



Angling for Conservation: Review and extension of conservation and sustainability-focussed initiatives which have been funded, supported or undertaken by Australia's recreational fishing sector

M. Barwick, B. Sawynok, S. Sawynok, D. Ansell and F. Prokop

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2009/333 Angling for Conservation: Review and extension of conservation and sustainability-focussed initiatives which have been funded, supported or undertaken by Australia's recreational fishing sector

Principal Investigator: Matt Barwick
Address: Greenfish Consulting
36 Sydney Street Labrador 4215
Telephone: 0422 752 789

Objectives:

1. Through consultation, identify activities (research, monitoring, education or direct environmental remediation) with a conservation or sustainability focus which have been funded, supported, or undertaken by the recreational fishing sector
2. Compile data relating to relevant activities into a single database
3. Where possible, describe how outputs of relevant activities have been utilised, or may be in future
4. Develop a strategy to communicate project outputs to key stakeholder groups

Non Technical Summary

OUTCOMES ACHIEVED TO DATE

The project "*Angling for Conservation*" has helped to provide a better understanding of the role that recreational fishers around Australia play in caring for our waterways and fish communities. The information gathered highlights that recreational fishers contribute significant value in caring for our waterways and fish stocks. Key findings and outcomes of the project include:

- Recreational fishers demonstrate the importance they place on healthy waterways and fish stocks through significant investment. The recreational fishing community has invested an amazing \$33,141,914 of their own money in projects and activities which have a conservation and sustainability focus.
- Of the variety of project types funded by recreational fishers, habitat improvement projects dominate when measured in terms of number of projects. 18% of all projects funded by the recreational fishing community involved revegetation of river banks and foreshores, 17% involved improvement of fish passage, and 14% involved bank stabilisation works to reduce erosion. By value (total \$ invested) the area of most involvement by the recreational fishing community was research to ensure fisheries remained sustainable (\$9.47m), however projects involving educating anglers and the broader community, monitoring of aquatic ecosystems (in particular fish communities), and improving fish passage (e.g. building fishways, removing old barriers etc) also received significant investment (\$7.9m, \$6.3m and \$5.7m, respectively).
- Most of the projects that have been undertaken have occurred in jurisdictions which have recreational fishing license programs in place, providing a mechanism for fishers to contribute financially to addressing issues they feel are important.

- Recreational fishers have been shown to demonstrate a natural affinity for projects which involve monitoring of fish communities and populations, or projects which focus on educating other recreational fishers and members of the community about the environment and sustainable practices.
- A web based information tool linked to an accessible database has been developed as part of this project, which provides easy access to information on conservation/sustainability related projects undertaken with angler involvement, using Google Earth as a platform. This output provides a useful way to condense a significant amount of project-specific information into a user-friendly format, to enable the user to learn about where projects have occurred, what was achieved, and who was responsible. It is very likely that this output would have broad application for communicating R&D outputs more broadly than applied in *Angling for Conservation*.

KEYWORDS: Recreational fishing, sustainability, conservation, angling, education, habitat, monitoring, research.

Before we start...

As you read this report you will notice the term 'at the time of writing this' a lot. That is because *Angling for Conservation* is not designed to be a static snapshot of angler involvement in conservation and sustainability-focussed activities. The project provides a live database which is continually being updated as new projects commence and as knowledge and outputs are generated from existing projects. In this way it is planned that *Angling for Conservation* will progressively become the primary source of information on angler's involvement in conservation and sustainability projects that is recognised, used, maintained and further developed by the recreational fishing community and accepted by the Australian community.

We would like to thank:

The project team would like to acknowledge the assistance of recreational fishers and representatives of government departments from all jurisdictions throughout Australia. Particular thanks to Charlotte Jenkins, Craig Copeland and Phil Bolton from NSW DPI, Mark Nicolai from TARFish, Neil Morrow from the Inland Fisheries Service, Chris Padovani from Victorian DPI, Chris Makepeace from AFANT, Alison Gibson and Christopher Collins from VRFish, Judy Lynne, John Johnston and David Bateman from Sunfish Queensland, Frank Prokop and Kane Moyle from Recfishwest, Trevor Watts from SARFAC, John Burgess from ANSA, Lorraine Hitch from the Department of Agriculture, Fisheries and Forestry, Shane Jasprizza from the Capital Region Fishing Alliance, Russell Conway from Recfish Australia, Doug Joyner from AFTA, and Graham Woollard from the GFAA. Thanks also to all of the recreational fishers who gave their time in offering information to inform case studies, to ensure that we told their stories as comprehensively as possible. Particular thanks to Bryan Dare, Peter Harding, Alan Fowkes and Alan Izzard, Kurt Edwards, Ben Diggles and Matt Landos.

The project team would also like to thank the Fisheries Research and Development Corporation for their investment and support, and One Pixel for their assistance in database and website development.

How did *Angling for Conservation* come about?

Australia is blessed with some of the most exciting recreational fishing opportunities in the world. Whether chasing black bream on tiny soft plastics in Tasmania's estuaries, or hunting juvenile black marlin on light line around Frazer Island. From tussling with back-breaking Samson fish off Rottnest Island in WA, to straining against knot-testing Murray cod in the mighty Murray. If you are an angler in Australia, you have plenty to smile about.

Successful fishing often relies on the angler's ability to read environmental conditions in order to determine where fish may be holding, and what they may be feeding on. This need to 'tune in' to the natural environment often means that recreational fishers quickly notice when things aren't right, and are often the first to observe and report changes in the environment, illegal activity, declining waterway health or fishery productivity. In reality, whilst many recreational fishers may not see themselves as conservationists, that's exactly what they are as a result of being actively engaged in activities to conserve and sustain the natural environment and in particular, fish stocks.

At Recfish Australia's Annual General Meeting in September 2009 concerns were raised at the fact that whilst recreational fishers are often active champions for environmental sustainability, this is not generally well understood by the broader community, some departments of government, or other interest groups. This concern was later echoed in the report funded by the Boating and Fishing Council of Australia entitled '*Keep Australia Fishing*' in which the author (Martin Salter) called for the recreational fishing community to take measures to highlight existing habitat initiatives and build partnerships with sensible environmental groups where there are common interests, position themselves as the "guardians of the waterside environment" to enable the public and politicians to see understand their contribution as protectors and defenders of the resource, not simply "another bunch of exploiters".

Many within the recreational fishing community acknowledge that there is value in bringing together information on the range of sustainability and conservation-focussed initiatives that recreational anglers have been/are involved with. This will help in developing an understanding of the level to which the fishing community are engaged in caring for Australia's aquatic resources, and communicating this message to stakeholders. *Angling for Conservation* was developed in response to this need. The project seeks to compile information relating to projects and activities with a sustainability or conservation-based focus, which are delivered with the assistance (either financial or physical) of the recreational fishing community.

The project team were conscious of the need to develop outputs from this project which would present the information gathered in interesting and interactive ways. To help achieve this, it was agreed that a web-based information tool should form a key output, which would enable users to quickly and easily find out about projects that have been undertaken with angler input in a given area, at a given time, or on a species of interest. Articles and podcasts were also developed and distributed electronically via a project-based website (www.anglingforconservation.org), to further assist in communicating the efforts of the recreational fishing sector.

What did we set out to achieve?

This project set out to develop an understanding of the role that recreational fishers play in delivering projects and initiatives to care for our waterways and fish stocks. The objectives of this project were as follows:

1. Through consultation, identify activities (research, monitoring, education or direct environmental remediation) with a conservation or sustainability focus which have been funded, supported, or undertaken by the recreational fishing sector
2. Compile data relating to relevant activities into a single database
3. Where possible, describe how outputs of relevant activities have been utilised, or may be in future
4. Develop a strategy to communicate project outputs to key stakeholder groups

How did we go about it?

In order to develop an understanding of the role that recreational fishers play in caring for our waterways and fisheries it was essential to first undertake a detailed review of relevant information, and consult with key representatives within the recreational fishing sector, funding organisations, the tackle industry, fishing media and Government.

The project team initially completed an extensive review of available literature and media, including books, magazines, brochures, websites, newsletters, journals, minutes, and other sources, to compile a database of relevant projects requiring further investigation. Information collected then formed the basis of follow-up phone interviews with recreational fishers, government representatives, and industry representatives, to obtain additional detail on projects of interest, and seek further advice on projects not already included. These interviews were supplemented by information provided by recreational fishers who learned about the project through postings on online forums, distribution of flyers, and other fishers.

A range of details were collected about each project including:

- Project delivery information
 - Issue(s) addressed (e.g. weed infestation, water quality decline, fish passage disruption)
 - Type of activity undertaken (e.g. monitoring, fishway construction etc)
 - Objectives
 - Outcomes achieved
 - Species or group of species impacted
- Temporal information (start/end date)
- Spatial information
 - Latitude/longitude
 - Habitat type within which it took place (fresh/estuarine/marine)
 - Municipalities affected
- Project administration information
 - Project contact
 - Funding body
 - Level of investment

Photos and reports for relevant projects were also collected. A web-based (SQL) database was developed to house data collected.

The need was identified to develop project outputs which would assist in making information gathered easily digestible, interesting, and relevant to the audience. Put simply, a database and final report wasn't going to cut it. It was originally intended to develop a book about recreational fishers involved in sustainability and conservation-based products called "Fishers Turning Green". However through discussions with a publishing group it was identified that the relatively small audience for such a product would not justify the cost associated with development of the product, and it was recommended that a website be considered as a viable alternative. The project team quickly recognised the benefit of this approach, in that a website would be accessible to anyone with a computer, and the interactive nature of the format would offer more variety in how users could experience outputs of *Angling for Conservation*. Consequently a website was developed for the project (www.anglingforconservation.org) to both provide an improved understanding on the need for anglers to take an active role in conservation and sustainability initiatives, and also to help end users to learn about projects already underway or complete with angler involvement through short articles and podcasts available for download (these will continue to be added to over time). A Facebook site was also developed for the project to provide a forum for discussion about projects included in outputs included as part of *Angling for Conservation*.

A key innovative output of *Angling for Conservation* is a web-based information tool located on the project website which enables the user to interact with information gathered during *Angling for Conservation* in time and space, and by subject or species of interest using Google Earth™ as a platform (see Figure 1). In this way the user can explore information on

projects undertaken along a spectrum of resolution, depending on the level of information they require. At a national scale, the user can - at a glance - gain an understanding of how much activity had been undertaken by recreational fishers, and in what locations. They can then 'drill down' into specific regions, or search by activity type (e.g. habitat rehabilitation or monitoring), by species, start/end date, or other searchable fields to learn about what has been undertaken from the perspective of their viewpoint of interest.

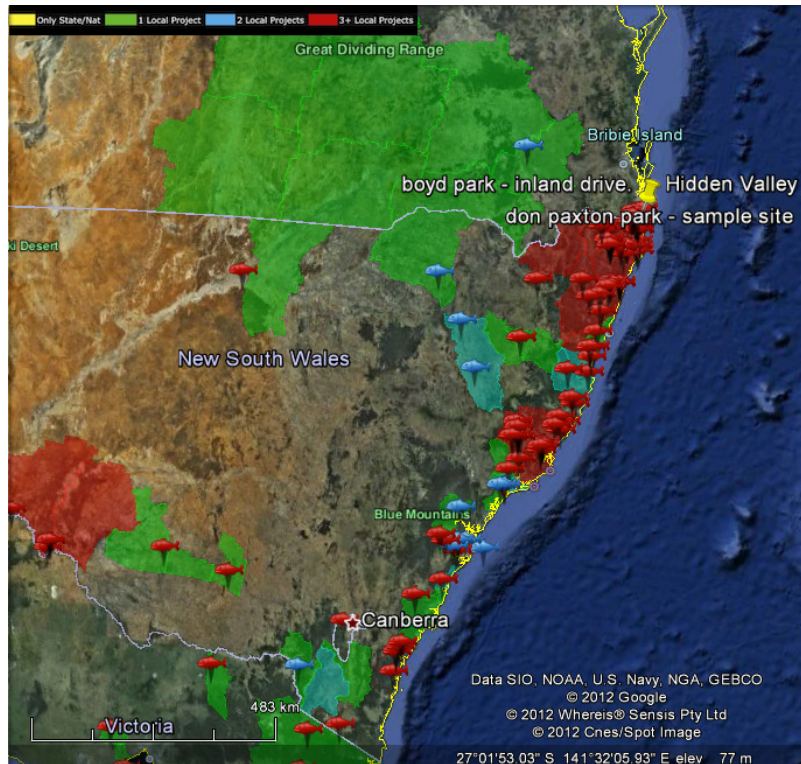


Figure 1 Mapping interface of *Angling for Conservation*, which shows (in this instance) where projects matching criteria nominated by the user have occurred throughout south eastern Australia

The user is then able to click on a project of interest, which initiates a pop-up summary report explaining to the viewer what the project set out to achieve, whether it achieved its planned outcomes, who was involved, and who funded the project (see Figure 2). Photos, video files or reports associated with the project are also provided as links to the pop-up report where they have been provided, to enable the user to access still greater levels of detail, should they choose.

Users of the *Angling for Conservation* information tool are also able to submit information on projects not yet included in the database, or provide updates on the progress of projects through a page on the website. They can also set up an auto-update function, which sends them an email if a new project or projects are added to the database addressing criteria of interest (these are nominated by the user).

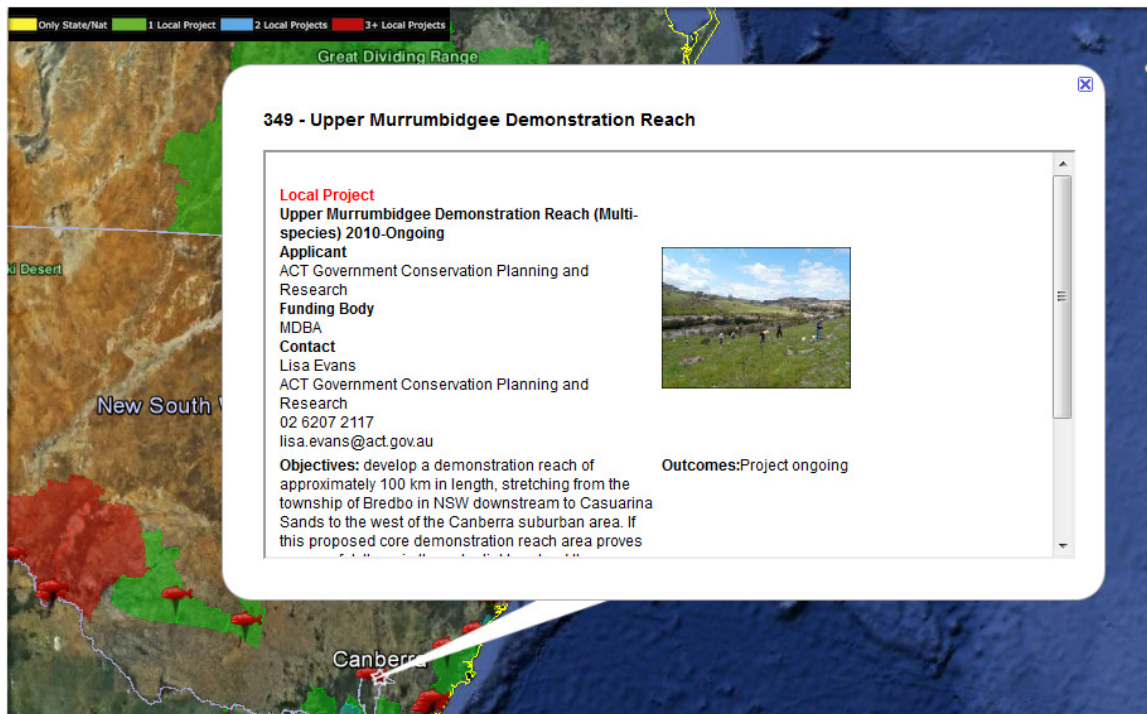


Figure 2 In selecting a project of interest, the user is then able to explore more detailed information, including links to reports and videos, and contact details to obtain more information.

