



RESEARCH PROPOSAL

Aquatic Biodiversity Survey and Baseline Mapping of Freshwater Crayfish and Aquatic Species of the Mid North Coast.



Research Proposal

AABio Project 100062

Aquatic Biodiversity Survey and Baseline Mapping of Freshwater Crayfish and Aquatic Species of the Mid North Coast.

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Cover Photos

Front

Top, *Tenuibranchiurus* habitat, Lennox Head, NSW

Bottom, *Gramastacus* habitat, Myall Lakes, NSW

Introduction

We propose to conduct aquatic biological surveys of all freshwater creeks, streams and swamps along the coastal strip between Forster in the south and Woolli in the north. This 260km section of coast is the focus of this survey. This survey will specifically target freshwater crayfish species as the first priority, followed by all freshwater aquatic species in the area. Currently, we have little knowledge of the freshwater crayfish species that occur along this coastal strip and this huge knowledge gap will be filled by this survey.

Previous surveys by Australian Aquatic Biological P/L (AABio) as part of the Australian Crayfish Project (ACP) from Woolli to the Queensland border has discovered potentially two new species of *Tenuibranchiurus* crayfish living in the swamps and creeks of that coastal strip. We now know that in the Woolli, Diggers Camp, Lake Hiawatha and parts of Yuraygir National Park a new species of *Tenuibranchiurus* occurs. We also know that from Iluka and up the coast towards the Tweed River, a seemingly different new species of *Tenuibranchiurus* occurs. This project (ACP Project 100011) is currently ongoing, with the species genetics being conducted by Kathryn Dawkins of Griffith University. Included

is a brief on Project 100011. Very high rates of extinction are recorded in freshwater ecosystems, with our coastally distributed species threatened by rapid urban development, pollution and climate change. The research continues and to date the different populations show clear differences between subclades suggesting that they should be recognised as evolutionarily significant units. Once the new species are described and the different populations identified they will be submitted to the NSW

Tenuibranchiurus crayfish from Woolli region



Tenuibranchiurus sp. from coastal NSW

Scientific Committee for conservation listing so conservation and management initiatives can be implemented.

There has been no comprehensive surveying of the coastal strip between Woolli and Forster and whether this Genus occurs south is unknown. This project will fill that knowledge gap.

Previous surveys of the NSW coast between Forster and Sydney has identified a new species of *Gramastacus* crayfish occurring in the coastal swamps and creeks of this region. Until now *Gramastacus* crayfish were only known from the Grampians area in Victoria. Because it has not previously been recorded in coastal NSW, this species has not been included in any local government or catchment management plans and as a consequence the majority of its habitat areas have been developed. *Gramastacus* crayfish occur in lowlying swampy land surrounding coastal lakes and lagoons. They only live in ephemeral habitats so these areas are the first to be filled in and built up and a large proportion of their habitat areas on the central coast are under roads, housing estates, canal developments, golf courses, ovals and industrial areas, etc. *Gramastacus* crayfish so far have been found in the catchments of Wamberal Lagoon, Tuggerah Lakes, Lake Macquarie, Port Stephens, Myall Lakes, Smiths Lake and Wallis Lake, yet management agencies are unaware of their existence and lack baseline data to factor into planning considerations. This new species is currently under description by R.B. McCormack and Professor Pierre Horwitz (Edith Cowan University, WA) ACP Project: 100041. We know that the species occurs within the township of Forster but we do not know if it occurs in Tuncurry or any locations north. This proposed survey intends to fill this knowledge gap.



Gramastacus sp.



Gramastacus sp. Lake Macquarie catchment

Background

The Mid North Coast region is experiencing rapid growth and development. This high population coastal area represents a significant environmental asset which is fundamentally important to our lifestyle and economy. Implementing the infrastructure needed to support the increased population, agriculture and tourism must be undertaken so as to minimize or avoid ecological impacts on coastal vegetation, wetlands and threatened species. It is essential that management agencies have the information on hand to wisely plan the development and future of these fragile coastal regions. Additionally, the region is increasingly affected by global warming and climate change. Any decisions made today could have lasting effects on the biodiversity of this coastal area. Currently, however, management agencies do not have access to all the appropriate information to enable the protection of our coastal crustacean and fish species and their fragile aquatic habitats. Over the last few years the Australian Crayfish Project (ACP) and Australian Aquatic Biodiversity Survey (AABS) has been surveying eastern Australia for freshwater crayfish and aquatic fauna. The survey has made numerous important discoveries, in addition to recording and describing several new species of crayfish in the region, the survey has also revealed that an alarming proportion of the region's endemic species appear to be facing serious threats.

