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Inquiry into the Role of Science for Fisheries and Aquaculture

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Role of Science for Fisheries and Aquaculture

A WWF – Australia submission to the House of Representatives Standing Committee on Agriculture, Resources, Fisheries and Forestry Inquiry

May 2012

INTRODUCTION

WWF welcomes the opportunity to provide input to the House of Representatives Standing Committee on Agriculture, Resources, Fisheries and Forestry Inquiry into the Role of Science for Fisheries and Aquaculture (the Inquiry).

Based on the rationale for the Inquiry provided in the Standing Committee's media release of 29 March 2012, WWF has addressed key elements of the terms of reference in broad terms only. The submission does not attempt to address each of the sub-elements identified in the terms of reference specifically, however this should not be interpreted as implying that WWF does not have an interest in, or a view, on those issues.

TERMS OF REFERENCE 1 SCIENTIFIC KNOWLEDGE AND FISH STOCK SUSTAINABILITY

The role of science

WWF believes that evidence-based decision making is central to the sustainable use of wild fish resources and to sustainable aquaculture enterprises. Scientific research clearly plays a key role in the delivery of such decisions. WWF considers that, generally, fisheries management in Australia is well served in terms of the quality of the scientific advice available to it. The provision of this advice is facilitated by key research bodies such as the CSIRO and State/Northern Territory fisheries research agencies and the funding available under the Fisheries Research and Development Corporation (FRDC), from other Commonwealth and State/Territory government sources and from the fishing and aquaculture industries.

In wild fisheries, science contributes to our knowledge and understanding of:

- the biology and life history of species;
- the abundance and trends in abundance of species; and
- the impacts of fishing on ecosystem structure and function.

In addition, science plays a key role in identifying data needs and appropriate data monitoring regimes, development of stock assessment and risk assessment methodologies and development of ecosystem approaches to managing fisheries.

In the past fisheries science and management focused on the target species of main commercial interest. However, the last two decades, in particular, have seen a broadening of these disciplines to encompass the wider ecological impacts of fishing. This broadening of the role reflects the rapidly increasing public and government demand for fisheries to be sustainable in terms of the commercial stocks, the impacts on by-catch species and the marine ecosystem. There is also increasing demand for minimisation of the impacts of aquaculture through pollution, contamination, introduction of new diseases and species and interference with other human users of the marine ecosystem. The broader objective of ecological sustainability is now enshrined in Commonwealth and State/NT fisheries legislation and, in particular, in the ecological sustainability assessment provisions for fisheries contained in the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In Australia, issues associated with the impact of fishing and aquaculture on non-target species, including impacts on threatened, endangered and protected species (TEPS), other discarded species and marine habitats, now play an increasingly prominent role in scientific research and in fisheries management discussions. More commonly, the questions addressed by fisheries science now relate to whole regional ecosystems rather than single species in a specific fishery. However, WWF believes that operationalizing ecosystem-based management remains a challenge in Australian fisheries (see discussion under Terms of Reference 2).

The development of a quantitative risk assessment framework (Ecological Assessment for the Effects of Fishing) by the CSIRO[1] and its application to Commonwealth-managed fisheries by AFMA has been a major scientific contribution to the understanding of risks posed to individual species (target and non-target) by each Commonwealth fishery. Unfortunately, at the State/NT level, there continues to be a reliance on qualitative risk assessment methodologies which provide less confidence to stakeholders about the nature and extent of the risk and the appropriateness of the management response.

Funding for fisheries science

The increased demand for fisheries science to underpin pursuit of broader ecosystem objectives requires increased scientific services which necessarily incur a cost. WWF believes that the funding available for fisheries and aquaculture science has not kept up with the increasing demand. This is constraining the ability of fisheries management and research agencies to discharge their responsibilities fully and efficiently.

In the face of this challenge fisheries research bodies have adopted a number of new approaches to maximise the cost-effectiveness of available research funds. These seek to achieve efficiencies by prioritising and addressing issues at a national/regional level rather than a sectoral/jurisdictional level (e.g. the National RD&E Strategy for Fisheries and Aquaculture developed under the Primary Industries Standing Committee, the CSIRO Wealth from Oceans Research Flagship[2], the Australian Research Council (ARC) processes, the Integrated Marine Observing System (IMOS) and the National Environment Research Program (NERP)). While these initiatives will deliver efficiency gains they will not address the widening gap between available funding and demand for scientific services. Moreover, many science delivery agencies, especially state-based research institutions, continue to operate in jurisdictional/sectoral silos and this restricts their access to funding and prevents them achieving the 'critical mass' required to address an increasingly complex set of questions.

