



Bellingen Shire Council Healthy Rivers

Developing capacity building and education strategies to address future impacts of Climate Change and manage and improve the health of the Bellinger and Kalang Rivers.

August 2012

Bellingen Shire
COUNCIL



Disclaimer

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Foreword

Bellingen Shire Council adopted the Bellinger and Kalang Rivers Estuary Management Plan in 2008 and the Bellinger and Kalang River Health Plans in 2010. Closure of the Bellinger and Kalang Rivers to oyster harvesting in 2006 and 2008 respectively, triggered a coordinated approach to water quality management and subsequent planning processes. This Healthy Rivers project was developed in response to information, objectives and strategies specified in these plans and has enabled Council to make significant progress in the following areas:

1. Identification of estuarine boat use activities and impacts;
2. Collection of information in relation to climate change impacts;
3. Collection of data in relation to tourism impacts including septic tanks and use of existing foreshore recreational facilities;
4. Increased landholder, community and visitor awareness of estuarine and river health issues and impacts;
5. Development of tools and strategies to address and manage water quality impacts more effectively in partnership with landholders, communities and visitors; and
6. Support of good practice riparian zone management through engagement and capacity building of key 'champions', demonstrations sites and workshops.

The outputs and outcomes described in this report are a significant step in the right direction towards a coordinated approach to water quality management in the Bellinger and Kalang River Catchments and provide a solid foundation upon which progress can continue as required to ultimately improve water quality and protect our natural environment, community and industries.

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- Bellinger Landcare Inc.;
- Macquarie University;
- Northern Rivers Catchment Management Authority;
- University of New England; and
- WetlandCare Australia.

The following people and organisations also assisted with project implementation:

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- Andrew Rickert, River Health Projects Officer, Bellingen Shire Council;
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- Shaun Morris and Peter Corlis, Northern Rivers Catchment Management Authority;
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- Lisa Siegel & Jane Noack, Waterwise Educators, Cascade Environmental Education Centre;
- Kim Cheney, Bellingen Bush Regenerators;
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- Daniel Freuden, Bellingen Canoe Adventures;
- Bellingen Shire Council Planning Team;
- Bellingen Shire Council Coastal & Estuarine Management Committee; and
- Local landholders implementing on-ground works through demonstration project sites.

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Summary

This Healthy Rivers project was undertaken over 3 years from 2009 to 2011 inclusive within Bellingen Shire on the Mid North Coast of New South Wales with funding from Bellingen Shire Council and the Office of Environment & Heritage (OEH) Estuary Management Program. The aim of the project was to start addressing the following key impacts on water quality as identified in Estuary Management and River Health Plans for the Bellinger and Kalang Rivers:

- Lack of onsite sewage monitoring, management and overloading;
- Boating;
- Tourism;
- Cattle;
- Lack of sustainable planning for the provision of foreshore recreational facilities; and
- Climate change and sea level rise.

The purpose of this report is for Bellingen Shire Council to meet the final reporting requirements for the OEH Estuary Management Program funding grant. Overall this project met its expectations and was highly successful. Due to a number of opportunities to value add to the project with other partners, the 50:50 financial contribution made between Council and OEH achieved a broad range of outcomes and outputs, with widespread stakeholder engagement and support. It has set the platform for Bellingen Shire Council to engage with the local community in catchment management activities in an unprecedented manner.

Project achievements are summarized in more detail below against each project milestone.

Milestone 1 - Recreational boat use survey & recommendations report

Large amounts of data were collected through observations and surveys of boat users and their activities on the Bellinger and Kalang Rivers. This information was analysed and presented in the Bellinger-Kalang Estuary Recreational Boat Use Assessment report by Jetty Research (2010). Information was also collected for river front landholders' observations and opinions. Both data sets were presented to Council's Coastal & Estuarine Management Committee (CEMC) which then made recommendations including:

- regulatory changes;
- works to improve bank stability; and
- further education and awareness raising.

These recommendations are currently being followed up by the CEMC and when implemented, will result in improved management practices and user behaviours with subsequent improvements in bank condition and water quality.

The Code of Conduct for recreational use of the Bellinger and Kalang Estuaries was also updated and distributed and new signs were erected at Urunga boat ramp.

Milestone 2 - Climate Change Adaptation Report

An internal workshop in 2009, identified and prioritized Climate Change risks within Council's operations and Bellingen Shire, including the following 'very high priority' risks for 2030:

- Damage to roads and infrastructure;
- Increased bushfire risks;
- Increased price of energy;
- Threats to sewer and water systems; and
- Isolation of the community during flooding events.

Results of economic implications were collated and discussed in the report, 'Climate Change Risk Assessment: Bellingen Shire Council' by Climate Risk Pty Ltd (2010). Based on the above risks, Council was also involved in the development of 'A Climate Change Adaptation Strategy for Nambucca, Bellingen and Kempsey' by Climate Risk Pty Ltd (2010). This Strategy includes the need for detailed assessment of critical infrastructure; research on storm surge and sea level rise; flood analysis; and identification of resources to drive adaptation.

Both the Risk Assessment and Adaptation Strategy were received at Council's December 2010 meeting where Council resolved to incorporate the Strategy into its 2030 Community Strategic Planning process. This is an important step towards implementing the Strategy and in the mean time, Council's 'Sustainability Team' can use the actions and gaps specified in the Strategy as platforms for funding applications.

Milestone 3 - Holiday OSMS facilities audit & recommendations

Water quality tests, surveys of public toilet use patterns and an audit of holiday letting onsite sewerage management systems (OSMS) were conducted. Findings are presented in the report, 'Investigation into the performance of onsite sewerage management systems at holiday letting properties and public toilet facilities within the Bellingen Shire' by B-COS Consulting Services (2011) which provides comprehensive data on the condition of OSMS on public land in the Shire. Inspections of 'at risk' OSMS were then conducted and upgrades and maintenance undertaken accordingly. However, further funding is required to implement the recommendations from the report before the data gathered becomes redundant and outdated.

Milestone 4 - Holiday OSMS education program delivery

An education package was developed and distributed to owners and managers of holiday letting properties with messages targeted towards tenants and visitors to improve awareness and management of OSMS. The package included OSMS data sheets, 2 Fact Sheets and a 'Be Septic Smart' sticker.

Milestone 5 - Healthy Rivers Program strategy formulated

A strategy was developed to increase awareness and capacity of estuarine and riparian zone management across a broad cross section of the community. The strategy was then applied to the development and implementation of the materials and events described below in Milestones 6 to 8 inclusive.

Milestone 6 - Development of technical & educational materials

Five booklets/pamphlets were developed and produced providing local guidance on the following management practices:

- Erosion Control;
- Stock Management;
- Biodiversity;
- Growing Lomandra from Seed; and
- 'Doing it by the book' Riparian Restoration Permit Approvals.

These materials have been very well received by the community and continue to provide a valuable tool for education.

Milestone 7 - Coordination & implementation of capacity building workshops

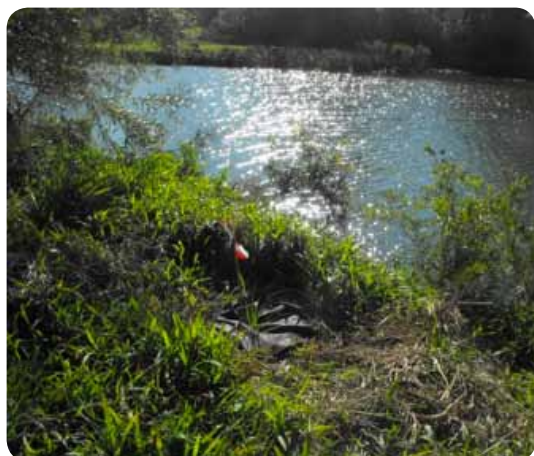
A series of field days, workshops and presentations were held from June 2010 to May 2011 featuring:

- Estuarine erosion processes and bank protection measures;
- River bank restoration sites;
- Flood planning and recovery scenarios;
- Floodplain management;
- Guided canoe tours with information about history, current management practices & projects; and
- Current issues and management practices at 2 significant local sites – Bellingen Island and Urunga Lagoon.

A trial of the Waterwise program was conducted at 5 schools in the Bellingen Shire. Based on the Waterwise Schools program developed by Western Australia's Water Corporation, this program supports teachers and students to gain an awareness and understanding of our local waterways and the importance of water conservation. Due to its success, funding proposals are currently being developed to ensure the program continues so more schools can benefit from the resources and support it provides.

Milestone 8 - Establishment of demonstration sites

Restoration works were undertaken at 7 strategic sites in the Bellinger Estuary establishing 'champion' landholders who now provide demonstrations of best practice riparian management and erosion control along the estuary. Projects included weed control, revegetation, bank battering and rock revetment for erosion control.



Introduction

Bellingen Shire Council is acutely aware of the importance of the Bellinger & Kalang River systems and what they mean to the residents of the Shire and visitors. History has shown that our rivers are major focal points and generate a uniting influence within the community. Council adopted the Bellinger & Kalang Rivers Estuary Management Plan in 2008 and the Bellinger and Kalang River Health Plans were subsequently adopted in 2010. These plans have provided key direction for river and estuary management in the Shire and a platform for sourcing external funds. The full title for this project is, 'Developing capacity building and education strategies to address future impacts of Climate Change and manage and improve the health of the Bellinger and Kalang Rivers' however for simplicity it has commonly been referred to as the 'Healthy Rivers' project. It was undertaken over 3 years from 2009 to 2011 through a funding agreement with the NSW Office of Environment & Heritage under their Estuary Management Program. It has launched Council's broader Healthy Rivers Program and has made significant progress towards achieving some of the management objectives and strategies outlined in the above Plans. The purpose of this report is for Council to meet the final reporting requirements for the OEH Estuary Management Program funding grant and to describe Council's progress and achievements accordingly.

Project Aims & Objectives

This project aimed to start addressing key issues identified in the Bellinger Kalang Estuary Management Plan (2008) and the Bellinger and Kalang River Health Plans (2010). In particular, these plans identified impacts on water quality from the following practices:

- Lack of onsite sewage monitoring, management and overloading particularly during holiday periods;
- Boating;
- Tourism;
- Cattle; and
- Lack of sustainable planning for the provision of foreshore recreational facilities to cater for present and future demands.

Climate change and sea level rise were also identified as implications for consideration.

To achieve this aim, the project objectives were to:

- a) Identify boat use activities and impacts to supplement the Bellinger-Kalang River Estuaries Erosion Study.
- b) Collect information in relation to climate change impacts and identify at risk areas.
- c) Collect data in relation to tourism impacts including septic tanks and use of existing foreshore recreational facilities.
- d) Increase the awareness and knowledge of landholders, communities and visitors in relation to the key issues impacting on estuarine and river health including future impacts of climate change.
- e) Develop tools and strategies to address and manage water and land based impacts more effectively in partnership with landholders, communities and visitors.
- f) Support good practice management through engagement and capacity building of "key champions", demonstration sites and workshops.

Project Location

Bellingen Shire is located on the Mid North Coast of New South Wales halfway between Sydney and Brisbane and immediately south west of Coffs Harbour. It is located within the traditional lands of the Gumbaynggirr people and has a total area of 1,605 square kilometres with a coastline of approximately 10km. Bellingen Shire consists of three broad topographical areas incorporating the seaboard around Mylestom, Repton and Urunga, the valleys of the Bellinger and Kalang Rivers and the Dorrigo plateau landscapes (*Annual Report 2010/11*, Bellingen Shire Council, 2012, p.1). More than half the catchment area is contained within State Forest, National Parks and Nature Reserve boundaries. Logged native forests are the next major land use type, followed by agriculture, beef cattle, dairy cattle, small fruit and nut operations, small vegetable and cut flowers operations (*Bellinger River Health Plan*, Bellingen Shire Council, 2010, p.13).

The resident population of the Shire was 13,450 in 2010 (*Annual Report 2010/11*, Bellingen Shire Council, 2012, p.1). Urban areas within the catchment are dominated by the towns of Urunga and Bellingen, and there are a number of small village settlements including Fernmount, Repton, Raleigh and Mylestom. Rural areas include Kalang, Newry Island and Brierfield (*Kalang River Health Plan*, Bellingen Shire Council, 2010, p.13).

The Shire's climate is sub-tropical with warm, wet and humid summers and mild, dry winters. Annual average rainfall for the area is 1526mm with majority of rainfall occurring in the summer period between December to April with average monthly rainfalls of 138-218mm. The relatively high rainfall and steep catchment slopes exacerbate impacts on water quality and river health (*Kalang River Health Plan*, Bellingen Shire Council, 2010, p.12).

The Bellinger River is estimated to have a catchment area of 780km² and the Kalang River 330km² (*Kalang River Health Plan*, Bellingen Shire Council, 2010, p.12). The Bellinger River estuary includes a total of 50km of river bank from Lavenders Bridge in Bellingen to the River mouth at Urunga (*Bellinger River Estuary Action Plan - Reach Plan*, Bellingen Shire Council, 2011, p.5). The Kalang River estuary extends from near Bowraville Road crossing at Brierfield to the river mouth at Urunga (*Bellingen and Kalang Rivers Estuary Management Plan*, BMT-WBM, 2010, p.1). Refer to Figure 1 below.



Figure 1 Location of the Bellinger and Kalang River estuaries (Source: *Bellinger and Kalang River Estuaries Erosion Study*, Telfer & Cohen, 2010, Figure 1, p.3).

Milestones & Project Achievements (Outcomes & Outputs)

5.1 Milestone 1: Recreational boat use survey & recommendations report

5.1.1 Jetty Research (consultants) conducted 523 interviews with boat users and recorded 1,524 observations of boat users and their activities on the Bellinger and Kalang Rivers during 348 hours of observation. Results were collated and presented in the 'Bellinger-Kalang Estuary Recreational Boat Use Assessment' report by Jetty Research (2010) (Refer to Appendix 1). The report is divided into five major sections:

1. Descriptive information relating to river users and their boats (e.g. gender, age, place of residence, boat length, engine size etc.);
2. Patterns of river use (e.g. types of activities, frequency of activities, times, tides etc.);
3. Boating observations (e.g. boat speed, position in stream, turning, towing etc.);
4. Locational data (e.g. frequency and types of activities at different locations); and
5. River User opinions.

The report provides direction for future planning and recommendations for regulatory changes.

In addition to the boat user surveys conducted by Jetty Research, Bellinger Shire Council conducted surveys with 80 river front landholders to gather their observations and opinions about boating activities adjacent to their land. Results were collated and presented in graphs (refer to Appendix 2) and were then considered in conjunction with the results from the boat user surveys and observations. This information was presented at a Coastal & Estuarine Management Committee workshop on the 22nd of February 2011 and provided workshop participants with the information required to make recommendations for bank stabilization, regulatory changes and further education/awareness raising. Workshop participants included representatives from Bellinger Shire Council, NSW Maritime, DECCW, Bellinger Landcare, Newry Island Rivercare, Bellinger Environment Centre and Urunga Amateur Anglers Club.

The following recommendations were developed and are currently being followed up by the Coastal & Estuarine Management Committee:

Upper Kalang –

- Improve bank condition; and
- Investigate passive recreation opportunities.

Newry Island, Kalang River –

- Reduce the speed limit to 4 or 6 knots in oyster lease and residential locations;
- Increase the speed limit to unrestricted outside these locations; and
- Maintain no wash zone across area.

Urunga Island/ River mouth/ Back Creek –

- Decrease boat speed to 4 knots, and include no wash along Back Creek;
- Increase the main Bellinger River to unrestricted, No Ski signs and No irregular riding; and
- Undertake works to improve bank stability at Urunga Island & Yellow Rock Rd.

Mylestom/Repton –

- No wakeboarding downstream of Rail Bridge and upstream of Old Pacific Highway bridge; and
- Undertake works to improve bank stability.

Upstream Pacific Highway on Bellinger River –

- No ski/wakeboard zone;
- No wash zone; and
- Works to improve bank stability.

5.1.2 The Coastal & Estuarine Management Committee reviewed the existing Code of Conduct for recreational use of the Bellinger and Kalang Estuaries and finalised an updated version in June 2010. The brochure of the new Code of Conduct (refer to Appendix 3) was then distributed in October 2010 to all relevant local boat user groups, tourist facilities and businesses for public dissemination. New boat user signs were also erected at Urunga boat ramp in April 2011 (refer to Appendix 4) to reflect the new Code of Conduct. Both of these tools will enhance public awareness of the Code of Conduct and the reasons behind it.

5.2 Milestone 2: Climate Change Adaptation Report

An online survey was conducted to determine climate change awareness, capacity and action within Council and gain a better understanding of the organisational response required to mitigate climate change risks. An internal workshop was held on the 8th of December 2009 to identify risks of climate change on Council's operations and area of influence. Ten staff members representing all sectors of Council attended the workshop and identified the following risks as 'very high priority' for 2030:

- Damage to roads and infrastructure from storms and flooding;
- Increased bushfire risks to life and property;
- Increased price of energy from a carbon constrained economy;
- Threats to sewer and water system from sea level rise; and
- Isolation of the community during flooding events.

An additional four risks were ranked as 'very high priority' for the longer-term future for 2050 including:

- Flooding of the Urunga CBD;
- Threats to biodiversity;
- Increased service demands (and operational costs); and
- Food security.

Economic modelling was undertaken for identified climate change risks to understand the economic costs associated with climate change and determine the costs and benefits of various projects and policies. Results were collated and discussed in the report, Climate Change Risk Assessment: Bellingen Shire Council by Climate Risk Pty Ltd (2010). This report concludes as follows:

"...by 2030 Council is likely to feel the ramifications from the confluence of the following impacts:

- Significant changes to runoff;
- Increased bushfire risks;
- A stressed economy;
- Business interruption;
- Increased cost of living;
- Increased maintenance regimes;
- An ageing population;
- Considerable increases in oil prices;
- Increased intensity of storms (and storm clean-up costs);
- Increased operational costs;
- Diminishing proportion of full-paying rateable properties;
- Concurrent extreme weather periods; and
- State policies inconsistent with changing climate science.

In accordance with the Federal Government's Local Adaptation Pathways Program, Council has also developed, A Climate Change Adaptation Strategy for Nambucca, Bellingen and Kempsey by Climate Risk Pty Ltd (2010) based on the above risks. This Strategy includes the need for detailed assessment of critical infrastructure; research on storm surge and sea level rise (down to individual lot level); flood analysis (based on current data); and identification of resources to drive adaptation. Both the Risk Assessment and Adaptation Strategy were received at Council's December 2010 meeting where Council resolved to incorporate the Strategy into its 2030 Community Strategic Planning process.

5.3 Milestone 3: Holiday OSMS facilities audit & recommendations

The report titled, Investigation into the performance of onsite sewage management systems at holiday letting properties and public toilet facilities within the Bellingen Shire – Part A' by B-COS Consulting Services (2011) provides an understanding of Onsite Sewage Management System (OSMS) condition and response to peak overloading according to property type, landscape and allotment scales. It also provides information about land managers' attitudes and behaviours regarding OSMS. This report was compiled based on results of the following undertakings:

- Water quality testing (microbial source tracking analysis) to determine the risk/ratio of human and ruminant based fecal contaminants in waterways within and outside peak usage periods;
- A Survey to determine peak loading and usage patterns on Council's public toilet facilities; and
- An audit and desktop review of holiday letting OSMS facilities to determine 'at risk' OSMS.

Inspections of 'at risk' OSMS were then conducted and upgrades and maintenance were undertaken accordingly to reduce failures, improve OSMS functioning and improve water quality in receiving environments. This project is closely aligned with the OSMS inspection program currently being undertaken on private dwellings in Bellingen Shire.

5.4 Milestone 4: Holiday OSMS education program delivery

An education package was developed and distributed to owners and managers of holiday letting properties including:

- Cabins;
- Residential type holiday letting properties;
- Bed & Breakfasts; and
- Holiday and Tourist Parks.

The materials were designed for ease of distribution, promotion and display by property owners and managers and the information was targeted towards tenants and visitors to improve awareness and management of OSMS. The education package included:

- OSMS data sheets including Property details, OSMS details, Occupancy loadings, Site characteristics and OSMS performance assessment results (Investigation into the performance of onsite sewage management systems at holiday letting properties and public toilet facilities within the Bellingen Shire – Part B, B-COS Consulting Services, 2011);
- Fact sheets titled, 'Managing Your Onsite Sewage Facility' (Appendix 5) and 'Water Conservation & Your Septic Tank' (Appendix 6); and
- Stickers with the caption, 'Be Septic Smart – Only ones and twos down the loo – No plastics, sanitary pads or chemicals' (Appendix 7).

5.5 Milestone 5: Healthy Rivers Program strategy formulated

A strategy was developed to address education and capacity building project objectives d), e) and f) in a collective manner. The scope of the strategy was to develop education and capacity building activities to address issues associated with climate change on estuarine riparian management, wetland management and fluvial processes (e.g. erosion and channel movement) resulting from flood events. A variety of delivery mechanisms were used in order to increase awareness and capacity across a broad cross section of the community. Aspects of the strategy were specifically targeted towards particular reaches of the Rivers which are considered to be high priority according to recovery

potential, proximity to ecologically significant areas and landholder willingness to participate, experiment and advocate to the community. The strategy was applied to the development and implementation of the materials and events outlined below in Milestones 6 to 8 inclusive.

5.6 Milestone 6: Development of technical & educational materials

Five booklets/pamphlets were developed and produced recommending management practices for local landholders including the following topics:

- Erosion Control (refer to Appendix 8);
- Stock Management (Appendix 9);
- Biodiversity (Appendix 10);
- 'Doing it by the book' Riparian Restoration Permit Approvals (Appendix 11); and
- Growing Lomandra from Seed (Appendix 12).

They are very useful materials which have received positive feedback from local landholders and continue to provide a valuable tool for community education and capacity building in Council's Healthy Rivers Program.

5.7 Milestone 7: Coordination & implementation of capacity building workshops

A series of field days, workshops and presentations were held from June 2010 – May 2011 as outlined below.

5.7.1 A Field Day was held on the 16th of June 2010 to examine estuarine erosion processes and bank protection measures. Damon Telfer from GECO Environmental, co-author of the 'Bellinger & Kalang River Estuaries Erosion Study', 2010, delivered a presentation to inform local residents about the content and findings of the study including:

- Historical changes to the estuary;
- 2009 Bank Condition Assessment Results; and
- Management Recommendations including Best Practice Rock Revetment & Embayment Works, Fencing and Revegetation/Regeneration.

Thirty local residents attended the presentation and then visited a local cattle farm demonstrating best practice riparian management techniques.



Left: Colin Matthews, Bellinger Landcare, describes best practice riparian fencing and revegetation to local landholders. Right: Rock revetment, large woody debris and revegetation demonstration site.

5.7.2 Twenty five local landholders attended a Catchment Crawl on the 14th of July 2010, visiting river bank restoration sites to see what it takes to achieve long term river bank stability and resilience including:

- Erosion control techniques and structures;
- Riparian weed control techniques and follow up procedures;
- Revegetation guidance – what plants are best to use, when and how to plant and look after them; and
- Approaches to managing large woody debris (logs & snags).



Left: Kim Cheney, Bellingen Bush Regenerators, describes weed control techniques and procedures to local landholders attending the Catchment Crawl. Right: Colin Matthews, Bellinger Landcare, explains an erosion control project at Bellingen Golf Club.

5.7.3 A Field Day was held on the 29th of September 2010 to examine and discuss flood planning and recovery scenarios on the Kalang River. Dr Tim Cohen, co-author of 'River Styles in Bellinger-Kalang catchment' (1998) and the 'Bellinger & Kalang River Estuaries Erosion Study' (2010) presented and participated in the Field Day. 22 local landholders attended.



Dr Tim Cohen discussing flood planning and recovery scenarios for the Kalang River with landholders.

5.7.4 Forty-five local landholders participated in a canoe tour of the upper Bellinger estuary from Bellingen to Fernmount on the 28th of August 2010 and another forty people attended the second canoe tour the following day to learn about:

- The historical context of the river catchment in which we live;
- Recent and current land-use patterns and impacts on the River;
- Findings from the Bellinger Estuary Erosion Study;
- What happens when it floods; and
- Examples of good and not-so-good management practices.



Andrew Rickert, Bellingen Shire Council's River Health Projects Officer, leads landholders on a guided tour of the Bellinger River, with stops along the way for interpretive information.

5.7.5 The Northern Rivers Floodplain Network meeting was held at the Bellingen Shire Council Chambers on the 26th of May 2011 with 20 members attending to share information and ideas about floodplain management and current projects as follows:

- Catchment Action Plan Review (CAP 2);
- Southern Cross University's GeoScience Centre - Acid Sulphate Soil Training Short Courses;
- WetlandCare Australia's Coastal 20 Wetlands project;
- Richmond River County Council, decoupling some swamp areas from flood mitigation systems;
- Clarence Valley Council Urban Sustainability Program;
- Bellingen Shire Council River Health Program; and
- Bundagen multiple occupancy community.

Members attended a Field Trip on the following day visiting Bellingen Island and other sites in the lower Bellinger River floodplain to examine current issues and projects.

5.7.6 Two site visits were held at Bellingen Island (a remnant Endangered Ecological Community under the EPBC Act 1999), each with thirty tertiary students in attendance. The purpose of the site visits was to examine current issues and riparian management/erosion control projects. Another visit was held at Urunga Lagoon with thirty environmental science honours students to examine current issues and wetland management/fish habitat projects.

5.7.7 The first phase of the Waterwise Schools Program was introduced in Bellingen Shire in 2011 by collaborating with the NSW Department of Education through Cascade Environmental Education Centre. Based on the Waterwise School Program developed by Western Australia's Water Corporation, the program aims to educate students, their families and wider communities about the need to value, protect and conserve our precious water resources.

Waterwise Educators present interactive water education lessons to all classes in the school, the school receives a free package of lesson plans and resources to continue Waterwise education activities and the school agrees to educate its parent body about Waterwise principles and facts and also commits to participating in National Water Week every year. Through this program 5 primary schools in the Shire have received locally relevant Waterwise resources and lessons and are ready for accreditation. It has been a very successful program and preparations are currently underway to ensure the program continues to improve and more schools benefit from an awareness and understanding of our local waterways.



Mayor Mark Troy (right) & Waterwise Educator Jane Noack (middle) present Bellingen Public School with Waterwise accreditation certificate. Principal Graeme Ross (left) and School Captains Mia Fisher and Zac Jones (front).

5.8 Milestone 8: Establishment of demonstration sites

Implementation of restoration works was undertaken at 7 strategic sites in the Bellinger Estuary. This established 'champion' landholders who are providing demonstrations of best practice riparian management and erosion control along the estuary.



Weed control and revegetation, Mylestom Drv, Mylestom.



Rock revetment, Shields' property, Fernmount.



Weed control and revegetation, Ford Street, Bellingin.



Weed control, Hammond Street, Bellingin.



Weed control and revegetation, Hannaford's property, Brierfield.



Erosion control, Hope's property, Bellingin.



Bank battering & rock revetment, Sanger's property, Bellingin.



Revegetation, Stuart's property, Bellingin.

6.0 Evaluation & Recommendations

6.1 Milestone 1: The boat use surveys captured a large amount of information which has been analysed and applied by the Coastal & Estuarine Management Committee to develop recommendations for further action. Bellingen Shire Council, the Coastal & Estuarine Management Committee and other river stakeholders must continue to communicate and work together to ensure that the appropriate changes are implemented. Further education and awareness campaigns are critical components to changing river users' behaviour especially to promote voluntary uptake of necessary changes.

6.2 Milestone 2: Council is aware of the potential risks and costs associated with Climate Change however lack of funding is a major barrier to action. Both the Risk Assessment and Adaptation Strategy were received at Council's December 2010 meeting where Council resolved to incorporate the Strategy into its 2030 Community Strategic Planning process. This is an important step towards implementing the Strategy and in the mean time, individual staff and perhaps Council's 'Sustainability Team' can use the actions and gaps specified in the Strategy as platforms for funding applications.

6.3 Milestone 3: Comprehensive data now exists for the condition of all Onsite Sewage Management Systems on public land in the Shire. However, further grant funding needs to be sourced to implement the recommendations from the survey before the data gathered becomes redundant and outdated. The data sheets for private OSMS from this study have been incorporated into Council's OSMS inspection database and will be picked up through routine inspections in the future.

6.4 Milestones 4 - 8: Community capacity building activities and outputs need to be periodically undertaken and reviewed according to currency of information and uptake by the community. Following the completion of this grant program, Council has a comprehensive range of technical material which is up to date and locally relevant on OSMS and riparian and catchment management. These are critical tools to guide landholders and contractors in the practical planning and implementation of their projects.

The general response from the community suggests that there is an oversaturation of workshops currently being offered in this field and perhaps energy should be focused elsewhere. Projects such as this one, enable Council and State Government to offer support to landholders to implement on-ground works. The amount of funding available for planning is currently disproportionate to the amount of funding available for on-ground works however, as more landholders become actively involved there is increasing demand for this to change.

7.0 Conclusion

Overall this project met its expectations and was highly successful. Due to a number of opportunities to value add to this grant with other partners, the 50:50 financial contribution arrangement between Council and OEH achieved a broad range of outcomes and outputs, with widespread stakeholder engagement and support. It has set the platform for Bellingen Shire Council to engage with the local community in catchment management activities in an unprecedented manner. Future funding to match Council's commitment to continue to build on the successes achieved in this Healthy Rivers project will ensure that the priorities are addressed and most importantly, that the recommendations are implemented.

8.0 References

- 8.1 *Annual Report 2010/11*, Bellingen Shire Council, 2012, p. 1.
- 8.2 *Bellinger River Health Plan*, Bellingen Shire Council, 2010, p. 13.
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- 8.9 *Investigation into the performance of Onsite Sewage Management Systems at holiday letting properties & public toilet facilities within the Bellingen Shire - Part A & B*, B-COS Consulting Services, 2011.

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Appendix 9.1

Report: *Bellinger-Kalang Estuary Recreational Boat Use Assessment*, Jetty Research, 2010

Bellingen Shire Council

Healthy Rivers Program Bellinger-Kalang Estuary Recreational Boat Use Assessment

Prepared by: Jetty Research



Final report dated: October 26th 2010



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Acknowledgements

The Bellinger-Kalang Estuary Recreational Boat Use Assessment was initiated by Bellingen Shire Council (BSC) through joint funding arrangements between NSW Department of Climate Change & Water (DECCW) and Australian Government Caring for our Country (Coastcare) projects. In partnership with Bellingen Shire Council, two grant funded projects have formed the core direction for this study:

- (a) *Developing capacity building and education strategies to address the future impacts of climate change and manage and improve the health of the Bellinger and Kalang Rivers* (DECCW); and
- (b) *Promoting sustainable boating practices to protect the Bellinger/Kalang coastal river systems* (Coastcare).

Many thanks to the Coastal & Estuarine Management Committee (BSC) for providing guidance in the design phase of the study, feedback on the initial results and direction for the final report. Also to NSW Maritime for providing feedback on the draft report. Thank you to all the research team at Jetty Research, to report writers James Parker and Jenny Grant, and also the landholders - Ted Drury, Annette and Peter Biggs, Patsy Bromley and Charlie Taylor - who offered their water frontage to undertake observational survey points. Finally much appreciation to all the boat users who took the time to participate in the interviews conducted at the boat ramps around the Shire. Your comments and concerns are invaluable in providing essential information and direction to inform our management decisions now and in the future.

Front cover photo: Bellinger River Landscape. Courtesy of Peter Mitchell
Other photos courtesy of <http://nellibellingen.wordpress.com>

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Executive summary

The Bellinger-Kalang Estuary Recreational Boat Use Assessment was initiated in mid-2009 by Bellinger Shire Council as part of its Healthy Rivers Program to address management actions outlined in the Bellinger River Health Plan (2010) and the Bellinger & Kalang Rivers Estuary Management Plan (2008). Funding from NSW Department of Environment, Climate Change & Water (Estuary Management Program) and Australian Government Caring For Our Country (Coastcare) have assisted in the delivery of this assessment. Specifically, two grants have provided seed funding for this study: (a) *Developing capacity building and education strategies to address the future impacts of climate change and manage and improve the health of the Bellinger and Kalang Rivers* (DECCW), and (b) *Promoting sustainable boating practices to protect the Bellinger/Kalang coastal river systems* (Coastcare). The project aimed to understand the behaviour, attitudes and usage patterns of boaters on the Bellinger and Kalang Rivers.

The project involved interviews with, and observation of users of the Bellinger and Kalang Rivers. Interviews and observations were conducted on random days and at random times, albeit with slight bias towards warmer weather months (November-March), weekends, public holidays and school holiday period.

The bulk of interviews were conducted in five separate locations: Urunga boat ramps (north and south); Bellinger River Caravan Park at Repton, and Mylestom boat ramps (east and west). Observations were carried out at ten different locations: see map on page 12.

The project was conducted in two phases: the first from March to June 2009, and the second from September 2009 to April 2010. Phase 1 was largely washed out as a consequence of repeat floods. Phase 2 was successfully completed with almost no days lost to bad weather.

In all, 523 interviews were conducted, and 1,524 separate observations during 348 hours of observation were recorded. Given that interviews involved 29 different data sets and observations were of 22 discreet items, this has provided a massive pool of data from which to draw conclusions on river user attitudes, usage patterns and behaviour.

A random interview of 523 boat users implies a random sampling error of 4.2 per cent at the 95 per cent confidence level. Due to the widely varying nature and location of the observations, we would be reluctant to apply random sampling error to this aspect of the research. However in most instances we have been able to note correlations between the two arms of the study (interview and observations) which provide comfort as to the accuracy of observation data.

For ease of use, this report has been divided into five major sections:

1. Descriptive information relating to rivers users and their boats;
2. Patterns of river use;
3. Boating observations;
4. Locational data; and
5. River User ("Boater") opinions.

The major findings of the study are summarised below.

Descriptive information

- 89% of interviewees were male;
- 52% were aged in their 40's or 50s, with 71% aged 40 or above;
- 65% were residents of Coffs Harbour and Bellingen LGAs;
- 57% used the river at least monthly on average;
- 77 % of boats observed carried multiple occupants;
- 95% of boats were motorised;
- 62% of motorised boats had engines larger than 25 horsepower (HP), while 38% were larger than 50 HP;

These findings are consistent with those of a recent study conducted by the National Marine Safety Committee.

Patterns of river use

- Fishing was the most popular activity on the river, nominated by 53% of interviewees and representing 39% of observations;
- Water-skiing was the next most popular activity¹ (13% of interviewees, 11% of observations), followed by canoeing/kayaking (9% and 4%) and donut/tubing (10% and 8%).
- Conversely, wake boarding was only carried out by 4% of interviewees , and jet-skiing – towing plus not towing – by 3% of those surveyed.
- Collectively “powered activity” (water-skiing, jet-skiing, wake boarding, tubing/donating) accounted for 29% of overall usage by interview, compared with 53% for fishing, 6% for sailing and paddling, 9% for traversing, and 2% for other.
- The proportion of fishers to powered users at low tide is significantly higher than at high tide. There are almost twice as many fishers on the rivers at low tide than there are power users. At high tide, there are equal numbers of fishers and power users on the rivers.
- The proportion of fishers to power users is closest in the hours between midday and 4pm whilst the mornings are more strongly dominated by fishers;
- The most frequent users of the river reside in the Coffs Harbour LGA: 27% of respondents said they lived in the Coffs Harbour LGA and use the river at least monthly. The next most frequent were residents of the Bellingen LGA, with 22% of interviewees saying they lived in the Bellingen LGA and use the river at least monthly;
- By age, the largest single group of respondents were those aged in their 40s who nominated fishing as their only activity. The next largest groups were also fishers: respondents in their 30s, 50s and 60s were present with almost equal frequency. Younger respondents (those aged under 40) nominated powered activities with almost equal frequency as respondents aged 40-plus;

¹ Excluding “traversing”, or moving from one area of the river to another

Rule-related observations

- 58% of observed boat movements were planing, with 32% non-planing and 5% each drifting and idle;
- 60% were travelling to right of centre;
- 22% of observations involved towing, with 46% of these involving water skis, 32% tubes, 18% boards and 4% other;
- 91% of those towing had only one tow rope (visible), while 72% were towing only one person;
- 76% towed in an anti-clockwise direction with all turns to port;
- 76% turned at the greatest practicable distance from shore;
- 27 instances of perceived exceptional or potentially risky behaviour were observed over the course of the research period;

Locational data

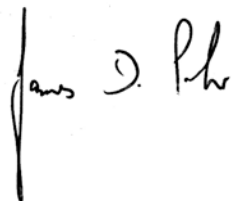
- An average of 4.4 craft per hour were observed across the 10 observation points;
- The frequency of boating ranged from nil observations (South Arm Road on a Friday afternoon before the October labour day long weekend) to 17.8 observations per hour on a Thursday in early January at Teds Oyster Lease (Repton). The busiest day was Good Friday in 2010 when there were 16.5 observations per hour at Mylestom Pool and 11.5 hourly at the Repton Caravan Park. .
- Based on interview data, activity by area can be broken down as follows:

Activity by area	POWER	FISHING	SAIL/ PADDLE	OTHER	TOTAL
Area 1: Upper Kalang	1%	3%	0%	1%	5%
Area 2: Newry Island	0%	7%	0%	1%	8%
Area 3: Urunga ski area	1%	6%	0%	0%	9%
Area 4: Lower Kalang/ Lower Bellinger	3%	18%	2%	2%	24%
Area 5: Mylestom ski area	9%	7%	1%	1%	18%
Area 6: Tuckers Island	2%	9%	1%	1%	13%
Area 7: Repton-Raleigh incl ski area	9%	9%	1%	1%	19%
Area 8: Upper Bellinger	1%	3%	0%	0%	4%
TOTAL	27%	61%	5%	6%	100%

- It shows that powered activity was greatest in the Mylestom ski area and Repton-Raleigh ski areas, while fishing was most commonly conducted in the Lower Kalang/Lower Bellinger, Tuckers Island, and the two aforementioned ski areas.
- However given that fishing tended to occur earlier in the day than skiing, there were few reported instances of tension between power users and fishers in the two most popular “joint use” zones, being areas 5 and 7.
- In the sensitive environments of Back Creek and Newry Island, fishing was the most common activity observed (32 %) followed by traversing (27%). There was one observation of donut/tubing in Back Creek. There was one observation of a jet ski in Back Creek though it was not planing. The majority of boats in these waterways were small (64.8%) though eight craft (6.6%) were deemed large. There were no power turns observed at either site.

River user opinions

- Of the 523 boaters interviewed, 245 chose to answer the open-ended question “What have you observed other river users doing that has frustrated or concerned you?” Most common responses to this involved speeding (25% of those responding), lack of consideration or manners (21%), disobeying signs or other rules (11%) and passing or travelling too close (8%) and creating wash (5%).
- In terms of “what rules do you believe are most commonly broken by other river users?”, 396 chose to respond. Of these, perceptions involved speed (57%), travelling or passing on the wrong side (12%), disobeying general rules (8%), passing/travelling too close (5%), safety issues such as sitting on bow (4%) and drinking alcohol (3%).
- In relation to “are there any boating rules that you find impractical or unenforceable?”, only 52 interviewees chose to – or were able to – answer this question. Of these, the major issues involved lack of staff to enforce rules (23%), safety rules such as jackets or other equipment (21%), speed rules (19%), distance rules (12%), and no wash zones (10%). However this is a very small sample size, with the balance appearing largely happy with the current rules and/or their application.
- Interestingly the zone most frequently proposed for a speed increase (area 4: lower Bellinger and Kalang) was also proposed most frequently as the zone requiring speed decreases. (All up 88 interviewees felt speed limits should be increased in zone 4, against 34 feeling it should be reduced). Area 6 (Tuckers Island) was also nominated for a speed decrease by 34 boaters.
- In terms of which areas boaters felt should be “no wash” zones, the largest proportion (28%) were unsure. A further 23% said “none”, while 14% nominated area 4, 11% suggested area 2 (i.e. around Newry Island), 8% in area 6, and 6% in area 7 (Repton-Raleigh).

A handwritten signature in black ink, appearing to read "James D. Parker".

James Parker, **B.Ec, Grad Cert Science (Stats), MAMSRS**
Managing Director
October 26th 2010

Disclaimer: While all care and diligence has been exercised in the preparation of this report, Jetty Research Pty Ltd. does not warrant the accuracy of the information contained within and accepts no liability for any loss or damage that may be suffered as a result of reliance on this information, whether or not there has been any error, omission or negligence on the part of Jetty Research Pty. Ltd. or its employees.

1 Introduction

1.1 Background and Objectives

The Bellinger-Kalang Estuary Recreational Boat Use Assessment was initiated in mid-2009 by Bellingen Shire Council as part of its Healthy Rivers Program to address management actions outlined in the Bellinger River Health Plan (2010) and the Bellinger & Kalang Rivers Estuary Management Plan (2008). Bellingen Shire Council adopted the Bellinger/Kalang Estuary Management Plan (EMP) in 2008. Strategy 24.1 of the EMP recommended “An assessment of actual boat use (including frequency of use, duration of use, boat types, boating activities performed, etc) should be made over one calendar year”. This assessment is intended to provide important information to assist in decision making for the future management of the estuary.

The project collected a large volume of data: There were 22 discrete items observed on each of 1491 occasions and 29 interview questions with 523 respondents. This is equivalent to 1.2M data cells, each of which can be counted and combined in different ways with every other data cell. The choices about what data to report have been guided by the objectives of the study, discussions with the Steering Committee, as well as feedback from the research team about trends and concerns discerned during their observations and interviews.



Figure 1. Debris from floods in May 2009 at Mylestom Pool on Bellinger River

1.2 Methodology

The project was conducted in two phases: the first from March to June 2009, and the second from September 2009 to April 2010. Phase 1 was largely washed out as a consequence of repeat floods. Phase 2 was successfully completed with almost no days lost to bad weather.

There were two components of the project undertaken by a team of six researchers – an interview component and an observational component. A structured interview format (survey form) and observational recording sheet were constructed collaboratively between Council staff and Jetty Research. Copies of the survey form and observational recording sheet can be found in the appendices (APPENDIX A: Interview form and APPENDIX B: Observation Recording Sheet).

Interviews and observations were conducted on random days and at different times. However there was some emphasis on predicted peak usage times such as weekends, public holidays and the October, Summer and Easter School holidays.

The interview component involved researchers approaching and interviewing interested people who were launching or landing boats at one of five locations:

- Urunga Boat ramps (south and north)
- Bellinger River Caravan Park (Repton)
- Mylestom boat ramps (east and west)

There were also three opportunistic interviews at South Arm Road (2 interviews) and Urunga Sailing Club (1 interview) conducted when researchers were present recording observations.

A total of 523 interviews were conducted. Only one boater declined to participate. Interviewees were asked not to participate more than once. The number of interviews conducted at each site is a function of the times when researchers were rostered and the intensity of boating activity at each launch site. On occasions when multiple launchings/landing occurred at an interview site at around the same time, researchers were not able to interview all those launching or landing.

The observational component involved recording specified observations at ten locations:

- A. Raleigh bridge (old highway)
- B. Bellinger River Caravan Park (Repton)
- C. Anchors Wharf, Urunga
- E. Mylestom pool
- F. Back Creek
- G. Urunga Sail Club
- H. Anchors Wharf
- I. Newry Island East (end Punt Rd)
- J. Newry Island West (Biggs property)
- K. South Arm Road

A map showing the interview and observation sites is at Figure 1.



