

Ecosystem-Based Fishery Management in South Australia and Victoria

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Abstract:

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The detrimental impact from fishing on various species as well as on the overall ecosystem has increased so much over the years that the Australian fishing industry is currently in jeopardy. Scientists, fishery managers, government agencies, industry, and environmental organizations have therefore been actively developing and researching management strategies focused on finding a balance between fisheries and the ecosystem. A new holistic and promising approach, ecosystem-based fishery management, invested in ecological sustainability and the recognition of the critical interdependence between human well-being and ecological health, is currently proposed as the best solution for fishery management.

This paper will consequently investigate the way in which two states, South Australia and Victoria, are beginning to implement ecosystem-based fishery management (EBFM). To understand why the states stand where they do in terms of implementation, this paper will also investigate the perceptions held by various stakeholders on EBFM, particularly addressing why it is needed, the pace at which it is being implemented, limitations, and ways in which it could be approached better. The overall questions for this project focus on: *How the states of South Australia and Victoria are beginning to move towards and implement ecosystem-based management into their fisheries and how different stakeholders perceive this movement.*

For this study, formal interviews were conducted with fishery managers, conservationists, industry members, and fishery scientists in both states throughout the month of April 2007 and the beginning of May 2007. After the data was collected, it was analyzed to determine which actions in each state are in fact following the principles of EBFM, as well as for trends and inconsistencies of perception.

Results show general agreement between all stakeholders that EBFM is the direction that states ought to be heading, but there is great divergence on how and why states ought to be doing so. This is supported by the data obtained through this study demonstrating that South Australia and Victoria are working towards and interpreting EBFM in considerably different ways. Results also show that both states are not necessarily taking actions specifically following ecosystem-based principles, but rather following basic standards of sustainability.

Overall, it is agreed upon by most stakeholders that state governments ought to be taking a more proactive and structured approach to implement EBFM. Additionally, government ought to be investing more money into ecosystem-based fishery research so as to fill in the gaps of ecological knowledge and eliminate dispute on how to go about implementation.

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- sustainable fishing
- ecological sustainable development

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List of acronyms:

- ACF – Australian Conservation Foundation
- AFMA: Australian Fishery Management Authority
- ESD: Ecologically sustainable development
- EBFM: Ecosystem based fishery management
- EPBC Act: Ecological Protection and Biodiversity Conservation Act
- DEH – Department for Environment and Heritage
- FRDC – Fishery Resource and Development Cooperation
- PIRSA – Primary Industries and Resources; South Australia
- PIRVic – Primary Industries and Resources; Victoria
- SA – South Australia
- SARDI – South Australia Research and Development Institute
- Vic – Victoria
- WWF – World Wildlife Foundation

1.0 INTRODUCTION

Definition of key terms:

- *Ecosystem*: a dynamic complex of plant, animal, and microorganism communities and their non-living environment interacting as a functional unit (DEH Marine Planning 2006)
- *Ecologically Sustainable Development*: development which aims to meet the needs of humans today, while conserving ecosystems for the benefit of future generations' (Jones 2002)
- *Ecosystem Based Fishery Management*: Management of ecosystem values and uses recognizing the interactions with the environment and responding to signals from the ecosystem to control anthropogenic activities and uses (DEH Marine Planning 2006)

1.1 Statement of Problem

Although much of the deep ocean is indeed unexplored and 'mysterious', there is enough knowledge about ocean processes today to realize that its productive capacity cannot keep up within the ever-increasing demand for fish. (Christianson and Pauly 2002) With rapidly growing populations and continuously developing technological advances, oceans are under increasing pressure from devastating fishing practices. Additionally, as knowledge of the natural values of oceans has increased, so too has the intensity of their use. (Oceans 11; 2002). Therefore, the world has been faced with the threat of a rapid decline in the fish species that have been incorporated so much into our everyday diet along with devastating habitat destruction, loss of valuable biodiversity, and loss of irreplaceable ecosystem services. According to Pauly from the University of British Columbia, "with global catches declining since the late 1980s, continuation of present trends will lead to supply shortfall, for which aquaculture and other practices cannot be expected to compensate." (Christianson and Pauly 2002) Additionally, over fishing is predicted to eventually lead to an assortment of social problems, including loss of employment, reduced economic activity, and loss of recreational opportunities. (AFMA 2007)

Consequently, with so much at stake, there has been a gradual push to develop a system of sustainable fishing; more specifically a way for the fishing industry to continue to prosper while ensuring that fish species are protected for future generations to come. (FRDC 2003). The main challenge to develop such a system is to find a way to maintain ecological balance by maintaining the integrity of the ecosystems that fish rely on and not threatening the long-term survival of wild stocks. (DEH 2006). A proposed solution for this challenge is the promising concept of ecosystem based fisheries management (EBFM); an approach that includes assessing

the impact on target species, bycatch species, protected species, habitats, and communities in order to ensure the future of Australian fisheries and coastal marine environments (Hall 2004). However, there is a perception in Australia that there has only been slow implementation of EBFM, largely due to a lack of consensus on how to proceed with it and due to the widely held view that certain obstacles are impossible to overcome (Oceans 11; 2002). Marine scientists and policy managers generally encourage EBFM, but there is limited guidance on how to operationalize the concept. (Oceans 11; 2002).

1.12 Justification for Study:

It is my opinion that this is an important topic to be studied, particularly during such a fragile time of global climate change and such a proactive time with globally heightened environmental awareness. It is therefore an especially interesting time to address what actions are being taken to ensure sustainable practices. Specifically, I find it essential to look at what possible solutions have been proposed and what action is being taken to ensure the long term stability of fisheries together with other species that fish interact and depend upon to survive.

The concept of ecosystem based management of fisheries is often proposed as being the “end goal of fisheries management” (Hall 2004). Therefore, this study will focus on a general assessment of the term EBFM according to different stakeholders’ perceptions as well as an analysis of how two different states in Australia, namely Victoria and South Australia, are beginning to approach EBFM. As fishery management is beginning to change on global scale to have a more ecosystem based focus, it is important to not only look at how different stakeholders view the practicality and issues behind implementation, but to also look at how different jurisdictions, on a smaller scale, are beginning to address this issue. It is only through studying different jurisdictions and analyzing both their successes and struggles with implementation that a more realistic and practical framework for EBFM will be developed.

1.2 Current Fishing Practices: What’s at Stake

As the knowledge of marine ecosystems increases, it is imperative that that knowledge is incorporated into fishery management so as to preserve the ecosystem for both its natural environment and ecosystem services, as well as recreational

enjoyment and economic profits. The viability of the fishing industry depends on ecological sustainable development and ecosystem based management. In turn, the viability of many coastal communities as well as the natural environment depends on the sustainability of the recreational, Indigenous, and commercial sectors of the fishing industry. (Davey, Grady, Prideaux, and Smyth 2003)

.1.21 Fishing Industry

Ecosystem based management can be seen as the main prerequisite to the future prosperity and security of the fishing industry. (Geddes and Mayfield 2006) According to the Fisheries Research and Development Corporation (FRDC), the fishing zone in Australia, at 11 million square kilometers, is the third largest in the world. Additionally, FRDC states that commercial fishing, earning an estimated \$2.4 billion a year, is Australia's fourth biggest food industry (FRDC 2006). Not only is the commercial industry exceptionally large and economically valuable, there is an equally large population of recreational fishers along the Australian coast. It is estimated that nearly 390,000 Australians engage in recreational fishing each year (CSIRO 2005). Clearly, if the natural ecosystem is not preserved there will be significant economic and recreational losses for Australia.