What was included, what wasn't

Angling for Conservation has attempted to provide the first estimate of angler involvement in conservation and sustainability initiatives. It was important to attempt to include only activities and initiatives that have been undertaken primarily with a sustainability or conservation focus, and consequently there was a need to initially define what should be included, and what should not.

Projects or activities involving buying out other resource users (such as Recreational Fishing Havens declared in New South Wales) have not been included in the *Angling for Conservation* database, even though they are often undertaken to achieve a sustainability outcome. This decision was made because resource allocation can be motivated by a number of factors, in addition to a desire for increased sustainability.

It was also agreed that stocking activities would only be included in the *Angling for Conservation database* under certain conditions. Specifically, stocking activities were included if they involved stocking of species which could not be targeted recreationally (for example, trout cod), or if the stocking events related to research to understand the benefits or costs associated with stocking. This decision was made for two reasons. Firstly, it was considered to be a significant task (and beyond the scope of this project) to compile information on every stocking event that has taken place within Australia. Secondly, stocking can be undertaken for a variety of reasons, which include (but are not limited to) the desire to sustain wild populations.

Installation of artificial reefs was included as they offer additional habitat for both species that are recreationally targeted as well as other non-fished species. Installation of pontoon structures were also included where they were intended to reduce erosion at the fishing site associated with fishing activities (thereby providing habitat protection and water quality

enhancement outcomes). Lobbying and advocacy activities were included only where they clearly related to conservation of natural resources (such as stopping a development likely to impact on ecosystem health).

Separating projects by activity type

To help users of *Angling for Conservation* to understand the sorts of activities that recreational fishers are most involved in, projects were grouped on the basis of the activity (or activities) they involved, as follows:

- Revegetation – planting of native vegetation to enhance habitat values;
- Re-snagging – installing woody debris into waterways for fish habitat;
- Technology change – introduction and adoption of new equipment/behaviours to enhance sustainability/conservation outcomes;
- Bank stabilisation – undertaking works to reduce erosion and improve water quality;
- Weed control – the management of introduced weed species (both terrestrial and aquatic) to enable recovery of native vegetation and ecosystems;
- Fish passage restoration – installation of fishways or removal of barriers to restore free movement of fish;
- Monitoring – collection of information to enable health of aquatic ecosystems/fish communities to be assessed;
- Pest control – the management of introduced pest species (e.g. Carp, Tilapia) to enable recovery of native fish communities;
- Management – involvement in management responses and decisions;
- Community enhancement – undertaking activities to enhance fish populations or communities (e.g. research to understand/maximise benefits received through stocking);
- Environmental flows – planned delivery of water to an ecosystem to provide environmental benefit; and
- Sustainability R&D – undertaking Research or Development activities to help ensure human interaction with fish populations and aquatic communities remains sustainable.

Of course, projects were able to be allocated to more than one of the abovementioned activity types in instances where this was appropriate. This created some challenges when it came to apportioning investment against each activity type. It was not considered feasible to look at the budget of each project individually and allocate an appropriate proportion to each activity. Instead in instances where a project has involved more than one activity type it has been counted against both activity. For example if a \$100,000 project addressed both poor water quality and disruption of fish passage, that \$100,000 was considered to contribute towards achieving both objectives. It should be noted however that in calculating the total investment

made by recreational fishers for all issues, each project was only counted once (i.e. total investment figures reported are an accurate representation of actual investment made by the recreational sector). In fact, it is likely that this would be a significant underestimate of investment, because many of the projects included in *Angling for Conservation* were delivered largely through voluntary investment of angler time (which was not incorporated into costings).

So what have we learned through Angling for Conservation?

Rec fishers are not afraid to put their hands in their pockets in the name of sustainability

The FRDC-funded “*Angling for Conservation*” project has helped to improve our understanding of the role that recreational fishers play in caring for our waterways and fish communities in Australia. The information gathered highlights that some sectors within the recreational fishing community are quite active in caring for our aquatic resources – particularly when it comes to investment.



Figure 3 Anglers involved in a project investigating the benefits of re-snagging (Source: Jarod Lyons)

At the time of writing this, the recreational angling community in Australia had invested approximately \$33,142 million of their own money in projects and activities which have a conservation and sustainability focus. Investment was found to be particularly significant within jurisdictions with fishing licenses, potentially highlighting the benefits which can flow from licensing systems.

The level of involvement by the recreational sector in each of the activity areas described above was examined in terms of relative number of projects, and total investment. Of approximately 351 sustainability/conservation-focussed projects funded by recreational fishers nationally which have been included in the *Angling for Conservation* database to date,

the largest percentage (in terms of number of projects) involved on-ground actions to improve fish habitat. 18% of all projects funded by the recreational fishing community involved revegetation of river banks and foreshores, 17% involved improvement of fish passage, and 14% involved bank stabilisation works to reduce erosion (see Figure 4). In terms of the value of investment however, the recreational sector invested more significantly in research to ensure fisheries remained sustainable (\$9.47m). Projects involving educating anglers and the broader community, monitoring of aquatic ecosystems (in particular fish communities), and improving fish passage (e.g. building fishways, removing old barriers etc) also received significant investment (\$7.9m, \$6.3m and \$5.7m, respectively). The recreational fishing community had also invested approximately \$2.3m in research and initiatives relating to enhancement of communities, and \$2.2m in projects to control pest species such as Carp.

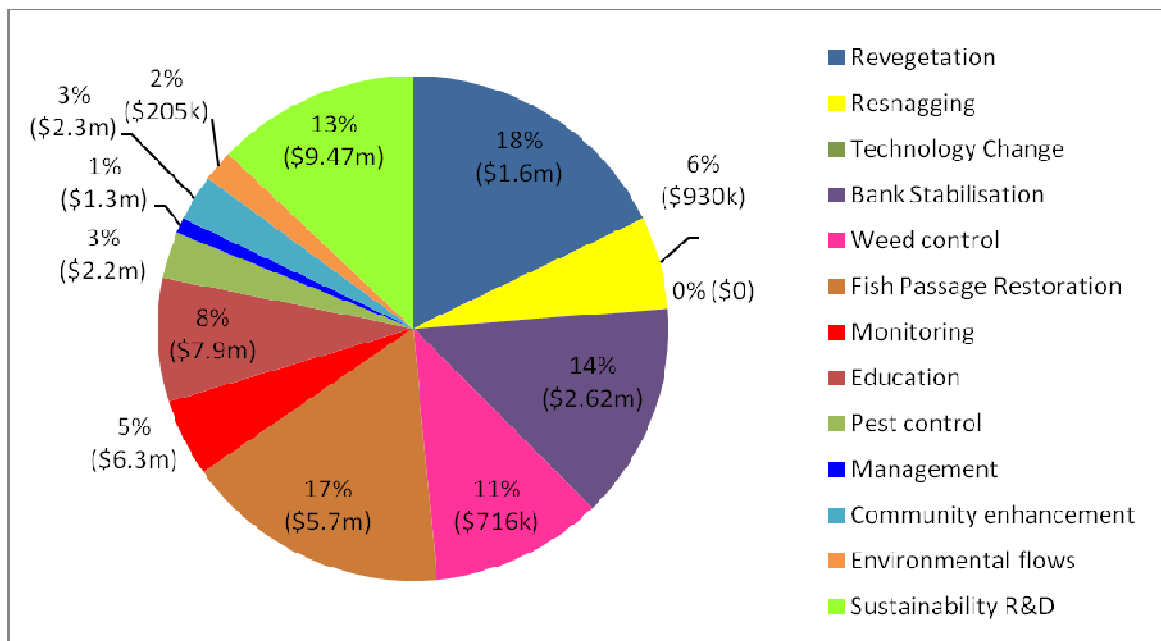


Figure 4 Percentage of 351 sustainability/conservation-focused projects funded by recreational fishers nationally in each area, and total investment to date by recreational fishers in each area (\$)

It should be noted here that investment made by recreational fishers in a number of activity areas, particularly 'Technology change', 'Monitoring' and 'Education' are likely to be significantly underestimated because many of the projects of this nature have often been delivered largely through voluntary investment of angler time (which is not incorporated into costings). Examples include efforts of ANSA in implementing new arrangements to enable use of breakaway rigs in competitive fishing (to reduce discarded line) and introduction of master angler awards (which are focussed towards returning fish to the water with minimal injury). These initiatives (grouped under 'technology change' in Figure 4 above) were implemented through voluntary contribution of angler time, and so are not well captured when describing investment by recreational fishers. Their contribution to sustainability outcomes, however, are significant.

Other examples not well reflected through the reporting of level of investment include the Schoolfish Program delivered by Sunfish Queensland, in which Sunfish members travel to schools throughout southeast Queensland to teach children about caring for our waterways and marine environment, and sustainable fishing. Fishcare volunteer programs in several jurisdictions (which enlist the voluntary help of recreational fishers to distribute information and educational material, offer assistance to recreational fishers, collect recreational fish catch data, visit schools and angling clubs and assist other natural resource related

programs) have also delivered significant benefits through educating recreational fishers and the broader community, but are not captured well in reporting investment due to significant voluntary contribution of time by participants.

Information gathered through “*Angling for Conservation*” highlights the significant contribution that the recreational fishing sector has made through investment in conservation and sustainability outcomes for fish communities and waterways throughout Australia. Examples include:

- funding of the installation of a rock-ramp fishway at Lockett’s Crossing on the Coolongolook River which has restored fish passage to approximately 63 kilometres of excellent habitat upstream
- enhancement of riverside vegetation along the Nicholson River in Victoria in which the riverside vegetation was enhanced through installation of 300m of fencing to exclude livestock, planting of over 1200 trees to protect the river bank from erosion and encourage regrowth of natural vegetation, stabilisation of snags for fish habitat and erosion protection.

Australia’s recreational fishers aren’t afraid to roll up their sleeves in the name of sustainability either

Information collected through “*Angling for Conservation*” also demonstrates that some groups and individuals within Australia’s recreational fishing community are fairly active in on-ground delivery of projects with a sustainability/conservation focus as well, though there is potential to do more. At the time of writing this the angling community had played a leading role in the delivery of over \$1.3 million worth of projects nationally.

Many recreational fishers have a natural desire to understand our waterways and fish, or a love for sharing information with others, and this appears to be reflected in the types of projects that they get involved in most frequently. Of the 51 projects delivered by recreational fishers, 25% of them (with a total value of \$284,000) have focussed on educating recreational fishers, children and/or the broader community (Figure 5). 16% of projects (with a total value of \$400,000) delivered by the recreational fishing community have involved monitoring of fish communities and ecosystems. Projects focussing on technology change (e.g. adopting more sustainable equipment or fishing practices) were also common (13% of all projects delivered by recreational fishers involved adoption of new technology or behaviours, with a total value of \$286,000), as were projects involving revegetation (13% of projects with a total investment value of \$73 million), and bank stabilisation to reduce erosion (8% of projects with a total value of \$345,000).

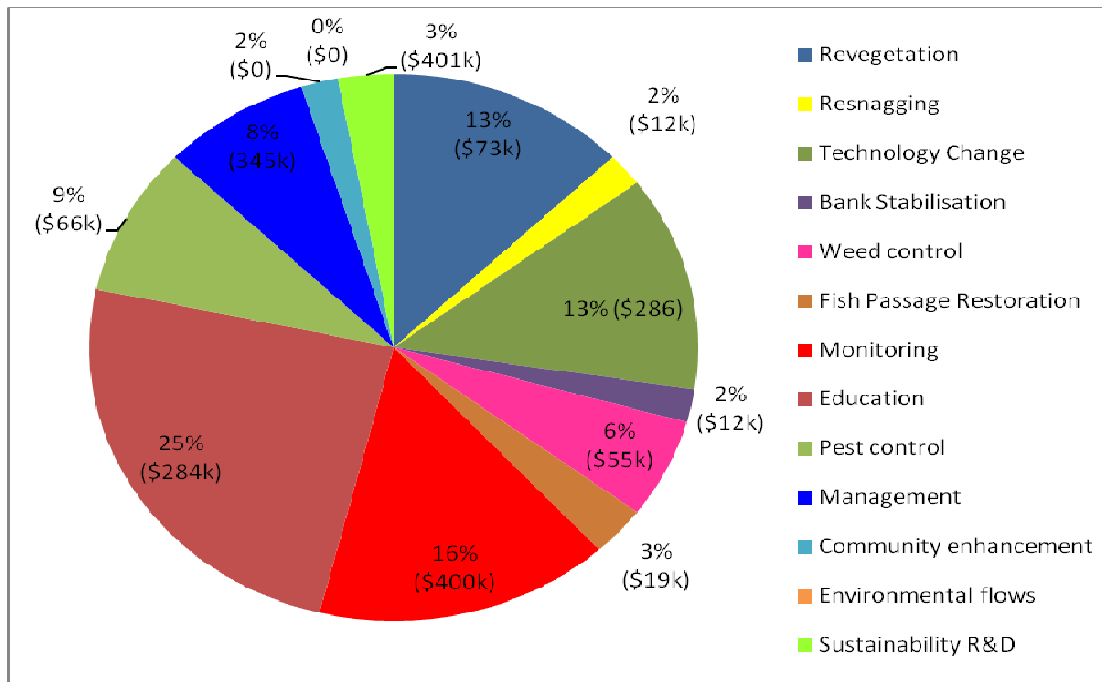


Figure 5 Percentage of 51 sustainability/conservation-focused projects whose delivery have been led by recreational fishers nationally in each area, and total investment to date by recreational fishers in each area (\$)

Examples of projects which have been undertaken with leadership from by the recreational fishing community include:

- Development and implementation of the Neatfish program, which is a national accreditation system for fishing competitions which involves an assessment of a fishing competition under a Standard to provide a score under a five star system, which encourages best practice in social and environmental practices
- The Great Australian Shark Count, which is an monitoring program managed and undertaken by spearfishers, which has grown to become the largest community shark count in the world, with over 7500 sightings recorded.
- Introduction of length only national and state records by ANSA, which has reduced the number of trophy fish taken in order to claim national and state records, and enabled quicker release of fish to maximise survival.
- Initiation of 'Halt the Salt', a lobby effort to stop the world's largest salt mine from being built on the sensitive eastern edge of the Exmouth Gulf. Collaborative efforts of Western Australian peak body Recfish West, in conjunction with the Conservation Council of Western Australia, the MG Kailis Group and others involved in the Halt the Salt Alliance resulted in termination of the proposal in 2010.
- Ongoing rehabilitation of a stretch of river at Emu Plains by Bass Sydney in partnership with McCarthy Catholic College, GA, Penrith City Council, Springwood Bass and the Hawkesbury/Nepean CMA, involving clearing of invasive weeds, collecting of seeds of native species of the area and to replanting.
- The annual 'Clean up the 'Pin' event run by Sunfish Queensland, which has resulted in the removal of approximately 150t of waste from the area (around 8t per event), inspired the involvement of approximately 1200 people in habitat rehabilitation activities (around 70 per event), raised community awareness on the need for action to care for our fishing habitats and received State and Federal awards for most significant community-based rehabilitation project.

