A Comprehensive ESD Analysis of a Fishery: The Incorporation of Regulatory, Ecological, Economical and Sociological Aspects

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A Comprehensive ESD Analysis of a Fishery: the Incorporation of Regulatory, Ecological, Economical and Sociological Aspects.

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Non Technical Summary: About the Book

This book argues the case – and establishes the means - for ensuring the future of wild-capture, commercial fishing. It is a great irony that as consumers world-wide are demanding ever more seafood and the world's population continues to grow rapidly (further increasing demand), the people who supply the food we want are under threat from sections of the community who wish to curtail commercial fishing.

There are good reasons to be concerned with the status of commercial fisheries. Until governments stepped in and set caps on allowable catches, species after species were in danger of being overfished. In unfortunate cases the government action came too late and the fishery collapsed. That is in the past, with the rare exception where our science has failed us and we have misjudged the sustainable limit, or poor country governments have not been able to enforce their fisheries laws. It is well over 20 years since the world's fish catch has increased.

Today fisheries biologists and fisheries economists have developed a common understanding of the fishery "problem", which is technically called "open access to a commons". Having made very significant progress on this matter by closing the door on open access, fisheries managers have had to turn their attention to new issues. The most basic is the need to put fishing and all that entails into a wide environmental framework. How does the removal of a proportion of top predators affect the marine food chain? How does the fishing method or the type of gear used impact on the benthic environment or on non-target species? These questions have been, or are being, addressed and it is now possible to illustrate that a range of types of commercial fishing

meet strict environmentally sustainable criteria. Australia is the world leader in introducing these standards. The Australian national government will not permit the export of Australian seafood unless it can be proven that it has been harvested in a sustainable way. In simple terms this criteria requires that the catch in 10, 20 or 100 years time should be similar to the catch today and the target stock and diversity of the other animals with which the target species share the environment should likewise remain constant.

Notwithstanding this very significant and relatively rapid improvement in the practice of commercial fishing, there have arisen new - and largely unwarranted - threats to the future of our seafood producers and the supply of wild-capture fish, the amateur fisher who no longer catches as many fish per trip as, say 10 or 20 years ago, blames the commercial fisher for this situation, overlooking the fact that the number of commercial fishers is likely to be lower now and their total catch is unlikely to have changed. The amateur fisher’s problem is the increase in numbers of amateur fishers! Yet the amateurs will use whatever political power they can muster to exclude the commercial fishers from productive fishing grounds.

The problem is not only between different groups of fishers competing for a limited resource. Other interests clash with those of the seafood provider. Seaside tourism businesses are too ready to seek the removal of commercial fishers while forgetting that their customers like to eat locally caught seafood and do not mind the working fishers and their" boats on the beach or in port. This vista does not, at least in the eye of tourism resort managers, fit their image of the seashore. Tourism operators who take this view need to visit Hobart waterfront or that of countless European cities where fishing boats and seafood dominate. Then there are some environmentalists who

are yet to be convinced that fisheries are sustainable or that biodiversity is being protected. This is understandable given the history of fishing. However, commercial fishing is being managed very differently to-day and environmentalists would serve their cause better by targeting the pollution that continues to enter our waters and effects biological diversity.

Much of the problem faced by commercial fishers is based on invalid perceptions or ignorance of the facts. In the present era, the most significant overfishing is likely to be due to the ever-increasing number of recreational fishers. There is no cap on their numbers. The tourism industry should take note of tourists' preferences - they like local seafood. The environmentalists have done a good job in drawing attention to over fishing and threats to non-target wildlife. Now that their concerns have been addressed by the introduction of sustainability criteria into legislation and industry-led adoption of environmental management systems they can fruitfully turn their attention to other threats to marine environment. However perceptions of problems with wild-capture commercial fishing persist and if perceptions become "reality" as the saying goes, there is still a real problem.

This book illustrates how the use of ecological science but particularly, economic analysis and sociological data and interpretation can be put to good use by commercial fishers and their government manages to guarantee the future of the seafood industry. It places most emphasis on the social factors as these are the neglected aspects, but fundamental to the future of fishing. The role of commercial fishers in their communities and the inter-relationships that exist or can be fostered ultimately will determine whether the fishers can counter the generally poorly informed threats to their survival as providers of seafood.

Acknowledgements

This book is the result of a major study funded by the Fisheries Research and Development Corporation (FROC). The Corporation's goal is the sustainability of Australia's fisheries, an objective it aims to achieve by funding targeted research projects and studies. It has pursued this objective with great vigour since a paradigm shifting conference on the topic .of sustainability (formerly called ecologically sustainable development in Australia) held in the Victorian city of Geelong in 2000.