These threats include habitat alteration and loss, the proliferation of exotic fish and invasive crayfish species, as well as aquatic plant species and even terrestrial plant species. This project will identify and map many of these threats. These are just a few examples of the need for a biological survey targeting crustaceans and fish in the Mid North Coast region. Baseline data on distribution and habitat is required, to facilitate all management agencies to better manage their native habitat and ensure the protection of these aquatic species in future planning and development considerations.

Aim

We intend to conduct biological surveys of all the smaller freshwater habitats of the Mid North Coast region between Forster in the south and Wooli in the north. The project will concentrate on the coastal strip between the sea and approximately 20 km inland with the emphasis on coastal swamps and ephemeral streams. The aim of this project is to provide baseline data on the extent and condition of aquatic biodiversity and the distribution and habitat of all species of freshwater crayfish and other aquatic species in this coastal region of New South Wales. This survey will generate a massive data base of the freshwater aquatic biodiversity in the region. The distributions and habitat areas of all species will be mapped providing valuable information for all time and providing baseline information of the species present at that site at that time.

This survey and mapping will target crayfish and fish but all other aquatic species will also be recorded, as the proponents have a good knowledge of other invertebrates and molluscs, etc. This will provide additional valuable information to management agencies on the health and distribution of both native and exotic species within each ecosystem. Invasive fish and crayfish species are also a concern and the distribution of invasive species will also be mapped.

The information gathered will provide a comprehensive foundation on which to establish

the successful management of these unique species, maintaining the valuable biodiversity of the Mid North Coastal region of New South Wales.

Method

Approximately 200 sites along the Mid North Coastal strip will be surveyed. The surveys will be site specific but targeted towards freshwater crustaceans initially and then all aquatic fauna.

At each site a record will be kept of the following.

1. Time and Date.
2. Location details. Road or street access, and/or creek and/or crossing name, if known. A location description will also be included (e.g. Track at end Morton Rd, 200 m down track then left 500 m to creek crossing).
3. GPS location recorded in Decimal to 5 places.
4. Altitude (m above sea level) taken at each location.
5. Crayfish species. All specimens will be identified and recorded, and voucher material will be retained for subsequent clarification of any uncertain records. DNA samples will be taken as part of the broader Australian Crayfish Project. Other signs of crayfish presence (e.g. burrows, remains) will also be noted.
6. Fish species. All specimens will be identified and recorded and voucher material will be retained for subsequent clarification of any uncertain records. The voucher material is also available for future researchers.
7. Other species. Each site will be surveyed wherever possible for all species eg. shrimp, snails, mussels, tadpoles, turtles, insect larvae, etc. This will allow a wider data base to be compiled for the Mid North Coast.

