Queensland **the Smart State**

Fisheries Long Term Monitoring Program

Summary of freshwater survey results: 2000–2005

November 2007

Queensland Government
Department of Primary Industries and Fisheries

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Contents

Acronyms

CPUE	Catch per unit of effort
CREB Track	Cairns Regional Electricity Board Track
DPI&F	Department of Primary Industries and Fisheries, Queensland
LTMP	Long Term Monitoring Program, DPI&F
GPS	Global Positioning System

Summary

This report is a summary of the data collected in the Fisheries Long Term Monitoring Program freshwater fish surveys from 2000 to 2005.

Queensland's freshwater reaches contain a diverse array of freshwater fish fauna. Over 130 native species are recognised in north eastern Australia which is approximately half of the freshwater fish fauna of the Australian continent (Pusey e*t al*. 2004).

The sustainability of freshwater fish is highly dependent on suitable riverine habitat as species diversity and populations are closely linked to habitat conditions. Exotic fish species including carp *(Cyprinus carpio*), tilapia (*Tilapia, Oreochromis* spp.) and mosquitofish (*Gambusia* spp.) may compete with, or prey on, the eggs and juveniles of native species.

The Department of Primary Industries and Fisheries (DPI&F) Long Term Monitoring Program (LTMP) has monitored the freshwater fish of 10 river systems in Queensland since 2000. The program uses electrofishing sampling techniques to collect annual information on populations of key recreational, commercial and exotic fish species. The program also collects ancillary information on water quality and habitat conditions that may help to correlate changes in fish community structure.

Species diversity in most rivers has remained fairly stable throughout the period of the study. Six exotic fish species have been encountered, with goldfish, European carp and tilapia being of major concern to state agencies.

The six years of sampling has been successful in obtaining a baseline dataset of the fish resources for the ten rivers monitored under the freshwater component of the LTMP.

Long Term Monitoring Program background

The Department of Primary Industries and Fisheries (DPI&F), Queensland, manages the State's fish, mollusc and crustacean species and their habitats. As part of this commitment, DPI&F monitors the condition of, and trends in, fish populations and their associated habitats. This information is used to assess the effectiveness of fisheries management strategies and helps ensure that the fisheries remain ecologically sustainable.

DPI&F uses the information to demonstrate that Queensland's fisheries comply with national sustainability guidelines, allowing exemption from export restrictions under the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999*.

DPI&F initiated a statewide Long Term Monitoring Program (LTMP) in 1999, in response to a need for enhanced data used in the assessment of Queensland's fisheries resources. The LTMP is managed centrally by a steering committee with operational aspects of the program managed regionally from the Southern and Northern Fisheries Centres located at Deception Bay and Cairns respectively. The regional teams are responsible for organising and undertaking the collection of data used for monitoring key commercial and recreational species, and for preparing data summaries and preliminary resource assessments.

A series of stock assessment workshops in 1998 identified the species to include in the LTMP. These workshops used several criteria to evaluate suitability including:

- the need for stock assessment
- the suitability of existing datasets
- the existence of agreed indicators of resource status
- the practical capacity to collect suitable data.

Resources monitored in the program include saucer scallops, spanner crabs, stout whiting, yellowfin bream, sand whiting, dusky flathead, rocky reef fish, eastern king prawns, blue swimmer crabs, sea mullet and tailor in southern Queensland; tiger and endeavour prawns and coral trout and redthroat emperor in northern Queensland; and mud crabs, barramundi, spotted and Spanish mackerel and freshwater fish throughout the state. Various sampling methods are used to study each species.

The LTMP collects data for resource assessment (ranging from analyses of trends in stock abundance indices to more complex, quantitative stock assessments) and management strategy evaluations.

Stock assessment models have already been developed for saucer scallops, spanner crabs, stout whiting, mullet, tailor, barramundi, tiger and endeavour prawns, redthroat emperor, and spotted and Spanish mackerel. In some cases management strategy evaluations have also been completed and the data collected in the LTMP proved integral to these activities.

The assessments and evaluations have allowed for improvements to the management of Queensland's fisheries resources. Enhancements to ongoing monitoring have also been identified, particularly to address the increasing demand for high quality data for dynamic fish population models.

Through the ongoing process of collecting and analysing LTMP data and incorporating these data into regular assessments and refining monitoring protocols as required, DPI&F is enhancing its capacity to ensure that Queensland's fisheries resources are managed on a sustainable basis.

Introduction

Queensland's freshwater reaches contain a diverse array of freshwater fish fauna. Over 130 native species are recognised in north eastern Australia which is approximately half of the fish fauna of the Australian continent (Pusey e*t al*. 2004). In addition to these freshwater fishes, many other species from marine or estuarine families utilise freshwater riverine reaches of Queensland during some stage of their lifecycle. These include a number of fish species important to recreational, indigenous and commercial fishing, such as mullet (Mugilidae), barramundi (Centropomidae), mangrove jack (Lutjanidae), bigeye trevally (Carangidae), bream (Sparidae) and some sharks and rays (Carcharhinidae and Dasyatidae).

The sustainability of freshwater fish is highly dependent on suitable riverine habitat as species diversity and populations are closely linked to habitat conditions. Changes in the water quality or temperature of the river can stress fish populations and the loss of riparian and instream vegetation can affect the habitat in which fish live. Barriers such as dams and weirs can impede migrations and movements of fish preventing spawning and access to food. Exotic fish species including carp *(Cyprinus carpio*), tilapia (*Tilapia, Oreochromis* spp.) and mosquitofish (*Gambusia* spp.) may compete with, or prey on, the eggs and juveniles of native species.

The majority of recreational, indigenous and commercially important fish in rivers are from wild stocks. These fisheries are therefore dependent on the maintenance of viable river systems and the implementation of appropriate fishing regulations to ensure adequate recruitment of fish into the populations.

The Department of Primary Industries and Fisheries (DPI&F) Long Term Monitoring Program (LTMP) has monitored the freshwater fish of 10 river systems in Queensland since 2000. The program uses fishery independent electrofishing sampling techniques to collect annual information on populations of key recreational and commercial species.

The sustainability of native freshwater fish stocks is highly dependent on the condition of the freshwater habitat. The program collects ancillary information on water quality and habitat conditions, and this may help to correlate changes in fish community structure. Data collected may provide early warning on declines, or show increases in fish numbers. Trends in abundance may be linked to changes in habitat, flow management, construction of fishways or introduction of fisheries regulations.

Noxious fish are monitored as a part of the LTMP surveys to assist in the development of management strategies to control their populations. The information collected during the annual LTMP surveys will be used to develop improved management practices, to target research to solve identified problems, and to provide advice to water managers and land management agencies on the impact of their activities.

Objectives

The objectives of the freshwater monitoring program are to monitor selected rivers for changes in:

- species diversity and abundance
- length structure of key recreational and commercial species
- occurrence of exotic fish species.

The objectives of this report are to provide a summary of:

- the methods used to conduct annual freshwater surveys
- the annual survey results from 2000 to 2005 including trends in the length and relative abundance of key commercial and recreational fish species for each river system, and trends in the water quality and habitat of each system.

Methods

For detailed sampling protocols see the document “Fisheries Long Term Monitoring Program Sampling Protocol – Freshwater: (2000 onwards) Section 1” DPI&F (2006).

Sites

Ten rivers are monitored by the program (Figure 1). In each river, seven reaches, each containing six random locations, are sampled.

Figure 1. Location of river systems monitored by the Long Term Monitoring Program.

Rivers

The river systems were selected based on the following criteria:

- level of recreational angling pressure
- importance to commercial fisheries in adjacent coastal/estuarine areas
- likelihood of changes in the near future (e.g. fishway installation, water infrastructure development)
- previous monitoring at established sites
- representative of a north east coastal, south east coastal, gulf or inland system
- level of modification (at least one relatively unmodified river in each region was chosen).

River systems chosen for monitoring include (Figure 1):

South east coastal drainage

- Noosa River
- Mary River
- Albert/Logan Rivers

West of the Great Dividing Range

- Condamine/Balonne River
- Warrego River

North east coastal systems

- Johnstone River
- Herbert River
- Daintree River

Gulf of Carpentaria drainage

- Gregory River
- Mitchell River

Reach selection and sampling

Sections of each river were selected that were navigable and fishable by an electrofishing boat and normally in the lower two-thirds of the river systems. On all river systems, reaches upstream of any low weirs, which occasionally or regularly drown out, were included. Reaches upstream of major dams were included on the Condamine and Warrego Rivers as yellowbelly (*Macquaria ambigua*), the main angler target species, may have self-sustaining populations upstream of the major dams. However impounded waters, which inundate more than the width of the main river channel, were excluded. On coastal river systems, tidal freshwaters were included if they were known to be consistently fresh. This was indicated by the presence of freshwater aquatic plants, including *Vallisneria gigantea* and by local knowledge.

Selected sections of each river were divided into two kilometre reaches and numbered from the source of the river. Random numbers were used to select seven sampling reaches on each river. If no access was available for a selected reach, the next upstream reach was used. Once reach selection was finalised, Global Positioning System (GPS) coordinates of the upstream and downstream limits were recorded. Reach locations were fixed for all sampling years. Reaches were divided into up to 80 shot locations, 50 m long, and numbered from upstream to downstream alternating from the left to right. Each year, six navigable shot locations were randomly sampled within each reach.

Times

Approximately one week is allocated to sample each coastal river system, including travel between reaches (Table 1).

Table 1. Approximate survey times for the LTMP freshwater surveys in north and south Queensland between 2000 and 2005. Shading indicates the regular sampling periods, and years indicate when sampling has been conducted outside regular sampling times.

River System	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Noosa River									
Mary River									
Albert-Logan River									
Condamine-Balonne River					2001				
Warrego River					2001				
Daintree River							2000 2001		
Mitchell River							2000 2001		
Gregory River							2000 2001		
Johnstone River							2002	2000 2001	
Herbert River								2000 2001	

On-site procedures

Sampling is conducted using a flat bottomed electrofishing vessel. This method involves an electric current being passed through the water to temporarily stun fish. The current is adjusted at each reach for the prevailing temperature and conductivity.

One standard electrofishing shot covers a 50 m section adjacent to the river bank, with total power on time of 5 minutes. Two parallel bank runs are conducted between 10 and 15 m from the bank or the edge of emergent vegetation, to ensure the capture of mid-water and pelagic species (Figure 2). The 50 m parallel runs are approximately one minute in duration and both are conducted travelling upstream from the same starting point. To minimise pushing fish ahead of the boat the electrofisher power is alternated on and off at 12 second intervals. Ten perpendicular runs are then conducted, one at every five metres (Figure 2). During each run into the bank the boat travels four metres for eight seconds, pauses at the bank for eight seconds and then reverses four metres away from the bank for eight seconds. This sampling method was designed to sample both pelagic and demersal species.

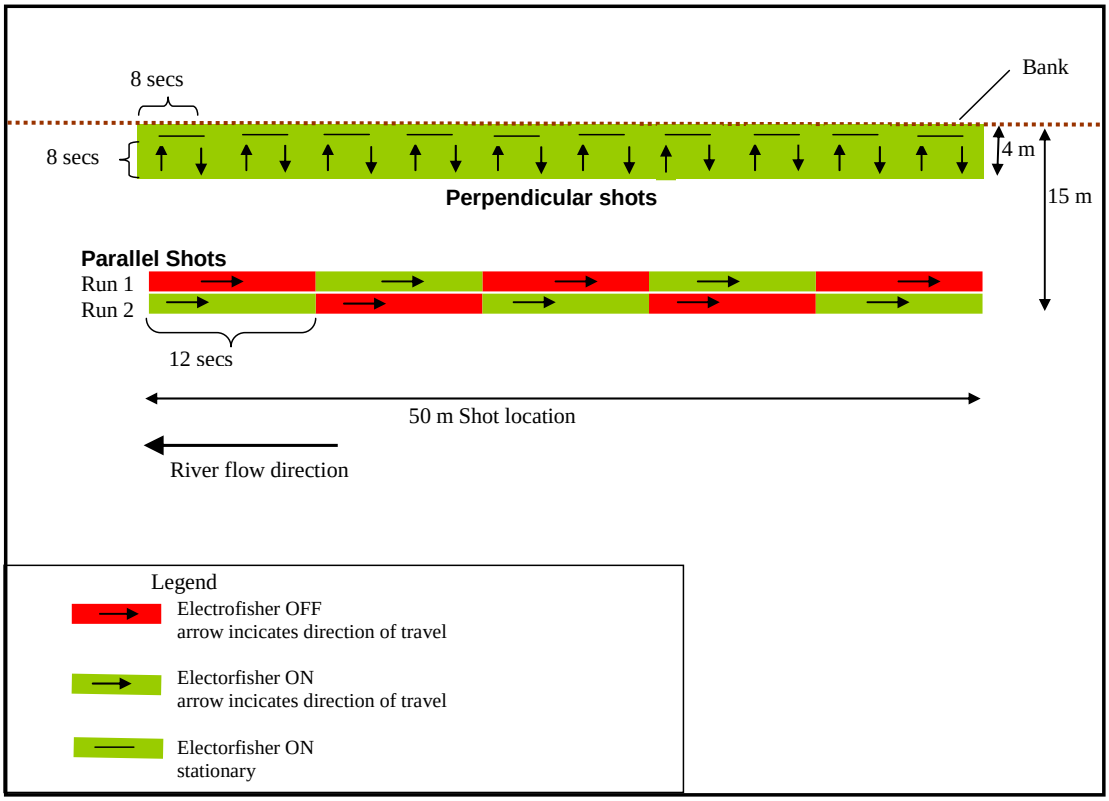


Figure 2. A standard shot, showing the two components: shots parallel and perpendicular to the bank. During the parallel shot, two runs are made, alternating the sections run with the electrofisher on and off. During the perpendicular shot, the electrofisher remains on for the entire 24 seconds of each shot.

Stunned fish are collected during and after electrofishing using soft-material dip-nets and are placed in an aerated holding tank. Abundance data are recorded for all species captured. The lengths of fish are also recorded for all commercial and recreational target species and exotic species.

Water quality is measured at the surface (0.5 m depth), with dissolved oxygen, temperature, salinity, conductivity, turbidity and pH being recorded with a digital analyser. In depths of more than three metres a bottom set of water quality measurements are also recorded. A Secchi depth reading is taken as a measure of water clarity.

For each shot location visual estimates are recorded of:

- stream structure
- water level
- river velocity
- disturbance
- riparian vegetation
- stream habitat
- bank habitat
- substrate
- riparian cover.

Further details of sampling procedures are documented in DPI&F (2006).

Species of interest

The target commercial, recreational and exotic species for which length and abundance information is collected each year are listed in Table 2.

Table 2. List of freshwater commercial or recreational target species and exotic species for which the Long Term Monitoring Program freshwater surveys collect length and abundance data.

Scientific name	Common name
Acanthopagrus australis	yellowfin bream
Acanthopagrus berda	pikey bream
Anguilla australis	Southern shortfin eel
Anguilla obscura	Pacific shortfin eel
Anguilla reinhardtii	longfin eel
Arius berneyi	highfin catfish
Arius midgleyi	silver cobbler
Arrhamphus sclerolepis	snubnose garfish
Bunaka gyrinoides	greenback gudgeon
Carassius auratus	goldfish
Chanos chanos	milkfish
Cyprinus carpio	European carp
Hephaestus carbo	coal grunter
Hephaestus fuliginosus	sooty grunter
Kuhlia rupestris	jungle perch
Lates calcarifer	barramundi
Leiopotherapon unicolor	spangled perch
Liza argentea	goldspot mullet
Lutjanus argentimaculatus	mangrove jack
Maccullochella peeli mariensis	Mary River cod
Maccullochella peeli peeli	Murray cod
Macquaria novemaculeata	Australian bass
Megalops cyprinoides	oxeye herring
Mesopristes argenteus	silver grunter
Mugil cephalus	sea mullet
Neosilurus ater	black catfish
Neosilurus hyrtlii	Hyrtl's catfish
Oxyeleotris lineolata	sleepy cod
Oxyeleotris selheimi	blackbanded gudgeon
Platycephalus fuscus	dusky flathead
Porochilus rendahli	Rendahl's catfish
Scortum hillii	leathery grunter
Selenotoca multifasciata	striped scat
Strongylura krefftii	freshwater longtom
Tandanus tandanus	freshwater catfish
Tilapia mariae	spotted tilapia
Toxotes chatareus	sevenspot archerfish
Trachystoma petardi	pinkeye mullet

Fish species identification in the field and laboratory was facilitated by using several fish identification books and field guides (Allen *et al.* 2002, Herbert and Peters 1995, Johnson 2000, and McDowall 1996). Species that were not identified in the field or laboratory were sent to Jeff Johnson of the Queensland Museum for formal identification.

Data summaries and analysis

Water quality results are presented with 95% confidence intervals.

The unit of effort that fish catch rate data are reported on relates to 30 minutes “on time” of electrofishing. This equates to the amount of electrofishing on time fished at each reach surveyed in this study. The application of on time is strictly regulated to standardise both the amount of power applied and the vessel and netter behaviour during the fishing period. This enables separate teams in different parts of the state to undertake a comparative sampling method.

In this summary report, average catch rates (catch per unit effort [CPUE] is the number of fish per 30 minutes of electrofishing on time) are calculated for each reach and averaged across the river for each year, together with length distribution of selected target species.

The Shannon Weaver diversity index (Zar 1984) was calculated for fish species caught during the electrofishing surveys. Diversity was compared between years for each river system.

Data limitations

While all due care and attention was paid in the collection of these data, caution needs to be applied when using the results of these surveys. Reasons for this include pooling of data and implicit assumptions on the sub-sampling techniques used (e.g. catch randomly sampled).

Results and discussion

Gregory River

River description

The Gregory River is 397 km long, drains into the Gulf of Carpentaria, has a catchment area of 5517 km² and flows into the Nicholson River some 25 km upstream of Escott Station (Figure 3). Baseflows of the Gregory River are fed by spring water discharge from the sandstones and limestones that underlie the Barkly Tableland (Whitehouse, F. 1947). This is reflected in the water chemistry which has relatively high conductivity because of concentrations of bicarbonate ions in the waters.

Many of the reaches on this river are long narrow pools or sections of river with steep, undercut banks (Figure 4). A weir on the river at Escott Station provides a potable water source for the Burketown area. This weir creates a barrier to upstream fish movement at low to medium water levels, being passable for fish at high water levels. Low density cattle grazing occurs throughout the catchment.

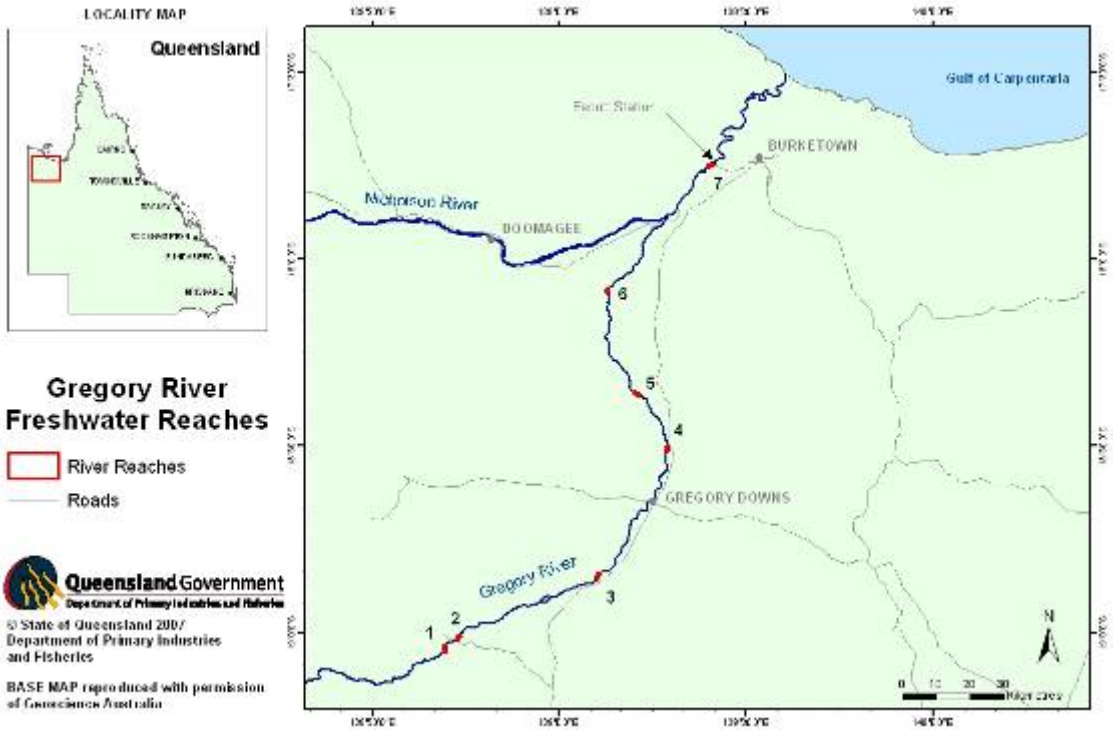


Figure 3. Location of the reaches sampled annually within the Gregory River.

Figure 4. Typical bank habitat sampled within the Gregory River.

Habitat

Riparian and in-stream habitat remains in excellent condition throughout the length of the river with disturbance ratings of undisturbed to low predominating (Figure 5). Stream bank disturbance is chiefly attributed to bank erosion from seasonal high flows, and cattle and pig access. In-stream habitat consists of snags, some extensive areas of aquatic macrophytes, undercut banks, overhanging vegetation, root mass and a light coverage of leaf litter.

In 2002 aquatic macrophytes covered large sections of reaches 1 and 2 as is displayed in Figure 6 with the greater frequency of >200m^2 coverage. Snags were present at almost all shot locations along with an overall light covering of leaf litter.

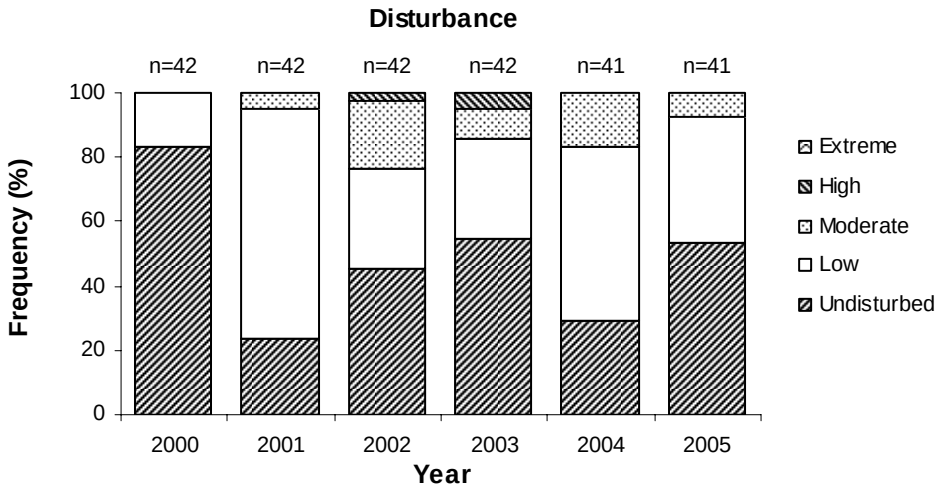


Figure 5. Stream bank disturbance ratings for the Gregory River between 2000 and 2005. The number of shot samples (n) are shown for each year.

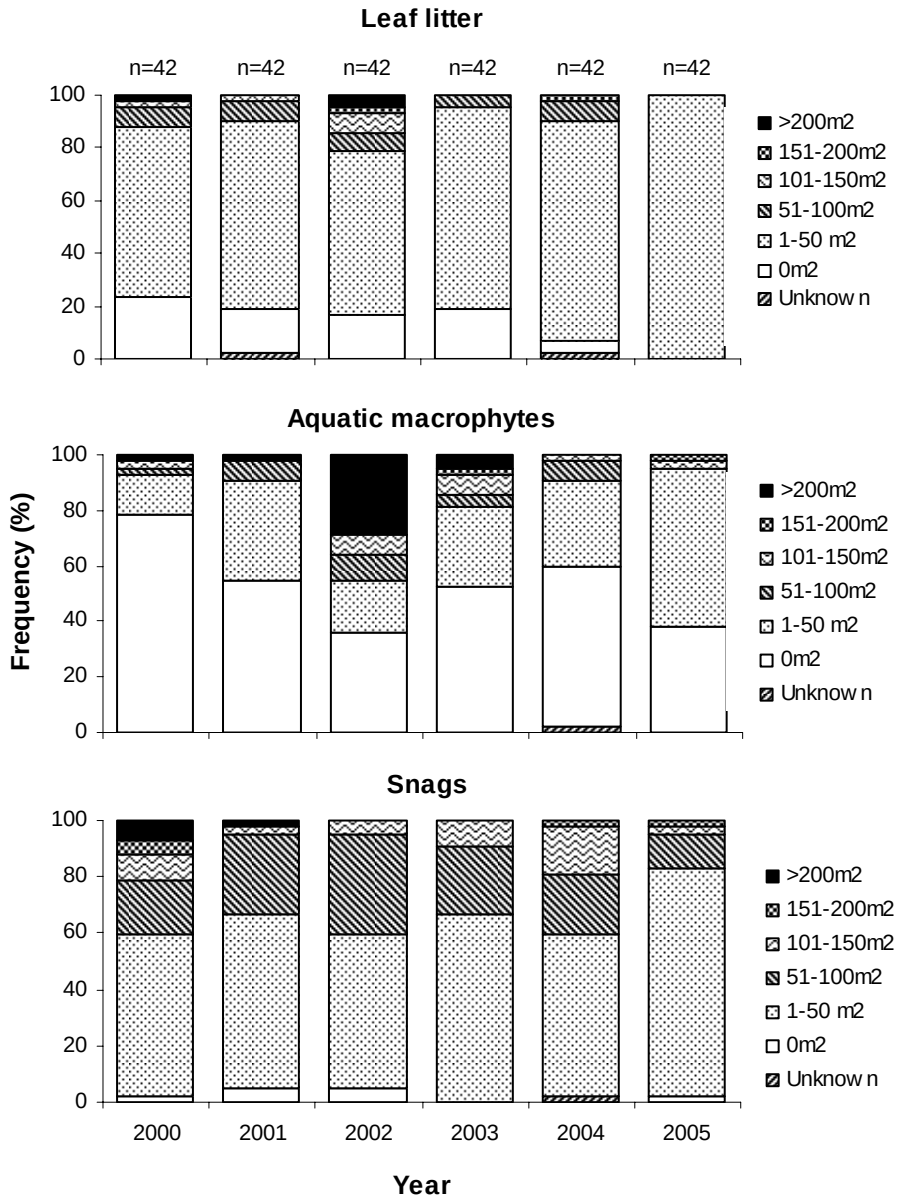


Figure 6. In-stream habitat parameters for the Gregory River including leaf litter, aquatic macrophytes and snag coverage. The number of shot samples (n) are provided for each year.

Water quality

Water clarity in the Gregory River is usually good with turbidity decreasing toward the river source. The lowest mean visibility in Secchi depth of 288 cm was recorded in 2005 (Figure 7). The highest mean visibility across the years was 342 cm in 2002. The high concentrations of bicarbonate ions in the water (reflected in the high conductivity readings) form calcium deposits on the substrate and in-stream vegetation.

Spot sampling for temperature and conductivity suggests that values are fairly uniform from one year to another (Figure 7). Similarly, dissolved oxygen concentrations were relatively stable at between 7 to 8.5 mg L^{-1}, levels that should pose no problems for resident fish populations (Figure 7).

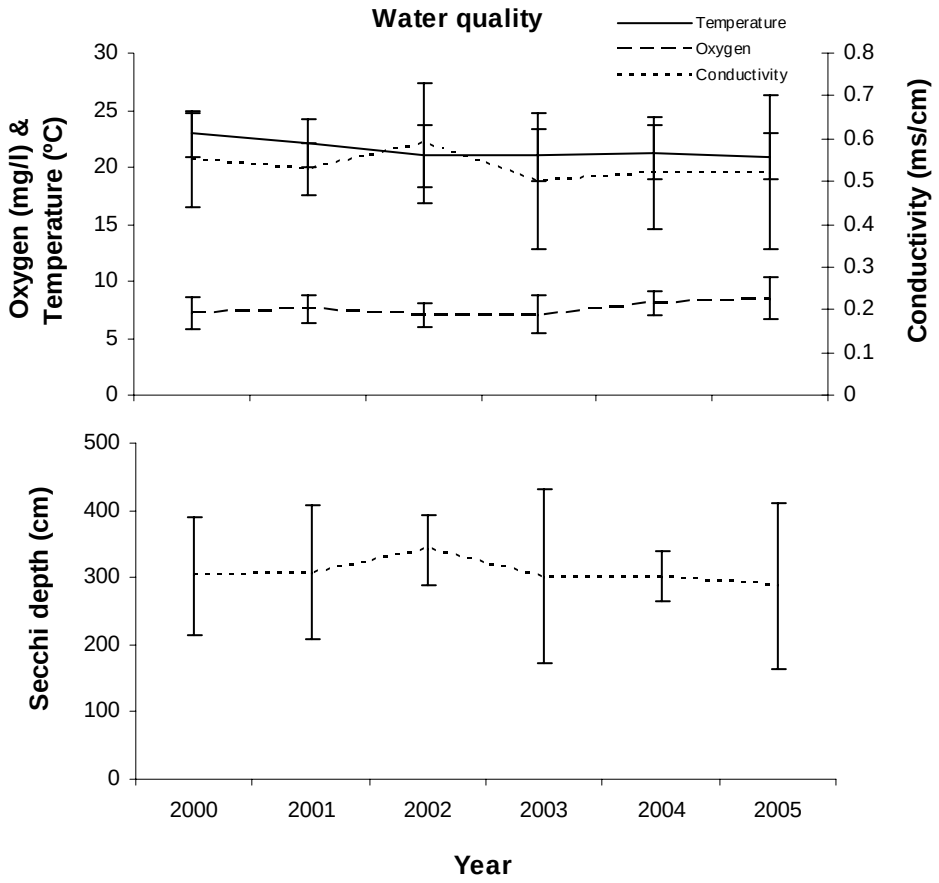


Figure 7. Water quality parameters for the Gregory River, including temperature, oxygen and conductivity (top) and Secchi depth measurements (bottom) between 2000 and 2005. Ninety-five percent confidence intervals are shown.

Fish fauna

There was generally a low catch rate (number of fish caught per sample location) for all reaches within this river (Table 3). The depth of pools (often over 4 m just off the bank) and excellent visibility may have decreased the effectiveness of the fishing method.

Sleepy cod (*Oxyeleotris lineolata*) were the most abundant species encountered across all years. The dominant sleepy cod size classes are from the 60–89 mm to 150–179 mm classes with a second notable size class of larger fish from 360 to 419 mm (Figure 9).

Table 3. Fish catch rates (CPUE) in the Gregory River. Target species are highlighted in bold.