In the years that have passed, the Corporation has funded a special program on sustainability. A team of researchers with qualifications in ecology, economics, and social science were commissioned by the FRDC to formulate a set of procedures and principles by which to gauge the contribution wild capture commercial fisheries made to sustainable development. Even after a decade of friendly collaborative work, the team was not able to agree on the proposition what the "sustainability of a fishery" was for practical purposes the same thing as "making a contribution to sustainable development". One perspective was that development in general had to be sustainable; the other was that development would not be sustainable unless its component parts (such as fishing, farming and furniture making) were not sustainable. The authors of this book are from the latter school of thought. They argue that what is of interest to society - and in particular to opponents of commercial fishing - is whether or not the activity can be sustained. They also argue that the starting point is a healthy and resilient marine environment and that only if the physical environment is healthy will fishing be sustainable. In this regard their perspective is similar to that of the Marine Stewardship Council and the Parliament of Australia when it enacted the Environment Protection Biodiversity Conservation Act of 1999 and applied it to the export of seafood from

Australia. Only if fishing did not degrade the environment and only if catches were sustainable would the product be permitted to be exported. However, there is more to the sustainability of a fishery than a healthy environment and constant catches, as we illustrate next.

Throughout the decade spent on promoting the principles of sustainable development to the fishing industry, two difficulties - major difficulties in fact have frustrated the endeavour. The first was how to determine what was meant by sustainability from a social (sociological) perspective. The ecological and economic dimensions of sustainability were successfully identified (and refined where necessary) over the period the research was underway but the third leg of sustainable development remained allusive. The second difficulty arose once progress was made on the first - how to integrate the social with the economic and the ecological so that a comprehensive assessment of a fishery could be undertaken. The research reported in this book is the first attempt to deal with these problems and present practical solutions. We show the social aspects of fisheries are likely to determine the future of a fishery. We show how these features are as important as the ecological and economic characteristics of sustainability. We show how we can measure the social relationships because if we cannot measure them we cannot link them to the other two dimensions. We are seeking a truly comprehensive analysis of a fishery, one that would meet the principles of sustainable development as formulated by the United Nations Commission on Environment and Development in 1987 and subsequently refined by experts in the field.

We do not claim that our study is the final word on the subject - far from it. First steps are usually tentative and open to correction. However, we do believe we are the

first in the world to have pushed the boundaries of fisheries (and natural resource management) to the limits in the search for sustainability measures that go beyond simply the ecological and economic. Many have written about. the importance of "the social", the application of the discipline of sociology and about the role social capital plays in achieving sustainability, but we know of no other attempt to actually measure the social aspect and illustrate in a real world situation how it can help, retard or close-down a fishery.

The other thing we do in much more detail than in most analyses of a fishery is to disaggregate the economic aspects into a large range of indicators. In virtually all cases, analysts rely on one (admittedly very important) indicator, economic rent. Those who struggle with understanding the difference between financial and economic measures will find our analysis very helpful. Most lay people think the two mean the same thing and can end up making wrong decisions by comparing the two.

Our research required both theoretical and practical work. We could not claim to have made progress if our ideas and principles were not tried in practice, and come through a trial without encountering serious problems. The practical part of the study required us to select a fishery and gather data from fishers using our measures of its social and economic characteristics. Most of the data was obtained in face-to-face interviews with fishers. Considerable confidential information was shared with us, often requiring the fisher to consult his or her written records in particular profit and loss statements and taxation returns. We thank all those fishers (and their family members where they participated) for their cooperation. Most of the fishers we interviewed had been subject to interviews for another study three years prior to our research. They have started to feel they were guinea pigs in an experiment contributed by government and

academic types for their own interest. Social science research is so different to biological science research. With regard to the latter, the researcher does not have to ask permission from the subject being studied.

The fieldwork was undertaken by an enthusiastic group of research assistants. They were required to cover significant distances in the State of South Australia, as they went from one small port to the next far-flung one. The fishers had to be found - at home or on the wharf - and then anything from half an hour to two hours was spent in interviewing and recording data.

The field staffs were Amy White, Michelle Wenner, Lizzie Clark and Lisa Rippin and Jacqueline Russell. The latter was a member of the Bureau of Rural Sciences staff, while the others worked with and for the authors. Amy White continued her work on the study to its near finality, typing, formatting and acting as a research assistant to the team. Eloise Weldon took over finalising the word-processing and formatting the body of the work as it approached completion. Without the efforts of these people the project would not have been possible. We thank each and every one of them.

