

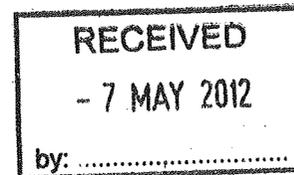


Australian Government

Department of Agriculture, Fisheries and Forestry

SUBMISSION NO. 24
Inquiry into the Role of Science
for Fisheries and Aquaculture

The Hon. Dick Adams MP
Chair
Standing Committee on Agriculture, Resources,
Fisheries and Forestry
Parliament House
CANBERRA ACT 2600



Dear Mr Adams

Thank you for the opportunity to make a submission to the House of Representatives inquiry into the role of science for fisheries and aquaculture, as provided in your letter to Senator the Hon. Joe Ludwig, Minister for Agriculture, Fisheries and Forestry on 29 March 2012.

The Department of Agriculture, Fisheries and Forestry (DAFF) develops and implements policies and programs to ensure competitive, profitable and sustainable fishing and aquaculture industries. It supports Australia's domestic fisheries and aquaculture, through research, quarantine, fish health and food safety programs, market access and trade negotiations, business development and management assistance, policy development and representing Australia in international fisheries forums.

The involvement of DAFF in fisheries and aquaculture is primarily through the fisheries branch, biosecurity group and the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES). I understand the Australian Fisheries Management Authority (AFMA) and the Fisheries Research and Development Corporation (FRDC) will be making separate submissions.

Context for the department's role

The department engages with science for fisheries and aquaculture across a broad range of interests, including informing policies and programs, research and development priorities, industry profitability, stock assessments, sustainable resource use, and interactions with the environment and marine ecosystems more broadly. Science is also fundamental to the day-to-day management of fisheries and to protect Australia's biosecurity.

A key issue for wild capture fisheries is that the institutional structures and relationships for science are significantly different from those for land-based science. Marine environments are generally far less accessible than their terrestrial equivalents and present a much more challenging environment in which to conduct research. As a result marine ecosystems are generally more difficult and expensive to study than terrestrial ecosystems.

Wild capture fisheries operate in a shared public space and in a complex interactive marine ecosystem. The indirect 'ecosystem effects' of fishing are often difficult to assess because marine ecosystems are highly complex and there is relatively sparse data, combined with a limited understanding of the structure and function of these ecosystems. Techniques for assessing commercial fish stocks have been developed and refined over the past 80 to 100 years and the systematic collection and analysis of bycatch data commenced in Australia in the 1980s. By contrast, research, development and testing of marine ecosystem models is an area of more recent science.

Good fisheries management requires specialist science in stock assessments, fisheries biology, marine ecology and population dynamics, and in related disciplines such as oceanography, marine conservation and climate. In practical terms, most empirical data for fisheries science comes from commercial fisheries, and in particular, from catch records (catch location, species composition, relative abundance, fishing method). Other information may come from species specific (as opposed to

fishery specific) studies or from other marine science investigations, including remote sensing, weather observation, oceanographic studies (e.g. IMOS), ship track records (e.g. water temperature, depth etc) and from hydrographic, marine geophysics and environment surveys.

In these circumstances, fisheries science has developed with diverse working relationships, ranging from close interdisciplinary collaboration between scientists and science providers, to scientific functions allocated to specific science providers or jurisdictions. In this mix some of the main fisheries science providers and stakeholders are:

- Australian Bureau of Agriculture and Resource Economics and Sciences
- Australian Fisheries Management Authority
- CSIRO Division of Marine and Atmospheric Research
- Fisheries Research and Development Corporation
- Australian universities and institutes and cooperative research centres (e.g. AMC, ANCORS, AIMS)
- State and Northern Territory fisheries agencies and institutes (e.g. SARDI)
- Great Barrier Reef Marine Park Authority
- Australian Antarctic Division

For aquaculture, both the circumstances and the science needs are substantially different; key issues include water quality, nutrient management, invasive species and pollution; in a regulatory space primarily managed by the states and the Northern Territory. Important areas of science for aquaculture are research into captive breeding, feeds, invasive species management, waste management and pathogens. Aquaculture is typically conducted on or relatively near to shore.

Australia's marine estate, the world's third largest, adjoins the estates of our neighbours and the high seas. The key fisheries science interest is internationally shared stocks, which include highly migratory species such as tuna, swordfish, marlin and shark, and non-highly migratory stocks that straddle international boundaries. Australia has a responsibility under international treaties to cooperate with other States, including improving scientific understanding of fisheries to underpin their conservation and management.

The department is the primary lead for the Commonwealth in international fisheries and related scientific engagement. In that role the department coordinates Australia's scientific engagement with other countries and international organisations, including the Pacific Islands Forum Fisheries Agency, the Secretariat for the Pacific Community, and relevant fisheries commissions that are established to manage the fisheries of the western and central Pacific Ocean, the Indian Ocean and southern bluefin tuna. A key priority for Australia's international fisheries science engagement is ensuring the region's shared fish stocks are managed sustainably, both to benefit Australia's fishing industry and economy as a whole, and to ensure developing countries in our region continue to obtain food supplies and economic support from their fisheries.

