

## Introduction

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Rebuilding depleted fisheries and maintaining sustainable fish stocks is the central objective of fisheries management. At the international level this is espoused through agreements such as the UN Convention on the Law of the Sea, the UN Fish Stocks Agreement, and most recently through the World Summit on Sustainable Development (WSSD) commitment to rebuild fish stocks to maximum sustainable yield (MSY) levels by 2015. In addition, ensuring a profitable fishing industry that supports coastal communities where few alternatives may exist, maintaining biodiversity and ensuring food security are key drivers for rebuilding fisheries. From an economic point of view, recent studies have estimated the lost rent from not rebuilding fisheries; the FAO/World Bank estimates that this could be as much as 50 billion USD each year. Moreover, many experts suggest that a necessary first step to rebuilding fisheries is evident and generally effective: a rapid reduction of fishing effort for overfished and depleted fisheries. But if that is the case, why does FAO data indicate that the percentage of overfished and depleted fisheries have been increasing, and now represent almost 30% of fisheries globally?

A closer examination of the problem demonstrates that there are many complexities involved in the development and implementation of fisheries rebuilding plans. While UNCLOS codified a 200-mile exclusive economic zone (EEZ) that provided countries with the ability and the responsibility to manage fisheries, much of the oceans are not under the exclusive jurisdiction of one country. Regional fisheries management organizations (RFMO) have been established to develop a collaborative management process for straddling and high seas stocks and are bound by the need for consensus based approaches to fisheries management, but are constrained by limited jurisdictional authorities as well as by enforcement issues and funding limitations. At the same time, exclusive jurisdiction does not necessarily guarantee sustainable fisheries. While the fisheries legislation of many OECD countries either explicitly or implicitly encourages, or perhaps requires rebuilding, there are often other factors that influence the decision making process, including the human dimension of fisheries adjustment. In order to successfully rebuild fisheries, close collaboration among stakeholders and government authorities will be necessary to ensure that the best available information is suitably utilized and that all participants in fishery rebuilding are effectively involved.

Against this backdrop of international commitments, domestic needs, and competing goals - social, biological and economic - it becomes apparent that a holistic approach to rebuilding fisheries is necessary. To be effective, fisheries rebuilding should be based on

the analysis of the biological and economic impacts and risks of various rebuilding options and the clear and transparent communication of the associated uncertainty. The additional complexities of climate change and ecosystem interactions largely exogenous to the fisheries sector also confound efforts, and must be taken into consideration to ensure effective fisheries rebuilding.

It is in this context that the OECD's Committee for Fisheries organized a workshop on the *Economics of Rebuilding Fisheries*, as part of the Committee's ongoing project on this topic. The purpose of the Workshop was to collect information for the preparation of a final report by analysing and discussing the key economic and institutional themes that emerge in the development of fisheries rebuilding plans, and how countries have been responding to these issues.

## The Workshop

This Workshop brought together over seventy international fisheries experts with training in both economics and biology including academics, fisheries managers, and government representatives. The Workshop provided a forum to showcase the current knowledge of the key economic and policy challenges in the development and implementation of fisheries rebuilding plans. It also provided a solid overview of the technical and practical issues involved in developing appropriate indicators for rebuilding paths and timeframes as well as reviewing progress of plans. Discussions at the workshop also helped to identify what type of information is necessary and at what level of detail in order to develop robust rebuilding plans; for example, one participant noted that directional trends in stock size may be an indicator that is satisfactory for the selection of appropriate rebuilding paths, rather than trying to obtain precise numbers given that there is always some level of uncertainty around scientific estimates. Finally, the workshop provided an assessment of how information constraints may be addressed with respect to rebuilding fisheries.

Specifically, the objectives of the workshop were to:

- Identify and analyse the economic and policy issues involved in rebuilding fisheries.
- Identify the biological and economic uncertainties and information constraints that influence the choice of rebuilding paths and policy instruments.
- Review the role of institutional arrangements in delivering successful rebuilding programs.
- Review selected country and international experiences in rebuilding fisheries.

Some of the interim conclusions of this intermediate step in the research agenda are summarized below showing how the objectives were met.