Figure 2. Mylestom Pool at left and motor boats beached adjacent to the Mylestom Pool

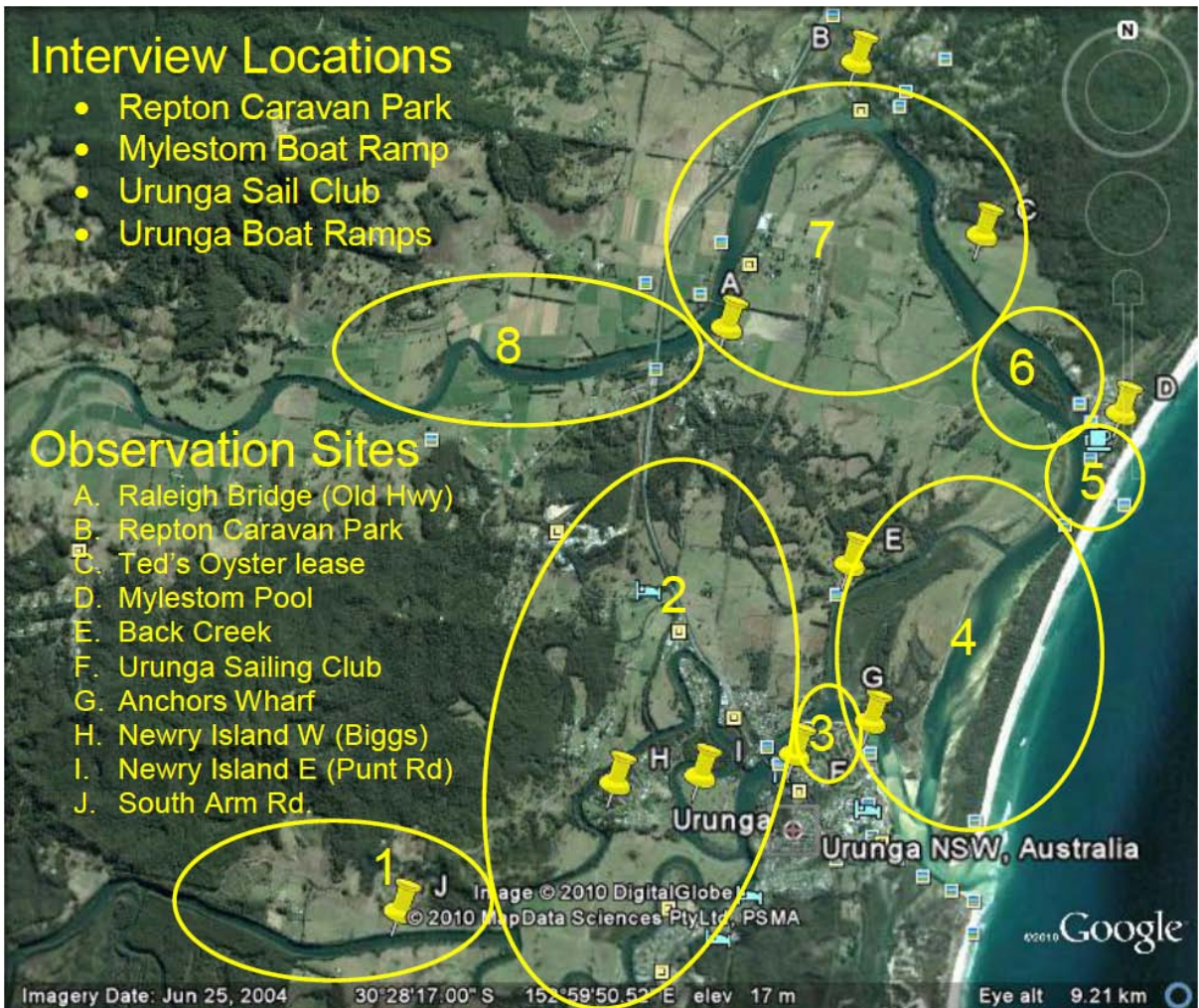


Figure 3. Map of Bellinger Kalang Rivers showing interview locations and observation sites

A total of 348 hours of observation were completed between the hours of 7am and 6pm on 48 days over the seven months of phases 1 and 2. Figure 3 Figure 4 and Figure 5 show the time of day, season and tides when observations were made. There were 1,491 observations recorded. The numbers of observations recorded is a function of the times when researchers were present and the frequency of river usage at each site. Section 5.1 of the report presents information about the hourly rate of observations at each site. There was a reasonably good match of observational hours rostered for each site and hourly rate of observations: the sites where researchers were rostered for the most hours were the same sites that had the highest frequency of observations as shown in Figure 4.

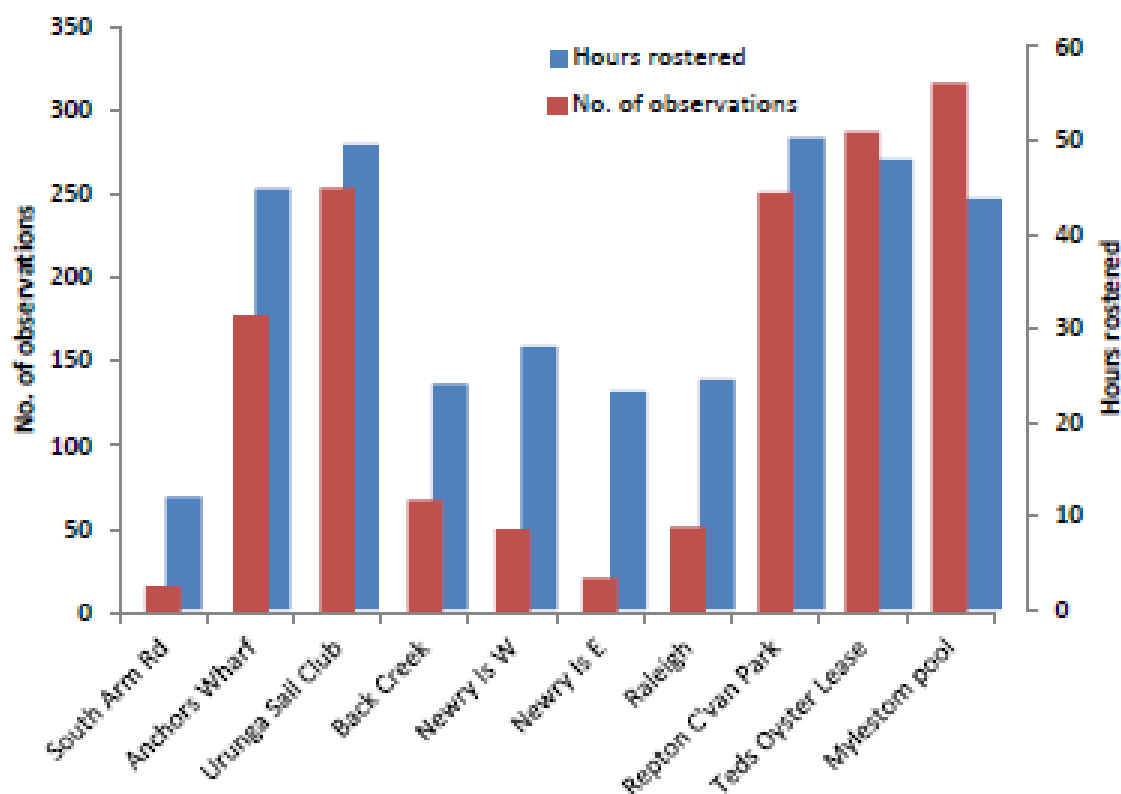


Figure 4. Number of observations and hours of rostered observation by site

More observations were recorded during the summer of 2009-10 (42%) than either of autumn 2009, autumn 2010 or spring 2009 (Figure 5). The majority of observations were recorded between the hours of 10am and 2pm (64%) (Figure 6). Almost half of the observations were recorded when the tide was tending towards low and a third when the tide was tending to high (Figure 7). Each time a craft passed by the observation point, one observation was recorded. This means a single boat making multiple passes had multiple observations recorded. An observation was recorded even if the boat was visible to the observer but did not actually pass by (e.g. if it turned before reaching the observation point).

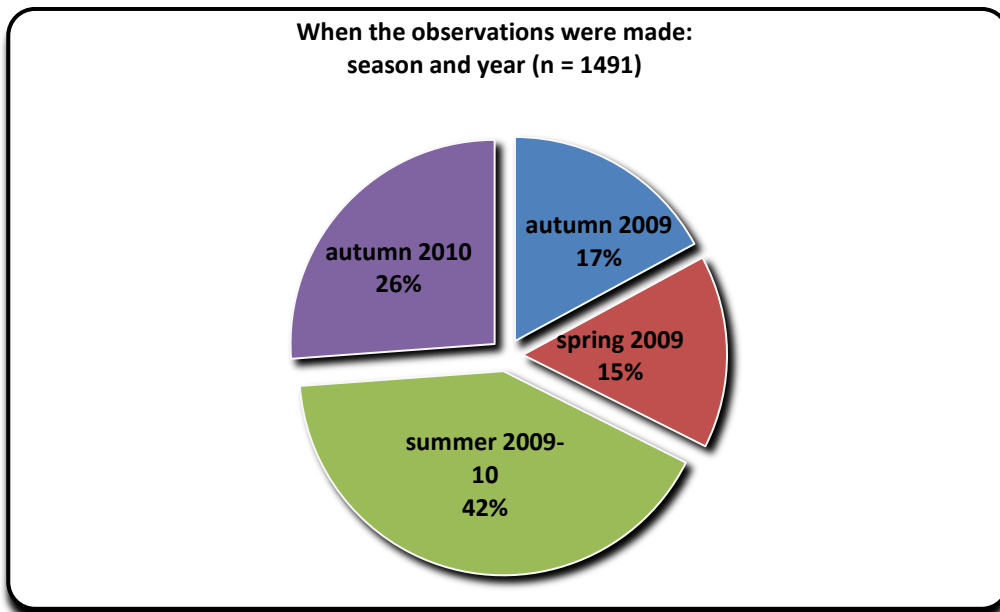


Figure 5. When the observations were made: season and year (n = 1491)

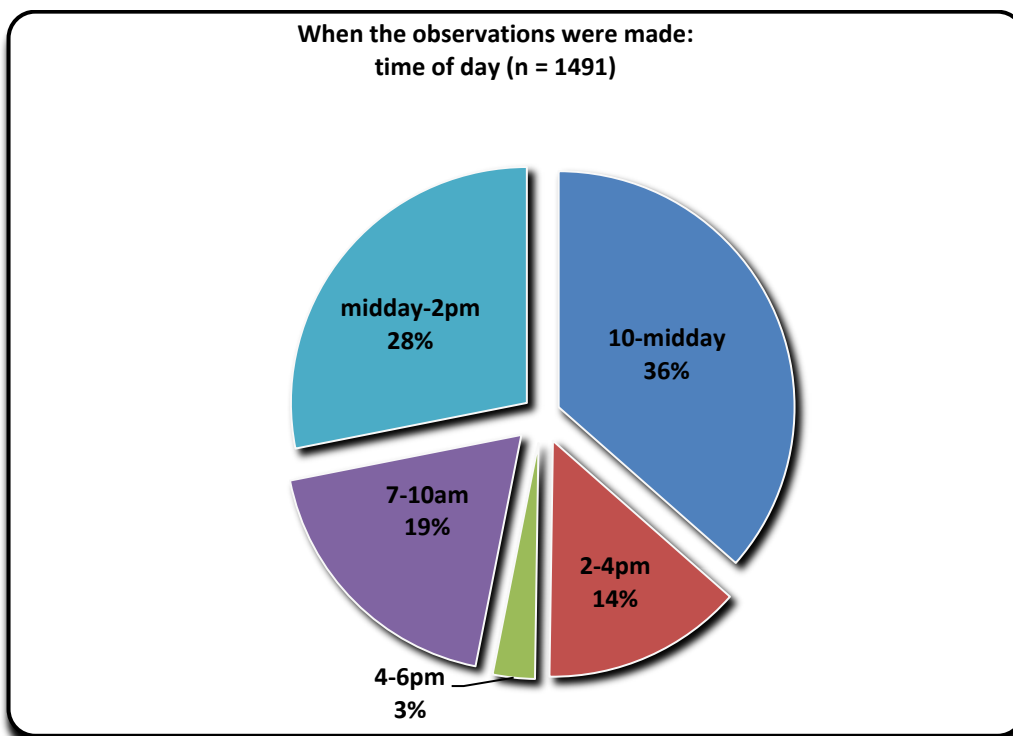


Figure 6. Time of day of the observations (n = 1491)

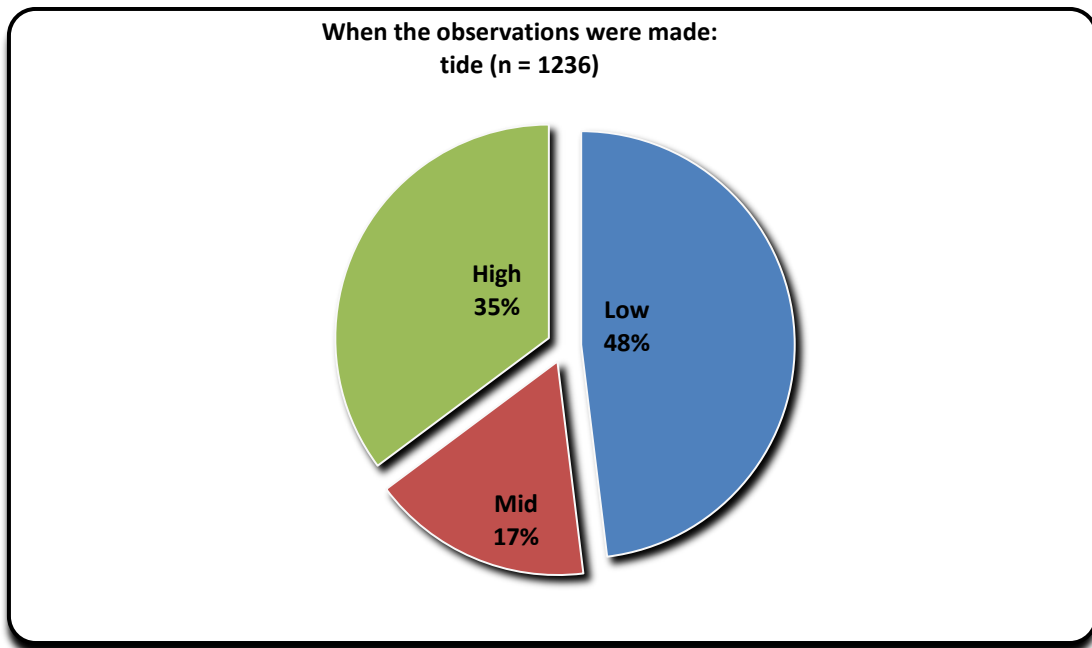


Figure 7. Percentage of observations made at low, mid and high tide



Figure 8. Kalang River at Urunga at low tide

2 Descriptive information

2.1 Characteristics of the interviewed boaters

The majority of those interviewed were:

- Male (89%);
- The driver of the boat (86%) rather than the passenger;
- Owners of the boat (97%) rather than hirers;
- Aged in their 40s or 50s (52%) (see Figure 9)
- Resident in the Coffs/Bellingen shires (65%) (see Figure 10); and
- Regular users of the rivers, reporting at least monthly use (57%) (see Figure 11).

Those interviewed reported spending an average of 4.2 hours (SD 1.8) on the river on each visit, ranging from 30 minutes to 12 hours.

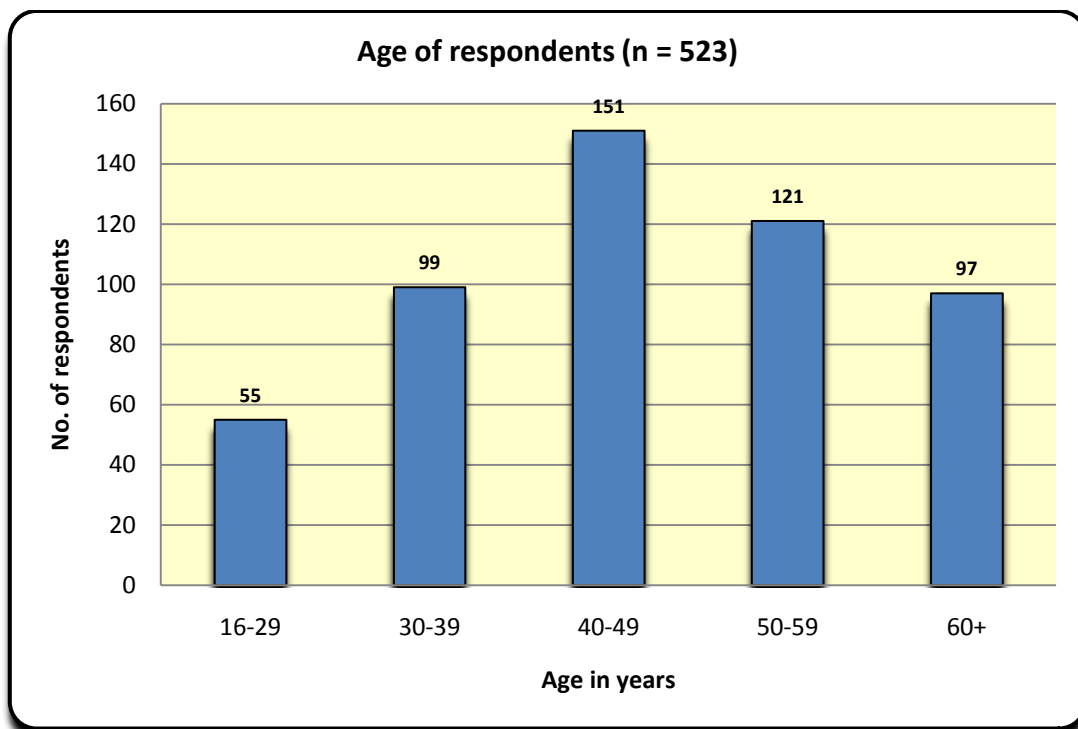


Figure 9. Age of respondents

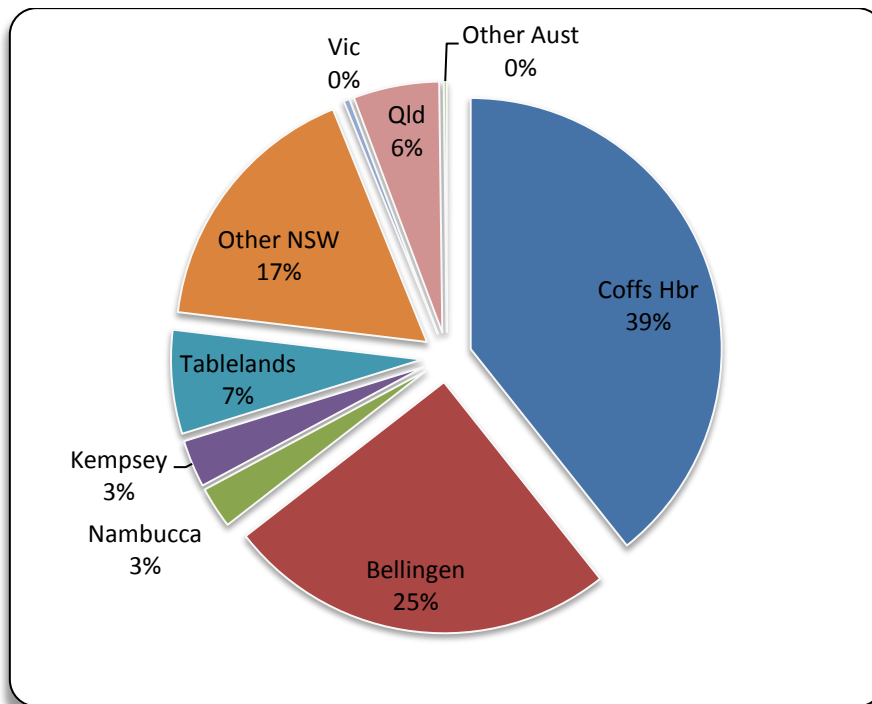
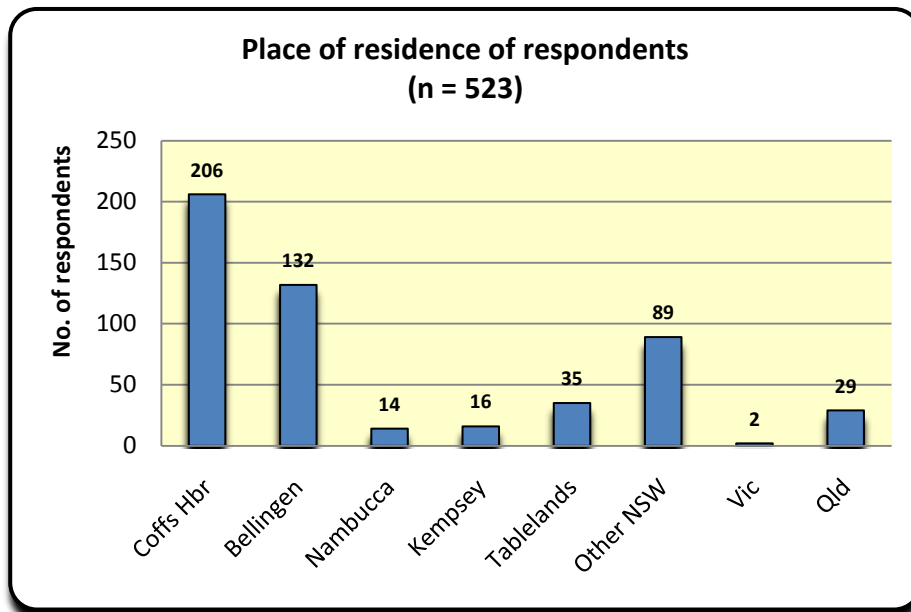


Figure 10. Place of residence of respondents

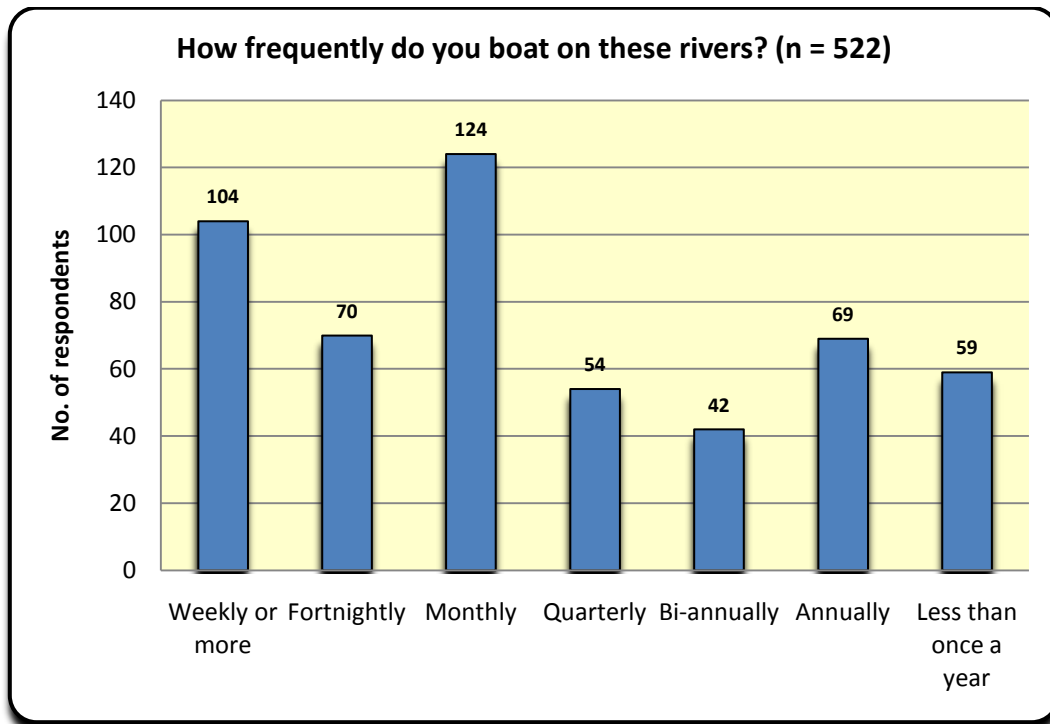


Figure 11. Frequency of boating on the Bellinger or Kalang rivers

The majority of observations were of boats carrying between 2 and 5 people (77%) though 22% carried only one person. Observations also confirmed that the majority of drivers were adults. Teenagers were observed in control of the craft on 6% of observations and a child on 1% of occasions. Further analysis of solo operators and teenage/child operators is provided in section 4.6

2.2 Characteristics of interviewees' craft

The majority of craft in use by interviewees were:

- Motorised (94.5%); and
- Between 3 and 5 metres in length (73%) (Figure 12)

Of the motorised craft, the majority were:

- 2-stroke carburettor engines (54%) (Figure 13); and
- more likely to be engine sized between 5 and 25HP (36%), with the 26-50HP and 51-120HP categories of similar but lesser prevalence (24% and 25% respectively) (Figure 14)

The mean length of craft as reported at interview was 4.5 metres (SD 1.5) and ranged from a minimum of 1.5 metres to a maximum of 16 metres.

Unmotorised craft included canoes, kayaks, row boats, sailboats, dragon boats, rubber dinghy and a paddle boat.

Of the observed craft, 87% were motorised, 10% were not motorised (missing data for 2.7%). The proportion of un-motorised craft recorded by observation is likely to be an under-representation of the true number of un-motorised craft on the river, as motorised craft were more likely to make multiple passes and thus be counted more than once. Additionally, it is likely un-motorised craft were more likely to launch or land at places other than the ramps where interviews were conducted and thus be under-represented in the sample of boaters who were interviewed.

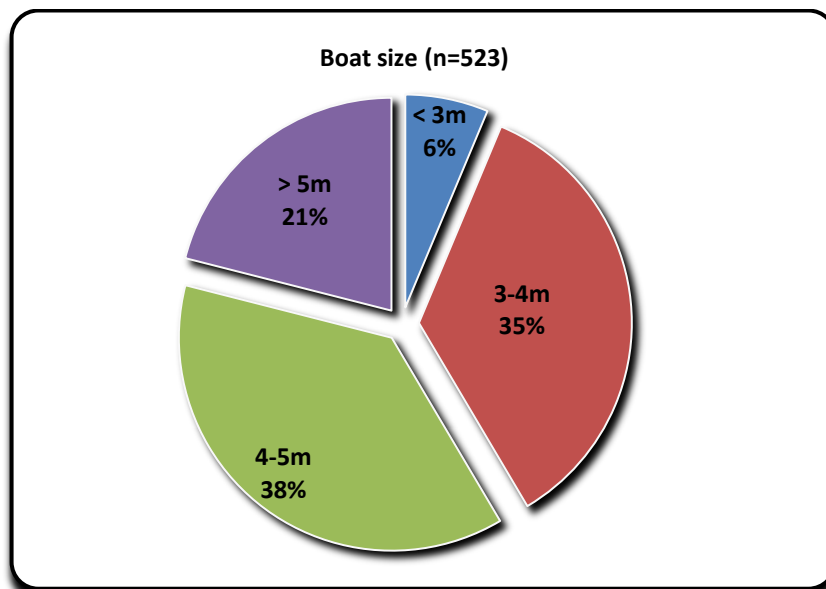


Figure 12. Size of the craft - from interviews

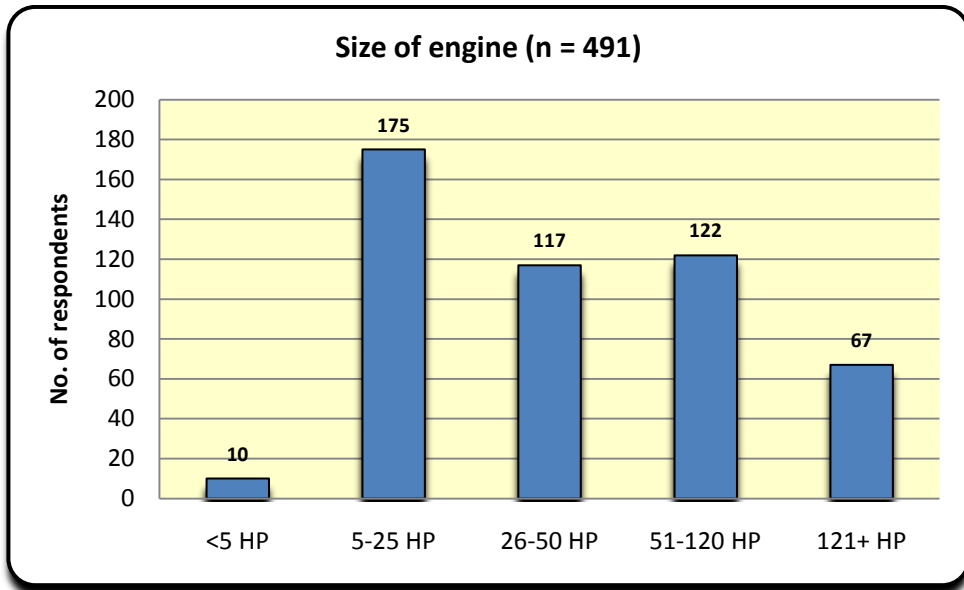


Figure 13. Engine size (HP)

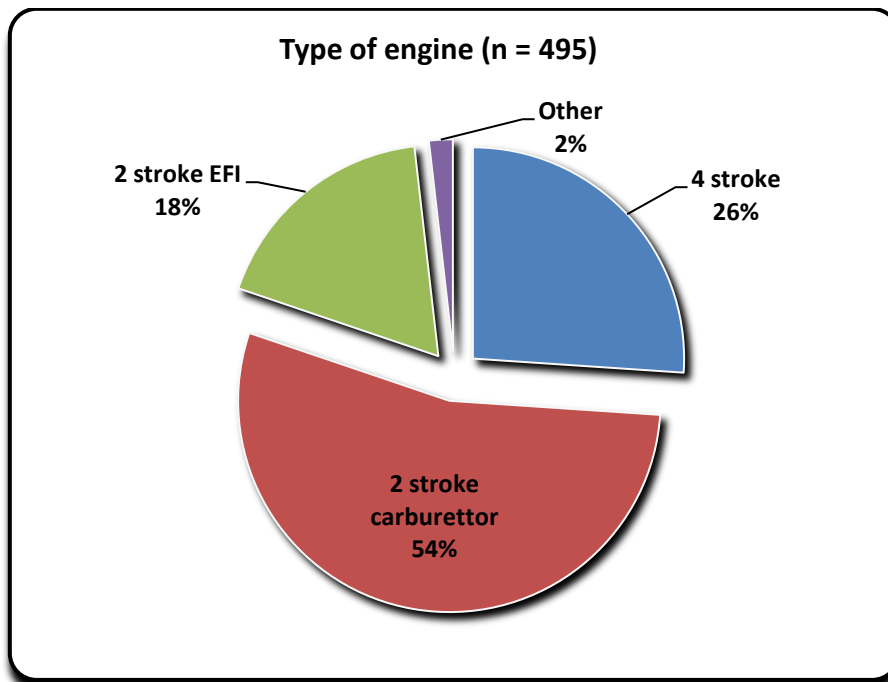


Figure 14. Type of engine

Interviewees were asked how frequently they serviced their engines. The available response options were time periods as shown in Table 1 below. However, interviewers commented that many interviewees serviced their engines according to the number of run hours and would have preferred to answer in this way instead of chronologically.

Table 1. Frequency of engine service reported at interview

How often do you service your engine?	Frequency	Percent
Once every four for five years	5	1.0
Once every two or three years	26	5.5
Once a year	254	53.7
Twice a year	148	31.3
Unsure	40	8.5
<i>Total</i>	<i>473</i>	<i>100.0</i>



Yellow Rock on Back Creek, one of the observation points

3 Patterns of river use

3.1 Activities

The frequency of observed and reported activities is presented in

Activity	Observed Frequency		Reported Frequency	
Water skiing	163	10.9%	91	13.0%
Jet skiing-towing	6	0.4%	4	0.6%
Jet skiing-not towing	34	2.3%	10	1.4%
Wake boarding	57	3.8%	31	4.4%
Donut/Tubing	121	8.1%	70	10.0%
Fishing	583	39.1%	374	53.4%
Sailing	12	0.8%	9	1.3%
Canoeing/ Kayaking	134	9.0%	31	4.4%
Traversing	319	21.4%	66	9.4%
Other	62	4.2%	14	2.0%
<i>Total</i>	<i>1491</i>	<i>100.0%</i>	<i>700</i>	<i>100.0%</i>

Table 2. Frequency of activities observed¹ and reported at interview²

¹single craft making multiple passes were counted multiple times

²respondents could nominate multiple activities

The frequency of observed fishing includes some who were not fishing at the time of observation but who were visibly carrying fishing equipment.

“Other” activities observed included dragon-boating, rowing, “hooning”, yabbying, purchasing (e.g., oysters, ice-creams), a houseboat at anchor, as well as traversing. (The traversing category was introduced in phase 2 of the research.)

“Other” activities reported at interview were further categorised at the time of analysis into activities that involved mainly traversing and “other” based on the following activities that were reported by respondents (Table 3).

	Traversing (66)	"Other" (14)
Picnicking	"just boating"	Dredge maintenance (3)
Exploring	"just cruising"	Swimming (4)
Sightseeing	putting	Surfboat training (1)
Leisure	accessing ocean	Yabbing/crabbing (4)
running in motor		Snorkelling (1)
		Waterways contractor (1)

Table 3. Types of activities nominated at interview as "other" and recategorised as "traversing" and "other". Count is of number of respondents.

For ease of interpretation, activities were then aggregated from 10 and 11 categories into 4 and 5 categories respectively. All activities reliant on a motor were aggregated as "power activities". This included water skiing, jet skiing (towing and not towing), wake boarding, donutting and tubing. All of the "power activities" involve towing with the exception of "jet-skiing-not-towing" of which there were only 34 observations (2.3%) and 10 respondents nominating it at interview (1.9%).

Fishing and traversing were retained as separate activities. Sailing and canoeing/kayaking were combined with dragon boating, paddle boating and rowing from the "other" category into "sailing/paddling". The frequency of aggregated activities observed and reported at interview are summarised in Table 4, and presented in Figure 15 and Figure 16.

Fishing makes up the most frequently observed and reported activity. The frequency of fishing as an observed activity (38%) is significantly less than that of fishing as an activity nominated in interview (54%). This will be because craft engaged in fishing are less likely to pass an observer multiple times than craft engaged in a powered activity, and are thus less frequently observed.

Activity	Observed Frequency		Reported Frequency	
Powered	414	27.2%	206	29.4%
Fishing	582	38.2%	374	53.4%
Sailing/paddling	153	10.0%	40	5.7%
Traversing	319	20.9%	66	9.4%
Other	56	3.7%	14	2.0%
<i>Total</i>	<i>1524</i>	<i>100.0%</i>	<i>700</i>	<i>100.0%</i>

Table 4. Frequency of aggregated activities observed¹ and reported at interview²

¹single craft making multiple passes were counted multiple times

² respondents could nominate multiple activities

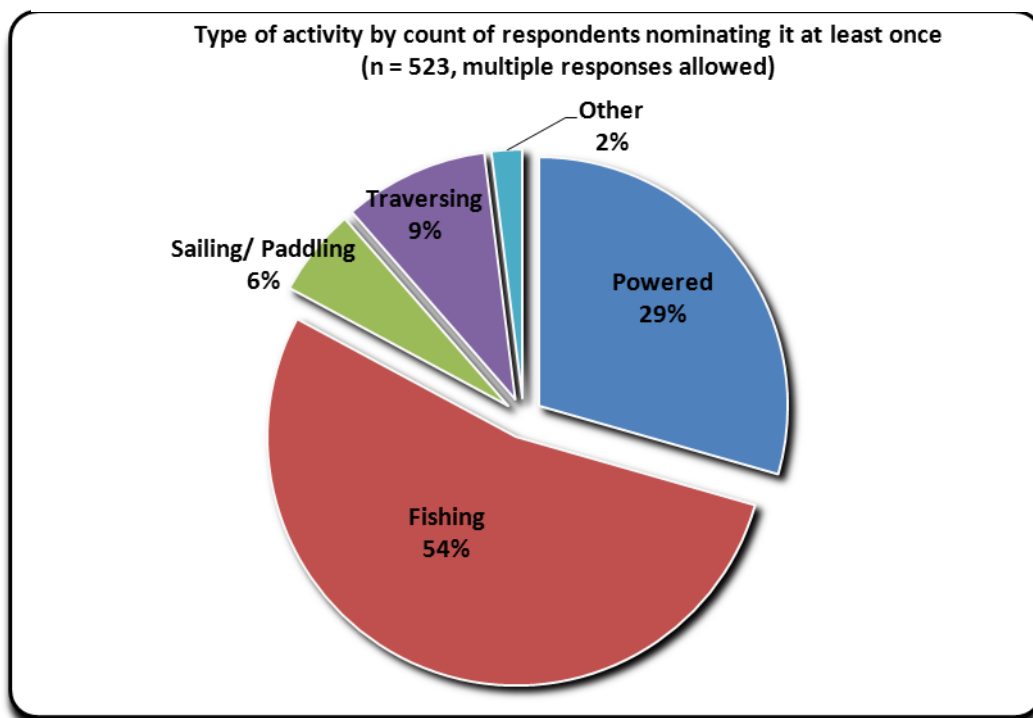


Figure 15. Frequency of activities nominated in interview

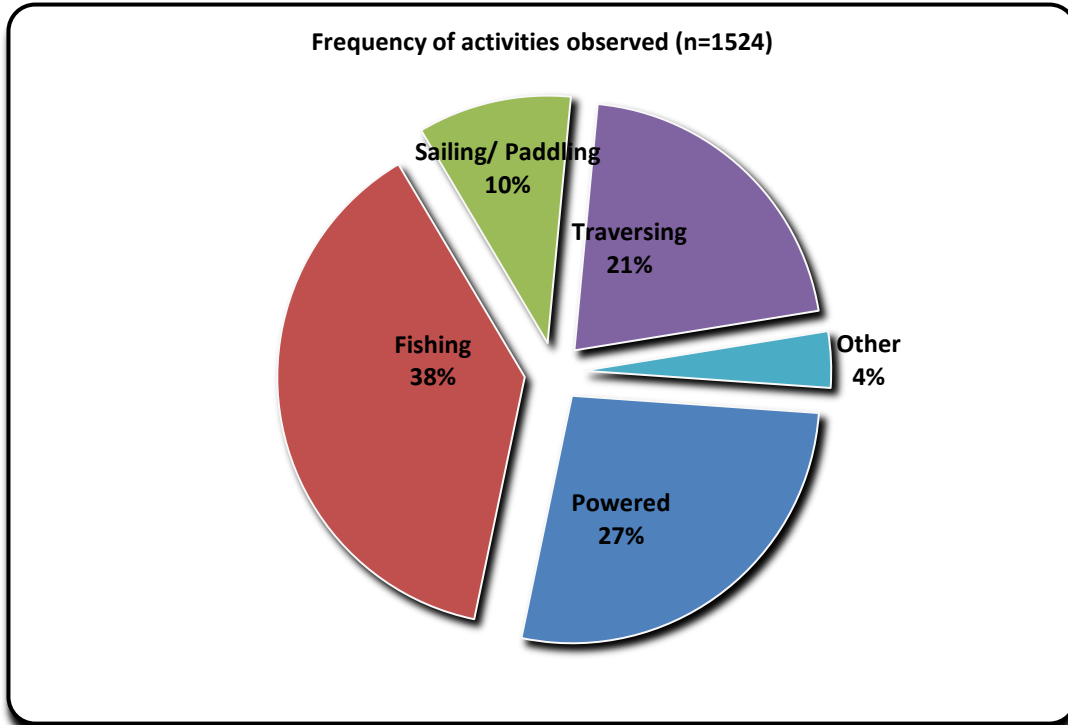


Figure 16. Frequency of activities observed (n = 1524)

3.2 Activities, time and tide

It was speculated that powered activities and fishing might each occur at different times of the day. As shown in Figure 17 and Figure 18, this is not unambiguously evident from the observations. Both fishing and powered activities are similarly represented at each time of the day with the exception of the hours between 4 and 6pm when fishing clearly dominates. However, the number of boaters observed at this time (n=43) is far less than at peak times so the finding is of limited practical value. However, the proportion of fishers to powered users at low tide is significantly higher (238:152) than at high tide (136:135). There are almost twice as many fishers on the rivers at low tide than there are power users. At high tide, there are equal numbers of fishers and power users on the rivers.

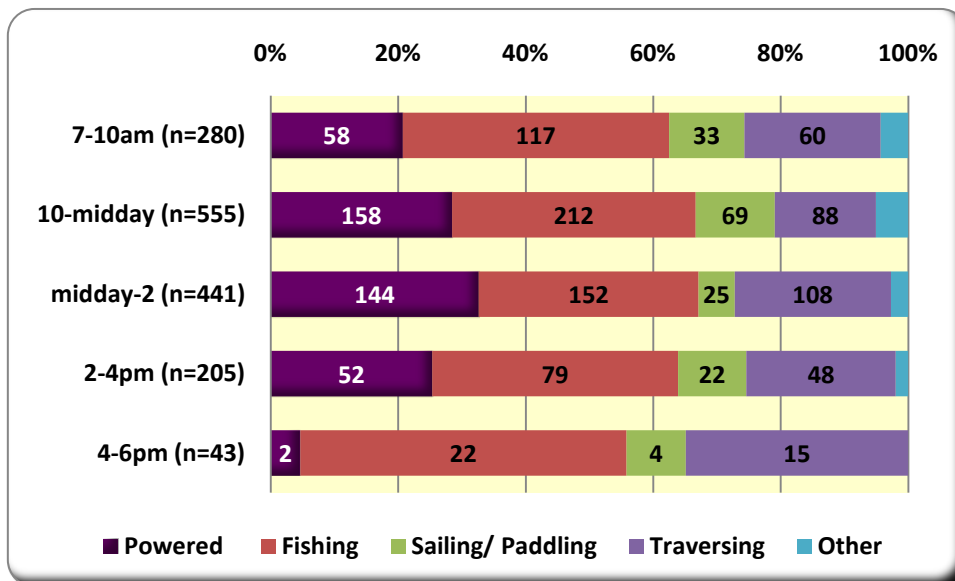


Figure 17. Type of activity at different times of the day

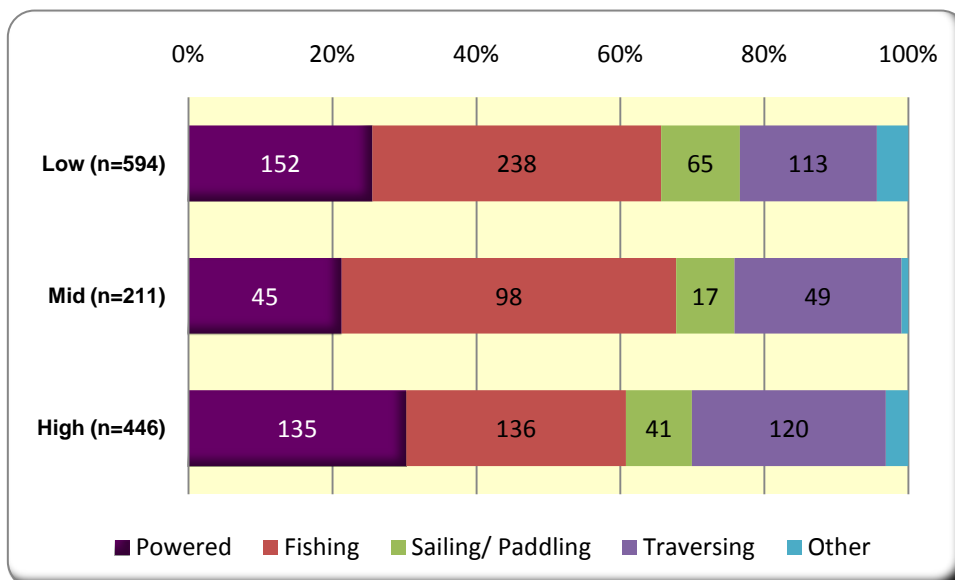


Figure 18. Type of activity at each tide (count of each activity shown on bars)

Information about the time of day boaters are usually on the river that was obtained at interview provides a different perspective on time-related patterns of river use. As shown in Figure 19, the proportion of fishers to power users is closest in the hours between midday and 4pm whilst the mornings are more strongly dominated by fishers. This pattern is clearer in Figure 20, where the times of day have been aggregated to morning vs. afternoon and evening.

A cautionary note about this data concerns the way in which respondents nominated their preferred times. Fishers were more likely to nominate multiple times of day, often saying “I go whenever the tide is right” or “I go whenever the fish are biting” while power users typically nominated only two time slots. Thus, fishers have a larger share of the time slots

nominations (60%) than power users (35%). As respondents could nominate multiple activities, the categories of fisher and power user are not discrete: 69 (13%) of respondents nominated both power activities and fishing. For respondents who both fish and do power activities, there is no data about when they separately engage in each of those activities.

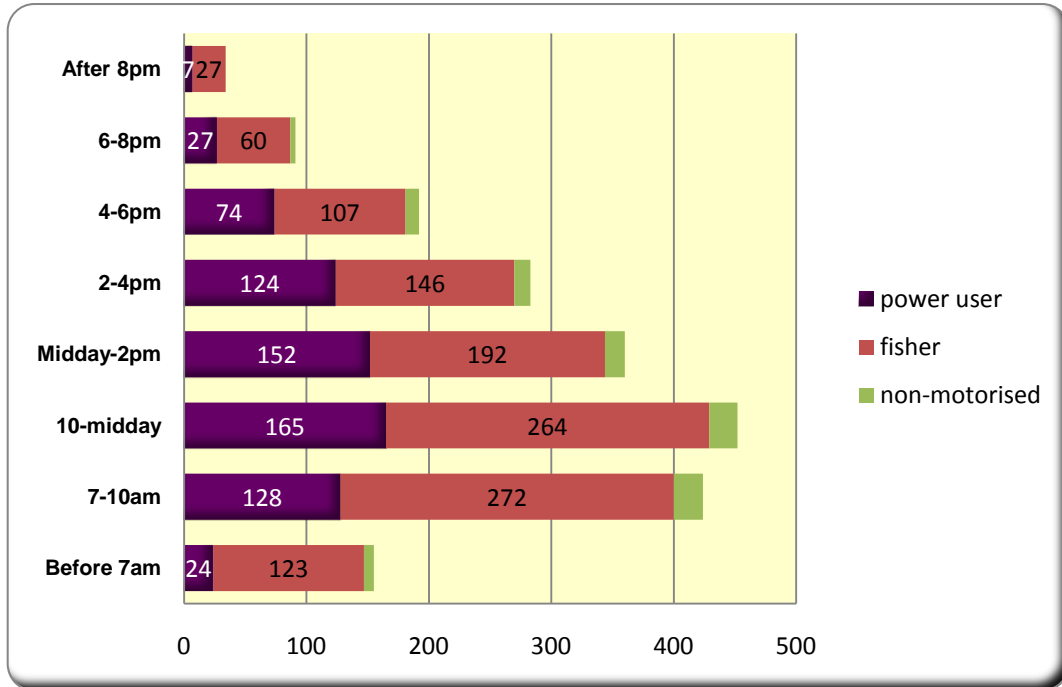


Figure 19. Time of day usually on the river as reported at interview (n=1991, multiple responses allowed)

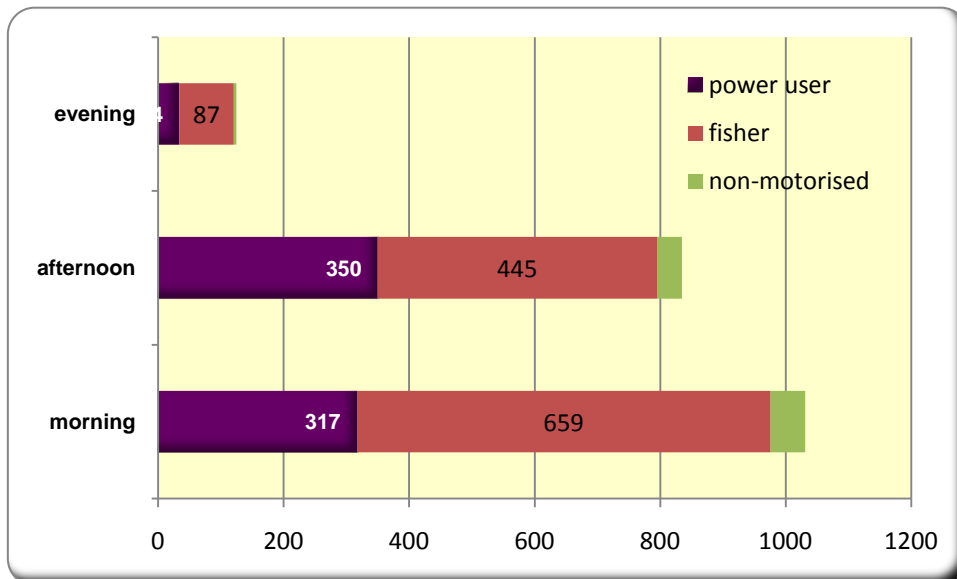


Figure 20. Time of day usually on the river as nominated at interview (n=1991, multiple responses allowed)

3.3 Activities and characteristics of the boaters

Fishing as the only activity was most commonly nominated at interview, followed by respondents who nominated both fishing and powered activities. This preference was of a similar frequency to respondents nominating powered activities as their only activity.

