

Topping up the "Crystal Bowl" for Barramundi





Topping up the "Crystal Bowl" for Barramundi

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Australian Government

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TABLE OF CONTENTS

ACKNOWLEDGEMENTS.....	6
1. NON-TECHNICAL SUMMARY.....	7
2. BACKGROUND	12
3. NEED	12
4. OBJECTIVES	13
5. CRYSTAL BOWL STUDY AREA.....	14
6. FISHING CHARACTERISTICS	14
7. WHAT INFLUENCES FISHING?.....	15
8. WHO GOES FISHING?	17
9. WHERE DID THEY GO FISHING?.....	18
10. WHEN DID THEY GO FISHING?	21
11. WHAT WAS THE FISHING EFFORT?.....	24
12. WHAT WAS THE CATCH?	28
13. WHAT WAS THE VALUE OF THE CATCH?.....	32
14. WHAT WAS THE SIZE COMPOSTION OF THE CATCH?.....	33
15. WHAT WAS THE GROWTH OF BARRAMUNDI?.....	34
16. HOW OLD WERE THE BARRAMUNDI?	36
17. WHERE WERE BARRAMUNDI TAGGED?	37
18. WHAT WERE THE TAG RECAPTURE RATES?	39
19. WHAT WAS THE EFFECT OF FISHING COMPETITIONS?	40
20. WHAT WAS THE ROLE OF FLOODPLAIN LAGOONS?	41
21. WHAT WAS THE ROLE OF STOCKED FISH?	45
22. WHAT WAS THE MOVEMENT OF BARRAMUNDI?	47
23. WHAT WAS THE LEVEL OF BARRAMUNDI RECRUITMENT?.....	50
24. CAN BARRAMUNDI RECRUITMENT BE PREDICTED?.....	55
25. CAN BARRAMUNDI STOCKS BE PREDICTED?	56
26. REGIONAL MANAGEMENT AND IMPACTS OF DEVELOPMENTS	57
27. DISCUSSION	57
28. FURTHER DEVELOPMENT.....	58
29. CONCLUSION.....	59
30. REFERENCES	60

TABLE OF FIGURES

Figure 1: The Crystal Bowl study area is the Fitzroy River delta below the Barrage at Rockhampton and adjacent waterways and boat ramp locations	14
Figure 2: Closures to commercial netting in the Fitzroy River	15
Figure 3: Monthly Fitzroy River flows (ml) and monthly Rockhampton Rainfall (mm) from 2000-2011	16
Figure 4: Barrage gates open and the Fitzroy River in full flood in January 2011	17
Figure 5: Residence of recreational fishers that fished the Fitzroy River in 2010/11	18
Figure 6: Nerimbera boat ramp provides access on the north side to the mid reaches of the Fitzroy River (left) and northside city ramp at Reaney Street (right)	19
Figure 7: New southside boat ramp off Quay Street opened in December 2010 (left) and boat ramp on Raglan Creek at Port Alma (right)	19
Figure 8: CFISH grids for commercial fishing in the Fitzroy River	20
Figure 9: Suntag grid maps used to record recreational fishing trips in the Fitzroy River	20
Figure 10: Key freshwater and brackish lagoons on the Fitzroy River delta	21
Figure 11: Numbers of days of commercial netting in CFISH grids R29 and R30 from 2000-2010	22
Figure 12: Start and finish times for boat fishing trips from all ramps in the Fitzroy River	22
Figure 13: Start and finish times for landbased trips to Fitzroy delta lagoons	23
Figure 14: Start and finish times for landbased fishing trips to the Fitzroy River	23
Figure 15: Total number of commercial fishing days in CFISH grids R29 and R30	24
Figure 16: Days of fishing trip counts as a percentage of the year	26
Figure 17: Adjusted average number of trips each month from key boat ramps in 2010-11	26
Figure 18: Adjusted average number of landbased trips each month in the Fitzroy River in 2010-11	27
Figure 19: Annual commercial catch of Barramundi in CFISH grids R29 and R30	28
Figure 20: Median trip length for trips in the Fitzroy River	29
Figure 21: Median number of fishers	29
Figure 22: Catch rates for total fish caught on typical fishing trips by season for 2010-11	30
Figure 23: Catch rates for kept fish on typical fishing trips by season for 2010-11	30
Figure 24: Numbers of Mud Crab and fish caught on 1052 trips in 2010-11	31
Figure 25: Estimate of Barramundi caught and kept based on habitat in 2010-11	31
Figure 26: GVP of the commercial catch from 2000-2010	32
Figure 27: Average length of commercial and recreational Barramundi and standard deviation from 2005-2010.....	33
Figure 28: Lengths of measured commercial and recreational caught Barramundi from 2000-2011	34
Figure 29: Size range of measured commercial and recreational caught Barramundi for February-October 2010.....	34
Figure 30: Recapture length for fish <400mm when tagged based on habitat from 2008-2011	35
Figure 31: Growth of Barramundi in Frogmore Lagoon from 2008-2011	35
Figure 32: Growth of Barramundi in all habitats from 2003-2008 (dry period) and 2008-2011 (wet period)	36
Figure 33: Length at age for commercial caught Barramundi in the Fitzroy River from 2005-2010	36
Figure 34: Length at age for recreational caught Barramundi in the Fitzroy River from 2008-2010	37
Figure 35: Age of fish in the legal commercial and recreational catch from 2008-2010	37
Figure 36: Locations where fish were tagged from 2000-2011	38
Figure 37: Locations where Barramundi were tagged from 2000-2011	38
Figure 38: Barramundi tagged and percentage recaptured from 2000-2011	39
Figure 39: Barramundi tagged and percentage of recaptures kept from 2000-2011 ..	39
Figure 40: Catch rates of Barramundi and all fish from the Rocky Barra Bounty from 2000-2009	40

Figure 41: Number of Barramundi tagged and the recapture rate each year in the Rocky Barra Bounty	41
Figure 42: Frogmore Lagoon when dry (left) a few days before it was filled in the 2008 flood (right)	41
Figure 43: River flows and Barramundi in Frogmore Lagoon from 2000-2011	42
Figure 44: Rescuing fish from Frogmore Lagoon in December 2009	42
Figure 45: River flows and Barramundi in Woolwash Lagoon from 2000-2011	43
Figure 46: Fish deaths in Woolwash Lagoon in December 2010	43
Figure 47: Rainfall and Barramundi in 12 Mile Creek from 2000-2011	44
Figure 48: Creek flows and Barramundi in Raglan Creek from 2000-2011	44
Figure 49: River flows and Barramundi in Nankin Creek from 2000-2011	45
Figure 50: Number of recaptured stocked and wild fish from fish tagged in the Fitzroy River	46
Figure 51: Recaptures of stocked fish by commercial and recreational fishers from 2008-2011	47
Figure 52: Average distance (km) moved (and standard deviation) by Barramundi between tagging and recapture in dry and wet periods	48
Figure 53: Recaptures of tagged stocked fish in the Fitzroy estuary and along the coast from 2008-2011	48
Figure 54: Movement of Barramundi recaptured from 2008-2011 tagged in the Fitzroy River	49
Figure 55: Barramundi recaptures from 2008-2011 for fish tagged in Fitzroy River	49
Figure 56: Barramundi tagged in lagoons and recaptured in the Fitzroy River and beyond from 2008-2011 (colour relates to lagoon where tagged)	50
Figure 57: Sites for recruitment surveys in 2010 using a castnet	52
Figure 58: Year 0 Barramundi recorded each year in the Fitzroy River	53
Figure 59: Year 0 recruits recorded per fisher day with standard deviation	53
Figure 60 : Barramundi recruits recorded each year (arrows show growth of fish over time and density of dots indicates strength of recruitment)	54
Figure 61: Barramundi recruits in Herbert Creek from 2009-2011	54
Figure 62: Predictor for Barramundi recruitment in the Fitzroy River from 1998-2011 (all green indicates years of strong recruitment)	55
Figure 63: Recruitment and river flows from 1998-2011	56

TABLES

Table 1: Estimate of annual recreational fishing trips in the Fitzroy River for 2010/11	28
Table 2: Estimate of Barramundi caught and kept in 2010-11	31

ACKNOWLEDGEMENTS

This project is about collecting data for the 2010-11 year and using that as the basis for progressing regional management and as a baseline for assessing the impacts of proposed port developments in the Fitzroy River. However that data alone would be of limited use without the data that has been previously collected since the mid 1980s.

Tagging data have been collected under the Suntag program which is a joint program between the Australian National Sportfishing Association Qld Inc (ANSAQ) and Fisheries Queensland. Funding provided by Fisheries Queensland has allowed a continuous timeline of data to be collected that underpins this project. Members of local ANSAQ clubs in Central Queensland have largely been responsible for the tagging of fish and providing the details of their fishing trips. Those clubs are Capricorn Tag and Release Sportfishing Club (Captag), Gladstone Sportfishing Club and Keppel Bay Sportfishing Club.

From 2005-09 additional data were collected under the CapReef project. This expanded data collection to obtaining catch and effort data of recreational fishers. The initial focus of CapReef was collecting data in the Great Barrier Reef Marine Park but expanded to estuaries, including the Fitzroy River, in 2007. Funding for CapReef was provided by a number of sources including Fitzroy Basin Association, Natural Heritage Trust, Great Barrier Reef Marine Park Authority, Fisheries Queensland and NRG. This has extended the data available to this project.

As well as the contribution of fishers providing tagging data and details of their fishing trips local fishers, both commercial and recreational, have provided details of recaptured fish. Local fishers have also provided valuable information on juvenile Barramundi caught while collecting bait. These data have provided valuable additional information for monitoring recruitment and assessing the status of fish stocks.

The collection of data on the fishery is complemented by a sophisticated web based database developed by One Pixel. This database has been continually upgraded to meet changing needs and was recently linked to Google Earth to provide an improved visualisation of data so that it can be better understood by the community.

The support of the Fisheries Research and Development Corporation (FRDC) in providing funding for this project is also acknowledged.

1. NON-TECHNICAL SUMMARY

Topping up the "Crystal Bowl" for Barramundi

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Objectives

The objectives of this project were:

- 1 Collection of commercial and recreational catch data in the Fitzroy River in 2010-11
- 2 Collection of Barramundi recruitment and environmental data for the 2011 recruitment season from January to April
- 3 Use of that data in the development of commitment to local or regional management among local stakeholders and as a baseline for estimating the impact of proposed port developments for the Fitzroy River

OUTCOMES ACHIEVED

- ❑ A comprehensive picture of the Barramundi fishery in the Fitzroy River from 2000-2011, including an estimate of recreational and commercial catch and effort for 2010-11.
- ❑ Documented a poor recruitment year in 2011.
- ❑ An improved understanding of Barramundi recruitment and the environmental drivers that influence recruitment.
- ❑ A qualitative prediction of Barramundi stocks for 2012-13.
- ❑ Baseline data that can be used to assess the impact of coal port development proposals in the Port Alma area.
- ❑ An important factual basis for informed debate on the future of the Barramundi fishery in the Fitzroy River and any move towards regional management.

While the objectives of this project were to collect data for 2010-11, to put that into context it is necessary to take a decadal view. Suntag and later CapReef have collected data on Barramundi in the Fitzroy River since the mid 1980s and recruitment has been monitored since 1999. Examining the effects of the drought period from 2003-2008 and the wet period from 2008-2011 provides an understanding of the impact of climate on stocks. This leads to the development of a predictive capacity which is the aim of the "Crystal Bowl".

Data from a number of sources have been collected since the mid 1980s including tagging (growth and movement), boat ramp surveys (catch and effort), castnet surveys (recruitment), electrofishing surveys (recruitment and use of lagoons), commercial logbooks (catch and effort), fish stocking (contribution to stocks) and environmental factors (river flow and rainfall). In 2010-11 the focus was on obtaining an estimate of the recreational catch and effort which was the most significant data gap. Commercial catch and effort at the river level was also examined.

The data have been presented in a way that answers questions about the fishery. Simple questions such as who, where and when people go fishing are examined through the data. What was the effort and catch of commercial and recreational fishers were the most important questions for 2010-11. To understand the fishery from a decadal perspective data on the value of the catch, size, growth, age, tagged fish recaptures, recruitment, floodplain lagoons, stocked fish and fishing competitions were examined.

Data have been mostly presented on a decadal scale with a focus on the period 2000-2011. This has led to the development and refinement of a recruitment predictor based on environmental drivers which, when combined with other data collected, provides a capacity to qualitatively predict Barramundi stocks.

The following is a summary of various aspects of the fishery.

The recreational fishery is mainly accessed by local fishers with 99% of those fishing in 2010-11 living within an hour's drive of the boat ramp used and 78.4% living in Rockhampton. The commercial fishery is accessed both by local and visiting fishers. In 2010 there were 32 licenses that were used to fish in the area and there were 14 locally based fishers.

Commercial fishing occurs in all areas downstream from Gavial Creek while recreational fishing occurs in all areas from 400m downstream of the Barrage.

There are 4 primary boat ramps and 4 secondary ramps used to access the area. Commercial fishing was recorded as being in CFISH grids R29 and R30 while recreational fishing was recorded as being in Suntag grid maps FRR, RAG and CIS.

Commercial fishing for Barramundi is both a day and night time activity and occurs from February-October each year. Peak fishing times are at the start of the fishing year in February and again in October just before the closed season. During winter there is reduced fishing effort due to low water temperatures, reduced Barramundi activity and a focus on other species such as Mud Crab, Threadfin and Mullet.

Recreational fishing is largely a daytime activity with boat fishing trips starting in the early morning from around dawn and mostly completed shortly after dark. A profile of boat ramp usage was developed based on start and finish times of trips. Landbased trips in the river and to the lagoons mostly occur in the early morning or late afternoon.

From 2000-2010 there were an average of 843.3 commercial fishing days each year with 870 days in the 2010 fishing year. From May 2010-April 2011 there were an estimated 12,331 recreational boat fishing trips and 7,530 landbased fishers.

From 2000-2010 the annual commercial catch peaked at 49.6 tonnes in 2003 following a low of 18.9 tonnes in 2002. In 2010 the catch was 37.9 tonnes. CPUE ranged from a low of 20kg/day in 2000 to a high of 46.3kg/day in 2007. The CPUE in 2010 was 43.6kg/day.

For recreational fishers a typical boat fishing trip is 2 fishers fishing for 5 hours. A typical landbased trip to the lagoons is 1 fisher fishing for 3 hours while a typical landbased trip to the river is 2 fishers fishing for 2 hours.

Mud Crab (37.7%) and Barramundi (28.9%) made up 66.6% of the recreational catch while Mud Crab (55.3%) and Pikey Bream (10.2%) make up 65.5% of the kept catch. Barramundi only make up 3.5% of the kept catch.

It was estimated that recreational fishers caught 56,270 Barramundi and kept 2,730 in 2010-11 with an estimated total weight of 8.2 tonnes.

From 2000-2010 the value of the commercial catch, based on the Gross Value of Production (GVP), peaked in 2003 at \$456,888 with a low in 2000 of \$171,916. The GVP in 2010 was \$348,012. There was no estimate of the value of the recreational fishery.

The average length of commercially caught Barramundi from 2005-2010 ranged from a high of 827mm in 2009 to a low of 761mm in 2010. The average length of recreationally caught Barramundi from 2005-2010 ranged from a high of 582.1mm in 2007 to a low of 340.7mm in 2008.

Barramundi growth was compared between the different habitats being river, lagoons and 12 Mile Creek. There was no significant difference in the growth rates however fish tagged in Frogmore Lagoon in late 2008 and recaptured in late 2009 showed little growth. Comparing growth rates between the dry period from 2003-2008 and wet period from 2008-2011 showed little difference in the growth rates.

There was no significant difference in the age of fish taken in the commercial and recreational catch. Fish aged from 2-7 years old dominated the legal catch being 93.0% of the commercial catch and 93.4% of the recreational catch.

The recapture rates for Barramundi in the Fitzroy River are the highest recorded

for any species for any river system in Queensland. The average Suntag recapture rate was 8.0% to 2009/10. From 2000-2011 the overall recapture rate in the Fitzroy River was 15.4% while for recaptured fish that were kept it was 5.7%.

The Rocky Barra Bounty is the only major fishing competition targeting Barramundi in the Fitzroy River. This is a tag and release only event that has been held each year from 1999-2009. The event was cancelled in 2010 due to the flooding. Catch rates for Barramundi ranged from a low of 43.1hrs/fish in 2006 to a high of 10.1hrs/fish in 2000 with 19.5hrs/fish in 2009. Recapture rates of fish tagged each year during the event average 15.3% and range from a low of 9.5% for fish tagged in 2006 to a high of 23.6% for fish tagged in 2001.

Floodplain lagoons play an important role in providing off river habitat for juvenile fish. There are 6 key lagoons where recreational fishing occurs and these are monitored for recruitment. During the drought period from 2003-2008 3 of these lagoons Bates, Frogmore and Woolwash dried with the loss of all fish. There were a significant number of fish that died in 12 Mile Creek in 2005. Flooding in 2008, 2010 and 2011 allowed Barramundi to enter these lagoons and they currently hold a good population of fish.

During the 2000s Barramundi were stocked in 10 locations in the upper Fitzroy catchment to provide a recreational fishery for local communities. Significant numbers of these fish were tagged, in some cases there were batch releases of fish over 200mm that were all tagged. Following the 2008, 2010 and 2011 floods 128 of these stocked fish were recaptured in the Fitzroy estuary including fish from 8 of the 10 stocked locations. There were 870 tagged fish released in Lake Theresa at Clermont in 2007 and in 2010-2011 there were 33 (3.8%) recaptures of these fish in the Fitzroy River and beyond over 750km down river. This is the longest fish movement recorded for any river in Queensland.

Movement of Barramundi was assessed from tag and recapture data. The average movement of Barramundi during the drought period from 2003-2008 was 10.5km while for fish recaptured during the wet period from 2008-2011 was 32.5km. Fish tagged in the river and adjacent waterways have been recaptured as far north as Corio Bay and as far south as the Burnett River. Of the 16 recaptures outside the river 14 (87.5%) were caught to the south.

The flooding allowed fish from the lagoons to return to the river and from 2008-2011 there were 67 fish that were tagged in the lagoons recaptured back in the river and elsewhere.

Recruitment was measured by the number of Barramundi caught from January-May that were less than 300mm to the end of March and less than 350mm to the end of May. After 3 years of strong recruitment in 2008, 2009 and 2010 recruitment in 2011 appears to have been poor.

A Barramundi recruitment predictor was developed by CapReef in 2007 which correlated recruitment to strong wet season river flows and local rainfall. The predictor was modified in 2011 to include a parameter for pre-wet season flooding in September-November. Flooding at that time had only occurred once before in the 24 years from 1988-2011 covered by the predictor so had not previously been considered as a factor. Early flooding in 2011 was the most likely reason for the poor recruitment year.

Based on the previous data and the data collected through this project it is possible to make a qualitative prediction on what Barramundi stocks are likely to be over the next 2-3 years.

The "Crystal Bowl" prediction is:

In the 2012 fishing year Barramundi stocks will be high with 3-5 year old fish (580-850mm) dominating the legal catch. There are large numbers of juvenile fish aged 2-3 years (450-580mm) which will start to enter the fishery in 2012 and 2013.

There a number of coal and liquid natural gas (LNG) proposals in various stages of development for Port Alma and Gladstone Harbour. All of these will have some level of impact on local fisheries. This report provides a baseline that can be used to assess the impacts of coal port developmental proposals for the Port Alma area.

This also provides an important factual basis for informed debate on the future of the Barramundi fishery in the Fitzroy River and any move towards regional management.

Keywords

Barramundi
Fitzroy River
Catch and effort

Commercial catch
Recreational catch
Recruitment

2. BACKGROUND

In 2008 data collected under the CapReef community monitoring program indicated that Barramundi numbers in Central Queensland, particularly in the Fitzroy River, were reaching a very low point. This view was reached based on:

- a number of years of below average rainfall and low river flows
- several years of poor recruitment with the last good recruitment in 2001 and moderate recruitment in 2004
- above average commercial catches in 2007 and 2008
- unknown levels of recreational catch
- unknown level of indigenous catch

By 2009 commercial catch rates were well down again and recreational catch rates were very poor. Significant concerns were raised by the CapReef steering committee as to what could be done to address the issue.

The announcement of 2 proposed coal port developments that would impact on the Fitzroy River and Barramundi heightened concerns. One proposal was for new port infrastructure and dredging in the spawning area at the mouth of the river.

Indigenous netting in the area of the Fitzroy River closed to commercial fishing at Rockhampton and elsewhere was also resulting in significant backlash from the local community (since largely resolved by a change in legislation).

Out of this developed the concept of having a predictive model that could forecast stocks 2-3 years into the future to provide a credible basis to work on addressing some of these issues. It was considered there were sufficient data covering a long timeline and a good understanding of recruitment to be able to develop an effective model. Being able to predict stocks would provide an early warning of risks to stocks. So the idea of a "Crystal Bowl" (combining a crystal ball and fish bowl) for Barramundi was born.

Following on from that, a desire emerged among commercial, recreational fishers, resource managers and others for using this as a stepping stone for regional or local management and work on local resolution of some of these and other issues.

As fate would have it there was strong Barramundi recruitment in 2008, 2009 and 2010 with improved rainfall and river flows. This has improved stocks significantly and the need for immediate action is no longer an imperative. It was considered this would assist in moving forward on regional management by taking away the need for action under duress and allowing the discussions to occur in a positive environment.

3. NEED

Application 2010/018: A "Crystal Bowl" for Barramundi was submitted to the FRDC 2010 round. While the application was rejected the Board indicated it was sympathetic to the approach described and suggested further discussion with Recfishing Research in the development of any future application. It was proposed that a further application be developed for the FRDC 2011 round addressing the issues raised by the Board.

The "Crystal Bowl" concept is required to underpin any move to regional management which is dependent on fine scale data collection on Barramundi in the Fitzroy River system and remains pivotal to the further development of regional management.

Data collected will also be used as baseline data for two coal port developments proposed by Xstrata for the Fitzroy River. These proposals are in their early stages. One proposal at Balaclava Island at the mouth of the river could impact on Barramundi and Threadfin spawning grounds and the other to barge coal down the Fitzroy River will significantly disrupt fishing activities. Discussions are underway with consultants for Xstrata to establish a monitoring program however this is unlikely to commence until the projects are approved.

The data required is commercial catch, recreational catch and recruitment. Also required are the environmental conditions including connectivity of wetland lagoons, river flows and rainfall.

Data on commercial catch is available from Fisheries Queensland. CapReef, a community based monitoring program, has collected data on recreational catch since 2007 and recruitment since 1999.

4. OBJECTIVES

The objectives of this project were:

- 1 Collection of commercial and recreational catch data in the Fitzroy River in 2010-11
- 2 Collection of Barramundi recruitment and environmental data for the 2011 recruitment season from January to April
- 3 Use of that data in the development of commitment to local or regional management among local stakeholders and as a baseline for estimating the impact of proposed port developments for the Fitzroy River

5. CRYSTAL BOWL STUDY AREA

The Fitzroy River is the second largest river system, behind the Murray-Darling Rivers, that reaches the ocean in Australia with a total catchment area of 142,665 square kilometres¹. River flows are among the most variable of any river system in the world ranging from near zero to over 26 million megalitres per year.

In 1970 a tidal barrage was constructed on the Fitzroy River at Rockhampton to provide a water supply for the city. While there is a fishway on the barrage that does allow fish movement from the saltwater to freshwater this has not been very effective for Barramundi. The area downstream from the Barrage remains tidal and is saline except during periods of freshwater releases from above the Barrage. This is the area where most fishing effort occurs and is the study area for the Crystal Bowl as shown in *figure 1*.

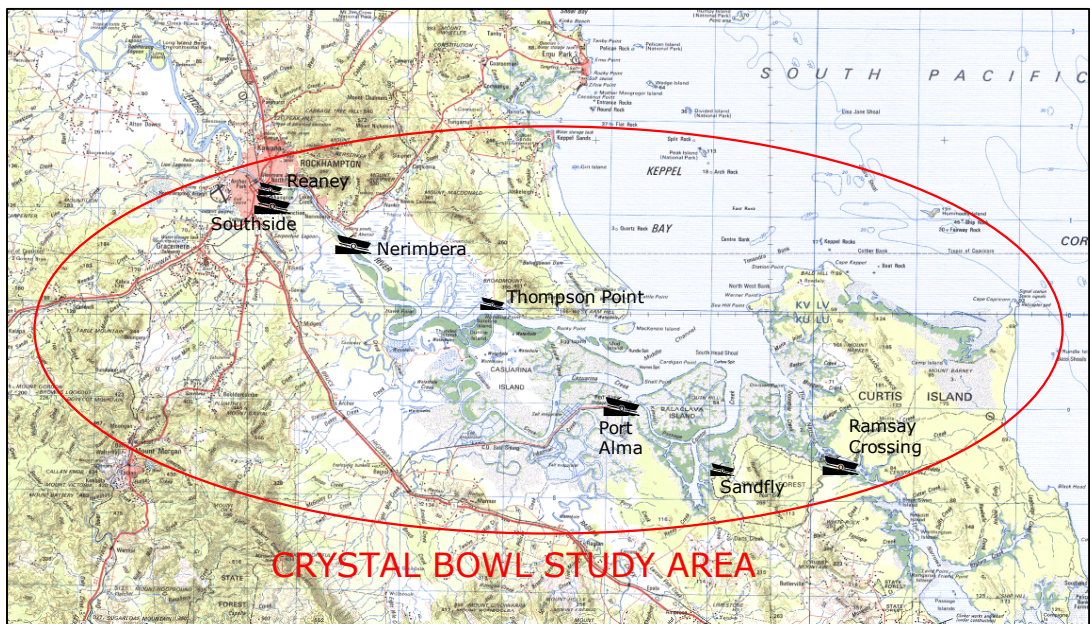


Figure 1: The Crystal Bowl study area is the Fitzroy River delta below the Barrage at Rockhampton and adjacent waterways and boat ramp locations

6. FISHING CHARACTERISTICS

Prior to 1970 catadromous species², particularly Barramundi, ranged well upstream in the freshwater and juvenile Barramundi were common in the Dawson River and other tributaries (Dunstan 1959) of the Fitzroy River up to 500km upstream. Following the completion of construction of a tidal barrage in 1970 these species are now largely confined to the bottom 60km of the river.