Recreational fishers also often play a supporting role in sustainability

Recreational fishers have also played a smaller supporting role, or were supportive of the delivery of approximately 165 projects around Australia with a conservation or sustainability focus, with a total value of \$56.7 million dollars. Of these, approximately 24% involved educational activities, 19% involved monitoring of fish communities and aquatic systems, 14% involved the delivery of research to ensure sustainable fisheries, with other activities comprising the remainder (Figure 6).

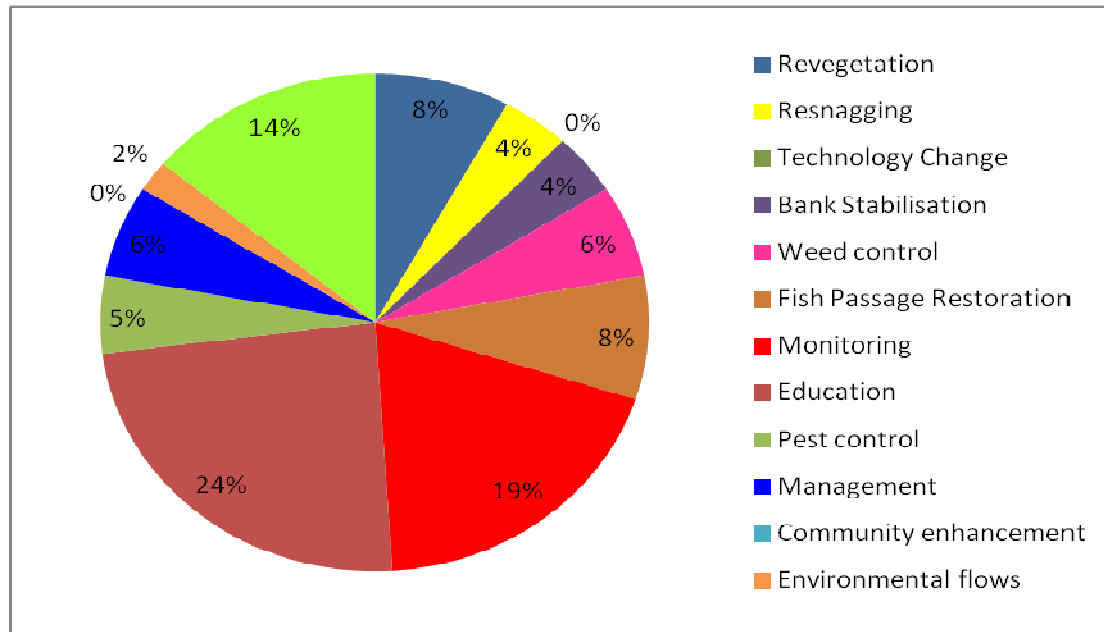


Figure 6 Percentage of 165 sustainability/conservation-focused projects whose delivery has been supported by recreational fishers nationally in each area.

Examples of projects which have been supported by the recreational fishing community include:

- the construction of a Fishway and Multi-level Offtake on Tallowa Dam on the Shoalhaven River (angler involvement has included engagement in consultation processes to establish the need for these structures during early development, through to undertaking fish monitoring activities to track rehabilitation of the river following completion (See case studies section below for more information);
- the Barred Galaxias recovery program at Marysville, in which members of the Australian Trout Foundation provided much-needed assistance to one of Australia's most endangered, and Victoria's only endemic, freshwater fish, which was affected by the 2009 bushfires through habitat restoration works;
- planning and implementation of the Hollands Creek Demonstration Reach, which has involved the installation of 15km of riparian fencing since January 2007, removal of willows from a 2.4 m stretch of river of willows, and undertaking of weed control over a 6.55 km of river in 2008/09. There has been some discussion of reintroducing Macquarie perch into this stretch of river as well.
- changing of the legal length for pink snapper as of 6 July 2007 to 41cm (to become consistent with everywhere else in Western Australia, except for Shark Bay's inner gulfs where a size limit of 50cm applies). This new minimum size limit applies to both recreational and commercial fishers.
- FRDC project "*Management and Monitoring of Fish Spawning Aggregations within the West Coast Bioregion of Western Australia*" which helped to provide an increased understanding of the ecological and fisheries importance of fish spawning aggregations.

To summarise

Recreational fishers are significant investors in the sustainable management of Australia's fish communities and waterways, and also show a desire and capacity for involvement in hands-on delivery of projects to care for Australia's fisheries. Recreational fishers appear to have a natural affinity with projects which involve monitoring of fish communities and ecosystems, and also education of fishers and the broader community.

Whilst the fishing community are clearly active in conserving our waterways and fish stocks, there is always a need to do more. With over 4 million recreational fishers throughout Australia the recreational fishing community has the capacity to become a significant force in caring for our waterways and fish stocks.

It is encouraging to note that one of four actions identified at the National Recreational Fishing Conference in August 2012 was the need to develop and implement a national strategy on fish habitat to improve recreational fishing opportunities. Successful international models such as the Wye and Usk Foundation in the United Kingdom and Trout unlimited in the United States demonstrate the significant role that recreational fishers can play in active conservation of aquatic systems to maximise the ecosystem services returned to the fishing community.

In Australia there is a need to develop and implement programs to further engage recreational fishers in caring for fisheries resources, including allocation of financial resources towards education/coordination programs and implementation initiatives, particularly within jurisdictions without benefit of a fishing license scheme. The Fish Habitat Network was identified as a particularly proactive and effective initiative, both in terms of motivating and educating the recreational fishing community, and achieving on-ground outcomes in terms of habitat enhancement. It is recommended that options be considered to facilitate further expansion of the network, and increase its capabilities in terms of on-ground action at a national scale.

Some case studies

Plastic not-so-fantastic. Sunfish working with industry to reduce marine debris



When plastic was introduced into Australia in around 1917, it was mainly used to manufacture items such as buttons, knobs, jewellery, radio parts, and electrical fittings. It wasn't until World War II that the full potential of plastic for use in the manufacture of a wide range of products was realised, when a shortage in many conventional materials necessitated exploration of other alternatives to manufacture products such as parachutes. The durability and cheap production cost of plastic materials helped carve a niche during post-war years, with a boom occurring in the 1970s and '80s in the manufacture products such as film, bags, milk and fruit juice bottles using high density polyethylene (HDPE)¹.

Unfortunately the low cost of production and durability also played a key role in the amount of plastic refuse which began to accumulate in the natural environment shortly afterwards. It has been estimated that of approximately 7 billion tonnes of debris enters our oceans annually, and around 60% of it is plastic products². Approximately 50-80 million plastic bags alone were estimated to enter the Australian environment as litter every year in 2002 (though the number is believed to have declined in recent years³. There have been a number of estimates of the

¹ Plastics - History, Types & Processing www.plasticsaust.com.au

²

http://www.derm.qld.gov.au/environmental_management/coast_and_oceans/coastal_management/beach_and_ocean_litter

³ <http://www.environment.gov.au/settlements/waste/plastic-bags/index.html>

length of time that plastics remain in the environment without breaking down⁴, with estimates ranging from 10-20 years to 600 years⁵. What we know for sure is that plastic can remain in the environment for a long time, and can be harmful for wildlife. It has been estimated that around one million seabirds and 100,000 marine mammals and turtles (including 30,000 seals) are killed by plastic marine litter every year around the world⁶. 44% of all seabirds are believed to ingest plastic materials⁷

When plastic came along it certainly solved a lot of problems for the bait industry. Plastic bags offered improved water resistance, strength, and hygienic properties over paper-based products such as newspaper (which were commonly used up until this time). Consequently the bait industry was among many others in quickly adopting plastic products to package their products. Unfortunately, plastic bait bags have now become a common type of refuse found washed up in estuarine regions around Australia. Over three million bait bags are used in Queensland alone each year⁸, and their use in close proximity to the ocean unfortunately means that a fairly large number are lost or discarded at sea.

Around 1998 Queensland's recreational fishing peak body (Sunfish) were among the first organisations in Australia to start experimenting with biodegradable plastic bags. Like others, they were alarmed at the significant volumes of discarded/lost bait bags in the environment, but were uniquely equipped to explore solutions to the issue, enlisting the help of long-time Sunfish member and retired plastics engineer, Harold Abell. Harold worked with plastic production company Jonmar Plastics in Brisbane, investigating use of cornstarch material to create packaging with plastic properties, but the additional attribute of being biodegradable. Jon Firman from Jonmar managed to utilise existing plastic manufacturing plant to produce biodegradable bait bags made of cornstarch, which possessed all of the desirable characteristics of plastic (durability, freezability, transparency), with the additional attribute of being biodegradable, and at a cost only marginally more expensive than conventional plastic bags.

Once they were sure that the packaging product they had developed met required specifications, they approached the major bait production companies to discuss adoption. Markwell's Bait (which later became Terry's Bait) agreed to trial the cornstarch bags on two of their primary products. At the time this was big news; a national first. A press release went out on 29 May 2001 advising of the trial:

⁴ Moore C.J. (2008). Synthetic polymers in the marine environment: A rapidly increasing, long-term threat. *Environmental Research*, Volume 8, Issue 2, Pp 131-139.

⁵

http://www.derm.qld.gov.au/environmental_management/coast_and_oceans/coastal_management/beach_and_ocean_litter

⁶ Dr David Kemp, Minister for the Environment and Heritage March 2004

⁷ Moore C.J. (2008). Synthetic polymers in the marine environment: A rapidly increasing, long-term threat. *Environmental Research*, Volume 8, Issue 2, Pp 131-139.

⁸ Sustainable packaging covenant, Queensland Government Environmental Protection Agency, www.soe-townsville.org/data/National_Packaging_Covenant_Queensland_achievements_20002005.pdf

“Queensland-based fishing bait retailer Markwell’s has partnered with the EPA, Sea World, Sunfish Queensland, PCC Packaging and Healthy Waterways to make biodegradable bait bags a reality in the market place.

Thousands of biodegradable bait bags have been sold over the past three years with plans to introduce different sizes and bait types. While production of these bags is currently more costly than conventional plastic bags, Markwell’s is selling biodegradable bags at the same price.

The EPA has been working with the fishing bait industry to find a longterm solution to the serious environmental impact of plastic bait bags.”

The new bag is 100 per cent biodegradable, decomposing in around 12 weeks to six months.”

The then Environmental Minister Dean Wells officially launched the bags, observing that they would “drastically cut the pollution levels on Queensland’s beaches and waterways”. Thousands of biodegradable bait bags were sold over a three year period, and there were plans to introduce different sizes and bait types to the biodegradable range. However unfortunately Terry’s Bait is no longer in business, and so these products are again no longer available on the Australian market.

At around the same time the Tweed Shire Council was undertaking a trial of their own producing approximately 30,000 biodegradable plastic bait bags for retail sale in the local area in 1996. The bait bags trialled by Tweed Bait were developed using international technology, brought to Australia by Fidene Corporation, and manufactured by B.J. Packaging of Brisbane. The bags were found to cost around 10 cents more per unit, but the Council undertook a phone poll of around 150 people from within the area, who indicated that they would happily pay the extra. Both Tweed Shire Council and Redcliffe City Council each donated \$2000 to pay for the trial which has the support of environment groups.

Through consultation with industry representatives it was revealed that the trial undertaken by Tweed Bait may have yielded unsatisfying results. The type of bags used were reported to perform poorly with respect to biodegradability (though it was not clear whether tests were completed within conditions conducive to biodegradation). Further, the bags were found to be comparatively less durable and often split when frozen, so the trial was discontinued.

It might be time for the recreational fishing sector to resume leadership in exploring options to assist major bait companies in trialling and selecting the optimal product for use, including follow-up analysis of comparative sales to measure customer satisfaction and willingness to pay. Watch this space....

Bass Sydney – it's all about the habitat

Bass Sydney was one of the first fishing clubs in Australia to start to get seriously involved with the conservation of our waterways and fish stocks. So dedicated are the members of this group that *“providing any kind of financial or other assistance to, or in respect of, specific conservation projects”* is one of the key tenets of their constitution. Whilst there are anglers all over Australia getting involved in conservation-based activities, it is pretty unique for an angling club to identify this function as core to their existence. And the members of Bass Sydney have been actively involved in protecting and enhancing our waterways and fish stocks for nearly 30 years now.

Alan Fowkes has been involved with Bass Sydney for over 20 years, and has seen the club grow and evolve over that period. He recalls it was Bass Sydney's focus on conservation which initially appealed to him. “Back in the early days Bass Sydney counted a number of high profile recreational angling journalists among its members, and their stories which often ended up in the fishing magazines emphasized the need for conservation as a key focus for anglers. This resonated with me and was one of the reasons I joined the group”.

Bass Sydney was the first fishing club in New South Wales to start collecting scientific data through regular ‘Basscatch’ events in partnership with NSW Fisheries (now Department of Industry and Investment) back in 1988. In these events, anglers record their catches over a weekend, including time fished, location, and, size and species of fish caught. This information is then used by the Department to monitor the health of the fishery, and inform future management decisions. The desire held by many anglers to become involved in the collection of scientific information for this purpose became quickly obvious, and a number of similar events soon popped up all over coastal and inland New South Wales under the Angling Catch Database banner.