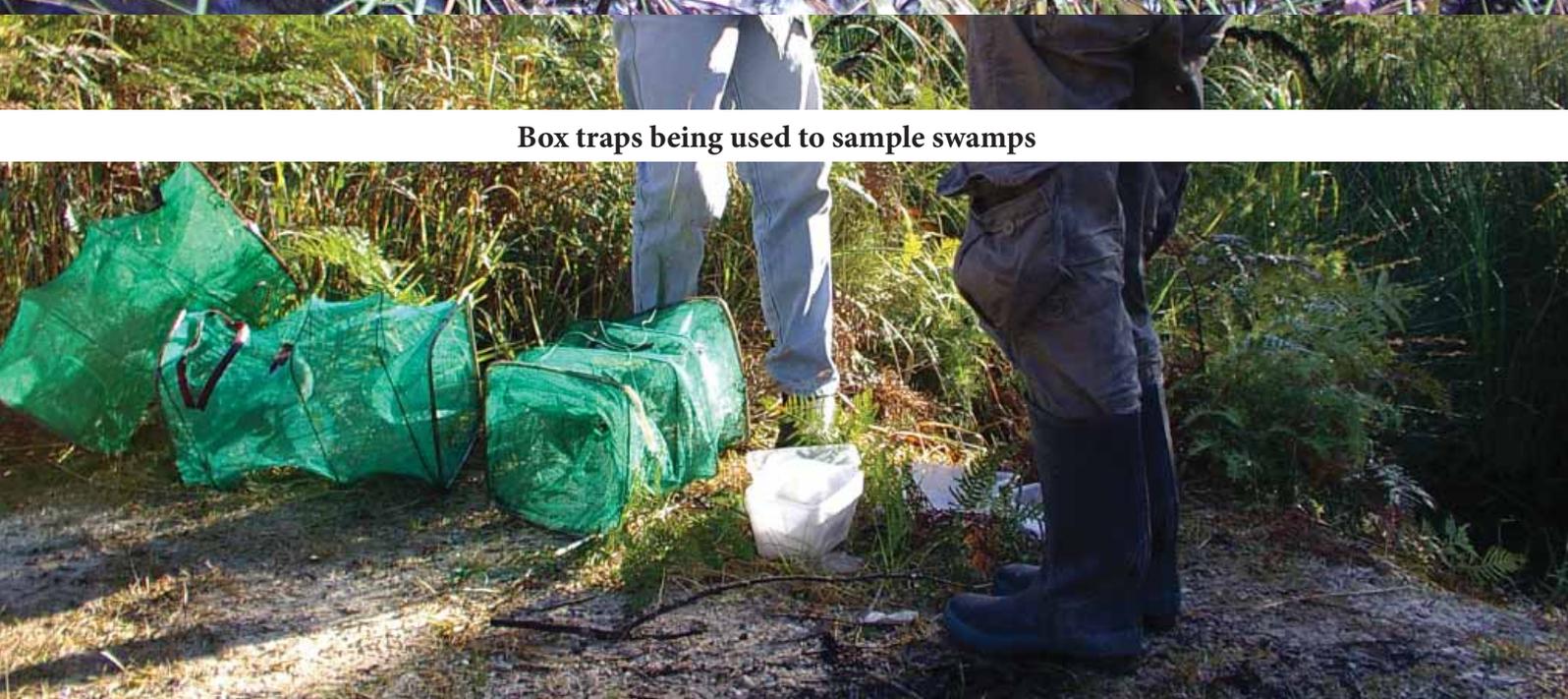
Collection methods include:

1. Visual observation. Each site will be visually inspected prior to sampling, enabling identification of potential habitat areas and the methods needed to sample those areas. Quite often preliminary visual observation also results in direct crayfish or fish capture. Targeted visual surveys may also be used at suitable sites (e.g. spotlight surveys).
2. Scoop netting. This involves using hand held scoop nets to scoop along the bottom sediments, weed beds and under ledges, etc. in aquatic habitats. This is a very effective method if crayfish/fish are out and about and its success can be determined by the species and time of day. Other species like native fish, (galaxiids, gudgeons, etc) and exotic fish like carp, gambusia and swordtails are also captured with this method as are snails, tadpoles and insect larvae, etc.
3. Trapping. Baited yabby traps are very effective at capturing some species of crayfish, shrimp and fish.
4. Baiting. Baiting with stringlines is the most effective method of capturing some species. A piece of meat attached to a string is placed at the front of a burrow to lure the crayfish out.
5. Turning rocks/logs. Rock turning is an effective method for capturing crayfish, particularly for elusive species that do not respond to baits.
6. Excavation. Freshwater crustaceans are not restricted to creeks and swamps. Many species colonize damp areas and paddocks away from the water body. These species create a burrow below the dry surface into the wet clays below. These will need to be physically dug from their burrows to identify the species.

Each survey site is unique and the surveying methods will reflect the site conditions. Typically, the site will be visually and scoop net surveyed. Records will be taken of all species observed or captured and all information recorded. Photographs of the site will be taken and then a set of baited traps will be placed at the survey site. Approximately 4 traps/site will be soaked for 3 to 14 hours and the species captured recorded.



Scoop nets to scoop the reed beds are very effective



Box traps being used to sample swamps

Project Benefits to Sponsors

A full survey report will be issued to the sponsors. The nature of these reports will depend on the needs of the sponsors. Ideally it would be a series of reports based on catchments or LGAs. The scope of each report is negotiable. For discussion purposes we propose a total of 5 reports.