Fishing in the Fitzroy River estuary has the following characteristics:

- This area is extensively used by both commercial and recreational fishers
- Barramundi, Mud Crabs and Banana Prawns are the most important commercial and recreational fish species
- There are a number of closures and restrictions that apply to Barramundi
- There are 4 key boat ramps and 4 secondary ramps that provide access for commercial and recreational boat fishing

¹ Wikipedia [http://en.wikipedia.org/wiki/Fitzroy_River_\(Queensland\)](http://en.wikipedia.org/wiki/Fitzroy_River_(Queensland))

² Living in fresh water but migrating to marine waters to breed

- ❑ Shore based fishing occurs in the city area, other points where there is vehicle access and at a number of lagoons on the floodplain and delta
- ❑ The commercial Barramundi fishery is fished by licensed commercial fishers with a N2 netting endorsement that allows the taking of Barramundi and other species except Sharks
- ❑ The recreational Barramundi fishery is based on line fishing using both bait and lure

The following management rules and closures (*figure 2*) apply to Barramundi fishing in the Fitzroy River:

- ❑ A slot size limit applies with only fish from 580-1200mm able to be legally taken
- ❑ A recreational bag limit of 5 fish in possession
- ❑ A closed season from 1 November-31 January to protect spawning stocks
- ❑ A closure to all fishing is in place from the Barrage to 400m downstream
- ❑ A permanent netting closure in the city area from the Barrage downstream to Gavial Creek about 5km downstream
- ❑ A weekend closure to netting downstream of Gavial Creek to the "cut through" around 23km downstream from Gavial Creek

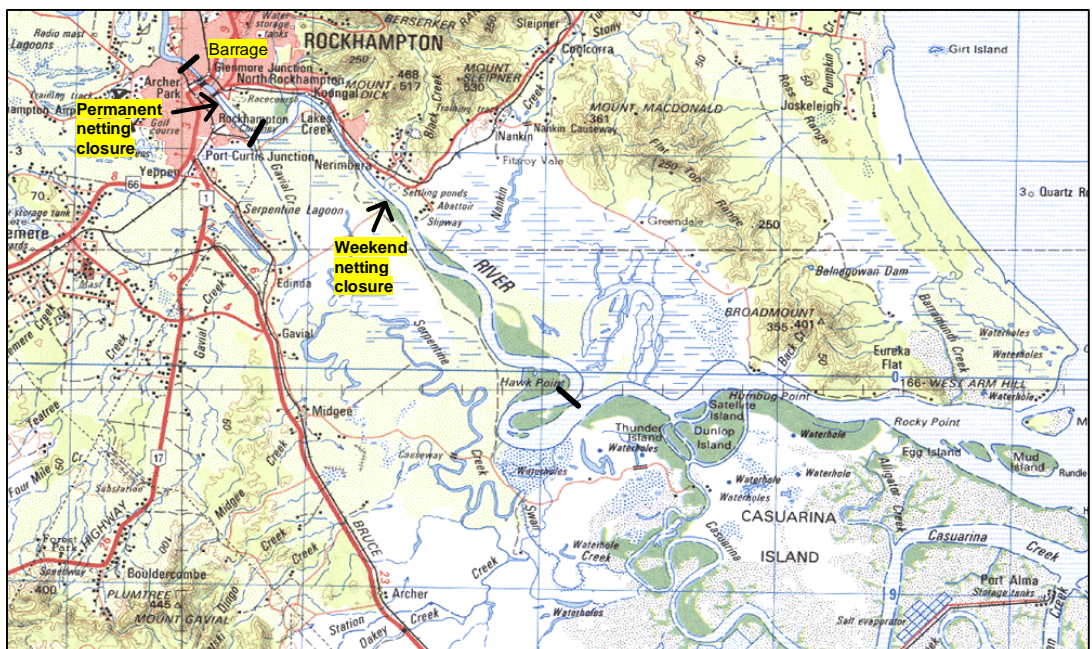


Figure 2: Closures to commercial netting in the Fitzroy River

The fishing year was defined by fishing seasons however these were adjusted so that the Barramundi closed season was within a single season:

Seasons were defined as:

- ❑ autumn being Feb-Apr
- ❑ winter being May-July
- ❑ spring being Aug-Oct
- ❑ summer being Nov-Jan (closed season)

7. WHAT INFLUENCES FISHING?

Both commercial and recreational fishing occur throughout the year however there is a closed season for Barramundi over summer. During that time both commercial (except netting) and recreational fishing continues but targets other species. The major influence on fishing effort is flooding associated with river flows or local runoff from rainfall.

Commercial fishing effort for Barramundi is characterised by peak fishing activity following the opening of the season from February-April. This is followed by a period of lesser activity from May-August (coinciding with colder water temperatures over winter) with an upsurge again in September-October before the next closed season. No commercial fishing for Barramundi occurs during the closed season.

Recreational fishing effort for Barramundi is similar to commercial fishing with peak activity occurring when the season opens in February. However recreational fishing is often curtailed by wet season flooding (which affects commercial fishing to a lesser extent). There is little recreational fishing for Barramundi over winter as low water temperatures reduce Barramundi feeding and activity and therefore catchability. There is an upsurge in recreational fishing activity as the weather warms up in September-October. Recreational fishing continues through the closed season however all Barramundi taken are released.

Tides also influence fishing as there is a 4-5m tidal range³ on spring tides. Strong currents during spring tides limit both commercial netting and recreational line fishing. Water clarity can be nil for much of the year, especially in years of flooding, due to high sediment loads and large tides. This does not have much effect on commercial fishing effort but does limit recreational fishing especially for those fishing with lures.

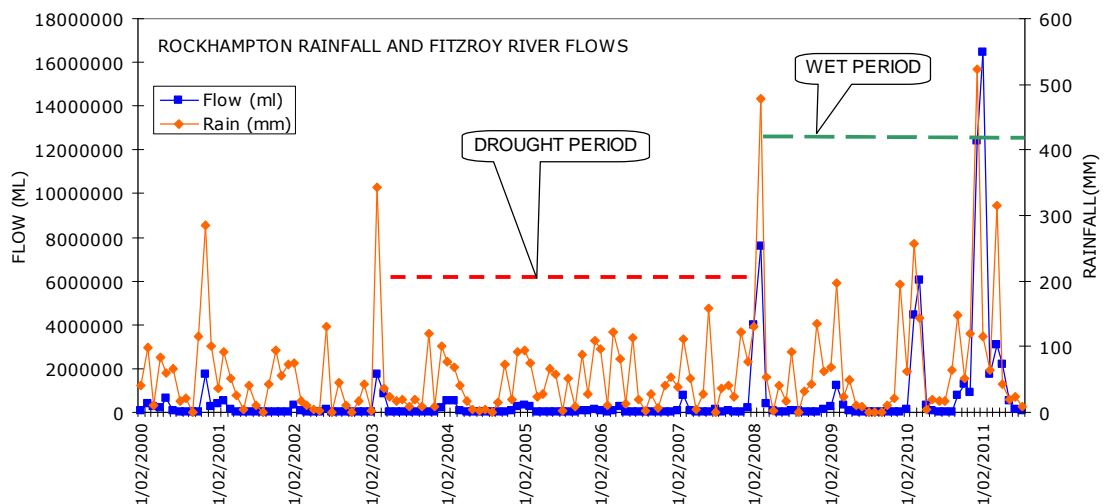


Figure 3: Monthly Fitzroy River flows (ml) and monthly Rockhampton Rainfall (mm) from 2000-2011

Figure 3 shows monthly Fitzroy River flows and monthly rainfall at Rockhampton from 2000-2011⁴. From autumn 2003 to spring 2008 there was a prolonged drought period followed by a wet period from spring 2008 until the present. In 2010-11 there was flooding in the river from September-April with a major flooding peak in January. Barrage gates (figure 4) were open for much of that time and the estuary was mostly fresh, especially in the city reach. This was the largest flooding in the Fitzroy River since 1991 peaking at 9.2m, the 5th largest flood on record and lasted much longer⁵.

³ Tidal data for Port Alma available at www.msg.qld.gov.au/qldtides

⁴ Data on rainfall obtained from Bureau of Meteorology website www.bom.gov.au for Rockhampton Aero station 039083 at 23.38°S 150.51°E and river flows from Department of Environment and Resource Management Gap station 130005A at 23.09°S 150.11°E

⁵ Flood summary for the Fitzroy River at Rockhampton - December 2010 and January 2011 available at www.bom.gov.au

This had a significant impact on fishing effort, particularly recreational effort during January-February when the flood was at its highest. In late January the Bruce Highway south of Rockhampton was cut by the flooding for a period of around 3 weeks, which not only isolated the city from the south it drowned out most of the boat ramps and resulted in almost no boat fishing effort.



Figure 4: Barrage gates open and the Fitzroy River in full flood in January 2011

8. WHO GOES FISHING?

Commercial fishers with an N2 endorsement can net fish for Barramundi and other species, except Sharks. No data are available on where commercial fishers come from to fish the Fitzroy River however there are 14 commercial licenses⁶ that are based in the Rockhampton area that are regularly used in netting the river for Barramundi.

There are no limitations as to where fishers with an N2 netting endorsement can fish on the east coast so that it is not possible to determine where commercial fishers come from to fish the Fitzroy River. There were 32 licensed operators that fished in CFISH grids R29 and R30 (see section 9) in 2010. Currently there are a total of 159 N2 netting endorsements on the east coast so that in 2010 20% of fishers with that endorsement fished in grids R29 and R30⁷.

For recreational fishers details of the residence (home town) of those taking part in a fishing trip were recorded as part of the details of a fishing trip. There were a total of 1,145 fishing trips from May 2010 to April 2011 where the home town was recorded. Fishing in the Fitzroy River is predominantly undertaken by local fishers with only 1% of fishers living more than an hour's drive from the boat ramp used. Of the local fishers 78.4% lived in Rockhampton. *Figure 5* provides a summary of the residence of fishers that fished in the Fitzroy River.

⁶ From local Queensland Seafood Industry Association branch

⁷ Data from Fisheries Queensland Commercial Logbook Program

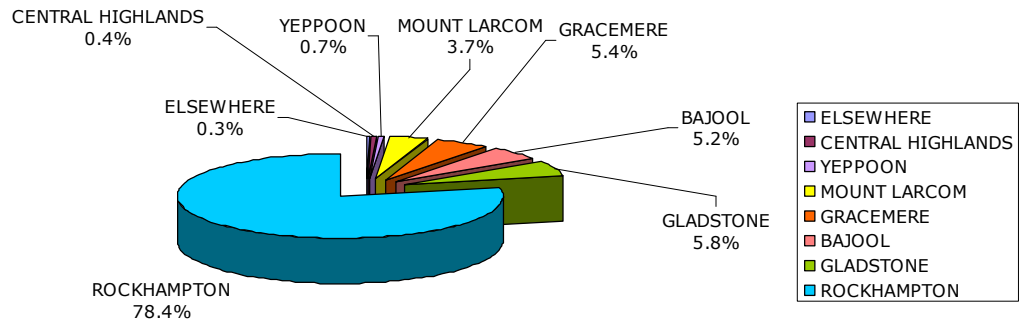


Figure 5: Residence of recreational fishers that fished the Fitzroy River in 2010/11

9. WHERE DID THEY GO FISHING?

Commercial fishing occurs in all areas of the river and delta waterways downstream from Gavial Creek while recreational fishing occurs in all areas from 400m downstream from the Barrage. There are 4 key boat ramps that are used to fish the Fitzroy River with locations shown in *figure 1*. These are:

- Nerimbera
- Reaney Street in North Rockhampton
- Southside in Quay Street South Rockhampton
- Port Alma

A further 4 ramps are used sporadically to fish the Fitzroy River. These are:

- Fitzroy Motor Boat Club (FMBC)
- Thompson Point
- Sandfly Creek
- Ramsay Crossing

The Nerimbera ramp (*figure 6*) is located on the north side of the Fitzroy River about 15km downstream from the city. It is the primary ramp used to fish the middle reaches of the Fitzroy River.

The ramp off Reaney Street (*figure 6*) is on the north side of the river in the centre of the city and provides access to the upper tidal reaches of the river to the fishing limits 400m downstream of the Barrage. This ramp can be badly affected by silt and in some years can only be used around the top of the tide. In 2010-11 the ramp was useable throughout except during the flood.

The Southside ramp off Quay Street (*figure 7*) was under construction at the commencement of this project and was scheduled for completion in July 2010 however was not completed and opened to the public until early December.

The ramp at Port Alma (*figure 7*) is the main ramp used to access the mouth of the Fitzroy River, Raglan Creek, Casuarina Creek, Inkerman Creek, Connor Creek, northern end of the Narrows, Curtis Island and reefs offshore from Curtis Island.

The ramp at the Fitzroy Motor Boat Club is a private ramp for club members only. It is mostly used by people that have boats moored in the city reaches of the river with only occasional use for fishing. With the new Southside ramp virtually next door use of this ramp for fishing has diminished to close to nil.



Figure 6: Nerimbera boat ramp provides access on the north side to the mid reaches of the Fitzroy River (left) and northside city ramp at Reaney Street (right)



Figure 7: New southside boat ramp off Quay Street opened in December 2010 (left) and boat ramp on Raglan Creek at Port Alma (right)

There is a rough rock ramp at Thompson Point and several rough dirt ramps in the area that are used to fish the lower reaches of the Fitzroy River. However usage is low due to the poor quality of the boat ramp, 15km of gravel road access and being in an isolated area where vehicle damage is an issue.

There is also a rough gravel ramp at Sandfly Creek that provides access to Connor Creek and other waterways at Port Alma. Access to this ramp is poor by a rough bush track which is often impassable after rain. Use is very limited and it is mostly used by people living in the Mount Larcom area.

The ramp at Ramsay Crossing is well used however effort is mostly in the Narrows and adjacent creeks on the mainland and Curtis Island. Some Gladstone fishers use the ramp to access creeks at the northern end of Curtis Island.

Where commercial fishing occurs is recorded on CFISH grids that cover the whole state. Grids are 30' of latitude x 30' of longitude or approximately 51km x 56km in the Rockhampton area. Grids R29 and R30 cover the Fitzroy River delta and the coast north to just south of Corio Bay as shown in *figure 8*. While grid R29 covers some coast to the north of the river most of the effort within that grid occurs within the river.

Recreational fishing occurs throughout the river and details of fishing trips have been recorded as being within the Suntag grid maps as shown in *figure 9*. The maps are:

- Fitzroy River FRR
- Raglan Creek RAG
- Curtis Island CIS

While there are some differences in the areas for commercial and recreational fishing trips in the river most of the fishing occurs in the common area.

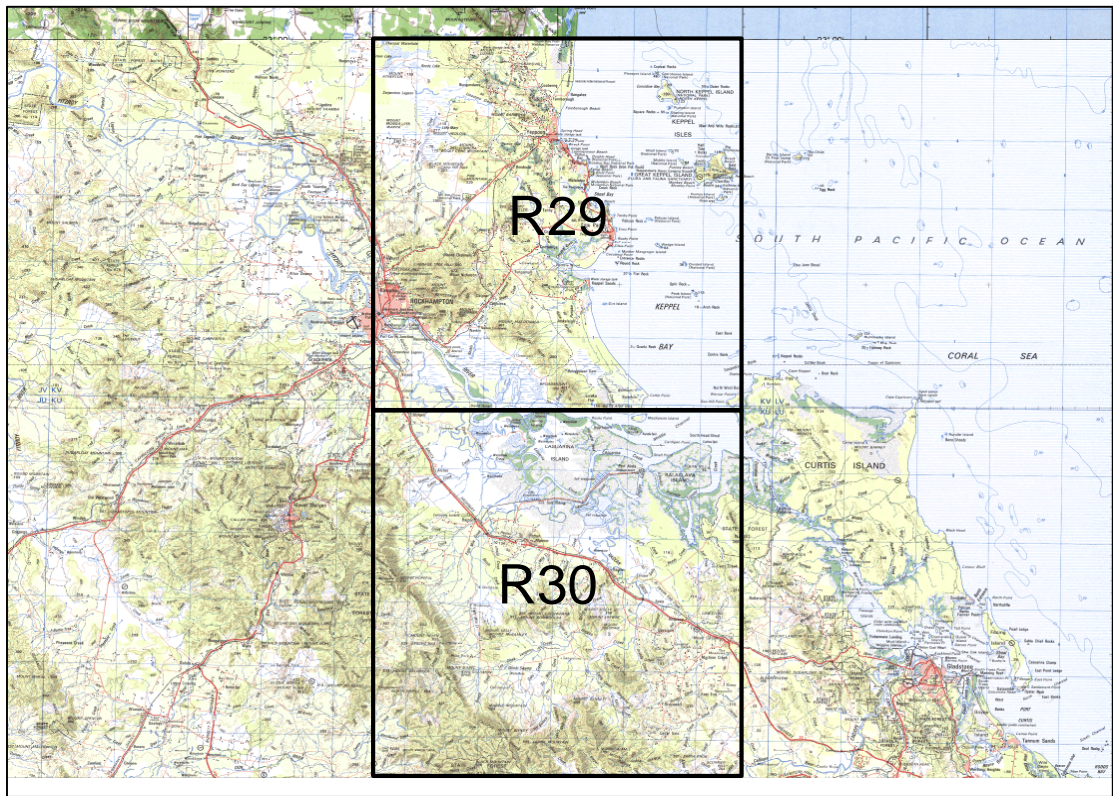


Figure 8: CFISH grids for commercial fishing in the Fitzroy River

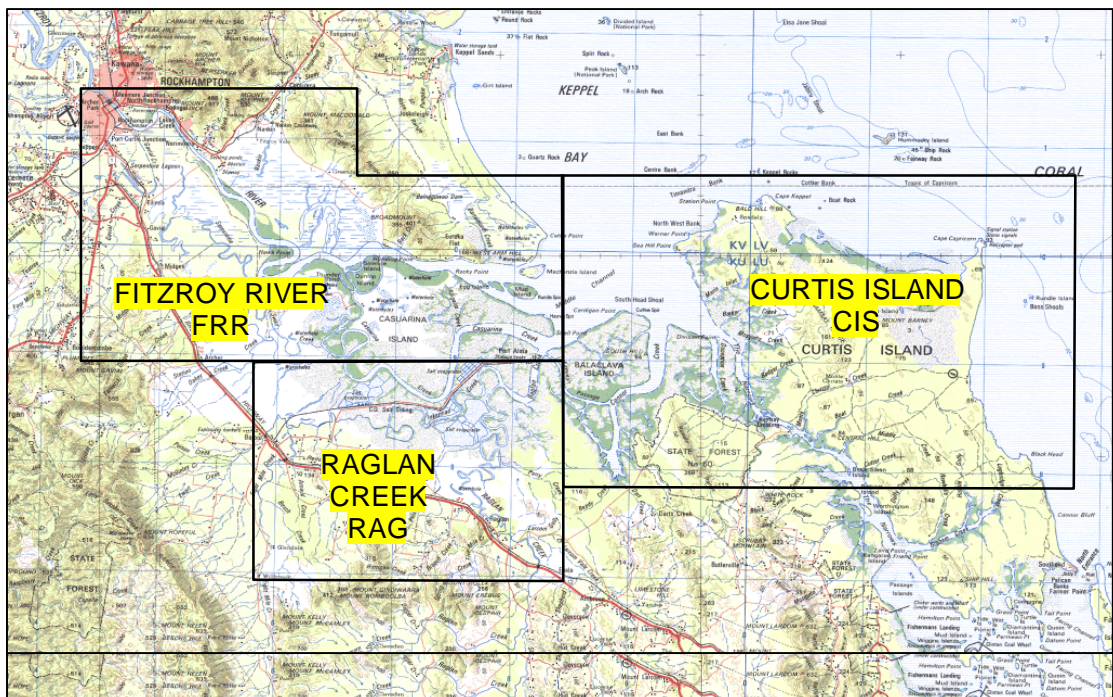


Figure 9: Suntag grid maps used to record recreational fishing trips in the Fitzroy River

There are a number of freshwater and brackish lagoons that are only fished by recreational fishers. A number of key lagoons as shown in *figure 10* have public access and are fished:

- Frogmore Lagoon (freshwater)
- Woolwash Lagoon (freshwater)
- Yeppen Lagoon (freshwater)
- 12 Mile Creek (brackish)
- Blacks Lagoon on Raglan Creek (freshwater)
- Nankin Creek Lagoon (freshwater monitoring site but no public access)

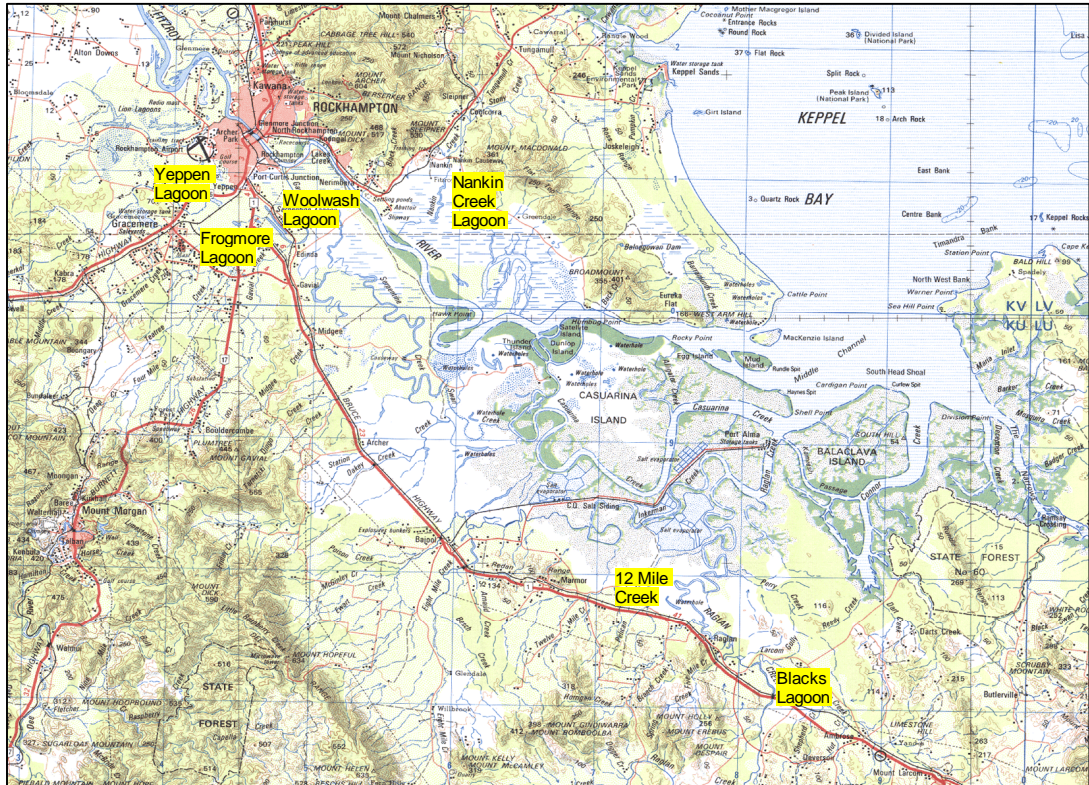


Figure 10: Key freshwater and brackish lagoons on the Fitzroy River delta

10. WHEN DID THEY GO FISHING?

The commercial fishing year for Barramundi is from February-October. While no data are available on when commercial fishers go fishing on a daily basis, from information provided by fishers netting is both a day and night time activity.

Data were obtained for CFISH grids R29 and R30⁸. These data provide the number of fishing days each month within each grid. This provides a measure of when commercial fishing occurs, however for months where there was less than 5 fishers the data are not available. Data for 2011 are not yet available.

Figure 11 shows the number of days fished each month from 2000-2010. Peak commercial fishing times are at the start of the fishing year in February and again in October just before the closed season. During winter there is reduced fishing effort for Barramundi due to low water temperatures and reduced fish activity. The highest number of fishing days was 300 in October 2003 while there were 210 days in February 2010.

