Gilbert River Irrigation Project: Preliminary Business Case: Environmental Values

Romy Greiner[1], Daniel Gregg[1] and Trevor Parker [2]

[1] River Consulting, Townsville. Email: romy.greiner@riverconsulting.com.au. PH: 07 47752448

[2] Northern Gulf Resource Management Group, Mareeba. Email:tmc@northerngulf.com.au. PH: 07 40921088

3 April 2009

Introduction

The potential of the Gilbert River as an irrigated agricultural area has recently been promoted to the Federal Government, by Etheridge Shire Council, based on planning work done by the State Government from 1998 – 2000. This document provides a brief description of the environmental values for the Gilbert River region that may be impacted upon through the development of new irrigation infrastructure and enterprises.

The Gilbert River catchment is located on the western side of Cape York in Queensland, Australia. The Gilbert River drains into the Gulf of Carpentaria with total annual flows averaging 4,375,000ML of which only 0.32% is currently allocated for non-environmental uses under existing water entitlements (ECOWISE, 2007).

The Gilbert River catchment is sparsely populated. A population of approximately 1,224 people inhabit and area of approximately 46,400 km^2 (ECOWISE, 2007). Irrigated agriculture in the Gilbert River catchment covered an area of 165ha in 1996/97 (www.anra.gov.au, accessed March, 2009). The majority of irrigated agriculture is located in an area approximately 25km west of Georgetown (NRW, 2006). Crops grown include mango, cucurbit and some fodder production for (supplementary) cattle feed (NRW, 2006). The existence of permanent water in the bed sands of the Gilbert River in this location has facilitated the development of permanent crops such as mango and cucurbit; however there is some concern that water allocations from this resource are approaching their upper limit (NRMW, 2006).

Development of irrigated agriculture in the Gulf of Carpentaria is limited not only by water availability but also by the availability of good agricultural soils. Future developments are therefore expected to occur in a patchwork manner throughout the region (NALWT, 2009). One area identified as possibly being suitable for irrigated agriculture is an expansion of the area currently under irrigated agriculture (NRW, 2006).

The feasibility of additional irrigation development in the Gilbert River catchment is being investigated. Two options identified are the damming of the Gilbert River at approximately the Northern boundary of the Green Hills station, and another is the construction of an in-stream regulating weir (NRMW, 2006). A proposed irrigation area associated with the potential development of an irrigation scheme in the Gilbert River catchment would be located along the banks of the Gilbert River between the Prestwood and Chadshunt stations.

Environmental values are defined broadly by ANZECC/ARMCANZ (2000, A-9) to be “particular values or uses of the environment that are important for a healthy ecosystem or for public benefit, welfare, safety or health…”. More specifically, the Queensland Government defines a range of environmental values for waterways in the *Environmental Protection (Water) Policy 1997*. These include values for: aquatic ecosystems, human consumption, primary and secondary recreation,

visual amenity, cultural and spiritual values, industrial use, aquaculture, drinking water, irrigation, stock water and farm water supply (QPC, 2009).

Irrigation development is likely to have significant implications for environmental values in the Gilbert River catchment. According to Queensland Department of Natural Resources and Water developments within one kilometer of declared wild rivers "have the potential to cause the most significant and immediate effects on natural values" in the Gulf of Carpentaria (NRW, 2006: p9). Although the Gilbert River is not a declared wild river, the impacts on environmental values from the development of an irrigation scheme would be most significant in close proximity to the stream.

Development proposals in Queensland are tested against relevant state legislation before being approved. One particular aspect of scrutiny for development proposals is the potential impacts they may have on environmental values.

Existing information on environmental values in the Gilbert River catchment is available for aquatic fauna existing in the stream and stream bed (ECOWISE, 2007; QDPIF, 2000) and for the status and types of vegetative communities existing in the area (see Appendices 1-4). This report reviews existing documents and information to provide an assessment of the environmental values directly associated with ecological assets such as wetlands, aquatic fauna, conservation areas, natural stream flows, and existing vegetation communities.

