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Report of the

EXPERT CONSULTATION ON CATALYSING THE TRANSITION AWAY FROM OVERCAPACITY IN MARINE CAPTURE FISHERIES

Rome, 15-18 October 2002

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PREPARATION OF THIS DOCUMENT

This document is the final report of the FAO Expert Consultation on Catalysing the Transition away from Overcapacity in Marine Capture Fisheries that was held, with the financial support of the United States of America, in Rome, Italy, from 15 to 18 October 2002.

The purpose of the Expert Consultation was to try to generate guidance on the topic of how to move away from situations of overcapacity in marine fisheries, as part of the FAO's ongoing efforts to assist countries in the implementation of the International Plan of Action for the Management of Fishing Capacity.

This document includes the Final General Recommendations and Guidance, documentation about some of the issues and potential solutions that the group believed to be important elements of moving away from situations of overcapacity, and the background documentation for the Expert Consultation.

The report and documentation was compiled by Dr John M. Ward, Senior Economist, National Marine Fisheries Service, Washington, D.C., USA and by Dr Rebecca Metzner, Fishery Planning Officer, FAO Fisheries Department and Technical Secretary of the Workshop.

Distribution:

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ABSTRACT

The *Expert Consultation on Catalysing the Transition away from Overcapacity in Marine Capture Fisheries* was intended and designed to develop a set of general recommendations to assist in addressing the difficult subject of overcapacity in marine capture fisheries. The result is guidance about a general, flexible process for assisting the transition of fisheries that are characterized by overcapacity into fisheries that are characterized as fully utilized, economically efficient *and* that meet the management objectives and goals of the agency or group that has fisheries management responsibility.

Long lasting regulatory solutions to these problems, to these symptoms of excess and overcapacity in fisheries, have been developed by a number of experts in the fields of fisheries sociology, marine policy, economics, biology, and anthropology. However, although the fundamental fishery management problem has been identified, capacity reduction solutions have been proposed, and solutions for resolving overcapacity problems exist, the transition process itself is not well understood and a procedure to implement the solution has not been previously identified.

The transitional procedure is intended to assist administrators and others to overcome some of the constraints that currently can inhibit or slow the introduction and implementation of capacity reduction programs. The approach is one that involves building understanding and consensus regarding various goals and objectives. While supportive quantitative or qualitative analysis is recommended, the guidance can be implemented without extensive data collection or analysis.

The experts recognized that different fisheries will likely adopt different capacity reduction programs that reflect particular social, management, economic, and other needs. Individual management authorities have different long term objectives and goals for their fisheries. Because there is no single solution, capacity reduction programs will likely be a combination of some of the issues and approaches that are outlined the background documentation.

It is the hope of the participants in the Expert Consultation that their efforts to provide practical guidance about an issue that is confronting many today will be useful.

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EXECUTIVE SUMMARY

This expert consultation was intended and designed to develop a set of general recommendations and guidance to assist in addressing the difficult subject of overcapacity in marine capture fisheries.

The result is guidance about a general, flexible process for assisting the transition of fisheries that are characterized by overcapacity into fisheries that are characterized as fully utilized, economically efficient[1] *and* that meet the management objectives and goals of the agency or group that has fisheries management responsibility.

The transitional procedure described in ***Part I: Results of the Expert Consultation on Catalysing the Transition away from Overcapacity in Marine Capture Fisheries, Final General Recommendations and Guidance*** is intended to assist managers, administrators, decision-makers and others to overcome some of the constraints that currently can inhibit or slow the introduction and implementation of capacity reduction programs.

The procedure is intended to facilitate the transition from the existing management approaches that create incentives to increase overcapacity to management approaches that generate incentives to eliminate overcapacity and also prevent its reappearance. The approach is one that involves building understanding and consensus regarding various goals and objectives.

While supportive quantitative or qualitative analysis is recommended, the guidance can be implemented without extensive data collection or analysis.

Both excess capacity and overcapacity in the fish harvesting sector have long been recognized as serious fisheries management problems. Studies - of both the short-run problem of *excess* capacity and the persistent, longer run problem of *overcapacity* - indicate that excessive levels of fish harvesting capacity exist in many fisheries.[2]

Furthermore, the negative impacts of such excessive levels of harvesting capacity are not limited to the financial well-being of participants in fisheries in terms of their over-investment in the capital and labor used to harvest fish. Excessive levels of harvesting capacity also have substantial social costs for fishing nations. These social costs can include serious ecological, human, and food security impacts.

Both excess and overcapacity have been cited as the primary cause of overfishing of fish stocks globally. Similarly, the practices of discarding of incidentally caught marine mammals, turtles, and finfish have also been attributed to excess and overcapacity in directed fisheries. Habitat degradation caused by the excessive use of superfluous fishing gear has been attributed to excess and overcapacity in the fishing industry. Still another type of these social costs is the impact on different groups of participants in the fisheries - such as the displacement of artisanal fishers by industrial fleets in coastal waters.

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[1] The phrase 'economic efficiency' is used here in the broadest sense to mean the maximization of the net present value of benefits net of costs of a management program. Thus, benefits include quantitative as well as qualitative values held by stakeholders such as, but not limited to, quality of life in a fishing-dependent community, dissatisfaction from knowing highly prize species are being harvested and discarded (such as in the case of endangered species), and food security.

[2] For example, Garcia and Newton (1995) estimated that world fishing capacity should be reduced by 53 percent for revenues to cover total costs of harvesting fish. Hsu (2000) also found substantial levels of excess capacity in world capture fisheries. In addition, Hsu found that the Canadian Atlantic inshore groundfish fishery had excess harvesting capacity in a study conducted between 1984 and 1991. Excess capacity was identified in the Malaysian purse seine fishery by Kirkley, Squires, Alam, and Omar (1999). The government of Japan (2001) determined that excessive fishing capacity was present in its coastal fisheries and in the large-scale purse seine and offshore trawling fisheries. Studies of *overcapacity* in fisheries are limited in number, but indicate that *overcapacity* can exist separately from *excess* capacity. Kirkley, et al. (2002) found high levels of *overcapacity* in five federally managed U.S. fisheries.

Part II – Report of the Expert Consultation on Catalysing the Transition away from Overcapacity in Marine Capture Fisheries includes a synthesis of the expert consultation discussions that formed the basis of the recommendations and guidance.

The synthesis includes some of the major social, management, legal, financial, political issues that were identified by the experts as potentially creating barriers to capacity reduction programs. The synthesis also includes some of the potential solutions that were suggested for overcoming these barriers.

The expert consultation reaffirmed the need to take into account social, economic, financial, management, political, and legal concerns of stakeholders in the fishery or fisheries – not only by providing information and education to the stakeholders, but also by providing for stakeholder input and feedback into the management process.

Long lasting regulatory solutions to these problems, to these symptoms of excess and overcapacity in fisheries, have been developed by a number of experts in the fields of fisheries sociology, marine policy, economics, biology, and anthropology, and these solutions have been categorized as either 'incentive blocking' and 'incentive adjusting' to reflect their likely impact on participants' behavior.[3]

Typically, these solutions involve a change from open access, regulated open access, or common property fisheries where 'incentive blocking' measures are used to fisheries management programs where 'incentive adjusting' measures are used to strengthen participants' harvesting rights by setting up community development quotas, territorial use rights, or even individual transferable quota systems. Very basically, this is because management systems that cause participants to behave as if they have strong property rights for fish in the sea will help eliminate overcapacity in the fishery. The weaker the property right for the *in situ* resource, the less likely that overcapacity will be eliminated and not reappear.

Even though the fundamental fishery management problem has been identified, capacity reduction solutions have been proposed, and solutions for resolving overcapacity problems exist, the transition process itself is not well understood and a procedure to implement the solution has not been previously identified. Both disbelief in the usefulness or efficacy of incentive adjusting management approaches and concern about intermediate financial, social and political issues prevents their adoption. In the interim, incentive blocking regulations continue to be used as temporary measures to control overcapacity.

The experts recognized that different fisheries will likely require different capacity reduction programs that reflect particular social, management, economic, and other needs.

Individual management authorities have different long term objectives and goals for their fisheries. Because there is no single solution, capacity reduction programs will likely be a combination of some of the issues and approaches that are outlined in ***Part III: Background Paper and Provisional Discussion Issues***, the background documentation to the Expert Consultation that includes *III-1. Fish Harvesting Capacity, Excess Capacity, and Overcapacity: A synthesis of measurement studies and management strategies*; and *III-2. Provisional Discussion Elements*.

It is the hope of the participants in the Expert Consultation that their efforts to provide practical guidance about an issue that is confronting many today will be useful.

[3] FAO, Technical Working Group, La Jolla, CA, USA.

PART I: RESULTS OF THE EXPERT CONSULTATION ON CATALYSING THE TRANSITION AWAY FROM OVERCAPACITY IN MARINE CAPTURE FISHERIES

Final General Recommendations and Guidance

1. In supporting the International Plan of Action (IPOA) for the Management of Fishing Capacity and the broader outcomes of the 2002 World Summit on Sustainable Development (WSSD), including ecosystem considerations and related roles of fisheries management, the Expert Consultation recognized that overcapacity is a cause for concern for the health of fish stocks, the achievement of sustainable fisheries, and the objectives of sustainable development in the implementation plan of the WSSD.

2. The Expert Consultation recognized that there are enormous technological changes and rapidly escalating external market forces on fisheries and the ecosystems that support fisheries, and that these forces, in turn, are driving a need to be more dynamic, integrated, and multi-disciplinary in our approaches to fisheries management, research, and analysis.

3. The Expert Consultation recognized that capacity reduction programs can be designed and structured in ways that do not transfer problems. As a result the Expert Consultation strongly endorses and encourages the redoubling of efforts to address overcapacity in ways that do not create problems in other places.

4. The Expert Consultation recognized that a capacity reduction program should not simply result in capacity reduction. It is critical that the management system avoids the regeneration of overcapacity and, thus, continues to limit the resulting capacity at levels that ensure the sustainability of the fishery.

5. Thus, the Expert Consultation:

5.1. *concluded* that addressing issues of overcapacity and capacity reduction is a process that should follow general principles, yet be developed according to the conditions, particularly the scale and social norms, of the specific fishery under consideration.

5.2. *agreed* that capacity reduction programs will have potentially significant social and economic impacts on the participants in the particular fishery and in supporting activities. These impacts will be both positive and negative. Outcomes of a capacity reduction program are, in the long term, positive in both economic and ecological terms, but the direct and related stakeholders may fear the negative effects of a capacity reduction program, especially in the short term, leading to resistance to the consideration of such a program. Capacity reduction programs can be designed to minimize or mitigate these negative impacts so that the overall benefits of a well-designed capacity reduction program are capable of receiving both government and community support.

5.3. *recognized* that the practical success of a capacity reduction program will be based on stakeholder support and commitment. Thus, it is necessary to define the problem of overcapacity, raise awareness about potential consequences, and build consensus to create a viable capacity reduction program.

5.4. *agreed* that, ideally, the design and implementation of capacity reduction programs should use a consultative, if not collaborative, approach throughout the process.

5.5. *agreed* that the process of developing, adopting and implementing capacity reduction programs should involve the following steps.

5.5.1. The first step is to characterize the fishery under consideration using available data and information. This may include stating:

- where the fishery occurs,
- who has and who could have responsibility for managing the fishery,
- the fish stock(s) harvested and the relative condition of the stock(s),
- the relative variability or stability of the fish stock(s),

- o the participants in the fishery,
- o the fleet(s),
- o the actual management system and regulations currently in effect in the fishery, and
- o potential drivers of overcapacity and the economic and social linkages, and
- o other characteristics of the fishery.

5.5.2. Step 2 is to list the measurable management objectives for the fishery if they exist, or to determine them in collaboration or consultation with the stakeholders in the fishery.

5.5.3. Step 3 is to determine, either quantitatively or qualitatively, if overcapacity exists in the fishery.

5.5.4. Step 4 is to identify a range of incentive blocking and incentive adjusting options for a capacity reduction program and the subsequent management plan for avoiding the regeneration of overcapacity, including the option of maintaining the *status quo*, as a basis for comparison and discussion of potential outcomes.

5.5.5. Step 5 is the identification of the users who will be affected, both directly and in terms of other effects, for each of the various options. At this stage, it is important to conduct integrated research on what the impacts of capacity reduction may be, the relative magnitude of these impacts, and who is affected.

5.5.6. Step 6 involves a program of significant information dissemination, education, and awareness raising to all stakeholders, including those in all levels in government, the fishery, and related industries in the community. This process can be formal or informal.

5.6.1.1. This process of discussion and awareness raising should involve explaining:

- o fishing capacity and how it is measured;
- o how much capacity may need to be reduced to achieve the management objectives;
- o potential capacity reduction program options relative to the identified management objectives for the fishery;
- o the benefits and costs of the capacity reduction program options; and
- o the potential consequences of not addressing overcapacity.

5.6.1.2. The process should also involve obtaining information from all relevant stakeholders about the proposed range of capacity reduction programs.

5.5.7. Step 7 is to conduct an analysis of the proposed range of capacity reduction programs. The purpose of this analysis is to determine:

- o whether the proposed programs will actually reduce capacity in the manner intended,
- o whether they meet management objectives,
- o who will be impacted,
- o how stakeholders will be affected, and
- o potential mitigation strategies for those most affected.

5.5.8. Step 8 is to select the preferred capacity reduction program and the subsequent management program to adopt. This step could be complemented with additional consultation.

5.5.9. Step 9 is to undertake the formal approval process for implementing the selected capacity reduction program.

5.5.10. Step 10 is to implement the particular capacity reduction program for the fishery under consideration.

5.5.10.1. The final step is to put into place administrative, monitoring, evaluation and adaptation strategies and mechanisms for a capacity reduction program.

5.6. *reiterated* the importance of including social and economic components in the design of capacity reduction programs to mitigate possible negative short term effects and to thereby facilitate the transition away from overcapacity. This is particularly important in fisheries where there are poor and vulnerable sections of the fishing community.

5.7. *recognized* that there will be many situations in which there is poor or inadequate information and knowledge, minimal financial means, and limited timeframes, but that these steps should be followed to the extent possible and based on the best available information.

5.8. *recognized* that the development of capacity reduction programs is an ongoing and continuous process of learning.

5.9. *agreed* that these steps are critical because there are difficult human issues associated with capacity reduction programs.

5.10. *recommended* that the FAO:

5.10.1. document case studies of capacity reduction management programs as reference for the development of national plans of action in support of the IPOA – Capacity;

5.10.2. elaborate and implement programs to facilitate human resource development and institutional strengthening, especially in developing countries, so as to promote the full and effective implementation of national plans of action on the reduction of overcapacity; and

5.10.3. convene an Expert Consultation addressing the design of capacity reduction management programs for capture fisheries of developing and developed countries, paying particular attention to the development of the procedures for implementing such programs and the consideration of related issues such as employment, poverty and food security.

PART II: REPORT OF THE EXPERT CONSULTATION ON CATALYSING THE TRANSITION AWAY FROM OVERCAPACITY IN MARINE CAPTURE FISHERIES

INTRODUCTION

6. The Expert Consultation on Catalysing the Transition away from Overcapacity in Marine Capture Fisheries was held at the FAO Headquarters, Rome, Italy, 15 - 18 October 2002.

7. Nine experts from a variety of backgrounds around the world participated in the Expert Consultation and were assisted by the Secretariat (Appendix B).

OPENING OF THE EXPERT CONSULTATION

8. Mr. J-F. Pulvenis de Séligny, the Director of Fisheries Policy and Planning Division of the Fisheries Department welcomed the participants on behalf of Mr. I. Nomura, Assistant Director-General of the Fisheries Department and opened the Expert Consultation on Catalysing the Transition away from Overcapacity in Marine Capture Fisheries.

9. In his opening remarks, Mr. Pulvenis de Séligny noted that overcapacity in marine capture fisheries is a very important yet complex problem. He remarked part of this complexity is due to the fact that the resolution of overcapacity has significant social, economic, and political consequences for the stakeholders in each country.

10. He noted that while the best intentions at national and international levels in developing the International Plan of Action on Capacity Management demonstrated a shared will to tackle and address a significant fisheries problem, concrete and practical implementation of the IPOA and the adoption of specific capacity reduction programs has proved to be much more difficult.

11. He urged the participants to consider the Expert Consultation as a collegial session and to work together to determine the steps that would assist fisheries managers everywhere to reduce capacity in fisheries and, most importantly, to provide ideas for solutions so that the existing tools could be implemented successfully.

ELECTION OF THE CHAIRPERSON

12. The participants in the Expert Consultation elected Dr. M. Agüero as Chairperson.

ADOPTION OF THE AGENDA AND TIMETABLE

13. The Expert Consultation adopted the agenda and timetable as contained in Appendix A to this report.

PRESENTATION: CAPACITY REDUCTION IN FISHERIES OF THE UNITED STATES

14. As part of setting the context for the expert consultation, Dr. John M. Ward presented an overview of fishing capacity issues and the situation in the U.S.A. His talk included some of the difficulties and problems that have occurred during the process of trying to develop and reach consensus on how to resolve situations of overcapacity.

15. The text that formed the basis of his talk follows.

Introduction

16. In the United States (U.S.), the management of fishing capacity is recognized as a serious management problem that is deemed responsible for the overfishing of many domestic fish stocks. The necessity to reduce fleet capacity has been cited by the Assistant Administrator for Fisheries as one of the two major problems facing U.S. fisheries management. However, this problem must be resolved within a complex management environment that involves many management entities and different management goals and objectives established by Congress and state legislatures.

17. This complex management environment is a significant challenge to actually adopting and implementing capacity reduction programs.

18. The role of the National Marine Fisheries Service (NMFS) in this management program to eliminate overcapacity is to provide scientific information and advice in the form of:

- definitions,
- measurement metrics, and
- capacity utilization levels in different fisheries.

19. As such, the NMFS program can be considered to be similar to other international capacity reduction programs - there are many different management entities and objectives. And, just as the FAO provides information and advice to its member countries that are trying to resolve their fish harvesting capacity problems, the NMFS provides information and advice to the eight federal fishery management councils about their many different fisheries.

Fishery Management Environment – Some of the legislation

20. Fisheries management in the United States has a myriad of goals and objectives, and these are based on a number of legal mandates including:

- the Marine Mammal Protection Act;
- the Endangered Species Act;
- the National Environmental Policy Act;
- the Regulatory Flexibility Act (RFA);
- the Legislative Mandates Act;
- Executive Order 12866; various international agreements involving ICCAT, FAO, OECD, APEC, and others; and
- the Magnuson–Stevens Fisheries Conservation and Management Act (MSFCMA).

All of these provide various and sometimes conflicting management objectives.

21. For example, the MSFCMA uses ten national standards to define fisheries management in the exclusive economics zone (EEZ). Three of these standards deal with:

- the specification of maximum sustainable yield as a management target;
- the preservation of fishing-dependent communities; and
- the reduction of discarded incidental harvest of fish species, marine mammals, and endangered species.

22. Conflicts in these national standards can result from negative impacts on fishing-dependent communities from reductions in landings to rebuild or maintain fish stocks.[4] While national problems such as fish harvesting capacity may exist, the regional variation in fisheries and fish stocks may require dramatically different solutions proposed by each fisheries management council to meet their management goals and objectives for a particular fish stock. Highly variable stocks in one region, for example, may require a level of excess capacity that is determined to be too high by a fishery management council in another region where stock recruitment is much more stable.

[4] This can happen when using the precautionary approach of setting biomass levels such that maximum sustainable yield is a limit instead of a target.

23. Judicial review is allowed under the MSFCMA. Law suites under the MSFCMA have been primarily based on the quality of the scientific advice given by biologists. These court cases have caused NMFS to focus its resources on biological stock assessment to ensure that the best possible utilization of stock assessment data was being employed in management decisions.

24. The impact of court decisions on the economics underlying fisheries management regulations has mainly been felt through the Regulatory Flexibility Act's impact on small entities provisions. With the passage of the reauthorized Regulatory Flexibility Act, economic impacts on small entities (businesses generating less than $3 million per year) also became judicially reviewable.

Fishery Management Environment – The use of economics

25 In addition to the standards described above, the national standards maintain economic efficiency as a secondary consideration in the management of marine fisheries.

26. To ensure that management regulations are not dismissed by the federal courts, NMFS has had to devote more resources to fisheries economics. While more resources have been devoted to economics, the RFA does not currently require the mitigation of impacts; it only requires that impacts be clearly delineated. As a result, fishery managers, are made aware of impacts on small entities, but they do not actually have to change their management regulations to mitigate those impacts.

27. The Executive Order 12866 requires all federal regulations that have a significant impact on the U.S. economy to undergo a benefit cost analysis. In fisheries, the benefit cost analysis has rarely exceeded the threshold for significance, but this is beginning to change. Recent analyses using input/output models suggest that these thresholds may actually be exceeded in some severely managed fisheries such as New England groundfish and Gulf of Mexico shrimp fisheries. If a proposed regulation is determined to be significant, the review by the Office of Management and Budget is more careful, but it does not require substantial changes in the regulation to require that benefits exceed costs.

28. While economic goals and objectives exist, economics does not necessarily take a primary role in the management of marine resources in the U.S. Once information on costs and benefits are made available to fishery managers for their consideration, management regulations that are designed to achieve one objective at the detriment of other objectives can still be adopted.

29. For the overcapacity reduction management program, this management approach allows the adoption of regulations that may not be particularly successful in reducing overcapacity in the long run. That is, the maximization of net benefits is not a requirement of the management process. As a result, management regulations that are politically acceptable - but not effective at reducing overcapacity - can be adopted.

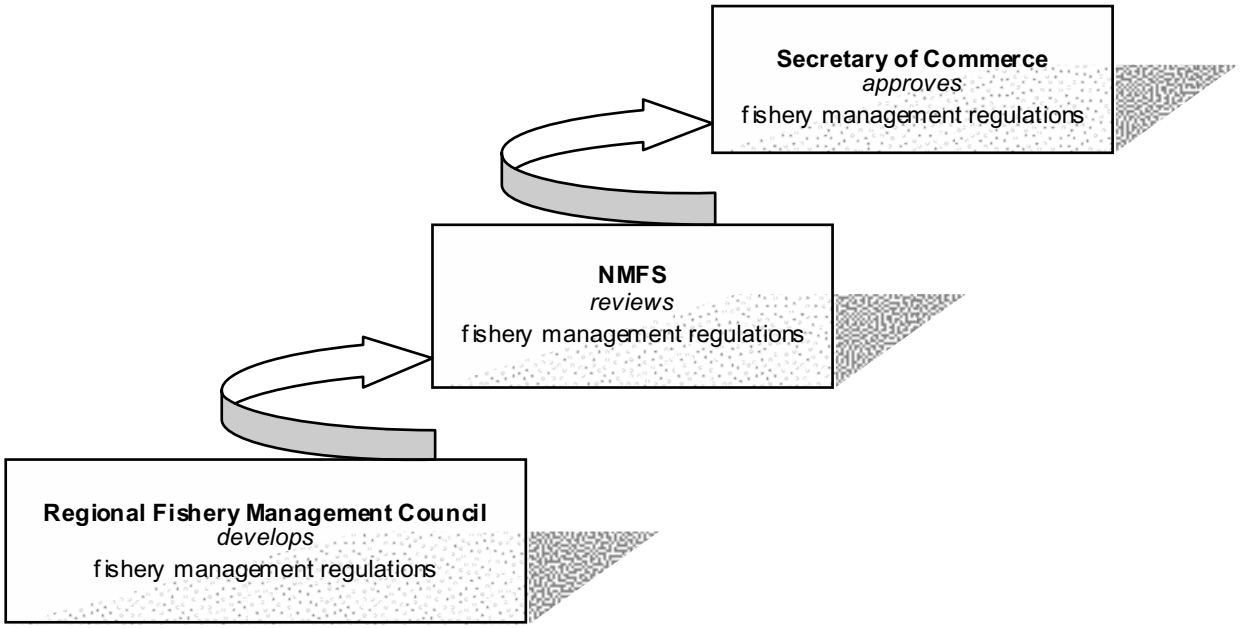
Fishery Management Entities

Federal Fisheries Management Councils

30. The eight federal fishery management councils were established under the MSFCMA. Initially, these served as regional fishery management advisors. Their role has evolved over time, and now they develop fishery management regulations that are then approved by the Secretary of Commerce after being reviewed by the National Marine Fisheries Service (Figure 1).

31. The regional fishery management councils specialize in the fisheries under their jurisdiction because the stocks and the fishers are fairly unique to each region. Each region's management issues also differ, so regulations set in one region do not necessarily correspond to those in another region. In addition, the fishery management councils tend not to develop joint fishery management plans where stocks overlap. As a result, management regulations while similar in type differ in their application to different stocks or species of fish.

Figure 1. US Federal Fisheries Management Roles



State Fishery Management Commissions & Agencies

32. In addition to the fishery management councils, state fishery management commissions also have jurisdiction over some fish species and stocks that are found in the state territorial sea. The species under the state fishery management commissions are agreed upon by each state in that regional commission. These species generally represent a jointly controlled stock of fish. Other species contained in each state's own territorial sea are managed by the respective state's fishery management agency.

33. The end result is that different species of fish are managed by different entities for different purposes.

34. State fishery commissions and state agencies that could have jurisdiction over juvenile stocks of fish found in the EEZ under federal control have different guidelines for management than the fishery management councils. Management regulations that are imposed by one management entity can be ignored or even subverted by another entity resulting in the failure of either to achieve its management objective. As a result, there is a need for the different fishery management entities to coordinate their proposed management regulations if they want to ensure that their different goals are achieved.

Capacity

35. Within the context of these multi-jurisdictional management authorities, fish harvesting capacity has become a crisis.

36. Numerous studies have been commissioned. Some have examined the role of federal investment subsidies in over-investing in capital used to harvest fish. Expert panels have looked at how studies of capacity utilization should be adapted to fisheries. Expert panels have also tried to determine - quantitatively or qualitatively - overcapacity levels in fisheries. Together, these studies have been

used to develop definitions for, measures of, and a general understanding of the role of fish harvesting capacity in federally managed fisheries.