Scientific name	Common name	Year					
		2000	2001	2002	2003	2004	2005
Ambassis agassizi	Agassiz's glassfish			0.14			
Ambassis agrammus	sailfin glassfish		0.14				
Ambassis macleayi	Macleay's glassfish	0.57	1.74	0.43	1.73	0.71	1.72
Ambassis spp	a glassfish	0.57	0.14	0.29	0.14	0.14	0.14
Amniataba percoides	barred grunter	2.30	2.90	1.30	1.58	2.29	2.01
Arius berneyi	**highfin catfish**				**0.14**		
Arius graffei	blue catfish						0.29
Arius leptaspis	boofhead catfish		0.14				
Belonidae - undifferentiated	longtoms		0.14				
Brachirus spp	a freshwater sole				0.14		
Craterocephalus stercusmuscarum	flyspecked hardyhead	1.87	1.01	1.44	2.73	0.71	2.44
Craterocephalus stramineus	blackmast	1.15	2.03	0.43	0.86	1.00	2.44
Eleotris melanosoma	black spine-cheek gudgeon	0.14					
Glossamia aprion	mouth almighty	4.89	4.78	4.77	5.04	5.00	5.44
Glossogobius aureus	golden flathead goby	0.14					0.43
Glossogobius giuris	tank goby						0.57
Glossogobius spp	a goby	1.01	1.74	0.87	0.72	1.57	0.43
Hephaestus carbo	**coal grunter**	**0.29**	**0.14**	**0.43**			
Hephaestus fuliginosus	**sooty grunter**	**1.29**	**0.87**	**0.58**	**0.29**	**0.14**	**0.43**
Lates calcarifer	**barramundi**	**3.02**	**2.61**	**1.73**	**0.43**	**0.29**	**1.15**
Leiopotherapon unicolor	**spangled perch**	**0.72**	**0.58**			**0.29**	**0.14**
Melanotaenia fluviatilis	Murray River rainbowfish	0.14					
Melanotaenia inornata	a rainbowfish	3.16	2.46	0.87	2.30	1.57	1.72
Nematalosa erebi	bony bream	1.58	2.90	0.87	1.44	1.00	1.43
Neosilurus ater	**black catfish**	**0.43**	**0.43**	**1.16**	**0.58**	**0.57**	**0.29**
Neosilurus hyrtlii	**Hytrl's catfish**				**0.14**		
***Neosilurus* spp**	**a catfish**		**0.14**				
Oxyeleotris lineolata	**sleepy cod**	**10.20**	**22.01**	**11.41**	**10.79**	**9.72**	**10.17**
Oxyeleotris selheimi	**blackbanded gudgeon**	**1.44**	**2.03**	**2.31**	**2.30**	**0.57**	
Porochilus rendahli	**Rendahl's catfish**					**0.14**	
Scortum hillii	**leathery grunter**	**0.29**					
Scortum ogilbyi	Gulf grunter					0.14	0.14
Scortum spp	a grunter		0.14				
Strongylura krefftii	**freshwater longtom**	**0.72**	**0.58**	**0.29**	**0.14**	**0.86**	**0.29**
Thryssa scratchleyi	freshwater anchovy		0.29	0.14			0.57
Toxotes chatareus	**sevenspot archerfish**	**7.04**	**13.32**	**1.30**	**4.46**	**2.86**	**3.87**
Toxotidae - undifferentiated	archerfishes		0.29				

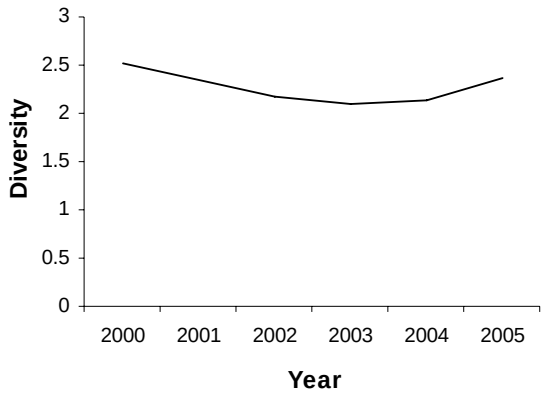


Figure 8. Species diversity in the Gregory River.

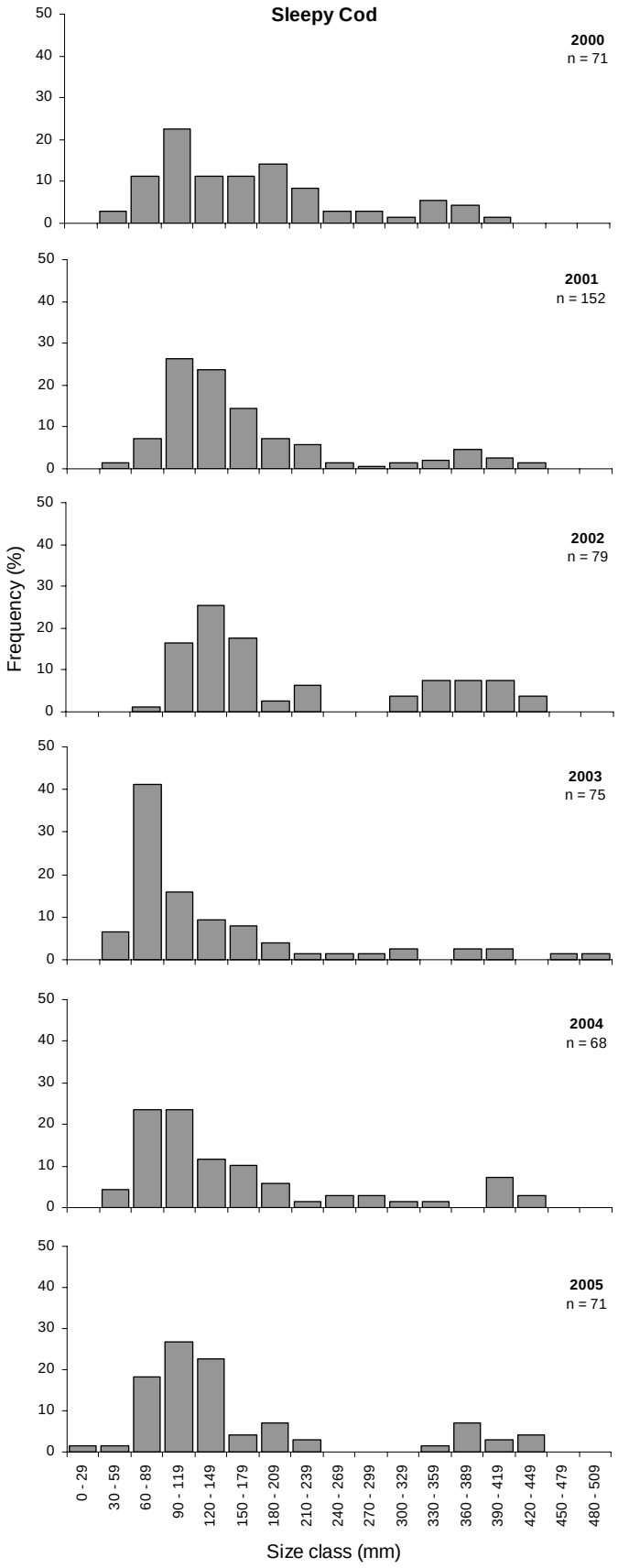


Figure 9. Length frequency distribution of sleepy cod (*Oxyeleotris lineolata*) in the Gregory River between 2000 and 2005.

Mitchell River

River description

The Mitchell River has the second highest flow of any river in Australia. It has a catchment area of 7464 km^2, stretching westward for 660 km from the peaks of the Great Dividing Range near Mareeba to the Gulf of Carpentaria near Kowanyama (Figure 10). The Mitchell River catchment is subject to low intensity grazing in the mid and lower reaches with some high intensity cropping in the upper reaches. The Mitchell River falls form a barrier for the upstream migration of catadromous (fish that live in freshwater but breed in saltwater) species such as barramundi, while small weirs in the upper catchment restrict fish passage during periods of low to medium flow and in some cases may prevent upstream movement all together. Much of the river is shallow and sandy with rock bars and many larger pools (Figure 11). Some of these pools have been selected as survey sites.

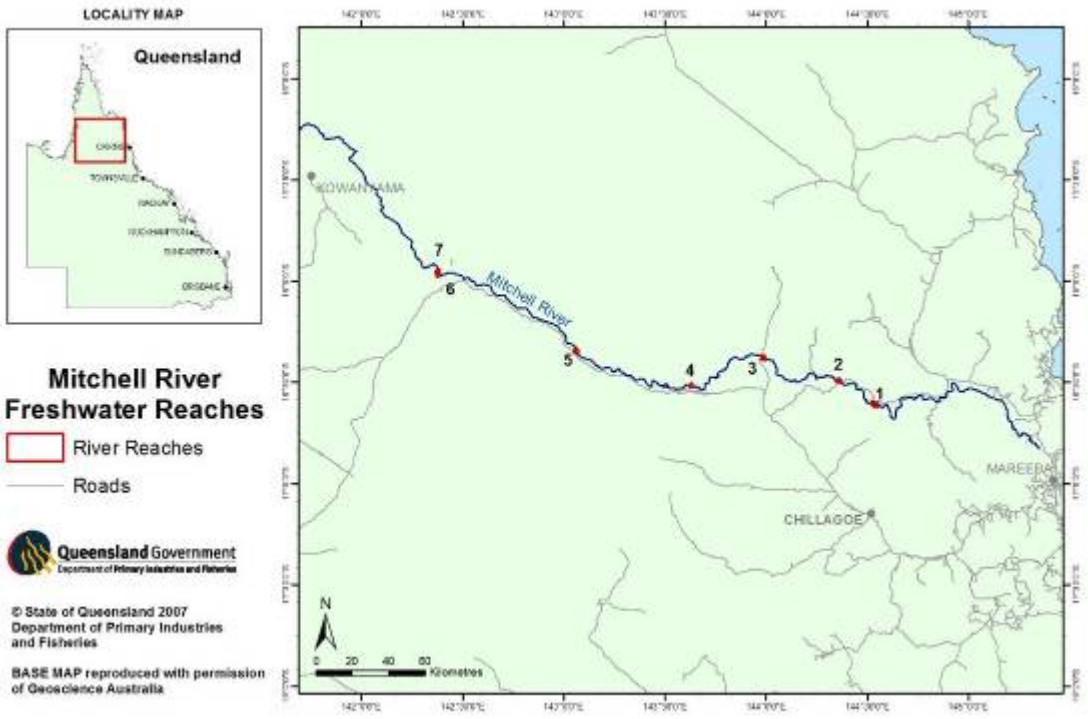


Figure 10. Location of the reaches sampled annually within the Mitchell River.

Figure 11. Typical bank habitat sampled within the Mitchell River.

Habitat
Overall habitat condition is good with generally low ratings of stream bank disturbance (Figure **12**). Disturbance is generally from livestock and some erosion. In-stream habitat is plentiful but patchy, denoted by snags, rocks, some leaf litter and root masses (Figure 13).

Aquatic macrophytes are notably absent from the majority of shots within all reaches although there were occasional shots with a coverage of >200 m^2 (Figure 13). In 2004 there were no aquatic macrophytes recorded. The absence of aquatic macrophytes may be due to the high flows and mobile sediments experienced during the wet season floods.

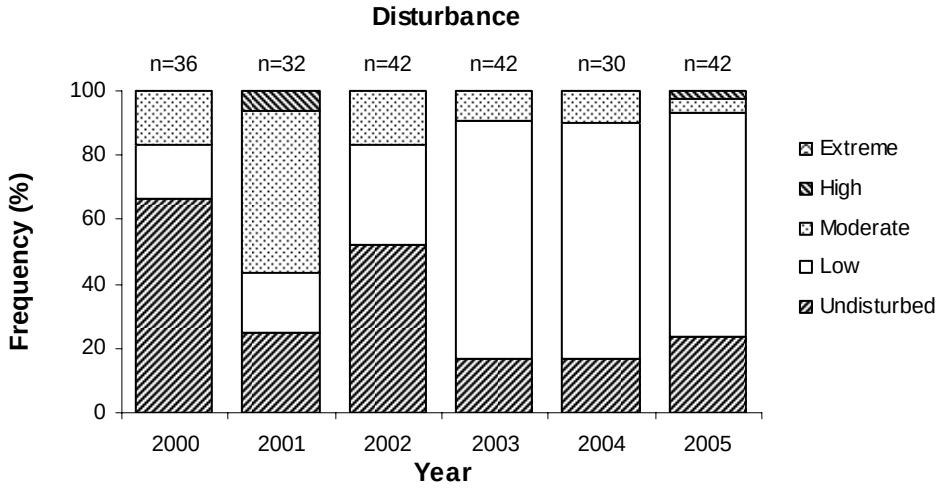


Figure 12. Stream bank disturbance ratings for the Mitchell River between 2000 and 2005. The number of shot samples (n) are shown for each year.

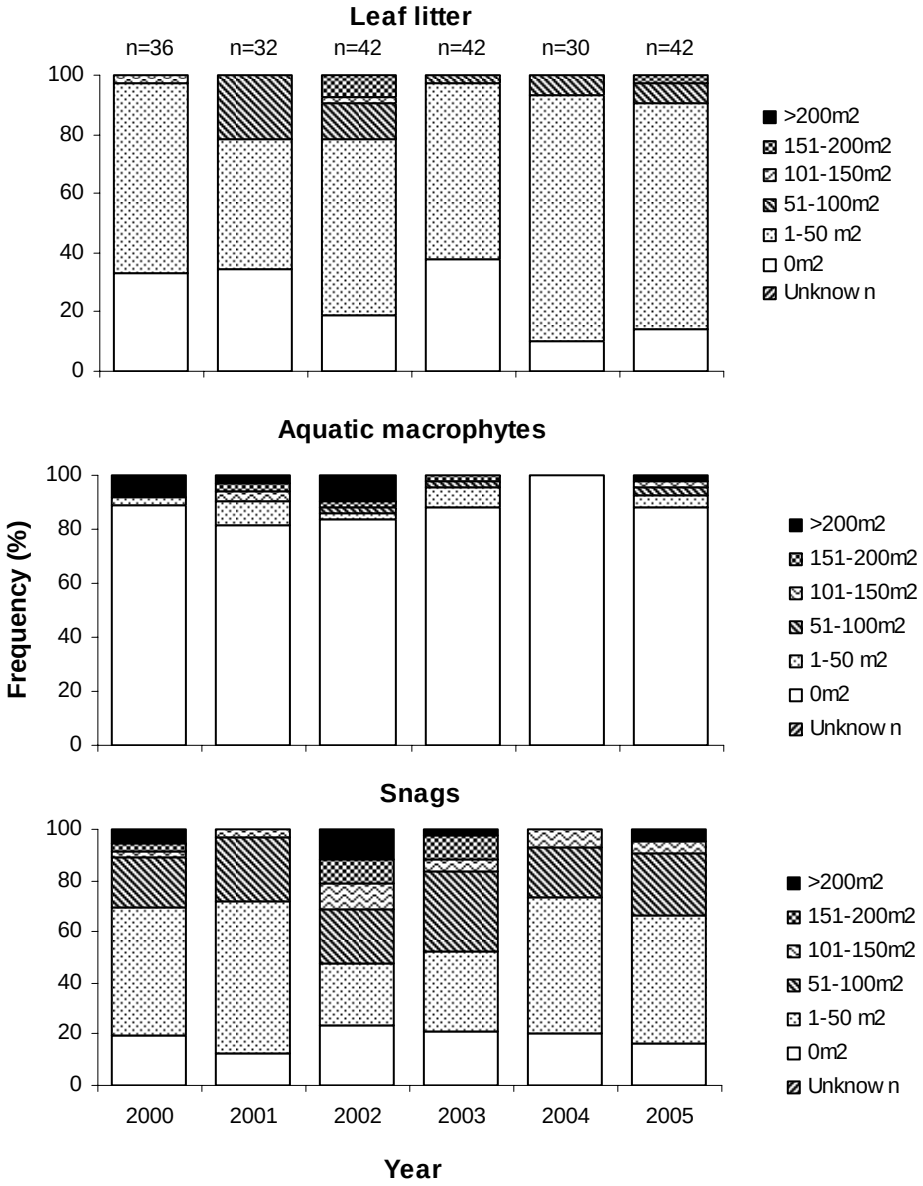


Figure 13. In-stream habitat parameters for the Mitchell River, including leaf litter, aquatic macrophytes and snag coverage. The number of shot samples (n) are provided for each year.

Water quality

Water quality in this river appeared to be good, with dissolved oxygen levels ranging between 7.1–8.9 mg L^{-1} (Figure 14). Water clarity was generally good with the lowest mean visibility (in Secchi depth) of 132 cm recorded in 2005 (Figure 14).

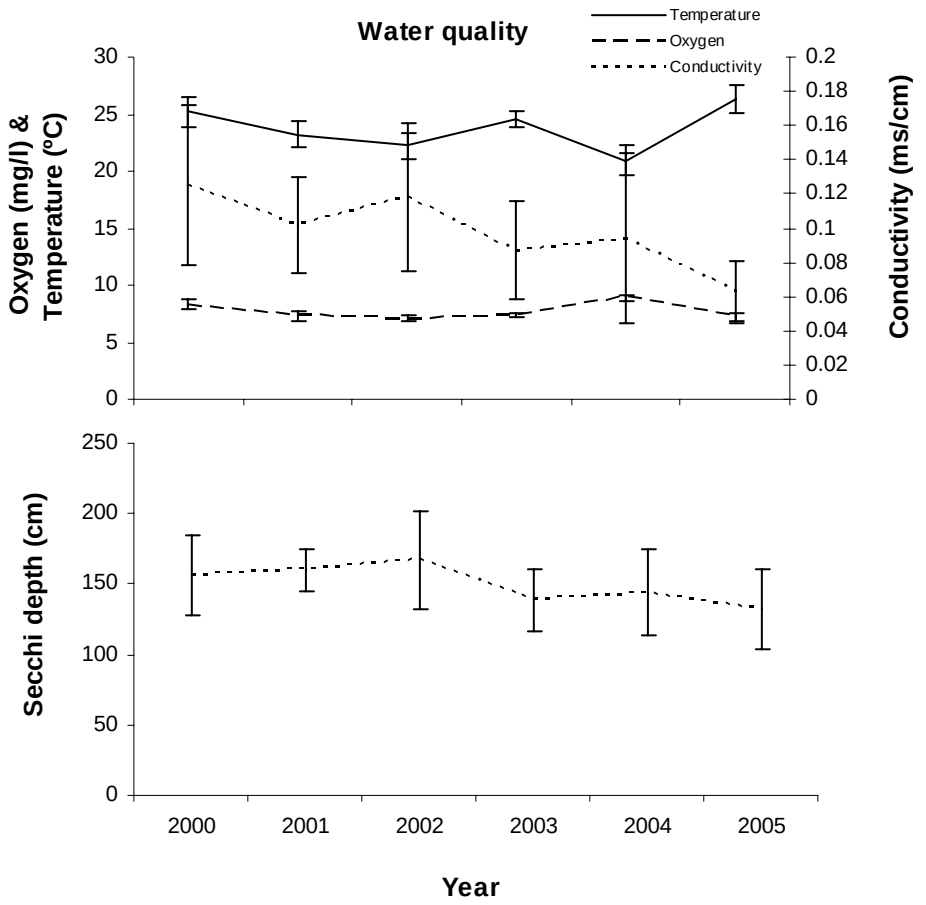


Figure 14. Water quality parameters for the Mitchell River, including temperature, oxygen and conductivity (top) and Secchi depth measurements (bottom) between 2000 and 2005. Ninety-five percent confidence intervals are shown.

Fish fauna

The predominant recreational species that were encountered included sooty grunter, sleepy cod and sevenspot archerfish (Table 4). Other common non-target species included barred grunter, bony bream and rainbow fish.

Sleepy cod encountered throughout the years ranged in size from 30 mm to 479 mm with an absence of fish greater than 299 mm in 2004 (Figure 16).

Table 4. Fish catch rates (CPUE) in the Mitchell River. Target species are highlighted in bold.

Scientific name	Common name	Year					
		2000	2001	2002	2003	2004	2005
Ambassis agassizi	Agassiz's glassfish						0.14
Ambassis agrammus	sailfin glassfish	0.17					
Ambassis macleayi	Macleay's glassfish	0.69	0.19	0.72	1.86	0.20	2.44
Ambassis spp	a glassfish	0.86	1.13	0.14	0.29	0.20	0.14
Amniataba percoides	barred grunter	2.76	2.81	4.49	4.59	2.64	3.31
Anodontiglanis dahli	toothless catfish	0.52	2.06	1.45	0.29		0.58
Arius berneyi	**highfin catfish**	**3.28**	**0.94**	**3.77**	**0.29**		**1.01**
Arius graffei	blue catfish	0.17	1.88	0.72	0.29	1.01	8.63
Arius leptaspis	boofhead catfish			0.14			
Arius midgleyi	**silver cobbler**	**4.49**	**0.94**	**3.62**	**1.86**	**2.84**	**0.86**
Arius spp	a fork tail catfish	0.17	0.19				
Brachirus spp	a sole	0.35	0.19	0.14			
Clupeidae - undifferentiated	herrings	0.17					
Craterocephalus stercusmuscarum	flyspecked hardyhead	0.35	0.75	1.30	1.72	1.62	0.86
Brachirus selheimi	freshwater sole	0.17	0.38	0.87	1.00	0.61	0.58
Glossamia aprion	mouth almighty	2.93	2.81	2.46	2.15	1.22	2.16
Glossogobius sp.1 [in Allen,1991]	square blotch goby						0.29
Glossogobius spp	a goby	2.76	3.75	3.91	4.44	4.47	3.45
Gobiidae - undifferentiated	gobies		0.38				0.14
Hemiramphidae - undifferentiated	**garfishes**		**0.19**				
Hephaestus carbo	**coal grunter**	**0.00**	**0.19**	**0.14**			
Hephaestus fuliginosus	**sooty grunter**	**5.70**	**8.44**	**10.28**	**2.58**	**3.45**	**3.59**
Lates calcarifer	**barramundi**	**2.24**	**1.13**	**4.49**	**0.72**	**0.20**	
Leiopotherapon unicolor	**spangled perch**	**8.80**	**12.94**	**5.94**	**5.59**	**22.33**	**9.49**
Megalops cyprinoides	**oxeye herring**	**0.17**					
Melanotaenia inornata	a rainbowfish	3.63	3.94	2.46	2.44	3.45	3.59
Melanotaenia splendida	Eastern rainbowfish	0.17		0.29	0.57		0.14
Nematalosa erebi	bony bream	4.66	3.19	3.33	3.44	1.83	4.74
Neosilurus ater	**black catfish**	**1.73**	**1.31**	**0.72**	**0.43**	**1.22**	**1.15**
Neosilurus hyrtlii	**Hytrl's catfish**	**0.35**		**0.14**			
Neosilurus spp	a catfish	0.86					
Oxyeleotris lineolata	**sleepy cod**	**15.02**	**15.01**	**14.05**	**7.74**	**7.51**	**10.78**
Oxyeleotris selheimi	**blackbanded gudgeon**	**0.69**	**0.94**	**0.29**	**0.43**		**0.14**
Oxyeleotris spp	a sleepy cod		0.19	0.14	1.15		
Pingalla gilberti	Gilbert's grunter			0.29	0.14	0.41	
Porochilus rendahli	**Rendahl's catfish**	**0.17**					
Scortum hillii	**leathery grunter**	**2.07**					
Scortum ogilbyi	Gulf grunter			2.03	2.15	0.61	1.73
Scortum spp	a grunter		2.25				
Strongylura krefftii	**freshwater longtom**	**0.69**	**0.38**	**0.43**	**2.29**	**0.81**	**1.29**
Thryssa scratchleyi	freshwater anchovy		0.19	0.14			
Toxotes chatareus	**sevenspot archerfish**	**4.32**	**2.44**	**2.90**	**2.29**	**5.48**	**6.90**
Toxotes jaculatrix	banded archerfish				0.14		
Zenarchopterus dispar	Spoonfin River garfish						0.14
Zenarchopterus spp	a garfish		0.19				

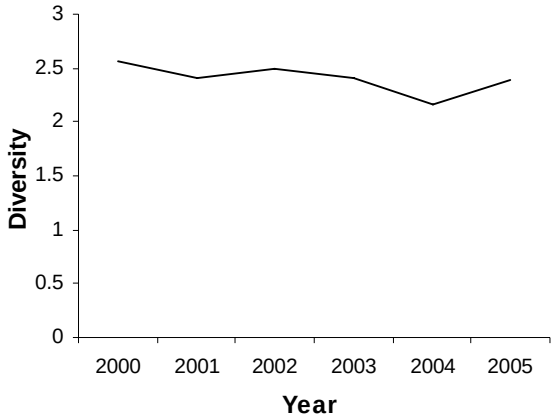


Figure 15. Species diversity in the Mitchell River.

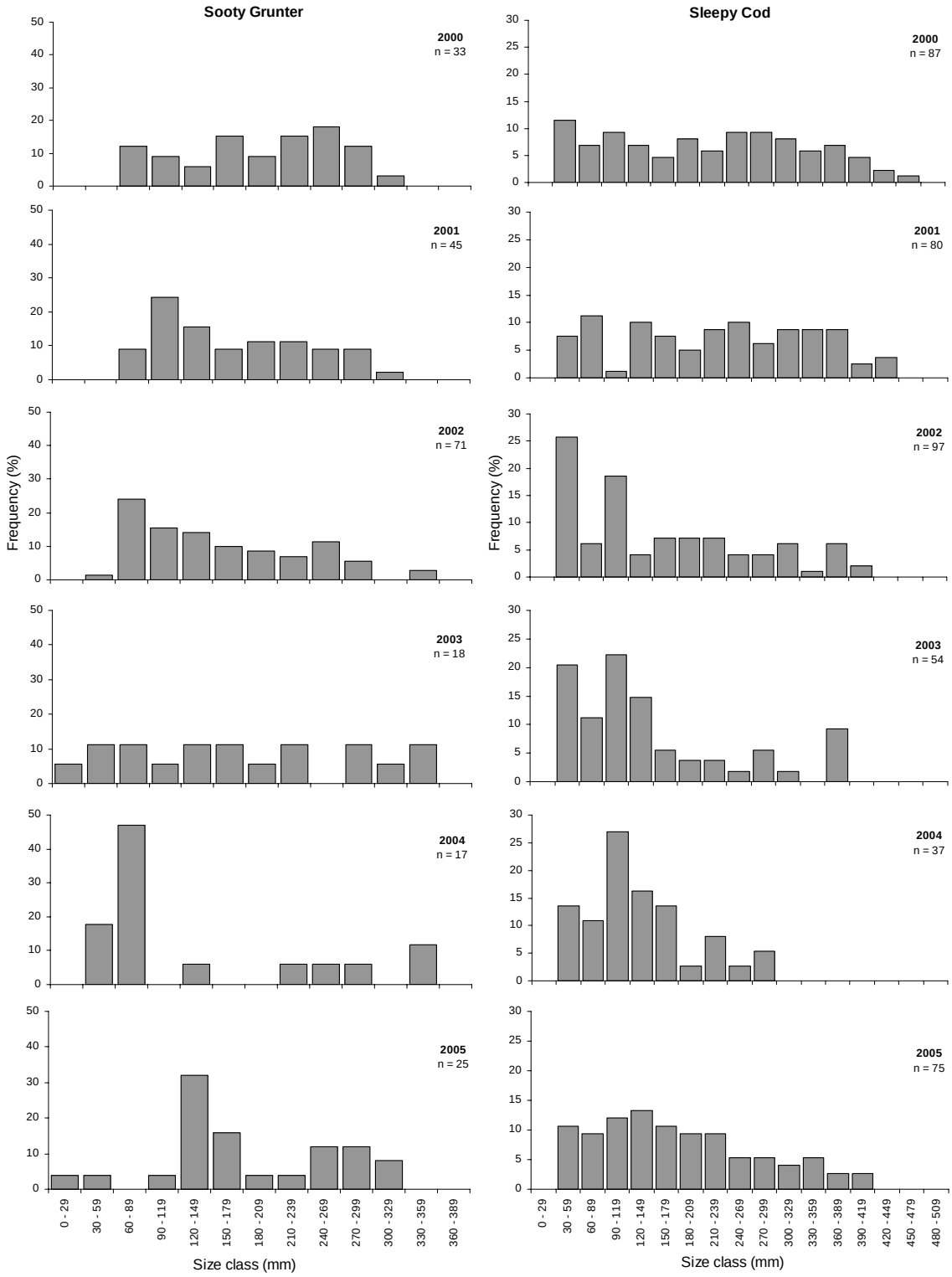


Figure 16. Length frequency distribution of sooty grunter and sleepy cod in the Mitchell River between 2000 and 2005.

Daintree River

River description

The Daintree River in the Wet Tropics of North Queensland flows uninterrupted for 118 km from its source in the Main Coast Range (Figure 17). It has a catchment area of about 1342 km^2 with natural forests covering 94% of the total area, including wetlands and tropical rainforest (Russell *et al*. 1998) (Figure 18). Agricultural land use is predominantly beef cattle grazing (3.25%) and some sugar cane production (1.05%) in the lower catchment (Russell *et al*. 1998). Eco-tourism is a significant industry with companies operating river-boat tours year-round.

Sample reaches are grouped close together from the four lower, tidally influenced reaches accessed via the Daintree township boat ramp, to the three reaches above the Cairns Regional Electricity Board (CREB) Track crossing (Figure 17).

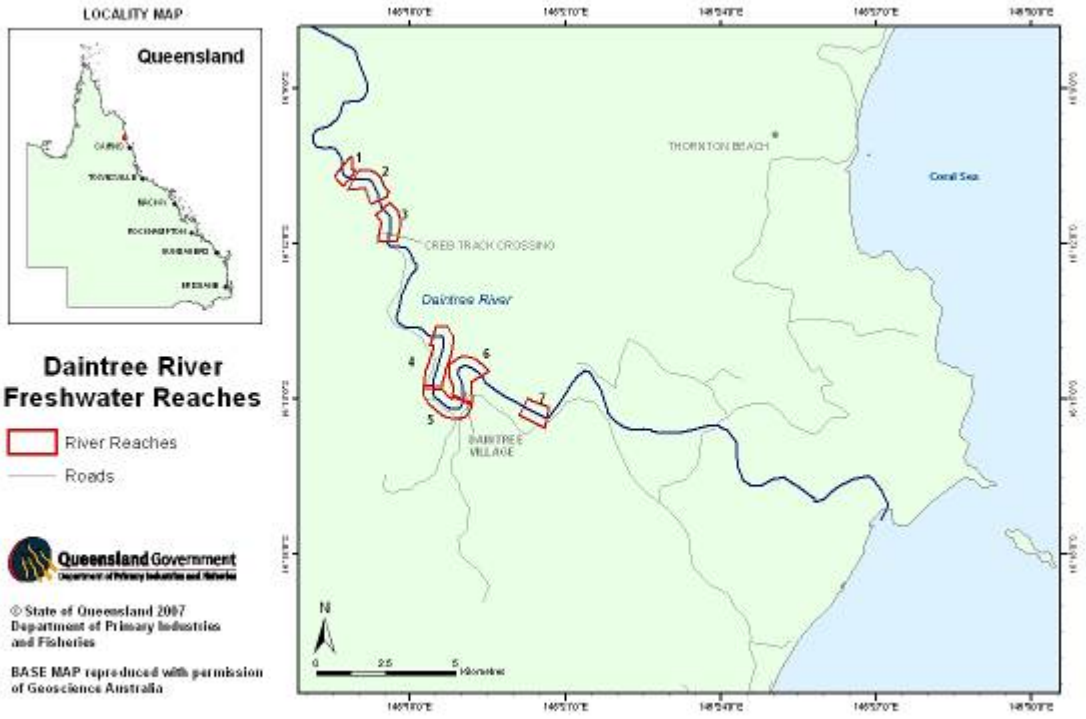


Figure 17. Location of the reaches sampled annually within the Daintree River.

Figure 18. Typical bank habitat sampled within the Daintree River.

Habitat
Overall river condition remains reasonable with disturbance indices mostly moderate or less than moderate (Figure 19). Disturbance ratings from moderate to extreme are mostly attributed to the lower four reaches. Disturbances include land clearing close to the main river channel, damage from livestock, feral pigs and some bank erosion. In-stream habitat remains plentiful including *Vallisneria* (eel grass) beds, snags, leaf litter, root mass and undercut banks.

Sites with heavy macrophyte coverage (>200m^2) made up more than 20% of the assessments in 2002 and 2003 (Figure 20).

