distribution that extends across northern Australia, down the east coast to Brisbane (Allen et al 2002, Pusey et al 2004). This species is commonly found in slow flowing areas in a variety of riverine and lagoon habitats with muddy substrata and dense macrophyte coverage (Pusey et al 2004). This species is tolerant of wide variety of environmental conditions including hypoxic waters, a wide pH range and moderate turbidity levels (Pusey et al 2004). Generally little is known about the migratory behaviour of this species, however spawning migrations to lowland lagoons have been reported in northern Australia (Bishop et al 2001 cited in Pusey et al 2004). The diet of this species consists of aquatic invertebrates and microcrustaceans including chironomid midge larvae and small ephemeropteran nymphs (Pusey et al 2004).

Eel-tailed Catfish (*Tandanus tandanus*)

Eel-tailed catfish have been stocked throughout eastern Australia for recreational angling. They are found in a range of habitats, from small-order streams to rivers, and they are generally more abundant when the riparian zone is intact and there is abundant terrestrial debris in the channel to provide habitat (Pusey et al. 2004). In general, they are tolerant of low oxygen concentrations and a range of temperatures (8.4 – 33.6 °C), although they can be sensitive to sudden decreases in temperature (Pusey et al. 2004). They mainly feed on aquatic insects as juveniles and switch to a more varied diet as adults. Adults exhibit some parental care by building circular nests in gravel beds.

Pacific Blue Eye (Pseudomugil signifer)

This species is found along the eastern Australia, along the coast from Cape York Peninsula, south to Narooma (NSW) (Pusey et al 2004 and references cited within). This species is common and widespread in a variety of fast flowing coastal habitats including rivers, lagoons, streams and estuaries in central Queensland (Pusey et al 2004 and references cited within). This loosely schooling species is most commonly found in the mid to upper water column, in association with some form of submerged cover. This species is tolerant of a wide variety of temperatures and salinity levels, given the distribution, and generally prefers well-oxygenated, low turbidity waters (Pusey et al 2004). This species can complete reproduction naturally in fresh or marine waters and may undertake dispersal migrations, although these are not common (Pusey et al 2004). This species is a microphagous carnivore. In freshwater habitats more than 62% of its diet consists of aquatic insects, with a greater proportion of flying aquatic insects in estuarine situations (Pusey et al 2004).

Bullrout (Notesthes robusta)

Bullrout are distributed along the east coast of Australia from Cooktown to southern New South Wales (Allen et al. 2002). They are ambush predators that feed primarily on macrocrustaceans and they hide under structure and use camouflage for disguise (Pusey et al. 2004). They have venomous dorsal pectoral and anal spines that can cause severe injury. They are typically found in well-oxygenated waters of neutral pH.

Bullrout appear to be catadromous and move into estuaries to spawn in April to June, and then migrate upstream between winter and early spring during colder periods with reduced flow. However, very little is known of their reproductive biology and females are thought to be capable of breeding in freshwater.

Barred Grunter (Amniataba percoides)

The barred grunter is widely distributed throughout river systems, from estuaries to upper reaches, in coastal rivers across northern Australia from the Ashburn River (WA) to the Gregory River (QLD) and in northern inland drainages such as Lake Eyre (Allen et al 2002; Pusey et al 2004). This benthic freshwater species occupies a wide variety of habitat types from still pools to fast flowing streams (Allen et al 2002), and is rarely observed in the upper half of the water column (Pusey et al 2004).

Limited data exists to determine the environmental tolerance range of this species, however, it has been found in a wide variety of environmental conditions, and may be tolerant of a range of water temperatures, pH and turbidity levels, and may also tolerate moderate salinity levels for short time periods (Pusey et al 2004). It is an omnivorous species, feeding largely on aquatic insects (59%) and up to 36% of aquatic vegetation (with the relative proportion of filamentous algae to macrophytes consumed, varying with size) (Pusey et al 2004).