37. For example, the federal investment subsidy program for capital investment was found to have played a role in developing excess and overcapacity in the fish harvesting sector. However, due to a conservative policy for selecting participants in the program, its impact on capacity levels was not as severe as it could have been.

38. Similarly, a NMFS national task force report built upon the 1998 FAO *Report of the Technical Working Group on the Management of Fishing Capacity*[5], to define capacity and develop metrics to measures capacity levels in U.S. fisheries based on capacity utilization. This study identified three objective approaches to measuring capacity utilization levels in the fish harvesting sector. And, after an FAO technical consultation on capacity in Mexico City, a program to develop qualitative measures of overcapacity and quantitative measures of excess capacity was developed in the U.S.

39. The qualitative measures indicated that over fifty percent of the 77 fisheries review had indications of overcapacity. A preliminary review of the quantitative capacity utilization measures that were being constructed suggested that *excess* and *overcapacity* in fisheries should be considered two separate concepts because *excess* capacity is a short-run situation that corrects itself whilst *overcapacity* is a longer-run, pernicious situation that requires management change – and, indeed, changes in the management approach - to correct. An independent panel of experts who reviewed the capacity measurement project in the U.S. also confirmed this distinction between *excess* and *overcapacity*.

40. Two projects to quantify the levels of excess and overcapacity in U.S. fisheries, respectively, were undertaken as a result of the expert panel. The first study resulted in a report on excess capacity that is to be published in the Our Living Oceans series as a report on the status of economics in managing U.S. fisheries. The second report on overcapacity is due in 2003.

41. In the interim, a report to Congress estimating overcapacity in five domestic fisheries was completed in June of 2002. It suggested that it would cost approximately $1 billion (U.S.) to reduce the fleet size to a level that would eliminate overcapacity in the five fisheries studied. In addition, this report clearly differentiated between the levels of (temporary and short term) *excess* and (harmful, long term) *overcapacity* in each fishery.

42. These studies have been used to present information to the fishery management councils on the level of capacity utilization in fisheries. Based on the draft National Plan of Action[6], the fishery management councils will evaluate conditions in each fishery that has been identified as having an overcapacity management problem. The fishery management councils will determine what management actions they need to adopt to resolve the overcapacity problem in each fishery relative to the numerous management objectives that have been specified for each specific fishery.

43. Each proposed management regulation has to go through a public review process where stakeholders can provide input into the management process. Costs and benefits of proposed regulations have to be evaluated under Executive Order 12866, the calculation of economic and financial impacts are required under the Regulatory Flexibility Act, and under the MSFCMA. This information is provided to the fishery management councils for consideration in preparing their final rules. This analysis and the information from stakeholders need not be considered in formulating the final rules, but steps to mitigate impacts could be undertaken by the fishery management council at this point in the process. These final rules are then reviewed by the NMFS and then forwarded to the Secretary of Commerce for final approval.

44. The NMFS also provides information and advice to the regional fishery commissions on fish harvesting capacity to ensure that state agencies and regional commissions coordinate their activities to reduce overcapacity in fisheries. However, regional fishery commissions and state agencies have different procedures for implementing regulations that do not require the approval of the Secretary of

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[5] FAO. 1998. Report of the Technical Working Group on the Management of Fishing Capacity, La Jolla, CA, USA, April 15-18. *FAO Fisheries Report*. No. 586. Rome, FAO. 57pp.

[6] National Marine Fisheries Service (2002 *in press*). "United States National Plan of Action for the Management of Fishing Capacity." Draft Final Report, Office of Sustainable Fisheries, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Silver Spring, Maryland, November, 32 pp.

Commerce to implement. As a result, measures proposed for federally managed fisheries could have direct and induced impacts on state regulated fisheries.

45. One missing factor, in this management approach, is the lack of policy analysis for fishery managers. Such a policy assessment could provide fishery managers with effective capacity reduction management programs that would eliminate overcapacity while increasing net benefits to the nation.

46. For example, there is currently a proposed vessel or fishing license or permit buyback program to reduce capacity. This is despite the fact that the General Accounting Office's assessment of the buyback programs in the New England groundfish fishery found them to be ineffective in reducing overcapacity simply because many latent permits were activated after the buyback program ended. (For example, some fishermen moved from groundfish into the lobster fishery while others purchased new fishing vessels for the groundfish fishery.) This approach is particularly difficult to apply in the Gulf of Mexico shrimp fishery where there are currently no access controls on new entrants (no limits on new entrants), thereby making a buyback program particularly costly and ineffective in controlling overcapacity. In addition to such problems, this management approach can never have an enduring impact on overcapacity because it only treats a symptom of the regulated open access management of marine resources and does not address the underlying cause of a lack of property rights for the *in situ* resource.

47. Other approaches such as incentive blocking and incentive adjusting regulations need to be assessed to determine if they might be more successful in eliminating overcapacity. Incentive blocking regulations - such as days at sea, trip limits, and restrictive total allowable catch levels - can reduce overcapacity but only in the short run. As stocks recover and the cost per fish landed declines, profits increase and a derby fishery ensues, thereby causing overcapacity to increase. The end result is a reduction in net benefits for the fishery.

48. In contrast, incentive adjusting regulations such as ITQs, permit stacking, and co-management can increase the costs of harvesting fish by capturing the resource rent in the management instrument held by each fisher. These systems create the incentive to conserve capital, labor, and the *in situ* resource as part of trying to maximize profits of whatever catch amount is allowed.

Conclusion

49. In the USA, the solutions to overcapacity that are proposed by the respective fishery management councils and adopted by the Secretary of Commerce will be based on discussions between representatives of stakeholder groups with input from scientific analyses. The information and analysis used to define, develop metrics for, and measure capacity levels in U.S. fisheries must be scientifically objective to ensure that the impacts of management regulations designed to reduce overcapacity are accurately estimated.

50. Even with objective information and analysis, however, it is likely that regulations to reduce overcapacity will be the result of a political agreement representing compromise between different groups. This is because some groups will suffer losses and be upset by these losses, while others will receive the benefits of capacity reduction programs.

51. Congress creates its role in fisheries management by legislatively directing actions of the NMFS and by directing which projects will be undertaken. It does this through the budgetary process by specifically allocating funds to them. In addition, stakeholder groups or even individuals with political influence can, when dissatisfied with the result of the fishery management council process, approach Congress to have it intervene on their behalf.[7] Congress can even set up a new form of fisheries management outside the council system such as it did by establishing individual processor quotas for Alaskan crab processors. Thus, actions by Congress can directly affect efforts to reduce overcapacity in fisheries if and when the fishery management council does not adequately address the concerns of politically powerful stakeholder groups.

52. In the end, it is the managers who will have to be aware of impacts to stakeholders, so that they can design capacity reduction programs that mitigate these impacts and, thus, ensure that the capacity reduction program is successful.

[7] For example, Congress placed a moratorium on the use of individual transferable quotas in the red snapper fishery in 1997.

FACILITATED DISCUSSION: *A SUMMARY*

Opening Discussions

53. Having heard about some of the issues in the USA regarding capacity and efforts to reduce capacity, the discussion shifted to the purpose of the expert consultation; namely, for the participants to:

> *identify and outline innovative strategies and mechanisms for convincing stakeholders to reduce overcapacity and subsequently avoid the regeneration of overcapacity.*

54. Beginning with a brief, general roundtable discussion about potential barriers to implementing capacity reduction (CR) programs, the following issues (in alphabetical order) were mentioned as potentially creating barriers to the adoption and implementation of capacity reduction programs.

54.1. **Awareness and recognition** – and the difficult balance between capacity and long term problems of overcapacity as well as of the fact that benefits from capacity reduction programs will not likely be immediately measurable;

54.2. **Balances of power and distributional issues** – and how these may occur within fleets, between various parts of fleets ,as well as between different stakeholder groups;

54.3. **Development** – and how coastal states have the right to fish and how this may affect having fishing vessels, even when overcapacity may already exist;

54.4. **Displacement** – and the movement and impacts of fishers when capacity is shifted out of one fishery but not necessarily removed from fishing;

54.5. **Employment** – and using fisheries as an alternative livelihood of last resort;

54.6. **Financing** – and who should pay or, at least, contribute to capacity reduction programs and of how good financial conditions may inhibit stakeholders' interest in undertaking capacity reduction strategies even when overcapacity exists.

54.7. **Food security** – and using fisheries as food source of last resort;

54.8. **Globalization** – and how market forces are reaching further and creating new incentives and pressures on previously isolated resources before local societies are prepared to deal with these forces; market forces, technological change and innovation, predicting change and continuous adaptation,

54.9. **Governance and institutions** - and how informal systems may perform better but have less formal legitimacy than official processes and how different stakeholder groups may make use of existing institutional arrangements to achieve their particular objectives;

54.10. **Information and education** – and about the real and perceived outcomes, objectives, and goals that different user groups may have; how different cultures may accept or reject capacity reduction programs; and about trust and accountability;

54.11. **International cooperation** – and the need to share knowledge, outcomes, and benefits about efforts to reduce overcapacity;

54.12. **Limitations** – and the fact wild capture fisheries are not capable of providing food, employment, and income for all who want to use them;

54.13. **Management and management systems** – and how existing regulations may influence, cause or change fishing behavior, and how to harness technology so that it increases productivity of the fleet while also supporting capacity reduction;

54.14. **Objectives and Perceptions** – and how much fish different user groups actually caught versus what they should be allowed to catch as well as the disputes that conflicting objectives may create;

54.15. **Politics** – and how management decisions may be influenced or changed by politics;

54.16. **Range of a fishery and the numbers of participants** – and how potentially enormous numbers of participants who may be individually operating at low levels but having significant cumulative impacts; and

54.17. **Serendipity and Total Chance** – and how the adoption of capacity reduction programs may simply depend on a combination of factors that cannot be controlled or predicted.

55. Without prioritizing these, the discussion shifted to a common theme that linked all of these issues – **information and education of all stakeholders** who would be involved in some way with the design, adoption, and implementation of capacity reduction programs.

Opening discussions: *A simple situation*

56. To assist the participants in focussing on the most basic issues regarding capacity reduction programs, the discussion was directed to consider a very simple, hypothetical situation of overcapacity in a high capital-to-labor ratio fishery[8]. The hypothetical fishery involved a single and not highly variable – but overfished – stock. It was being harvested by a single homogeneous fleet. And, it occurred within a single jurisdiction, to which access was limited.

57. One of the first points of discussion was that - because capacity reduction will probably involve changes to people's livelihoods, lifestyles, and lives – discussions about overcapacity and capacity reduction will create significant uncertainty and concern for those who may be affected. Thus, it is absolutely critical to provide and share unbiased information, guidance, and education about the effects of overcapacity, the effects of various capacity reduction programs, and the longer term impacts of reducing capacity.

58. For example, many local efforts to address overcapacity in a fishery often can be slowed or blocked by the objective of trying to maintain local employment – or by concerns about potential losses of employment. At the national level, broader objectives of resource and overall employment may make capacity reduction programs less difficult to implement, simply because concern about particular local employment issues may not be as strong. However, even at the national level fishery management authorities have been reluctant to deal with overcapacity due to the issue of having to put people out of their current fishing jobs. (It was also noted that in some countries there may be differences in the balance of power amongst different stakeholder groups that may need to be taken into account.)

59. *Allocation issues – who gets what - are part of dealing with overcapacity problems. As a result, the details of who "wins" and who "loses" - may be at the center of arguments for not addressing overcapacity.*

60. There was strong belief that a co-management approach is likely to produce a more positive and durable outcome. As a result, the group believed that it is useful to present the problem of overcapacity in a particular fishery to the fishers in ways that allow them to see how, if action is taken, it can improve their personal situations as well as the condition of the fishery.

61. *It will be useful to share and communicate knowledge, both informally and formally, amongst and between administrators, fishers, managers, scientists, and other groups.*

62. It is also important to understand the particular situation, the particular people and fishery who are facing a situation of overcapacity. Formally, this can be described as "needs identification and assessment". Informally, it means learning as much as possible about the issues and critical human problems facing the fishers. This process of working with fishers and others to make decisions about

[8] The participants in the expert consultation adopted this description of the simple hypothetical fishery to minimize the multi-cultural confusion caused by describing it as either a "commercial" or an "industrial" fishery. Quite simply, these words are used to describe fisheries in different ways in different parts of the world.

the actions to be taken also helps all stakeholders to better understand the implications of not taking action.

63. The main issues raised in this discussion are listed in Table 1. Based on these issues, the group identified the essential elements and steps for sharing information and knowledge; namely, that it is important to:

- *get consensus on the issue* – which will involve learning about, identifying, and sharing information about different stakeholders' needs and concerns in relation to reducing overcapacity;
- *determine and measure* the different components of an overcapacity problem;
- *establish the goals and objectives* of the capacity reduction program - as part of determining the possible options for achieving these outcomes; and
- *identify the appropriate pathways* for influencing policy makers and for undertaking a process to reduce overcapacity and prevent its reappearance.

64. In this way, fishers and the people in a fishery management authority can work together to implement a specific capacity reduction plan.

65. The participants noted, however, that in just about any fishery, it is not possible to convince everybody about the benefits of reducing overcapacity. In the end, there will be some fishermen who will benefit, and some who will lose. Thus, it is also important to work to reduce the losses to as few participants as possible.

66. At the conclusion of the discussion regarding information and education, the group designed a possible communication pathway for sharing information with stakeholders about overcapacity and different capacity reduction strategies, options, and impacts (Figure 2).

67. ***Discussion Outcome*: Information and education about overcapacity, capacity reduction, and different types of capacity reduction programs is critical.**

68. Providing and sharing this information with fishers needs to be the first step, followed by working with political persons. Next, the economic aspects and the management approaches for practically achieving a particular capacity reduction strategy need to be shared.

Figure 2. Communication pathway

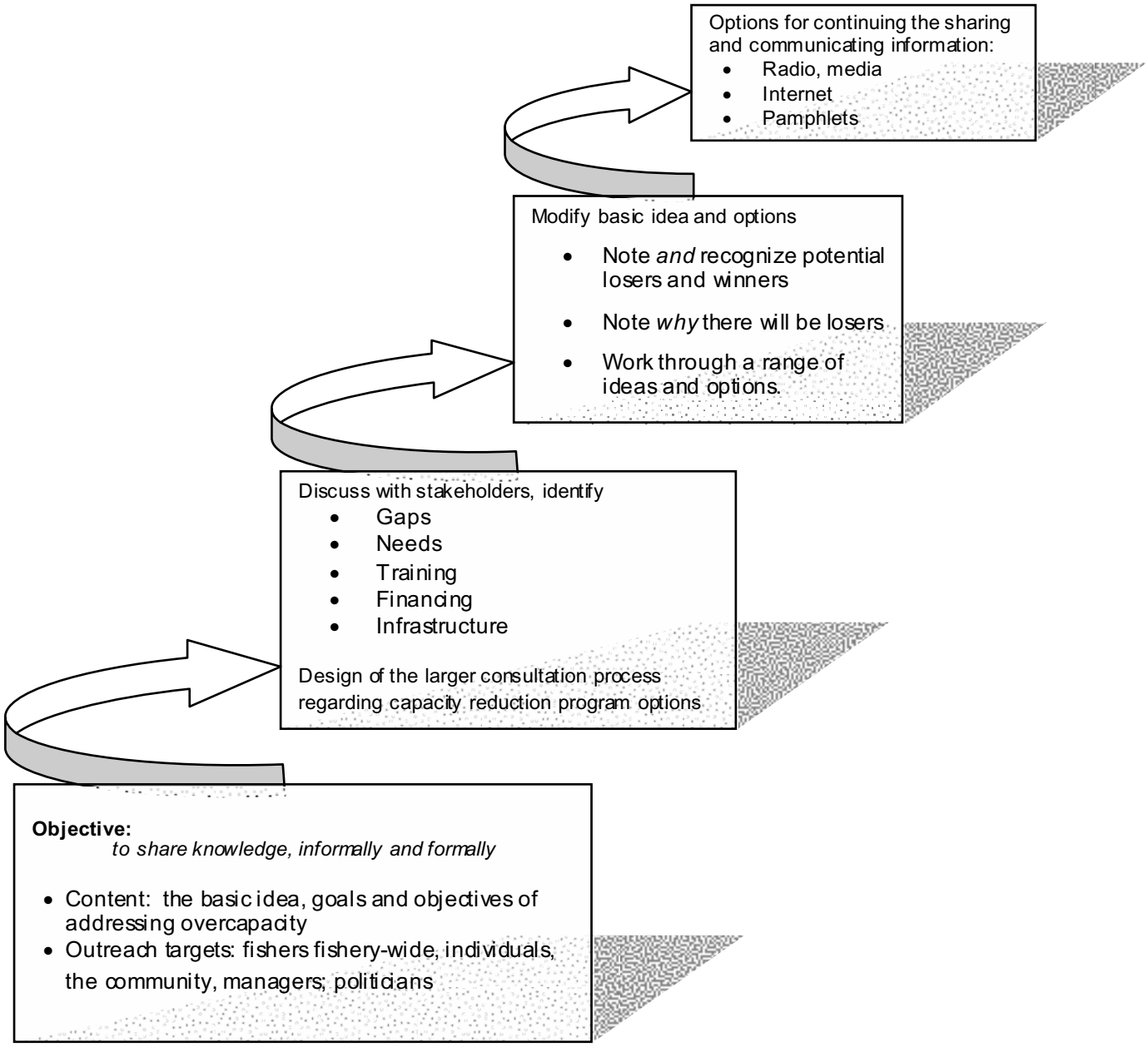

Table 1. Information and educational issues associated with capacity reduction programs

NEEDS IDENTIFICATION & ASSESSMENT	IMPART KNOWLEDGE	WHOM TO EDUCATE	HOW COMMUNICATE	IMPART KNOWLEDGE	WHO PAYS FOR THE EDUCATION?
Discuss with stakeholders Create-interest / "buy in"	-What knowledge to impart? There is a need to differentiate from the *normative* knowledge and *positive* knowledge with regard to capacity reduction.	How does one recognize the group(s) to educate? ▪ stakeholders ▪ general public	the start up process: Stakeholders, including • movers and shakers • serendipity • political path • agency path	*Duration:* Run an information "campaign" over 12 months or other duration *Timeframe for the education program will depend on the time frame expected to reduce a targeted level of capacity.*	• Govt. • Stakeholders • Others • NGO/donors
Include ministry in research	implications of no capacity reduction for industry, the fishers, government	Why will others listen to managers? • need to create confidence	Stakeholders, including • political stakeholders • operational stakeholders • technical stakeholders (fishermen, other operators)	The country -- and degree of democracy -- may be VERY relevant to such an education process.	
Consult and talk with fishers Consult and talk with related stakeholders Determine community concerns	provide options for reduction	Education for whom? • fishers • scientists • administrators • related stakeholders • communities • political, operational, and technical stakeholders	Pathways of communication: In developing countries policy is often driven from the top through the cabinet decisions, thus: • There may be a need to influence politicians at the top to make any policy realized. • At the same time there is a need to understand the needs at lower political levels (e.g., at the fisher level) so that appropriate policy can be pushed from the top. • To influence policy there is a need to drive it from both the bottom and from the top.	*Possible Approaches* • encourage fishermen to take continuing training programs • training course on capacity reduction program (e.g., 2 months) • provide organized knowledge about overcapacity and capacity reduction programs to minimize confusion and misinformation • explain the economic and social benefits of capacity reduction programs	
Encourage scientists to work in collaboration with fishers	high grading in fisheries education to fishermen	Who decides what to teach?		Radio-TV program(s)	
scientific information and research program	educate policy makers: economics versus conservation	How to get knowledge to policy makers and members of parliament?	• Part of the issue is when are you pooling ignorance and when are pooling knowledge. • There is a need to organize knowledge so that it does not add confusion with regard to the problem.	Publicity brochure on capacity reduction program – *ongoing*	
Talk to member(s) of parliament	explain needs for reduction			Internet	
Work to build consensus	explain potential consequences, both positive and negative			Target the press	

Continuing Discussions

69. The discussions next focused on a series of topics that may need consideration when trying to generate interest and support for capacity reduction programs.

70. These topics included:

- social concerns and issues;
- politics and political issues, including the political environment(s) in which the program is being developed, adopted and implemented;
- legal issues;
- financial issues;
- management and managerial issues, ranging from training to inspiration; and
- economics.

71. Again, the discussions focused on the purpose of the expert consultation; namely, how these different elements might influence the design of capacity reduction options, facilitate or prevent the adoption and subsequent implementation of capacity reduction programs, and avoid the regeneration of overcapacity.

72. The following sections reflect the ideas and outcomes that provided the basis for the general recommendations and guidance of the expert consultation.

Social Concerns / Issues

73. The expert consultation agreed that social concerns can create potentially significant barriers to designing, adopting, and implement capacity reduction programs. Thus, it is critical to include and address the following in the design of any particular capacity reduction package. (See also Table 2.)

73.1. **Employment displacement and the degree of related opportunity costs** – The extent to which new or alternative jobs or few other means of earning income are readily available will influence concerns about short and long term hardship, if not poverty, for fishers and the extended community.

73.2. **Social heterogeneity and/or cultural resistance** – Both a diverse community or one in which there is resistance to change, there will be difficulties in building consensus. If there is considerable social heterogeneity amongst the participants in the fishery, the development and design of a capacity reduction program will have to be more sensitive to different groups concerns and needs. Similarly, if there is cultural resistance to not being able to fish and/or a desire to maintain fishing as a way of life, then it will be more challenging to try to convince fishers of the need to reduce overcapacity and to have fewer fishers.[9] As a result, it is important to consider overcapacity and capacity reduction in the full context of the objectives and goals of the management of the particular fishery.

73.3. **Knowledge-based perceptions** – There may be many incorrect perceptions about what capacity reduction programs can and cannot do and the impacts that they may or may not have. Thus, education is a key element for overcoming uncertainty and creating program support.

73.4. **Historical or traditional rights** – If there are long-standing traditions of fishing, these may be difficult to overcome, regardless of the current legal or fisheries governance system. Again these are sensitive and important matters to incorporate into the design of a capacity reduction program and to consider when working with the stakeholders to build consensus.

73.5. **Fear of Change** – Uncertainty about social change and about destabilizing a community can create enormous barriers to being able to address overcapacity. Education, information sharing, and listening and responding to these concerns is critical to build trust, confidence, and the success of a capacity reduction program.

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[9] Indeed, traditional values or cultural priorities may not necessarily consider capacity reduction as an inevitable "need" if, for example, participants are willing to trade some loss of income in return for more employment in the fishery.

73.6. **Upstream and down-stream effects** – Capacity reduction programs will probably have impacts on related sectors. The perceived, if not the actual, magnitude of these distributional impacts can create barriers to the adoption and implementation of capacity reduction programs.

73.7. **Mistrust and concerns about social justice** – There will be so-called "winners" and "losers" as the result of a capacity reduction program, and this will likely create resistance to such programs. This may be especially true if there are concerns about social inequalities, discrimination, and/or changes in balances of power.

Social Concerns: Potential / partial solutions

74. Table 2 lists some of the potential means to overcome potential social barriers or issues within the design of a capacity reduction program.

75. The specific design of any particular capacity reduction program and the particular solutions to social concerns will likely reflect the particular situation being addressed. However, there will likely be similar types of solutions, such as those addressing:

- employment and displacement;
- training in other marketable skills;
- sharing knowledge and building consensus;
- respecting traditions and historical participation; and
- understanding change, uncertainty, and distributional impacts.

76. *It is important to create better understanding about both the short- and long term effects of capacity reduction programs to reduce these concerns.*

77. *The process for addressing overcapacity involves people and creates - at the very least - temporary uncertainty about their livelihoods and, frequently, about their incomes. Unfortunately, these concerns will probably be just as much about perceived and potential effects as about likely actual effects.*

78. More specifically, the suggested solutions included:

- the development and use of **alternative skills** through training and other programs;
- the provision of **income and other supports** during the transitional period;
- **outreach and communication** about capacity reduction programs and their impacts, including potential distributional impacts;
- **transparency and discussions** about the implications of capacity reduction programs and how to manage these impacts;
- **working together** with affected communities to design of capacity reduction and support programs; and
- working with affected communities to set up **new development alternatives** and specific economic activities for displaced fishers.

79. One of the significant outcomes of this discussion was the consensus about the energy and commitment needed to make these sorts of programs successful.

80. ***Discussion Outcome:*** **There are no quick solutions to mitigating social concerns.**

81. The possible proposed solutions involve communication, training, and trust-building – activities that take time, dedication, and patience.

