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AUSTRALIAN INSTITUTE OF MARINE SCIENCE

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Inquiry into the Role of Science for Fisheries and Aquaculture

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Committee Secretary
House of Representatives Standing Committee on Agriculture, Resources, Fisheries and Forestry
PO Box 6021
Parliament House
CANBERRA ACT 2600

To Whom it May Concern

Inquiry into the Role of Science for Fisheries and Aquaculture

Thank you for the opportunity to provide comment to the Inquiry. This submission is provided by the Australian Institute of Marine Science (AIMS), a publicly funded research agency and international leader in tropical marine science. Through active engagement with our stakeholders across government and industry AIMS maintains relevant, high quality research that addresses challenges facing tropical marine science and sustainable use of marine resources. This includes an understanding of needs and opportunities facing fisheries and aquaculture. Indeed an independent review of the impact of AIMS' research found that AIMS research had "led to improved management of fisheries and/or aquaculture production" (Insight Economics 2006). Our comments in this submission are largely focussed on our experience in tropical aquaculture.

This inquiry is timely noting the growing national and global need for increased production of seafood. This need for increased production is set against a backdrop of global decline in wild fisheries production with many fish stocks either overexploited or at maximum productive capacity. The challenges to meeting this growing demand will require significant growth in global production from aquaculture (Duarte et al. 2009). There is a vital role for science in meeting this challenge, not only to address the technical challenges in developing truly farmed species but also to address environmental concerns about potential impacts.

Nationally, Australia has well-managed wild fisheries but, despite having the world's third largest marine territory, production capacity is limited by the relatively low productivity of our shelf waters. We are already far from meeting our current needs, with 70% of our existing seafood demand being met through imports (Ruello 2010). In addition, although there has been success in building community awareness about the health value of seafood, we are importing freshwater finfish species with little health promoting value (in fish oils) than local produce (Ho and Paul 2009). Looking forward, as the Asian market for seafood increases, Australia will also be faced with a much more competitive global market limiting the availability and potentially the quality of future seafood imports. This is a food security issue and will require significant growth in Australian production from aquaculture.

The Australian science community has a proven track record in research to support fisheries and aquaculture. Sound investment in focussed research over decades on stock assessment and ecosystem-based research of wild fisheries has resulted in acknowledgement that Australia has amongst the most sustainably managed wild fishery stocks in the world. Our wild fisheries will continue to meet only a proportion of demand. Annual yield from wild fisheries is static at approximately 171,100 metric tonnes whereas domestic seafood consumption is over 422,000 metric tonnes and increasing. Therefore, to increase seafood supply, we need to increase effort in science to support production from aquaculture.

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Science has already made significant contribution to support the development of a sustainable aquaculture industry. A major, multiagency research program led to the complete domestication and selective breeding programs for the Black tiger prawn and Australian production is on a more sustainable footing because of this. Important advances are being made in evaluating new and emerging aquaculture candidates. For example, current research at AIMS is closing the life cycle of the Tropical Rock Lobster – a species of high interest to the Asian market – through expertise in seawater processing engineering, nutrition and disease mitigation for high health. In addition, with the construction of SeaSim, a world class seawater experimental facility at AIMS (www.aims.gov.au), there is new capacity for research into the development of new and novel technologies for rearing marine organisms in captivity.

Development of technologies for optimum nutritional qualities and high health production systems are a major opportunity to securing future supply needs. We need to increase capacity in the development and application of new technologies to support environmentally and economically effective production systems and science has a critical role to play in addressing this challenge (Reijnders and Soret 2003). This includes for production systems aspects of water quality, engineering, microbial management, biosecurity, aquafeeds, domestication and selective breeding.

The development of the National Food Plan recognises the need for food security not only to meet national needs but also in the maintenance of regional stability. In addition, an increase in Australian based aquaculture will also provide economic benefits through regional development and increased trade opportunities. The global demand for seafood is expected to increase many fold over the next few decades, particularly with the rise of wealth in Asia, where seafood consumption per capita is 3 times that in the West (Kharas 2010; York and Gossard 2004). As the National Food Plan issue paper states "the global food market is rapidly changing and facing new challenges. With the changing face of international food markets Australia must position itself to manage future risks, but equally, to reap future gains." (www.daff.gov.au/agriculture-food/food/national-food-plan). As a largely regionally located industry with an existing export market focussed on high-end produce the Australian aquaculture industry is well positioned to contribute to future food security and development of wealth creation industries (PMSEIC 2010).