Scientific context

Compared with many other oceans, Australia's Exclusive Economic Zone (EEZ) is characterised by nutrient poor waters and relatively small and diverse fisheries. This presents challenges for ensuring that fisheries management and research is cost effective. The demand for scientific advice is increasing with requirements to manage by-product, bycatch, recreational fishing and the effects of climate change.

Since 2000, the CSIRO and AFMA have been developing and implementing ecological risk assessments (ERAs) to identify high risk species and bycatch issues that require management intervention. A risk assessment approach was taken because of the data paucity for many bycatch species. In some fisheries, this approach has been extended to assess the risks to habitat types. ABARES draws on the ERA results in describing the environmental status of Commonwealth Fisheries in the *Fishery Status Reports*.

Routine monitoring of marine ecosystems, particularly the biological components, is not undertaken in Australia. A number of studies have focused on understanding marine ecosystems and the influence of fishing on them. The CSIRO's *Atlantis* ecosystem model provides a framework for studying the ecosystem-wide implications of climate change and fishery management strategies^[1]. This is not a predictive tool, but it allows exploration of the performance of alternative fishery management strategies over a range of potential scenarios. The *Atlantis* modelling system is currently being used to examine the effects of climate change on marine ecosystems and fisheries in South-eastern Australian waters change^[2].

The *Guidelines for the ecologically sustainable management of fisheries* (DEWR 2007), which guide the strategic assessment of fisheries under the EPBC Act, outline specific principles and objectives designed to ensure a strategic and transparent approach to evaluating the ecological sustainability of fishery management arrangements. The systematic collection of data is fundamental to understanding and managing Australia's fisheries and their interactions with the environment. Data needs include: the amount, species and size composition of the catch and bycatch, biological samples, information on fishing effort, effects of the environment on the distribution and abundance of fish, and the impacts of fishing on the environment.

It is difficult to predict exactly how climate change will affect marine environments and therefore, Australia's fisheries. With this uncertainty, the approach is to ensure that policies are robust to a range of scenarios. The FRDC is co-ordinating fisheries climate change research at the national level, in line with the National Climate Change Research Strategy for Primary Industries and the Fisheries and Climate Change Action Plan. The National Climate Change Adaptation Research Facility has led the development of the National Climate Change Adaptation Research Plan: Marine Biodiversity and Resources, which addresses climate change and the marine environment more broadly. Australian fishers have often coped with considerable inter-annual variability in the availability, abundance and location of target species, as well as economic factors such as fluctuating exchange rates, fuel prices and access to markets. They are often able to adapt by changing fishing practices such as switching target species, fishing location or modifying fishing gear.

The productivity and the size ('biomass') of most fish stocks vary considerably with environmental conditions. The overarching guide for Commonwealth fisheries management is the *Commonwealth Harvest Strategy Policy* and guidelines which are currently under review. Under the Harvest Strategy Policy the aim is for fishery managers to maintain biomass above limit reference points. The Policy includes guidance on exceptional circumstances that would override the application of the harvest strategy where there has been a rapid change in the ecological environment of the fishery unrelated to the impacts of fishing (e.g. climate change).

Recent initiatives, such as the *Commonwealth Fisheries Harvest Strategy Policy*, have been instrumental in recovering commercial fish stocks and preventing others from declining to unsustainable levels. There remains areas where work is ongoing, such as improving the economic performance of commercial fisheries, assessing the socioeconomic value of activities, including recreational fishing, and managing the environmental impacts of fishing. The latter includes broader marine environmental monitoring and management, such as monitoring of closures (e.g. marine reserves) and assessing their performance, including the delivery of benefits to recreational and commercial fishing industries.

A collaborative approach is required for monitoring, researching, assessing and managing straddling stocks and highly migratory species, including tunas. Australia's involvement in regional fishery management organisations helps to ensure consistency in the management of highly migratory fish species and straddling stocks. Similarly, consistency and collaboration across Australian jurisdictions is central to effective management of stocks that cross Australian jurisdictions.

[1] <http://www.csiro.au/Organisation-Structure/Divisions/Marine--Atmospheric-Research/Atlantis-ecosystem-model.aspx>

[2] <http://www.frdc.com.au/environment/south-east>

Fisheries Branch

The Fisheries Branch is a part of the Sustainable Resource Management Division of DAFF. The five work streams are: domestic fisheries policy, marine environment, legislation and governance, northern fisheries and international fisheries. The branch works closely with the Australian Fisheries Management Authority, the Fisheries Research and Development Corporation, the Department of Sustainability, Environment, Water, Population and Communities and industry, and provides policy advice on:

- the management of Commonwealth fisheries
- progressing fisheries legislative amendments and reform
- recreational fishing and resource sharing arrangements
- Australia's engagement in regional and international marine fisheries organisations
- participation in multilateral international fora with implications for the marine environment
- research priorities for Commonwealth fisheries
- cooperating with states and Northern Territory on cross jurisdictional matters, including offshore constitutional settlements

DAFF Biosecurity

The biosecurity group within DAFF provides co-ordination and leadership for aquatic animal health issues of national significance, contributes to enhanced aquatic animal disease emergency preparedness and response, and provides leadership in international and regional aquatic animal health activities.

