

# Waterwatch Brisbane Fish Snapshot

## Standard procedures for conducting a community fish monitoring program

### Acknowledgements

These protocols were developed as a collaboration between the University of Queensland (Kev Warburton), Waterwatch Brisbane (Chris Chinn), Greening Australia Queensland, Waterwatch Queensland (Kirstin Kenyon, Christina Dwyer), and the Brisbane City Council (Stacey McLean). The original resource was developed for undergraduate fish biology students in the Department of Zoology and Entomology, University of Queensland. The procedures have since been adapted for the wider community, with successful trials being conducted during community training sessions held at Moggill Creek with members of a number of catchment groups.

### General Information

These guidelines describe simple, rapid techniques that can be used to assess the abundance and diversity of stream fish species. To ensure that the information collected is as useful as possible, follow the instructions as closely as possible.

Most stream fish species are quite small (less than 15 cm). Larger species will be caught less often with the equipment described, but even if not caught they may still be observed at a distance – if so, they should be added to the list of species found at the sampling site.

#### **Safety:**

Conduct sampling as a group activity and at a site that is safe and accessible all year round. Wear sturdy footwear (e.g., gum boots or waders), sunscreen and a hat. Move carefully (shuffle) in streams to avoid slipping or stepping on sharp objects.

#### **Environmental considerations:**

No permit is needed for small fish sampling. All native species should be returned to the water. Exotic species cannot be returned (see details below).

#### **Aims**

The main aim of this activity is to collect information on the status and habitat

requirements of fish in freshwater streams.

This information has direct conservation value and will help to answer questions such as:

1. What is the **distribution and abundance** of native and introduced (exotic) fish species?
2. How is the distribution and abundance of **native and exotic fish species changing with time**?
3. What are the **key types of threat** (e.g. habitat degradation, invasions by exotic species) that affect native Australian fish species?
4. Which waterways or sites are **critical conservation areas**?
5. Can particular habitat elements or the composition of fish communities be used as **indicators of overall stream quality**?

Because habitat quality has an important impact on the fish fauna, **information on fish, habitat structure and water quality should be collected at the same time and place** if at all possible.

## Equipment

**Table 1: Equipment check list**

Equipment required:	Where to get it:
Rectangular rigid frame dip net (60 x 40 cm; 25 cm deep bag; 3 mm mesh)	Brisbane Waterwatch
2-4 standard bait traps (c. 43 x 26 x 26 cm; 8 cm diameter entrance hole)	Brisbane Waterwatch
Bait (dry, prawn-flavoured "Go-Kat" cat food)	Supermarket/Pet supplies
2 small aquarium dip nets	Brisbane Waterwatch
40 m string	Brisbane Waterwatch
10 marking pegs	Brisbane Waterwatch
Depth pole	Brisbane Waterwatch
3 buckets	Brisbane Waterwatch
2 glass/plastic jars	Brisbane Waterwatch
Soft gloves for handling fish	Brisbane Waterwatch
Magnifying glass for fish identification	Brisbane Waterwatch
Clove oil or ice slurry for euthanasing fish	Brisbane Waterwatch
Stopwatch and tennis ball for current velocity estimation	Your Waterwatch kit
Turbidity tube for water clarity measurement	Your Waterwatch kit
Meters for pH, temperature, electrical conductivity and oxygen measurement	Your Waterwatch kit
Clipboard, graph paper	Brisbane Waterwatch
Fish identification guide (e.g., Allen et al. 2002 or Cutmore and Warburton 2003)	DPI Bookshop or Brisbane Waterwatch (loan)
Aquatic plant guide (e.g., Sainty and Jacobs 1994)	CSIRO Publications or Brisbane Waterwatch (loan)
Community Waterway Monitoring Field Manual (Brisbane Waterwatch)	Brisbane Waterwatch
Box or bin for carrying equipment	Brisbane Waterwatch

**Note:** Brisbane Waterwatch will have most equipment available on loan or you may choose to start your own kit. For advice/or training contact Brisbane Waterwatch.

Reference sheets:

- ❑ Freshwater Fish Species of the Brisbane Area.
- ❑ Habitat Field Guide Ratings.