The rapidly increasing demand for seafood is both a threat and an opportunity. In order to meet the challenges facing future seafood supply we need a step change in approach, we need to enable an Australian aquaculture industry. This includes investment in science to enable increased production, science to underpin environmentally sustainable operations and a review of regulatory requirements to facilitate industry development.

We have provided comment against the Terms of Reference in Attachment 1 and further background information (including references) in Attachment 2. If you would like any further explanation or information about the content of this submission please contact Dr Mike Hall

Yours sincerely

John Gunn
CEO

Appendix I

AIMS Feedback on the Terms of Reference

a) the relationship between scientific knowledge of fish species, ecosystems, biodiversity and fish stock sustainability;

Sound scientific investigations over decades into Australian wild fisheries, by-catch and marine ecosystems have provided critical information for the development of effective management plans. Based on this information Australia now has amongst the most sustainably managed wild fishery stocks in the world. This same effort now needs to be applied to underpin increased production from aquaculture.

Seafood supplied through wild-catch fisheries from the Australian Exclusive Economic Zone (EEZ) is not capable of meeting the seafood demand of a nation of 22 million and production volume has been decreasing. Further investment in the management of wild fisheries may further reduce remaining uncertainty and risk in setting sustainable harvest quota but it will not increase overall supply (World Bank and FAO, 2009).

b) 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,***

  Ongoing assessment of stock size, yield and by-catch remain important for wild-catch fisheries and will continue to improve sustainability. However, such investment is unlikely to significantly increase total harvest or to adequately address supply shortages.

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

  Based on climate change models there are likely to be impacts on fisheries and aquaculture that will be revealed over decadal timelines (Lobell et al. 2008; Battisti and Naylor 2009; Bell et al. 2011). Science will continue to play a key role in understanding the response of fish populations to environmental disturbances and human impacts. Continued and improved monitoring of populations contributes to such efforts. However, given current and global predictions for increasing seafood shortages, the immediate focus for science should be developing the technologies necessary to increase supply in the short term.

- ***pest and disease management and mitigation,***

  Refer to comment in pest and disease below.

- ***minimising risks to the natural environment and human health,***

  Seafood is recognised by the medical community as delivering health benefits against cardiovascular disease, degenerative neurological conditions and diabetes (McManus et al. 2009). It has a clear role in preventative medicine and government public health initiatives (Torpy et. al. 2006). Science to meet the global shortfall in seafood supply will also benefit public health initiatives (Nesheim and Yaktine 2007).

  In contrast to its health promoting attributes, seafood is also the most common source of food poisoning. This is partially due to inappropriate preparation and storage conditions which can be rectified through the implementation of science-based guidelines. However, seafood can also be a source of marine toxins. There is a need for research investment for the development of more rapid and sensitive diagnostic assays to prevent tainted (and potentially deadly) seafood entering the human food chain.

  As Australia is importing most of its seafood further consideration needs to be given to the growing conditions of imported species. This product can be exposed to a wide range of pollutants and contaminants that are not necessarily tested/screened by the exporter or the importer. There is a need for scientific evaluation of seafood to determine if there are potential health risks and the development of appropriate screens if required so that they can be detected before entry in to the human food chain.

- ***cooperation among Australian governments on the above;***

  See comment below.

c) research, development and applied science of aquaculture, including:

- ***transitioning from wild fisheries to aquaculture in individual species***

  Transitioning from wild fisheries to aquaculture is critically important to increasing global seafood production to meet current and projected needs. Scientific evaluation of wild species is essential to identify the select few species that meet the prerequisites for domestication. These species must have reasonable fast growth rate; the ability reproduce in captivity; the ability to be held in reasonably high densities; manageable nutritional requirements and future market prospects. Few species are suitable for domestication. As a comparison, only 0.08% of land plant species and 0.0002% of land animal species have been domesticated and it is expected that there will be similar limits on the suitability of species for aquaculture. In both cases timelines for domestication are in many years to decades (Duarte et al. 2007).