The two-day workshop was composed of six sessions, each of which focussed on a particular aspect of rebuilding fisheries. Workshop participants shared the view that the key issues related to fisheries rebuilding are similar to those involved in general fisheries management. However, certain elements associated with fisheries rebuilding can be particularly complex, particularly regarding political economy aspects. In some cases, trust in the regulator may be severely diminished when there is a stock collapse, challenging the collaborative development of credible and effective fisheries rebuilding

plans. In addition, the dilemma of shifting the status quo becomes even more acute when rebuilding fisheries, unless due consideration is given to the structure of the fishery coming out of the rebuilding process. In this regard, a distinction can be drawn between *stock rebuilding* and *rebuilding fisheries*; the former is focussed more or less exclusively on the species and its habitat, while the latter would extend to the fishing industry and consider the human dimension as well, thus necessitating an economic component to rebuilding. In the case of fisheries rebuilding, the impacts of issues such as illegal or unregulated fishing are emphasized and cases of so-called institutional overfishing (where scientific-based TACs for depleted stocks are not applied) becomes amplified. As such, case studies of successful rebuilding plans become important as a way to identify best practices for not only rebuilding fisheries, but also to identify the fisheries management tools that can be applied to avoid depletion and maintain fisheries at sustainable levels.

In addition to the Introduction, the proceedings also include research papers focussing on the major themes that were presented at the Workshop; these papers represent a significant body of work that will inform fisheries rebuilding from an economic perspective, will be summarized briefly below. Finally, this publication concludes with biographies of the speakers who presented their papers at the workshop, including those who contributed a paper to this volume, followed by a list of workshop participants.

### *Day 1*

The first day was structured to set out the broad analytical context for the workshop through sessions devoted to an overview of the range of economic issues involved in developing and implementing fishery rebuilding programs; a review of the economic and biological aspects linked to the choice of stock rebuilding paths, identifying the costs and benefits of rebuilding paths, reviewing valuation methods, and addressing incomplete and imperfect data; a review of the role of risk and uncertainty in the design and implementation of rebuilding programs by identifying the types of natural, economic and political risk that can influence the outcomes of rebuilding programs and reviewing the range of institutional mechanisms for mitigating risks.

During the first day, several issues that confound rebuilding from a fisheries manager's perspective were identified, namely conflicts between competing interest groups and organizations, dealing with vested interests as well as the optimum way in which to integrate economic factors and social interest. Fisheries managers are often required to balance short term interests and costs with longer term opportunities and benefits in order to effect change in situations where there are often political implications. Some examples of rebuilding approaches were provided and it was noted that in order to raise the profile of this issue, the economic context of fisheries rebuilding should be considered, particularly the economic benefits of doing so as well as the social and economic costs of delay. In the context of global food security issues, the importance of fish as a food source was highlighted.

Another point raised during the discussions of the first day was that collaboration among biologists, economists and stakeholders is needed in order to effectively evaluate the overall costs and benefits of different rebuilding paths and targets, as well as the resultant distributional impacts. This type of collaboration would also strengthen the determination of the relative efficiency and effectiveness of various rebuilding options and measures. It was also noted that the diversity of factors that are sometimes overlooked in terms of setting rebuilding timeframes and targets include: the question of how to manage multispecies fisheries where rebuilding weak stocks may have an effect

on the overall value of mixed stock fisheries; how to address factors that may change stock productivity, including climate change; and, the potential for long-term social costs that may result when there are strict rebuilding constraints (e.g. imposed through legislation or otherwise) to attain rebuilding targets or goals in a certain timeframe.

Importantly, it was noted that the definition of an optimal rebuilding strategy is subjective, and based upon the characterization and measurement of current and future benefits and goals. For example, a basic bioeconomic model would generally indicate that the shortest timeframe to rebuild a stock is ideal through cessation of fishing until the objective is reached. However, there are economic and technical factors that may rationalize a slower path towards rebuilding and should be considered; these would include elements such as the inverse relationship between landings and prices; increased marginal costs of harvest; high discount rates; the potential loss of processing capacity and market access; and, possible social disruption. It was also noted that the fishing industry generally opted for approaches that allow for a certain level of harvest over time, with few sudden peaks or lows; the point was made that while this may be considered as delaying the inevitable in the case of depleted fisheries, it may be optimal from an economic point of view to have a uniform rate of change in allowable harvest levels.