Data sheets:

- ❑ Fish Sampling Data Sheet.
- ❑ Habitat and Fish Summary Sheet.
- ❑ Waterwatch Field Record Sheet.

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## Procedures

### **A. Site preparation**

Record the time of day when the survey was carried out, and the weather conditions on the **Habitat and Fish Survey Sheet** attached. Try not to enter the water before sampling takes place and minimise the disturbance to habitats while sampling.

- 1 Using a string line or tape measure mark a 40m stretch of the stream as the sampling area.

**Note:** This should be representative of the local stream environment and include both slow flow / pool and fast flow / riffle habitats (see definitions below) with a variety of cover. Try to choose a stream section where water depths in the slow flow/pool and fast flow/riffle habitats are sufficient to submerge the door of a bait trap. The 0-reference point should be downstream, the 40m point upstream.

#### **Definitions**

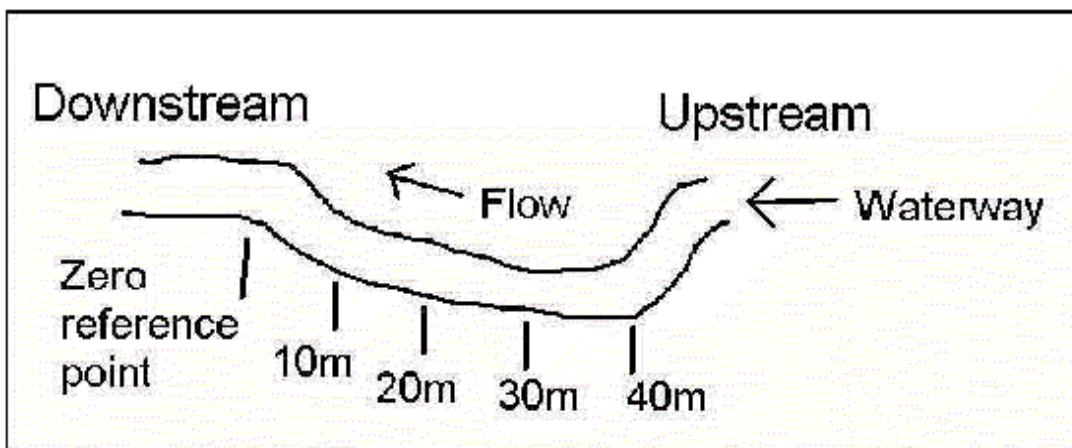
##### **Pool**

Pool bed habitats are zones of relatively deep stationary or very slow flowing water over silty, sandy or rocky beds.

##### **Riffle**

This is a reach of relatively steep/shallow (<0.3m), fast flowing (>0.2m/s) and broken water over stony beds.

- 2 Mark the 0, 10, 20, 30 and 40m points with pegs on the banks (see Fig. 1). These points will be used as reference points for dip-netting.
- 3 Fill three buckets with stream water from downstream of the sampling area.



**Figure 1: Example of sampling area showing reference points**

### **B. Bait trapping**

Traps should be set in all four possible habitat types defined below, or as many of these habitats as are present at the site. To save time, you will find it useful to have at least two bait traps.

**Table 2: Four habitat types to be sampled**

	<b>No cover</b>	<b>Cover</b>
<b>Slow flow/pool</b>	2 samples	2 samples
<b>Fast flow/riffle</b>	2 samples	2 samples

Cover can be provided by large woody debris, fine branching snags, floating, submerged or emergent mid-stream or bankside vegetation, overhanging vegetation, or undercut banks.

1. Fill the bait compartment with bait (c. a double-handful). Remember to close the zips of the traps.
2. If you have a limited number of bait traps, randomise the order by which the habitat types are sampled.
3. Set replicate traps in different locations within a given habitat type (e.g. not within the same weed bed). Make sure the bait is submerged (!).
4. Try to orientate bait traps in the direction of the current, preferably in gently flowing water.
5. Set the traps for 20 minutes for each sample (**remember to record the time once a trap has been set**) and at the end of the period retrieve the trap.
6. Quickly and carefully transfer the contents of each trap into a separate bucket containing stream water (**It may be wise to number the buckets and traps so you don't get the buckets mixed up**).
7. Before identifying and counting the fish move the bait trap to the next sampling point and record the start time as before (use a given batch of bait twice, then replace it with fresh bait).
8. Use an aquarium net to remove a few fish at a time from the bucket to a glass jar for identification. Record the number of individuals of each fish species on the **Habitat and Fish Summary Sheet**.
9. Return fish to the stream (away from areas to be sampled) after identification. Keep fish cool – don't let them stand in warm water while awaiting examination.