  As one marine example, AIMS has devoted significant research effort on the evaluation of the tropical rock lobster as a high value aquaculture species candidate. The tropical rock lobster meets most of the prerequisites for domestication. A critical hurdle to domestication was developing appropriate feeds to get the relatively long larval stage through to settlement. AIMS scientists undertook several research cruises to observe larvae captured at sea and investigation of gut content and locally available plankton. Based on this research and novel use of probiotics to control disease researchers have completed the life in aquaculture conditions. However, the hatchery phase is a critical bottleneck and further research is

necessary in larval nutrition and microbial disease management to provide robust technologies needed for commercial success.

Aquaculture development will take significant effort and is an area of considerable focus in countries, including Norway, South Korea, Japan Chile and China. Australia has the expertise and existing links with these international efforts but needs to prioritise this research.

- ***improving sustainability and lifecycle management practices***

To make seafood production sustainable production needs be independent of wild stocks. Closed life-cycle production of selected species is critical in order to provide a reliable source of young and improve stock traits and yields. The greatest gains in food production in land based farming came through the 'Green Revolution' through which domestication and selected breeding provided huge improvements in efficiencies and productivity gains.

In aquaculture, the hatchery stage carries the most risk during a production cycle. In order to reduce commercial risk there needs to be an available supply of high health larvae for grow-out and this requires research to develop technologies to improve the survival rate and quality of larvae. Key areas requiring science input include microbial management; the identification of nutritional requirements for the target species; development of specific feeds that are independent of wild harvested fishmeal and fish oils; and seawater processing engineering to ensure the highest quality seawater.

- ***pest and disease management and mitigation***

Microbial management technologies are particularly important for successful aquaculture production. For example, at AIMS research is focussed on the use of microbial communities to maintain aquaculture larvae in high health without the use of antibiotics. As the use of antibiotics in food production systems is being increasingly banned, the use of 'good' bacteria as probiotics to control the establishment and spread of 'bad', or pathogenic bacteria is becoming increasingly important. The development of technologies that minimize production loss due to pathogens is an important area for research.

Disease and parasites are mortality factors that can be particularly detrimental in high density animal and plant production systems. As in agriculture, there is an on-going requirement for research to allow the development of microbial and parasite management regimes that either minimise their impact or neutralise them. In closed-life cycle production, larvae can be produced certified as specific disease or parasite free but without appropriate biosecurity protocols in place the larvae can be infected during the period of growth before harvesting. In pond, or containment, production systems, research can assist in the development of management and treatment regimes, within the confinement of the production area. In open systems, such as sea cages, the flow of disease and parasites is bi-directional, and requires research on how to limit invasion of the high density production system by disease and parasite vectors.

d) *governance arrangements relating to fisheries and aquaculture, including the implications for sustainability and industry development;*

There are complex jurisdictional issues with current split between wild-catch fisheries and aquaculture which some consider hinder commercial investment. Aquaculture is required to deal with both marine/coastal and land-based regulations. There is need to review regulations and provide science-based standards and guidelines for industry.

e) *current initiatives and responses to the above matters by state, territory and Australian governments;*

In order to meet the future seafood needs for Australia we need a greater focus on aquaculture. Although the Research and Development Corporations (RDCs) provide stakeholder focussed research through levies and government investment they are not a good mechanism for small, emerging industries that don't have sufficient size to provide the required funding.

f) ***any other related matter.***

The benefits of increasing seafood production in Australia through aquaculture to help meet growing national needs are clearly aligned with the National Food Plan but the issue is global. Australia has well recognised science capabilities that can contribute to global solutions.

i. Australia is engaged in international collaborative arrangements such as the Network of Aquaculture Centres in Asia-Pacific (NACA) however, as wild-catch fisheries continue to decline and demand for seafood continues to rise there is an immediate need to increase Australia's own research capacity so as to further engage in the development of science solutions to this global challenge.

ii. While Australia has implemented strong environmental controls over its own fisheries and aquaculture activities we import most of our seafood, and will import more unless aquaculture production is increased. The product imported for the domestic market is largely from farmed systems that would not meet our environmental (and potentially) health standards.