## *Day 2*

Day 2 of the Workshop focussed on implementation experiences at the national and regional level. Specifically, there were presentations of a number of country case studies in rebuilding programs, which focussed on the economic, biological and social outcomes and identified the economic and policy issues that were of particular importance. These case studies provided an indication of the types of challenges facing governments in developing and implementing rebuilding programs. A session devoted to international experiences with stock rebuilding reviewed the particular challenges in developing and implementing rebuilding programs for international fisheries, including the role of RFMOs, enforcement mechanisms, and links to national rebuilding programs.

Discussions took place on the role of institutional arrangements in determining the success of rebuilding programs, including alternative management strategies, enforcement, stakeholder involvement, feedback and adjustment mechanisms within the programs, and the use of triggers and rules to assist decision-making.

In terms of mitigating distributional effects of rebuilding, the following factors were identified for consideration – the use of property rights as a means to shift the focus to the long term value of the resource as opposed to the short term; flexibility in management as opposed to complexity, which can for example be imposed through rigid timeframes and targets; collaboration with stakeholders to allow for a participatory and transparent process; clarity in terms of the rationale for decision rules, timeframes and goals; and, appropriate monitoring and enforcement of decision rules.

Day 2 also included several case studies of international experiences with fisheries rebuilding, as discussed in Chapter 10. In particular, this session built upon the previous discussions around theoretical concepts towards action and implementation of rebuilding plans.

For example, the status of five stocks of Atlantic cod was reviewed with a focus on the complexities involved in the rebuilding process. In particular, the role of shared stewardship was examined in a context where there are few realized benefits. In this case, the role of the regulator was described as precarious, as the fact that the stocks have

remained at low levels for a significant period of time may decrease the prospects for collaboration with industry to develop a meaningful rebuilding plan. Against this backdrop, Canada's endangered species legislation plays an uncertain role in the rebuilding process, given the emphasis on the short term aspects of cost benefit analyses by policy makers, and that it may not be well suited to the management of commercial species. The complexities of Atlantic cod are also characterized by the lack of significant recovery despite a long term fishing moratoria of some stocks and uncertainties in the science has led to the continuation of small scale fisheries to help monitor the resource. Issues of climate change and ecosystem shifts have also been discussed as possible reasons for the continued low stock status of Atlantic cod.

The Workshop concluded with a plenary discussion that drew together the various strands of the lessons learned, identified the key issues, and suggested case studies that would yield insights into fisheries rebuilding.

## Research Papers

This section presents a short summary of the papers that follow in the proceeding sections of this publication, with an emphasis on points from the papers that relate to the four objectives of the workshop.

John Davis, an Associate with the Institute for Coastal and Oceans Research at the University of Victoria, presented the first paper, entitled: "Rebuilding fisheries: Challenges for fisheries managers". This paper provides an overview of the key scientific, management and political economy issues associated with fisheries rebuilding and introduces the variety of the policies and programs established in selected OECD countries designed to rebuild fisheries. Notably, the paper hinges on the idea that economics has an important role to play in the design of rebuilding plans given the numerous choices that are to be made throughout the process; this includes the time horizon for rebuilding, and the management tools to be used. The role of fisheries economists in making a successful case for the economic advantages of fisheries renewal, rebuilding approaches, and sustainability is also emphasized, as is the importance of managing the transition to rebuilding, including development of support for rebuilding from often conflicting interest groups.

The second paper, prepared by Saba Khwaja & Anthony Cox presented a review of approaches in OECD countries and identifies the range of legislative and policy mechanisms available to support or guide rebuilding through comprehensive and detailed legislation that frames each step, as compared to integrated approaches where a depleted fishery triggers a certain set of actions within the broader fisheries management framework. The paper notes that in designing and implementing fisheries rebuilding programs, policy makers need to ensure that the programs are cost efficient and effective. The paper also notes that there is also a need to ensure that economic information is integrated into decision making at key points in the process as successful rebuilding often depends more on institutional structure and socio-economic context than any other factors alone.