A lack of funding makes it difficult for management agencies to meet their information needs. Uncertainty about ongoing funding also impedes the adoption of a strategic, long-term approach to scientific research and the retention of expertise in research agencies. With some exceptions (notably the core funding of CSIRO) there is increasing use of relatively short term funding, mostly at project level (e.g. ARC and FRDC) and decreasing use of program level funds (e.g. NERP). This does not engender good strategic planning of either expertise or research.

Major advances have been made in genomics, observational technology, information management, mathematical modelling, and coupling of biophysical ecosystem models with human social-economic system models to address regional planning and management questions. As a result, science now has the capability to address the more complex questions that are being asked of it. However, the application of these new tools is constrained by the lack of funding available to acquire the tools and necessary expertise. This is particularly true for those fishery management institutions that operate under some form of cost recovery model for management (including research) costs but which must deal with an increasingly wide range of environmental and human use issues.

Failure to address the gap between demand for and supply of scientific services to the fishing and aquaculture industries through the provision of additional funding will, in the long term, jeopardise the delivery of the outcomes sought by these industries, the Australian community and governments. WWF

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[1] Hobday, A. J., A. Smith, H. Webb, R. Daley, S. Wayte, C. Bulman, J. Dowdney, A. Williams, M. Sporcic, J. Dambacher, M. Fuller, T. Walker. Ecological Risk Assessments for the Effects of Fishing: Methodology. Available at: http://www.wcpfc.int/doc/eb-wp-14/ecological-risk-assessment-effects-fishing-methodology

[2] See http://www.csiro.au/Organisation-Structure/Flagships/Wealth-from-Oceans-Flagship/WfO-overview.aspx

believes there is a need to increase the quantum of funds available for fisheries and aquaculture science and the long term security of funding.

This may involve a reassessment of the current sources of funding and the roles of these sources and consideration of the merits of funding a new strategically-focused science facility to support longer-term (5-10 year) strategic science. New Zealand's Crown Research Institutes[3] may serve as an appropriate model.

As noted above, industry contributes to the funding of scientific research. This can occur through a variety of mechanisms including levies paid to FRDC, cost recovery and direct funding of research. Like many other Australian industries, the fisheries and aquaculture industries are subject to cost-price pressures resulting from the strong Australian dollar, cheaper imports often from less rigorously managed fisheries, high labour and fuel costs and increased management costs associated with meeting Australia's environmental standards. The capacity of the industry to fill the research funding gap is limited. WWF believes that it may be appropriate to review the current allocation of the burden of funding of science for fisheries and aquaculture to re-assess the public good component arising from effective, science-based fisheries management that delivers the ecosystem wide outcomes demanded by the community and governments. Such a review could, for example, examine the appropriateness of the existing level of public good funding contributed by the Government to the FRDC.

TERMS OF REFERENCE 2 FISHERY MANAGEMENT AND BIOSECURITY

Ecosystem-based management (EBM) is the cornerstone of WWF's work on sustainable fisheries[4]. EBM is a science-based framework that aims to achieve sustainable exploitation of natural resources by balancing the social and economic needs of human communities with the maintenance of healthy ecosystems. WWF is committed to management that conserves fish populations, doesn't harm other marine species, protects the structure and function of marine ecosystems and supports sustainable fisheries and the fishers that depend on them. This involves understanding and responding to both the ecosystem conditions that may affect fish stocks and their productivity, and the effects of fishing activities on marine ecosystems. Science has a key role to play in improving our understanding of these issues.

Without scientific information attempts to ensure that impacts of fishing and aquaculture on the marine environment are sustainable are largely futile. However, in isolation, science cannot deliver sustainable fish stocks and marine ecosystems. A number of other important factors are at play. These include the:

- the structure and effectiveness of the science-management interface;
- the way in which uncertainty is dealt with in management;
- the weighting given to sustainability in management decision making; and
- the acknowledgement of the importance of economics as a driver of commercial fisheries and aquaculture undertakings.

Each of these issues is considered below.

