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Development of a strategy to address national needs for recreational fishing data for fisheries management and development

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Project No. 2008/042

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The Fisheries Research and Development Corporation plans, invests in and manages fisheries research and development throughout Australia. It is a statutory authority within the portfolio of the federal Minister for Agriculture, Fisheries and Forestry, jointly funded by the Australian Government and the fishing industry.

2008/042 Development of a strategy to address national needs for recreational fishing data for fisheries management and development.

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OBJECTIVE

1. To develop a national strategy for the efficient and effective collection and management of recreational fisheries data for government and industry.

NON TECHNICAL SUMMARY

OUTCOMES ACHIEVED TO DATE

A workshop was conducted on the 25th July 2008, as well as other related meetings at later dates, discussing the development of a plan to address national needs for recreational fisheries data for fisheries management and development. A draft strategy was developed and accepted by the working group that included experts in fisheries management, recreational fishing, social science, economics and fisheries science and policy.

The project has identified the key biological, social and economic data required to build a solid foundation for future analysis of the recreational fishing sector. It also identified potential users of this data, their knowledge, attitudes, skills and abilities, and their desired practice change. Importantly it focussed work in this area on the outcomes to be delivered. This project has developed recommendations to guide research and activity in the to progress efficient and effective collection of biological, social and economic data in the recreational fishing industry. As a result of the implementation of the strategy planned in this project, and the use of its outputs to assist recreational fisheries management decisions, social and economic benefits to the community from recreational fishing will be increased.

The sustainability of the recreational fishing sector and its ability to meet its full potential in terms of creating additional economic and social value will be facilitated by the creation of an effective system of collection, curation and sharing of fishery/biological, social and economic data for the sector. The objective of this report is to develop a national strategy to guide future research and activity for the efficient and effective collection and management of recreational fisheries data for government, industry and the community.

A working group was formed to assist in identifying the sources and methodologies required to collect and manage data for the recreational fishing sector. The recommendations of this report, developed in consultation with the working group, will guide future research toward areas of need within the recreational fishing sector. As critical gaps in research and data management are addressed, government, fishers and industry will be better equipped to make informed management and investment decisions in relation to recreational fishing — ultimately achieving better social, economic and biological outcomes.

The fishery, economic and social objectives of fisheries management vary among jurisdictions according to community expectations and the condition of local fisheries. Fishery data that provides an estimate of recreational catch and fishing effort is currently collected by researches and anglers to aid the understanding of the impact of fishing on stocks of important recreational fishing species both targeted

and caught. This data underpins the sustainable development of these fisheries. A strategic approach to addressing national needs for fishery data relevant to recreational fishing is required to establish a national long-term historical data set for the sector. Qualitative data collection methods are currently used across fisheries, but not in a consistent manner; the current need for biological recreational fisheries data would require large scale quantitative data collection, which is applicable to selective fisheries. This large-scale assessment can be completed as infrequently as every 10 years given that it incorporates acceptable levels of accuracy, and is collected as a complete set that can be applied nationally.

Methods for the collection of social demographic data have been broadly applied to inform assessments of the social impacts of the recreational use of natural resources in specific regions. Data exclusively collected for recreational fishing in the area of social impact at the community level is however extremely limited. Sound analysis of the different segments of the recreational fishing sector to determine parameters such as fisher's attitudes, values, behaviours and current practices and their knowledge continuum will enable ongoing work to monitor changes in these parameters over time. Greater understanding of the social demographics of the recreational fishing sector will enable more effective communication with specific groups. Communication to each specific group within the recreational fishing sector should be tailored to ensure that it is effective for the purposes of data collection, development and implementation of fisheries management policy, and for formal consultation purposes.

There is currently little reliable information about the economic value of recreational fisheries in Australia. Without quantitative measures of economic value, the preferences of recreational fishers cannot be fully accounted for in policy and management decisions. Any plan to collect economic data should include identification and estimation of the 'non-market' values and economic drivers' of the sector to enable analysis of change in these values overtime. It is likely that data which provides an indication of economic impact is collected through existing state wide and site specific data collection programs within various jurisdictions. More complex, specialised economic valuation techniques will provide more complete measures of value than a simple expenditure assessment approach. Collection and management of data which provides a measure of state wide and fishery-specific economic values will provide a basis for the calculation of the net benefits of recreational fishing.

As originally proposed, this project was to deliver recommendations on; making existing and future data sets accessible to stakeholders, the development or identification of skills and resources, minimum data needs for fisheries ranging from high value national fisheries to low value fisheries, and methods for the development and reporting standards for angler-based data collection programs in order to prepare a national recreational fisheries data plan. However, under the methodology adopted it has only been possible to achieve recommendations mainly focussed on minimum data elements. Recommendations, albeit to a lesser extent, are also made in areas of methods development, reporting standards, and the development or identification of skills and resources. To form the basis of the national data plan further research is required into the use of online data accessibility and reporting, the development of skills in social and economic data collection, processes to achieve consistency and the development of a pathway from current processes of data collection to ones that facilitate the aggregation of data.

The strategy outlined in this report will assist Research and Development investors and providers to focus their resources on areas of national need and priority. It will assist researchers to identify and access recreational fisheries data sets, thus expanding the resources engaged in analysis and methods development. It will also assist industry to access information for development and extension purposes. The widespread recognition and uptake of this national plan will facilitate constructive networks, industry-government partnerships and dialogues. The plan will be the starting point for a continuing process of improving the objective basis for managing and developing Australia's recreational fisheries.

KEYWORDS: **Recreational fishing, data collection, fisheries management.**

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1. Background

Late in 2006, the need for a coordinated national approach to the collection of recreational fisheries data was identified. The Australian Fisheries Management Forum (AFMF) Sub-Committee for Science and Research then liaised with Recfish Australia and Recfishing Research (FRDC 2007/227) concerning a national approach to data collection and management that meets the needs of government, industry and community. There is strong support for the development of a national recreational fisheries data plan based on the respective and combined needs of government and industry stakeholders.

The approach proposed here recognises that the 2000 National Recreational and Indigenous Fishing Survey provided information that while useful and widely used is unlikely to be repeated. As a result, each jurisdiction is independently collecting recreational fishing data for stock assessment, resource allocation and other management requirements.

2. Need

Governments and industry have recognised the importance and potential for further development of the recreational fishing sector. Management and development of the sector requires data on the economic and social values, and its interaction with the resource. There is a need to effectively and efficiently collect, curate and share related recreational fisheries data. A systematic national approach to the collection and management of recreational fisheries data would assist with the prediction of the impacts of regulatory decisions, involvement and program implementation.

A systematic and coordinated approach to the collection and sharing of recreational fisheries data for fisheries management and industry development are common themes in the;

- FRDC Research and Development Plan to 2010
- AFMF 2006-2008 Research Priorities
- 2006 State of the Marine Environment Report (SOMER) (Zann L. P.2006)
- AFMF Fisheries Statistics Working Group 'Strategy to improve the quality, comparability and availability of fisheries data and statistics in Australia'.

The Program Logic Diagram for the data needs for recreational fishing (Figure 1) illustrates how data collection links to the desired outcomes for government, fishers and the broader community. The diagram seeks to identify the key users of the data; it will be used to drive practice change and outcomes. The strategy is the initial stage in implementing a national strategic, coordinated approach to the collection, management and access of data. The adoption of the strategy alone will not directly achieve high level community outcomes relating to the maximisation of the social and economic benefits to the community from recreational fishing. The recommendations of this report will guide future research and investment toward areas of need within the recreational fishing sector. As critical gaps in research and data management are addressed, government and industry will be better equipped to make informed management and investment decisions in relation to recreational fishing- ultimately achieving higher level social, economic and biological outcomes.

3. Current government and industry data collection programs

The 2000-2001 National Recreational and Indigenous Fishing Survey (NRIFS) has been the most comprehensive assessment of recreational fishing in Australia. This survey provided a snapshot of all recreational fisheries in Australia, presenting information that has been and is still currently widely used. The 1994 Recreational Fishing National Policy stated that a national survey seeking data on expenditure, participation, desirable species, catch rates, and fisher attitudes and motivations, should be undertaken on a five-yearly basis. Further national surveys collecting this data have not been undertaken since the 2000-2001 NRIFS.

The greatest challenge in successfully conducting a national survey to facilitate future management and development decisions is to meet the variety of information needs between government, industry and the community. A large scale survey provides limited detail about rare events or specific issues, such as game-fish catch or social value; however assessments that intend to obtain detail on these events or issues are not likely to provide broader information beyond the issue itself.