A map providing context for the following discussion on environmental values is provided in Appendix 1. Further details on the proposed potential water storage infrastructure options and a proposed irrigation area are provided in DNR (2000).

Environmental valuation framework

Value is a human concept and thus cannot properly account for the intrinsic value of natural ecological assets – this is particularly the case when tradeoffs of intrinsic environmental values are required (HA, 2001). Frameworks have, however, been developed to enable full accounting of the human value for the use, and existence of ecological assets. One influential framework is the concept of total economic value (HA, 2001). Figure 1 shows the components of total economic value and how they can be decomposed into separate units of value.

Figure 1: The components of Total Economic Value

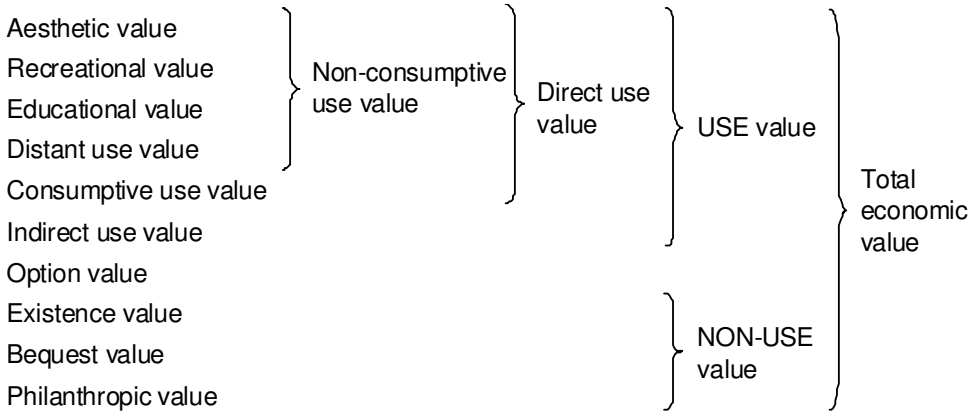

Table 1: Summary review of impacts of irrigation development on consumptive environmental values

Environmental values	Description	Examples/evidence
Land condition	• Irrigated agriculture along the Gilbert River	• Concern over the expansion of neem plantations (DNR, 2000)
Drinking water	• Suitability/availability of raw drinking water supply – assumes minimal treatment	• Increased supply of drinking water (DNR, 2000)
Stock watering	• Suitability/availability of water supply for production of healthy livestock	• Increased/decreased supply of water – depends on effect on water tables
Commercial fishing	• Clean, high quality water for healthy fisheries production	• Intensive agriculture may lead to increased nutrient loads in the Gilbert River which can potentially affect fisheries operating in the estuary of the Gilbert River • Appendix 6 provides information on fish caught by commercial anglers at the mouth of the Gilbert River in 2005. Total value of catch in 2005 was approximately $500,000
	• Natural annual flows with minimal non-natural barriers to fish movement/migration	• River systems in the Gulf are important for the health and sustainability of fisheries in the area (NRW, 2006). The river sands of the Gilbert River are important for the health of the river and provide a year-round supply of water to the flows in the lower sections (NRW, 2006; DNR, 2000) • Many of the fish species found in the Gilbert River migrate along (at least part of) the length of the River (ECOWISE, 2007) and some species (e.g. Barramundi) migrate upriver after spawning. Changes to the water flow regime and installation of barriers to fish migration resulting from irrigation development may affect commercial fisheries through declines in fish abundance
Recreational fishing	• Natural flows and/or suitable/sufficient areas to engage in recreational fishing	• Irrigation infrastructure may provide more opportunities for fishing (e.g. Green Hills dam) Changes to the flow regime and installation of barriers to fish migration may impact on species that use different sections of the river over their lifecycle
	• Clean, high quality water for healthy fisheries production	• Irrigated agriculture may affect in-stream water quality and thus fish health/abundance
Industrial	• Suitability/availability of water for industrial use	• Increased availability of industrial-use water

Using the total economic value framework, three categories of environmental values within the Gilbert River catchment were derived: (1) consumptive use environmental values; (2) non-consumptive use environmental values and; (3) non-use environmental values.