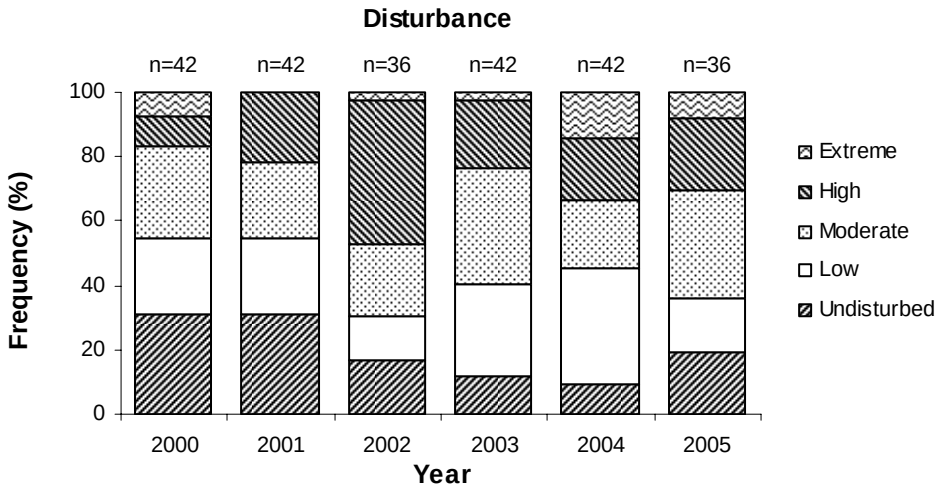


Figure 19. Stream bank disturbance ratings for the Daintree River between 2000 and 2005. The number of shot samples (n) are shown for each year.

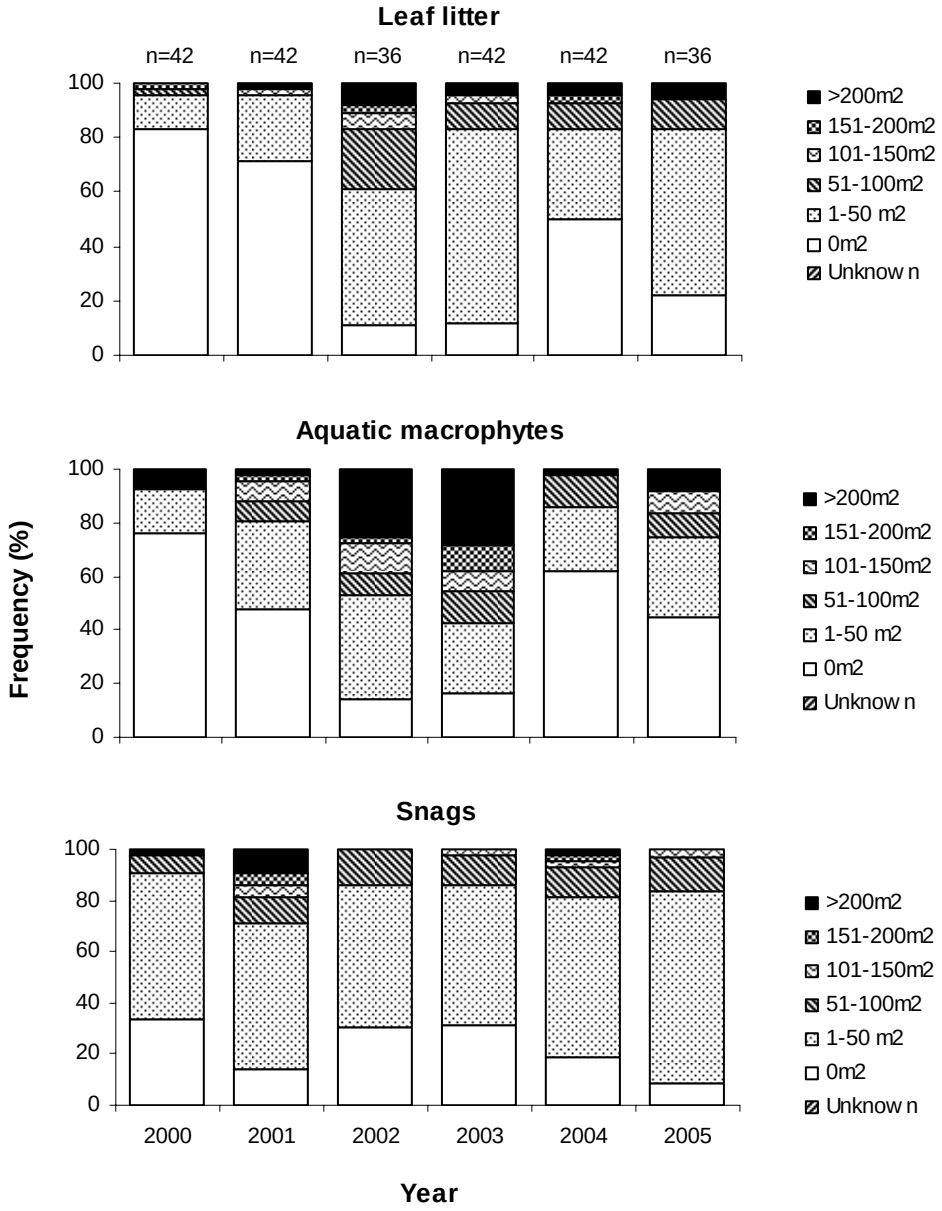


Figure 20. In-stream habitat parameters for the Daintree River, including leaf litter, aquatic macrophytes and snag coverage. The number of shot samples (n) are provided for each year.

Water quality

Water clarity was good with the lowest mean visibility of 131 cm in 2004. A rise in conductivity in 2004 is the result of a salt wedge intrusion at the furthest downstream reach (Figure 21).

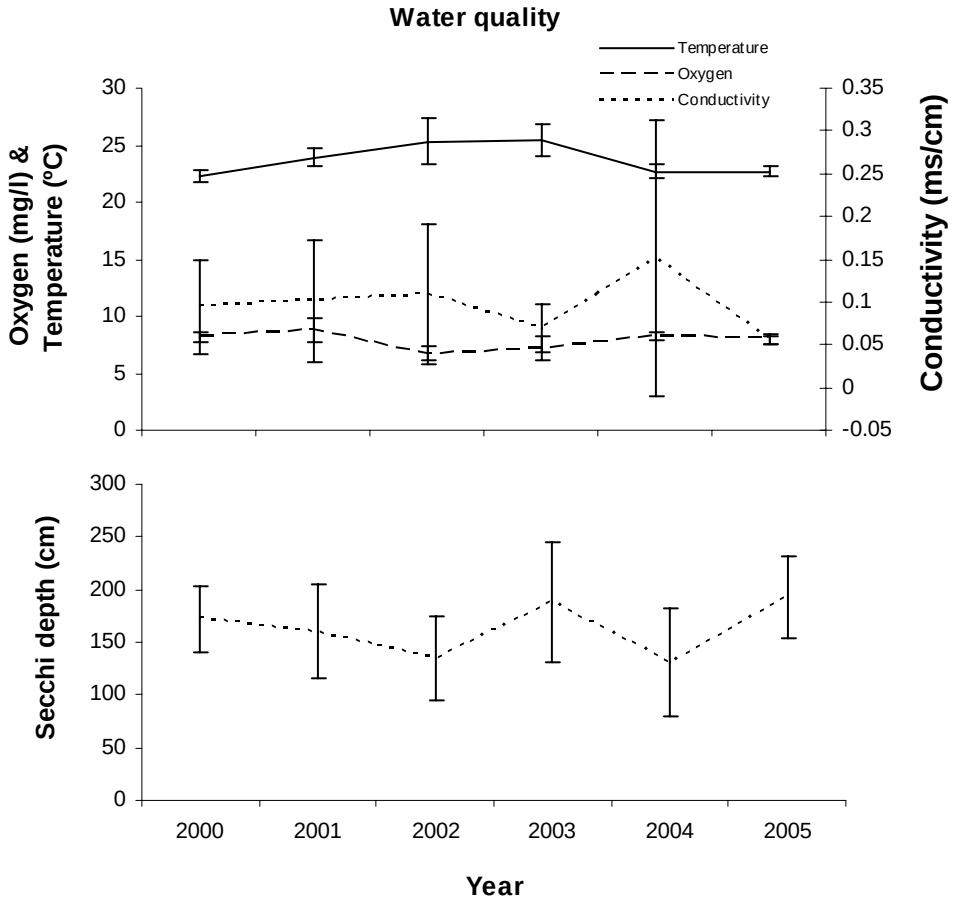


Figure 21. Water quality parameters for the Daintree River including temperature, oxygen and conductivity (top) and Secchi depth measurements (bottom) between 2000 and 2005. Ninety-five percent confidence intervals are shown.

Fish fauna

Target species of recreational, commercial or indigenous significance in the Daintree River included longfin eel, barramundi and mangrove jack (Table 5). Other common non target species were gudgeon, silver biddies and pacific blue eyes. The relatively high catch rates of barramundi, mangrove jack and longfin eel compared to other rivers in the survey may reflect both the abundance of prey fish and high incidence of in-stream cover the Daintree River provides. The high number of fish species encountered is probably a reflection of contributions from estuarine species present in the inter-tidal reaches surveyed, abundance of in-stream habitat and absence of natural or man made barriers to fish movement.

The majority of barramundi and mangrove jack captured are under the Queensland minimum legal size limit (580 mm and 350 mm respective Total Length) (Figure 23). Young-of-the-year cohorts for mangrove jack were particularly strong from 2002 to 2005.

Table 5. Fish catch rates (CPUE) in the Daintree River. Target species are highlighted in bold.

Scientific name	Common name	Year					
		2000	2001	2002	2003	2004	2005
Acanthopagrus australis	**yellowfin bream**				**0.14**	**0.15**	**0.50**
Acanthopagrus berda	**pikey bream**		**0.14**	**0.34**	**0.87**		**1.17**
Ambassis interrupta	longspine glassfish					1.46	1.34
Ambassis miops	flagtail glassfish					1.46	1.34
Ambassis spp	a glassfish	1.42	2.45	1.86	2.03		0.17
Amniataba caudavittata	yellowtail grunter				0.29		
Anguilla obscura	**Pacific shortfin eel**	**0.14**	**0.14**	**0.34**		**0.15**	**0.33**
Anguilla reinhardtii	**longfin eel**	**13.31**	**9.22**	**8.77**	**2.46**	**10.22**	**5.86**
Arrhamphus sclerolepis	**snubnose garfish**	**3.54**			**2.46**	**0.44**	**4.18**
Awaous acritosus	Roman-nose goby	1.98	1.01	1.18	0.72	1.75	1.17
Brachirus spp	a sole		0.29				
Bunaka gyrinoides	**greenback gudgeon**	**3.11**	**3.60**	**0.67**	**1.45**	**1.46**	**4.02**
Butis butis	crimsontip gudgeon	0.14	0.29	0.17	0.29	0.44	1.34
Carangidae - undifferentiated	trevallies	0.14	0.14				
Caranx sexfasciatus	bigeye trevally			0.67	0.00	1.90	0.50
Chanos chanos	**milkfish**	**0.14**		**0.34**			
Clupeidae - undifferentiated	herrings				0.29		
Dasyatidae - undifferentiated	stingrays			0.17			
Eleotris fusca	brown spine-cheek gudgeon			0.17			
Eleotris melanosoma	black spine-cheek gudgeon		0.86	0.17	0.14		0.17
Eleotris spp	a gudgeon		0.14	2.19	2.17	0.44	0.67
Gerres filamentosus	threadfin silverbiddy	2.97	4.18	4.72	4.20	2.92	4.69
Gerres spp	a silver biddy	2.12	4.18	3.04	3.04	2.92	4.02
Giurus margaritacea	snakehead gudgeon	1.13	1.73	0.34	0.29	1.02	0.17
Glossamia aprion	mouth almighty	0.85	1.15	2.36	4.64	3.65	3.01
Glossogobius circumspectus	mangrove flathead goby					0.15	
Glossogobius giuris	tank goby			0.17		0.29	0.17
Glossogobius sp.1 [in Allen *et al*., 2002]	Celebes flathead goby					0.58	0.50
Glossogobius spp	a goby	4.25	3.60	0.67	0.58	0.29	0.84
Gobiidae - undifferentiated	gobies	0.14	0.29	0.17	0.14		
Gymnothorax polyuranodon	freshwater moray			0.17			
Hemiramphus regularis ardelio	Eastern river garfish	0.14					
Hephaestus spp	a grunter	0.28					
Hephaestus tulliensis	khaki grunter			0.67	0.14	0.58	0.33
Herklotsichthys castelnaui	Southern herring			0.17			
Hippichthys heptagonus	madura pipefish	0.14		0.17		0.15	
Hyporhamphus spp	a garfish	0.28				0.58	0.17
Hypseleotris compressa	empire gudgeon	4.53	4.47	4.22	3.91	3.36	3.51
Kuhlia marginata	spotted flagtail	0.14					
Kuhlia rupestris	**jungle perch**	**0.57**	**1.30**	**0.84**	**1.01**	**1.46**	**1.17**
Lates calcarifer	**barramundi**	**6.23**	**6.77**	**8.10**	**3.91**	**2.19**	**5.86**
Leiognathus equulus	common ponyfish	1.27	1.73	0.17		1.02	1.34
Leiognathus spp	a pony fish	0.28	0.72		0.87		
Lutjanus argentimaculatus	**mangrove jack**	**7.50**	**5.62**	**7.76**	**13.76**	**6.42**	**9.20**
Megalops cyprinoides	**oxeye herring**		**0.72**		**0.58**	**0.15**	**0.67**
Melanotaenia splendida	Eastern rainbowfish	3.96	0.86	2.36	3.04	3.65	2.01
Mesopristes argenteus	**silver grunter**	**3.54**	**3.60**	**1.69**	**1.16**	**1.75**	**3.35**
Monodactylus argenteus	diamondfish				1.01		0.17
Mugil cephalus	**sea mullet**	**0.99**	**1.15**	**0.51**	**0.58**	**0.73**	**0.17**
Nematalosa erebi	bony bream	0.57	0.58		0.72	1.02	0.84
Nematalosa spp	a herring	0.14					
Neosilurus ater	**black catfish**	**0.99**	**1.01**	**1.18**	**0.29**	**0.44**	**1.51**
Notesthes robusta	bullrout	0.99	1.01	1.35	0.72	0.88	0.50
Ophisternon gutturale	swamp eel	0.14			0.14		
Ophisternon spp	a swamp eel		0.14				
Oxyeleotris aruensis	Aru gudgeon				0.43		
Pardachirus spp	a sole			0.34			
Plectorhinchus gibbosus	brown sweetlips				0.14		0.17
Poecilia reticulata	guppy	0.14	0.14				
Psammogobius biocellatus	sleepy goby				0.14		
Pseudomugil signifer	Pacific blue eye	3.68	5.62	1.35	1.45	3.07	3.85
Redigobius bikolanus	speckled goby	1.70	2.45	0.51	0.72	1.17	3.01
Redigobius chrysosoma	spotfin goby		0.29	0.51	0.43		0.84
Scatophagus argus	spotted scat	0.57	0.58	0.17	0.58	0.29	0.84
Sillago spp	a whiting		0.58				
Stenogobius psilosinionus	teardrop goby						0.17
Syngnathidae - undifferentiated	pipefishes		0.58			0.15	
Tandanus tandanus	**freshwater catfish**						**0.33**

Scientific name	Common name	Year					
		2000	2001	2002	2003	2004	2005
Toxotes chatareus	**sevenspot archerfish**		**0.00**	**0.51**	**1.16**	**1.17**	**1.00**
Toxotes jaculatrix	banded archerfish	0.14	0.14	0.17		0.29	0.17

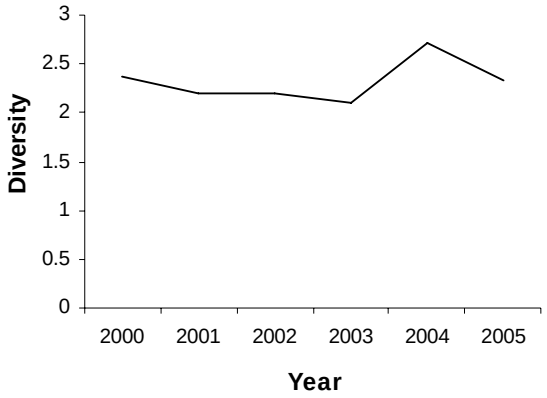


Figure 22. Species diversity in the Daintree River.

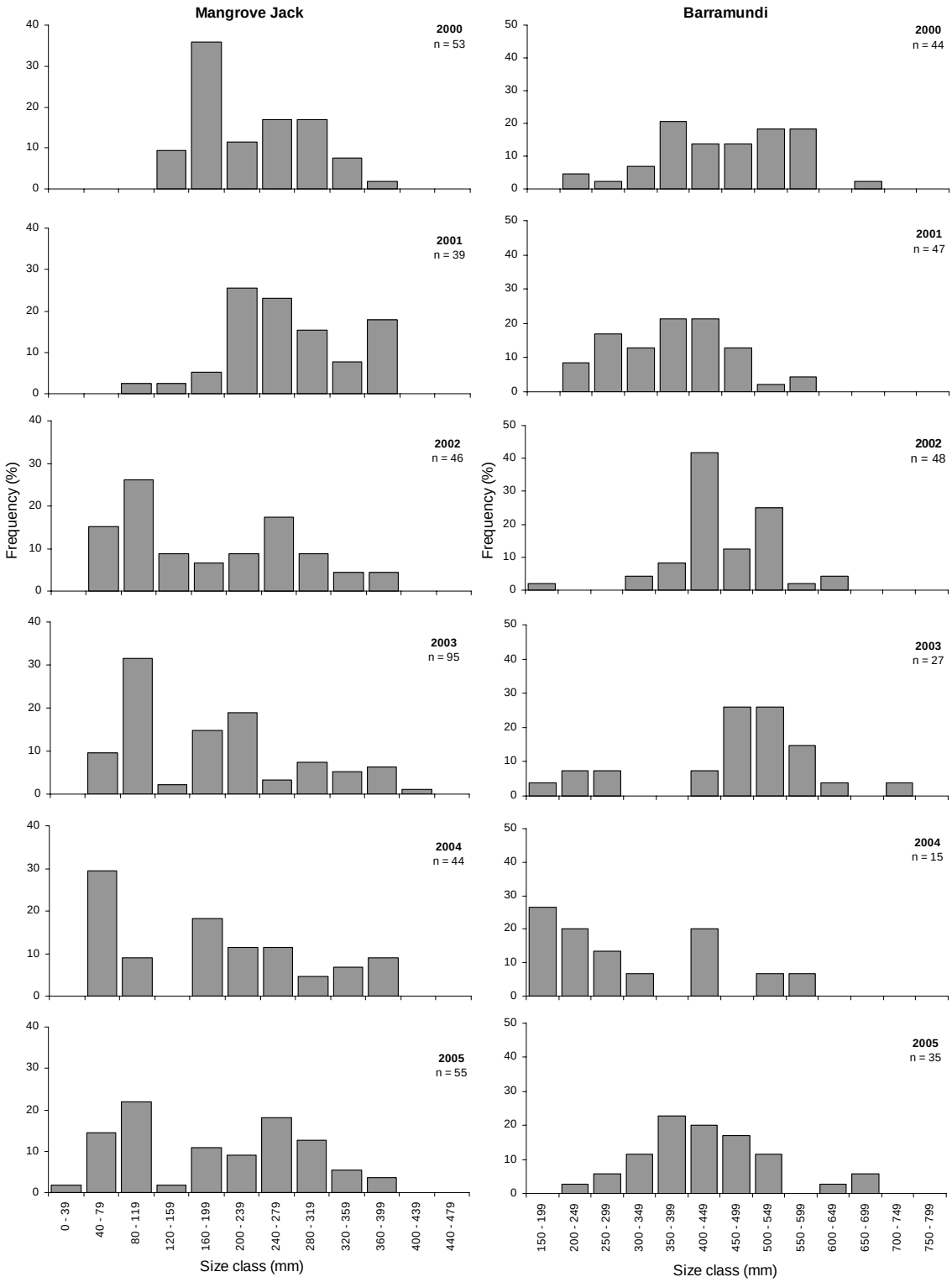


Figure 23. Length frequency distribution of mangrove jack and barramundi in the Daintree River between 2000 and 2005.

Johnstone River

River description

The Johnstone River, incorporating both the North and South Johnstone Rivers, flows east for 210 km from its source on the Atherton Tablelands to drain into the Coral Sea near Innisfail and is unregulated (Figure 24). The catchment of 244 km² consists of dairy and agriculture in the upstream reaches on the Atherton Tablelands, rainforest and steep rocky gorges in the mid-catchment and primarily banana and sugarcane production on the lower coastal strip (Figure 25).

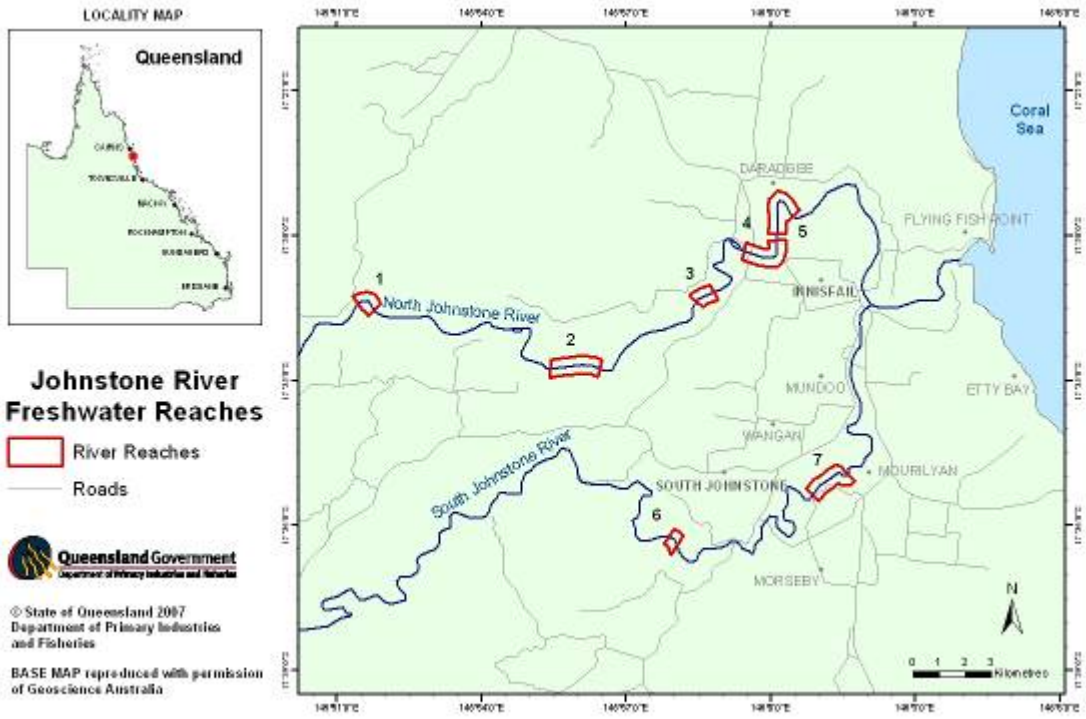


Figure 24. Location of the reaches sampled annually within the Johnstone River.

Figure 25. Typical bank habitat sampled within the Johnstone River.

Habitat

Overall river condition at the sampling locations was poor with a high frequency of moderate, high and extreme disturbance ratings recorded for most years (Figure 26). The riparian zone is not intact in places and evidence of bank erosion and sedimentation are obvious. Introduced grasses and plants often dominate the bank cover in the lower reaches and intrude into the stream. In-stream habitat is sparse within the coastal sites, with few snags and macrophyte beds being heavily impacted upon by the large flows during the wet seasons. The frequency distributions of aquatic macrophytes show increased frequencies of greater coverage in 2003 and 2005 (Figure 27). In the upper reaches boulders are the dominant habitat feature although there is some snag cover (Figure 27).

Stream bank disturbance ratings are similar for all years with the exception in 2001 where the extreme rating was mostly replaced by the high rating (Figure 26). The frequency of low disturbance sites was generally less than 20%.

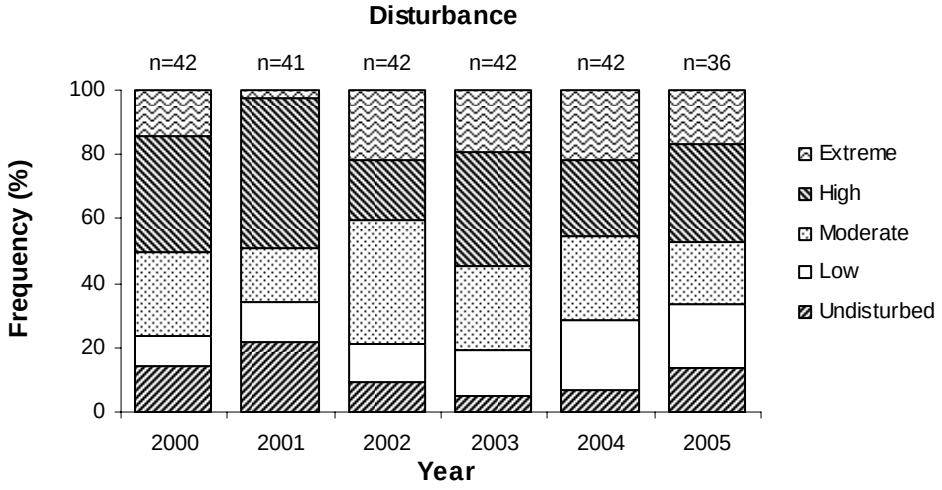


Figure 26. Stream bank disturbance ratings for the Johnstone River between 2000 and 2005. The number of shot samples (n) are shown for each year.

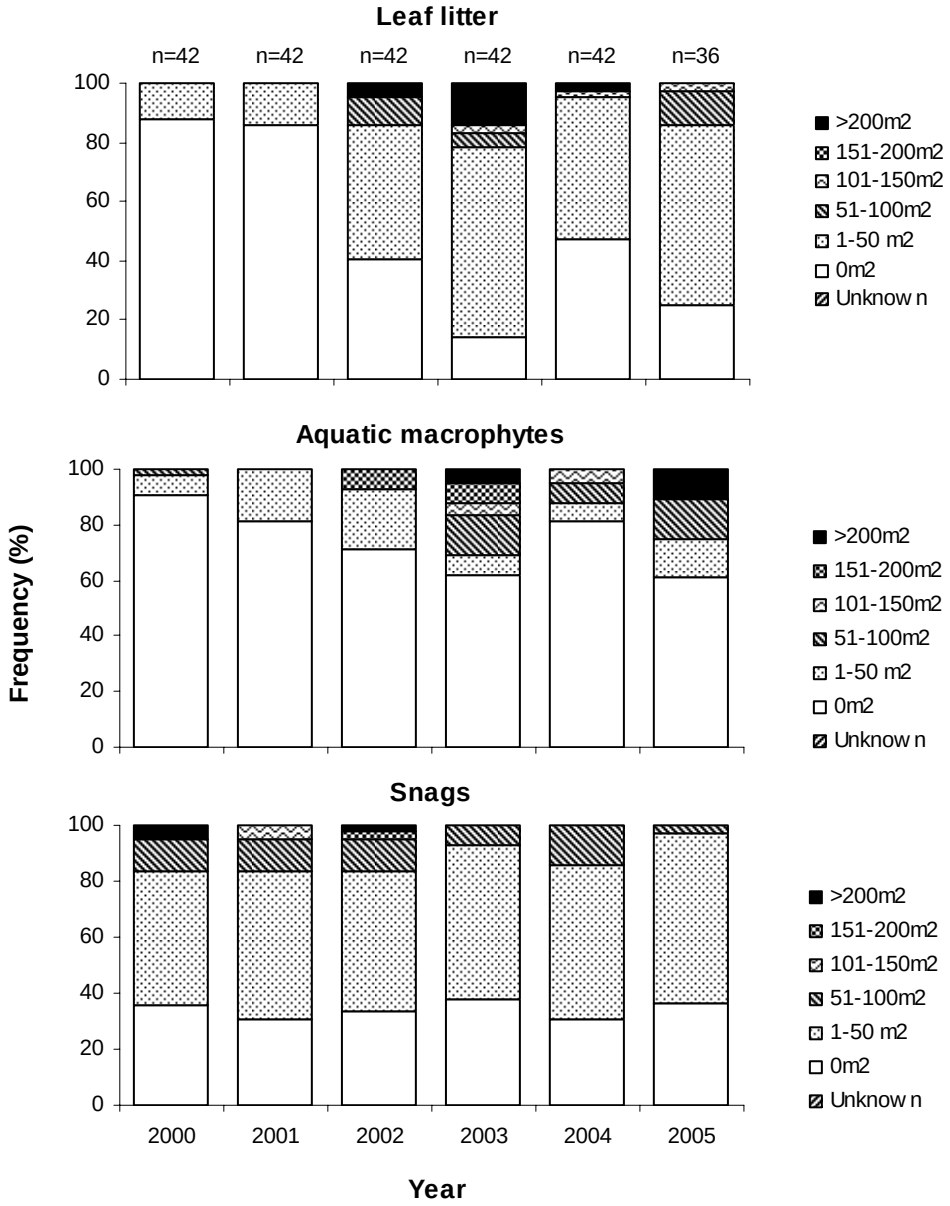


Figure 27. In-stream habitat parameters for the Johnstone River including leaf litter, aquatic macrophytes and snag coverage. The number of shot samples (n) are provided for each year.

Water quality

Water clarity, as indicated by Secchi disk depth, was excellent with the lowest mean visibility of just 155 cm in 2005 (Figure 28). Lower reaches are tidal and had a salt wedge in 2000 and 2001. As the efficiency of the electrofisher was reduced under these conditions, the catch rates in the pelagic runs were reduced in those years. Other water quality parameters however, indicated excellent conditions for fish (Figure 28).

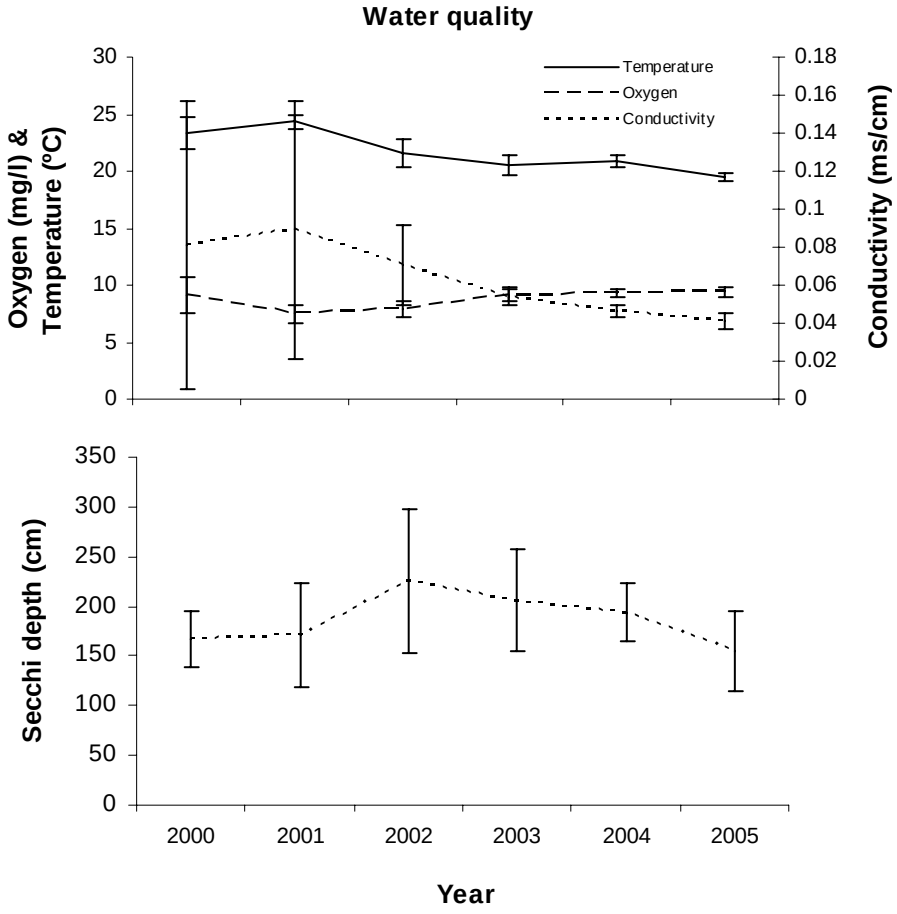


Figure 28. Water quality parameters for the Johnstone River, including temperature, oxygen and conductivity (top) and Secchi depth measurements (bottom) between 2000 and 2005. Ninety-five percent confidence intervals are shown.