Since the 2000-2001 national survey several states have undertaken additional comprehensive state-wide surveys. Most of these have comprised large scale off-site data collection. Few have been complemented with on-site data collection providing finer detail. Although current state surveys are collecting catch data, there is a need for supporting data collection at a finer scale to validate catch rate estimates by species, provide accurate weight and size/age composition if used for stock assessments, and review of management arrangements – for example the adherence to or need for change of regulations such as size and bag limits. On-site data collection provides additional information on fishing by interstate and overseas visitors, which cannot be collected through interviews relying on local telephone directories. This is particularly important for areas of high recreational fishing tourism.

Bureau of Rural Sciences (BRS) (2008) describes 33 Australian recreational fisheries databases, at least half of which can be considered to have an ongoing component and represent considerable investment in recreational fishery data collection. The report identifies common data collection and management methods and gives an indication of the extent to which social and economic data is collected in addition to biological data.

The current collection of biological data is substantial and methodologies vary greatly between fisheries. This is expected with varying objectives and spatial scales. Surveys are patchy in distribution. Widespread, statistically robust methodologies are required to be able to assess the biological impact of recreational fishing activity and to enhance the sustainable management of recreational fisheries. Fishing effort at the jurisdiction/population level has only been collected by three states since NRIFS in 2001. Even though there is the expectation that the Northern Territory will also be providing this data in 2009, the collection of this data is patchy. South Australia and Tasmania have recently completed state wide surveys (2008-09), aimed at providing information on participation (including fisher demographics), catch and effort. The Northern Territory has recently implemented a Recreational Fishing Survey 2009-10 which will collect catch and fishing effort data, as well as participation and expenditure, for both local and visiting anglers in the territory. The New South Wales government have conducted a two year Recreational Fishing Survey starting in March 2007, which collected data on participants and associated catch.

Important recreational fisheries information is collected and managed in a number of data-bases that are not described in BRS (2008). In Victoria, these include Victag angler-based fish tagging program, the Victorian Department of Primary Industries fish stocking data-bases and the Recreational Fishing Licence data-base which has potential value for participation trends, communication with fishers and for survey sampling frames. The Rock Lobster Database in Tasmania is another example. Recreational Fishing Licence databases hold details of one and three year fishing licence holders. There are limitations however of using a licence holder database for which there is exempt categories, such as fishers under the age of 18 or seniors, since these groups may be the greatest beneficiaries of the outcomes or highest users of the resource. Exempt categories create incomplete coverage of participants or additional costs to collect the required information. Licence databases are not in place in all Australian states and territories and would therefore not be useful on a national scale.

Current large scale social and economic surveys mainly cover demographic, expenditure and attitudinal components. There is no coordination of social and economic data collection across jurisdictions in terms of data items. This co-ordination would be desirable to quantify the socioeconomic value of recreational fishing and provide key stakeholders and government with comparable data to use as a basis to frame recreational activity, research and policy. Records of participation for an array of recreational activities, including fishing, have been obtained over the last couple of decades through many of the state government sports and recreation departments as well as through the Australian Bureau of Statistics.

The recreational fishing 'industry' is comprised of organisations which obtain revenue to some extent from recreational fishing such as the fishing tackle trade, fishing tourism and boating industry, all of which require various sorts of recreational fisheries data to meet its various purposes. The recreational fishing community, comprising of the fishers themselves, have formed various fishing organisations and community based groups. Several states are currently running industry and community recreational fishing data-bases, for examples in Queensland the Capricorn Reef Monitoring Program (CapReef) and Ray Joyce charter/snapper database. State based tagging programs run by sportfishing associations throughout Australia, under the umbrella of AUSTAG, are building a knowledge base on the fish species that form the basis of sportfishing.

Recreational fishing data bases held by Australian universities contribute to the current body of knowledge in all biological, social and economic aspects of the fishery. For example, the Queensland state wide recreational fishing social survey conducted by James Cook University in 2004. A current post graduate study at Melbourne University is surveying twelve sites at Port Phillip Bay with time lapse cameras to acquire numbers on the actual fishing pressure at these sites. Some areas of university research can also be used to indirectly assess the affects of fishing, for example the difference in community assemblages of fish inside and outside of marine protected areas.

Morrison (2006) compiled a brief overview of the current recreational surveys being completed in Australia, finding that these surveys are widely used but unevenly distributed and make use of a range of different methods. The most commonly collected category of information was found to be fishing effort, although broad biological data and catch rates are also being frequently collected. Less than half of the surveys were collecting data associated with social and economic aspects of recreational fishing. The value of this information has been underestimated. A better balanced investment in social, economic and fisheries data would facilitate a well rounded assessment of the sector.

The access to data derived from current surveys is limited. Only one of the 33 surveys described in BRS (2008) is accessible in an interactive web application. Access to data from other surveys is mostly limited to statistics published in project reports. There is an immense amount of data and scientific research material in existence relative to recreational fishing, even with the basic knowledge and right tools it

would take a great amount of time to actually find it. The need for recreational fisheries information to be available to government, industry and community requires improved data management and accessibility. Efficient recovery and access to source data would necessitate storage in dedicated data warehouses or directories along with published metadata records.

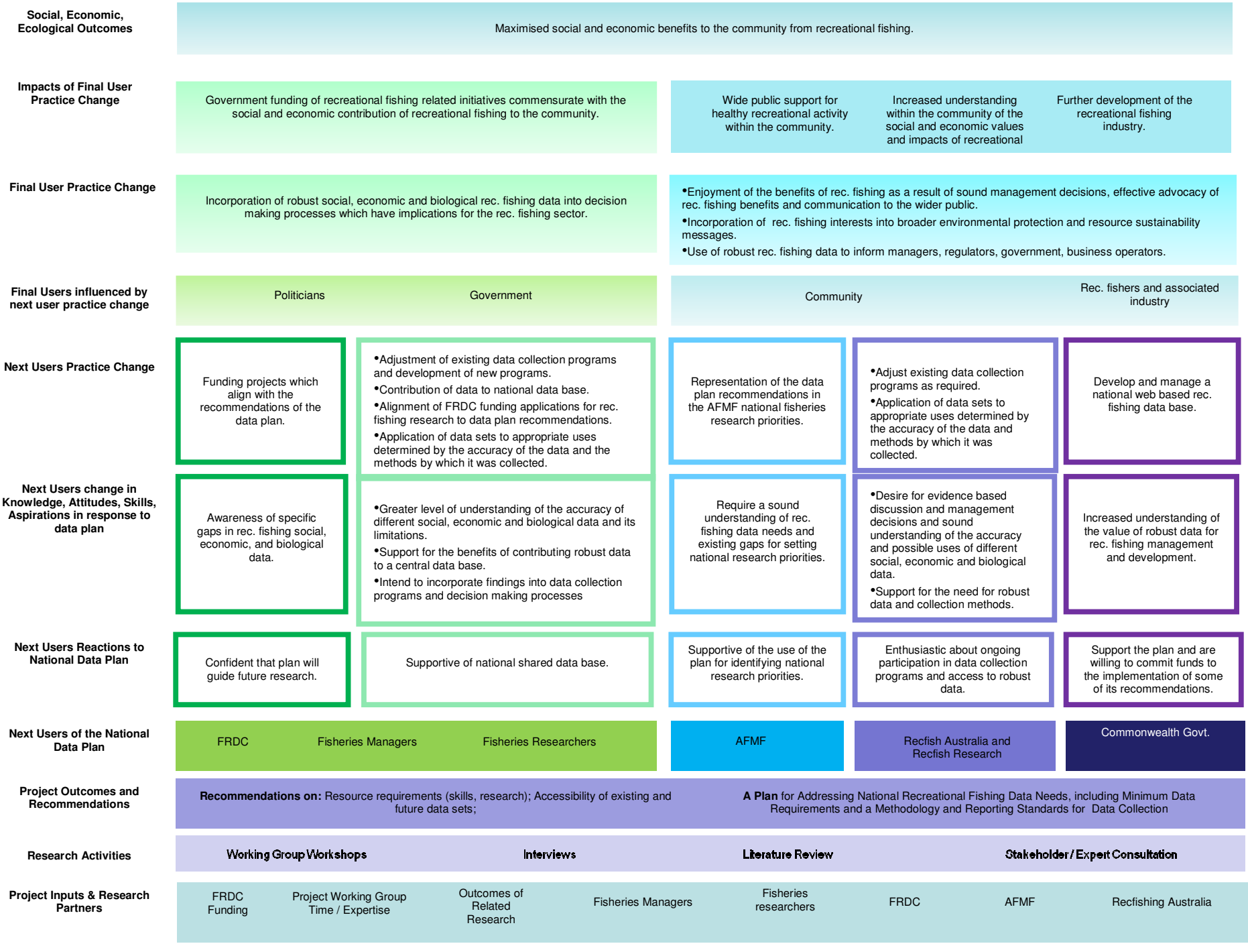
Priority areas in addressing the gaps in current data sets should deal with the needs that are of highest importance to the management and development of the fishery. Improved knowledge of catch and effort across all jurisdictions is an important output of biological data collection. A holistic approach must be taken when estimating the 'value' of the recreational fishing sector, including all defining benefits. Economic indicators, including the 'dollar value' of effort is another priority area, ensuring the inclusion of economic factors such as tackle, bait, fuel, transport and tourism drivers. Social priorities should include identifying distinct demographic groups and market segments within the recreational fishing community as well as the values, health and wellbeing of recreational fisheries within these groups.