Residents of the Coffs Harbour local government area (LGA) were numerically the largest boater group (n=205) interviewed, followed by residents of the Bellingen LGA (132). As shown in Figure 21, there is not a large difference between the activities in which residents of each of these LGAs engage. Bellingen residents are slightly more likely than Coffs Harbour users to nominate both fishing and power uses, and to nominate fishing as their only activity. Visitors from the Tablelands (Tamworth and Armidale LGAs) and other parts of NSW show a similar usage pattern to Bellingen residents.

The most frequent users of the river have nominated Coffs Harbour LGA: as their place of residence: 141 respondents (27% of all respondents) said they lived in the Coffs Harbour LGA and use the river at least monthly. The next most frequent were residents of the Bellingen LGA: 116 respondents (22.2% of all interviewees) said they lived in the Bellingen LGA and use the river at least monthly. Bellingen residents are more likely to use the river at least weekly (n = 58, or 56% of all weekly-plus users) while weekly-plus users from Coffs Harbour are numerically fewer (39) and a smaller proportion of all weekly-plus users (38%). Details are set out in Table 5 and Figure 22.

It is difficult to discern age-related patterns of activity. As shown the largest single group of respondents were those aged in their 40s who nominated fishing as their only activity. The next largest groups were also fishers: respondents in their 30s, 50s and 60s were present with almost equal frequency. Younger respondents (those aged under 40) nominated powered activities with almost equal frequency to respondents aged 40 and over (at 36 younger respondents compared to 39 older respondents).



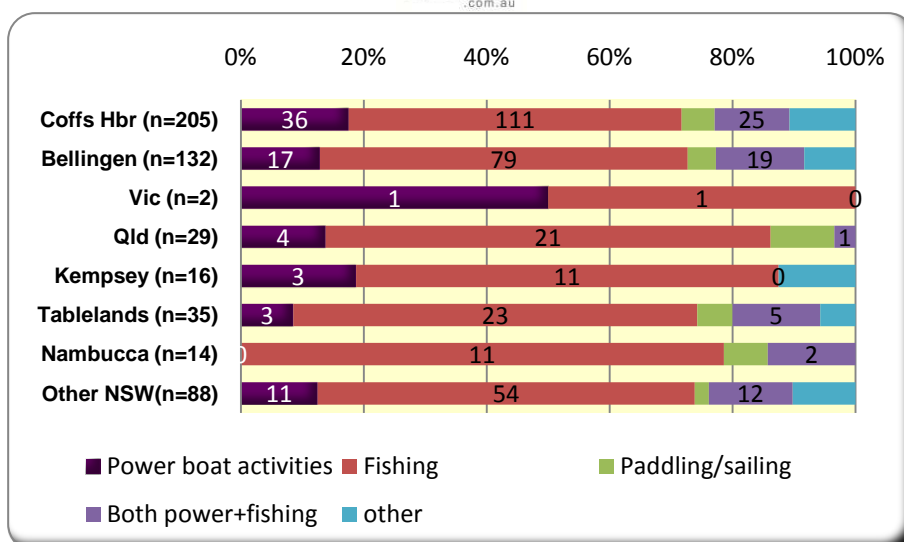


Figure 21. Activity nominated at interview by usual place of residence of respondent (n= 521)

Q. On average, how often would you boat on these river/s?

Place of residence	Weekly or more	Fortnightly	Monthly	Quarterly	Bi-annually	Annually	Less	Total
Coffs Hbr	39	35	67	24	22	5	14	206
Bellingen	58	29	29	7	1	1	7	132
Nambucca & Kempsey	3	3	10	2	2	6	4	30
Other NSW	3	3	16	19	12	44	26	123
Interstate	1	0	2	2	5	13	8	31
Total	104	70	124	54	42	69	59	522

Table 5. Frequency of boating according to place of usual residence (from interview) (n = 522)

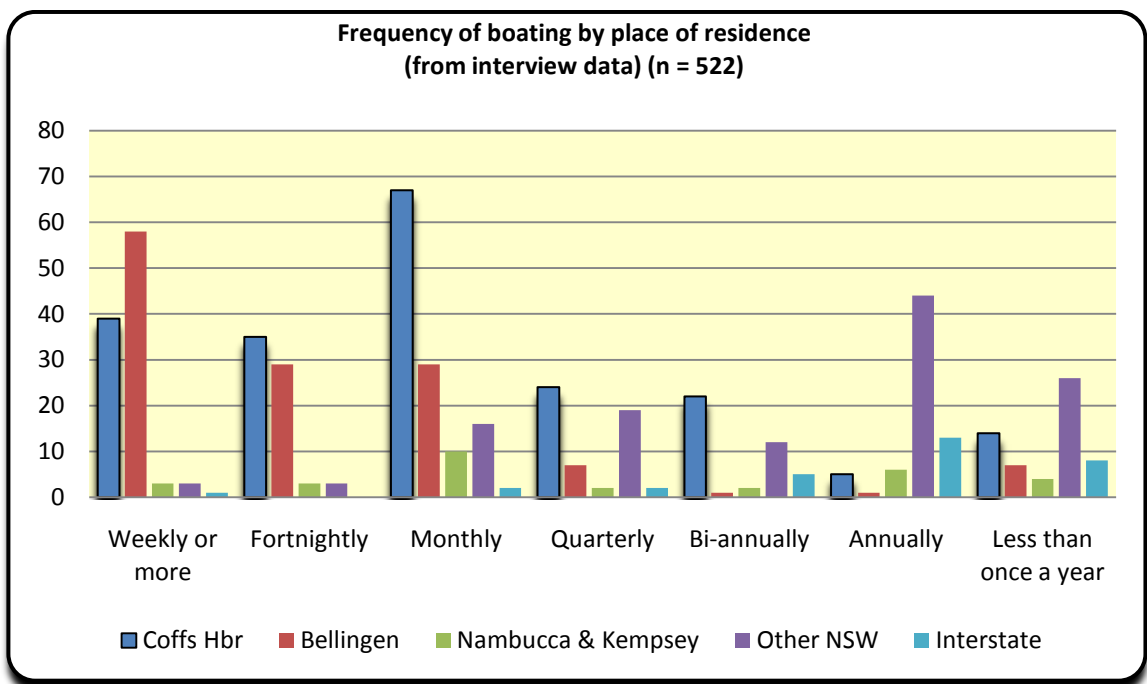
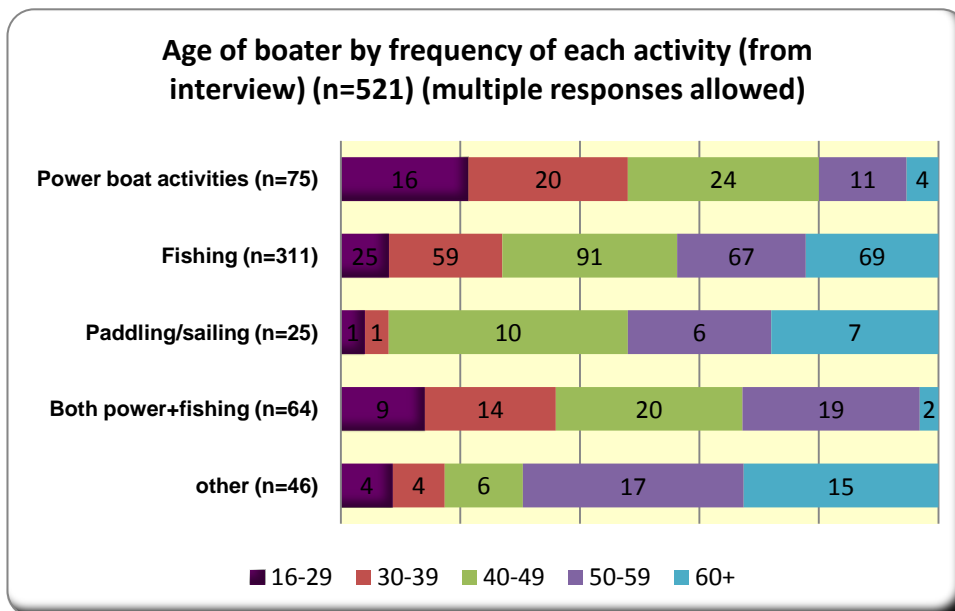


Figure 22. Frequency of boating by usual place of residence (from interviews) (n = 522)



Note. The minimum age for interview was 16

Figure 23. Age of respondents by type of activity nominated at interview (n=521).

4 Boating observations

In this section, observational data that may relate to rule-relevant or safe river use is presented, including boat speed, position in stream, and specific towing-related information.

It is difficult to draw conclusions from the aggregated data as the safety of certain boating behaviours will depend on the location of the activity (see section 5), the compounding effect of multiple practices, and the number of other boaters in the vicinity. It is useful to understand the predominant types of boating behaviour in relation to speed, turning and towing in order to:

- *firstly*, understand the extent and practicality of rule compliance;
- make comparisons with boating behaviour on other river systems; and
- *secondly*, to inform judgements over time about trends in boating behaviour.

4.1 Rule and safety-related observations

Eight specifically rule or safety-related observations were made of each craft as it passed the researcher. Seven of these observations relate to specific Maritime NSW rules as shown in Table 6.

4.2 Observation question	4.3 Relevant Maritime NSW rule/s
1. Travelling to right of centre?	Power driven vessels meeting head on must pass each other by moving to starboard (right). When navigating in a channel, vessels must keep to the RH side as is safe and practicable
2. Operating well away from shoreline?	A safe distance must be maintained between the vessel and any thing.
3. Power turns?	No relevant rule other than distance off and safe speed rules
4. Towing in an anticlockwise direction with all turns executed to port?	No relevant rule
5. Turning at greatest distance from shore as practicable?	The vessel and the towed person must be kept at least 30 metres from the shore or, if that is not possible, a safe distance

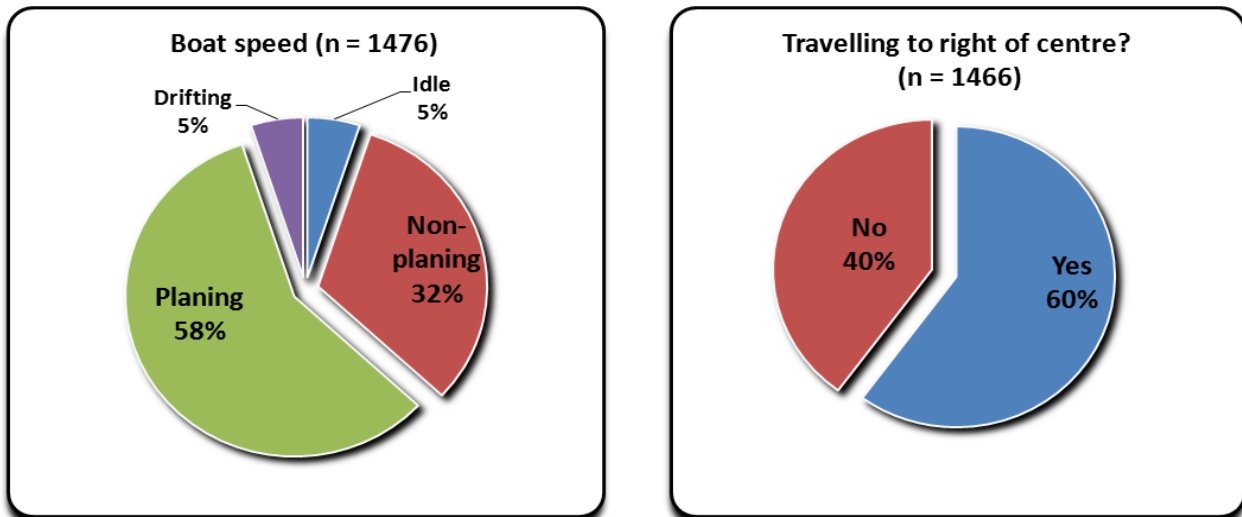
4.2 Observation question	4.3 Relevant Maritime NSW rule/s
6. Towing under bridges?	Prohibited to tow under the Raleigh bridge
7. Number of people being towed?	No more than 3 persons can be towed at once
8. Number of people on board?	A vessel that is towing must have an observer present

Table 6. Safety related observations and Maritime NSW rules

Observations about boat speed and lane of travel are presented in Figure 25, and towing behaviours are in Figure 26. The majority of observations were of boats at planing speed (58%) and 22% of all observations were towing. The most typical towing behaviour was of a single skier being towed in an anti-clockwise direction with all turns executed to port and at the greatest distance from the shore as practicable.

The only observations of behaviour that were categorically not compliant with the relevant Maritime NSW rules were:

- 3 vessels (including one jet ski) towing more than three people (total of 4 observations).



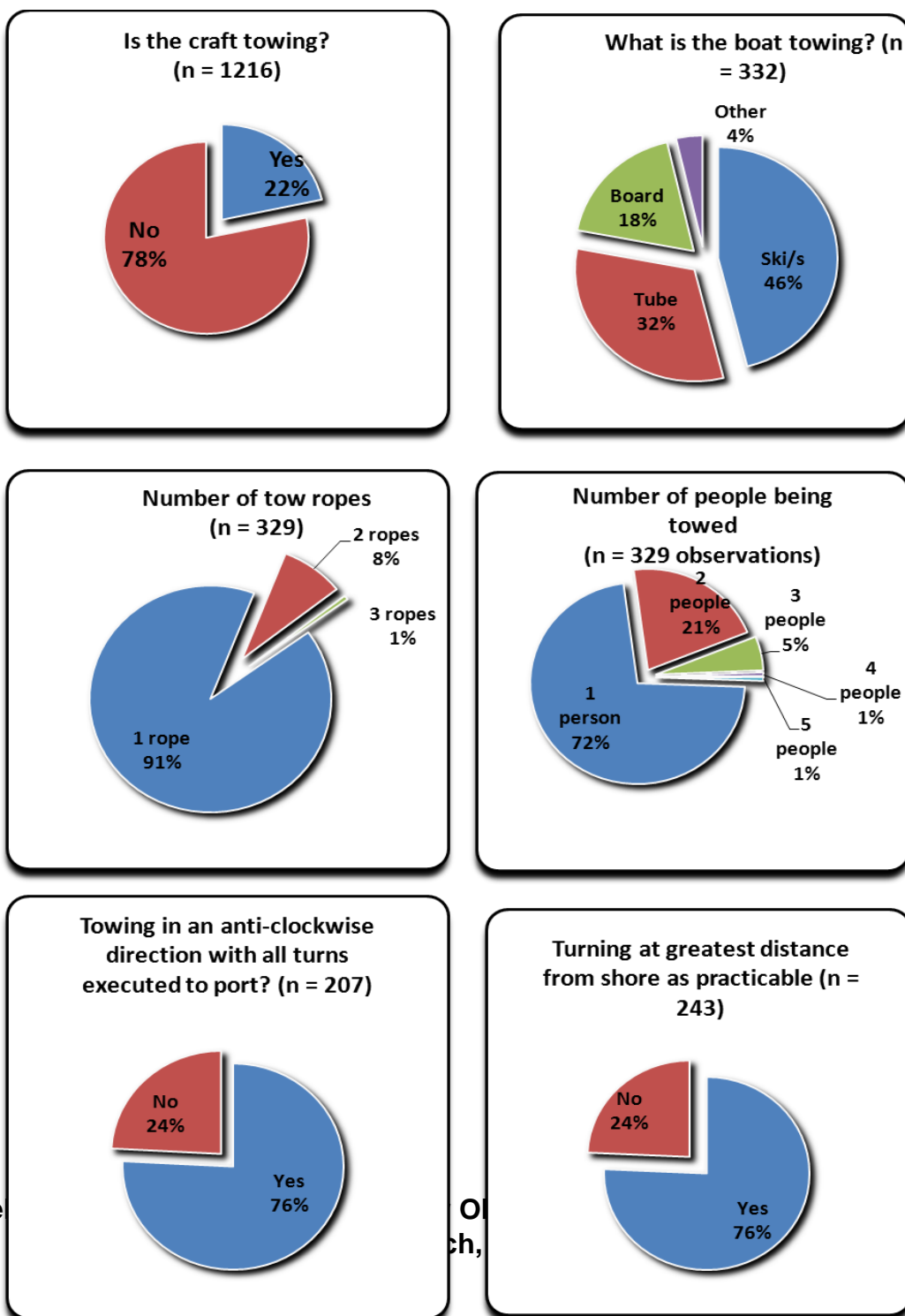
- 2 vessels observed towing without an observer present (total of 5 observations: 1 wake boarding, 4 skiing)

Figure 24. Frequency of observations: speed and lane of travel.

4.4 Towing under bridges

There were 176 observations of craft who were towing where a bridge was visible from the observation site. A bridge was visible from three observation sites: Anchors Wharf at Urunga, Raleigh and the Bellinger River Caravan Park at Repton. Towing is prohibited under the Raleigh bridge; there was no towing observed under this bridge. Table 7 sets out the frequencies that craft were observed towing under each of these bridges.

Figure 26. Set of charts presenting frequency of observations related to towing



Observation site	YES		NO		Total
	n	%	n	%	
Anchors Wharf	2	8.3%	22	91.7%	24
Raleigh Bridge	0	0.0%	14	100.0%	14
Repton C'van Park	76	84.4%	17	18.9%	90
Total	78		53		128

Table 7. Frequency of craft towing within sight of a bridge who towed under the bridge (n = 128)

4.5 Power turns

“Power turns” were defined as “turn 180 degrees at speed”. Fifteen per cent of all interviewees said they frequently perform power turns; 14% said they occasionally perform power turns; and 12% of all observations were of craft making power turns.

The point of including “power turns” in the present discussion is not to deny that power turns can be executed safely, and are an important part of the enjoyment of boating for many. However power turns, when combined with other practices, arguably in some contexts are less safe than other combinations of practices and for that reason data is presented about the 186 power turns below.

Of the 186 power turns observed, 51 were of craft which also engaged in two or more of the following practices:

- Not travelling to right of centre?
- Not operating well away from shoreline?
- Not towing in an anticlockwise direction with all turns executed to port?
- Not turning at greatest distance from shore as practicable?

Of those 51 observations, 40 were engaged in three or more of these practices, and 25 observations were of craft making power turns who were not travelling to right of centre, were not operating well away from shoreline, were not towing in an anticlockwise direction with all turns executed to port and were not turning at greatest distance from shore as practicable?

There were 10 observations of craft making power turns, who were also towing under a bridge and who were engaged in three or all of these four identified practices.

4.6 Exceptional observations

Researchers recorded unprompted comments about boating behaviour they observed that seemed exceptional, or particularly inconsiderate. Those 27 comments are listed below in Table 8. While these observations represent only a small proportion of total

observations (1.8%), they represent behaviour that perceived by researchers more extreme than the typical behaviour observed and likely to the type of behaviour that is negatively perceived by other river users. The type of activities being undertaken at the time of the observation varied across the spectrum of activities as shown in Table 9.

If this type of exceptional behaviour was expected to be observed proportionally across all activities according to the frequency of those activities, then water-skiing was under-represented (1 case compared to expected 3 cases) and both wakeboarding and donut/tubing were over-represented in the observation of exceptional behaviours.

Comment	Location of observation
<i>Disobeyed boating rules.</i>	Anchor's Wharf
<i>Hugged shoreline/ increased speed past bridge</i>	Anchor's Wharf
<i>Exceeding speed limit with excessive wash.</i>	Back Creek
<i>Was exceeding speed limit.</i>	Back Creek
<i>Approached shoreline with excessive speed then disembarked.</i>	Mylestom Pool
<i>Boat caused excessive wash swamping a small boat when passing by.</i>	Mylestom Pool
<i>Boat created excessive wash.</i>	Mylestom Pool
<i>Hooning around in boat for fun. Very noisy</i>	Mylestom Pool
<i>Large speed boat, speeding.</i>	Mylestom Pool
<i>Speed boat came close to the pool and inundated everyone with its wake; very bad manners.</i>	Mylestom Pool
<i>Planing until they saw people then slowed down considerably.</i>	Newry Island West
<i>Wake boarding wash was churning up the clay from the wall as it's in a soft state after the floods.</i>	Raleigh Bridge
<i>Boat was zig zagging quickly all over the river.</i>	Repton C'van Park
<i>Passed stationary boat. Didn't follow under bridge rules.</i>	Repton C'van Park
<i>Speeding close to shore on wrong side of river, made ski boat move left of centre under bridge.</i>	Repton C'van Park
<i>Speeding down the wrong side of the river close to mangroves.</i>	Repton C'van Park
<i>Boat travelling immediately behind in wake of lead boat.</i>	Teds Oyster Shed
<i>Created substantial wake.</i>	Teds Oyster Shed
<i>The tubing boat zig zagged from side to side of the river</i>	Teds Oyster Shed
<i>Boat travelling with excessive speed.</i>	Urunga Sailing Club
<i>Boat travelling with excessive speed.</i>	Urunga Sailing Club
<i>Did 360 degree turns regularly.</i>	Urunga Sailing Club

Comment	Location of observation
<i>Exceeding speed limit.</i>	Urunga Sailing Club
<i>Excessive wash near kayakers.</i>	Urunga Sailing Club
<i>Excessive wash near other boats.</i>	Urunga Sailing Club
<i>Fast and reckless.</i>	Urunga Sailing Club
<i>Hugged the shoreline travelling fast.</i>	Urunga Sailing Club

**Table 8. Unprompted comments by researchers about exceptional behaviour
(n = 27)**

Activity	Actual		Expected ^a	
	No.	%	No.	%
Water skiing	1	3.7%	2.9	10.9%
Jet skiing-not towing	1	3.7%	0.6	2.3%
Wake boarding	2	7.4%	1.0	3.8%
Donut/Tubing	5	18.5%	2.2	8.1%
Fishing	12	44.4%	10.6	39.1%
Other	1	7.4%	2.9	4.2%
Traversing	5	14.8%	2.2	21.4%
Total	27	100.0%	27	100.0%

Table 9. Share of observations of exceptional boating behaviour by type of activity – actual and expected

Note.

^a the “expected” value is the percentage of total observations attributed to each activity (n = 1491)

4.7 Potentially less safe practices

If we allow the liberty of identifying certain practices in combination with other practices to be inherently less safe than others in certain contexts (e.g., at busy times), then the following items from the data set might usefully be aggregated:

- Travelling at planing speed
- Travelling to left of centre;
- Operating close to shoreline;
- Making power turns;
- Towing;
- Towing in clockwise direction and not executing all turns to port;
- Not turning at furthest practicable distance from shoreline; and

- Towing under bridges.
- The results of this aggregation are presented in Figure 27 and Figure 28.

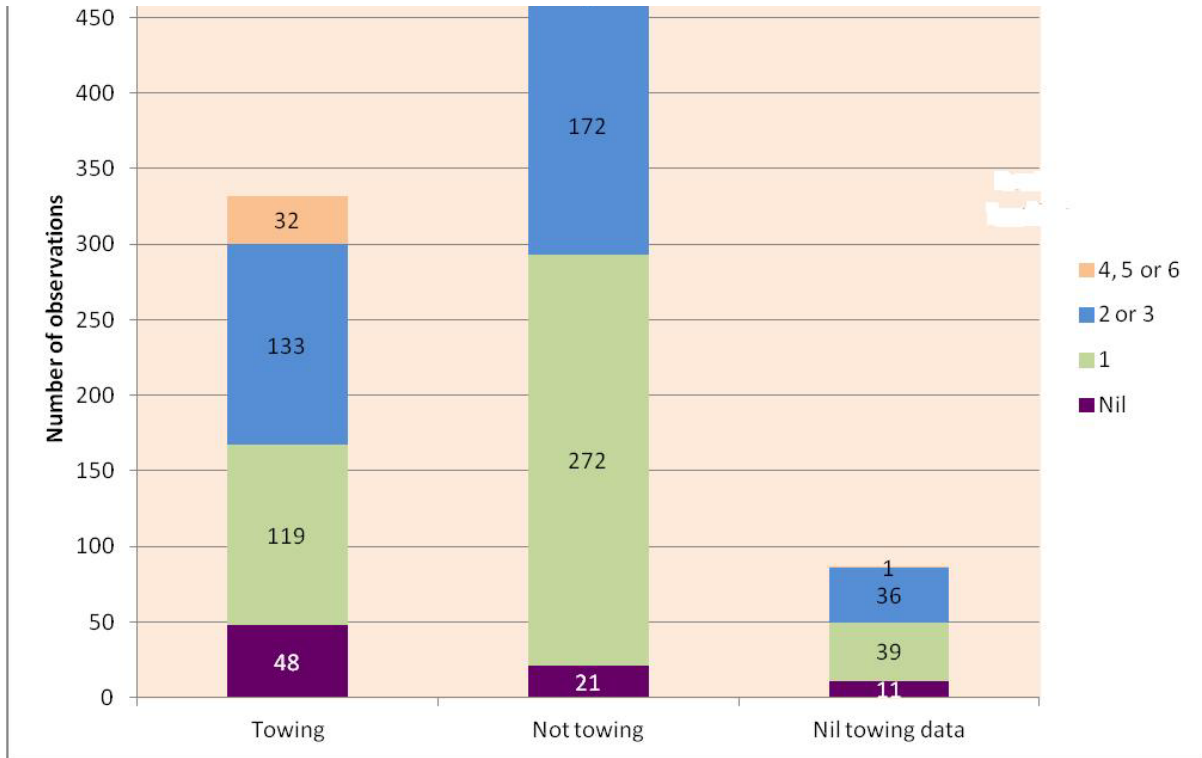


Figure 25. Boats at planing speed: number observed in multiple identified practices (see text) by towing status (n=887)

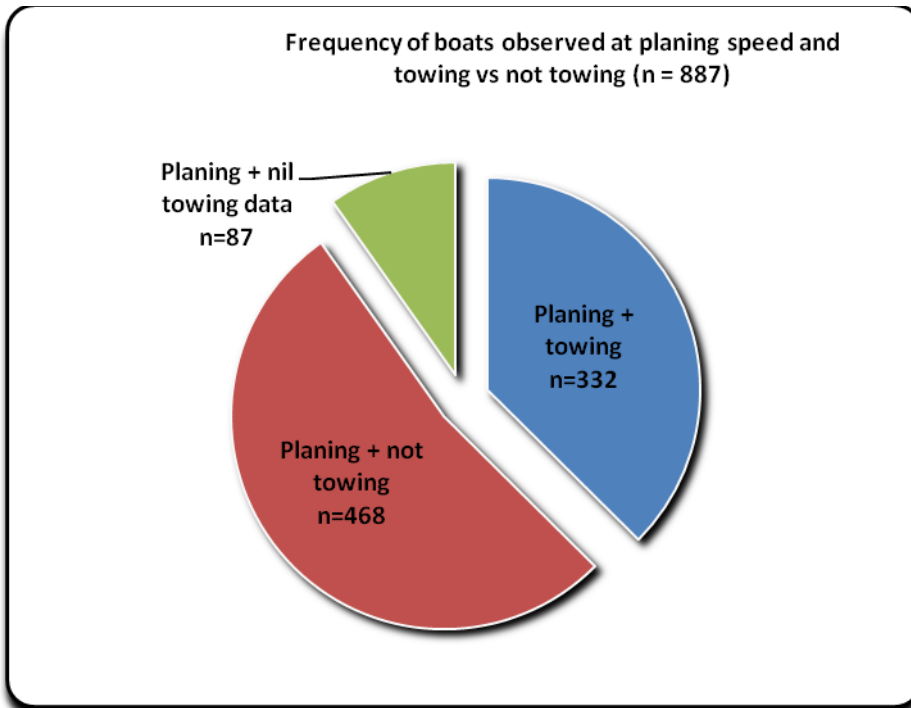


Figure 26. Frequency of boats observed at planing speed who were towing vs not-towing

4.8 Solo operators

There were five observations of two craft engaged in water skiing or wake boarding with only one person (the driver) on board Table 10. This is a contravention of the boating rules which require such activities to have a dedicated observer.

Type of activity?	Water skiing	4
	Jet skiing-towing	1
	Jet skiing-not towing	19
	Wake boarding	3
	Donut/tubing	0
	Fishing	104
	Sailing	9
	Canoeing/Kayaking	109
	Other	11
	Traversing	62
	Total	322

Table 10 Count of observations where only one person on board by type of activity(n=322)

4.9 Child and teenage drivers

Researcher's made a judgement about the age the driver of each craft as either child, teenager or adult. Teenagers were in control of 6% (84 observations) of all craft and a child was in control of 1% (12 observations) of all craft observed. As shown in Table 11, the type of activities being undertaken with a child boat driver were predominantly fishing (3 cases), canoeing or kayaking (3 cases) and the other 6 cases were traversing. Teenagers were most commonly found in control of a boat while fishing (35 observations) and evenly distributed across almost all other activities.

		Driver of boat?			Total
		Adult	Teenager	Child	
Type of activity?	Water skiing	158	4	0	162
	Jet skiing-towing	6	0	0	6
	Jet skiing-not towing	30	4	0	34
	Wake boarding	56	1	0	57
	Donut/Tubing	146	8	0	154
	Fishing	536	35	3	574
	Sailing	9	3	0	12
	Canoeing/Kayaking	122	9	3	134
	Other	53	7	0	60
	Traversing	311	13	6	330
Total		1427	84	12	1523

Table 11. Type of activity observed by maturity of driver (n=1523)

4.10 Boat licence and engine size

A total of 431 boat licensees were interviewed which was 82.6% of all interviewees

The Maritime NSW Boating Handbook says *“The speed at which a boat is driven determines whether a person needs to be licensed. Any person who drives a powered vessel recreationally on NSW waters at a speed of 10 knots (18.5kph) or more must have a boat driver’s licence. Ten knots is the speed at which most accelerating boats will start to plane – that is rise up and skim on top of the water instead of ploughing through it. The exception is anyone who drives a personal watercraft (PWC) at ANY speed must have a PWC Licence”*.

A person must be aged 16 in order to obtain a general boat licence. A restricted licence is available for teenagers aged 12-15. Restricted licence holders must not travel at 10 knots or more when towing a person, or when unaccompanied by a general licence holder.

Boats with an engine size of 5Hp are generally capable of planing though drivers who remain below 10 knots are not required to be licensed, regardless of engine size. Almost all of those interviewed who were the drivers of the craft with an engine size of 5Hp or more (n=445) and were operating a craft with an engine size over 5HP (n=405) were licensed. (n=373, 92%) 32 said they did not have a boat licence. Some drivers of smaller vessels were also licensed.

5 Locations

This section presents data gathered from interviews and observations about the activities of boaters at each location as well as selected characteristics of the respondents who use the different locations and the boating practices observed at each location. In view of the particular environmental sensitivity of some locations, the frequency of boating practices that may degrade those environments have been specifically selected for presentation. Similarly, the intensity of boating at some locations renders safety and boater opinions of particular significance and these are also presented.

5.1 Locations, frequency of boating and day of week

An average of 4.4 craft were observed each hour across the 10 observation sites. The frequency of boating activity varied according to time of day, season, weather, day of week and whether day was a public holiday. The frequency of boating ranged from nil observations (South Arm Road on a Friday afternoon before the October labour day long weekend) to 17.8 observations per hour on a Thursday in early January at Teds Oyster Lease (Repton). The busiest day was Good Friday in 2010 when there were 16.5 observations per hour at Mylestom Pool and 11.5 hourly at the Repton Caravan Park. Figure 29 presents the average number of observations recorded each hour at the ten sites.

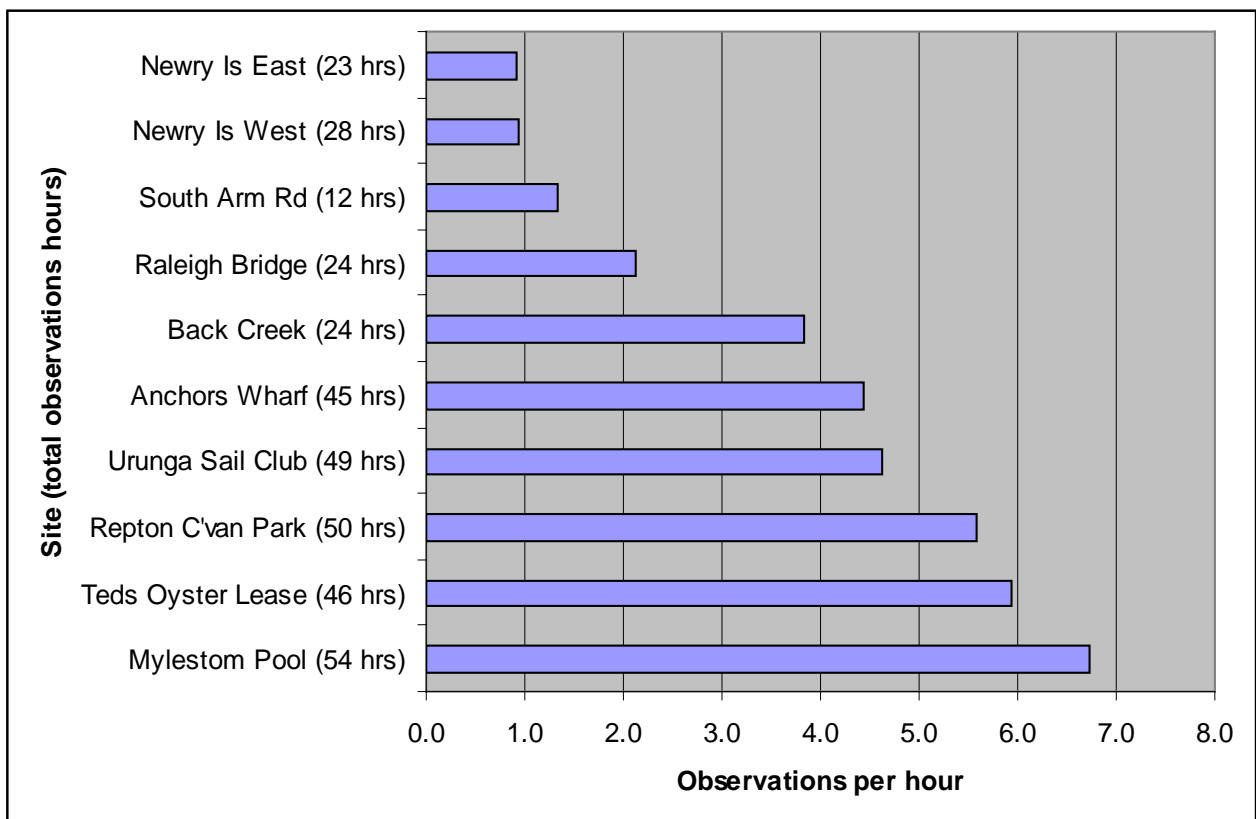


Figure 27. Hourly frequency of craft observations at each site

The dates on which the highest frequencies of craft observations were made are shown in Table 12.

Date	Day of week	Public hol?	School hol?	Site	Obs per hr
5-Oct-09	Monday	Yes	Yes	Teds Oyster Lease	10.25
26-Dec-09	Saturday	Yes	Yes	Mylestom Pool	11
1-Jan-10	Friday	Yes	Yes	Anchors Wharf	11.25
24-Jan-10	Sunday	No	Yes	Urunga Sail Club	11.25
23-Jan-10	Saturday	No	Yes	Repton Caravan Pk	11.25
15-Nov-09	Sunday	No	No	Mylestom Pool	11.25
2-Apr-10	Sunday	Yes	Yes	Repton Caravan Pk	11.5
28-Dec-09	Monday	No	Yes	Urunga Sail Club	12
2-Apr-10	Friday	Yes	Yes	Repton Caravan Pk	15
24-Apr-09	Friday	No	Yes	Mylestom Pool	16.25
2-Apr-10	Friday	Yes	Yes	Mylestom Pool	16.5
7-Jan-10	Thursday	No	Yes	Teds Oyster Lease	17.75

Table 12. Busiest dates for observation of craft

School holidays and public holidays were generally busier than other days as shown in Table 12.

Holidays?	No. of observations	No. hours of observation	Observations per hour
School holidays	1285	275	4.7
Not school holidays	263	80	3.3
<i>Total</i>	<i>1548</i>	<i>355</i>	<i>4.4</i>
Public holiday	438	58	7.6
Not public holiday	1110	297	3.7
<i>Total</i>	<i>1548</i>	<i>355</i>	<i>4.4</i>

Table 13. Observations on holidays compared to non-holidays

There was little difference in the frequency of observations on different days of the week, as shown in Table 14, with frequencies ranging from 3.4 observations on Mondays to 4.9 on Fridays. However, some caution should be applied when interpreting these findings because the selection of days for observation was not random: there was a deliberate bias to observe on holidays. Thus, for example, there were observations on three Tuesdays, two of which were during school holidays and one of those was also a public holiday. Similarly, there were observations on three Thursdays, all of which were during school holidays. The frequency of observations on each day of the week in school holidays compared to non-school holidays is shown in Figure 30. The only exception to the general finding that school holidays are busier than non-school holidays is on Sundays. Non-school holiday Sundays were busier than all other days, with the exception of school holiday Tuesdays which were the busiest days. However, the sample size of school holiday Tuesdays is small: there were observations on

only two school holiday Tuesdays, (a total of 12 observation hours at 3 of the busier sites) one of which was the Australia Day public holiday.

Day of week	No. of observations	No. hours of observation	Observations per hour
Sunday	365	80	4.6
Monday	109	32	3.4
Tuesday	92	20	4.6
Wednesday	90	26	3.5
Thursday	104	24	4.3
Friday	331	67	4.9
Saturday	457	106	4.3
<i>Total</i>	<i>1548</i>	<i>355</i>	<i>4.4</i>

Table 14. Frequency of observations on each day of the week

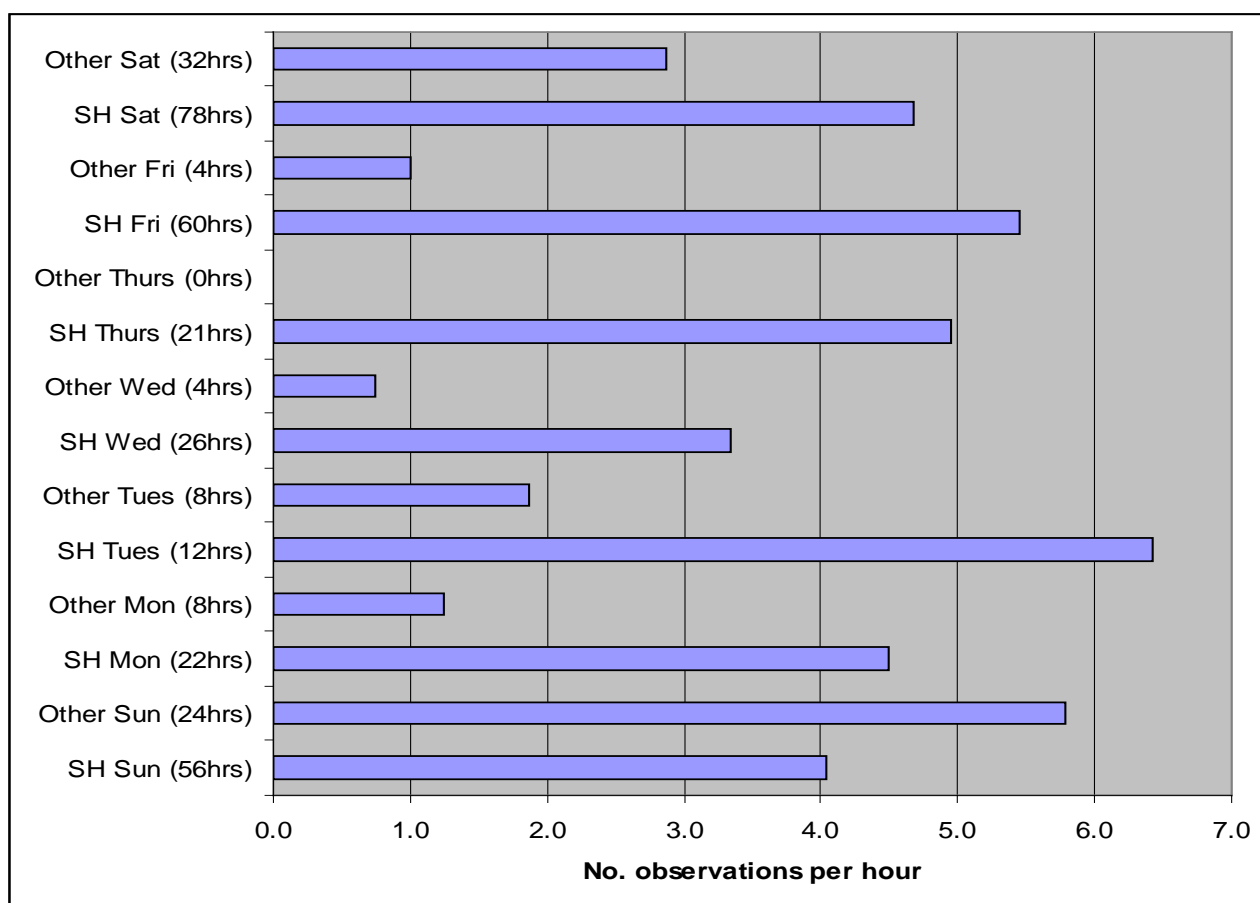


Figure 28. Frequency of observations per hour by day of week in school holidays and not-school holidays

Note. SH indicates school holidays. Bracketed numbers on x-axis are the total number of hours of observation on those days. Note that the school holiday Tuesdays were 26/1/10 and 13/10/09.

5.2 Locations and activities

The count of activities at each of the two Newry Island (East and West) observation sites was small (see Table 14). For ease of interpretation, this data has been aggregated into a single Newry Island site in this section.

	Towing	Fishing	Sailing/ Paddling	Traversing	Other	Total
Newry Island West	0	7	0	4	0	11
Newry Island East	0	8	2	10	1	21

Table 15. Count of activities observed at the two Newry Island sites (n = 32)

Observed powered activities and fishing alternately predominate at the five busiest sites (Mylestom Pool, Teds Oyster Lease, Urunga Sail Club, Repton Caravan Park, Anchors Wharf). The longest ski area on the Bellinger/Kalang River system is at Repton and is observable from Teds Oyster Lease and the Repton Caravan Park.

Powered activities were predominant at these sites (55% and 38% respectively of all observations). Fishing was the predominant activity at locations with 8-knot speed restrictions (Back Creek, Newry Island, Urunga Sailing Club), followed by “traversing”. The Mylestom Pool observational line of sight includes both an 8-knot zone and an unrestricted zone. Numerically, there were almost the same number of powered-activity observations at Mylestom as at Repton Caravan Park (92 and 94 respectively) but fishing was a larger share of the total activities observed at Mylestom (44%). Figure 28 and Figure 29 present the frequencies of observed activities at each site.

By interview, the most frequently nominated activity areas were Areas 4 (Lower Bellinger + Lower Kalang including Back Creek) with 24% of all nominations, followed by Areas 7 (Repton-Raleigh) and 5 (south of Mylestom Pool) with 19% and 18% respectively. The least nominated areas were Area 1 (Upper Kalang “mad mile”) and Area 8 (Upper Bellinger) with 5% and 4% of nominations each.

In order to best understand the patterns of different activities across the river system, Areas 1-8 which were used in interviews for identifying the usual place of activities, have been aggregated with the 10 observation sites into a total of seven locations. While there is no direct equivalence between the Areas and sites, the match is meaningful and relevant when considered in context of explanatory comments. Data and comments are provided in three tables below. Table 14 provides frequency data about the five major categories of activity (powered, fishing, sailing/ paddling, traversing and other) at the level it was original collected (Area vs site), together with information about each location’s share total activities. Table 15 ranks each of the seven locations both overall and according to frequency of each type of activity nominated at interview and observed. Table 16 presents comment about the frequency of the different types of activity found by each methodology, the overall pattern for each location and notes consistencies and anomalies between the two methods. Table 16 also comments on the equivalency of the match between areas and sites.