Table 2. Social concerns associated with capacity reduction programs

Employment Displacement & Degree of Related Opportunity Cost Alternative / new jobs <-> poverty			Difficulty in Building Consensus		Knowledge - based Perceptions	historical / traditional Rights	Fear of Change	Upstream & Down Stream Effects	Mistrust & Concerns about Social Justice
			Social Heterogeneity	Cultural Resistance					
poverty from loss of employment	no alternative incomes	local food security and employment	social diversity	value of traditional society	perception of CR program may be a function of the level of stakeholders' education / understanding	participants "rights" to subsidies for fishing	uncertainty about social change	can schools support less students -- impacts on other residents	CR -- likely to change and perhaps increase social inequality
CR will cause loss of employment in short run	alternative crew employment in area		heterogeneous social groups	fishing as a way of life	perceptions (wrong)	the "right" to fish	bias in social stability - and fears of destabilizing community	CR efforts can go beyond the harvesting sector	resistance due to the (perception) of being discriminated against
poverty and lack of alternative livelihoods	limited alternative employment opportunities		CR will affect different groups on different areas differently	reluctance to impose sanctions	educational barriers (level of education is too low)		difficulties in obtaining consensus	impact on related activities (e.g. shipbuilding, inputs	
employment	employment		social / ethnic religious / language heterogeneity	loss of lifestyle			fear of unemployment /displacement	distributional impacts	
community displacement	community displacement		lack of well-defined communities	reduction in quality of life			role of different social organizations e.g., associations, fishermen's cooperatives		
	ability to adjust to CR programs		no / lack of community support	socio cultural barriers to change					
	opportunity cost of labor		extinction of fishing dependent communities	loss of job related satisfaction					
				loss of prestigious job & status					
				local culture					

Table 3. Potential means of addressing social concerns in the design of a capacity reduction program

Employment Displacement & Related Opportunity Costs	Training in Other Marketable Skills	Difficulty in Building Consensus	Knowledge-based Perceptions	Historical / Traditional Rights	Fear of Change	Upstream & Downstream Effects	Mistrust & Concerns about Social Justice
design and implement acceptable compensation program	alternative job opportunities	public meetings present evidence solicit opinions / solutions	educate about the eventual problems if there is no capacity reduction	community meetings and discussions on fishing rights	outreach to various groups	tax over remaining capacity or transfers to people who "lose" (investment or work-wise)	explain the impacts of capacity reduction programs and the respective distributional consequences
ensure the linkage between social programs and the capacity reduction program	provide development assistance following adjustment program	explain impacts of capacity reduction programs and their distributional consequences	improve understanding of benefits and impacts of a capacity reduction program by fishers	implement co-community based management	explain the impacts of capacity reduction programs and the respective distributional consequences	identify the upstream and downstream effects - costs & benefits	reach out to and work with various groups that would be affected
develop an alternative livelihood program for those who may be displaced	set up job training programs	explanation and getting community consensus on the state of fisheries	enhance education levels of fishers		provide and explain information about the inevitability of change		transparency
campaign for non-consumptive use, alternative livelihoods	provide alternative training and employment	develop cross-community fishery management group	outreach to various groups		discuss implications of capacity reduction with those to be affected to help reduce fears		provide transfers to people who lose (investment or work-wise)
provide feedback to the community -- information on expected outcomes (including problems)	institute retraining and education programs	outreach to various groups	information -- present realities		provide alternative training and employment		provide alternative training and employment
introduce unemployment compensation during transition	remote development / alternative fisheries	discuss implications of capacity reduction with those to be affected (reduce fear)	undertake broader education related to a capacity reduction program		conduct training about capacity reduction program impacts		tax remaining capacity
tax over remaining capacity or transfers to people who lose (investment or work-wise)	provide opportunity for relocation grants if desired	accompanying measures to protect cultural values	provide information about present-day realities				
offer income support during transition	to make proposals on economic alternatives, e.g. eco tourism, sea farming	build consensus amongst social organizations about capacity reduction programs	educate about potential unemployment and income levels if no capacity reduction				
set up retraining programs		involve stakeholders					

Legal Concerns / Issues

82. The expert consultation examined the sorts of legal issues and concerns that might arise when trying to design, adopt, and implement capacity reduction programs. Described in Table 4, the following six categories of issues were discussed as creating potential barriers.

82.1. **The definition(s) of rights** – Issues relating to the definition of access or other property rights, historical rights, takings, and constitutional rights may all affect what may or may not be considered as options for capacity reduction programs. These considerations will vary from State to State and from jurisdiction to jurisdiction.

82.2. **The ability to actually formulate capacity reduction programs** – There may be practical limits on the power or abilities of a fisheries management agency to design or implement a capacity reduction program. There may be existing legislation that limits the types of options that could be suggested and designed. Similarly, other legislation for other purposes may have to be considered, taken into account, or even specifically addressed and, thus, influence the options for capacity reduction program or the details of a particular program's design. Examples may include endangered species legislation, labor legislation, and financial legislation.

82.3. **The ability to enforce capacity reduction programs** – The problems of monitoring, control, and surveillance are not new ones. However, in implementing capacity reduction programs, having adequate enforcement is critical, especially when it may take several years to see the benefits of supporting and participating in capacity reduction rules. Efforts to reduce illegal fishing are similarly important.

82.4. **Various judicial or other legal dispute resolution issues** – Judicial and other dispute resolution systems are essential to achieving due process, but they can also hamper the implementation of capacity reduction programs. There is a need to ensure that the participants in these systems are fully briefed and understand what is to many, the relatively new issue area of fisheries and fisheries management. Without this information, for example, the penalties and other punishments may not reflect the seriousness of the problems they are meant to address. It is also important to design capacity reduction programs in ways that do not allow a few participants to stall their implementation to the detriment of all other participants.

82.5. **Existing regulatory mechanisms** – Even when there is interest and will to simplifying rules and regulations, driving change in a bureaucracy can be difficult. Complex legal frameworks and the time to write or change existing rules and regulations can slow or even stop the adoption of a capacity reduction program. If there is a poor legal framework, it may need to be strengthened or otherwise clarified before capacity reduction strategies can be considered. Similarly, if there is a lot of bureaucracy, existing regulatory mechanisms and methods may make it difficult to introduce new, different or innovative programs.

82.6. **Informal arrangements or other relationships** – It is normal that informal arrangements or other relationships between members of different sectors exist. If various constituent groups have objectives that are different from those of a capacity reduction plan, the groups may call upon these informal relationships to achieve their respective objectives, potentially creating conflicts or creating barriers to the adoption or implementation of a capacity reduction program.

Table 4. Legal concerns associated with capacity reduction programs

DEFINITIONS OF RIGHTS	ABILITY TO FORMULATE PROGRAMS	ENFORCEMENT CAPACITY	JUDICIAL / LEGAL DISPUTE RESOLUTION	REGULATORY MECHANISMS	INFORMAL RELATIONSHIPS
constitutional rights access rights property rights	limitation on power of agency	law and regulation enforcement mechanisms	court / judicial decisions	bureaucratic methods (no dialog)	arrangements between members of various sectors
badly defined property/access rights	existing legislation may limit type of program	develop enforceable laws and regulations	propensity to sue increases legal back costs, delays / slows implementation	complex legal framework	

DEFINITIONS OF RIGHTS	ABILITY TO FORMULATE PROGRAMS	ENFORCEMENT CAPACITY	JUDICIAL / LEGAL DISPUTE RESOLUTION	REGULATORY MECHANISMS	INFORMAL RELATIONSHIPS
need to know what constitutes a "taking" and the "right of taking" by government	other legislation may have to be considered and/or affect capacity reduction program options e.g. endangered species	problem of monitoring control and surveillance	failure of penalties to be enforced in courts	simplification in rules and regulations	
Need to understand the difference between property rights and access rights	conflicting legislation prevents viable capacity reduction program	monitoring and enforcement capacity	retarding in law application	time required to write or change legislation	
Need to be aware of the existence of historical rights	legally required analysis may limit consideration of capacity reduction programs	limits in the authority of fishery management agencies	no proportion between punishment and profits to not respect limits	poor legal framework	
the existence of legal "common property"	requirements for adequate scientific information for implementing a capacity reduction program	reduction in illegal fishing [legal efforts to cope with the existence of this]		public awareness on capacity reduction law and regulations	
constitutional issues & constitutionality of some capacity reduction programs	legal limitation on the types of capacity reduction programs that can be implemented	enhance legal efforts to cope with illegal fishing			
inconsistency between laws	"poison pill" reservations / clauses on certain measures				
	prohibition on certain measures / options				
	separation of law makers (executive and implementers (administrators) - different roles of government				
	inconsistency between laws				

Legal Concerns: Potential / partial solutions

83. The expert consultation listed various practical options to try to overcome some of the legal issues that they identified. As with other areas of concern, knowledge building, information sharing, consensus building and transparency were priority actions as part of addressing legal issues.

84. Knowledge building, information sharing and constituency building may involve the building of consensus with stakeholders who are part of the legislative processes at both local and national levels. This is especially true if there is a need to amend or to write new legislation.

85. ***Discussion Outcome:*** **It is very important to create incentives for self regulation – by understanding the business realities of fishing and by building on local, traditional, and customary forms of compliance.**

86. In the short term, capacity reduction options may need to reflect the practical realities of existing legal and enforcement budgets and penalty systems. However, this does not prevent longer term efforts to change legislation and to set up regulatory structures in ways that encourage flexibility and responsibilities.

Table 5. Potential means of addressing legal concerns in the design of a capacity reduction program

DEFINITIONS OF RIGHTS	ABILITY TO FORMULATE PROGRAMS / PROGRAM FORMULATION	ENFORCEMENT CAPACITY	JUDICIAL / LEGAL DISPUTE RESOLUTION	REGULATORY MECHANISMS	INFORMAL ARRANGEMENTS
enumerate property rights consistent with constitution	seek local and national support constituency building, etc	improve the regulatory programs (and funding for) of enforcement and compliance	reinforcement of need to impose adequate penalties in courts	local arrangements	develop framework for public inquiry into fisheries management
undertake definition or clarification of fishing rights	review of legal requirements for capacity reduction program	consider the cost application of regulations before adopting it	public inquiry into fisheries management framework		seek local and national support,
clearly define access rights	build consensus with congressmen, legislators, executive, judicial, politicians	create incentives for self-enforcement	develop framework for public inquiry into fisheries management		undertake constituency building, etc
flexibility in law	redrafting fisheries legislation	develop enforcement program that is practical , feasible	transparency in public reports		
amend constitution	framework adjustment / devise escape routes in legislation	eradicate corruption in law enforcement	speed up court cases regarding fishery management disputes		
adapt law to use scientific evidence	public inquiring into fisheries management framework	strengthen the capacity of law enforcement personnel	"sunshine" laws - legal transparency requirements		
	update / revise legislation to meet issues of today	simplification of legal dispute procedures	limit the discretion of judges`		
	alternative legislative requirements				
	lobby for neutral change legislation to require neutral treatment of all different regulation types				
	new comprehensive legislation to remove conflicts between existing laws				

Financial Concerns / Issues

87. During this part of the expert consultation, the group focused on financial concerns and did not focus on social or economic costs. As a group, the expert consultation did not discuss the various incentive adjusting management tools that are also available for reducing and preventing the reappearance of overcapacity.

88. Instead, the discussion primarily covered the five financial issue areas below that are only relevant to buy-back programs and not a broader range of financial issues that may arise generally as part of capacity reduction (Table 6).

88.1. **Information** – Information gathering, especially the cost of research, was seen as a potentially significant barrier to providing full information about capacity reduction programs. However, it was noted that capacity reduction programs could be implemented with a minimum of research.

88.2. **Management and program costs** - Capacity reduction programs require more than a one-time, direct cost of a buyout. Thus, even with buyout programs, it is important to include the subsequent costs of running the management program that follows a buyout. In addition to such direct costs, it is important to clearly document the transfer and use of funds for capacity reduction, so that all stakeholders can clearly account for monies raised and spent.

88.3. **Buy-back hurdles** – There are several categories of financial issues regarding the distributional consequences of capacity reduction programs, especially those including buyouts as part of the program. Perhaps the biggest concern is the question of who pays. The financial concerns listed in Table 6 regarding the funding of buybacks as part of capacity reduction programs are very much linked to financial distributional concerns.

88.4. **Distributional consequences** –While some participants may want the government to fund or offer other financial assistance, the principle of "user pays" is one that civil society is frequently using when talking about natural resources. Thus, if remaining participants benefit from capacity reduction programs, they may also be the ones who help to fund the adjustment process. In other situations, donor organizations, seeking to provide the community at large with the benefits of capacity reduction, may consider paying for the temporary benefits achieved through buyout programs. For the participants who exit a fishery, it is important to assist their transition to new activities and livelihoods.

88.5. **Competition for funds** – Even in countries where funding is not a barrier in itself, budget priorities, within fisheries administrations and at broader government levels, may not consider the funding of buyout programs as a high priority. In countries where funding issues are extremely serious, buyouts may be not be considered a main concern when compared to other matters. If the fishing industry is going to fund its own buyout program, then the current financial position of the participants will have a significant influence on the ability to self-finance this part of a capacity reduction program.

Table 6. Financial concerns associated with capacity reduction programs

INFORMATION	MANAGEMENT/ PROGRAM COSTS (INCLUDING MONITORING, SURVEILLANCE, ETC.)	BUY-BACK HURDLES	DISTRIBUTIONAL CONSEQUENCES	COMPETITION FOR FUNDS
cost of research	cost of management structure in which capacity reduction is included	financial transfer to support buy-back systems	who pays? industry or government (society)	budget priorities
costs of implementing a capacity reduction program	levels of direct costs of program	buy-backs are expensive	user pays principle	priority of budget allocation
costs of implementing social components of capacity reduction programs	program costs	remaining participants pay for those who exit	specify benefits of capacity reduction	low priority to compete for (treasury) funds
	malpractice of fund administration	not possible to recover investments	who benefits / profits? the community or industry?	opportunity cost of public funds
	transparency on subsidies		who pays for the adjustments?	availability of donor aid
	ability to transfer costs		welfare coverage from loss of employment	lack of funding in developing countries
			invest in other alternative activities	financial condition of industry
			help to move to other activities	sustained source of funding
			public and private financial support	relative wealth of competing groups to pay

Financial Concerns: Potential / partial solutions

89. Many of the solutions to financial concerns that were offered by the expert consultation were linked to the notion of transparent and accountable comparisons of costs and benefits.

90. The ideas of coordinating capacity reduction research as a cost saving, setting priority areas for further capacity-related research, considering various capacity reduction approaches, and evaluating the costs of doing nothing are all related to the notion of providing the best possible policy advice as the basis on which to make capacity reduction decisions.

91. When comparing various capacity reduction programs, it is critical to pay attention to the total program costs (including ongoing management) and not just to portions of a capacity reduction program, such as the buyout component.

92. This is essential when competing for funds and / or trying to secure donor funding to implement the program. However, even the most balanced benefit cost analyses may not be able to overcome historical issues or precedence and the influence of these on the feasibility of different options for capacity reduction tools that are applicable in a country.

93. It is also crucial to know the costs of doing nothing new, particularly because existing management program costs may continue to escalate over time when there is overcapacity. In addition, because reducing capacity can frequently mean a reduction in the participants in a fishery, it may be necessary to secure some form of income compensation for them as part of the reality of getting the capacity reduction program adopted.

Table 7. Potential means of addressing financial concerns in the design of a capacity reduction program

INFORMATION	COORDINATED RESEARCH ON CAPACITY REDUCTION	PRIORITIZE CAPACITY RESEARCH COMPETE FOR FUNDS	EVALUATE THE COST OF DOING NOTHING (INFORMATION ANALYSIS)	BENEFIT COST ANALYSIS	CONSIDER VARIOUS CAPACITY REDUCTION POSSIBILITIES (INCLUDING TECHNOLOGICAL)
capacity reduction program management costs (including implementation, monitoring, surveillance, etc.)	secure funding from donors and other stakeholders	develop scenarios about property rights systems	adopt the "users pay" principle	develop program with industry to minimize costs and create link to the various distributional consequences	create partnerships – for funding link to distributional consequences
competition for funds	evaluate the cost of "doing nothing" and information collection	cost benefit analysis of the capacity reduction. program as part of marketing the capacity reduction program	lobbying / marketing for funds		
buy-back hurdles	income compensation programs may be necessary to get capacity reduction program adopted	cost-benefit approaches			
distributional consequences	distribute financial costs amongst users / society				

Political Concerns / Issues

94. In addressing the matter of political concerns, the expert consultation focussed on the six issue areas listed in Table 8 and described below.

94.1. **Ideas and the decision-making framework** – Participatory processes, from local to multi-national, were deemed to create more durable solutions in the long term, but potentially more difficult to set up and implement in the near term. However, with increasingly global markets these days, fisheries may provide an entrée to additional international activities. In working to build amicable working relationships with policy makers and politicians, it may also be essential to work with party agendas and various spheres of influence.

94.2. **Defining the decision-making framework and process** – The politics of setting up and implementing capacity reduction programs may make it essential to understand who or which administrative entities may have the power to run the program and who or which entities should run the program. Thus, it is important to be aware of the balances of power amongst different politicians, policy makers, administrative agencies and agency staff.

94.3. **Representatives' political objective and mandates** – The challenges of overcoming problems such as those associated with capacity reduction programs are difficult ones that may not be political priorities, politically expedient or timely. Elections, party issues, and political will are issues that can work to create political support for capacity reduction programs, but these issues can also result in the postponement of political support until more opportune times.

94.4. **Different costs** – The financial and social costs of capacity reduction programs, especially in the short term, are likely to create political discomfort unless capacity reduction programs are designed to include ways of addressing these issues.

94.5. **Information and understanding** – Many potentially significant political concerns associated with capacity reduction programs will reflect the current widespread lack of understanding about the impacts and issues of addressing overcapacity. Constituents' incomplete knowledge, perceptions and fears about change will also likely create areas of concern for politicians if there is little or no guidance offered about the impacts, changes, and benefits of addressing overcapacity as part of justifying the need for capacity reduction programs.

94.6. **Decision-making mechanisms** – Political concerns generated by the idea of capacity reduction programs can range from situations that are quite normal – such as public hearings- to situations that are difficult, such as demonstrations and consultations run by the party in power.

Table 8. Political concerns associated with capacity reduction programs

ELEMENTS OF THE DECISION-MAKING FRAMEWORK	DEFINING THE DECISION-MAKING FRAMEWORK AND PROCESS	REPRESENTATIVES' POLITICAL OBJECTIVE, MANDATES	DIFFERENT COSTS	INFORMATION / UNDERSTANDING	DECISION-MAKING MECHANISMS
participatory process versus non-participatory	define who are the decision makers	politicians like to conciliate	likely to increase unemployment → poverty	ignorance of impacts	public hearing
multinational cooperative approach	management of program - who gets it - may not be who SHOULD have the program includes issues of who is going to fund the program	short term problems / difficult decisions & long term benefits may not be appreciated by politicians	unemployed constituents	fear of change	legal demonstrations
existing situation	politicians, policy makers, administrative agency staff	preferences: 1) no loss of influence 2) minimization of complaints	hard to get support when individual outcomes are uncertain	failure to understand problem	expert consultation in ruling party
for politicians - a greater opening on world-wide fisheries		fisheries may not be highest priority	program costs	lack of understanding	
build up amicable working relationships with policy makers and politicians		there may be vested interests	politically determined funding options	acceptance of capacity reduction	
formal and informal influencing groups		the frequency of elections may affect political interest and support		encourage change of politicians views about capacity reduction programs	
fisheries cooperatives work		capacity reduction programs can be stopped through the political process		justification of needs	
determination of which government department holds responsibility for capacity reduction		fisheries may be a relatively unimportant industry (commercially) or relatively small political constituency		poor signals to politicians	
not good to appear too different relative to other administrators		political will may change throughout the process			
		Caveat: there may be two-stages of decisions: 1) to undertake (or not undertake) capacity reduction; and then 2) how to undertake the reductions within a capacity reduction program Or, there may just be a political mandate to proceed. Objectives of the Politician(s) and/or power groups may require balancing or maintaining groups' power			

Political Concerns: Potential / partial solutions

95. The discussion of potential or partial solutions to political concerns focused on the need to know how to capture the power of various political objectives and processes without creating significant additional problems for politicians (Table 9).

96. The basis of the **decision-making framework** is the definition of roles and responsibilities, especially for the design and implementation of a capacity reduction program. This may involve setting up regional or more local fisheries management authorities or a framework that allows the industry to regulate itself, either in part or fully.

97. Similarly, a key part of **defining the decision-making process** is to identify the beneficiaries of capacity reduction programs – such as civil society, fishers, other users of the marine environment – and to involve these groups in the decision-making processes of capacity reduction. A related possible solution that can be part of the **decision-making mechanism** is to provide financial and other support resources during the transition period to those directly affected. It is also important for the design of a capacity reduction program to provide possible solutions to address potential unemployment.

98. If industry and other constituencies are supportive of a capacity reduction program, this can help to overcome concerns that politicians may have about achieving their **political objectives and mandates**. In some cases, it may be more powerful or successful to ensure that industry is on-side and informed than to work on the political side of things. However, in other cases, the political sector and angle may be stronger and be able to over-ride pressure groups.

99. The **different costs** of overcapacity – to society at large, to fishers, to future generations – as well as the immediate costs to the fishing industry, consumers and other sectors need to be clearly explained as part of the process of recognizing and reducing political fears about capacity reduction programs.

100. Politicians' **understanding and knowledge** of the complexities of capacity reduction programs can be greatly enhance if both the costs of doing nothing and the elements and costs of the long term problems of overcapacity are fully and clearly explained. This knowledge sharing process should include an explanation of all the various angles and elements of capacity reduction programs, including clear information about the so-called "winner", "losers", and what will happen to them.

Table 9. Potential means of addressing political concerns in the design of a capacity reduction program

DECISION-MAKING FRAMEWORK	DEFINING THE DECISION-MAKING FRAMEWORK & PROCESS	REPRESENTATIVES' POLITICAL OBJECTIVES AND MANDATES	IDENTIFY DIFFERENT COSTS	INFORMATION & COMPREHENSION	DECISION-MAKING MECHANISMS
fishery management councils	identify beneficiaries	get industry on-side (see information / education	industry groups	expose the long term problem	provide resources for the transition
define stakeholders' responsibilities	involve beneficiaries in the decision-making process	provide possible solutions to deal with unemployment	consumers	re-enforce the social and economic costs of doing NOTHING	utilize market mechanisms and the power of the consumer
transparency on distribution of fishing rights		link capacity reduction with other programs	other sectors	carry out education programs to ensure politicians get the full story	
industrial self-management framework		open pathways for all sides to lobby / promote their perspectives	other groups	engage politicians through dialog	
formal and informal decision–making mechanisms (identification)		rally / lobby politicians to support capacity reduction program		educate decision-makers about the benefits / costs	
regional fisheries management councils		form coalitions with wider groups outside fisheries		convince politicians, policy makers of the benefits and impacts of capacity reduction programs	
process based on subsidiarity principles (smaller cost)		build consensus, targeting opinion makers		inform and educate by carrying out structured lobbying campaign(s)	

Management Concerns / Issues

101. In many ways, the management concerns listed by the expert consultation reflect the enormous changes occurring in the field of fisheries management. Indeed, it is not only information and analytical requirements are expanding far beyond what was previously sufficient for managing fisheries. Institutional, policy, and management issues are also changing rapidly.

102. Table 10 shows just some of the management-related issues that were identified as potential barriers to the introduction and implementation of capacity reduction programs, including the following.

102.1. **Information and analytical requirements** – Information and analysis that *supports* fisheries management is increasingly necessary. This is especially important because the incentives that cause participants' behavior are counter-intuitive and not like those in agriculture or other businesses.

102.2. **Institutional impediments** – Fisheries management is undergoing enormous changes in the roles that different stakeholders play. The role of industry in the management process is changing as fisheries managers and others try to determine who has management authority and for what decisions. Even the growing number of agencies with different elements of jurisdiction over the marine environment and its use creates potential barriers to the introduction and implementation of capacity reduction programs.

102.3. **Legal impediments** – As discussed in the previous section, legal impediments can allow or prevent the use of certain capacity reduction management strategies, potentially constraining management options.

102.4. **Knowledge levels of managers, policy makers** – As in any discipline, change creates challenges and requires continuous improvement. Uninformed managers and policy makers can thus create significant challenges to the introduction of comparatively new approaches to addressing overcapacity. Similarly, administrators may not be as aware of market realities and incentives that fishers may face on a daily bases.

102.5. **Compliance** – Weaknesses in enforcement as well as the lack of enforcement capabilities can pose significant barriers to capacity reduction programs, especially if the reduction programs rely on incentive blocking measures and fail to motivate participants to enforce themselves. Cost recovery in management is a relatively new concept that is not applied in many fisheries, thereby further requiring fisheries managers to match enforcement forces with existing budget realities.

102.6. **Reluctance to involve stakeholder participation** – Many management authorities are still trying to find a useful level of public input into the fisheries management process. User participation, roles, and responsibilities are not yet clearly resolved.

102.7. **Entrenched management biases** – There are both potential human and mechanical biases that may pose barriers to fisheries management. Personal backgrounds, biases, interests and incomplete understanding of management options can limit the use of innovative management approaches to addressing overcapacity. In addition, the lack of managers with social science and people management skills can seriously limit the ability of management authorities to manage fishers, i.e. the people who fish. Similarly, the belief that rules or regulations without taking human concerns into account can limit capacity reduction program options. Even the notion that fisheries management is the management of *people*, not fish, is a relatively new concept that is not necessarily well accepted by managers around the world and thus poses a potential barrier to dealing with the human issues of overcapacity.

102.8. **Distributional effects** – Both the actual and the perceived distributional effects of overcapacity and capacity reduction programs can create enormous barriers to the introduction and implementation of capacity reduction programs.

102.9. **Multiple management objectives** – Multiple, and typically conflicting, management objectives can be found in fisheries legislation and in the objectives that fisheries managers may have. This type of barrier to the introduction and implementation of capacity reduction programs is made even more difficult because of the need, the desire, and the willingness, to take hard decisions about fishers and their activities.

Table 10. Management concerns associated with capacity reduction programs

Information and Analytical Requirements	Institutional Impediments	Legal Impediments	Unapprised Managers, Policy Makers	Compliance	Reluctance to Involve Stakeholders / Encourage Participation	Entrenched Management Biases		Distributional Effects	Multiple Management Objectives
						A. Individual barriers	B. Mechanical barriers		
information research available to support	multiple government agencies jurisdiction	what legislation allows or authorizes	new / different approaches not well understood	enforcement weaknesses	management system (permits or solicits public inputs)	poor understanding of the effects of overcapacity	belief that rules or regulations will solve the problem	initial distribution of access rights	conflict with political objectives
analysis required to support management	role of industry in management process		inertia, not encouraging change	lack of capacity monitor effort	role of industry in management process	biases of managers	present management regulations/regimes	necessary conditions for efficient allocation in relation to capacity	objectives of managers
fisheries are counter-intuitive	who/what has management authority		regional council for fisheries ITQs in debate	control, monitoring and surveillance	user participation	personal interest of managers	control and command system		goals & objectives may conflict
poor scientific evidence	number of agencies / entities required		market incentives may not be understood by managers	strengthen enforcement mechanisms	management cost recovery (degree of participation)	background of managers	annual TACs and catch quotas are barriers		desire for high employment in the fisheries industry
poor understanding of effects of overcapacity	position in the hierarchy of management agency		education of managers			management of fishers not fish	regulatory incentives to increase overcapacity		willingness to take "hard" decisions
						lack of social science based management	some technologies will increase excess and overcapacity		
						strong opposition to ITQs	tax exemptions for fisheries and fishers		

Management Concerns: Potential / partial solutions

103. Setting aside discussions about the various types of **incentive blocking** and **incentive adjusting** management approaches that can be used to try to address overcapacity, the expert consultation listed a variety of potential solutions (Table 11) to help solve some of the management concerns listed in Table 10.