Existing information on aquatic fauna in the Gilbert River catchment (ECOWISE, 2007; QDPIF, 2000) and vegetation communities (Appendices 2,3 and 4) provide a description of specific environmental assets that may be affected under a proposed irrigation development.

Table 1 reviews consumptive use environmental values in the Gilbert River catchment providing a description of each value and supporting evidence or examples of their existence.

The pastoral industry is the predominant land user in the region and represents a stakeholder with interests in non-consumptive use for environmental values in the Gilbert River catchment. A review of non-consumptive use environmental values in the Gilbert River catchment is shown in Table 2.

Table 2: Summary review of impacts of irrigation development on non-consumptive environmental values

Environmental values	Description	Examples/evidence
Pastoral production	• Pastoral production is supported by the current water regime but is not directly consumptive and the land remains in a largely un-modified state (NRW, 2009)	• Impacts on the water table and thus pastoral production from the construction of irrigation infrastructure and increasing water withdrawals
Indigenous and non-indigenous heritage	• The maintenance of waterways in a condition/state to allow the observation of indigenous/non-indigenous ceremonies, traditions, or heritage.	• Any developments should take potential emergence of these values into consideration in future development proposals – Indigenous Traditional Owner interests in project options exist regardless of the existence of Native Title or Native Title claims (DNR, 2000).
Recreation	• Non-consumptive recreational values such as those relating to boating, camping, canoeing etc.	• The development of an irrigation dam may allow increased realisation of recreational values (DNR, 2000)
Amenity	• Amenity value for natural environments	• Increasing intensification of agriculture and the construction of irrigation infrastructure will change visual amenity (DNR, 2000)

Non-use values are much harder to define and identify than use values for environmental assets. These types of values include anthropogenic (human) oriented values for the intrinsic qualities of environmental assets – for example: values held purely for the knowledge that a species exists/is not in danger of extinction. They may take the form of existence, bequest (ensuring the resource is there for future generations), and philanthropic (value for the enjoyment experienced by others due to the resource) values. Descriptions are provided below in Table 3.

Table 3: Evidence of non-use values in the Gilbert River catchment

Environmental values	Description	Examples/evidence
Existence value	• The values that are held for the knowledge of the existence of intact or high-quality natural ecosystems – with no intention of ever realising a use value for the resource.	• Property acquisitions by groups such as the Australian Conservation Foundation/Bush Heritage • Wild Rivers and Remnant vegetation legislation enacted by the Queensland Government • Some fish species occurring in the Gilbert River have highly specific habitat requirements which may be threatened by irrigation infrastructure development and increased withdrawals. • Two fish species found in the river may be previously undescribed whilst others found were previously not known to exist in the Gilbert River (ECOWISE, 2007) • DNR (2000) list one of the concerns over irrigation development in the region as the potential impacts on any rare/endangered species • The bed-sands of the Gilbert River currently provide an environment (the hyporheic zone) which holds a large diversity of stream-based aquatic fauna during the dry season – these may be threatened by changes to the hydrology of the area (ECOWISE, 2007). Damages to this zone could severely impact on the capacity of the Gilbert River to recolonise with fish species following the dry season (ECOWISE, 2007)
Bequest value	• The values held by one generation in ensuring a natural resource is available for use, or enjoyment (non-use) for younger or future generations These values may potentially include all of the values listed above – that is they are an alternative form of option value with the option for use/valuation being deferred to future generations	• Property acquisitions by groups such as the Australian Conservation Foundation/Bush Heritage • Engagement in the Nature Refuge scheme – conservation covenants • Graziers in the Northern Gulf are motivated predominantly by the desire to "pass on land in good condition" (Greiner and Miller, 2008)
Philanthropic value	• Value for the vicarious pleasure a person feels from the provision of environmental resources which enables another to obtain enjoyment/ satisfaction	• Property acquisitions by groups such as the Australian Conservation Foundation/Bush Heritage