4. Methods

The majority of the recommendations made in this report in relation to data requirements, collection and management have been developed in consultation with experts in the fields of collecting and managing social, economic and biological data relating to the recreational use of natural resources. Meetings with key individuals in government and representatives from the recreational fishing industry and community provided information on current data collection programs, and the extent to which these meet government and industry needs for recreational fisheries management and development. Review of activities measuring the social and economic impacts and values of users of natural resources assisted in guiding recommendations for future social and economic research in relation to recreational fishing.

Participation by the project working group in a workshop at the commencement of the project aided the development of a detailed program logic. The program logic (Figure 1) is included in this report and is intended to outline how data collection will bring about practice change and improvements in the management and development of recreational fishing, and ultimately how this data will be applied in recreational fisheries management and development and result in social and economic benefits to the broader community.

Figure 1. Program logic for data needs for recreational fishing.



5. Discussion

5.1. Design of data collection strategy

To serve the purpose of government, recreational fishers and industry, a strategic approach to the collection and management of social, economic and biological data for recreational fishing is required. This approach will need to deliver detailed data for long term, large scale fishery assessments, and less detailed data that can be collected quickly for use as short term fishery indicators. Large scale collection of qualitative and quantitative data should be collected less frequently, in much the same manner as the 2001 NRIFS, and complemented by fishery indicator data collected through ongoing collection programs. Once established, it is anticipated that large scale, fishery assessment data sets will require periodic repeats, around every 5 years, and should develop and change in specification based on increased knowledge. These data sets will be reassessed using information from fishery or performance indicators collected outside of the large-scale data assessments. Where analysis shows that existing social, economic or biological data parameters are no longer valid or new parameters need to be considered – new surveys are to be developed which captures this data.

The recreational fishing data continuum shown in Figure 2 represents an approach to collecting robust data, without the need for continuous, high-cost assessments. An initial qualitative assessment will indicate what information is required and which questions need answering through quantitative assessment. The quantitative assessment then provides an evaluation of the fishery and is used to identify indicator parameters. Ongoing monitoring can then be completed using these indicator parameters over a period of time, providing information regarding trends and rates of change, assuming that these indicators are sensitive to both direction and magnitude of change. Qualitative and quantitative reassessment completed periodically is desirable to validate and quantify the magnitude of indicators. This should occur about every 5 years to ensure the validation of ongoing indicators. The use of survey triggers should also indicate the frequency of reassessments.

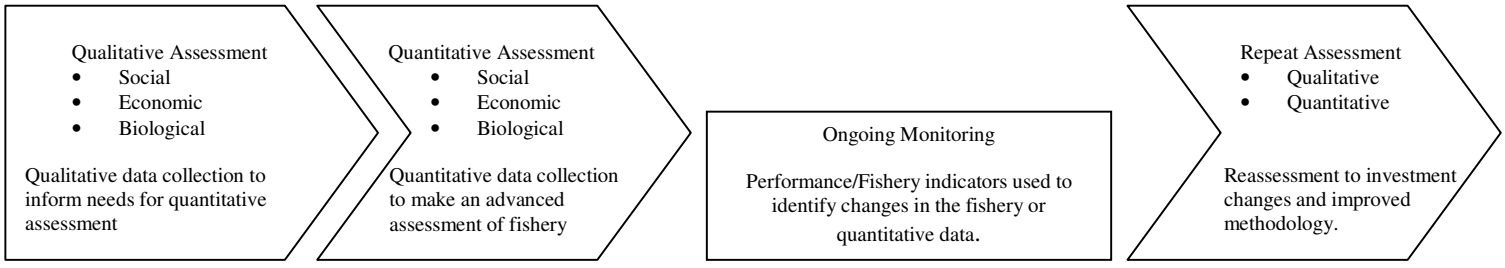


Figure (2) Recreational fishing data continuum

The utility of any recreational fisheries data will be most effective when derived from statistically robust methodologies, and based on structured guidelines and operational procedures that are consistent between fisheries. This consistency will assure that both local and national collection of data can result in reliable information, with limited non-sample error and statistically acceptable results. Pilot tests of survey methodologies are an effective means of providing validation and quality control.

Data sets compiled by using different methodologies have limitations due to the differences in survey designs. Morrison (2006) provides a brief overview of current recreational fishing surveys in Australia finding that differences are inevitable due to factors such as differing survey objectives, available

resources, the spatial and temporal scale of the target fisheries, and the availability of appropriate sampling frames. Individual researchers and jurisdictions will have their own goals and causes and the need for different data sets and outcomes will vary with the passing of time and the needs of the data end users. A more consistent approach to the collection of data (including data elements) would help reduce the effect these factors have on the cost-effectiveness and utility of accumulated data sets but would still need to be considered in the context of the requirements of the specific survey. Research will need to look further into how to overcome the persistent problems that lie in the pathway of getting more consistency and cohesion in data collection nationally, meeting the needs of various jurisdictions while developing the capability to produce national statistics.

Achieving data consistency should still allow for the needs of various jurisdictions while developing the capacity of producing national statistics. It is not intended to impose or advocate standardisation of data collection methods nationally. Consistency in the type of information collected can occur as the result of the use of the minimum data elements recommended in this report. Opportunistic collection options that achieve consistency are also suggested, and would include the essential information that would be required if space, time, funding or interest was limited.

The management and development of the recreational fishing sector will require a better balance of investment in the collection of fishery, social and economic data. There is generally a trade-off between the cost of data collection and data accuracy and precision. The extent of the funding available for the research will have a direct effect on the reliability of the data provided. A study currently being undertaken by CSIRO is focusing on developing innovative and cost-effective tools for monitoring recreational fishing in Commonwealth fisheries. This study may provide recommendations that could lower the cost of data collection without compromising data quality and utility.

Effective data collection methodologies, that plan to encompass biological, social and economic aspects, should incorporate off-site and on-site surveys. The type of questions asked should be dependant on whether the sampling frame is off-site or on-site. Essentially on-site collection allows the collection of more specific information about the actual trip being undertaken (e.g. catch by species) however it is difficult to incorporate extensive questions such as those that would need to be incorporated into a social data set. Off-site collection can be incorporated to provide the use of more detailed questions that tend to be less specific to particular trips. Off-site surveys derive selection issues that are effectively avoided in on-site collection. An ideal data collection program would incorporate telephone interviews, angler diaries as well as on-site surveys.

Data access by government, industry and the community is an important aspect of data management. An online service similar to that of the Marine Recreational Information Program (MRIP) constructed by the National Oceanic and Atmospheric Administration of the United States (NOAA, 2008), would allow data to be easily accessed and monitored. This service allows stakeholders to review knowledge about the fishery tailored for their needs and can upload and administrate their own observations and data online. BlueNet is another example of a data management system which plans to manage research data online. BlueNet is an Australian initiative established by the University of Tasmania; its scheme is to support long term curation and management of data for Australia's marine science researchers by linking vast data repositories and marine resources that currently exist in academic and government institutions both in Australia and overseas (BlueNet, 2008).

Making existing and future data available through comprehensive metadata and database schemas would be of benefit to recreational fishers, the associated industry and the community. It would increase the ease of accessibility for use and would be an effective way to relay the methodology used and accuracy of the data. Extensive amounts of work and resources would be needed to construct and ensure the success of such a data base. It is necessary that data is available in raw format, similar to that provided by the Australian Bureau of Statistics, so it can then be analysed as required.

Engagement, involvement and feedback to the community and industry are important links in a sustainable fisheries management solution. Community involvement in continuous recreational fisheries monitoring is invaluable in factually understanding social, economic and biological impact while at the same time providing real time, valid, reference data. This cost effective approach allows community to be involved, informed and empowered as part of sustainable fisheries solutions and management strategies. Likewise the method of management and accessibility of the data would only be successful if its existence is communicated to the potential users. An accessible data-base will still not be achieving its purpose if it is not actually being used. Reflecting the accuracy of the data in the reporting is also an important factor that affects its utility.