The valuable comments by two independent reviewers were certainly welcomed. They pointed to matters that needed clarification and we have sought to address these. Where we differ with the reviewers on either semantic or philosophical points we have retained our position often re-examining it.

We must also thank Primary Industries and Resources South Australian (the fishery management agency in South Australia) for its in-kind contribution to the study, and (the fishing industry organisation) for its strong support of our work. A special thanks

goes to the supremo of fisheries management in South Australia, Will Zacharin. Will was instrumental in facilitating the case study research.

Tor Hundloe

Background, Need, Objectives and Methods

Since the release of the Brundtland Report in 1987 the principles of sustainable development (called ecologically sustainable development in Australia) have come 10 be gradually applied throughout society. This is the case for fisheries, and today all fisheries jurisdictions in Australia require adherence to sustainable development principles by statute.

Sustainable development requires the proper consideration of three aspects of an activity: the ecological, the economic and the social. This is often referred to as the Triple Bottom Line.

FROG, quite some time ago, identified the importance of ESO in fisheries management. The Geelong conference in the late 1990's set the scene for a major new research focus for the FROC. This is overseen by the ESD Sub-Program. The members of this Sub-Program Working Group have produced "How to" guides for both wild-capture and aquaculture fisheries. These are used extensively throughout the country; however different jurisdictions have focused on the aspects which suit their needs:

Australian fisheries which export product are required to meet the legislative requirements of the EPBG Act At present, this focuses on the ecological elements.

Experience with the rezoning of the Great Barrier Reef Marine Park to include much larger no-fishing zones highlights the importance of including economic and social considerations at an early. stage, and the data and research to underpin this.

The experience of the ESD Working Group and the ESD Reference Group is that fisheries managers and fishers are extremely keen to have economic and social aspects researched and

put on the table at the same time as the ecological data. There is uncertainty among fisheries managers about how best to do this, and how such information can be applied in fisheries management decisions. The main issues identified have been those of scale and relevance.

An impediment to this holistic assessment of management changes to a fishery is the lack of appropriate base-line data at an appropriate scale linking social and economic aspects.

As there is a small number of fisheries economists in Australia, with some difficulty (waiting for researchers to become available) the economic aspects can be researched.

When it comes to the social sciences (sociology, anthropology, psychology) there is an extremely small group who have an interest and expertise in fisheries. This needs to change. It will take time.

To address uncertainty among fisheries managers about how to use such information effectively in the first instance there is a need to demonstrate the usefulness of the information and its application to management issues. This should lead to increased interest in this field.

This project takes up the first task which Is 10 illustrate that it is feasible to bring the ecological, economic and social data together and provide it to the regulators and politicians when they are to make decisions.

The second task is to train people, in particular future fisheries managers and industry leaders, in the application of a holistic approach. Not only do the basics of the individual methodologies On ecology, economics and sociology) have to be understood, it is also necessary to train people in understanding t!1e interdependencies of the "three legs' of a fishery. For example, it is generally accepted that in the long run a profitable (economically healthy) fishery will only be sustained if the

ecosystem is also healthy. Far less is understood in terms of the relationship between social and economic factors and the sustainability and long-term profitability of a fishery.

There is one fishery in Australia which picks itself as an ideal case study for the task at hand. It is the SA Marine Scalefish Fishery (MSF) Net Sector. Decisions on its management have been fully supported by economic data. Economic studies have been done in the past eight years. The ecology is very well researched and understood. More recently, a social survey (funded by FROG) provided social infonnation on the fishery and its linkages to the local community. These research undertakings plus a sound regulatory-political environment have permitted a holistic approach to management.

The FROC ESD Reference Group identified this fishery as the best example to illustrate - and generalise - the principles that should guide fisheries management in the 21st century.

There are other aspects of this fishery which suggest its appropriateness. It has a small number of operators and hence data collecting is relatively inexpensive. It presently has 55 licence holders with net endorsements, down from approximately 130 before a recent buyback, given this restructure, it will be necessary to re-run the social and economic survey as a component of this research. The results of the survey will provide information to be written up in the relevant chapters of the "How to guide".

Need

This has been covered in both the Background and Consultation. The benefits of including social science and economic information in fisheries management are not well recognised. The bringing together on one agenda - at the one time and one place - of

the ecological, economic, and sociological aspects simply does not occur - with one or two notable exceptions.