The description of option values is not included in any of the tables above. Option value reflects value for the option to realise a consumptive use, non-consumptive use, or non-use value in the future. Option values can be significant in many cases – an example is provided by the moratorium placed over activities that may increase water withdrawals in the Gilbert River catchment in 2003. The moratorium was enacted to limit the incidence of increased withdrawals of water by entitlement holders during a review of water use and entitlements in the region (NRW, 2006) – users might otherwise increase withdrawals to strategically depict a higher than truthful reliance on water and thus retain an option to use this water in the future.

Specific environmental values

This section describes specific examples of environmental values in the Gilbert River catchment using existing scientific information from ecosystem assessments and maps developed in conjunction with this document (see Appendix). Details in the maps are combined with existing information on aquatic species distributions for the area (QDPIF, 2000 and ECOWISE, 2007). Two dam options are explored in this section – one is located approximately 333km from the Gilbert River mouth, the other approximately 338km from the river mouth.

Gilbert River Catchment context map – Appendix 1

The proposed irrigation area is located a short distance west of Georgetown. The dam options are involve the construction of a dam wall located at approximately the northern boundary of Green Hills station (shown in pink). Key features of interest on this map are the nationally significant wetlands (the Gilbert-Smithburne fan aggregation and Macaroni Swamp) at the mouth of the Gilbert River. Both of these wetlands meet three of the criteria for classification of a wetland as nationally important (one is needed to achieve this classification) (Environment Australia, 2001):

1. It is a good example of a wetland type occurring within a biogeographic region in Australia
2. It is a wetland which plays an important ecological or hydrological role in the functioning of a major wetland system/complex
3. It is a wetland which is important as the habitat for animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions such as drought prevail

The estuarine zone of the Gilbert River was considered to be in near pristine condition according to the Australian National Resources Audit in 2000 (NLWRA, 2000).

An assessment of the aquatic fauna of the Gilbert River catchment (ECOWISE, 2007) found that:

- The distribution of fish species in the Gilbert River catchment is most probably a result of the history of flow characteristics of the River.
- The aquatic biodiversity in the Catchment is considered to be in very healthy condition.
- Current major threats are invasive plants (e.g. rubber vine) and introduced animal pests (e.g. pigs).

Of 20 sites visited during an assessment of aquatic fauna in the Gilbert River catchment in 2006 (ECOWISE, 2007) only one was located within the proposed irrigation area described in Appendix 1. The number of species found at this site was one of the highest recorded of all 20 sites at 31 species. Two sites were located within the Gilbert-Smithburne fan aggregation at the end of the catchment – one of these sites was the location of the highest level of biodiversity in

the assessment (32 species). No sites fell within the dam-water inundation areas described in Appendix 2 and Appendix 3. The fauna assessment sites used in the ECOWISE report (2007) are confidential and not shown on any of the maps developed for this review. A list of fish species found in the Gilbert River catchment is shown in Appendix 5.

Green Hills dam inundation maps (AMTD 338km - Vegetation status and Ecological community designation) – Appendix 2

These maps show the status of remnant vegetation and ecological descriptions of different vegetation communities in a section of the Gilbert River catchment relevant to this report. They represent a proposed irrigation development option where a dam wall is located at 338km AMTD (Adopted Middle Thread Distance – the distance from the mouth of the river to the proposed dam wall site). The dam inundation area under this scenario has been calculated as 2900 hectares. For a broader geographical context the reader should refer to Appendix 1.