5. 2 Fisheries Data Collection

Fisheries data is typically used to support decisions relating to fisheries policy and management. In broad terms, objectives focus on management of stocks for sustainable harvest, allocation of fisheries resources and optimising the productivity and value of fisheries resources. Fisheries data is collected to seek to understand the status of fish stocks and the fishery to ensure the management of fishing activity is meeting community values, promoting sustainability and equitable resource allocation arrangements. Improved management of fishery resources can occur by accounting more accurately for non-commercial take.

Management of recreational fishing faces several unique challenges in regards to biological impact of fishing, noting that recreational fishing effort and catch cannot be readily constrained within the management frameworks that apply in Australia. Even with licensing systems, size and bag limits and/or closed areas or seasons, the actual levels of fishing activity remain highly variable between individuals. This makes accurate assessment of the number of active fishers, the total time spent fishing and the total harvest difficult. Furthermore, unlike commercial operators, recreational fishers are not required to maintain records or their fishing activities, and thus in order to understand fishery dynamics and fishing induced mortality some form of survey is required for recreational fisheries.

The interaction between recreational fishers and the resource is generally well understood. The challenge is to quantify the interaction in a manner that supports sustainable development. The collection of accurate fishery and biological data for the recreational sector is becoming increasingly important with the increase in recreational fisher participation. Fisheries managers and researchers collect data to support the estimation of recreational catch sporadically in targeted studies. Most studies are implemented in response to management issues or crises and very few are on-going. Incorporated into this is the collection of relevant angler information to provide an indication of levels of participation (avidity) and ability.

A variety of methods including off-site, on-site or complemented survey designs are available to quantitatively determine effort and take. These are often expensive to undertake, noting the large numbers of fishers, the need for representative and unbiased sampling, spatial and temporal scales that many fisheries operate over, and the need for data precision.

Recommendations

A strategic approach to addressing national needs for biological fishery data relevant to recreational fishing should provide clarity in regards to;

- Developing nationally consistent methodology to meet the data requirements for periodic, detailed fishery snap-shots, incorporating acceptable levels of accuracy which enable robust, large-scale assessments of recreational fisheries. This information will anchor time series analysis and enable identification of fishery trends over time.
- Developing a validation fishery indicator program which meets minimum requirements for data for continuous fishery assessments and monitoring.
- Developing quality assurance and quality control processes to support the above recommendations.

Data requirements for detailed fishery assessments.

Periodic, quantitative fishery surveys, carried out either within a single jurisdiction, a specific fishery, or collaboratively by several jurisdictions, should provide data of sufficient quality that enables its use as part of broader regional and national assessments. Table 1 outlines parameters considered critical to any data set collected to provide robust benchmarks from which long term trend analysis for specific fisheries to be monitored. As a minimum, information should include total catch, structure of catch, and be capable of being spatially and temporarily disaggregated.

Existing data collection programs already collect many of the elements listed. To supply data which can be applied nationally there is a need to ensure that data are collected in a consistent manner. Total catch should be based on number of fish kept and numbers released by species. The number of released fish is becoming more common and important. Catch and release areas such as that near remote Weipa, Qld, and the Sydney Harbour, as well as catch and release tournaments and size regulations, all are contributing factors to the levels of released fish. Catch structure incorporates length and weight information, and need to be sensitive to operational parameters, including fishing methods, targeting and location. From size composition information it is possible to express harvest in terms of weight for input into stock assessments and for comparison with commercial fishery production. Lynch (2008) provides an example of the use of spatial and temporal recreational fisheries information for management decisions in determining the configuration of zoning in marine protected areas.

A broader set of parameters that characterises fisheries and fishing activity are also desirable outputs of quantitative surveys (Table 2). These data provide detail regarding fishing success rates (party and individual catches), catch structure (catch by species and method), and fishing effort (supported by fishing method and platform) as well as temporal and spatial detail (location, date, time of day). Fisher avidity is an important profiling characteristic that influences a number of factors such as probability of selection (on-site surveys), likelihood to respond to surveys, skill and fishing success. It is recommended that such information be collected at the level of the fishing party and/or individual fisher. The platform of a fisher can be complicated given that there is the possibility of a fisher taking a boat to an island/site and fishing from land, therefore options of ‘boat, land or both’ all need to be provided.

Data requirements for fishery biological indicators.

Fishery indicators will be collected largely through data collection programs and survey processes which already exist in most jurisdictions or can be cost effectively implemented. Such data cannot be used to directly estimate total recreational effort or harvest since data sources are unlikely to be representative of all fishery components. Information such as catch rates and catch composition can be used to inform on trends in fishing success, stock status, population structure and management control changes. It is critical there is underlying consistency over time in how the data are collected to ensure valid interpretation of trends in indicators.

Table 3 outlines data requirements for data sets to be used as fishery/ biological indicators. The most critical parameters to use as biological indicators include; catch rate, size composition, key species composition, gear/method, location, platform and date. Catch rate, in relation to catch, effort, method, avidity and target species, is a commonly utilised metric for recreational fishing and is an important factor that is used to support decisions relating to fisheries policy and management. The ongoing collection of this information will allow changes in the fishery to be identified and investigated further to then be incorporated into these decisions.

The Victorian Angler Fishing Diary Program represents an example of an approach to collect biological indicators. This program collects data consistent to that listed in Table 3 through the use of angler diaries. Structured on site surveys are also undertaken to complement the angler diaries to collect catch rate and

size composition data for the purpose of stock assessment. Information provided by a similar approach would enable the ongoing collection of data required to identify biological changes without the need to provide total harvest or effort estimates and would aid in addressing management questions where time or resources to collect data are not available. Indicator data can also indicate possible changes in the fishery in future that may require further investigation and investment.

The collection of recreational fisheries data requires ground truthing to validate the effectiveness of collection methods, in particular the utility of biological indicators. This will require periodic larger scale, quantitative assessments to reference indicators in the context of the overall fishery and test sensitivity of indicators to correctly detect change. This along with regular audit and quality checks will increase the confidence that can be placed on the data.

While quantitative assessments require sound statistical basis and expert survey staff, less expertise is required when collecting indicator data. The use of volunteer recreational fishers in data collection for indicator data is possible, if not preferable. This would assist in offsetting costs and enhancing fisher stewardship. Community based groups in each state provide volunteer anglers who are passionate about the preservation of fisheries resources. Such volunteers could play a large part in the collection of indicator data and also with assisting scientific experts in large-scale assessment. A partnership between government and industry needs to be developed to ensure data is collected from the smaller fisheries in the future. The ensure data quality, however standard operational procedures and quality assured methodologies are essential.

Table 1: Minimum data requirements for large-scale, biological fishery assessments

Indicator	Descriptor	Comment
Total catch (by species)	Total fish kept / killed Total released	Catch numbers
Catch structure (supported by gear type and targeted species)	Harvested component of the population	Length, weight structure of catch Size information required to convert harvest numbers to weight.
Spatial catch information	Fishing location (region)	
Temporal catch information	Seasonality	

**The above information must be supported by sampling which is representative and recognises the expansion needs of each of the following elements;*

- *Fishing method*
- *Fisher profile*
    - *demographic information - age, gender, postcode, RFL holder Y/N*
    - *fishing information - avidity*

Table 2: Information required in support of fisher and fishery characterisation

Indicator	Descriptor	Comment
Fishing party catch	Estimated total number of sample units	
	Avidity of sample unit	
Individual angler catch		Primary sample unit
Catch by species	Number of fish kept and released for each species	
Gear / fishing method	Line – bait, lure or both/mixed	Event-based data element
	Pot, trap, etc.	
Targeted species		Event-based data element
Effort	Number of fishers	
	Hours fished	Start / finish times and breaks
Catch structure	Length, species	
Location fished		
Platform	Boat / land-based / both	
Date		
Reasons for release		

**Fisher information must be collected in consideration of:*

- *Total catch / catch structure / effort vs. Monitoring (tracking) (and the interaction between each)*

Sample size relative to cost and precision

Table 3: Data requirements to support fishery indicators

Indicator	Descriptor	Comment
Catch rate	Catch	Total fish kept / total fish released
	Effort	Hours fisher, start and end times and breaks
	Fisher avidity	Measure of fisher experience
	Target species	
Gear / method	Line –bait, lure or both/mixed	
	Pot, trap, etc.	
Size composition	Length/frequency distribution	
Location		
Platform	Boat/land-based/both	
Date		
Optional data elements		
Reason for release		
Stock related data	Abundance (relative)	
	Catch rate by avid anglers (targeted)	Determined through diary anglers and / or segment targeted survey, and / or fishing to specifications (research anglers)
	Independent surveys (defined fisheries)	Length / frequency distribution Species identification

5.3 Social Data Collection

There are three key areas where social data collection is required for recreational fishing: attitudinal data (how fishers' fish and why), social demographic data (the different types of recreational fishers and their drivers), and impact quantification (the total social impact of recreational fishing). Of these key areas, attitudinal data has been collected in a number of fisheries and as a component of the National Recreational and Indigenous Fishing Survey (NRIFS, 2000) which identified several key motivators for recreational fishing. Qualitative and quantitative data specifically collected for Australian recreational fishing in the areas of social demographic and community impact is extremely limited.