1. Forster to Moorland
2. Johns River to Crescent Head
3. Crescent Head to Nambucca Heads
4. Nambucca Heads to Sawtell
5. Sawtell to Wooli

These will be stand alone documents issued as an electronic pdf suitable for reproduction on Council or management agency websites, etc. The reports will reflect the survey results and the species in the local swamps and streams, it will include colour photographs of many of the more common species and indicate to all residents as to what species are in their local area. This document will be extremely valuable to all residents with an interest in what's in their local stream and every school in not just the Mid North Coast region but the whole east coast will regularly refer to these documents.

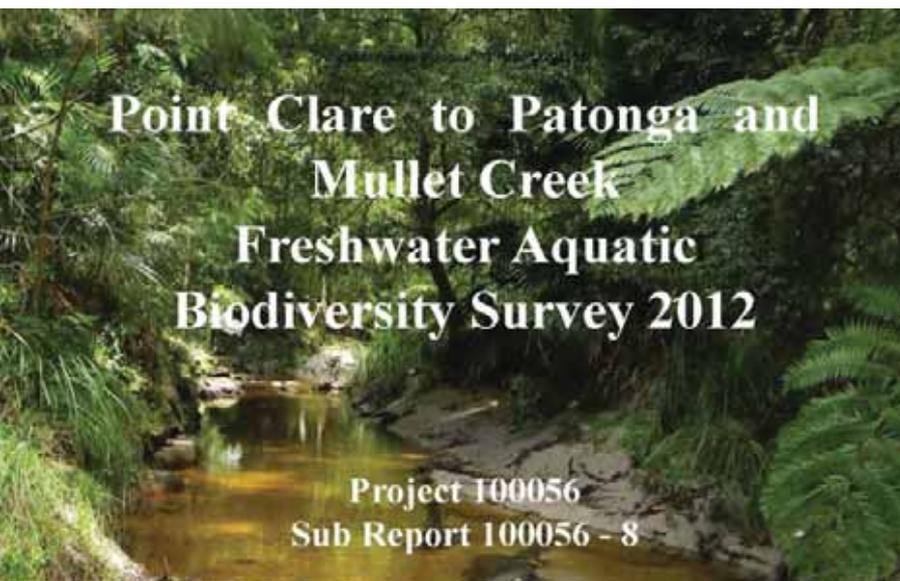


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Example of a Typical Survey Report



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human altered habitats, mosquito fish were more common.

Other pest and exotic fish species like swordtails, guppies, mollies, carp & goldfish were all absent from the catchment. Much of eastern NSW is impacted by these pest species and their absence in the survey area was fantastic news and very encouraging for the future health of the local environment and prosperity of the native aquatic fauna.

WPT001 corner of Singleton Road and Finch Place, Point Clare. WPT002 Coorombee Creek crossing Manooka Road, Point Clare. WPT003 Glenbrook Parade, Tarcoott. WPT004 The Broadwaters, Tarcoott. WPT005 Blenheim Crescent, Tarcoott. WPT019 opposite Dolphin Street, Tarcoott. WPT006 beside Mofalena Crescent, Tarcoott. WPT008 Railway Street, Woy Woy. WPT009 Vernon Road, Woy Woy. WPT011 Kahliah Creek crossing Brisbane Avenue, Umina Beach. WPT014 Orson Point Creek crossing Diamond Road, Pearl Beach.

5.2.2 Characidae

The White Cloud Mountain minnow (*Tanichthys albonotata*) is an introduced freshwater fish species usually restricted to home fish tanks. It is a robust species and a member of the carp family being a native of China.

Their robust nature and bright coloration makes them popular as an aquarium species and they are not normally found in natural waterways of NSW. Three specimens were found over a 6 metre section of stream and indications are they are doing well in the stream. There is only two known feral populations of this exotic species in NSW, one here and one at Piles Creek near Somersby.

Green Point Crk, Tormaline Avenue WPT015, Pearl Beach.



Figure 6. The White Cloud Mountain Minnow *Tanichthys albonotata*



Figure 12. Flat shaped freshwater snails *Helicorbis australiensis*

native of East Africa but now they are widespread in NSW so if you come across them, "Crush Them".