**IMPORTANT NOTE:** It is illegal to return exotic species (see species list) to the water so dispose of them ethically: euthanase them in a little water with a few drops of clove oil, or in a container containing ice slurry. Don't take fish home with you.

### **C. Stream Habitat and Water Quality Variables**

Describe the stream habitat and water quality variables at the site according to Waterwatch Brisbane guidelines (see attached **Habitat Survey Field Guide Ratings** and refer to the **Community Waterway Monitoring Field Manual (Brisbane Waterwatch)** for water quality testing protocols). Enter details on the **Habitat and Fish Summary Sheet** and the **Water Quality Results Sheet**.

### **D. In-stream vegetation**

Collect and identify each species of in-stream vegetation within the sampling area. The “**Waterplants in Australia**” (Sainty & Jacobs, 1994) is a suitable text for plant identification. Note whether each species is extensive at the site and whether it is native or exotic. Enter details on the

## Habitat and Fish Summary Sheet.

### E. Dip netting

1. Allocate one person to dip netting, one to transfer and identify fish, and one to record information.
2. Start dip netting at the downstream end of the sampling area.
3. Walking upstream, take samples with the dip net adjacent to each bank and in midstream every 10m along the sampling area. After taking a group of three samples, move along to the next 10 m section and start again.
4. Each sample should consist of one steady, continuous 3m strike: push the net over the bottom at an angle of about 60 degrees. Keep the net ahead of you, to reduce the chance that you will scare the fish. Some species, such as gudgeons, tend to occur near the bottom, so keep the net close to the creek bed. Many species like to hide in cover – move the net through weed beds and into undercut banks etc.
5. Transfer the nets' contents to the bucket.
6. Use an aquarium net to remove a few fish at a time from the bucket to a clean glass jar for identification. At each sampling point, record the number of individuals of each fish species on the **Fish Sampling Data Sheet**.

**Note:** As with fish caught with the bait traps, after identification **return** native fish to the stream (away from areas to be sampled) and **euthanase** members of exotic species.

### F. Stream map, water depth and flow speed

1. Every 10m along the sampling stretch measure the width and obtain a depth profile across the stream. Sketch the configuration of the stream on graph paper.
2. On your map mark the depth contours and the pattern of habitats and microhabitats (including the main stands of aquatic vegetation and the microhabitats at the sampling points). Fish catch results can be superimposed. This will be a useful reminder of the sampling site and exactly where fish tended to occur.
3. At different stream locations estimate water velocity by timing the movement of a tennis ball across a known distance (see the **Community Water Monitoring Field Manual** for the procedure). Include flow details on your stream map.
4. Photographs of the study site can also be useful reminders of habitat conditions.

### Other observations

Note incidental observations of other fish (e.g. larger fish such as catfish, eels and mullet that may not be caught) and fauna such as larger insects, amphibians and reptiles in the study area - some of these may help you characterise habitat quality.

### G. Interpretation

Studies carried out in South-East Queensland indicate that the number of native fish species and the

percentage of exotic individuals (i.e., no. of exotics x 100 / total no. of individuals) are good indicators of stream quality (Smith and Storey 2001). With the sampling method described here, up to five or six native species can be collected in a single session in creeks around Brisbane in late summer (March). Additional species may be found as sampling is repeated.

At the other extreme, native fish species are often absent altogether from highly degraded streams. Indicators of stream condition based on fish data should be used in conjunction with other complementary measures based on habitat complexity, macro-invertebrates and water quality variables.

## References

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## Habitat and Fish Summary Sheet

Name of sampler

Name of group

Location / map ref.