A key to accurately determining the social impact of recreational fishing is to have an understanding of drivers for decision making within the sector and the perceptions and attitudes of the key stakeholders that influence these decisions. Greater understanding of the social demographic of the recreational fishing sector will also enable more effective communication with specific groups. The likelihood of different response patterns from different sub-groups of fishers and different circumstances needs to be incorporated into the data collection methodology to provide data in which management decisions can be better based to provide targeted management responses.

Methods for the collection of qualitative data have been applied broadly to inform assessments of the social impacts of the recreational use of natural resources in specific regions. For example the social survey of the Coorong Lakes in South Australia, this included recreational fishing as a use (Dyack, 2007). Recreational fishing social data used to inform management decisions has typically been collected in conjunction with fishery biological data, generally related to attitudinal data. This social data is of limited use in providing a broader understanding of social drivers for decision making by recreational fishers as it is not targeted for this purpose, is usually collected in an ad hoc fashion and is not generally used to build on a historical social data set. Research aimed directly at the social impacts/benefits of recreational fishing and the motivation of recreational fishers has been completed in small, localised studies and is also present as a segment of the NRIFS.

The greatest issue related to social recreational fishing data, is the lack of resources to undertake research in this area. The management and development of the sector will require a better balance of investment in fishery, social and economic data collection. Developing skills in social recreational fishing data collection will increase resources available as well as improve the validity of the data collected. Utilizing experts in market research to help develop social survey questions will ensure that the data collected is suitable to its original objective. In addressing needs for methodology which enables measurement of the social impacts and benefits of recreational fishing, it is also important to consider the types of issues or questions this data will be used to address or may be used to address in the future. At present the questions this data will be used to address mostly relate to the regulation of the resource by resource managers and investment in the sector, generally by government.

Methods to research social topics have been previously employed to the recreational fishing sector, including numerous surveys rating why recreational fishers make certain choices regarding motivations as well as expectations concerning the management of fish stocks. For example, Tseng et al (2006) applied methodology to conduct a broad analysis of demographics, participation, attitudes and management preferences of anglers in the US state of Texas. These methods are yet to be applied widely to social data collection and analysis of the recreational fishing sector in Australia. Many of the theories' methods and findings used internationally are reasonably applicable in Australia, given that standardisation and guides are used to produce quality assured data.

The role of social research is not only to provide profiles of fishers attitudes, knowledge and behaviour, but also involves answering questions, providing information, making connections between stakeholders and collecting responses to past and potential changes in fisheries management. The research will aim at aiding the management of recreational fisheries which requires the exchange of knowledge between local, expert and strategic stakeholders - fishers, scientists and fisheries managers and policy makers. Different research methodologies are required to be applied to facilitate the flow of communication between these groups as there are different requirements of data at each level.

Decisions made by managers, regulators, business operators and government, that are informed by a robust social data set, will increase public support for healthy recreational activity within the community, understanding of the social and economic values and impacts of recreational fishing and development of the industry. Enjoyment can then be taken in the benefits of recreational fishing as a result of sound management decisions, effective advocacy of recreational fishing benefits and communication to wider public.

The need to define the recreational fishing community in order to accurately measure the social impacts of recreational fishing would be addressed through investment in social research which seeks to document:

- participant attitudes & values,
- knowledge networks through which the different segments of the recreational fishing sector, exchange ideas and information (knowledge continuum),
- participant position on the knowledge continuum, and
- participant behaviours and practices.

A greater level of understanding of these characteristics will assist in identifying market segments. For example, those who are primarily interested in game fishing may typically have different attitudes and values to those who fly-fish for trout. It is anticipated that identification of market segments will enable communication with each of these groups to be tailored to ensure that it is effective for purposes relating to data collection, development and implementation of fisheries management policy, and for formal consultation purposes. Segmentation analysis will enable effectiveness in delivering key messages and developing and implementing specific management approaches. The approach requires that distinct groups are identified and are engaged directly. According to Witten and Adams (1994), marketing in support of fisheries management is essential to ensure the public do not lose sight of the importance of the resource. For the recreational fishing sector this may initially require targeted research of individuals who participate in distinctly different fishing methods. For example, game fishing participants may be interviewed separately from those who fly-fish for trout.

Approaches to obtain social data will be used to build on existing knowledge to develop a set of indicators that can be used to monitor key social variables over time. The social variables that these indicators would monitor and are of most importance in recreational fisheries research consist of;

- social profiles - for demographic groups and overall sector,
- benefits that relate to social cohesion, health, education and crime reduction,
- engagement in decision - making processes and compliance with regulations,
- fishing attitudes (including conservation), values and practices, monitoring and reporting capacity awareness, and
- participation rates and distribution.

Achieving a representative sample, as in all surveys, is an important issue in recreational fisheries surveys. The fundamental differences between definitive groups within the sector can create skewed results and inaccuracy. It is therefore important that social data informs the design and delivery of other

methodologies for biological and economic recreational data collection. It will also be relevant for fisheries managers and researchers to consider the extent to which the perceived social benefits of recreational fishing to the community are valued by non- recreational fishers. Incorporating research aimed at wider society including commercial fishers, other recreational users of waterways and the general public would eliminate bias in evaluating the social benefits/impacts of recreational fishing.

Recommendations

Effective future development of the collection of social recreational fisheries data will require:

- development of broad research methodology informed by previous studies,
- development of a structured survey that will collect a wide range of social variables which generally identifies fishers attitudes, values, behaviours and knowledge continuum amongst and within distinct demographic groups,
- evaluation of the need, and methodology, of quantitative social data collection,
- identification of three or four succinct 'surrogate' questions, with the aid of qualitative and/or quantitative survey results, to be used as indicators,
- undertaking ongoing social surveys with the use of these indicators,
- application of survey results to the communication of outcomes and key messages as well as the development of target surveys, and
- development of a quality assured and quality control process to support the above recommendations.

Previous recreational human dimensions theory and methods[1] conducted in Australia and elsewhere should be used to inform the development of social research methodologies. Before deciding appropriate parameters for targeted surveys, there is a need to collect broad qualitative social data to make a general assessment of how recreational fisheries are structured socially. This broad assessment will allow the further development of social data collection skills, specialised in recreational fishing, which can be implemented in future research and targeted surveys. The development of targeted research will be driven by the need to populate findings in answer to questions that arise from this broad research. The collected data will also provide key concepts, categories and language upon which the survey work will draw. The structure of the survey should also be customized depending on its objective and level of use. There are a wide range of objectives for the use of social science research in the recreational fishing sector including; the evaluation of fishers participation in consultation programs, the development of indicator surveys or fishery surveys, identifying fishers motivations or identifying responses to past and potential changes in fisheries management.

A research plan to support the collection of this information will be most effective if it is based on sound analysis of the market segments of the recreational fishing sector, which aims to determine fisher attitudes, values, behaviours and practices and their knowledge continuum. There currently exists a broad body of knowledge about attitudes, behaviours and motivations of recreational fishers that should be used to build on through this research. The collection of this data will enable ongoing work to monitor changes in these views and characteristics over time. A range of survey parameters are required depending on the aim of the survey. For example a survey that aims to measure demographics and fishing participation could include parameters such as: age, time spent fishing in the last year, gender, years of fishing experience, income and whether the participant is a member of any fishing organisations. A survey which aims to

[1] Manning, R. 1999 *Studies in outdoor recreation: search and research for satisfaction*. Oregon State University Press, Corvalis. 374pp. Aas, O (editor). 2008. *Global challenges in recreational fisheries*. Blackwell Publishing, Oxford. 364pp Vaske, J. 2009. *Survey research and analysis: applications in parks, recreation and human dimensions*. Venture Publishing, State College, Pennsylvania.

identify responses to past and potential changes in fisheries management would be more specific at asking the participant to rate their level of support to a list of these changes.