Figure 30, Figure 31, Figure 32 and Figure 33 present the volume and share of types of activities nominated at interview for each Area and observed for each site. Charts for de-aggregated activities by Area as nominated at interview and by observation site are provided at Appendices F and G. The de-aggregated data separates out the different types of powered activities, as well as sailing from paddling.

Area nominated at interview N=1267	Powered		Fishing		Sailing/ Paddling		Traversing		Other		Observation site N=1524	Powered		Fishing		Sailing/ Paddling		Traversing		Other	
	No.	%	No.	%	No.	%	No.	%	No.	%		No.	%	No.	%	No.	%	No.	%	No.	%
Area 1 (Upper Kalang) (n=59, 4.7%)	13	22.0%	36	61.0%	1	1.7%	8	13.6%	1	1.7%	South Arm Rd (n=16, 1%)	9	56.3%	1	6.3%	2	12.5%	4	25.0%	0	0.00%
Area 3 (Sth of Anchors Wharf) (n=108, 8.5%)	19	17.6%	81	75.0%	4	3.7%	4	3.7%	0	0.0%	Anchors Wharf (n=220, 14.4%)	40	18.2%	67	30.5%	27	12.3%	75	34.1%	11	5.0%
Area 4 (Lower Rivers incl Back Ck) (n=307, 24.2%)	34	11.1%	228	74.3%	20	6.5%	20	6.5%	5	1.6%	Urunga Sail Club (n=227, 14.9%) Back Creek (n=99, 6.4%)	8	3.5%	154	67.8%	25	11.0%	31	13.7%	9	4.0%
Area 2 (Newry Is) (n=101, 8%)	1	1.0%	83	82.2%	5	5.0%	11	10.9%	1	1.0%	Newry Island (n=32, 2%)	0	0.0%	15	82.2%	2	5.0%	14	3.1%	1	1.0%
Area 8 (Upper Bellinger) (n=56, 4.4%)	13	23.2%	39	69.6%	1	1.8%	3	5.4%	0	0.0%	Raleigh Bridge (n=51, 3.3%)	19	37.3%	3	5.9%	6	11.8%	21	41.2%	2	3.9%
Area 7 (Repton-Raleigh) (n=245, 19.3%)	116	47.3%	108	44.1%	12	4.9%	7	2.9%	2	0.8%	Repton C'van Park (n=250, 16.4%) Ted's Oyster Shed (n=273, 17.9%)	94	37.6%	85	34.0%	30	12.0%	31	12.4%	10	4.0%
Area 5 (Sth of Mylestom Pool) (n=226, 17.8%) Area 6 (Tuckers Is-Mylestom) (n=165, 13%)	114	50.4%	91	40.3%	12	5.3%	9	4.0%	0	0.0%	Mylestom Pool (n=356, 23.4%)	92	25.8%	158	44.4%	41	11.5%	47	13.2%	18	5.1%
Total (% of all activities nominated)	341	26.9%	779	61.5%	69	5.4%	66	5.2%	12	0.9%	Total (% of all activities observed)	413	27.1%	582	38.2%	153	10.0%	320	21.0%	56	3.7%

Table 16. Count and percentage of activities by (a) Area as nominated at interview (n = 8), and (b) observation sites (n = 10)

Note. The red shaded columns to the left is data collected at interview. The blue shaded columns at right is data collected during observations. Red circled data indicates areas where fishing and power users are both present in significant and similar proportions

Row percentages are % of each activity as a total of all activities in each area.

Percentages nominated in the area/site-name columns are % of activities in that area as a total of all activities nominated/observed.

AREAS AND SITES AGGREGATED INTO SEVEN LOCATIONS

Area nominated at interview N=1267	Observation site N=1524	<u>Rank by count of nominations</u>						<u>Rank by count of observations</u>					
		overall	powered	fishing	sail/ paddle	traverse	other	overall	powered	fishing	sail/ paddle	traverse	other
Area 1 (Upper Kalang) (n=59, 4.7%)	South Arm Rd (n=16, 1%)	6	5	7	6	4	-	17	5	6	6	7	5
Area 3 (Sth of Anchors Wharf) (n=108, 8.5%)	Anchors Wharf (n=220, 14.4%)	4	4	4	4	6	-	4	3	4	4	2	2
Area 4 (Lower Rivers incl Back Ck) (n=307, 24.2%)	Urunga Sail Club (n=227, 14.9%) Back Creek (n=99, 6.4%)	2	3	1	2	1	-	3	5	1	1	3	2
Area 2 (Newry Is) (n=101, 8%)	Newry Island (n=32, 2%)	4	7	4	4	2	-	6	7	5	6	6	5
Area 8 (Upper Bellinger) (n=56, 4.4%)	Raleigh Bridge (n=51, 3.3%)	6	5	7	6	6	-	5	4	6	5	5	5
Area 7 (Repton-Raleigh) (n=245, 19.3%)	Repton C'van Park (n=250, 16.4%) Ted's Oyster Shed (n=273, 17.9%)	3	2	3	3	4	-	1	1	3	3	1	2
Area 5 (Sth of Mylestom Pool) (n=226, 17.8%) Area 6 (Tuckers Is-Mylestom) (n=165, 13%)	Mylestom Pool (n=356, 23.4%)	1	1	2	1	2	-	2	2	2	1	4	1

Table 17 Activity by location – interview and observational data combined to rank busiest locations

Area nominated at interview <i>N</i> =1267	Observation site <i>N</i> =1524	AREAS AND SITES AGGREGATED INTO SEVEN LOCATIONS Comment about frequency of different activity types according to the two methodologies noting comparability of interview and observational data, consistencies and anomalies.
Area 1 (Upper Kalang) (n=59, 4.7%)	South Arm Rd (n=16, 1%)	Low level activity location. Fishing was the most frequently nominated activity at interview (36) but was rarely observed (6). This is likely to be because boaters in this area did not need to pass the observation site in order to find a large tract of fishing space. The observation site had visibility of only a small tract, albeit anecdotally an important area for powered activities. Neither observational nor interview data recorded much powered activity (9 observations of 2 boats skiing and wakeboarding on a single Sunday afternoon in October; 13 nominations at interview).
Area 3 (Sth of Anchors Wharf) (n=108, 8.5%)	Anchors Wharf (n=220, 14.4%)	This match of Area to site was the least successful of all matches. The observation site encompassed a larger area than the nearest equivalent site that could be nominated at interview (Area 3) . This is one explanation for why there were twice as many activities observed than were nominated at interview. However, as this is a popular site for power activities, and as power-boaters tend to make multiple passes there are more multiple counts of individual users than there are of other types of activities. The proportion of power-activities that were observed (as a total of all activities observed at that site) was very similar to the proportion of respondents who nominated this area for power-activities (17.6% and 18.2% respectively)
Area 4 (Lower Rivers incl Back Ck) (n=307, 24.2%)	Urunga Sail Club (n=227, 14.9%) Back Creek (n=99, 6.4%)	According to nominations at interview, this site has numerically and proportionally the most activity of all sites on the river system. According to observations it is second only to the Repton-Raleigh area. The observation sites at Back Creek and the Urunga Sail Club were well positioned to observe most of Area 4. Boaters who headed south-west from launching (into Area 3) were the only boaters who would not have been observed. The proportion and number of activities that were nominated for this site at interview is is very similar to that summed from Back Creek and Urunga Sail Club observation sites: 307 (24.2%) at interview compared to 326 (21.3%) from observation. The relative counts of each type of activity are also quite similar except that there were more observations of boats traversing (64) and more interview nominations of powered activities (34). Fishing is the predominant activity at this location (228 nominations, 199 observations) and, according to observations the next most common activity is traversing (64) (it is a major access to all other points on the river system as well as to the ocean) and powered activities are the next most common activity (34).
Area 2 (Newry Is) (n=101, 8%)	Newry Island (n=32, 2%)	Low level activity site with good comparability of data from interview/observations. There were 3 times as many nominations of this location as an area for activities (n=101) as there were for observations (n=32/15). Fishing was the most frequent activity nominated at interview (82%) and observed (82%).

<p>Area 8 (Upper Bellingier) (n=56, 4.4%)</p> <p>Raleigh Bridge (n=51, 3.3%)</p>	<p>Low level activity site with good comparability between data from interview and observations. The total count of activities at this location as nominated and observed is almost identical, and the proportion of activities at this location as a proportion of all activities on the river system is comparable with both methods. If we assume that a significant proportion of the boaters observed traversing at this site (n=21) were travelling to a fishing location, then the activity break-up is quite similar for both methods. Powered activities were more frequently observed (37%) than nominated (23%) but the multiple observations of power-activities as discussed elsewhere is a probable explanation. It is worth noting that 2 respondents nominated this site as usual place for their wakeboarding and that there were 19 observations of wakeboarding.</p>
<p>Area 7 (Repton-Raleigh) (n=245, 19.3%)</p> <p>Repton C'van Park (n=250, 16.4%)</p> <p>Ted's Oyster Shed (n=273, 17.9%)</p>	<p>This is a high activity area with the largest number of power-activity observations (243), and the second largest number of power activity nominations (116). There were also more observations of "traversing" at this location than at any other location. It was mid-ranked for nominations of other activities as well as for observations of fishing and sailing/paddling. The two observation sites in this location afforded good visibility of the eastern reach of this Area but not the western reach</p>
<p>Area 5 (Sth of Mylestom Pool) (n=226, 17.8%)</p> <p>Area 6 (Tuckers Is-Mylestom) (n=165, 13%)</p> <p>Mylestom Pool (n=356, 23.4%)</p>	<p>This is a high activity area. Power activities were more frequently nominated at interview for this location than for any other location (145). It was ranked 2nd for observations of power activities. It was also ranked 1st for both nominations at interview of sailing/ paddling (26) and observations of same (41). It had the 2nd largest number of nominations and observations for fishing. The single observation site had good visibility of both Area 5 and Area 6. It is likely that the number of observations is an accurate reflection of the actual number of craft movements in the location.</p>

Table 18. Comment about activities at each of the 7 aggregated locations

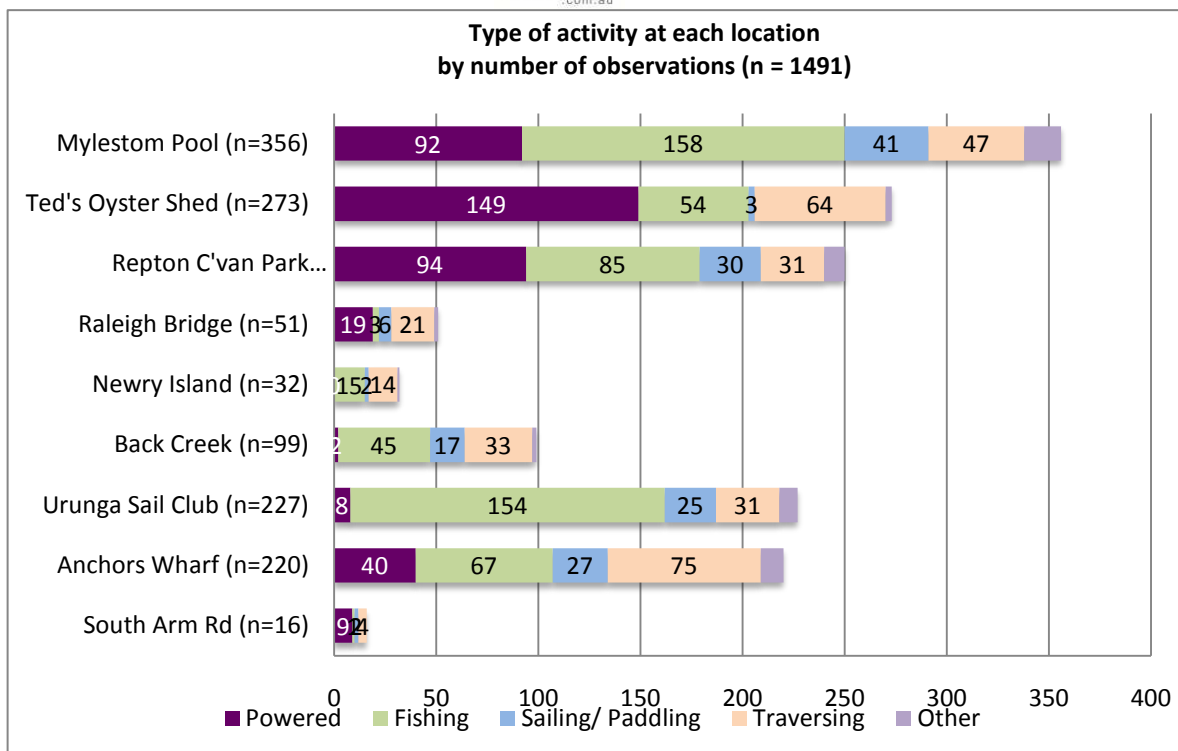


Figure 29. Type of activity at each location by number of observations (n = 1491)

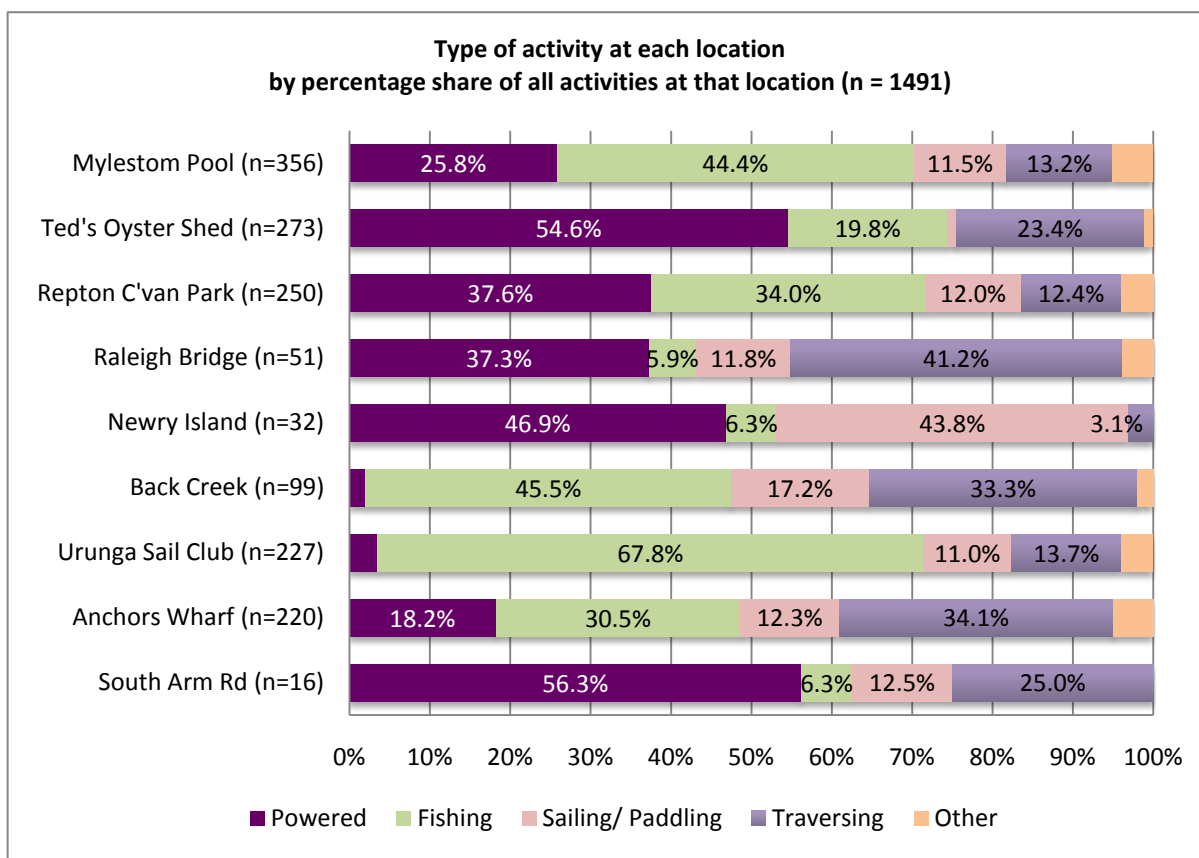


Figure 30. Type of activity at each location by percentage share of all activities at that location.

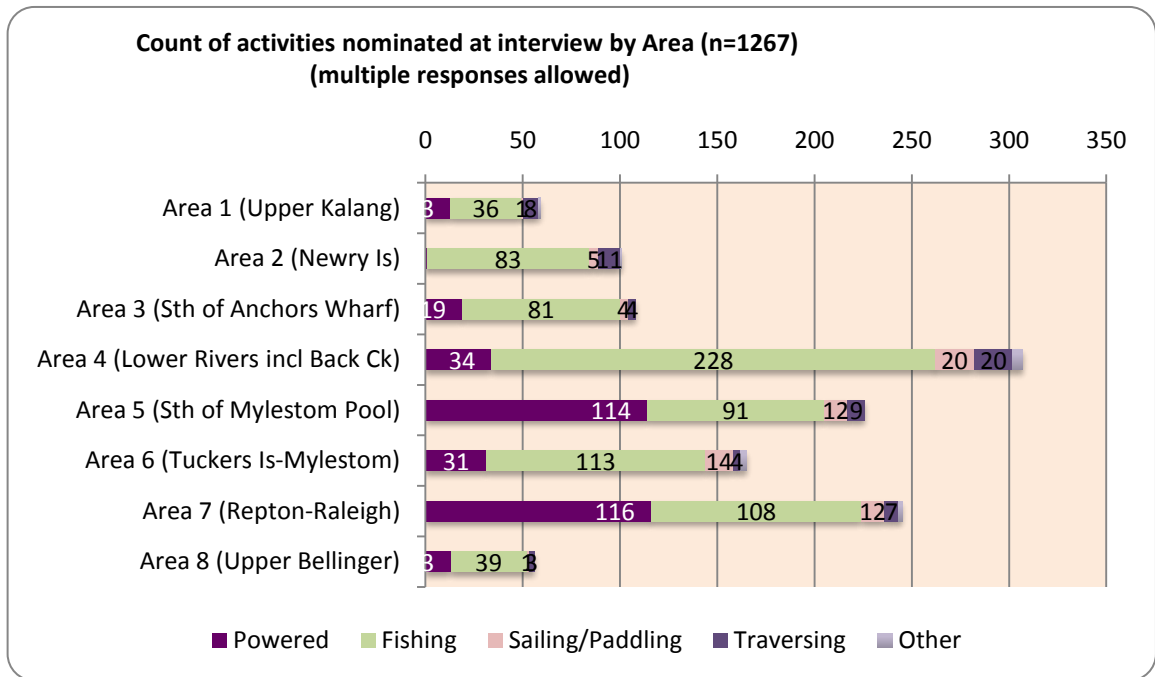


Figure 31. Count of activities nominated at interview by Area (n=1267)(multiple responses allowed)

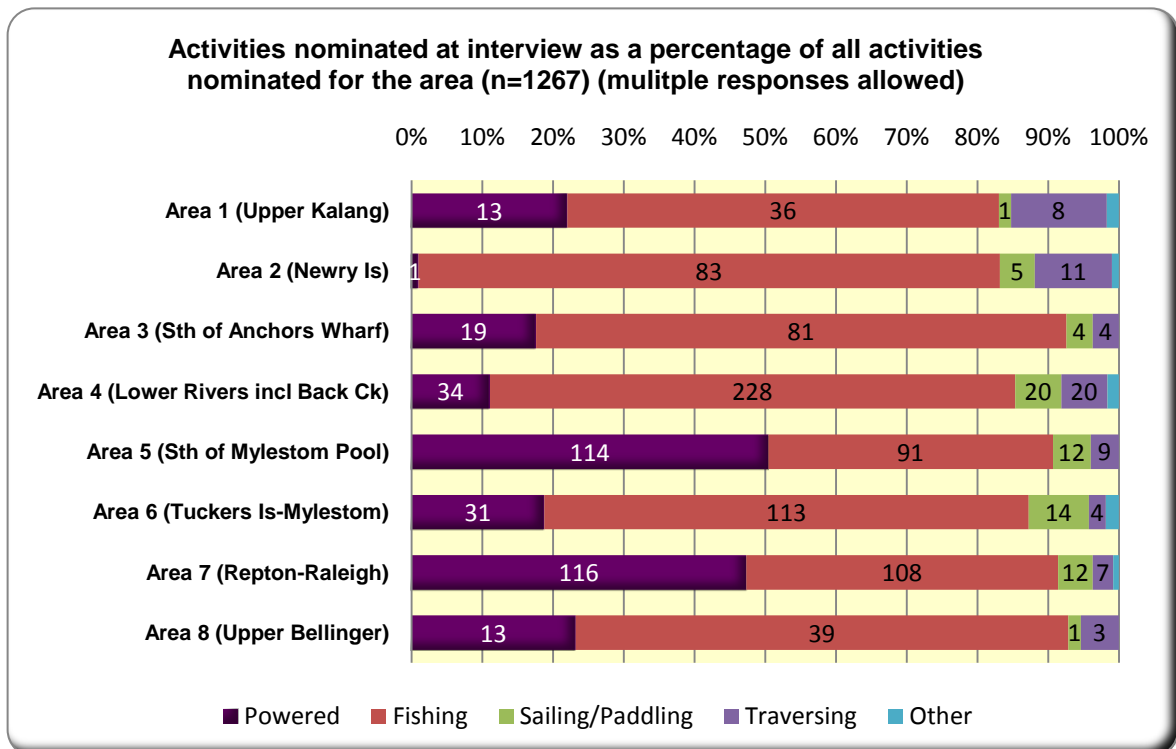


Figure 32. Activities nominated at interview as a percentage of all activities nominated for the Area (n=1267) (multiple responses allowed)

5.3 Sensitive environments: Back Creek and Newry Island

Boating activity can damage sensitive environments by creating wave wash in excess of that which the river bed or banks can sustain. The *Bellinger and Kalang River Estuaries Erosion Study* (Feb 2010) prepared for Bellinger Council by GECON Environmental and IRM Consultants noted that both Newry Island and Back Creek show multiple signs of negative boat wave wash impact (Figure 44, p. 86). Both Newry Island and Back Creek are 8-knot speed limit areas and Newry Island is the only no-wash zone in the river system. Observations made at the Newry Island and Back Creek sites that are relevant to wash (planing or not planing, proximity to shoreline, excess speed near banks, power turns, size of boat, boating intensity and tide) are reported in this section.

There were a total of 99 observations at Back Creek, 21 at Newry Island East and 11 at Newry Island West. As noted in section 5.1, the data suggests boating is less frequent around Newry Island compared to other parts of the river with an average of 0.9 boating observations per hour at Newry Island East and 0.6 at Newry Island West, compared to average across the river system of 3.5 per hour. Intensity of boating on Back Creek is exactly average at 3.5 observations per hour.

Tables presenting frequency of environmental-related observations at each of these three sites is contained in the set of tables at Table 17. Key observations may be summarised as:

- Fishing was the most common activity observed (32 %) followed by traversing (27%).
- There was one observation of donut/tubing in Back Creek. The craft was planing but there is no comment otherwise about speed.
- There was one observation of a jet ski in Back Creek though it was not planing.
- The majority of boats in these waterways were small (64.8%) though eight craft (6.6%) were deemed large.
- Craft on these waterways are more likely to be non-planing than planing (68 compared to 45).
- The majority of craft were on these waterways at low tide (58 or 47.9%) rather than mid or high tide.
- There were no power turns observed at either site.

Type of activity?

	Back Creek	Newry East	Newry West
Jet skiing-not towing	1	0	0
Donut/Tubing	1	0	0
Fishing	45	7	8
Canoeing/Kayaking	17	0	2
Other	2	0	1
Traversing	33	4	10
Total	99	11	21

Size of boat

	Back Creek	Newry East	Newry West
Large	7	1	
Medium	24	5	5
Small	60	5	14
Jetski	1	.0	.0
Total	92	11.0	89.0

Speed?

	Back Creek	Newry East	Newry West
Idle	5	.0	.0
Non-planing	47	9	12
Planing	35	2	8
Drifting	10	.0	1
Total	97		.0

Operating well away from shoreline?

	Back Creek	Newry East	Newry West
Yes	78	8	14
No	21	3	7
Total	99	11	21

Travelling slowly near banks?

	Back Creek	Newry East	Newry West
Yes	41	6	14
No	10	1	7
Total	51	7	21

Tide

	Back Creek	Newry East	Newry West
Low	40	1	17
Mid	28	0	2
High	24	10	0
Total	92	10	19

Back Creek, Newry Is (E & W)

Type of activity	Tide		
	Low	Mid	High
Jet skiing-not towing	1	0	0
Donut/Tubing	1	0	0
Fishing	12	15	12
Canoeing/Kayaking	6	2	9
Other	0	0	1
Traversing	20	11	2
total	40	28	24

Back Creek, Newry Island (E & W)

Speed	Tide		
	Low	Mid	High
Idle	0	1	4
Non-planing	16	14	14
Planing	16	10	5
Drifting	6	3	1
Total	38	28	24

Table 19. Set of tables presenting observations at Back Creek and Newry Island (N=122: Back Creek $n=99$, Newry Is East $n=11$, Newry Is West $n= 21$)

6 Boater opinions

Frustrations, concerns, and perceived rule breaches

Interviewees responded well to being asked their opinions about frustrations, concerns, rules and rule breaches. Of the 523 boaters who were interviewed 245 (47%) responded to question 19, 326 (62%) responded to question 20 and 49 (9%) responded to question 21. Of those who chose not to respond, most said they had no concerns or problems with the rules. “People seem to generally do the right thing” was a typical response. Others who chose not to respond were infrequent boaters on the rivers who said they didn’t have sufficient knowledge.

Excess speed was a recurring theme in response to each of the three questions. Responses to each of the three questions were coded (themed) into logical categories and are presented in Figure 32, Figure 33 and Figure 34. A full list of all responses is to questions 19, 20 and 21 is in the Appendices (APPENDIX H: Responses to Question 19. Question 20 and APPENDIX J: Responses to Question 21)

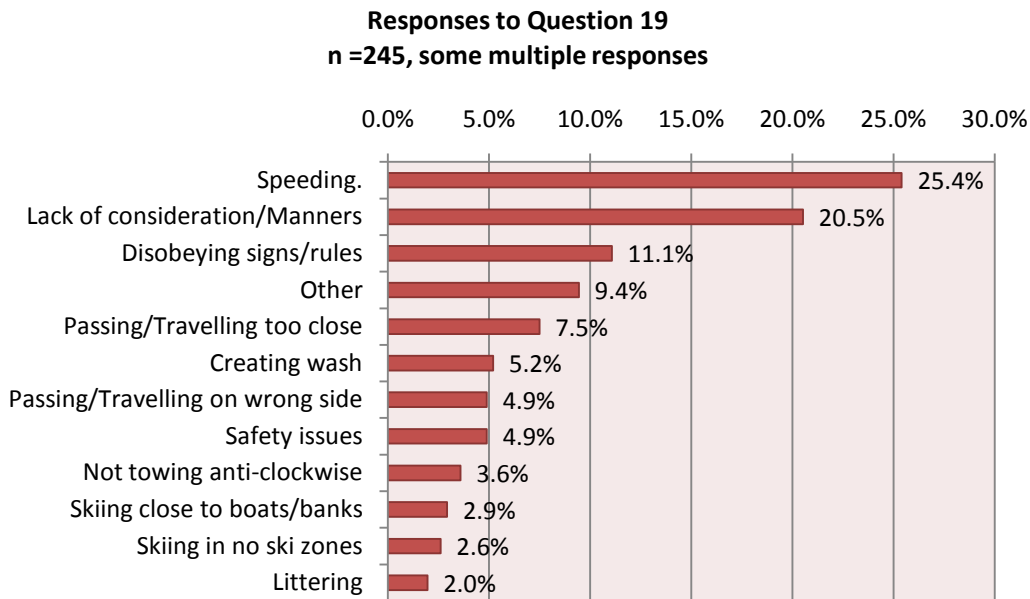


Figure 33. Responses to Q.19 “What have you observed other river users doing that has frustrated or concerned you?”

Responses to Question 20 (n = 396 ; some multiple responses)

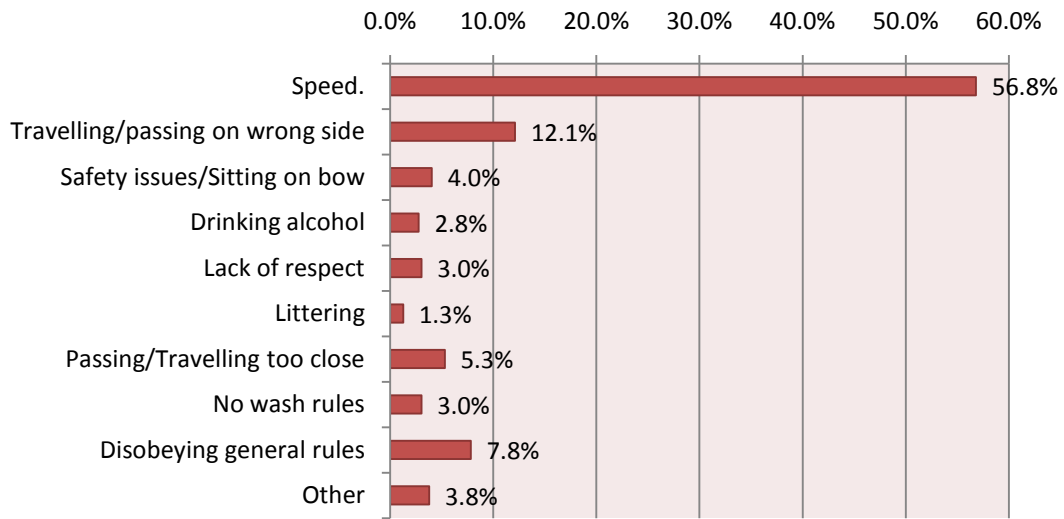


Figure 34. Responses to Q.20 “What rules do you believe are most commonly broken by other river users?”

Responses to Question 21 (n=52, few multiple responses)

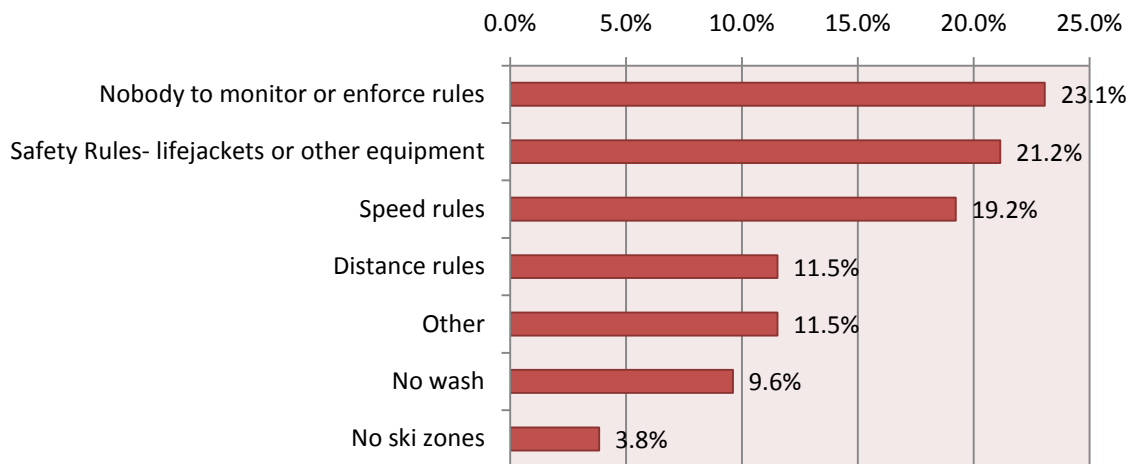


Figure 35. . Responses to Q.21 “Are there any boating rules that you find impractical or unenforceable?”

6.1 Speed increases and decreases

As shown on the map at Figure 35, the area proposed most frequently by respondents for a speed increase (n=88) is the same zone – Area 4 - as was proposed most frequently (jointly) for a speed decrease (n=34). Area 6 was also nominated by 34 boaters for a speed decrease.

Speed decreases were most frequently sought by non-motorised boaters and fishers. Speed increases were most frequently sought by fishers. Table 18 and Table 19 set out the detail. Researchers commented that many fishing boaters objected to the time it took to travel to their favourite fishing spot/s.

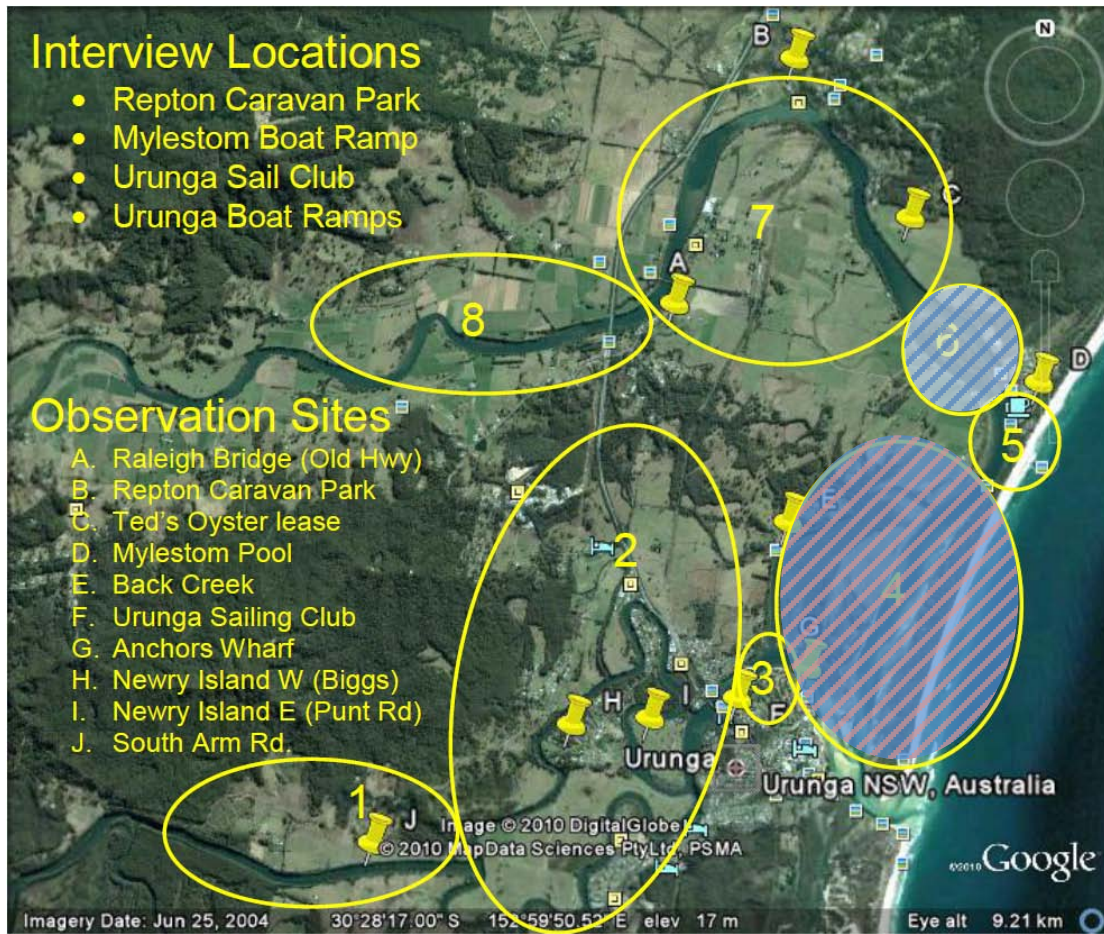


Figure 36. Map showing areas most frequently nominated for decrease in speed limit shown in blue stripes (n=36 for Area 4 and n=34 for Area 6) and for increase in speed limit shown in pink stripes (n=88).

6.1.1 Areas recommended by respondents for increase in speed limit

Q.14. “What areas of the river, if any, do you believe the speed limit should be increased? (Show map)”

	Increase speed in areas ^a										Total
	Area 1 (n=13)	Area 2 (n=18)	Area 3 (n=12)	Area 4 (n=109)	Area 5 (n=13)	Area 6 (n=11)	Area 7 (n=12)	Area 8 (n=7)	None (n=304)	Don't know (n=89)	
power users	3		2	31	6	4	5	4	67	28	203
fishers	10	18	10	77	7	7	6	3	09	53	369
non-powered				1			1		28	8	38
total	13	18	12	109	13	11	12	7	304	89	610

Table 20. Areas nominated at interview for/against an increase in speed limit (n=610) (multiple responses allowed)

6.1.2 Areas recommended by respondents for decrease in speed limit

Question 15. “What areas of the river, if any, do you believe the speed limit should be decreased? (Show map)”

	Decrease speed in areas										
	Area 1 (n=4)	Area 2 (n=7)	Area 3 (n=6)	Area 4 (n=34)	Area 5 (n=8)	Area 6 (n=36)	Area 7 (n=25)	Area 8 (n=12)	None (n=416)	Don't know (n=89)	
power users	0	0	0	11	2	4	3	2	161	25	208
fishers	4	6	5	21	6	29	20	9	235	53	388
non-motorised users	0	1	1	2	0	3	2	1	20	11	41
total	4	7	6	34	8	36	25	12	416	89	637

**Table 21. Areas nominated at interview for/against a decrease in speed limit
(n=637) (multiple responses allowed)**

6.2 Turning areas

Question 16 “Looking at this map of the rivers, can you please point out in which areas you would typically turn in?”

The areas nominated in interview in response to the question “looking at this map of the rivers, can you please point out in which areas you would typically turn in?” reflect the busiest areas that were identified previously in Table 14 and Table 15. Areas 4, 5 and 7 account for 67% of the 572 nominations (Figure 36). Respondents who nominated fishing as their main activity typically nominated a wide range of areas for turning while power-activity respondents nominated predominantly the ski areas and launch ramp sites (Figure 37 and Figure 38). A maximum of two areas could be nominated. Researchers commented that fishing users found it difficult to identify their “typical” turning area, saying “it depends where the fish are”.

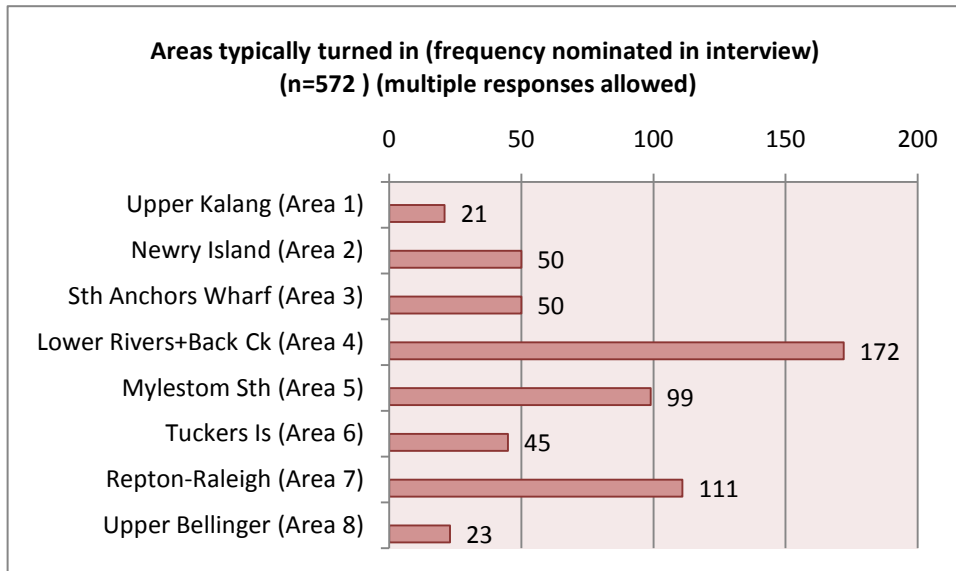


Figure 37. Areas typically turned in: frequency as nominated at interview (n=572)

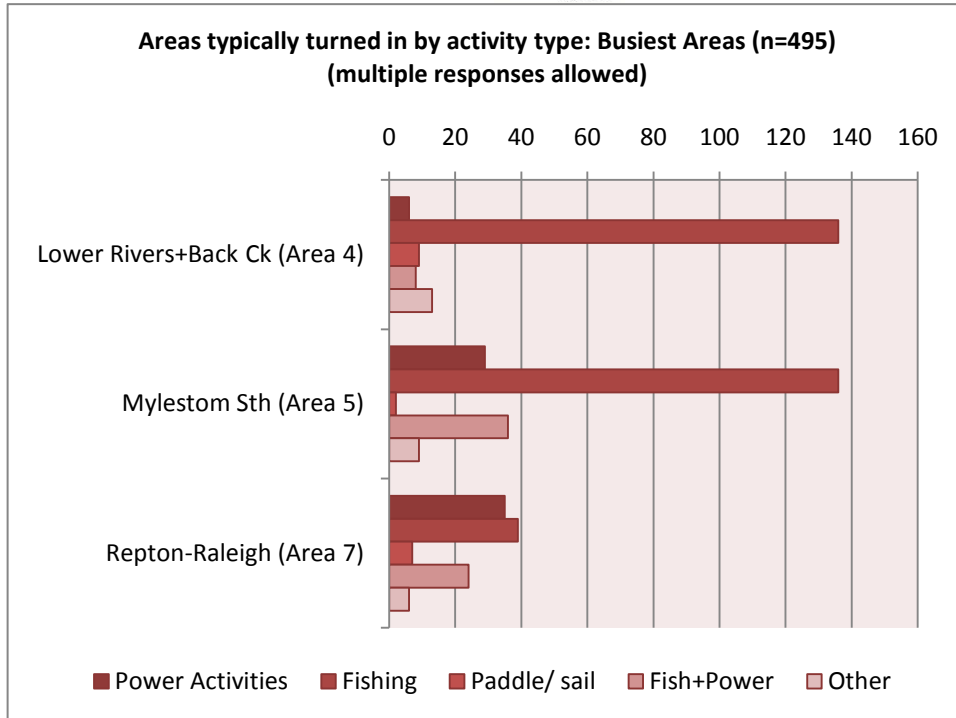


Figure 38. Areas typically turned in by activity: Busiest areas (n=495)

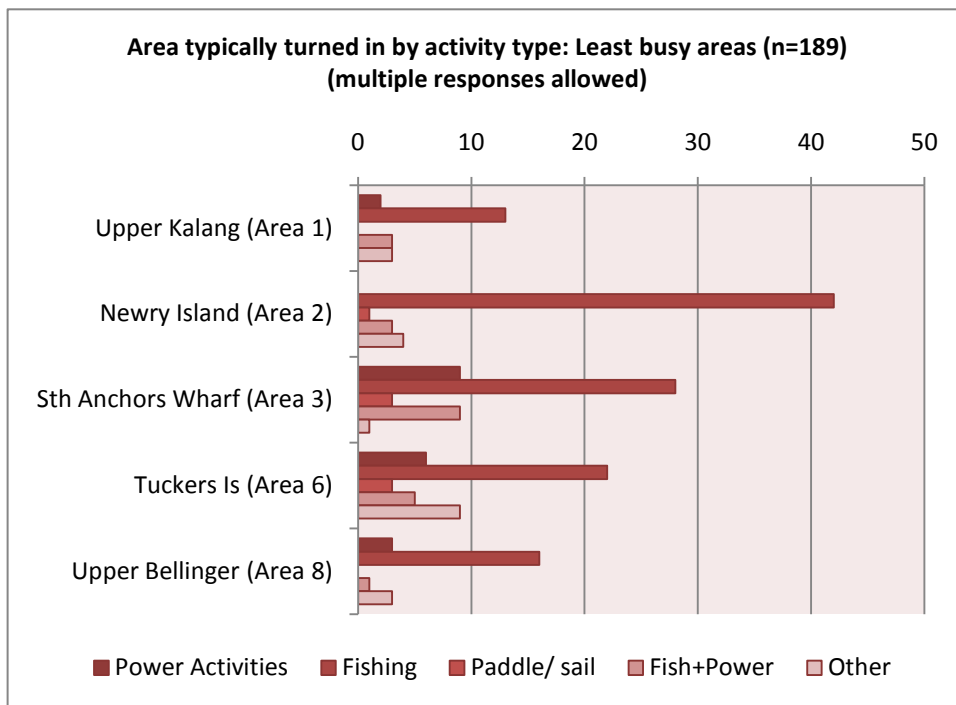


Figure 39. Areas typically turned in by activity: Least busy areas

6.3 No-wash zones

Question 18 “What areas do you think should be no wash zones?”

At present the only no-wash zone in the river system is Area 4 (Newry Island).

The most frequent response to this question was that they “don’t know” what areas should be no-wash zones (28.2%). The next most frequent was “none” (22.9%). Given the relative infrequency of boaters who nominated the Newry Island area (Area 4) as a site for their usual boating activities (see section 5.15.1), and as this is presently the only “no wash” zone in the river system, it is possible that respondents did not know this is an existing “no wash” zone. Some researchers pointed this out to respondents and when they did so, the typical response was that it should stay “as is”. It is not clear how a “as is” response would have been recorded on the survey sheets.