5.4 Macro invertebrates/ Insect Larvae

Macroinvertebrates were not a key component of this survey, more a by catch. They were recorded throughout the catchment in health quantities. Large numbers were recorded from WPT008, WPT010, WPT017, WPT020, WPT021, WPT022, WPT024.



Figure 15. Flat Water bug (Belostomatidae) was common at WPT001



Figure 16. Flat Water bug (Belostomatidae) was common at WPT001

Figure 17. Flat Water bug (Belostomatidae) was common at WPT019



Figure 18. Flat Water bug (Belostomatidae) was common at WPT019

5.5 Birds

Birds were not a part of this survey, however, some of the species recorded are listed here. They were the common species in almost the catchment but only in only small numbers. Chestnut Teal (*Anas castroreus*), Dusky Woodswallow (*Malurus melanocephalus*), Bush-turkey (*Alectura lathami*), Red-capped Robin (*Phalacrocorax melanoleucus*).

Erin Cook, Catchment Report



Figure 12. Flat shaped freshwater snails *Helicorbis australiensis*

Flat shaped freshwater snails (*Helicorbis australiensis*) were found at Marina Road, Springfield, WPT019. These are small under 5 mm flat shelled snails and good to see in the area. This was exciting and adds significantly to the biodiversity in the Erina Creek catchment. A tributary of Erina Creek crossing Marana Road, Springfield, at WPT019, Willow Road, Springfield WPT021.

Figure 13. Flat shaped freshwater snails



Figure 14. *Helicorbis australiensis*



Typically reports cover exotic species and natives from crayfish to macroinvertebrates

Written in plain English, with high quality photos, the reports provide valuable reference material. Recorded within the report is a colour photo of the survey site, together with site information and a record of the species observed at that location. The species recorded in the report area are recorded separately, complete with their colour photograph. Additionally, exotic plant and animal pest species are recorded as well as recommendations.

Striped Gudgeons (*Gobionomorphus australis*) were also captured in Forrester's Creek. These Gudgeons were very large and very healthy with good numbers in the stream. The specimens captured were very dark in colouration and this was unusual as generally the species has a lighter body colour.



Figure 19. A large striped Gudgeon (*Gobionomorphus australis*) was very dark in colouration in Forrester's Creek.

In early June a trap survey was conducted over a 24 hour period. Being winter with cold water temperatures, catch numbers were small, however, results are a good indication of the distribution and size of animals in residence. Only two larger specimens were vouchered (JACP Specimen 2982 & 2985), however, another 18 crayfish were captured. Refer to Table 2.

Cherax destructor		
Number	Sex	Weight Grams
1.	Male	58
2.	Male	80
3.	Male	54
4.	Aberrant	50
5.	Aberrant	99
6.	Male	71
7.	Male	83
8.	Male	59
9.	Male	77
10.	Male	42
11.	Male	67
12.	Male	71
13.	Female	34
14.	Male	32
15.	Male	25
16.	Female	14
17.	Female	29
18.	Aberrant	8



Figure 15. *Cherax destructor*



Figure 16. The cooked yukkie

Table 2. *Cherax destructor* captured in June survey.

These crayfish were removed from the environment and destroyed. (We cooked them up and they made a tasty treat).



Figure 17. A *Cherax destructor* and *Gambaussina* sp. captured together in the same trap.

Wentworth Lagoon Catchment Report

Australian Aquatic Biological FS

squids and photographed. Crustacean specimens were then euthanized by freezing at least 24 hours and subsequently stored in clean, labelled specimen jars containing ethanol. Tissue samples were retained in cool light buffer from selected species subsequent DNA analysis, as part of the broader ACP.

These simple methods were used to find and capture freshwater aquatic animal identification in Wentworth Lagoon Catchment, however, AMBS employs a code of pr that is designed to limit the transfer of any pests and diseases from one catchment to another. For each catchment separate traps/nets are utilized and boots, etc. is workers are sterilized between catchments.

Use of traps in western drainage is prohibited under the Fisheries Management Act. All methods and collection was authorized under special scientific collection permit. All collections were authorized by the NSW Department of Industry and Investment Scientific Collection Permit P95/0077-4.1. All collections were authorized National Parks and Wildlife Service, under Scientific Licence S13112.