When asked what it was that made Bass Sydney so heavily focussed on protection and enhancement of ecological health, Alan responded “the original older generation of Bass Sydney members made it easy for the club to start to become involved in conservation activities, through having the foresight to write it into our constitution all those years ago. Back then our involvement in the protection and enhancement of waterways and fisheries was mainly through involvement in Basscatch events and subsequently on a couple of key fish passage projects e.g. Liverpool Weir fishway. It was really the younger generation of members who started to explore the linkages between habitat and fishery health, and getting involved in riparian vegetation projects”.

Hanging about with a bunch of like-minded anglers who are passionate about environmental conservation can change the way you think about your fishing, but it can also change your career path as well. Alan's involvement in Bass Sydney was probably a catalyst to a fairly brave and radical career change recently. “Yeah, a little while ago I gave up a pretty good corporate job in Sydney to start working as a bush regenerator. There are actually two of us in the club who have made the change to this new career path. It was a total change – it meant going back to TAFE, and starting again really. It's hard work, but there's that satisfaction at the end of the day that you have contributed to something worthwhile”. On reflection, Alan realised that this was probably a slow train coming, brought about through time spent fishing with some of the old-guard Bass Sydney members many years ago. “I used to fish with Dr Wayne Erskine (long-time patron of Bass Sydney and highly esteemed aquatic ecologist), and in the events of a days fishing you couldn't help but learn so much from the man about geomorphology, and the ecology of river systems – it really helped me to fully appreciate the natural environment.

And it seems that this appreciation is shared by his fellow club members. Like most angling clubs their financial resources are modest, but they use what they have wisely. “In the past we attempted to provide small scholarships to help students looking to undertake conservation projects, but this ended up being quite difficult”. Nowadays we use club funds to keep members happy and interested in our projects and we try to access grant funds to support major projects e.g. like those committed to the construction of the first of four

fishways on the Parramatta River (the fourth and final fishway is now in the planning phase at the moment). Our data collected through in-house Basscatch events has convinced us of the need for these fishways, and will monitor their success, as well". Where the club is unable to contribute financially to a worthy venture, they have been only too happy to provide in-kind resources, in the form of hard labour. "Our members often get their hands dirty cleaning out debris from the fishway on the Lane Cover River to ensure it is working properly. We have been running an in-house Basscatch monitoring event on the Lane Cove for a number of years now to assess the effectiveness of the fishway and the debris cleanup has become a regular part of the BassCatch ritual".



Figure 7 Bass Sydney member Ron Rogers clearing debris from Lane Cove River Fishway (source: Bass Sydney)

Bass Sydney's involvement in habitat rehabilitation extends beyond the wet stuff too; they have also delivered a range of terrestrial weed control and revegetation projects around western Sydney. From 2003 to 2005 they partnered with Greening Australia to gain investment from the NSW Recreational Fishing Trust for use in revegetating three reaches along the bankline of South Creek, west of Sydney. With help from members of the Blue Mountains and District Anglers Association they planted nearly 2,000 trees and learned a lot as they progressed about maximising the efficiency of their planting operations through use of planting drills and systemised procedures, and optimising survival of seedlings through modified watering practices.

They were unsuccessful in gaining additional funds in later years to undertake follow-up planting, with feedback provided indicating that the water quality was not good enough to warrant investment, and they should apply again when water quality had improved. This presented a conundrum to the folks at Bass Sydney, as riparian vegetation (which they were looking to enhance) plays an important role in improving water quality. But undeterred, they continued their search for other areas in need of rehabilitation.



Figure 8 The results of several hard day's work on South Creek (Source: Bass Sydney).



Figure 9 South Creek 12 months after planting (Source: Bass Sydney)

They learned of a large infestation of Lantana and various other weeds at Woods Reserve on the banks of the Grose River through contacts at the National Parks and Wildlife Service at Richmond. They knew this area to be near-pristine bushland, and when they heard that NPWS didn't have the resources to control this infestation themselves, they decided to get involved. "These weeds are very productive and grow vigorously, often forming dense single species infestations" Bass Sydney member Alan Izzard said. "This impacts on the food web, both on land and instream, which impacts on the bass populations. But it's also horrible stuff to negotiate as you're walking along the bank of a river, and can be a nightmare when a wayward cast gets stuck in a patch of lantana on the far bank, so we were keen to get rid of

it". So with a number of club members having achieved Chemical Certification training through NPWS to enable them to safely handle herbicides, The Blue Mountains and District Anglers Association and Bass Sydney combined forces again to get in there and restore the natural beauty of the reserve.

The group of volunteers were disheartened initially when they surveyed the huge area they needed to treat, as they faced a near impenetrable wall of Lantana bushes up to 6 feet tall. However they quickly realised that they could crawl underneath the canopy and lop each plant off at its base, apply poison efficiently, before moving on. Despite this it was tough going, requiring sustained effort over nearly two years, but by 2009 the fruits of their labour were becoming obvious. Lantana regrowth was limited, and native bracken fern and other small shrubs were starting to regenerate along the river banks, preventing establishment of weeds from the seed bank in the soil. Their success became infectious, and they were joined by members of the Blue Mountains 4 x 4 club in 2009 as they continued to expand the horizons of their weed control activities towards the boundary of the reserve. The site is now complete, though their volunteers will continue to hold a watching brief over the reserve, picking off little infestations where they crop up, to ensure that the system stays healthy and native.

The Bass Sydney Fishing mob also received approval from Penrith City Council in 2011 to start work on regenerating a large section of the Nepean River riparian zone at Emu Plains. Club members will be working with the Penrith Council and McCarthy Catholic College to will remove many species of invasive weeds including balloon vine, privet and lantana, and then replant with native vegetation. The club and school will also start a seed bank, collecting seed from the site which will eventually be used to propagate native plants for replanting. This will be their biggest project yet, and is expected to take between five and ten years to complete. Bass Sydney will be applying for grant funds and is also seeking sponsorship from suppliers to help offset costs. And they will also need help! So if you are interested jump on their website and lend a hand. www.basssydney.com.

So what does the future hold? Well the folks at Bass Sydney are starting to explore the scientific theory which underpins best practice, and a number of their members have now completed courses run by Greening Australia to learn more about riparian assessments, seed collection and propagation. This training will help the club to start developing rehabilitation plans themselves, and collect and grow their own seedlings of appropriate species from local provenance for future projects. In addition to training provided to the group by experts in other fields, these new skills are enabling Bass Sydney members to play an ever-increasing role in the management of their local natural resources, and ensuring a bright future for recreational angling in western Sydney.

If you are interested in learning more about the great work being done by the members of Bass Sydney, or if you represent a funding organisation who might be interested in helping them to continue to deliver great natural area rehabilitation and conservation outcomes, please visit their website www.basssydney.com.

Barra like a bit of shade too! Anglers put the habitat back on 12 mile Creek

12 Mile Creek is located about 50km south of Rockhampton. The creek is very small with a catchment area of about 80km² and only runs after rainfall events of around 100mm or more. Bill Sawynok, Director of Infofish Australia and driving force behind this project, explains: "Over 80% of habitat previously available to Barramundi in Central Queensland is no longer available, because of construction of weirs and barriers, creation of ponded pastures etc. Now we only have 4 key sites which are still as accessible for fish now as they were in times gone by. Of these, 12 Mile Creek is probably one of most important, being right adjacent to the coastal delta. The site has supported a huge population of barramundi in the past years, and I would say it is probably the most valuable habitat in Central Queensland."

Unfortunately, 12 Mile Creek was also really degraded, with much of the catchment cleared and used for farming and grazing (see picture below). Only small remnant areas of riparian vegetation remained along the creek. Capricorn Sunfish recognised the importance of this location, and seized the opportunity to rehabilitate it with funding through the National Heritage Trust's Bushcare and Fisheries Action Programs. The project team assessed the site, and determined that historical vegetation clearing was a key contributing factor, but that inappropriate use by campers, and grazing by cattle was preventing the site from naturally rehabilitating. It was agreed that large-scale revegetation would help give the area a kick start, coupled with fencing off newly planted trees to protect them from wildlife and damage, relocation of the access track (which was being bypassed by visitors to avoid wet areas, damaging trees and creating erosion on the process), and removal of cattle and a cattle watering point from the northern part of the reserve.



Figure 10 (left) 12 Mile Creek in drought, showing the barren riparian zone prior to rehabilitation (right) 8 years following completion of rehabilitation works (Photo Bill Sawynok).

The project team identified the need to restore riparian vegetation to the site, to provide refuge among tree roots for fish, and control water temperature and dissolved oxygen levels through providing shade. The project team revegetated an area of the creek's riparian zone approximately 5.3 hectares in size, which was adjacent to an area of natural remnant vegetation approximately 4.6 hectares in size, to create an area of native vegetation nearly ten hectares in size. A total of 3,100 trees were planted in 3 plantings however due to drought conditions only about 1,500 survived. The revegetation site is located adjacent to a camping area, and so work was also undertaken to fix minor erosion and improve the management of some of the usage of the area.

When asked what challenges they experienced during the project, Bill reflected "It was in the middle of a drought, so it was nearly impossible to get hold of any healthy trees, and those we

could get were nearly impossible to keep alive". But the community banded together to achieve the best outcome they could. Driving 40 minutes out to the site every week to water the seedlings, check on the fencing and keep weeds at bay.

The project became a collaboration, with organisations and people contributing what they could. Over \$40,000 was contributed from community as in-kind through their time and effort. The Australian conservation volunteers played a key role in delivery. Council also pitched in and built a new gravel road to access the site, with Captag paying for the materials. The adjacent landholders eradicated weeds from the site (rubber plants), in exchange for continued access to a small area for their livestock.

Where this story gets really interesting, is that for most small projects of this type, that's usually the end of the story, but not here. Infish Australia have been managing a 25 year dataset of angler tagging data for the area, to which rec fishers have contributed some 8,000 tags through the Suntag program. The dataset has really helped to provide an understanding of the place, its fish, and the anglers who love them. Bill explains "it is vitally important that the community recognise the importance of a site or fish population. If not, it's easily lost. Captag and this rehabilitation project has been really useful in helping people to appreciate the value of this place. That's what it's really about."

And it's not just the fish data that are showing signs of recovery. A little yellow bird called a Yellow chat occupied the area up until the 1920s, but was thought to have been extinct until the 1990s. However a Uni student found a small remnant population at 12 Mile Creek.

When asked if he thought being involved in a fishing club was a key element to getting involved in projects such as this one on 12 Mile Creek, Bill replied "definitely. Fishing clubs give you the network of people that you need to engage in this sort of stuff. There are 1200 or so people involved in fishing clubs around here, and that's a lot of the reason why we are successful, are able to get these sorts of benefits through working within our community networks".

Helping fish to get over their problems; Installation of a new fishway and oftake on Tallowa Dam, Shoalhaven River.

The Shoalhaven River is a large, beautiful and important system to the region of southeast New South Wales. The river begins its journey approximately 300 kilometres southwest of Sydney, flowing northwards through pastoral country near the sleepy town of Braidwood. From there the Shoalhaven carves through impressive gorge country near the town of Marulan, eventually merging with the Kangaroo River as it fills Lake Yarrunga. Lake Yarrunga is impressive in itself; a broad, steep-sided, snag-infested, tannin stained body of water formed by Tallowa Dam, an imposing 43m high spillway. Perfect bass country.

Tallowa dam was completed in 1976 to supplement the water supply for Sydney and the Illawarra during times of drought, and provide water for local Shoalhaven and Kangaroo Valley communities. Construction of the dam also created a significant barrier to fish passage within the river system. Eastern grayling (*Prototroctes maraena*), once abundant within this river system, are now thought to be locally extinct. And Australian bass (*Macquaria novemaculeata*) have for a long time only persisted within Lake Yarrunga as a result of regular stocking activity from local anglers (including translocation of larger bass by hand from the river downstream by an enthusiastic few).



Figure 11 Prime Bass water, Lake Yarrunga, upstream of Tallowa Dam (source: Peter Harding)

Peter Harding is a member of a small, passionate fishing club called Southern Bass. He and his club members have been a driving force in the recently constructed fishway on Tallowa Dam which (when fully operational) will restore fish movement along this impressive river.

Through discussions with club members he learned that of the need for a fishway on Tallowa Dam, and that his club members were among those pushing to convince political decision-makers of the need for a fishway. The latest science supported their views; Research undertaken by (then) NSW Fisheries showed that Tallowa dam had taken its toll on upstream fish communities. 14 fish species including the endangered Australian Grayling (*Prototroctes maraena*) were shown to be locally extinct above the Dam: unable to ascend the massive, 47m high concrete structure.



Figure 12 Looking downstream of Tallowa Dam (Source Peter Harding).

Peter recalls the early steps in the process.

“In 2003 the Sydney Catchment Authority and NSW Fisheries invited a representative of Southern Bass and other community groups to attend a Value Management Study relating to potential construction of a fishway. The purpose of the meeting was to understand exactly what it was that the community valued about the river, dam and lake, to work out what the benefit might be from building a fishway. I volunteered to attend, despite the meeting being held a few hours away, which would take up a whole day.”

When asked why he would put his hand up to give up a day of his time Peter responded

“I felt it was important to communicate the desire of local anglers to have the fish community upstream of the dam restored to its natural diversity and abundance.”

Fortunately, others at the meeting shared this view. Participants of the meeting expressed concern that 14 fish species had become locally extinct above the dam wall, particularly the endangered Grayling. The group also raised concerns at the health of river downstream because of coldwater pollution. Those in attendance highlighted the linkage between water temperature and ecosystem productivity (much in the same way as more sunlight promotes increased crop yield on dry land), and suggested that the unnaturally cold water being released downstream of the dam would not only be affecting recreational fish species, but other species with commercial and ecological value as well. Community members involved in the meeting that day certainly sent a clear message: they valued the natural ecology and balance of the river, and wished to see it restored.

Another meeting was held in 2004 called the Risk Management Study, and again community groups including Southern Bass were invited to attend. Once again, Peter volunteered to make the long journey from his home to Penrith in Western Sydney to participate in this

meeting, which sought to identify any potential risks to the success of building a fishway on Tallowa Dam.

In recounting discussions on that day, Peter recalled that the meeting was a turning point of sorts.

“Initially people were only really concerned in restoring upstream fish passage, however Southern Bass members showed participants pictures of fish with no scales on one side, which had been taken shortly after a period of heavy rainfall when a lot of water had gone over the dam. We thought it looked like these fish had lost their slime coating and scales as they travelled over the dam wall. From that point forward discussions turned towards the need to restore fish passage in both directions: up and downstream.

Southern Bass members also raised concerns that water being released downstream of the dam was different in quality to the water in the dam, or in the river upstream. “We noticed the water being released downstream was freezing compared to normal temperatures, and had a distinct smell of ‘rotten egg’. It was clear this was because the water was being extracted from deep in the lake, and that this probably wasn’t good for the fish, which can be quite sensitive to temperature change” Peter explains. Also, we thought that the flows sent downstream should more closely mimic natural flows, in terms of providing increased water levels following rainfall events, rather than just releasing a constant 90 megalitres a day (as was the general practice at the time).