1.22 Natural Environment:

Marine capture fisheries affect the environment directly, such as through removal of target and non-target species and indirectly, such as through changing biological interactions. (FAO Fisheries 2003). Maintaining biological diversity is regarded as being of major importance to ecosystem functioning and productive fisheries, as well as providing flexibility for future uses. Current management practices tend to give insufficient recognition to the fact that many components are intrinsically linked in the system in a complex flow of material, energy, and information. (FAO Fisheries 2003). Without proper management of these ecosystems, their valuable services will be forever lost

1.3 Ecosystem Based Fishery Management: A proposed solution

In recognition of the concerns about the range of impacts of fishing activities on the marine environment, the international and domestic community has actively

pushed for improved management of the world's commercial fisheries. (Ward, Geddes, and Mayfield 2006.) Ecosystem-based management can be seen as an important complement to already existing fishery management approaches. When fishery managers understand the complex ecological and socioeconomic environments in which fish and fisheries exist, they may then be able to better anticipate the effects that fishery management will have on the ecosystem and the effects that ecosystem changes may have on fisheries. (Ecosystem Principles Advisory Council 1998).

According to CSIRO (2003), "Australian fisheries management is already shifting from a focus on target species to a management approach that considers the full effects of fishing on marine ecosystems". This shift in management is directly following the larger global movement away from single stock species management to broader ecosystem based approaches. It is an appropriate shift, in that ecosystem based management of the oceans is often labeled as an approach that is likely to succeed where many other initiatives have failed. (Grieve and Short 2007)

1.31 Definition; what does it all mean?

While there is currently no internationally agreed upon exact definition of EBFM, there is a general consensus regarding the broader principles and themes of the term. EBFM, in one of its more general definitions, is the assessment and management of all impacts and outcomes related to any commercial, recreational, or charter sector operating, within an ecosystem or bioregion (Fletcher 2006). It requires that "we take into account the condition of ecosystems that may affect fish stocks and their productivity while also taking into account the ways that fishing activities may affect those marine ecosystems" (WWF 2007). The concept of EBFM includes the assessment of more than just the negative effects on the one particular species harvested by a fishery, but rather addresses "the effects of fishing on target and non-target species and habitats, the effects on marine food webs, the impact on fisheries of other human activities, the effect on variability and change, the productivity of marine systems, and the socio-economic aspects of fishing." (CSIRO 2005). A comprehensive ecosystem-based fisheries management approach would require managers to consider all interactions that a target fish stock has with its predators, and competitors; the effects of weather and climate on fisheries biology and ecology; the complex interactions between fishes and their habitat; and the

effects of fishing on fish stocks and their habitat. (Ecosystem Principles Advisory Council 1998). EBFM is a highly integrated approach that encompasses all the complexities and economic needs of human communities, and the maintenance of diverse functioning and healthy ecosystems. (WWF 2007). The World Wildlife Foundation has laid out the following internationally agreed upon general principles for EBFM:

- Focus on maintaining the natural structure and function of ecosystems and their productivity;
- Incorporation of human use and values of ecosystems in managing the resource;
- Recognition that ecosystems are dynamic and constantly changing;
- A basis on shared visions of all stakeholders; and
- A basis on scientific knowledge, adapted by continual learning and monitoring

1.32 Implementation; how do we get there?

To undertake EBFM effectively requires integrating the management all individual fishing activities within a region to ensure that they are collectively achieving the whole of region objectives. (Fletcher 2006). It furthermore requires a shift that will ultimately reverse the usual order of management, so that ecosystems rather than single target species are the main priority. (WWF 2007).

Although there is controversy over how exactly to implement EBFM, the demonstrated range of ecosystem approaches being implemented in Australia can often be characterized into similar themes (Fletcher 2006). According to the WWF (Grieve and Short 2007), there are six basic internationally agreed upon principles / themes underpinning the implementation of EBFM:

- Operate within a policy framework designed to incorporate EBFM principles;
- Recognize economic, social, and cultural interests of all stakeholders;
- Recognize the risk of the impacts of resource exploitation on ecological and species values;
- Incorporate adequate information on exploited and threatened species;

- Ensure the fishery management system is adequate for EBFM to be effective; and
- Consider all externalities that may affect the resource

Fully implemented, the EBFM approach would greatly assist decision-making as it provides an overall framework for understanding the full implications of any management decisions (Fletcher 2006).

1.33 EBFM in Australia

Australia's progress in fisheries is at the forefront internationally, with ESD principles having been incorporated into most fisheries and resource management legislation (Ward, Geddes, and Mayfield. 2006). Following these measures, Australia is now beginning to address, more specifically, the concept of EBFM. The main way that Australia has done this is through the Commonwealth *Environment Protection Biodiversity Conservation Act* that came into effect on 16 July 2000. Through this act, "all fisheries based on export of marine species are required to undergo assessment (against the EPBC Assessment Guidelines) to determine the extent to which management arrangements will ensure the fishery is managed in an ecologically sustainable way" (Lack 2004). This act imposes a consistent measure of sustainability for fisheries management nationally and encourages continuous improvement to ensure long-term sustainability. (Lack 2004). Principles of EBFM underpin most assessment guidelines within this act with a main goal of the EPBC act being, "to set up management practices so as to maintain ecological processes and conserve ecosystems for the benefit of future generations, whilst meeting the needs of Australians today" (WWF 2002). Each state is currently work to address this guidelines laid out through this act.

Aside from the Commonwealth requirements laid out by the EPBC Act, each state is also beginning to implement principles of EBFM following their own approach and at their own pace.

1.4 Review of Previous Research:

Most of the previous research on EBFM focuses on broad generalizations of different methods and strategies to go about implementation. Nearly all research on EBFM currently published addresses the problem of how exactly to define and

approach the concept. Numerous organizations, such as the World Wildlife Foundation in Australia, FRDC in Australia, and the international FAO have developed and published practical guidelines to implement EBFM, but all three of these documents are compilations of vague recommendations. There is little research and very few case studies analyzing the actual actions being taken by different jurisdictions as well as their successes and struggles with implementation. There is also limited research analyzing and comparing different stakeholders and their perception of EBFM; including views on limitations, the need for EBFM, and ways to better implement it.

2.0 METHODOLOGY

2.1 Location and time frame:

This independent study was based out of Canberra, South Australia, and Victoria and took place throughout the month of April 2007. Primary research began in the Australian capital city of Canberra on April 9th and continued through April 12th. This location was chosen mainly due to wealth of EBFM resources and documents held at the Australian National Library and because it is the home of the Australian Fishery Management Authority, where I was able to acquire a better understanding of where EBFM stands on a national level through interviews with various people.

Primary research then began on April 15th and continued on through April 25th in South Australia. I stayed in Adelaide for this portion of the study since it was the most central location and where most of the organizations were located that I met with. This state was chosen as it is often labeled as a leader in the move towards EBFM and the interest of the South Australian Department for Environment and Heritage through my advisor, Patricia vonBaumgarten, DEH's Marine Adviser, on this project. Primary research continued on in the state of Victoria from April 26th to May 6th. For this part of the project I stayed in the city of Melbourne. This state was chosen primarily due to its close proximity to South Australia and relatively small size, which made it easier to travel throughout the state and meet people in the given time frame.

2.2 Data Collection:

Formal interviews were the primary source of data collection for this project, as expert opinions were essential to the study. General public perceptions and opinions of EBFM that would have been gained through surveys would not have been beneficial to this study. Surveys and observational studies were not appropriate for this study, particularly because of the fact the EBFM is such a new concept and not generally spoken of in mainstream society.

A total of sixteen targeted different interviews were conducted; with eight in South Australia, seven in Victoria, and one in Canberra. (*See tables 2.1-2.3 for interview contacts*) Data was recorded during interviews with either a tape recorder and/or hand written notes into my work journal. A tape recorder was used mostly

when meeting with government employees, with their approval, where as hand written notes were taken when meeting with individuals of different conservation / environmental organizations.