It is anticipated that using this approach may enable the development of questions as well as identify a set of three or four succinct 'surrogate' questions (quantitative, qualitative or a mixture of both) that can be used in ongoing social surveys, at a national level, which will provide information for ongoing historical data sets. These questions, if monitored on a regular basis, could be used to identify problems or issues that need addressing, and would also point to areas where more social science research is needed.

Both qualitative and quantitative research should have their place in human dimensions of fisheries research. Qualitative data which effectively and accurately identifies fishers' motivations and attitudes and distinct market segment groups for recreational fishers, and enables monitoring of changes in these elements over time, may be sufficient to avoid the need for an ongoing program for the collection of quantitative social data. Quantitative social data could then be collected as required as part of smaller surveys or data collection efforts. The ease and cost of these data collection efforts can be improved with the use of volunteers.

Research methodologies aimed at engaging fishers in participating in surveys and reporting catches will require the development of participatory research methodologies that allow the fishers to be involved in the interpretation of these findings. The communication of outcomes of the consultation into the information collection plan will encourage ongoing participation in social, biological and economic data collection activities by recreational fishers. This communication will be most effective if it were to begin with individuals and groups, keeping stakeholders engaged at a local level. Active engagement will encourage greater buy-in into the eventual decisions which have been made with the assistance of the information provided directly by recreational fishers.

The understanding of interactions within the industry that will come from the data collection will be an important factor in order to establish how to engage effectively with each of the definitive groups, and will also guide the development of surveys. The data obtained that establishes motivators within segments of the sector will facilitate targeted surveys for each of these groups, however it is possible to extrapolate data collected from a specific fishery across other fisheries identified as being similar within a region (it may be considered that information collected in Port Phillip Bay may also be applicable to Western Port bay). Social research can also play an important role in improving upon and evaluating the success of the data collection processes for all areas of recreation fisheries.

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5.4 Economic Data Collection

Recreational fishing economic data will be increasingly needed for the management and development of recreational fisheries. Any plan to collect economic data will need to include the development of a robust, historical data set reflecting the economic drivers' specific to the sector. This should include identification and estimation of the 'non-market' values of the sector to enable analysis of change in these values over time. A strategic approach to the collection of this data will help guide and support the development of a set of useful economic indicators for monitoring recreational fisheries. Economic analysis in monetary terms of the value that individuals attach to their recreational fishing experience will further inform the development and maintenance of a historical data set of economic information. Dyack *et al* (2007) highlights the benefits of this type of approach in supporting evidence- based policy development and decision making among alternative options for management of natural resources where there is competition among users for access to the resource. There is currently little reliable detailed knowledge about the composition, attributes or values of recreational fishers in Australia. Without quantitative measures of values, the preferences of recreational fishers cannot be fully accounted for in policy and management decisions. In addressing this gap in knowledge and investigating the potential to provide measures of estimated values associated with recreational fishing, it is anticipated that fisheries managers will be better placed to account for the likely impact of management decisions.

Recent economic assessments[2] of the non-market economic value of the recreational use of publicly owned natural resources at specific locations have effectively employed 'revealed preference' and 'stated preference' theories to provide these estimates. 'Revealed preference' determines the preferences of consumers/users through analysis of their purchasing habits, while 'stated preference' uses direct questioning of consumers/users to determine preferences for goods and services. It is anticipated that these approaches could be applied effectively to measure the non-market value of recreational fishing. Estimates of the manner in which recreational fishing is valued will assist further identification of how values might be increased or decreased directly as a result of management decisions for the fisheries resource and associated land and water resources.

Calculations of the amounts people spend on recreational fishing (e.g. fishing tackle, boats and trailers, vehicles and fuel, accommodations, food) does not provide a complete estimate of the economic value of the sector, but does provide a useful proxy to the value that fishers in the recreational fishing sector place on their activity. Rolfe *et al* (2005) distinguished several techniques for identifying and measuring the economic impacts of recreational fishing for specific fisheries and highlighted the benefit of these approaches for demonstrating what the expenditure impacts of recreational fishing are on local, regional and state economies. Techniques used for measuring economic impact focus on input-output analysis, and factors such as the additional spending or employment generated by the sector. It is likely that data of this nature which provides an indication of economic impact is collected through existing state- wide and site specific data collection programs within various jurisdictions. The NRIFS 2000-2001 provides broad information at a state and national level.

[2] Examples for Australia include the following: Dyack et al., (2007) *Valuing Recreation in the Murray. An assessment of the non-market recreational values at Barmah Forest and the Coorong*. Commonwealth of Australia, CSIRO, 2007 and Rolfe, John, Prabha Prayaga, Peter Long and Rod Cheetham (2005) *The Economic Value of Freshwater Impoundment Fisheries in Queensland: The Bjelke-Petersen, Boondooma and Fairbairn Dams* Report by Central Queensland University to the Queensland Department of Primary Industries and Fisheries, February 2005.

Non-market values - the range of values which recreational fishers enjoy but do not purchase - can also be estimated, and would provide a more complete estimate of the total value attached to recreational fisheries by fishers themselves and society more widely. This is because the majority of the value of recreational fishing is enjoyed outside market transactions. The valuation of non market values involves more complex and specialised economic valuation techniques such as those employed by Dyack *et al* (2007) and Rolfe *et al* (2005), and will provide more complete measures of value than a simple expenditure assessment approach. Collection and management of data which provides a measure of state wide and fishery-specific economic values, and focuses on the estimation of consumer economic surpluses associated with recreational fishing activity, will provide a calculation of the net benefits of recreational fishing (in contrast to simple measures of expenditure). Rolfe *et al* (2005) highlight the benefit of this approach in providing information at a site level which enables thorough analysis of the economic implications of: government planning and decision making; public funding allocation decisions; and for evaluating fish stocking, infrastructure and maintenance proposals. These techniques would also be effective at estimating the 'bequeath value' of recreational fisheries, allowing the consideration of the value of maintaining recreational fisheries into future management decisions.

The application of these valuation techniques range in cost and complexity, and involve a varying degree of human resources to complete successfully. As such these methodologies should only be employed if the benefits gained from the research outweigh the cost of the research. These methodologies have not yet been widely applied to the recreational fishing sector in Australia, but have been most widely adapted in the United States and Canada. Applying these methodologies to the economic valuation of Australia's recreational fisheries would assist in the development of a consistent set of economic data for the sector.

Recommendations

In outlining a strategic approach to the collection and management of economic data for recreational fishing, it is recommended that a similar approach be employed to that of Rolfe *et al* (2005) and that collection of economic data be targeted toward achieving the following objectives:

- Measurement of the economic impacts of recreational fishing (obtained by identifying the expenditure of recreational anglers from different spending categories, for specific fisheries). In focussing on the analysis of expenditure on recreational fishing within a specific region, this objective will involve assessment of both the direct and indirect impacts of additional spending. Indirect impacts are estimated through the application of multipliers or input-output analysis.
- Identification and measurement of the economic benefits of recreational fishing (will be different to the economic impacts as economic benefits account for the private satisfaction that fishers derive from fishing after their costs have been accounted for). This objective is achieved through application of the Travel Cost Method (TCM) which uses information about the amount of money and time that people have expended to reach a site to assess how valuable it is.
- Identification and measurement of the change in additional benefits and values should fishing experiences be altered as a direct result of management (i.e. issues in relation to access). Information is obtained through application of the Contingent Valuation Method (CVM) and Contingent Behaviour Method (CB)[3] which uses information about the extent to which fishers are prepared to pay more for their fishing experience in consideration of altered fisheries management arrangements.

[3] Contingent Behaviour is an economic value assessment technique which analyses the extent to which future behaviour and preferences would change if the quality or quantity of a recreational activity, or environmental asset was varied.

Dyack *et al* (2007) highlights a typical list of parameters required to provide an economic valuation of recreational use of natural resources through the TCM, CVM and CB, valuation techniques. The parameters listed in Table 4 are modified to provide an economic valuation of recreational fishing in particular. The use of these parameters in these techniques allow the practitioner to measure economic consumer surplus associated with natural resource use for each of the three methods, permitting a general overview of the economic value of the recreational activities. It is highlighted that in considering these parameters in the development of surveys for collection of economic data, survey results can be used productively to provide an in-depth understanding of values and can be achieved using a relatively short survey with straight forward questions. A small number of the parameters could be omitted; however there is a relatively small cost to adding these questions and they provide significant extra information that is highly relevant to the use of a specific fishing location. An example is the activities that the fisher is participating in during their holiday. It is thought that the value of recreational fishing is augmented in some sites because of the wider set of activities that are available and will add value to the trip of a family or group. It is highlighted that in combining TCM, CVM and CB techniques for the development of surveys for collection of economic data, results can be combined productively to provide an in-depth understanding of values and can be achieved using a relatively short survey with straight forward questions.