Activities undertaken by the biosecurity group include:

- Managing the national aquatic animal disease reporting system and ensuring Australia meets its international disease reporting obligations.
- Providing national coordination and leadership for aquatic animal health policy and programs (managing the business of the Sub-committee on Aquatic Animal Health (SCAAH); national strategic planning for aquatic animal health, e.g. AQUAPLAN 2005-2010)
- Maintaining and strengthening emergency preparedness arrangements for aquatic animal diseases (coordinating maintenance of the Australian Aquatic Veterinary Emergency Plan (AQUAVETPLAN); coordinating the development of the Aquatic Animal Diseases Significant to Australia: Identification Field Guide)
- Coordinating national responses to emergency aquatic animal diseases (managing effective functioning of the Aquatic Consultative Committee on Emergency Animal Disease (AqCCEAD) Influencing the development of international aquatic animal health standards (e.g. coordinating Australia's responses to draft World Organisation for Animal Health (OIE) standards)
- Leading Asia-Pacific regional aquatic animal disease capacity building projects.

Australian Bureau of Agricultural and Resource Economics and Sciences

The Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), a research bureau within DAFF, provides professionally independent, world-class research, analysis and advice to inform decision-makers on policy challenges affecting Australia's primary industries. The fisheries and quantitative sciences and the biosecurity and farm analysis branches undertake a range of scientific and economic research relevant to fisheries and aquaculture. Broadly speaking ABARES has staff with skills in the areas of scientific and economic analysis and modelling, data (including survey) collection and statistical analysis, risk assessment and management, geographical mapping particularly in areas related to natural resource management, commodity and market analysis, and integrated analysis.

In terms of science, ABARES focuses more strongly on fisheries and related marine environment issues, rather than aquaculture, reflecting the department's priorities. One of ABARES key roles is producing an annual assessment and report of the biological status of fish stocks and the economic status of Commonwealth fisheries. The latest ABARES *Fishery Status reports 2010* can be found at http://www.daff.gov.au/abares/publications_remote_content/publication_topics/fisheries_and_aquaculture.

Attachment A provides further information on the priorities and activities of the fisheries branch, biosecurity group and ABARES.

Should you require any further information please contact Mr Gordon Neil, Assistant Secretary, Fisheries Branch on

Yours sincerely

Ian Thompson
First Assistant Secretary
Sustainable Resource Management Division

4 May 2012

Priorities and activities of the Department of Agriculture, Fisheries and Forestry (DAFF) fisheries branch, biosecurity group and Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)

1. Fisheries branch

Reviews of fisheries policy

As previously advised, the department has started two separate but co-ordinated reviews of the *Commonwealth Fisheries Harvest Strategy Policy and Guidelines* and the *Commonwealth Policy on Fisheries Bycatch*. Both reviews are scheduled to be completed in early 2013.

Commonwealth Fisheries Harvest Strategy Policy and Guidelines

The *Commonwealth Fisheries Harvest Strategy Policy and Guidelines* was developed in 2007 to provide a framework for setting targets, limits and decision rules in Commonwealth fisheries. This means that a science-based approach to fishing is used, addressing the objectives of managing fish stocks sustainably and profitably, putting an end to overfishing, and ensuring overfished stocks are rebuilt. The department monitors AFMA's implementation of the harvest strategy policy including assessing fish stocks. As part of the review of the harvest strategy policy, a discussion paper addressing the current content of the policy and relevant issues will be released. A review report synthesising issues outlined in the discussion paper, and issues raised through public and targeted consultations will be prepared for the Australian Government ministers with responsibility for fisheries and the environment for consideration.

Commonwealth Policy on Fisheries Bycatch

The *Commonwealth Policy on Fisheries Bycatch* was released in 2000, building on the national framework and to meet the government initiatives at that time. The overarching objective of the *Commonwealth Policy on Fisheries Bycatch* is to ensure that bycatch species populations are maintained. In the ten years since the bycatch policy was developed, the broader legislative and policy environment covering Australia's oceans, and their sustainable use has evolved. The bycatch policy review aims to deliver a revised policy that will provide a more streamlined and clearer direction for fishers in Commonwealth waters to manage interactions with bycatch, such as some shark species and seabirds. This should assist in creating greater management certainty for fishers, and also provide greater transparency for consumers to be confident that Australian seafood is being sourced from well-managed, sustainably managed fisheries.

Regional and international fisheries

The department leads Australia's engagement in a range of regional and international fisheries conservation and management forums. Australia is party to treaties establishing five regional fisheries management organisations; these organisations take decisions that are subsequently binding on Australia's domestic fisheries management, including on the second most valuable Commonwealth fishery, the Southern Bluefin Tuna Fishery. The department works within these organisations to ensure that the conservation and management measures for those fish species that occur in both the high seas and in waters under Australia's national jurisdiction are compatible with Australia's high standards of domestic management. Management measures cover species that form the basis of commercial fisheries as well as measures to mitigate the impacts of fishing on the marine environment, including on bycatch species such as seabirds and sharks. Some species managed under regional fisheries management organisations, such as yellowfin tuna and marlins, also form an important component of domestic recreational and gamefishing.