The interview conducted in Canberra focused largely on the general concept of EBFM and its current standing on a national level. This interview helped me recognize the various different issues surrounding the implementation of EBFM and to focus my interview questions for future data collection in South Australia and Victoria. Once in South Australia, interviews were conducted first with individuals at Primary Industries and Resources South Australia Fisheries, in order to understand what actions were being taken in the State to implement EBFM. From there, interviews were carried out with government funded fishery scientists, members of conservation organizations, fishery managers, industry managers, and marine officers with the Department for Environment and Heritage.. These interviewees were chosen so as to obtain a balanced perspective of various stakeholders and their opinions of the concept of EBFM. Once I moved to Victoria, interviews were conducted with members with similar affiliations. I met with people of Fisheries Victoria, conservation organizations, management agencies, and environmental groups.

The questions for each of these interviews focused on four general themes:

- actions being taken to implement EBFM
- priority / pace of EBFM in research
- limitations / deficiencies associated with EBFM
- suggestions on ways to better implement EBFM

(see Appendix 2 for the interview guide used)

Table 2.1 List of Interviewees, their organization, and affiliation with that organization in South Australia:

Name	Position	Affiliation
Cameron Dixon	Fishery Manager- Prawns	Primary Industries and Resources; South Australia, Fisheries Sector
Keith Jones	Project Officer- Recreational Fisheries	Primary Industries and Resources; South Australia, Fisheries Sector
Josh Coates	Marine and Coastal Facilitator	South Australia Conservation Council
Heidi Bartram	Marine Biologist	The Wilderness Society (South Australia Branch)
Richard McGarvey	Ecosystem Modeler	South Australia Research and Development Institute

Scoresby Shepherd	Senior Research Fellow	South Australia Research and Development Institute
Grahame Byron	Manager- Coast and Marine Conservation Branch	South Australia Department for Environment and Heritage
Neil MacDonald	General Manager	South Australia Fishing Industry Council

Table 2.2 List of Interviewees, their organization, and affiliation with that organization in Victoria

Name	Position	Affiliation
Chris Smyth	Marine Campaign Coordinator	Australian Conservation Foundation
Jarrod Gooden	Special Projects Manager	Victoria Co-Management Fishing Council
Margaret Moore	Senior Marine Policy Officer	World Wide Foundation – Australia
Peter Appleton	Executive Director	Fisheries Victoria (Primary Industries)
Candice Basham	Fisheries Administration Officer	Fisheries Victoria (Primary Industries)
Sonia Talzman	Senior Policy Fishery Manager	Fisheries Victoria (Primary Industries)
David Molloy	Manager- Rock Lobster	Fisheries Victoria (Primary Industries)

Table 2.3 List of Interviewees, their organization, and affiliation with that organization in Canberra:

Name	Position	Affiliation
Tim Smith	Manager –Environmental Policy	Australian Fishery Management Authority

Data was also collected through literature reviews of various research documents and resources that I received throughout the project period from a range of different sources. A number of the people that I had contacted to interview that were not able to personally meet emailed relevant political documents and research papers on the topic. Additionally, most of the organizations I met with gave background information on how their group is approaching EBFM or the general concept of EBFM. Some of the key documents used to better understand EBFM were:

- Oceans Eleven
- FAO Technical Guidelines for Responsible Fisheries
- WWF Guidelines for Ecosystem Based Management for Marine Capture Fisheries

- FRDC Guide to Implementing an Ecosystem Based Approach for Fisheries and the Marine Environment

(See References 5.0 for a complete list of documents)

2.3 Data Analysis:

After each interview notes were recorded into the ISP journal as well as an entry into the “interpretation and evaluation” section . For the interviews that were recorded, the tapes were immediately replayed and recorded after each interview as well. Data on the actions being taken in each state were analyzed through comparison with the principles of EBFM laid out by the World Wildlife Foundation. *(see sections 1.31 and 1.32)* Data obtained on the various perceptions of EBFM were analyzed for inconsistencies, similarities, and differences between one another and previous research. Throughout the course of this study, themes were also taken out of each interview and compiled together. Since all data obtained was qualitative, charts and graphs were not appropriate for analysis. Data was primarily analyzed based on the following themes obtained from the general concept of EBFM:

- view on how EBFM is being implemented in state
- opinion on the pace of implementation
- perception on why EBFM is needed for fisheries
- limitations / deficiencies associated with EBFM
- proposed strategies to better implement EBFM

2.4 Limitations of Data:

Since this topic is relatively new and still not clearly defined, there are a few limitations to the data obtained. A few of the individuals interviewed had a broad understanding of the EBFM concept, but could not necessarily elaborate on ways it is or could be practically implemented. Additionally, most of the people who I spoke with had a slightly different idea of what exactly EBFM meant for fishery management. While the general concept remained consistent, the varying views of what it meant for management made the analysis a bit difficult.

It is also important to note that fishery management is a highly political and often controversial field. For this reason, some of the responses given may have been biased. Furthermore, opinions may be biased due to the “interviewer effect”. People

may have felt obligated to alter their responses knowing that I was an environmental studies student approaching EBFM from a more environmentalist perspective.

There are also a few limitations in the data collected due to the time frame given for this project. While in Victoria, I did not have a chance to speak with fishery scientists or industry managers, as I had in South Australia. This may have resulted in a less balanced perspective. In addition, after researching in South Australia and Victoria, there are a number of other people back at AFMA and the FRDC in Canberra that I would have liked to have gone back and spoke with about EBFM, had time permitted.

A final limitation may have been due to my own struggles with understanding the concept of EBFM. When I began my interviews in Canberra, my interview questions were not nearly as focused as they were by the time I arrived in Victoria. This is because of my own troubles trying to understand how exactly EBFM works and can be practically implemented into management. With each interview, I became aware of a new aspect of EBFM that I had not previously been exposed to. This may have resulted in varying degrees of data from each interview and each state. I feel it would strongly benefit this project if I had more time to go back and speak with some of the first people I met with to ask some of the more challenging and in depth questions I came across throughout the course of the project period.

3.0 RESULTS AND ANALYSIS

This study focuses on the concept of ecosystem-based fishery management and how it is being approached, primarily in South Australia and Victoria. For the purpose of this study, the results have been broken into two different sections; implementation and perception. Analysis has been included with results, as all of the data obtained was qualitative and best presented in this manner.

3.1 Implementation of EBFM in South Australia and Victoria

In an interview conducted on April 12th, 2007 with Tim Smith, Policy Manager at AFMA, it was revealed that state level fishery management is generally highly participatory when it comes to EBFM, but varies from state to state due to the management agencies, politics, culture, community, and levels of exploitation in each state. The varying political, social, and biological scenes of each state are often labeled as the main factors responsible for the inconsistencies of implementation (Jones, 2007. pers. comm. 18 May). In an interview with Cameron Dixon, Prawn Fishery Manager at PIRSA Fisheries on May 2nd, he confirmed that state based agencies are moving to EBFM for each fishery, however the approach varies significantly due to the nature of each fishery and level of available resources. Cameron explained how different states have different approaches mainly driven by the existing funds.

For example, only a certain proportion of the revenue generated in Victoria from fishers' license fees is given back to fishery management and research, whereas South Australia puts all the money generated from license fees back into the fisheries. This allows the two states to manage EBFM differently and fund varying levels of research. Additionally, Cameron explained how the smaller fisheries in each state that do not generate as much money are not able to fund the same efforts to implement EBFM as other fisheries might be able to. Therefore, a standard approach for implementation has not been developed across each state agency or fishery committee. This was confirmed through this study.

Results:

The data obtained from South Australia and Victoria clearly demonstrates the lack of a standard approach to EBFM. While each state feels that they are moving in

the direction of EBFM and taking action following the principles and measures laid out by the World Wildlife Foundation in 2007 (*see sections 1.31 and 1.32*), they are doing so in considerably different ways.