One reason for this is that fisheries managers take the view that it is simply too difficult to do because .of the lack of appropriate scale data and its application. On the other hand, fisheries managers know that what is missing is important.

Written-up in easy-to-read English, with informative illustrations, the proposed "How To Guide" will be an invaluable tool for to-day's managers and source for the training of the next generation.

Objectives

1 Provide a tool for today's fisheries managers

2 Provide a reference/text for the next generation of managers

Outputs & Extension

The output from this research is a (small) book, a "How To Guide" for today's managers and fishers, and to be able used as a text for the next generation.

In this sense, this research is different from much other where consideration has to be made with regard to publishing journal articles, road-shows etc.

Intellectual Property

Published, widely disseminated and promoted, and/or training and extension provided. Relates mainly to outputs that will be available in the public domain.

Planned Outcomes and Benefits

The outcome will be better-informed discussions on fisheries management generally, but certainly in terms of the roll-out of Marine Protected Areas, resource allocation, and restructuring. By definition better informed decisions should result in benefits to fishers and other stakeholders in a fishery.

To illustrate to the fishing industry (in particular managers, other parties such as Environmental Departments, fishers and future fishing industry staff) how to integrate all decision-making data and approaches in the management of fisheries. The range of relevant data is: the regulatory-political framework; the ecological understanding of the

fishery; the economic understanding of the .fishery; the sociological understanding of the fishery.

The product will be a "How to Guide", in book form, written in plain English but nevertheless of a scholarly standard such that it can serve as a text in fisheries courses (at the AMC and other universities).

How to integrate the various aspects will be illustrated by a major case-study (and some minor ones). The case-study will be by the South Australian Marine Scalefish Fishery (MSF) Net Sector. This is the only fishery in the nation which has been subject to extensive analysis from all disciplinary perspectives. To complement the existing data, another new social-cum-economic survey will be undertaken as part of this research.

Methods

1.Design contents of manuscript: Tor Hundloe - already done in draft.

2.Design new survey: Dr. Kate Brooks, BRS and Econsearch with input from PIRSA.

3.Administration of survey: Prof. Hundloe and Elizabeth Clerk

4.Field work: as above.

5.Data recording: as above.

6.Analysis and write-up: Or. Kate Brooks, BRS and Econsearch. ..

7.Writing individual chapters: Team. Hundloe {Introduction / Background, Will Zachrin/Craig Noell (Regulatory framework/ecology) will commence at the start of the project. Others, during and after the survey:

8.Editing and formatting: Tor Hundloe and M. Wenner - this is the penultimate task.

9.Manuscript preparation: Tor Hundloe and M. Wenner - this is the last task and will be completed in time for publication as early as possible.

The details on the new survey are presented in some detail next.

THE NEW SURVEY

There are currently 55 MSF licence holders with net endorsements, down from approximately 130 before the buyback.

From the previous BRS survey, there were approximately 90 responses from holders with ~et endorsements. Around 60 responded to the financial questions of the questionnaire (response vaned according to the question, e.g. gross sales n=53, employment n= 69, costs n=59, capital n=58).

A similar response rate would yield 35 to 40 responses from a population of 55. Because we will be using face-to-face interviews for all respondents, the response rate could be higher. We have budgeted on 40 interviews.

SURVEY & QUESTIONNAIRE DESIGN

Use previous questionnaires as a starting point. Will need to ensure consistency with previous survey so comparisons are valid. Will need additional questions regarding response (social and economic) to buy back program.

SURVEY ADMINISTRATION

Obtain contact list from PIRSA Fisheries. Contact SAFIC to gain their support for the study - they may send letter of support direct to licence holders (we could offer to draft the letter) and/or put notice in Newsletter advising that the study is being conducted and encouraging licence holder support. Contact all 55 licence holders by phone initially. Arrange tentative interview times.

FIELDWORK

Given the length of the questionnaire, 2-3 hours would be needed for a full interview. The interview length and the geographical dispersion of licence holders mean that an average of just 2 interviews/day IS likely. Because the questionnaire covers both social and economic issues, it will be important that interviewers, who will be conducting the interviews, fully understand the questions in each other's discipline. To achieve this

consistency in interpretation, around 10 interviews will conducted jointly and the remaining 30 will be conducted with one interviewer.

DATA RECORDING

Interviews will be lengthy with some open-ended questions and so recording them is likely to be time consuming as well (2 hrs/response x 40 responses = 80 hrs= 10 days).