104. To meet **information and analytical requirements**, it is important to have structured and prioritized research programs that freely and transparently share information and data. In addition, it is increasingly important to use socio-bio-economic models that reflect the real complexities and human elements of capacity reduction programs.

105. In terms of **compliance**, it is important to reduce the incentives that currently encourage fishers to overcapitalize. In addition, the use of standardized mechanisms for conflict resolution as well as current technologies for enforcement will help to alleviate management concerns.

106. To overcome **legal impediments**, it may be necessary to obtain legislation or regulations that require fisheries managers to eliminate overcapacity in fisheries. This may only require minor changes or improvements to laws and regulatory frameworks, or it may involve more significant political interventions.

107. **Institutional barriers** are difficult to overcome, but with the identification of key people in fisheries management institutions around the world, networks to share information and to drive changes will develop. In addition, as the use of tools such as conflict resolution techniques become more familiar, it will become increasingly possible to implement them as part of the process of addressing overcapacity. This will also help overcome reluctance to using consensus building strategies, joint management commissions, and stakeholder involvement as normal management tools.

108. **Awareness building and knowledge sharing** are key elements to overcoming ongoing education and training needs for fisheries managers and policy makers. The introduction of additional management, social, and economic skills into agencies as well as the diffusion of practical experiences amongst fisheries managers can also help to keep them and policy makers up to date.

109. It is no simple task to address the concerns created by the **distributional effects** of *any* fisheries regulations, and addressing the distributional impacts of capacity reduction programs is no different. A policy of open, transparent assessment and explanation of how the different capacity reduction options create and deal with these impacts is critical. In addition, it is important to address transitional management impacts, such as through the provision of interim financial aid or other opportunities.

110. The matter of resolving **multiple management objectives** is similarly complex. It is important to work on possible ways in which to meet multiple objectives, but it may not be reasonable to expect that these differences can be perfectly resolved. Thus, the use of mechanisms for conflict resolution as well as determining different user groups' preferences and priorities will allow different groups to make trade-offs.

111. **Entrenched management biases** may take time to resolve, but greater use of stakeholder participation in setting fisheries management objectives, co-management or collaborative management, and locally-based management will help. In addition, these sorts of strategies will help to become more multi-disciplinary and inclusive.

Table 11. Potential means of addressing management concerns in the design of a capacity reduction program

Information and Analytical Requirements	Compliance	Legal Impediments	Institutional Barriers (Assignment of responsibilities)	Reluctance to Involve Stakeholders	Unapprised Managers, Policy-makers	Distribution Effects of Management	Multiple Objectives	Entrenched Management Biases:	
								Individual Biases	Mechanical Biases
initiate research program(s)	reduce overcapacity incentives	obtain regulations that mandate an end to overcapacity (properly defined)	use mechanisms for conflict resolution	set up consensus building strategies among stakeholders and policy makers	change awareness about consequences	property rights system	work on possible accommodation of conflicting goals and objectives, noting that perfection may not be necessary	encourage greater stakeholder participation in determination of fishery management objectives	encourage use of flexible, multiple management measures
determine analytical requirements	mechanisms for conflict resolution	develop/improve laws and regulatory frameworks	identify key players in each institution	develop joint management commissions	education of fishery managers on capacity reduction program	assess potential distribution of income/impacts of capacity reduction	develop and use mechanisms for conflict resolution	local based management	require multi-disciplinary approach to management
structured research priorities and programs	on-board monitoring	lobby politicians to remove/reduce legal impediments	clear distribution of responsibilites	initiate stakeholder discussions	build other skills, e.g., management skills, social skills, economic skills, etc	explain variety of options in the initial distribution of rights (quotas, territories, countries)	determine different interest group preferences and priorities regarding conflicting objectives rights	try to use more co-management	
provide transparent / free access to data (base); availability					promote public discussion on capacity reduction	obtain financial aid to ease pain of transition	help to define trade-offs		
develop and use socio-bio-economic models					initiate programs to train / inform managers, policy makers, fishers about practical experiences about capacity reduction programs				
					define time frame for capacity reduction (provide clarity to process, beware of legal implications)				
					prepare a brochure about capacity reduction programs				

Management Options

112. Fisheries management systems and tools can be generalized into two categories:

- those called "incentive blocking", and
- those called "incentive adjusting".

113. All of the tools in these categories can be used as part of an overall capacity reduction program. However, it is essential to know how they respectively differ, both in the short term and in the long term, because they create different incentives for fishers and change fishers' behavior. Table 12 lists some of the intended and potential side effects of these approaches.

Table 12. Potential capacity reduction effects of "incentive blocking" tools

INCENTIVE BLOCKING TOOLS		
REGULATORY APPROACH	INTENT / INITIAL IMPACT	POTENTIAL / POSSIBLE SIDE EFFECTS
limited entry	▪ restricts the number of participants	▪ defines competition ▪ inspires fierce competition and even conflict ▪ no limit on individual or total catch ▪ requires monitoring to ensure entry remains limited
buy-back	▪ purchases and removes vessels	▪ does not restrict the entry of new vessels / entrants ▪ unless vessels destroyed, they will displace / move into other fisheries and activities ▪ no limit on individual or total catch
gear and vessel restrictions	▪ limit fishers' options on how to fish, ▪ limits fishers' options on how go to sea	▪ safety at sea may be jeopardized if determined by a bureaucrat ▪ inspires creative thinking to find and use unrestricted inputs in place of restricted ones ▪ no limit on individual or total catch
total allowable catches (TACs)	▪ sets a regulatory limit on total allowable catch ▪ TAC setting can be difficult and subject to pressures	▪ no limit on individual catch ▪ inspires racing to harvest greater share of the limited catch or resource ▪ racing / derby fishing causes short-term gluts in markets ▪ requires real-time monitoring and catch counting to minimize over-harvesting ▪ prices impacted by short-term gluts ▪ processor schedules have to accommodate uneven receipt and storage of short-term gluts
vessel catch limits	▪ sets regulatory limits on each vessel's allowable catch ▪ setting catch limit can be difficult and subject to pressures	▪ requires real-time monitoring and catch counting to minimize over-harvesting ▪ allocated allowable catch may not be enough to match (or may be too much for) individual vessel's ability to catch ▪ inspires creative thinking to find and use unrestricted inputs in place of restricted ones ▪ creates pressure to *re*-allocate individual vessel catches ▪ inspires racing to be sure that vessel can its share of limited catch ▪ if transferable, transferability allows individuals to exit and enter
individual effort quotas (IEQs)	▪ sets regulatory limits on effort	▪ not a direct link to actual catch levels ▪ requires real-time monitoring and catch counting to minimize over-harvesting ▪ inspires creative thinking to find and use unrestricted inputs in place of restricted ones ▪ if transferable, transferability allows for individuals to approximately match their desired level of activity and catch ▪ if transferable, transferability allows individuals to exit and enter ▪ requires monitoring to ensure entry remains limited

Table 13. Potential capacity reduction effects of " incentive adjusting" tools

INCENTIVE ADJUSTING TOOLS		
REGULATORY APPROACH	INTENT / INITIAL IMPACT	POTENTIAL SIDE EFFECTS
individual transferable quotas (ITQs)	▪ sets regulatory shares of a total allowable catch ▪ initial allocation can be designed in any way and can reflect comparative level of participation in fishery ▪ transferability allows for flexibility and trading to match level of fishing as desired (new entrants have to purchase ITQs (assets)) ▪ sale of ITQ to other participants provides funds for retirement / doing other activities (transferability allows individuals to exit and enter) ▪ TAC setting can be difficult and subject to pressures	▪ windfall gains to recipients if provided free ▪ creates a direct link to actual catch levels ▪ requires real-time monitoring and catch counting to minimize over-harvesting ▪ inspires creative thinking to find and use any inputs ▪ transferability allows for individuals to approximately match their desired level of activity and catch ▪ creates incentives to safeguard the asset (ITQ) value ▪ safety at sea is determined by the fisherman, not a bureaucrat ▪ inspires fishers to fish to minimize their costs ▪ changes fishing from hunting to accounting ▪ requires monitoring to ensure entry remains limited
individual effort quotas (IEQs)	▪ sets regulatory shares of a total allowable effort (not catch) ▪ initial allocation can be designed in any way and can reflect comparative level of participation in fishery ▪ transferability allows for flexibility and trading to match level of fishing as desired ▪ sale of IEQ to other participants provides funds for retirement / doing other activities (transferability allows individuals to exit and enter because new entrants have to purchase IEQs (assets)) ▪ quota setting can be difficult and subject to pressures	▪ windfall gains to recipients if provided free ▪ does not create a direct link to actual catch levels ▪ inspires creative thinking to find and use unrestricted inputs in place of restricted ones ▪ inspires creative thinking to find and use any inputs ▪ transferability allows individuals to approximately match their desired level of activity and catch ▪ creates incentives to safeguard the asset (IEQ) value ▪ safety at sea is determined by the fisherman, not a bureaucrat ▪ inspires fishers to fish to minimize their costs ▪ changes the nature of fishing from hunting to accounting ▪ requires monitoring to ensure entry remains limited
taxes & royalties	▪ charges set on basis of fish landed or caught ▪ does not restrict the number of participants to those in the group ▪ does not define the actual rules of fishing	▪ does not create a direct link to actual catch levels ▪ requires real-time monitoring and catch counting to minimize over-harvesting ▪ inspires creative thinking to find and use any inputs ▪ safety at sea is determined by the fisherman, not a bureaucrat ▪ inspires fishers to fish to minimize their costs ▪ changes fishing from hunting to accounting
group fishing rights	▪ restricts the number of participants to those in the group ▪ does not define the actual rules of fishing	▪ does not create a direct link to actual catch levels ▪ requires real-time monitoring and catch counting to minimize over-harvesting ▪ inspires creative thinking to find and use any inputs ▪ safety at sea is determined by the fisherman, not a bureaucrat
territorial user rights (TURFs)	▪ restricts the number of participants to those in the territory ▪ does not define the actual rules of fishing	▪ does not create a direct link to actual catch levels ▪ requires real-time monitoring and catch counting to minimize over-harvesting ▪ inspires creative thinking to find and use any inputs ▪ safety at sea is determined by the fisherman, not a bureaucrat

Economics

114. Economic arguments, *per se*, tend to focus on efficiency too much, and do not take into account the other aspects. The design of a capacity reduction program needs to balance different objectives, to make trade-offs, and to be aware of what those adaptations mean with respect to both the entire program package and the rest of the economy.

115. Initially, attention was devoted to the issue of "what might be implied by economic concerns?" After considerable discussion, the group focused on the economic issues or potential impacts that might need to be addressed in designing and implementing a capacity reduction program. Broadly speaking, these include issues such as:

- economic efficiency,
- allocation and cumulative impacts of capacity reduction programs,
- distributional impacts, and

- the use of economically efficient solutions to overcapacity.

Economic Efficiency

116. Generally, efficiency in economics is concerned with the **allocation of resources** such that the maximum net benefits are achieved in the marketplace. Importantly, this concept of efficiency has been extended to include non-market values as well; e.g., the existence value of a pristine environment or of a stock of marine mammals.

117. Including these non-market values does reduce the level of harvest from what would otherwise be considered to be the optimal level of harvest in a commercial and/or recreational fishery. It also can address values that could be increased by correcting market failures that occur in regulated open access fisheries.

118. Capacity reduction programs can be economically efficient if they create incentives that eliminate overcapacity by causing fishermen to behave as if property rights exist for the *in situ* resource. This is because stronger property rights programs - where the access rights are clearly defined and enforceable - are preferred to weaker property rights programs because they give fishermen a greater market incentive to conserve capital, labor, and the fish stock.

Allocation and Cumulative Impacts of Capacity Reduction Programs

119. Significant displacement effects will result with the implementation of a capacity reduction program. These **allocative impacts** will depend upon how the capacity reduction program is implemented. If capacity reduction programs are designed solely to increase efficiency, the least efficient producers are likely to be displaced. Alternatively, if other management objectives such as preserving or protecting artisanal fishermen or maximizing employment are also desired, then production levels of the more efficient producers may have to be reduced.

120. The initial allocation and the selection of the implicit owners of the marine resource will determine who will be the “winners” and “losers”. The identification of “winners” and “losers” goes beyond just those directly involved in the fishery. Individuals who supply goods and services to or receive goods and services from fishermen will also be affected by a change in the size and location of the fishing fleet that results from capacity reduction program.

121. Thus, the implementation process needs to:

- identify the management objectives and goals of the fishery managers,
- carefully determine the likely stakeholder groups that will be displaced by the capacity reduction program, and
- take steps to identify and implement mitigation strategies to reduce these displacement effects.

Distributional Effects

122. Capacity reduction programs will have distributional effects.

123. Individuals will have already been made worse off by managers allowing overcapacity to develop in a fishery. If the fishermen who are removed from the fishery along with their capital investment can be absorbed into another industry in the local economy, then they and the nation should be better off. That is, more goods and services will be provided to final consumers and less environmental harm will be generated by the fishing industry. This is what is described as a Pareto Optimal solution: at least one person is made better off, and no one is made worse off by the change in the management program.

124. If there is no alternative employment for the fisherman that pays at least as well as fishing (i.e., if the opportunity costs of fishermen are zero) and there is no other use for his fishing vessel (i.e., if his capital is immalleable), then the displaced individuals will not be able to contribute to the local economy at the same level.

125. On the other hand, if those who receive the benefit from the capacity reduction program more than offset the costs to those who have to leave the fishery, then a second best solution has been achieved. In such a situation, the nation is better off even though there are those who are worse off individually. In this case, the issue becomes one of redistributing income from those who received the benefits to those who bear the costs. Such methods may include market mechanisms or transfer payments.

126. Achieving pareto optimal solutions is only possible if there is perfect competition, no technological externalities, and no market failure connected with uncertainty. It is unlikely - even with market adjusting management regimes - that truly pareto optimal solutions will result. This means that there will be so-called "winners" and "losers".

127. Under the second-best scenario, the alternative strategy adopted satisfies at least one of the standard Pareto efficient conditions. The remaining efficiency conditions, while not fulfilled, do not prevent an improvement in the allocation of capital, labor, and the stock of fish for the nation.

128. An additional discussion considered including the concept of "Superfairness".[10] In very simple terms, "Superfairness" characterizes a distribution in which each category of participants prefers its own share to the share received by another group. No participant group envies another and, thus, this also relates to an equitable distribution. Another way of describing the superfairness concept is when one uses the "I cut the pieces of cake and you choose first" rule used to divide a cake between two persons.

129. It is critical to remember that:

- individuals will have already been made worse off by managers allowing overcapacity to develop in a fishery, and that
- capacity reduction programs will have distributional effects.

130. The issue is to resolve the overcapacity problem and to do it in a way that results in a sustainable fishery and, preferably, minimize additional losses.

Using Economic Efficiency Analyses to Compare Capacity Reduction Programs

131. Basically, the economic impacts of the different capacity reduction program options can be evaluated using **quantitative and/or qualitative bioeconomic analysis**.

132. Models of fisheries can be put together to correspond to the fish stock dynamics, the fishing fleets' dynamics, the vessels' operating costs, and the markets' analysis. If empirical data is not available, expert opinion or theoretical constructs can be used to parameterize the model to determine

[10] Baumol initially described this in his book "Superfairness" (1986), The MIT Press, Cambridge, Massachusetts.

expected directions of change in the fishery caused by the adoption of capacity reduction programs. When empirical data is available, the magnitude of the change in direction can also be determined.

133. These models are simplifications of real world processes and, thus, will not perfectly predict changes in the behavior of fishermen. However, they will give an indication about the impacts of different capacity reduction programs and provide managers and decision-makers with guidance. In addition, models can be made more complex, with better estimates made if more empirical data is collected and analyzed.

Economically Efficiency and Capacity Reduction Programs

134. Economically efficient solutions tend to be those that **maximize social net benefits** which include non-market values by stakeholders in or concerned with the fishery. However, it may be necessary to introduce additional, **secondary considerations** for a particular capacity reduction program even those these could reduce the net benefits of the economically efficient solution.

135. For example, if there are concerns about maintaining a minimum level of employment in a fishery, managers may decide to maintain fish harvesting capacity above the economically optimal level. While this will not be the best result for the conservation of capital and the fish stock, it could meet management objectives that are important to the management organization.

Complications and Trade-offs

136. It may also be necessary to consider the role of fisheries in relation to both the local and the national economy

137. If it is a major component of the national economy, then the effects will likely be felt nation-wide. As a result, changes that might be beneficial to one group of stakeholders might have substantial negative impacts on other stakeholders and on the economy in general. This would require that any analysis of the impacts of capacity reduction programs as well as the capacity reduction programs themselves on the entire economy. In this situation, if the economy can absorb the displaced labor and capital investment relatively quickly, the proper incentive adjusting[11] capacity management program could generate substantial net benefits to the national economy and generally improve the availability of goods and services available to the final consumer. In contrast, an incentive blocking[12] capacity management program that would preserve the status quo management in a fishery might eventually lead to a substantial loss in net benefits to the final consumer.

138. The effects of capacity reduction programs may be substantially greater on local communities than on the national economy, especially if the fishing industry is a small component of the national economy. Additionally, if the fishery is a small part of the national economy, the impacts of an incentive blocking capacity reduction program might minimize the short run costs of eliminating overcapacity and not result in substantial impacts on final consumers. Similarly, the improvement in net benefits from an incentive adjusting capacity reduction program might not be felt by the final consumers, particularly if other market inefficiencies in the processing and wholesale sectors exist.

139. The impacts of capacity reduction programs on fish stocks and the environment will depend on the scale of the fisheries and on the level of the overcapacity in the fishery.

140. In categorical form, the list of impacts considered by the group (Table 14) are issues that are part of any fishery management decision and the design of any regulatory strategy, i.e. how the program will affect:

- economic (in)efficiency;
- impacts on overall income of the community;
- (non-)compliance issues;

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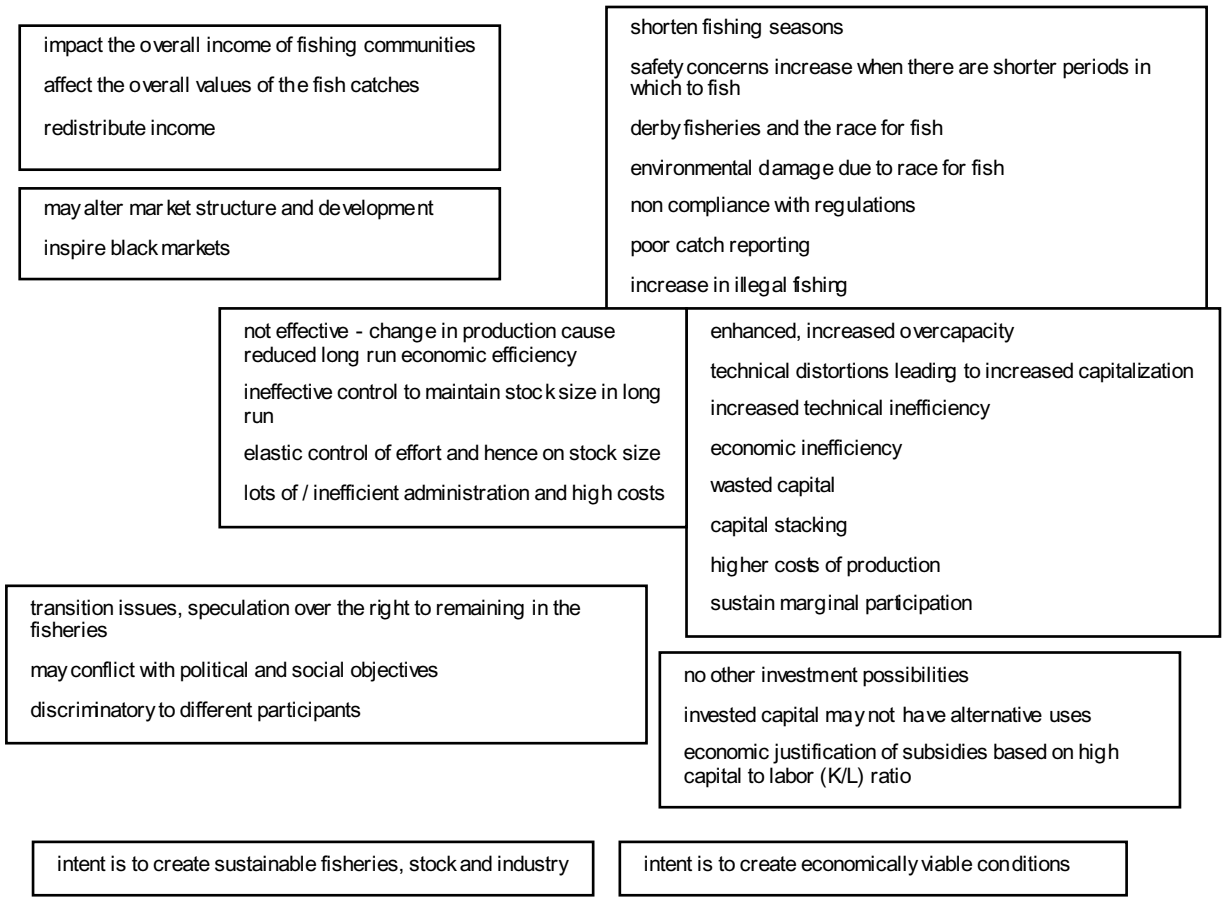
[11] The incentive adjusting programs that were considered included, but are not limited to, individual transferable quotas, co-management, cost recovery, cooperative, territorial use rights, and IEQs (individual effort controls, which were also considered under incentive blocking mechanisms).

[12] The incentive blocking programs that were considered included, but are not limited to, limited entry, buyback programs, gear and vessel restrictions, total allowable catch levels (TACs), vessel catch limits, and IEQs (individual effort controls, which were also considered for incentive adjusting mechanisms).

- the relative effectiveness or ineffectiveness of incentive blocking programs;
- the need for administration;
- the likelihood of having over-capitalization;
- input substitution possibilities;
- effects on market structure and development;
- issues related to data reporting;
- the potential to increase illegal fishing;
- the problems of supporting sustainable fisheries and stocks;
- increased costs of production;
- capital stuffing or stacking;
- vessel safety;
- the lack of alternative investment opportunities;
- economic justification of subsidies;
- the redistribution of income;
- derby-fishing, environmental damage, product quality and product storage costs; and
- self-management.

Table 14. Concerns about some of the side effects of incentive blocking programs



141. And, as for any fishery management situation, the range of these impacts will differ depending on the design of each capacity reduction program. The impacts will also depend on whether the overcapacity is in fleets that are large-, medium-, or small-scale commercial fisheries or whether the participants are subsistence and artisanal fishermen.

142. Finally, macroeconomic changes in a national economy can affect a fishery and cause different effects on overcapacity and capacity reduction programs.[13] Examples of this include:

- increases in fuel or other input prices used to harvest fish;
- changes in interest rates used to finance capital investment in the fishery; and
- shifts in demand for seafood - whether caused by studies describing the health effects of fish, mercury levels in top predator species, or changes in disposable per capita income.

143. These macroeconomic changes can lead to increases or reductions in both excess and overcapacity. Managers need to be aware of the distinction between the two forms of capacity to ensure that they do not undertake capacity reduction programs for fisheries that will eventually correct themselves or ignore potentially disastrous effects from unchecked overcapacity developing in the fishery.

Concluding Ideas

144. The expert consultation concluded this discussion by noting that implementing a capacity reduction program is more complicated for more complicated fisheries and that the scale of the fishery must be taken into consideration. Thus, any capacity reduction program must be situation- or case-specific.

145. **There is no single capacity reduction program that can be applied to all fisheries.** However, regardless of the design of a capacity reduction program, it should bring about certain benefits, including the increased probability of promoting a sustainable resource and, as a result, the increased probability of having a healthy and sustainable industry or fishing activity.

146. In this way, a well-designed capacity reduction program can increase the economic value of a fishery and the help to avoid subsequent - and even more severe - economic and social catastrophe.

CLOSING SESSION OF THE EXPERT CONSULTATION

147. During the last day of the Expert Consultation, the experts worked on, agreed to, and adopted the *Final General Recommendations and Guidance* (found in Part 1 of this report).

148. The facilitator thanked the participants for their hard work and inputs over the 4 days of the Expert Consultation and noted that the complete final Report would be circulated for their approval and adoption.

149. Dr. M. Agüero closed the Expert Consultation on Friday, 18 October, 2002 at 19.15.

ADOPTION OF THE REPORT OF THE EXPERT CONSULTATION

150. This Report was adopted on 22 November 2002.

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[13] Although not discussed during the expert consultation, the impact of the increased importation of relatively cheap shrimp in the U.S. has resulted in a substantial reduction in the capacity of the Gulf of Mexico shrimp fishery. This has allegedly greatly reduced the level of *excess* capacity in that fishery, but it has not necessarily altered the *overcapacity* in that fishery.