Table 3.1: State Jurisdictions and their main efforts to implement EBFM

State	Main efforts towards EBFM
South Australia	-response targets and strategies to address DEH recommendations in the EPBC Act -development of a statewide logbook to monitor interactions with protected species -fishery co-management committees
Victoria	-“within fishery” risk assessments for all state fisheries -development of policy statement based on EBFM principles - development of a statewide fishery co-management council

3.12 Implementation in South Australia

3.12.1 Results

According to Cameron Dixon, Prawn Fishery Manager at PIRSA Fisheries, “South Australia is taking a proactive cooperative approach to implementing EBFM”. Management plans that previously focused solely on target species are now beginning to look at the broader ecosystem and habitat in which these species live.

Overall, South Australia’s main approach to addressing EBFM is done through the way that fishery management plans are set up and the way that these management plans respond to the recommendations and guidelines laid out by the EPBC Act 1999. (Dixon, 2007, pers. comm. 16 April). This act, focused primarily on ecological sustainable development, requires each state to take a number of steps in order to ensure that their fishing practices are sustainable enough and that their environmental impact is small enough to be granted approval to export fish. These steps are laid out as recommendations. According to Cameron Dixon, South Australia is the only state so far that has developed targets and proposed strategies / actions in response to each of these EPBC recommendations for each fishery. South Australia, due to these accomplishments, claims to be actively implementing EBFM. Cameron states that the EPBC recommendations are the main drivers of EBFM in the state.

South Australia is also implementing EBFM through the way they have organized fishery management; with a focus on the idea of “co-management”. (Dixon, 2007, pers. comm.. 16 April). Each fishery has developed a co-management committee, including commercial fishers, government employees, scientists, policy managers, and recreational fishers to facilitate the day to day management and decisions of each fishery. Cameron states, “By doing it this way and incorporating such a wide variety of stakeholders, South Australia has been able to document how they have progressed and changed in terms of compliance, public consultation, bycatch, and ecosystem impacts”. (Dixon, 2007, pers. comm. 16 April).

A further way that South Australia claims to be implementing EBFM into management is through the development of a state-wide log book that will require all fishers to report any interactions that they have with protected species. (Jones, 2007. pers. comm. 18 April.) According to Keith Jones, Project Officer of Recreational Fisheries at PIRSA Fisheries, this log book has been pushed from community pressure and the national movement towards EBFM. It will go into effect July 1st of this year. The data obtained from this log book, including the method of interaction (collision, bycatch, gear), the state of the species (dead/injured), the type of species, and the location of the interaction will all be used to develop practices and change management so as to reduce harm to threatened species. (Jones, 2007. pers. comm.. 18 April).

Aside from these “across-the-board” practices, South Australia is implementing principles of EBFM on a fishery specific basis, depending on resources available to each fishery. According to Senior Research Fellow - Scoresby Shepherd at SARDI Research, South Australia is currently still approaching management on a sectored fishery to fishery foundation and can therefore only implement principles of EBFM in that manner. (Scoresby, 2007. pers. comm. 20 April) This is demonstrated though the fact that risk assessments are being applied to some fisheries whereas others are taking different measures, such as placing scientific observers on boats in order to monitor bycatch and quotas. Each fishery is applying the principles of EBFM to a different degree. In an interview with Rick McGarvey, ecosystem modeler at SARDI, on April 20th, it was revealed, for example, how the sardine fishery in South Australia is approaching EBFM in a completely different way from the rest of the state. For this fishery there is currently a great deal of funding to assess the impact of fishing on this species as well as the other related and interconnected species. Trophic supplies,

habitat mapping, seal populations, bird populations, nutrients, species interactions, and food webs are among some of the few factors being analyzed in relation to the sardine fishery. Other fisheries in the state are not at this point.

3.122 Discussion

Overall it seems that South Australia is, in fact, taking small steps forward to implement EBFM into their fisheries. For example, the general move from a focus on target species to a broader focus on the ecosystem as a whole is a first step in the right direction. This follows the EBFM principle laid out by the WWF stating that for successful EBFM there needs to be a “focus on maintaining the natural structure and function of ecosystems and their productivity”. (WWF 2007. pp 5) Additionally, the creation and utilization of fishery co-management committees for each fishery is heading in the right direction of another one of six main elements necessary to implement EBFM that states that “management recognizes the economic, social, and cultural interests of all stakeholders”. (WWF 2007. pp 5) Having a system that requires scientists, commercial fishers, recreational fisheries, and government to have to come to a consensus on tough management decision underpins EBFM. The creation of a logbook in order to monitor interactions with protected species enforces the EBFM principle, “incorporation of adequate information on exploited and threatened species”. Furthermore, the move in research to focus on non-target species, habitat, and trophic levels follows the WWF principle of EBFM, stating that management ought to “have a basis on scientific knowledge”. (WWF 2007. pp 5) .

Cameron Dixon labels South Australia as a leader in EBFM for the rest of Australia. He emphasizes how this state is taking a proactive approach and that he is quite proud of their efforts. Keith Jones, the other interviewee from PIRSA fisheries, however, disagreed by saying that South Australia is still currently focused primarily on target species and quotas. Keith argued that EBFM is the state’s long term goal, but that they are no where near fully implementing it in its true form. These conflicting views coming from the same management agency reinforce the fact that there is no clear interpretation of EBFM or how to approach it.

3.13 Implementation in Victoria

3.131 Results:

The main approach to EBFM that Victoria is taking is through “within-fishery” risk assessments that have been developed for all fisheries. (Appleford, 2007. pers. comm. 3 May) These risk assessments are classified as being ecosystem-based and the foundation for all future management plans. (Basham, 2007 pers. comm. 3rd May). According to the Risk-Based Fishery Assessment Framework (Fisheries Victoria 2007), risk assessment outlines are based on the following principles:

- risks to the resources (“Securing the fish)
- risks to the economic and social benefits of fisheries (“Growing the value”)
- risks to the broader environment from fishing activities (“Ensuring EBFM”)

During the “within-fishery” risk assessments, all fisheries are given a ranking based on the “consequence” and “likelihood” of each of the above risks occurring. (Talzman, 2007. pers. comm.. 3 May). The results of this assessment are then included in management plans and decisions.

Victoria has also implemented and developed principles of EBFM into a policy statement that was finalized earlier this year. (Talzman, 2007. pers. comm. 3 May). This policy statement sets out principles for adoption of a risk-based approach to the management of Victoria’s fishery resources. According to the Policy Statement (Andrews 2007), “an ecosystem-based approach to fisheries management will allow Fisheries Victoria to plan, develop, and manage fisheries in a way that recognizes the broader context in which fisheries operate, including the abiotic, biotic, and human components of ecosystems”. These principles are expected to be implemented into all fisheries within the next five years and include, but are not limited to the following:

- Fisheries Victoria will manage access to fisheries resources in a way that maintains them for the future
- Fisheries Victoria will manage fisheries resources to minimize the risk of unacceptable impacts on the ecosystem
- Fisheries Victoria will apply a risk-based, precautionary approach to fisheries management where this is uncertainty

In addition, Victoria has developed a Fishery Co-Management Council. According to Jarrod Gooten – Senior Project Manager with the Fishery Co-

Management Council, this council provides expert, non-representative advice to the minister and fishery management agencies in the state. Jarrod explained how the council is set up to include commercial fishers, recreational fishers, environmental organizations, scientists, and indigenous individuals in order to provide the broadest range of stakeholders. Unlike South Australia, this council covers all fisheries, rather than having individual committees/councils for each fishery.

Victoria is also beginning to implement EBFM on a fishery to fishery basis. According to Peter Appleford, Executive Director at Fisheries Victoria, “Victoria is actively engaging in EBFM research, implementing the precautionary principle into fisheries when necessary, and changing fishing practices and gear to limit by catch.”