Date

Time

Weather

### *Stream Habitat Ratings (Results sheet for Procedure C)*

Bank vegetation /10	Verge vegetation /10	In-stream Cover /10	Bank erosion and stability / 5	Riffles, pools and bends / 5	Total Score /40

### *In-Stream Plant Species (Results sheet for Procedure D)*

Latin name/Common Name	Native (N) or exotic (E)	Extensive at the site? (Tick)
Total number of species:		
<b>Number of native species:</b>		

### *Fish Species (Results sheet for procedures B and E)*


Latin name/Common Name	Species code	Native (N) or exotic (E)	Number caught	Seen but not caught (tick)
Total number of species:				
Total number of individuals:				
<b>Number of native species:</b>				
<b>% exotic individuals:</b>				

## Freshwater fish species of the Brisbane area (from McKay and Johnson 1990)

Abundant or common species in bold; exotic species are asterisked

Group	Common name	Latin name	Code
Blue-eyes	<b>Pacific blue-eye</b>	<i>Pseudomugil signifer</i>	<b>PBE</b>
Bream	Yellow-fin bream	<i>Acanthopagrus australis</i>	YFB
Carp	Common carp*	<i>Cyprinus carpio*</i>	CC
	<b>Goldfish*</b>	<i>Carassius auratus*</i>	<b>Go</b>
Catfish	<b>Blue catfish</b>	<i>Arius graeffei</i>	<b>BC</b>
	<b>Eel-tailed catfish</b>	<i>Tandanus tandanus</i>	<b>ETC</b>
	Hyrtl's tandan	<i>Neosilurus hyrtlii</i>	HT
	Rendahl's tandan	<i>Porochilus rendahli</i>	RT
Eels	<b>Long-finned eel</b>	<i>Anguilla reinhardtii</i>	<b>LFE</b>
	<b>Short-finned eel</b>	<i>Anguilla australis</i>	<b>SFE</b>
Flatheads	Dusky flathead	<i>Platycephalus fuscus</i>	DF
Garfish	River garfish	<i>Hyporhamphus regularis ardelio</i>	RG
	<b>Snub-nosed garfish</b>	<i>Arrhamphus sclerolepis</i>	<b>SNG</b>
Gobies	Blue-spotted goby	<i>Pseudogobius sp.</i>	BSG
	Speckled goby	<i>Redigobius bikolanus</i>	SpG
Gudgeons	<b>Big-headed gudgeon</b>	<i>Philypnodon grandiceps</i>	<b>BHG</b>
	Dwarf flathead gudgeon	<i>Philypnodon species</i>	DFG
	<b>Empire gudgeon</b>	<i>Hypseleotris compressa</i>	<b>EG</b>
	<b>Firetail / Western carp gudgeon</b>	<i>Hypseleotris galii / klunzingeri</i>	<b>FG</b>
	Crimson-tipped gudgeon	<i>Butis butis</i>	CTG
	<b>Purple-spotted gudgeon</b>	<i>Mogurnda adspersa</i>	<b>PSG</b>
	<b>Striped gudgeon</b>	<i>Gobiomorphus australis</i>	<b>SG</b>
Hardyheads	Cox's gudgeon	<i>Gobiomorphus coxii</i>	CG
	<b>Fly-specked hardyhead</b>	<i>Craterocephalus stercusmuscarum</i>	<b>FSH</b>
	<b>Marjorie's hardyhead</b>	<i>Craterocephalus marjorae</i>	<b>MH</b>
Herrings	<b>Bony bream</b>	<i>Nematolosa erebi</i>	<b>BB</b>
Livebearers	<b>Guppy*</b>	<i>Poecilia reticulata*</i>	<b>G</b>
	<b>Mosquitofish*</b>	<i>Gambusia holbrooki*</i>	<b>M</b>
	<b>Platy*</b>	<i>Xiphophorus maculatus*</i>	<b>P</b>
	<b>Swordtail*</b>	<i>Xiphophorus helleri*</i>	<b>S</b>
Lungfish	<b>Queensland lungfish</b>	<i>Neoceratodus forsteri</i>	<b>QL</b>
Mouth almighty	<b>Mouth almighty</b>	<i>Glossamia aprion</i>	<b>MA</b>
Mullet	<b>Freshwater mullet</b>	<i>Trachystoma petardi</i>	<b>FM</b>
	<b>Sea mullet</b>	<i>Mugil cephalus</i>	<b>SM</b>
Perch-like fish	Australian bass	<i>Macquaria novemaculeata</i>	AB
	Golden perch	<i>Macquaria ambigua</i>	GP
	Mary River cod	<i>Macullochella sp.</i>	MRC
Perchlets	<b>Agassiz's Glassfish</b>	<i>Ambassis agassizii</i>	<b>AG</b>
	<b>Estuary Perchlet</b>	<i>Ambassis marianus</i>	EP
Rainbowfish	<b>Crimson-spotted rainbowfish</b>	<i>Melanotaenia duboulayi</i>	<b>CSR</b>
	Soft-spined sunfish	<i>Rhadinocentrus ornatus</i>	SSS
Saratogas	Saratoga	<i>Scleropages leichardti</i>	Sa
Scorpion fish	<b>Bullrout</b>	<i>Notesthes robusta</i>	<b>B</b>
Sharks	River whaler	<i>Carcharhinus leucas</i>	RW
Silverbellies	Common silverbelly	<i>Gerres subfasciatus</i>	CS
Smelt	<b>Australian smelt</b>	<i>Retropinna semoni</i>	<b>AS</b>
Teraponids	Silver perch	<i>Bidyanus bidyanus</i>	SiP
	<b>Spangled perch</b>	<i>Leiopotherapon unicolor</i>	<b>SP</b>
Tilapia	Mozambique mouth-brooder*	<i>Oreochromis mossambicus*</i>	MMB