⁸ Data from Fisheries Queensland Commercial Logbook Program

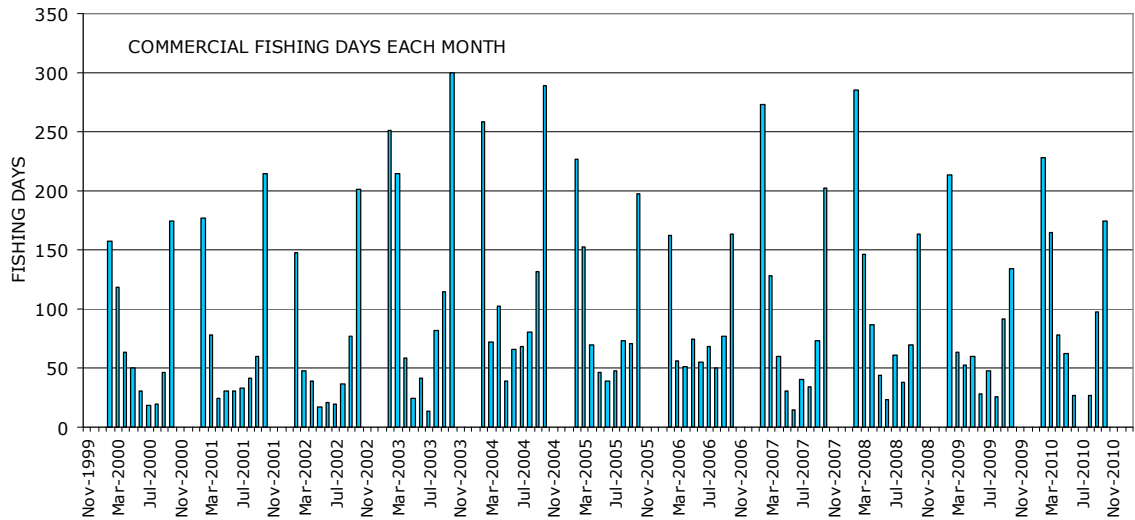


Figure 11: Numbers of days of commercial netting in CFISH grids R29 and R30 from 2000-2010

For recreational boat fishing trips the time of leaving the boat ramp and time of return were recorded. A total of 576 boat trips were available that recorded start and finish times for 2010-11. A profile of trip times in *figure 12* shows that most trips start in the early morning around dawn, trips occur during daylight hours and trips are completed shortly after dark. A likely reason for the low number of night trips is that risks associated with crocodiles increase significantly during the night.

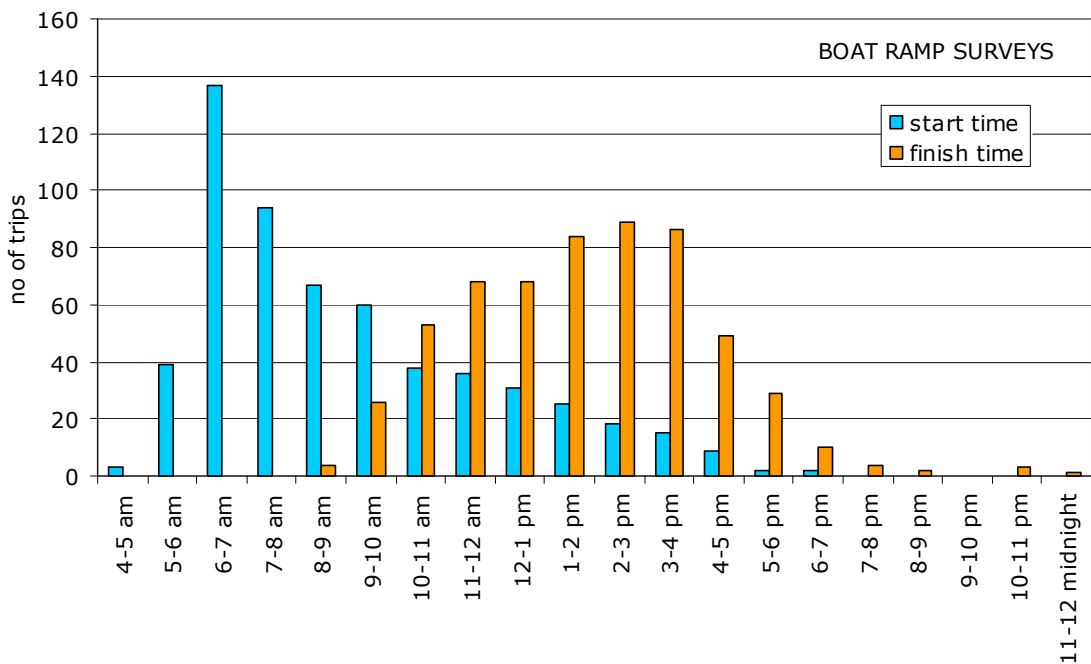


Figure 12: Start and finish times for boat fishing trips from all ramps in the Fitzroy River

For 2010-11 there was a significant increase in the number of landbased fishing trips compared with previous years. This resulted from boat ramps being flooded for much of January and into February and boat fishing during the flood was considered high risk due to the strong current. Also the movement of fish into the lagoons encouraged fishing there.

There were a total of 301 trips to the lagoons that recorded start and finish times in 2010-11. A profile of trip times in *figure 13* shows that there are two main fishing periods being predominantly early morning with some trips in the late afternoon. Likely reasons for this are Barramundi are most active in the early morning and late afternoon and fishing is not that attractive during the heat of the day. Also a number of fishers undertake landbased trips either before or after work. There were few trips during the night with concern about crocodiles being a factor.

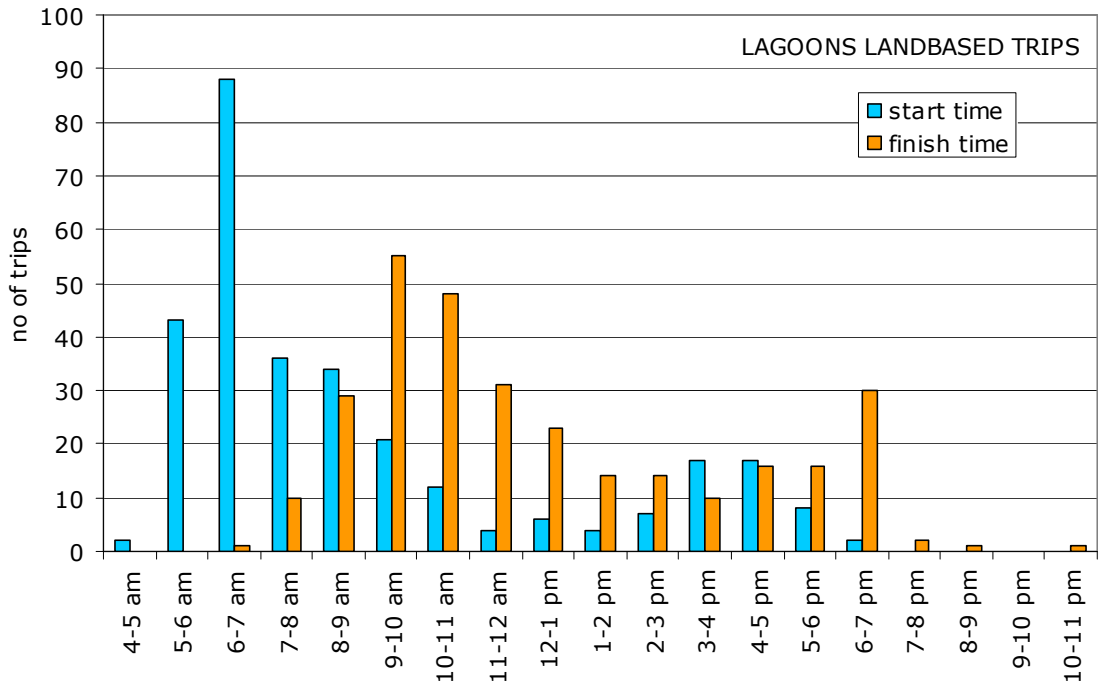


Figure 13: Start and finish times for landbased trips to Fitzroy delta lagoons

As well as landbased trips to lagoons there were a number of landbased trips in the river. Most of these were in the city reaches of the river. These have been treated separately as the catch rates for the trips are not the same as boat trips or trips to the lagoons.

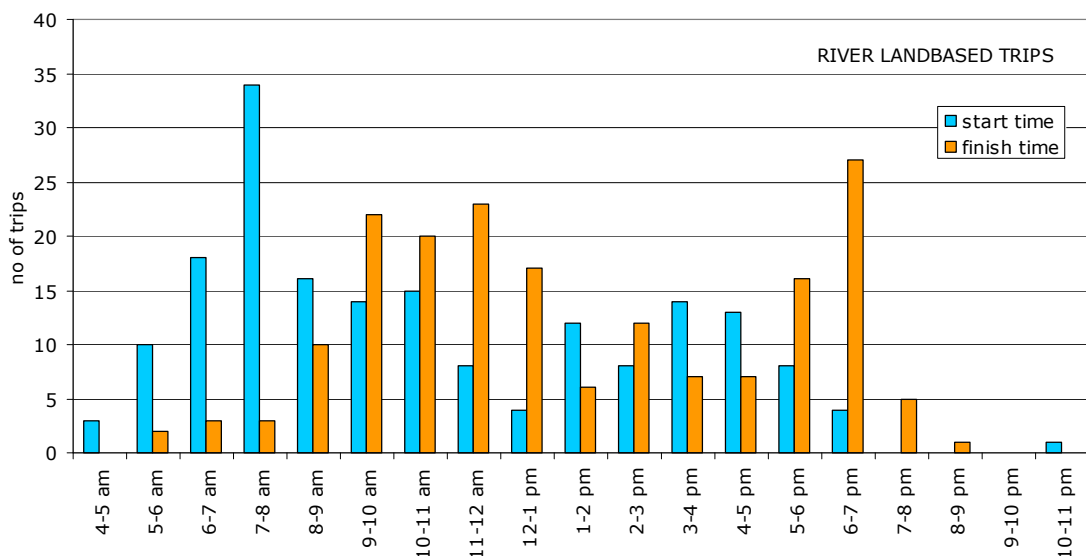


Figure 14: Start and finish times for landbased fishing trips to the Fitzroy River

There were a total of 182 landbased trips to the river where start and finish times were recorded. A profile of trip times in *figure 14* shows that landbased trips to the river are similar to those to the lagoons with peaks in fishing in the early morning and late afternoon. Reasons for these trips are similar to those for the lagoons.

11. WHAT WAS THE FISHING EFFORT?

Data were obtained for CFISH grids R29 and R30⁹ showing the number of licensed operators fishing each year and the total number of days fished. This provided a measure of commercial fishing effort. Data are not yet available for 2011.

Figure 15 shows the number of commercial fishing days each year from 2000-2010. Over those 11 years there was an average of 843.3 fishing days/year. In 2010 there were 870 fishing days.

The numbers of licenses that have operated in those grids have averaged 35.9 per year with 32 operators in 2010. There are currently a total of 159 N2 netting endorsements on the east coast so that in 2010 20% of fishers with that endorsement fished in grids R29 and R30.

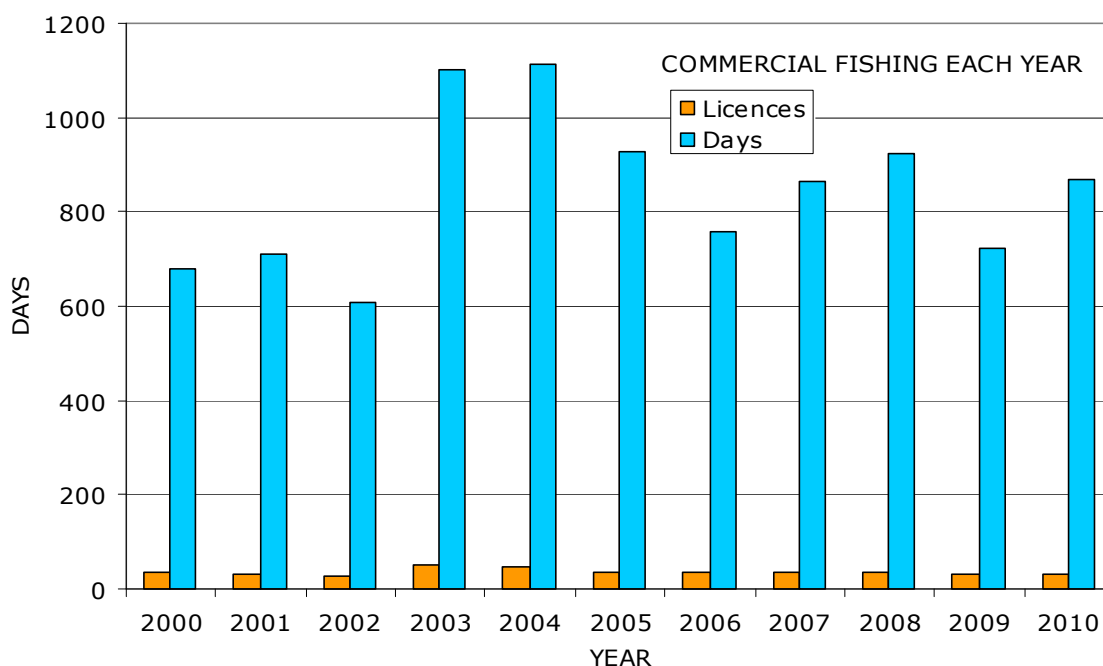


Figure 15: Total number of commercial fishing days in CFISH grids R29 and R30

Recreational fishing effort in the Fitzroy River was categorised as being carried out from a number of boat ramps, from landbased locations along the river and landbased locations at a number of freshwater or brackish floodplain lagoons accessible to the public.

Boat fishing effort was determined by counting trailers at boat ramps at various times of the day. A target was set for the number of days of trailer counts for each boat ramp to ensure that a reliable estimate of annual usage could be made.

⁹ Data from Fisheries Queensland Commercial Logbook Program

The target for trailer counts at the 4 key boat ramps was counts on 400 days (100 days at each ramp) for the year. The key ramps were:

- Reaney Street in North Rockhampton
- Southside in Quay Street Rockhampton
- Nerimbera
- Port Alma

The target for trailer counts at the 4 minor boat ramps was counts on 120 days (30 days at each ramp) for the year. The minor ramps were:

- Thompson Point
- Fitzroy Motor Boat Club (FMBC)
- Sandfly Creek
- Ramsay Crossing at the Narrows

The FMBC ramp is a private ramp available to members only, mostly used by boat owners that have boats moored in the river. With the opening of the Southside ramp just a few 100m downstream the use of this ramp by fishers has virtually ceased.

The Ramsay Crossing ramp provides access to the Narrows with effort both to the north (50%) and the south (50%). Only effort to the north is relevant to the Fitzroy River.

To estimate the number of fishing trips from each ramp the start and finish times of trips was used to calculate the number of boats on the water each hour. A correction factor was then calculated based on the number of boats on the water compared with the total number of boats over the day. This correction factor was then applied to the trailer counts at a particular hour to estimate the total trips per day. A robust correction factor was obtained by using as many trips as available pooled for boat ramps with a similar profile of usage. This was then used to estimate the total number of trips each day for days when trailer counts were available. An average number of trips per day was then obtained for each month and multiplied by the number of days in the month.

Calculating trips each month:

$$\begin{aligned} \text{Total trips}_{(\text{day})} &= \text{trailer count}_{(\text{hour})} \times 1/\text{CF}_{(\text{hour})} \\ \text{where Correction factor } \text{CF}_{(\text{hour})} &= \text{boats fishing}_{(\text{hour})} / \text{total boats}_{(\text{day})} \\ \text{and Boats fishing}_{(\text{hour})} &= \text{boats}_{(\text{left ramp})} - \text{boats}_{(\text{returned ramp})} \\ \text{Total trips}_{(\text{month})} &= \text{average total trips}_{(\text{day})} \times \text{days}_{(\text{month})} \end{aligned}$$

In months affected by flooding the number of trailers dropped to 0 when the ramps were flooded. These months were split and separate estimates of trailers were made for the number of day affected. This provided a more realistic estimate of the number of trailers per month.

For landbased fishing the river and lagoons were divided up into a number of sectors to count the number of fishers. A roving survey was carried out to count the number of landbased fishers and obtain catch details in each sector. Landbased effort was then separated into those fishing the river, those fishing the Gavial Creek lagoons and those fishing the 12 Mile Creek and Raglan Creek.

The target for landbased fishers was counts on 50 days for the year as landbased effort was considered to be low. However the flooding in the river reduced boat fishing and resulted in a significant increase in landbased effort, particularly at the lagoons due to good number of Barramundi in the lagoons following the flooding. Therefore the target for counts was raised to 150.

The total number of landbased fishers each month was calculated using the same process as for boat trips with the correction factor derived from start and finish times of landbased trips.

Figure 16 shows the percentage of days in the year where trailer counts have been made at boat ramps and trips by landbased fishers at the river and lagoons. The high count at Southside ramp includes days prior to the ramp being opened to use in early December.

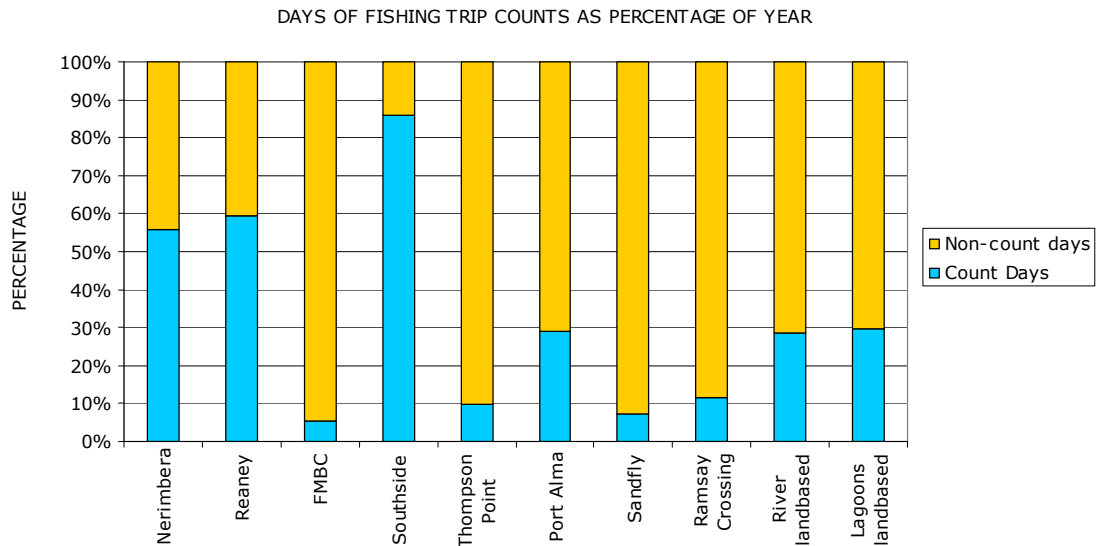


Figure 16: Days of fishing trip counts as a percentage of the year

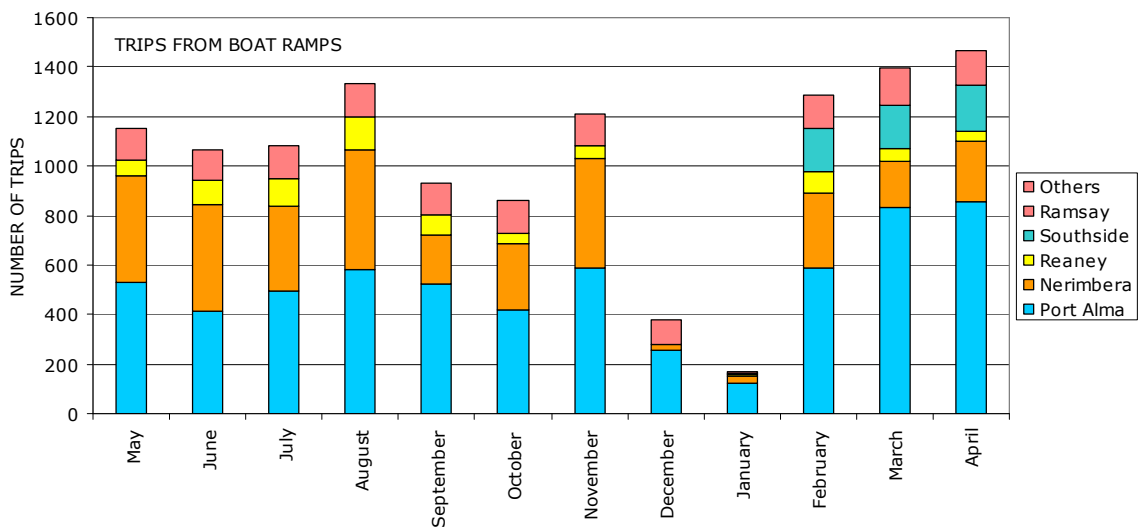


Figure 17: Adjusted average number of trips each month from key boat ramps in 2010-11

There were 840 days of trailer counts at the 4 key boat ramps (target was 400) with over 100 days of counts at each ramp.

There were 124 days of trailer counts at the 4 minor ramps (target was 120) however at 2 of the ramps there were less than 30 days of counts. Counts were only made on 20 days at the FMBC ramp as it virtually ceased being used for fishing in October 2010. Counts on 26 days was also low at the Sandfly ramp as it is accessed by a rough 4WD track which was often impassable for much of the wet season. Use of the Thompson Point ramp was also limited due to minor to major flooding that continued from September-February and the dirt access road was often cut by heavy rain.

Figure 17 shows the adjusted number of fishing trips each month for 2010-11. The low figures for the river ramps for September coincide with the initial flooding in the river. The low figures from December-January coincide with the major flood. The Port Alma area was less affected by the flooding and a high number of trips occurred from this ramp from February-March.

For Ramsay Crossing ramp fishing can be either to the north in the Narrows which is within the study area or to the south towards Gladstone Harbour. It is estimated that 50% of trips are to the north. Effort from other minor ramps is very low and no estimate is available for those ramps, however this would not have significantly added to the total number of trips.

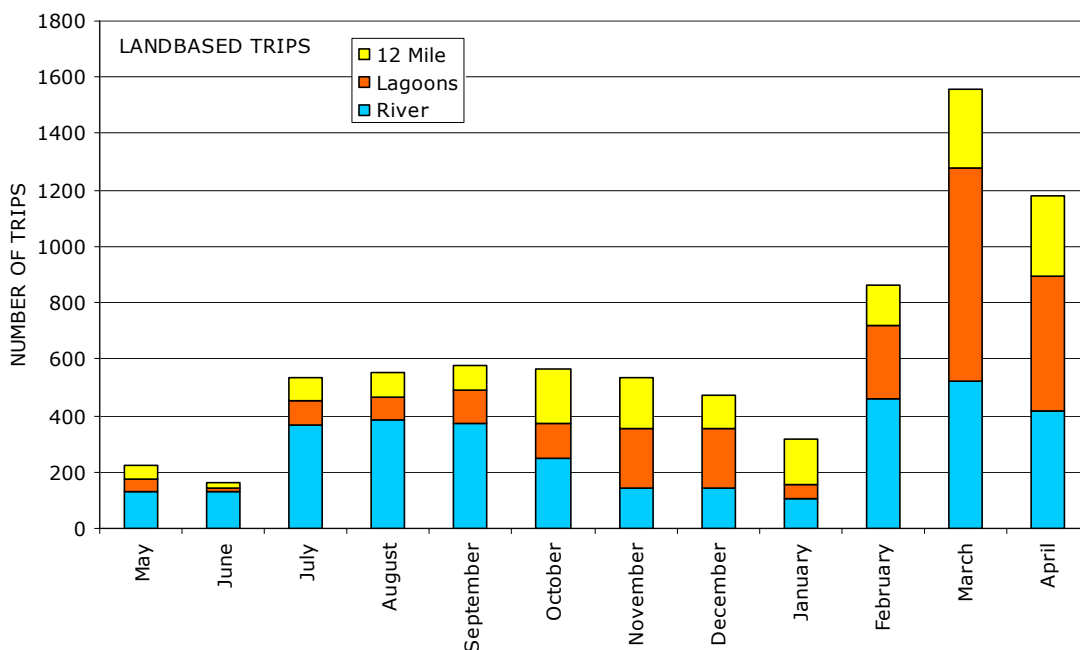


Figure 18: Adjusted average number of landbased trips each month in the Fitzroy River in 2010-11

Figure 18 shows the adjusted number of landbased trips each month to the river, lagoons and 12 Mile Creek for each month for 2010-11. The low number of trips for December-January coincided with the flooding in the river.

Landbased trips to the lagoons were primarily to the following:

- Frogmore Lagoon
- Woolwash Lagoon
- Yeppen Lagoon
- 12 Mile Creek

Data on trips to the first 3 lagoons were aggregated as the lagoons are in close proximity while the 12 Mile Creek has been treated separately. Trips to the lagoons were low in January as they were flooded and inaccessible. The 12 Mile Creek was less affected and remained accessible to fishers from Gladstone.

Table 1 provides a modelled annual estimate of recreational fishing trips for the Fitzroy River. It was estimated that in 2010-11 there were 12,331 boat trips and 7,530 landbased fishers.

Ramp/location	Total
Nerimbera	3380
Reaney	770
Southside	543
Port Alma	6198
Ramsay Crossing	1440
Minor ramps	0
All ramps	12331
River Landbased	3411
Lagoons Landbased	2442
12 Mile Creek	1677
All landbased	7530

Table 1: Estimate of annual recreational fishing trips in the Fitzroy River for 2010/11

12. WHAT WAS THE CATCH?

Data were obtained for CFISH grids R29 and R30¹⁰ showing the weight in tonnes and kgs caught each year. This provides a measure of commercial fishing catch however for months where there was less than 5 fishers the data are not available. This means that there could be a slight underestimate of commercial catch. Data are not yet available for 2011.