3.132 Discussion

Overall it seems that Victoria is quite proactive in implementing EBFM. According to Margaret Moore, Senior Marine Policy Officer with the WWF, “ecological risk assessments are the first step necessary in order to implement EBFM”. It is only through these assessments that management agencies will be able to truly understand the impact that fishing practices have on target species and to truly “recognize that ecosystems are dynamic and constantly changing”, a principle of EBFM according to the WWF. These assessments are also necessary tools to determine where to direct research and when to apply the precautionary principle. Victoria, having just developed ecological risk assessments for all fisheries in the state, regardless of their size or profit, has taken a significant step towards EBFM. Additionally, their commitment to EBFM is made clear with their development of a policy statement focused primarily on the principles of ecosystem-based management. According to the six elements necessary for implementation of EBFM by the WWF, one of the first steps is to “operate within a policy framework designed to incorporate EBFM principles” which is exactly what they are doing.

In an interview with Peter Appleford, Executive Director of Fisheries Victoria on May 3rd, he emphasized that Victoria is actively trying to achieve EBFM across all fisheries. When speaking with Candice Basham, Fisheries Administration Officer with Fisheries Victoria on that very same day, however, she argued however that EBFM is not necessarily in management plans right now, but will hopefully be implemented soon. Similarly to South Australia, these conflicting views from

individuals of the same agency reinforce the fact that there is no standard approach or interpretation of EBFM.

3.14 Discussion of Implementation in South Australia vs. Victoria

In general, while both states are slowly beginning to look at ways to manage fisheries with more of an ecosystem-based focus, it seems that EBFM is only in its infancy and that there are limited efforts being taken. There also seems to be considerable confusion and disagreement over what actions can be labeled as ecosystem-based and what actions can not.

In an interview with Grahame Byron, Manager from the Department of Environment and Heritage on April 18th, he argued that states are not acting for EBFM, but simply taking a broader approach to management. Grahame explained how states are making changes due to environmental impacts, but that these changes are not necessarily ecosystem based. In an interview with Margaret Moore of the WWF on May 4th, she reinforced this idea by explaining how states are addressing the smaller outside “symptoms” surrounding EBFM rather than approaching the concept as a whole. She argued that if states would commit to fully implementing EBFM, the smaller issues that states are trying to address, such as bycatch or habitat destruction, would automatically be taken care of. Looking at some of the actions of each state, such as the development of a wildlife log book in South Australia or the change of fishing gear in Victoria so as to limit bycatch, it seems that Grahame and Margaret are correct. Both states appear to be focusing on smaller aspects of EBFM rather than the larger framework. The attempts that they are making to approach the larger framework, such as the policy statement in Victoria, have only recently be laid out and are not adequately being enforced.

While both states are taking small measures to implement EBFM, it seems that Victoria is making more progress. South Australia is mainly and only truly addressing EBFM in ways that are required through the recommendations put forward by the EPBC Act. South Australia’s actions only cover two of the six steps laid out by the World Wildlife Foundation that are necessary to implement EBFM. This is a halfhearted effort. Victoria, having implemented ecological risk assessments, a policy framework, and a management plan focused on stockholder’s visions has addressed three of the steps laid out by the World Wildlife Foundation to implement EBFM

While these actions in Victoria have not been perfected, they are at least heading in the right direction. South Australia ought to follow their lead.

3.2 Perceptions of EBFM in South Australia and Victoria

While EBFM is a newer model for management, only beginning to be implemented into fisheries and not commonly spoken of in mainstream society, it is currently a “buzz word” in government, industry, and scientific conversation. (Byron, 2007. pers. comm. 18 May). The following perceptions were obtained from fishery scientists, government employees, industry, and conservationists in South Australia and Victoria in reference to EBFM and why it stands where it does today. With EBFM being such a new concept, a few of the people interviewed did not have input on the following topics. For the purpose of this analysis, only those who provided information on the following topics were included in results and analysis. Analysis and results were integrated together because this part of the study has more of a conceptual focus.

3.21 Perception of the Need for EBFM and the Pace of Implementation

Since states are beginning to implement EBFM into management, it is important to understand why. The following chart presents various stakeholder perceptions on why there is such a strong need for EBFM as well as how they perceive its progress.

Table 3.2 Interviewee perception of need for EBFM and Pace of Implementation

Interviewee	Major reasons to implement EBFM	Current Pace of Implementation
Rick McGarvey (research) SARDI	-EBFM is a “common sense approach”	-considering how complicated EBFM is, the pace is still not acceptable
Scoresby Shepherd (research) SARDI	-we need a path to follow that focuses on assessing ecosystem impacts and EBFM provides us the framework to do so -the theory has already been developed, and practice should therefore follow	-while EBFM is an extremely complex system and states are making significant advances, the progression has been slow and states ought to be taking a much more proactive approach (especially in terms of EBFM research)
Josh Coates	-ecosystems are not healthy enough	-implementation is not

(conservation) South Australia Conservation Council	-competing interests need to be kept in check -fishers are generally willing to change practices in order to conserve the ecosystem	nearly fast enough
Grahame Byron (conservation) DEH	-we need a healthier system to manage fisheries and keep the fishing industry in check -society expects better management due to heightened environmental awareness and increase in coastal development	-considering how complex implementation is for EBFM, states are doing enough
Heidi Bartram (conservation) Wilderness Society	-there is currently no balance between fisheries and the ecosystem in management	- the states are behind in implementation
Chris Smyth (conservation) ACF	-everything is interconnected and ought to be considered in management -the theory and legislation have already been developed and laid out -the role of fisheries is off and needs to be kept in check -Australia is in desperate need of a way to integrate all sectors and stakeholders -the Southern Oceans consist of mostly endemic species and is where most fisheries are located -most of the world's fisheries will collapse if management does not focus on the ecosystem -climate change requires us to better understand the ecosystem	-the states in general are not taking enough action and the pace is entirely too slow -looking at small EBFM accomplishments however, South Australia is ahead in terms of regional marine planning whereas Victoria is ahead in terms of habitat mapping
Margaret Moore (conservation) WWF	-it is in the best interest of the fishing industry to secure and protect the ecosystem that target species thrive off of -there is enough knowledge to implement and simply no reason not to -inevitable threats from global require us to address EBFM now -there is a general concern from fishers and willingness to change practices as necessary -there is significant community pressure to manage fisheries in a sustainable fashion -healthy ecosystems are the only real way to ensure healthy fisheries -ecosystems have been destroyed to the point that some target species can no longer survive	-the states are doing well to move to a broader management approach, but there is still doubt about whether they are implementing EBFM in the true sense of the term -the pace could be faster
Peter Appleford (government) Fisheries Victoria	-believes that the move to EBFM is more a natural process that will continue to occur through the improved management of single species -there is a increased push to move to EBFM because of greater community expectations of natural resource management	-most fisheries are generally sustainable -content with the pace of implementation of EBFM
Cameron Dixon (government) PIRSA Fisheries	-Australian fisheries are young and the theory of EBFM has been developed at a proper time -there is increased pressure from the community to move to a system of more sustainable management	-South Australia is taking a very proactive approach and is a leader in terms of implementing EBFM. -other states ought to be moving along as well
Keith Jones	-technological advances have allowed	-states are making

(government) PIRSA Fisheries	fishing to increase and therefore requires better management -there needs to be a way for management to take into account interactions between major species -it is in the fishing industries best interest to change practices to focus on the ecosystem -there is great community pressure to develop more efficient fishing methods / management	important advances, but more could certainly be done
Neil Macdonald (industry) SA Fishing Industry Council	-the fishing industry is not satisfied with the traditional fishery research and management system as it does not provide enough information / answers to why stock populations vary so much -believes the fishing industry will accept an economic loss in order to secure Australian fisheries	-while implementation of EBFM is incredibly complicated and political, it should be moving a bit faster

Throughout both Victoria and South Australia there is a general consensus that EBFM is vital to the future of fishing in both states, but being applied at a pace that is ranked as either “too slow” or merely “acceptable”. Of the eleven people interviewed who commented on this subject, eight individuals agreed that the pace was entirely too slow whereas three stated that the pace of implementation was “acceptable”. All eleven people, however, agreed that advances to EBFM were necessary for fishery management and were able to justify this with firm conviction.