APPENDIX A: Agenda

Tuesday 15 October: 09.00 – 10.30

1. Opening of the expert consultation by Mr. Jean François Pulvenis de Séligny
2. Overview of objectives, administrative arrangements
3. Adoption of the agenda
4. Review of options and strategies: *Capacity Reduction in Fisheries of the United States*

Tuesday 15 October: 11.00 – 13.00, 14.00 – 16.00

5. Situation 1 – Issues

Tuesday 15 October: 16.30 – 18.30

6. Situation 1 – Issues

Wednesday 16 October: 09.00 – 10.30, 11.00 – 13.00, 14.00 – 16.00

7. Situation 1 and Beyond – Issues

Wednesday 16 October: 16.30 – 18.30

8. Situation 1 and Beyond – Issues & Options

Thursday 17 October: 09.00 – 10.30, 11.00 – 13.00, 14.00 – 16.00

9. Situation 1 and Beyond – Issues & Options

Thursday 17 October: 16.30 – 18.30

10. Situation 1 and Beyond – Options & Solutions

Friday 18 October: 14.00 – 16.00

11. Finalization and Adoption of *Final Recommendations and Guidance* on Catalysing the Transition from Overcapacity in Marine Capture Fisheries

APPENDIX B: List of Participants

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APPENDIX C: List of Documents

Background Paper

CTOC/2002/4 Ward, John M. and R. Metzner Fish Harvesting Capacity, Excess Capacity, and Overcapacity

Discussion Issues

CTOC/2002/5 List of Provisional Discussion Issues

APPENDIX D: Prospectus

Background

5.1. Overcapacity is often cited as the primary cause of overfishing, economic waste, and the unsustainable development of living marine resources.

5.2. Numerous international and domestic fisheries studies indicate that overcapacity and excessive fish harvesting capacity are prevalent in many common property and open access fisheries, regardless of the scale of fishing or the type of fishery.

5.3. Overcapacity and excessive fish harvesting capacity can also occur in limited access fisheries, contributing to overfishing, economic waste and unsustainable development in these situations.

5.4. One of the great challenges to achieving sustainable fisheries involves the management of fishing capacity in such a way that avoids or, at least, mitigates the deleterious effects – such as overfishing and/or economic inefficiency - of overcapacity.

5.5. The Code of Conduct for Responsible Fisheries (CCRF) urges States to work to prevent overfishing and excess fishing capacity and to implement management measures to ensure that fishing effort is commensurate with the productive capacity of the fishery resources and their sustainable utilization.

5.6. As part of efforts to support sustainable development and, in particular, under the International Plan of Action (IPOA) for the Management of Fishing Capacity, FAO has been called upon to gather information about and to provide guidance regarding the management of fishing capacity and the management of overcapacity.

5.7. The social and economic impacts of overcapacity on sustainable development are creating increasingly significant conflicts and costs on civil societies, hence the importance of supporting fisheries managers around the world in their efforts to move away from situations of overcapacity.

5.8. Solutions for correcting situations of overcapacity that are both (i) practical to implement and (ii) durable in their effect can result in substantial improvements in the food security and the standard of living for fishermen and their communities as well as in the conservation of fish stocks.

5.9. Building on previous work which has described basic policy and technical issues relating to the management of fishing capacity,[14] FAO is hosting this Expert Consultation on catalysing the transition away from overcapacity to support local, national and regional management efforts to cope with situations of overcapacity.

Objective

5.10. The purpose of the Expert Consultation will be to identify and outline innovative strategies and mechanisms for reducing overcapacity and subsequently avoiding the regeneration of overcapacity.

Scope

5.11. The Expert Consultation will emphasize the process of catalysing political will, partnerships, and policy reforms by:

5.11.1. identifying the sorts of approaches that can be used to implement both incentive blocking and incentive adjusting strategies for managing situations of overcapacity;

5.11.2. identifying innovative opportunities and strategies for overcoming impediments to reducing overcapacity – such as innovative opportunities for investing in disinvestment; and

[14] Previous FAO-related work includes that of the Technical Working Group on the Management of Fishing Capacity, La Jolla, USA, 15 - 18 April 1998; FAO Consultation, Rome, Italy, 26 - 30 October, 1998; a preparatory meeting, 22 - 24 July, 1998; and such publications as *Management of Fishing Capacity: A Review of Policy and Technical Issues*, FAO Fisheries Technical Paper 409.

5.11.3. suggesting elements for ensuring the ongoing success of capacity management.

5.12. The Expert Consultation will cover issues of subsistence, employment, and the raising of revenues and foreign exchange in various types of industrial fisheries, taking into account the flow-on and downstream effects that adjustment programs can have on other sectors, including artisanal fisheries sectors.

Documentation

5.13. A background paper will be prepared as a basic platform from which to work. It will be available to any interested reader on the Internet.

5.14. Previous FAO reports and other documents, including previous FAO working group and consultation reports, will be provided to the experts.

Output

5.15. The principal output expected from the expert consultation will be guidance on how to catalyze the transition away from overcapitalized fisheries. (Tentative title: Catalysng the Transition from Overcapacity: Guidelines of the Rome Expert Consultation: Report of the expert consultation on catalysing the transition from overcapacity in marine capture fisheries, Rome, 2002)

5.16. The principal output will be available prior to the 25th session of the FAO Committee on Fisheries (COFI) that is being held in Rome in 2003.

Participants

5.17. Participants in the expert consultation (approximately 8) will attend in their personal capacities. The invitations will be extended to individuals recognized as competent in disciplines relevant to the scope and purpose.

5.18. The organizer will work to ensure that participants reflect an appropriate inter-disciplinary, regional, and experiential balance to reflect a variety of perspectives on the issues under consideration as well as the breadth of different approaches and practical experiences in addressing (over)capacity in fisheries.

Venue & Date

5.19. The expert consultation will take place at the FAO Headquarters, Rome, Italy, from 15-18 October. Additional details regarding hotels and other relevant information will be sent to participants at an appropriate time.

Technical Support

5.20. The Technical Secretary of the expert consultation is Ms. Rebecca Metzner, Fishery Officer Fishery Policy & Planning Division. She may be contacted in Rome:

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Fish Harvesting Capacity, Excess Capacity, & Overcapacity

A Synthesis of Measurement Studies and Management Strategies

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1 Capacity, Excess Capacity and Overcapacity

1.1 Introduction

Capacity utilization is a well recognized concept in economics and has had many industrial applications. However, the implementation of capacity utilization concepts in fisheries is a relatively new and unique application.

This paper seeks to identify some of the differences between *excess* capacity and *overcapacity* before going on to look at various measures that can and have been used to assess capacity. The paper then looks at how to recognize situations of overcapacity and at how to incorporate capacity mitigating or correcting measures when regulating fisheries. The paper ends by touching upon some of many types of considerations that need to accompany management efforts to mitigate or correct capacity problems.

1.2 The Terminology

The phrase "excess capacity" has been often cited as the cause of overfishing in many fisheries around the world, and current management philosophy is that - if this so-called excess capacity can be eliminated from fisheries – there is a good chance both that overfishing can be eliminated and that the long term potential yield from a living marine resource can be sustained indefinitely. As a result, quantitative measures of capacity have been proposed and estimated for specific fisheries and globally.

In this paper, a distinction is made between ***excess*** capacity, which is a short term phenomenon that is self-correcting in the marketplace, and ***overcapacity*** which is pernicious and of indefinite duration. Unfortunately, the role of *overcapacity* is not well understood with regard to preventing the long term sustainability of fishery resources.

In general terms, **capacity** can be expressed

- in terms of the maximum output from a given level of inputs used to produce fish, or
- as the minimum level of inputs needed to produce a given level of outputs.

More specifically, *excess* capacity and *overcapacity* can be expressed

- **Excess capacity** is a short run phenomenon that occurs when a firm produces less than it could under normal operating conditions because of a change in market conditions for input costs, output prices, or, in the case of the fishery, the fish stock abundance; whilst
- **Overcapacity** is a long run phenomenon that exists when the potential output that could exist under normal operating conditions is different from a target level of production in fishery such as maximum economic yield or maximum sustainable yield.

The traditional economics literature on production does not make a clear distinction between *excess* capacity and *overcapacity*, and, in fact, these terms are often used as synonyms. Similarly, much of the theoretical discussion of fish harvesting capacity does not make a clear distinction between *excess* capacity and *overcapacity* in fisheries. Indeed, most case studies measuring fish harvesting capacity in fisheries focus on *excess* capacity measures, while *overcapacity* has generally remained a theoretical discussion expressed in terms of the optimum yield generated by a fishery.

However, making this distinction clear provides guidance to fishery managers in their deliberations to develop effective management strategies and to fishery scientists designing new methods to measure excess and overcapacity in fisheries.[15] Thus, it is important to work on understanding:

- the differences between *excess* capacity and *overcapacity*;
- causes of *excess* capacity and of *overcapacity*; and
- how different management environments contribute to these two different aspects of capacity.

[15] This seemingly minor distinction between excess capacity and over capacity can be developed based on a model introduced by Greboval and Munroe (1999), and the distinction takes on greater importance once the magnitude of the capacity problem and the concern being expressed by fishery managers and conservation groups is taken into consideration. Once the magnitude of this problem for fisheries managers is understood through a review of the existing fish harvesting capacity studies, then the Greboval and Munroe model is restated and extended to clarify the capacity utilization model.

Firms can change their production levels in response to market conditions to eliminate *excess* capacity over the short run, but the elimination of *overcapacity* requires a change in the management environment. Thus, if managers are to understand the fishery management problem they face, then a clear distinction between these two situations *is* needed.[16]

Providing information to fishery managers on both types of capacity measures is particularly important when fisheries are heavily regulated to achieve stock conservation goals – because in those situations *excess* capacity and *overcapacity* can exist simultaneously.

In contrast, in common property fisheries where fishermen do not have an incentive to conserve fish in the sea and where there are few, if any, regulations to achieve stock conservation goals, *excess* capacity can be nonexistent while *overcapacity* can be rampant. Correspondingly, where fishermen have an incentive to conserve fish in the sea, *overcapacity* can be nonexistent while *excess* capacity can be extensive.

[16] An expert panel in the USA, composed of Sutinen, J.G., Lee G. Anderson, James Kirkley, Cathy Morrison Paul, Rolf Fare, and Bob O'Boyle identified the need to measure excess and overcapacity as *two distinct measures* (Sutinen et al., 2001).

2 Models of Excess Capacity and Overcapacity

While the development of regulations to reduce *excess* capacity and to eliminate *overcapacity* in actual fisheries is a complex problem, a simple model can be used to distinguish between the concepts of *excess* capacity and *overcapacity* in a single species fishery.[17]

These concepts are described in the following sections.

2.1 Excess Capacity

Fishery managers faced with the knowledge that large levels of fish harvesting capacity exists in the fishery do not know if it is a short run phenomenon that the market will resolve through its normal processes, or if it is long run problem that needs action by management to correct. Traditionally, most industrial applications treat excess capacity as a short run phenomenon, but the question remains whether this holds true for fisheries.

For example, a firm's scale of production is determined based on economic conditions in the marketplace; i.e., a level of output is chosen that minimizes the cost of production. As market conditions change (prices of inputs and outputs increase or decrease), the plant's scale of production may not produce a level of output that minimizes its costs of production.

If the costs of production increase and the firm reduces its output level to maximize profits, then the potential output of the firm becomes greater than the actual output level and *excess* capacity exists, and this short run, *excess* capacity condition will exist until the firm can change its scale of production to minimize its production costs again.

In fisheries, this type of *excess* capacity can develop when a fishing vessel has a hold capacity that exceeds the regulated trip limit. If fisheries were managed like other industries, this *excess* capacity would similarly be a short run phenomenon and likely of little importance to fishery managers - simply because *excess* capacity in most industrial sectors is a short run problem of adjusting capital investment to the uncertainty caused by random variations in the marketplace.

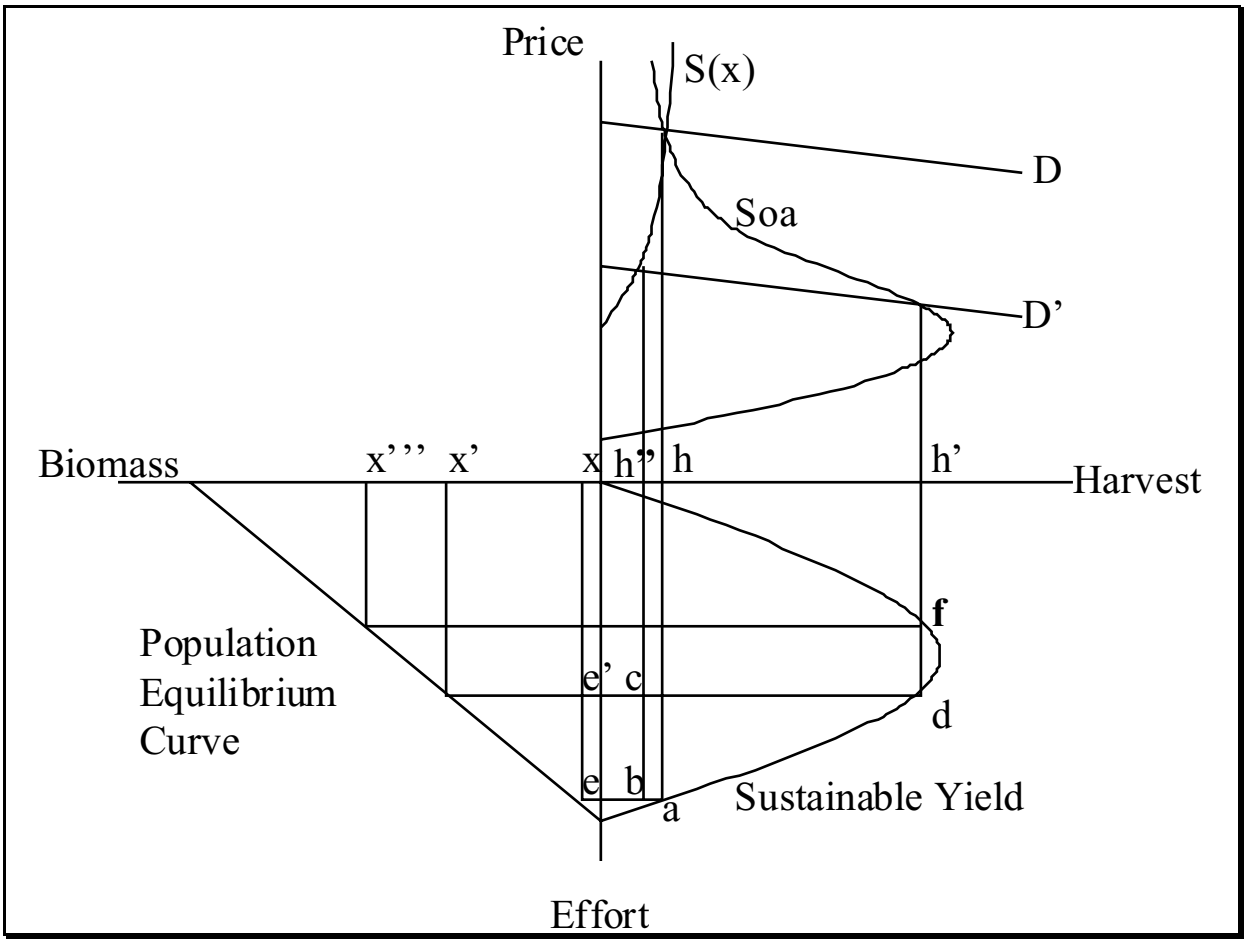
In this situation and for a single species fishery, *excess* capacity can be represented in Figure 1 using the bioeconomic model suggested by Greboval and Munro (1999).

Assuming that the initial equilibrium for harvest level (h), effort level (e), and equilibrium stock size (x) occurs in Figure 1 where the open access supply function (Soa) equals demand (D), then the stock constant supply function for stock size (x) is S(x), which intersects the demand curve (D) at its intersection with Soa. A decline in market price would be represented by a shift in D to D', causing the long run equilibrium harvest level to increase to h'. However, in the short run, harvest would decline to h" where D' and S(x) are equal. Since the potential harvest (h) is greater than the actual harvest (h"), *excess* capacity exists for this level of effort (e) and stock size (x).

In the short run, fishing effort cannot decline because capital is immalleable. However, point (b), corresponding to effort level (e) and harvest level (h"), is *below* the sustainable yield curve, point (a). Since the harvest level is less than the growth level, stock size will begin to grow at point (b). This causes the stock constant supply curve to shift down and to the right representing a decline in the cost of harvesting fish. Eventually, the stock constant supply function will intersect both the demand curve (D') and the open access supply function (Soa) corresponding to harvest level (h'), point (d) on the sustainable yield curve and stock size (x').

[17] For this simple model, originally proposed by Greboval, and Munro (1999), an output approach is used to differentiate between excess and overcapacity.

Figure 1 *Excess* Capacity and *Overcapacity* in a Single Species Fishery



If the stock does not act as a constraint in the estimation of excess capacity, then *excess* capacity also can be represented as the difference between point (c) and point (d) in Figure 1. Over time - as the fishery responds to the change in market demand by reducing fishing effort which allows growth in the stock – *excess* capacity will disappear in the fishery.

2.2 Overcapacity

Regardless of the *excess* capacity issues in this fishery, this open access fishery also experiences *overcapacity*, which is a long run and persistent form of capacity.

Quite simply, *overcapacity*, like overcapitalization and overfishing, is a symptom of a regulated open access or common property fishery management institution (Anderson, 1986, Hannesson, 1978 and 1993, and Clark, 1990). When fishermen do not have an incentive to conserve fish by leaving them in the sea, they will over-invest in the capital and labor used to harvest fish as well as other inputs[18] used to produce fish. *Overcapacity* results.

Even where barriers to entry exist in a fishery, such as exclusive economic zones (EEZs), permit moratoriums, or transferable licenses, the fishermen who participate in the fishery react to market conditions. Because of this, they tend to operate where management institutions and market conditions combine to make *overcapacity* both of indeterminate duration and of a considerably greater magnitude than would occur in most other industries, and it is the persistence and magnitude of this excessive level of harvest capacity in fisheries that create concerns for fishery managers around the world.

[18] Factor inputs in the production process also include labor, fuel, ice, bait, electronic equipment, fishing gear, etc.

In Figure 1, overcapacity can be expressed in terms of a long run target level of production point (f). Initially, the equilibrium level of effort and harvest is found where demand (D) and open assess supply (Soa) intersect with S(x) - at point (a) on the sustainable yield curve. Point (a) can then be compared to the target stock size (x'") which corresponds to the target harvest level (h'). Basically, the difference between the target yield point (f) and the potential yield point (a) represents *overcapacity* in the fishery.

2.3 Comparison of Excess and Overcapacity

Initially, at point (a), no *excess* capacity exists in the fishery, but there is substantial *overcapacity* present as indicated by point (a) relative to point (f) in Figure 1. The decline in price caused by the shift in the demand curve from D to D' creates *excess* capacity – as seen by point (b) relative to point (a). *Overcapacity* remains the same because it is measured as potential production, point (a), relative to the target level of production, point (f).

When the biomass constraint is relaxed, then the potential level of production is point (d), and excess capacity increases relative to points (b) or (c) while overcapacity declines - because overcapacity is a comparison between potential production at point (d) and the target level of production at point (f).

2.4 Linking Capacity and Fishing Mortality

The same discussion of *excess* capacity and *overcapacity* can be expressed in terms of fishing power, effort, or in terms of fishing mortality.

A total catch level (TCL) is a set equal to the fishing mortality times the average biomass level in a fishery; e.g.,

$$TCL = F\,B$$

This equation can be restated as

$$C = F\,B$$

where: C = catch

B = biomass

$\overline{B}$ = average biomass

F = fishing mortality

Solving this relationship for fishing mortality results in

$$F = \frac{C}{B} \qquad \overline{}$$

Thereby expressing fishing mortality, F, in terms of capacity utilization.

Let

C* be the actual catch,

C_T be the target catch based on a set of biological parameters,

and where

B* is the actual average biomass

F* is the actual fishing mortality, and

$\overline{B_T}$ is the target average biomass

Then,

$$F^* = \frac{C^*}{\overline{B^*}}$$

is the actual fishing mortality, and the target fishing mortality, F_T, is:

$$F_T = \frac{C_T}{\overline{B_T}}$$

Then the ratio of actual to target fishing mortality, $F^*/F_T = [C^*/C_T][B_T/B^*]$. As a result, excess and over capacity can be related to fishing mortality.

In the case of excess capacity where $B_T=B^*$, then

$$F^*/F_T = C^*/C_T$$

and the ratio of the actual and target fishing mortalities equals the capacity utilization rate.

This result is particularly useful since fishery managers with training in biological stock assessment techniques may feel more comfortable dealing with *excess* capacity and *overcapacity* measures based on fishing mortality estimates.

2.5 Modeling Nuances

Technically speaking, the generic topic of capacity, in itself, is not necessarily a problem for fisheries managers. Some level of capacity is necessary to harvest fish in a fishery, regardless of whether the management of the fishery is based on open access, regulated open access, common property, or rights-based regulations.

Thus, *excess* capacity is theoretically not a problem for fishery managers because, in the long term, marketplace incentives to increase profits cause the fisherman to adjust his use of inputs to eliminate it. However, *excess* capacity can be a problem for fishery managers if it exceeds an implicit or explicit target catch level either in an open access or in a regulated open access fishery that used command and control management regulations – and these types of management arrangements are prevalent around the world.

Overcapacity, however, is a problem for fishery managers. The marketplace does not provide the financial incentives necessary to induce fishermen to alter their production levels to eliminate it. Because clearly defined and enforceable property rights do not exist for fish-in-the-sea, fishermen continue to instead invest in capital and labor in order to harvest their perceived share of the resource - and a derby fishery results.

Not surprisingly, there are numerous problems, special cases, and exceptions in applying these simple capacity concepts:

- Multi-species fisheries, different age or size cohorts, multiple fishing grounds, and dissimilarities in fishing vessel characteristics - all confound the calculation and interpretation of capacity;
- Fluctuations in fish stock abundance and costs of other inputs in the production process – these issues can complicate application of these concepts;
- Problems exist for aggregating capacity estimates - from the fisherman to the industry level;
- Addressing capacity and capacity measurement in recreational and artisanal fisheries - needs to be resolved;
- The role subsidies could play in reducing or eliminating overcapacity needs to be better understood - beyond knowing that it is a contributing factor in limited entry and regulated open access fisheries. (Moreover, efforts to address often-cited contributing factors, such as subsidies, will not eliminate situations of *overcapacity* in fisheries, quite simply because these efforts do not eliminate the market incentives for fishers to over invest in harvesting capital.);

- Research on the utility of expressing excess and overcapacity in terms of fishing mortality - needs to continue;
- The values associated with both user groups that do not consume the fisheries resources *per se* and instead use fisheries in concert with activities such as from sport diving on coral reefs and the protection of endangered species, either of which may require a reduction in commercial and recreational harvest levels - need to be incorporated into capacity models and estimates; and
- The increased attention being given to essential fish habitat protection –needs to be incorporated into capacity models and estimates.

In short, there are still considerable gaps and issues to be resolved in the various approaches for modeling *excess* capacity and *overcapacity*.

3 Indicative and Analytical Measures of Capacity

To address both *excess* capacity and *overcapacity* in a fishery, it must first be determined by fishery managers that a problem does in fact exist in that fishery.

In terms of measurement, the level of capacity utilization can be measured in a fishery both in indicative or qualitative terms and in analytical or quantitative terms. While quantitative metrics might be preferred, indicative measures are exceedingly practical in providing a first glimpse of the status of a fishery.

Secondarily, knowing the efficacy of a particular regulation in eliminating capacity requires an unbiased metric to determine the trend in capacity utilization over time.

It is critical to note that short run corrections in capacity levels might not persist over the long run if the underlying market incentives to over invest in capital and labor are not corrected by the regulation. For example, certain types of fishery management approaches, such as open access fisheries management, inevitably lead to *overcapacity* in a fishery, whilst other rights-based management approaches correct the underlying market incentives to over invest in capital and labor and prevent overcapitalization from occurring.

However, *excess* capacity can still develop in fisheries managed under these types of regulations. As a result, the management approach is a qualitative indicator of the existence of *overcapacity*, but not necessarily *excess* capacity. Quantitative metrics can be used to determine if *excess* capacity and *overcapacity* exist as well as providing a measure of their magnitude and direction of change over time in a fishery.

3.1 Indicative Measures[19]

Qualitative assessments should use verifiable indicators that are based on scientific methods. The fundamental rationale of this approach is to apply common yardsticks to all fisheries, and minimize the role of subjective judgment. At the same time, it is recognized that the judgement, individual knowledge, and experience of the analysts will necessarily play an important role. The indicators approach has important advantages: it makes maximum use of existing information and it incorporates biological, management, and fleet-specific data.

Qualitative capacity indicators can be developed from bioeconomic theory based on existing conditions in or characteristics of a fishery. Clearly, no single indicator would be sufficient to make a determination of overcapacity in a fishery. A combination of indicators utilizing time trend information is needed to determine qualitative capacity levels in fisheries. Keeping in mind these practical difficulties and categories, it may be useful to consider the qualitative indicators of:

- the biological status of the fishery;
- management category;
- the harvest – total allowable catch (TAC) relationship;
- the TAC and the season length;
- the total catch level;
- the existence of latent permits; and/or
- the catch per unit effort.

3.1.1 Biological status of the fishery

The annual report to the U.S. Congress entitled Status of Fisheries of the United States, prepared by the National Marine Fisheries Service, identifies fisheries that are:

- (1) overfished,
- (2) approaching a condition of being overfished, and
- (3) are subject to overfishing.

[19] This section is reproduced from Ward et al. (2000). "Assessing Capacity and Excess capacity in Federally Managed Fisheries, A Preliminary and Qualitative Report." National Marine Fisheries Service, Offices of Science and Technology and Sustainable Fisheries, Silver Spring, Maryland, September, 131 pp.

If the species in a directed fishery are overfished, overcapacity almost certainly exists since overfishing and overcapacity are both symptoms of the same underlying management problem. Further, a fishery that is characterized as fully utilized or that may be approaching a condition of being overfished is also likely to exhibit overcapacity since fewer inputs in the production process could be used to provide the same level of harvest.

This indicator may apply somewhat differently to non-targeted and multispecies fisheries. The above general observations pertain to directed fisheries. However, many multiple species fisheries include a mix of overfished, fully utilized and developing fisheries. In these cases, the individual analyst in each region has to determine capacity levels on a case-by-case basis.

Put simply, incidental harvests in a fishery directed at another overfished and/or fully utilized species may or may not indicate overcapacity for the incidentally caught species.