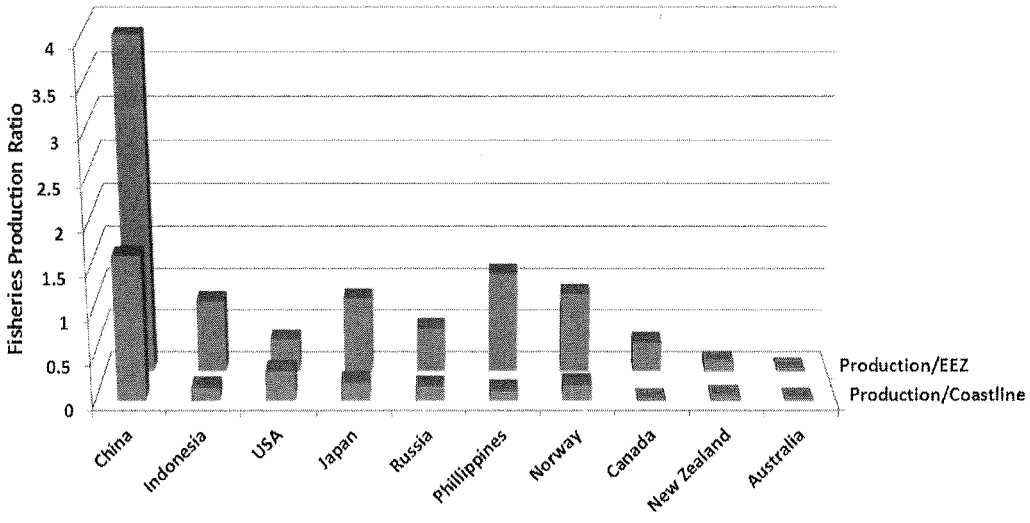
While the role for science in ensuring sustainable and productive fisheries and aquaculture is clear some attention needs to be given to establishing improved links between the science and users (regulators and industry). For example, how we would establish appropriate water quality standards for production systems.

Appendix 2

Background information

For the purposes of Australian food production and food security policy, fisheries and aquaculture should be collectively dealt with as they both supply the same food for meeting national demand regardless of the supply source; the final product is seafood. Government investment into science support for research and development (R&D), and technological development, requires a focus on the issue of seafood supply and to identify the most appropriate avenue, whether fisheries, aquaculture or a combination, on meeting this objective in the most cost and environmental effective manner in the national interest.

Australia has the worlds' 3rd largest marine Exclusive Economic Zone (EEZ) and the 6th longest coastline. However, these waters have generally low productivity and hence fisheries production from the Australian EEZ, or coastline, is low (see graph below). While production is low, a focus on high value export species means that fisheries and aquaculture are still highly valued marine based industries with an annual value of over $2 billion. However, Australia's seafood production is well short of annual consumption.