In addition to treaty-level engagement, the department leads Australia's engagement in a range of forums to influence regional and global marine fisheries policy, including the United Nations Food and Agriculture Organization's Committee on Fisheries and the Regional Plan of Action to Promote Responsible Fishing Practices in south-east Asia. The department also contributes to the development

of the Australian Government's position to other international policy forums that may impact marine fisheries governance. Such forums include the Convention on the International Trade in Endangered Species of Wild Fauna and Flora, the Convention on Biodiversity and the Convention on the Conservation of Migratory Species.

The department also provides policy advice on bilateral fisheries issues in the region to Australia's immediate north, including promoting the adoption of sustainable fishing practices and for combating illegal, unreported and unregulated fishing. The Section engages in bilateral and multilateral cooperation activities through a regional plan of action which includes interactions with 10 countries in the region of South East Asia region.

National plans of action

Australia has an international commitment to address shark conservation and management issues, through the United Nations' Food and Agriculture Organization (FAO) *International Plan of Action for the Conservation and Management of Sharks* and also to reduce the incidental catch of seabirds during fishing operations, through the FAO *International Plan of Action for Reducing the Incidental Catch of Seabirds*.

Australia's first *National Plan of Action for the Conservation and Management of Sharks* (Shark-plan) was released in 2004 and provides guidance to fisheries and conservation managers and the public and includes actions to ensure Australia's shark populations are managed sustainably. DAFF commissioned a review and revision of the 2004 Shark-plan and is currently finalising a revised Shark-plan (to be known as Shark-plan 2). The draft Shark-plan 2 was opened for public comment from 13 May to 15 July 2011. Shark-plan 2 is expected to be released in May 2012.

The department commissioned a national assessment report for reducing the incidental catch of seabirds in longline fisheries in 2008, and is currently undertaking an assessment of trawl, gillnet and purse-seine fisheries to determine the extent and potential significance of seabird bycatch in these fisheries. Following the assessment, DAFF will develop a *National Plan of Action for Reducing Incidental Catch of Seabirds* for fisheries, which would bring together fisheries plans and actions to reduce the incidental catch of seabirds in longline, trawl and gillnet fisheries.

Recreational fishing

The Recreational Fishing Advisory Committee (RFAC) submitted its report *Recreational fishing in Australia—2011 and beyond: a national industry development strategy* to the Australian Government in June 2011. The strategy was developed following consultation with a range of stakeholders including state and national recreational fishing associations, representative bodies and the government.

The report concludes a three-year \$2 million program which involved a review of the 1994 *National Recreational Fishing Policy*, the development of the strategy and the strategic investment of \$1.74 million for 10 recreational fishing projects supporting the strategy.

The Minister for Agriculture, Fisheries and Forestry chairs the Recreational Fishing Roundtable as a forum to discuss current issues of importance to the recreational fishing sector and to provide feedback on findings of the projects in support of the strategy.

Aquaculture

At a national and international level, the aquaculture industry is growing, and is expected to continue to grow. Environmentally sustainable aquaculture is an industry of the future. The sector has grown by 18 per cent since 2004-05. Aquaculture's share of total fisheries value has increased from 26 per cent in 2000-01 to 38 per cent in 2009-10. The Department works through the Australian Fisheries Management Forum to cooperate with the State and Northern Territory governments on aquaculture issues that require a national focus.

At a regional level, the department supports the Network of Aquaculture Centres in the Asia-Pacific (NACA), an intergovernmental organisation of aquaculture centres in the Asia Pacific. Australia has been a member of NACA since 1998 and retains a position on NACA's Governing Council, as well as on the Technical Advisory Committee. The Department appoints Australia's representative to the NACA Technical Advisory Committee, which meets biannually to advise the NACA Governing Council on technical aspects of the Network's activities, including priority needs for aquaculture development in the Asia-Pacific region and areas in which technical cooperation between member countries and specialist institutions can make significant contributions to meet those needs.

Offshore Constitutional Settlement (OCS) fisheries arrangements

Generally state and Northern Territory governments have responsibility for fisheries in their internal waters and fisheries within three nautical miles from their coastline. The Commonwealth has responsibility for waters from three nautical miles to the limit of the Australian Fishing Zone, which extends to 200 nautical miles from the coast.

When a fishery falls within two or more jurisdictions, an Offshore Constitutional Settlement (OCS) arrangement is generally developed and responsibility is passed to one jurisdiction. OCS arrangements are usually defined in terms of species, fishing method and area and form the basis for ongoing cooperation between governments who share the management responsibilities. Alternatively, a Joint Authority may be formed whereby a fishery is co-managed through the legislation of one jurisdiction.

Currently there are 59 fisheries OCS arrangements in place between the Commonwealth, states and the Northern Territory. Under the terms of these arrangements, the states and Northern Territory generally manage coastal, slow moving or inshore species such as rock lobster and abalone, while the Australian Government manages deepwater or migratory species subject to international agreements such as orange roughy, tuna and billfish throughout their range.

Legislation and governance

The department facilitates the passage of implementing legislation for the regulation of fisheries managed by the Australian Fisheries Management Authority and also for the operation of the Fisheries Research and Development Corporation. Other activities include developing and implementing policies, programs and levies for governance-related arrangements including government funded fisheries research and reviewing legislative requirements in the context of regulatory reform.