The Minister for the Environment at the time, Mr Bob Debus formed a committee called the Shoalhaven Transfers Community Reference Committee, comprising several community and government representatives, and once again Peter volunteered to be involved. The committee meetings provided an opportunity for Peter to express the views of his colleagues from Southern Bass in terms of the importance of improved fish passage and more natural flows for fish communities.

“I raised the issue of coldwater pollution caused by Tallowa dam with the Minister” Peter explains, “and directed his attention to research undertaken by NSW Fisheries which indicated that a drop in temperature of 10 degrees can result in 16% mortality in juveniles fish, stunted growth, and lower abundances of feed levels needed to sustain them⁹”. The Minister lamented a lack of feasible options to correct it, to which Peter responded

“there’s a dam at Jindabyne which a siphon system fitted for this very purpose. Why can’t we do that?”

Peter explained that the Minister asked the Managing Director of the Sydney Catchment Authority at the time, Mr Graham Head to look into it. Within months an aeration system had been installed in the dam, which helped to create mixing in the water column, in doing so breaking down the thermocline, warming and oxygenating deeper waters. Whilst not a permanent solution, the aeration system improved the quality of waters being released downstream “practically overnight”, Peter observed. It was certainly a step in the right direction. The aeration system ran for a few years until the fishway and dam modifications were complete.

⁹ Astles, K.L., Winstanley, R.K., Harris, J.H. and Gehrke, P.C., (2003). Experimental study of the effects of cold water pollution on native fish. A final report for the Regulated Rivers and Fisheries Restoration Project . NSW Fisheries Final Report Series No. 44. ISSN 1440-3544. 55pp.

Construction of the fishway began in March 2008. A 'trap and transport' type fishway was constructed, wherein fish are attracted to swim into a big hopper, which then travels up and down the dam wall on tracks on a set cycle, eventually spilling its contents into the receiving waters at the end of its journey, before beginning another cycle.

An overshot gate was also installed to release warmer, oxygen-rich surface water downstream. And a rule is now in place requiring that a set percentage of water travelling down Shoalhaven and Kangaroo Rivers must be passed downstream each day, to mimic inflows.

The fishway and dam modification works were completed on June 2009. Peter explains "there have been major, major improvements in the health and function of the lake and river system", but highlights that there is still a road to go. "The fishway is still being worked on to iron out some bugs in its function, but the overshot wall modification, and changed water release practices are working wonders".

Monitoring Success

With the fishway built there was a need to ensure that it was working. A number of Passive Integrated Transponder (PIT) Tag readers were also built into the fishway during construction, to help understand how many fish are using the fishway, and when. PIT tags are slightly larger than a grain of rice, and when a tag travels past a reader, it receives energy from the reader which it uses to transmit a unique code to the receiver, which enables the tag to be identified. Because they are inserted under a fishes skin and don't require batteries, PIT tags last a long time, are relatively inexpensive, and are ideal for tagging fish.



Figure 13 A Bass successfully fitted with a PIT tag, ready for release. (source Peter Harding)

Southern Bass anglers have been working with the NSW Department of Industry and Innovation and a small team of scientists to monitor movement of fish through the fishway using these pit tag readers. A select group of Southern Bass anglers have been trained on

how to insert PIT tags, and have been marking captured fish with both PIT Tags and spaghetti tags. Despite only a very small percentage of fish having tags, the study has identified tagged fish using the fishway during trials. Southern Bass anglers are also helping with monitoring to determine the effectiveness of the fishway through provision of their catch data. Every year since 2000 the club has held a Basscatch event as part of the Angling Catch Database program, in which anglers come together to fish for a set period of time, and record the number of fish they caught, their length, and the location of capture. This information is then used by fisheries researchers to evaluate the health of the fishery. In 2010 851 fish were caught by 57 anglers. In years gone past up to 80-90 anglers used to fish the weekend events, and approximately 50% of anglers went home fishless.

When asked why Peter volunteered to become involved in such a lengthy, involved process, Peter explains “I wanted to contribute to a project that I believed in. I was fairly interested in what the project was trying to do to begin with, really. I guess I’m a bit green, but I don’t see myself as a greenie, does that make sense?. I just think that if we expect rivers and dams to be a good place for recreational fishing in future then we have got to look after the place.”

When asked if his involvement in Southern Bass was instrumental in allowing him to be involved in the project to restore fish passage on the Shoalhaven River, he replied

“absolutely. Being involved in an angling club enables you to have a voice, and gives decision-makers a way to easily communicate with the angling community, to learn about their issues and needs.”

The Shoalhaven Fishway project recently won an Australian Institute of Project Management NSW Chapter Excellence Award in the Sustainable Projects category

Determining optimal stocking rates for Murray cod in the Dumaresq River: The Study of an Icon

With over four million recreational fishers in Australia, angling is undoubtedly Australia's favourite pastime. And considering the number of fish that are stocked into our waterways every year in the name of fisheries enhancement, it would seem that fish stocking might come a close second. Since 2006 over twenty-two million fish were stocked throughout New South Wales, over nine million fish in Victorian waters, and approximately 15 million fish of at least seven species into Queensland waters.

These stocking efforts have resulted in the creation of a number of valuable new 'put and take' fisheries, with significant social and economic benefit flowing to both industry and local communities. However anglers, researchers and managers have also started to take a closer look at the role that stocking plays as a tool for fishery enhancement in Australia, to ensure that we derive maximum benefit from stocking efforts and minimise risk to resident wildstocks, ecological communities and fishing experiences.



Figure 14 Stocking can play a role in creating great fisheries for species such as the iconic Murray cod (source Jamin Forbes)

Anglers from the Glenlyon Dam Fish Restocking Group have been working closely with researchers from NSW Department of Primary Industries (DPI) and Queensland's Department of Employment, Economic Development and Innovation (DEEDI) to learn more about appropriate stocking rates, ecological impacts of stocking predatory species, and management of genetic diversity within wild fish populations in the Dumaresq River on the Queensland/NSW border. The Dumaresq is home to some twenty fish species, of which sixteen are native. Of these, the most noteworthy for recreational anglers is undoubtedly the resident population of Murray cod. There are very few places where you can sight fish to Australia's largest freshwater fish species in crystal-clear, flowing waters, and the Dumaresq is one of those places. Recognising the significance of the fishery on their doorstep, the local fishing community have been raising money through raffles and donations to undertake stocking activities in the area for approximately 20 years to enhance cod numbers.

Approximately 10,000 Murray cod fingerlings have been stocked into this stretch of the river each year – that’s approximately 200,000 fingerlings in total.

The local angling community started to raise concerns that all was not well with the fish community within this stretch of river back in 2001. Bryan Dare, who runs the local caravan park on the shores of Glenlyon Dam, explains.

“Back 10 years ago we knew we had a fantastic fishery: you could catch up to seventeen to nineteen Murray cod in a single session. But we started to notice that not many of them would be of legal size. We also started to notice that we weren’t catching any of the other fish that would normally occur in the river. The silver perch, yellowbelly, cat fish... These species were once prolific, but over time they became less common, until we reached the point where we hardly saw them. It occurred to us that there might be a communication problem between both states that shared banks of this river. A group on one bank would put 10,000 fingerlings in one year, and on the opposite bank a stocking group from the other jurisdiction was doing the same thing a couple of weeks later! So we were getting a stocking density of up to 24,000 fish per year.”

When asked what the implications of this realisation might be, Bryan responded:

“Any farmer will tell you that you can only put so many head of cattle in a paddock of a certain size, and it’s no different for fish in a river. Scientists have developed proven formulas to use to determine an appropriate stocking density for a body of water, which considers factors such as the amount of water available, natural population size, and habitat availability. But we started to become concerned that the stocking intensity of the Dumaresq wasn’t based on sound scientific information, and I think that may be contributing to the situation we see now.”



Figure 15 The Dumaresq River is full of good habitat like this, which might help explain why there are so many Murray cod. But why are they so small? (Source Bryan Dare)

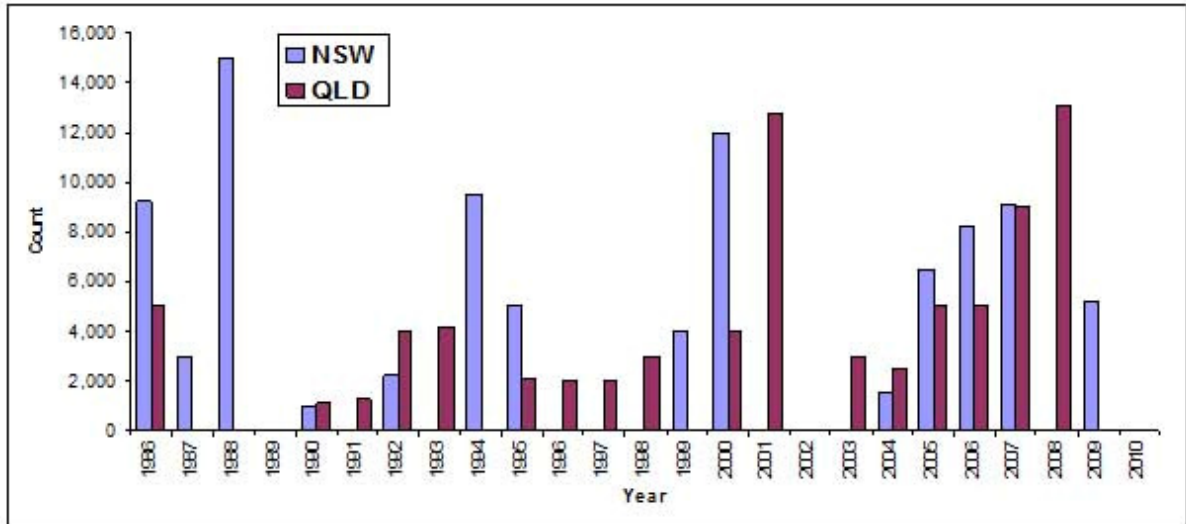


Figure 16 NSW and QLD stocking numbers in the Dumaresq Area (source: Gavin Butler)

Bryan’s old friend, champion luremaker Peter Newell, provided the motivation to develop a research project to look at the problem more closely.

“Peter was a good friend of mine, and we were sitting around sharing our concerns for the state of the river. Peter was getting fairly sick by that time, and asked me to do something to ensure we didn’t stuff the fishery for good before he passed on. So I decided to start a research project up to work out what was going on.”

The aim of the project was to understand the contribution of stocking and natural recruitment to the Murray cod population in the Dumaresq River between Mingoola and Bonshaw. This information would then be used to identify optimal stocking rates to create a self-maintaining population, and to improve the stocking management plans presently in place. It was also hoped that the study would provide a compelling case to water managers for the need for ‘cod-friendly’ water releases from Glenlyon Dam upstream. Currently when water is released from the bottom of the spillway it alters the temperature of downstream flows dramatically (this part of the project is currently unfunded, but the project team are trying to forge ahead regardless, given the likely significance of this critical piece of the puzzle).

Conducting a monitoring program to look at environmental effects can be expensive and labour intensive, but Brian and the project team recognised the significant contribution the angling community could make in collecting meaningful scientific information.

“We decided to enlist the help of anglers to do surveys on the river. Because all fish would be caught and released unharmed, and we were pretty sure anglers would be happy to volunteer their time, we knew this would be the best way to collect information on fish in the river, at minimal cost.”

The early years of this project were tough going for Bryan and the small but passionate project team, which were unsuccessful in early attempts to secure funding. Fortunately, they were eventually successful and secured funding from the Queensland Murray Darling Basin Committee (QMDC) for the project entitled ‘The Study of an Icon’. Bryan explains:

“Finding somebody who believed in the project and had the means to make it happen was difficult at first. Fortunately the Queensland Murray-Darling Committee indicated they were interested in what we were trying to do, and they agreed to come on board.”

The project team have also received funds from the Border Rivers CMA and the NSW Recreational Fishing Trust to do things like analyse the data from the project. However they need more and are always looking out for more help.



Figure 17 Measuring Murray cod on the Dumaresq (Picture courtesy of Gavin Butler)



Figure 18 Anglers monitoring fish populations as part of ‘Study of an Icon’, with a healthy Dumaresq cod, tagged and ready for careful release (Picture courtesy of Bryan Dare).

Approximately 80 anglers have been involved in the 5-year project, which involves biannual angling-based surveys of a 63 km stretch of river. Anglers collect information about fish caught (length, weight, location, habitat association), before tagging them, taking a small DNA sample, and returning them to the water. These samples are supplemented by electrofishing surveys twice yearly by Fisheries researchers. Information about population size, growth rates, habitat requirements and home ranges of resident Murray cod is helping anglers and researchers understand the level of health of Murray cod populations within the river.

Because this project has been driven by anglers and their keen desire to ensure that the quality of this fishery is enhanced and protected, the group has been successful in negotiating a moratorium on stocking activities since 2005 to help make any trend in data collected easy to identify.

Unfortunately preliminary results seem to confirm the group's initial concerns. Mr Steve Brooks, a researcher from Queensland's Department of Agriculture, Fisheries and Forestry, explains:

"around 1056 Murray cod have been tagged and returned to the water (795 by anglers and a further 261 by electrofishing). 75 of these (7%) have been recaptured. Of Murray cod caught, tagged and released, 86 were over the 600mm legal limit and only 17 over 700mm. One fish aged using its otoliths or ear bones was 7+ years old, only 390mm in length, and mature enough to breed. Fish of this size would normally be approximately only 3-4 years old".

Results also indicate that cod abundance may also be quite high within the Dumaresq. It is estimated that between 6133 and 8053 Murray cod occur within the 63km stretch of river between Mingoola and Bonshaw (approximately one fish for every 9 metres of river length). When asked what this meant for the fish community present, Bryan responded

"I think that's just too many apex predators for the place to handle". "The size and age of Murray cod we are catching are a concern as well. Cod generally grow around 1.5 pounds each year, but we have caught fish 39 cm long, weighing 2 pounds, which were seven years old! We caught a 2kg fish that was 13 years of age as well. And of twenty fish species known to occur within the river, we have caught four species during the whole study: 426 Murray cod, 8 Yellow belly, one Bony bream, and four catfish. Whilst we can't distinguish stocked fish from wild fish, what we think is that our emphasis has been too heavy on stocking Murray cod, the iconic species that it is. But in doing so, we have forgotten to stock the other species that live in the system, and are important parts of the ecosystem."