3.1.2 Management category

Another qualitative indicator of overcapacity is the management environment of the fishery. The fundamental rationale for this indicator is that certain management categories are more likely, or tend, to be associated with overcapacity than others.

Under this indicator, there are three broad management categories:

- (1) open access (no limits on the number of participants or vessels);
- (2) limited access (controls on the number of participants or vessels); and
- (3) harvest rights-based systems (ITQs, cooperatives, IFQs, or CDQs).

These broad relationships, or associations, between management systems and capacity levels enjoy considerable support in the technical literature, and have been borne out in a major comparative study prepared by OECD in 1997.[20] Accordingly, while individual fisheries undoubtedly have their unique features, certain general relationships seem to emerge over time. It is assumed that, in most instances, open access fisheries tend to be associated with overcapacity; limited access fisheries usually have the same association, and harvest rights-based fisheries tend over time to eliminate overcapacity.

In **open access fisheries**, anyone can participate since there are no barriers to entry. More importantly, participants in open access fisheries have incentives to increase effort and investments as long as the fishery is profitable. Under these circumstances, overfishing and overcapacity almost always occur in the long run.

In looking at this issue, Hannesson (1987) found that free access led to over-exploitation, and that the optimal rate of exploitation is less than the maximum sustainable yield - in contradiction to the biological doctrine that fish stocks should be managed to give maximum sustainable yield (MSY).[21] Optimal catch capacity was also shown to depend on the cost of investment, but that the derivation of optimal harvesting and investment policies became very complicated in stochastic fishery models.

In **limited access fisheries**, new entrants are prohibited or restricted but existing permit holders can behave as though they are operating in an open access fishery. In this situation, a restrictive TAC in a limited access fishery could lead to some stock recovery, and existing participants will have incentives to invest in new capital equipment. Without further restrictions on investments, these types of fisheries tend to supply inputs at levels that result in overcapacity. In limited access systems in which permits are transferable, the over investment problem may be mitigated but not necessarily eliminated.

In fisheries where quite **specific harvest rights** exist, fishermen have incentives to use only the capacity required to take their allotted quotas or shares. If there is overcapacity, the fishery will tend over time to reduce that excess to an optimum level. Some overcapacity may remain for some time in the fishery after harvest rights-based arrangements were first introduced. However, such systems give fishermen incentives to reduce inputs, thus eliminating overcapacity in the long run.

Subject to the qualifications noted above, the sheer presence of open access and (to a lesser degree) limited access management systems may be considered as indicators of overcapacity in fisheries,

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[20] Towards Sustainable Fisheries: Economic Aspects of the Management of Living Marine Resources (Paris: OECD, 1997).

[21] The result that this optimal rate of exploitation may be greater than the MSY rate when a higher discount rate exists becomes ambiguous when the higher discount rate implies a higher required rate of return on capital.

whereas harvest rights-based management systems may be considered an indicator of no overcapacity in a fishery.[22]

3.1.3 The Harvest - TAC relationship

The ratio between harvest levels and quotas is another management-related indicator of overcapacity, especially because most managed fisheries operate under harvest guidelines; usually a TAC.

Overcapacity may be thought to exist if harvest level exceeds the TAC on a regular basis. Under this indicator, it is assumed that the target, or optimal, level of capacity is that level that is necessary to harvest the TAC in a single species fishery during a fishing season.

It should be noted that this is not a perfect measure of overcapacity. For one thing, effective enforcement and monitoring of the harvest levels could close the fishery before the TAC is exceeded. For another, this indicator does not work well in multi-species fisheries. Nevertheless, under most circumstances, a harvest-to-TAC ratio that exceeds "one" on a regular basis indicates at least the potential for overcapacity to exist.

3.1.4 The TAC / season length relationship

Another indicator of overcapacity is the "race for fish" in which fishermen harvest the TAC before the end of fishing season.

The total catch level divided by the days fished may be used as a qualitative indicator of overcapacity. If the number of days fished declines progressively for a number of years, that may be an indicator of overcapacity.

This indicator is not a perfect test of overcapacity for the same reasons as the harvest-to-TAC relationship. However, an increase over time of this ratio could indicate the potential for overcapacity in a fishery.

3.1.5 Total catch level

Controversies surrounding the setting of the TAC and the extent to which setting its sub-allocation or distribution among different user groups may also be an indicator of overcapacity in a fishery.

Typically, disputes occur between commercial fishermen using different gear types or residing in different areas, and/or between commercial and recreational fishermen. Evidence that the determination and sub-allocation of TACs are accompanied by a meaningful level of political controversy suggests that there may be a potential for the existence of overcapacity in that fishery. Obviously, this is an extremely rough indicator of overcapacity for the simple reason that it is difficult to evaluate objectively the seriousness and intensity of these differences.

3.1.6 Latent permits

Another qualitative indicator of overcapacity is the trend in unused permits, or latent permits. By defining latent permits to be permits issued to fishermen that have never been used to harvest fish, it follows that the ratio of active permits to total permits (active plus latent) may be used as an indicator of overcapacity.

A relatively large number of latent permits, or a low ratio of active to total permits, would indicate the potential for overcapacity in a fishery. Further, as this ratio declines, the likelihood that overcapacity exists in the fishery probably increases.

This is not a perfect measure of overcapacity since speculators who never intend to harvest fish may hold a permit in the hope of benefiting by selling or leasing the permit if they are made transferable. In addition, fishery managers may decide to purchase or cancel inactive permits. Nevertheless, a relatively low and declining ratio of active to total permits may under certain conditions indicate overcapacity in a fishery.

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[22] At a point in time, excess capacity could exist in a harvest rights-based fishery. Excess capacity could exist to respond to random market or recruitment fluctuations. This level of excess capacity should not be of concern to fishery managers because it would be short run in duration and not like the persistent overcapacity in the long run.

3.1.7 Catch per unit of effort

A decline over time in catch per unit of effort (CPUE) implies overfishing and overcapacity. However, the CPUE indicator of overcapacity must be used with care.

Fluctuating TACs under a constant-fishing-mortality management strategy could mask this effect. The CPUE could remain constant or improve even with overcapacity in the fishery as the TAC increases with the recovery of the stock. In addition, CPUE trends could remain constant or increase for schooling species even though overall stock abundance is declining.

In general, in fisheries where TACs and harvest levels are fairly constant, a declining trend in CPUE over time probably indicates overcapacity.

3.2 Analytical Measures[23]

A number of quantitative methods have been developed in the economics literature that may be used to estimate various types of fishing capacity. Three general approaches to estimating technical capacity are:

- the peak-to-peak method,
- data envelopment analysis (DEA), and
- stochastic production frontiers (SPF) method.

The "**peak-to-peak**" method of Klein (1960) and the **DEA** model developed by Fare et al. (1989) based on Johansen (1968), are two approaches that have been used to estimate capacity utilization in fisheries.

SPF is an alternative method that has been used to estimate efficient (frontier) production in fisheries (Kirkley, Squires, and Strand, 1995) and may also be a useful method for developing a measure of capacity under certain circumstances.

Each method has strengths and weaknesses, and the choice of the appropriate model will vary depending on the nature of the fishery, the data available, and the intended use of the capacity measure

3.2.1 Peak-to-peak

The peak-to-peak method is best suited when capacity related data are especially limited, for example when data are limited to catch and number of participants. The approach is called peak-to-peak because the periods of full utilization, called peaks, are used as the primary reference points for the capacity index.

In practice, a peak year is often identified on the basis of having a level of output per producing unit that is significantly higher than both the preceding and following years. Capacity output is compared to actual output in different time periods to give measures of capacity utilization after adjusting catch levels for technological change.

The peak-to-peak method requires data on landings and participants, such as vessel numbers, and some identification of a technological time trend. Minimum fleet sizes (number of vessels) that correspond to different levels of capacity can be calculated.

The peak-to-peak method is quite simple to apply even when sparse data are available. The method has been applied to fisheries and examples can be found in the literature; e.g., Kirkley and Squires (1999), Ballard and Roberts (1977) and Garcia and Newton (1995). However, peak-to-peak has a number of shortcomings that should be considered when evaluating the meaning of the capacity measure it provides.

In most cases, peak-to-peak can be expected to provide only a rough measure of capacity since the number of vessels or other measures of physical capital are only a loose proxy for the actual catching power of the fleet. The analysis ignores economic factors that impact what the fleet will actually catch. If only the total number of participants and catch are used in the model, differences in capacity across

[23] This section is taken from Ward, John (1999). "Report of the National Task Force for Defining and Measuring Fishing Capacity." Draft report, National Marine Fisheries Service, Office of Science and Technology, Silver Spring, Maryland, June.

gear types or other sectoral disaggregations cannot be identified; thus the index may not account for changes in the composition of the fleet that may have significantly changed its overall capacity.

Determining the impacts of removing different groups of participants from a fishery will not be possible since the capacity of individual producing units is not identified.

Also, if significant changes in fishery regulations or other factors that impact capacity have occurred, this measure of capacity may not be a reliable predictor of current capacity.

Finally, the measure is based on observations over time where both the resource stock and the intensity of capital input utilization have varied.

3.2.2 Data envelopment analysis (DEA)

DEA uses linear programming methods[24] to determine either

- the maximum output that can be produced with a given set of inputs, or
- the minimum level of inputs required to produce a given level and mix of outputs.

DEA models were originally designed to measure technical efficiency. Fare et al. (1989) proposed a variation on the standard output oriented model that is designed to measure capacity output and capacity utilization assuming unconstrained use of variable inputs. Thus, to be at the frontier of maximum production, firms must be efficiently producing the most output for a given level of fixed inputs. This primal approach was extended by Fare, Grosskopf, and Kirkley (2000). They developed a multioutput DEA measure based on a revenue or cost function framework that could be applied to a multi-species fisheries. Firms that are not on the frontier can be below it either because they are using inputs inefficiently or because they are using lower levels of the variable inputs relative to firms on the frontier.

DEA has several attributes that make it a useful tool for measuring capacity in fisheries. Capacity estimates can be calculated for multispecies fisheries if certain, fairly strong, assumptions are made about the nature of production.[25] DEA readily accommodates multiple outputs (e.g., species and market categories) and multiple types of inputs such as capital and labor. The analysis accepts virtually all data possibilities, ranging from the most limited (catch levels, number of trips, and vessel numbers) to the most complete (a full suite of cost and revenue data), where the more complete data improve the analysis.

The DEA model may also include constraints on outputs of particular species (e.g., bycatch or trip limits). Since DEA identifies the efficiency and capacity of individual firms, it can be used to identify operating units (individual vessels or vessel size classes) that can be decommissioned to meet various objectives.

Capacity estimates can also be made for different groups of firms (e.g., by region and vessel size class) and the number of operating units could be determined by adding the capacities of each operating unit until the total reaches a target. If data on input costs or output prices are available, DEA can be used to measure both technical and allocative efficiency of firms, i.e., the model will calculate how much costs could be reduced or revenues increased by efficiently producing the optimal product mix.[26]

As with the other capacity measurement methods, DEA has a number of potential shortcomings.

First, a quite significant problem with DEA is that it is typically a deterministic model. Random variations in measured output (which may have been caused by measurement error or simply by normal variation in catch rates) are interpreted as inefficiency and influence the position of the frontier. In effect, the model assumes that vessels should be able to duplicate the highest catch rates observed. Recent research in the economics literature has focused on methods to overcome this problem.

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[24] Mathematical programming, which includes linear programming, is the optimization of an objective function given a series of constraints.

[25] Since outputs and inputs are expanded in fixed proportions, the model assumes and imposes Leontief separability, but does not test for it.

[26] *Technical* efficiency occurs when the maximum level of output is produced with the inputs (e.g., capital and labor) available to the firm. *Allocative* efficiency in input selection involves selecting that mix of inputs that produce a given quantity of output at minimum cost given the input prices that prevail.

Second, capacity output is based on observed practice and the economic and environmental conditions at the time observations were made. If fishermen were not operating at capacity in the past it may not be possible to identify the true technical capacity, and changing conditions may have altered what the fishermen can produce currently.

Third, capacity output is based on observed practice and the economic and environmental conditions at the time observations were made. If fishermen were not operating at capacity in the past it may not be possible to identify the true technical capacity, and changing conditions may have altered what the fishermen can produce currently.

3.2.3 Stochastic production frontier (SPF) analysis[27]

SPF analysis is an econometric approach that can be used to estimate the maximum potential output (i.e., catch) for the observed factors of production (Kirkley and Squires, 1998). The estimated frontier production function can be used to estimate the capacity of a vessel, firm, or individual by predicting output with their actual level of fixed inputs and a maximum level of variable inputs.

SPF can be used to calculate both technical and allocative efficiency if data on input and output prices are available.[28] Additional advantages of SPF relative to the other approaches are that it is designed to handle noisy data and it allows for the estimation of standard errors and confidence intervals.

While SPF has the same shortcomings as DEA to varying degrees, the usual problems and assumptions associated with parametric analysis are also present. The selection of a distribution for the inefficiency effects may affect the capacity measure. The SPF approach is only well developed for single-output technologies unless a cost-minimizing objective is assumed.

To accommodate multiple outputs in a multiple species fishery, SPF requires representing the production technology in terms of one output as a function of normalized outputs. The representation of jointness in production is limited if species are heterogeneous in price, catchability and costs of production. The data requirements include firm or vessel output and input quantities, but richer models can be estimated if prices are available.

3.3 Summary

While qualitative indicators have limitations, they can suggest the existence of overcapacity in a fishery. While no single qualitative indicator would be sufficient, a combination of indicators could be used to make a determination if overcapacity existed in a fishery. Qualitative indicators show if overcapacity exists at a point in time, but do not indicate the magnitude of the problem or the direction of change. In addition, the expertise of the analyst can influence the application of these indicators.

Even with limited data, quantitative capacity measurement techniques may be able to provide information on capacity output and the number of operating units. Where data permits the use of either the SPF or DEA methods, a much richer set of management guidance may be offered. Since both of these methods are based on vessel level information, managers may be able to identify measures for particular fleet components or may facilitate the design of capacity reduction programs.

Regardless, it is prudent to use bioeconomic analyses to determine the actual details of which management system should be used to achieve capacity reductions, how many vessels of which type need to be eliminated, or which regulations will work best for different fishery management approaches in fisheries characterized by large, medium, and small scales of operation or in artisanal fisheries.

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[27] This is taken from Kirkley and Squires (1998); and, Coelli, Tim, D.S. Prasada Rao, and George E. Battese (1998) An Introduction to Efficiency and Productivity Analysis. Kluwer Academic Publishers, Boston.

[28] *Technical* efficiency occurs when the maximum level of output is produced with the inputs (e.g., capital and labor) available to the firm. Allocative efficiency in input selection involves selecting that mix of inputs that produce a given quantity of output at minimum cost given the input prices that prevail.

4 An Overview of Capacity Measurement Studies

The measurement of capacity and capacity utilization rates in various sectors of the economy is not a new phenomenon.[29] Capacity and efficiency studies have been conducted in the agriculture, medical, and industrial sectors of the economy as well as in domestic and foreign fisheries.

For example, Morrison (1985) used annual U.S. manufacturing data from 1954 to 1980 to construct and compare traditional indices and alternative economic capacity utilization measures. Stochastic production frontiers have been used to conduct a comparative study of wheat farmers in Pakistan (Battese and Broca, 1996) and to determine the technical efficiency of 26 rural Nevada water utilities (Bhattacharyya et al., 1995). Reinhard and Thijssen (1998) used an output distance function approach to define and estimate a resource use efficiency measure using a panel of Dutch dairy farms to characterize non-point source pollution. A nonparametric approach to measure capacity, competition, and efficiency in hospitals was developed by Fare, et al. (1989).

These studies are indicative of the capacity metrics that have been in use in many industries and that are well accepted by scientists as well as by a broad range of managers and policy decision makers. What is new is the desire of fishery managers to explicitly address capacity in fisheries.

While excessive capacity utilization levels are cited in a number of studies of both international and United States fisheries, the unique nature of most fisheries is often ignored when traditional methodologies to measure capacity are employed. The traditional methodological approach assumes the existence of relatively efficient markets for the allocation of goods and services (commodities) used in the production process.

In most U.S. and international fisheries, an extensive market externality exists (usually described as the "common property externality") which results in a set of incentives that can cause a severe misallocation of resources used in the production process. One symptom of this misallocation is the excessive use by the fishing sector of capital and labor in the production of fish.

As a result, capacity utilization estimates based on the presently existing methods of data envelopment analysis (DEA) and stochastic production frontiers (SPF) indicate exceedingly large estimates of excess capacity in open access and in regulated open access fisheries where command and control regulations are used to try to restrict harvest levels.

More importantly for fishery managers, these methods designed to measure excess capacity in a regulated open access fishery do not correctly account for the overcapacity that exists as a result of the common property externality.

4.1 Capacity Measurement in Global Fisheries

Interest in the problem of fish harvesting capacity has grown steadily over the last decade at both international and respective domestic levels, and international studies that have attempted to measure global fishing capacity levels are often cited as examples of how excessive levels of investment in fish harvesting technology have lead to the decimation of global fish stocks.

For example, Fitzpatrick (1995) calculated a 270 percent increase in average fishing power between 1965 and 1995 – essentially, a 9 percent average annual growth rate. This increase in vessel fishing power has been coupled with an increase in total vessels from 0.6 million in 1970 to 1.2 million in 1992, or a 2.2 percent average annual growth rate. Garcia and Newton (1995) estimated that world fishing capacity should be reduced by 25 percent for revenues to cover operating costs and by 53 percent for revenues to cover total costs. Similarly, a substantial reduction in global fleet capacity - perhaps as much as a 50 percent reduction in existing global fishing capacity - would be required for levels to become commensurate with sustainable resource productivity (Mace, 1996).

In other studies, such as a summary of the results of various DEA and peak-to-peak analyses of fishing capacity using primarily input data from selected Canadian and FAO member country fisheries (Hsu, 2000) found that:

- the Atlantic inshore groundfish fishery between 1984 and 1991 had excess capacity;
- the Pacific salmon fishery between 1984 and 1995 had substantial excess capacity;

[29] The Bureau of Census habitually estimates quantitative industrial capacity levels for major U.S. industries.

- the aggregate Atlantic inshore fishery between 1984 and 1991 had nominal capacity levels; and,
- substantial levels of excess capacity existed in world capture fisheries.

4.2 Capacity Measurement in Specific Commercial Fisheries

Although the literature on capacity in commercial fisheries is not abundant, various papers and case studies have shed some light on different aspects of this complicated problem:

- Kirkley, Squires, Alam, and Omar (1999) developed estimates of harvesting capacity for the Malaysian purse seine fishery;
- Banks (1998) evaluated the fishing vessel decommissioning scheme of the European Union designed to achieve a 20 percent reduction in bottom trawl fisheries and a 15 percent reduction in beam trawl fisheries for benthic stocks;
- Bardarson and Vassdal (date unknown) used DEA to define total factor productivity in the Norwegian trawler fleet over the 1985 to 1996 time period;
- Cook (1990) developed a dynamic bioeconomic model to determine the efficacy of management options to reduce capacity in the Canadian halibut fishery and increase social returns from the fishery; and
- the Government of Japan (2001) assessed capacity in its domestic fisheries and determined generally that excessive fishing capacity was present in its coastal fisheries and, as a result, for the large-scale purse seine and offshore trawling fisheries in which capacity was deemed to be excessive, vessel reduction projects are being advanced.

The review by Ward et al. (2000) provides a source of information that can be used to help determine whether excess capacity is a severe problem in a particular fishery, The review covers the published literature that is available and that assesses capacity levels in U.S. fisheries using these accepted measures of capacity and capacity utilization

4.2.1 Early Studies

One of the earliest efforts to estimate capacity levels in United States fisheries was conducted by Ballard and Roberts (1977). They used the peak-to-peak method to estimate capacity utilization rates for 10 Pacific coast fisheries that, in 1973, accounted for 86 percent of the dollar value and 72 percent of the total weight of landings for the Pacific region. Over the 24 year time period, vessel tonnage in these fisheries grew by 197.4 percent, the real value of the fishery increased by only 65.4 percent, and the catch declined by 0.5 percent. Table 1 indicates that the capacity utilization level declined over the time period of analysis.

However, some caveats apply to this approach. First, these figures only indicate that the potential exists for an increase in catch without major new capital expenditures. That is, a fifty percent capacity utilization rate does not imply that the fleet would be economically more efficient with a fifty percent reduction in fleet size. Second, fluctuations in weather conditions or biological stocks may result in the exaggeration of the fleet's potential catch capability causing the peak years to be abnormally high and the intervening years to appear excessively depressed. Third, the technology trend used to estimate the potential output per input unit is calculated as the percentage change in unit input production over the time period between peaks and can as a result be influenced by regulatory policy and changes in labor skill levels causing biased estimated capacity rates.

Smith and Hanna (1990) estimated capacity utilization rates for the Oregon bottom trawl fishery between 1976 and 1985. Capacity utilization was calculated by multiplying the number of vessels with vessel size, technical efficiency, and number of trips. Table 2 indicates that utilization was at a maximum in 1976, and declined to a low of 3.9 percent in 1980.

Table 1 Ten Major Pacific Coast Fishery Capacity Utilization Rates (Ballard and Roberts, 1977)

Year	Species									
	Albacore Tuna	Dungeness Crab	King & Snow Crab	Ground-fish	Herring	Salmon Gill Net	Salmon Troll Line	Salmon Purse Seine	Shrimp	Tropical Tuna
1956	92.7									
1957	107.3*			100.0*						
1958	69.6			102.3*						
1959	89.3	100.0*	88.3	100.0*	100.0*					73.4
1960	49.6	90.3	84.8	57.8	49.9	28.1	2.8	7.2	85.2	78.4
1961	48.1	81.2	100.0*	56.2	46.0	27.6	3.4	12.2	100.0*	100.0*
1962	64.2	58.3	83.5	68.0	70.6	22.1	3.7	14.0	68.4	85.9
1963	80.8	60.9	100.0	67.8	68.1	15.5	5.0	12.5	70.0	85.6
1964	67.3	53.2	76.3	64.9	69.5	24.1	4.8	17.4	55.4	100.0*
1965	46.5	59.0	100.0*	74.5	53.1	33.6	4.5	10.2	60.0	93.7
1966	37.5	84.8	67.9	67.1	29.6	27.2	3.7	18.3	100.0*	75.4
1967	48.0	90.8	66.5	58.4	27.0	18.8	4.0	8.2	67.0	100.0*
1968	47.7	100.0*	29.9	61.1	60.3	16.8	2.9	15.7	84.1	77.8
1969	36.2	73.5	20.8	61.1	47.2	15.5	2.1	11.3	73.4	74.1
1970	47.2	82.2	18.5	58.4	30.2	28.4	3.1	13.8	100.0*	76.8
1971	39.1	47.2	26.1	41.2	10.3	18.2	3.1	12.9	83.2	61.2
1972	44.6	27.4	34.8	53.4	26.2	15.3	2.5	9.0	66.4	53.0
1973	33.6	14.3	21.1	52.0	19.4	11.5	2.8	7.6	74.4	51.0
1974										46.5
1975										42.6

* indicates a peak year for the evaluation of trends

Table 2 Annual Oregon Trawl Fleet Capacity Utilization, 1976-85 (Smith and Hanna, 1990)

YEAR	ANNUAL FLEET CAPACITY*	ANNUAL CATCH CAPACITY IN NET TONS	UTILIZATION IN % CATCH/CAPACITY
1976	74480	6258	8.4
1977	80322	5235	6.5
1978	131487	7958	6.1
1979	216792	11389	5.3
1980	238294	9356	3.9
1981	220382	11326	5.1
1982	294240	15810	5.4
1983	278051	16233	5.8
1984	245448	11650	4.7
1985	206949	11612	5.6

*Fleet Capacity from Table 2 in Smith and Hanna (1990) times 28 trips.

The elimination of foreign fishing between 1976 and 1982 caused the domestic fleet to triple capacity as new and larger vessels entered the fishery. Large rockfish catches beginning in 1981 caused capacity utilization rates to rebound until 1983. The 1982 recession caused fixed and variable costs in the fishery to rise resulting in a reduction in fleet size (annual fleet capacity in Table 2) while regulations reduced catch levels (annual catch capacity in net tons in Table 2) causing capacity utilization to increase after 1984.

This analysis demonstrated that no one management measure will effectively control capacity growth.

4.2.2 Other Capacity Measurement Studies

Data envelopment analysis (DEA) was applied to domestic fishery capacity estimation by Kirkley and Squires (1999) and by Kirkley et al (1999).

These studies used DEA on panel data from ten Northwest Atlantic scallop vessels operating between 1987 and 1990. They found substantial excess capacity relative to current harvest levels in this sample fleet. Vessels operating efficiently could increase their total production by approximately 50.8 percent between 1987 and 1990. Operating at the optimum level of days at sea and crew size and over 285 days, subject to resource conditions, would have allowed production to increase by another 39.9 percent.

Capacity utilization per trip based on observed output and resource constraints was found to be quite low, but was relatively high in terms of technical efficiency. Technical inefficiency appeared to be a major reason why vessels have not operated near optimal capacity, but capacity utilization rates differed depending upon the standard of measurement used. If measured relative to observed days fished per year, capacity utilization rates were much higher than if measured relative to optimal number of days fished per year; e.g., 96.6 versus 85.6 capacity utilization rate, respectively.

A bioeconomic model, developed by Edwards and Murawski (1993), assessed the economic benefits that could be derived from the efficient harvest of the New England groundfish fishery. While not a direct estimate of harvest capacity, this study did indicate that substantial net benefits could be generated if the fishery were operated at its social optimum. Table 3 indicates that optimum effort was estimated to be 70% less than effort in 1989. Excess fishing effort was estimated to be 60 % in the Atlantic cod fishery, 70% in the yellowtail flounder fishery, and 80% for the haddock fishery.

An output based measure of capacity utilization would estimate the level of landings that could potentially be landed relative to the actual level harvested. However, their input based approach allowed the determination of the effort level needed to maximize net benefits to the nation. By determining the optimal level of the fishing effort input needed to harvest a given level of output, the

study provided an indication of the substantial level of excess capacity that appeared to exist in this fishery.