Climate change and fisheries

The department also works to manage the impacts of climate change on fisheries. The government has developed a *National Climate Change and Fisheries Action Plan* to identify strategies and actions to guide management, policy, research and operational decisions. The plan provides a framework for developing the adaptive capacity of fisheries sectors. Strategies include identifying and informing targeted research and developing management arrangements to respond to climate change induced impacts on fish stocks and associated fishing operations. Implementation of the plan's recommendations has begun with over \$5 million committed for 16 research projects to provide information for the fisheries and aquaculture industries.

2. Biosecurity

Disease Management and Mitigation

Australia is fortunate to be free from many aquatic animal diseases found elsewhere in the world, and is free from most of the aquatic animal diseases reportable to the World Organisation for Animal Health (OIE) (page 78, www.animalhealthaustralia.com.au/wp-content/uploads/2011/01/AHIA-2010-Web-version.pdf). This provides advantages for trade, industry productivity and environmental sustainability. Australian fisheries production in 2009-2010 was worth \$2.18 billion, of which \$1.2 billion was exported (ABARES 2011). Losses in productivity from diseases of aquatic animals can be massive. Diseases such as ostreid herpes virus resulted in losses of 38 per cent in French Pacific oyster farming in recent years, and an outbreak of a salmon virus in Chile in 2007 caused

unemployment and losses of over half of Chile's salmon production. Research into the development of species resistant to disease, disease treatments, and improved management practices is crucial to minimising the impact of disease on production, and flow-on effects such as unemployment.

Maintaining Australia's enviable aquatic animal health status requires ongoing investment and allocation of resources to build and maintain systems to mitigate risks and manage disease threats when they occur. Investment in science to continue to improve our understanding of aquatic animal diseases is important to maintain Australia's favourable aquatic animal health status and to mitigate the impacts of endemic diseases. Research into accurate and reliable surveillance methods to prove Australia's health status (e.g. white spot survey, East et al 2005) and to enhance management of diseases as they emerge will enable Australia to maintain and expand export markets. Additionally, fisheries provide important revenue through tourism, particularly in regional economies. Aquatic animals may also be culturally significant to indigenous people.

Aquatic animal health is poorly understood in comparison to terrestrial animal health. Sick wild aquatic animals are usually eaten by predators, and diseases may become apparent in i) aquaculture (because animals are under observation), ii) when naïve populations are exposed to pathogens, or iii) when environmental conditions enhance disease transmission and/or susceptibility. While international knowledge is sometimes useful, behaviour of pathogens in the Australian context (where the environment, farming systems and species of native animals differ substantially from overseas) requires research to determine best management and mitigation strategies applicable to our situation. For example, the detrimental effect of some iridoviruses on native Australian fish (e.g. on Murray cod) is quite different to the overseas experience, and extensive research has been required to understand the nature of the risk and develop suitable management responses. In addition, Australia needs the capacity to respond to new disease outbreaks where there are no overseas examples. Pilchard herpes virus, QX disease (of edible oysters), oyster oedema disease (of pearl oysters) and abalone viral ganglioneuritis are examples of diseases that were not known in other countries when found in Australia. Without basic research into these agents, we would not be able to determine the nature of the problem, management and mitigation options, or the risk that they pose.

All native species have their own suite of pathogens, which as mentioned above, may remain undiscovered until they cause observable disease or mortalities. In disease outbreaks, the disease may also affect species beyond those that are commercially exploited and have implications for broader environmental and social impacts. These effects can include loss of primary food species in an ecosystem (with substantial flow-on effect), changes in the balance of grazers which control aquatic plant growth, significant reduction in tourism revenue, and loss of amenity due to fouling of water by large numbers of dead aquatic animals. Research is crucial to detect these pathogens before they cause losses, or at least have some knowledge of them to allow early detection should they emerge.

Many native Australian aquatic animals are utilised for animal production (i.e. aquaculture), capture fisheries and recreational fisheries, and may also have significant environmental or cultural importance. For example, barramundi are farmed, harvested from the wild, constitute an important recreational fishery, and are important predators in aquatic systems. Barramundi also have cultural significance to indigenous people in northern Australia. The loss or significant reduction in numbers and availability of barramundi through disease would have substantial impacts on productivity and tourism.

Many aquatic animal diseases can result in high mortalities (>95 per cent), with recovery of affected stock often uncertain. Containment of diseases in the aquatic environment is not possible in many situations and hence research into transmission and control of these diseases is critical to develop management strategies to minimise losses.