ANALYSIS AND REPORTING

Analysis and reporting will be not only of the results from this survey but will also include a comparative analysis of the results from the previous survey given the significant changes that have occurred in this sector of the fishery.

Tor Hundioe

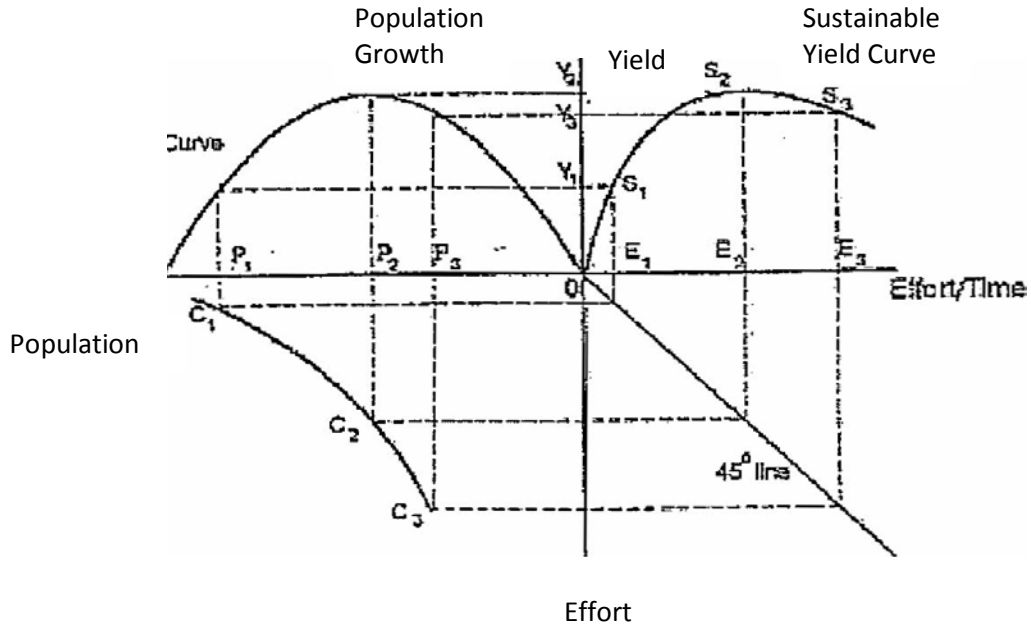
Chapter Seven: Conclusion

This book has focused on one fundamental aspect of fisheries management - our ability, or lack thereof, to integrate the three key things we are most worried about: the long term ecological health of the fishery; the long term economic profitability; and the long term relationships fishers have with the local community and society generally. This is the first attempt to seek to truly integrate these three essential components of fisheries management. While governments and the community are placing more and more emphasis on the need to link these three foundations of a fishery, very little is being done in practice to determine whether or not this is possible. This we have seen "as our challenge. We have taken it up by reference to a detailed case study of a small, geographically-diverse and well-studied Australian fishery.

In this concluding summary, we shall highlight what we have discovered. To do that we shall put aside any discussions of the large number of traditional aspects of fishery management so to go directly to our task. For example, we will assume the fishery manager is using tools such as area closures, seasonal closures, size limits, gear restrictions and the like to manage the fisheries impact on the environment. We will also assume that the fishery manager has had his biologists/ecologists study the targeted (and non-targeted) species in detail and, as a consequence, the manager has as good as possible understanding of the target stock, its growth function and sustainable yield. The manager is also assumed to have modelled individual fish growth. We assume the manager and the fishers will be using state-of-the-art technology to ensure the safe return of non-target species to the environment. Simply put, we do not want to be distracted by these basic management tasks.

Having set the scene, the task for the manager is to decide between two ways of managing the catch at sustainable levels. Either a total allowable catch can be established (a TAC) and individual quotas allocated, or a set of input controls (number of boats, type of gear, etc) can be designed and put in place. Whichever approach is used, the manager would have in mind a model of catch per unit of effort (CPUE) as set out in Figure 21. We shall use this diagram to illustrate how a fishery manager can integrate two of the three legs of sustainability for a fishery. The two legs (the economic and biological) form a bio-economic model.

Figure* 21: *Optimal Harvests



Source: Hundloe, 2002

Figure 21 is the conventional sustainable yield, four-quadrant diagram. The yield curve is 'based on the typical Schaefer curve in fisheries ecology. It is recognised that not all species, particularly short-lived one such as prawns, conform to the normal Schaefer curve.