The third paper, entitled "Getting the economics and incentives right: Instrument Choices in Rebuilding Fisheries" was presented by Gordon Munro, from the University of British Columbia and CEMARE, University of Portsmouth. This paper equated a fisheries rebuilding program with a "natural" capital investment program, as all natural resources, including marine capture fishery resources, are properly regarded as "natural"

capital. Following this reasoning, the paper argues that the proper incentives must be in place so as to ensure that the cost of investment is borne willingly. The author notes that such an incentive would be an assured share of the future resource investment payoff while also stating that there are aspects to solving the question of the appropriate incentive that require further consideration and research. Examples from the British Columbia groundfish fisheries show that “Incentive Blocking” approaches to resource management were ineffective, while “Incentive Adjusting” approaches such as ITQs created resource rents through cooperative games among fishers, although this result is highly dependent on establishing effective monitoring schemes. The author shows that while effective at halting overexploitation, Incentive adjusting measures such as ITQs alone are not enough to induce stock rebuilding. They call for future research into what incentives can be put in place to encourage investment in the resource, or not to discourage resource investment programs, at both intra-EEZ and international levels.

Daniel S. Holland, from the Gulf of Maine Research Institute, presented the fourth paper: “Economic considerations and methods for evaluating fishery rebuilding strategies”. The paper focused on how different rebuilding strategies, including timing and setting catch and biomass targets, impact the net benefits generated by the fishery during rebuilding and beyond. Oft-neglected issues such as multispecies fisheries and changes in fishery productivity relating to climate change were also discussed, as well as the advantages of Management Strategy Evaluation (MSE) as a tool to design rebuilding strategies that are robust to uncertainty. The paper shows, using a simple fisheries model, that more gradual rebuilding strategies are likely to generate greater economic benefits if demand is inelastic or marginal costs are increasing with the level of fishing activity, and that depending on the fishery, in many cases it may be desirable to rebuild fish stocks to well above  $BM_{sy}$ .

In the paper “Harvest Strategy Policy and Stock Rebuilding for Commonwealth Fisheries in Australia” by Peter Gooday et al, describes the development of the Australian harvest policy strategy, and in particular the shift towards the goal of maximum economic yield (MEY). The authors note the importance of having pre-defined harvest rules as a means to improve transparency and provide fishers with enhanced certainty over their current and more importantly future fishing activity. Notably, the paper describes how the implementation of the harvest strategy policy along with other measures to improve fisheries management arrangements are essential if the benefits from a recent decommissioning program to remove excess capacity are to be maintained. It is recognised in the harvest strategy policy that achieving the MEY target in fisheries that require rebuilding involves trading off short term economic gains against longer term fishery profitability. A number of issues associated with implementing an MEY target are canvassed in the paper.

Susan Hanna’s paper discusses the theme of “Managing the transition: Distributional Issues of Fish Stock Rebuilding” illustrated through three United States fisheries, and draws three key conclusions. First, the resolution of access rights is necessary in order to provide fishers with an incentive to take a long term view, rather than focussing on short term benefits and uncertain long term gains (if any). Second, the larger economic and social goals of the fishery need to also be addressed; this includes effectively engaging stakeholders in the rebuilding process. The third point raised is regarding the ability to mitigate distributional effects effectively; the case studies note that this depends on having clear decision rules with defined limit points and non-discretionary actions.

Lee Anderson's paper "Setting Allowable Catch Levels within a Stock Rebuilding Plan", defines a stock rebuilding plan as in essence a harvest control rule that specifies the level of harvest that is to be permitted at each stock size over the relevant range from the current size to the target stock size,  $X_{tar}$ . The paper develops an analytical probabilistic framework to consider how a harvest level (or TAC) given by a control rule can be modified to account for uncertain information about stock characteristics and conditions, and weaknesses in the construction of control rules. The amount by which a harvest level can be adjusted is defined as a "buffer", which has a cost in terms of lost of the net value of fish foregone, but also has a benefit in terms of decreasing the risk of deviating from the stock growth trajectory specified by the control rule. The author shows that conceptually the optimal size of this buffer occurs where the marginal reduction in the value of expected losses from missing the target (something we have little information on at the present) is equal to the marginal cost of increasing the buffer. Optimal buffer sizes also depend on the value of the loss ( $L$ ) for missing interim stock sizes, or deviating from the stock growth trajectory. The author presents the optimal buffer sizes for different values of  $L$ .