Members of conservation organizations, in particular, perceive EBFM as the next step necessary in management, but argue that implementation is occurring at a pace that is much too slow. Margaret Moore at the WWF, argues that right now management is wrongly focused more on taking from than caring for the marine environment. (Moore, 2007. pers. comm.. 4 May). Margaret stated, “EBFM is needed as we haven’t just depleted species, we have impacted the ecosystem that these species thrive on to the point that they can no longer survive.” She continued on to explain how some fisheries that were closed over twenty years ago haven’t been able to come back yet because their ecosystem has been so greatly damaged. In an interview with Chris Smyth of the ACF on April 30th, this idea was further reinforced. Chris made the point that we ought to planning and implementing EBFM now, while at least some of ecosystems are still intact and that the slower we move, the less possible it will be to obtain the necessary knowledge for proper and sustainable management. Heidi Bartram, marine biologist and conservationist with the

Wilderness Society, agreed with Chris Smyth in saying that now is the time to implement EBFM as most fisheries and ecosystems are not currently completely over fished or destroyed. (Bartram. 2007. pers. comm. 20 April). All five conservationists interviewed agreed that the pace of implementation was much too slow and used the unhealthy state of ecosystems in order to justify implementation.

When speaking with government affiliates, however, there was a much more positive outlook on state actions. Of the three government employees who commented on this topic, each of them made a point to state, regardless of whether they thought more could be done or not, that both states were active in implementing EBFM and moving at an “acceptable” pace. These individuals did not seem to think there was as much of a need for EBFM. Most of them mentioned the community push to better manage natural resources as the main motive for implementation, rather than the damage currently being done to the ecosystem. EBFM was not as urgent for these individuals. Peter Appleford, Executive Director of Fisheries Victoria, for example, summed up these findings when he stated in an interview on May 3rd, that “EBFM is not necessarily a priority right now, but more of a philosophy.”

Scientists and industry members, however, tended to agree more closely with the conservationist view on EBFM than the governments view. There was 100% agreement among these individuals that the pace of implementation was too slow. Scoresby Shepherd, senior research fellow at SARDI, stated that “we need to head down a path of assessing ecosystem impacts and not look back” during an interview on April 20th. Scoresby argued that EBFM is necessary to the future of Australian fisheries. Similarly, Neil Macdonald, Executive Director of the South Australia Fishing Industry, argued that EBFM is necessary in order to fill in the holes in fishery knowledge. Neil Macdonald rationalized the need for EBFM a bit differently stating, “there is a general dissatisfaction by industry with traditional fishery research and management because it does not provide enough information / answers as to why stock population numbers vary so much beyond fishing impacts”. (MacDonald. 2007. pers. comm.. 23 May). This was a different perception than given by anyone else interviewed.

3.22 Perception on Limitations to Implementing EBFM

Throughout both South Australia and Victoria there are several obstacles that need to be overcome, in order to fully and practically implement the much needed

practice of EBFM into management. These obstacles can be used to help explain why the states are not moving faster towards EBFM. Key issues/challenges for implementation of EBFM across both jurisdictions are the lack of adequate resources (funding and people), ecological knowledge, analysis, research, government support, and legislation. The following table displays each individual who commented on this topic and their perception as to what the main limitations of EBFM are.

Table 3.3: Interviewee perception of the main limitations to implementation of EBFM

Interviewee	Main Limitations to EBFM
Rick McGarvey Ecosystem Modeler, SARDI	-Lack of ecological knowledge on non-harvested species -too many unknowns
Neil Macdonald Executive Director, SA Fishing Industry	-lack of investment to look at performance measures in ecological context
Josh Coates South Australia Conservation Council	-confusion over the exact definition of EBFM -lack of ecological knowledge -economics and the power of the fishing industry -lack of government recognition
Grahame Byron Department of Environment and Heritage	-lack of a clear definition for EBFM -inability to define an ecosystem separate from everything else
Scoresby Shepherd Senior Research Fellow, SARDI	-attitude towards to EBFM -lack of funding
Chris Smyth Marine Campaign Coordinator, ACF	-lack of integration in Marine Planning -management is too sectoral to implement EBFM -ocean is not valued enough -lack of stakeholder awareness -lack of ecological knowledge
Peter Appleford Executive Director, Fisheries Victoria	-lack of ecological knowledge -no way to assess EBFM, too many uncertainties -lack of funding to manage EBFM
Margaret Moore Senior Marine Policy Officer, WWF	-cost to implement EBFM -lack of ecological knowledge and research funding -practicality to operationalize
Dave Malloy Manager- Rock Lobster, Fisheries Victoria	-lack of ecological knowledge other than that from fishers on target species -lack of government funding and support
Tim Smith AFMA	-no way to assess EBFM -lack of a standard approach to EBFM -varying views on what is "sustainable" -lack of ecological knowledge

Of the ten people interviewed who commented on limitations to implementation of EBFM, 80% mentioned the lack of ecological knowledge as one of the main limiting factors. All of the individuals who mentioned this limitation explained how there are simply too many unknowns when it comes to ecosystems in order to currently implement a fully EBFM approach. This view was shared by

stakeholders from all of the different sectors, including government, industry, conservation, and science. Rick McGarvey, an ecosystem modeler and scientist at SARDI, for example stated that “EBFM is not technically fully possible right now because there is only a fraction of information available for the species of an ecosystem”. He continued on to explain how we can only really estimate the total biomass of the species that are harvested. The lack of knowledge on the rest of the ecosystem species, especially non-target species, is entirely too limited to ever be able to implement EBFM in its true form. Peter Appleford from Fisheries Victoria agreed with Rick in saying that there is no way to determine or demonstrate if states are actually achieving EBFM because there is not enough ecosystem knowledge to make such an assessment. Conservationists, such as Margaret Moore with the WWF also held strong to this belief. In an interview with Margaret on May 4th she stated, “we know more about the surface of the moon than we do about the marine environment”. Some individuals interviewed, however, while they agreed that there was a lack of ecosystem knowledge, continued on to express concern that fishers knowledge is not considered enough in management and that if it was, it could possibly benefit the implementation of EBFM. Grahame Byron, Marine Planning Manager at DEH, argued that while fishers can benefit greatly from science, science can also benefit from hearing out the fishers who have been out on the water for years. (Byron, 2007. pers. comm.. 18 April) Rick McGarvey at SARDI Research similarly argued that while fisheries do impact greatly on the environment, they also provide a wealth of scientific data and knowledge through their fishing reports. (McGarvey. 2007. pers. comm.. 20 April).

Another factor that can often be seen as one of the bigger challenges for implementation is in finding a way to define EBFM within the realm of sustainable management. (Dixon, 2007. pers. comm. 18 April) Of the ten people who commented on limitations, 40% mentioned the lack of a nationally agreed upon approach and/or definition for EBFM as one of the main features responsible for holding back implementation. Grahame Byron, for example, with the Department for Environment and Heritage confirms that there is not and can not be any true example of EBFM for others to follow until there is a universally agreed upon and true understanding of the term.. (Byron. 2007. pers. comm.18 April).