Fish fauna

The highest catch rates were for sooty grunter, khaki grunter, longfin eel and Pacific blue eye (Table 6). Species diversity was high including several diadromous species such as barramundi, sea mullet and bigeye trevally (Figure 29). Species richness was high with 61 species identified across the years. The introduced pest species tilapia, mosquito fish, guppies and platys are also present in this system possibly highlighting the disturbed nature of the system (Table 6).

Table 6. Fish catch rates (CPUE) in the Johnstone River. Target species are highlighted in bold.

Scientific name	Common name	Year					
		2000	2001	2002	2003	2004	2005
Acanthopagrus australis	**yellowfin bream**		**0.14**		**0.14**		
Acanthopagrus berda	**pikey bream**	**0.72**	**0.14**	**0.86**	**0.86**	**0.14**	**0.50**
Ambassis agrammus	sailfin glassfish		0.14				0.17
Ambassis interrupta	longspine glassfish					0.29	
Ambassis miops	flagtail glassfish					0.72	2.66
Ambassis spp	a glassfish	0.57	1.29	2.43	1.58		
Anguilla australis	**Southern shortfin eel**						**0.17**
Anguilla obscura	**Pacific shortfin eel**	**0.14**		**0.14**	**0.14**		
Anguilla reinhardtii	**longfin eel**	**4.29**	**3.02**	**5.16**	**3.02**	**6.30**	**3.33**
Arrhamphus sclerolepis	**snubnose garfish**	**0.29**	**0.43**	**0.29**			**2.33**
Awaous acritosus	Roman-nose goby	2.86	1.01	1.43	1.15	2.00	2.16
Bunaka gyrinoides	**greenback gudgeon**	**1.14**	**1.58**	**0.86**	**0.86**	**2.58**	**1.50**
Butis butis	crimsontip gudgeon		0.29	0.57			0.17
Caranx sexfasciatus	bigeye trevally	0.14	0.29	0.29	0.14		
Chaetodontidae - undifferentiated	butterflyfishes						0.17
Chanos chanos	**milkfish**				**1.29**		**0.50**
Craterocephalus stercusmuscarum	flyspecked hardyhead	0.14		0.86	1.58	1.57	0.83
Eleotris fusca	brown spine-cheek gudgeon	0.14					
Eleotris melanosoma	black spine-cheek gudgeon		0.14				
Eleotris spp	a gudgeon			0.14	0.72	0.57	0.67
Gambusia holbrooki	Eastern gambusia						0.67
Gerres filamentosus	threadfin silver biddy	2.15	2.59	2.00	1.72	0.72	2.16
Gerres spp	a silver biddy	1.29	2.44	1.29	2.01	0.57	2.00
Glossogobius bicirrhosus	bearded flathead goby			0.14			0.17
Glossogobius circumspectus	mangrove flathead goby					0.14	
Glossogobius giuris	tank goby	0.29				0.57	0.33
Glossogobius sp.1 [in Allen *et al*., 2002]	Celebes flathead goby					1.15	0.83
Glossogobius sp.C [in Allen,1988]	Mulgrave goby						0.17
Glossogobius spp	a goby	2.15	6.04	3.15	0.86	0.43	0.67
Gobiidae - undifferentiated	gobies		0.14	0.29			
Hephaestus fuliginosus	**sooty grunter**	**21.46**	**16.54**	**21.34**	**17.95**	**13.88**	**12.14**
Hephaestus tulliensis	khaki grunter	5.72	8.92	9.17	5.60	1.57	13.47
Herklotsichthys castelnaui	Southern herring	0.14			0.14		0.50
Hippichthys heptagonus	madura pipefish					0.14	
Hypseleotris compressa	empire gudgeon	2.00	3.02	3.29	3.45	2.29	2.50
Kuhlia marginata	spotted flagtail	0.14	0.14				
Kuhlia rupestris	**jungle perch**	**2.29**	**1.29**	**0.72**	**0.29**	**0.86**	**0.83**
Lates calcarifer	**barramundi**	**1.43**	**1.29**	**1.29**	**1.44**	**0.43**	**1.33**
Leiognathidae - undifferentiated	ponyfishes			0.14			
Leiognathus equulus	common ponyfish	1.14	0.14	0.14	0.57	0.14	0.67
Leiognathus splendens	blacktip ponyfish			0.14			
Leiognathus spp	a pony fish		0.14		0.14		
Lutjanus argentimaculatus	**mangrove jack**	**0.86**	**2.01**	**1.86**	**2.30**	**3.72**	**1.00**
Melanotaenia splendida	Eastern rainbowfish	1.43	2.73	3.15	3.73	2.72	1.83
Melanotaenia spp	a rainbowfish						0.17
Melanotaenia trifasciata	banded rainbowfish		0.58				
Melanotaenia utcheensis	Utchee rainbowfish						0.50
Mesopristes argenteus	**silver grunter**	**0.43**	**0.58**	**1.29**	**0.43**	**1.15**	
Microphis brachyurus	short-tail pipefish					0.14	
Monodactylus argenteus	diamondfish			0.14			
Mugil cephalus	**sea mullet**	**1.57**	**0.43**			**0.00**	**0.67**
Mugilidae - undifferentiated	mullets			0.14		0.14	
Mugilogobius notospilus	freshwater mangrovegoby				0.14		
Mugilogobius spp	a goby	0.14		0.14			
Nematalosa erebi	bony bream	0.14			0.72	0.29	0.83
Neosilurus ater	**black catfish**	**0.86**	**1.29**	**2.00**	**1.29**	**0.14**	
Neosilurus hyrtlii	**Hytrl's catfish**			**0.43**			
Notesthes robusta	bullrout	0.57	0.72	0.29	0.43		0.33
Oxyeleotris lineolata	**sleepy cod**					**0.29**	**0.33**
Platycephalus fuscus	**dusky flathead**			**0.14**			
Poecilia reticulata	guppy	0.14	0.14	0.72	0.14	0.14	0.17
Porochilus rendahli	**Rendahl's catfish**		**0.14**				
Psammogobius biocellatus	sleepy goby			0.29	0.43		0.17
Pseudomugil signifer	Pacific blue eye	2.86	4.03	3.15	3.30	1.00	4.49

Scientific name	Common name	Year					
		2000	2001	2002	2003	2004	2005
Redigobius bikolanus	speckled goby	1.57	3.60	2.29	3.88	3.29	3.66
Scatophagus argus	spotted scat	0.29	0.14	0.14		0.29	0.17
Schismatogobius sp. [in Allen, 1989, and Allen *et al.*, 2002]	scaleless goby			0.14			
Tandanus tandanus	**freshwater catfish**	**1.43**	**0.58**	**0.72**	**0.43**	**0.43**	**0.17**
Tilapia mariae	**spotted tilapia**	**5.87**	**1.15**	**1.00**	**4.88**	**0.72**	**4.99**
Toxotes chatareus	**sevenspot archerfish**		**0.14**	**0.57**	**0.14**	**0.14**	**0.17**
Toxotes jaculatrix	banded archerfish	0.14					
unknown species	unknown species	0.14					
Xiphophorus maculatus	platy						0.17

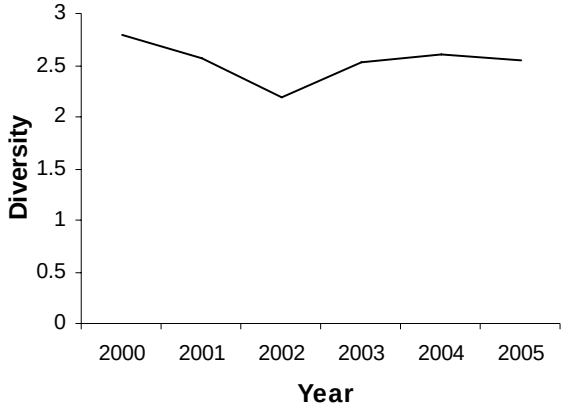


Figure 29. Species diversity in the Johnstone River.

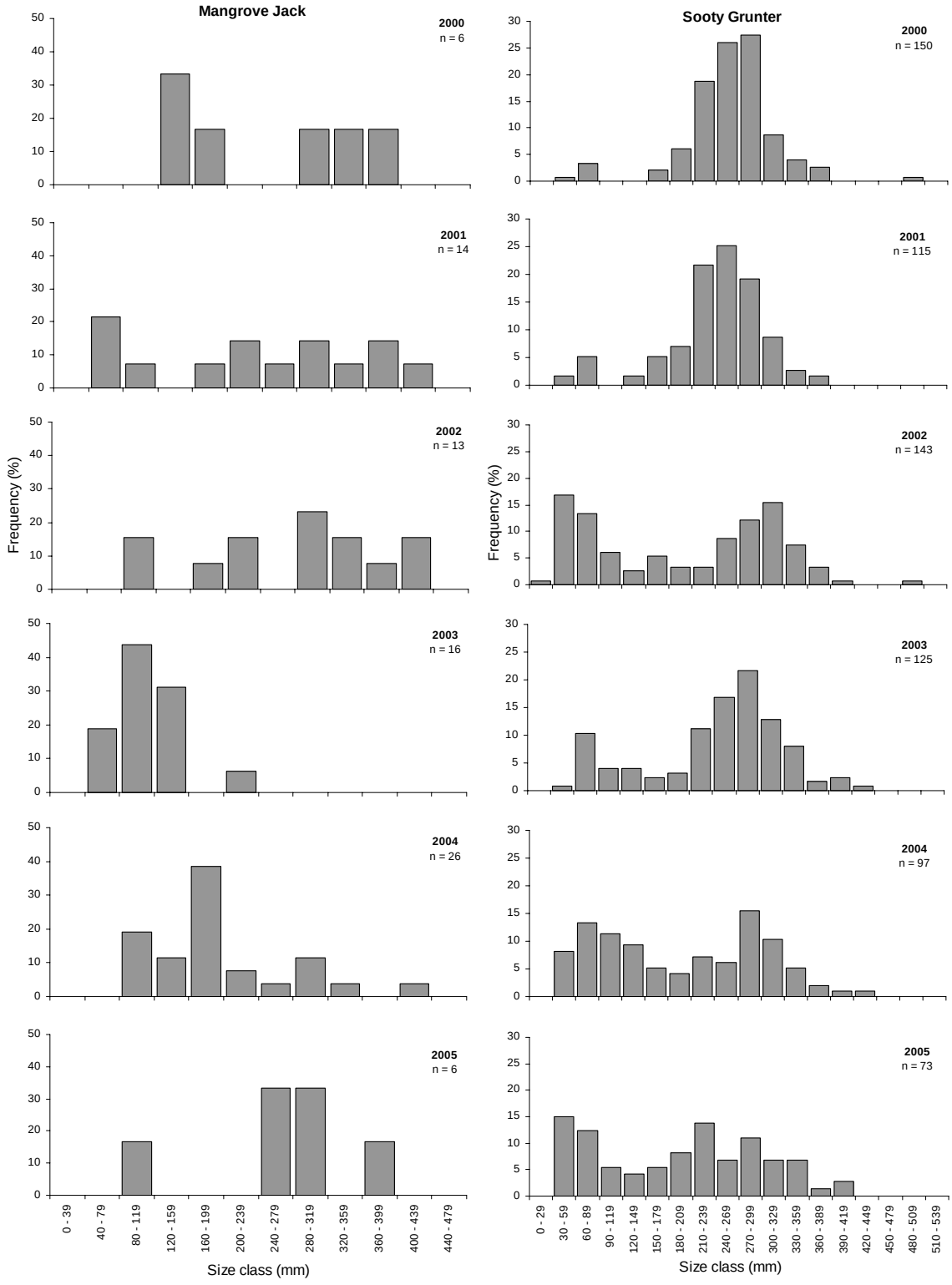


Figure 30. Length frequency distribution of mangrove jack and sooty grunter in the Johnstone River between 2000 and 2005.

Herbert River

River description

The Herbert River flows east for 294 km through the Wet Tropics World Heritage Area and drains into the Hinchinbrook Channel near the sugar township of Ingham (Figure 31). It has a total catchment area of 1038 km^2. It remains unregulated for its entire length although fish movement is restricted because of waterfalls in the upper reaches of the system. Upper catchment areas consist of low impact cattle grazing and forest reserves, while the lower catchment consists of predominantly sugarcane agriculture. Riparian zones in the lower catchment are more impacted than those in the upper parts of the system.

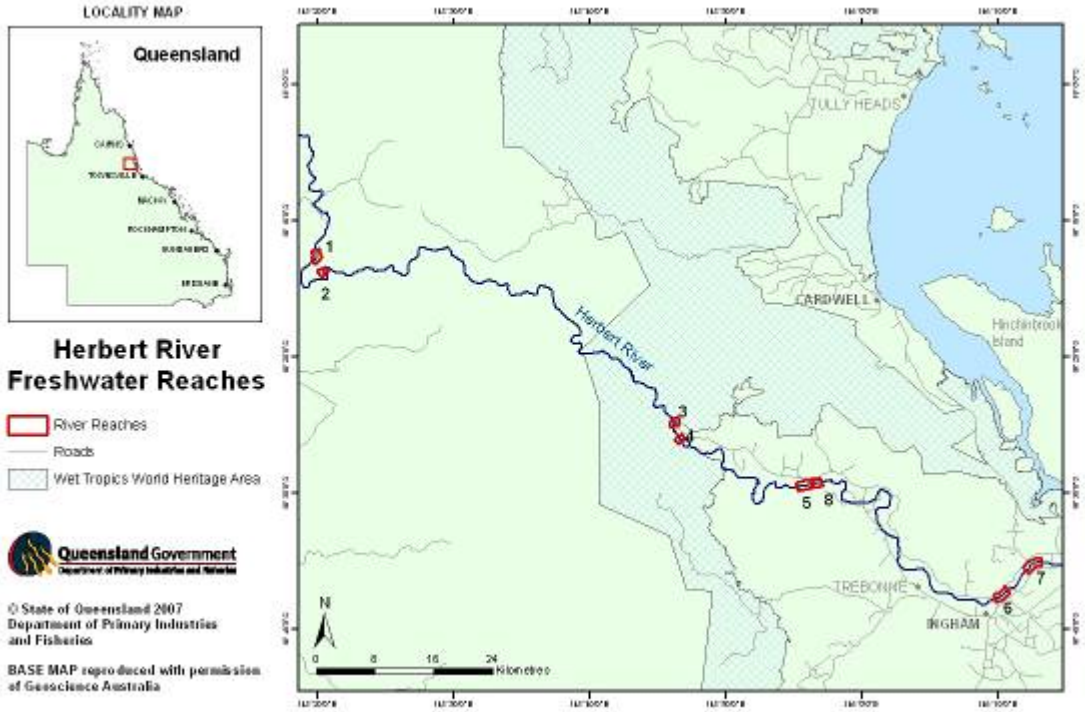


Figure 31. Location of the reaches sampled annually within the Herbert River.

Figure 32. Typical bank habitat sampled within the Herbert River.

Habitat

River condition is generally good with mostly undisturbed to low disturbance ratings at all sites (Figure 33). The majority of in-stream habitat consists of aquatic macrophytes, snags and rock bars (Figure 34). Sections of reaches surveyed contained limited in-stream structure dominated by sandy substrate. Some areas of sedimentation and high coverage of leaf litter can be seen.

The area of aquatic macrophyte beds increased from 2002, possibly due to less scouring as a result of smaller flood events during the wet seasons encountered during the last four surveys (Figure 34).

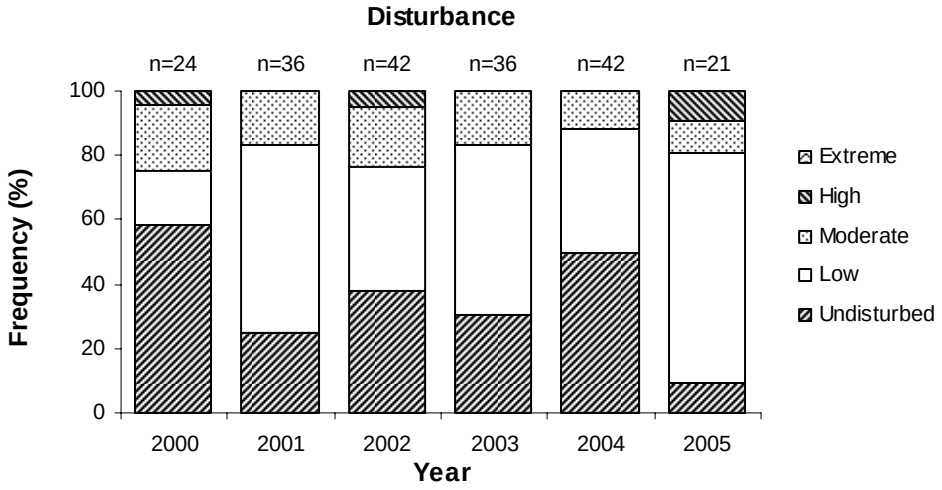


Figure 33. Stream bank disturbance ratings for the Herbert River between 2000 and 2005. The number of shot samples (n) are shown for each year.

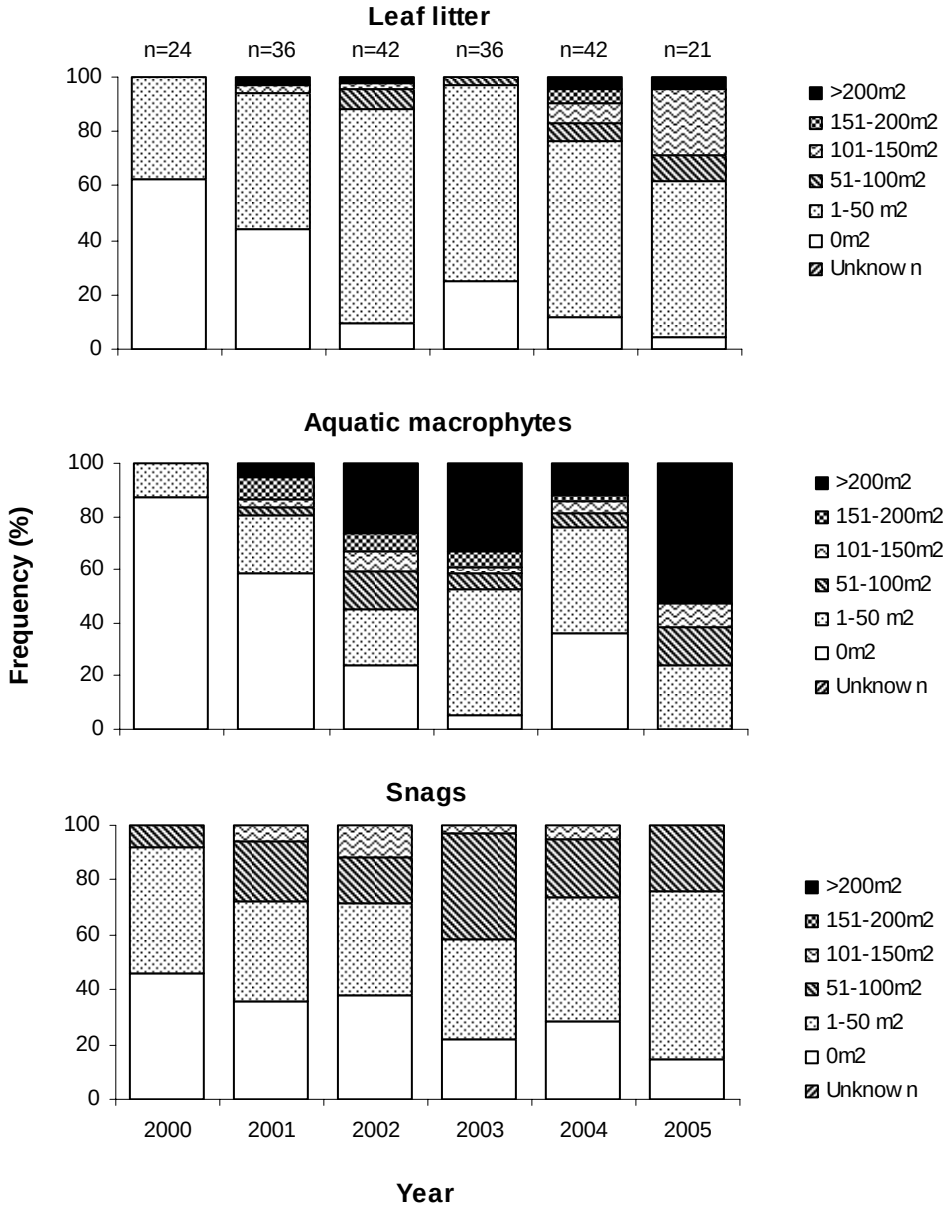


Figure 34. In-stream habitat parameters for the Herbert River including leaf litter, aquatic macrophytes and snag coverage. The number of shot samples (n) are provided for each year.

Water quality

Water clarity (in Secchi depth measure) is excellent with a lowest mean visibility of 144 cm in 2000 (Figure 35).

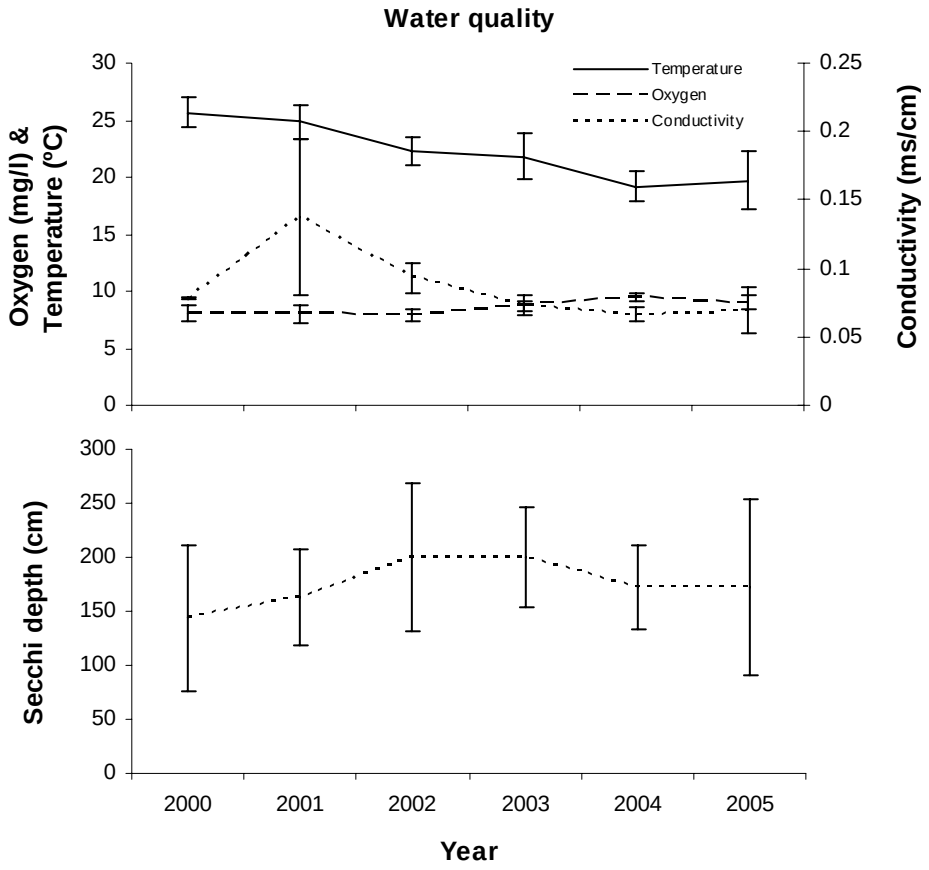


Figure 35. Water quality parameters for the Herbert River, including temperature, oxygen and conductivity (top) and Secchi depth measurements (bottom) between 2000 and 2005. Ninety-five percent confidence intervals are shown.

Fish fauna

Target species, sooty grunter and longfin eel, along with non-target species, gudgeon (*Hypseleotris compressa*) and rainbow fish, were the most abundant species captured across all years surveyed (Table 7). Species richness was high with a minimum of 54 species identified across all years.

There was an absence of spangled grunter in the 2000 catches, probably because of a failure to sample in the upper reaches (Table 7). Evidence for this is that the majority of spangled grunter came from these reaches in the following years with only 8 of the 192 fish captured coming from downstream reaches.

Table 7. Fish catch rates (CPUE) in the Herbert River. Target species are highlighted in bold.

Scientific name	Common name	Year					
		2000	2001	2002	2003	2004	2005
Acanthopagrus australis	**yellowfin bream**		**0.17**				
Acanthopagrus berda	**pikey bream**		**0.68**	**0.14**	**0.51**		
Ambassis agassizi	Agassizi's glassfish		0.34			1.29	1.43
Ambassis interrupta	longspine glassfish					0.43	
Ambassis miops	flagtail glassfish						0.29
Ambassis spp	a glassfish	0.74	0.17	1.15	2.55	1.00	1.72
Amniataba percoides	barred grunter	1.23	1.19	2.58	2.55	2.72	3.16
Anguilla obscura	**Pacific shortfin eel**		**0.17**				
Anguilla reinhardtii	**longfin eel**	**8.85**	**6.96**	**5.45**	**2.89**	**13.47**	**3.44**
Arrhamphus sclerolepis	**snubnose garfish**	**0.25**		**0.72**			
Awaous acritosus	Roman-nose goby	0.98	0.85	0.43	0.51	0.29	0.57
Bunaka gyrinoides	**greenback gudgeon**	**0.74**		**0.72**	**0.17**	**0.14**	**5.16**
Butis butis	crimsontip gudgeon						0.29
Caranx sexfasciatus	bigeye trevally		0.34	0.72			
Craterocephalus spp	a hardyhead		0.00				
Craterocephalus stercusmuscarum	flyspecked hardyhead	0.49	1.70	2.72	3.57	2.58	2.58
Eleotris melanosoma	black spine-cheek gudgeon			0.14			
Eleotris spp	a gudgeon			0.86	0.68	0.29	1.43
Gambusia holbrooki	Eastern gambusia				0.17		0.29
Gerres filamentosus	threadfin silverbiddy	1.72	1.53	2.58	2.21	1.29	1.72
Giurus margaritacea	snakehead gudgeon			0.29		0.14	
Gerres spp	a silverbiddy	0.74	1.53		0.85	0.43	2.01
Glossamia aprion	mouth almighty	0.25	0.34	0.43	2.55	1.29	2.01
Glossogobius giuris	tank goby	0.25		0.14			0.29
Glossogobius spp	a goby	0.98	1.53	0.57	0.17	0.43	
Gobiidae - undifferentiated	gobies		0.34				
Hephaestus fuliginosus	**sooty grunter**	**4.67**	**11.54**	**6.31**	**5.61**	**4.58**	**8.61**
Hephaestus tulliensis	khaki grunter		0.34				
Herklotsichthys castelnaui	Southern herring					0.14	
Hippichthys heptagonus	madura pipefish	0.25					
Hypseleotris compressa	empire gudgeon	4.18	2.71	3.58	4.08	2.58	3.16
Hypseleotris sp. 1 [in Allen *et al*., 2002]	Midgley's carp gudgeon			0.86	2.04	1.86	2.87
Hypseleotris spp	a gudgeon		1.19				
Lates calcarifer	**barramundi**	**2.95**	**2.71**	**4.73**	**0.51**	**2.29**	**1.15**
Leiognathidae - undifferentiated	ponyfishes		0.17				
Leiognathus equulus	common ponyfish	0.25		0.14			
Leiognathus spp	a ponyfish		0.17				
Leiopotherapon unicolor	**spangled perch**		**6.62**	**9.32**	**2.89**	**5.73**	**8.90**
Liza vaigiensis	diamondscale mullet		0.17				
Lutjanus argentimaculatus	**mangrove jack**	**2.46**	**1.02**	**2.44**	**1.70**	**1.72**	**2.30**
Megalops cyprinoides	**oxeye herring**			**0.72**		**3.29**	
Melanotaenia splendida	Eastern rainbowfish	3.44	3.73	4.44	4.76	3.72	4.02
Melanotaenia spp	a rainbowfish					0.14	
Mesopristes argenteus	**silver grunter**		**0.17**				**0.57**
Mogurnda adspersa	southern purple-spotted gudgeon		0.34	0.72		0.43	
Mogurnda spp	a gudgeon	0.25	0.51		1.02		0.86
Monodactylus argenteus	diamond fish			0.14			
Mugil cephalus	**sea mullet**		**0.34**	**0.86**	**0.34**		
Nematalosa erebi	bony bream	1.23	0.85	1.00	0.68	0.43	
Neosilurus ater	**black catfish**	**2.95**	**0.51**	**3.58**	**1.02**	**3.01**	**3.16**
Neosilurus hyrtlii	**Hytrl's catfish**	**1.23**	**0.34**	**0.86**	**0.34**	**3.01**	**0.86**
Notesthes robusta	bullrout	1.23	1.53	1.15	0.85	0.86	0.57
Ophisternon spp	a swamp eel			0.14			
Oxyeleotris lineolata	**sleepy cod**		**1.87**	**8.60**	**1.02**	**1.43**	**2.87**
Oxyeleotris nullipora	poreless gudgeon		0.17				
Platycephalus fuscus	**dusky flathead**			**0.14**			
Poecilia reticulata	guppy				0.17		
Porochilus rendahli	**Rendahl's catfish**	**0.74**					
Pseudomugil signifer	Pacific blue eye	1.48	1.19	1.15	0.85		
Redigobius bikolanus	speckled goby	0.49	1.02	0.72	1.87	1.00	1.43
Scatophagus argus	spotted scat	0.25				0.14	0.29
Strongylura krefftii	**freshwater longtom**		**0.34**	**0.57**	**0.85**		**0.86**
Toxotes chatareus	**sevenspot archerfish**						**0.29**
unknown species	unknown species		0.17				

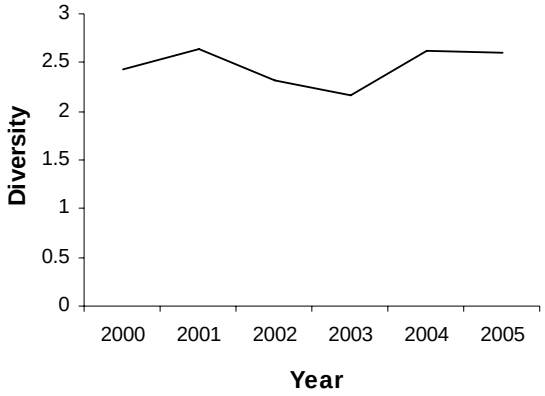


Figure 36. Species diversity in the Herbert River.