Annual catch per unit effort (CPUE) was calculated as:

$$\text{CPUE}_{\text{Annual}} = \text{Weight of fish caught (kgs)}/\text{Number of days fished}$$

Figure 19 shows the weight of the annual commercial catch of Barramundi in grids R29 and R30 from 2000-2010. The catch peaked at 49.6 tonnes in 2003 while in 2010 the catch was 37.9 tonnes however was as low as 18.9 tonnes in 2002.

CPUE ranged from a low of 20.6kg/day in 2000 to a high of 46.3kg/day in 2007. The CPUE in 2010 was 43.6kg/day.

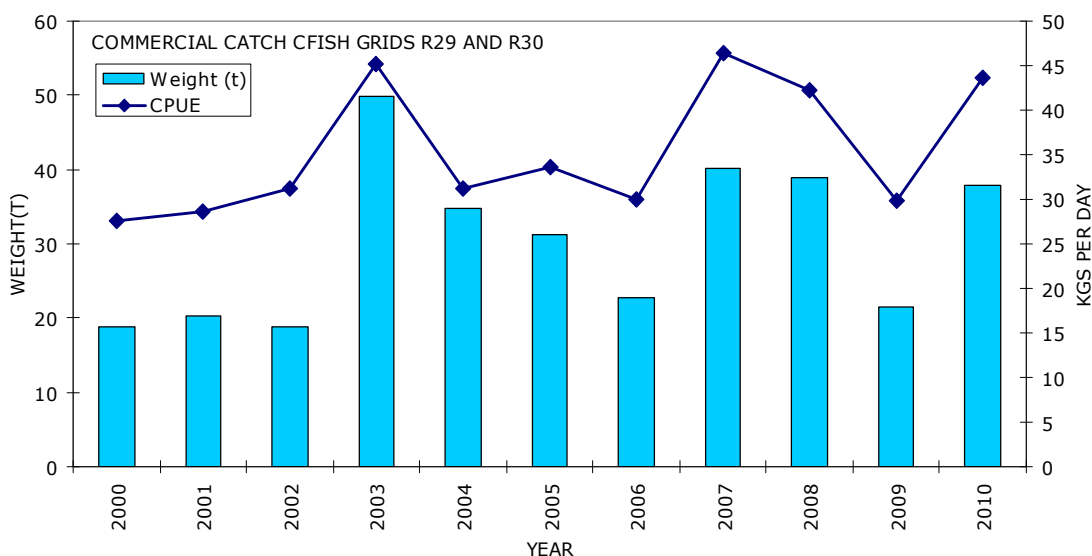


Figure 19: Annual commercial catch of Barramundi in CFISH grids R29 and R30

¹⁰ Data from Fisheries Queensland Commercial Logbook Program

Recreational catch data were obtained from boat ramp surveys, roving creel surveys and fishing trip details being provided by fish taggers and other recreational fishers. The target for the year was details of 800 fishing trips (estimated 10% of total fishing effort).

Details obtained from fishing trips were:

- Date of trip
- Number of fishers
- Boat ramp or landbased location
- Start and finish times of the fishing trip
- Catch kept and released by species

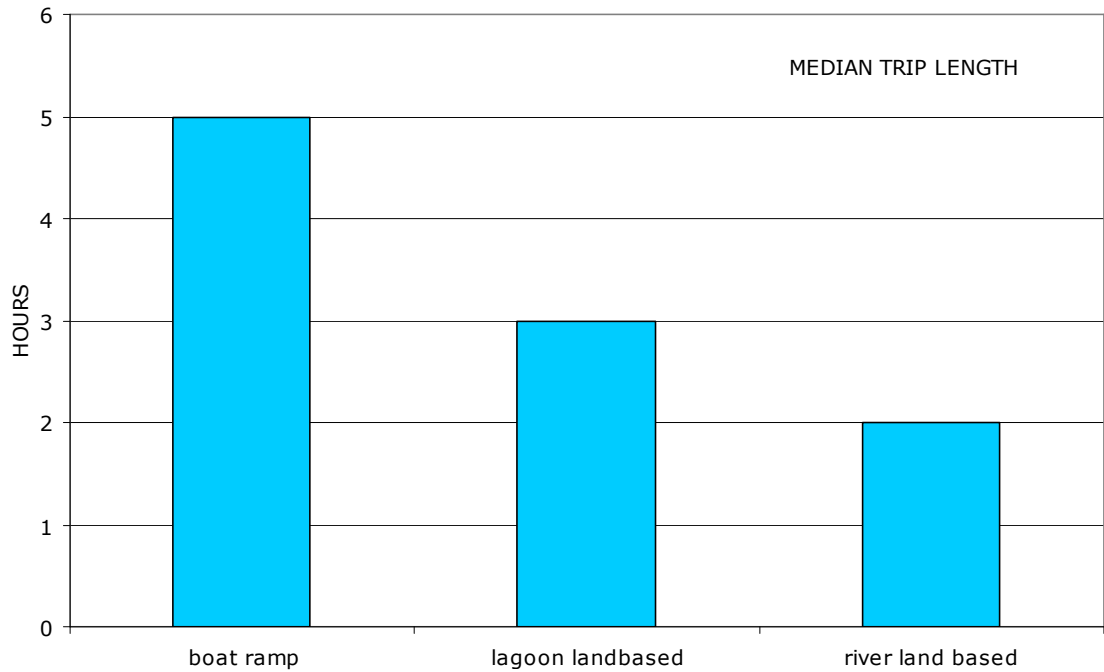


Figure 20: Median trip length for trips in the Fitzroy River

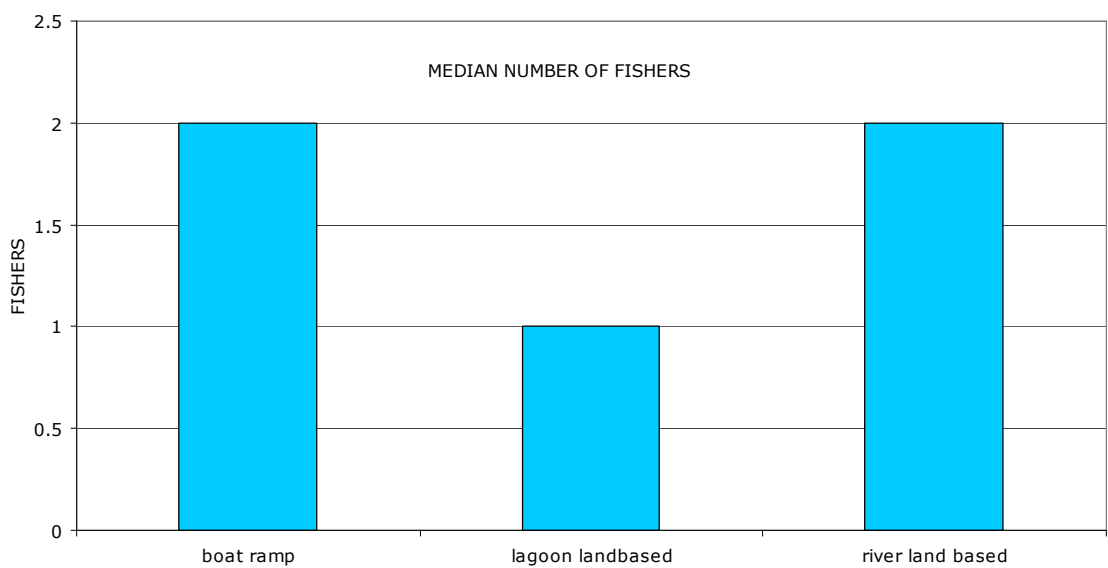


Figure 21: Median number of fishers

Figure 20 shows the median trip length while figure 21 shows the median number of fishers per trip. A typical boating trip is 2 fishers fishing for 5 hours. A typical landbased trip to the lagoons is 1 fisher fishing for 3 hours while a typical landbased trip to the river is 2 fishers fishing for 2 hours.

A total of 1052 trips were recorded where catch details were provided. Figure 22 shows the catch rates for 2010-11 adjusted seasons based on the typical fishing trips while figure 23 shows the catch rate for fish kept. The high catch rates for boat fishing for spring and summer are influenced by the catch of Mud Crabs. For lagoon landbased fishing there were very few fish kept as most of the fish caught were undersized Barramundi that were released or tagged and released.

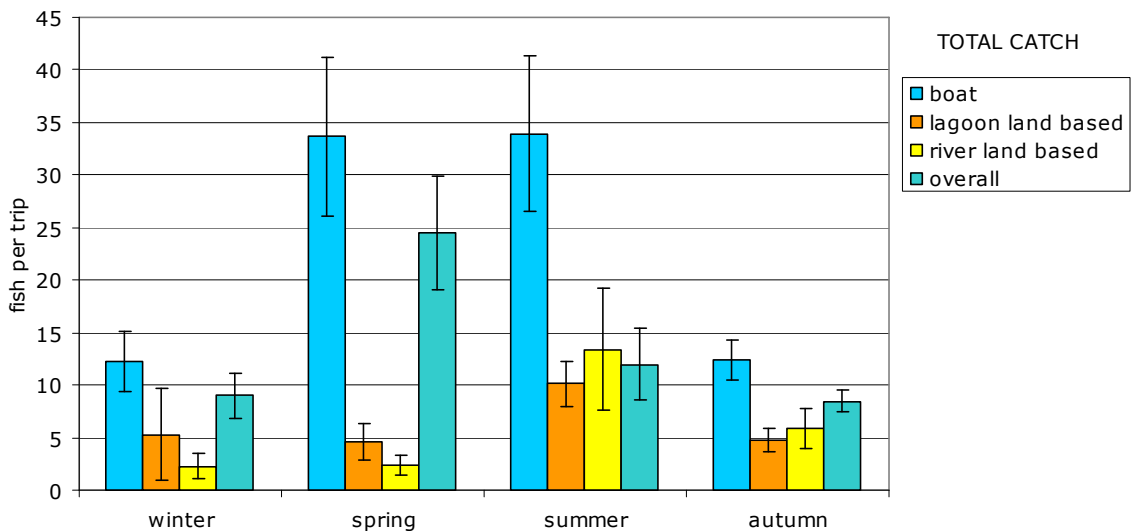


Figure 22: Catch rates for total fish caught on typical fishing trips by season for 2010-11

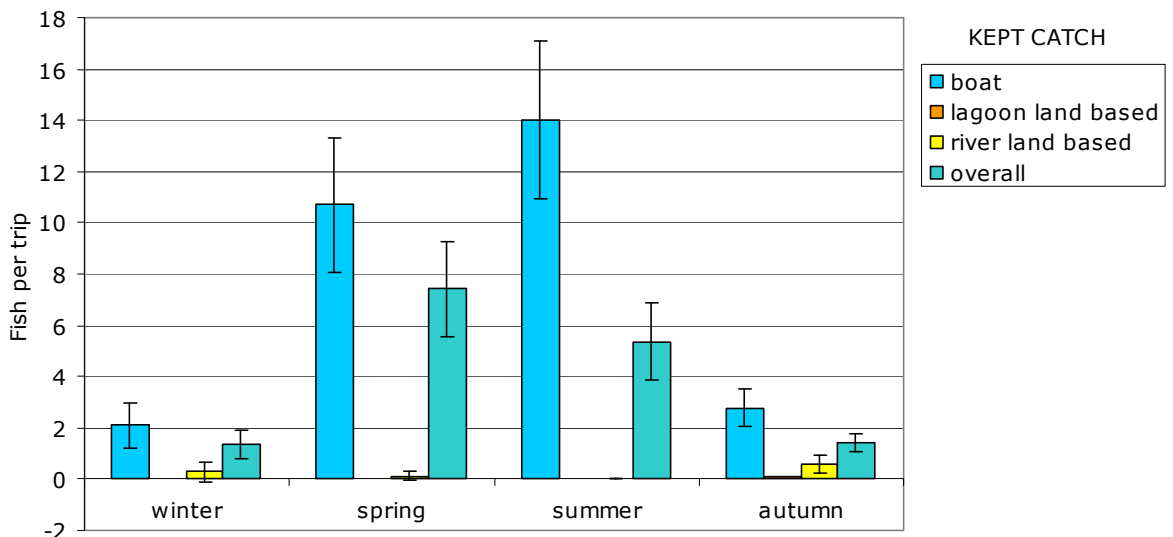


Figure 23: Catch rates for kept fish on typical fishing trips by season for 2010-11

Figure 24 shows the number of Mud Crab and the top 10 fish species caught in 2010-11. Mud Crab dominates the catch (37.7%) and the kept catch (55.3%) while Barramundi is the most caught fish species (28.9%) however the kept catch is low (3.5%). Mud Crab and Barramundi make up two-thirds (66.6%) of the catch while Mud Crab and Pikey Bream (10.2%) make up close to two-thirds (65.5%) of the kept catch.

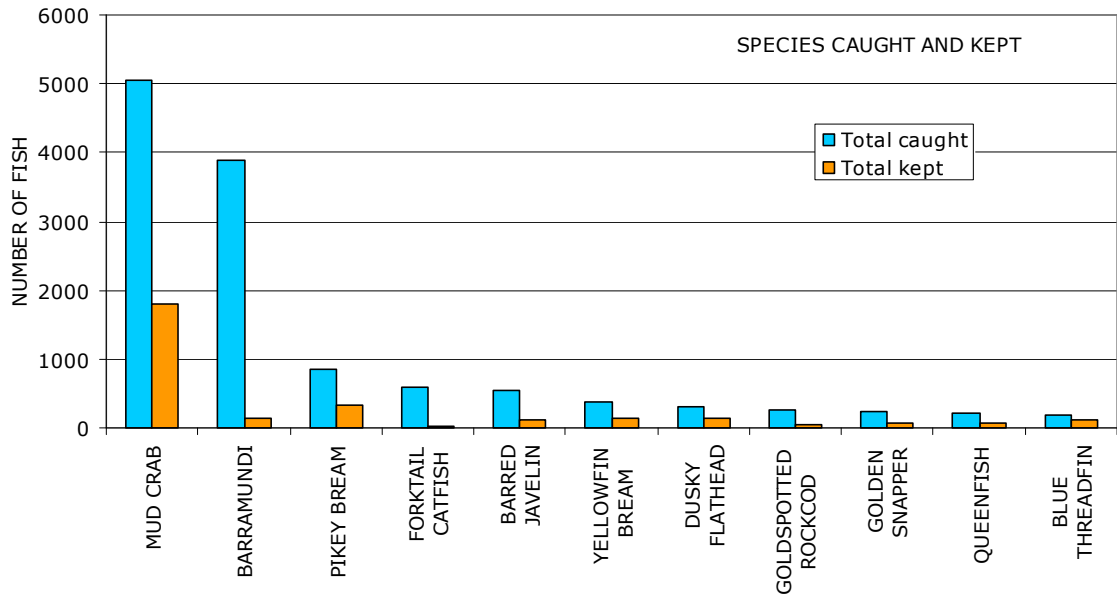


Figure 24: Numbers of Mud Crab and fish caught on 1052 trips in 2010-11

Estimate of Barramundi caught and kept					
	caught rate	kept rate	modelled trips	catch	kept
	fish/trip	fish/trip		estimated catch	estimated catch
Land River	2.52	0.21	3410	8581.21	711.98
Land lagoon	6.68	0.03	4120	27503.78	125.27
Boat Ramp	1.64	0.15	12330	20187.98	1895.28
Total				56272.97	2732.53

Table 2: Estimate of Barramundi caught and kept in 2010-11

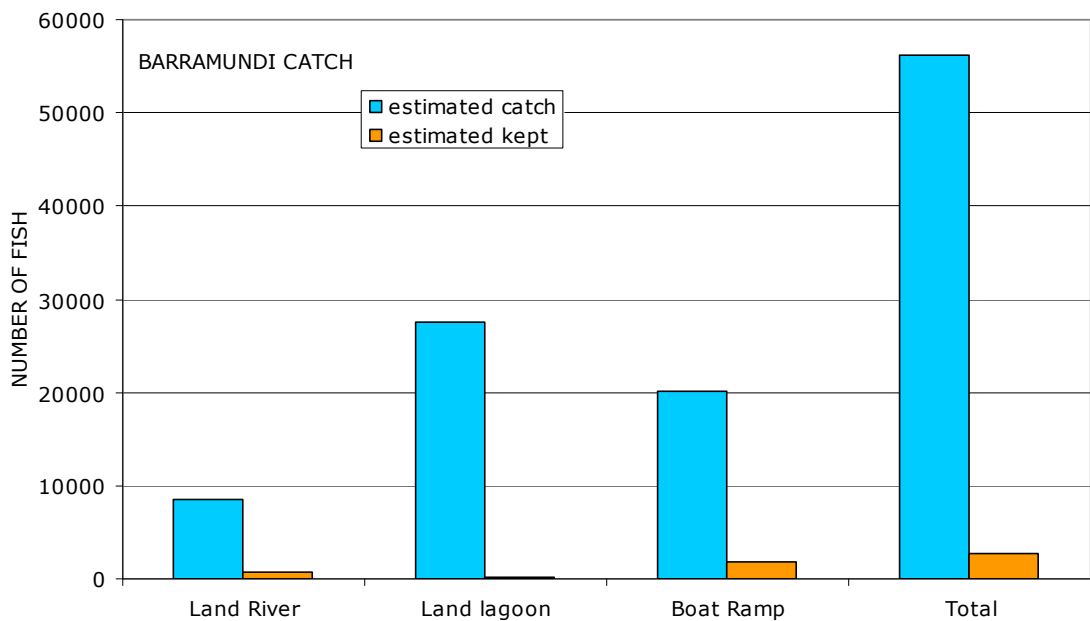


Figure 25: Estimate of Barramundi caught and kept based on habitat in 2010-11

Based on the catch details the catch rates for Barramundi caught and kept were calculated for landbased river trips, landbased lagoon trips and boat fishing trips. This was then combined with the modelled number of fishing trips for each habitat to provide an estimate of the Barramundi caught and kept as shown in *table 2* and *figure 25*. It was estimated that around 56,270 Barramundi were caught and 2,730 kept.

The average length of Barramundi kept by recreational fishers was 647mm. This equates to a weight of 3-3.5kg¹¹. Using 3kg as the estimated weight the recreational catch was 8.2 tonnes.

The estimated recreational catch of Barramundi is considered to be at the high end of the range as fishers who specifically targeted Barramundi may be over represented in the catch statistics.

13. WHAT WAS THE VALUE OF THE CATCH?

Data were obtained on the value of the commercial catch based on the Gross Value of Production (GVP) for CFISH grids R29 and R30¹².

Figure 26 shows the annual GVP of the commercial Barramundi catch from 2000-2010. The GVP ranged from a low of \$171,916 in 2000 to a high of \$456,888 in 2003. The GVP of the commercial catch was \$348,012 in 2010. With 32 licenses operating in 2010 the average return per licence was \$10,875.

There was no measure of the value of the recreational catch.

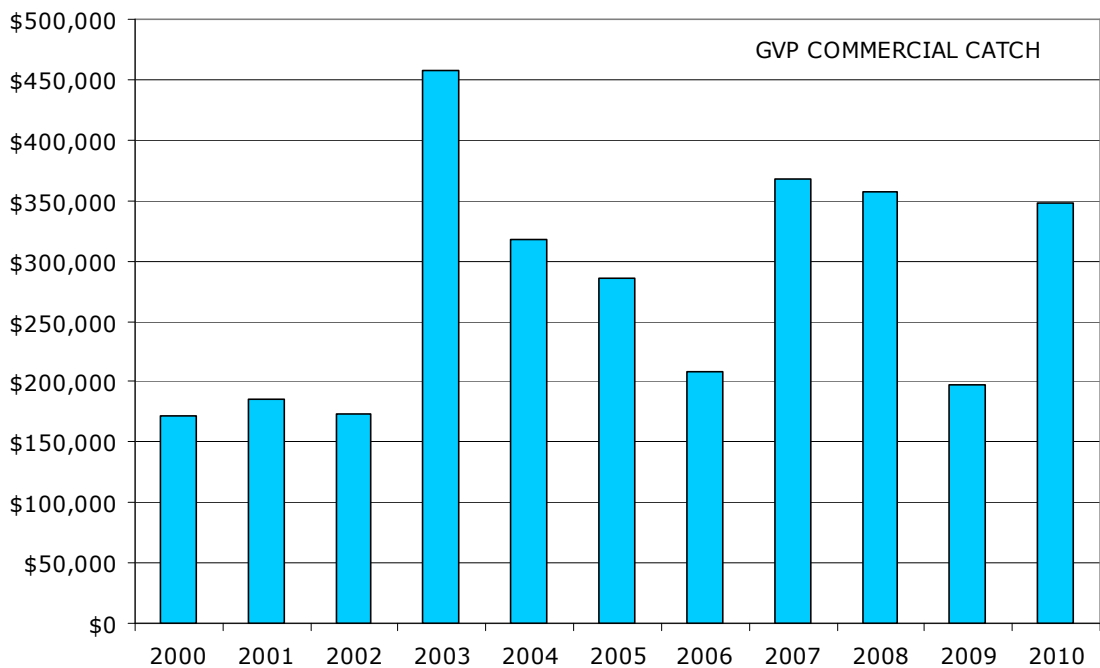


Figure 26: GVP of the commercial catch from 2000-2010

¹¹ From www.fishbase.org

¹² Obtained from Fisheries Queensland Logbook Program

14. WHAT WAS THE SIZE COMPOSITION OF THE CATCH?

Fisheries Queensland has been monitoring the commercial catch in Central Queensland through the Long Term Monitoring Program (LTMP) since around 2000. Measuring samples from the commercial catch has been ongoing since 2005. This allows the analysis of the size composition of the commercial catch.

From 2005-2010 there were 3,639 commercial fish measured including 1,108 in 2010. *Figure 27* shows the average size of commercially caught Barramundi from 2005-2010. The average size has remained reasonably constant around 800mm with the highest in 2009 at 827mm while it was the lowest in 2010 at 761mm.

Data on the size of Barramundi from the recreational catch was obtained by measuring fish during boat ramp surveys, from tagging records, trip sheets where lengths are recorded and from fish frames collected from recreational fishers.

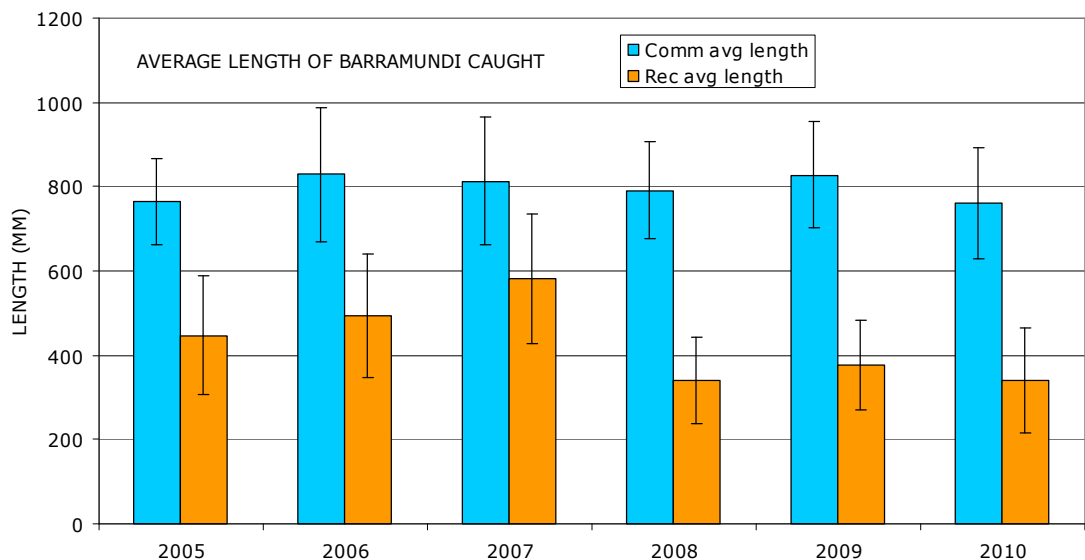


Figure 27: Average length of commercial and recreational Barramundi and standard deviation from 2005-2010

From 2005-2010 (for the same periods as for the commercial catch) there were 6,887 recreational fish measured. *Figure 27* shows the average length of recreational fish each year. The average size has ranged from a low of 340.7mm in 2008 to a high of 582.1mm. The lower average sizes in 2008, 2009 and 2010 reflect the strong recruitment of fish in those years.

Figure 28 shows the lengths of measured commercial and recreational Barramundi from 2000-2011 while *figure 29* shows the size range of fish caught and measured from February-October 2010. The data needs to be treated with care as recreational fish include a significant number of fish from the lagoons where there are mostly juvenile fish and there is no commercial fishing.