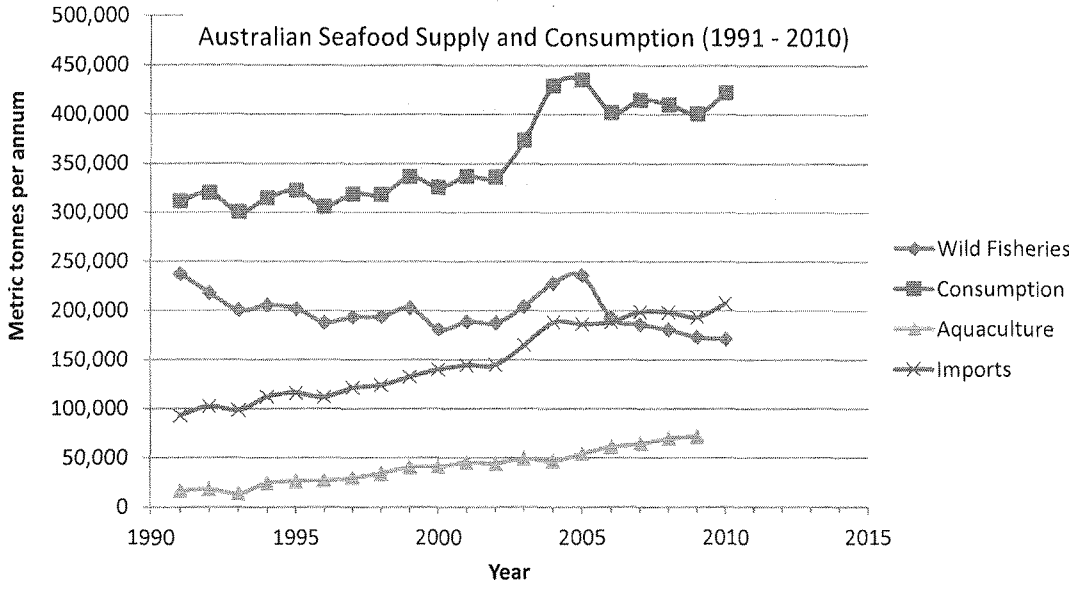


In 2010 the annual consumption of seafood in Australia exceeded 422,539 metric tonnes (mt) and domestic production was 131,187 mt (after 39,967 mt of exports). This means Australia imports over 70% of its seafood[1], to meet the demands of a country of 22 million. Based on current production and expected population growth, by 2025 import requirements will be more than 3 times the Australian entire wild catch, increasing to 4 times by 2048. This dependency for imported product will be set against growing demands for seafood in other countries driving a vastly bigger and more competitive global market for seafood putting future supply at risk.

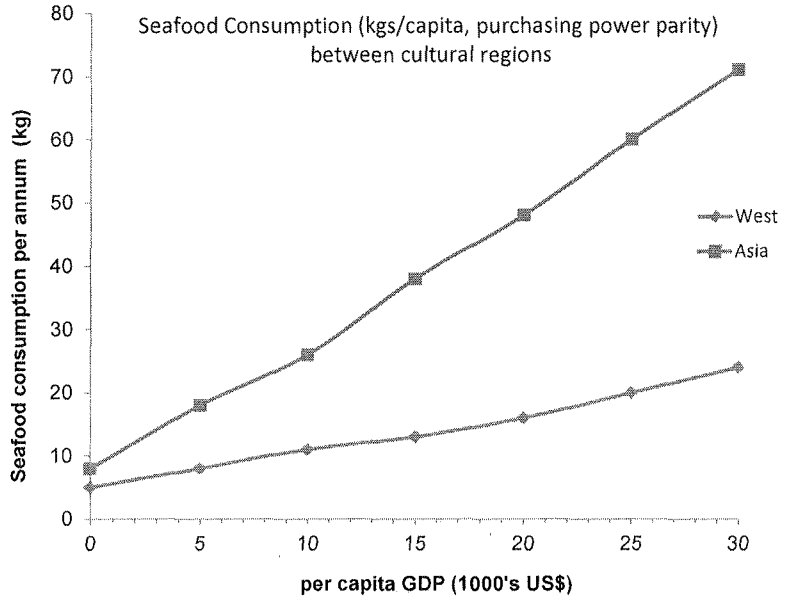
Australia has well-developed fishery management practices in place, despite this the supply of seafood from its wild catch fisheries has plateaued at approximately 182,819 mt/year (2005-2010) compared to a decadal average of 200,234 mt/year (1995-2005); an approximate 10% loss in supply. With an increasing population and consumption per capita Australia has

[1] Based on whole product (not processed).

become increasingly reliant on imports (see graph below). Wild catch fisheries cannot meet the growing demand for seafood.



The shortfall in seafood production is a global issue. Seafood is the most globally traded food commodity and exposed to the drivers of supply and demand. It is predicted that there will be major increases in global seafood demand, not only for basic subsistence but also increasingly by demand from the middle classes, within the next decade. The growth of economies in Asia is driving a growth 'middle classes' predicted to expand from a current 0.5 billion to over 3 billion within decades (Kharas 2010). In these countries seafood consumption per capita is 3 times that of Western cultures (York and Gossard 2004).



Any nation that currently depends on food imports (like Australia) will be exposed to intense competition to meet their needs. The change is here now. In 2012 the historical status between developed and developing nations has shifted so that developing countries are now the dominate importer of goods.

In addition, depending on how broadly protection of human health and the environment are interpreted, trade actions of individual countries have the potential to fall under the jurisdiction, and conflict with, a wide range of World Trade Organisation (WTO) rules, of which Australia is a signatory. Already, court cases by countries are being taken through the WTO in relation to the sourcing of seafood from sources which damage the marine environment under the United Nations Law of the Sea (UNCLOS) legislation (Asche and Smith 2009).

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