5. Results and discussion

Please note that results listed here reflect the species at that site at that time during different conditions different species or numbers may be present.

5.1. Crustaceans

5.1.1. Freshwater Crayfish.

Only *Cherax australiensis* and *Gambaussina sp.* were recorded from the G LSA, neither were known to occur within Wentworth Lagoon catchment and the species were specifically searched for. Additionally, recent research indicates that coastal habitats in NSW may contain two undescribed species of freshwater cray genus *Tanultrichulus* and *Gambaussina* and these were also targeted.



Wentworth Lagoon Catchment Report

Australian Aquatic Biological FS

Typical pages from a survey report

Of more immediate concern was an outbreak of exotic Water Hyacinth, (*Eichhornia crassipes*), a native of the upper Amazon catchment, this is one of the world's worst aquatic weeds. Water hyacinth is a floating waterweed with a fibrous root system and dark green rounded leaves up to 5 cm in diameter. The leaf stalks are swollen into spongy, bulbous structures. They have flowers that are light purple with a darker blue/purple and yellow centred which make them attractive for ornamental ponds and this leads to their spread.

In the Gosford City Council control area water hyacinth is declared a Class 2 noxious weed under the NSW Noxious Weeds Act 1993. The declaration class defines how the weed needs to be treated in your area. Class 2 states the plant must be fully and continuously suppressed and destroyed.



Figure 28. Water Hyacinths WPT007

Figure 29. Water Hyacinths have a thick root system that clogs waterways



Figure 30. Water Hyacinths WPT007



Wingello Creek crossing Jarrett Street at WPT027. Here the creek had intact riparian zones, was strongly flowing but carrying an extremely high sediment load. Someone was obviously polluting this stream at the time of survey on the 5th October. The pollution was entering the stream within 50m upstream of Jarrett Street as further upstream was unaffected by the sediments. The damage from this illegal pollution is unknown but could not be good for the health of the stream and Narara Creek. Despite the heavy sediment load, native freshwater snails and common jellyfish were present.