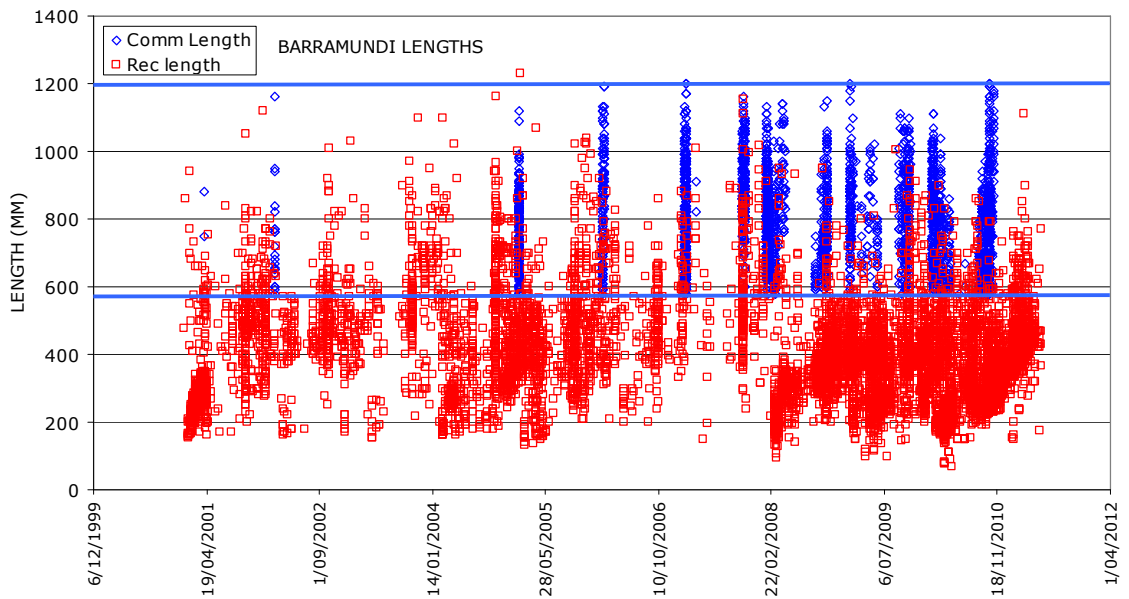


Figure 28: Lengths of measured commercial and recreational caught Barramundi from 2000-2011

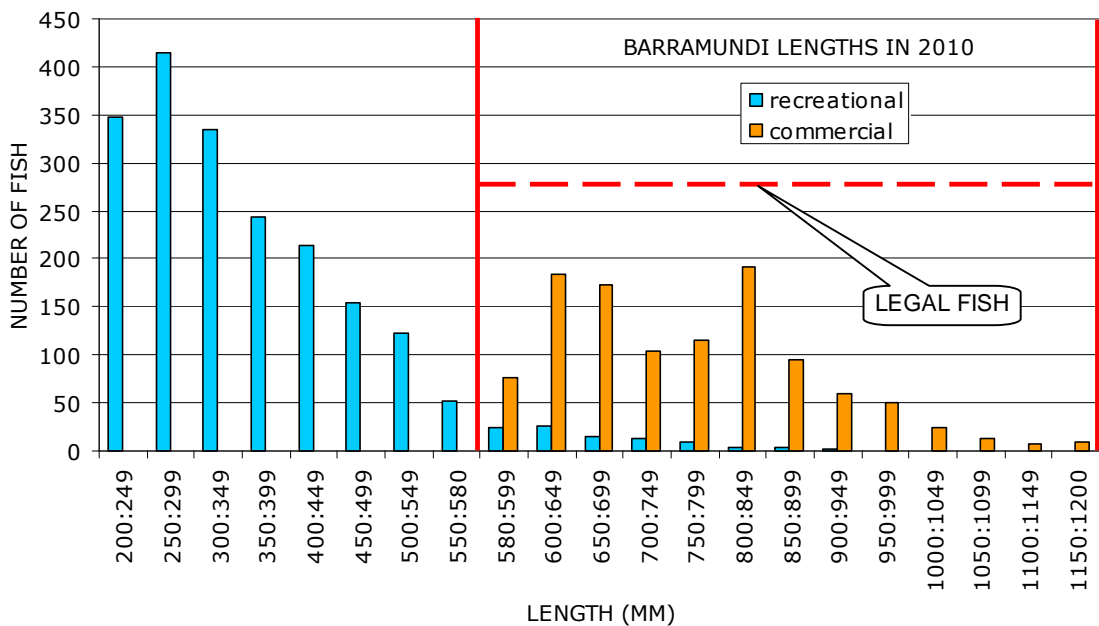


Figure 29: Size range of measured commercial and recreational caught Barramundi for February-October 2010

15. WHAT WAS THE GROWTH OF BARRAMUNDI?

Growth of Barramundi in the Fitzroy River is very variable depending on the habitat occupied by the fish and climatic conditions. Growth of Barramundi was assessed for fish recaptured in maps FRR, RAG and CIS over the wet period from 2008-2011. Growth was assessed for fish tagged at less than 400mm, recaptured over 30 days from when tagged and based on habitat type defined as:

- River being saltwater estuary
- 12 Mile Creek being brackish
- Lagoons being freshwater

There were a total of 822 recaptures from 2008-2011. *Figure 30* shows the length of the fish at recapture. The red area highlighted is for fish in Frogmore Lagoon. Frogmore Lagoon was filled in early 2008 after being dry for 1.5 years (see *section 17*). Barramundi moved into the lagoon in large numbers which were estimated at over 4,000 fish in late 2009 (see *section 17*). *Figure 31* shows the growth of fish in Frogmore Lagoon. Fish tagged in early 2008 and recaptured before the end of 2008 showed expected growth however fish tagged in late 2008 and recaptured in late 2009 showed little growth. This was likely to be due to the fish consuming most of the food in the lagoon and no growth over winter.

Recaptures for all habitats were combined to provide an estimate of growth during the wet period from 2008-2011 compared with the dry period 2003-2008 (*figure 32*). This indicated that growth was a little higher in the dry period from 2003-2008. This was influenced by the much larger number of fish in the wet period competing for the food supply as exemplified by the fish in Frogmore Lagoon. Over the longer term there was little difference in the growth rates.

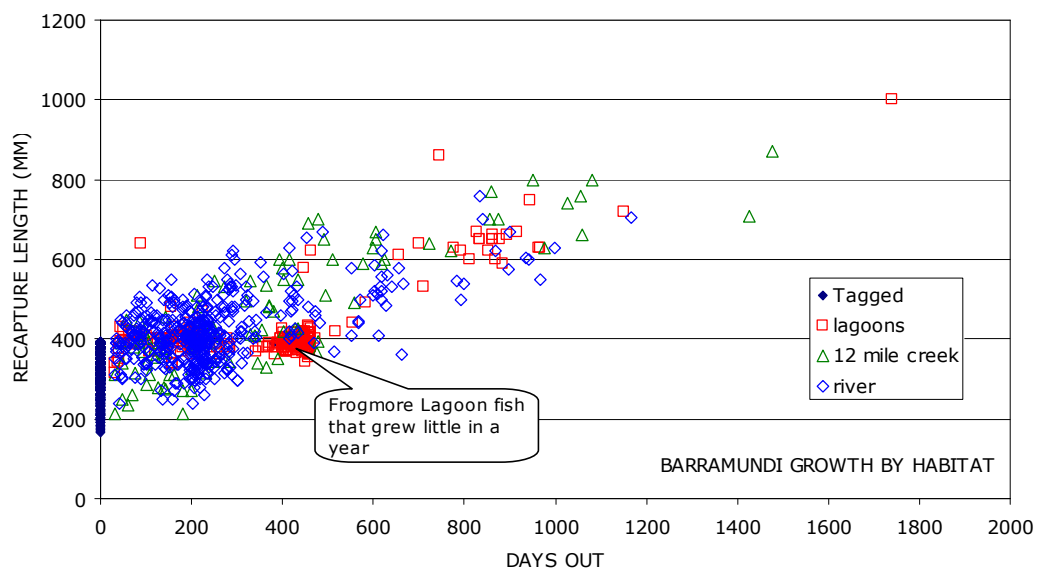


Figure 30: Recapture length for fish <400mm when tagged based on habitat from 2008-2011

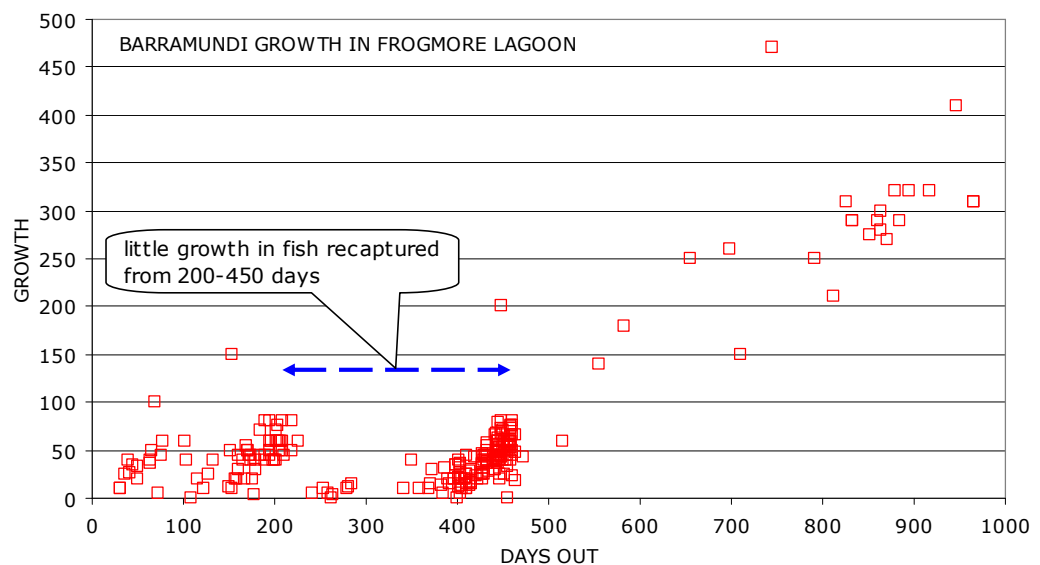


Figure 31: Growth of Barramundi in Frogmore Lagoon from 2008-2011

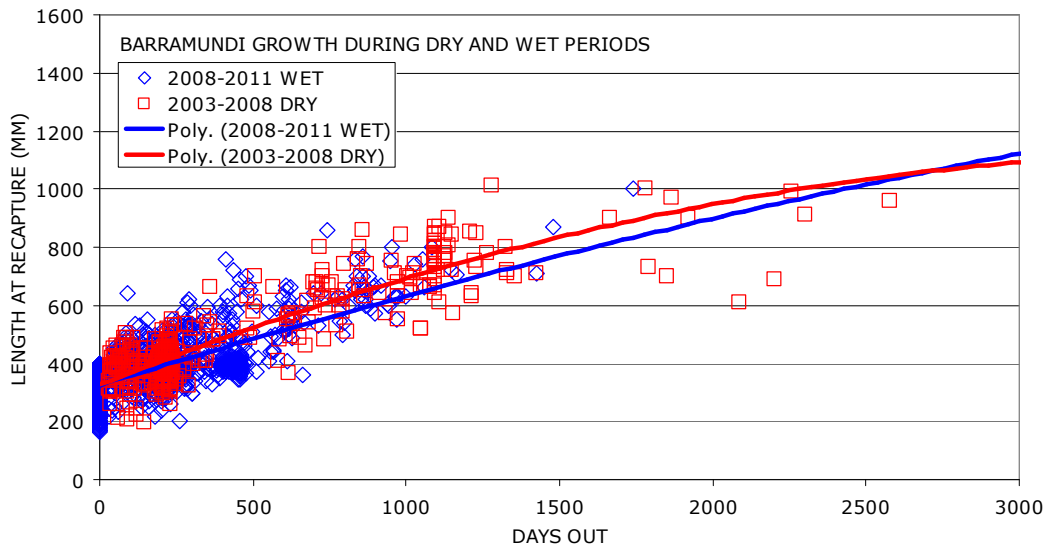


Figure 32: Growth of Barramundi in all habitats from 2003-2008 (dry period) and 2008-2011 (wet period)

16. HOW OLD WERE THE BARRAMUNDI?

Fisheries Queensland has aged Barramundi from otoliths that were collected as part of the LTMP. Age was determined from the otolith increment count and the edge type which provided an estimate of the age of the fish.

From 2005-2010 there were 2,470 fish aged from the commercial catch from the Fitzroy area. *Figure 33* shows the length at age of commercially caught Barramundi. The oldest fish was aged at 36 years while all other fish were aged at 22 years or less.

From 2008-2010 there were 76 fish aged from the recreational catch from the Fitzroy area. *Figure 34* shows the length at age of recreationally caught Barramundi. While the sample size is small the oldest fish was aged at 19 years while all other fish were aged at 13 years or less.

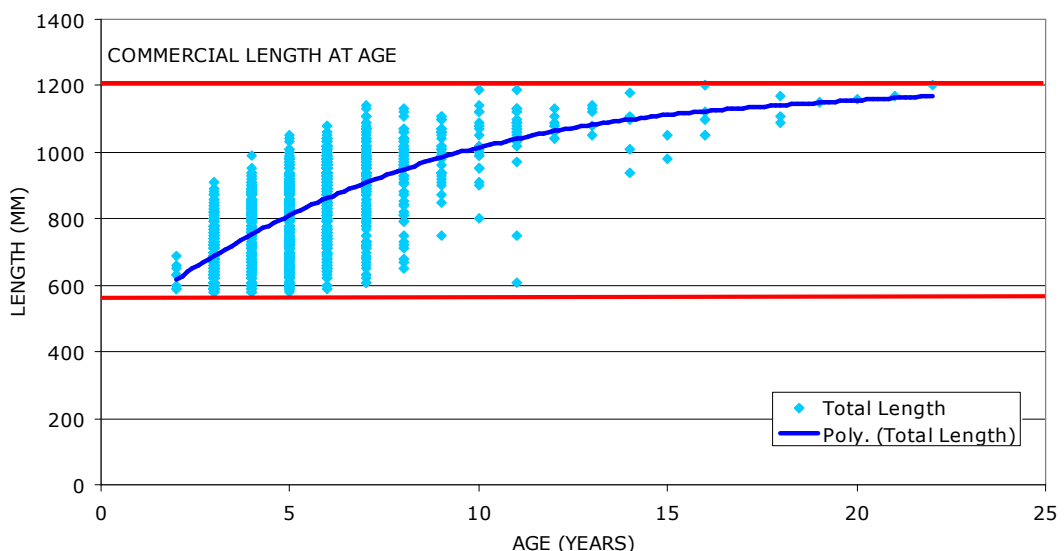


Figure 33: Length at age for commercial caught Barramundi in the Fitzroy River from 2005-2010

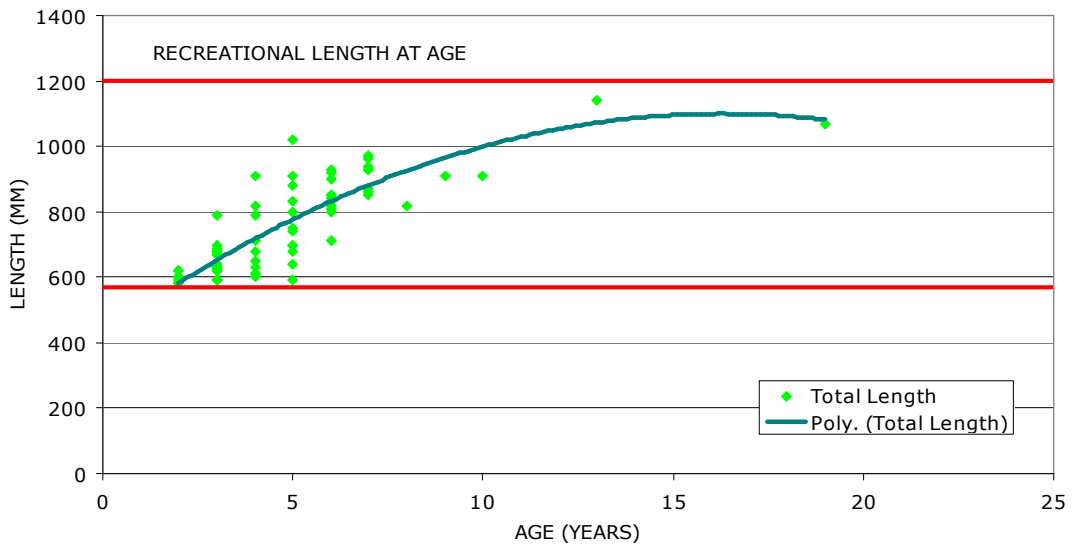


Figure 34: Length at age for recreational caught Barramundi in the Fitzroy River from 2008-2010

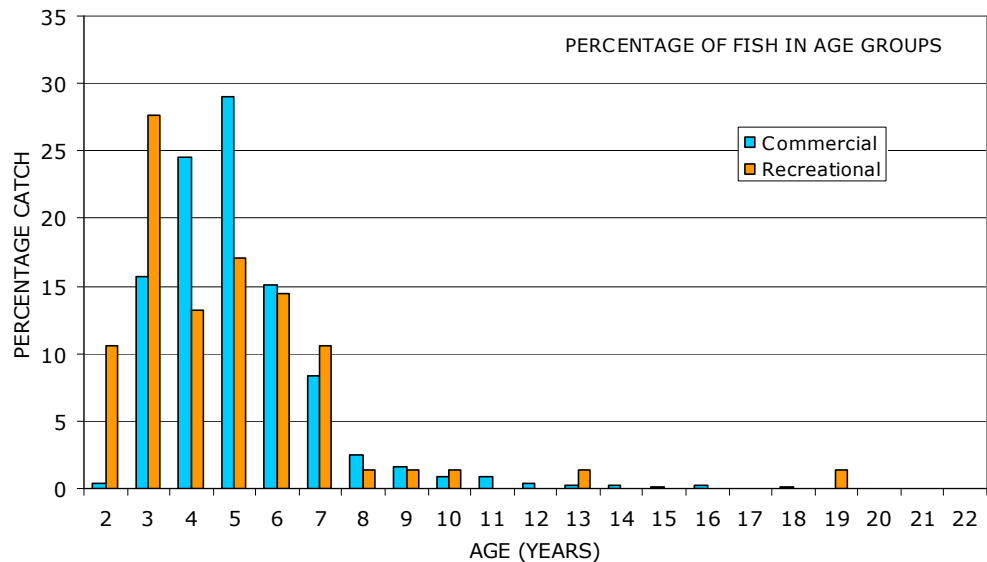


Figure 35: Age of fish in the legal commercial and recreational catch from 2008-2010

Figure 35 shows the ages of fish as part of the commercial and recreational catch. There does not appear to be any significant difference in the age of legal fish kept by commercial and recreational fishers. Fish aged from 2-7 years dominated the legal catch being 93.0% of the commercial catch and 93.4% of the recreational catch.

17. WHERE WERE BARRAMUNDI TAGGED?

Barramundi and other species have been tagged in the Fitzroy River and adjacent waterways since the mid 1980s. Where fish were tagged was recorded based on map grids where the grids are 1km². Where fish were tagged provided some indication of where fishing effort has occurred.

From 2000-2011 there were 20,228 fish tagged including 13,631 Barramundi in the area covered by maps FRR, RAG and CIS. Figure 36 shows the number of fish tagged in each location while figure 37 shows the number of Barramundi tagged in each location.

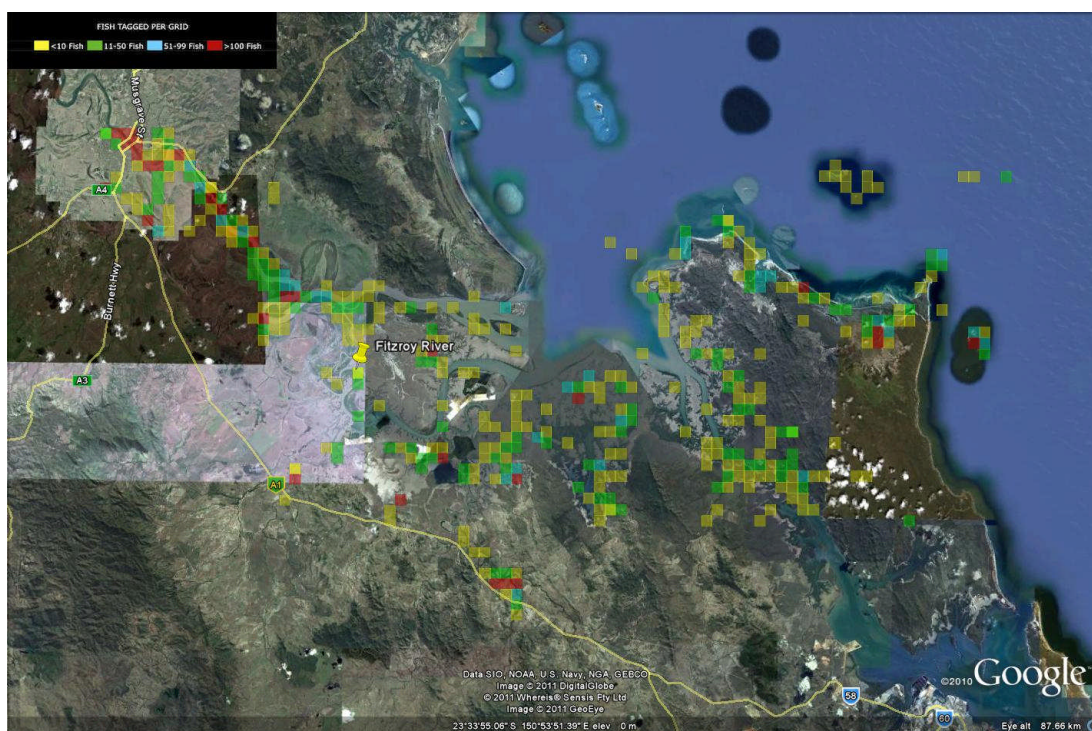


Figure 36: Locations where fish were tagged from 2000-2011

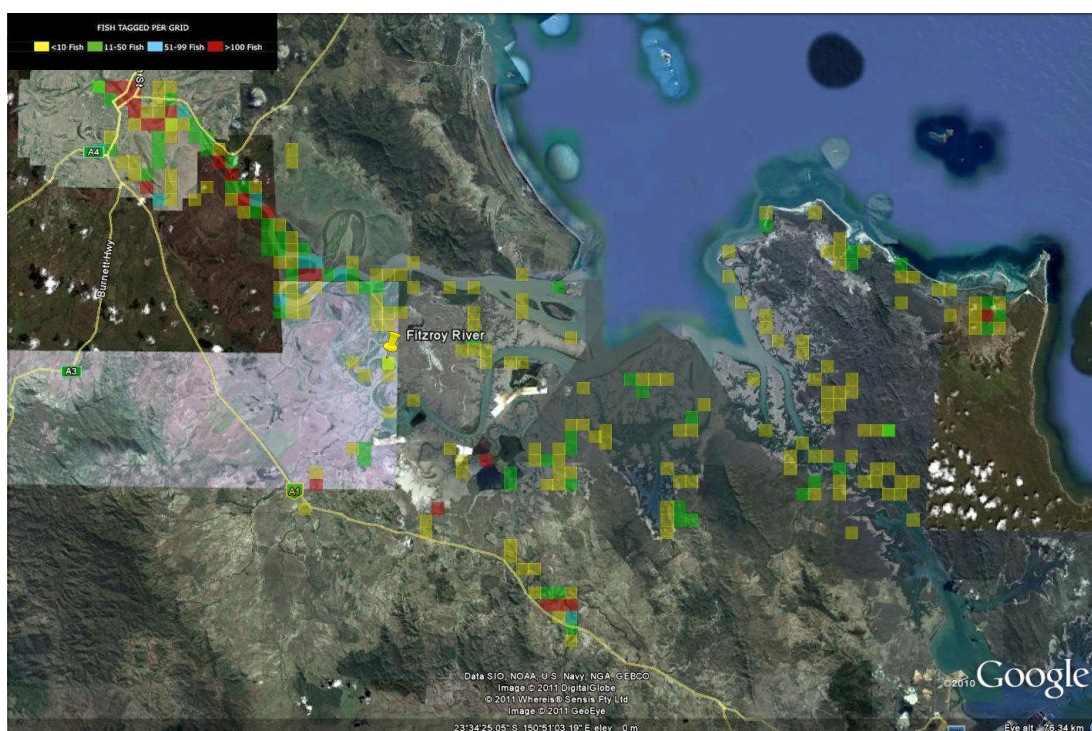


Figure 37: Locations where Barramundi were tagged from 2000-2011

Where fish have been tagged as shown in *figures 33 and 34* can be viewed interactively in Google Earth¹³ with details provided of the number and size range of fish tagged at each location.

¹³ Kml files for viewing in Google Earth available from Infofish Australia

18. WHAT WERE THE TAG RECAPTURE RATES?

Recaptures rates provide an approximate measure of fishing effort (Sawynok 2010). The number of fish tagged each year in grid maps FRR, RAG and CIS were compared with the number of fish recaptured in the same year.