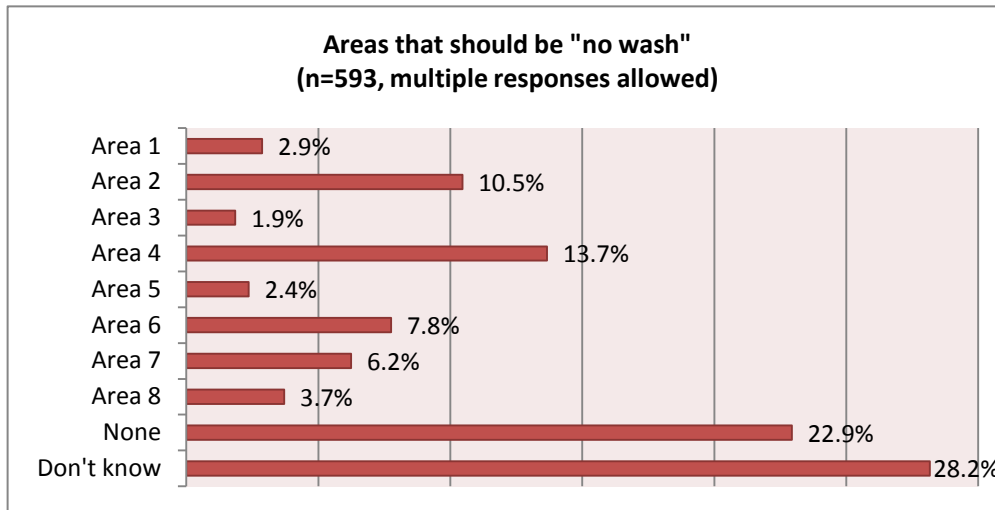


Figure 40. Areas nominated by respondents to be no wash

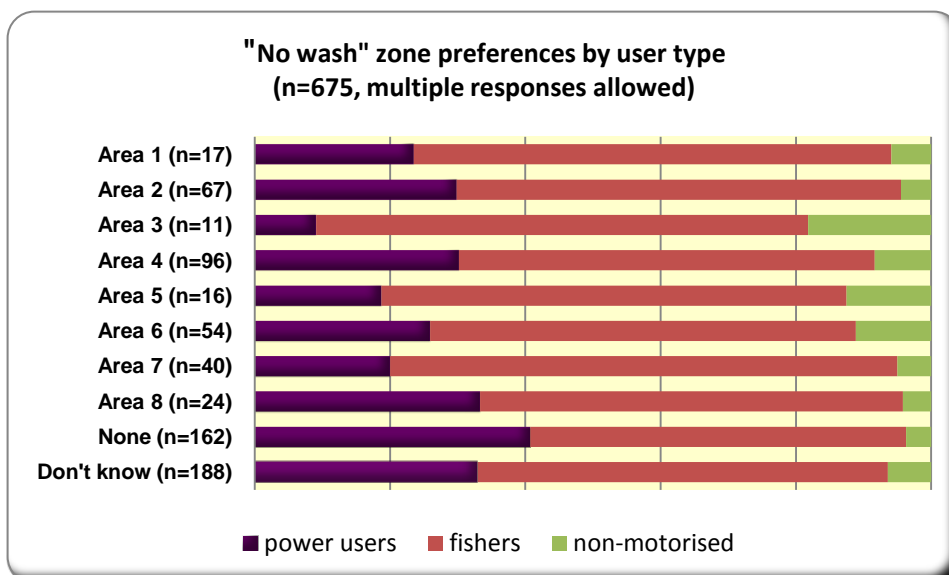


Figure 41. Areas nominated by respondents for no wash, by type of user

7 GLOSSARY

“Powered activities” include skiing, donut/tubing, jet skiing (towing or not towing) and wake boarding.

BSC Bellingen Shire Council

DECCW Department of Climate Change and Water

n = the number in the sample

SD is standard deviation. A standard deviation is the average amount by which values in a distribution differ from the mean, ignoring the sign of the difference. Sometimes, the standard deviation is defined as the average distance between any value in a distribution and the mean of the distribution

8 REFERENCES

Bellingen Shire Council, 2008, *Estuary Management Plan*

Bellinger and Kalang River Estuaries Erosion Study (Feb 2010), prepared for Bellingen Council by GECO Environmental and IRM Consultants.

Maritime NSW, *Boating Handbook* retrieved from www.maritime.nsw.gov.au

9 APPENDICES

9.1 APPENDIX A: Interview form & prompt map



**Bellingen Shire Council Health Rivers Program:
Survey of boat users on Kalang and Bellinger Rivers**

Interviewers: Unless indicated otherwise, please circle number relating to appropriate answer/s

Interview Date: _____	Interview time: _____
Interviewer initials: _____	Coder initials: _____
	Manager initials: _____

1. Have you participated in this survey before?

- Yes 1 (Thank and discontinue)
No 2

2. May I have your residential postcode?

3. Place of Interview

- | | |
|------------------------------|---|
| Urunga Boat ramp – south | 1 |
| Urunga Boat ramp – north | 2 |
| Bellinger River caravan park | 3 |
| Mylestom Boat ramp – west | 4 |
| Mylestom Boat ramp – east | 5 |
| South Arm Road | 6 |
| Urunga Sailing Club | 7 |

4. River Craft Driver or passenger

- | | |
|-----------|---|
| Driver | 1 |
| Passenger | 2 |

5. Boat owned or hired

- | | |
|-------|---|
| Owned | 1 |
| Hired | 2 |

6. What type/s of activity do you typically perform on the Bellinger and/or Kalang river/s? (Show map and tick any boxes that apply)

Area	Area	Area	Area	Area	Area	Area	Area
1	2	3	4	5	6	7	8

1. Water skiing
2. Jet skiing – towing
3. Jet skiing – not towing
4. Wake boarding
5. Donut/Tubing
6. Fishing
7. Sailing
8. Canoeing/kayaking
9. Other _____

7. On average, how often would you boat on these river/s?

- Weekly or more
- Fortnightly
- Monthly
- Quarterly
- Bi-annually
- Annually
- Less than once a year

8. What hours of the day would you most likely make use of the river/s? (tick any that apply)

Before 7am	1
7-10am	2
10-midday	3
Midday-2pm	4
2-4 pm	5
4-6 pm	6
6-8 pm	7
After 8 pm	8

9. On average, how long would you spend on the river on each visit?

_____ hours

10. What is the size of this boat? (Approx. metre length)

11. What is the size of the engine? (If twin engine, combined total)

<5 HP	1
5-25 HP	2
26-50 HP	3
51-120 HP	4
121+ HP	5
None (Go to Q12)	6

12. Does your boat's engine have a 4-stroke or 2-stroke motor?

4 Stroke	1
2 Stroke Carburettor	2
2-stroke electronic fuel-injected	3
Other	4

13. On average, how often do you service your engine?

Once every four or five years	1
Once every two or three years	2
Once a year	3
Twice a year	4
Unsure	5
Never/Not applicable	6

14. What areas of the river, if any, do you believe the speed limit should be increased (Show map)?

Area 1	1
Area 2	2
Area 3	3
Area 4	4
Area 5	5
Area 6	6
Area 7	7
Area 8	8
None	9
Don't Know	10

15. What areas of the river, if any, do you believe the speed limit should be decreased (Show map)?

Area 1	1
Area 2	2
Area 3	3
Area 4	4
Area 5	5
Area 6	6
Area 7	7
Area 8	8
None	9
Don't Know	10

16. Looking at this map of the rivers, can you please point out in which areas you would typically turn in?

Area 1	1
Area 2	2
Area 3	3
Area 4	4
Area 5	5
Area 6	6
Area 7	7
Area 8	8
None	9
Don't Know	10

17. How often do you do power turns? (i.e. turn 180 degrees at speed)?

Frequently	1
Occasionally	2
Never	3

(Survey concludes on next page)

18. What areas do you think should be No wash zones?

- Area 1 1
- Area 2 2
- Area 3 3
- Area 4 4
- Area 5 5
- Area 6 6
- Area 7 7
- Area 8 8
- None 9
- Don't know 10

19. What have you observed other river users doing that has frustrated or concerned you?

20. What rules do you believe are most commonly broken by other river users?

21. Are there any boating rules that you find impractical or unenforceable?

22. Do you have a boat licence?

- Yes 1
- No 2

23. Are you travelling today from the Bellinger to the Kalang River or vice versa?

- Yes 1
- No 2 (Go to Q. 25)

24. If yes, what route will you take?

- Back creek 1
- Via river mouth 2
- Other 3

25. When using these waterways, have you ever modified your boat with wedges and/or ballast?

- Yes – both 1
- Yes – wedges only 2
- Yes – ballast only 3
- No 4

26. If yes, would you do this:

- Frequently 1
- Occasionally 2

27. Where do you typically clean your boat?

- In the water 1
- In the car park 2
- At home 3
- Other: _____ 4

28. Age

- 16-29 1
- 30-39 2
- 40-49 3
- 50-59 4
- 60+ 5

29. Gender

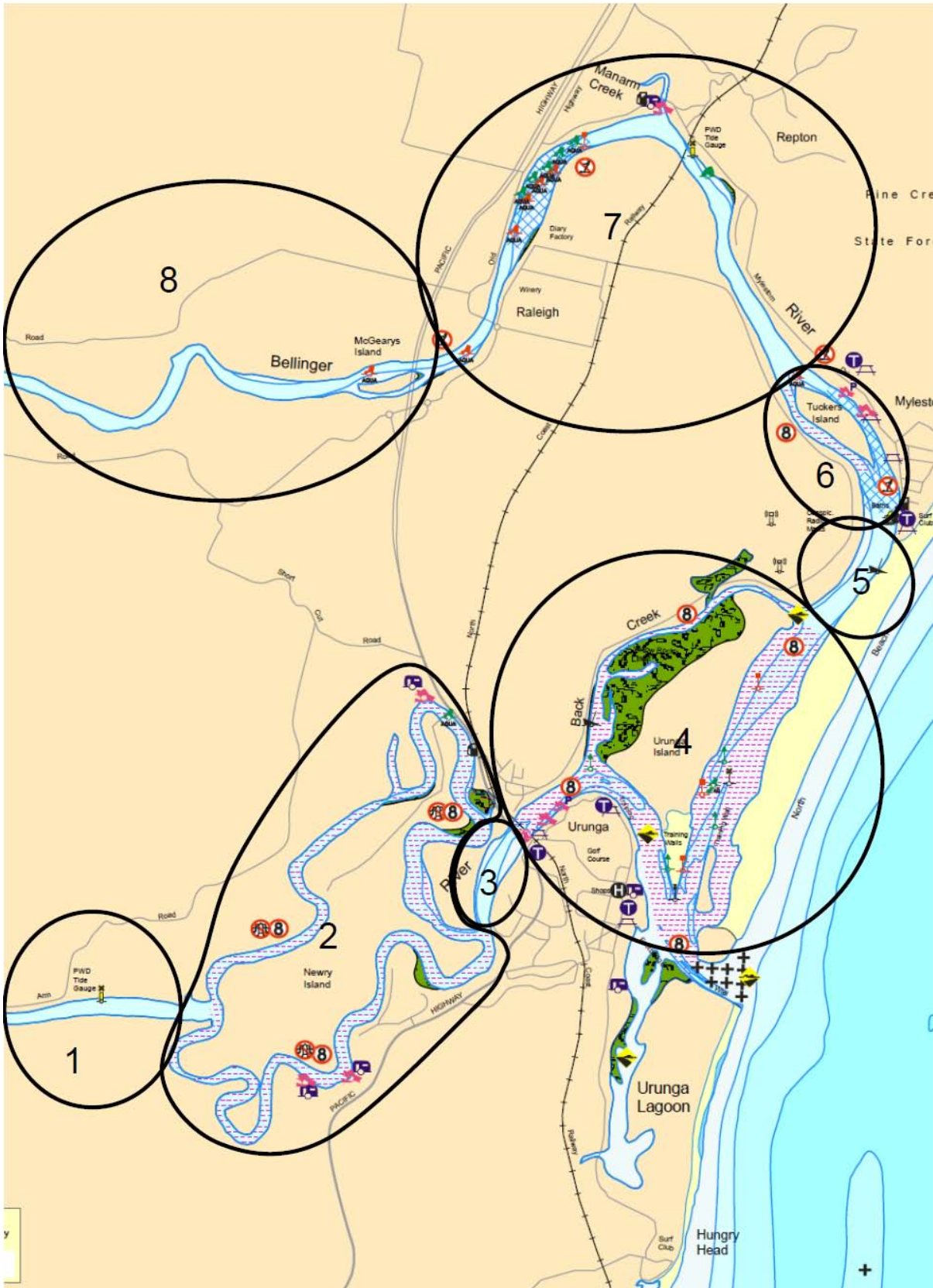
- Male 1
- Female 2

30. First name: _____

31. Phone number: _____

N.B. If respondent is concerned about divulging this, assure them that no individual responses will be revealed to Bellinger Council, nor will contact details be passed onto any third party or used for marketing purposes. Numbers are solely required to (occasionally) follow up on any answers, and to conduct random checks on interview quality.

Other Interviewer Notes:



9.3 APPENDIX C: Tables of frequencies for each item on the observation recording sheet

Driver of boat?		
	Frequency	Percent
Adult	1394	93.6%
Teenager	84	5.6%
Child	12	0.8%
Total	1490	100.0%

Size of boat		
	Frequency	Percent
Large	153	12.4%
Medium	492	39.9%
Small	570	46.2%
Jetski	18	1.5%
Total	1233	100.0%

Activity type		
	Frequency	Percent
powered	380	26.0%
fishing	583	39.9%
paddling	146	10.0%
other	353	24.1%
Total	1462	100.0%

Travelling slowly near banks? (if appropriate)		
	Frequency	Percent
Yes	402	67.8%
No	191	32.2%
Total	593	100.0%

Stereo's playing?		
	Frequency	Percent
Yes	15	1.0%
No	1464	99.0%
Total	1479	100.0%

Time of observation		
	Frequency	Percent
10-midday	544	36.5%
2-4pm	205	13.7%
4-6pm	43	2.9%
7-10am	280	18.8%
midday-2	419	28.1%
Total	1491	100.0%

Speed?		
	Frequency	Percent
Idle	74	5.0%
Non-planing	471	31.9%
Planing	857	58.1%
Drifting	74	5.0%
Total	1476	100.0%

Travelling to right of centre?		
	Frequency	Percent
Yes	881	60.1%
No	585	39.9%
Total	1466	100.0%

Operating well away from shoreline?		
	Frequency	Percent
Yes	1150	78.0%
No	324	22.0%
Total	1474	100.0%

Position in stream passing observer?		
	Frequency	Percent
Mid-stream	615	43.0%
3/4	533	37.3%
Close to bank	281	19.7%
Total	1429	100.0%

Using recognised landing areas & access points for embarking/disembarking?		
	Frequency	Percent
Yes	261	79.1%
No	69	20.9%
Total	330	100.0%

Number of people being towed?		
	Frequency	Percent
1	238	72.3%
2	69	21.0%
3	18	5.5%
4	2	0.6%
5	2	0.6%
Total	329	100.0%

Turning at greatest distance from shore as practicable?		
	Frequency	Percent
Yes	184	75.7%
No	59	24.3%
Total	243	100.0%

Number of people on board?		
	Frequency	Percent
1	322	21.6%
2	622	41.7%
3	331	22.2%
4	163	10.9%
5	25	1.7%
6	19	1.3%
8	1	0.1%
10	3	0.2%
15	2	0.1%
20, 21	2	0.2%
Total	1490	100.0%

Is the craft towing?		
	Frequency	Percent
Yes	263	21.6%
No	953	78.4%
Total	1216	100.0%

What's being towed?		
	Frequency	Percent
Ski/s	153	46.1%
Tube	106	31.9%
Board	61	18.4%
Other	12	3.6%
Total	332	100.0%

Number of tow ropes?		
	Frequency	Percent
1	299	90.9%
2	28	8.5%
3	2	0.6%
Total	329	100.0%

Towing in an anticlockwise direction with all turns executed to port?		
	Frequency	Percent
Yes	157	75.8%
No	50	24.2%
Total	207	100.0%

Towing under bridges?		
	Frequency	Percent
Yes	78	45.1%
No	95	54.9%
Total	173	100.0%

9.4 APPENDIX D: Tables of frequency for each interview question

Q2. LGA of place of residence		
	Frequency	Percent
Coffs Hbr	206	39.4
Bellingen	132	25.2
Nambucca	14	2.7
Kempsey	16	3.1
Tablelands	35	6.7
Other NSW	89	17.0
Vic	2	.4
Qld	29	5.5
Other Aust	1	.2
Total	524	100.0

Q3. Interview location		
	Frequency	Percent
Urunga Ramp-Sth	118	22.6
Urunga Ramp-Nth	78	14.9
Repton C'van Park	65	12.4
Mylestom Ramp-W	157	30.0
Mylestom Ramp-E	92	17.6
South Arm Rd	2	.4
Urunga Sail Club	1	.2
Urunga Caravan Park	10	1.9
Total	523	100.0

Q4. River Craft driver or passenger?		
	Frequency	Percent
Driver	447	85.6
Passenger	75	14.4
Total	522	100.0

Q5. Is the boat owned or hired?		
	Frequency	Percent
Owned	508	97.5
Hired	13	2.5
Total	521	100.0

Q6. What types of activities do you typically perform on

(show map & tick any that apply)

Area	waterski	jetski	wake-board	tubing	fishing	sailing	canoe/kayak	other	total
1	6	0	4	3	36	0	1	9	60
2	1	0	0	0	83	0	5	12	103
3	8	2	1	8	81	0	4	4	111
4	11	4	5	14	228	4	16	25	311
5	51	10	12	41	91	4	8	9	231
6	12	4	4	11	113	2	12	7	171
7	51	8	20	37	108	4	8	9	252
8	7	0	2	4	39	0	1	3	64
total	147	28	48	118	779	14	55	78	1267

Q7. On average, how often would you boat on these river/s ?

	Frequency
Weekly or more	104
Fortnightly	70
Monthly	124
Quarterly	54
Bi-annually	42
Annually	69
Less than once a year	59
Total	522

Q8. What hours of the day would you most likely make use the allowed)

	Frequency
Before 7am	272
7-10am	433
10-midday	276
Midday-2pm	234
2-4pm	208
4-6pm	130
6-8pm	66
After 8pm	28
Total	1649

Q9. On average, how long do you spend on the river on each visit?

	Frequency	Percent
< 2hrs	74	14.2
2-3hrs	99	19.0
3-4hrs	140	26.9
4-5hrs	98	18.8

> 5hrs	110	21.1
Total	521	100.0

Average time on the river each visit? (hrs) Min 0.5 Max 12.0 Mean 4.2 Std Deviation 1.8

Q10. What is the size of this boat?

	Frequency	Percent
< 3m	33	6.3
3-4m	184	35.2
4-5m	196	37.5
> 5m	110	21.0
Total	523	100.0

What is the size of this boat? (m) Min 1.5 Max 16.0 Mean 4.2

Q11. What is the size of the engine (if twin engine, combined total)?

	Frequency	Percent
<5 HP	10	1.9
5-25 HP	175	33.5
26-50 HP	117	22.4
51-120 HP	122	23.3
121+ HP	67	12.8
None	32	6.1
Total	523	100.0

Q12. Does your boats engine have a 4-stroke or 2-stroke motor?

	Frequency	Percent
4-stroke	129	26.1
2-stroke carburettor	268	54.1
2-stroke EFI	89	18.0
other	9	1.8
Total	495	100.0

Q13. On average, how often do you service your engine?

	Frequency	Percent
Once every four for five years	5	1.0
Once every two or three years	26	5.2

Once a year	254	50.7
Twice a year	148	29.5
Unsure	40	8.0
Never/not applicable	25	5.0
Other	3	.6
Total	501	100.0

Q17. How often do you do power turns (i.e. turn 180 degrees at speed)?

	Frequency	Percent
Frequently	76	14.6
Occasionally	74	14.2
Never	371	71.2
Total	521	100.0

Q22. Do you have a boat licence?

	Frequency	Percent
Yes	431	82.6
No	91	17.4
Total	522	100.0

Q23. Are you travelling today from the Bellinger to the Kalang River or vice versa?

	Frequency	Percent
Yes	190	36.6
No	329	63.4
Total	519	100.0

Q24. What route will you take travelling from the Bellinger to the Kalang River or vice versa?

	Frequency	Percent
Back creek	61	31.0
Via river mouth	121	61.4
Other	11	5.6
Both backcreek and river mouth	4	2.0
Total	197	100.0

Q25. When using these waterways, have you ever modified your boat with wedges and/or ballast?

Frequency Percent

	cy	
Yes-wedges only	1	.2
Yes-ballast only	2	.4
No	519	99.4
Total	522	100.0

Q26. If yes, how often would you do this?		
	Frequency	Percent
Occasionally	1	100.0

Q27. Where do you typically clean your boat?		
	Frequency	Percent
In the water	2	.4
In the carpark	22	4.2
At home	430	82.5
Other	67	12.9
Total	521	100.0

Q28. Age		
	Frequency	Percent
16-29	55	10.5
30-39	99	18.9
40-49	151	28.9
50-59	121	23.1
60+	97	18.5
Total	523	100.0

Q29. Gender		
	Frequency	Percent
Male	464	89.1
Female	57	10.9
Total	523	100.0

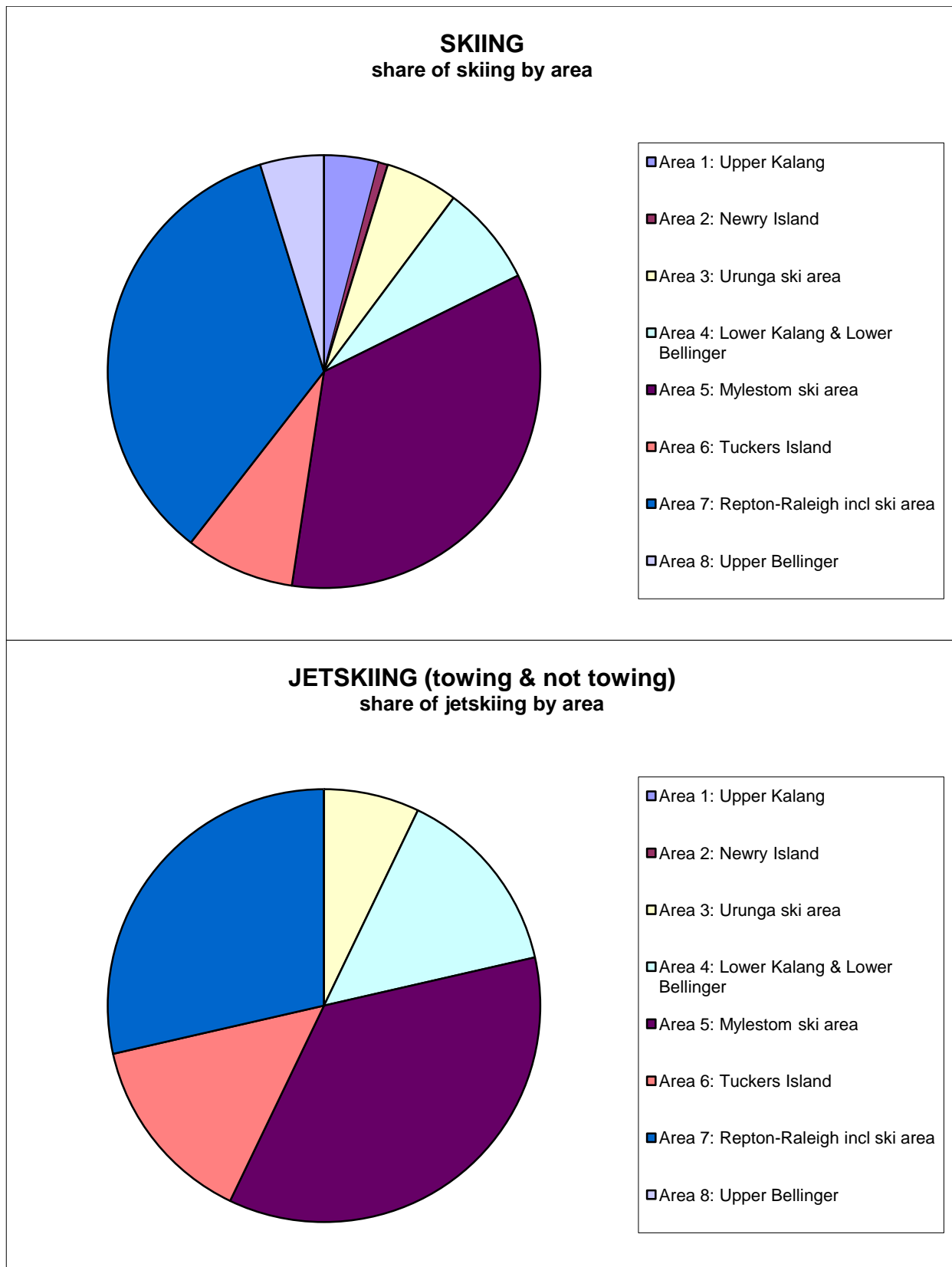
9.5 APPENDIX E. Cross-tabulation tables

Location * Type of activity Crosstabulation

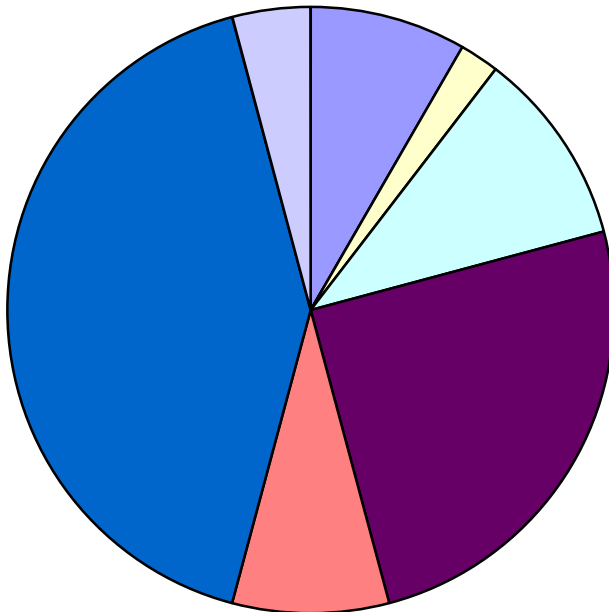
			Type of activity					Total
			Towing	Fishing	Sailing/ Paddling	Traversing	Other	
Location South Arm Rd	Count		9	1	2	4	0	16
	% within Location		56.3%	6.3%	12.5%	25.0%	.0%	100.0%
	% within Type of activity		2.4%	.2%	1.4%	1.3%	.0%	1.1%
Anchors Wharf	Count		25	67	25	75	13	205
	% within Location		12.2%	32.7%	12.2%	36.6%	6.3%	100.0%
	% within Type of activity		6.6%	11.5%	17.1%	23.5%	21.0%	13.7%
Urunga Sail Club	Count		8	154	25	31	9	227
	% within Location		3.5%	67.8%	11.0%	13.7%	4.0%	100.0%
	% within Type of activity		2.1%	26.4%	17.1%	9.7%	14.5%	15.2%
Back Creek	Count		0	45	17	33	2	99
	% within Location		0.0%	45.5%	17.2%	33.3%	2.0%	100.0%
	% within Type of activity		0.0%	7.7%	11.6%	10.3%	3.2%	6.6%
Newry Island W	Count		3	11	1	3	0	18
	% within Location		16.7%	61.1%	5.6%	16.7%	.0%	100.0%
	% within Type of activity		.8%	1.9%	.7%	.9%	.0%	1.2%
Newry Island E	Count		0	8	2	10	1	21
	% within Location		.0%	38.1%	9.5%	47.6%	4.8%	100.0%
	% within Type of activity		.0%	1.4%	1.4%	3.1%	1.6%	1.4%
Raleigh Bridge	Count		19	3	6	21	2	51
	% within Location		37.3%	5.9%	11.8%	41.2%	3.9%	100.0%
	% within Type of activity		5.0%	.5%	4.1%	6.6%	3.2%	3.4%
Repton C'van	Count		94	86	27	31	12	250

Park	% within Location	37.6%	34.4%	10.8%	12.4%	4.8%	100.0%
	% within Type of activity	24.7%	14.8%	18.5%	9.7%	19.4%	16.8%
Ted's Oyster Shed	Count	149	54	1	64	5	273
	% within Location	54.6%	19.8%	.4%	23.4%	1.8%	100.0%
	% within Type of activity	39.1%	9.3%	.7%	20.1%	8.1%	18.3%
Mylestom Pool	Count	72	154	40	47	18	331
	% within Location	21.8%	46.5%	12.1%	14.2%	5.4%	100.0%
	% within Type of activity	18.9%	26.4%	27.4%	14.7%	29.0%	22.2%
Total	Count	381	583	146	319	62	1491
	% within Location	25.6%	39.1%	9.8%	21.4%	4.2%	100.0%
	% within Type of activity	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

9.6 APPENDIX F: Charts of observations

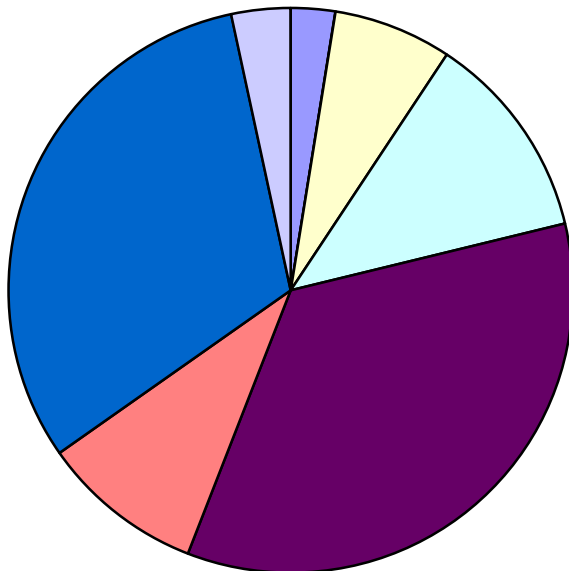


WAKEBOARDING
share of wakeboarding by area



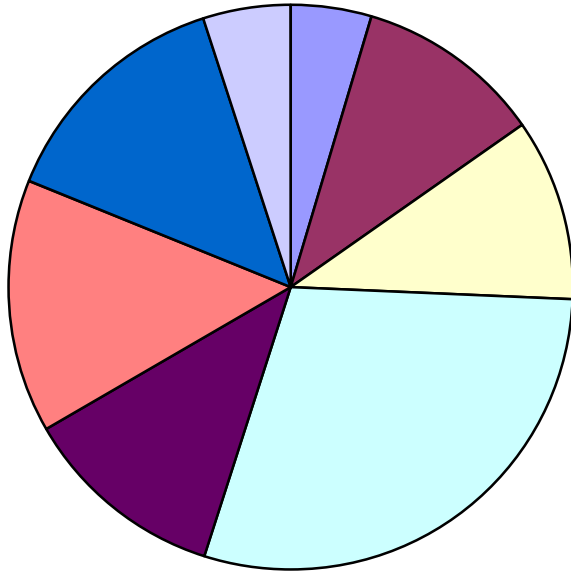
- Area 1: Upper Kalang
- Area 2: Newry Island
- Area 3: Urunga ski area
- Area 4: Lower Kalang & Lower Bellinger
- Area 5: Mylestom ski area
- Area 6: Tuckers Island
- Area 7: Repton-Raleigh incl ski area
- Area 8: Upper Bellinger

TUBING
share of tubing by area



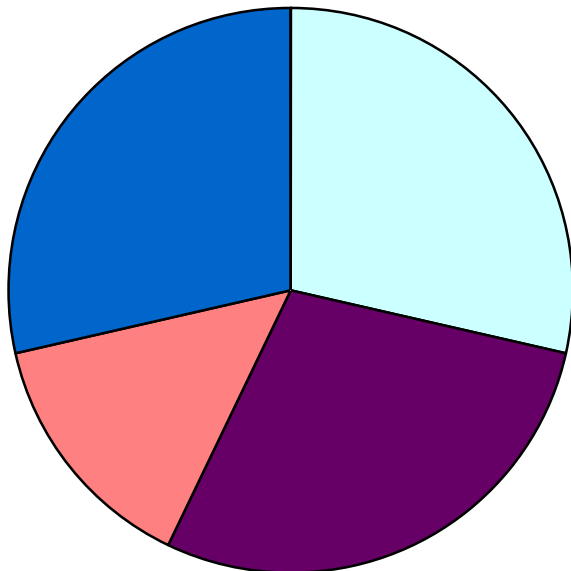
- Area 1: Upper Kalang
- Area 2: Newry Island
- Area 3: Urunga ski area
- Area 4: Lower Kalang & Lower Bellinger
- Area 5: Mylestom ski area
- Area 6: Tuckers Island
- Area 7: Repton-Raleigh incl ski area
- Area 8: Upper Bellinger

FISHING
share of fishing by area



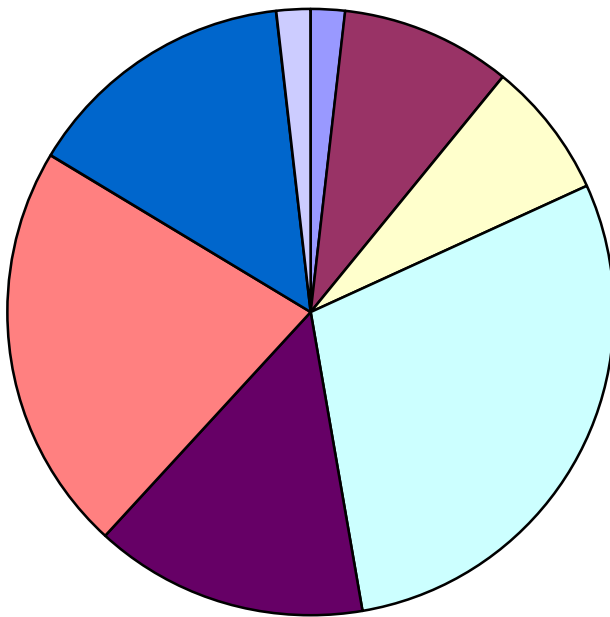
- Area 1: Upper Kalang
- Area 2: Newry Island
- Area 3: Urunga ski area
- Area 4: Lower Kalang & Lower Bellinger
- Area 5: Mylestom ski area
- Area 6: Tuckers Island
- Area 7: Repton-Raleigh incl ski area
- Area 8: Upper Bellinger

SAILING
share of sailing by area



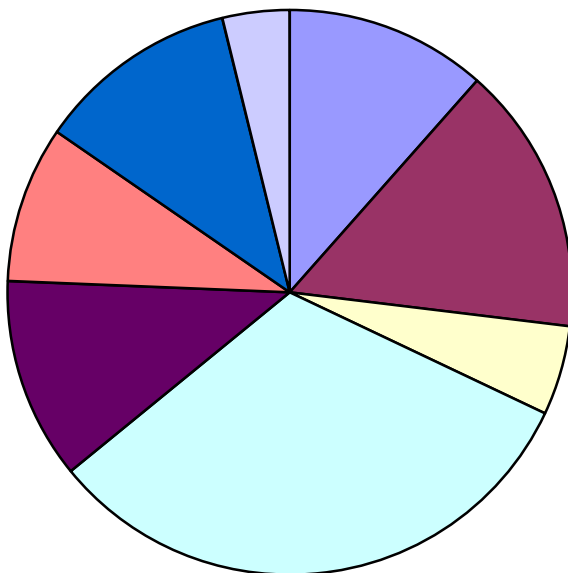
- Area 1: Upper Kalang
- Area 2: Newry Island
- Area 3: Urunga ski area
- Area 4: Lower Kalang & Lower Bellinger
- Area 5: Mylestom ski area
- Area 6: Tuckers Island
- Area 7: Repton-Raleigh incl ski area
- Area 8: Upper Bellinger

PADDLING (KAYAK + CANOE)
share of paddling by area



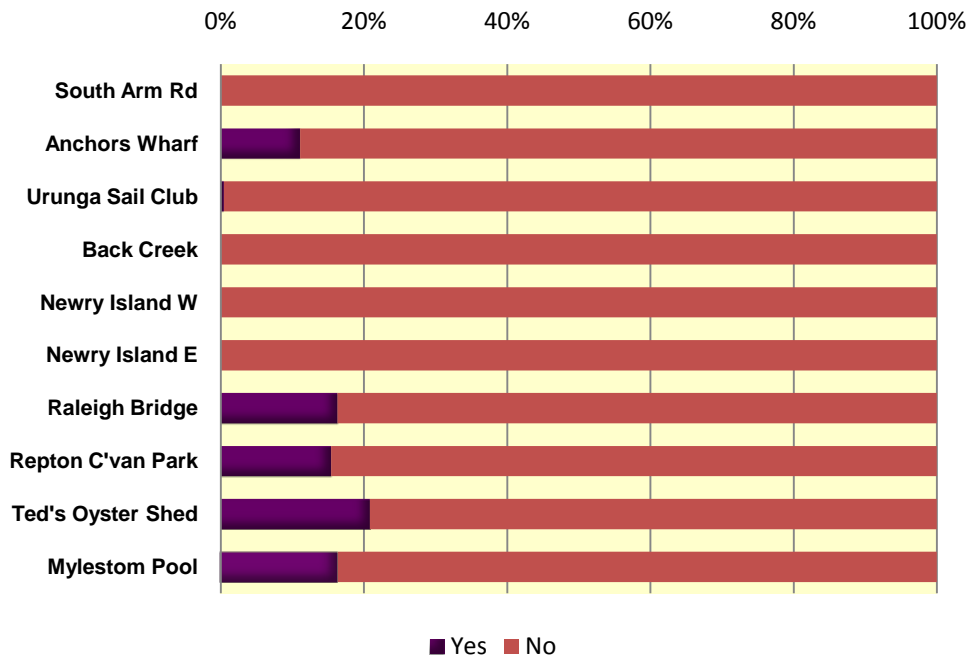
- Area 1: Upper Kalang
- Area 2: Newry Island
- Area 3: Urunga ski area
- Area 4: Lower Kalang & Lower Bellinger
- Area 5: Mylestom ski area
- Area 6: Tuckers Island
- Area 7: Repton-Raleigh incl ski area
- Area 8: Upper Bellinger

"OTHER" ACTIVITIES
share by area

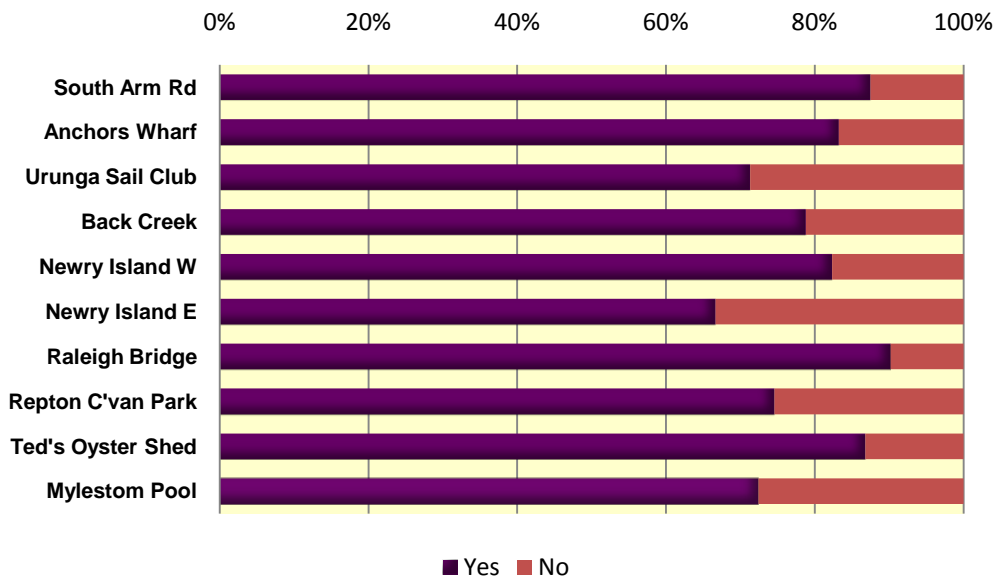


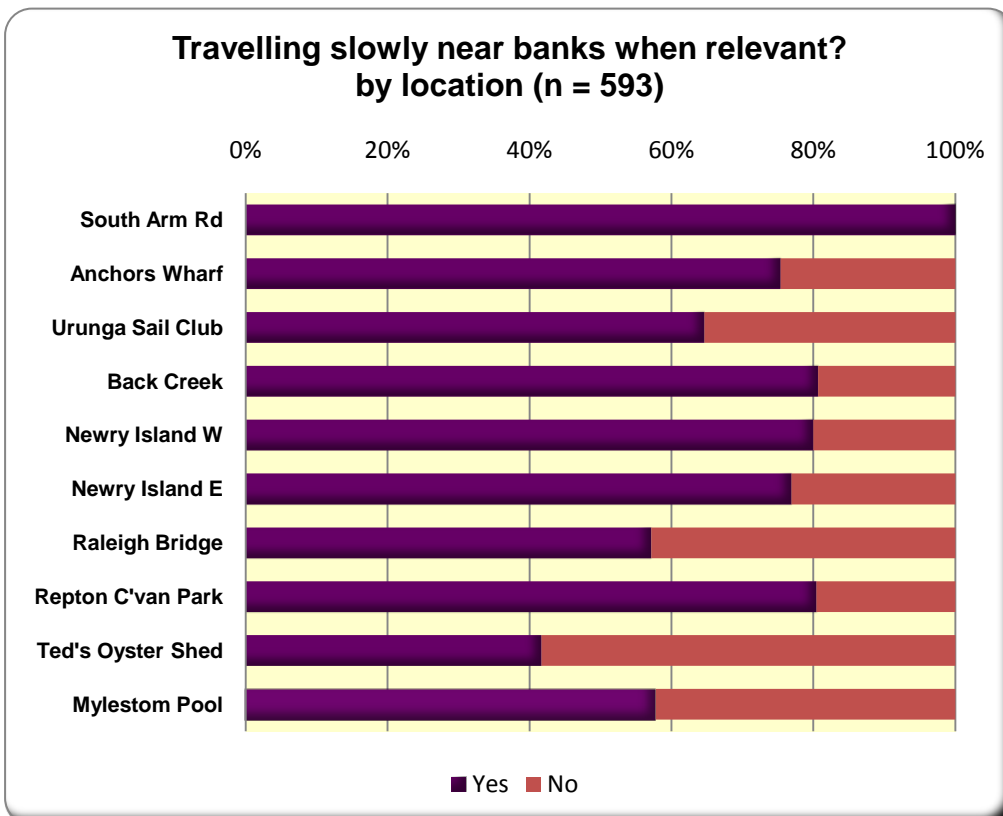
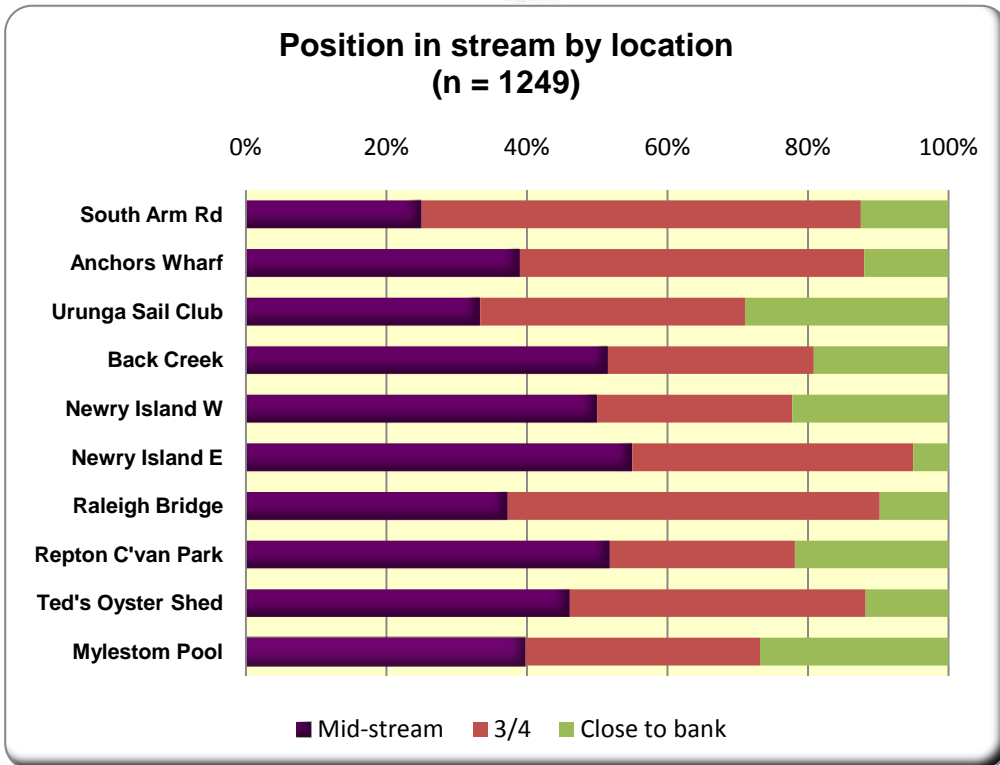
- Area 1: Upper Kalang
- Area 2: Newry Island
- Area 3: Urunga ski area
- Area 4: Lower Kalang & Lower Bellinger
- Area 5: Mylestom ski area
- Area 6: Tuckers Island
- Area 7: Repton-Raleigh incl ski area
- Area 8: Upper Bellinger