A third limitation consistently mentioned was the lack of funding for ecosystem-based research and assessment. 40% of individuals who commented on

this topic mentioned limited research efforts as a major restraint. While nearly everyone interviewed agreed that fishery research was slowly changing to direct its efforts towards EBFM, various interviewees expressed concern over the lack of funding for this research. Heidi Bartram, a marine biologist with the Wilderness Society, supported this view in stating, “we are slowly beginning to obtain the knowledge to implement EBFM, but can not do anything with it until government funds more research to fill in the gaps and provides proper legislation”. (Bartram.2007. pers. comm. 20 April). Neil MacDonald from the fishing industry similarly argued that there is a severe lack of investment to look fishery performance measures in a more ecological way. (MacDonald. 2007. pers. comm. 23 April) Additionally, when speaking with Scoresby Shepherd, senior research fellow at SARDI, on April 20th, he explained how research has only begun on this topic and that most of that research is biased anyway since it is funded by both the government and fishing industry. Scoresby also made a point to mention that management agencies are not doing much with the current research anyway..

While each of the above limitations were mentioned individually, it is important to note how closely they tie in and are connected with one another. Clearly, if individuals are going to define a lack of ecological knowledge as a main limitation, it makes that a lack of research and funding is responsible for that limited knowledge. In addition, it sensibly follows that without enough research and knowledge on the ecosystem, there can not be a standardized approach to managing it. Upon closer analysis, it seems that it is the lack of research that is responsible for all of the other mentioned limitations of EBFM.

3.23 Perception on Better Ways to Implement EBFM

Every individual spoken with, whether they were associated with industry, government, research, or conservation organizations avidly agreed that EBFM is a realistic goal for fishery management, although with varying insight on how we ought to get there. The following table summarizes individual views on what exactly is necessary in order to wholly, or at least better, implement EBFM. None of the following suggestions are currently fully in practice or policy in either South Australia or Victoria.

Table 3.4 : Perception on how to better implement EBFM

Interviewee	How to better implement EBFM
Rick McGarvey (research) Ecosystem Modeler, SARDI	-incorporate other fisheries into management plans -systems based / regional based approach
Scoresby Shepherd (research) Senior Research Fellow, SARDI Neil	-more risk assessments
Josh Coates (conservation) South Australia Conservation Council	-regional marine plans -precautionary principle for all fisheries -implementation of a combination of EBFM principles and marine parks -incorporation of indigenous traditional fishing practices and knowledge
Grahame Byron (conservation) Department of Environment and Heritage	-regional marine planning -awareness of EBFM in the mainstream
Heidi Bartram (conservation) Marine Biologist, Wilderness Society	-rapid assessment of areas based on ecosystem values rather than target species -regulate fisheries based on regionally defined areas -draw boundaries for management based on the marine environment
Chris Smyth (conservation) Marine Campaign Coordinator, ACF	-National Ocean's Policy / regional marine plans (to integrate all waters within the limits of the ocean) -EBFM management of areas between marine parks -education to increase how we value the marine environment (promotes stewardship)
Margaret Moore (conservation) Senior Marine Policy Officer, WWF	-implementation of a broader EBM approach, including all other users of the marine environment
Peter Appleford (government) Executive Director, Fisheries Victoria	-implementation of a broader EBM approach, including all other users of the marine environment
Cameron Dixon (government) PIRSA Fisheries	-achievement of all EPBC Act recommendations -application of precautionary principle -development of a less sectoral fishery management system, more regional based perhaps
Keith Jones (government) PIRSA Fisheries	-better management of bycatch -better method of recording interactions with protected species -system to manage all marine impacts, not just fishing -more holistic regional approach to management -way to regulate and monitor recreational fishing
Tim Smith (government) AFMA	-ecological risk assessments across all fisheries -harvest strategies across all fisheries
Neil Macdonald (industry) Executive Director, SA Fishing Industry	-begin managing at a local level -take into consideration the knowledge and expertise of fishers and industry -have a stable investment in research

Since every individual interviewed during the course of this study agreed that ecosystem based management was the way for fisheries to head, it is important to note the way in which they feel states could go about doing this. Of the twelve people who

commented on how EBFM could be better implemented in management, 75% mentioned the development of a more regional system based management plan. This would require the breakdown of the traditional sectoral fishery management and replacement with a more expansive holistic approach. Of the nine who recommended a broader approach to management, seven individuals proposed a system of bioregional marine planning whereas two proposed an even broader system of ecosystem-based management that would stretch far beyond fishing impacts and address all marine uses. Grahame Byron of the DEH argued that a bioregional marine planning scheme that splits up regions for management based primarily on species and habitat is the way to go. (Byron. 2007. pers. comm.. 18 April). Chris Smyth of the ACF agreed in stating that marine planning is needed in order to integrate all waters within the limits of the ocean. (Smyth. 2007. 30 April) A recently developed marine planning framework in South Australia states, “marine planning is an ecologically based zoning model that defines areas according to marine, coastal, and estuarine habitats. Each zone is supported by goals, objectives, and strategies for us and development in order to protect the integrity of these ecosystems” (DEH 2006). Each individual who mentioned marine planning as a possible way to go about implementing EBFM had heard of South Australia’s proposed marine planning and agreed that it was the closest example of EBFM to date.

Other individuals who suggested a change in management felt there needed to be an even broader approach applied than EBFM. Margaret Moore at WWF and Peter Appleford at Fisheries Victoria, agreed that there was no real reason to implement EBFM unless there was a way to address ecosystem impacts that other users of the marine environment have on the ecosystem. Margaret states, “We can not treat the marine environment with walled boundaries, which is what EBFM still proposes to do. We need a system that addresses the impact of all of the users of the ocean’s waters; including tourism, mining, transportation, etc”. (Moore. 2007. pers. comm.. 4 May) Peter Appleford similarly agreed in saying that there a number of other impacts that affect the marine ecosystem and without a way to address them EBFM is full of uncertainty and nearly impossible to approach. (Appleford. 2007. pers. comm..3 May). Of all sixteen people interviewed, Margaret and Peter were the only two to mention the need for EBFM to look at other users of the marine environment.

Other suggestions that were presented, such as increasing the number of risk assessments, better management of bycatch, and better ways to assess interactions

with non-target species do not seem to address the overall concept of EBFM as directly as the previously proposed regional marine plans / broader EBM frameworks. It looks as if the overall management system must be addressed before these smaller indicators are taken care of.

4.0 CONCLUSION

Ecosystem-based fishery management, while surrounded by a number of challenging obstacles and political barriers, is a valuable and sustainable approach to fishery management for South Australia and Victoria. Throughout both states, there is undeniable consensus among stakeholders that EBFM is the route that management ought to be taking but great discrepancy on how the states ought to be doing so. This discrepancy stems largely from a lack of ecosystem-based research, lack of ecological knowledge, and lack of a nationally agreed upon approach for Australia. The disagreement on how to approach EBFM is supported by the data obtained from this study which demonstrates that South Australia and Victoria are taking significantly different actions to implement this practice.

In South Australia and Victoria, while both states are taking different steps to improve the sustainability of their practices, they are not necessarily doing so within ecosystem-based objectives. For example, South Australia and Victoria both claim to be implementing EBFM, but, aside from a few actions across all fisheries, they are mostly doing so on a fishery to fishery basis. While I understand that fisheries vary in size and profit, implementing EBFM into each fisheries independently from one another goes completely against what exactly EBFM is out to accomplish. Ecosystem-based management, with its main focus on looking at the “broader picture”, indisputably requires that traditional sectoral management be broken down and management plans begin to incorporate the impacts that their fisheries have on one another. Without doing so, states can not rationally claim to be pursuing EBFM in its true form. Australia, with a marine management system that follows a confusing scheme including state, Commonwealth, fishery committees, and fishery managers makes implementation of EBFM inefficient and fundamentally impossible. Therefore, with both states being tied into such a complex system, I am not sure that it is appropriate to categorize most of their actions as having truly EBFM objectives.