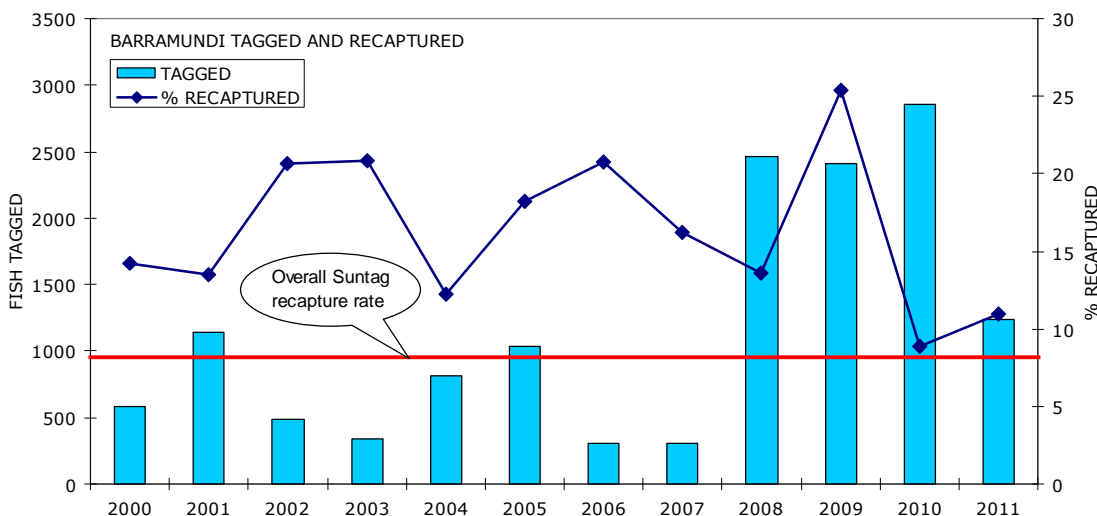


Figure 38: Barramundi tagged and percentage recaptured from 2000-2011

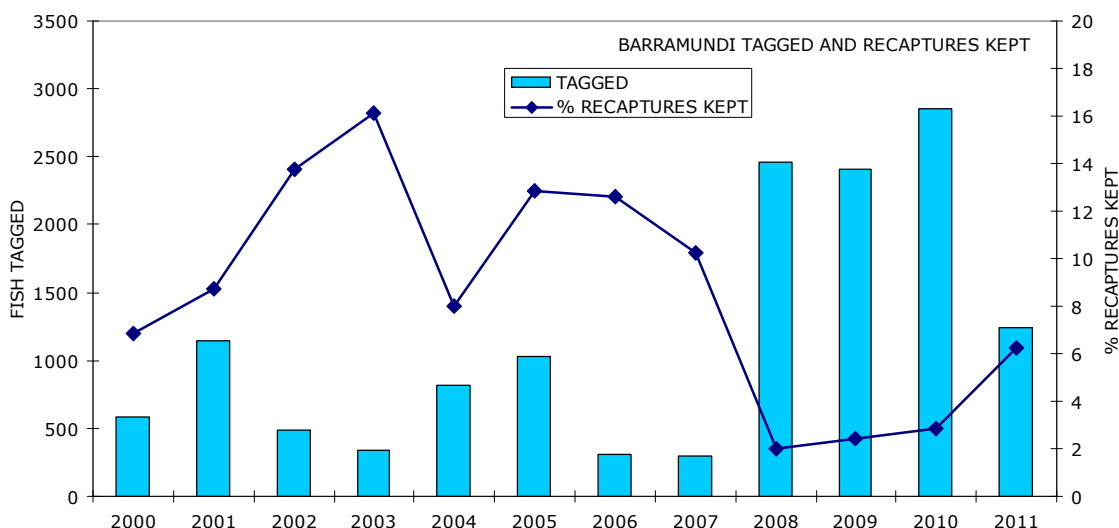


Figure 39: Barramundi tagged and percentage of recaptures kept from 2000-2011

Figure 38 shows the number of Barramundi tagged each year compared with the percentage of recaptures. The highest recapture rate was 25.4% in 2009 with the lowest rate of 8.9% in 2010 and overall the rate was 15.4%. By comparison the overall Suntag recapture rate from 1986-2010 was 8.0%¹⁴.

Figure 39 shows the number of Barramundi tagged each year compared with the number of recaptures kept. The highest rate of recaptures kept was in 2003 with 16.1% while the lowest was in 2008 with 2.0% and the overall rate was 5.7%. The drop in the kept recapture rates for 2008, 2009 and 2010 reflect the large number of recruits in those year which were tagged and recaptured.

The recapture rates for Barramundi in the Fitzroy River are the highest recorded for any species in any river system in Queensland.

¹⁴ Suntag Research Report 2009/10

19. WHAT WAS THE EFFECT OF FISHING COMPETITIONS?

The Rocky Barra Bounty is the only major competition that is held on the Fitzroy River. The event is held in October just before the closed season and commenced in 1999. It is a tag and release only competition that has a 5 star rating from NEATFish¹⁵ which is a national standard for fishing competitions. The event is held over 2 days and participation is limited to a maximum of 70 two person teams. Tagging data from the event have been collected since 1999 and catch and effort data since 2000. The consistent way in which the event is held provides a snapshot of recreational fishing each year.

Due to flooding in the river from September 2010 the event was cancelled and a Bounty weekend competition was held in the lagoons instead. Data from this competition is not comparable with data from other years due to the different habitats that the event was held in.

Figure 40 provides a summary of effort and the catch rates each year for Barramundi and for all fish tagged. Catch rates for Barramundi have varied from a high of 10.1 hours/fish in 2000 to a low of 43.1 hours/fish in 2006. The catch rate in 2009 was 19.5 hours/fish. Catch rates for Barramundi have varied substantially however the overall catch rate for all fish has remained fairly steady.

Figure 41 shows the numbers of Barramundi tagged each year and the recapture rate for those fish. The highest recapture rate was for fish tagged in 2001 with 23.6% recaptured once while in 2005 and 2006 the recapture rate was 9.5%. The overall recapture for all Bounties is 15.3%. This suggests that the stocks in the river are under significant fishing pressure.

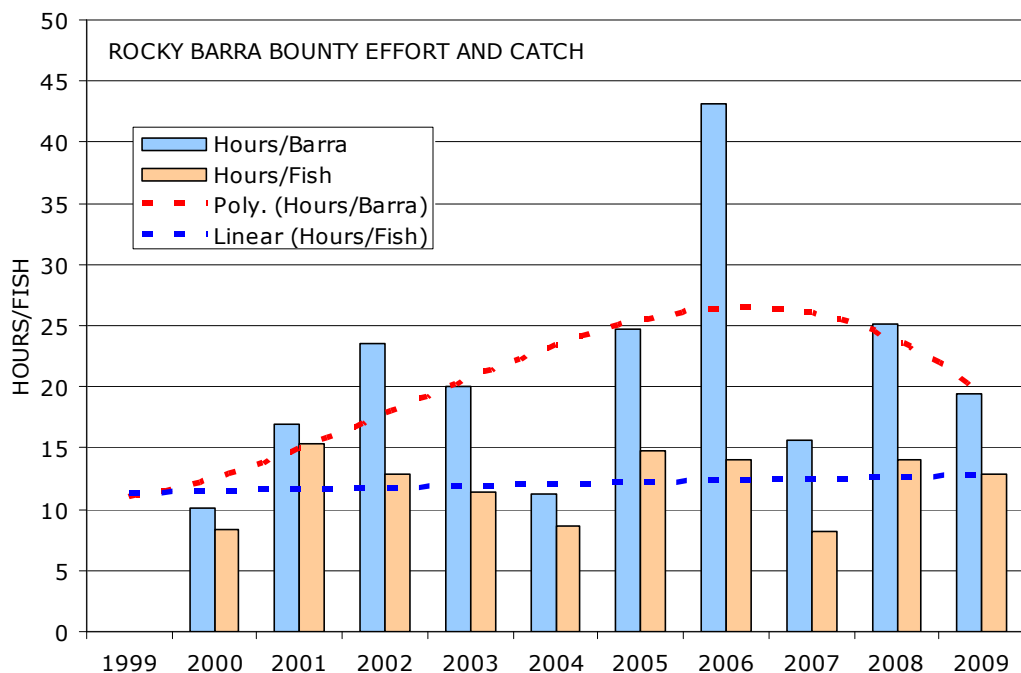


Figure 40: Catch rates of Barramundi and all fish from the Rocky Barra Bounty from 2000-2009

¹⁵ Details of NEATFish are available at www.neatfish.com

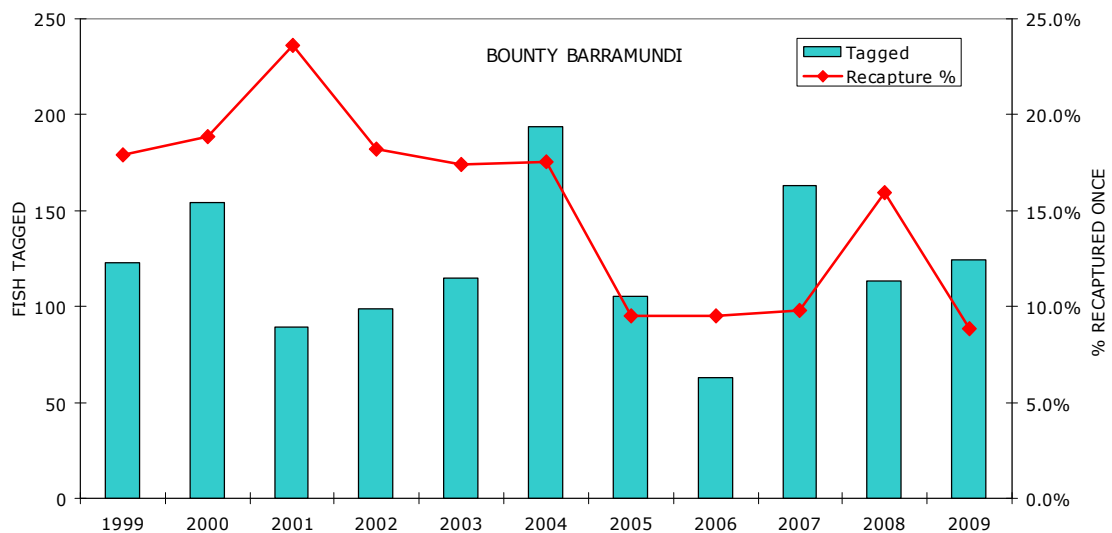


Figure 41: Number of Barramundi tagged and the recapture rate each year in the Rocky Barra Bounty

20. WHAT WAS THE ROLE OF FLOODPLAIN LAGOONS?

Floods and local runoff play an important role in the maintenance of fish stocks by allowing fish, particularly juveniles, access to offstream lagoons that are not normally connected to the river. A number of lagoons are accessed regularly by Barramundi, particularly juveniles, and a number of these lagoons have been monitored since the mid-1980s. The main lagoons that have been monitored for use by Barramundi are:

- Bates Lagoon
- Frogmore Lagoon
- Woolwash Lagoon
- Yeppen Lagoon
- 12 Mile Creek
- Blacks Lagoon on Raglan Creek
- Nankin Creek

The first 4 lagoons form part of the freshwater Gavial Creek system which enters the Fitzroy River just downstream of the city. When the river flood height reaches 7m¹⁶ water is pushed back up Gavial Creek and fills these lagoons and fish use this to access the lagoons. When flood levels reach 8m the river breaks its banks above Rockhampton and flows around the south of the city and links up with floodwater being pushed up Gavial Creek.



Figure 42: Frogmore Lagoon when dry (left) a few days before it was filled in the 2008 flood (right)

¹⁶ Personal observation Bill Sawynok

Figure 43 shows the use of Frogmore Lagoon by Barramundi from 2000-2011. From 2000 through to 2008 there was a prolonged drought period and water levels in the lagoon fell until in mid 2006 it dried up. Just before it dried all the fish died and it was estimated that several hundred large Barramundi were lost. The lagoon stayed dry until it was refilled by the 2008 flood as shown in figure 42. Large numbers of Barramundi entered the lagoon in 2008.

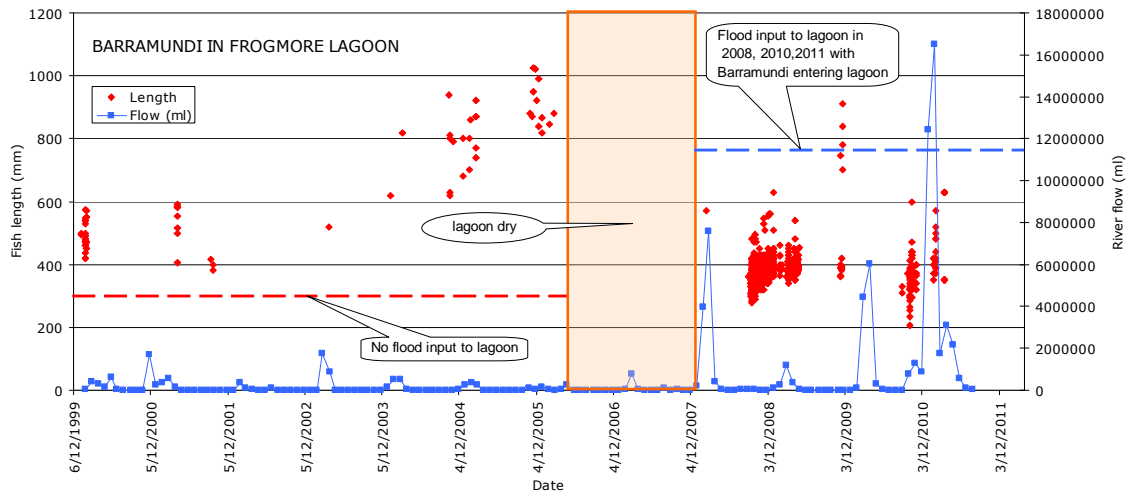


Figure 43: River flows and Barramundi in Frogmore Lagoon from 2000-2011

There was no input of water to the lagoon in 2009 and towards the end of the year water levels were dropping rapidly and concerns were raised that the lagoon might dry again as in 2006. In early December the situation was getting serious as there were a large number of fish in the lagoon.

It was decided to initiate a fish rescue and move as many fish as possible to the river. DERM provided an electrofisher to assist with catching the fish for the rescue as shown in figure 44. Over several weeks in December there were 510 fish moved to the river including 175 fish that had been previously tagged. As fate would have it in early January the river flooded and the lagoon was filled again allowing fish to return to the river unaided. A total of 1,316 had been tagged in the lagoon in 2008-2009 and with the ratio of tagged to untagged fish being 34% it was estimated that there were close to 4,000 fish in the lagoon.



Figure 44: Rescuing fish from Frogmore Lagoon in December 2009

Figure 45 shows the use of Woolwash Lagoon by Barramundi from 2000-2011. While Frogmore and Woolwash Lagoons are less than 1km apart and are connected by a channel during flooding there were differences in the use of the

lagoons by Barramundi. Like Frogmore Lagoon, there was no flood inflow to the lagoon between 2000 and 2008. However the Woolwash Lagoon dried about a year earlier in mid 2005 with the death of all remaining fish and did not refill until the 2008 flood. While there was a significant number of Barramundi in Frogmore Lagoon after 2008 there were no fish recorded in the Woolwash Lagoon until after the 2010 flood. This could be because the connecting channel between the lagoons did not have sufficient water for long enough for fish to move between the lagoons.

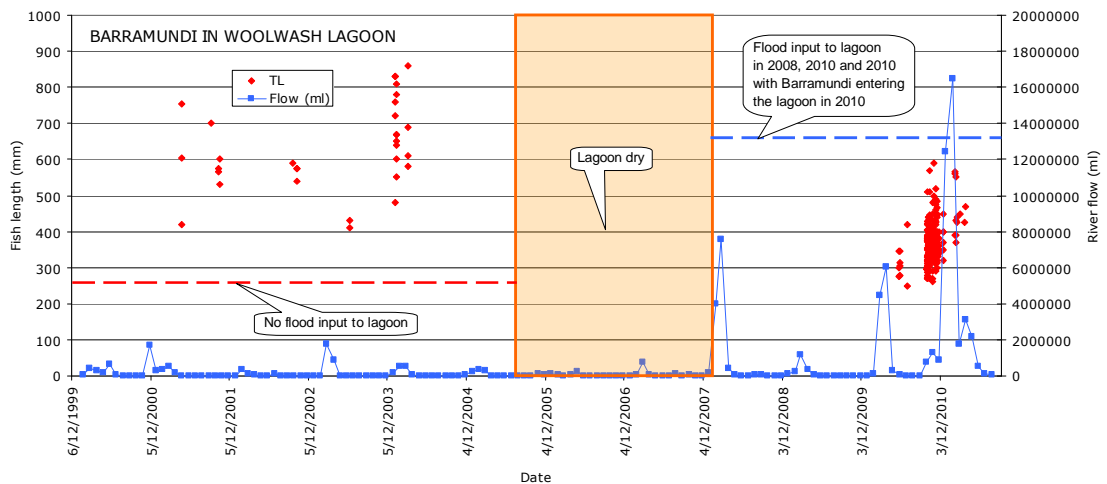


Figure 45: River flows and Barramundi in Woolwash Lagoon from 2000-2011

With a very wet winter in 2010 and leading into summer in 2011 the Frogmore and Woolwash Lagoons were full with further flooding of the lagoon in December 2010. In the first 2 weeks of December, prior to the bulk of the floodwater reaching the lagoons, a large number of fish died in Woolwash Lagoon, victims of the flooding. The most likely cause of their deaths was low oxygen levels in the water caused by vegetation rotting after being covered by earlier floodwater and taking up the oxygen in the water.

The number of fish that died by the second weekend of December was estimated to be between 5,400 and 6,700. The largest numbers of dead fish were Bony Bream (*Nematalosa erebi*) with numbers estimated at 4,000-5,000. There were also 1,200-1,500 dead Barramundi and small numbers, less than 50 fish, of 9 other species. The loss of Barramundi was estimated at 1.0-1.5 tonnes.

Figure 46 shows the extent of dead fish in Woolwash Lagoon in December 2010. Barramundi that died are circled in red.



Figure 46: Fish deaths in Woolwash Lagoon in December 2010

Twelve Mile Creek is significantly different to the Gavial Creek lagoons in that it is on the edge of the river delta and can range from freshwater to super saline depending on the climatic conditions. It is not connected to the river by flooding. It is connected to the river when local rainfall exceeds approximately 150mm/month or on the largest spring tides which exceed 4.7m at Port Alma. These conditions are generally met each year and Barramundi and other species access this lagoon in most years. Small Barramundi less than 200mm are regularly caught during surveys at this site.

Figure 47 shows the use of 12 Mile Creek by Barramundi from 2000-2011 and rainfall¹⁷. There was a good recruitment of juvenile Barramundi in 2001 however in May that year all fish died, estimated at 3,200 including around 150 Barramundi (Sawynok 2002). While there was sufficient rainfall in early 2002 fish were not recorded in significant numbers until 2003. By 2006 the area was in an extended dry period and many fish died, however there were some fish that survived. The lagoon was largely devoid of Barramundi until early 2008 when there was strong recruitment of juvenile fish. Further strong recruitments occurred in 2009 and 2010. In spite of flooding in the river and record rainfall there was little recruitment to the lagoon in 2011 (see section 16).

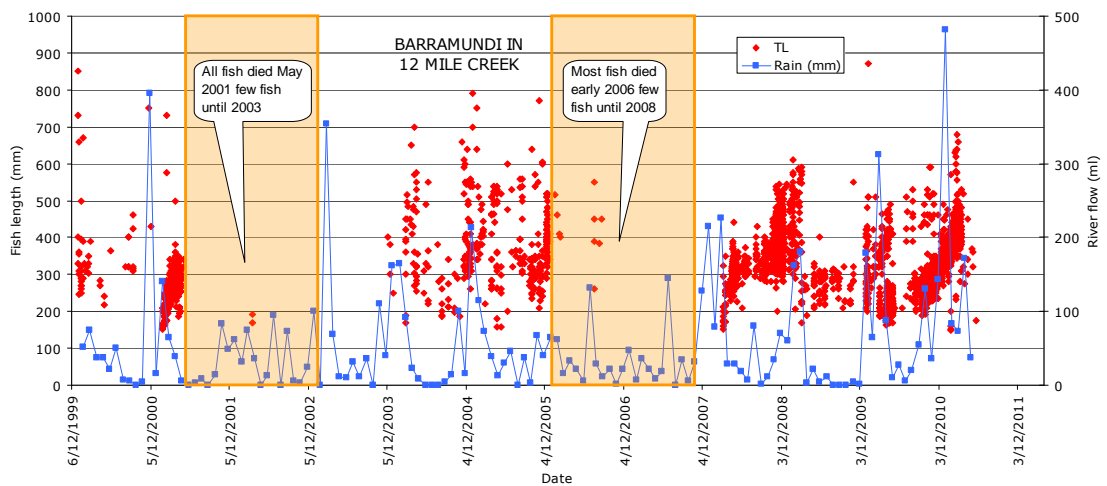


Figure 47: Rainfall and Barramundi in 12 Mile Creek from 2000-2011

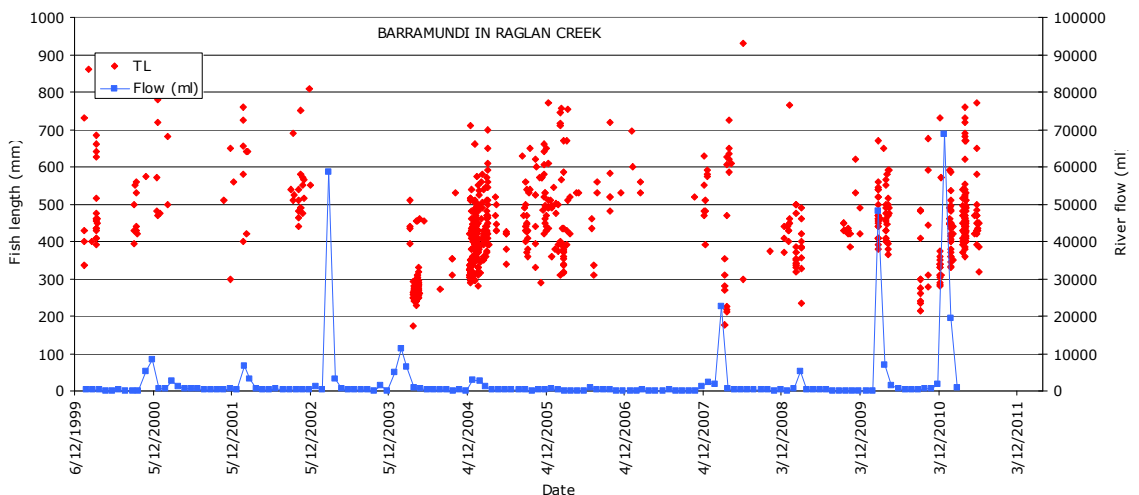


Figure 48: Creek flows and Barramundi in Raglan Creek from 2000-2011

¹⁷ Rainfall data obtained from Cheetham Saltworks recording station at Inkerman Creek at 23.63°S and 150.8°E

Raglan Creek is the largest tributary entering the Fitzroy River from the south near its mouth at Port Alma. It also is the largest permanent freshwater instream system that is still accessible by Barramundi. *Figure 48* shows the use of the freshwater reaches of Raglan Creek by Barramundi from 2000-2011 compared to creek flows¹⁸. Raglan Creek was impacted less than other lagoons during the drought period with fish recorded continuously over that time.

Nankin Creek is the largest creek that enters the Fitzroy River from the north however, unlike the other lagoons, has no public access. Some recreational fishers have gained permission to fish the main lagoon on the creek. In 2009 and 2010 the Department of Environment and Resource Management (DERM) assisted with electrofishing surveys of the lagoon.

Figure 49 shows the use of Nankin Creek by Barramundi from 2000-2011. The lack of data from the earlier years reflects the lack of access to the area.

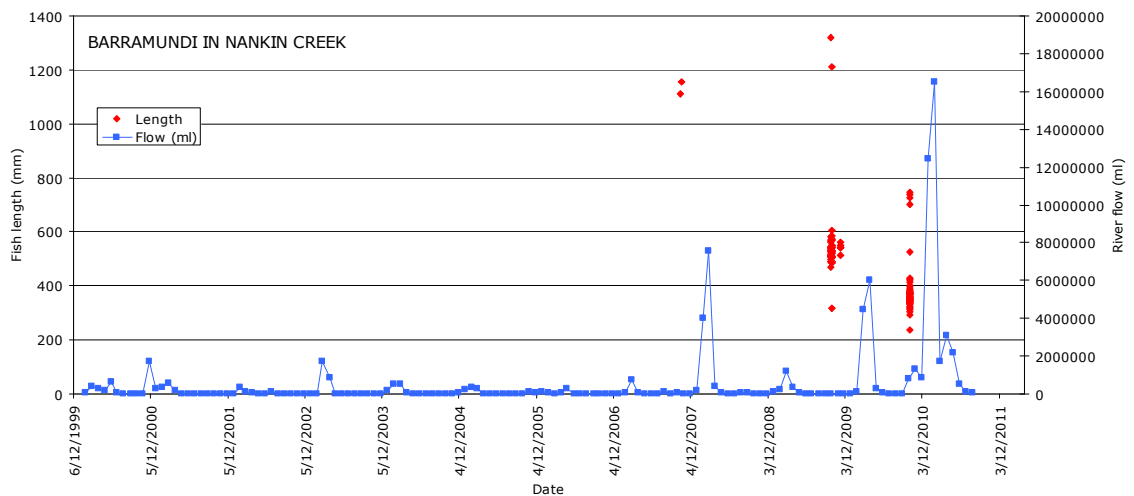


Figure 49: River flows and Barramundi in Nankin Creek from 2000-2011

21. WHAT WAS THE ROLE OF STOCKED FISH?

The construction of the Barrage on the Fitzroy River in 1970 resulted in fish having limited ability to migrate from the estuary to freshwater, this is despite there being a fishway on the Barrage. Monitoring of the fishway has shown some use by fish but limited use by Barramundi (Stuart and Mallen-Cooper 1999). In a number of upstream locations that previously recorded Barramundi they were considered to be locally extinct by the 1990s.