**Power turns observed?
by location (n = 1324)**

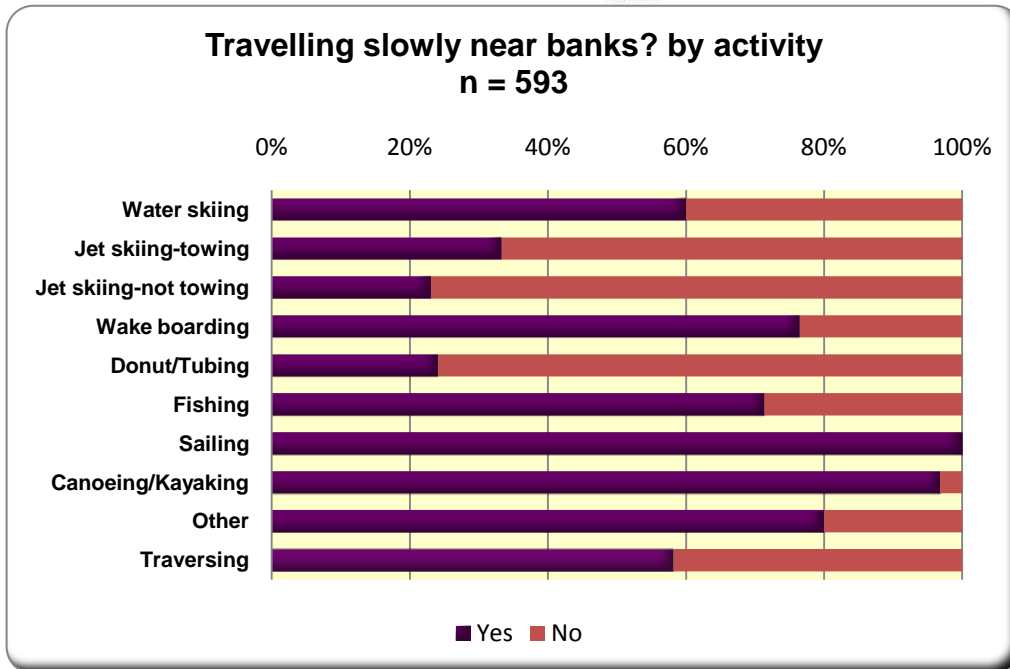


**Operating well away from shoreline? by location
(n = 1474)**

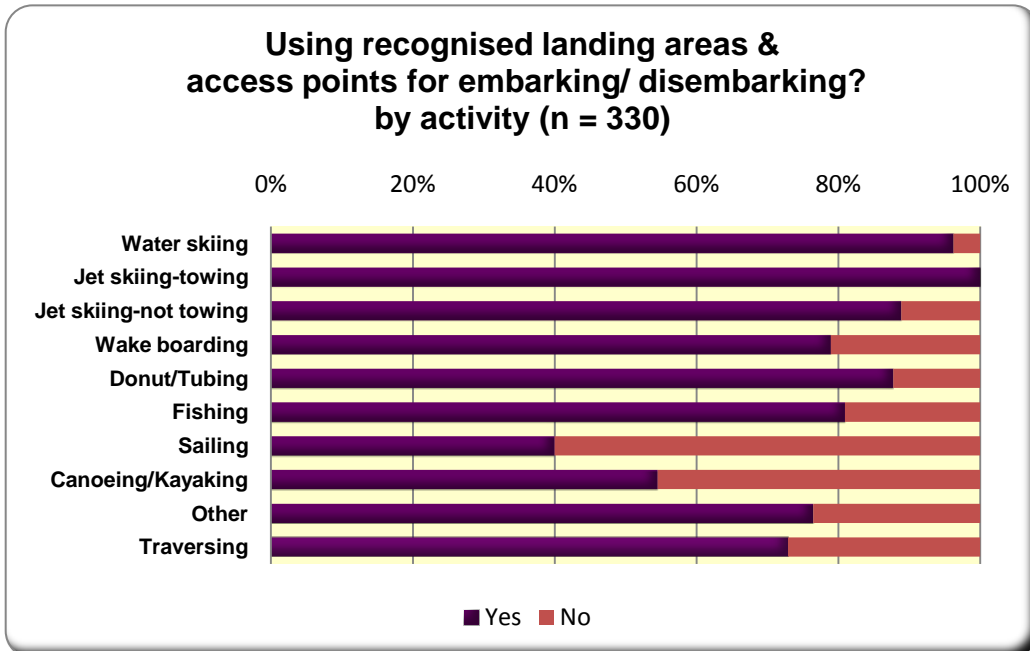




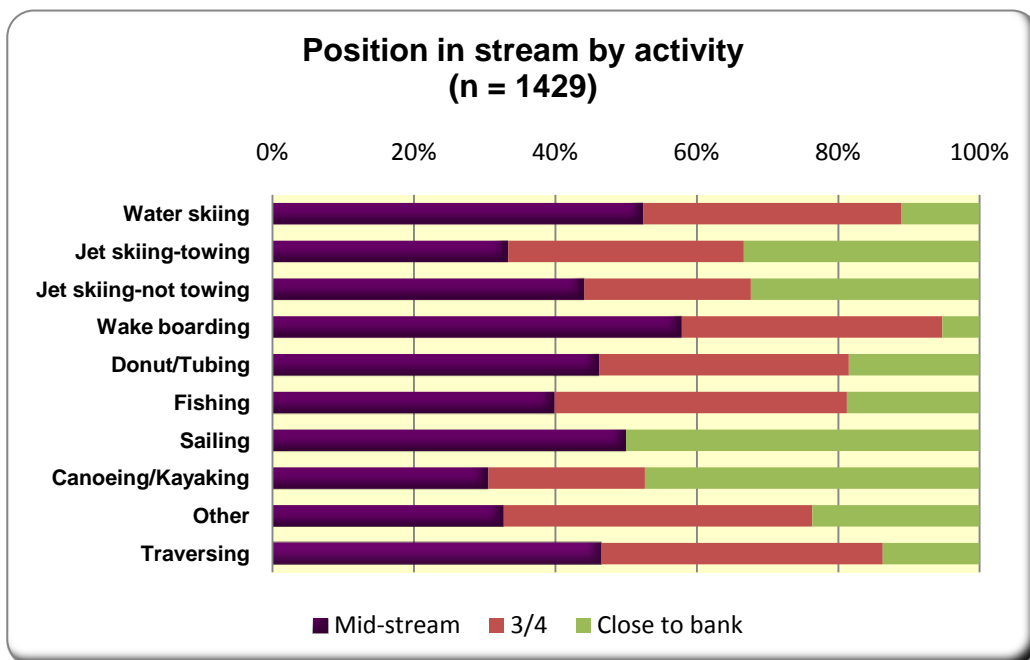
Note. Researchers recorded an observation about whether a craft was travelling slowly near banks only when the vessel was travelling near the bank. That is, “when relevant”



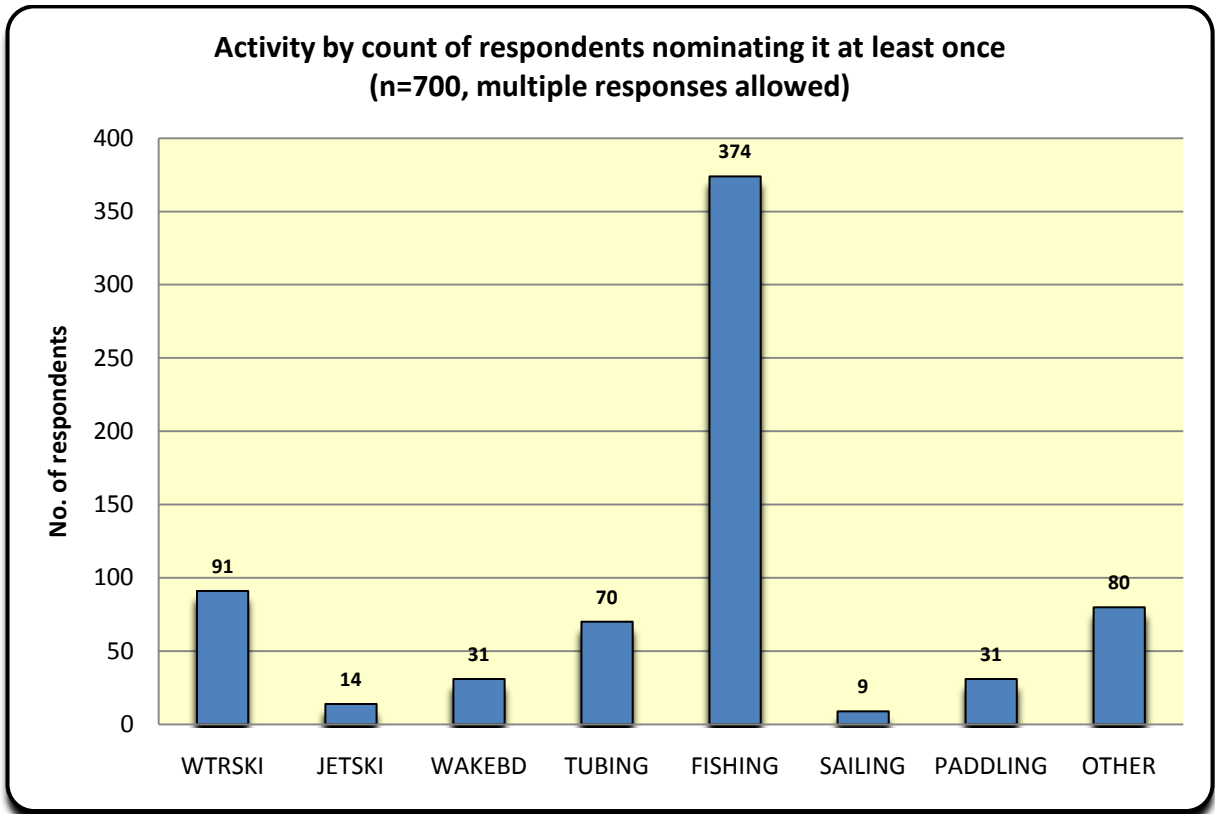
Note. This observational item asked researchers to record whether, when a craft was travelling near a bank, it was travelling slowly. This graph shows the activity observed for those craft travelling near banks and whether the craft was travelling slowly.



Note. This observational item asked researchers to record whether a craft, which was engaged in embarking or disembarking, was using a recognised landing area/ access point.



9.7 APPENDIX G: Charts from interview data



9.8 APPENDIX H: Responses to Question 19.

Q.19 What have you observed other river users doing that has frustrated or concerned you?"

Lack of manners and consideration for others.

Skiers under the bridge.

Not knowing the rules.

Speed and noise. Idiots hanging feet over the front of boats.

Saturday's and Sunday's yacht racing occurs and they take up the whole river.

Over fishing.

Skiing in no ski zones. Speeding in area 6.

People fishing where we are trying to ski. We are only allowed in small areas.

Skiing in front of Mylestrom store.

Speed past too quickly.

People towing without an observer. Drinking in the boat. No life gear.

Dropping garbage in river.

Speeding.

Water skiers coming out at high speed from ramps.

Speed.

Speed and overtaking on wrong side of river.

Disregard for other river users.

Speed.

Disrespect.

Going the wrong way.

Jet ski turns, they need educating and they are inexperienced.

Up near the bridge the buoy's are wrong.

Speeding jet skis interrupting launch areas with wash and jet skis flying through back creek.

Skiing above the road bridge.

Oyster leases not marked.

Fishing too close to me.

Discourteous speed boats passing close by speeding.

Speeding around the bridge area too fast.

Water skiers are so rude, they go so close to the banks and to boats.

Skiing while fishing under the bridge, some come too close. Too fast up back creek.

Anchoring in the middle of the causeway and fishing either side.

Overtaking at speed on wrong side of river.

Boats passing too fast.

Jet skis too close to people enjoying peace and quiet. Too noisy.

Towing more than one person behind the boat.

People don't seem to like jet skiers.

Rules breaking, I had a guy tailgate once which was scary.

Speeding around launch areas. Not being respectful and lowering throttle when passing fishers.

People that don't know the rules.

Tube riders going around circles without regard to boaters.

Q.19 What have you observed other river users doing that has frustrated or concerned you?"

People being stupid on wave runners.

Wakeboards have dangerous wake.

Loud music on ski boats.

Very noisy boats are unpleasant.

Travelling the wrong way.

Not towing anti-clockwise.

Not towing anti-clockwise.

Irresponsible tubing and on the wrong side of the river, zig zagging and not anti-clockwise. Fishers in the middle of the river in a ski zone.

Speeding.

8 knots wash causes more damage.

Speed.

Not respecting other river uses.

Water skiers not travelling anti-clockwise.

Speeding and using more crab traps than permitted.

No respect for other river users.

Passing other boats while speeding.

Wake boarders and skiers not obeying the rules.

Faster than 8 knots.

Not following rules generally.

Wake boarders and jet skiers.

Speeding around recreational areas.

Speeding in 8 knot zones.

Other boats speeding and creating a big wake that threatens to swamp our little boat.

Stupidity with water skiing.

Not on the right side.

Speed.

lack of consideration.

Not obeying speed zones.

Speed.

Skiers encroaching on fishing spaces.

Not considerate around other people especially at the Mylestom pool.

Skiers and speed. Sometimes the big boats get in too close.

Disobeying speed zones

Passing on the wrong side.

Area 5 has a lot of launching and beaching.

Skiers out of there area and going too fast and close to us while drifting.

Speed when other boats are launching or retrieving.

Wake boarders.

Speeding too close and not considering needs of others or circumstances.

Speeding especially too fast past smaller boats or idling craft.

Speeding on back creek.

Q.19 What have you observed other river users doing that has frustrated or concerned you?"

They travel on the wrong side of the river.
Power turns too close to fishers and coming to close.
Boat ramp issues.
Speeding and coming in too close when we're fishing.
Speeding in the back channel.
Skiers too close when on the drift. Ramp users who take too long.
Skiing at night with no lights.
No observer sitting on bow.
Drinking alcohol and then water skiing. No observer and sitting on the bow of the boat.
Skiers not observing rules.
Ballasted wake board boats.
Ski boats wake.
Boats causing too much wake.
Ignoring signs- boats wash speed.
Jet skis come to close and fast.
Boats going too fast too close. Throwing rubbish out.
Boats too close when overtaking.
Speeding past fisherman.
Tourists passing too close and on the wrong side.
Speeding Jet skis.
Traffic rules are not carried out.
Not knowing the rules.
Boats speeding where people are swimming.
Speeding especially with amount of debris floating in water.
Going too fast in the 8 knot zone.
Speeding around Newry Island.
Water skiers too close to others.
Skiers going too fast too close.
Lack of consideration for other river uses, especially jet skis.
Lack of consideration for other river uses.
Towing clockwise.
No consideration for others on the river.
Large boats blocking access to facilities.
Speed.
Speed boats with skiers.
Speeding.
Drinking too much.
Lack of courtesy for fisherman.
Lack of courtesy and travelling too close to other boats while speeding.
Crab traps or fish traps not removed or checked regularly.
Skiers skiing under the bridge at Urunga.
Breaking the rules.

Q.19 What have you observed other river users doing that has frustrated or concerned you?"

Boats cutting across in front of you.

People skiing the wrong way on loop around in the ski zones.

Passing on wrong side and too close. Inconsiderate people when I'm sitting anchored/drifted and fishing.

Skiers showing no respect and going too close at speed and all over the place.

Wake boarding and the heavy wash created by the boats being used.

Not being courteous.

Donuters and skiers have no consideration.

Boats towing have excessive wash.

Skiers not following the rules.

Boat users with no consideration for kayakers. I was tipped as a result of boat wake.

Pollution- septic overflow into the river.

Wash and a general lack of consideration.

No respect for people by increasing speed around other boats.

Not keeping to the right.

Travelling on the right.

Speed.

Power boats and jet skiers not considering others.

Speeding.

Kids sitting on bow of boat.

Wake boarders creating large wake.

Speeding near boat ramps.

Jet skiers go everywhere and don't care if they disobey the rules.

Skiers disregard for others. Kids tubing at high speed and flying at height. Too dangerous.

Speeding through back creek.

Jet skis are too fast and noisy and cause wash on banks especially near the swimming area.

A wake boarder sunk another boat the other day and didn't stop.

Huge wakes damaging banks.

Speeding.

Speed.

Ski boats passing too close to other boats.

Littering.

Skiers and tubers passing too close to anchored boats.

Speeding in 8 knot zones.

Littering.

Littering.

People sitting on bow of boat travelling at speed.

Not towing anti-clockwise. Not obeying signs.

Speeding in 8 knot zones.

Travelling too close and too fast.

Jet skiers with no manners.

No consideration of others and travelling too close.

Q.19 What have you observed other river users doing that has frustrated or concerned you?"

No lights at night. Not keeping safe distance.
Being discourteous.
Drinking while boating.
Lack of respect for fishers.
Wake boarding.
Jets skiers lack of consideration.
Wake board boats too close.
Speeding.
Jet skis damaging river banks.
Wake boarders passing too close to other boats.
Speed.
People pulling your crab traps. Skiers lack of respect.
Wake in front of Caravan Park.
Not following boating rules and speeding.
Speeding in zone 4.
Speeding.
Lack of respect for others.
Passing too fast and close.
Jet skiers breaking the rules.
Overloading their boats. Towing kids on rubber ring over sand flats.
Fishing mid stream. Wake boats running mid stream.
Jet skiing where people are swimming and going too fast.
Skiers need to obey the rules.
Speeding.
Speeding jet skiers.
Skiers going too fast near the beach. Skiing too close to banks.
Skiing in no ski zones.
Drinking while boating. Lack of general courtesy.
Skiing too close to other boats.
Travelling on the wrong side of the river.
Skiing too close to the banks.
No consideration to others and speeding too close to the bank.
Speed.
People who don't know the rules.
Wake boarding.
Not navigating according to the rules.
Power boats with skiers turning too tight and close to other craft. Wash throws us around.
Children sitting on the bow. Power boats too close to swimmers.
Towing knee boarders and cutting in front of me.
Boat ramp issues.
Inconsiderate boat use.
Littering and people speeding.

Q.19 What have you observed other river users doing that has frustrated or concerned you?"

When drifting speed boat goes past too fast.
Ignoring navigational rules.
Lack of consideration. Jet skiers too noisy and too fast. Skiing under the bridge.
Lack of courtesy.
Jet skis passing too close to other boats.
Skiing too close to the banks.
Wake boat too close to shoreline.
Travelling on wrong side of river.
Not looking out for other users on the river.
Skiing near fishers.
Speed.
Speed.
Inconsiderate boat use.
Not knowing the rules.
Lack of respect for other river users.
Speed.
Lack of respect for other river users.
Not towing anti-clockwise.
Travelling on the wrong side of the river.
Navigational rules not being followed.
Speeding.
Being idiots and not knowing the rules. Coming up too close to water skiers and people fishing.
People not observing and not paying attention.
Excessive speeding and not slowing down near other boats. Drinking while boating.
Lack of general respect.
Speeding.
People not organised at the ramp.
Carelessness and pushiness around the ramps.
Teenagers doing circles in tinnies.
Passing too close and no consideration for other boat users.
Lack of respect when launching boats eg: impatient.
Over loading boats and travelling too close.
Lack of concern for other river users.
Causing unnecessary wash and speeding.
Jet skis with no manners.
No consideration of others.
Jet skiers with no consideration.
Speed and lack of courtesy.
Lack of respect and manners.

APPENDIX I: Responses to Question 20

Q.20 “What rules do you believe are most commonly broken by other river users?”

Safety issues and feet dangling over boats edge whilst travelling.
Speed limit.
Passing on wrong side.
Speeding.
Exceeding 8 knots.
Skiing to close to structures.
Speed and navigation rules.
Speed, noise of boats (V8's) and jet ski.
Speeding.
Speeding.
Speeding and taking under sized fish.
Speed.
Speeding jet skiers through area 4.
Breaking 8 knot rule.
Speed limits.
Skiing to close to sail boats and fishers.
Driving on the wrong side of the river and not giving way.
Drinking and boating.
No observer when skiing. Speed. Too close when passing other boats.
Speeding.
Speeding.
Speeding.
Speed.
Speed.
Speed.
Speeding.
Going the wrong way and turning the wrong way.
Speed.
Slowing down increases wash.
Visitors at xmas not very courteous, skiing close to bank on wrong side.
Speed and skiing where not allowed. Not on correct side and not giving way.
Speeding past 8 knot zone.
Too close by to anchored boats.
No wash zones along the Kalang River.
Speeding.
Speeding.
Riding on the bow.
Speeding.
Speeding.
Speeding.
Speeding through the 4 knot zone at ramp.

Q.20 “What rules do you believe are most commonly broken by other river users?”

Travelling on the wrong side of the river.
Speeding.
Speeding.
Speeding in the zones.
Speeding in the zones.
Dropping off and picking up skiers too close the pool.
Speed when towing.
Drinking and driving boats.
Rules regarding passing and speeding. Not being courteous or respectful.
Speeding and passing on the wrong side.
Going down the wrong side and too close to swimmers.
Going on the wrong side of the river.
Speed.
Boating on wrong side and turning in front of you.
Littering.
Speeding.
Not driving boats clockwise.
Travelling the wrong way.
Speed.
Unlicensed boat drivers.
Speed limits.
Kids sitting on bow of boat.
Not running anti-clockwise, drinking while boating and jumping off boats in front of children.
Speed.
Speed.
Speed.
Drinking.
Speeding.
Passing too close while speeding.
Speed.
Speed and not being courteous.
Speeding.
Speeding.
Speed limits especially by jet skis.
Overtaking at 8 knots.
Using more crab traps than permitted.
Speed.
Speed.
Littering.
Speeding. Number of traps per boat.
Speeding.
Boats being too close to each other.
Going anti-clockwise and not staying on their side.

Q.20 “What rules do you believe are most commonly broken by other river users?”

Speed.

Speed.

No life jackets on kids.

Water skiers coming within 30 metres.

Speeding.

Speeding.

Speeding.

Speeding and drinking.

Speeding and drinking.

No observers when towing.

Travelling down the centre of the river.

Speed limits.

No safety gear.

Skiers not looking when taking off. Not dropping your speed when passing fishing boats. General lack of courtesy.

Crab traps with no buoys on them.

Skiers with no observer.

Not adhering to speed limits and not knowing the rules.

Speed.

Traffic rules and safety gear.

Creating wash and being discourteous.

Speed.

Passing too close on wrong side. Not observing.

Speed.

Direction of travel.

Speed.

Speeding.

Jet skis are noisy and don't pass on the right side.

Skiers speeding.

Doing stupid things like power boats speeding too close and on the wrong side.

Speed limits.

Speeding.

Speeding.

Speeding

Travelling on the wrong side and passing too fast.

No wash zones rules.

No wash zone rules and speeding.

Passing too close on the wrong side and speeding.

Speed limit.

Speed.

Speed.

Speed.

Speed limits and dropping rubbish.

Q.20 “What rules do you believe are most commonly broken by other river users?”

Speeding.
Speed.
Speed.
Speed limits.
No wash zones.
Speed zones.
Speeding.
Speeding where it is ridiculously slow eg. Straight out front of the Caravan Park.
Speeding.
Speeding.
No compliance with no wash zones and speeding.
Speed and courtesy.
Skiing too close to wall outside Caravan Park.
Not following rules generally.
Travelling too fast and too close.
Driving at night time with no navigational lights. Jet skiers not considerate of distance.
Speed limits.
Speeding.
Speeding.
wash in no wash zones.
Speed.
Speeding.
Speeding.
Navigational rules - keeping to the right etc.
Not keeping to the right side.
Speeding and jet skis being where they shouldn't.
Speeding, especially in 8 knot zones.
Not passing boat on right hand side.
Direction of travel.
Speed.
Speed.
Speeding and not passing on the right side. Creating wash around fishers.
Speed.
Speeding.
keeping safe distances from others.
Speeding.
Poaching crabs from crab traps.
Speed and littering.
Speed limits.
Towing clockwise.
Speed limits and passing too close to other boats.
Speed and catching and keeping under sized fish.
Skiing in no ski zones.

Q.20 “What rules do you believe are most commonly broken by other river users?”

Speeding.
Speeding.
Insufficient use of new signals.
Drinking on boats.
Speed.
Speed.
Speed.
Speed.
Speed.
skiers not observing or obeying the rules.
Speed.
Speeding near the sand bar.
Speeding in 8 knot zone.
wash in the no wash zones and breaking speed limits.
Speeding.
Speed.
Skiing in zones where it's not permitted.
Speed and not wearing life jackets.
Speed.
Speed.
Towing or skiing in no ski areas.
Inconsiderate skiers.
Inconsiderate and speed.
Illegal fishing and jet ski rules.
Speed and rubbish.
Speeding. No life jackets.
Speed and no wash rules.
Speed.
Speed.
Speed.
Speed.
Speed.
Speeding.
Speed.
Speed.
Speeding.
Speeding and drinking alcohol on boats.
Speed and distance from other boats.
Speed and no life jackets.
Speeding.
Speed.
Speed.
Speed.

Q.20 “What rules do you believe are most commonly broken by other river users?”

Not turning on right hand side of river.
Towing in no ski zones.
Speeding.
Not towing on right hand side of river.
Speeding in 8 knot zone.
Drinking while boating.
Not travelling on right hand side of river.
Speed.
Speed and travelling close to other river users.
Speeding.
Speed.
Speeding through back creek.
Speed.
Speed.
Speeding and drinking.
Not keeping a safe distance.
Speed limits.
Speed limits.
Speed.
Breaking speed limits.
Speed limits.
Speed limit and lack of life jackets on kids.
Speed.
Speed.
Speed.
Speed limits.
Speeding.
Travelling on wrong side of river.
Speeding and navigational rules.
Give ways rules.
Speeding.
Too fast under bridge.
Travelling in the wrong direction and on wrong side.
Speeding.
Speeding.
Speeding.
Speeding.
Cast netting.
Speeding.
Improper navigation.
Passing too close to other river users. No observers. Drinking while driving.

Speeding and ignoring channel markers.

Q.20 “What rules do you believe are most commonly broken by other river users?”

Passing on the wrong side and travelling on the wrong side.

Speed and no life jackets.

Speeding and no lights at night.

Navigational rules - keeping to the right etc.

Speeding.

Speeding in 8 knot zone.

Travelling on the wrong side of the river.

Speeding.

Passing on the wrong side.

Speed.

Speed.

Skiers speeding where people are fishing.

Passing on wrong side and too close.

Not keeping to the right.

Not keeping to the right.

Speed.

Passing on wrong side. Kids sitting on bow of boat.

Distance of port to port. Passing on the channel.

Passing at speed when were idle or travelling slow.

Speeding.

Speed and using the wrong side.

Speeding.

Not obeying signs. Travelling too close and fast.

Speed.

Speed.

Speed.

Speeding.

Travelling on the wrong side of the river.

Passing on the wrong side.

Speeding outside ski zone. Passing on wrong side of river.

Speeding and alcohol.

Skiing within meters of anchored boats.

Speed.

Speed.

Not staying to the right side of river.

Skiers and wake boarders coming too close to other boats.

Speed.

Speeding.

Speed.

Not towing anti-clockwise and speeding.

Speeding.

Speeding.

Q.20 “What rules do you believe are most commonly broken by other river users?”

Navigational rules.

Travelling on the wrong side of the river.

Speeding.

Speed.

Speed.

Speeding.

Speed. Drinking alcohol and no wash rules.

Speeding.

Navigational rules.

Life jackets.

Speeding.

Navigational rules.

Not travelling on right hand side of river.

Speed.

Speed.

Speed.

Speeding.

Speeding.

Speeding.

Disrespecting speed limits and no wash zones.

Speeding sometimes with the aim to minimise wash.

Speeding.

Speeding.

Speeding.

Speed.

Speeding up back creek.

Not travelling on the right side of the river.

Speed.

Fishing boats trying to act as a ski boat.

Skiers with no observer.

9.9 APPENDIX J: Responses to Question 21

Q.21 “Are there any boating rules that you find impractical or unenforceable?”

Should be restrictions on size of motor. Kids with 15hp 10ft boat with no license or safety gear.

No wash zones.

Distance limits.

Distance limits.

The skiing outside permitted areas. Not enough man power to enforce or monitor.

Kalang speed and no wash zones. It takes too long to get up river.

Speed is hard without a speedometer.

Fire extinguishers and all the stuff needed to go out to sea, impractical/unnecessary for river boating.

Not wearing life jackets especially near the mouth of the river.

Not wearing life jackets.

Not enough police to monitor compliance.

Lots of confusion over what activities/craft need a license.

Passing rules on narrow streams especially with mixed usage i.e.. Skiers.

Licensing- not enough inspectors to monitor.

Not enough monitoring of speeders.

No maritime or police to monitor.

How to monitor speed, how do I know what speed I'm doing.

Most are unenforceable in instances of greater waterway traffic.

8 knots in no wash zone.

Safety regulations and individual rules eg. Life jackets are unnecessary on the river as no one uses them.

Age limit decreased for license.

Jet skis are unpredictable.

Speed is hard to keep to, plane > 10 knots but zodiac is always on the plane regardless of speed.

Speeding with no water police.

\$500 eperb is too expensive when I'm only going out a couple of miles.

Lots of them especially 30 metres from person in the wake.

Life jackets when fishing in power boats unenforceable.

Necessities like a bailing bucket.

Distances for skiers re: bridges are impractical.

Life jackets over bar, it limits vision.

Inspectors interrupting fishing when fish are on and biting.

Speed rules.

Life jackets not necessary for all passengers.

No wash zones because the slower we go the more wash we make.

Towing rule maximum of 3, I understand reason why but I have a small boat with minimal power.

Speed.

Speeding and only slowing down when visually see maritime etc.

Speed limits.

Reducing speed doesn't necessarily reduce wake.

Wake boards no respect to speed.

Q.21 “Are there any boating rules that you find impractical or unenforceable?”

Eperbs not needed as have mobile phones.

Kids sitting on front of boats while going slow.

Insufficient monitoring of boating by maritime police.

Distance from river banks.

Lack of monitoring and enforcement is a problem.

Lack of monitoring and enforcement is a problem.

No monitoring of speed.

Speed as there is no one to monitor it.

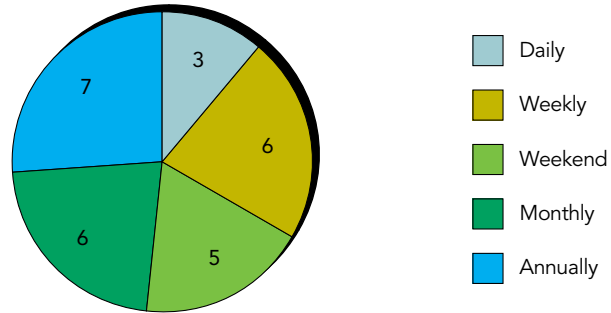
Wearing of life jackets over bars should be discretionary.



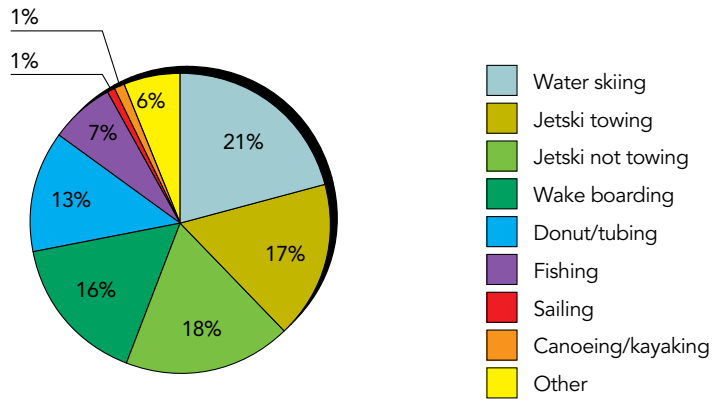
Appendix 9.2

Results of River-front Landholder Surveys

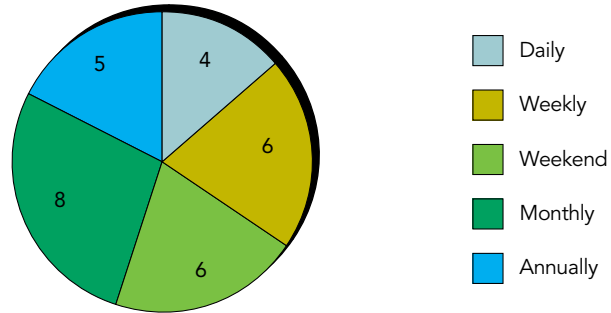
Jetski Towing



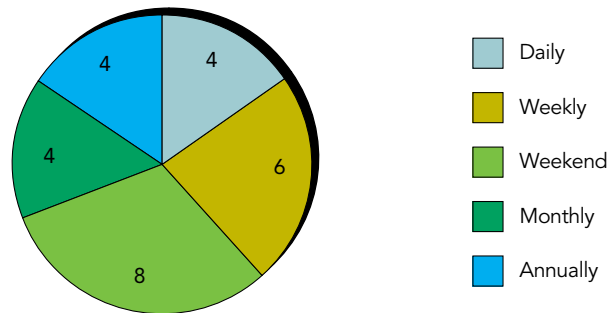
Activities Causing Concern



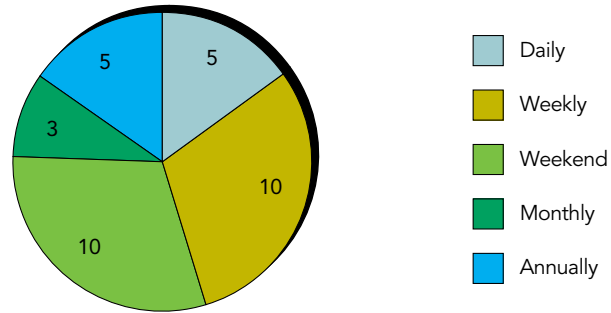
Jetski Not Towing



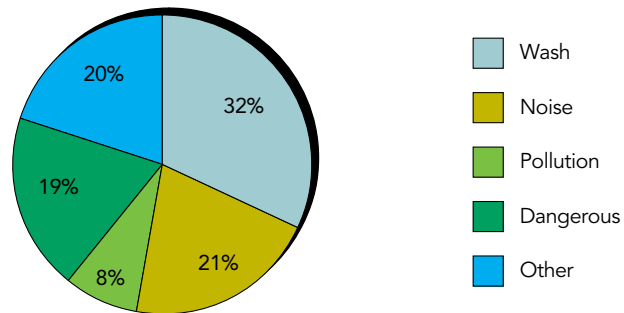
Wake Boarding



Water Skiing

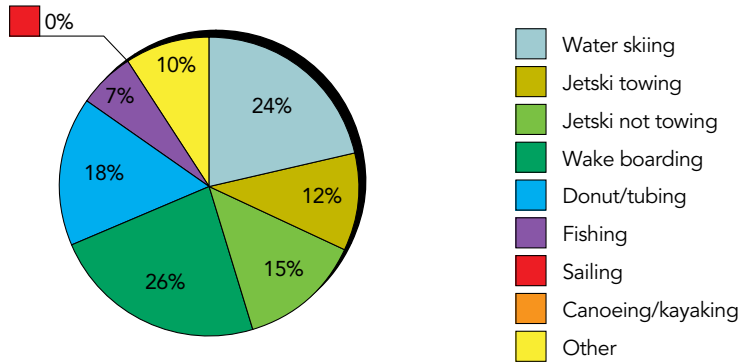


Contribution of Concerning Activities

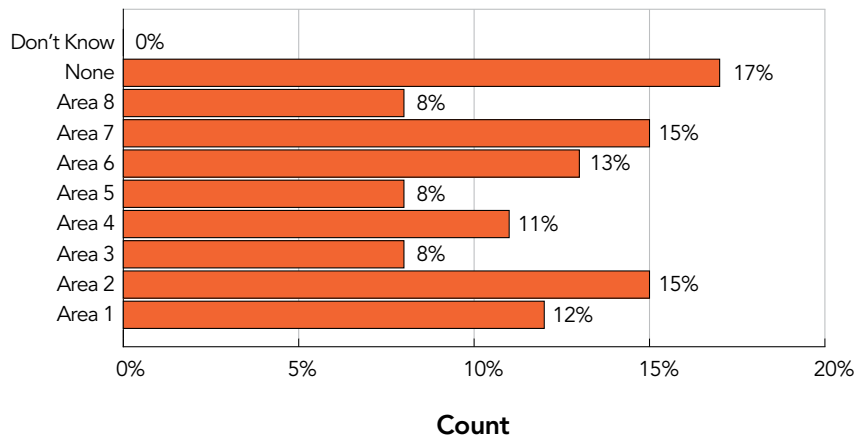


Wash Related Concerns

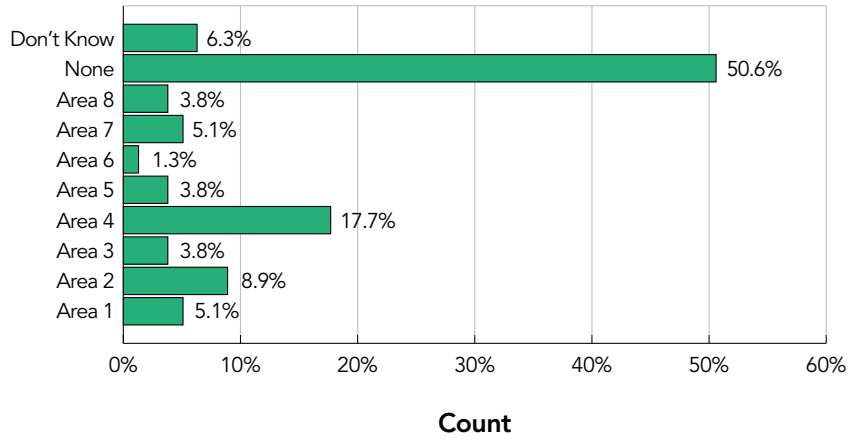
THIS NEEDS CLARIFICATION



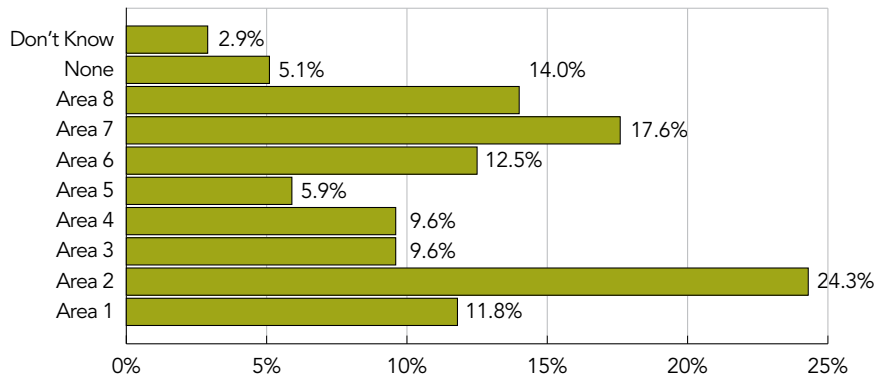
Areas Nominated for Speed Decrease (n=69)



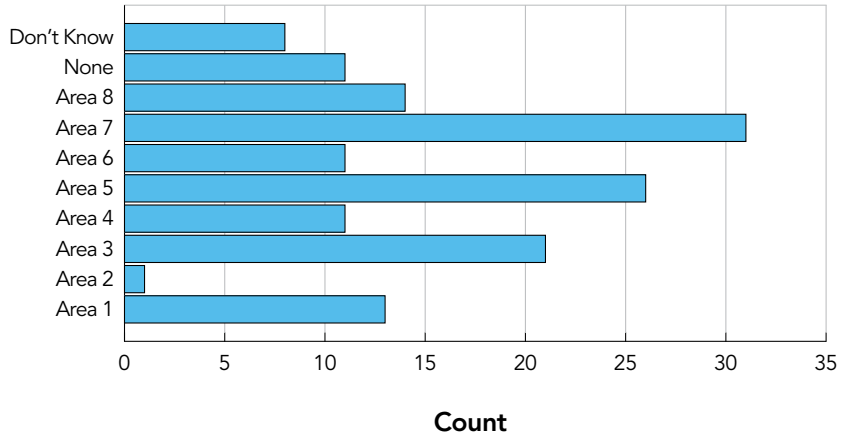
Areas Nominated for Speed Increase



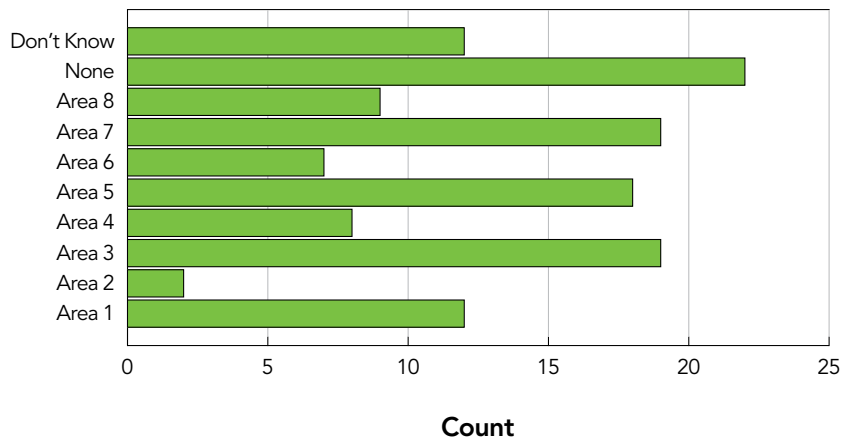
Areas Nominated as No Wash Zones (n=69)



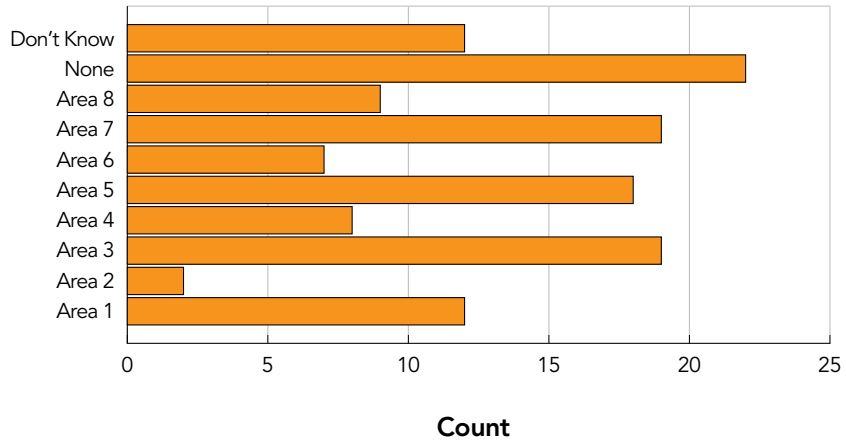
Areas Nominated for Water Skiing



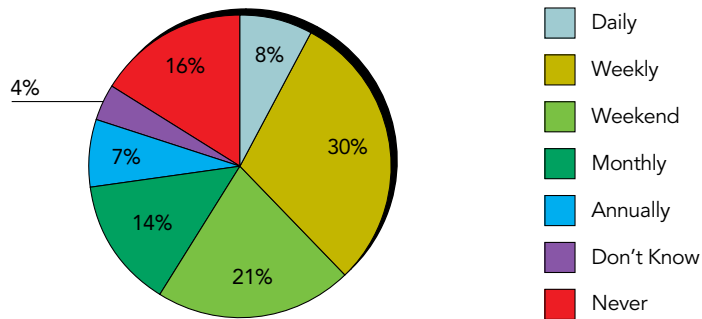
Areas Nominated for Wakeboarding



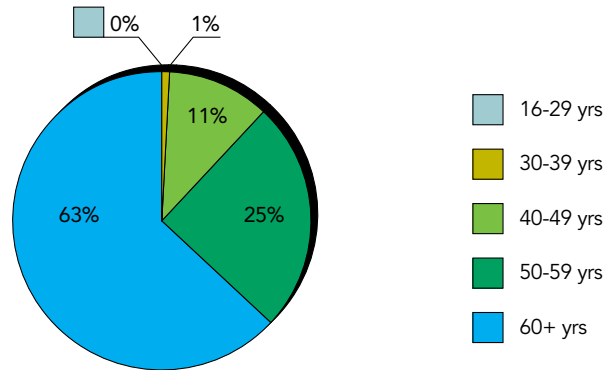
Areas Nominated for Donut/tubing



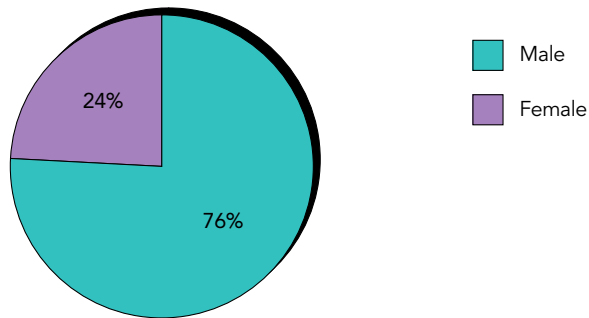
Frequency of Observed Power Turns (n=64)



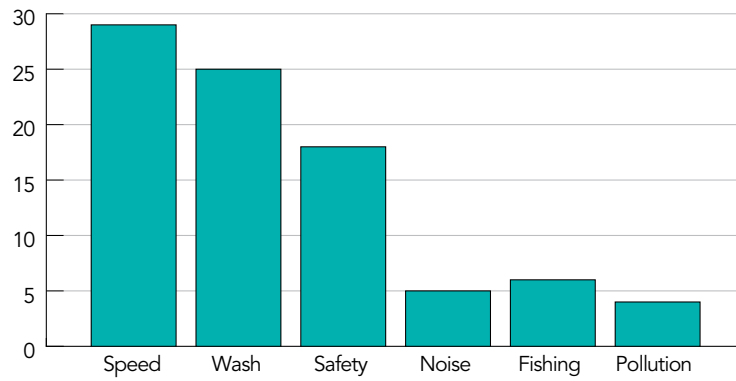
Age of Respondants (n=76)



Gender of Respondants (n=76)

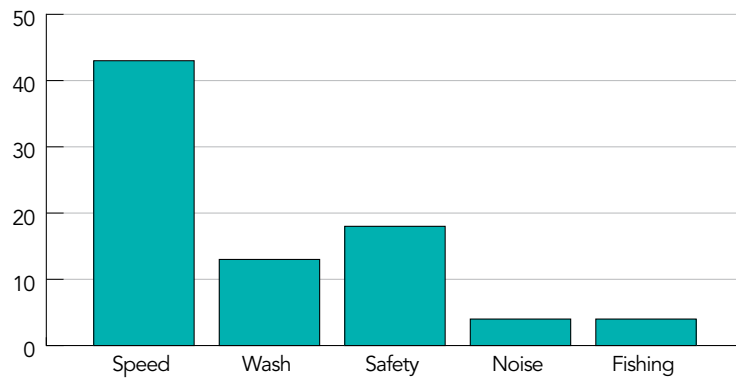


Grouped Responses to Q9 (n=58)



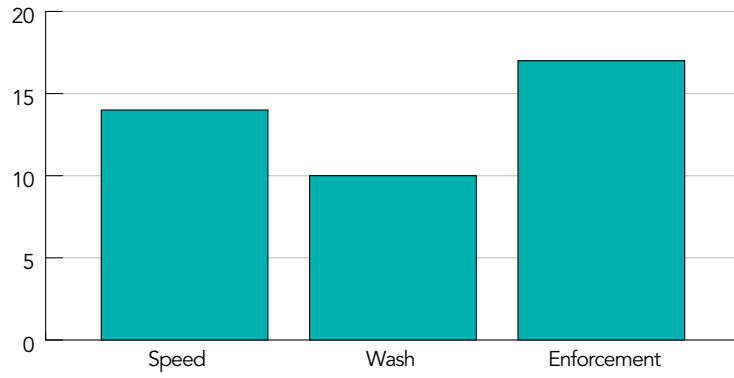
What have you observed river users doing that has frustrated or concerned you?