Science-management interface

The interface between science and management is critical to sustainable fisheries and marine ecosystems. It is increasingly common for fisheries scientists to not only provide advice on the state of

[3] See http://www.sciencenewzealand.org/About-Science-New-Zealand/Who-we-are

[4] Ward, T., Tarte, D., Hegerl, E. and Short, K. (2002). *Policy Proposals and Operational Guidance for Ecosystem-based Management of Marine Capture Fisheries*. WWF, Sydney, Australia.

the stock but to provide a scientific perspective on the likely outcomes of possible management actions. WWF believes that this is a positive development and should be encouraged.

Successful, EBM relies on there being an effective relationship between science and management and effective engagement of all other stakeholders. An effective relationship requires, among other things:

- good communication between the stakeholders;
- informed clients (managers and other stakeholders) who can drive scientific research relevant to management needs and who can interrogate scientific advice;
- trust in the independence of the research; and
- confidence in the quality and cost effectiveness of the research outcomes.

WWF believes that these requirements are met to varying degrees across Australia's fisheries management jurisdictions and agencies. There are significant differences, across the jurisdictions' arrangements for delivery of scientific advice, engagement of stakeholders, the identification of research priorities and the conduct of peer review and evaluation of scientific research.

Importantly, WWF believes that there is a need to maintain the independence of scientific advice while at the same time providing for active engagement of scientists in decision making. WWF is particularly supportive of increased use of independent peer review of scientific research across all research bodies. Independent peer review provides confidence that the research is relevant, that it is not influenced by bias and that it represents best practice approaches to fisheries and aquaculture research. There is a need for all jurisdictions to incorporate regular peer review as a formal component of their scientific processes. WWF is also supportive of periodic market testing of research services to ensure that value for money is being achieved.

Dealing with uncertainty

Fisheries science is not an exact science. Imperfect data and variability in marine ecosystems necessarily mean that there is considerable uncertainty attached to much of the scientific advice provided to stakeholders and managers. It is critical that the nature and extent of this uncertainty is clear so that the scientific advice can be responded to appropriately. WWF believes, that in the main, the uncertainty associated with scientific advice on fisheries matters in Australia, is clearly acknowledged by the scientists.

The United Nations Rio Declaration on Environment and Development 1992 endorsed the application of the Precautionary Approach to protect the environment. The Declaration stated that "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."[5] The precautionary principle has been enshrined in fisheries legislation in Australia for many years. It is defined, in section 391(2) of the EPBC Act, as follows: "lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage".

Where there is little or no scientific advice it is critical that management processes are in place to prevent marine ecosystems being put at risk. Too often, fisheries have been allowed to develop and expand in the absence of a good scientific understanding of their likely impacts on target and non-target stocks. The overfishing of gulper sharks in the trawl sector of the Southern and Eastern Scalefish and Shark Fishery and the impacts on protected species, such as Australian sea lions and dolphins, in the

[5] United Nations Environment Programme (1992) Rio Declaration on Environment and Development. Available at: http://www.unep.org/Documents.Multilingual/Default.asp?documentid=78&articleid=1163

gillnet sector of the same fishery exemplify this problem. In new and developing fisheries, whether it be for a new stock or by a new gear, it is extremely important that precautionary management measures, reflecting the nature and extent of the risk of the activity in question, are put in place.

In most Australian fisheries there is now at least a basic understanding of the impacts of fishing. But, as noted above, scientific research is costly, and there is a trade-off to be made between investing in the collection of more information and the level of catch that can be taken. A precautionary approach dictates that the less scientific advice is available, and/or the greater the uncertainty surrounding the available advice, the more precautionary the allowable level of catch should be.

Despite the quality of scientific advice available, and the transparency with which uncertainty associated with this advice is generally acknowledged in Australia, WWF remains concerned about the extent to which fisheries management decisions reflect the scientific advice and, in particular, how those decisions, respond to the uncertainty inherent in it. WWF continues to observe instances where management responses are delayed pending the delivery of scientific advice or the resolution of some uncertainty in that advice.

Harvest strategies have been adopted at the Commonwealth level[6]. Harvest strategies articulate clear rules about management responses under particular circumstances and provide for a tiered approach to dealing with uncertainty, reflecting the trade-off between investing in more research/information and the level of allowable catch. WWF believes this approach should be adopted more widely in Australian managed fisheries and in particular in data-poor fisheries.

Climate change as a source of uncertainty

Short-term environmental variation adds uncertainty to fisheries management. However, the impacts of long-term shifts in the climate, represent an additional challenge for fisheries science and management. Incorporating the impact of climate change into fisheries management will require additional scientific research on the impact of climate change on:

- the distribution and abundance of marine species and communities ;
- different marine habitat types; and
- the productivity of the oceans.