In the 2000s fish stocking groups in local communities upstream in the catchment commenced stocking Barramundi in their local waterways to re-establish a local Barramundi fishery. Locations that were stocked were:

- Lake Callide at Biloela
- Moura Weir at Moura
- Baralaba Weir at Baralaba
- Theodore Weir at Theodore
- Bedford Weir at Blackwater
- Lake Maraboon at Emerald
- Lake Theresa at Clermont
- Hedlow Creek and Serpentine Lagoon at Rossmoya
- Alligator Creek at Yaamba
- Fitzroy River at Laurel Bank

¹⁸ Data on creek flow obtained from Department of Environment and Resource Management from www.derm.qld.gov.au for Raglan Creek at Old Station 130004A at 23.50°S and 150.49°E

At all locations except Lake Maraboon Barramundi were tagged to monitor the results of stocking (Sawynok 2008). While these stockings provided a local fishery for a few years, as the fish matured they migrated downstream on high flows or when the rivers flooded and numbers of these fish were caught in the Fitzroy estuary (Sawynok and Platten 2009). No fish have been recorded in the Fitzroy estuary that were tagged in Lake Callide as all fish died there during winter 2007 (Sawynok, Parsons and Platten 2008) and the dam has never overflowed. Only 21 fish were tagged in Theodore Weir and none of those have been recaptured. Fish stocked and tagged at all other locations have been recaptured in the estuary.

After a prolonged dry period from 2003-2008 there was a moderate to high flood throughout the entire catchment in 2008. Following that flooding there were numbers of stocked fish caught in the Fitzroy estuary and to the north and south along the coast. Tagged stocked fish have continued to be recaptured since then.

It is difficult to assess the impact of stocked fish on wild fish in the estuary. An indicator was the proportion of recaptures of tagged stocked fish each year compared with recaptures of wild fish tagged in the Fitzroy River as shown in *figure 50*. In 2008, of the stocked fish recaptures 61 (77.2%) were from a batch release of 1,198 tagged Barramundi in Alligator Creek in February 2005. This was 5.1% of the total number of tagged fish released. There have now been a total of 67 (5.6%) from that batch release that have been recaptured in the estuary.

In 2010 29 (87.9%) of the stocked fish recaptures were from a batch release of 870 tagged fish in Lake Theresa in November 2007. This was 3.3% of the total number of tagged fish released. There have now been a total of 33 (3.8%) of fish from that batch release that have been recaptured in the estuary.

It is likely that the Alligator Creek fish used the 2008 flood to reach the estuary while the Lake Theresa fish used the 2010 flood. This is supported by 4 recaptures of Lake Theresa fish above Bedford Weir in late 2009 and suggests that at least some of these fish made the journey in 2 stages, leaving the lake on the 2008 flood and making it as far as Bedford Weir or other parts of the McKenzie River. The rest of the journey was made on the 2010 flood.

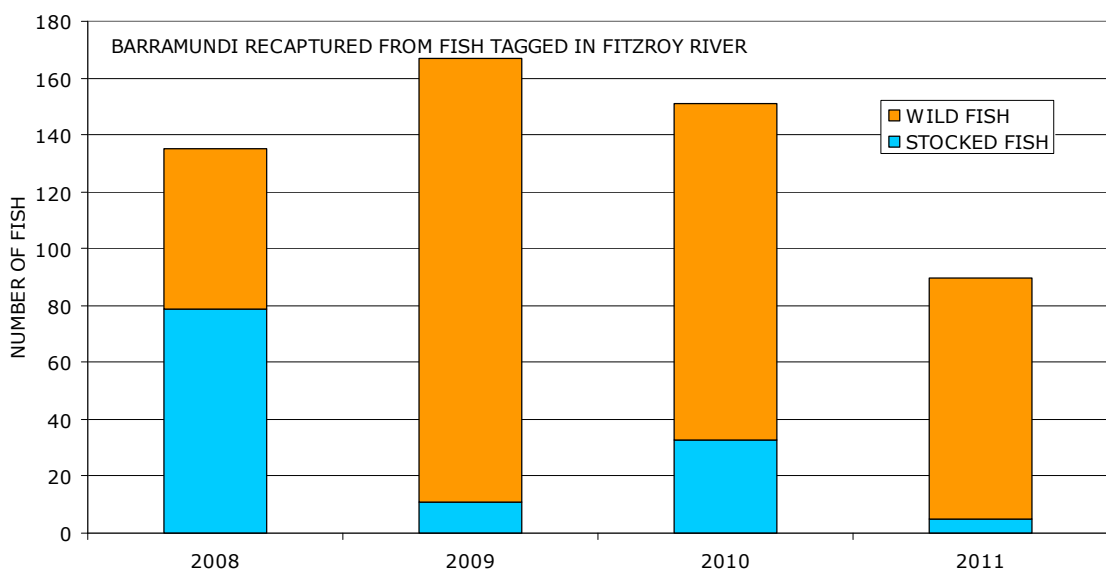


Figure 50: Number of recaptured stocked and wild fish from fish tagged in the Fitzroy River

There were a total of 128 tagged stocked fish recaptured from 2008-2011 in the Fitzroy estuary. Of these, 98 (76.6%) were caught by commercial fishers while 30 (23.4%) were caught by recreational fishers. *Figure 51* shows the number of recaptures of stocked fish caught by commercial and recreational fishers from 2008-2011.

There have been fish from almost every stocked location that have been recaptured in the Fitzroy estuary and these fish have contributed to the catches of recreational and particularly commercial fishers.

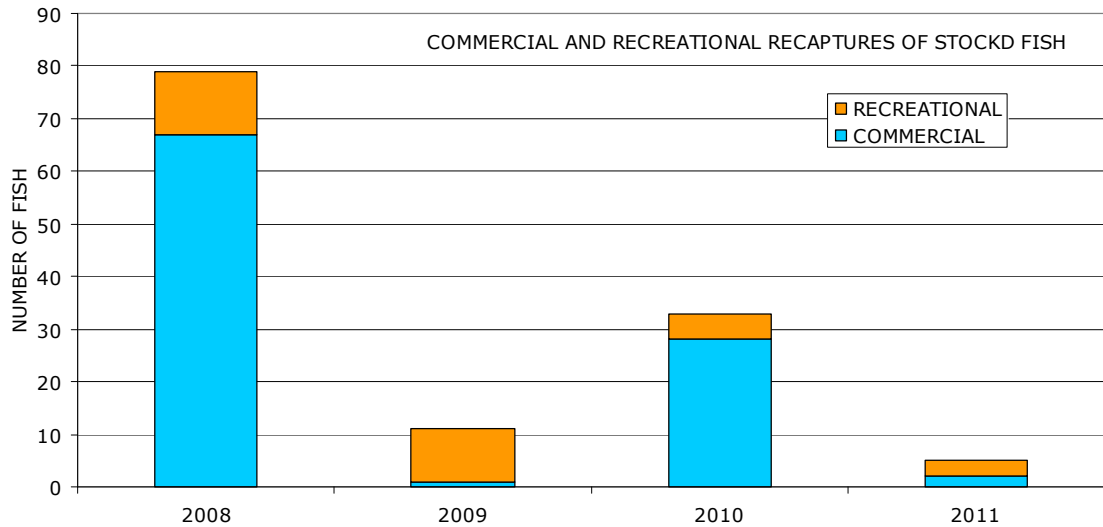


Figure 51: Recaptures of stocked fish by commercial and recreational fishers from 2008-2011

22. WHAT WAS THE MOVEMENT OF BARRAMUNDI?

Movement of Barramundi correlates with river flow. Recaptures of Barramundi in the Fitzroy estuary showed that 71.6% of juvenile Barramundi moved upstream on flows while 84.5% of adult fish migrated downstream (Sawynok and Platten 2009). Adult migration can be associated with movement to spawning sites.

Figure 52 shows the average distance moved by Barramundi during dry and wet periods. Movement was assessed for fish that had been tagged within Suntag maps FRR, RAG and CIS, were not landlocked and had been at liberty for over a year. These were fish that would have experienced at least one flow event between tagging and recapture. During the drought period from 2003-2008 fish that were tagged and recaptured during that period moved an average of 10.5km while those fish recaptured after the flood in 2008 had moved an average of 30.2km. For fish tagged and recaptured in the wet period after 2008 the average distance moved was 32.5km.

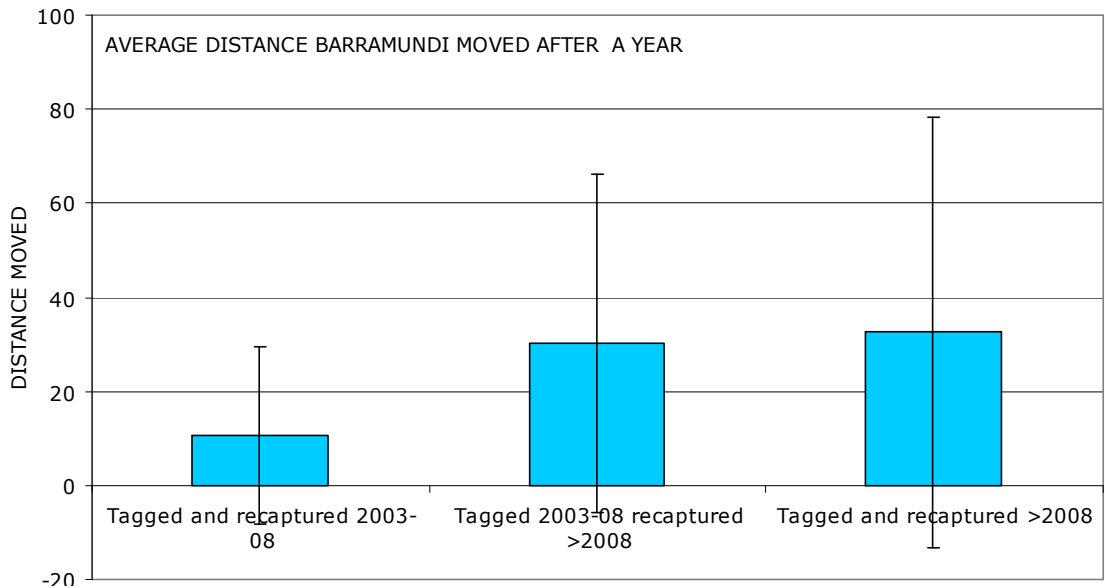


Figure 52: Average distance (km) moved (and standard deviation) by Barramundi between tagging and recapture in dry and wet periods

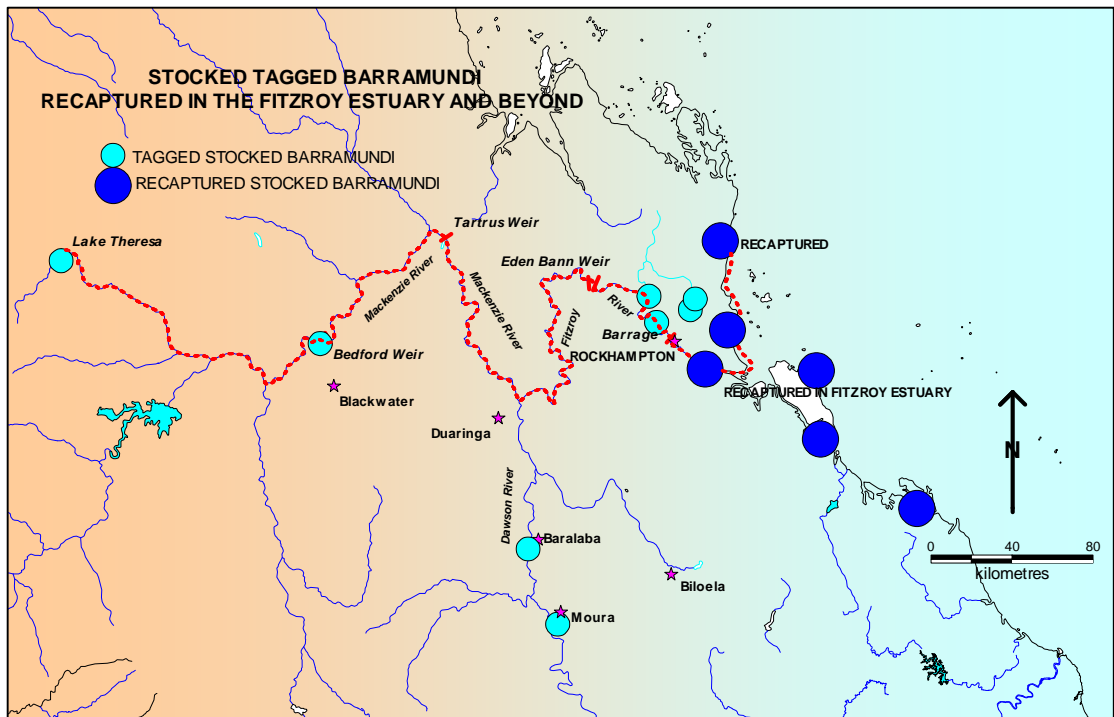


Figure 53: Recaptures of tagged stocked fish in the Fitzroy estuary and along the coast from 2008-2011

Fish stocked in the upper catchment used the floods in 2003, 2008, 2010 and 2011 to migrate down river to the Fitzroy River and along the adjacent coast. Fish from Moura Weir had to travel over 400km and go over 4 weirs and the Barrage to reach the estuary. Fish from Lake Theresa had to travel over 750km and go over 5 weirs and the Barrage to reach the estuary. This is the longest migration of Barramundi recorded in any river system in Queensland to date. Stocked fish have been recaptured along the adjacent coast in Corio Bay north of Yeppoon and as far south as Turkey Beach. *Figure 53* shows where stocked fish were recaptured in the Fitzroy estuary and beyond.

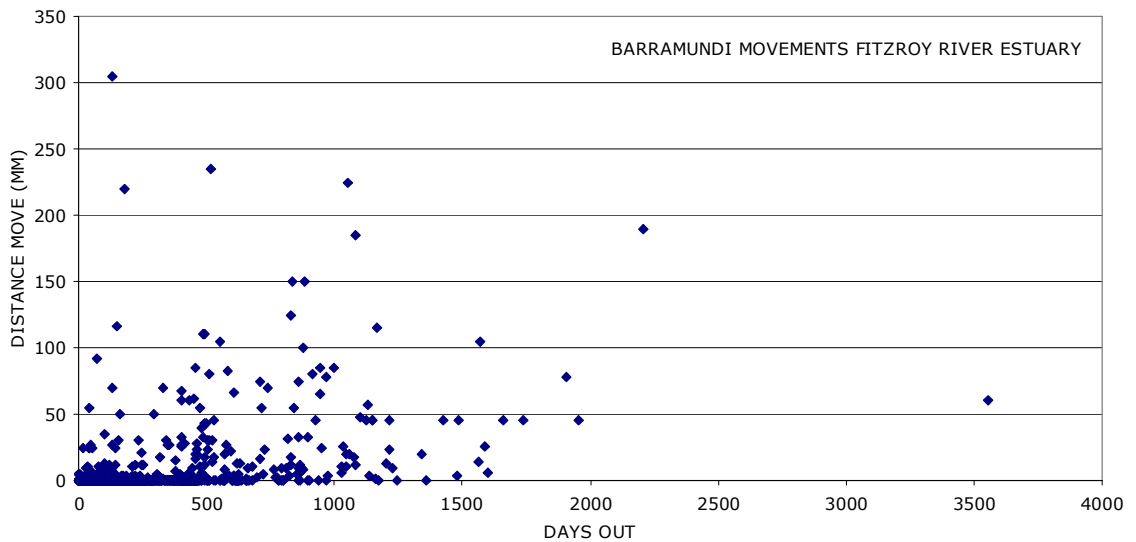


Figure 54: Movement of Barramundi recaptured from 2008-2011 tagged in the Fitzroy River

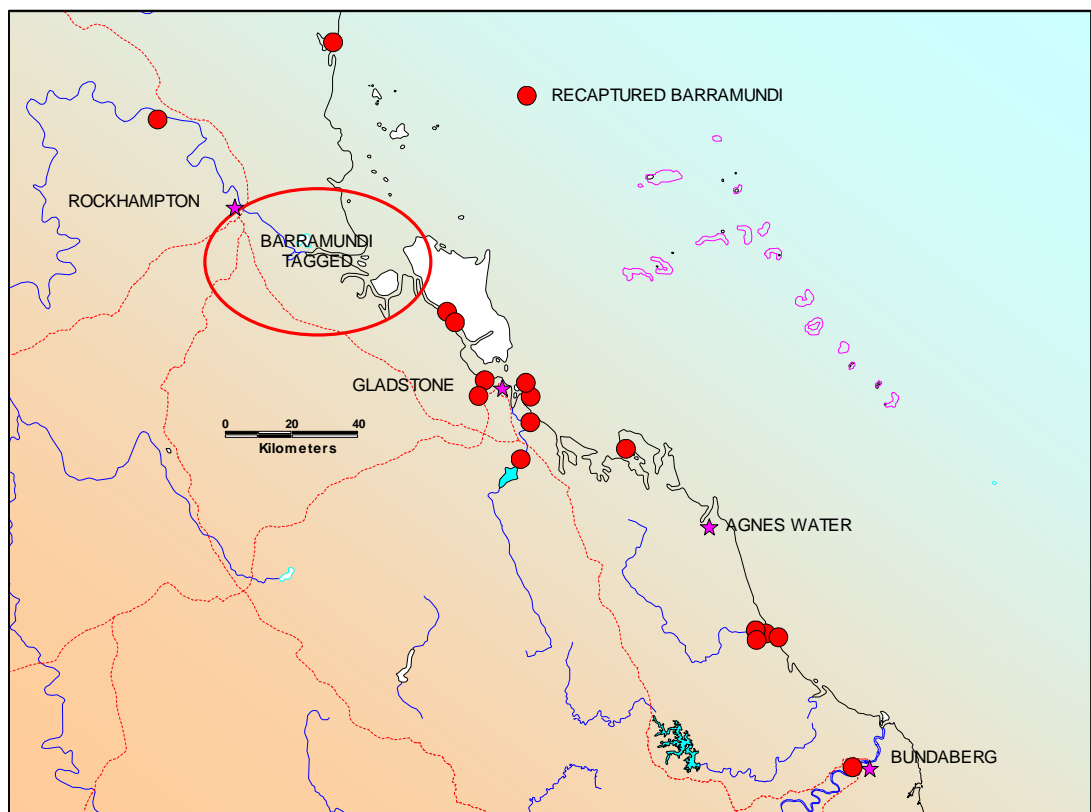


Figure 55: Barramundi recaptures from 2008-2011 for fish tagged in Fitzroy River

From 2008-2011 there have been 1,314 recaptures of Barramundi tagged in the Fitzroy River in maps FRR, RAG and CIS. *Figure 54* shows the distance moved compared to the days between tagging and recapture. While most fish were caught within 50km of where they were tagged 16 (1.2%) were recaptured greater than 100km and outside the area where tagged.

Figure 55 shows Barramundi recaptures for fish that were caught outside the river. Of the 16 recaptures 14 (87.5%) were caught to the south and as far away as the Burnett River at Bundaberg. This fish was recaptured 305km from where it was tagged. One fish was recaptured to the north at Corio Bay 115km from where it was tagged. There have been few fish recaptured from above the

Barrage with 1 fish recaptured following the 2011 flood. This fish was recaptured in a paddock during the flood 66km from where it was tagged.

The only time other fish have been recaptured above the Barrage was following the previous big flood in 1991 when 7 fish were recaptured up to 200km above the Barrage (Sawynok 1998). There have been numerous reports of Barramundi being caught above the Barrage up to Yaamba (about 60km north west of Rockhampton) so the fish have been able to bypass the Barrage during the flood. Further recaptures of fish from above the Barrage are possible.

The flooding also allowed fish from the lagoons to return to the river and beyond. From 2008-2011 there were 67 fish tagged in the lagoons and recaptured in the Fitzroy River and elsewhere as shown in *figure 56*. This shows that lagoon fish were recaptured throughout the river.

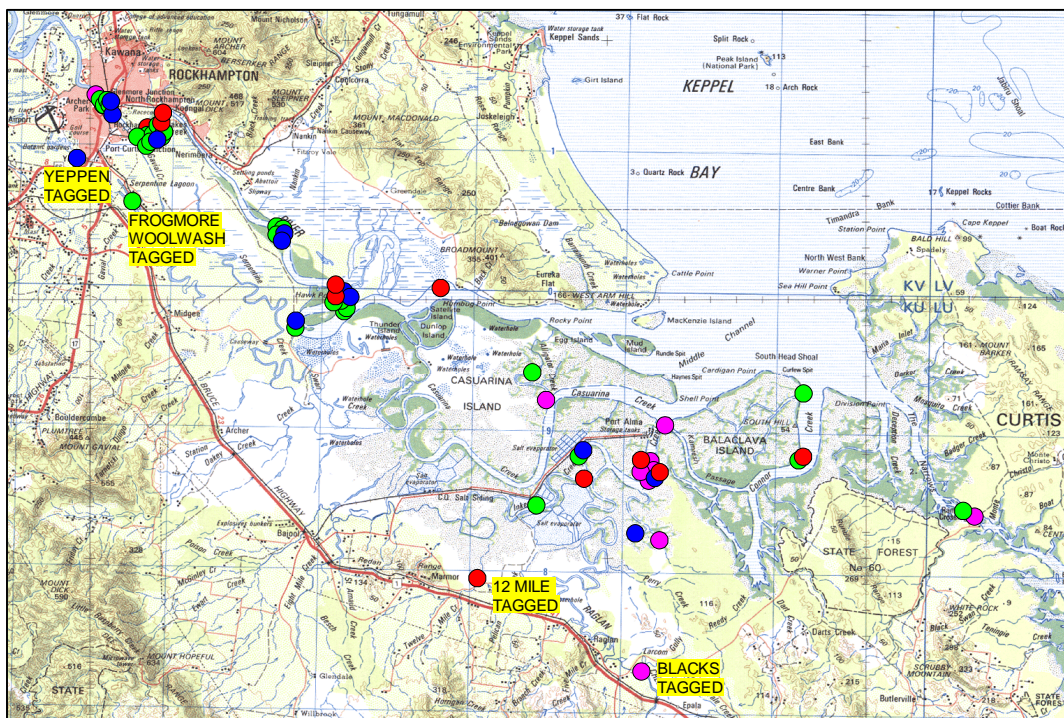


Figure 56: Barramundi tagged in lagoons and recaptured in the Fitzroy River and beyond from 2008-2011 (colour relates to lagoon where tagged)

23. WHAT WAS THE LEVEL OF BARRAMUNDI RECRUITMENT?

Recruits are defined as fish below legal size that have yet to "recruit" to the fishery. Barramundi generally recruit to the fishery in 3 years when they reach the legal minimum length of 580mm. Understanding recruitment is a key to understanding fluctuations in fish stocks. Surveys to obtain data on annual recruitment have been undertaken since 1999 although tagging data provides information on recruitment from the mid 1980s.

Based on growth rates and some aging of juvenile fish year classes of fish reach the following sizes:

Year 0	250-350mm
Year 1	300-550mm
Year 2	500-600mm
Year 3	550-700mm (legal size 580mm)

Year 0 recruits are considered to be fish less than 300mm by the end of March and less than 350mm before the end of May.

Two methods were used to collect data on these year classes of fish. Recreational fishers under the Suntag program have caught and tagged these fish as part of their normal fishing activities, generally using rod and line.

Data collected was stored in the web based Infofish 2011 database and includes the following data that can be used to track recruits:

- Tag number
- Fisher
- Date of tagging
- Length of fish (to nearest half centimetre)
- Location (including a map and grid location that can be used to geo-locate where the fish was tagged)

Generally fish longer than 200mm were tagged using standard anchor or dart tags supplied by Hallprint Pty Ltd. While tagging can track recruits longer than 200mm, fish below that size are generally too small to be caught on rod and line and tagged. These smaller fish are monitored by castnet surveys.

Sites within the Fitzroy River delta that are known to be used by these juvenile Barramundi were monitored using a standard methodology (Sawynok 2002). Castnetting is carried out using a standard castnet¹⁹. Each site is assessed based on its size and a set number of casts is adopted for each site. These are normally 5, 10 or 20 casts depending on the site. Each time the site is surveyed the same number of casts (or a subset) are repeated to allow the results to be standardised. Data have been collected through castnet surveys since 1999.

Data collected through castnet surveys is maintained in an Access Sampling database and includes the following data:

- Monitoring site
- Date of sampling
- Cast number
- Species
- Length of fish (to nearest millimetre)

Recruits are monitored by plotting individual fish size over time. This allows the growth of a year class of fish to be tracked over time with the numbers of recruits recorded being indicative of the recruitment strength for that year class.

Barramundi spawning is correlated to high salinity levels and moon phase (Moore 1982) and takes place adjacent to the mouth of the Fitzroy River. The spawning season is generally from October to December but can be as early as September in some years and as late as January in others.

Following spawning juveniles make their way up the river and, if flow conditions are suitable, move to offstream lagoons and wetlands. This is dependent on both river flow and local rainfall that provides connectivity between the river and offstream sites.

Surveys of juvenile Barramundi in the river, wetlands and lagoons were proposed after king tides each month from January to May. Due to the extensive flooding from December through to April castnet surveys were not carried out at a number of survey sites as they were not accessible. One site at 12 Mile Creek (*figure 57*) was used as a reference site and that was able to be surveyed each month from January to May. This site is consistently used by

¹⁹ Standard castnet is a monofilament net with a 2.7m drop and 20mm mesh size

year 0 fish. Other sites in *figure 57* were surveyed at least once.