<b>Waterwatch Field Record Sheet (for Procedure C)</b>			
<b>Group:</b>		<b>Coordinator:</b>	<b>Name/s of tester/s:</b>
<b>Site name/description/map ref:</b>		<b>Site code:</b>	<b>Date of test:</b>
<b>Calibration and maintenance completed as outlined in procedures: YES / NO</b>		<b>Time of test:</b>	
<b>Parameter</b>	<b>Result</b>	<b>Comments</b>	
Flow (m <sup>3</sup> /s) or velocity (m/s)	m <sup>3</sup> /s		
Temperature (°C)	°C		
pH			
Electrical conductivity (uS/cm)	uS/cm		
Dissolved Oxygen (%sat)	%sat		
Water clarity (Turbidity) (NTU)	NTU		
Stream depth and width	<b>Mean maximum depth (m):</b>	<b>Mean width (m):</b>	
<b>Turbidity tube event monitoring</b>			
<b>Date</b>	<b>Time</b>	<b>1st reading (NTU)</b>	<b>2<sup>nd</sup> reading (NTU)</b>
<b>Weather conditions:</b>	<b>Last Rainfall:</b>	<b>Water flow:</b>	
<input type="checkbox"/> Sunny <input type="checkbox"/> Cloudy <input type="checkbox"/> Overcast <input type="checkbox"/> Raining <input type="checkbox"/> Windy	<input type="checkbox"/> More than 1 week ago <input type="checkbox"/> During the last week <input type="checkbox"/> During the last 24 hours <input type="checkbox"/> Currently raining Amount if known.....	<input type="checkbox"/> Fast <input type="checkbox"/> Slow <input type="checkbox"/> Not flowing <input type="checkbox"/> Temporary or <input type="checkbox"/> Permanent flow	
<b>Water appearance: (tick appropriate box/es)</b>		<b>Notes/Observations:</b>	
<input type="checkbox"/> Clear <input type="checkbox"/> Muddy <input type="checkbox"/> Milky <input type="checkbox"/> Oily <input type="checkbox"/> Foamy <input type="checkbox"/> Stained green <input type="checkbox"/> Stained brown <input type="checkbox"/> Scummy Percentage of water shaded (%):			