AQUAPLAN 1998-2003, Australia's first national strategic plan for aquatic animal health, was developed after mass mortality events in pilchards in southern Australian waters in 1995 and 1998 (www.daff.gov.au/___data/assets/pdf_file/0008/146825/aquaplan98_03.pdf). These mortality events

highlighted the need for a coordinated national approach to aquatic animal health management in Australia, and in 1997 the Australian Government committed \$2.7 million to develop a comprehensive aquatic animal health plan for Australia. A joint government/industry body was established in 1997 to develop AQUAPLAN 1998-2003. The Australian Government committed additional funds in 2000 and 2001 to ensure that specific programs within AQUAPLAN were adequately resourced. AQUAPLAN 1998-2003 delivered a number of outcomes that continue to benefit aquatic animal health management in Australia. Some outcomes include:

- Establishing Australia's National List of Reportable Diseases of Aquatic Animals and mechanisms to update the list.
- Establishing emergency aquatic animal disease preparedness and response arrangements including AQUAVETPLAN and the Aquatic Consultative Committee for Aquatic Animal Diseases.
- Establishing the Aquatic Animal Health Subprogram (AHHS) of the Fisheries Research and Development Corporation (FRDC) to coordinate and lead aquatic animal health research and development (R&D) (www.frdc.com.au/research/Animal-Health).
- Raising awareness of aquatic animal health issues through a range of educational and awareness materials e.g. Aquatic Animal Diseases Significant to Australia: Identification Field Guide.

Following a review of AQUAPLAN 1998-2003, it was agreed that a successor strategy was necessary to further build aquatic animal health management capacity

(www.daff.gov.au/_data/assets/pdf_file/0009/155961/aquaplan_review.pdf).

AQUAPLAN 2005-2010 was Australia's second national strategic plan for aquatic animal health (www.daff.gov.au/_data/assets/pdf_file/0007/146824/aquaplan.pdf). AQUAPLAN 2005-2010 focussed on health in fish, molluscs and crustaceans in aquaculture (including ornamental fish) and recreational fishing, as well as the role of health in commercial (harvest) fisheries. Given the importance of R&D in aquatic animal health management, AQUAPLAN had many activities requiring investment in scientific research. AQUAPLAN 2005-2010 is currently under review, and a successor strategy may be developed pending agreement by governments and industry.

Coordinated aquatic animal health research and development (R&D)

The Fisheries Research and Development Corporation (FRDC) Aquatic Animal Health Subprogram (AAHS) was established (through AQUAPLAN 1998-2003) to invest in aquatic animal health R&D of national significance. The program was developed to ensure that projects of national significance that may not have received funding from any one aquatic animal sector were funded (e.g. diagnostic capability for exotic diseases). The AAHS provides funding for aquatic animal health projects relating to aquaculture, wild capture, recreational fisheries and ornamental fish sectors. There is increasing demand on the limited available funds which means that only the highest priority projects are funded through the AAHS. Effective management of aquatic animal diseases can require significant research expenditure, for example, research into the development of tests, modes of transmission, vaccines, disease resistance and other management options. Emerging diseases such as abalone viral ganglioneuritis (Corbeil et al 2010), ostreid herpes virus-1 μ variant (Frances et al 2011), and oyster oedema disease (Crockford and Jones 2011) have, or have the potential to, significantly damage some of Australia's most valuable aquatic animal industries (these industries were valued at more than \$429 million dollars in 2004-2005—prior to the emergence of any of these diseases) (adl.brs.gov.au/data/warehouse/pe_abarebrs99001448/fish_stats_2007.pdf). It is important that there continues to be investment in aquatic animal health R&D to ensure that Australia has the capacity to effectively respond to and manage aquatic animal disease incidents as they arise.

Laboratory capability and capacity

It is crucial that Australia has the laboratory capability to deal with significant aquatic animal health issues when they arise. In disease emergencies, laboratories need to have the testing and/or diagnostic capacity to process high volumes of samples often in a short period of time. This is of particular importance if the disease being investigated is an internationally reportable disease or has

potential trade implications. Laboratories also need to have the capacity to carry out ongoing R&D (e.g. test development and validation, disease agent characterisation, vaccine development, facilitating selective breeding for disease resistance) to support disease management and mitigation in Australian aquatic animal industries.

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) Australian Animal Health Laboratory (AAHL) is Australia's national laboratory for emergency animal disease diagnosis, research and technical advice on related animal health issues. It includes a unit that specialises in aquatic animal diseases, the AAHL Fish Diseases Laboratory (AFDL). (www.csiro.au/en/Outcomes/Food-and-Agriculture/AAHL-fish-diseases-laboratory.aspx). AFDL plays a key role in disease diagnosis during aquatic animal disease incidents of national significance.

Ongoing investment in Australia's network of animal health laboratories is crucial to ensuring the continuation of research into aquatic animal diseases of significance to Australia. The Laboratories for Emergency Animal Disease Diagnosis and Response (LEADDR) network, which was established in 2009, has a mandate to improve the consistency and quality of national testing capacity for targeted animal diseases of national significance across all jurisdictions. Aquatic animal diseases caused by white spot syndrome virus and ostreid herpes virus has recently been listed by LEADDR for test harmonisation across relevant jurisdictions.

Climate change is likely to impact fisheries and aquaculture production, with both direct (e.g. geographical ranges of fish populations, fish physiology such as breeding and immunity) and indirect impacts (e.g. impacts on microorganism populations). As an illustration, amoebic gill disease is the most significant health issue for the Atlantic salmon industry in Tasmania (valued at over of \$320 million). Research has shown that temperature is a major risk factor for this disease (Douglas-Helders 2001; Mitchell and Rodger 2011).