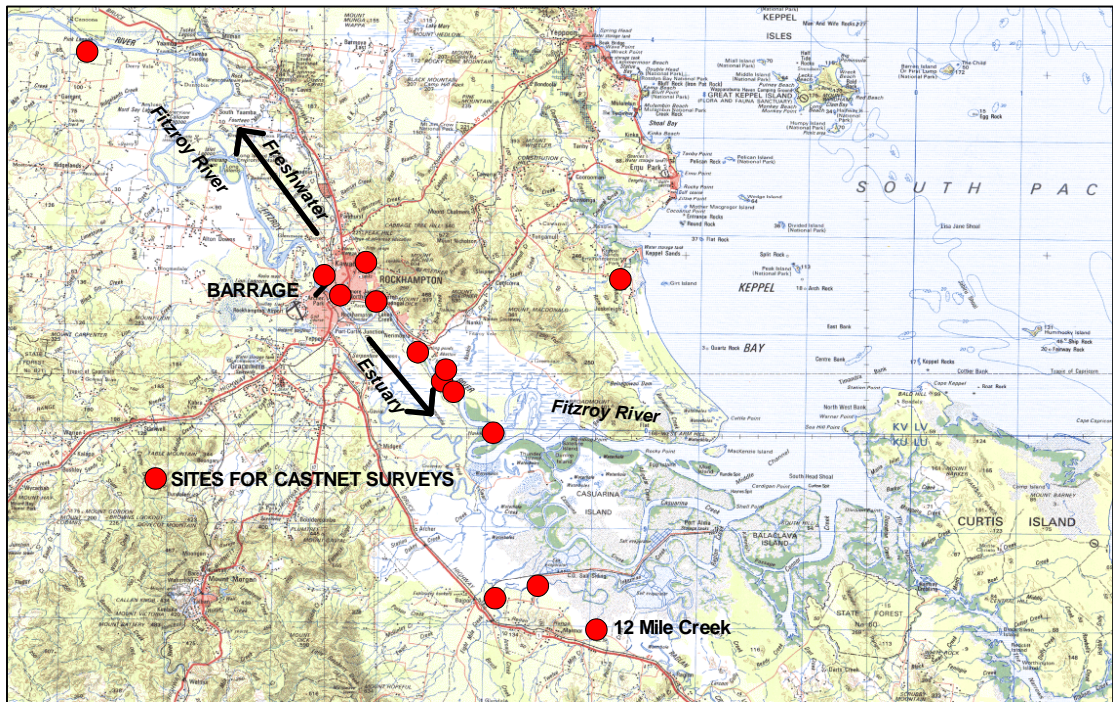


Figure 57: Sites for recruitment surveys in 2010 using a castnet

Monthly flow data were obtained for the Fitzroy River²⁰ and for Glenlands²¹. Data from Glenlands provided additional information on flows in Gavial Creek and lagoons.

Rainfall data were obtained for the 12 Mile Creek catchment²² and the Herbert Creek catchment²³. Data on Hebert Creek were obtained to compare recruitment in 2011 with that catchment.

From a total of 22 surveys at 14 sites there were only 3 year 0 fish recorded with a further 14 recorded from tagging and in recreational catches.

By the end of January reports are generally received from recreational fishers catching year 0 fish in castnets and baitnets. Only 2 reports (1 verified and 1 unverified) were received however this could be the result of reduced recreational fishing effort due to the flooding and its after effects. This indicated a very poor recruitment year despite the record rainfall and flooding.

The number of year 0 recruits recorded in 2011 was very low. There could be a number of reasons for this low recording of recruits:

- ❑ The large and powerful flooding has hampered the ability of recruits to reach nursery areas (no recruits were recorded in the river proper)
- ❑ In some years recruits are not detected in these nursery areas until February and sometimes March (little evidence as late as May)
- ❑ The extensive flooding has allowed recruits to access areas they have not been able to access for around 20 years (surveys have been made in some areas that recruits may have reached with none recorded)

²⁰ Obtained from Department of Environment and Resource Management for the Gap recording station 130005A at 23.08°S and 150.10°E

²¹ Obtained from Department of Environment and Resource Management for the Glenlands recording station 39043 at 23.53°S and 150.51°E

²² Obtained from Cheetham Saltworks recording station at Inkerman Creek at 23.63°S and 150.80°E

²³ Obtained from Bureau of Meteorology website www.bom.gov.au for the Williamson recording station at 22.47°S and 150.18°E

- ❑ The early flooding has impacted on spawning and/or survival of recruits may be low

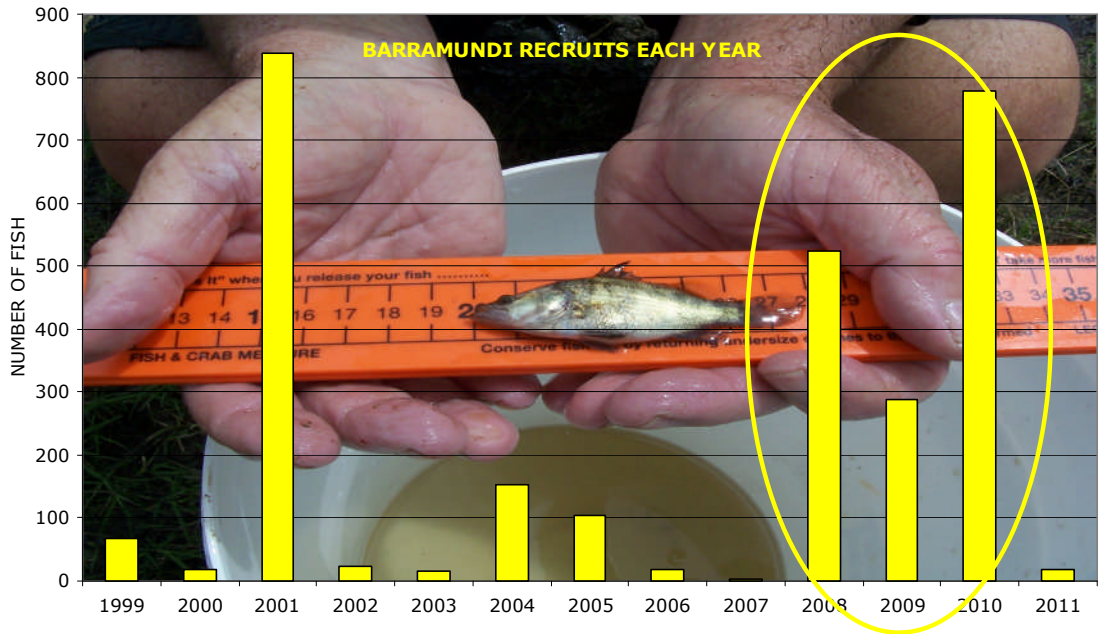


Figure 58: Year 0 Barramundi recorded each year in the Fitzroy River

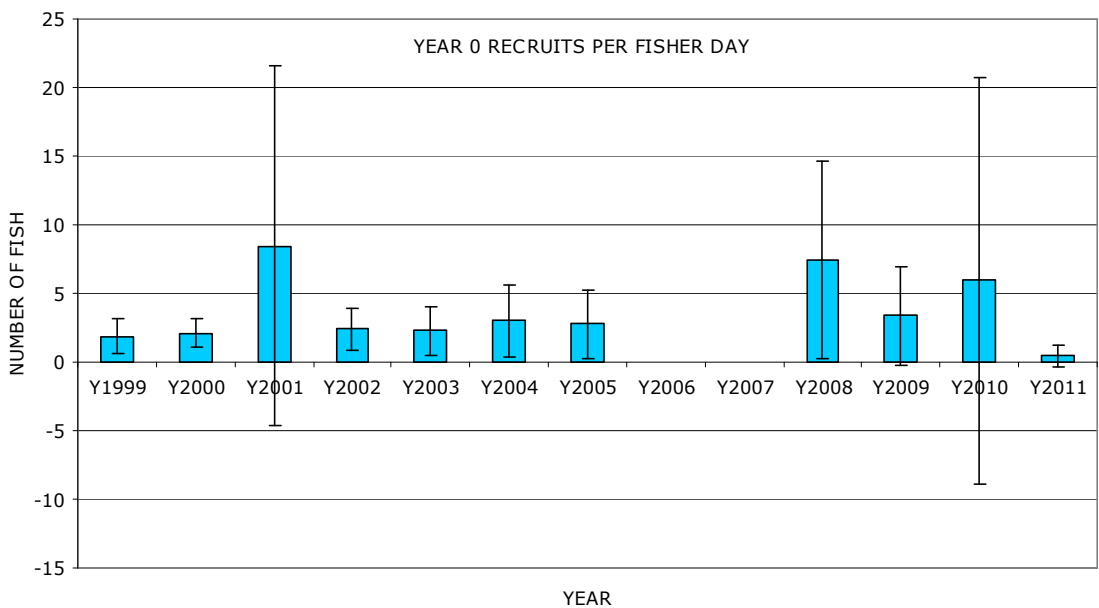


Figure 59: Year 0 recruits recorded per fisher day with standard deviation

Figure 58 shows the number of year 0 fish recorded each year from January-May with a large number of year 0 fish from 2008-2010, while figure 59 shows the catch rate of recruits per fisher day (days where juvenile fish were reported). Data for 2006, 2007 have been omitted due to the there being 5 or less days where recruits were recorded in those year.

The data collected suggests that the early flooding, followed by the much larger flooding, may have impacted spawning or the survival of small recruits. In some years of low recruitment the year class does not show up until the following year when they are of a size that can be caught on rod and line. This will be monitored in 2012.

To determine if this was a local phenomenon checks were made in other areas of the State. Poor recruitment was reported from the Johnstone River²⁴ and the Burdekin River²⁵ while a reasonable level of recruitment was reported from Herbert Creek about 100km north of Rockhampton.

Figure 60 shows the actual recruits recorded up to 580mm over time from 1998-2011. Arrows show the year class of fish from when first recorded to their growth over time towards legal size. This shows the strong recruitment that occurred from 2008-2010 while it indicated a very low level of recruitment in 2011.

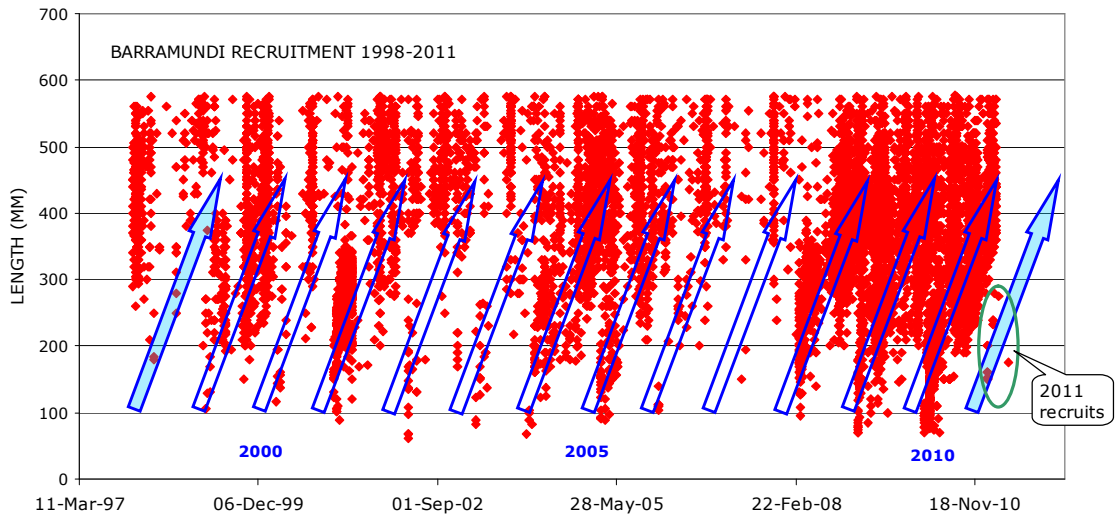


Figure 60 : Barramundi recruits recorded each year (arrows show growth of fish over time and density of dots indicates strength of recruitment)

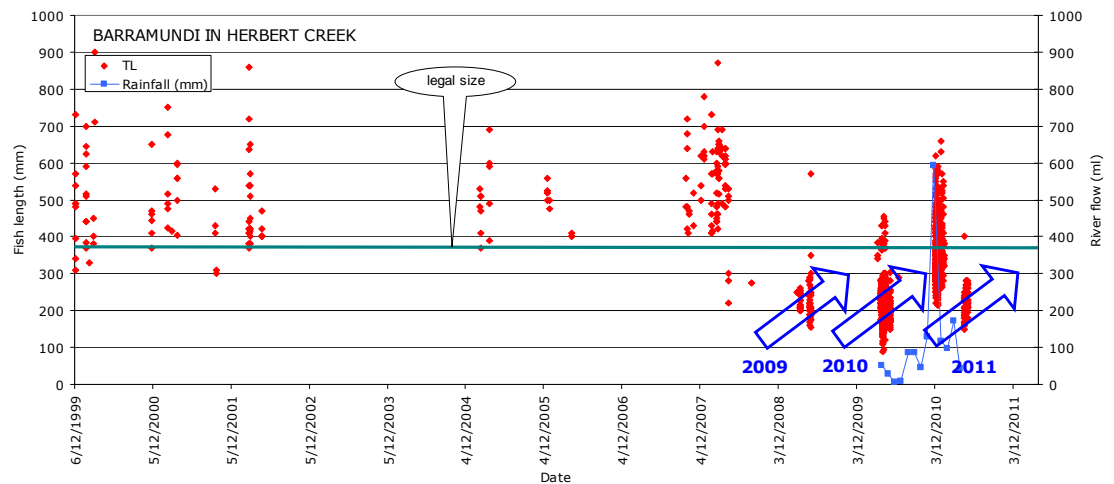


Figure 61: Barramundi recruits in Herbert Creek from 2009-2011

By comparison with the Fitzroy River recruitment in Herbert Creek was reasonable this year with 168 year 0 fish recorded. Figure 61 shows recruits for 2009-2011. Unlike the Fitzroy River there was no early heavy rain in September or October with the heavy rainfall in January, which is associated with good recruitment.

There were also reliable reports of numbers of 200mm Barramundi in Pancake and Eurimbula Creeks to the south in early winter however these reports were not investigated and confirmed.

²⁴ Personal communication from Malcolm Pearce Northern Fisheries Centre

²⁵ Personal communication from Alan Griggs Burdekin Fish Restocking Association

24. CAN BARRAMUNDI RECRUITMENT BE PREDICTED?

Recruitment is a key driver of Barramundi stocks. While monitoring recruitment can provide useful information, understanding the environmental drivers of recruitment can lead to being able to predict the level of recruitment.

In 2007 CapReef developed a recruitment predictor, based on environmental cues, for the strength of Barramundi recruitment each year. The predictor is for the Fitzroy River and 12 Mile Creek. This creek is an instream lagoon that is consistently accessed each year by Barramundi recruits and is used as a reference site. Since 2007 the predictor has been continually refined based on collecting data on actual recruitment. While the predictor was developed for the Fitzroy River it is considered that it could be readily adapted to other areas when threshold values for flows and rainfall are determined for particular sites.

Strong recruitment has been recorded in years where:

- wet season (Dec-Mar) monthly flows exceed 0.5GL
- total wet season flows exceed 1.5GL
- maximum flows occur in Jan-Feb
- monthly rainfall exceeds 150mm in January-February to allow recruits to access offshore lagoons and wetlands
- low total flows of less than 0.5GL from Sept-Nov²⁶

The last parameter was added at it was considered that flooding from September-October could interfere with spawning, which requires high salinity. This parameter was not previously considered as, prior to 2011, there was only 1 year in the last 24 years where this parameter was applicable.

YEAR	FLOW AND TIMING					RECRUITS		FITZROY RIVER			12 MILE	
	monthly flow >0.5GL	wet season flow >1.5GL	Max flow Jan-Feb	low flow previous Sept-Nov <0.5GL	12 mile rain>150mm Jan-Feb	Fitzroy recruits <350mm Jan-May	12mile recruits <350mm Jan-May	monthly flow	wet season flow	low flow previous Sept-Nov	12 mile rain	rain timing
1988	✓	✓	✓	✓		19	18					
1989	✓	✓		✓		85	0					
1990				✓		8	0					
1991	✓	✓	✓	✓	✓	397	199					
1992				✓	✓	25	3					
1993				✓		7	0					
1994				✓	✓	4	0					
1995			✓	✓		1	0					
1996	✓	✓	✓	✓	✓	1485	1469					
1997		✓		✓	✓	24	11					
1998				✓		10	6					
1999	✓	✓	✓	✓	✓	67	65					
2000				✓		17	9					
2001	✓	✓	✓	✓	✓	837	807					
2002				✓		24	5					
2003	✓	✓		✓	✓	16	2					
2004	✓		✓	✓	✓	153	17					
2005		✓		✓	✓	105	27					
2006				✓		18	4					
2007				✓		3	0					
2008	✓	✓	✓	✓	✓	524	380					
2009	✓	✓	✓	✓	✓	289	79					
2010	✓	✓	✓	✓	✓	778	253					
2011	✓	✓	✓			17	11					

	Conditions outside range
	Conditions close to range
	Conditions inside range

Figure 62: Predictor for Barramundi recruitment in the Fitzroy River from 1998-2011 (all green indicates years of strong recruitment)

The predictor was then compared with data collected on year 0 recruits (less than 300mm before end March and less than 350mm before the end of May) that were recorded from January-May each year. Recruits from around 50-100mm are recorded in January and can grow to 300-350mm by the end of May. Once winter sets in the growth drops to near zero until the weather warms up again in late August.

²⁶ New parameter added in 2011

Figure 62 shows the current version of the recruitment predictor developed through CapReef. The low flow parameter for the previous September-November has been added. Where all parameters are shown in green it was expected that there would be strong recruitment. The actual number of year 0 recruits was recorded under recruits. In most years the number of recruits recorded is consistent with what was predicted.

Figure 63 shows the same recruitment data compared with river flows. This shows the mostly very dry years from 2003-2008.

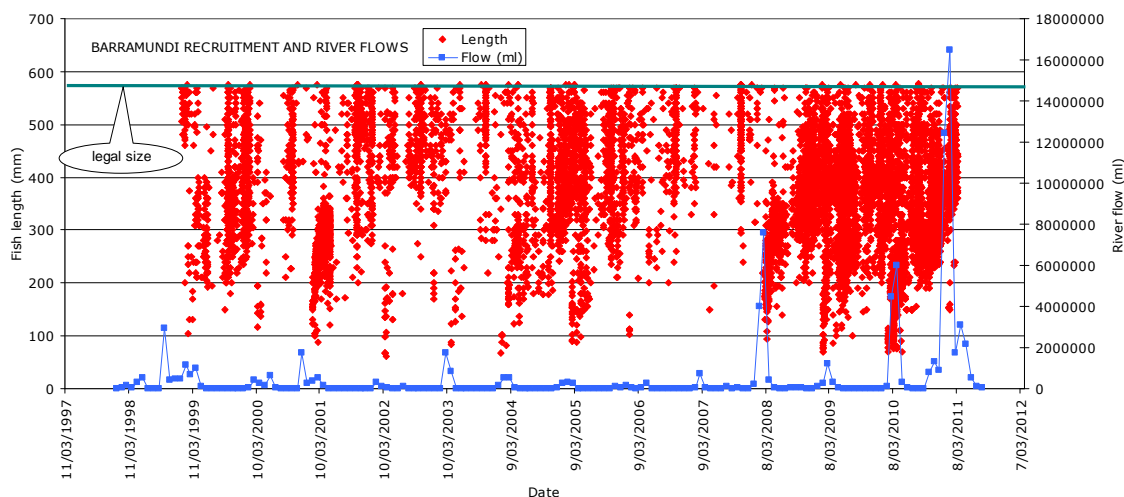


Figure 63: Recruitment and river flows from 1998-2011

There have only been 2 years in the last 24 years where there has been flooding from September-November and total flows have exceeded 0.5GL. In 1998, prior to 1999 recruitment, there was a flow of 3.9GL while in 2010, prior to 2011 recruitment, the flow in those months was 3.0GL.

There was still moderate recruitment in 1999 however in that year wet season flows from December-March were only 3.3GL, whereas in 2011 there was a major flood with total wet season flows of 30+GL. This volume of water exceeded the 22.7GL in 1991 wet season and flood. The two floods were similar in timing. However in 1991 there was still strong recruitment that year with flows from September-October just less than 0.5GL.

25. CAN BARRAMUNDI STOCKS BE PREDICTED?

Based on the previous data collected and the data collected through this project it is possible to predict what Barramundi stocks are likely to be over the next 2-3 years. That was the purpose for establishing the "Crystal Bowl". It was proposed that a numerical model be developed that would provide quantitative estimates of future stocks. With the rejection of the project proposal by FRDC for 'A "Crystal Bowl" for Barramundi: predicting the future for regional management' that will not be possible in the immediate future.

However the development of a predictive capacity will continue based on a qualitative approach. The following is the prediction for the 2012-13 fishing years.

In the 2012 fishing year Barramundi stocks will be high with 3-5 year old fish (580-850mm) dominating the legal catch. There are be large numbers of juvenile fish aged 2-3 years (450-580mm) which will start to enter the fishery in 2012 and 2013.

26. REGIONAL MANAGEMENT AND IMPACTS OF DEVELOPMENTS

During the second half of 2010 a project proposal titled 'A "Crystal Bowl" for Barramundi: predicting the future for regional management' was developed. The development of this application was used in gaining Fisheries Queensland, local commercial and recreational fisher and other stakeholder support for working towards regional management.

As part of the development of project "Who's fish is it anyway?" Fisheries Queensland identified Central Queensland as a priority for the development of regional management. This was supported by local commercial and recreational fishers and other stakeholders.

That application was submitted to the FRDC to be considered as part of its 2011 open call round. The application was supported by all stakeholder groups and the project team or steering committee included a representative from all groups including:

- Fisheries Queensland (both management and research)
- Department of Environment and Resource Management
- Great Barrier Reef Marine Park Authority
- Fitzroy Basin Association
- Central Queensland University
- James Cook University
- CapReef
- Local recreational fishing clubs
- Local commercial fishers from the Queensland Seafood Industry Association

Progress on addressing regional management will be delayed as the project proposal was rejected by FRDC. However work will continue towards engaging all stakeholders in regional management.

Progress on dealing with port development proposals is dealt with under further development.

27. DISCUSSION

The "Crystal Bowl" has provided the opportunity to review data that have been collected through Suntag, CapReef and by Fisheries Queensland over the past 25 years on fishing in the Fitzroy River. The key data that were missing were related to recreational catch and effort and this project has at least provided an initial estimate. Due to the major flooding that occurred this estimate may not be indicative of what happens in other years.

The data have provided a comprehensive picture of what the Barramundi fishery in the river looks like and what are the effects of environmental drivers. The data collected from 2000-2011, where available, have been reviewed in detail.

Barramundi stocks in the Fitzroy River are largely driven by environmental factors that determine the level of recruitment, which in turn determines the availability of fish to the fishery in 3 years time. The concerns raised in 2008 that led to the development of the Crystal Bowl concept largely dissipated with 3 strong recruitment years in 2008, 2009 and 2010. This was the first time in the 25 years of data collection that there were 3 successive years of strong recruitment. Despite the record rainfall and river flows in 2010-11 it appears that recruitment has been poor.

The current status of stocks will provide some comfort for fisheries managers in that the current management arrangements are working. However the stocks are under significant pressures from fishing effort and developments that may

impact on spawning and habitat. This comfort will only last as long as the environmental drivers continue to play a positive role on stocks.

The opportunity to move towards regional management in a positive environment has been temporarily set back by the rejection of the proposal submitted to FRDC. The opportunity remains for the immediate future but is likely to fade over time, particularly if the environmental drivers continue to play a negative role as they have in 2011. Climate predictions suggest that is likely to be the case.

28. FURTHER DEVELOPMENT

Data collected as part of this project was considered integral to the development of regional management and monitoring the impact of major infrastructure proposals for the Fitzroy River and for Gladstone Harbour.

There are currently 2 coal port proposals for the Port Alma area, the Gladstone Port is being expanded and there are currently 4 Liquid Natural Gas (LNG) proposals at Gladstone Harbour at various stages of development. All these developments will have some level of impact on fisheries and it will be important that effects on fisheries are monitored. The local fishing community is very supportive of taking a community monitoring approach.

Xstrata Coal has a proposal for the Balaclava Island Coal Export Terminal Project (BICET) which is a coal port proposal for Balaclava Island in the Port Alma area. Xstrata Coal has established a Community Reference Group (CRG) for the feasibility phase of this project. Bill Sawynok has been appointed to represent fisheries on that group. Baseline data relating to the Port Alma area collected through this project was provided to Xstrata Coal for its Environmental Impact Statement which is currently being prepared.

A further proposal for Fitzroy River Development by the Mitchell Group has recently been made to barge coal from Port Alma to be loaded onto ships offshore. This proposal is in its very early stages.

Additional funding has been provided by the Fitzroy Basin Association to continue community engagement and collecting fisheries data at Port Alma and the Fitzroy River.

A project to monitor trends in recreational fishing in Gladstone Harbour will commence shortly. This is a one year project being funded by QGCLNG Operating Company.

Over the next year CapReef will work with local fishing communities towards an overall proposal for monitoring of fisheries in the Rockhampton and Gladstone areas. Ideally such a project would be best implemented with costs shared by all developments. The "Crystal Bowl" is considered to be fundamental to such a proposal.

Moving towards regional management will be dependent on how quickly local commercial fishers, recreational fishers and Fisheries Queensland want to progress the matter.

29. CONCLUSION

This report should be an important part of informed debate on the future of the Barramundi fishery in the Fitzroy River and any move towards regional management.

It also forms an important baseline of information that can be used to assess the impacts of current or future developments.

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