Table 3 The Efficient Harvest of New England Groundfish Resource, 1989 (Edwards and Murawski, 1993)

Species/Gear	Fishing Effort		
	Actual	Sustainable	Social Optimum
Otter Trawl: All Species	75	49	22
Atlantic Cod	80	71	31
Yellowtail flounder	57	26	17
Haddock	145	42	28

A hedonic approach was used by Kirkley and Squires (1988) to estimate capital stock and investment in the New England otter trawl fishery. An index of constant dollar capital stock values was estimated based on a subsample of this fishing fleet. Table 4 indicates that fluctuations in capital investment did not necessarily coincide with the vessel count. The number of trawl vessels increased in each year after 1965. However, capital stock levels fluctuated during the same period and even declined during four of those years.

Table 4 Indices of Capital Stock Based on Constant Dollar Value and Vessel Count (Kirkley and Squires, 1988)

	Capital Stock					
	Constant Dollar Value			Vessel Count		
Year	Trawler*	Dredge*	Total	Trawler*	Dredge*	Total
1965	100	100	100	100	100	100
1966	111	91	105	102	94	104
1967	152	70	119	109	77	106
1968	110	95	103	104	106	103
1969	113	79	98	104	106	101
1970	99	51	80	108	74	102
1971	91	79	86	108	83	104
1972	104	48	89	108	74	110
1973	109	44	92	105	79	112
1974	82	26	72	107	49	117
1975	112	32	96	105	66	124
1976	80	47	83	109	202	132
1977	111	87	115	107	202	141
1978	144	79	133	116	189	148
1979	175	168	190	137	313	186
1980	201	211	222	158	440	212
1981	167	185	192	158	413	210

*Gear type assigned by plurality of days absent.

Di Jin, et al. (2000) used a similar approach to conduct an analysis of total factor productivity to separate changes in stock abundance from improvements in technical efficiency for the same fishery. The overall annual decline in total factor productivity found in the New England groundfish fishery between 1964 and 1993 of 6.6 percent was due primarily to a decline in stock abundance. Correcting for the decline in stock abundance, total factor productivity actually rose by 4.8 percent per year on average.

These results confirm that the key problem in New England groundfish fisheries is excess capacity.

A qualitative approach to measuring overcapacity was conducted by the National Marine Fisheries Service (Ward et al., 2001) and was comprised of an assessment of the harvest capacity levels in federally managed fisheries.

An initial qualitative assessment determined that overcapacity is a problem requiring the attention of fishery managers in 55 percent of the federally managed fisheries reviewed in seven regional reports. The fisheries without overcapacity included two individual transferable quota fisheries on the east coast, several low-value pelagic species fisheries on both the east and west coasts, and various small-scale, largely part-time, and subsistence fisheries in the western Pacific and in the U.S. Caribbean.

These results suggested that overcapacity in federally managed fisheries is a management issue that should be addressed by fishery managers.

4.3 Capacity Measurement in Recreational Fisheries

Capacity is not only an issue for the commercial fishing industry; it can also be an issue for recreational fisheries. Furthermore, excessive recreational capacity has been identified as a concern where the data necessary to develop capacity measures is not available and where the concept relative to recreational fisheries is not well understood (Kirkley, 1998).

Defining and measuring capacity levels in recreational fisheries is complicated. First, the recreational output is not the pounds landed or number of fish caught, but the quality of the recreational fishing experience. While the quality of the fishing experience is related to the number of fish caught, it also includes other factors. Unfortunately, data for accessing the quality of the fishing experience, the maximum potential quality for the angler, or even the maximum potential harvest, is usually unavailable.

A second issue is determining the work-leisure trade-off and how it affects the subsequent assessment of the associated fishing satisfaction or utility levels. Third, the determination of the demand for recreational trips is critical in the assessment of recreational capacity.

Using a physical output approach, Kirkley (1998) estimated capacity and capacity utilization for the Gulf of Mexico and Atlantic recreational fisheries from 1986 to 1995 by defining capacity to be the maximum potential catch in terms of the number of angler trips using a peak-to-peak approach (Table 5).

Table 5 Atlantic and Gulf Recreational Fishery Landings and Effort, 1985-1995 (Kirkley, 1998)

YEAR	LANDINGS	TRIPS	LANDINGS PER TRIP	CAPACITY	CAPACITY UTILIZATION
1986	407	60	6.78	407	100
1987	272	51	5.33	346	79
1988	291	59	4.93	400	73
1989	248	49	5.08	332	75
1990	250	46	5.43	312	75
1991	385	58	6.63	393	98
1992	292	53	5.51	360	81
1993	284	51	5.57	346	82
1994	331	58	5.71	393	84
1995	312	58	5.38	393	79

Relative to capacity utilization, recreational anglers consistently caught fewer fish than the maximum they could have caught if the resource or something else had not constrained their harvest levels, but some extreme assumptions were made to utilize this definition of capacity and capacity utilization.

First, it was assumed that the demand for recreational fishing must be separable from the demand for all other goods and services, including other recreational activities; more typically, when consumers purchase various goods and services, they group items together as composite bundles such as food, shelter, clothing, and recreational activity. However, this assumption about separability allows an analysis of the demand for recreational fishing and, subsequently, its utility without performing a demand analysis for all goods and services. Second, the peak-to-peak approach uses the highest output per unit of input (trip) and adjusts it for changes in technology over time, but in the study the technology was assumed to remain constant over time.

As a result, the maximum potential physical catch is not an adequate indicator of capacity or an assessment of capacity utilization in recreational fisheries. Given customary and traditional recreational fishing practices, however, it does represent a potential upper limit on the maximum catch.

4.4 Capacity Measurement in Artisanal Fisheries

Capacity utilization measures for artisanal fisheries are missing from the literature.

While comparable capacity utilization rates can be calculated for small, medium, and large scale commercial fishing firms, artisanal and sometimes small-scale fishermen often rely on multiple outputs to ensure their economic and perhaps even physical survival.

Adopting existing capacity utilization measures to small scale and artisanal fisheries would require assuming the separability of outputs. Yet, by separating capacity from other outputs necessary for survival, existing measures of capacity utilization that focus solely on fishery output or input levels may not provide fishery managers with sufficient information to properly account for artisanal and small scale fishermen.

4.5 Summary

Case studies of capacity in various fisheries have been conducted over time using different qualitative and quantitative measurement techniques. Generally, they indicate that excess capacity is a management problem for those fisheries in which measures were calculated.

The use of different approaches to measure capacity at different points in time generally prevents direct comparison of capacity estimates between these fisheries. These studies also show that many assumptions had to be made to develop capacity estimates, especially in recreational fisheries. A standardized approach to capacity measurement is necessary to make possible comparisons between fisheries, scales of production, and over different time periods.

However, on a more positive note, even though comparisons between fisheries, regions, or over time are not possible, these case studies do indicate the interest in and the seriousness of excess capacity in commercial and recreational fisheries. In addition, capacity estimates are not available for many managed fisheries in the literature, indicating a need for more analyses if policy makers and managers are going to focus on the matter of reducing overcapacity as a strategy for moving towards sustainable fisheries.

These case studies indicate that a number of problems still need to be resolved before capacity measures can be estimated in multi-species, multi-area, multi-output, and multi-seasonal fisheries and in artisanal and recreational fisheries. Moreover, these global assessments and individual case studies indicate that the distinction between the concepts of *excess* and *overcapacity* capacity have not been explicitly incorporated into estimates of capacity in fisheries.

5 Capacity Management Strategies

5.1 Recognizing Capacity Problems

Excessive levels of fish harvesting capacity have been held largely responsible for:

- the degradation of marine fisheries resources,
- the dissipation of food production potential, and
- significant economic waste, especially manifest in the form of redundant fishing inputs.

Yet, while many concerns about the need to resolve capacity-related problems have been expressed by scientists in different disciplines, little has actually been accomplished in terms of addressing *excess* capacity and *overcapacity* directly, especially in the fisheries sector. However, the situation is changing. The globalization of this phenomenon and the impact of excessive fishing capacity on the biological and economic condition of many fisheries throughout the world have been a matter of increasing concern in recent years (FAO, 1997).

For example, in 1998 the FAO established a technical working group (TWG) on the management of fishing capacity to review the various issues related to measurement and monitoring, management and reduction methods, broader policy and institutional considerations as well as specific high seas aspects of the issue. The TWG stressed the crucial need for countries and the international community at large to take steps to address and to prevent *overcapacity* as recommended by the 1995 Code of Conduct for Responsible Fisheries (CCRF) and produced a wide consensus on the need to:

- develop more appropriate measurement methods and monitoring mechanisms, including a fishing vessel registry program;
- give far greater emphasis to fleet monitoring and the assessment of fleet dynamics;
- adopt policies which clearly specify access conditions;
- give a greater priority to management methods aiming at adjusting rather than blocking the pervasive tendency for overfishing and overinvestment that results from open access conditions;
- reassess and strengthen management methods currently used and implemented, recognizing that available management methods are situation specific; and
- approach the reduction of fishing capacity with care, in order to try to avoid spillover effects and to carefully control the induced effects of scrapping programs.

5.2 Incorporating Capacity Issues into Management

Proposed management approaches designed to solve the fish harvesting capacity problem in industrial fisheries typically have not explicitly incorporated the two different concepts of *excess* capacity and *overcapacity*. Furthermore, even where there have been distinctions made between incentive adjusting and incentive blocking management approaches, the distinctions of the impacts of these management approaches and their respective impacts on *overcapacity* have not been separated from their impacts on *excess* capacity.

Most proposed management approaches for commercial fish harvesting capacity have also not differentiated between small and large scale production platforms. Similarly, the issues of *excess* capacity and *overcapacity* in recreational and artisanal fisheries have not been explicitly addressed in management approaches.

Harvesting capacity management regulations have also not been related to strategic fishery management goals. Most proposed fish harvesting capacity management regulations implicitly or explicitly assume that economic efficiency is the desired objective. In actuality, the preservation of fishing-dependent communities or of communities which depend on artisanal fisheries for their survival may be equally relevant, if not higher priority, social objectives. For example, an allocation of the total catch level between commercial and artisanal fishermen that is economically and biologically sub-optimal may be required to preserve an artisanal fishing community; however, given that strategy and choice for sub-optimal allocation, the catch should be harvested as economically efficiently as possible; i.e., with the minimum level of harvest capacity for both sets of fishermen.

These sorts of additional management concerns need to be brought to the forefront of the fish harvest capacity debate, and the establishment of second-best bioeconomic criteria for their evaluation needs to be reaffirmed.

Once a fishery has been identified as having unacceptable levels of excess and overcapacity, a set of regulations that will control capacity in the short run and reduce capacity levels in the long run need to be developed by fishery managers. Capacity management strategies have focused on **incentive blocking** and **incentive adjusting** measures (FAO, 1998).

Incentive blocking measures can be argued to be measures that are designed to hasten the market adjustment of *excess* capacity. These short run solutions mitigate harvesting capacity by stopping or slowing its growth rate, but they do not change the market incentives that caused the *overcapacity* in the fishery.[30]

Incentive adjusting measures are designed to eliminate *overcapacity* by correcting the open access market externality endemic in fisheries. These long run solutions to correct overcapacity change the regulatory environment to create market incentives that reduce capacity levels in a fishery.[31]

Cunningham and Greboval (2001) have provided a background to the need for managing fishing capacity as well as a review of the technical and policy issues that arise in doing so. Guiding principles based on the CCRF are used as the basis for examining the origin, consequences, and dynamics of excessive fishing capacity development. Noting the problems associated with free and open access, together with the issues that arise when attempting to manage fisheries under such regimes, the authors reviewed a variety of the possible management actions - such as economic incentives and disincentives, individual quotas, limited entry, and co-management - in terms of their ability to reduce fishing capacity. The likely effect and constraints associated with these measures were also examined.[32]

5.3 Incentive Blocking Capacity Mitigating Measures

Incentive blocking measures attempt to block the open access fishery economic incentive to increase fishing fleet capacity and include:

- limited entry programs,
- buyback programs,
- gear and vessel restrictions,
- total allowable catches,
- vessel catch limits, and
- individual effort quotas.

Compliance is a problem with incentive blocking measures to control capacity. If a fishing firm is prevented from maximizing profits for its scale of production by a fishery management regulation, then an incentive has been created to circumvent the regulation. That is, if a different fishing strategy can be employed or if another factor input can be substituted for the controlled input, fishermen may violate the spirit of the regulation; e.g., widening a boat in response to a length restriction. If circumventing the regulation is not possible and the probability of detection and conviction are sufficiently low to cause the expected value of the fine to be less than the lost net revenue, then fishermen may adopt strategies to violate the letter of the regulation.

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[30] Permit moratoria or license limitation programs are examples of what the FAO TWG termed incentive blocking mechanisms. Entry by new fishermen is prevented, but existing fishermen still behave as if an open access fishery exists. As a result, the rate of growth in harvest capacity is slowed but not prevented nor is total capacity reduced.

[31] The wreckfish fishery in the southeastern region of the United States and the halibut and sablefish fisheries in the northwest region are two examples where fishery managers have changed market incentives by altering the management institution and have caused fishermen to reduce their harvest capacity.

[32] There are also selected administrative and institutional requirements and issues that arise in specific fisheries, such as the high seas and small-scale fisheries. The recommendations of the paper include the assessment of fishing capacity, policy framework, management options, monitoring and research, small scale fisheries, and industry participation.

The solution to these compliance problems is to carefully craft fisheries management regulations and to provide sufficiently large penalties and enforcement levels that the expected fine creates a sufficient disincentive for fishermen considering violating either the letter or the spirit of the regulation.

Unfortunately, no evidence exists that strict compliance will lead to a reduction in capacity in a fishery.

5.3.1 Limited entry

License limitation is not by itself a sufficient measure to reduce capacity, and it requires other mechanisms to control the rate of increase in capacity that can take the form of:

- capital stuffing (where a vessel's horsepower, length, breadth, and tonnage can increase);
- changes in gear and fishing periods or areas; and
- adoption of new technological innovations in fishing gear.

Limited entry licensing did not prove to be effective in Mexico, for example, because enforcement lacked the capability to determine if vessels actually fishing had a license (FAO, 1998).

Modifications to license limitation programs to address capital stuffing include transferability and fractionalization of licenses. Transferring of licenses allows new entry to occur as existing fishermen exit the fishery. While the charge for the license captures some of the rents generated by the stock, it does not prevent capacity from increasing over the long run. The rate of increase of capacity is reduced, but it continues to increase over time.

Fractional license programs assign each participant in a limited entry fishery a portion of a license to fish. As an example of how a fractional license would work, the holder of such a license would be required to buy another fractional license from another fisherman to obtain a whole license. As a result, the total number of license holders in a fishery could be reduced.

5.3.2 Buyback programs

Vessel and license buyback programs are being proposed and increasingly used as a management instrument to reduce excess fish harvesting capacity. Such program literally buy and removes vessels and/or licenses from a fleet to decrease capacity. Many countries have experience in operating buyback programs including Japan, the United States, Canada, Norway, Australia, the European Community, and Taiwan.

Similar motivations and goals existed in each program even though the mechanics differed; some programs purchased licenses instead of vessels, whilst others restricted license use or participation in commercial fishing. Typically, the conservation of fish, improvement of economic efficiency through fleet rationalization, and transfer payments (such as disaster aid to the fishing industry) are the goals of vessel buyback programs.

Holland, Gudmundsson, and Gates (1999) examined vessel and permit buyback programs in a number of fisheries around the world to evaluate their efficacy and discovered that, while the program objectives are usually similar, the design details of the different buyback programs varied widely. The authors concluded that, although the proper design of buyback programs can improve the immediate performance of this sort of approach, the programs have not generally been an effective way to achieve their stated goals of reducing capacity.

At best, buyback programs may reduce capacity be reduced in a fishery in the short run; however, as long as the open access fishery incentives remain, improvements in stock abundance will attract additional capacity into the fishery. If the market incentives are corrected through regulatory and management changes, then individual fishermen are more likely to conserve their resource stocks including the stock of fish and then buyback programs would be more effective because then resource rents are captured by the regulatory instrument that grants access to the fishery.

5.3.3 Gear and vessel restrictions

Gear and vessel restrictions attempt to control capacity by controlling the use of inputs in the production of fishing effort. Minimum mesh sizes (New England Groundfish Fishery), restrictions on the number of pots or traps (Florida Spiny Lobster Fishery), limits on the length of longlines, or the banning of gear (Florida trawl gear) are methods that have been employed in various fisheries. Regulating a vessel's physical characteristics to control capacity have also been used.

In general, fishermen circumvent the regulations by substituting other factor inputs or new types of gear for the inputs that have been restricted. Vessel length restrictions have been circumvented by increasing the beam of a vessel or improving the horsepower of its power plant. In the Florida finfish fishery, fishermen substituted tarps for trawl nets and continued to fish under a net ban.

5.3.4 Total allowable catch

Total allowable catch (TAC) is used to maintain or rebuild fish stocks by establishing catch quotas for domestic fisheries, to allocate a fish stock between different fishing gears or user groups, and to allocate international stocks between nations.

At the Technical Working Group meeting, "There was general agreement that TACs used in isolation in virtually all situations are an invitation to disaster, that is, to speedy growth of fishing capacity" (FAO, 1998). As stocks of fish recover due to reduced fishing mortality, rents appear and attract new capacity into the fishery if entry of new fishermen or the expansion of existing fishing effort is not controlled. As a result, a race for fish or fishing derby develops that results in increased harvest capacity, shorter fishing seasons, and higher harvesting costs needed to land the same amount of fish in a shorter period of time. When approaching the limits of a binding TAC, sufficient real time data may be difficult to obtain to use as a basis to close the fishery, resulting in frequent overruns of the TAC.

These large landings over short time periods frequently result in excess processing capacity; i.e., the peak load problem. This results in excess-capacity and idle capacity in the fish processing sector.

5.3.5 Vessel catch limits

Individual vessel catch limits are a form of individual quota without transferability between fishermen.

By restricting the amount of fish landed, the race for fish can be slowed which is one indication of excess capacity in a fishery. Staggered or tiered catch limits have been used in fisheries to allow full time or specialist fishermen higher catch limits than part time or generalist fishermen; e.g., the Gulf of Mexico red snapper fishery. Fishermen could circumvent catch limits by landing fish at out of the way docks and ports. Vessel catch limits could have applications in community-based fisheries and where landing sites are restricted.

5.3.6 Individual effort quotas

Individual effort quotas (IEQs) limit the fishing effort a fishing craft can apply to a fishery. Usually a restriction is placed on trawl time, time away from port, or fishing days that the vessel can employ. Where IEQs are transferable, fishermen can purchase IEQs from existing fishermen or sell to new entrants. However, as with vessel catch limits, enforcement is difficult since effort is expended away from port and restrictions can be evaded.

As with gear and vessel restrictions, capital stuffing is a common occurrence under IEQ programs. While days fished or trawl time may remain constant, the fishing power of the vessel can be increased by substituting other factor inputs in the production process for the fixed effort variable causing the effective fishing effort of the vessel to increase. As a result, fleet capacity can increase over the long run.

5.4 Incentive Adjusting Capacity Correcting Measures

Incentive adjusting measures offer long run strategies to control capacity by changing the regulatory environment to create market incentives that causes fishermen to adjust their fishing capacity. Measures in this category include:

- individual transferable quotas (ITQs),
- taxes,
- royalties,
- group fishing rights, and
- territorial use rights (TURFs).

These sorts of fishery management regulations eliminate the open access externality by causing fishermen to behave as if they own the *in situ* fishery resource. When fishery resources are no longer

free to whomever harvests them first, fishermen are willing to invest in the future by conserving the fishery resource as well as other resources used to harvest fish.

As a result, overcapacity is eliminated in the fishery.

5.4.1 Individual transferable quotas

Individual transferable quotas (ITQs) are effective at controlling capacity in the fishery to which they are applied.

While self-adjusting with regard to capacity, ITQs are not believed to be practicable in all cases. Questions have been raised regarding the application of ITQs to highly variable fish stocks, such as the Gulf of Mexico shrimp fishery, and to multi-cohort stocks because of concerns with high-grading catch. Bycatch is another issue that has been raised with regard to ITQs that has not been adequately addressed empirically. A capacity cascade or spillover of capacity may occur if ITQs are sequentially adopted in a series of fisheries. Processors who have overinvested in inventory capacity in response to derby fisheries may face severe economic impacts if excluded from the initial ITQ allocations.

However, for fisheries in which ITQs have been applied, substantial long run declines in capacity have been observed. Moving beyond issues of improved market performance under individual transferable quota systems, Arnason, (1998), specifically addressed the effect that individual transferable quotas have had, as management instruments, on excess and overcapacity. He found that new investment in fishing capital had been reduced and that the fishing fleet contracted under the individual vessel quota system in Iceland. Indeed, in some Icelandic fisheries, the number of operating units and, as a result, fishing effort levels dropped significantly. In addition, an analysis of economic rents and the value of quota shares indicated that substantial net economic benefits were being generated by this management system.

5.4.2 Taxes

While a tax on landings is theoretically equivalent to ITQs in reducing capacity in a fishery, little empirical evidence of their actual impacts is available.

A serious problem in developing taxes is determining the optimal tax rate to apply to the fishery at each point in time. That is, the amount of capacity in a fishery depends upon the abundance of fish, the ex-vessel price, and the unit cost of fishing effort at each point in time. As costs, prices, and abundance fluctuate, capacity levels need to be adjusted by the appropriate tax. The tax needs to be adjusted on a timely basis. With ITQs, these adjustments occur in the ITQ market automatically to determine the optimal capacity level. With taxes, a government authority has to determine the appropriate level and when to change it to optimally control capacity. In Asian countries, a tax on landings caused widespread protests amongst small scale fishermen and consumers who expected the taxes to result in higher prices (FAO, 1998).

5.4.3 Royalties

Royalties are similar to a tax on landings in their effect on reducing capacity.

A fee paid per pound of fish landed or on quota holdings to the managing authority would theoretically reduce the ex-vessel price received by fishermen which would slow the rate of growth in harvest capacity in a fishery. New Zealand is the only country that has tried this approach prior to implementing management cost recovery. In the United States, this method is used by the Department of Interior for recovering rents in natural resource extraction activities (e.g., offshore oil leases) and could be employed in fisheries management.

5.4.4 Group fishing rights

Community-based and co-management systems have been introduced in several countries with some success at controlling and reducing capacity. However, they are not expected to perform well where there is no institution building capability, when membership cannot be restricted, or when the ability to enforce rights and rules does not reside with the community.

For group fishing rights systems to be effective, it is essential that the group be able to exclude outsiders; i.e., that the group right is enforceable. In addition, if the costs of reaching an enforceable

agreement (transaction costs) are not too great, community based management may be fully efficient. If the transaction costs are too high, the outcomes may be undesirable.

Community-based management methods have proven to be effective in some cases; e.g., Senegal, Japan, and, during the 1940's and 1950's, the Gulf of Mexico shrimp fishery.

In the United States, the National Marine Fisheries Service (NMFS) and the Fisheries Management Council system may be considered a co-management system that has been unsuccessful in controlling capacity in domestic fisheries.

Community-based management is attractive because of the improved proximity of the decision-makers to the consequences, but the wide scope of potential decisions and outcomes means that capacity issues may not be adequately resolved. Quite simply, because community-based management still result in the application of any method for governing capacity decisions within the community, there is the possibility of using incentive-blocking measures to mitigate, not correct, capacity problems.

Nonetheless, a number of exceptions to this general result exist and where groups have adopted capacity correcting measures. In the United States examples of this include: the wreckfish fishery in the southeastern region, the halibut and sablefish fisheries in the northwest and Alaskan fisheries, and the surf clam fishery in the mid-Atlantic region of the United States. Similarly, the Community Development Quotas (CDQs) instituted for Alaskan native tribes serve as an example of an effective group fishing rights program: because the community can effectively control effort, they are able to reduce capacity.

5.4.5 Territorial use rights (TURFs)

TURFs are another means to control capacity by causing fishermen to behave as if property rights for a fishing ground exist. Access to, and use of, a particular fishing ground or site is restricted to a small group or an individual, and this group can determine how to harvest fish from the site and to whom the fish gets allocated.

Oyster leases can be considered a form of TURFs, and a study comparing private ownership to public access revealed that the TURFs resulted in both a reduction in capital investment and an increase in labor employed to harvest oysters (Agnello and Donnelley, 1976).

5.5 Strategic Capacity Management

There is a plethora of management tools that can be used in the effort to try to mitigate or otherwise manage capacity problems.

The most durable solutions to overcapacity in fisheries come under the category of incentive adjusting capacity correcting measures, but the use of these strategies may actually require changing existing management approaches, and this is not necessarily simple to do. Alternative, interim measure can be implemented, but then consideration must be given to both the near and longer term incentives and impacts that these measures create. Ultimately, the actual adoption of capacity mitigating or capacity correcting measures is a political decision and, as such, may not necessarily relate directly to the most technically efficient strategy.

6 Capacity Measurement: Considerations for Management

6.1 Capacity Management Considerations – the simplest case

No simple management solutions exist to the problems of *excess* capacity and *overcapacity* in fisheries, even in the simplest case.

Advice to managers must include both short run and long run considerations, and the advice must distinguish between *excess* capacity and *overcapacity* - since the two imply different policy choices.

6.1.1 Reduction issues

If *overcapacity* is high relative to current (depleted) resource conditions but less so relative to the long run target (rebuilt) resource condition, managers may want to introduce temporary regulations to reduce fishing effort, rather than developing plans for a large scale permanent reduction in fleet size.

However, if capacity levels at current conditions also exceed optimal capacity levels corresponding to long term target conditions, a joint policy of capacity and fishing effort reduction may be appropriate.