Answering these questions and monitoring the impact of climate change also require the development and implementation of new data collection processes. Within already stretched research budgets it is difficult to see how these research needs can be met without compromising existing programs. In the absence of the data and the research, the need for additional precaution in developing management settings will be required. Stocks will need to be maintained at a level that allows them to be resilient against the potential impacts of climate change. It is yet to be determined whether the will exists at the government and management level to adopt the level of precaution required to ameliorate the risks associated with the potential impacts of climate change.

Data as a source of uncertainty

Data-poor fisheries

Despite significant improvements in the quantity and quality of data available in some fisheries, there remain some fisheries that are classified as "data poor". Such fisheries are characterized by a lack of

[6] Department of Agriculture, Fisheries and Forestry (2007). *Commonwealth Fisheries Harvest Strategy Policy and Guidelines*. DAFF, Canberra. Available at: http://www.daff.gov.au/fisheries/domestic/harvest_strategy_policy

knowledge and differences in assessment, viewpoint and opinion about the biological properties of the species fished and/or their social and economic value and significance. This situation can also apply to specific management problems (e.g. management of TEPS, benthic communities etc) in fisheries that are otherwise considered to be data-rich. Such issue-specific situations may be better termed data-deficient. The information underpinning the management of data-poor fisheries or data-deficient issues is either unavailable or highly uncertain.

Despite the inherent biological, economic and social trade-offs that fisheries management demands, managers have been slow to adopt approaches to aid fisheries management and decision making in data poor situations. Many new methods have arisen in the last few years to address data poor situations and to aid decision making. These approaches are ideally suited to situations where there is incommensurate data, conflicting user values and considerable uncertainty in the best available biophysical, social and economic information. WWF would like to see more attention given to the development of assessment methods for data poor fisheries and the use of uncertain information in fisheries management.

Quality of data

A major source of uncertainty in scientific advice is the quality of the data. In many fisheries, science and management relies largely on catch and fishing effort data collected through logbooks completed by fishers. This is an invaluable source of information. However, across the jurisdictions there remains considerable variability in the nature of the data collected in logbooks and much of the logbook data remains un-validated, i.e. the accuracy of the data supplied by fishers has not been checked. Reliance on assessment of stocks based on catch-per-unit effort (CPUE) data sourced from un-validated logbook data is a significant risk. Further, CPUE data is influenced by commercial fishing decisions based on the most productive areas to fish. It is not, therefore, always reflective of the abundance of a stock across the whole of the fishery. These uncertainties are amplified in relation to logbook data on non-target stocks including discarded species and interactions with TEPS. Traditionally, less emphasis has been given to collection of data on these parts of the catch and experience has shown that, even where there is a requirement to report interactions with TEPS, interactions have been significantly under-reported.

To improve the certainty in the data underlying stock assessments and management of broader ecosystem impacts there is a need for consistency of data collection across fisheries and jurisdictions, validation of logbook data and the conduct of fishery-independent surveys that will reduce the reliance on CPUE data.

Data in non-commercial sectors

Of course fish stocks are not only affected by commercial fisheries. Recreational fishers and Indigenous fishers also place pressure on fish stocks. In fact, for some species the recreational take far exceeds the commercial take. However, data on the catch by these fishing sectors is very poorly monitored and subject only to periodic surveys at best. Fisheries science needs to take into account all sources of removals from the stock. Currently, the lack of reliable estimates of catch by the recreational and, to a lesser extent, Indigenous sectors, constitutes a significant source of uncertainty in the scientific understanding of stock status of some species. This is an important shortcoming that must be addressed.

Weighting of management objectives

In the absence of transparent rules to guide decision making, it is too often the case that short-term socio-economic issues take precedence over sustainability concerns. As noted above, EBM incorporates

such issues but, importantly, WWF believes that the weighting should be in favour of ecological sustainability since, ultimately, this is required to underpin the long-term socio-economic benefits available from the marine environment. WWF believes that it is important that decision making is transparent so that the weighting to be given to ecological, economic and social impacts is known. Equally, there must be sound processes in place to improve our understanding of the nature and extent of each of these impacts, not only the ecological. Without such transparency, and without an emphasis on sustainability, the investment in sound scientific advice is unlikely to result in the ecological outcomes demanded by consumers and by fisheries and environment legislation.