Barred grunters undertake spawning and dispersal migrations, and are capable of passing barriers that most other species are unable to negotiate (Pusey et al 2004). Downstream spawning migrations often occur in the wet season when adults move from refuge habitats downstream to lowland floodplains. Adult and juvenile undertake return migrations from lowland lagoons upstream to refuge habitats as lowland habitats begin to dry up during the dry season (Marsden & Power 2007 and references within).

Silver Perch (Bidyanus bidyanus)

Silver perch were originally distributed throughout the Murray-Darling drainage, however, they have been stocked into impoundments and rivers outside of the Murray-Darling. The species is now considered vulnerable by the ICUN and is protected in rivers within NSW and South Australia.

Silver perch formerly made large spawning migrations from lowland to the upland reaches of the Murray-Darling in late spring to early summer. They inhabit fast flowing waters and feed on invertebrates, fish, and vegetative matter. Population declines are thought to be the result of weirs impeding fish passage, predation and competition from introduced fish, introduced diseases (namely from redfin) and egg mortality. Silver perch produce partially bouyant eggs that sink without significant current. It is thought that alterations to flow and sedimentation (from dams, carp foraging and agriculture) have caused eggs to sink into beds of soft sediment leading to egg mortality via anoxia.

Sooty Grunter (Hephaestus fuliginosus)

The sooty grunter has a patchy distribution across northern and eastern Australia from the Daly River (NT) to the Pioneer River (QLD) (Pusey et al 2004), with records from the Connors and Isaac rivers in the Fitzroy Basin (Marsden & Power 2007; this study). This species is commonly found in the upper reaches of river systems, typically with high flows (Allen et al 2002; Pusey et al 2004). Adults are more abundant in deeper pools with submerged woody debris and undercut banks (Pusey et al 2004). This species is generally found in tropical waters with moderately dissolved oxygen concentrations and low salinity and turbidity levels.

The sooty grunter completes its entire lifecycle in freshwater and may undertake migrations upstream to spawn, in response to wet season flooding. Adults and juveniles make subsequent migrations back downstream and into refuge habitats during the dry season (Pusey et al 2004; Marsden & Power 2007).

The dietary preferences of this aggressive predator vary with age, however, its diet generally includes aquatic insects, macrocrustaceans, filamentous algae and macrophytes (Pusey et al 2004).

Spangled Perch (Leiopotherapon unicolor)

Spangled perch are Australia's most widespread native fish, being abundant within most aquatic habitats extending across coastal northern Australia and inland waters (Allen et al. 2002; Pusey et al 2004). Of particular relevance to their abundance in western and central Queensland creeks is their ability to aestivate in wet mud or under moist leaf litter in ephemeral water holes during droughts (Allen et al. 2002); therefore spangled perch are likely to persist in the creeks within the study area throughout the year. As an adaptation to living in quick-drying waterholes, spangled perch eggs hatch in 2 days and the larvae develop in 24 days (Allen et al. 2002). This species can generally tolerate a wide range of environmental conditions including water temperatures (5 – 44 °C), salinity (0 –34 ppt) and pH (4 – 10.2) (Pusey et al 2004).

Like other terapontids, the spangled perch is also capable of rapid and extensive movements and migrating past barriers that impede other fish species (Pusey et al 2004; Marsden & Power 2007). Adults migrate upstream during high flow events to spawn and adults and juveniles undertake dispersive (lateral) migrations from refuge habitats to floodplain habitats during the wet season (Marsden & Power 2007).

Leathery Grunter (*Scortum hillii*)

This species is endemic to the Fitzroy-Dawson river system, where it is commonly found in still pools or flowing streams (Allen et al 2002; Marsden & Power 2007). This species can form shoals near the benthos in both clear and turbid waters and generally tolerates water temperatures from 12 to 35°C (Allen et al 2002). This species is a specialist consumer, with dietary preferences for freshwater mussels and algae.

This species undertakes substantial upstream migrations to spawn, in response to increased water flows during the wet season. Juveniles then disperse back downstream once flows have subsided (Marsden & Power 2007). Anecdotal reports suggest that the numerous barrages and weirs may prevent upstream spawning migrations and decrease preferred habitat types, which would have a profound effect on the population size of this endemic species (Marsden & Power 2007).