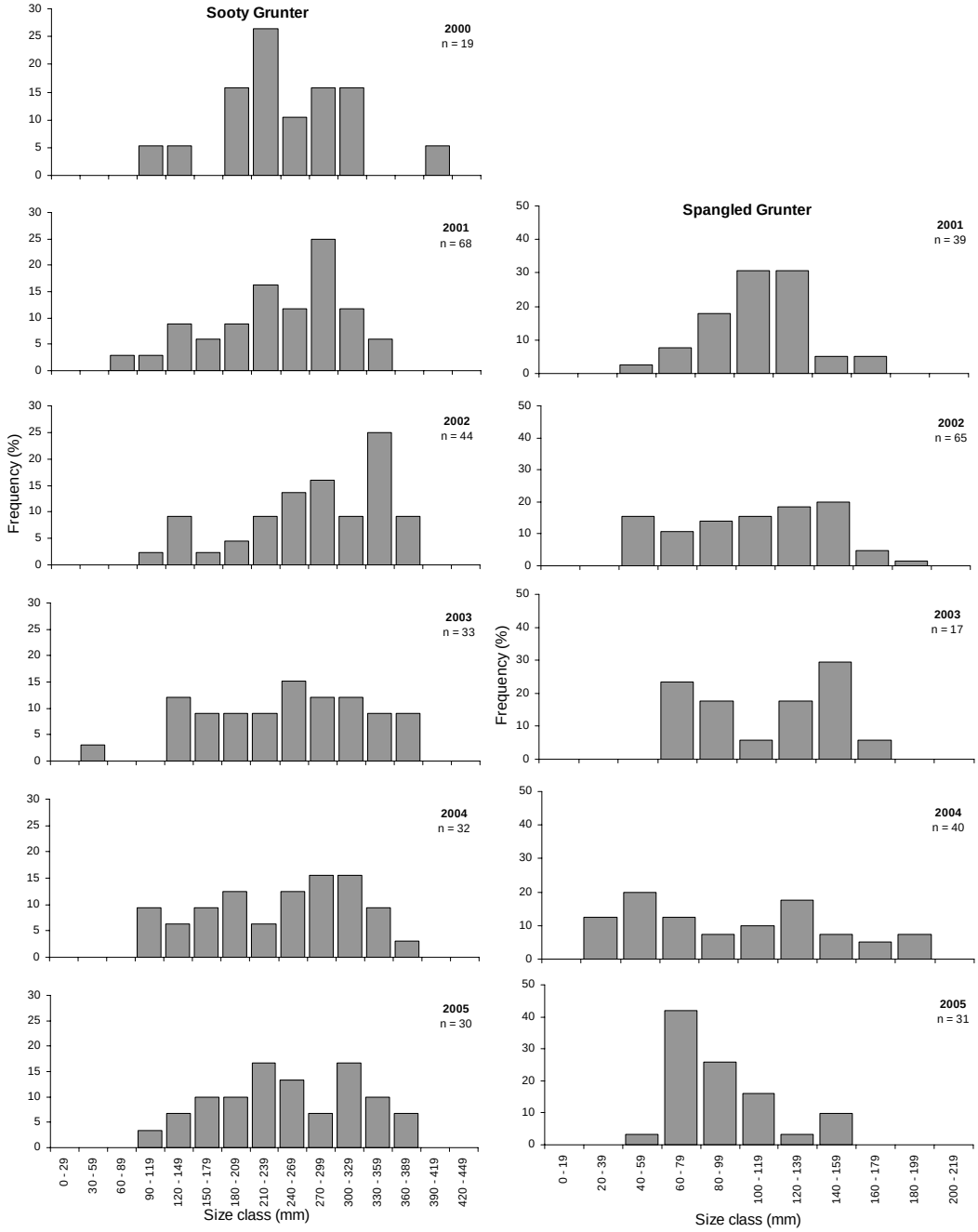


Figure 37. Length frequency distribution of sooty grunter and spangled grunter in the Herbert River between 2000 and 2005.

Mary River

River description

The Mary River has its source in the Sunshine Coast hinterland ranges near Kenilworth (Figure 38). It is 306 km long and has a total catchment area of 1051km^2. At present, the Mary River has only 2 significant barriers to flow and fish migration, the Gympie weir and the Mary River Barrage (Figure 38). The Mary River Barrage near Tairo is fitted with a functional fishway.

Upstream sites are characterised by dairy and beef cattle grazing with some quarrying and logging operations. Apart from the major population centres, some residential development occurs along the Tairo stretch of the river but this is mostly restricted to larger properties for much of its length.

A good spread of sites along the Mary River was possible thanks to relatively good flow rates, moderate pool size and the support of surrounding landholders. Sites extend downstream from Kenilworth to the Mary River Barrage (Figure 38). No sampling occurred downstream of the Mary River Barrage.

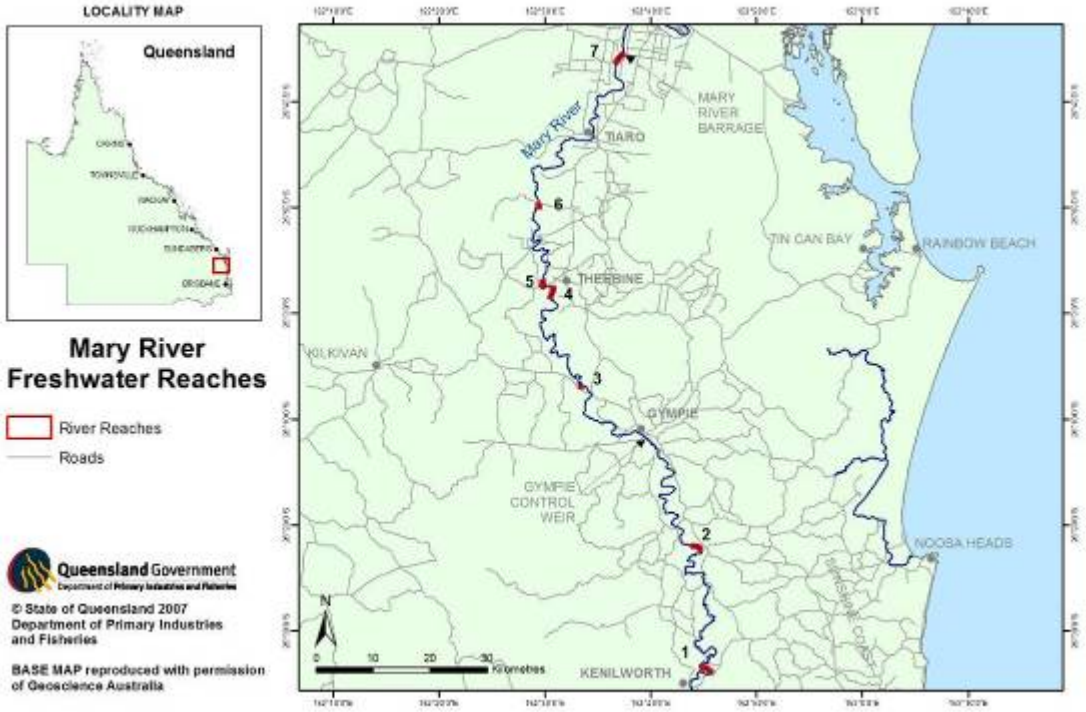


Figure 38. Location of the reaches sampled annually within the Mary River.

Figure 39. Typical bank habitat sampled within the Mary River.

Habitat

Up to 2003, the river bank condition at most sites was rated as moderate or high disturbance (Figure 40). In 2004 and 2005 an increase in the frequency of low disturbances was recorded. These assessments in 2004 and 2005 may not be a true reflection of stream bank disturbance but may be attributed to the qualitative technique used to assess habitat condition. Disturbances within the reaches included land clearing close to main river channels, damage from livestock, gravel and sand dredging operations.

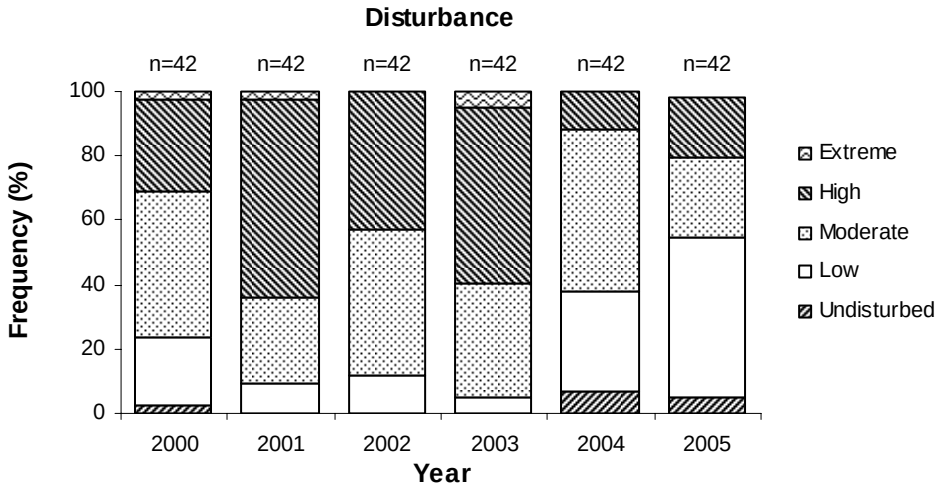


Figure 40. Stream bank disturbance ratings for the Mary River between 2000 and 2005. The number of shot samples (n) are shown for each year.

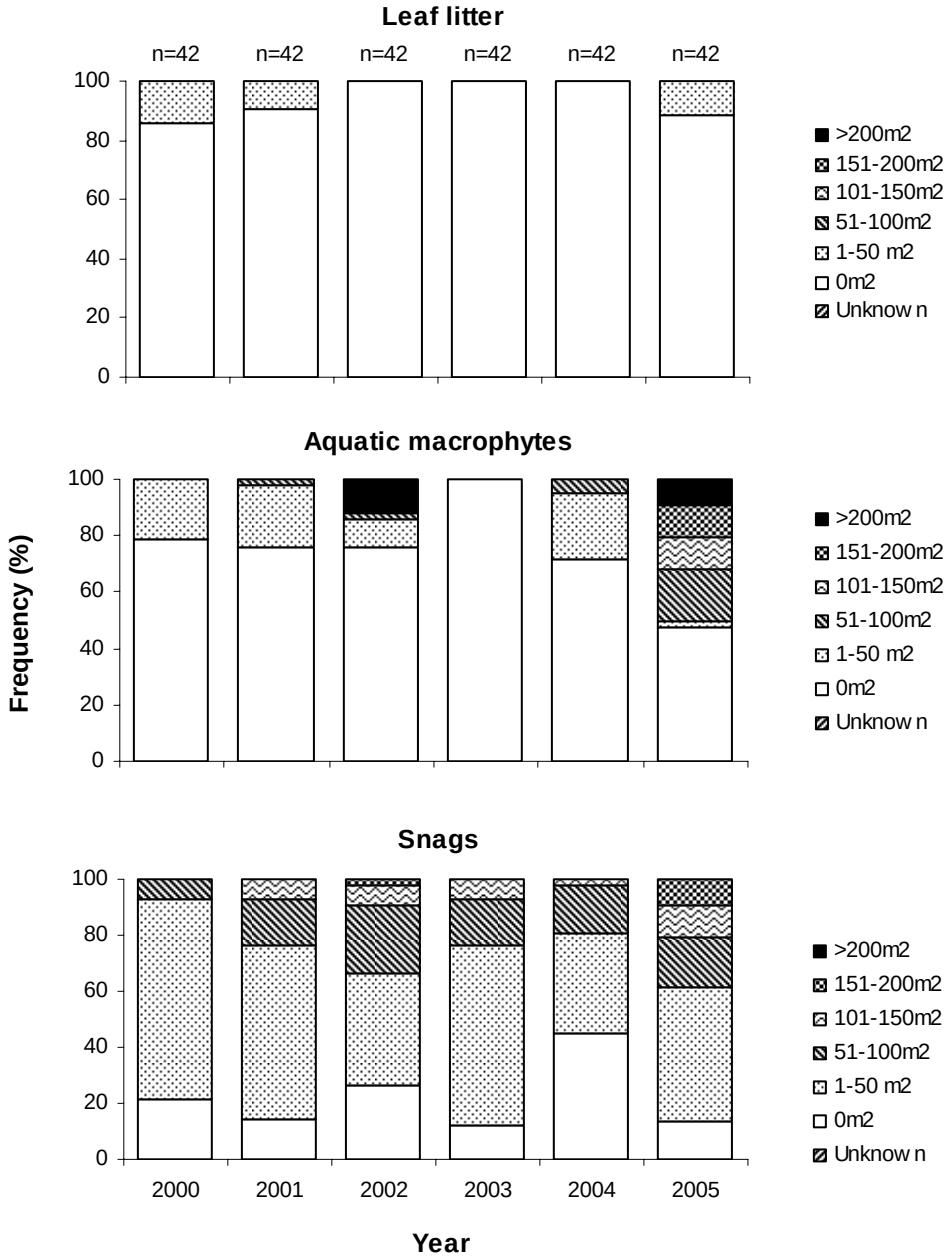


Figure 41. In-stream habitat parameters for the Mary River, including leaf litter, aquatic macrophytes and snag coverage. The number of shot samples (n) are provided for each year.

Water quality

Water clarity was generally good except in 2004 when a mean low of 44 cm corresponded with recent flow events in the river (Figure 42). Conductivity was particularly high in 2004 and peaked at a mean of 1.36 ms/cm in 2004 (Figure 42). High conductivity readings in the lower survey reaches may be a result of leakage from marine formations of the surrounding geology into the Mary River (D. Dempster, Department of Natural Resources and Water, pers. comm.).

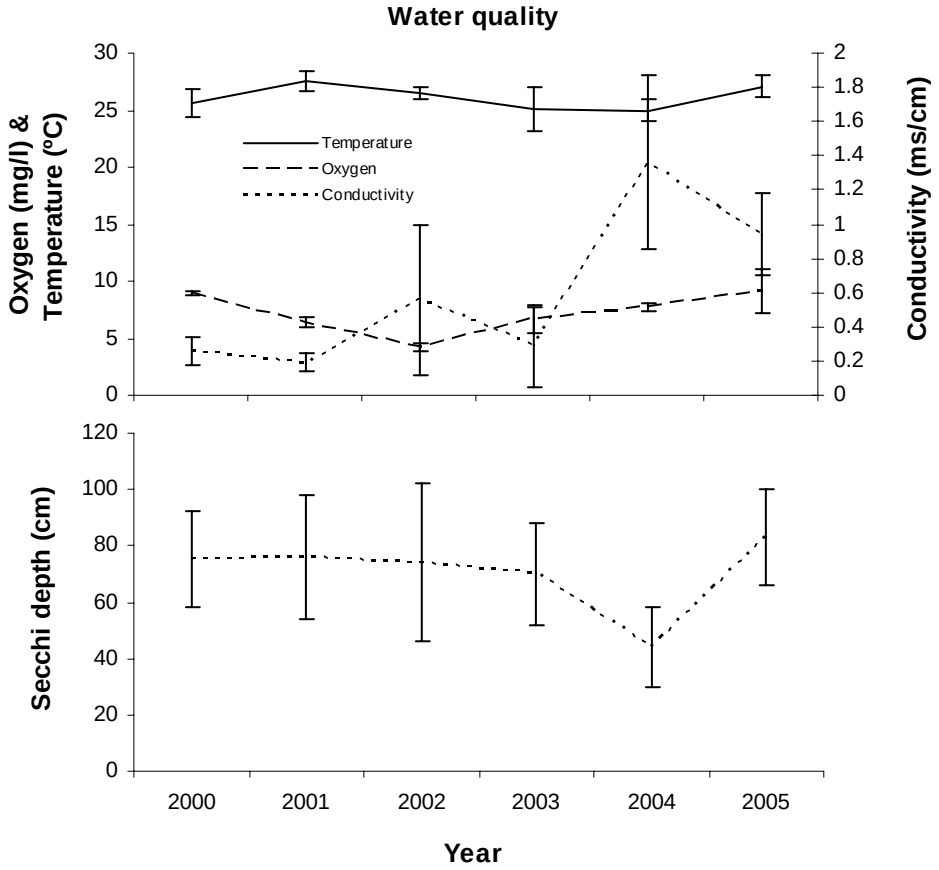


Figure 42. Water quality parameters for the Mary River, including temperature, oxygen and conductivity (top) and Secchi depth measurements (bottom) between 2000 and 2005. Ninety-five percent confidence intervals are shown.

Fish fauna

Target species, longfin eel and sea mullet, along with non-target species bony bream and crimsonspotted rainbowfish were well represented in the catch (Table 8). Yellowfin bream, a marine species that occasionally inhabits freshwater, was captured in 2005 after an absence in the data from previous years.

The dominant size class for sea mullet are the 330–359 mm to 420–449 mm classes (Figure 44).

Table 8. Fish catch rates (CPUE) in the Mary River. Target species are highlighted in bold.

Scientific name	Common name	Year					
		2000	2001	2002	2003	2004	2005
Acanthopagrus australis	**yellowfin bream**						**1.00**
Ambassis spp	a glassfish	0.30	0.29	0.88	2.48	1.43	1.57
Anguilla australis	**Southern shortfin eel**				**0.15**		
Anguilla reinhardtii	**longfin eel**	**2.12**	**4.03**	**3.52**	**2.04**	**1.57**	**4.86**
Arius graffei	blue catfish	0.30	1.01				
***Arius* spp**	**a fork tail catfish**	**1.21**	**0.14**	**0.88**	**0.29**	**1.00**	**2.00**
Arrhamphus sclerolepis	**snubnose garfish**	**0.00**		**0.88**	**3.65**	**5.71**	**4.72**
Craterocephalus marjoriae	Marjorie's hardyhead		0.58	1.32	0.58	0.43	0.43
Craterocephalus stercusmuscarum	flyspecked hardyhead	0.61	1.44	2.05	5.25	5.42	3.43
Gambusia holbrooki	Eastern gambusia	0.15	0.86	0.88	2.77	1.85	0.72
Glossamia aprion	mouth almighty	0.76	1.44	1.90	4.23	3.28	3.86
Gobiomorphus australis	striped gudgeon		0.86		0.15		
Hypseleotris compressa	empire gudgeon		0.29	3.37	3.50	1.28	0.43
Hypseleotris galii	firetail gudgeon	0.30	2.01	1.61	4.52	2.85	
Hypseleotris klunzingeri	Western carp gudgeon		2.45				3.00
Hypseleotris sp. 1 [in Allen *et al*., 2002]	Midgley's carp gudgeon	0.15		1.61	0.44	1.00	
Hypseleotris spp	a gudgeon				3.06		3.43
Leiopotherapon unicolor	**spangled perch**	**2.73**	**0.86**	**2.20**	**1.60**	**2.14**	**12.59**
Maccullochella peeli peeli	**Murray cod**					**0.29**	**0.14**
Macquaria novemaculeata	**Australian bass**	**0.30**	**0.72**	**1.61**	**0.29**	**0.14**	**0.57**
Megalops cyprinoides	**oxeye herring**		**0.14**				**0.29**
Melanotaenia duboulayi	crimsonspotted rainbowfish	3.33	5.18	5.42	5.25	5.56	5.58
Mogurnda adspersa	southern purple-spotted gudgeon					0.29	
Mugil cephalus	**sea mullet**	**11.82**	**9.64**	**13.63**	**18.23**	**28.68**	**17.74**
Nematalosa erebi	bony bream	5.15	5.75	4.98	4.81	5.71	5.15
Neoceratodus forsteri	Australian lungfish	1.82	1.15	2.34	2.92	3.85	2.72
Notesthes robusta	bullrout					0.14	0.29
Philypnodon grandiceps	flathead gudgeon	0.15	0.14		0.73		0.29
Philypnodon macrostomus	dwarf flathead gudgeon		0.14			0.14	
Pseudomugil signifer	Pacific blue eye		1.15	0.73	0.29	1.14	1.00
Retropinna semoni	Australian smelt	1.21	1.29	1.32	2.04	2.28	1.72
Tandanus tandanus	**freshwater catfish**	**1.21**	**1.44**	**1.03**	**2.19**	**0.57**	**2.00**
Trachystoma petardi	**pinkeye mullet**	**1.97**				**0.14**	
Xiphophorus maculatus	platy				0.15	0.14	

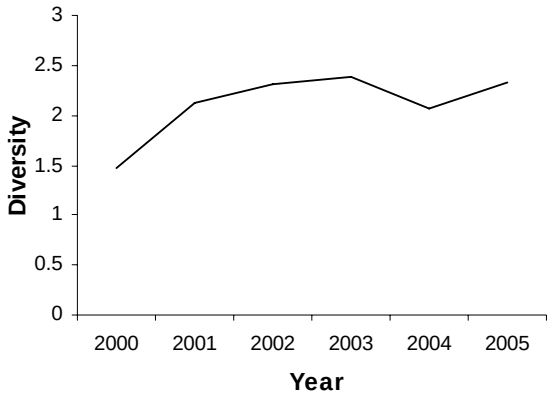


Figure 43. Species diversity in the Mary River.

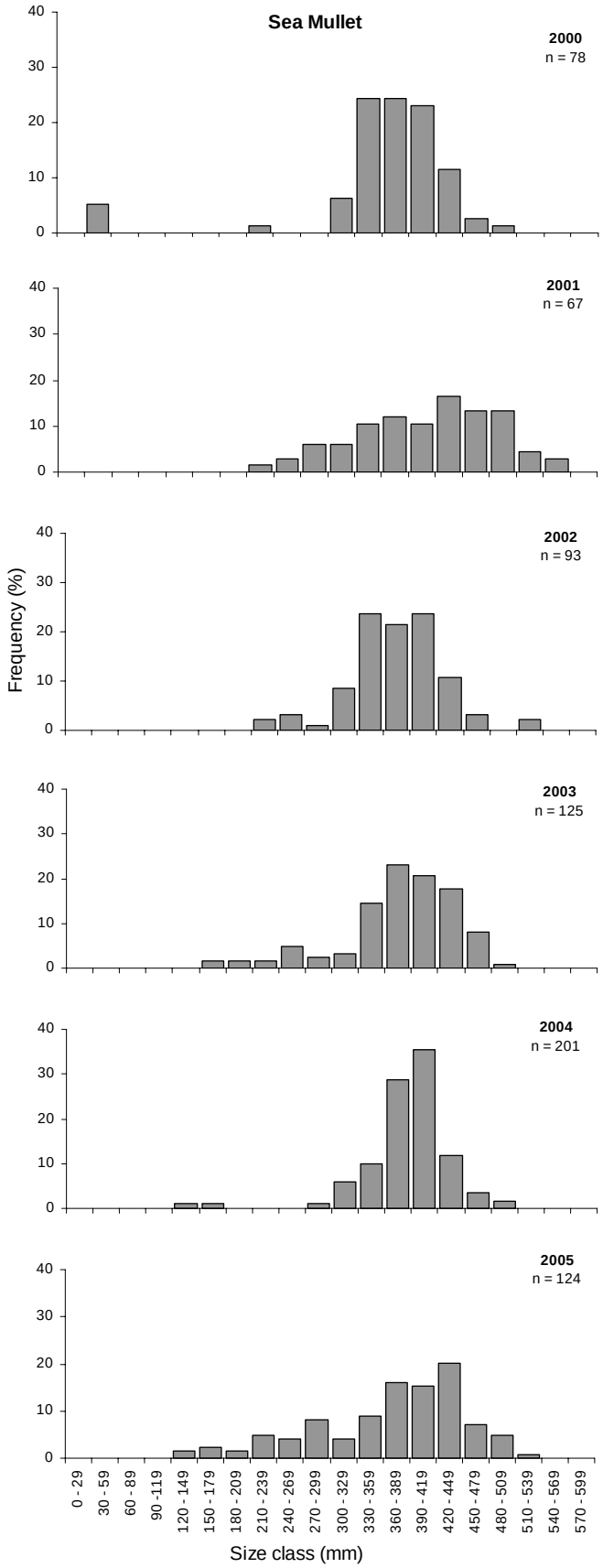


Figure 44. Length frequency distribution of sea mullet in the Mary River between 2000 and 2005.

Noosa River

River description

The Noosa River is relatively short at only 69 km long and with a catchment area of 216 km^2 it is the smallest river included in the LTMP survey. The Noosa River runs from it's headwaters in the Cooloola National Park in the Sunshine Coast Hinterland north west of Noosa entering the ocean on the north side of the Noosa headland (Figure 45). The Noosa River remains un-impounded for its entire length.

The river has a series of tidal lakes in the lower reaches and all sampling conducted by the LTMP occurred upstream of these lakes. Kin Kin Creek, which flows into Lake Cootharaba, is also included in this survey as part of the Noosa River system (Figure 45). Boating activity is restricted in the upstream section of the Noosa River. No petrol powered vessels are permitted upstream of Harry's Hut in Cooloola National Park and no power assisted vessels are permitted above Campsite Three. Research vessels and other restricted access users have strict speed limits to below 4 knots. Sites are spread evenly along the length of both the Noosa River and Kin Kin Creek (Figure 45).

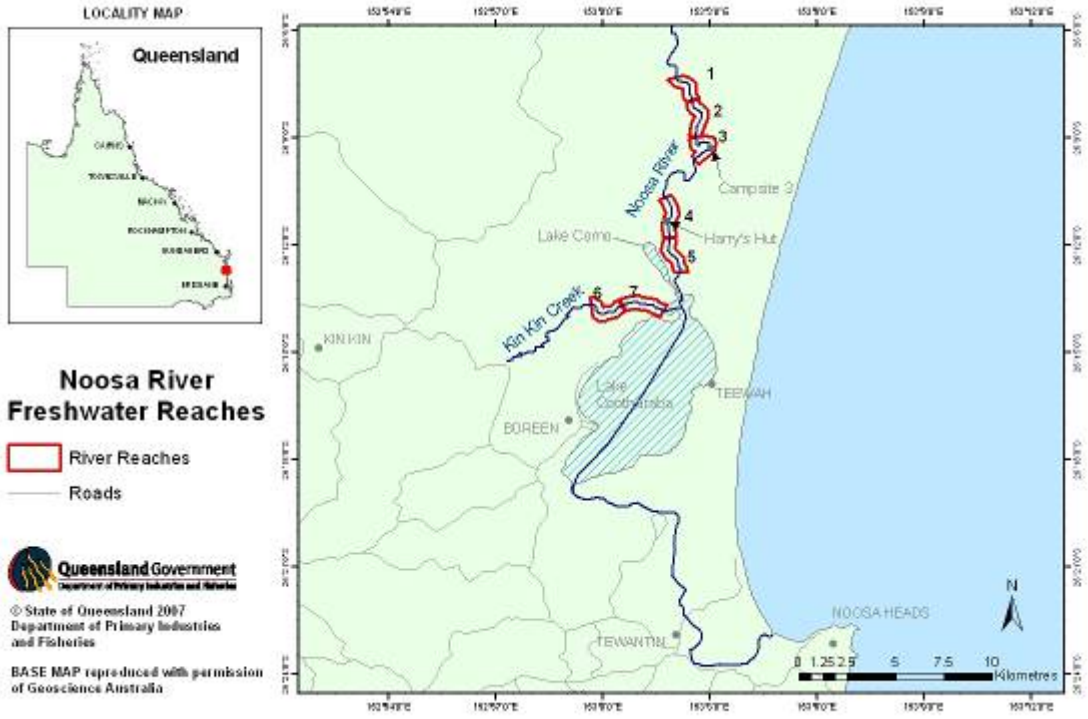


Figure 45. Location of the reaches sampled annually within the Noosa River.

Figure 46. Typical bank habitat sampled within the Noosa River.

Habitat

Overall river condition is pristine with predominantly undisturbed to low disturbance ratings (Figure 47). The riparian zone is typically wide with the river being close to the upper level of the bank in most places. A significant amount of emergent vegetation exists in the form of reeds and grasses.

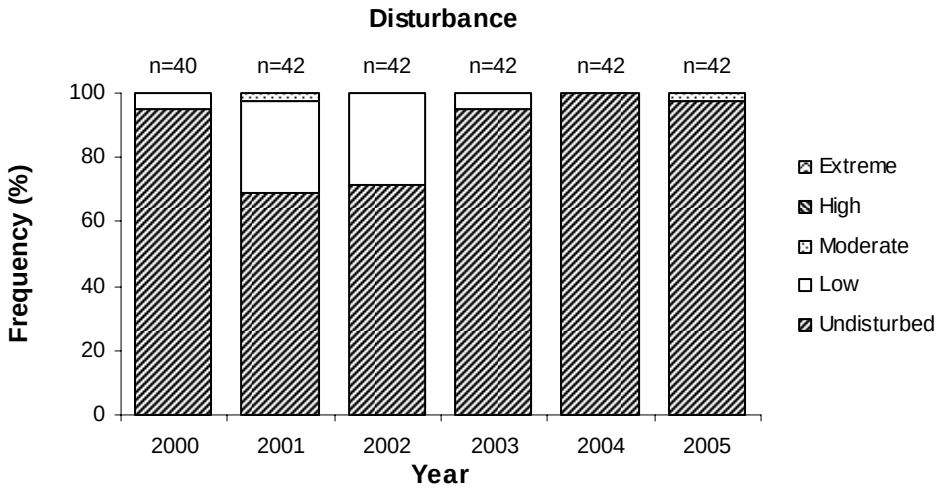


Figure 47. Stream bank disturbance ratings for the Noosa River between 2000 and 2005. The number of shot samples (n) are shown for each year.

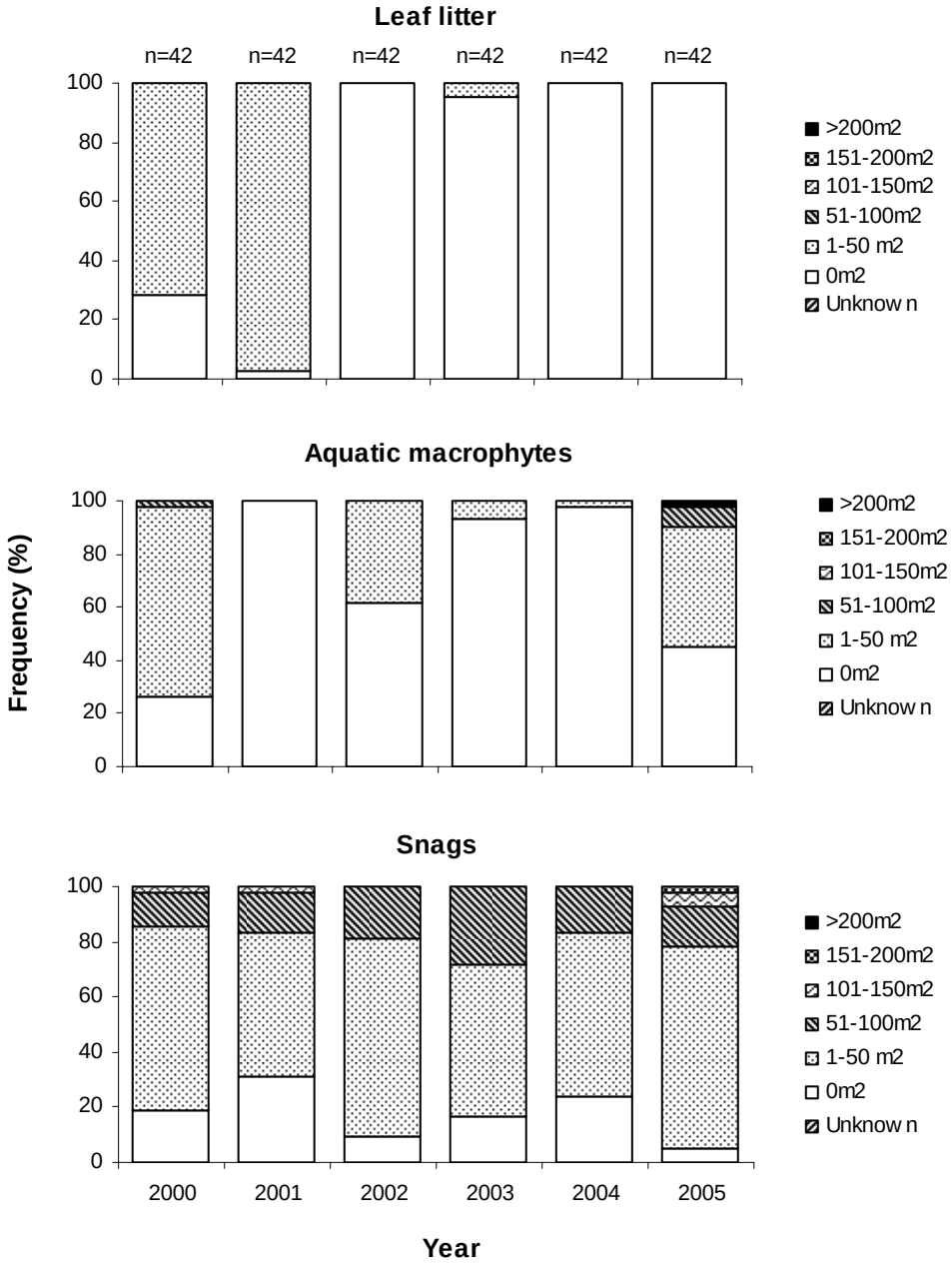


Figure 48. In-stream habitat parameters for the Noosa River, including leaf litter, aquatic macrophytes and snag coverage. The number of shot samples (n) are provided for each year.