Science and economics

Fishing of wild-caught fish and aquaculture enterprises are commercial undertakings which variously constitute a way of life, employment, income or returns to shareholders. While biological and ecological scientific research is critical to understanding the impact of such enterprises economic research is of critical importance in understanding the drivers for these economic activities. Fisheries management is as much about people as it is about fish. The need to take into account both ecological sustainability and economic efficiency in the management of fish resources is recognized in the objectives of the Commonwealth's *Fisheries Management Act 1991*. Further, the Commonwealth Harvest Strategy Policy promotes the adoption of maximum economic yield (MEY), as opposed to the more traditional maximum sustainable yield (MSY), as the target for fisheries under Commonwealth management. MEY is an inherently more precautionary target than MSY and relies on both science and economics to deliver sustainable fisheries. Recognition of both these drivers increases the likelihood of maximising returns to both scientific and economic research. There remains considerable work to be done to operationalize this approach at the Commonwealth level and there is a need to extend this approach to all Australian jurisdictions responsible for managing fisheries.

Understanding cumulative impacts

Fisheries science and management in Australia is typically fishery or jurisdiction-centric. However, increasingly, science is being asked to answer questions on a regional or ecosystem basis that involve overlapping fisheries and jurisdictions. Existing science and management structures and legislation, which generally operate in 'silos', are not well-equipped to deal with this, and there is no efficient and effective mechanism for dispute resolution or negotiation among jurisdictions and stakeholders interacting in the same ecosystem.

The Offshore Constitutional Settlement (OCS) provides a mechanism for cross-jurisdictional management of certain species. However, the arrangements agreed under the OCS have proved extremely difficult to renegotiate as circumstances change. Further, these arrangements have focused on target species. There is, therefore, no clear mechanism to ensure that the cumulative impact of fishing, on other species, habitat types or ecosystems, is well understood or managed. Cumulative impacts can arise from:

- different fisheries under same jurisdiction; and/or
- different fisheries across jurisdictions; and/or
- commercial, recreational and indigenous fishing sectors; and/or
- international and domestic fisheries.

WWF believes that additional scientific effort should be devoted to understanding the cumulative impacts on retained and discarded species, TEPS, habitats and ecosystems. The current piecemeal approach to managing these is unlikely to be effective in the longer term.

To deliver more sustainable outcomes, the adoption of a cumulative approach to scientific research in fisheries would necessarily entail greater cooperation at all stages in the science and management frameworks. WWF strongly encourages greater cooperation and coordination across jurisdictions and sectors in relation to setting research priorities, evaluating research proposals and developing management responses. WWF believes that, not only would it facilitate the achievement of better outcomes for Australia's marine environment, it would also result in cost savings in the delivery of science by avoiding duplication and facilitating more effective use of the available scientific expertise.

TERMS OF REFERENCE 3 SCIENCE AND AQUACULTURE

WWF notes that the Standing Committee's media release characterizes the Inquiry as a "timely opportunity to consider how our scientific knowledge can be applied to ensure seafood productivity can be assured in to the future" in the context of:

- "exceptional pressure" on global fish stocks;
- the plateau in the level of wild fish production;
- the need for more effective management in order to increase wild fish production;
- "considerable potential for growth" in aquaculture;
- aquaculture "fulfilling demand in place of wild fisheries"; and
- the potential for changes to the marine environment, especially through climate change, to cause a mixture of known and unknown impacts in relation to fish stocks and habitats.

WWF does not dispute these statements. However, WWF is somewhat concerned, that taken together, these statements could be interpreted as implying that there is no scope to increase capture fisheries production and that aquaculture is the solution to addressing this problem. While WWF believes there is an important role for aquaculture in satisfying global demand for seafood products, we wish to emphasize that science-based and sustainable management is as important for aquaculture enterprises as it is for wild capture fisheries. The nature or the weighting of the risks involved in aquaculture may vary from that of wild capture fisheries but the need to understand and to mitigate those risks remains. Aquaculture does not represent a riskless solution to overfishing of wild fish stocks and "transitioning from wild fisheries to aquaculture in individual species" as mentioned in the Terms of Reference should not, in WWF's view, be the first response to overfishing of a species.