In "Information Issues and Constraints in the Design and Implementation of Stock Rebuilding Programs", Andy Rosenberg and Susan B. Mogenson review two case studies (North Sea Cod and George's Bank groundfish) and develop a general scientific advice framework which identifies information needs for designing rebuilding plans. The authors identify, amongst the important considerations when designing management and rebuilding plans, uncertainty, reference points, effort control, implementation and monitoring. The importance of reducing bycatch and discarding is underlined, as well as the need to avoid adjusting measures too early in response to apparent or early signs of recovery. Three types of uncertainty are identified, including uncertainty in model formulation. The authors guard against "shifting baselines", which the tendency to assume that recent history reflects the full capacity of the resource. Instead, longer time series should be used. Recovery measures should be limited to data-rich fisheries but to data-poor fisheries as well. Recent research on how to support recovery planning for data-poor stocks is presented.

The paper entitled "Rebuilding Fishery Stocks in Korea: A National Comprehensive Approach" by Sang-Go Lee, College of Fisheries Sciences, Pukyong National University, Korea, provides a detailed overview of a new rebuilding strategy implemented in Korea in 2005: the fish stock rebuilding plan (FSRP). A novel aspect of this strategy is the establishment of a joint management system with fish harvesters, to increase stakeholder participation and sense of ownership. 10 FSRPs have been implemented so far in Korea, with some success. The sandfish fishery in the East Sea is given as an example, where the catch per unit effort (CPUE) increased from 0.44 in 2005 (before the FSRP) to 0.78 in 2007. Consequently, fishing income has increased by 10%.

The final two papers presented in this publication are case studies of national fisheries. The first, "Rebuilding the stock of Norwegian Spring Spawning Herring: lessons learned", by Per Sandberg, from the Norwegian Directorate of Fisheries, is a case study of the rebuilding of the Norwegian spring spawning herring stock, one of the largest pelagic fish stocks in the world. The author assesses the regulatory measures adopted to facilitate the recovery of the stock and discusses economic consequences of improving the exploitation pattern and exploitation rate in the fishery. The second paper, "Community-based Management for Sustainable Fishery: Lessons from Japan" was presented by Hirotsugu Uchida, from the Department of Environmental and Natural Resource Economics, University of Rhode Island. Inspired by the success of co-

management approaches for rebuilding stocks in Japan, driven by fishery cooperative associations (FCAs) and legally defined fishing rights, the author presents the three necessary conditions for successful co-management: well-defined boundaries, an affordable exclusion mechanism, and a condition of “privileged.” The author argues as well for successful rebuilding, enhancing profitability of the fishery is important because without tangible rewards, such as more profits, fishermen will not be interested in or sustain their interest in stock-rebuilding efforts.

## Summary of interim conclusions

This section provides a summary of the main interim conclusions regarding fisheries rebuilding as discussed by the Workshop participants. This section brings together the areas of agreement, organized around the stated goals of the workshop.

### Objective 1.

#### **Identify and analyse the economic and policy issues involved in rebuilding fisheries.**

Integrating economics throughout the rebuilding process: There was overwhelming agreement among Workshop participants that **integrating economics throughout the fisheries rebuilding process** is not only feasible, but necessary to enable sustainable fisheries. The discussion then turned towards *how* economic analysis and information can be fully utilized early on in the design and implementation of fisheries rebuilding plans, as well as identifying obstacles that prevent the explicit inclusion of economic considerations. There was considerable discussion around using maximum economic yield (MEY) as a target, given that it allows for optimization of rent as well as it is more precautionary with respect to biological targets.

While it was argued that economics should already be an integral part of fisheries management, there is an added significance in this context regarding transparency about the economic tradeoffs associated with various rebuilding paths. In most instances, economic information is generally present as a backdrop to the development of fisheries rebuilding plans, given that decision makers consider a broad range of factors in the design of rebuilding targets, objectives and measures. As such, there is a need to find credible approaches to embedding economic information in the development of rebuilding plans, in order to be explicit about economic impacts (both costs and benefits) and also to arrive at targets and outcomes that are both biologically and economically beneficial. The exclusion of economic considerations can lead to severe measures such as extended fisheries closures that may lead to favourable outcomes from a biological perspective (more rapid rebuilding of a stock), but may have devastating economic consequences (e.g. lead to the loss of existing markets and access should substitutes be readily available and idle harvest and processing capacity may weaken harvest efficiency once the fishery is rebuilt). In this regard, Workshop participants shared the view that economics can play a significant role in fisheries rebuilding by identifying the rebuilding trajectory, measures and timeframes that address biological, social and economic goals and communicate clearly the tradeoffs that are being made.