Water quality

Although the waters are stained dark brown with tannin from surrounding vegetation, water clarity was high in the first three years of the study but dropped off in the following years with a lowest mean value of 50 cm in 2004 (Figure 49). Conductivity readings are high and this noticeably reduced the efficiency of the electrofishing unit where it was unable to pick fish up if they were more than a couple of meters below the surface (Figure 49). A saline wedge was evident in some dry years at downstream sites, further reducing the effective range of electrofishing equipment.

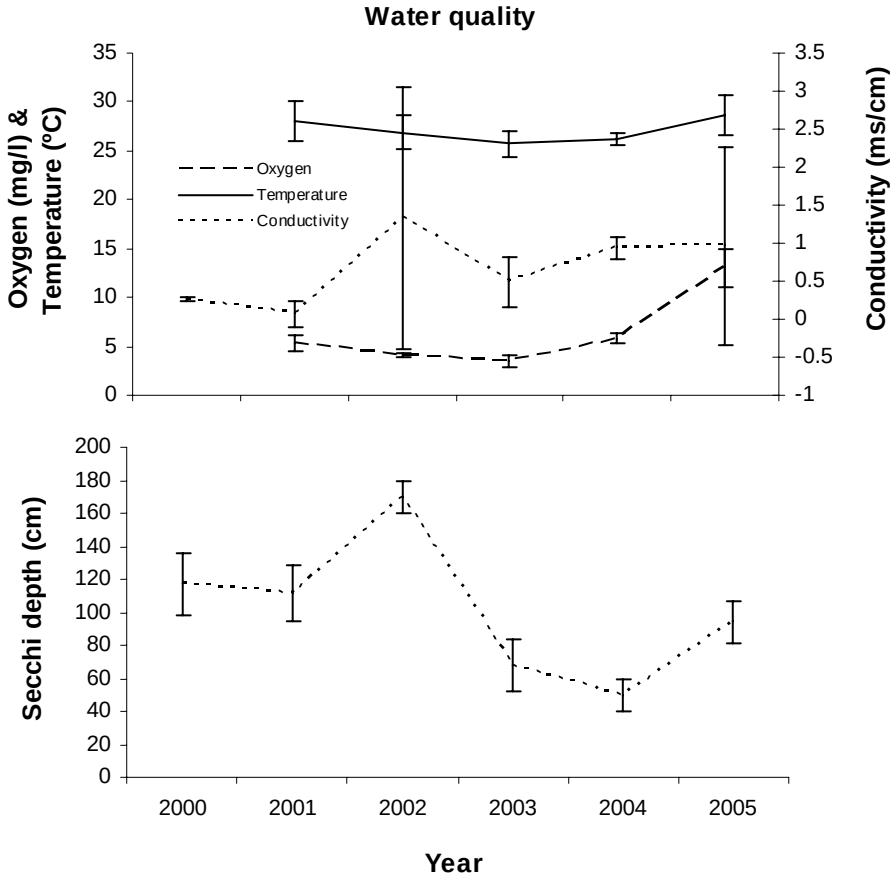


Figure 49. Water quality parameters for the Noosa River including temperature, oxygen and conductivity (top), and Secchi depth measurements (bottom) between 2000 and 2005. Ninety-five percent confidence intervals are shown.

Fish fauna

Catch rates of all species are relatively low in the Noosa River with the exception of smaller rainbowfish and some diadromous species (Table 9). The endangered oxleyan pigmy perch and honey blue eye have been a feature of our catch records in this catchment (Table 9).

Table 9. Fish catch rates (CPUE) in the Noosa River. Target species are highlighted in bold.

Scientific name	Common name	Year					
		2000	2001	2002	2003	2004	2005
Acanthopagrus australis	**yellowfin bream**	**1.71**	**0.58**	**0.29**	**7.12**	**3.57**	
Ambassis spp	a glassfish	1.28	0.58	0.88	0.58	1.00	0.26
Anguilla australis	**Southern shortfin eel**	**0.14**				**0.29**	
Anguilla reinhardtii	**longfin eel**	**0.86**	**0.58**	**0.44**	**0.44**	**0.29**	**0.79**
Arius spp	a fork tail catfish				1.45	0.14	
Arrhamphus sclerolepis	**snubnose garfish**				**1.89**		
Arrhamphus spp	a garfish				0.29		
Butis butis	crimsontip gudgeon					0.14	
Craterocephalus stercusmuscarum	flyspecked hardyhead					0.14	
Gambusia holbrooki	Eastern gambusia	0.14			0.15	0.71	0.79
Gerres spp	a silverbiddy		0.29				
Girella tricuspidata	luderick					0.29	
Glossogobius giuris	tank goby	0.71					
Gobiomorphus australis	striped gudgeon	3.00	2.60	0.88	1.02	2.29	2.38
Herklotsichthys castelnaui	Southern herring	0.86	0.14	0.29	0.29		
Hypseleotris compressa	empire gudgeon	5.00	2.02	0.58	2.04	4.00	3.18
Hypseleotris galii	firetailed gudgeon	2.43	1.01	0.15		0.43	1.32
Hypseleotris klunzingeri	Western carp gudgeon	5.00				0.14	
Hypseleotris sp.1 [in Allen *et al*., 2002]	Midgley's carp gudgeon		0.58	0.15	0.15	0.71	
Hypseleotris spp	a gudgeon						1.32
Liza argentea	**goldspot mullet**				**1.31**	**0.14**	
Lutjanus argentimaculatus	**mangrove jack**	**0.29**				**0.29**	
Macquaria novemaculeata	**Australian bass**	**1.57**	**1.30**	**1.02**	**3.49**	**1.00**	**1.59**
Megalops cyprinoides	**oxeye herring**	**0.43**	**0.43**				
Melanotaenia duboulayi	crimsonspotted rainbowfish	4.28	4.33	2.92	3.93	3.72	5.83
Mogurnda adspersa	southern purple-spotted gudgeon	0.29	0.29	0.15			
Monodactylus argenteus	diamond fish				0.15		
Mugil cephalus	**sea mullet**	**5.14**	**0.58**	**0.15**	**1.16**	**4.72**	
Myxus petardi	**pink eye mullet**	**0.57**	**0.14**	**0.29**	**2.33**	**0.57**	**0.26**
Myxus spp	a mullet					0.29	
Nannoperca oxleyana	oxleyan pygmy perch	0.29	0.29				0.53
Nematalosa erebi	bony bream				0.58	0.14	
Notesthes robusta	bullrout	0.14			0.15		
Philypnodon grandiceps	flathead gudgeon		0.29	0.15	0.15	0.14	0.79
Philypnodon macrostomus	dwarf flathead gudgeon	0.14				0.14	
Pseudomugil mellis	honey blue eye	1.57			0.15	0.14	0.53
Pseudomugil signifer	Pacific blue eye				1.02	0.71	
Retropinna semoni	Australian smelt	0.43	0.14		0.15	0.14	
Scatophagus argus	spotted scat				0.87		
Tandanus tandanus	**freshwater catfish**	**0.57**	**0.14**				**0.26**
Rhadinocentrus ornatus	ornate rainbowfish						0.26

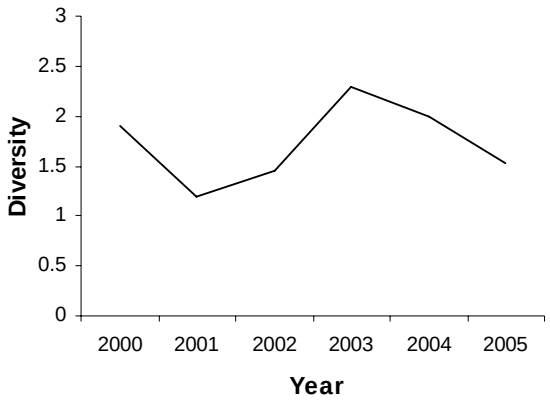


Figure 50. Species diversity in the Noosa River.

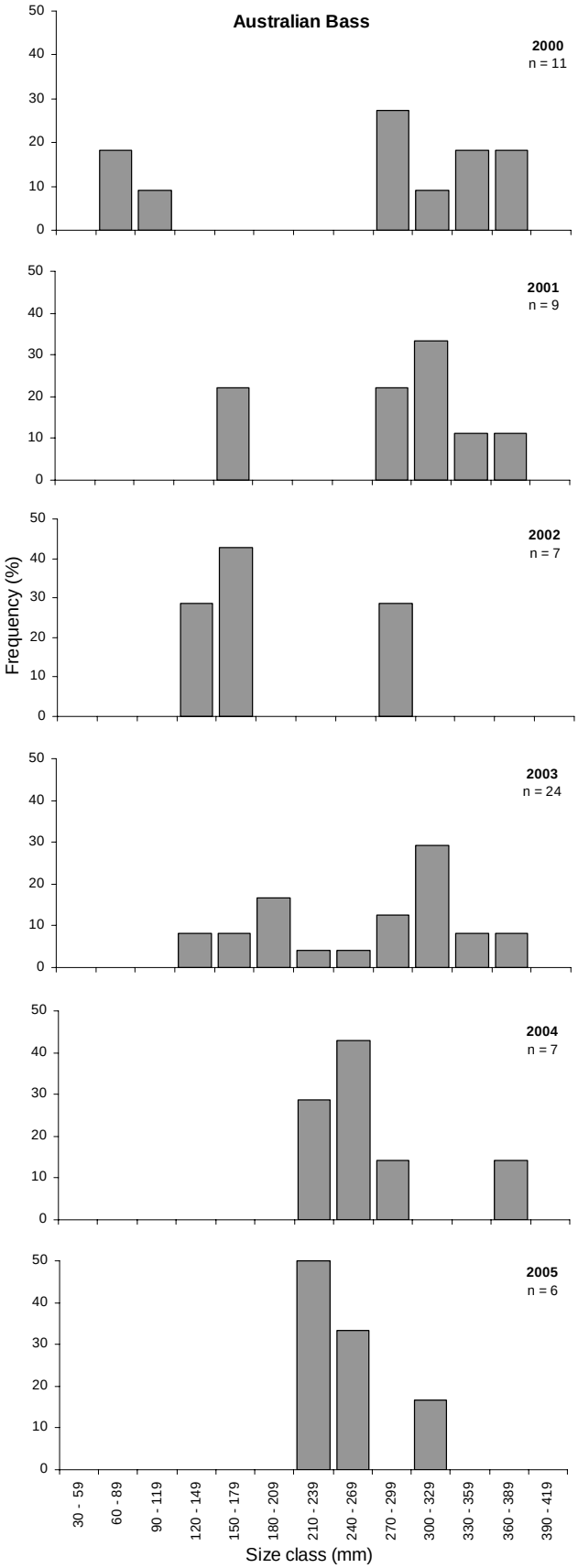


Figure 51. Length frequency distribution of Australian bass in the Noosa River between 2000 and 2005.

Logan-Albert River

River description

The Logan-Albert River system is comprised of two major rivers, the Logan and Albert Rivers. Both rivers have their origins in the region of the Border Ranges between Queensland and New South Wales (Figure 52). The Logan-Albert River is 302 km long and has a total catchment area of 470 km². The system has only 2 major barriers to flow and fish migration, one of which is fitted with a fish way.

Upstream sites are characterised by dairy and beef cattle grazing with some pastoral and logging practices. Residential housing, golf courses and recreational activities dominate land use in downstream reaches.

Small river size and restricted bank side access have limited the number of upstream sites included in this survey and three sites are located in tidal waters. Electrofishing efficiency in the most downstream sites is periodically affected by high salinities during periods of low flow.

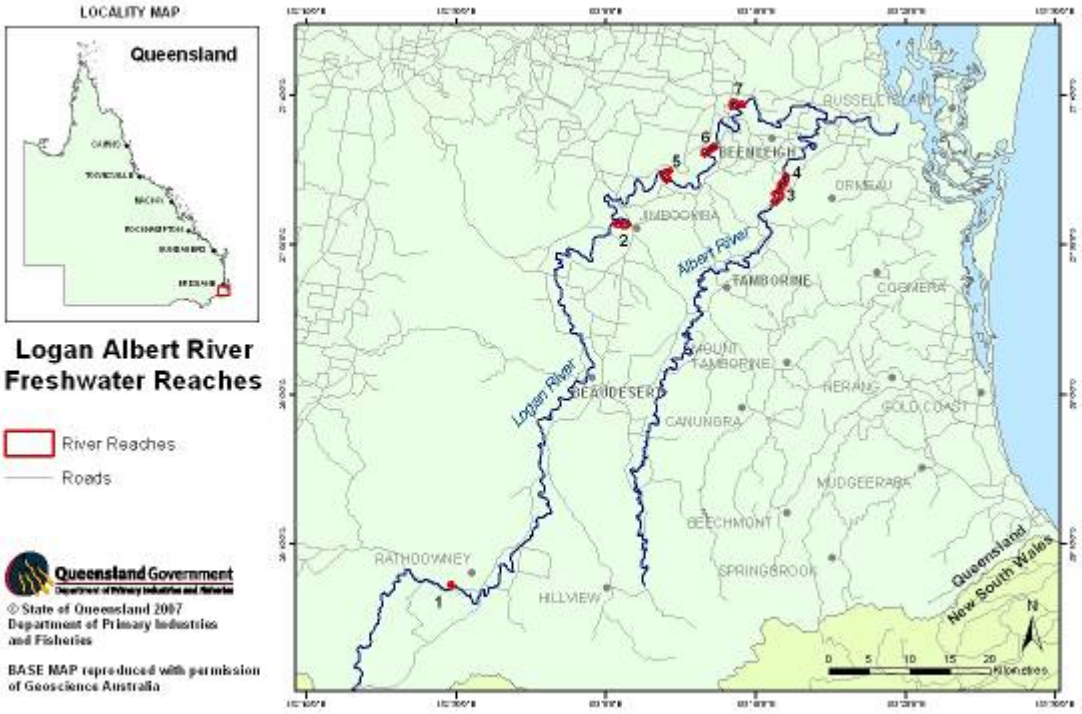


Figure 52. Location of the reaches sampled annually within the Logan and Albert Rivers.

Figure 53. Typical bank habitat sampled within the Logan-Albert River system.

Habitat

Overall river condition remains very poor with predominantly moderate to high disturbance ratings at the majority of shot locations (Figure 54). Land clearing close to main river channels, damage from livestock, gravel and sand dredging operations and urban development all contributed to the poor condition of this river. Macrophyte coverage and leaf litter habitat were poor at the selected shot locations although there were quantities of woody debris present at many sites throughout the period of the study (Figure 55).

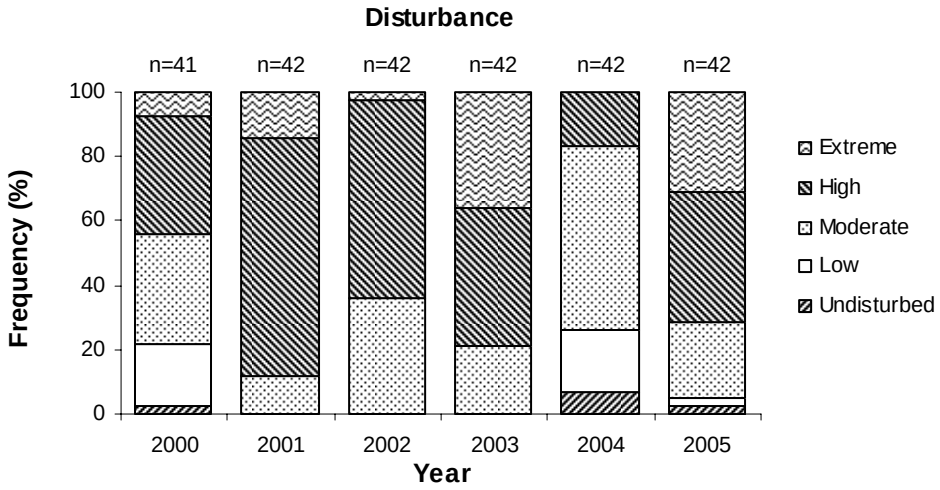


Figure 54. Stream bank disturbance ratings for the Logan-Albert River between 2000 and 2005. The number of shot samples (n) are shown for each year.

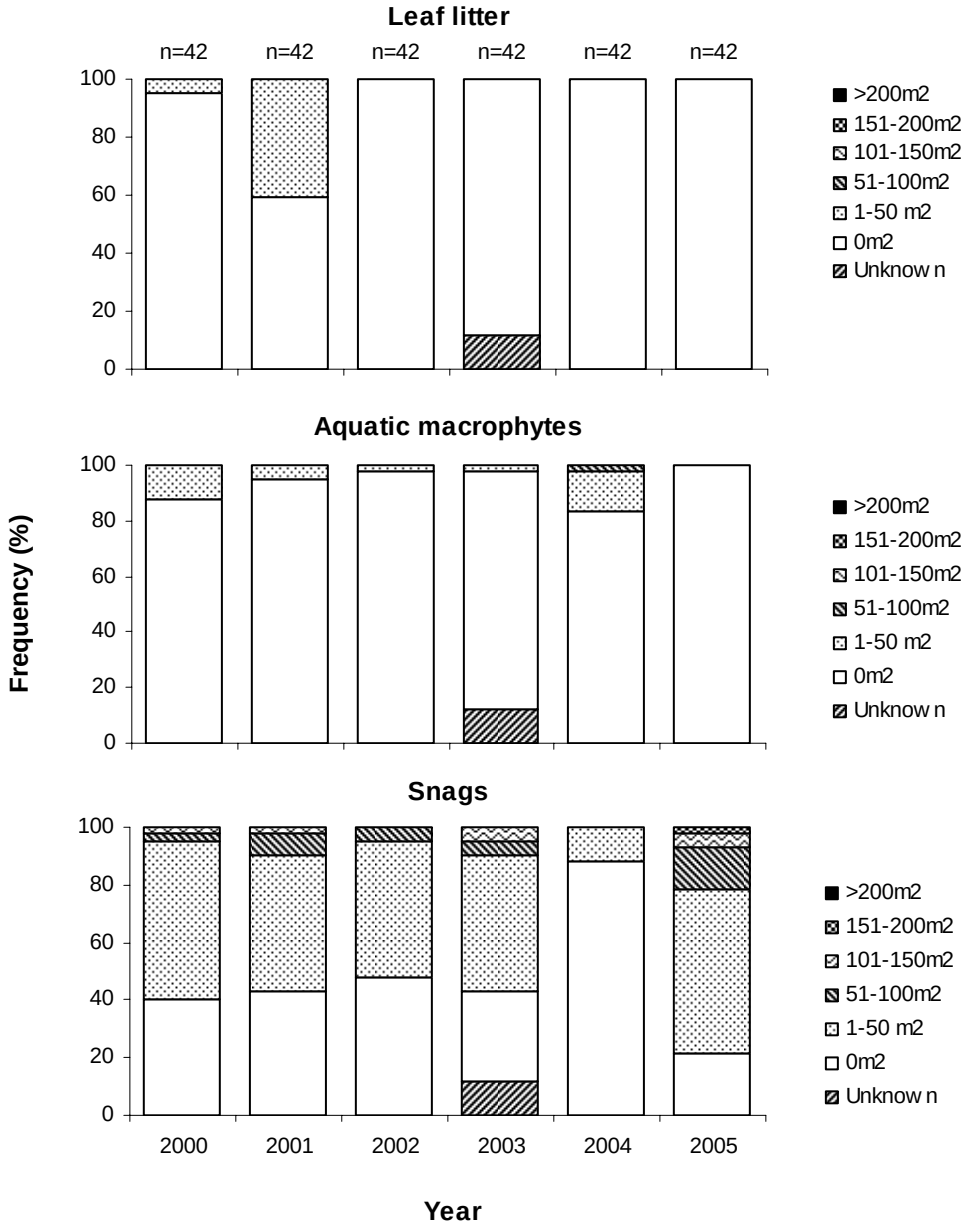


Figure 55. In-stream habitat parameters for the Logan-Albert River, including leaf litter, aquatic macrophytes and snag coverage. The number of shot samples (n) are provided for each year.

Water quality

Visibility was generally good in the first years of the surveys with a mean average of 66 cm in 2000 and declined in subsequent years to a low mean average of 31 cm in 2004 (Figure 56). Mean conductivity is relatively high in 2002, 2004 and 2005, being largely due to higher readings from the four tidal downstream reaches (Figure 56).

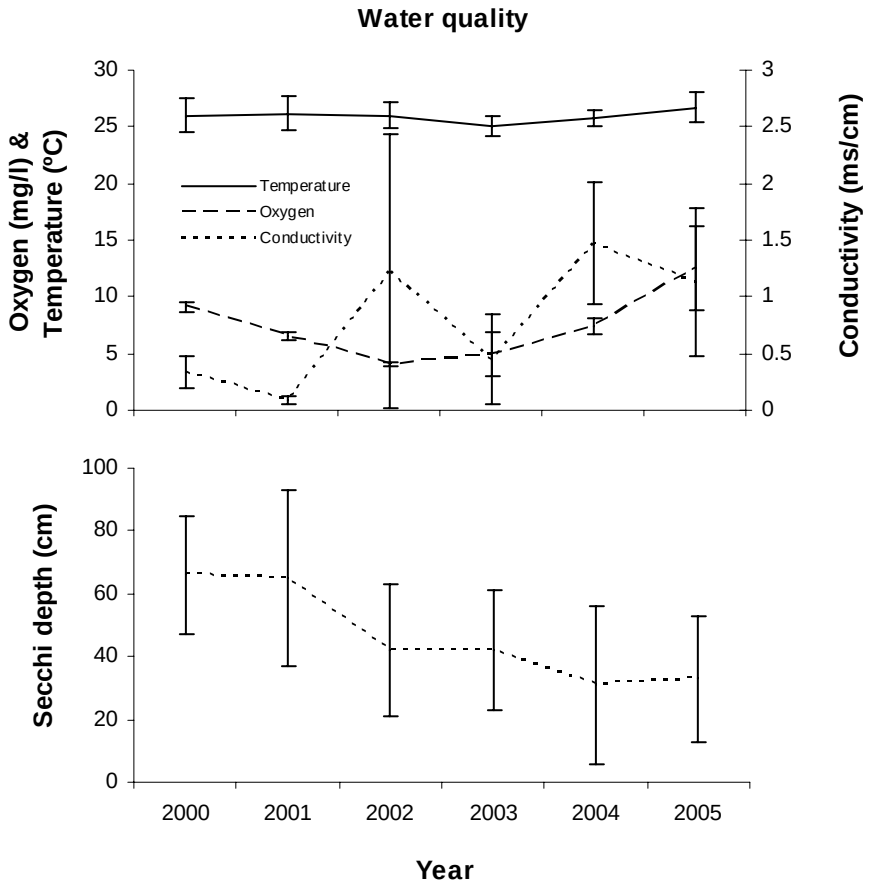


Figure 56. Water quality parameters for the Logan-Albert River, including temperature, oxygen and conductivity (top) and Secchi depth measurements (bottom) between 2000 and 2005. Ninety-five percent confidence intervals are shown.

Fish fauna

Target species, Australian bass, sea mullet and yellowfin bream, feature prominently in the catch along with the introduced species, European carp (Table 10). Of the non-target species encountered, glassfish and bony bream were the most prolific.

Table 10. Fish catch rates (CPUE) in the Logan-Albert River. Target species are highlighted in bold.

Scientific name	Common name	Year					
		2000	2001	2002	2003	2004	2005
Acanthopagrus australis	**yellowfin bream**	**8.16**	**9.54**	**7.01**	**17.44**	**6.70**	**14.30**
Ambassis agassizi	Agassizi's glassfish					0.14	
Ambassis spp	a glassfish	4.15	3.03	1.52	3.78	2.42	2.60
Anguilla australis	**Southern shortfin eel**	**0.14**				**1.57**	**0.22**
Anguilla reinhardtii	**longfin eel**	**2.86**	**2.46**	**0.46**	**0.44**	**0.86**	**2.17**
Arius graffei	blue catfish		0.43				
Arius spp	a fork tail catfish	1.29		0.76	1.60	2.28	3.25
Arrhamphus sclerolepis	**snubnose garfish**			**0.1\5**	**1.74**	**0.29**	**0.65**
Butis butis	crimsontip gudgeon		0.58	0.30	0.44	0.29	0.22
Carassius auratus	**goldfish**						**0.65**
Carcharhinus leucas	bull shark			0.15			
Conger wilsoni	Eastern conger			0.30			
Cyprinus carpio	**European carp**	**2.43**	**6.79**	**2.29**	**1.60**	**1.57**	**2.38**
Gambusia holbrooki	Eastern gambusia	0.57	2.31	0.15	1.89	2.42	1.30
Gerres spp	a silverbiddy	1.00	1.30		0.44	1.71	0.65
Gobiomorphus australis	striped gudgeon	1.43	2.17	0.15	1.45	1.85	0.87
Herklotsichthys castelnaui	Southern herring	0.29		0.46	0.15		0.22
Hypseleotris compressa	empire gudgeon		3.18	0.30	1.74	0.29	0.43
Hypseleotris galii	firetail gudgeon		0.58	0.46	1.16	1.57	
Hypseleotris klunzingeri	Western carp gudgeon	1.43					0.87
Hypseleotris sp. 1 [in Allen *et al*., 2002]	Midgley's carp gudgeon	1.00	2.46			0.29	
Hypseleotris spp	a gudgeon				0.87		1.73
Leiopotherapon unicolor	**spangled perch**		**0.29**			**0.14**	**1.30**
Liza argentea	**goldspot mullet**	**0.14**		**0.15**	**1.45**	**1.57**	
Maccullochella peeli mariensis	**Mary River cod**	**0.14**					
Maccullochella peeli peeli	**Murray cod**						**0.22**
Macquaria novemaculeata	**Australian bass**	**3.87**	**3.76**	**5.49**	**4.36**	**3.71**	**6.72**
Melanotaenia duboulayi	crimsonspotted rainbowfish	0.86	2.17	0.46	1.89	1.57	2.60
Monodactylus argenteus	diamondfish	0.14	0.14	0.30	0.15	0.57	0.87
Mugil cephalus	**sea mullet**	**33.93**	**53.02**	**37.94**	**40.70**	**32.79**	**48.31**
Myxus elongatus	sand mullet	2.58					
Myxus spp	a mullet			0.15	0.29		3.47
Nematalosa erebi	bony bream	2.86	3.03	2.59	2.76	1.14	2.82
Notesthes robusta	bullrout	0.29	0.29	0.30		0.43	0.65
Philypnodon grandiceps	flathead gudgeon		1.44		0.29	1.28	0.65
Philypnodon macrostomus	dwarf flathead gudgeon				0.15	0.43	0.43
Platycephalus fuscus	**dusky flathead**	**0.29**	**0.29**	**0.46**	**0.58**	**0.71**	**0.43**
Pseudomugil signifer	Pacific blue eye	0.72	3.76	0.15	2.33	2.85	2.17
Redigobius macrostoma	largemouth goby					0.14	
Retropinna semoni	Australian smelt	0.72	0.58		0.29	0.71	0.43
Scatophagus argus	spotted scat		0.14				
Selenotoca multifasciata	**striped scat**	**0.43**			**1.31**		
Tandanus tandanus	**freshwater catfish**	**0.29**	**0.58**	**0.15**	**0.15**	**0.14**	
Trachystoma petardi	**pinkeye mullet**	**4.58**	**3.03**	**4.42**	**2.03**	**1.43**	**4.12**

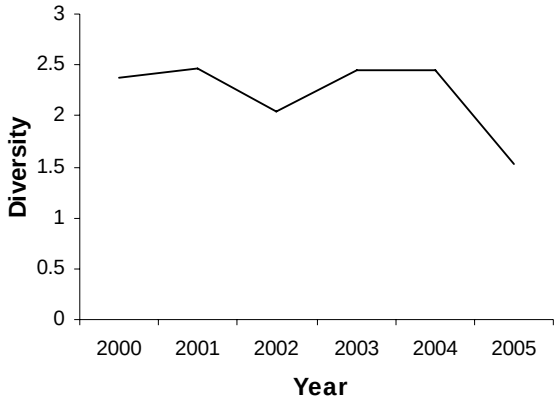


Figure 57. Species diversity in the Logan-Albert River.

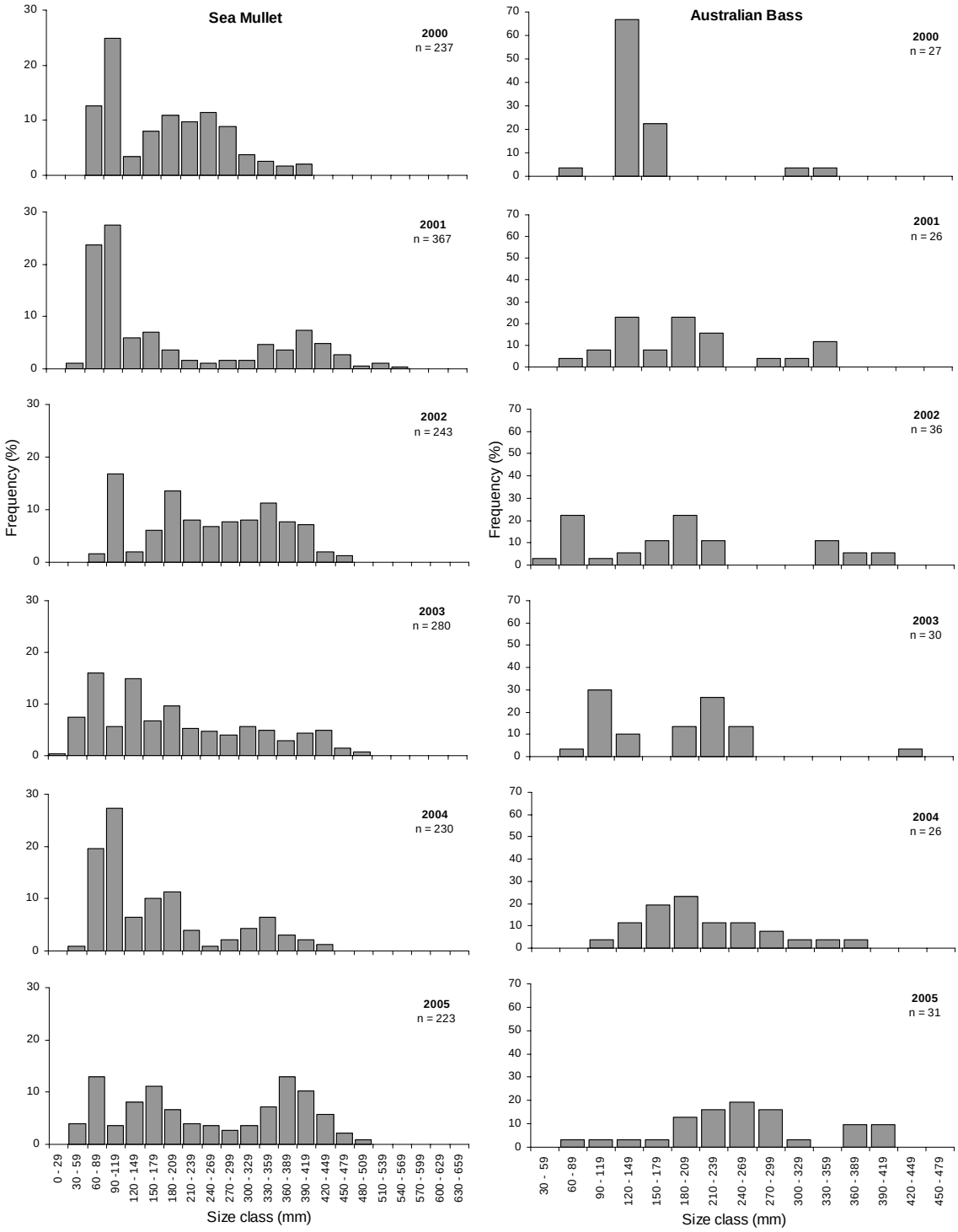


Figure 58. Length frequency distribution of sea mullet and Australian bass in the Logan-Albert River between 2000 and 2005.