Current Initiatives and Responses by State, Territory and Australian Governments

There are a number of committees that deal with aquatic animal health issues. These committees include:

Aquatic Consultative Committee on Emergency Animal Diseases (AqCCEAD)

www.daff.gov.au/animal-plant-health/aquatic/emergency/cceaad

AqCCEAD coordinates the national, technical response to emergency aquatic animal disease issues of public health or trade significance. AqCCEAD comprises the Australian Chief Veterinary Officer, the chief veterinary officers (or director of the fisheries department) from each Australian state and territory, representatives from DAFF Biosecurity, and the head of CSIRO-AAHL. Technical representatives from industry may also be invited to participate. DAFF provides secretariat support for this committee. The provision of accurate scientific advice to AqCCEAD (e.g. information on the disease, results of diagnostic testing etc.) is crucial to ensuring the committee can make informed decisions on appropriate disease management or response actions.

Animal Health Committee (AHC)

www.daff.gov.au/animal-plant-health/aquatic/committees

AHC is responsible for providing strategic scientific and policy advice to government on terrestrial and aquatic animal biosecurity, including due consideration of environment and social amenity policy and operational issues. AHC also prioritises and coordinates national animal health and veterinary public health activities. AHC is comprised of the Australian, state, territory and New Zealand Chief Veterinary Officers, representatives from CSIRO AAHL, DAFF and Animal Health Australia. On aquatic animal health issues, AHC is primarily supported by the **Sub-committee on Aquatic Animal Health (SCAAH)**. SCAAH provides robust scientific and technical advice to AHC on aquatic animal health issues. The **Sub-committee on Animal Health Laboratory Standards (SCAHLs)**; (www.scahls.org.au/) and the **Sub-committee on Emergency Animal Diseases (SCEAD)**; (www.daff.gov.au/animal-plant-health/animal/committees/ahc/scead) also support AHC on some aspects of aquatic animal health where necessary.

State governments contribute substantially to aquatic animal health diagnostics and response through their aquatic animal health experts, fisheries and environment departments. Universities also contribute substantial resources to research into emerging and endemic diseases affecting aquatic animals, including identification of new pathogens previously unknown or exotic to Australia.

AQUAVETPLAN

AQUAVETPLAN is a series of technical response plans that describe the proposed Australian approach to an occurrence of an emergency aquatic animal disease. DAFF coordinates the development and maintenance of AQUAVETPLAN manuals. AHC prioritises AQUAVETPLAN activities based on SCAAH advice, industry support, availability of funding and urgency. SCAAH provides scientific and technical review of manuals. Industry also provides advice on priorities and comments on the manuals through that National Aquatic Animal Health Industry Reference Group (NAAHIRG). www.daff.gov.au/animal-plant-health/aquatic/committees. Research is critical to ensure that technical information on specific diseases and the agreed response policies in these manuals is appropriate and will be effective.

AQUAPLAN

AQUAPLAN 1998-2003 was Australia's first national strategic plan for aquatic animal health. AQUAPLAN 2005-2010 was developed to further build Australia's capacity to manage aquatic animal health. Both plans represented a collaborative approach between government and industry to identify priority issues to maintain Australia's relative disease freedom, support trade, and enhance productivity. AQUAPLAN 2005-2010 is currently under review. Pending the review outcomes and agreement by industry and government stakeholders, a successor strategy may be developed.

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3. Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)

The relationship between scientific knowledge of fish species, ecosystems, biodiversity and fish stock sustainability

ABARES reports on the biological status of key Commonwealth fish stocks and fishery management performance through annual *Fishery status reports* (Woodhams et al 2011). These reports have been undertaken since 1992 and have been expanded in recent years to cover the economic performance of Commonwealth fisheries. The reports also describe the environmental status of Commonwealth fisheries, including interactions with species protected under the EPBC Act. ABARES has also undertaken stock assessments for some target species, western gemfish, sawshark and striped marlin, as well as completing management strategy evaluation for small pelagic species (Giannini et al. 2010).

The Australian Government is currently reviewing the *Commonwealth Policy on Fisheries Bycatch* (2000). This will assist in refining the policy basis for managing bycatch, which is a fundamental component of ecosystem-based fisheries management (EBFM) and ecologically sustainable development (ESD). ABARES has previously reviewed the implementation and effectiveness of wildlife bycatch policies and management in Commonwealth fisheries (Bensley et al. 2010). The ABARES research was one of the drivers for the policy review. It also led to current research into establishing standards and guidelines for bycatch management in Commonwealth Fisheries (expected to be finalised by mid-2012). This should provide for a more systematic approach to mitigating bycatch in Commonwealth fisheries. Currently, in support of the review of the policy, ABARES is assessing risk-based approaches to bycatch management, evaluating reference points and decision rules, and assessing approaches to dealing with the potential cumulative impacts of fisheries on bycatch species. ABARES provides analyses and scientific advice to DAFF policy areas and the Australian Fisheries Management Authority (AFMA) on specific environmental and bycatch issues, including monitoring bycatch, bycatch mitigation measures, protected species recovery plans and threat abatement plans. Recent examples include work on upper-slope gulper sharks (Wilson et al. 2009) and shark and ray management (Patterson & Tudman 2009).