## Habitat Survey Field Guide Ratings (for procedure C)

Excellent	Good	Fair	Poor	Very Poor
<b>Bank Vegetation</b>				
(10) Mainly undisturbed native vegetation. No signs of alteration.	(8) Mainly native vegetation. Little disturbance or no signs of recent site disturbance	(6) Medium cover, mixed native/ introduced. Or one side cleared, the other undisturbed.	(4) Introduced ground cover, little native under or overstory, predominantly introduced vegetation.	(2) Introduced ground cover with lots of bare ground, occasional tree. Also includes sites with concrete lined channels
<b>Verge Vegetation</b>				
(10) Mainly undisturbed native vegetation on both sides of the stream. Verge more than 30m	(8) Well-vegetated wide verge corridor. Mainly undisturbed native vegetation on both sides of stream; some introduced or reduced cover of native vegetation	(6) Wide corridor of mixed native and exotics, or one side cleared and other wide corridor of native vegetation	(4) Very narrow corridor of native or introduced vegetation.	(2) Bare cover or introduced cover such as pasture land.
<b>In Stream cover</b>				
(10) Abundant cover. Frequent snags, logs or boulders with extensive areas of in-stream, aquatic vegetation and overhanging bank.	(8) A good cover of snags. Logs or boulders, with considerable areas of in-stream and overhanging vegetation.	(6) Some snags or boulders present and/or occasional areas of in-stream or overhanging vegetation.	(4) Only slight cover. The stream is largely cleared, with occasional snags and very little in-stream vegetation. Generally no overhanging vegetation.	(2) No cover, no snags, boulders submerged or overhanging vegetation. No undercut banks. Site may have rock or concrete lining.
<b>Bank erosion and Stability</b>				
(5) Stable: no erosion/ sedimentation evident. No undercutting of banks, usually gentle bank slopes, lower banks covered with root mat grasses, reeds or shrubs.	(4) Only spot erosion occurring, little undercutting of bank, good vegetation cover, usually gentle bank slopes, no significant change to bank structure.	(3) Localised erosion evident. A relatively good vegetation cover. No continuous damage to bank structure or vegetation.	(2) Significant active erosion evident especially during high flows. Unstable, excessive areas of bare banks, little vegetation cover.	(1) Extensive or almost continuous erosion. Over 50% of banks have some form of erosion: very unstable with little vegetation cover.
<b>Riffles, pools and bends (flowing water only)</b>				
(5) Wide variety of habitats. Riffles and pools present of varying depths, bends present.	(4) Good variety of habitats – eg: riffles and pools or bends and pools. Variation in depth of riffle and pool.	(3) Some variety of habitat – eg: occasional riffle or bend. Some variation in depth	(2) Only slight variety of habitat. All riffle or pool with only slight variation in depth.	(1) Uniform habitat. Straight stream, all shallow riffle or pool of uniform depth eg: channelled stream or irrigation channel.

Source: Cited in Waterwatch Qld 2002, Waterbug and Riparian Vegetation Survey 2002 This information was largely extracted from the 'Community Water Quality Monitoring Manual for Victoria' (1994). The Habitat Survey technique was adapted from 'The Environmental Condition of Victorian Streams', a Report by Phillip Mitchell for the Department of Water Resources, Victoria (Feb 1990).



## Supplementary data

**Group:**

**Location / map ref.**

**Date:**

**Secchi turbidity (cm):**

**Turbidity tube (NTU):**

**Number of habitat types present (1-4):**

### **Riparian Vegetation**

For each bank of the sampling area estimate the proportion of the bank which is dominated by each of the following categories:

1. Clear (no vegetation present, e.g. sand bars/rockbanks).....
2. Grasses/reeds.....
3. Shrubs.....
4. Small trees.....
5. Large or overhanging trees.....

Estimate the overall percentage dominance of native riparian species.....

### **Cover Index**

Allocate a score for each of the habitat variables in the table overleaf to indicate their abundance. When the table is complete sum all scores to obtain a cover diversity index for the sampling area (0-32).

<b>Description</b>	<b>Absent</b>	<b>Un- common</b>	<b>Common</b>	<b>Abundant</b>	<b>Very abundant</b>
	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
Large woody snags or logs					
Fine branching snags					
Floating midstream vegetation					
Submerged midstream vegetation					
Emergent midstream vegetation					
Bank side vegetation (floating, submerged or emergent)					
Overhanging vegetation					
Bank undercutting					
<b>Total Score</b>					

(Adapted from Pusey *et al.* 1995)

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