What the bio-economic model illustrates is the ease by which economics and biology can be married to provide an analysis of the sustainability of a fishery. However, the model neglects the social aspects of the fishery, a matter we are very keen to develop as the previous chapter illustrates. We will return to that after integrating the biology with the economics. The social aspects are just as important to the survival of a fishery, as all it takes is an ill-informed campaign by those opposed to fishing to result in the closure of the fishery. There are examples of this happening in Australia in recent years - and this in a developed mature country with excellent fishery management. In fact, Australia is considered a world leader in modern fisheries management - primarily because sustainability is treated as the fundamental goal. Less developed and less mature countries find their valuable commercial fisheries under all sorts of threats and the last thing we would want to see, is them Closed due to ill-informed anti-fishing campaigns.

We can use Figure 21 to illustrate how our case study fishery was restructured to allow for the optimum level of fishing effort consistent with the sustainable yield of the fishery. Prior to the restructure, the amount of effort (number of fishers, boats and gear) in the fishery was at a point such as C_3 in quadrant III.

This was a significant amount of effort - and as we will see, too much to maximise profits while maintaining the fish sock.

To make sense of the model, trace C_3 through to the population estimate in the second quadrant (11). It corresponds to a low population of P_3. Recall there are many fishers and boats with effort at C_3 and over-fishing is the result. Next, from this relatively

low population go to the population growth curve in quadrant 11 and note that it leads to growth of the stock at Y 3. This is a lower growth rate than is possible. The highest rate that is consistent with the growth function the biologists have estimated is at Y2. Go back to Y3 and trace it to the yield curve in quadrant I and note that the yield is 8_3. Also, note that a higher yield at 8_2 is possible if effort is adjusted by restructuring the fishery.

The South Australian fishery manager responsible for our fishery had come to the view, on the basis of the research done prior to 2004, that there was too much effort in the fishery and hence it was not producing its highest yield per unit of effort. This we have shown. The manager understood that to achieve the maximum sustainable yield a reduction in effort was required. The fishery manager could have over-reacted (assuming he had unreliable data – which was not the case) and set out to reduce effort to the very low level of C_1 in quadrant Ill. Trace C1 all the way through step by step to the sustainable yield curve and you will discover that a very low level of catch, at Si, in quadrant I results. Obviously, the fishery manager's goal was to aim for an effort level of C_2 which when traced through maximises the sustainable yield at S2.

The economic data presented in Chapter 6 shows a significant reduction in effort was achieved with the restructure and a significant increase in profit for individual fishers resulted. It should be noted, as stated previously, that an increase in the selling price of fish was also a factor in the increased profit. The moves we have sketched out in our four-quadrant diagram above took place and were successful. To illustrate this consider Figure 22, where the sustainable yield curve and a cost curve (representing the fishers' cost of operations) are superimposed To simplify the analysis, the yield curve (similar to the one in Figure 1 if not quite of the same shape - recall these are models not precise descriptions of an actual fishery) is deemed to be the revenue curve for the fishers; that

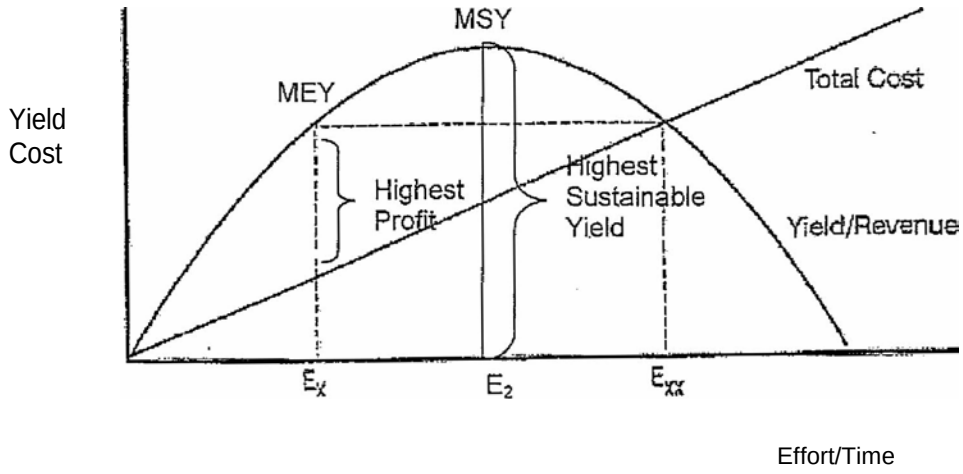
is, each kilogram of fish caught sell at the same price (this is a realistic assumption on the basis of this fishery supplying only a small amount of total demand for the species in question). The greatest distance between total revenue obtained by the fishers' sales and total cost they incur in fishing results in the highest profits, we can see no reason why the fishers would not seek to achieve this goal - in fact, this is the obvious expectation. As the highest profit is achieved by maintaining the fishery on its sustainable yield curve - and at a level of effort which is less than that capable of taking the maximum sustainable yield (MSY) - we have achieved simultaneously two desirable outcomes - ecological sustainability and economic sustainability. What economists call the maximum economic yield (MEY) is at a lower level of effort than maximum sustainable yield - hence there is no need to be concerned with over-fishing (see the technical appendix for the criteria that apply).