Dr Stuart Rowland, who is widely regarded as one of Australia's experts on freshwater cod, has some thoughts on what could be happening with the cod in this part of the river:

"There are a number of possible causes for what we are seeing on the Dumaresq. It may be the result of historical stocking using fingerlings of low genetic health, combined with excessive stocking, which has reduced the available resources for these fish. Cold water pollution could also be a factor here, which may be lowering the productivity of the river, and testing the thermal resilience of these fish. The fish also appear to be breeding very early, which might not be unusual given how far north this population is, but what it means is that they are breeding before the season closure commences (which is in place to protect adult spawners who become more aggressive and catchable at this time). When you consider that almost none of the fish are reaching legal size, this means that basically the entire population is exposed to angling pressure".

“The really concerning thing is that we have heard that catches of similar stunted fish may be occurring on the Macintyre brook further downstream, on the Severn further upstream, and in the Namoi and Gwydir as well. I'd hate to think that these rivers might be suffering the same issues, but this looks as if it might be the case”. Dr Rowling noted “we really need to look at other rivers such as the Gwydir, because if thermal pollution is a factor, then the Murray cod population within this river may be showing similar symptoms downstream of Copeton Dam. We also need to conduct more work on the Dumaresq, including radio and acoustic tracking of fish to understand their movements and behaviour in relation to factors such as breeding and cold water pollution, more ageing work in adjoining rivers, and detailed research on breeding timing and success”

On the basis of the results obtained so far a ban has been placed on keeping silver perch or catfish, which has received the support of the local community. The unfortunate thing is, the causes and solutions to problems relating to Murray cod uncovered during the study are still out of reach, and this project, despite its strong support from the local anglers, landholders, and fish stocking groups is suffering from an uncertain future. Without additional funding the project is severely compromised. Dr Rowland explains “we have funding to insert acoustic tags into fish, and to install listening stations along the river to understand where they are going, and how they are responding to environmental changes. However, with future funding of the project uncertain, we haven't implanted the tags yet – there would be no point if we don't have enough money to analyse the results”.

The project won first place in the Queensland Landcare Awards in the Landcare Community Group Awards in 2009.



Figure 19 DAFF staff electrofishing on the Dumaresq (Picture courtesy of Bryan Dare)

Improved Technologies - Innovations in Sustainable Fishing Gear

You only have to look at the rows and rows of products adorning tackleshop shelves which would look at home in any space station to know that most anglers are early adopters of new technology. However there has been an interesting shift in new tackle development over recent years, with discerning anglers selectively using products not just because they work, or because they are a pleasure to use, but also because they are sustainable. The tackle industry have worked in partnership with the recreational fishing community to explore a variety of ways to reduce the collective footprint of the angling community, from terminal tackle right down to equipment for handling and landing fish.

Disappearing without a trace - Biodegradable Fishing Line

War, space travel and medicine have probably contributed more to technological innovation than any other pursuit. And so it is probably fitting that it was a medicine technology company that has given us our first biodegradable fishing line.

The impact of discarded or lost fishing line on wildlife is fairly well known. Birds, seals, sea turtles and other wildlife are occasionally entangled in discarded line, resulting in reduced health, stress, and in extreme cases, death. And the hazards presented by lost or discarded line doesn't go away in a hurry, either: studies indicate that conventional fishing line (monofilament and fluorocarbon) may persist in the environment for more than 100 years¹⁰. A company that designs, develops and manufactures medical products called Riverpoint Medical, in Oregon in the USA recognised the potential application of the modified polymers used to manufacture dissolvable sutures to make fishing more environmentally friendly. Maybe one of their technologists was a mad angler themselves? In any event, that was the genesis of the first biodegradable fishing line – Bioline.

Made from polybutylene succinate or PBS, bioline is engineered to retain its strength and durability for the first 10-12 months of use and then completely degrade in water or landfill within 5 years. Microorganisms begin breaking down and digesting the line with the aid of sunlight and moisture. Eventually the line breaks down to the environmentally benign components CO₂, H₂O, and biomass. Bioline meets “ready biodegradability” standards (ASTMD 6400) in compost, which requires degradation within 6 months. Even the spool that the line comes in has been found to meet these standards (see Figure 20b).

If you haven't heard of this product before you probably have the same initial response as most anglers: “but won't it break right as you're trying to land that fish of a lifetime?” The answer, happily, is no. Despite the product's capacity to degrade relatively quickly, it has been found to have excellent knot strength and UV and abrasion resistance for its intended lifespan (10-12 months). In 2009 the Australian National Sportfishing Association undertook durability testing of Bioline, and noted a high level of consistency between the stated breaking strain and the test results. Follow-up tests were conducted following 12 months of exposure to the sun, wind and rain, and the level of reduction in breaking strain recorded was as little as 3.7 percent. ANSA Business Director, Shane Jasprizza commented having reviewed the results that the rigorous testing “should allay any fears of Bioline breaking down rapidly under regular use. For the Bioline to lose as little as 3.7% of its original breaking strain after

¹⁰ Clark, R.B. (1986). *Marine Pollution*. Clarendon Press, Oxford, New York.

constant 12 month's exposure to sun, wind and rain on the reel is a surprising result and a testament to the technology used in developing these lines. Anglers can be confident about the durability of Bioline under regular fishing use”.

Dr Ben Diggles, Australian and New Zealand distributor of Bioline has conducted additional tests confirming the biodegradability of the product:

“The 4 pound Bioline disintegrates after six months in compost, with the thicker lines lasting a bit longer due to their larger diameter.” said Diggles. “Even the spools the line comes on become completely soft and brittle after 12 months in compost,”

The good abrasion resistance, excellent knot strength, and high level of UV stability (higher than mono) make it a great leader material. Recent changes in ANSA rules to sanction use of breakaway rigs for all levels of ANSA competition and records enable ANSA anglers to take advantage of this, using short length of lighter line as their lineclass, then a heavier mainline, to help minimise line left trailing in the event of a break off due to a lost fish or snag. Use of Bioline as a leader in this circumstance will help to ensure that even this small amount of line quickly disappears from the environment. When used in combination with bronze hooks, this will ensure that any unintentionally lost tackle quickly disappears from the environment, leaving no trace (literally), and helping to reduce our environmental footprint as anglers.



Figure 20a Bioline – the first biodegradable fishing line available in Australia, and 4b degraded bioline spool after 2 years of composting, 9c bioline samples exposed to sunlight, wind and rain during trials undertaken by ANSA (Source: Digsfish Services).

Bioline was awarded “best environmentally friendly product” at the 2009 AFTA Tackle Trade Show. Unfortunately despite exceeding stated performance with respect to durability, and living up to its claims with respect to biodegradability, biodegradable fishing line is currently not available in any tackle stores two years later. Fortunately you can purchase Bioline via the website www.billfishjuice.com or by calling (07) 3408 8443.



Figure 21 Bioline was awarded the best environmentally friendly product at the 2009 AFTA Tackle Trade Show (Source: Digsfish Services).

Biodegradable soft plastic lures

Recreational fishing in Australia has undergone something of a soft plastic revolution over the past decade. Soft plastics have been around for a while, with many Australians sourcing early versions from overseas since the late 1950's and early 1960's, but innovations in materials used to make them softer and more flexible saw them really carve a niche when Mister Twister released the patented Curly Tail onto the market. Further innovations including the integration of attractants, coupled with effective marketing around 2000 saw Australian anglers re-discover soft plastics in a big way. So much so, that some anglers were beginning to become concerned at the impact of lost lures, both on the environment, and on fish who unknowingly ingest them. Additionally, anglers were concerned at the environmental impact of lost lead-based jigheads, given the impact that lead has been shown to have on aquatic ecosystems.

A number of companies have responded to these concerns, investing in trialling new compounds with the flexibility and durability of rubber, but the added advantage of being biodegradable. The first to hit Australian shores was the Gulp! Range, which made an impression straight away, being awarded "Best New Soft Lure" at the ICAST 2003 tackle show in the United States. Shortly afterwards a column was printed in the Western Angler Magazine that espoused the virtues of the line of biodegradable lures

"Gulp! is completely biodegradable – after a few months in water, it's gone. But more immediately important, Gulp! is water-based, so (compared to a soft plastic) it releases the inbuilt fish attractants into water 400 times faster than a plastic bait can. And, as a direct result, it catches more fish than soft plastics will – and in some cases, even more than live bait will. Berkley take their science seriously. They've been working on making Gulp! for 20 years, since before most people had heard of 'biodegradable'. It took them that long to work out how to do it right. When they throw out a figure like 400 times more scent release than plastic, it's easy to scoff; but they're serious."

As with any successful product, it was followed by a large variety of new entries to the market, all claiming to be biodegradable, and with lifelike actions and scents designed to catch more fish (and anglers). However independent trials undertaken by Dr Ben Diggles from Digsfish Services have shown the biodegradability of various soft plastic lures claiming to be biodegradable to vary significantly. The benchmark for environmentally friendly lures is the foodsource range, which are made of food-grade ingredients and bound with gelatine, and consequently fall apart in around 2 or 3 weeks in water. However, unfortunately despite solid performance in the biodegradability stakes, anglers have been underwhelmed with the swimming action of foodsource lures, and consequently they are not currently widely available in Australia.

The results of Dr Diggles's hard work appears to be showing that many of the other soft lures currently on the market which claim to be biodegradable may not meet the ready biodegradability standard, which requires that test samples degrade at least 90% (dry weight) over a six month trial period. Figure 22 below show a handful of different soft plastic lures after 3 months of composting, and 2 years. Whilst there is evidence of significant degradation after two years, it doesn't look like the products shown would have met the requirement of being 90% degraded at 6 months on the basis of these trials. And when you consider that the degradation rate in seawater appears to be significantly slower than in a compost environment, this suggests that the degradation rates in the real world would need to be multiplied by many times in order to achieve acceptable results for degradation. For example, the results achieved after 2 years of composting may take upward of a decade in the marine environment.

Of the conventional polymer soft plastic lures, the best performers with respect to biodegradation (of those tested) appear to be the atomic guzzler range, closely followed by the stimulate slam range and gulp.

What's on the horizon next for sustainable tackle? Perhaps biodegradable hard bodied lures? When asked how long conventional hard bodied lures might persist in the marine environment, Dr Ben Diggles suggests that they may well approach the 600 to 100 years required to break down monofilament line and braid lines. There are some exciting opportunities however. Testing of the degradability of Bioline's plastic spools have shown evidence of advanced degradation in a composted environment within 2 years. Maybe hard body lure manufacturers can consider using similar materials for their lures in future? If so, it would be reasonable to assume that we might be able to start using hard bodied plastic lures which disappear from the environment when lost within 3 to 5 years...

Watch this space...



Figure 22 A variety of biodegradable soft plastic lures prior to (left) and following three months in compost (Source: Digsfish Services).

Hook Innovations

Non-stainless steel hooks are one of the most degradable parts of the fishing tackle chain, with bronze coated hooks shown to oxidise and dissolve within six months in seawater. Research has also shown that these types of hooks rapidly degrade when embedded in a fish, and so are easily discarded with minimal impact (particularly when the fish is mouth hooked). A study examining survival of released black bream and snapper reported survival rates of 95% and 97%, respectively for shallow-hooked fish. Another FRDC-funded project examining the short-term survival rate for flathead species in eastern Australia found survival of shallow-hooked fish to be almost 100% for sand flathead and 96% for dusky flathead¹¹.

Unfortunately some anglers choose to buy and use stainless steel hooks, as they are more resistant to corrosion, and so can last a long time in your tacklebox. This, of course, also means that stainless steel hooks are more resistant to corrosion in the environment, and so can stay embedded in a lost fish, in wildlife, or just snagged in the marine environment for much longer. Stainless steel hooks have a number of other important disadvantages, as well. Importantly, they are made of softer material, and so tend to bend and become blunt more easily, and they are also more expensive.

Where hooks have really changed in recent years to maximise sustainability, is in their design. The J-hook is progressively being replaced with circle hook patterns in many applications (and is actually mandated in many fishing competitions now). The design of circle hooks enable them to catch in the corner of a fish's mouth, so are less likely to be swallowed than traditional 'J' hooks. This means that released fish are less likely to suffer internal damage and die from infection thereby reducing mortality of released fish. Studies have found

¹¹ Lyle, J.M., Brown, I.W., Moltschaniwskyi, N.A., Mayer, D. and Sawynok, W. (2006) National Strategy for the Survival of Released Line Caught Fish: Maximising Post-Release Survival in line caught Flathead taken in sheltered coastal waters. FRDC., Canberra, Australia.

significantly lower deep hooking rates (1-4% depending on species), compared with conventional hook types which have deep hooking rates of up to 16%¹²¹³.

It also seems that for some species, circle hooks don't only assist in releasing fish unharmed, they may also help you catch more. A study done aboard a longline vessels monitored 95,000 hook sets, and found that circle hooks can actually result in an increased catches of species such as albacore, yellowfin tuna and striped marlin.

Sinkers

In terms of terminal tackle, the humble sinker has come a long way. Historically sinkers have been constructed using lead because of its density and ease with which it can be moulded. However unfortunately, lead is also a toxic heavy metal, which has been known to be accumulated by marine organisms, particularly those which are benthic dwelling¹⁴. Lead's chemical resemblance enables it to be taken up by organisms and stored in the same organs as calcium. Whilst thought to be comparatively less toxic to aquatic organisms compared to metals including copper and mercury, chronic lead exposure has been shown to result in decreased growth, and increased mortality in some species.

A number of companies have been exploring environmentally benign sinker options, which are lead-free and decompose back into harmless base materials over time. Made of a variety of biologically inert materials including iron (which is more environmentally benign and breaks down quickly) these products do their job (sink quickly to the bottom), and are purported to decompose back to harmless base ingredients over time.

Knotless landing nets

Landing nets are an essential part of the fishing kit, particularly if you are fishing from a boat. Traditionally landing nets have been constructed of knotted nylon mesh, however studies have shown that the older-style, knotted nylon landing nets can cause increased injury to fish when captured, exposing released fish to increased risk of infection. Research done in the Northern Territory has shown that when fish are lifted in a nylon net, their fins and tail are often pushed through the mesh by their weight, splitting these delicate body parts, and removing their protective slime coating¹⁵. Fortunately a number of newer net designs are on

¹² Cooke, S.J., and Suski, C.D. (2004) Are circle hooks an effective tool for conserving marine and freshwater recreational catch-and-release fisheries? *Aquatic Conservation: Marine and Freshwater Ecosystems* 14: 299-326.

¹³ Cooke, S.J., Suski, C.D., Siepker, M.J., and Ostrand, K.G. (2003c) Injury rates, hooking efficiency and mortality potential of largemouth bass (*Micropterus salmoides*) captured on circle hooks and octopus hooks. *Fisheries Research* 61: 135-144.

¹⁴ Sorenson, E.M. (1991). *Metal Poisoning in Fish*. CRC Press, Boca Raton, Florida.

¹⁵ Allsop Q. and De Lestang P. (2004). "Catch and Release - Doing it Better A comparison between two types of landing nets". *Fisheries Research*, Darwin.

the market these days, with smaller mesh sizes, and no knots, which have been shown to drastically reduce incidence of injury to released fish (see Figure 23).