Grouped Responses to Q10 (n=59)



What rules do you believe are most commonly broken by other river users?

Grouped Responses to Q11 (n=35)



Are there any boating rules that you find impractical or unenforceable?

Appendix 9.3

Code of Conduct for Recreational Use – Bellinger & Kalang Estuary

Noise

- Sound travels over water so, early in the morning, in calm conditions, when wind is blowing into residential areas or near bird life, be considerate - move away.
- Noise must be kept to a minimum, including music.
- Power boats must have noise control equipment.

Water Skiing, Wakeboarding, Aquaplaning and Using Personal Watercraft

Most of the river is less than 100m wide: wakeboarding and tubing opportunities are limited.

- Don't create additional wash by boat loading, boat modifications, or careless operation.
- Tow in straight lines to the right of the centre of the channel.

- Travel anticlockwise; turns to port at least 30m from river bank.

- Reduce speed to idle before turning to collect skier. No power turns.

- Skiing, aquaplaning and wake boarding: 2 hours after sunrise.

- Towing under bridges is prohibited, except Repton Rail Bridge when:

- A single person or object is being towed and aligned directly behind the boat and the area is clear of anchored vessels.

- The vessel maintains course to the centre of the channel
- The driver has clear vision of all anchored or approaching vessels and persons in the water

Jet Skiing

- The only unpopulated area where irregular riding is permitted is just downstream of Myestom.
- 80m must be maintained from all swimmers and non-motorised craft.

It is an Offence to Pollute

- Avoid spilling fuel, oil, chemicals or cleaners of oil-contaminated bike water
- Use low or non-phosphate soaps.
- Remove boat from water and allow where debris can be disposed of properly.
- Ensure craft is well maintained.
- Do not litter; dispose of rubbish in a bin or take it home.
- Plan toilet trips; it is illegal to pollute waterways.

By choosing to utilize these rivers, you are agreeing to comply with:

1. The Water Traffic Rules; and

2. This Code of Conduct

Numbers to call for:

Boating offences, pollution, or noise – NSW Maritime, 13 12 56

Alcohol offences – Police, 000

Inappropriate and overfishing, crabbing etc – DPI Fisheries, 1800 043 636

Littering, pollution – Council, 6655 7300

code of conduct for recreational use

Bellinger & Kalang Estuary

Bellinger Shire Council

healthy rivers program

working together for our rivers our future



Welcome to the Bellingin Shire.

The Bellingin and Kalang River estuarine system provides recreation for many people. Please be considerate to swimmers, skiers, fisherman and kayakers, those enjoying the shore-side reserves and the people who live here. Observe speed zones, no wash areas and help protect sensitive areas and species.

Before enjoying your day out, get to know the attached map, this Code of Conduct and the Marine Safety Regulations Rules.

General Good Practice

- Minimise impact of activities.
- Choose locations least likely to interfere with others and the environment.

Vessel Wash

- Creating wash that causes damage, annoyance or has an unreasonable impact is an Offence.
- Observe speed limits and NO WASH ZONES – Penalties apply.
- Travel to the right of centre of the channel.
- Before increasing speed get into deep water – only then move quickly onto the plane.
- Operate away from shoreline - wildlife inhabit vegetation along river's edge.
- Close to banks, slow speed is safer and causes less damage to banks.
- Consider traffic, other users and wildlife (dolphins, nesting & feeding birds).
- Water is shallow at low tide – shore sediment is easily disturbed causing scouring of banks, erosion, smothering of aquatic plants; impacting on oysters, degrading habitat, and spooking feeding fish.
- Newry Island: vessels to produce minimal wash and not exceed the Max. 8 knot speed limit.
- Use recognised landing areas and access points. Other locations damage sensitive areas. Don't climb up or slide down embankments



Appendix 9.4

Boat Use Awareness Signs for Urunga Boat Ramp

Appendix 9.5

Fact Sheet: Managing Your Onsite Sewage Facility

Managing Your Onsite Sewerage Facility

- An onsite sewerage facility is a self enclosed wastewater treatment system that is designed to treat and release domestic wastewater to the land area within your property.
- On-site sewerage facilities are usually an effective means of treating your household wastewater providing that the system is regularly maintained.
- New South Wales legislation states that all aerobic wastewater treatment systems are to be maintained every three months and sand filter treatment systems are monitored annually (by a qualified operator).
- State legislation does not address maintenance of septic systems, however it is recommended that maintenance on these systems is carried out annually depending on various factors including septic type, size, number of people at the dwelling, past performance, soil type and proximity to environmentally sensitive areas such as waterways.
- A poorly maintained or malfunctioning wastewater treatment facility can potentially cause environmental and human health concerns through the release of harmful pathogens and highly nutrient laden wastewater. Wastewater seepage from such facilities is a leading cause of waterborne disease outbreaks and contamination of nearby waterways.
- When carrying out an annual inspection of your septic system you should check the depth of the scum and sludge building up in your septic tank. If it is approximately two thirds of the tank volume then you need to have the system pumped out. Ensure when it is cleaned that all the crusty material is removed, not just the underlying sludge.
- Onsite wastewater treatment systems are designed to process human waste only. Do not discard paints, hazardous substances, chemicals, cigarette butts, plastic products, rags, pet bath water, cat litter or sanitary napkins into your system. These products do not decompose well, may block your system and/or kill bacteria that perform treatment activity in the tank.
- Avoid discarding grease, fats and oils into your kitchen and laundry sinks and try to use environmentally friendly (low phosphorous and sodium) cleaning and washing products.
- Do not direct stormwater runoff towards septic tanks or effluent land application areas. The soil in the land application area performs the function of absorbing effluent. If the soil becomes saturated from excess runoff, it may result in backup of effluent onto the soil surface.
- Avoid heavy machinery and livestock movement over the land application area as this may compact the soil and crush pipes.
- Do not build permanent structures (e.g. garages, patios, swimming pools) over the top of the land application area.
- Do not plant deep rooted plants near the drainage pipes in your land application area. Their root systems can clog pipes and fittings disrupting the normal function of the drainage pipes. This can lead to surface ponding which creates foul odours, risks to human health and contamination of waterways.

Managing Your Onsite Sewerage Facility

The following list of plant species can be used as a guide for planting a vegetative buffer around your land application area:

Common Name	Genus	Species
Grasses		
Buffalo		
Kikuyu	Pennisetum	clandestinum
Mondo Grass	Ophiopogon	
Ground Cover		
Swamp Lily	Crinum	pendiculatum
Snake Vine	Hibertia	scandens
Lomandra	Lomandra	longifolia / hystrix
Native violet	Viola	hederacea
Shrubs		
Tall Baeckea	Sannantha	angusta
Swamp Banksia	Banksia	robur
Wallum Bottlebrush	Callistemon	pachyphyllus
Lemon Scented Tea Tree	Leptospermum	liversidgei
Thin Fruited Tea Tree	Leptospermum	brachyandrum
Blue Tongue	Malastoma	affine

- Leaking and ponding effluent from malfunctioning systems can pollute receiving environments, harbour disease carrying organisms and encourage pests such as mosquitoes, flies and cane toads. Ensure that plumbing fixtures are not leaking, cracked or open to the surrounding environment.
- Practice water conservation by installing dual flush toilets and reduced flow tap and shower fixtures. Also spread your laundry loads over the whole week. Through reducing your water use, you reduce the demand on your septic system. This will maximise the functional life of your septic system and minimise the potential for environmental and health concerns.

In Summary:

- *Inspect your OSMS regularly (annually for most septics)- pumpout may be necessary.*
- *If you notice slushy ground, ponding or an unpleasant odour around your OSMS then you have a problem.*
- *Number 1 and number 2 only in the loo.*
- *Avoid directing greywater into your OSMS.*

Appendix 9.6

Fact Sheet: Water Conservation & Your Septic Tank



Water conservation measures inside the home will assist in optimizing the performance of your septic tank and effluent disposal area.

The quantity and composition of waste generated in the home varies according to the number of residents, their personal water usage, and the water-utilizing appliances in the home.

All household waste is disposed of through the septic system – it is broken down in the septic tank and the treated effluent flows into the soil via absorption and/or evapotranspiration. Septic seepage poses human health risks by releasing harmful pathogens into the water table and nearby watercourses.

TIPS ON SAVING WATER:

Laundry

- The laundry is a place where you not only use a lot of water but you also use energy and detergents. The best way to save water in the laundry is to make sure that you select the right washing machine, one that has a water rating of 4 stars or more. This will usually mean a front-loading washing machine. On average, front-loading washing machines use up to 50 per cent less water, 35 per cent less detergent and 30 per cent less energy than top loaders.

Here are some other changes you can make to your laundry habits:

- Only use the washing machine when you have a full load; you can sort and wash bigger loads more efficiently over the week.
- Pre-treat stains before you wash to reduce the chances of having to rewash.
- Make sure that everyone picks up and sorts the clothes they wear each day. That way, clean clothes won't get washed just because they are left lying on the floor.
- If you are washing clothes by hand, use only as much water as you need in the sink or bucket. Reuse this water in your garden.



Kitchen



There are many ways to save water in the kitchen.

- A 5-star water-efficient dishwasher uses as little as 7 litres of water - so a water-efficient dishwasher will use less water than washing dishes by hand.

Make sure you:

- Only use the dishwasher when you have a full load
- Scrape plates instead of pre-rinsing under the tap.
- Non-water efficient dishwashers can use up to 25 litres of water a cycle. If you have this type of dishwasher, you will save more water if you wash your dishes by hand. If you hand-wash your dishes, don't rinse them under running water. A running kitchen tap can use up to 15 litres of water a minute.
- If you have two sinks, half-fill the second with rinsing water. If you only have one sink, rinse the washed dishes in a pan of hot water.
- Don't use running water to wash your vegetables or to defrost food. Instead, wash vegetables in a bowl and place your frozen food in the fridge to thaw overnight.
- Scrape your dishes and soak pots and pans to remove food rather than rinsing them under running water.

Bellingen Shire Council

Environmental Health & Planning Division

PO Box 117 BELLINGEN NSW 2454

Phone: 6655 7353 Facsimile: 6655 2310

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Bathroom

Toilet

Up to 16 per cent of household water is flushed down the toilet:

- Don't flush needlessly, and only flush toilet paper down the toilet.
- Use the half-flush option on dual-flush toilets.
- Replace your older-style toilet with a 4-star dual-flush system. This can save you up to 8 litres of water with every flush.
- If this is not practical, try reducing the volume of water you use with each flush. You can do this by installing a flow restrictor or by putting a bottle filled with water in the cistern.



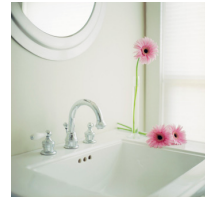
Showers, baths and basins

A standard shower can use 20 litres of water per minute. To use less water in the shower, try the following:

- Install a water-efficient shower head. A 3-star rated shower head will use no more than 9 litres of water per minute.
- Take a shorter shower. Shorter showers will not only save water but will help to save on the energy associated with heating the water.
- Insulate your hot water pipes. This means you will not need to wait as long for the hot water to flow through—saving you both water and energy.
- Make sure your hot water system thermostat is not set too high. Adding cold water to reduce the temperature of very hot water wastes both water and energy.
- Use a bucket to catch water while the shower warms up. You can then reuse this water on your garden.

For baths and basins:

- Use a plug when washing your hands and face
- Turn off the tap while cleaning your teeth or shaving
- Use as little water as possible in the bath. Put the plug in before you turn on the tap and fill the bath to less than a third. You may also like to bath small children together.



Check for leaks



- A lot of water around the home can be lost because of leaking pipes and dripping taps. Just one slowly dripping tap can waste 9000 litres of water a year, while a visibly leaking toilet can waste more than 60 000 litres. Make sure that you turn all your taps off properly, check for leaks, repair leaking taps, and check washers for wear and tear.
- You can check if your toilet is leaking by putting a little food colouring in the tank. If the food colouring appears in the bowl without flushing, have the cistern repaired immediately.
- To find out if you have a leak in your pipes and you are on mains water, turn off all taps and make sure that nobody will be using any water. Check your water meter and make a note of the reading. Recheck the meter after at least one hour. If the reading has changed, you may have a leak. This needs to be found and fixed.

By saving water you will also save:

- ❖ energy—it takes energy to treat, transfer and heat water. The less water you use, the less energy you use and the less greenhouse gases you create
- ❖ the environment—the less wastewater you generate, the less contaminants and detergents you release into our rivers and oceans.

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Appendix 9.7

Sticker: Be Septic Smart

Be Septic Smart

Only ones and twos down the loo

No plastics, sanitary pads or chemicals



Bellingen Shire Council
Healthy Rivers Program



CARING
FOR
OUR
COUNTRY

Appendix 9.8

Information sheet: Erosion Control



Bellinger Valley

MANAGING EROSION IN THE BELLINGER AND KALANG RIVER SYSTEM

What is Riverbank erosion?

Riverbank erosion is a process by which soils and other bank materials are moved by water or gravity and transported downstream. This can cause a loss of productive land and valuable habitat and can lead to impacts on water quality and aquatic habitats downstream.

Whilst streams and rivers naturally experience erosion, sediment deposition and other channel changes, the accelerated rates of erosion seen today are the result of the removal of native vegetation through land clearing, over-grazing and other development pressures.

Mechanisms of bank erosion occurring in the Bellinger and Kalang Rivers include:

- Sub-aerial erosion – this occurs when the bank is exposed to the weather and is subject to a variety of processes e.g. rainfall run-off and stock trampling.
- Wave-induced erosion – wind and boat wave action causes undercutting of the bank.
- Scour – the direct removal of bank and riverbed material by flowing water.
- Scour of the base (toe) of the bank can lead to:
Slumping or Mass Failure – mass movement of soil downward into the stream. Slumps frequently occur in zones where the toe and upper banks are lacking vegetation or other protection and soils have become saturated during flooding rains.



Bellinger Valley

MANAGING EROSION IN THE BELLINGER AND KALANG RIVER SYSTEM

Erosion in the Bellinger Shire

When Europeans arrived in the Bellinger Valley, the river channel was narrower and deeper with more bends than now. Clearing led to increased bank erosion by fast-flowing floodwaters, which were no longer slowed down by riparian and flood-plain vegetation. During big floods the river channel cut through meanders, growing straighter and shorter; the Bellinger has lost more than 1.2km or 7% of its length since clearing began. This shortening of the channel has steepened the river, further increasing the potential for erosion. Today the Bellinger River channel is 2-3 times wider than before clearing, has up to 10 times the flow capacity, and delivers up to 15 times as much flow energy.



Bellinger- Kalang Estuary Erosion Study 2010

As part of Bellinger Council's Estuary Management Plan implementation process, an investigation into erosion processes in the Bellinger and Kalang estuaries has been a priority. The Bellinger-Kalang Estuary Erosion Study includes a thorough analysis of the current patterns of erosion occurring in the estuaries.



Findings from the study include:

- A lack of structurally diverse vegetation, unmanaged stock access, low cohesion of soils and in some sites wind and/or boat wave wash were found to increase susceptibility of banks to erosion in the Bellinger and Kalang estuaries.
- The Bellinger River erodes/migrates at a faster rate than the Kalang River. This is inferred to be a function of more cohesive bank materials and better quality and extent of riparian vegetation in the Kalang River estuary.
- A snap-shot survey of bank erosion undertaken in June 2009 revealed that of the 60.3km of banks in the Bellinger estuary, 32.4km (or 54%) are classified as stable, either naturally or through protective works. Minor levels of erosion occur over 19.5 km (32%) of the estuary's banks. Moderate to severe erosion occurs over 7.4km (14%) of the Bellinger estuary. In the Kalang River estuary, of the 60.5km of banks, 41.2 km (or 68%) of banks are stable, 12.8 km (21%) of banks are experiencing minor erosion and 6.5 km (10%) of banks are experiencing moderate to severe erosion.
- In comparison with earlier studies conducted in the early 1980's, the 2009 study showed a very large increase in minor erosion and a net reduction in moderate and severe erosion.
- Through this study, 28 sites of erosion significance were identified in the Bellinger/Kalang estuaries and assigned priority ratings based on a variety of factors including protecting infrastructure and conservation values.



Bellinger Valley

MANAGING EROSION IN THE BELLINGER AND KALANG RIVER SYSTEM



ARRANGE SITE VISIT



PLAN



FUNDING



CARRY OUT WORKS

Preparing to manage erosion

Getting professional advice on the best way to manage erosion on your property is an important first step. Because each site has specific factors influencing the causes of erosion (such as position on bend, land use, and conditions up-stream), a person trained in understanding river processes is needed to assess the nature of the erosion and plan any control works. Improvement of river health is an important goal that should always be considered when carrying out works on riverbanks, and therefore revegetation and regeneration of local native plant species is essential in any plan to restore a functioning riparian buffer.

1. ARRANGE SITE VISIT

Call Landcare or Council to arrange an initial site visit. Depending on the severity of the erosion a Catchment Management Authority (CMA) representative may also attend the site visit.

2. PLAN

Using advice provided, plan what you are going to do. For structural works, the CMA officer will draw up a site plan. For revegetation and fencing, Landcare and Council can provide advice and guides upon which your plan can be based. To keep costs down, the design of works can be guided by materials available on-farm and locally.

3. LOOK FOR FUNDING POSSIBILITIES

From time to time there are opportunities to gain full or part-funding for erosion control works. The likelihood of success is higher if your project includes substantial environmental benefits such as restoring habitat connectivity. To apply for funding, you will need quotes for materials and contractors and well-drawn plans to enhance your application. Landcare and Council can help with this.

4. CARRY OUT WORKS

- Apply for Permits – Check the Riparian Restoration Process Guide available from Council to see if the works you plan to do will need a permit and from which government department. If in doubt check with Council.
- Source materials – Try to obtain structural materials that are clean and free of soil and debris. This will prevent weeds, pests and diseases from being introduced into the river system.
- Undertake structural works – If possible use contractors who are familiar with riparian works.
- Carry out revegetation and fencing – Follow Landcare guidelines and always use local species.
- Maintain planting – Check recommendations and regulations on herbicide use near waterways.



Bellinger Valley

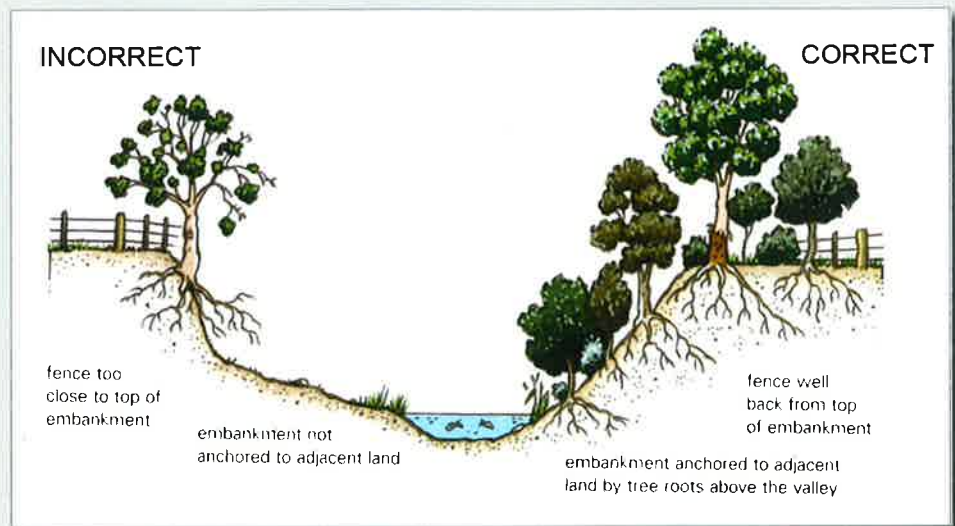
MANAGING EROSION IN THE BELLINGER AND KALANG RIVER SYSTEM

Managing erosion – current Best Practice Techniques

The following techniques may be recommended for erosion control on your property.

Please note: Any works within the stream channel require permits.

Waterway with steep banks



Source - Stock & Waterways: a manerages guide

Fencing to remove stock and natural regeneration

A simple and low cost way to improve bank stability and river health is to manage stock access to allow natural regeneration to occur. Fences should be at least 5 metres from the top of the bank – and much further where the bank is higher and erosion is actively occurring. Natural regeneration is perhaps better suited to estuarine sites, where there is less weed growth than in freshwater reaches. In freshwater reaches, fencing and revegetation and active weed control is a better option. In all cases, periodic monitoring and on going weed management will be crucial.



Bellinger Valley

MANAGING EROSION IN THE BELLINGER AND KALANG RIVER SYSTEM



Revegetation (freshwater & estuary)

Revegetation is recommended on almost all erosion sites, either as a stand-alone measure or combined with structural works. A well-vegetated riparian zone, including trees and ground cover, protects the bank from erosion by slowing water movement. Trees remove water from riverbank soil and prevent slumping.

When revegetating riverbanks for stability it is essential to plant at the toe of the bank, in or at the water's edge. Also, it is important to plant as wide a zone as possible. Planting on the bank toe, middle and upper bank leads to greater stability, as roots become interwoven, holding bank material together, with large trees anchoring the upper bank. It may also be wise to establish a 'sacrificial zone' revegetated with fast-growing species that slow erosion sufficiently for larger, slower-growing species to establish further back from the bank top. The key species for protecting the bank toe are *Lomandra hystrix* in freshwater reaches and Mangroves in the estuary. Two detailed guides are available to assist in designing and carrying out a revegetation project:

- Bellinger River Estuary Revegetation Guide
- Revegetating Streams in the Bellinger and Coffs Harbour Catchments



Manage River Oaks which are deflecting flows into bank (freshwater)

Gravel deposited during floods can form islands which are then colonised and "locked up" by River Oaks. This is a natural process, but can be a problem when River Oak islands deflect high-energy water flows into weak and unprotected banks. To alleviate the force of water against the vulnerable bank it is possible to cut or thin River Oaks to let the water flow through. This practice must be accompanied by increasing bank strength with structural works and revegetation.

Experts agree that removal of in-channel vegetation alone without the strengthening of the banks will not repair the channel sufficiently to reduce future damage to banks. Like all in-stream vegetation, River Oaks are protected by law, and managing them is a specialized skill. For further information refer to the Landcare pamphlet *Managing River Oaks* and other in-stream vegetation in *Gravel-bed Rivers on the NSW Coast*. Refer to contacts for further information and advice.

Battering of bank (freshwater & estuary)

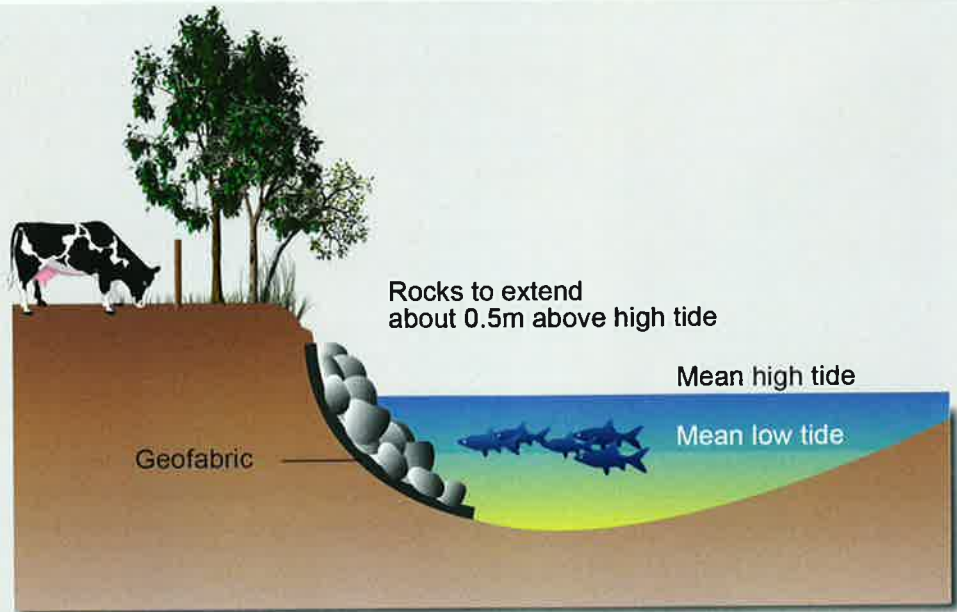
In some circumstances battering or reshaping of the bank is necessary to achieve better revegetation or structural works. This approach alone (without revegetation and /or structural works) is unlikely to alleviate ongoing erosion.



Bellinger Valley

MANAGING EROSION IN THE
BELLINGER AND KALANG RIVER SYSTEM

Rock Revetment cross section



Rock Revetment (freshwater & estuary)

A highly successful but relatively expensive technique, often recommended to protect valuable assets such as roads, bridge abutments and buildings. Hard, durable and chunky rocks of various sizes are placed against the base (toe) of the bank up to a height of 1 metre above the low flow water-level. Rock sizes needed are determined by stream power and flow velocity. Generally, rock is dumped on the bank and then arranged by excavator or bulldozer. Sometimes Geofabric is recommended beneath rock to prevent soil from washing out and undermining the works.

Hardwood Root ball revetment (freshwater & estuary)

Hardwood root balls from road construction projects and logging operations can be used to dissipate wave-wash energy from wind and boats and reduce river velocities during floods. Root balls are generally placed with the rough root end outwards and tied with cable to pins driven into the streambed or a low bank. In estuaries, hardwood structures have a limited lifespan due to copra and other organisms, and therefore must be re-enforced with revegetation. If possible Turpentine timber should be used.

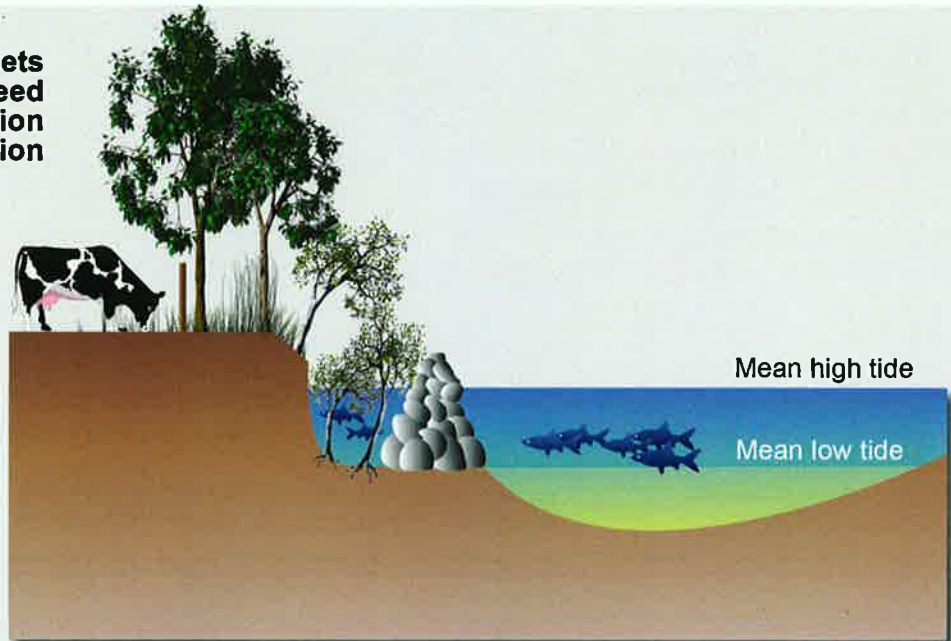




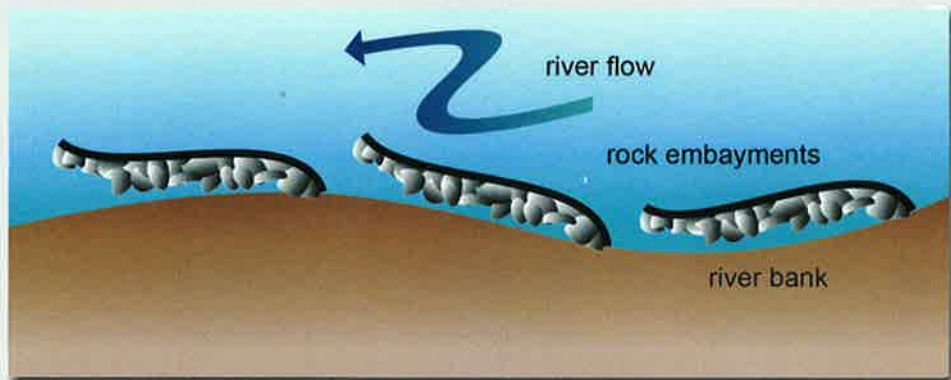
Bellinger Valley

MANAGING EROSION IN THE
BELLINGER AND KALANG RIVER SYSTEM

**Rock embayments/fillets
and mangrove/river reed
regeneration
cross section**



**Rock embayments/
fillets plan view**



Rock embayments/fillets and mangrove/river reed regeneration (estuary)

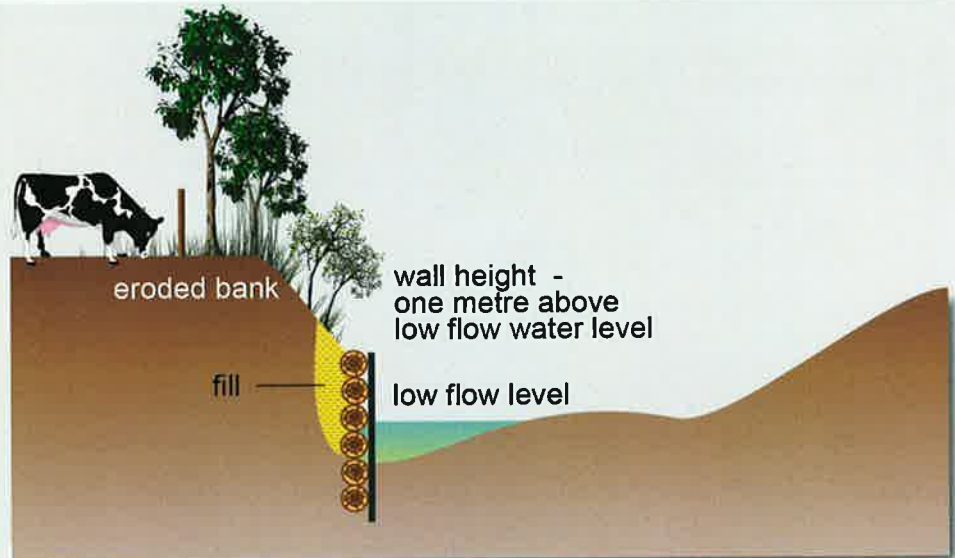
A type of rock revetment principally designed to reduce the effect of waves from wind and boats. Rock embayments are constructed to the height of the mean high tide and have openings at the downstream end which allow water to flow behind them and deposit seeds and debris. This technique can only be used where there is a suitable bench upon which to construct the embayment. An excavator is used to place the rock.



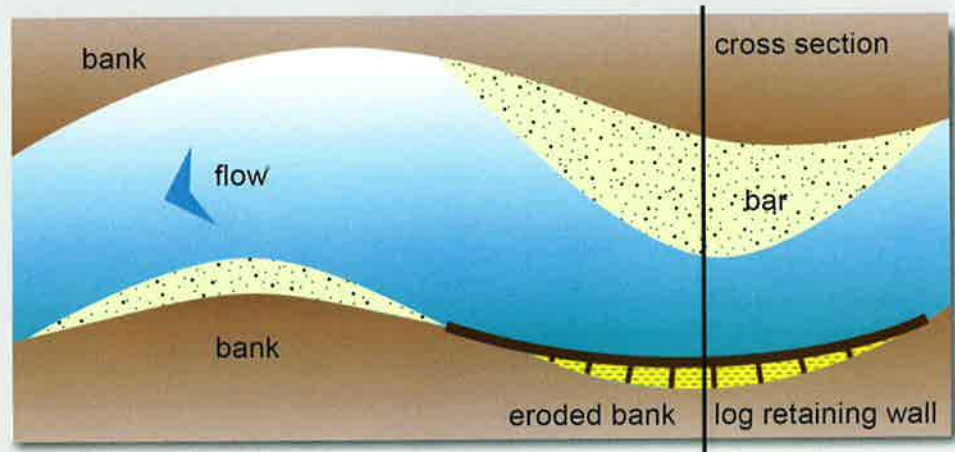
Bellinger Valley

MANAGING EROSION IN THE
BELLINGER AND KALANG RIVER SYSTEM

**Log wall
cross section**



**Log wall
plan view**



Log walls (freshwater & estuary)

Log piles are first driven into the stream bed by excavator and then logs are placed horizontally behind them and tied on using wire cable. Any remaining space between logs and bank should be filled with earth. Plant above.



Bellinger Valley

MANAGING EROSION IN THE
BELLINGER AND KALANG RIVER SYSTEM

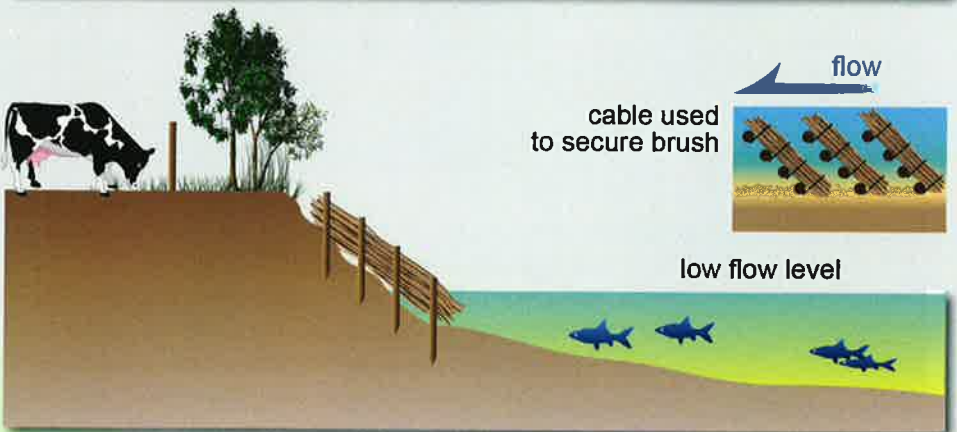
Pin groynes



Mesh Pin groynes



Brush Pin groynes



Timber pin groynes (freshwater & estuary)

A series of groynes made of timber piles are driven into the riverbed extending into the water angled in a downstream direction. These are designed to slow stream velocities, catch flood debris and rebuild the bank over time. Revegetate bank.



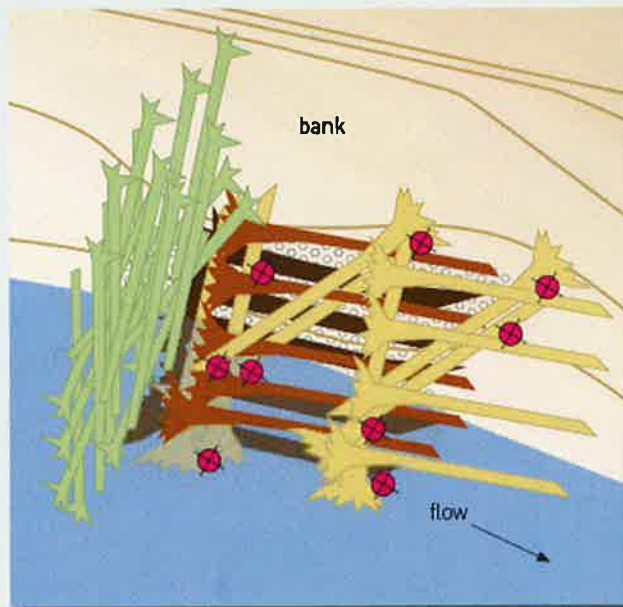
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MANAGING EROSION IN THE BELLINGER AND KALANG RIVER SYSTEM

Brush & Mesh groynes (freshwater & estuary)

A series of low walls built out of logs and brush or mesh is constructed along the eroded bank, extending into the stream. The walls slow the stream flow near the bank and direct it downstream. This allows sediment to deposit at the base of the bank. Very useful at sites where vegetation growing on an opposite bar has blocked part of the stream, deflecting flow into the bank. The vegetation can be cut and used to build groynes. For this technique piles are driven into the streambed and brush or mesh is placed on the upstream side, secured to the piles by cable. Revegetate bank. (Refer to diagrams on previous page)

Engineered log jam



Engineered Log Jam

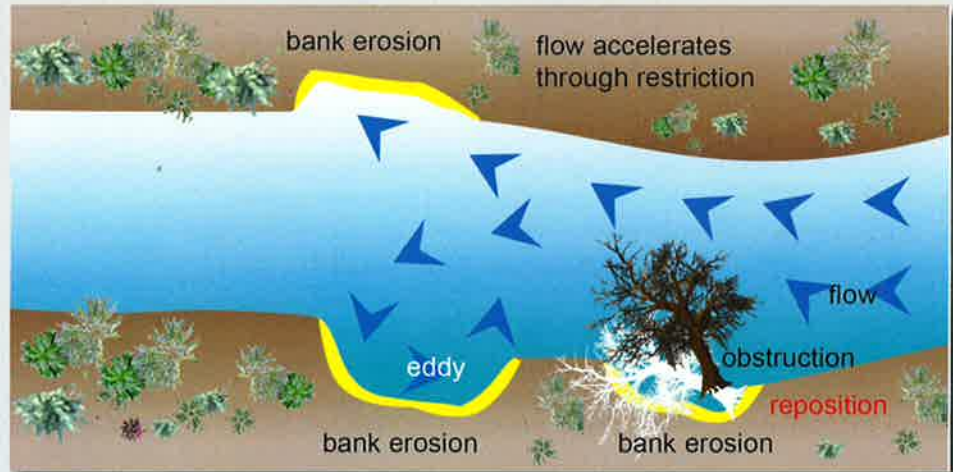
Natural log accumulations in rivers tend to be very stable, providing long-term protection for banks. An engineered log jam is modeled on a natural log jam, and thus restores the natural character and in-stream biota of rivers. Hardwood logs with rootballs are buried in the gravel bed to anchor a structure of interlocking logs. Engineered log jams are pinned with log piles driven into the stream bed and also tied with cable. To protect the bank it is also necessary to key logs into the bank. Over time, flood debris and sediment accumulates around the log jam, resulting in the colonization of vegetation and restoration of the bank profile.



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MANAGING EROSION IN THE BELLINGER AND KALANG RIVER SYSTEM

Log alignment and positioning



Log alignment and positioning (freshwater and estuary)

Sometimes fallen logs can cause bank erosion through associated bank collapse and by directing the flow into the bank. This is usually only a problem with large individual trees not supported by surrounding vegetation. Fallen logs can actually be useful in protecting the toe of the bank from erosional flows if they are repositioned at an angle of 40 degrees or less to eroding bank, root ball upstream. Ideally the root ball should be secured into the bank toe. This provides armouring against the flow and encourages water to move down the centre of the channel. Accompanying revegetation is crucial to ensure long term resilience.

Further Information

- Bellinger and Kalang River Estuaries Erosion Study (2010). Telfer, D. and Cohen, T.
- Doing it by the book: Process Guide for Undertaking Structural Works in the Bellinger & Kalang Rivers, (2011). Matthews, C. & Rickert, A. Bellinger Shire Council/Bellinger Landcare.
- Revegetating Streams in the Bellinger and Coffs Harbour Catchments- A Guide to Species, Planting Locations and Planting Methods (2007). Northern Rivers Catchment Management Authority.
- Bellinger River Estuary Revegetation Guide. Compiled by Bellinger Landcare
- Managing River Oaks and other in-stream vegetation in Gravel-bed Rivers on the NSW Coast. Bellinger Landcare Inc and Tim Cohen.

For Advice contact

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Bellingen Shire Council
Phone: (02) 6655 7300
www.bellingen.nsw.gov.au

Land and Property Management Authority, Crown Lands Division
Phone: Grafton (02) 6591 3500 Coffs Harbour (02) 6691 9610
Information on Natural boundaries including riparian boundaries
http://rgdirections.lands.nsw.gov.au/deposited_plans/natural_boundaries

NSW Office of Water (DECCW),
Grafton, Phone (02) 6641 6521
Information on approvals and link to controlled Activity Application Form
<http://www.water.nsw.gov.au/WaterLicensing/Approvals/Controlled-activities/default.aspx>

Acknowledgements: Prepared by Flametree Ecological Consulting with assistance by Bellinger Landcare Inc. A joint funded project by Bellingen Shire Council and Department of Environment, Climate Change & Water under the Estuary Management Program: Developing capacity building and education strategies to address future impacts of climate change and manage and improve the health of the Bellinger and Kalang Rivers.



Appendix 9.9

Information sheet: Stock Management



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MANAGING STOCK ON WATERWAYS AND IN WETLANDS

On-farm Benefits of active stock management on waterways

A well planned farm including riparian (stream bank) fencing can lead to

- More efficient stock mustering.
- Reduced loss of stock through accidents, falls and bogging.
- Less erosion and loss of land.
- An increase in productivity.
- More even grazing patterns.

Off-Stream watering leads to

- Reduced environmental mastitis and less time spent cleaning udders.
- Reduced foot health problems (e.g. foot rot).
- Reduced risk of water-borne parasites and diseases.
- An increase in farm productivity through stock access to clean water. Clean water helps maintain stock condition and improves milk and wool production.
- Stock have been shown to prefer drinking cleaner water from troughs.

Retaining and restoring riparian and wetland vegetation can

- Improve the ability of the land to trap and use available rainfall.
- Provide a shelter-belt for neighbouring paddocks by reducing wind velocity and moderating extreme temperatures. This is particularly valuable during calving and lambing.
- Increase land value by making the farm more attractive. A well managed stream frontage can increase property values by up to 10%.
- Provide drought reserves for stock.
- Reduce loss of valuable land by erosion.
- Increased biodiversity benefits such as insect pest control through increased bird numbers.

A well-managed sustainable farm that is considerate of other river users including plants and animals gives the landowner a sense of pride.



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MANAGING STOCK ON WATERWAYS AND IN WETLANDS

River health benefits

A vegetated riparian zone which excludes stock:

- Rapidly restores river water quality.
- Filters run-off from developed and agricultural land uses. Generally, the wider the buffer zone the better it can filter pollutants such as sediment, heavy metals, pesticides, herbicides and fertilisers.
- Is less likely to erode than cleared areas. Trees, shrubs and rushes protect the bank with their roots and reduce stream velocities especially in times of flood.
- Provides excellent habitat for many species of plant and animal. There are many flow-on effects which lead to a healthier river system.

What impacts do stock have?

Sedimentation and pollution of streams

- Stock excreting directly into streams reduces water quality and can lead to outbreaks of algae.
- Stock loitering in streams can stir up sediment, damaging the habitat of fish and other important aquatic organisms.
- Many people use the local rivers for recreation and as a source of household water - decreased water quality can put their health at risk.

Increased erosion

- Stock trample and destroy riparian vegetation leaving banks exposed and vulnerable to erosion.
- Stock cut tracks into the banks that can lead to slumping and erosion; tracks also concentrate run-off which can lead to gully erosion.
- Stock can damage the toe of the bank causing the bank to collapse.
- Stock pug damp sites, which damage the soil structure, leads to erosion and draining of important wetland soak.

Damage to important riparian and wetland vegetation

- Wetland, riparian and in-stream vegetation slow down the movement of water and filter out sediments, maintaining river health.
- Without the shade of riparian vegetation, higher water temperatures can cause excess algal growth and dominance of exotic species.
- Stock compact the soil, which prevents growth and regeneration of desirable species.
- Opening up of the plant canopy, combined with high nutrient loads from dung and urine, provides ideal conditions for weeds.