In terms of whether EBFM is the right approach for management in these states, I wholeheartedly believe so. Considering the current state of Australian fisheries, the irrefutable consensus and support from all stakeholders for a move towards EBFM, the inevitable risks associated with global warming, and the increase in community pressure to better manage natural resources, both states should be taking a much more proactive approach to implement EBFM. It only seems logical for states to strive to

improve ecosystem health which would naturally ensure fishery health and in turn secure economic stability and growth. Granted that there are a number of limitations, governments ought to begin actively embracing the beneficial long-term principles of EBFM. It is within their best interests.

In conclusion, it seems that no matter how good of a concept EBFM may be and how many stakeholders support it, ecosystem-based management cannot and will not resolve the fundamental problems of the present fisheries management regimes without the political determination to stop over fishing, protect habitat, and support extended research and monitoring programs. The fact that South Australia has already developed a Marine Planning Framework but is not getting put into action because government refuses to move the traditional system of fishery management to a more holistic management structure is a noticeable example. The fact that there is a lack of investment into ecosystem based research is yet another. Without government backing this practice, it is hard to imagine any more action that could be taken.

While the framework of EBFM assessed through this study is a newer system, it will continue to evolve as scientists and managers gradually obtain a better understanding of ecological processes. The only question is; to what extent will it then be implemented.

4.2 Recommendations

The concept of EBFM is slowly being implemented into both state and commonwealth fisheries throughout Australia. However, the pace is much too slow and jurisdictions are not taking nearly enough of a proactive approach. Australia has an exciting opportunity to lead the rest of the global fishing industry in the implementation of EBFM and ought to be doing so. After speaking with numerous different stakeholders, I feel the following steps are not only feasible, but critical in securing the future of Australian fisheries.

- Development of a nationally agreed upon approach to EBFM
- A breakdown of the complex sectoral fishery management system currently in place in Australia
 - Communication between state and commonwealth fishery agencies
 - Communication between the fishery managers of each state
 - Development of a decentralized more regional approach to management

- Implementation of the precautionary principle at all costs
 - Wherever there are uncertainties or gaps in ecological knowledge, management ought to head down the path of conservation and implement the precautionary principles
- Increased funding for ecosystem-based fishery research
 - Funding of research looking specifically at ecosystem / habitat modeling, food web modeling, predator / prey interactions, ecosystem health, bycatch impacts on ecosystems, interactions with protected species, and impacts of different fishing gear on the marine habitat
- Mandatory training /education for fishery managers, industry, and researchers on ecological values and the principles of EBFM
- Development of a long-term method to assess and monitor EBFM
- Development of a policy framework that would realistically operationalize EBFM

4.3 Suggestions for Future Research:

Since EBFM is in its infancy, research is equally as important to the future and development of a means to practically implement EBFM principles into fishery management. While conducting this study, I came across a number of different areas that I feel could be studied further which would ultimately benefit the implementation of EBFM. These topics include, but are certainly not limited to the following:

- Ecosystem models for all bioregions of South Australia and Victoria coastlines
- Food web models for all marine ecosystems impacted by fishing practices
- Research and assessment of EBFM implementation in all states of Australia, as well as commonwealth managed fisheries
- Research on different methods of governance in order to implement EBFM
 - Case studies analyzing successes and failures of different governance systems
 - Experiments to test different cooperative management plans
 - Plans / methods to integrate fisheries management with the other sectors of marine management, including tourism and coastal development

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Bartram, Heidi. Marine Biologist – Wilderness Society. *Personal communication*. 20 April 2007

Basham, Candice. Fisheries Administration Officer – Fisheries Victoria. *Personal communication*. 2 May 2007

Byron, Grahame. Marine and Coastal Manager - DEH. *Personal communication*. 18 April 2007

Coates, Josh. Marine and Coastal Facilitator - South Australia Conservation Council. *Personal Communication*. 17 April 2007

Dixon, Cameron. Prawn Fishery Manager - PIRSA Fisheries. *Personal communication*. 16 April 2007

Jones, Keith. Recreational Fisheries Project Manager - PIRSA Fisheries. *Personal communication*. 18 April 2007

MacDonald, Neil. Executive Director – South Australia Fishing Industry Council. *Personal Communication*. 20 April 2007

McGarvey, Rick. Ecosystem Modeler – SARDI. *Personal communication*. 20 April 2007

Moore, Margaret. Senior Marine Policy Officer – WWF. *Personal communication*. 3 May 2007

Shepherd, Scoresby. Senior Research Fellow – SARDI. *Personal communication*. 20 April 2007

Smith, Tim. Director of Environmental Policy- AFMA. *Personal communication*. 11 April 2007

Smyth, Chris. Marine Campaign Coordinator – ACF. *Personal communication*. 30 April 2007

**Appendix I:
Interview Schedule:**

Date	Interview	Affiliation
Wednesday April 11 th	Tim Smith	Australian Fishery Management Authority
Monday April 16 th	Cameron Dixon	PIRSA Fisheries
Tuesday April 17 th	Patricia vonBaumgarten	Department of Environment and Heritage, South Australia
Tuesday April 17 th	Josh Coates	South Australia Conservation Council
Wednesday April 18 th	Keith Jones	PIRSA Fisheries
Wednesday April 18 th	Grahame Byron	Department of Environment and Heritage
Friday April 20 th	Heidi Bartram	Wilderness Society
Friday April 20 th	Scoresby Shepherd	South Australia Research and Development Institute
Friday April 20 th	Rick McGarvey	South Australia Research and Development Institute
Monday April 23 rd	Neil McDonald	South Australia Fishing Industry Council
Friday April 27 th	Jarrod Gordon	Fishery Co-Management Council, Victoria
Monday April 30 th	Chris Smyth	Australian Conservation Foundation
Tuesday May 1 st	Sonia Talzman	Fisheries Victoria (Primary Industries)
Wednesday May 2 nd	Peter Appleton	Fisheries Victoria (Primary Industries)
Wednesday May 2 nd	Candice Basham	Fisheries Victoria (Primary Industries)
Wednesday May 2 nd	David Alloy	Fisheries Victoria (Primary Industries)
Thursday May 3 rd	Margaret Moore	World Wildlife Foundation

Appendix II Interview Guide

1. Considering the international move towards EBFM, how is (state) beginning to implement EBFM into fishery management plans?
Probes:
 - what different tools and methods
 - integrated rather than sectored approach?
 - how recent are these methods?
2. How is EBFM being monitored and assessed in (state)?
Probes:
 - who supplies the scientific data?
 - if is not being assessed, why not?
3. What changes if any have had to be made to previous management plans in order to implement these methods?
4. What do you think is the main factor responsible for the move towards a more ecosystem based approach for fisheries?
Probes:
 - increased environmental awareness?
 - community pressure?
 - overfished stocks?
5. Have you encountered any resistance in implementing EBFM?
Probes:
 - who is the resistance from?
 - what is there reasoning against EBFM?
6. How much of a priority is EBFM in fishery management plans right now?
Probes:
 - in comparison to target species research?
 - in comparison to economic interest?
7. Would you say that (state) is moving faster, slower, or at the same pace as the rest of Australia?
8. What limitations or deficiencies are there in the EBFM principles?
Probes:
 - lack of ecological knowledge?
 - management is too political?
9. Do you have any suggestions about how EBFM could be implemented better?

Appendix III
Contacts:
Aside from interviewees

- Baker, Janine; Independent Marine Biology
- Bohm, Craig; National Fisheries Campaigner
Australian Marine Conservation Society
- vonBaumgarten, Patricia; marine consultant
South Australia Department of Environment and Heritage
- Flaherty, Tony; Marine Planning Liaison
Adelaide Mount Lofty Ranges National Resources Management Board
- Jenkins, Greg; Statewide leader – Marine Estuarine Ecology
Primary Industries Victoria
- Slocombe, Janine; Sustainability and the Environment Coordinator
University of South Australia
- Hitch, Lorraine; Project Leader – Sustainable Fisheries
World Wildlife Foundation