WWF defines aquaculture to include activities based on the capture of stock from wild fisheries and the feeding of that stock to enhance production as well as closed life cycle operations. Scientific information on the sustainability of aquaculture activities includes:

- the sustainability of the harvest of any wild caught stock;
- the sustainability of the harvest of any fish species used as feed;
- the risks associated with:
    - the location of aquaculture activities and their potential impacts on habitats
    - translocation of feed species;
    - the use of drugs, antibiotics and other chemicals to control disease;
    - the disposal of fish and chemical waste;
    - interactions with other wildlife, particularly TEPS; and
    - escape of captive bred species into the wild.

The delivery of scientific advice on these issues is no less challenging than it is for wild fisheries. Likewise, funding constraints and uncertainty associated with imperfect data and external factors such as climate change, are equally relevant to both aquaculture and wild capture fisheries.

TERMS OF REFERENCE 4 GOVERNANCE

This submission has alluded to various elements of governance in relation to the other terms of reference. Key points raised include:

- the need for formalization of stakeholder engagement opportunities in some jurisdictions;
- the need for greater transparency with regard to the development of management responses to scientific advice;
- the need for appropriate expertise in government management and environment agencies charged with driving, interpreting and responding to scientific advice;
- the need for greater cooperation and coordination across agencies and jurisdictions to ensure that cumulative impacts are recognized and responded to and to maximise the cost-effectiveness of scarce scientific research funds; and
- the need for higher levels of funding to ensure that the demand for scientific services can be met.

An additional factor relates to the governance of fisheries for highly migratory stocks which are subject to management by regional fisheries management organizations (RFMOs) of which Australia is a member. WWF believes that Australia makes a significant contribution to the scientific advice available to these RFMOs and that it is important to safeguard the independence of that advice. The advice itself should not be influenced by policy makers. WWF acknowledges that negotiated outcomes are a reality in RFMOs, especially in those with consensus decision making, and that it is not always possible to agree on measures that are entirely consistent with the best scientific advice. However, WWF believes that there is a need for further clarity around how Australia interprets the scientific advice it receives for these fisheries and the rationale for Australia's position in its negotiations. In particular, WWF believes that there is a need to ensure that Australia's position in RFMOs is consistent with the sustainability standards set for domestically-managed fisheries.

TERMS OF REFERENCE 5 CURRENT INITIATIVES

WWF understands that there are currently initiatives underway related to development of a national approach to harvest strategies and to assessing the status of fisheries. WWF supports these initiatives but cautions against gaining consensus on these initiatives at the cost of sub-optimal approaches. If national and consistent approaches are to be developed it is important that these reflect current best practice.

Finally, WWF acknowledges that reviews of the Commonwealth Harvest Strategy and Bycatch Policies are underway. WWF looks forward to engaging in these reviews with a view to addressing some of the challenges identified in this submission.

CONCLUDING COMMENTS

Science plays a critical role in delivery of sustainable marine ecosystems, fisheries and aquaculture. WWF believes that:

1. across the fisheries science infrastructure in Australia there is a need for science to:
    - be more responsive to the needs of managers and policy makers;
    - be more proactive about identifying issues which require scientific investigation to support longer term sustainability;
    - maintain its independence while being prepared to contribute to management decision making;
    - be inclusive of all stakeholders in relation to development of research priorities and assessment of research outcomes; and

- be subject to scrutiny from stakeholders and peers;

2. there is a need to increase the level of funding available to fisheries and aquaculture science and there would be merit in reviewing the current funding arrangements;
3. there is a need for increased transparency in relation to the weighting of objectives as well as the treatment of uncertainty in management decision making;
4. in order to maximise the returns for science and management there is a need to ensure that the right data are collected from all fishing sectors, that these data are validated and that there is an appropriate mix of fishery independent and fishery dependent data;
5. there are opportunities for broader adoption of best practice approaches to the application of science drawing, in particular, on previous Commonwealth investment in the development of harvest strategies and associated policy settings, and quantitative ecological risk assessments;
6. there is a need to move away from a fishery and jurisdiction based approach to science so that the cumulative impacts of fishery and aquaculture activities on species, stocks, habitats and ecosystems are better understood and that efficiencies in the delivery of scientific outcomes are achieved; and
7. there is need for greater cooperation across jurisdictions and greater coordination of research priorities, data gathering, scientific research and, ultimately, management responses.

A key point in WWF's submission is that while science plays a key role in the delivery of sustainable fisheries and aquaculture and marine ecosystems, it cannot, regardless of how well it is funded or how efficiently it operates, ensure that outcome. Science is not an end in itself but a means to an end. WWF encourages the Committee to consider the role of science, not in isolation, but as part of the fishery and aquaculture management framework as a whole.