Let us use Figure 22 to make this point concrete. We show MSY (at effort level E_2) and MEY (at effort level E_1) in Figure 22. The next important point to note is that the same quantity of fish can be taken by either E_{xx} or E_x level of effort. They are both at the same level on the sustainability yield curve. Clearly E_x is the winner as much less effort, meaning much less cost, is capable of harvesting the same amount of fish. Economic sustainability in this simple model assumes no change **in** demand, more generally the ceteris paribus (all other things being equal) assumption in economics. We can relax this and the same general conclusions will hold - maximum economic yield is achieved by taking LESS fish than maximum sustainable yield.

The fish catch is conservative and will remain stable (assuming the manager has addressed the broader environmental matters, as discussed above). This leaves the most challenging aspect of sustainable development to be brought into focus, the social

considerations.

Figure* 22: *The Most Profitable Harvest



If the integration of the economics and the ecological (or, at least, the biological) can be and, in our case, were achieved, what of the social dimensions? Both the economic and social aspects of a fishery have "flows" to the community, such as employment and participation in social and sporting events, and "flows" from the community. The latter include economic resources such as payment for fuel and local goods and services and political resources such as networks of people supporting the fishers' right to earn an income.

We have used the concept of social capital and its specific attributes to measure the level of negative or positive flows. We have found the fishery to be healthy on ecological-economic grounds but is this enough for a sustainable future? Let us see. Our survey results show that the level and degree of social capital associated with the fishery is not as broad and deep as one would want for a sustainable fishery. Notwithstanding the restructure of the fishery, commercial fishers remain concerned that as time goes by they will again be put under pressure by the demands for greater access by recreational

fishers and the demands for new marine parks. The commercial fishers are dependent on the support of local people, the communities they live in, to counter such claims. Our survey results suggest that bonding social capital is relatively strong and this will help in this regard. This is a two-way thing. The fishers have proven to be good at bonding and making a positive contribution to the community. Involvement in sport is an obvious example. People in the small fishing communities do not "bowl alone" (as Putman would put it).

Commercial fishers also require the advantages that bridging and linking social capital bring. This amounts to enhancing the resilience of the fisheries in situations of threatening changing circumstances. Strengthening these forms of social capital is not so much a task for the fishers, but for others who hold the fishers' future in their hands. The survey data shows that linking social capital (hierarchical power relationships) is not strong, possibly weakened after the successful restructure, as there are fewer fishers to deal with this issue and there is a sense that "the job is done". It never is. Now more so than before, the fishery manager and the fishery associations have a prime task of building and maintaining linking social capital.

The enhancement of bridging social capital needs to be a joint effort by fishers and those in key community organisations. In all but the capital city of Adelaide, the small coastal communities in which our case study fishers live and work benefit from the fishers' existence. While most of the catch might be sold in faraway markets for example, Sydney and Melbourne, the existence of the fishery, the boats tied to the wharf, fresh fish in hotel meals and the very presence of fishers, make these communities special. Throughout the world coastal fishing villages play a special part in the social and cultural histories of countries. They are often tourist draw cards.

Social capital at a community level is built and maintained by people living and working in the community and it is also facilitated by - or hampered by - the structural environment in which individuals operate. In other words, the easier it is for fishers (or whoever) to make and maintain 'links' and 'bridges' in their community, the stronger the social capital. These characteristics of social capital are vastly different to macro-scale social capital (the existence of good governance, laws, trust in institutions and the like) which makes some countries a pleasure to live in and do business in, where others are a nightmare. Australia ranks high on macro-scale social capital and our fishers benefit as much from this as any other Australian.