Table 4: Summary of Economic data requirements

Description	TCM	CVM	CB	Comments
Size of group	v	v	v	Important for appointment of individual benefits
Group profile			v	Important for social grouping
Where they live	v	v		Allows categorisation and a way of checking travel distance
Length of visit	v	v	v	Important variable in model, may also be used to apportion values over time
Length of holiday	v	v	v	Compare to Q3 to identify ratio for multipurpose trips
Type of trip	v	v	v	Check on multipurpose trips
Mode of transport	v	v	v	Allows categorisation of respondents and gives check on travel costs
Gear/method	v	v	v	Allows categorisation of respondents and gives check on fishing costs
Additional equipment	v	v	v	Allows categorisation of respondents and gives check on travel costs
Time taken	v	v	v	Sometimes added to TCM
Total trip cost	v			Key variable in TCM
Engine size of boat	v	v		Valuable information to industry, easily collected as 'horsepower'
Previous visits	v	v	v	Testing the use of that particular site
Effort/avidity	v	v	v	Testing the experience and effort of a fisher over a period of time
Visits last 2 years	v		v	Key variable for CB
Activities	v	v	v	Allows categorisation of respondents
Alternative locations				Testing how unique/ substitutable the site is
Motivation	v	v	v	Testing what recreational fishers seek in an experience
Recreation trends				Testing attitudes, and framing question for CB
Environment trends				Testing attitudes, and framing question for CB
Particular areas to use			v	Checking if site is unique
CVM question		v		Key variable in CVM
CB questions			v	The CB questions
Attitudinal questions	v	v	v	Allows categorisation of the respondents
Gender	v	v	v	Allows categorisation of the respondents
Age	v	v	v	Allows categorisation of the respondents
Retired	v	v	v	Allows categorisation of the respondents
Household size	v	v	v	Allows categorisation of the respondents
Income	v	v	v	Allows categorisation of the respondents
Survey location	v	v	v	Allows categorisation of the respondents

Derived from Dyack *et al* (2007)

TCM - Travel Cost Method – value of recreational fisheries estimated using information about the amount of money and time that people have expended to reach a site.
CVM – Contingent Valuation Method – recreational fisheries value estimated as an economic measure of consumer surplus.
CB – Contingent Behaviour - estimated change in recreational fisheries value based on visitors' estimates of their change in visitation rates.

The phrasing of survey questions relevant to the parameters shown in Table 4 can be constructed in such a way to allow for ease of completion and relevance to use. Examples of survey questions, similar to that used by Dyack *et al* (2007), that correspond to some of the listed minimum parameters are shown in Appendix 1. These suggested survey questions highlight the intent of the parameters in Table 4, however alterations should be made to refine phrasing and sequencing before implementation. Applying market research expertise to the phrasing and sequencing of the more complicated questions will ensure the validity of the data. In order to make an accurate economic assessment, angler surveys will need to be quite thorough and lengthy. Placing lengthy questions at the beginning of the survey, and incorporating multiple choice and 'box ticking' questions will help to shorten the time that the fisher needs to complete the survey. The use of data parameters that are consistent to that used by the Australian Bureau of Statistics, such as age and income brackets, will allow for the cross matching of data and collaboration to gross up estimates.

Much like biological and social methodologies, it is critical that economic recreational fishing surveys employ a sample that is expandable and representative. The data collection method is critical. Social research on recreational fisheries research can allow for the identification of demographic and market groups to consider when choosing the representative composition of survey samples. In addition to being representative, the sample size also should be large enough to derive the most cost-effective statistically accurate estimates. Results of representative samples can be expanded to resident population estimates supplied by the ABS. Collection of economic data for recreational fisheries may be obtained as a component of other surveys or data collection methods that may not be related directly to recreational fishing - for example, general recreational surveys covering holiday expenses or boating industry economic data collection.

5.5 Synergies of fishery, social and economic data collection

The identified minimum requirements for data sets can be used to construct a simplified survey that is then more likely to be completed accurately. In addition to the reduction of the size of the survey, due to fisher reluctance to participate or time constraints, identifying the priority questions and including these at the beginning of the survey will ensure that the most important information will be reported most frequently and accurately.

An overlap of important parameters to each of the social, fisheries and economic data sets can be of advantage to data collection. Table 5 presents the key parameters which are required for fisheries and economic data sets, and also highlights which of these parameters are likely to be of use in a social data set. The incorporation of these synergies into data collection methodology, possibly combining the collection of two or all three data sets in both the assessment and monitoring phases, can simplify surveys benefiting the fisher and collector as well as offsetting costs.

Table 5: A comparison of parameters which are required for ideal fishery and economic data sets and are likely to be of use in a social data set.

	Fishery	Economic	Social
Party catch	■		■
Individual catch	■		■
Catch by species	■		
Gear/fishing method	■	■	■
Targeted species	■		■
Effort	■		■
Location	■	■	■
Platform	■		
Date	■	■	■
Catch structure	■		
Reasons for release	■		■
Size of group	■	■	■
Where they live	■	■	
Length of visit		■	
Length of holiday		■	
Type of trip		■	
Mode of transport		■	
Additional equipment		■	
Time taken		■	
Total trip cost		■	
Effort/Avidity		■	■
Visits last 2 years		■	■
Activities		■	
Alternative locations		■	
Motivation		■	■
Recreation trends		■	■
Environment trends		■	■
Particular areas to use		■	■
CVM question		■	
CB questions		■	■
Attitudinal questions		■	■
Gender	■	■	■
Age	■	■	■
Retired		■	■
Household size		■	■
Income		■	■
		■	■

6. Benefits

This plan will assist Research and Development investors and providers to focus their resources on areas of national need and priority. It will assist researchers to identify and access recreational fisheries data sets, thus expanding the resources engaged in analysis and methods development. It will also assist industry to access information for development and extension purposes.

The effective and efficient collection and management of social, economic and biological data on recreational fisheries will facilitate increased understanding of the social and economic values and impacts of the fisheries, enhanced management of the fisheries, and the further development of the industry.

This strategy to address national needs for recreational fishing data for fisheries management and development will provide direct benefits to recreational fishers and associated industry as well as the wider community. The impacts of the final use of this strategy, shown on the program logic (Figure 1), will increase public support for healthy recreational activity within the community, increase understanding within the community of the social and economic values and impacts of recreational fishing and support further development of the recreational fishing sector. The strategy will also benefit politicians and government (decision makers), as government funds and fisheries resources can be allocated to areas of national need and priority. The incorporation of robust social, economic and biological recreational fishing data into decision making processes will result in sound management decisions, effective advocacy of benefits and communication to the wider public and the incorporation of recreational fishing interests into broader environmental protection and resource sustainability messages.

7. Further Development

The widespread recognition and uptake of this national plan will facilitate constructive networks, industry-government partnerships and dialogues. In this way the plan will be the starting point for a continuing process of improving the objective basis for managing and developing Australia's recreational fishery.

Data Strategy Evaluation Plan – Overview

It is proposed that project evaluation occur mainly during the draft phases of the report with the aim of ensuring that recommendations to be presented in the final report are reflective of the views of key fisheries managers, researches, industry and community representatives. Evaluation of the extent to which the Data Strategy is guiding research programs and improving data accessibility may be considered by FRDC and/or AFMF once stakeholders have had the opportunity to implement its recommendations and establish new or amend existing data collection programs.

The evaluation plan seeks to identify the key audiences of the final report, who will ultimately shape its final recommendations. By seeking their reviews and feedback at key stages of the development of the report it is anticipated that the final report will be adopted more readily. Key evaluation questions have been proposed with the intention of seeking particular feedback which will enable the Principal Investigator to ensure that the report addresses the research need identified in the research proposal. Evaluation will therefore take the form of feedback from the project working group and key industry and government stakeholders. Feedback will be sought at workshops, 'one on one' meetings and from peer review of the report while in draft form.

Areas to Further Develop Data Collection Plan

As originally proposed, this project was to deliver recommendations on; making existing and future data sets accessible to stakeholders, areas where the development or identification of skills and resources are required, minimum data needs for fisheries ranging from high value national fisheries to small or low value fisheries, and methods for the development and reporting standards for angler-based data collection programs in order to prepare a national recreational fisheries data plan. However, under the methodology adopted it has only been possible to achieve recommendations mainly focussed on minimum data elements. Recommendations, albeit to a lesser extent, are also made in areas of methods development, reporting standards, and the development or identification of skills and resources. This means that to form the basis of the national data plan further research is required into the use of online data accessibility and reporting, the development of skills in social and economic data collection, processes to achieve consistency and the development of a pathway from current processes of data collection to ones that facilitate the aggregation of data.