The remnant vegetation that would be inundated under this scenario is considered to be not of concern based on Map 2. The remnant vegetation status map does not provide definitive information on changes to the status of vegetation communities following development of the proposed irrigation scenario. However it does show that at the current level of health and quantity existence, option and other non-market values for these vegetation types are not currently of concern.

No information is available on whether there are engangered species living in the inundation area or if species may become endangered/extinct upon inundation under the proposed dam waters for this potential development option.

More detailed information is provided by the map describing the ecological communities to be inundated under this scenario.

Green Hills dam inundation map (AMTD 333km - Vegetation status and dominant Regional Ecosystem designation) – Appendix 3

These maps show the status of remnant vegetation and ecological descriptions of different vegetation communities in a section of the Gilbert River catchment relevant to this report. They represent a proposed irrigation development option where a dam wall is located at 333km AMTD (Adopted Middle Thread Distance – the distance from the mouth of the river to the proposed dam wall site). The dam inundation area under this scenario has been calculated as 5180 hectares. For a broader geographical context the reader should refer to Appendix 1.

The majority of remnant vegetation that would be inundated under this scenario is not considered to be of concern based on the remnant vegetation status map. There is however an area of land, close to the dam wall, which is considered to include a non-dominant vegetation community that is of concern. The vegetation type is described as a mixed-open grassland type community with designation 9.3.26 (see regional ecosystem map for more detail).

Gilbert River Catchment proposed irrigation area (Vegetation status and Ecological community designation) – Appendix 4

These maps show the status of remnant vegetation and ecological descriptions of different vegetation communities in a section of the Gilbert River catchment relevant to this report. Specifically, they depict a proposed irrigation area that would utilise water from potential dam/weir development options described above. For a broader geographical context the reader should refer to Appendix 1.

The proposed irrigation area, west of Georgetown, incorporates a majority of vegetative communities currently considered to be of a not of concern status. However there are several sections of area considered to be of concern, sub-dominant and an area of vegetative communities considered to be of concern, dominant.

There are two main vegetative communities representing the areas considered to be of concern (sub-dominant). These are:

- Molloy red box and bloodwood (designation #2.3.21) in the lower section of the proposed irrigation area and
- Deepwater lagoons with lilies and sedges (designation #2.3.16) in the upper section of the proposed irrigation area. For details refer to the ecological community designation map.

The main vegetation community representing those areas considered to be of concern (dominant) is described as:

- River red gum and Leichardt tree open forest fringing major tributaries (designation #2.3.26).

Freshwater sawfish (*Pristis microdon*) – a species considered to be critically endangered by the WWF (QDPIF, 2004) and that is listed as threatened under the *Environment Protection and Biodiversity Conservation Act* (EPBC Act) – have been reported in the Gilbert River in close proximity to the Rockfields Station homestead which would be the geographical centre of the proposed irrigation area. Threats to the continued existence of Freshwater sawfish include habitat degradation of riverine areas and commercial and recreational fishing (Pogonoski *et al.*, 2002).

Description of recorded fish species in the Gilbert River catchment (ECOWISE, 2007) – Appendix 5

A total of 38 species of fish were identified in the Gilbert River catchment. A list of these and their current status is presented in Appendix 5.

Conclusions

The environmental values for the Gilbert River catchment cover a wide range of use and non-use values including those associated with commercial production (e.g. agriculture, aquaculture) and recreation (e.g. fishing). This report describes known environmental values using information on existing ecological assets and the proposed irrigation development. The report identifies existence values for some specific species and vegetation communities in the Gilbert River catchment.

There is general paucity of information on many of the environmental values described in this report and potentially on others that have not been described. Research into the recreational (e.g. recreational fishing, amenity), cultural (Indigenous/non-indigenous heritage) and other environmental values is required to describe the suite of existing environmental values and estimate the potential impacts of dam/irrigation development.