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MANAGING STOCK ON WATERWAYS AND IN WETLANDS

KEY CONSIDERATIONS FOR MANAGING STOCK

Planning

Having a plan is very important. A rough sketch of your waterway can be a good start but a whole farm plan will allow you to manage your property in a way that will save time, cost and effort in the long run. A whole farm plan:

- Uses an aerial photograph or map to identify natural features such as water ways and rock outcrops, problem areas, and farm infrastructure such as fences, crossings and buildings.
- Identifies areas with similar management requirements and land capability and locates fences following natural landforms. Many farmers have found that subdivision of larger paddocks and development of rotational grazing programs boosts productivity by letting them use each part of the farm according to its capabilities.
- Leads to practical and well planned siting of new infrastructure (e.g. appropriately locates laneways, gates, watering points, stock crossings and other easements to help control stock and manage grazing pressure in riparian areas).
- Takes a long-term and realistic view- all works require time, effort and money. Seeking appropriate technical expertise (e.g. from Landcare, Council, & Catchment Management Authority (CMA) and applying for funding can assist in achieving the goals of sustainable farm management.



Fencing

Developing effective and practical fencing is probably the main challenge for landholders managing stock on waterways. Things to consider include:

- Where a fence should go depends on the size of the waterway, landform features and local flood characteristics.
- Functional aspects should also be considered when siting a fence. Some farmers in the local area include a laneway on the bank side of their riparian fences. This allows them to maintain the fence from both sides, access the bank vegetation to carry out weed control and also to move stock through.
- Fences should be sited as far away from the waterway as possible. In an ideal situation, 5-10 metres away from banks of small creeks and at least 20 metres from major creeks and rivers. Anywhere that there is active erosion, banks are steep or unstable, or vegetation cover is poor, a greater setback should be allowed, to achieve better control through revegetation. Ultimately, site specific characteristics will determine suitable fence placement and this may need to be reassessed periodically.

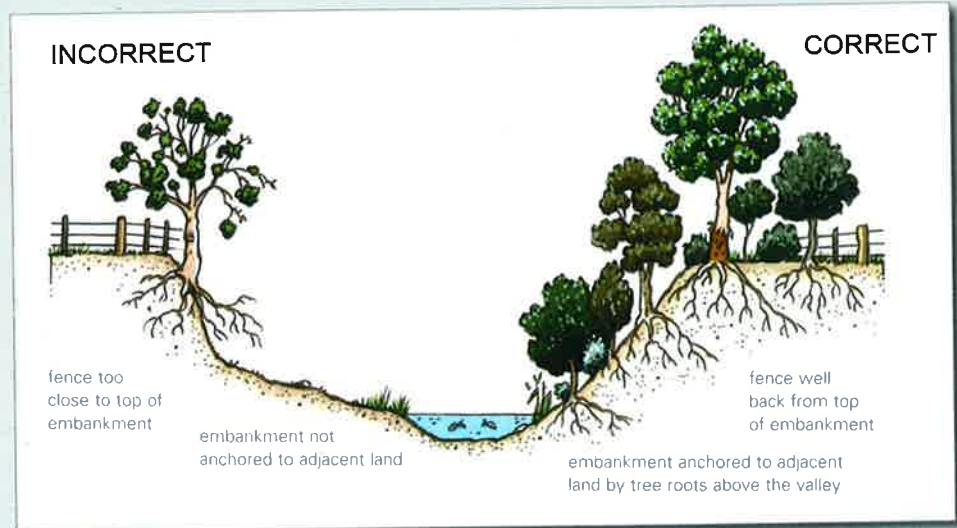




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MANAGING STOCK ON WATERWAYS AND IN WETLANDS

Fence positioning



Source - Stock & Waterways: a manager's guide



- To restore functional riparian zones that provide habitat for wildlife, fencing a minimum of 30m and preferably 50m from stream banks is recommended.
- Fencing should be situated above the annual peak flood level, in a position that avoids high flows and also debris. If this excludes too large an area, place a permanent fence above the floodline and use replaceable electric fencing to protect the stream bank vegetation.
- Straight fences are cheaper and simpler to erect than one that follows the bends of a waterway and also less likely to collect debris during floods. Setbacks generally need to be larger with a straight fence; however, the fence will be safer from changes in the watercourse. Position the fence parallel to the stream/flood flow direction to reduce the risk of damage.
- In upper catchment areas some farmers use "run around" strainers. In this situation wire is not secured to each strainer but is tensioned around several consecutive strainers in notches cut with a chainsaw. This makes fences following a winding creek line much more practical.



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MANAGING STOCK ON WATERWAYS AND IN WETLANDS

- In flood-prone areas, a drop-down fence design can be used; these fences drop down when pressure from water and debris builds up behind them. Also useful are fences that can be laid flat prior to flooding; for these to work, good flood forecasting and time for active management is vital.
- Some floodplain fences are designed with a built in “weak link” which allows the fence to trail downstream as the water level builds. These are then reinstated after the flood.
- Electric fences allow more flexibility of positioning and are cheaper than traditional fences. Electric fences can be temporary structures using tape or permanent structures made from plain wire. Portable electric fences which have a solar charger are available and provide the advantage of an independent power supply.
- Use different types of fencing around the farm. Important fences (eg boundary fences) should be made of sturdy materials, while cheaper fences can be used for various purposes (e.g. rotational grazing, fencing of small wetlands etc).
- To boost rehabilitation of fenced areas and to control erosion, it is recommended to plant native trees, shrubs and groundcover. Information guides available from Council, Landcare & CMA detail methods for riparian revegetation. See further information section for details.

Off-Stream Watering

A major consideration in planning to fence and manage riparian areas is the need to provide stock with water. Things to consider include:

- The cheapest and most common system is to pump to a tank installed on a high point in the landscape and gravity-feed water to troughs.
- A relatively cheap option is to use moveable plastic troughs and poly-pipe with a system of frequently spaced taps. This allows movement of watering points to control grazing pressure and assist with locating and mustering stock.
- Plastic troughs need to be situated above flood level, otherwise they may float away. On floodplains, use concrete troughs.
- Diesel, petrol or mains powered pumps are commonly used to fill tanks from creeks and dams. Other types of pump such as solar are increasingly available. No permit is required for domestic and stock watering purposes.
- As a general rule the daily amount of water required per head of stock during summer is: Sheep 7 litres; Beef Cattle 30 litres; Dairy Cattle 50 litres.
- Local pump and irrigation equipment suppliers can provide advice tailored to farm situation and goals.





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MANAGING STOCK ON WATERWAYS AND IN WETLANDS

In-Stream Watering

In some circumstances, using the stream for stock watering is the only option. It is then important to restrict stock to designated watering points along the stream to minimise disturbance. When choosing an access point, keep the following in mind;

- The site should be relatively flat, with a maximum slope of 1:6, to reduce erosion and make it easier for stock to get to the stream edge.
- The site should be located on the inside of a bend, where water movement is slower and the banks are less prone to erosion. The outer bend of the stream is the eroding point and is thus more sensitive to trampling.
- To prevent erosion, harden the surface of the access point with gravel. A hardened surface will also provide a better footing for stock.
- To minimise problems associated with stock camping or loafing around the watering point, make sure the site is not well sheltered.
- Angle the access point in a downstream direction, so stock enter in direction of water flow, to minimise flood damage and erosion.
- Fence the access point as part of the riparian corridor fencing. The corridor can be broken at selected places and two parallel fences run from one side of the stream to the other, or else to the low water mark in the stream. It is important to ensure that stock cannot get into the riparian corridor from the stream channel. Depending on the grazing system and stream characteristics the fence can be temporary or permanent.
- Width will depend on the number of available access points and the number of stock to be watered – the suggested range is 2 to 20 m wide.

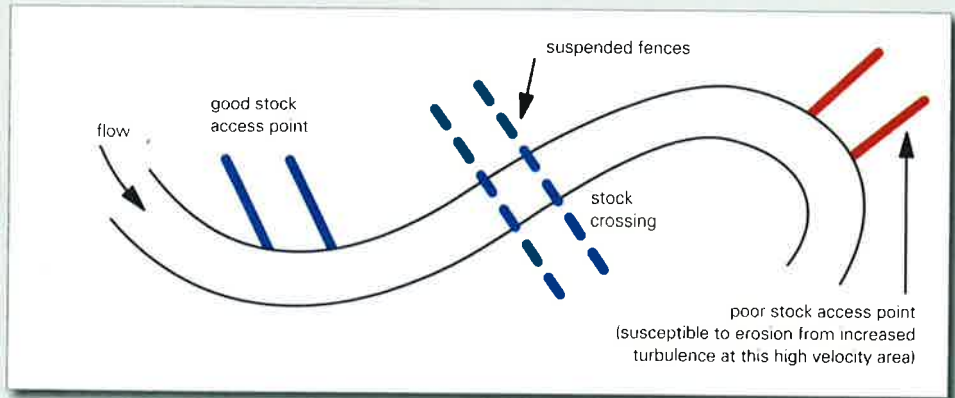




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MANAGING STOCK ON WATERWAYS AND IN WETLANDS

Placement of stock crossings & in-stream watering points



Source - Stock & Waterways: a manager's guide

Crossings

In some parts of the landscape, stock will need to cross waterways. Ways of minimising impacts include:

- Crossings should not be sited on a bend.
- Ideally each crossing should be gated on each side of the stream and opened only when transferring stock from one paddock to another, but this is not always feasible. Where the crossing needs to remain open or forms part of an in-stream watering point, it may be necessary to hang a suspended fence across the stream to prevent stock from entering riparian areas during low flow times. Further information on the design of suspended fences is available in Stock and Waterways: A managers guide. See further information section.
- Any construction of a crossing on a stream (e.g. a culvert) requires approval from Industry and Investment NSW (former DPI Fisheries) to ensure minimal impacts of passage of fish. A guideline for designing and constructing crossings so as to minimise the impacts on fish passage and aquatic habitats is available from their website. See further information section.





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MANAGING STOCK ON WATERWAYS
AND IN WETLANDS



Grazing management

Grazing management practices can be used to help maintain the health of riparian areas and benefit production through more even paddock use. To improve paddock use, keep the following in mind:

- Locate gates, watering points and salt, protein or mineral blocks away from the riparian margin.
- Ensure there is adequate shade in the paddock - plant shade trees or preferably a shade lot.
- If it is necessary to graze riparian land, adjust the stocking rates and frequency to suit the sensitive nature of the land i.e. smaller animals at low stocking rates for short periods with long rest periods.
- It is recommended not to graze riparian zones in the first few years after fencing, to let the vegetation recover and avoid setbacks to growth.
- Only graze riparian areas when the bulk of the vegetation is dormant and the soil moisture levels are low, i.e. not after floods and not at all during the wet season (November-April).
- Avoid grazing riparian land during the growing and flowering season (Spring-Summer); seedlings can be destroyed by grazing and trampling, and grazing when plants are actively growing leads to plant stress and poor root development.
- Strategic crash grazing of fenced areas can help with weed control.



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MANAGING STOCK ON WATERWAYS
AND IN WETLANDS

Local Case Study- Richard Bromley

Where: Old Punt Road Urunga

Enterprise: Breeding cattle

Size: 25ha (60 acres with 50 acres available to cattle)

Length of Riparian Zone: 4.5 km

What was the motivation?

- Controlling erosion - When the property was purchased the majority of the bank was exposed to wave action, boat wash and flood erosion. This, combined with easily dispersed sodic soils, meant that valuable land was being lost through erosion.
- Protecting the asset - It's expensive to set up a farm so it's important to protect that asset. It may take money and time to fence and restore vegetation but it's worth it to protect the asset of farm acreage.
- Richard knew that by establishing a rotational grazing system he could make up in productivity for any loss of land due to fencing and re-planting the riparian zone.

What has been done to protect riparian areas?

- Fencing at an average distance of 10-15 metres from the bank – more in some places, depending on bank height and shape.
- Tree planting- site preparation of spraying out grass at 3 metre spacing, then planting with a mix of fast growing species suitable to the site including Acacia, Eucalyptus, Casuarina and Lophostemon, watering in and during dry spells watering from a tank on the back of the farm buggy.
- Tree root balls (sourced from highway upgrade works) were anchored along a low bank exposed to wind driven wave action and boat wash using posts, wires and cables. Trees were also planted behind the root balls.
- A tidal wetland was fenced and the edges planted with native trees.

Assistance

- Advice on permits, management techniques, funding and appropriate species selection was sought from Bellingen Shire Council, Northern Rivers Catchment Management Authority and Bellinger Landcare.
- Site visits were conducted by the Land and Property Management Authority, NSW Maritime, & Northern Rivers Catchment Management Authority.
- Envirofund Incentive funding was secured in 2006/2007 to fence and plant the 5ha riparian zone and 2.5 ha wetland margins.





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MANAGING STOCK ON WATERWAYS AND IN WETLANDS



Wetland before



Regeneration



Wetland after

Benefits

- Improved bank stability.
- Better stock control – no risk of them falling into or bogging in the river.
- The plantings act as shelter belts and provide shade which protects stock.
- Natural regeneration of mangroves and other species has occurred along the banks which further helps protect banks from erosion.
- Increased soil moisture near shelterbelts resulting in better growth in pastures.
- Planted trees slow water flow during floods which protects riparian fences and reduces erosion risk.
- More attractive river frontage.

Challenges

- Installing root balls - working with government departments to determine boundaries was an issue but persistence paid off.
- In some areas cattle have accessed planted areas and pruned new shrubs setting them back in their growth. In the wetland, crabs damaged plantings resulting in them dying off.
- Some plants have died, possibly due to species being unsuitable for the site, but enough have survived to form a canopy and others are naturally regenerating (e.g. Swamp Oak).

Additional information

- Weed control is minimal- Richard estimates that he carries out weed control approximately 2 days a quarter. His main weed control includes spot spraying and cutting out of Lantana, Bitou Bush and Coastal Morning Glory and cutting back of native vines, which grow up the trees. He is reluctant to spray around plantings as spray drift will affect their growth.
- Richard's recommendation is to get as much advice as you can before you start.



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MANAGING STOCK ON WATERWAYS AND IN WETLANDS



Wetland before



Regeneration



Wetland after

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Appendix 9.10

Information sheet: Biodiversity



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BIODIVERSITY OF THE BELLINGER AND KALANG RIVER SYSTEM

What is biodiversity?

Biodiversity, short for "biological diversity", refers to the full variety of living things, encompassing not just diversity of species, but also of ecosystems and genes. Biodiversity is difficult to measure, but the number of species in an area is thought to be a useful proxy.

Biodiversity of the Bellinger-Kalang

The Bellinger-Kalang Rivers and adjacent lands are extremely biodiverse. Most properties with some native bush are home to over 100 higher plant species (there are well over 1,000 in the catchment as a whole), 8-20 species of frog, 20+ reptile species, 10-40 mammal species and over 100 bird species – not to mention invertebrates, which are poorly known. The Bellinger-Kalang includes at least one turtle species (the Bellinger River Elseya), and several species of freshwater fish (the Galaxiids of the upper Rosewood catchment), found in no other river system on earth. As well as a handful of plants and animals restricted to the local area (e.g. the Ringwood), there is a multitude of regional endemics which are confined to north-east NSW and south-east Queensland (e.g. Giant Barred Frog, Stephens' Banded Snake, Logrunner and Pale-yellow Robin). At least 10 Threatened plant species and 50 Threatened animal species occur in the Bellinger-Kalang river system and adjacent lands.

What are Threatened species?

In Australia, the term "Threatened species" refers to species listed under either state or federal legislation such as the NSW Threatened Species Conservation Act (1995) or the Commonwealth Environment Protection and Biodiversity Act (1999). The legislation lists species that are considered at risk of extinction. Within the umbrella term "Threatened", there are four main sub-classes: Vulnerable (the least serious level of threat), Endangered, Critically Endangered, and Presumed Extinct. In NSW, all native frogs, reptiles, birds and mammals (except the Dingo), together with some plants and fish, are protected by law, whether or not they are listed as Threatened. State and federal Threatened species legislation provides Threatened species, and their habitats, with additional protection.



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BIODIVERSITY OF THE
BELLINGER AND KALANG RIVER SYSTEM

FLOODPLAIN ENDANGERED ECOLOGICAL COMMUNITIES

Endangered Ecological Communities (EECs), as defined by the NSW Threatened Species Conservation Act (1995), are vegetation communities that face a very high risk of extinction in the near future. Due to extensive clearing for agriculture and grazing, all of the remaining native vegetation on coastal floodplains in NSW is considered to be Endangered. The boundaries between the five floodplain EECs of the Bellinger-Kalang (Swamp Oak Floodplain Forest, Swamp Sclerophyll Forest, Sub-tropical Eucalypt Forest, Lowland Rainforest and Freshwater Wetland) are not always clear-cut, and some areas of native vegetation may have characteristics of more than one EEC. In general, Swamp Oak Floodplain Forest occurs where there is semi-regular inundation with some salt-water influence, Swamp Sclerophyll Forest where there is semi-regular inundation with little or no salt-water influence, Sub-tropical Eucalypt Forest on loamy soils where inundation is relatively infrequent, Lowland Rainforest on silty soils where inundation is relatively infrequent, and Freshwater Wetland where inundation is frequent.

LOWLAND RAINFOREST ON FLOODPLAIN

Scientific name: Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion

NSW conservation status: Endangered Ecological Community.



photography
Brian Hawkins

- Lowland Rainforest on Floodplain grows along riverine corridors and alluvial flats with rich, moist silts.
- Prior to clearing, much of the vegetation along the Bellinger and Kalang Rivers would have been Lowland Rainforest.
- Lowland Rainforest on Floodplain supports a rich diversity of plants and animals. Typical tree species in the community include Strangler Figs (*Ficus macrophylla*, *F. obliqua* and *F. watkinsiana*), Bangalow and Cabbage-tree Palms (*Archontophoenix cunninghamiana* and *Livistona australis*), and Brush Cherry (*Syzygium australe*). Animals present include fruit-eating rain forest pigeons, Noisy Pitta, Australian Brush-turkey, pademelons, flying-foxes, skinks and the Giant Panda Snail.
- Even small stands have conservation value.
- There is a good example of Lowland Rainforest on Bellingen Island.
- Many of the native plants found along creeks and regenerating riverbanks are Lowland Rainforest species.
- Threats to the survival of this community include clearing, burning and weed invasion.



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BIODIVERSITY OF THE
BELLINGER AND KALANG RIVER SYSTEM

SALTMARSH

Scientific name: Coastal Saltmarsh

NSW conservation status: Endangered Ecological Community.

- Occurs in the intertidal zone on the shores of estuaries and lagoons that are permanently or intermittently open to the sea; frequently found (as at Urunga Lagoon) on the landward side of mangrove stands.
- Characteristic plants are small, salt-tolerant sedges, grasses and succulents such as *Baumea juncea*, *Juncus kraussii*, *Sarcocornia quinqueflora*, *Sporobolus virginicus*, *Isolepis nodosa* and *Zoysia macrantha*. Occasionally mangroves are scattered through the saltmarsh.
- Saltmarshes play an important role as a juvenile habitat for species such as bream and mullet. Crabs are common in saltmarsh and are a significant food for many fish species.
- Saltmarshes also act as a buffering and filtration system for sediments and nutrients.
- Threats to Saltmarsh survival include infilling, weed invasion, water pollution, changes to tidal flows and invasion by mangroves.



photography
Brian Hawkins

FRESHWATER WETLAND

Scientific name: *Freshwater Wetlands on Coastal Floodplains*

NSW conservation status: Endangered Ecological Community.

- Occurs where floodplains are periodically or permanently inundated by fresh water.
- Has very few woody species. The structure and composition of the community varies depending on the flood regime: for example, grasses, sedges and rushes occur where submersion is not prolonged, while aquatic herbs dominate where semi-permanent or permanent standing water is present.
- Even degraded wetlands qualify as Endangered Ecological Communities.
- Wetlands are often called 'nature's kidneys' because they improve water quality by filtering sediment and pollutants, and reduce erosion by slowing the movement of water across the landscape during storms and floods.
- Freshwater Wetland is critically important to many species, including Threatened plants, fish and birds such as the Brolga and Black-necked Stork (Jabiru).
- Many areas of Freshwater Wetland can be seen from the Waterfall Way between Bellinger and the Pacific Highway
- Threats to its survival include clearing, draining, grazing, pollution and weed invasion.



photography
Brian Hawkins



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BIODIVERSITY OF THE
BELLINGER AND KALANG RIVER SYSTEM

SWAMP SCLEROPHYLL FOREST

Scientific name: Swamp Sclerophyll Forest on Coastal Floodplains
NSW conservation status: Endangered Ecological Community.



photography
Brian Hawkins

- Occurs on waterlogged or periodically flooded areas on coastal floodplains.
- Swamp Sclerophyll forest in the Bellinger and Kalang valleys is dominated by the Broad-leaved Paperbark (*Melaleuca quinquenervia*); Swamp Mahogany (*Eucalyptus robusta*) is also common.
- Good examples occur along the Waterfall Way between Bellingen and the Pacific Highway.
- Broad-leaved Paperbark and Swamp Mahogany flower in winter, a time when there is often very little nectar available in south-eastern Australia, and attract animals such as flying-foxes, honeyeaters and parrots from thousands of kilometres away.
- Threats to the survival of Swamp Sclerophyll Forest include clearing, draining, grazing, pollution and weed invasion.

SWAMP OAK FLOODPLAIN FOREST

Scientific name: Swamp Oak Floodplain Forest
NSW conservation status: Endangered Ecological Community.



photography
Brian Hawkins

- Occurs on coastal floodplains where groundwater is saline or sub-saline and soils are periodically or permanently waterlogged
- Has a dense to sparse tree layer in which *Casuarina glauca* (Swamp Oak) is the dominant species. The understorey is characterised by frequent vines (e.g. Common Silkpod, Scrambling Lily and Snake Vine), a sparse cover of shrubs, and a continuous groundcover of forbs, sedges, grasses and leaf litter.
- Threats to the survival of Swamp Oak Floodplain Forest include clearing, draining, grazing, pollution and weed invasion.



Bellinger Valley

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THREATENED SPECIES



photography
Sally Hawkins

RINGWOOD or ANISEED MYRTLE

Scientific name: *Anetholea anisata*

NSW conservation status: Unprotected.

- This uncommon rainforest tree is found only in the Bellinger and Nambucca river valleys, usually near streams.
- The leaves have an aniseed smell and can be used in cooking.

SEAGRASSES

NSW conservation status: Protected.



photography
Mark Price

- The only flowering plants that can live underwater (seaweeds are algae and do not produce flowers); seagrasses evolved from grasses on land
- The most common seagrass in the Bellinger-Kalang estuary is Eelgrass (*Zostera capricorni*). Another present particularly around Urunga Island is Paddleweed (*Halophila* sp.)
- Seagrasses are crucial to marine ecosystems: they provide habitat and food for fish (especially juveniles) and other aquatic fauna, they reduce erosion and improve water quality.
- Forty times more animals are found in seagrass beds than in adjacent bare sand.
- Threats to seagrass include dredging, sedimentation and water pollution.

BEACH STONE CURLEW

Scientific name: *Esacus neglectus*

NSW conservation status: Critically Endangered



photography
Brian Hawkins

- Found exclusively along the coast; forages for invertebrates such as crabs in the intertidal zone of beaches and estuaries.
- Extremely rare in NSW, with surveys in 2000 counting only 16 birds.
- Active mainly at dawn, dusk and at night.
- The nest is a shallow scrape in the sand just above high-tide level; known to breed in the Bellinger-Kalang estuary.
- Recreational activities such four-wheel-driving, boating and the walking of dogs can cause significant disturbance to this species, leading to desertion of nests. The birds are also vulnerable to predation by foxes, pigs, dogs and cats.



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BLACK BITTERN

Scientific name: *Ixobrychus flavicollis*
NSW conservation status: Vulnerable



photography
Ian Kethel

- A thick-necked, skulking heron, dark grey to black. The colour alone readily distinguishes it from the other two much paler bittern species (Brown Bittern and Little Bittern).
- Has a distinctive booming call heard mainly heard during the breeding season (December to March).
- Inhabits both freshwater and estuarine wetlands, generally in areas of permanent water with dense vegetation.
- Feeds on frogs, reptiles, fish and invertebrates, mostly at dusk and at night. During the day, Black Bitterns roost in trees or on the ground amongst dense reeds.
- Nests are located on a branch overhanging water and consist of a bed of sticks and reeds on a base of larger sticks. Between three and five eggs are laid and both parents incubate and rear the young.
- Known from Urunga Lagoon, Hydes Creek and the lower reaches of the Bellinger and Kalang Rivers.
- Threats to its survival include clearing of riparian vegetation and predation on eggs and juveniles by foxes and cats.

BLACK-NECKED STORK ("JABIRU")

Scientific name: *Ephippiorhynchus asiaticus*
NSW conservation status: Vulnerable



photography
Terry Evans

- The only species of stork in Australia. It stands about 1.3 m tall and has a wingspan of around 2 m.
- The name "Jabiru" properly refers to a South American stork species. It appears likely that the Australian form of the Black-necked Stork (which also occurs in South-east Asia) will soon be treated as a separate species and renamed the "Satin Stork".
- Black-necked Storks are most often seen in shallow freshwater wetlands (such as at Camerons Corner on the Waterfall Way) or near estuaries.
- They forage in shallow, still water, and take a variety of prey, including eels and other fish, frogs, turtles, snakes, and small invertebrates.
- In NSW, Storks usually make a large platform style nest in a tall, isolated paddock tree.



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photography
markspencer.com

BELLINGER RIVER ELSEYA

Scientific name: *Elseya georgesii*
NSW conservation status: Protected

- One of two short-necked turtles in the Bellinger and Kalang Rivers. Can be distinguished from the other short-necked turtle, the Bellinger River *Emydura* by the presence of dark, "dirty", lines between the shell-plates on the belly.
- Lays 10-15 eggs on the river-bank between October and December.
- Feeds on invertebrates and some plant material.
- Found only in the Bellinger and Kalang Rivers, where it is common.

BROLGA

Scientific name: *Grus rubicunda*
NSW conservation status: Vulnerable



photography
Brian Hawkins

- One of Australia's largest birds – stands 1.3 metres tall and has a wingspan of nearly 2.5 metres.
- The only crane found in NSW.
- Brolgas have nested in wetlands to the north of the river in the past few years. The nest is a platform of grasses and sticks built on the ground near or in water. Two eggs are laid during winter or autumn.
- Forages for food across a variety of landscapes including wetlands, grass lands and paddocks.
- Feeds using heavy straight bill as a 'crowbar' to probe the ground for roots and tubers. Also eats large insects, crustaceans, molluscs and frogs.
- The main threats to its survival are draining of its wetland habitat, and disturbance of nesting birds.

EASTERN WATER DRAGON

Scientific name: *Physignathus lesueurii lesueurii*
NSW conservation status: Protected



photography
Ian Kethel

- A day-active semi-aquatic lizard growing to over a metre.
- Feeds on insects, small reptiles and frogs, and plant material including fruit.
- Can remain under water for up to an hour.
- Hibernates over winter.
- Adult males can be distinguished by the blood-red colouring on the chest; they are territorial and signal to rivals by waving their arms.
- Egg-laying occurs between October and December; the mother Water Dragon excavates a 10-15 cm deep burrow in soft or sandy soil in a sunny spot and lays 6-18 eggs. Burrow temperature determines the sex of the hatchlings, which appear in February and March and are around 5 cm long (snout to vent).



Bellinger Valley

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photography
Michael Pennay

FISHING BAT or SOUTHERN MYOTIS

Scientific name: *Myotis macropus*

NSW conservation status: Vulnerable

- This microbat weighs up to 15 grams and has disproportionately large feet.
- Feeds at night on aquatic insects and small fish caught from streams, dams or lakes. It catches prey by raking the water with the curved claws on its large feet.
- Generally roosts in groups of 10-15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges or in dense foliage.
- Females have one young each year – usually in November or December.
- Threats to its survival include reduction in water quality, loss of roosting sites, clearing and pesticide use.



photography
Brian Hawkins

GIANT BARRED FROG

Scientific name: *Mixophyes iteratus*

NSW conservation status: Endangered

- A large tan frog up to 115mm in length, with distinct barring on the limbs and golden eyes with vertical pupils. Of the three similar Barred Frog species found in the area, the Giant Barred Frog is the only one with golden eyes.
- The call is a soft, deep 'Woh'.
- Reasonably common on vegetated banks of the Bellinger and Kalang Rivers and their tributaries, even in the middle of Bellingen. The area is a strong hold for the species.
- Forages for large insects amongst deep, damp leaf litter in rainforests and eucalypt forests; rarely travels more than 50 m away from a water-course.
- Breeds along rivers and permanent creeks from late spring to summer. Females lay eggs on moist banks or rocks above water level. The large tadpoles, which take up to 14 months before metamorphosing into frogs, may be seen in the water all through winter.
- Threats to its survival include sedimentation and pollution of streams, removal of riparian vegetation, use of chemical sprays near water-courses and the lethal Chytrid fungus, which can spread via mud or damp soil.



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photography
Vivien Jones

GREY-HEADED FLYING FOX

Scientific name: Pteropus poliocephalus
NSW conservation status: Vulnerable

- Bellingen Island has been used as a maternity camp by Grey-headed Flying-foxes for many generations; other nearby camps at Urunga, Pine Creek and Dorrigo are occupied only occasionally.
- Flying foxes eat nectar and fruit and will commute up to 50 km in a night to feed.
- When certain eucalypt species (e.g. Pink Bloodwood) come into flower, Flying-foxes from all over eastern Australia congregate in Bellingen. At such times there may be hundreds of thousands of animals in the camp; at other times, the local population is much less. Very rarely – usually in late winter – the camp may empty completely.
- Births in the Bellingen camp occur in October, with each mother rearing only a single young.
- Threats to its survival include clearing, shooting by orchardists, electrocution by power-lines and entanglement on barbed wire.

OSPREY

Scientific name: Pandion haliaetus
NSW conservation status: Vulnerable



photography
Brian Hawkins

- A large and distinctive bird of prey. Perched, the upper parts are dark brown and the underparts are white. In flight, the wings are bowed, dark brown above and barred underneath.
- Found in coastal areas, especially around the mouths of large rivers, lagoons and lakes, where it hunts fish.
- Hunts by diving spectacularly feet-first into the water, plunging its talons into the back of a fish. The bird must then struggle into flight, carrying its prey beneath it.
- There are at least three local Osprey nests, including on top of the Railway bridges at Urunga and Repton.
- World-wide Osprey populations declined dramatically in the 1950s and 60s, due to the toxic effects of the insecticide DDT. Poisoned insects were eaten by fish which were then ingested by Ospreys, causing eggshell thinning which led to very low breeding success. Osprey populations have recovered since the banning of DDT in the 1970s.
- Threats to the Osprey's survival include water pollution and removal of large nesting trees.



Bellinger Valley

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photography
Vivien Jones

PINK UNDERWING MOTH

Scientific name: *Phyllodes imperialis* southern subspecies
NSW conservation status: Endangered

- A large brown moth with pink patches on the back wings.
- Known from only a handful of locations – the Bellinger Valley is one of them.
- Breeding habitat is restricted to areas where the caterpillar's food plant, the rainforest vine *Carronia multisepalea*, occurs.
- Threats to its survival include clearing and weed invasion.



photography
Sandy Carol

PLATYPUS

Scientific name: *Ornithorynchus anatinus*
NSW conservation status: Protected.

- One of only three species of egg-laying mammal (together with the two types of *Echidna*).
- Mainly active around dawn and dusk, when it forages in the water for shrimp and other invertebrates.
- Uses its electro-sensitive bill to home in on electrical discharges produced by the muscles of prey.
- Can remain under water for around 10 minutes.
- Each Platypus uses several short (3-5 m) resting burrows to shelter from predators and temperature extremes; nesting burrows tend to be longer and more elaborate.
- Male Platypuses have poisonous spurs on their hind legs; the venom is powerful enough to kill a dog, but not as yet a human being.
- Restricted to fresh water in rivers, streams and lakes; reasonably common in the Bellinger and Kalang Rivers, but not often seen due to its shyness and inactivity during the middle of the day.

FURTHER READING

Department of Environment, Climate Change and Water- Threatened Species Website

<http://www.threatenedspecies.environment.nsw.gov.au/index.aspx>

PLANT NET – Sydney Royal Botanic Gardens Flora Online Site

<http://plantnet.rbgsyd.nsw.gov.au/floraonline.htm>

Australian Museum Website - animals

<http://australianmuseum.net.au/animals>

Department of Primary Industries NSW- Factsheets on Agriculture, Fishing, Minerals and Forests

<http://www.dpi.nsw.gov.au/aboutus/resources/factsheets>

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Appendix 9.11

Information sheet: 'Doing it by the Book' - Riparian Restoration
Permit Approvals

Riparian Restoration – Doing it by the book....

Introduction

This leaflet aims to give Bellingen Shire residents an understanding of permit and approval requirements for riverbank restoration activities including bank/bed stabilisation and erosion control works and improving riparian vegetation. There are significant government controls over any activities close to streams and rivers. This aims to minimise impacts of human activities.. Restoration projects which require revegetation only will not need a permit (if undertaken with landholder approval) but projects which require an engineering approach will. The restoration treatment option selected will vary depending on the particular site characteristics, local availability and cost of materials and should balance maximum chance of long term success, minimal environmental impact, cost and practicality. Engineering treatments are usually coupled with planting woody native vegetation on the banks next to works which provides long term and broader scale protection to the bank beyond the physical extent of the engineering works.

Project Planning

River and stream banks are dynamic systems and successful stabilisation and management can be challenging and potentially expensive. It is therefore important to have the best possible plan for your restoration project based on expert advice. This can be sourced through a site visit from a Northern Rivers Catchment Management Authority (CMA) Catchment Officer, Council River Health Projects Officer and/or local Landcare staff. These staff are trained in the special knowledge necessary to assess your site and help develop plans for restoration projects.

The site visit will result in a works/site plan developed by the CMA Officer. This will typically include dimensions, materials, cross sections, an outline specification and description of the works and their location and will include landholder name and contact number, street address and Lot/DP number. This information will form the basis of applications for the relevant permits and approvals. This project plan is the main tool you will have to communicate your project proposal to the government agencies which will permit the works and is therefore an important part of the process.

In Bellingen Shire, up to five government agencies can be involved in permitting river restoration activities and the process can be tedious. Staff working in permitting agencies generally make judgements and decisions on your proposal based on the information you provide them without visiting the site, so the more detailed and well communicated your project description and plans are, the easier it is for them to understand and approve your proposal. The key elements for you to prepare and collate before you proceed with obtaining permits/ approvals from the relevant agencies include:

- Consent from all landholders involved- it is important to ascertain who owns the land and gain their support at an early stage (i.e. before lodging applications for funding).
- A clear plan showing where you are proposing to carry out the works (with property boundaries marked in) preferably overlying or clearly related to an aerial photograph or topographic map.
- The works/site plan developed by the CMA Catchment Officer, Council River Health Projects Officer and/or Landcare staff.

Statement of the envisaged environmental impact and benefits of the proposal. The level of detail required here depends on the extent and scope of works (for assistance contact relevant staff as outlined previously).

Permits and approvals

The agencies potentially involved in approving works and a brief description of requirements are detailed below. Each agency produces guidelines and information aimed at helping landholders develop their projects and fill in forms. Researching and understanding these is an important part of project development. Advice is also available from the Landcare or Council office.

Permit type/ Agency Details/Links to Key Documents	Agency involvement
<p>Development Consent</p> <p>Bellingen Shire Council Environmental Health & Planning Department Ph: (02) 6655 7300 www.bellingen.nsw.gov.au</p> <p>Planning information http://www.bellingen.nsw.gov.au/planning.html</p> <p>Development application forms http://www.bellingen.nsw.gov.au/planning/1471.html</p>	<p>Council can be involved in approving and coordinating river restoration works in the Shire and controls and coordinates the activity through its Development Consent process. Generally speaking if works are to be undertaken above the tidal limit then the project is exempt from a Development Application (D/A) requirement. However exceptions apply and it is essential that you confirm this with Council prior to commencing any works. If there is a D/A requirement, it is a good idea to meet with a Council officer before or when lodging the D/A to discuss the works with them. They can assist you and ensure that you have attached sufficient information for them to assess the application and refer it to the appropriate government department.</p> <p>A D/A for environmental restoration is subject to a fee. For riverbank restoration works with a high public benefit, it is reasonable to ask for the fee to be waived and it is best to do this in writing at time of application.</p>
<p>Owners Consent &/or License</p> <p>Land & Property Management Authority (LPMA) Crown Lands Division Ph: (02) 6640 3400 www.lands.nsw.gov.au</p> <p>Boundary determinations general information http://rgdirections.lands.nsw.gov.au/deposited_plans/boundary_definition/general_principles</p> <p>Natural boundaries including riparian boundaries http://rgdirections.lands.nsw.gov.au/deposited_plans/natural_boundaries</p>	<p>Consent may be needed from LPMA who may own part of the land (the river bed or banks) where the works are being carried out. If the works involve structures on Crown and then you will also need a license from the LPMA. Generally structural works undertaken beyond water's edge will involve Crown land. It is advisable to carry out the land status search with LPMA before proceeding with a request for owners consent. A processing fee applies- contact LPMA for details. Even if the works do not involve structures, you will still be required to obtain an authority to occupy the subject Crown lands. The authority serves two purposes: it gives you a legal interest in the land for the term of the works; and also indemnifies the Crown. If you hold an authority from the LPMA under the Crown Lands Act then exemptions may apply under other legislation such as the Fisheries Management Act and the Water Management Act.</p> <p>In some cases survey may be required to identify where property boundaries are in relation to the river as this may change over time.</p>
<p>Controlled Activity Approval</p> <p>Department of Environment, Climate Change & Water NSW Office of Water (NOW) Phone: (02) 6676 7386 www.water.nsw.gov.au</p> <p>Information on approvals and link to Controlled Activity Application form http://www.water.nsw.gov.au/Water-licensing/Approvals/Controlled-activities/rights_controlled_faq/default.aspx</p>	<p>River restoration structural works within 40m of a watercourse require a Controlled Activity Approval under the Water Management Act 2000. The Application form is available on the NOW website or through the Landcare office. Most of the information required for the NOW assessment should be outlined in the works/site plan (see Project Planning above). Current advice is to complete the Controlled Activity application and attach a copy of the Council D/A (if required).</p> <p>Fees apply to CAA - contact NOW for details</p>

<p>Fisheries Management Act Part 7 Permit</p> <p>NSW Department of Industry & Investment (DI&I; formerly DPI) Aquatic Habitat Protection Unit Ph: (02) 6626 1269 www.dpi.nsw.gov.au</p> <p>Information on planning and approvals http://www.dpi.nsw.gov.au/fisheries/habitat/protecting-habitats</p> <p>Link to permit under Fisheries Management Act http://www.dpi.nsw.gov.au/fisheries/habitat/protecting-habitats/activities-requiring-a-permit</p>	<p>A permit under the Fisheries Management Act 1994 may be needed if works and structures are likely to have impacts on fish passage, harm marine vegetation or involve dredging or reclamation in waterways. Works which require excavation in the bed of the stream, obstructing the free passage of fish (eg crossings and revetments/deflection groynes) or which impact on marine vegetation may also require a permit under the Fisheries Management Act. Although the basic information required is similar to the CAA, this application requires more detail. There is coordination of permitting between OOW and DI&I which may result in a permit from one agency (NOW) covering the requirements of both. It is important that you contact DI&I to confirm requirements before commencing works. Fees may be applicable – contact the department for more details.</p>
<p>Native Vegetation Act Department of Environment and Climate Change and Water</p> <p>Northern Rivers Catchment Management Authority Ph: (02) 6653 0150 www.northern.cma.nsw.gov.au</p> <p>Information on approvals http://www.northern.cma.nsw.gov.au/programmes_native_vegetation.php</p> <p>Guidelines for clearing exotic vegetation on state protected land http://www.environment.nsw.gov.au/resources/vegetation/splguideline.pdf</p>	<p>Generally restoration works will re-establish native vegetation as part of the project but there may be cases where vegetation needs to be removed or earthworks carried out to facilitate works. Under the Native Vegetation Act 2003 approval is not required where works are carried out under a CAA or other license under the Water Management Act. Therefore such clearing should be clearly identified on the works/site plan (see Project Planning above) and other permits for the proposed works should cover this without a separate application. Under the NV Act approval is required through DECCWA for the clearing of exotic or dead native vegetation on "State Protected Land" (includes most riparian land) unless carried out in accordance with the Ministers Guideline for the clearing of exotic trees and dead native trees on state protected land which is available through the Landcare or Council Office.</p> <p>Under the NV Act approval is required through the NRCMA for the clearing of Native Vegetation unless it is land excluded from the act, excluded clearing, permitted clearing or a permitted activity. The NRCMA will assist in identifying any exemption.</p>

Check List	Y/N
Discussions with Bellingen Shire Council to determine need for D/A	
Site and works plan developed with Northern Rivers Catchment Management Authority officer	
Boundary locations clarified	
LPMA consent as landholder and licence if necessary obtained (if any works on Crown land)	
NSW Office of Water permit obtained (works within 40m of a stream)	
NSW DI & I permit obtained if necessary (in stream works)	
Northern Rivers Catchment Management Authority Vegetation clearing permit obtained if necessary	
Discussions with Landcare on re-planting guidelines and species	

Appendix 9.12

Information sheet: Growing Lomandra by Seed

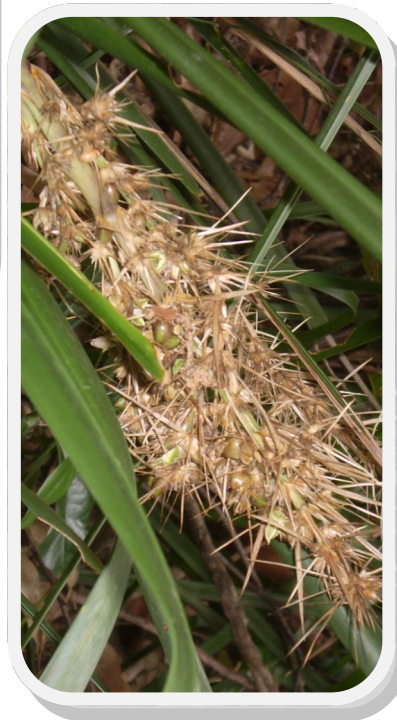
Growing

Lomandra from seed

A step by step guide for landholders



THE MAT RUSH *LOMANDRA HYSTRIX* IS AN IMPORTANT RIVER BANK STABILISER



A female seed head of *Lomandra hystrix* showing the ball like seed containing fruit



Lomandra hystrix or river mat rush is important riparian species that stabilises the banks of waterways. Landholders often need them in large numbers for dense riparian plantings. They are easy to grow from seed and it is worthwhile having a go at growing your own. This leaflet explains how.

The species has separate male and female plants which are most easily identified when they are fruiting from December to February. The female plants seed heads are much more robust with hundreds of tightly held “ball” like fruits. In nature the seeds are shot out explosively, so the seed heads need to be collected before seed release has begun. However, the seeds need to be ripe and the easiest way to do this is to test the seed “balls” with your fingernail: if they are firm to hard they are ready to harvest.

Cut the flowering stalks and put them in a paper bag in a warm place. The fruit will open and release the seed. There is no need to separate the seed from the other papery fruit parts. The mix should be scattered over firmly packed potting mix in a standard seed tray. Kept moist, the seeds should germinate in 4-6 weeks. Protect the trays from mice which love *Lomandra* seed. When between 50 and 75mm high the seedlings can be potted on into 50mm tubes (recycling centres are often a good, cheap source for these).

Keep well watered and partly shaded for a month or so after potting on and harden off in full sunlight when they are between 100 and 150mm high.

Lomandras will grow to planting size within a season and are robust enough to be planted out when they are around 200-300mm high. Make sure you mark where they have been planted with a stake as they are easily “lost” in summer’s grass growth.

If you already have established *Lomandra* plants on your property, another quick way to propagate them is to dig up and split clumps. Make sure each small clump you plant has a good root system and trim back the leaves to about 1/3 of their original length before planting to help establishment.

Alternatively, the collected seeds can be broadcast on gravel and other disturbed sites where competition by grass is unlikely.

Using *Lomandra*

Although naturally found growing at the toe of river banks during normal flows *Lomandra* can be planted throughout the bank profile. They survive well when submerged during flooding and bend over with water flow to protect the soil beneath.

Bare paddock sites are usually prepared by spot spraying with glyphosate where the *Lomandra* plants are to be planted. If not using herbicide, it is important to remove the grass sward which will compete with *Lomandra*.

To ensure dense coverage of *Lomandra*, especially in actively eroding areas, plant at 0.5-1m centres in an offset, zig-zag pattern with rows 1m apart. The clumps will quickly expand and form dense mats. It is important to mark the *Lomandras* with a stake as they are easily "lost" in summers grass growth.

Plant by loosening the *Lomandra* in the pot by squeezing on the diagonals and place in a hole which should be deep enough for the joint of the shoot and root to be at ground level. Water in and use mulch or place/pin weed mat around each plant if practicable.

It is important to control competition from grass and other weeds particularly in the first few seasons while the plants establish. Herbicide control around the young plants is effective. It can help protect *Lomandra* as you spray by placing a bucket over it.

Hand weeding or brush cutting are alternative maintenance techniques.



Separated seeds ready to sow



Seeds spread on potting mix in seedling tray



Seedling from tray ready for transplanting to pot



Young plants in tubes almost ready for planting

When using chemicals, always follow instructions on the label and wear correct protective clothing.

This brochure has been produced by Bellinger Landcare as part of its 2010 Community Support Project funded by the Australian Government's Caring for our Country Program, the Northern Rivers CMA, DECCW and Bellinger Shire Council.



CARING
FOR
OUR
COUNTRY



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