8. Planned outcomes

The planned outcome of this report is to assist in the effective and efficient collection of recreational fisheries data to support management and development. The main outcome of this plan, stated on the program logic (Fig. 1), is to contribute to maximised social and economic benefits to the community from recreational fishing. This report contributes to this outcome as it is directing recreational fisheries research into the most important areas that will contribute to the ongoing monitoring and development of the sector.

9. Conclusion

A strategy to provide an effective national assessment of recreational fisheries, taking into account the collection of biological, social and economic data, has been summarised in this report. Recommendations to guide future research towards areas of need have been made for each data type and suggestions made for the development of a strategy to address national needs for recreational fishing data for fisheries management and development.

Fisheries researchers and managers generally have a sound understanding of how recreational fishers interact with the resource in a biological sense; the challenge is now quantifying that interaction in a manner in which supports sustainable development. Further work is needed to determine appropriate quantitative data for specific fisheries. Determining the recreational catch is a priority for fisheries management. A strategic approach to addressing biological data sets is needed and must provide clarity for national long-term historical data sets with a high level of accuracy and large scale assessments, as well as minimum data requirements for small scale, less robust data sets to be used as biological indicators. Ongoing collection of fishery specific biological indicators which provide a time-series of catches from the stock is an efficient and effective method for the setting and revising of catch share targets and for determining whether reallocation is required to meet new catch share targets.

The application of social data collection methodology to the Australian recreational fisheries sector has been minimal; however there is a recognised need among fisheries managers and industry for a structured approach to the collection of a social data set which, as a minimum, identifies distinct demographic groups within the recreational fishing sector. Before considering appropriate targeted social survey questions, there is a need to collect broad qualitative social data to make a general assessment of how recreational fisheries are structured socially. Sound analysis of the market segments of the sector, which aims to determine fishers' attitudes, values, behaviours, practices and knowledge continuum, will enable ongoing

work to monitor change in these views and characters over time. Data collection which enables monitoring of changes may allow quantitative social data to be collected as required as part of a smaller survey or data collection efforts driven by questions that arise.

There is currently little reliable detailed knowledge about the composition, attributed or values of recreational fisheries in Australia. Without quantitative measures of the value of recreational fishing, the preferences of fishers cannot be fully accounted for in policy and management decisions. Specialised economic valuation techniques will provide more appropriate measures of value than a simple expenditure assessment approach. The amounts people spend on recreational fishing may provide a useful proxy estimate of the economic value of the sector; however assessments of non-market values would provide a more complete estimate of the total value attached to recreational fishers themselves and society more widely. Collection and management of data which provides a measure of state wide and fishery-specific economic values and focuses on the fishing activity will provide a calculation of the net benefits of recreational fishing.

The objective of this report was to develop a national strategy for the efficient and effective collection and management of recreational fisheries data for government and industry. This objective has been met and recommendations of the minimum data needs are presented, developed in consultation with experts in the fields of collecting and managing social, economic and biological data relating to the recreational use of natural resources. The widespread recognition and uptake of this national plan will facilitate constructive networks, industry-government partnerships and dialogues. In this way the plan will be the starting point for a continuing process of improving the objective basis for managing and developing Australia's recreational fisheries.

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Appendix 1 – Examples of possible economic survey questions

Description	Example Survey Question
Size of group	How many people are in your group: Children (<15 years) ___ Adults ___
Group profile	Are the people in your group: family, friends or mixed How many people in your group are: Male ___ Female ___
Where they live	What are the post codes of the members of your group?
Length of visit	If you are on holiday, how long will your group be spending in this area?
Length of holiday	If you are on holiday, how long is your groups total trip?
Type of trip	Is your trip: A day trip from home, a day trip as part of a longer holiday, a holiday where you stay here for at least one night or driving past as part of another journey.
Mode of transport	How have you travelled to this site: 4WD, small car (less than 2 litres), large car (2 litres or more), boat, motorbike, bus tour, walk or other.
Gear/ fishing method	What type of fishing method have you used on this trip: Line: purchased bait, self caught bait, lure or mixture Pot and traps Net Diving Other.
Additional equipment	If on holiday, did you bring any of the following: Tent, caravan, camper trailer, Ski boat, 'Jet Ski', other boat.
Total trip cost	Which of these categories has added a cost to your trip: Accommodation ___ Camping gear ___ Bait /berley ___ Clothing ___ Dive gear ___ Fees and licences ___ Fishing gear ___ Travel ___ Annual boat costs ___ Other ___
Engine size of boat	What is the horsepower of your boat engine?
Previous visits	How many times have you visited this site in the last two years?
Effort/ avidity	How often do you go fishing: weekly, at least monthly, at least four times a year, or once a year or so.
Activities	Please tick the four activities you and your group will participate in most during your trip: (provide a list of common holiday activities)

Description	Example Survey Question
Alternate locations	If this site had not been available for fishing what would you have done: (provide options)
Motivations	Please tick the four most important reasons for fishing: Relax and unwind ___ To be outdoors ___ For solitude ___ To be with family ___ To be with friends ___ Fishing competition ___ Fish for sport ___ Fish for food ___ Unsure ___
Recreational trends	Do you think the recreational fishing opportunities in this area in the past few years have been: increased in general, decreased in general, remained the same or don't know.
Particular areas to use	Are there any areas for recreational fishing you particularly like to use?
CVM questions	Did the rise in petrol prises: Cause you to fish less often, Cause you to change your fishing destinations, Have some other affect on your fishing trips, Make no difference to your fishing trips.
CB questions	How would you respond to a change in recreational access to this site: (provide a list of alternate locations and activities as well as an option of just staying at home)
Attitudinal questions	Please tick the following which best reflects your attitude towards fishing: I come as often as possible, nothing else compares, It is an activity I take part in every now and again, when I can, It is a holiday activity, It is an activity I rarely take part in, I have other priorities.
Gender	Male/Female
Age	5 – 14 years 14 – 24 years 25 – 34 years 35 – 44 years 45 – 54 years 55 – 65 years 65+ years
Retired	Yes/No
Household size	
Survey location	

Description	Example Survey Question
Income (individual, weekly)	$1 – $99 $100 – $199 $200 – $299 $300 – $399 $400 – $499 $500 – $599 $600 – $699 $700 - $799 $800 – $899 $900 - $999 $1000 - $1099 $1100 - $1399 $1400 - $1699 $1700 - $1999 $2000+

Appendix 2 – Evaluation Plan for the Development of the National Recreational Fishing Data Strategy.

Evaluation Audience	Purpose	Focus	Key Evaluation Questions	Evidence Required	Data Source	Methods	Management	Timing
FRDC	Meeting contract obligations	Final report	To what extent have budgetary and time related milestones been met?	Reports submitted according to timelines in the project agreement	FRDC Project Agreement.	Overview of the reporting that occurred throughout the duration of the project.	Project Officer	To be incorporated into the final report.
	Ensure that the final report will guide ongoing R&D for the sector.		How will the recommendations in the data plan provide guidance for future rec. fishing data collection and management related funding applications?	Feedback from review of draft by FRDC.	FRDC contacts	Direct consultation with FRDC.		To occur throughout the life of the project – review of key sections of the report.
Project Working Gp / Principal Investigator	Review progress against project proposal.	Final report	To what extent does the plan make clear recommendations on national needs for social, economic and biological data for recreational fishing management and development?	Notes from workshop discussion	Working group meetings / comments from review of report drafts.	Discussion with working group on feedback from key stakeholders on draft and inclusion of comments into final report.	Project Officer	To occur throughout the life of the project – review of key sections of the report.
Key fisheries managers & Industry Stakeholders / Reps.	Raise awareness of the plan	Final report	To what extent will existing recreational fishing data collection and management programs and research priorities, be altered as a result of the recommendations of the data plan?	Notes / feedback from direct consultation with key reps.	Key fisheries managers and industry stakeholders.	Direct meetings at key stages of the draft report.	Project Officer	Completion of the draft report
			How can the data plan be improved? What needs to be included in the data plan for it to be used by your organisation?	Notes / feedback from direct consultation with key reps.	Key fisheries managers and industry stakeholders.	Direct meetings at key stages of the draft report.	Project Officer	Completion of the draft report
			How will the plan be used to guide the development of a centrally managed national recreational fishing data-base?	Notes / feedback from direct consultation with key reps.	Key fisheries managers and industry stakeholders.	Direct meetings at key stages of the draft report.	Project Officer	Completion of the draft report

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