A Japanese company by the name Nippon Seimo Co. Ltd. Invented the first type of knotless netting in 1922, however it took quite a while for this technology to filter through to recreational fishing gear. Fortunately however, they are now commonly and cheaply available, and widely adopted. A number of state and territory peak bodies now request that anglers use knotless landing nets, in addition to the national Peak Body for recreational fishing, Recfish Australia. Some countries have gone even further; in England, Scotland and Wales knotted mesh is illegal on all inland waters.

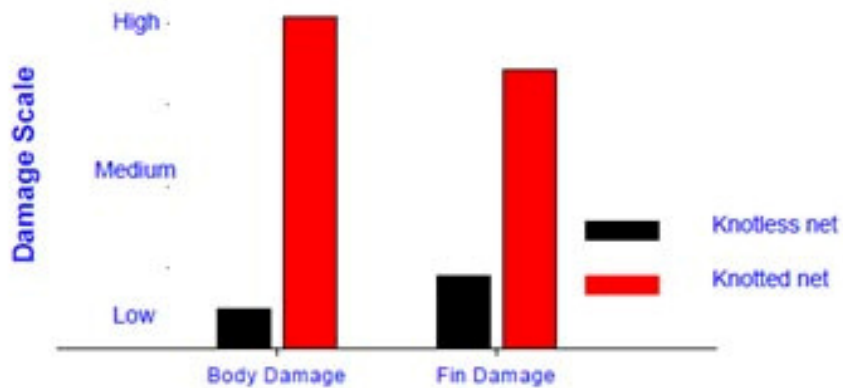


Figure 23 Mean total damage to Barramundi caused by knotted nylon landing nets and knotless nets (Source: Allsop and de Lestang, 2004)



Figure 24 a) barramundi tail captured in a nylon net, and b) in a knotless net (Source, Allsop and De Lestang, 2004)

Release Weights

Anyone who bottom-bounces or fishes in waters deeper than 10 metres will have encountered a fish suffering from barotraumas from time to time. Barotrauma is a pressure-related injury, which is caused by the expansion of gases in the swim bladder and other organs as fish are brought quickly to the surface. It is usually easy to identify a fish suffering from barotrauma, they often have an inflated abdomen, bulging eyes, and can in extreme cases have their stomach pushed into their mouth, or distended intestines. These symptoms

can make it difficult to release fish successfully, preventing them from being able to swim back to the bottom.

Fortunately a device has been developed to help increase survival of fish suffering from barotrauma. Essentially it comprises a barbless hook, and a weight used to get fish quickly back down to a suitable depth for them to enable them to manage their buoyancy once more. The release weight is attached through the lip of the fish to be released, lowered into the water and dropped back to the bottom. The fish is then easily released with a tug on the line.

Sales of release weights are increasing all the time, as anglers recognise the benefits of these easy to use tools to maximise survival of released fish.

Australian Land-Based Anglers Association – Ledgcare Program

If Ian Kiernan, yachtsman, builder, every-day Aussie bloke and founder of Clean up Australia Day has taught us one thing, it is that a single individual can make a big difference. Ian resolved to do something about cleaning up our planet whilst competing in a solo around-the-world yacht race in 1986/87. Ian looked forward to experiencing the many natural oceanic wonders including the rafts of Sargassum algae which gave the Sargasso Sea its name, however his anticipation turned to horror and frustration when he arrived there, and observed all of the floating debris and rubbish. And this experience would repeat itself again, and again throughout his journey. So on his return he organised a community event - Clean Up Sydney Harbour on Sunday 8 January 1989. The event struck a chord with the Australian public, with over 40,000 volunteers turned up to get involved. This was the genesis of the Clean up Australia Day.

The first clean up Australia day in 1990 attracted 300,000 volunteers, and participation has progressively swelled over the last 21 years. The concept became so big that Ian and his team decided it was time to take on the next challenge: the world. Clean Up the World was launched in 1993 with the support of the United Nations Environment Programme (UNEP), and an estimated 35 million people over 130 countries now participate annually.

It is easy to understand how Ian's experience of looking out over a much-anticipated remote, pristine seascape hundreds of miles from land back in 1987, only to see rafts of take-away food containers and shopping bags bobbing would have spurred him into action. Equally, it is also easy to understand how many angling clubs throughout Australia have also mobilised in large numbers to become involved in cleaning up our waterways. For an angler the impulse to escape as far from civilisation as possible is strong. The increased distance from civilisation helps to escape the burden of everyday stresses, but also increases your chances of enjoying uninterrupted tranquillity in near-virgin habitat (hopefully interrupted occasionally by the odd monster fish). So to an angler, stumbling upon a burnt out car body, or some other carelessly discarded pile of garbage is an instant reminder that the problems of everyday life, and civilisation, really aren't that far away. And so for many it invokes exactly the same jarring frustration that Ian must have experienced all those years ago.

There were a number of fishing clubs around Australia who get involved in Clean up Australia Day events and similar initiatives to look after our waterways. However one group which has been particularly active in keeping favourite fishing spots clean is the Australian Land-Based Anglers Association (ALBAA). The enthusiasm shown by ALBAA members in caring for rock ledges around Australia might come as no surprise to those who know a thing or two about land-based game fishing and the people who do it. Land-based game (or LBG) fishing really is the Mount Everest of angling. The need to get up well before any sane person would, drive long distances to remote locations, scuffle in the dark over difficult terrain (carrying cumbersome fishing rods, reels and an amazing array of other equipment all the while), to set up on a cold, exposed, cramped ledge and sit...for, well days, sometimes weeks on end in the hope of attracting a single bite is enough to discourage anyone but the keenest of angler.

But the level of stewardship displayed by ALBAA and its members can be attributed to more than just their 'go hard or go home' mentality. Kurt Edwards, long-time ALBAA member, explains that the scarcity of suitable land-based locations around Australia to target gamefish also has a role to play in engendering the high level of respect shown by their members for their favourite fishing haunts. There simply aren't too many places around Australia with the prerequisite ingredients of deep water right in tight to land, at latitudes suitable for big pelagic species, and with suitable platforms from which to fish. And so those few locations that exist have become hallowed stones to the LBG fraternity; elevated to legend status by stories of the enormous fish tamed from them. And so these rare locations (which are becoming ever-

rarer thanks to lockouts from the declaration of MPAs) are important to these people, and their desire to care for them, makes sense.

ALBAA itself was formed when land-based anglers from around Australia started to interact, and realise there were others out there as mad as they were. The birth of ALBAA provided a forum for Australia's land-based anglers to share stories and learn from each other, but it also provided a vehicle to enable them to start to deal with issues that they collectively cared about. And the amount of garbage that was relentlessly turning up on their favourite rock platforms after every storm surge was an issue for many. The persistence of a few unthinking anglers who would continue to thoughtlessly discard their waste whilst fishing was also a key concern, and the Ledgecare Program also provides value as an educative initiative, to teach others to fish in a way that is compatible with ALBAAs objectives, particularly the need to "foster and demonstrate an environmental conscience throughout Australia by adhering to a self-imposed code of conduct as well as the laws and regulations in each Australian state". And so in 2008 the ALBAAs Ledgecare Program was formed to allow anglers to actively share in the stewardship of their local areas, promoting a shared responsibility and encouraging co-management principles.

ALBAA regularly hold clean-up events through their Ledge Care program throughout the year in various locations up and down the east coast of Australia and the Northern Territory. To date ALBAA have been involved in a total of 14 events during 2008, 2009 and 2010 with members and volunteers attending selected locations a total of 24 times, removing an approximated 3.96 tonnes of garbage from Rocky foreshore environments in NSW and the Northern Territory. Participants invest significantly in these events, both through contribution of their time and effort, and their own money. Chris Gough, organiser of the Ledgecare Program was staggered to calculate that the combined distance travelled by all participants to attend Ledgecare events is equivalent to driving a car around the world 2.3 times!

One of the more recent and successful events held under the Ledgecare banner was the clean-up day in 2009 held at a favourite world famous land-based game fishing location - the Outer Torpedo Tubes at Jervis Bay. "The Tubes" as it is known by many in the angling community, is renowned for its impressive landscape of soaring cliffs dropping into an impossibly deep pacific ocean. Its deep, protected waters are also a key factor contributing to the amazing fishing opportunities on offer, with huge kingfish, Black marlin in excess of 300lb and Tuna of a an assortment of species landed off its ledges throughout the years.

ALBAA members worked in partnership with the Defence Force's environment team and cadets in 2009 to restore the area to its natural, garbage-free condition. These events tend to become highly organised operations, with some participants charged with garbage collection duties, whilst others are put to work carrying sacks of garbage out of these often e remote locations. It is nothing for these guys to remove over a tonne of garbage in one day, as was the case at this event in 2009.

The appeal of these events is that they are equal parts hard work, and an opportunity to catch up with friends, and share a rewarding experience with family members. There are a number of families who regularly get involved, enabling them to share time together, have a laugh, and contribute to something positive. It also provides an opportunity for the younger club members to learn from the 'old sea dogs', who regale them with stories of live baits being buzzed by tunas the size of motorbikes as they carefully move around the ledges, picking up rubbish.

Unfortunately these events are also expensive to hold. By itself, the cost of insurance required to help assure the safety of participants is steep. Add to that the bill for ensuring participants are adequately fed and watered, garbage disposal costs and expenses

associated with planning the events, and it can be almost too much for a small voluntary organisation such as ALBAA. If you would like to provide financial support to enable Ledgecare to continue the great work they are accomplishing, or if you would like to become involved in a future event, or even start one of your own – please call Christian Gough on 0437492090, or email ledgecare@albaa.com.au.



Figure 25 ALBAA members participating in clean up days (Source: ALBAA)

I Fish and I Vote - Recreational anglers as advocates

The role of recreational anglers in the conservation and management of fish and their habitats is not limited to participation in on-ground activities. The importance of advocacy in influencing the very policies and legislation that govern recreational anglers' access and use of resource, in addition to how habitats are protected and managed, cannot be underestimated. Around Australia, angling clubs and individual anglers devote significant time advocating for the sustainable management of the resource on which they depend.

The role of recreational anglers in advocacy varies from representation of the recreational angler sector in formulation of policy through membership on government committees and preparing written submissions, through to media campaigns, commissioning of independent research, organisation of demonstrations and lobbying of politicians. There are many examples of this occurring across issues as diverse as access and formulation of aquatic reserves, opposing unsustainable development proposals, changes to size and bag limits, control of pest species and environmental flows among others.

Membership of clubs and associations is a popular means of sharing information, combining resources, and of course, tall stories of fishing escapades, across the country. There are approximately 570 fishing clubs and associations in Australia, varying from small special interest clubs in regional Australia, through to the national peak body Recfish Australia, with broad national membership, established in order to provide a single voice for recreational anglers.

In addition to Recfish representing anglers at the national level, individual States and Territories have their own peak bodies, including the Anglers Alliance Tasmania, VRFish (Victoria), Recreational Fishing Alliance of NSW, Sunfish (Queensland), Amateur Fishermens Association of the Northern Territory, Recfishwest (Western Australia) and South Australian Recreational Fishing Advisory Council. Together, these organisations add an additional level of coordination and representation for recreational anglers, advocating for their rights, access to resources and increasing opportunities to contribute to the management of fisheries and fish habitats.

The Amateur Fishermen's Association of the Northern Territory (AFANT) was formed in 1980 by a group of keen anglers who wanted a body to represent and advocate their interests to the Government of the day. Today, AFANT is recognised by both the NT and Commonwealth Governments as the peak body representing recreational fishing interests in the Northern Territory.

"We have around 3500 members through affiliated clubs, but we don't only represent members, we represent the recreational fishing sector as a whole" says Chris Makepeace, AFANT's Executive Officer. As the peak body representing anglers in NT, AFANT plays an important role in the management of fisheries and the habitats that support them. "We tend to focus on three main areas," says Chris "advocacy and lobbying activities, angler representation in the management of fish and fisheries, and managing environments"

"You've got to have genuine involvement and engagement with recreational fishers in terms of managing the fisheries." Chris talks about the growing national trend in the concept of co-management of fisheries, where anglers share responsibility with other stakeholders for making decisions about natural resources. "We're involved in co-management in the Northern Territory. We sit down at the table with the commercial fishers and the fisheries bureaucrats and the land councils and all the other players and we're part of the decision-making process.

You've got to have genuine involvement and engagement with recreational fishers in terms of managing the fisheries."

"At the end of the day it's really a case of getting everyone to understand, and that's fishers, Government and in particular fisheries bureaucrats, that the people who are best placed to talk about management of recreational fisheries are the people who are doing it".

The list of policy issues in which the organisation has played a key advocacy role is long and diverse, covering fish passage, threatened species management, recreational fishing regulations, commercial fisheries, mining activities and unsustainable land development among others. However, AFANT's involvement in the management of recreational fisheries, including controversial issues such as changes to size and bag limits, is not always understood by some.

"Sometimes we're asked why AFANT is involved rather than just letting Government make the decisions, but as we keep saying, if we're going to make these changes, it's much better we're doing it to ourselves than have other people do it to us' says Chris. "You can't just sit back and let other people do it because there are two things you can guarantee, one is, you're not going to be happy and two is, you really don't have any right to complain about it because you really didn't do anything at the front end. Therefore you've really got to be in on the ground clawing, you've got to be in these decision-making processes."

Asked what has led to AFANT's success in becoming an important player in recreational fisheries management in NT, Chris explains that having a strong, independent peak body that is recognised by Government has been critical.

"You've got to have an independent body that's recognised. The hardest thing for Government is when its got to deal with different groups who might have different views, so if you've got a single voice it just makes life so much easier for them and for everybody else."

As an example of AFANT's status as an advocacy body in NT, the organisation was recently consulted by an international company seeking to build a multibillion dollar gas plant in Darwin Harbour. "We were one of the first groups that the company talked to when it started to consider building the plant. There's no doubt that some of the design of that gas plant is going to be on the basis of some of the things that we've said to them in terms of not blocking off access to certain creeks and not blasting the shoal to allow them to get their ships in. AFANT is an organisation that they're dealing with that they're taking seriously in terms of the issues that we're raising, and that's a pretty big achievement, the fact that someone building a multibillion dollar gas plant is taking recreational fishing into account, and taking it into account seriously. That's an example of where we've been able to get 'on the agenda'". In another example, AFANT was briefed by the head of a mining company about a proposal to expand one of its operations before the public announcement and consultation process was initiated. "That's the sort of level that recreational fishing is taken seriously in all these things".

And AFANT's greatest achievement to date? "There are lots of them, but I think the most important thing is that Government here wouldn't seriously make any major moves to do things in recreational fishing without going through adequate consultative processes and involving AFANT. I think that's the biggest achievement, a good co-management approach with Government."