Condamine-Balonne River

River description

The Condamine-Balonne River system has its source in the Buckland Tableland, Carnarvon National Park. It incorporates several other rivers including the Maranoa, Culgoa, Narran and Balonne Minor before crossing the New South Wales Border (Figure 59). The Condamine-Balonne River is 696 km long and has a total catchment area of 15,290 km^2. It also forms a significant part of the Murray Darling Basin headwaters.

In contrast to the Warrego River (see below), the Condamine-Balonne River system has 355-listed stream barriers. Forty-one of these are located on main river stems between Killarney and the New South Wales Border. Of these at least 9 represent significant barriers to water flow and fish migration, being between 2.4 m and 12 m high. A significant feature of water storage in this catchment is the use of large off stream storage tanks. Covering approximately 10,000 hectares, these tanks are primarily used for crop irrigation. Grazing and irrigated cropping are major land uses in the Condamine-Balonne catchment.

Extensive lengths of river system in this catchment continue from one weir to the next, making the identification of un-impounded sections suitable for sampling very difficult. All sites except one have been located on permanent water holes in the main river channel. Site 3 has been located in a permanent natural pool off the main system. This pool flows with the main river channel with relatively minor flows.

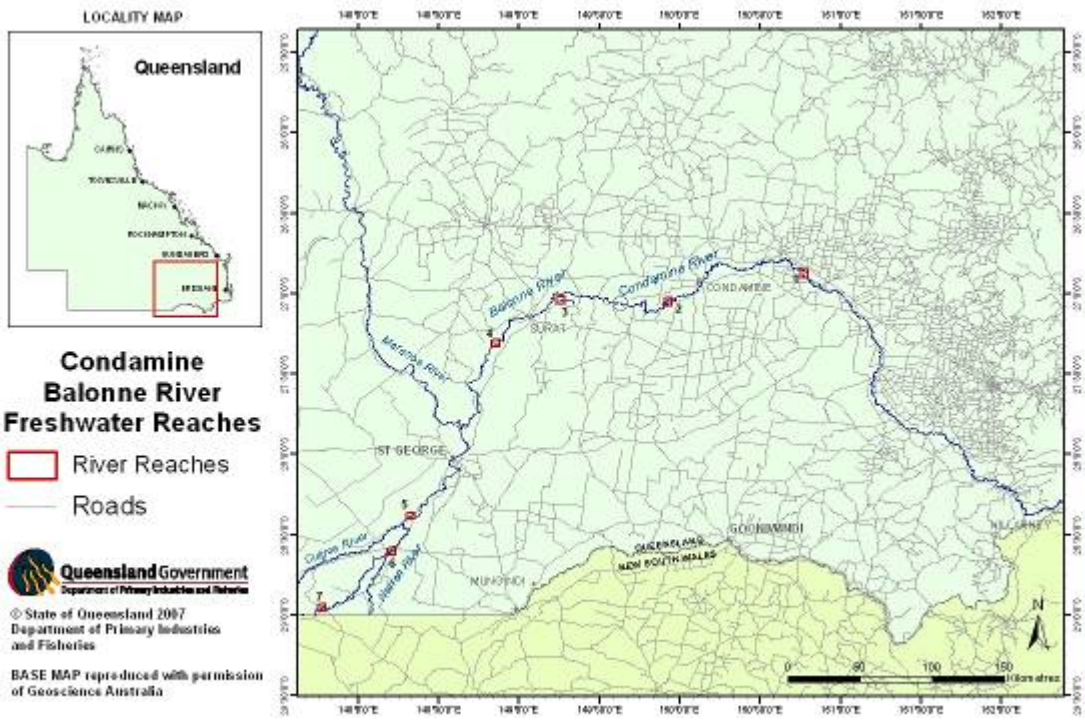


Figure 59. Location of the reaches sampled annually within the Condamine-Balonne River system.

Figure 60. Typical bank habitat sampled within the Condamine-Balonne River.

Habitat

Riparian and in-stream habitat at sites in the Condamine-Balonne catchment is generally of a poor condition with sites having an overall moderate to high disturbance rating apart from disturbance ratings of undisturbed to moderate in 2004 (Figure 61). This assessment in 2004 may not be a true reflection of stream bank disturbance but may be attributed to the qualitative technique used to assess habitat condition. In-stream habitat is limited with snags being the most prominent type and very little leaf litter or aquatic macrophytes recorded (Figure 62). Damage by grazing animals, land clearing close to channel boundaries, and stream channel modification for water use (e.g. pump access and impoundments) combine to reduce the quality of habitat along the main river channels of this catchment.

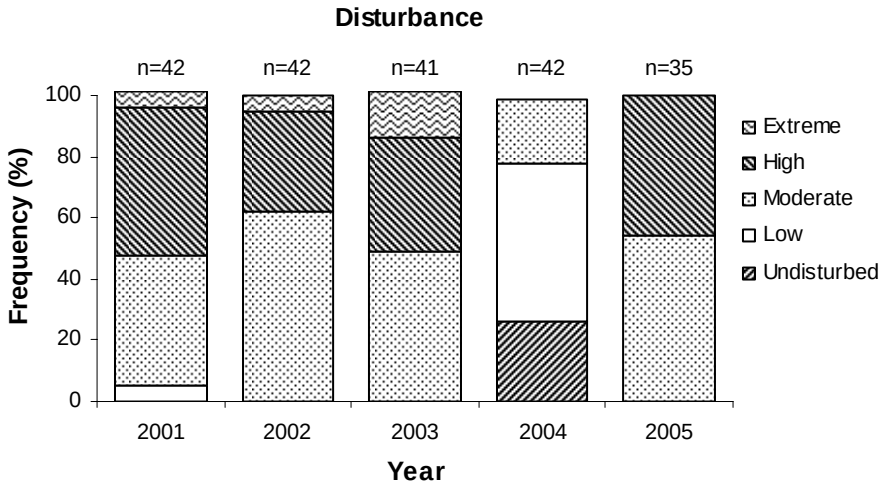


Figure 61. Stream bank disturbance ratings for the Condamine-Balonne River between 2001 and 2005. The number of shot samples (n) are shown for each year.

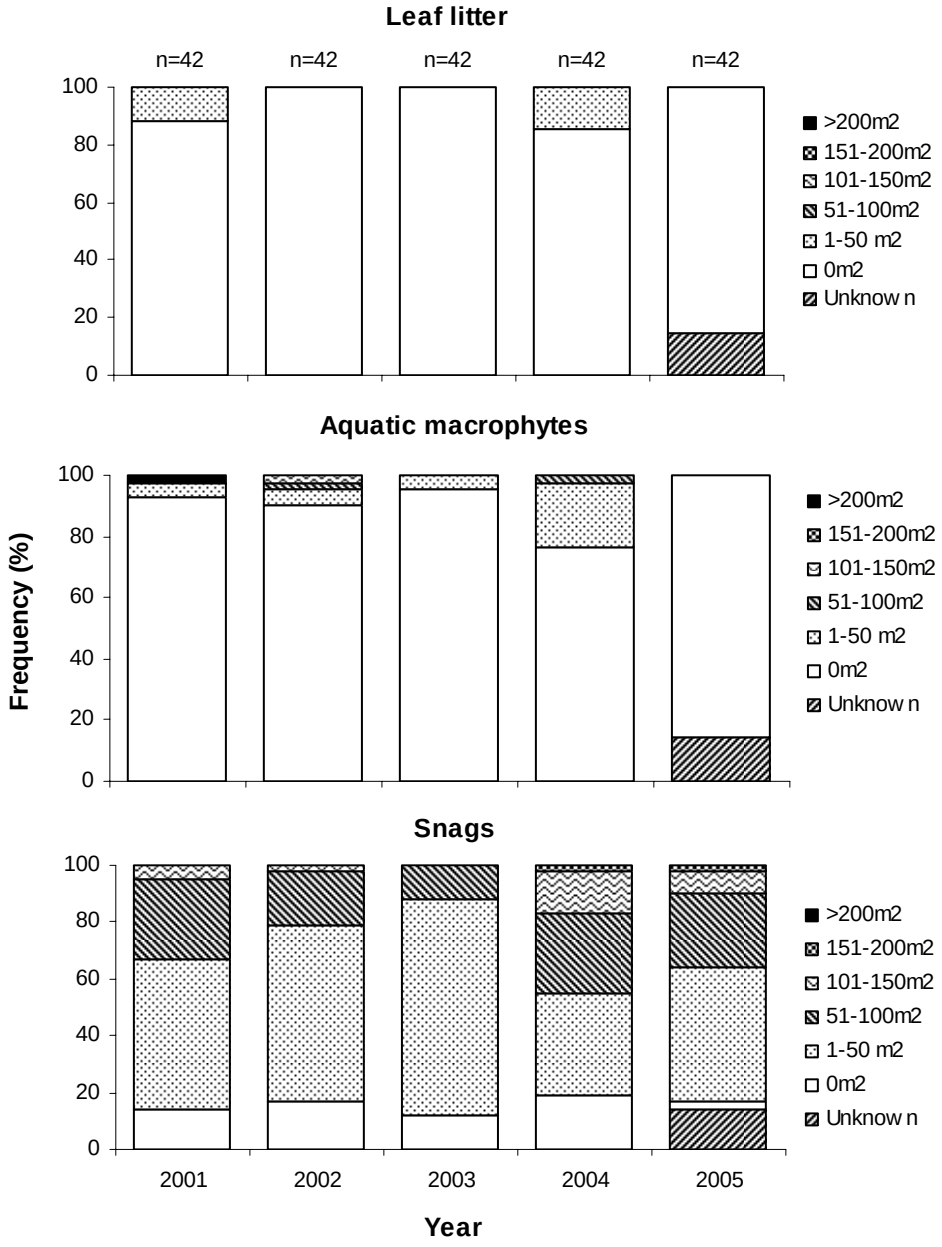


Figure 62. In-stream habitat parameters for the Condamine-Balonne River including leaf litter, aquatic macrophytes and snag coverage. The number of shot samples (n) are provided for each year.

Water quality

Visibility was poor in the Condamine-Balonne catchment with a lowest mean visibility of 2.7 cm recorded in 2003 (Figure 63). The large variation for Secchi depth in 2001 was caused by three readings from 55-60 cm at reach 1, while the downstream reaches had readings of 6–10 cm visibility. Poor visibility may have had some influence on total catch for abundant species but does not seem to have influenced total species counts observed using boat-mounted electrofishing apparatus. The high conductivity reading in 2004 can possibly be attributed to low flows experienced in this catchment (Figure 63).

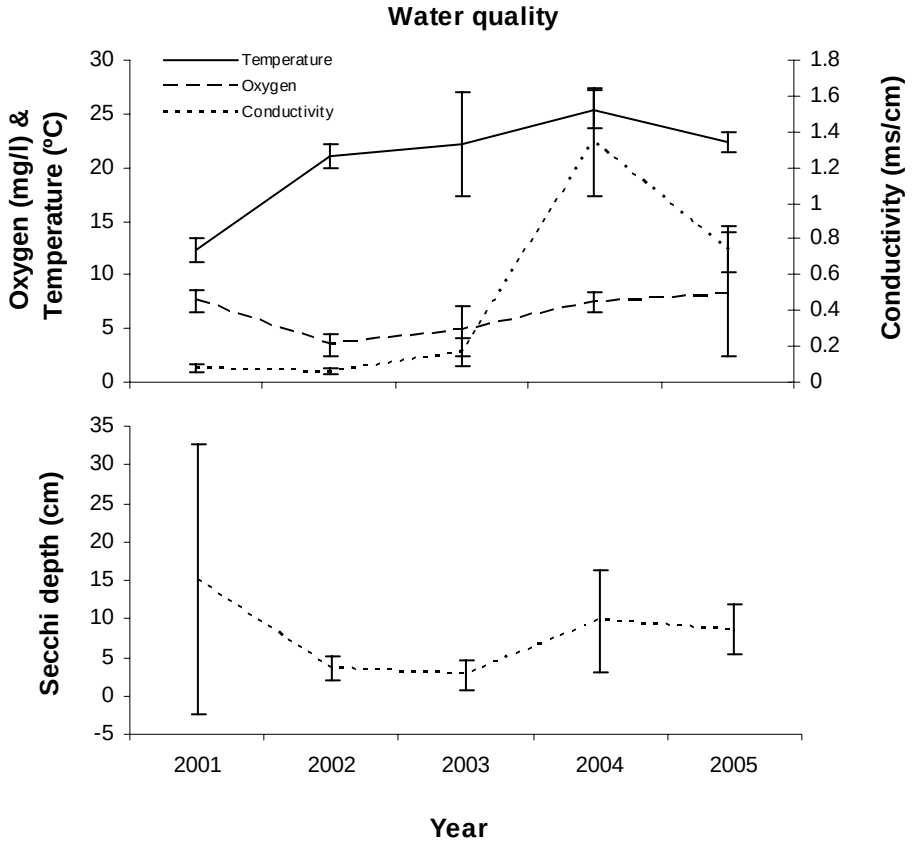


Figure 63. Water quality parameters for the Condamine-Balonne River including oxygen, conductivity, temperature (top) and Secchi depth measurement (bottom) between 2001 and 2005. Ninety-five percent confidence intervals are shown.

Fish fauna

Golden perch, European carp and bony bream had the highest catch rates of all the fish species encountered (Table 11). Species diversity is fairly low within the system (Figure 64). Juvenile and adult European carp were captured across the years surveyed ranging in size classes from 50–99 mm to 650–699 mm (Figure 65).

Table 11. Fish catch rates (CPUE) in the Condamine-Balonne River. Target species are highlighted in bold.

Scientific name	Common name	Year				
		2001	2002	2003	2004	2005
Carassius auratus	**goldfish**	**1.58**	**1.88**		**10.38**	**1.00**
Craterocephalus amniculus	Darling hardyhead				0.14	
Craterocephalus stercusmuscarum	flyspecked hardyhead	0.14				
Cyprinus carpio	**European carp**	**9.74**	**8.12**	**2.74**	**6.54**	**10.00**
Gambusia holbrooki	Eastern gambusia	1.43	2.61	1.01	4.41	2.20
Hypseleotris klunzingeri	Western carp gudgeon	1.58	0.87	1.16	2.99	1.20
Hypseleotris sp.1 [in Allen *et al*., 2002]	Midgley's carp gudgeon	1.29	2.32	1.30	2.28	
Hypseleotris spp	a gudgeon	0.29				1.80
Leiopotherapon unicolor	**spangled perch**	**2.87**	**2.17**	**0.87**	**14.08**	**5.80**
Maccullochella peeli peeli	**Murray cod**	**0.14**	**0.29**		**0.28**	
Macquaria ambigua	golden perch	9.03	8.26	5.34	7.68	22.40
Melanotaenia fluviatilis	Murray River rainbowfish	1.72	3.33	1.16	2.13	3.80
Nematalosa erebi	bony bream	5.73	6.09	2.74	5.83	6.00
Philypnodon grandiceps	flathead gudgeon		0.29			
Retropinna semoni	Australian smelt	2.87	1.59	1.16		2.00
Tandanus tandanus	**freshwater catfish**	**0.14**		**0.14**		
unidentified larval fish	unidentified larval fish	0.14				

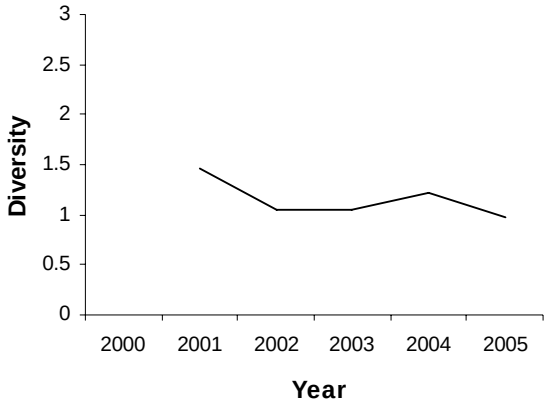


Figure 64. Species diversity in the Condamine-Balonne River.

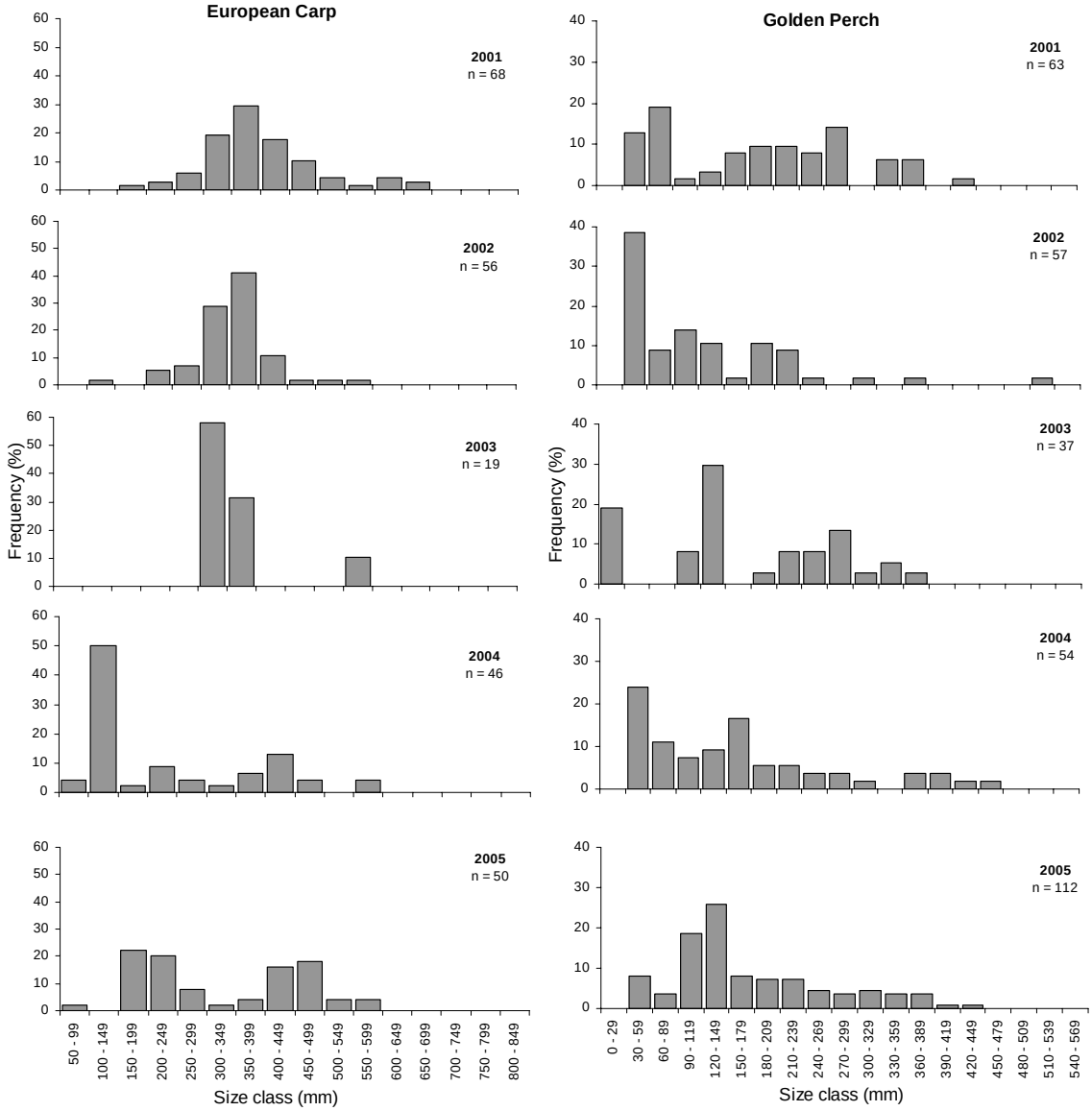


Figure 65. Length frequency distribution of European carp and golden perch in the Condamine-Balonne River between 2001 and 2005.

Warrego River

River description

The Warrego River has its source in the Buckland Tableland, Carnarvon National Park in South Western Queensland. The Warrego River is 993 km long and has a catchment area of 6,635 km^2. In conjunction with several other rivers in this region, the Warrego River forms a major component of the headwaters of the Murray Darling Basin.

The Warrego River has a total of 43 listed water barriers, of which only one, the Cunnamulla town weir at 4.5 m high, is on the main stem. The Warrego River remains largely un-impounded while the main river channel is characterised by natural pools. Pools typically have steep banks with overhanging vegetation, are deep and those included for study represent permanent water bodies. In flood the Warrego River can spread as wide as 20 km and include the main river channels of the Paroo and Neebine Rivers (Figure 66).

Surrounding land use is predominantly dedicated to grazing with none or very little irrigated cropping at the present time. Good bank side access and deep pools offered abundant sites suitable for sampling (Figure 67). Random site selection on the Warrego River resulted in a relatively even spread of sites downstream of Augathella to the New South Wales border.

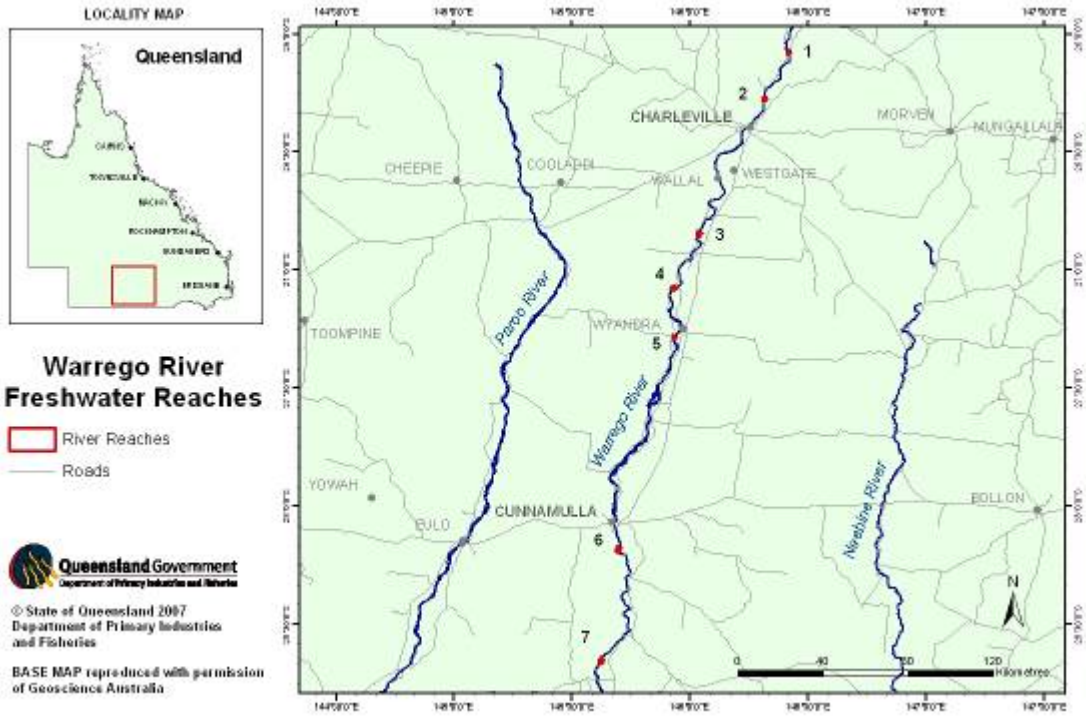


Figure 66. Location of the reaches sampled annually within the Warrego River.

Figure 67. Typical bank habitat sampled within the Warrego River.

Habitat

Riparian habitat of the Warrego River had an average of low to moderate disturbance ratings throughout the years of survey apart from 2004 where a high percent frequency rating of undisturbed was recorded (Figure 68). This high recording may not be a true reflection of stream bank disturbance but may be attributed to the qualitative technique used to assess habitat condition. Snag habitat is the most prominent in-stream habitat type within this system (Figure 69).

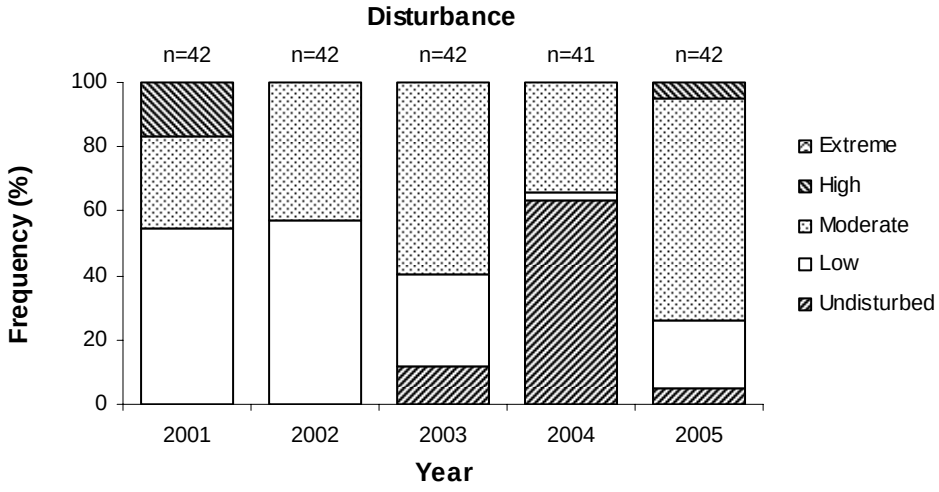


Figure 68. Stream bank disturbance ratings for the Warrego River between 2001 and 2005. The number of shot samples (n) are shown for each year.

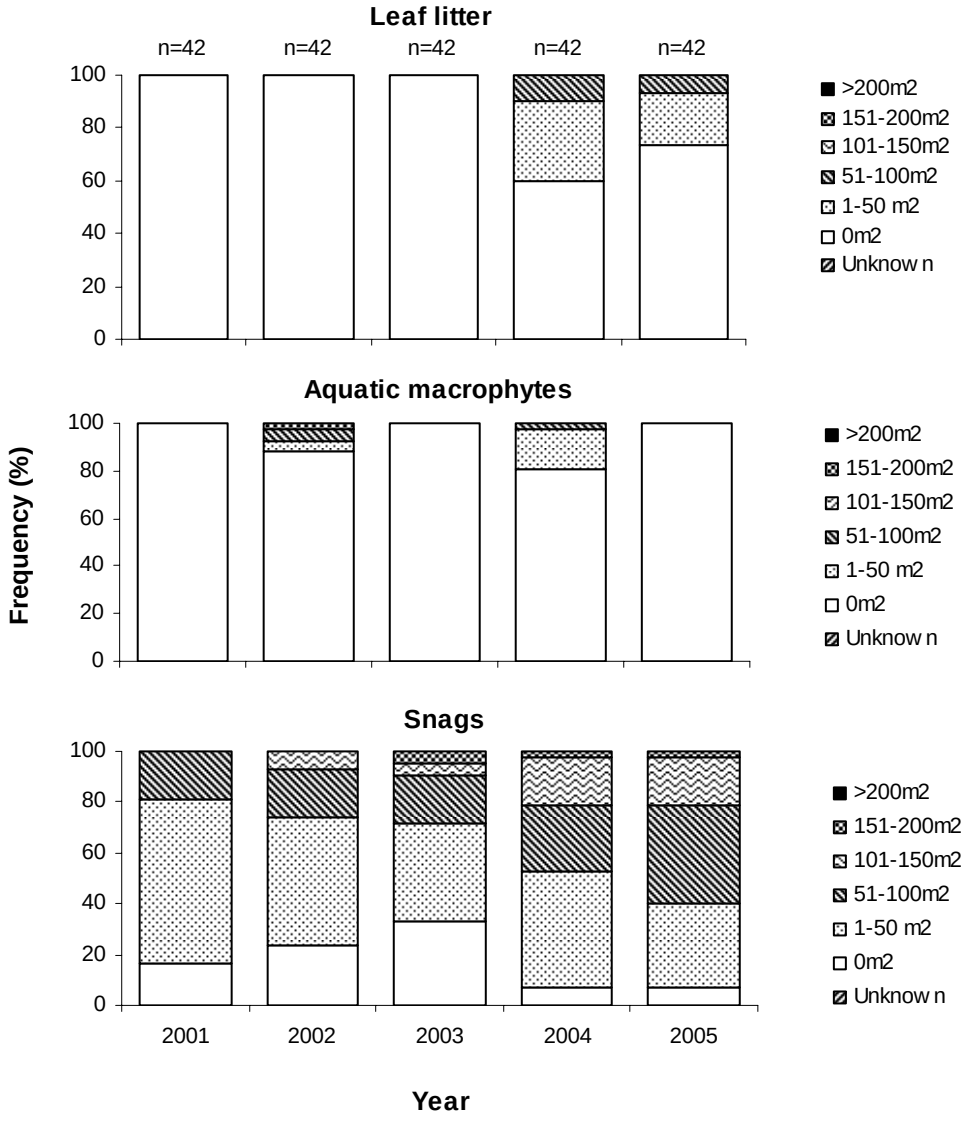


Figure 69. In-stream habitat parameters for the Warrego River, including leaf litter, aquatic macrophytes and snag coverage. The number of shot samples (n) are provided for each year.

Water quality

Visibility in the Warrego River was poor with a mean visibility of 4.6 cm in 2002 (Figure 70). This may have had some influence on total catch for abundant species but does not seem to have influenced total species count observed using the boat mounted electrofishing apparatus. The large variation in Secchi depth in 2004 was the result of good visibility from 30 to 50 cm depth in reaches 1 and 2 compared with poor visibility of up to 10 cm in downstream reaches. The high conductivity reading in 2004 can possibly be attributed to low flows experienced in this catchment (Figure 70).