The elicitation of specific environmental values for any particular ecosystem requires ecological assessment to identify the range of processes and species present and their condition. “Values” are an anthropogenic (human) concept. The description of environmental values requires consultation with stakeholders and experts to first identify the nature and relative importance of various environmental values.

The Gulf of Carpentaria remains a place of near-pristine wilderness in many areas (NLWRA, 2000) and thus is likely an area of high environmental value both for the population residing within it and the wider Australian population. Any development that involves a tradeoff between commercial values and environmental values (i.e. development of an irrigation scheme) in the area should ensure that the full suite of values are accounted for and the true net benefits of the project proposal are understood (HA, 2001).

Caveat

The documentation listed in the reference section of this report and the maps included in the appendix are the sources of information on which this report is based. We are not aware of any other relevant documents but acknowledge that they may well exist.

References

ANZECC and ARMCANZ, 2000. An introduction to the Australian and New Zealand Guidelines for fresh and marine water quality. The Australia and New Zealand Environment and Conservation Council and the Agriculture and Resource Management Council of Australia and New Zealand, Artarmon NSW.

CHRIS, 2005. Coastal Habitat Resources Information System. Queensland Department of Primary Industries and Fisheries, http://chrisweb.dpi.qld.gov.au, accessed March, 2009.

DNR, 2000. Water Infrastructure Planning: Gulf region social issues report. Queensland Department of Natural Resources: Regional Infrastructure Development, North region.

ECOWISE, 2007. Aquatic fauna survey of the Northern Gulf region – June 2006. Confidential report for the Northern Gulf Resource Management Group. Ecowise Environmental, Australia.

Environment Australia, 2001. A Directory of Important Wetlands in Australia. 3rd Edition. Environment Australia, Canberra.

Greiner, R. and Miller, O., 2008. "Environmental duty of care": Concept and relevance for graziers in the Northern Gulf region of Queensland. Report prepared for the Northern Gulf Resource Management Group. River Consulting, Townsville.

HA, 2001. Discussion paper: Non-market Economic Values and the South-East Marine Region. Prepared for the National Oceans Office. Hassall and Associates, Sydney.

NALWT, 2009. Midterm report: February 2009. Northern Australia Land and Water Taskforce, Canberra.

NLWRA, 2000. National Land and Water Resources Audit. Australian Natural Resources Atlas: www.anra.gov.au, accessed 30th March 2009.

NRW, 2006. Gulf draft water resource plan: overview report and draft plan. Queensland Government Department of Natural Resources and Water, Brisbane.

NRMW, 2006. Gulf draft water resource plan: economic and social assessment report. Queensland Government Departiment of Natural Resources, Mines and Water, Brisbane.

NRW, 2009. Gilbert River – Chadshunt to Mount Sircom: Remant Vegetation classification map. Queensland Government Department of Natural Resources and Water, Mareeba.

Pogonoski, J.J., Pollard, D.A. and Paxton, J.R., 2002. Conservation overview and action plan for Australian threatened and potentially threatened marine and estuarine fishes. Environment Australia, Canberra.

QDPIF, 2000. Scoping report – Gulf rivers, dams, and weirs: Initial appraisal of fisheries aspects. Report to Regional Infrastructure and Development – Department of Natural Resources, Townsville. Queensland Department of Primary Industries and Fisheries, Walkamin.

QDPIF, 2004. A guide to releasing sawfish – Gulf of Carpentaria inshore and offshore set net fishery. Queensland Department of Primary Industries and Fisheries, Cairns.

QPC, 2009. *Environmental Protection (Water) Policy 1997*. Reprinted as in force 1st January 2009. Queensland Parliamentary Counsel, Brisbane.