Fishery management and biosecurity, including but not limited to the calculation and monitoring of stock size, sustainable yield and bycatch, as well as related data collection

Fishery management

The estimation of stock size for species targeted by fisheries, includes the evaluation of empirical indicators (e.g. catch rates and the size composition of commercial catches) through to quantitative stock assessment models that integrate a wide variety of information, e.g. catch levels, catch rates, size, age and sex composition, growth rates, size or age at maturity, fecundity, fishing gear selectivity, catchability, tag-recapture data and movement. In Commonwealth fisheries the science and assessments are usually reviewed by AFMA resource assessment groups (RAGs). ABARES participates in most fishery RAGs as either a scientific member or observer. The stock assessments considered by the RAGs are a key input to the ABARES *Fishery status reports*.

ABARES has also undertaken the Reducing Uncertainty in Stock Status project, in collaboration with CSIRO. This project forms part of the Government's expanded Fisheries Research Program, to facilitate the classification of Australian Government-managed fish stocks that are currently classified as uncertain. The project will be completed in 2012.

The *Commonwealth Fisheries Harvest Strategy Policy and Guidelines 2007* provided overarching direction on the science with respect to monitoring and assessment of stocks of key commercial species. The biological and economic reference points from the policy are used in the ABARES *Fishery status reports*.

ABARES is leading a project that will report on the status of 50 key commercial fish stocks at the national level. This is a collaborative project with the Northern Territory, state jurisdictions and the

Fisheries Research and Development Corporation (FRDC). These reports will provide stakeholders with an indication of the biological sustainability of key fish stocks that underpin Australia's commercial fisheries.

AFMA is responsible for data collection in Commonwealth fisheries. Fisheries data are primarily based on commercial fishing activities through self-reporting in logbooks, the monitoring of landings, onboard observers and, more recently, 'e-monitoring' (e.g. onboard cameras). ABARES maintains copies of AFMA logbook and observer databases, which are used in the various reporting functions. Biological samples and measurements are also collected by observers and, for the landed catch, port-based monitoring programs. Commonwealth logbooks provide reasonably long time-series of catch and fishing effort data that are used in the assessment of commercial fish stocks. Logbooks cannot always be relied on for information on bycatch. Consequently, information on bycatch tends to be based on onboard observers and e-monitoring. The time-series of data on bycatch are shorter than those of commercial species and they vary in their representativeness due to varying coverage levels.

Biosecurity

ABARES expertise in cost benefit analysis, spatial modelling and marine biology contribute to integrated assessments of biosecurity issues. ABARES has previously modelled the potential survival range for invasive marine pest species (Summerson et al. 2007). ABARES is currently conducting an economic evaluation of the cost effectiveness of biosecurity response options to address a potential incursion of *Mytilopsis sallei* (black-striped mussel) into Australia. This project involves modelling the potential spread of incursions in Australian ports and calculating the potential costs and benefits of biosecurity response strategies. The project aims to provide guidance and build capacity applicable more broadly to incursions of other aquatic species.

ABARES is also involved in projects that support the National System for the Prevention and Management of Marine Pest Incursions. This includes updating of the National Introduced Marine Pest Information System (NIMPIS), an on-line information resource developed to support the National System (<http://adl.brs.gov.au/marinepests/>). Updating includes enhancing the capability of the NIMPIS database, uploading additional species profiles, range maps and improving the useability of NIMPIS. ABARES is also improving the Monitoring Design Excel Template (MDET) that assists in the design of surveys to monitor for selected marine pests. MDET is an evolving tool and together with the Monitoring Design Report Template (MDRT) it forms part of the Monitoring Design Package within the National System.

ABARES is currently involved in the Risk Return Resource Allocation Project. This project aims to describe the key biosecurity risks (animal, plant, aquatic), the consequences should they occur and the effectiveness of the current controls. This will then feed into the design of a risk-return decision making model to assist in the allocation of biosecurity resources.

The effects of climate change, especially relating to species dispersion, stock levels and impacts on fishing communities

ABARES worked in developing the Fisheries and Climate Change Action Plan. In line with the plan, ABARES reviewed the potential challenges and opportunities of climate change for Commonwealth fisheries (Sands 2011). Predicting the likely impacts of climate change on Australia's wild fisheries is complicated by uncertainties in climate model projections and gaps in the understanding of ecosystem processes. Depending on the fishery, climate change may cause changes (either positive or negative) to access and fishing costs, catch quality, storm activity, abundance, catch levels and the fishery's distribution. The review highlighted that Australian fishers have often coped with considerable interannual variability in the availability, abundance and location of target species, as well as economic factors such as fluctuating exchange rates, fuel prices and access to markets. They are often able to adapt by changing fishing practices such as switching target species, fishing location or modifying fishing gear.

The FRDC is co-ordinating fisheries climate change research at the national level, in line with the National Climate Change Research Strategy for Primary Industries and the Fisheries and Climate Change Action Plan. The National Climate Change Adaptation Research Facility has led the development of the National Climate Change Adaptation Research Plan: Marine Biodiversity and Resources, which addresses climate change and the marine environment more broadly.

Relevant ABARES References

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