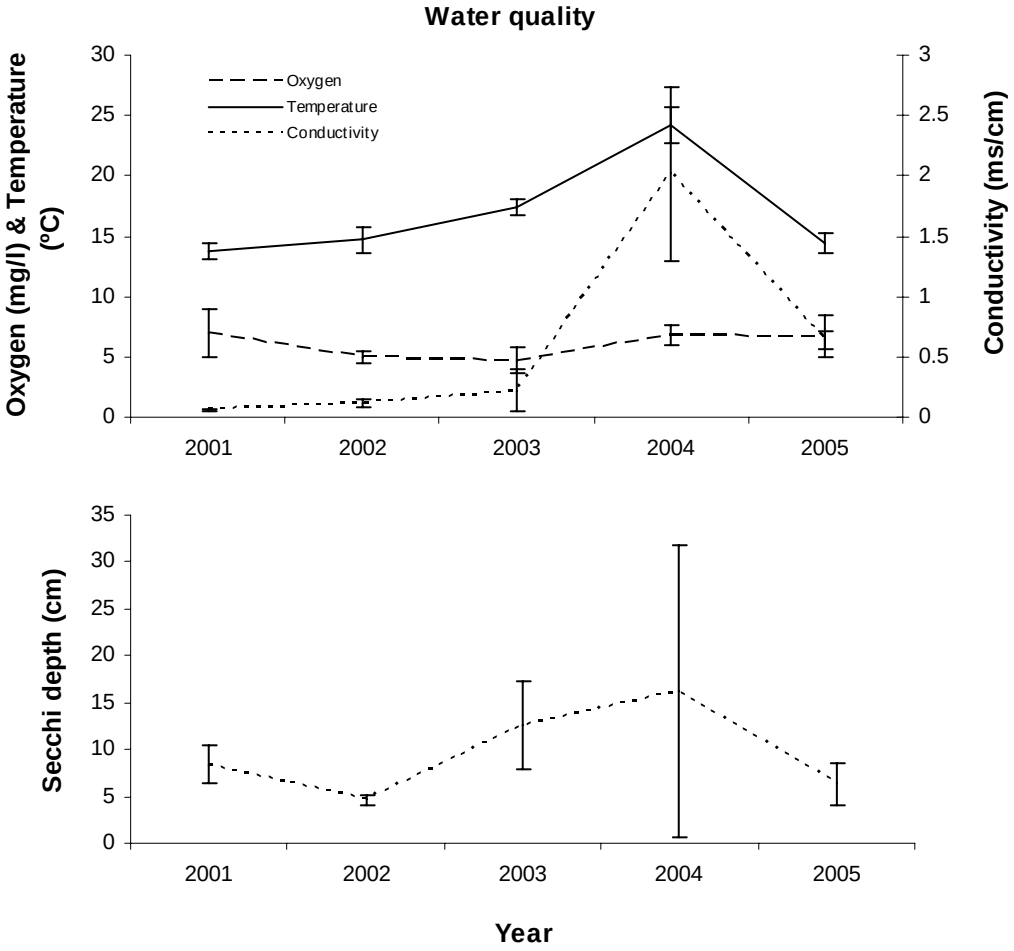
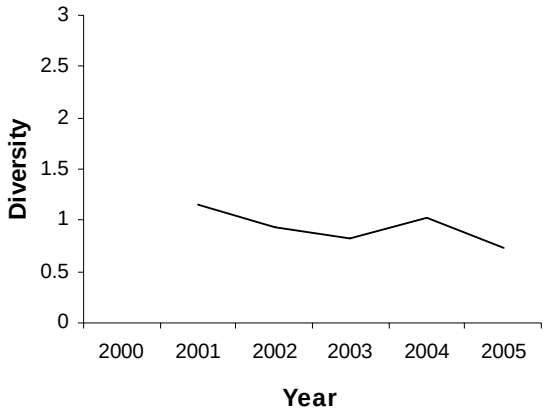


Figure 70. Water quality parameters for the Warrego River, including temperature, oxygen and conductivity (top) and Secchi depth measurements (bottom) between 2001 and 2005. Ninety-five percent confidence intervals are shown.

Fish fauna

Golden perch had the highest catch rate of any species, possibly an indication of fish stocking practices (Table 12). The catch rate of European carp was high, reflecting the high abundance of this introduced species. The introduced species goldfish had a high catch rate in 2001 and subsequent very low catch rates in the following years, indicating that this species may be highly susceptible to drought conditions within this catchment (Table 12). Species diversity is



low in the Warrego River (
Figure 71). Three of the 16 species encountered are introduced species.

Table 12. Fish catch rates (CPUE) in the Warrego River. Target species are highlighted in bold.

Scientific name	Common name	Year				
		2001	2002	2003	2004	2005
Bidyanus bidyanus	silver perch	0.14			0.28	0.29
Carassius auratus	**goldfish**	**9.32**	**0.86**	**0.14**	**0.14**	**0.29**
Cyprinus carpio	**European carp**	**12.05**	**8.02**	**5.72**	**7.69**	**6.03**
Gambusia holbrooki	Eastern gambusia		0.14	0.14	1.28	0.14
Hypseleotris galii	firetail gudgeon	0.29				
Hypseleotris klunzingeri	Western carp gudgeon		0.72	2.15	1.71	0.57
Hypseleotris sp.1 [in Allen *et al*., 2002]	Midgley's carp gudgeon	0.72	0.86	3.58	1.57	
Hypseleotris spp	a gudgeon			0.14		0.57
Leiopotherapon unicolor	**spangled perch**	**5.59**	**0.14**	**3.58**	**13.81**	**1.01**
Maccullochella peeli peeli	**Murray cod**	**0.14**		**0.14**	**0.14**	**0.14**
Macquaria ambigua	golden perch	12.62	12.17	8.58	6.27	11.78
Melanotaenia fluviatilis	Murray River rainbowfish	0.57	1.00	1.86	2.71	0.29
Nematalosa erebi	bony bream	6.02	5.87	5.15	5.84	6.03
Retropinna semoni	Australian smelt	2.58	2.43	2.15	1.14	2.73
Tandanus tandanus	**freshwater catfish**	**2.15**	**1.15**	**0.43**	**0.57**	**0.14**

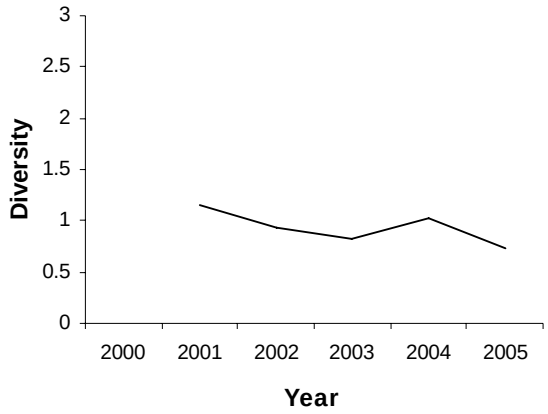


Figure 71. Species diversity in the Warrego River.

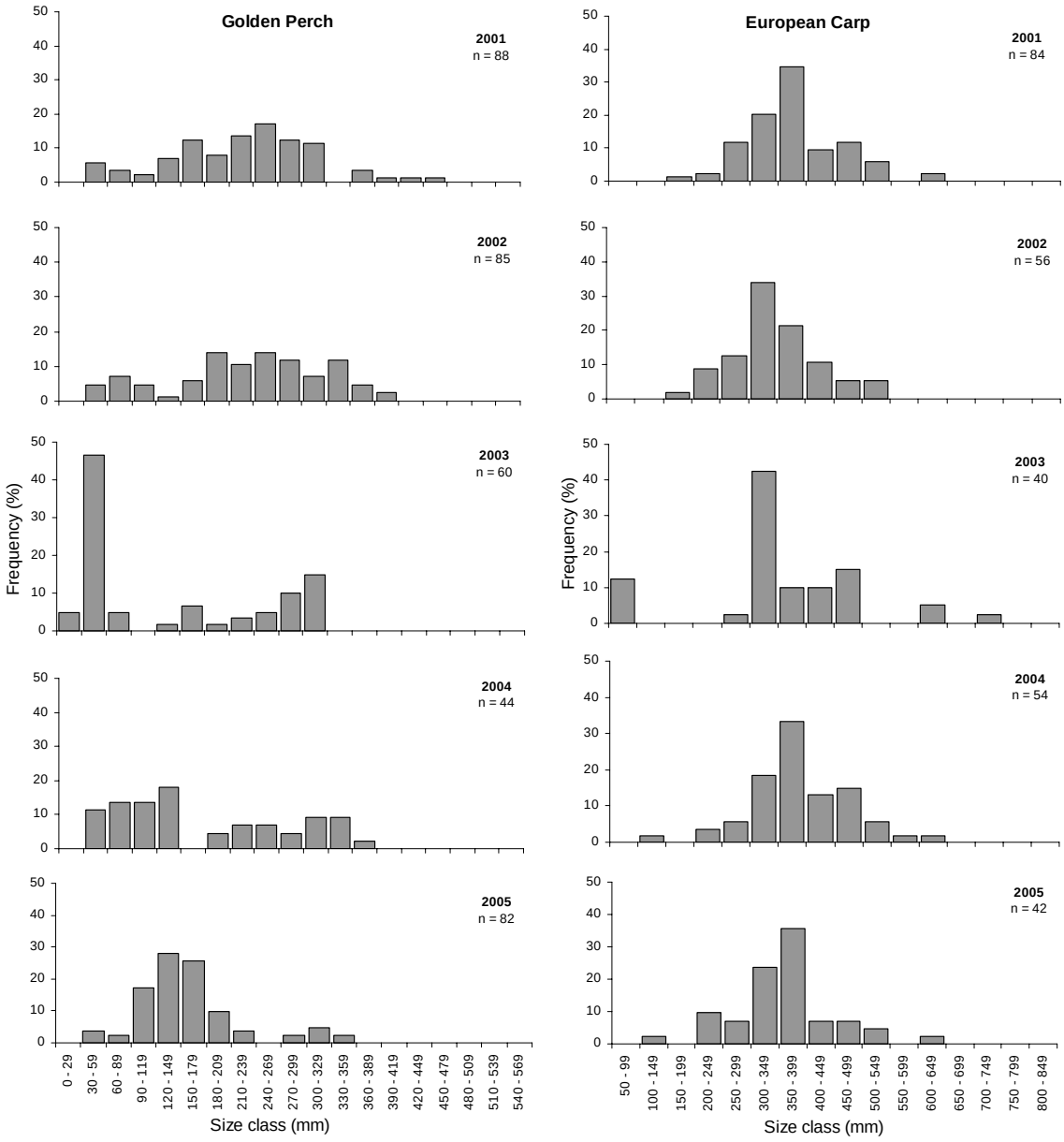


Figure 72. Length frequency distribution of golden perch and European carp in the Warrego River between 2001 and 2005.

Conclusions

The six years of sampling has been successful in obtaining a baseline dataset of fish resources for the ten rivers monitored under the freshwater component of the LTMP.

Species diversity in most rivers has remained fairly stable throughout the period of the study. Species diversity was notably lower in inland rivers west of the Great Dividing Range as opposed to the rivers of the east coast and Gulf of Carpentaria. The occurrence of marine vagrant fish species that are captured within the downstream reaches of the eastern and gulf drainages contribute significantly to the species diversity of these river systems.

Sampling efficiency of the electrofishing equipment was reduced in bodies of water where there were high readings of conductivity. Salt wedges in tidal reaches, higher concentration of ions in periods of low flow or drought, or naturally high conductivity due to the geomorphology of the region are some of the contributing factors to higher conductivity readings. The reduced efficiency of the equipment, smaller effective electric field, results in fewer fish being drawn to the anodes for capture. This however tends only to affect the total number of fishes being captured and not the species diversity.

Six exotic fish species have been encountered with goldfish, European carp and tilapia being of major concern to state agencies. The occurrence of exotic fish species will continue to be monitored, as the potential for the introduction of species such as tilapia into new catchments poses a significant threat to the stability of native ecosystems.

A review of the LTMP freshwater sampling program is being undertaken by the University of the Sunshine Coast to assess the data for their effectiveness to identify changes within populations and the relevance of collected data.

This program also has linkages with other monitoring programs. Surveys of the Condamine-Balonne and the Warrego Rivers parallel broader ecosystem health monitoring of freshwater fish being undertaken for the Murray Darling Basin Commission's Sustainable Rivers Audit. The tagging data collected during these monitoring surveys informs various stocking programs and survey data has also been included in fish biodiversity assessments (e.g. Hogan and Vallance 2005).

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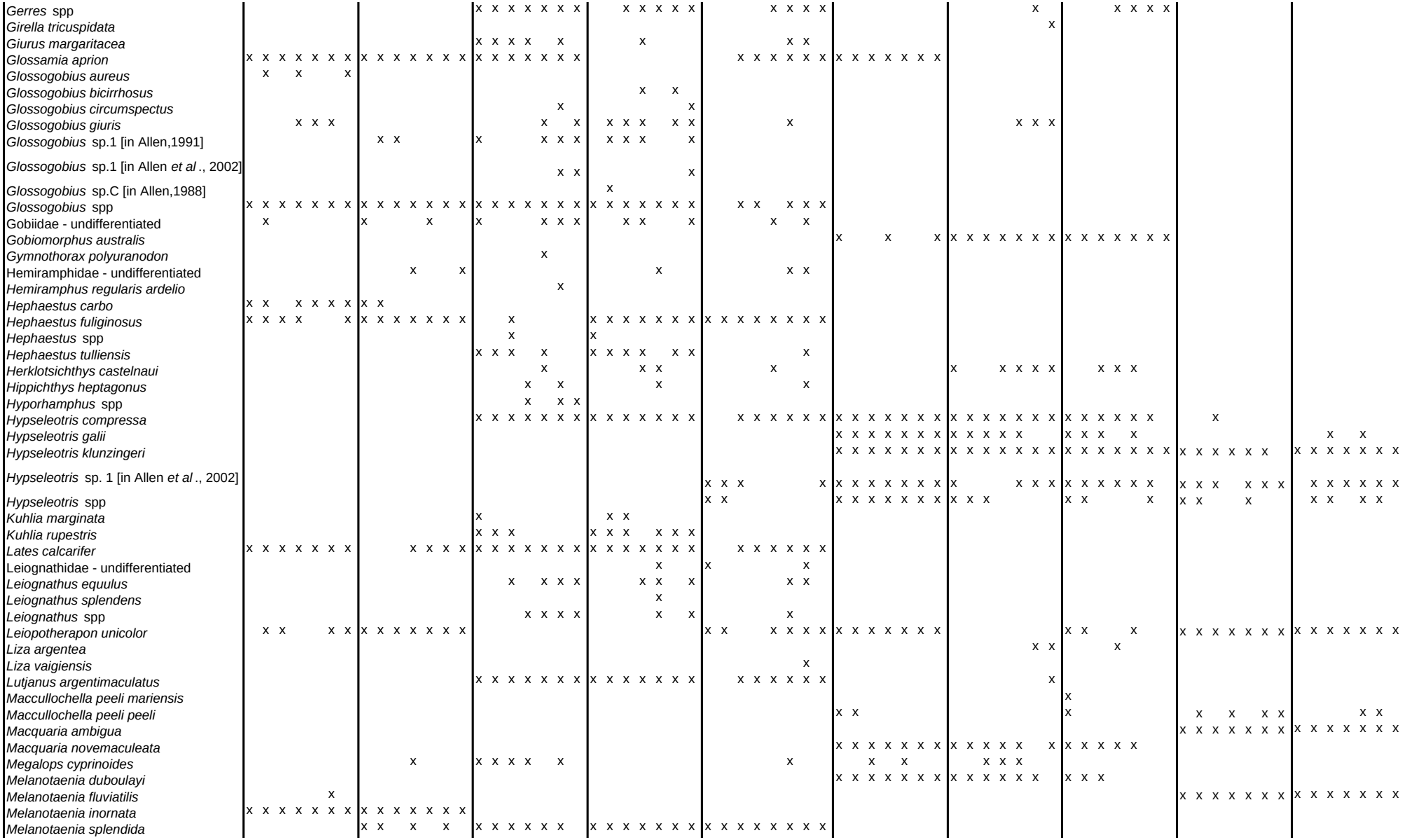
	Gregory River							Mitchell River						
Scientific Name	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Acanthopagrus australis														
Acanthopagrus berda														
Ambassis agassizi					x									x
Ambassis agrammus					x				x					
Ambassis interrupta														
Ambassis macleayi	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Ambassis miops														
Ambassis spp	x	x	x	x		x	x	x	x	x	x	x	x	
Amniataba caudavittata														
Amniataba percoides	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Anguilla australis														
Anguilla obscura														
Anguilla reinhardtii														
Anguillidae - undifferentiated														
Anodontiglanis dahli								x	x		x	x	x	x
Arius berneyi							x		x	x	x	x	x	x
Arius graffei							x	x	x	x	x	x	x	x
Arius leptaspis						x								x
Arius midgleyi								x	x	x	x	x	x	x
Arius spp								x	x		x			x
Arrhamphus sclerolepis												x		x
Arrhamphus spp														
Awaous acritosus														
Belonidae - undifferentiated		x					x						x	
Bidyanus bidyanus														
Brachirus selheimi							x	x	x		x	x	x	x
Brachirus spp								x	x			x	x	
Bunaka gyrinoides														
Butis butis														
Carangidae - undifferentiated														
Caranx sexfasciatus														
Carassius auratus														
Carcharhinus leucas														
Chaetodontidae - undifferentiated														
Chanos chanos														
Clupeidae - undifferentiated														x
Conger wilsoni														
Craterocephalus amniculus														
Craterocephalus marjoriae														
Craterocephalus spp														
Craterocephalus stercusmuscarum	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Craterocephalus stramineus	x	x	x	x	x	x								
Cyprinus carpio														
Dasyatidae - undifferentiated														
Eleotris fusca														
Eleotris melanosoma							x							
Eleotris spp														
Gambusia holbrooki														
Gerres filamentosus														

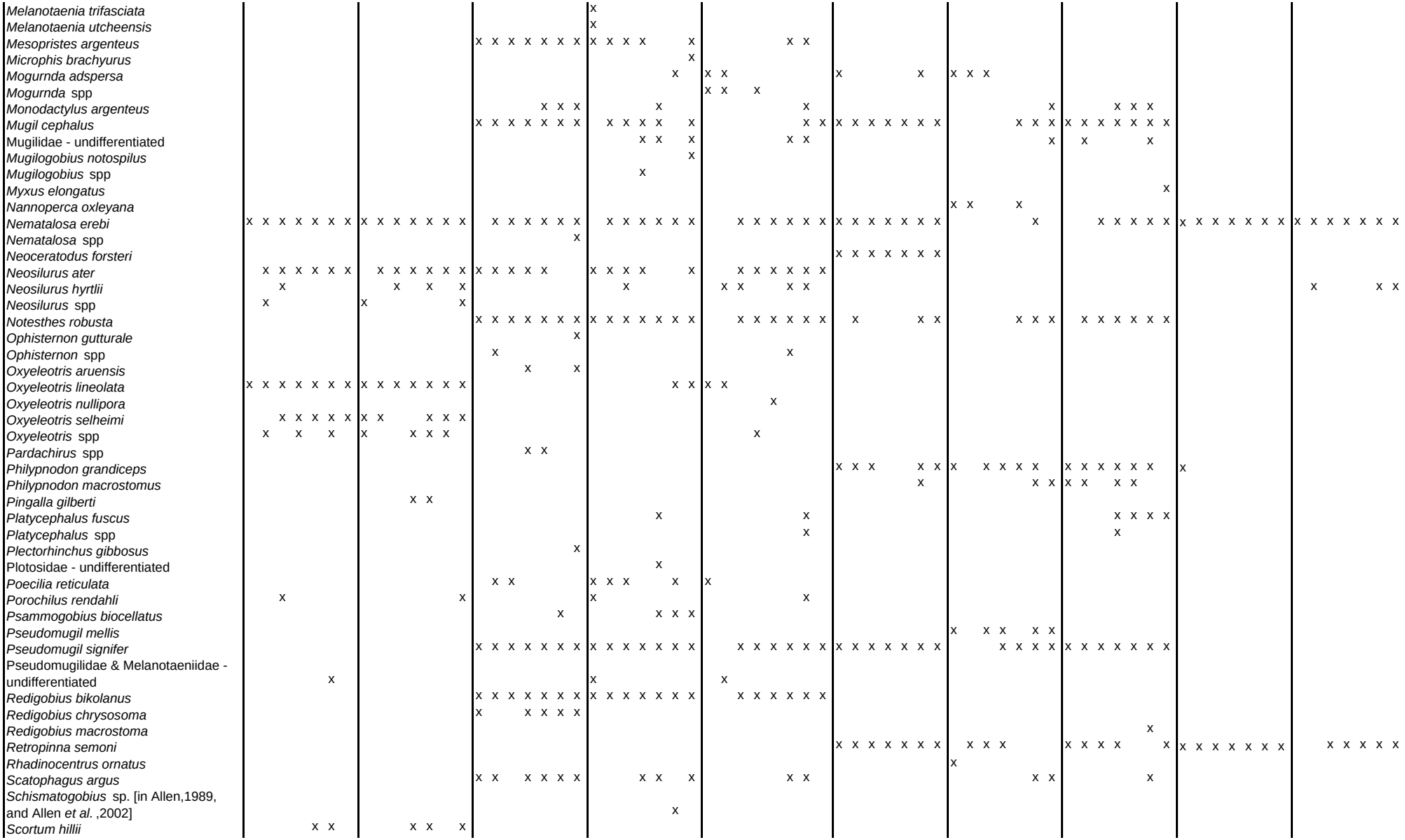
	Daintree River							Johnstone River						
Scientific Name	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Acanthopagrus australis						x	x					x		
Acanthopagrus berda					x	x	x				x	x		
Ambassis agassizi														
Ambassis agrammus								x						x
Ambassis interrupta				x	x	x	x				x	x		
Ambassis macleayi														
Ambassis miops	x		x	x	x	x	x	x			x	x		x
Ambassis spp	x	x		x	x	x	x	x	x	x	x	x		x
Amniataba caudavittata							x							
Amniataba percoides														
Anguilla australis										x				
Anguilla obscura	x		x	x	x	x					x	x	x	x
Anguilla reinhardtii	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Anguillidae - undifferentiated											x	x	x	
Anodontiglanis dahli														
Arius berneyi														
Arius graffei														
Arius leptaspis														
Arius midgleyi														
Arius spp														
Arrhamphus sclerolepis			x	x	x	x	x				x	x		x
Arrhamphus spp														
Awaous acritosus	x	x	x	x	x	x	x	x	x	x	x		x	x
Belonidae - undifferentiated														
Bidyanus bidyanus														
Brachirus selheimi														
Brachirus spp					x	x								
Bunaka gyrinoides	x	x	x	x	x	x	x		x	x	x	x		x
Butis butis				x	x	x	x				x	x		x
Carangidae - undifferentiated					x									
Caranx sexfasciatus		x	x	x	x	x	x			x	x	x		x
Carassius auratus														
Carcharhinus leucas														
Chaetodontidae - undifferentiated														x
Chanos chanos	x		x									x		x
Clupeidae - undifferentiated						x	x							
Conger wilsoni														
Craterocephalus amniculus														
Craterocephalus marjoriae														
Craterocephalus spp														
Craterocephalus stercusmuscarum								x	x	x			x	
Craterocephalus stramineus														
Cyprinus carpio														
Dasyatidae - undifferentiated				x										
Eleotris fusca						x					x			
Eleotris melanosoma	x			x		x	x							x
Eleotris spp			x	x	x	x	x		x		x	x		x
Gambusia holbrooki									x	x				
Gerres filamentosus	x	x	x	x	x	x	x		x	x	x	x	x	x

	Herbert River								Mary River						
Scientific Name	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7
Acanthopagrus australis							x								x
Acanthopagrus berda							x								
Ambassis agassizi	x	x													
Ambassis agrammus															
Ambassis interrupta					x	x									
Ambassis macleayi															
Ambassis miops							x								
Ambassis spp	x	x	x	x	x	x	x	x	x	x		x	x	x	
Amniataba caudavittata															
Amniataba percoides			x	x	x	x	x	x							
Anguilla australis										x					
Anguilla obscura						x									
Anguilla reinhardtii	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Anguillidae - undifferentiated															
Anodontiglanis dahli															
Arius berneyi															
Arius graffei										x	x	x		x	
Arius leptaspis															
Arius midgleyi															
Arius spp									x	x	x	x	x	x	x
Arrhamphus sclerolepis				x		x		x	x	x	x	x	x	x	x
Arrhamphus spp															
Awaous acritosus			x	x	x	x	x	x							
Belonidae - undifferentiated															
Bidyanus bidyanus															
Brachirus selheimi															
Brachirus spp															
Bunaka gyrinoides			x	x		x	x								
Butis butis						x									
Carangidae - undifferentiated															
Caranx sexfasciatus						x	x								
Carassius auratus															
Carcharhinus leucas															
Chaetodontidae - undifferentiated															
Chanos chanos															
Clupeidae - undifferentiated															
Conger wilsoni															
Craterocephalus amniculus															
Craterocephalus marjoriae									x	x	x	x	x	x	x
Craterocephalus spp			x												
Craterocephalus stercusmuscarum	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Craterocephalus stramineus															
Cyprinus carpio															
Dasyatidae - undifferentiated															
Eleotris fusca															
Eleotris melanosoma						x									
Eleotris spp						x	x								
Gambusia holbrooki	x					x			x	x	x	x	x	x	x
Gerres filamentosus			x		x	x	x	x							

	Noosa River							Logan River						
Scientific Name	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Acanthopagrus australis				x	x	x	x			x	x	x	x	x
Acanthopagrus berda														
Ambassis agassizi													x	
Ambassis agrammus														
Ambassis interrupta														
Ambassis macleayi														
Ambassis miops														
Ambassis spp	x	x		x	x	x	x	x	x	x	x	x	x	x
Amniataba caudavittata														
Amniataba percoides														
Anguilla australis			x		x	x			x	x	x			x
Anguilla obscura														
Anguilla reinhardtii	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Anguillidae - undifferentiated														
Anodontiglanis dahli														
Arius berneyi														
Arius graffei												x	x	x
Arius leptaspis														
Arius midgleyi														
Arius spp						x	x			x	x	x	x	x
Arrhamphus sclerolepis						x	x				x	x	x	x
Arrhamphus spp							x							
Awaous acritosus														
Belonidae - undifferentiated														
Bidyanus bidyanus														
Brachirus selheimi														
Brachirus spp														
Bunaka gyrinoides														
Butis butis							x			x	x	x	x	x
Carangidae - undifferentiated														
Caranx sexfasciatus														
Carassius auratus								x						
Carcharhinus leucas												x		
Chaetodontidae - undifferentiated														
Chanos chanos														
Clupeidae - undifferentiated														
Conger wilsoni											x			
Craterocephalus amniculus														
Craterocephalus marjoriae														
Craterocephalus spp														
Craterocephalus stercusmuscarum	x													
Craterocephalus stramineus														
Cyprinus carpio								x	x	x	x	x		x
Dasyatidae - undifferentiated														
Eleotris fusca														
Eleotris melanosoma														
Eleotris spp														
Gambusia holbrooki	x	x	x	x		x		x	x	x	x	x	x	x
Gerres filamentosus														

	Condamine River							Warrego River						
Scientific Name	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Acanthopagrus australis														
Acanthopagrus berda														
Ambassis agassizi														
Ambassis agrammus														
Ambassis interrupta														
Ambassis macleayi														
Ambassis miops														
Ambassis spp														
Amniataba caudavittata														
Amniataba percoides														
Anguilla australis														
Anguilla obscura														
Anguilla reinhardtii														
Anguillidae - undifferentiated														
Anodontiglanis dahli														
Arius berneyi														
Arius graffei														
Arius leptaspis														
Arius midgleyi														
Arius spp														
Arrhamphus sclerolepis														
Arrhamphus spp														
Awaous acritosus														
Belonidae - undifferentiated														
Bidyanus bidyanus								x	x		x		x	
Brachirus selheimi														
Brachirus spp														
Bunaka gyrinoides														
Butis butis														
Carangidae - undifferentiated														
Caranx sexfasciatus														
Carassius auratus	x		x	x	x	x	x	x	x	x	x		x	x
Carcharhinus leucas														
Chaetodontidae - undifferentiated														
Chanos chanos														
Clupeidae - undifferentiated														
Conger wilsoni														
Craterocephalus amniculus		x												
Craterocephalus marjoriae														
Craterocephalus spp														
Craterocephalus stercusmuscarum	x													
Craterocephalus stramineus														
Cyprinus carpio	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Dasyatidae - undifferentiated														
Eleotris fusca														
Eleotris melanosoma														
Eleotris spp					x									
Gambusia holbrooki	x	x	x	x	x	x	x	x	x	x	x	x		
Gerres filamentosus														


Gerres spp
Girella tricuspidata
Giurus margaritacea
Glossamia aprion
Glossogobius aureus
Glossogobius bicirrhosus
Glossogobius circumspectus
Glossogobius giuris
Glossogobius sp.1 [in Allen,1991]
Glossogobius sp.1 [in Allen *et al* ., 2002]
Glossogobius sp.C [in Allen,1988]
Glossogobius spp
Gobiidae - undifferentiated
Gobiomorphus australis
Gymnothorax polyuranodon
Hemiramphidae - undifferentiated
Hemiramphus regularis ardelio
Hephaestus carbo
Hephaestus fuliginosus
Hephaestus spp
Hephaestus tulliensis
Herklotsichthys castelnaui
Hippichthys heptagonus
Hyporhamphus spp
Hypseleotris compressa
Hypseleotris galii
Hypseleotris klunzingeri
Hypseleotris sp. 1 [in Allen *et al* ., 2002]
Hypseleotris spp
Kuhlia marginata
Kuhlia rupestris
Lates calcarifer
Leiognathidae - undifferentiated
Leiognathus equulus
Leiognathus splendens
Leiognathus spp
Leiopotherapon unicolor
Liza argentea
Liza vaigiensis
Lutjanus argentimaculatus
Maccullochella peeli mariensis
Maccullochella peeli peeli
Macquaria ambigua
Macquaria novemaculeata
Megalops cyprinoides
Melanotaenia duboulayi
Melanotaenia fluviatilis
Melanotaenia inornata
Melanotaenia splendida


Melanotaenia trifasciata
Melanotaenia utcheensis
Mesopristes argenteus
Microphis brachyurus
Mogurnda adspersa
Mogurnda spp
Monodactylus argenteus
Mugil cephalus
Mugilidae - undifferentiated
Mugilogobius notospilus
Mugilogobius spp
Myxus elongatus
Nannoperca oxleyana
Nematalosa erebi
Nematalosa spp
Neoceratodus forsteri
Neosilurus ater
Neosilurus hyrtlii
Neosilurus spp
Notesthes robusta
Ophisternon gutturale
Ophisternon spp
Oxyeleotris aruensis
Oxyeleotris lineolata
Oxyeleotris nullipora
Oxyeleotris selheimi
Oxyeleotris spp
Pardachirus spp
Philypnodon grandiceps
Philypnodon macrostomus
Pingalla gilberti
Platycephalus fuscus
Platycephalus spp
Plectorhinchus gibbosus
Plotosidae - undifferentiated
Poecilia reticulata
Porochilus rendahli
Psammogobius biocellatus
Pseudomugil mellis
Pseudomugil signifer
Pseudomugilidae & Melanotaeniidae - undifferentiated
Redigobius bikolanus
Redigobius chrysosoma
Redigobius macrostoma
Retropinna semoni
Rhadinocentrus ornatus
Scatophagus argus
Schismatogobius sp. [in Allen,1989, and Allen et al. ,2002]
Scortum hillii

Scortum ogilbyi		x	x		x		x		x	x	x	x	x	x																																																								
Scortum spp	x					x		x			x	x	x	x																																																								
Selenotoca multifasciata																																																						x	x		x														
Sillago spp																				x	x																																																		
Stenogobius psilosinionus																				x																																																			
Strongylura krefftii	x	x	x	x	x	x	x	x	x	x			x	x																	x		x	x	x																																			
Syngnathidae - undifferentiated																		x		x	x																																																	
Tandanus tandanus																x						x	x	x			x										x	x	x	x	x	x	x	x	x					x	x								x						x	x	x	x	x	x	
Thryssa scratchleyi						x	x					x	x																																																									
Tilapia mariae																							x	x	x	x	x	x																																												
Toxotes chatareus	x	x	x	x	x	x	x	x	x	x	x	x	x	x					x	x	x				x	x									x																																				
Toxotes jaculatrix											x								x	x	x					x																																													
Toxotidae - undifferentiated		x			x																					x																																														
Trachystoma petardi																																								x	x	x		x	x		x	x	x	x	x	x	x	x	x	x	x														
Unidentified larval fish																																																														x								
Unknown species																											x								x																																				
Xiphophorus maculatus																							x																x	x																																
Zenarchopterus dispar								x																																																																
Zenarchopterus spp								x																																																																	

Information Series
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