Appendix 1

Gilbert in context map here

Appendix 2

Inundation 338 (remnant vegetation and regional ecosystems) maps here

Appendix 3

Inundation 333 (remnant vegetation and regional ecosystems) maps here

Appendix 4

Irrigation area (remnant vegetation and regional ecosystems) maps here

Appendix 5: Fish species recorded in the Gilbert River catchment (ECOWISE, 2007)

Common name	Species name	Status
Eastern rainbowfish	*Melnotaenia splendida*	Widespread
Spangled perch	*Leiopotherapon unicolor*	Widespread in north Australia
Bony bream	*Nematalosa erebi*	Widespread in north Australia
Sleepy cod	*Oxyeleotris lineolata*	Widespread in north Australia
Archerfish	*Toxotes chatareus*	Widespread in north Australia
Sooty grunter	*Hephaestus fuliginosus*	Widespread in north Australia
Long tom	*Strongylura krefftii*	Widespread in north Australia
Mouth almighty	*Glossamia aprion*	Widespread in north Australia
Banded grunter	*Amniataba percoides*	Widespread in north Australia
Hyrtl's tandan	*Neosilurus hyrtlii*	Widespread in north Australia
Square-blotched goby	*Glossogobius sp. C*	Widespread in north Australia
Flathead goby	*Glossogobius giurus*	Widespread in north Australia
Barramundi	*Lates calcarifer*	Widespread in north Australia
Forktailed catfish	*Arius graeffei*	Widespread in north Australia
Tarpon	*Megalops cyprinoides*	Widespread in north Australia
Gulf grunter	*Scortum ogiibyi*	Widespread in gulf
Reticulated glassfish	*Ambassis macleayi*	Widespread in gulf
Golden goby	*Glossogobius aureus*	Widespread in gulf
Berney's catfish	*Arius berneyi*	Widespread in gulf
Salmon catfish	*Arius leptaspis*	Widespread in gulf
Striped sleepy cod	*Oxyeleotris selheimi*	Widespread in gulf
Carpentaria catfish	*Arius paucus*	Widespread in gulf
Northern trout gudgeon	*Mogurnda mogurnda*	Widespread
Snub-nosed gar	*Arrhamphus sclerolepis*	Widespread - possibly undescribed species
Fly-specked hardyhead	*Craterocephalus stercusmuscarum*	Probably a number of distinct sub-species
Freshwater anchovy	*Thryssa scratchleyi*	Uncommon
Gilbert's grunter	*Pingalla gilberti*	Uncommon
Elongate glassfish	*Ambassis elongatus*	New record for Gilbert River
Giant glassfish	*Parambassis gulliveri*	New record for Gilbert River
Northwest glassfish	*Ambassis sp.*	New record for Gilbert River
Papuan river sprat	*Clupeoides cf. papuensis*	New record for Gilbert River
Toothless catfish	*Anodontiglanis dahli*	New record for Gilbert River
Black catfish	*Neosilurus ater*	New record for Gilbert River
Saltpan sole	*Brachirus salinarum*	New record for Gilbert River
Rendahl's catfish	*Porochilus rendahli*	New record for Gilbert River
Freshwater sole	*Brachirus selheimi*	New record for Gilbert River
unkown goby	*Glossogobius sp. C*	Undescribed species
Gilbert gudgeon	*Hypseleotris n. sp.*	Undescribed species

Appendix 6: Tonnes and value of fish caught by commercial anglers at the mouth of the Gilbert River, 2005

Common name	Species name	Tonnes of caught fish	Value of caught fish
King salmon	*Polydactylus macrochir*	30.9	$123,700
Blue salmon	*Eleutheronema tetradactylum*	5	$20,100
Shark (unspecified)	--	11.4	$68,100
Grey mackerel	--	5.2	$31,300
Jewfish - Jewelfish	--	2.8	$14,100
Grunter (unspecified)	--	1.6	$8,100
Barramundi	*Lates Calcarifer*	33.8	$236,300
	Total	**90.7**	**$501,700**

Source: CHRIS (Coastal Habitat Resources Information System) 2005.