Thus, advice regarding capacity and considerations for its management should be formulated in terms of:

- whether the current fleet size is commensurate with the current target catch level (the TAC);
- whether the current fleet size is commensurate with a specific, operational set of fisheries management objectives corresponding to some target level of output;
- in the cases of depleted stocks - whether the fleet size is commensurate with the projected target catch corresponding to a target stock biomass; or
- in the cases of booming stocks - whether the fleet size is commensurate with the projected target catch corresponding to a target stock biomass.

6.1.2 Implementing issues

Managers also need to appreciate the myriad of difficulties of implementing explicit capacity reduction programs.

For example, when one input is reduced, it is both possible and reasonable to expect that a substitute input can be increased to offset the impacts of capacity reduction efforts. Thus, while a regulation reducing the days absent from port to reduce time spent fishing could theoretically reduce capacity, the real result may be an that fishermen increase the horsepower of their fishing craft to reduce the travel time spent getting to the fishing grounds - thereby effectively increasing the proportion of days spent fishing.

In addition, even if there are not incentives caused by regulations or management strategies, the capacity in a fishery may also increase over time simply due to technological improvements in fishing gear.

It is also important to remember that the management advice from these quantitative and qualitative approaches is limited without additional social and economic information, and this is particularly important with respect to trying to determine *overcapacity*. Determination of *overcapacity* implies that capacity exceeds some desired level, but determining optimal capacity levels must take account of the social and economic context within which the fishery or fisheries are operating. Social and economic considerations will also be of paramount importance in the design of capacity reduction programs.

To achieve a enduring reduction of capacity, it is preferable to make changes in the regulatory institutions so that fishermen have a market incentive to reduce capacity, simply because changes in regulated, open access fishery management regimes will provide only short run relief from overcapacity. Regardless, any proposed management regulations must be carefully crafted by fishery managers and tested prior to their adoption to ensure they meet their goals and objectives – and this frequently means that additional research needs to be completed before the impacts of proposed regulations on fleet capacity levels can be determined.

6.2 Capacity Management Considerations – beyond the simple case

Concerns about designating a desired level of output are particularly important when moving beyond the simplest case of a single stock, a single homogeneous stakeholder group, and single fisheries jurisdiction.

Dealing with heterogeneous fisheries that are characterized by multiple cohorts, species, stocks, fishing areas, different groups of fishermen, and also combinations of consumptive and non-consumptive user groups rapidly increases the complexity of management.

6.2.1 Multiple stakeholder groups

In fisheries where there are different groups of fishermen, it is important to recognize the potential social and economic impacts of capacity reduction programs on the different sectors. If, for example, a fishery includes both artisanal and industrial fishermen, yet the management objective for a fishery is to maximize foreign trade revenue using a large scale industrial fleet, the artisanal fishers may loose a source of food and/or income that is necessary for their sheer survival.

Multiple output measures of capacity can be developed using either DEA or SPF techniques, but selecting a desired target level of output or the appropriate configuration for the resulting fishing fleet once overcapacity is eliminated is a serious policy question deserving special attention.

The analysis necessary to determine the composition of the resulting fishing fleet has not been done in the literature, but theoretically could be developed if fishery managers identified their policy objectives. Bioeconomic models of commercial and recreational fisheries have been developed[33] and, although these models do not deal directly with capacity utilization in fisheries, they could be adapted to determine the impact of management regulations on both fleet size and fleet composition for different user groups in the fishery.[34]

6.2.2 Variable fish stocks

In fisheries where the stocks are randomly variable, optimal fishing capacity may not be linked with fishing effort the way it is in more stable stocks, and the matter of coping with stochastic variations becomes even more complex.

Hannesson (1993) considered the choice of optimum fishing capacity for fish stocks that vary at random and where optimum fishing capacity is normally a decision variable that is separate from fishing effort. The optimum fishing capacity is shown to depend on the price of fish, the cost of capacity, and the "harvest rule" that links the permitted catch to the size of the fish stock. Operating costs may also influence the optimum capacity through the effect of stock "thinning" on the cost per unit of fish caught and the level at which further depletion becomes unprofitable.

6.2.3 High seas fisheries

There has been recognition of the fact that the high seas may be confronted with an even greater overcapitalization problem than EEZ fisheries. This is due both to the prevalence of open access conditions and to the fact that there are presently no internationally agreed measures that would require states to control fishing capacity on the high seas.

Thus, in the absence of strong regulatory frameworks, the first step of the solution has been to recommend the ratification of the 1995 UN Straddling Stocks Agreement[35] and the FAO Compliance

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[33] See Seijo, Defeo, and Salas (1998), Ward (1994), Ward and Keithly (1998), Ward and Mecinko (1996), Grant, Isakson, and Griffin (1981), and Thunberg, (1995).

[34] The benefits of using such models are significant, because they could be used to develop effective capacity reduction regulations prior to their adoption in a particular fishery. Once a strategy is found that conforms with the management objectives of the fishery, then a regulation could be developed that would selectively reduce capacity in only those sectors of the industry necessary to eliminate overcapacity. Quantitative measures of capacity utilization using DEA or SPF techniques could then be used to monitor the fishery to ensure that overcapacity did not reassert itself.

[35] The United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks. The Agreement was adopted on 4 August 1995 by the United Nations Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks, was open for signature from 4 December 1995 until 4 December 1996, and was signed by 59 States and entities. The Agreement is in force as from 11 December 2001.

Agreement.[36] Further capacity management suggestions, such as those from the 1998 FAO TWG, include a variety of complementary measures:

- improving monitoring mechanisms for high seas fleets;
- strengthening and empowering regional fishery organizations;
- creating new organizations to ensure full coverage of the resource concerned;
- controlling the disposal of excess national capacity in general, and of older vessels to developing countries in particular; and
- in addressing the growing importance of flags of convenience in illegal, unreported, and unregulated fishing.

6.3 Capacity, Capacity Management, and Beyond

As was stated at the beginning of this section, there are no simple management solutions to the problems of *excess* capacity and *overcapacity* in fisheries.

Management considerations regarding capacity and capacity reduction programs have to recognize and accommodate:

- temporal issues – such as the differences between short term and long run options and solutions,
- social and economic issues, and the impacts of capacity reduction on the primary and secondary sectors that may be affected by capacity reduction programs;
- legal, political and jurisdictional issues – such as the differences in governance and management structures for national and international waters; and, last but not certainly the least,
- the advice must distinguish between *excess* capacity and *overcapacity* - since the two situations imply different sets of policy choices and actions.

None of these are easy issues to deal with, and there is an enormous need to improve national and international research, institutional, and management capabilities in order to move forward and to be able to properly address the many issues pertaining to the effective control and reduction of fishing capacity.

[36] Agreement To Promote Compliance With International Conservation And Management Measures By Fishing Vessels On The High Seas

7 References

Anderson, Lee G. (1986). The Economics of Fisheries Management. 2nd edition. The Johns Hopkins University Press, Baltimore.

Arnason, Ragnar (1998). "Notes on the Impact of ITQs in Iceland." Technical Working Group on the Management of Fishing Capacity, FAO, La Jolla CA, April 15-18, 5 pp.

Ballard, Kenneth and James Roberts (1977). "Empirical Estimation of the Capacity Utilization Rates of Fishing Vessels in 10 Major Pacific Coast Fisheries." Office of Scientific and Technical Services, Washington, D.C., March, 35 pp.

Banks, Richard (1998). "Adjustments to Fishing Capacity in the European Union." Draft Report, Technical Working Group on the Management of Fishing Capacity, La Jolla, CA, U.S.A., April 15-18, Nautilus Consultants, March, 29 pp.

Bardarson, Hermann and Terje Vassdal (unknown). "Efficiency in Norwegian Trawl Fisheries; A Nonparametric Frontier Production Analysis." Draft report, Norwegian College of Fishery Science, University of Tromso, Breivika, –9037 Tromso, Norway.

Battese, George E. and Sumiter S. Broca (1996). "Functional Forms of Stochastic Frontier Production Functions and Models for Technical Inefficiency Effects: A Comparative Study for Wheat Farmers in Pakistan." No. 4/96, CEPA Working Papers, Department of Econometrics, University of New England, Armidale, NSW 2351, Australia, 26 pp.

Bhattacharyya, Arunava, Thomas R. Harris, Rangesan Narayanan, and Kambiz Raffiee (1995). "Technical Efficiency of Rural Water Utilities." Journal of Agricultural and Resource Economics, 20(3): 373-391.

Clark, Colin W. (1990). Mathematical Bioeconomics, The Optimal Management of Renewable Resources, Second Edition. John Wiley & Sons, Inc., New York.

Cook, B.A. (1990). "Maximum Social Returns for Canada's Pacific Halibut Fishery." North American Journal of Fisheries Management, 10:11-18.

Cunningham, Stephen and D. Greboval (2001). "Management of Fishing Capacity: A Review of Policy and Technical Issues." FAO Fisheries Technical Paper, No. 409, Rome, FAO, 60 pp.

Di, Jin, Eric Thunberg, Hauke L. Kite-Powell, and Kevin Blake (2000). "Total Factor Productivity Change in New England Fisheries: 1964-1993." Draft Report, Marine Policy Center, Woods Hole Oceanographic Institution, Woods Hole, February, 42 pp.

Edwards, Steven F. and Steven A. Murawski (1993). "Potential Economic Benefits from Efficient Harvest of New England Groundfish." North American Journal of Fisheries Management, 13: 437-449.

Fare, Rolf, Shawna Grosskopf, and James E. Kirkley (2000). "Multi-Output Capacity Measures and Their Relevance for Productivity." Bulletin of Economic Research, 52(2)101-112.

Fare, R. S. Grosskopf, and V. Valdmanis (1989). Capacity, Competition, and Efficiency in Hospitals: A Nonparametric Approach. Journal of Productivity Analysis, (2), 123-138.

Fitzpatrick, J. 1995. "Technology and Fisheries Legislation." Paper presented to the International Technical Consultation on the Precautionary Approach to Capture Fisheries. Lysekil, Sweden, 6-13, June, 1995.

Food and Agriculture Organization Fisheries Department (1998). "FAO Technical Working Group on the Management of Fishing Capacity." Preliminary Version, Technical Working Group on the Management of Fishing Capacity, FAO, La Jolla CA, April 15-18, Food and Agriculture Organization of the United Nations, Rome, Italy, 41 pp.

Food and Agriculture Organization Fisheries Department (1998). "Report of the Technical Working Group on the Management of Fishing Capacity." FAO Fisheries Report No. 586, FAO, La Jolla CA, April 15-18, Food and Agriculture Organization of the United Nations, Rome, Italy, 57 pp.

Garcia, S.M. and C. Newton. 1995. "Current Situation, Trends and Prospects in World Capture Fisheries." Presented at the Conference on Fisheries Management, Global Trends, Seattle (Washington, U.S.A.), June 14-16, 1994, FAO Fisheries Department, Rome Italy, 10 pp.

Grant, W.E., K.G. Isakson, and W.L. Griffin (1981). "A General Bioeconomic Simulation Model for Annual Crop Marine Fisheries." Ecological Modeling, 13:195-219.

Greboval, Dominique and Gordon Munro (1999). "Overcapitalization and Excess Capacity in World Fisheries: Underlying Economics and Methods of Control." In Dominique Greboval (ed.), "Managing Fishing Capacity." FAO Fisheries Technical Paper 386, Food and Agriculture Organization of the United Nations, Rome, Italy.

Hannesson, Rognvaldur (1978). Economics of Fisheries, An Introduction. Universitetsforlaget, Begen, Columbia University Press, New York.

Hannesson, Rognvaldur (1987). "Optimal Catch Capacity and Fishing Effort in Deterministic and Stochastic Fishery Models." Fisheries Research, 5:1-21.

Hannesson, Rognvaldur (1993). "Fishing Capacity and Harvest Rules." Marine Resource Economics, 8(2):133-143.

Holland, Daniel S., Eyjolfur Gudmundsson, and John Gates (1999). "Do Fishing Vessel Buyback Programs Work: A Survey of the Evidence." Marine Policy, 23(1):47-69.

Hsu, T. (2000). "Simple Capacity Indicators for Peak-To-Peak and Data Envelopment Analyses of Fishing Capacity - A Preliminary Assessment." Executive Summary, AGR/FI/RD(2000)9, COFI, Paris, France, Organization for Economic Co-operation and Development, 5 pp.

Japan, Government of (2001). "Implementation of the FAO International Plan of Action for the Management of Fishing Capacity." Preliminary Assessment of Fishing Capacity in Major Fisheries, February.

Johansen, Leif. 1968. "Production Functions and the Concept of Capacity." In Recherches Recentes sur la Fonction de Production." Namur: Centre d:'Etudes et de la Recherche Universitaire de Namur.

Kirkley, James E. (1998). "Concepts of Capacity, Capitalization." Virginia Institute of Marine Science, School of Marine Science, College of William and Mary, Gloucester Point, VA.

Kirkley, James E. and Dale Squires (1988). "A Limited Information Approach for Determining Capital Stock and Investment in a Fishery." Fisheries Bulletin, 88(2): 339-349.

Kirkley, James and Dale Squires. 1998. Measuring Capacity and Capacity Utilization in Fisheries. Background paper prepared for FAO Technical Working Group on the Management of Fishing Capacity, La Jolla, USA, 15-18 April, 160 pp. Forthcoming, FAO Fisheries Report.

Kirkley, James E. and Dale Squires (1999). "Capacity and Capacity Utilization in Fishing Industries." Discussion Paper 99-16, Department of Economics, University of California, San Diego, July, 38 pp.

Kirkley, James, Dale Squires, and Ivar Strand. 1995. "Technical Efficiency in Commercial Fisheries," American Journal of Agricultural Economics, Vol. 77, No. 4, pp. 686-697.

Kirkley, James, Dale Squires, Mohammad Ferdous Alam, and Ishak Haji Omar (1999). "Capacity and Offshore Fisheries Development: The Malaysian Purse Seine Fishery." Draft report, Virginia Institute of Marine Science, VA, April, 36 pp.

Kirkley, James E., Rolf Fare, Shawna Grosskopf, Kenneth McConnell, Dale E. Squires, and Ivar Strand (1999). "Assessing Capacity and Capacity Utilization in Fisheries When Data are Limited." Draft report, College of William and Mary, School of Marine Science, Gloucester Point, VA, September, 37 pp.

Klein, Lawrence R. 1960. "Some Theoretical Issues in the Measurement of Capacity," Econometrica, Vol. 28, pp. 272-286.

Mace, Pamela M. 1996. "Developing and Sustaining World Fisheries Resources: the State of the Science and Management." Keynote Presentation, World Fisheries Congress, Sidney, Australia, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD.

Morrison, Catherine J. (1985). "On the Economic Interpretation and Measurement of Optimal Capacity Utilization with Anticipatory Expectations." Review of Economic Studies, 52(169): 295-310.

Reinhard, Stijn and Geert Thijssen (1998). “Resource Use Efficiency of Dutch Dairy Farms: A Parametric Distance Function Approach.” Paper presented at the American Agricultural Economics Association Annual Meeting in Salt Lake City, Agricultural Economics Research Institute, P.O. Box 29703, 2502LS The Hague, The Netherlands, May, 14 pp.

Seijo, J.C., O. Defeo, and S. Salas (1998). “Fisheries Bioeconomics, Theory, Modelling, and Management.” FAO Fisheries Technical Paper No. 368, Food and Agriculture Organization of the United Nations, Rome, 108 pp.

Smith, Courtland L. and Susan S. Hanna (1990). "Measuring Fleet Capacity and Capacity Utilization." Can. J. Fish. Aquat. Sci., 47:2085-2091.

Sutinen, J.G., Lee G. Anderson, James Kirkley, Cathy Morrison Paul, Rolf Fare, and Bob O’Boyle (2001). "Report of the Expert Group on Fish Harvesting Capacity." Contract No. 40-AA-NF-109717, Office of Sustainable Fisheries, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD, June, 44 pp.

Thunberg, Eric (1995). “Bio-Economic Analysis of Alternative Selection Patterns in the United States Atlantic Silver Hake Fishery.” In, Bio-Economic Modelling in the EU, Concerted Action Coordination of Research in Fishery Economics, Working Document Nr: 7,(AIR CT94 1489), Workshop, Edinburgh, October: 100-128.

Ward, John M. (1994). "The Bioeconomic Implications of A Bycatch Reduction Device as a Stock Conservation Management Measure." Marine Resource Economics, 9(3):227-240.

Ward, John M. and Walter R. Keithly, Jr. (1998). “Practical Implications of Property Rights Based Management Using Empirical Models of a Common Property Fishery: The Case of the Gulf of Mexico Shrimp Fishery.” Fisheries Management and Development Presentation, Ninth IIFET Conference, Norway.

Ward, John M. and Seth Macinko (1996). "Static and Dynamic Implications of a Gear Modification Designed to Reduce Bycatch in a Stylized Fishery.” The Southern Business and Economic Journal, 19(4):273-292.

Ward, John M., Theo Brainerd, and Matteo Milazzo (2000). “Assessing Capacity and Excess capacity in Federally Managed Fisheries, A Preliminary and Qualitative Report.” National Marine Fisheries Service, Offices of Science and Technology and Sustainable Fisheries, Silver Spring, Maryland, September, 131 pp.

Ward, John M., Theo Brainerd, Steve Freese, Pamela Mace, Matteo Milazzo, Dale Squires, Joe Terry, Eric Thunberg, Mike Travis, and John Walden (1999). “Report of the National Task Force for Defining and Measuring Fishing Capacity.” National Marine Fisheries Service, Office of Science and Technology, Silver Spring, Maryland, June.

Ward, John M., Theo Brainerd, Matteo Milazzo, Eric Thunberg, Andrew Kitts, John Walden, Mike Travis, Joe Terry, Todd Lee, Dan Holland, Jim Hastie, Dale Squires, Sam Herrick, Marcia Hamilton, Karyl Brewster-Geisz, and Rebecca Lent (2001). “Identifying Harvest Capacity and Overcapacity in Federally Managed Fisheries, A Preliminary and Qualitative Report.” National Marine Fisheries Service, Offices of Science and Technology and Sustainable Fisheries, Silver Spring, Maryland, March, 118 pp.

III-2. Provisional Discussion Elements

Setting the Scene for the Expert Consultation

Overcapacity is often cited as the primary cause of overfishing, economic waste, and the unsustainable development of living marine resources. Numerous international and domestic fisheries studies indicate that overcapacity and excessive fish harvesting capacity are prevalent in many common property and open access fisheries, regardless of the scale of fishing or the type of fishery. Overcapacity and excessive fish harvesting capacity can also occur in limited access fisheries. Wherever these situations occur, overcapacity contributes to overfishing, economic waste and unsustainable development.

One of the great challenges to achieving sustainable fisheries involves the management of fishing capacity in such a way that avoids or, at least, mitigates the deleterious effects – such as overfishing and/or economic inefficiency - of overcapacity.

Objective of the Expert Consultation

The expert consultation *Catalysing the Transition away from Overcapacity in Marine Fisheries* is an opportunity to gather experts from a diversity of technical backgrounds – including resource economics, marine policy, biology, marine and coastal management - and cultural backgrounds – including South America, Southeast Asia, Oceania, North America, and Europe.

The group will discuss and provide guidance on ways to facilitate the adoption and implementation of capacity reduction programs and, more specifically, on the difficulties associated with adopting and implementing such programs. In doing so, and as part of the issue of how to get various stakeholders to embrace capacity reduction programs, the guidance will likely also offer ideas on how to mitigate the negative effects of capacity reduction programs.

As stated in the Prospectus:

> *The purpose of the Expert Consultation will be to identify and outline innovative strategies and mechanisms for reducing overcapacity and subsequently avoiding the regeneration of overcapacity*.

The Expert Consultation recognizes the need to catalyze political will, partnerships, and policy reforms in order to create capacity reduction programs are going to be. Thus, the participants will work to:

- identify the sorts of approaches that can be used to implement both incentive blocking and incentive adjusting strategies for managing situations of overcapacity;
- identify impediments to introducing and implementing capacity reduction programs;
- identify innovative opportunities and strategies for overcoming impediments to reducing overcapacity – such as innovative opportunities for investing in disinvestment; and
- suggest elements for ensuring the ongoing success of a capacity management package.

In addition, the Expert Consultation will cover issues such as subsistence, employment, and the raising of revenues and foreign exchange in various types of industrial fisheries. The discussions will also take into account the flow-on and downstream effects that adjustment programs can have on other sectors, including artisanal fisheries sectors.

Approach of the Expert Consultation: Facilitated discussion of issues within the context of three situations

As a basis for discussions, the Expert Consultation will make use of (i) a background paper, and (ii) a framework of three situations that will help to focus discussions on a variety of possible topics/issues and/or impediments.

(i) The background paper briefly summarizes current knowledge and issues regarding fish harvesting capacity and provides a synthesis of both measurement studies and management strategies.

(ii) Three situations will be used as the basis for the more specific discussions during the expert consultation.

Each skeleton situation below describes a possible circumstance in which a capacity reduction program may be applied. Although the situations may reflect conditions found in many parts of the world, they are not intended to refer to any one particular real fishery.

These situation descriptions are intentionally simplistic. The idea is to let these cases provide a basic framework for the group's discussions about various topics/issues that might need to be considered when trying to get capacity reduction programs adopted and implemented.

Examples of the actual sorts of topics / issues that may either help or prevent the adoption or implementation of capacity reduction programs are also listed below.

Using brainstorming and other facilitation techniques, the participants will generate their guidance on how to catalyze the transition away from overcapacity.

Results & Outputs

The principal output expected from the expert consultation will be guidance on how to catalyze the transition away from overcapitalized fisheries. (Tentative title: Catalysing the Transition from Overcapacity: Guidelines of the Rome Expert Consultation: Report of the expert consultation on catalysing the transition from overcapacity, Rome, 2002)

The principal output will be available prior to the 25th session of the FAO Committee on Fisheries (COFI) that is being held in Rome in 2003.

Framework Situations

Situation 1 – Overcapacity in an industrial fishery

Stock:
- single stock
- not highly variable

Fleet & Participants:
- single industrial fleet

Jurisdiction
- single jurisdiction

Situation 2 – Overcapacity in a small-scale fishery

Stock:
- single stock
- not highly variable

Fleet & Participants:
- single small scale fleet
- large numbers of participants

Jurisdiction
- single jurisdiction

Situation 3 – Overcapacity in a mixed-scale fishery

Stock:
- two stocks
- not highly variable

Fleets & Participants::
- two relatively homogeneous fleets – one artisanal, one industrial
- identified participants in the industrial portion of the fishery
- "reasonable" numbers of participants in the artisanal portion of the fishery

Jurisdiction
- single jurisdiction

Possible Topics and Issues for Consideration

When trying to generate interest and support for capacity reduction programs, it may be useful to be aware of:

- Politics and the political environment(s) in which the program is being developed, adopted and implemented;
- Management and managerial issues;
- Economic development strategies and development objectives;
- Social concerns;
- Financial issues; and
- Legal issues.

It may also be useful to consider how these different elements may facilitate or prevent the adoption and subsequent implementation of capacity reduction programs.

A few, more specific examples of just some of the issues that may be – or may not be – of relevance to fisheries managers when trying to design, gather support for, and successfully implement capacity reduction programs are listed below. *This list is clearly not complete. It is intended to inspire additional ideas and issues for consideration by the participants.*

TOPIC	POTENTIAL ISSUES RELATING TO CAPACITY REDUCTION ACTIVITIES
POLITICAL ISSUES & CONSIDERATIONS	Direct Issues & Considerations Current political environment and electoral issues food security revenues direct trade / foreign exchange flow-on Effects / impacts on Non-Fishing Sectors displacement impacts food & civil security non-harvesting uses (other sectors including tourism, conservation, non-fishing recreation, industry) recreational fishing use flow-on Effects / impacts on Subsistence & Artisanal Sectors food & civil security displacement impacts

MANAGERIAL ISSUES & CONSIDERATIONS	Direct Issues & Considerations management capacities current actual state of management / management situation current stock condition current condition of fleet(s) changes to current management ability to implement changes ability to enforce changes flow-on Effects / impacts on Subsistence & Artisanal Sectors food & civil security displacement impacts
ECONOMIC ISSUES & CONSIDERATIONS	Explicit Funding Mechanisms for adopting capacity correcting measures and implementing capacity correcting measures for implementing capacity mitigating measures for repeating capacity mitigating measures Implicit Funding Mechanisms domestic considerations issues potentially enhancing or accelerating capacity reduction programs issues potentially detracting from or impeding capacity reduction programs achieving multiple objectives timeframes regional considerations enhancing considerations distracting considerations achieving multiple objectives timeframes international considerations enhancing considerations distracting considerations achieving multiple objectives timeframes

LEGAL ISSUES & CONSIDERATIONS	national considerations International considerations regional considerations timeframes
FINANCIAL ISSUES & CONSIDERATIONS	Revenue Raising – Capacity Mitigating / Conditional Investment in Disinvestment Sources fishing sector at-large fishery-by-fishery basis international / regional / national private governmental Repayment Options industrial other sectors
SOCIAL & CULTURAL ISSUES & CONSIDERATIONS	Employment social safety net employment of last resort Effects / impacts on Targeted Sector income / livelihood security food & civil security livelihoods displacement impacts flow-on Effects / impacts on Subsistence & Artisanal Sectors food & civil security displacement impacts alternative livelihoods flow-on Effects / impacts on Other Sectors food & civil security displacement impacts non-harvesting (tourist) use recreational fishing use

This publication contains the final report and background documentation of the *Expert Consultation on Catalysing the Transition away from Overcapacity in Marine Capture Fisheries* held in Rome, Italy, from 15 to 18 October 2002.

The Expert Consultation was intended and designed to develop a set of general recommendations to assist in addressing the difficult subject of overcapacity in marine capture fisheries. The result is guidance about a general, flexible process for assisting the transition of fisheries that are characterized by overcapacity into fisheries that are characterized as fully utilized, economically efficient *and* that meet the management objectives and goals of the agency or group that has fisheries management responsibility. The experts recognized that different fisheries will likely adopt different capacity reduction programs to reflect particular social, management, economic, and other needs. Because there is no single solution, capacity reduction programs will likely be a combination of some of the issues and approaches that are also described in the documentation.