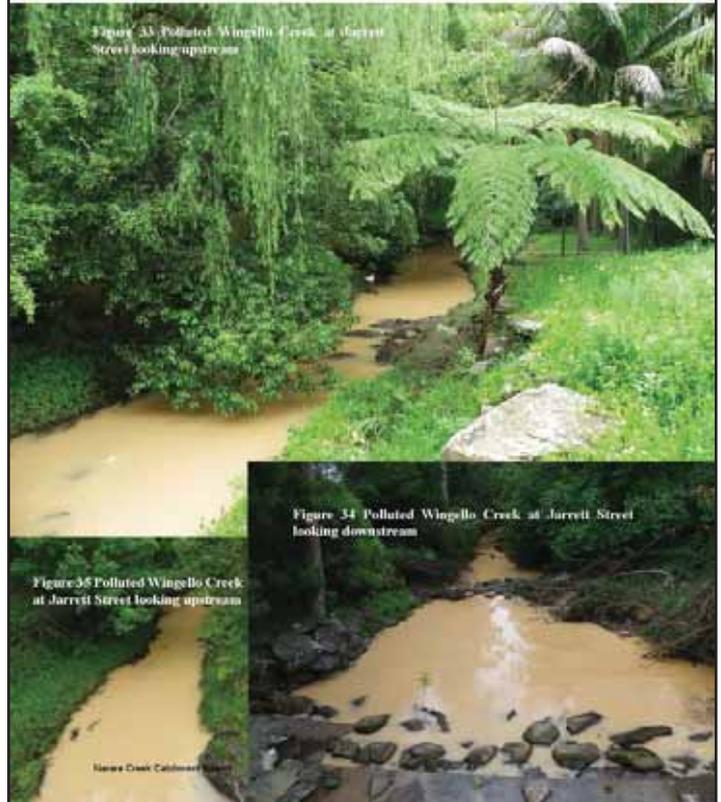


Figure 33. Polluted Wingello Creek at Jarrett Street looking upstream



Figure 35. Polluted Wingello Creek at Jarrett Street looking upstream

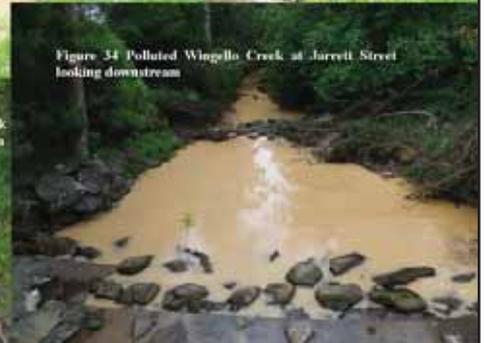


Figure 34. Polluted Wingello Creek at Jarrett Street looking downstream

Typical pages from a survey report, covering exotic plants and pollution events

Outcomes - Benefits to councils and the scientific community

The full benefits of this project are unknown as we just don't know what we will find, however, the biological data gathered will have immense benefits.

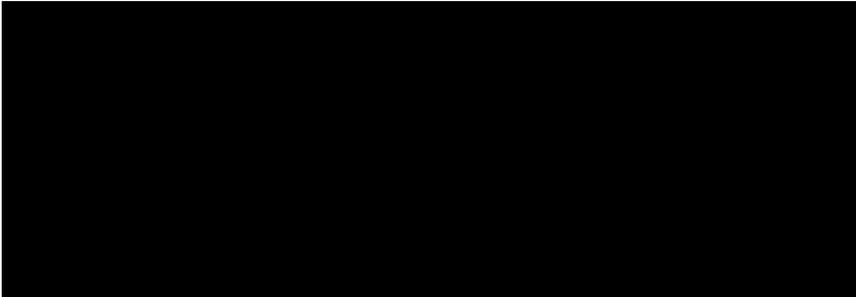
- Information generated from this project can be used by all management agencies to help protect and conserve our endemic crayfish and fragile aquatic ecosystems along this highly populated coastal strip.
- The reports record the aquatic biodiversity of the survey site, all fish, shrimp, mussels, snails, crabs and macroinvertebrates, etc. are recorded.
- The information will allow the sustainable management of native habitat and vegetation which is essential for Australia to meet its international and national environmental objectives.
- Identify the areas of conservation importance and allow conservation of threatened species. The survey may identify biodiversity hotspots or significant areas that need special conservation.
- Allow long term planning to identify priority areas within landscapes leading to the increase in native habitat. This may include construction of habitat corridors re-joining fragmented native habitat areas.
- Readily available information will allow better management of native habitat and vegetation which will contribute to the National Framework for the Management and Monitoring of Australia's Native Vegetation.
- Potentially provide further information on the role these crayfish and fish might play in the wider coastal ecosystems, e.g. their role as a food source for migratory

birds, etc.

- Help all management agencies to reduce the threats to important habitat areas indicated in the reports generated. Potential threats include: physical modification or encroachment, catchment modification, disturbance of acid sulphate soils, loss of biodiversity, pollution and increased nutrient input, changes to water regimes, utilization of resources, recreational fishing or poaching and the introduction of invasive species, both plant and animal.
- Identify current introduced/pest plant or animal species threatening the aquatic ecosystems and provide data regarding the distribution and habitat of exotic aquatic fauna.

The information gathered in the Mid North Coast aquatic biodiversity surveys, will be valuable information essential to the northern rivers CMA and local councils and can be utilized in a mass of different avenues e.g. Planning ecologically sustainable developments, adding to State of the Environment Reports or using this knowledge and understanding of the processes affecting the environment, to strategically develop targeted programs to address any specific issues identified, etc. Additionally, the reports are of interest to environmental and landcare groups as problems found and recommendations given within the reports can be corrected by these groups.

As part of the broader Australian Crayfish Project, the project results will directly result in several scientific papers and be included in several broader papers.



Currently seeking sponsors

Conclusion

Australian Aquatic Biological is currently sponsoring the Australian Crayfish Project and the Australian Aquatic Biodiversity Survey. AABio is prepared to significantly sponsor survey costs for this research project. One commercial sponsor and 2 private sponsors will also contribute towards this project.

This project will require approximately 2 years to reach fruition. This is a major project with huge benefits, a small investment now will generate data on the Mid North Coastal region that will have ongoing benefits for generations.

For Further Information Contact
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