We can summarise the survey results with regard to the three types of social capital we have identified, commencing with bonding social capital. *Local* scale bonding social capital is about wanting to be -and, therefore, being -part of the local community. Being involved in assisting local schools, sporting clubs, community associations and doing as much business as possible in the community are the means to this end. Our case study fishers have some elements of this (for example, via sporting club membership and participation); however, due to their small number (spread across a vast area of the South Australian coast) their bonding relationship may not necessarily be strong enough to protect fishers from campaigners by those who wish to reduce their numbers, if not eliminate the industry. It is as much in the hands of local people (the businesses they operate, the clubs they run) as it in the hands of fishers to construct bonds which will sustain whatever pressures the fishery might be forced to bear in the future.

It is not a criticism of our fishers that their involvement might fall short of an ideal. There is only so much a person busy making a living at sea can do. The commercial fishers, particularly the younger ones who play football during the season, are clearly doing more than simply working. And all working people have homes and yards to maintain, errands to run, a social life to be had.

Playing sport is an example of a social activity where there is no need for an incentive to be' part of the community. Obviously one enjoys the sport. A similar situation exists when fisher families have children in primary school. This provides an incentive to help with "tuck shops", school fetes, or go a step further and become a member of a parents or citizens group. Our survey results show that most of the fishers do not have young children going to school.

As business people selling the majority of their product in distant markets (Adelaide and other cities) the fishers do not have the opportunity to engage, with their customers. Primary producers supplying local markets, as some fruit and vegetable farmers do, get to know their customers and their customers get to know them. This results in a strengthening of bonds and the local producers can count on the support of customers. Political support when the producers' interests are threatened can be very important. There is very little, if anything, that fishers can do about their circumstances, other than work harder to establish stronger bonds, if this is required. In this circumstance, the initiative has to be with the local community and/or fishers' associations who need to work to develop the community's interest in, and concern for, local fishers.

However, the survey results indicate that bonding social capital is sufficiently

strong to provide a broad base on which the other two forms of social capital can sit - and be maintained. The problem discovered in our survey is the weakness of both linking and bridging social capital. This can only be remedied with the assistance of the fishers' professional bodies and the State Government managers. Both these bodies need to recognise the difficulties faced by a small number of professional operators spread widely across the state. This makes it difficult to arrange meetings so that all can attend. The very nature of the fishery - owner-operators, spending considerable time at sea and landing product in small ports - works against establishing and maintaining social and professional networks, both locally and in the capital city of Adelaide. The latter is where the important decisions are made about the fishery's future.

Linking and bridging social capital have to be strong if the fishery is to become resilient. Social resilience is like ecological resilience, it is a prerequisite for the sustainability of the social part of sustainable development. In countries like Australia, where commercial fishing is unlikely to rank in the top 50 industries, it is very important that fishers' representative bodies and government management agencies recognise that they have a significant role in establishing and maintaining fisheries. It is important to recognise that fishers, unlike farmers and furniture-makers, are not free agents - government plays a significant role in fishers' businesses. Even in fisheries committed to co-management, the power and influence of government managers cannot be under-estimated. Hence, fisheries managers have a crucial role in assisting fishers develop and maintain strong linking and bridging social capital, while the fishers can take prime responsibility for maintaining bonding social capital.

What our study illustrates is that a comprehensive (ecological, economic and

sociological) investigation of a fishery can determine whether or not it is sustainable and, just as importantly, point to what needs to be done to support sustainability, As the first attempt to bring a high degree of comprehensiveness and integration to fisheries management, we are aware that much more theoretical and practical research needs to be done before we can claim we have solved the problems we have identified. The approach we have taken is not the only one possible, although it is not obvious what alternative methods would be as useful. The major difficulty in attempting integration is the potential tension between economic objectives (the maximising of total profit for the fishery) and social objectives (the retention of a large fleet of small-scale fishers who by their numbers, along with community and industry involvement and collaboration with management increase the breadth and depth of social capital in the community). The social objectives are important (necessary for the sustainability of a community and its businesses). Some suggest that a hierarchical approach is appropriate -society's goals come before the economic objectives. This is not totally a radical proposal. There are many aspects of life where social goals override economic ones, the prohibition of drug-taking being an obvious example. It is possible to measure the costs and benefits of social decisions of this kind before deciding they are, or are not, desirable. That approach we support. However, there does not need to be tension between economic .and social objectives. Where there is, the cause is likely to be a narrow understanding of economics - too often what is overlooked is that economics is about the use of resources for the well-being of people. As such it is not to be confused with 'the gamblers in the financial world who unfortunately love the ability to adversely influence our well-being.

Having shown that there is no need for tension between the economy and biology-cum-ecology, we encourage readers to continue the task of seeking a smooth

integration of these legs of the sustainability stool with the other leg, the social.

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