The approach AFANT takes to advocacy was summed up by Chris "I think it was Roosevelt that said 'Speak softly and carry a big stick'". The organisation avoids the type of direct action taken by some advocacy groups "it's not just us sitting and squealing and throwing tantrums in the street. We don't march on Parliament House - every now and again our members want

us to, but we haven't done it yet anyway" he adds laughing, "we use other methods and that gets us taken quite seriously."

Chris is quick to point out the importance of engaging the media as a means of advocating for fishers, for fish and for their habitats. "AFANT did 80 media interviews in 2010, but we only put out 5 media releases. So we're not doing what people think is the traditional way of dealing with the media, we're dealing one-to-one with people in the media". Asked how other angling groups can harness the media to help with their own issues, Chris replies "The media will only be interested in what you've got to say if it's interesting. There's a fine line between feeding the media and just being controversial for the sake of being controversial. The media is not going to talk to you if you're just going to be boring. Why would they bother? So you've got to have a message that the media AND the general public will pick up on....something that sparks peoples interest."

When asked if he had any final advice for angling groups wanting to play a more active role in managing fisheries and fish habitats, Chris proudly replies "Yeah, come to the Northern Territory!". Looking at the level of involvement recreational anglers have achieved in management of fisheries and the environment in the Territory, some may just take that advice.

For more information

National bodies

Australian Recreational Fishing Foundation www.arff.com.au

Recfish Australia <http://www.recfish.com.au/>

Sportfish Australia <http://www.sportsfish.com.au>

Australian National Sportfishing Association <http://www.ansa.com.au/>

State/Territory Bodies

Recfish SA <http://www.sarfac.com>

TARFISH www.tarfish.org

Recreational Fishing Alliance of NSW <http://www.rfansw.com.au>

VRFish <http://www.vrfish.com.au/>

Sunfish Queensland <http://www.sunfishqld.com.au/>

Amateur Fishermans Association of the Northern Territory <http://www.afant.com.au/>

Recfishwest <http://www.recfishwest.org.au/>

Capital Region Fishing Alliance www.crfa.org.au

Further Development

As mentioned earlier *Angling for Conservation* is not designed to be a static snapshot of angler involvement in conservation and sustainability-focussed activities. It is intended to provide a live database that is able to be continually updated as new projects commence and as knowledge and outputs are generated from existing projects. To it is intended that further development will involve additional projects being continually added to the database, and more information being provided on projects already included, as they progress. Recfishing Research's Extension Manager will continually add to the database as an ongoing commitment, and users of the website will be encouraged to tell us about projects that they know about which aren't currently included.

Benefits

Angling for Conservation is expected to provide significant benefit to the recreational fishing community, through providing – for the first time – a data source which is easily accessible to enable users to understand the role that recreational fishers play in caring for our waterways and fish stocks. This information will help to inform discussions regarding access, as well as demonstrating that recreational fishers are not just 'extractors' of our fisheries resources, but are also stewards.

Planned outcomes

The planned outcome of *Angling for Conservation* is to become the primary source of information on angler's involvement in conservation and sustainability projects that is recognised, used, maintained and further developed by the recreational fishing community and accepted by the Australian community.

Conclusions

The project "*Angling for Conservation*" has helped to provide a better understanding of the role that recreational fishers around Australia play in caring for our waterways and fish communities. The information gathered highlights that recreational fishers contribute significant value in caring for our waterways and fish stocks. Key findings of the project include:

- Recreational demonstrate the importance they place on healthy waterways and fish stocks through significant investment. The recreational fishing community have invested an amazing \$33,141,914 of their own money in projects and activities which have a conservation and sustainability focus.
- Of the variety of project types funded by recreational fishers, habitat improvement projects dominate when measured in terms of number of projects. 18% of all projects funded by the recreational fishing community involved revegetation of river banks and foreshores, 17% involved improvement of fish passage, and 14% involved bank stabilisation works to reduce erosion. By value (total \$ invested) the area of most involvement by the recreational fishing community was research to ensure fisheries remained sustainable (\$9.47m), however projects involving educating anglers and the broader community, monitoring of aquatic ecosystems (in particular fish communities), and improving fish passage (e.g. building fishways, removing old

barriers etc) also received significant investment (\$7.9m, \$6.3m and \$5.7m, respectively).

- Most of the projects that have been undertaken have occurred in jurisdictions which have recreational fishing licence programs in place, providing a mechanism for fishers to contribute financially to addressing issues they feel are important.
- Recreational fishers have a natural affinity for projects which involve monitoring of fish communities and populations, or projects which focus on educating other recreational fishers and members of the community about the environment and sustainable practices.
- A web based information tool linked to an accessible database has been developed as part of this project, which provides easy access to information on conservation/sustainability related projects undertaken with angler involvement, using Google Earth as a platform. This output provides a useful way to condense a significant amount of project-specific information into a user-friendly format, to enable the user to learn about where projects have occurred, what they did, and who was responsible. It is very likely that this output would have broad application for communicating R&D outputs more broadly than applied in *Angling for Conservation*.

Appendix 1: Project Communications Strategy

Goal

The goals of this Communication Strategy are to:

- Increase awareness of the level of involvement of the recreational fishing sector in conservation/sustainability-focussed initiatives
- Promote further increases in participation in conservation/sustainability-focussed initiatives

Aims

- guide and support all communications relevant to the implementation of the *Angling for Conservation* project;
- ensure that key messages are delivered efficiently and effectively to key stakeholder groups;
- identify potential impediments to successful implementation of this Communications Strategy (Challenges);
- clarify what will be accomplished through communication/extension activities (objectives);
- identify intended audience(s);
- summarise key messages;
- clarify proposed channels for communication with key audience groups; and,
- establish how results will be measured (evaluation).

Challenges

Key challenges relating to planned communication initiatives include:

1. Understanding and meeting expectations of stakeholder groups;
2. Explaining the purpose and findings of *Angling for Conservation* in a way that all audiences can understand and support; and
3. Promote active engagement in *Angling for Conservation* to ensure project legacy;

Understanding and meeting expectations of stakeholder groups

There is a need to understand the expectations held by various stakeholder groups with respect to implementation of *Angling for Conservation* to ensure it addresses identified needs. Ongoing communication with recreational fishers nationally (principally through peak bodies) will be essential, as will the need to engage with relevant government departments (state fisheries agencies, the Department of Sustainability Environment, Water Populations and Communities (SEWPaC), environmental groups and NGOs to ensure this challenge is addressed.

Explaining the purpose and findings of *Angling for Conservation* in a way that all audiences can understand and support

Developing sound understanding of the purpose of this project will be essential to gain support and involvement of the recreational fishing community. Consequently it will be essential to target early extension towards communicating the purpose of the project, and how it will benefit the recreational fishing sector.

Promote active engagement in Angling for Conservation to ensure project legacy purpose

Ongoing contributions from the recreational sector will be essential to ensure the *Angling for Conservation* database remains current. It will be essential to provide results to the recreational sector which are correct, and relevant to them, in order to ensure appropriate incentives exist for their ongoing participation. This will require consultation with the recreational fishing community (principally through peak bodies) to ensure information provided as outputs of *Angling for Conservation* address their needs.

Objectives

Through the implementation of this Communication Strategy it is intended that target audiences will:

1. appreciate the purpose of *Angling for Conservation*;
2. be cognizant of the process through which they can provide input to the project, and benefits from doing so;
3. be kept informed about progress with implementation of the project (including specific findings/outcomes).
4. recognise *Angling for Conservation* as the primary source of information on angler's involvement in conservation and sustainability projects.

Stakeholder Analysis

There are five key audiences for *Angling for Conservation*:

- recreational fishers (including indigenous fishers);
- funding bodies/advisory groups and government agencies;
- research providers;
- environmental groups/NGOs;
- the broader community.

The project team will utilise appropriate channels to engage with each of these audiences to deliver key messages (See Table 1 for more information).

Key messages are identified for each audience below, and the 'Approach' section then identifies primary communication tools and channels to target each audience in the most efficient and effective manner.

Key Messages:

- *Angling for Conservation* is an initiative funded by the Fisheries Research and Development Corporation to bring together information on the range of projects and initiatives occurring and completed around Australia with a conservation/sustainability focus, and involvement from recreational fishers.
- Recreational fishers are increasingly involved in caring for our fish stocks and waterways, and there are some great examples of projects funded by or delivered with the help of anglers around Australia.
- It is important that we continue to build on these good examples and get more recreational fishers involved in looking after our fish and waterways.
- Direct recreational fishers and other stakeholder groups on how to provide updates to the *Angling for Conservation* database and website, to provide a comprehensive resource to draw upon when seeking information on angler involvement in conservation-based initiatives.

Approach

The following table describes primary channels for engaging with key audiences identified above. Emphasis will be placed upon utilising appropriate technology and building on/utilising existing communication networks where possible.

Table 1 Primary channels for engaging with key audiences

Channel	Details	Audience(s)	Timing
Printed media	Articles will be published in fishing media and disseminated through Recfishing Research’s extension network, explaining the genesis and purpose of <i>Angling for Conservation</i> , and communicating results obtained.		
Flyer	Development and distribution of a flyer communicating the purpose of <i>Angling for Conservation</i> , and seeking contribution of information on relevant projects	Recreational fishing clubs, individuals and peak bodies	One month after commencement
Escape with ET and Fishing World magazines	Publication of article explaining the purpose of <i>Angling for Conservation</i> , and results received. Summary should also highlight the need for more similar actions, direct readers to the <i>Angling for Conservation</i> website, and provide information on how to contribute information on relevant projects.	Recreational fishers	On completion of first draft of the database and website
Rip Rap magazine	Publication of article explaining the purpose of <i>Angling for Conservation</i> , and results received. Summary should also highlight the need for more similar actions, direct readers to the <i>Angling for Conservation</i> website, and provide information on how to contribute information on relevant projects.	Funding bodies/advisory groups and government agencies, Research providers, Environmental groups/NGOs;	On completion of first draft of the database and website

FRDC's FISH Magazine	Publication of article explaining the purpose of <i>Angling for Conservation</i> , and results received. Summary should also highlight the need for more similar actions, direct readers to the <i>Angling for Conservation</i> website, and provide information on how to contribute information on relevant projects.	Funding bodies/advisory groups and government agencies, Research providers, Environmental groups/NGOs;	On completion of first draft of the database and website
NSW DPI's Newstreams e-newsletter, MDBA E-Newsletter, SA fishfacts e-newsletter, Vic fish-e-fax e-newsletter, QLD 'Direct' e-newsletter, VR Fish's E-newsletter, SARFAC's E-newsletter, Sunfish's E-newsletter, NSW Recreational Fishing Alliance Bulletin	Publication of article explaining the purpose of <i>Angling for Conservation</i> , and results received. Summary should also highlight the need for more similar actions, direct readers to the <i>Angling for Conservation</i> website, and provide information on how to contribute information on relevant projects.	Recreational fishers, Funding bodies/advisory groups and government agencies, Research providers, Environmental groups/NGOs	Bi-monthly circular. Submit article for April 2012 edition, and again as milestones are achieved.

WWF's E-newsletter	Publication of article explaining the purpose of <i>Angling for Conservation</i> , and results received. Summary should also highlight the need for more similar actions, direct readers to the <i>Angling for Conservation</i> website, and provide information on how to contribute information on relevant projects.	Non-fishing public, NGOs, Conservationists	Monthly circular. Submit article as key milestones are achieved.
Recfishing Research Network	Distribute content explaining the purpose of <i>Angling for Conservation</i> , and results received. Summary should also highlight the need for more similar actions, direct readers to the <i>Angling for Conservation</i> website, and provide information on how to contribute information on relevant projects.	Funding bodies/advisory groups and government agencies, Research providers	On completion of first draft of the database and website
Electronic media	Efficient and effective electronic means (website development, social media etc) should be utilised to increase awareness of <i>Angling for Conservation</i> , and promote involvement in submission of information. These approaches should also be utilised for communication of project outcomes.		
Angling for Conservation Website	Develop and launch a dedicated website enabling users to learn about conservation/sustainability-focussed issues being addressed through involvement of recreational fishers. The website should also incorporate a web-based information tool which interrogates the <i>Angling for Conservation</i> website, so that users can learn more about projects occurring in a specific location, or addressing a specific issue.	Recreational fishers (including indigenous fishers), funding bodies/advisory groups and government agencies, research providers, environmental groups/NGOs, the broader community.	By June 2012
Fishing World - website	Submit summary piece explaining the purpose of <i>Angling</i>	Recreational fishers	August 2012

	<i>for Conservation</i> , and results received. Summary should also highlight the need for more similar actions, direct readers to the <i>Angling for Conservation</i> website, and provide information on how to contribute information on relevant projects.		
Austfish, Fishnet and Tacklebox online forums	Submit posts explaining the purpose of <i>Angling for Conservation</i> , and results received. Summary should also highlight the need for more similar actions, direct readers to the <i>Angling for Conservation</i> website, and provide information on how to contribute information on relevant projects.	Recreational fishers	On project commencement and periodically throughout project delivery.
Podcasts 'Fishing for Answers'	Develop a series of podcasts entitled 'Fishing for Answers', which interviews recreational fishers involved in projects included in the <i>Angling for Conservation database</i> , explaining what was done, how they benefited through involvement, and how others can become involved in similar activities.	Recreational fishers (including indigenous fishers), funding bodies/advisory groups and government agencies, research providers, environmental groups/NGOs, the broader community.	Podcasts will be developed on a monthly basis following completion of the database and website.
<i>Angling for Conservation</i> Facebook page	Develop and maintain a Facebook site for <i>Angling for Conservation</i> which provides regular updates on projects underway and directs people to the AfC website	Recreational fishers (including indigenous fishers), funding bodies/advisory groups and government agencies, research providers, environmental groups/NGOs, the broader community.	On project commencement and periodically throughout project delivery.

Proposed Podcast Schedule

1. How does improving fish habitat help me catch more fish? (Allan Fowkes, Bass Sydney)
2. How do dams, road crossings and weirs affect my fishing? (Tim Marsden DAFF)
3. Maximising survival of the fish that I catch – (Bill Sawynok, Infofish Australia)
4. Recreational fishers restoring populations of threatened fish species (Graham Creed, Native Fish Australia)
5. More Habitat = More Fish: The Fish Habitat Network (Craig Copeland, NSW DPI and Christopher Collins VRFish)
6. Does controlling pest fish species (e.g. carp) actually improve recreational fishing? (Peter Gehrke, SMEC)
7. Anglers advocating for healthier fisheries (Frank Prokop)
8. Does re-snagging actually improve my fishing? (Jarod Lyon, DSE)
9. Careful community monitoring (Bill Sawynok, Infofish Australia and Daniel Grixti, Consultant)
10. Rec fishers takin' out the trash (Judy Lynne, Sunfish Queensland and Kurt Edwards, ALBAA)