As part of a comprehensive approach that includes the environment, biology, economics as well as stakeholder consultations towards fisheries rebuilding, it was agreed that the application and use of economics is an essential early warning system that can trigger action to rebuild fisheries rather than biological signs of depletion or overfishing on their own. The pressure to take action to rebuild fisheries often is realized when profits



decrease, as opposed to reductions in TACs or catch alone; in some cases, subsidies can blur these signals and mask the signs of stock depletion. Often, an economic crisis is required to prompt a political and management response in terms of rebuilding.

**An integrated approach**, where a broader suite of policy measures is developed, creates a stable foundation for fisheries rebuilding. Introducing flanking measures that reinforce rebuilding, concurrently with fisheries plans and management measures that ensure that appropriate support mechanisms are in place, protects the investments made towards sustainable fisheries and address the underlying issues that are a factor in stock depletion. Such short term measures as decommissioning schemes and capacity reduction programs can be applied to enable adjustment and rationalization of fisheries in parallel with measures to rebuild stocks, given that they are time bound and targeted. These measures are necessary to effectively rebuild fisheries in that they shore up the specific measures aimed at fisheries rebuilding by considering the post rebuilding phase – the eventual structure of the fishery.

In addition, an integrated and holistic approach requires the review and realignment of the broad suite of policies that affect the fisheries, from harvesting to the processing sectors. This would place fisheries on a stable footing and also supplement short term efforts such as capacity reduction with a broad suite of coherent policies that deal with longer term issues in order to smooth the transition and allow future adjustments to be self-directed.

Finally, a comprehensive approach also extends to the suite of measures used to rebuild fisheries. For example, limiting harvest is often not the only solution as consideration must be given to the carrying capacity of a particular species. In this regard, habitat restoration also becomes important.

Fisheries rebuilding can be viewed as an **investment program**. As is the case with all natural resources, capture fisheries can be identified as capital assets from a societal perspective. To this end, rebuilding fisheries can be considered as an investment program; as such, the optimal stock capital must be determined as well as the rate of investment (rapid versus gradual rebuilding). In order to efficiently address these two points, **aligning incentives** becomes critical for effective fisheries rebuilding. If the right incentive structures are not in place, there is no assurance that investment costs will be borne willingly. In some cases, this may include introducing property rights to support fisheries rebuilding, or some other such schemes whereby fishers are encouraged to be as precautionary as needed to ensure durable access at sustainable harvest levels. This institutes a vested interest in right holders and increases the probability of success in agreeing to and in implementing rebuilding. These property rights also may be a solution towards long term assessments in regards to the management options in fisheries rebuilding by somewhat addressing distributional issues – by ensuring that fishers have an established right to the resource, they are provided an opportunity to reap the future benefits of a rebuilt stock, after managing through conservation measures (e.g. reduced fishing seasons, allowable harvests) and the associated costs. In the context of aligning incentives, it is also important to note that governments may also wish to examine any possible disincentives that are in place that hamper effective management and rebuilding of depleted resources, including various subsidies that do not encourage self-rationalization of fleets.

There was considerable discussion on the **toolbox available** to governments in terms of rebuilding fisheries. Specifically, it was recognized that fisheries departments alone cannot achieve rebuilding and maintain stocks at a viable status, given the social and

other transition issues that accompany the inevitable pain of strict measures that often lead to significant short term costs in order to rebuild fisheries. In order to ensure that the policy response is coherent, the transition to a post rebuilding period must also be considered when designing rebuilding plans; for example, social policies should be used in the event of social disruption rather than fisheries management tools. To that end, a broader suite of tools should be considered in the development of rebuilding plans that may extend further than the mandates of fisheries departments. In cases where significant disruption to the fishery may be required to rebuild fisheries, a comprehensive policy response may also include income support and retraining. This would imply a close collaboration among government agencies that are responsible for broader economic development and social policies.

### **Objective 2.**

#### **Identify the biological and economic uncertainties and information constraints that influence the choice of rebuilding paths and policy instruments**

**Dealing with risk and uncertainty:** Further work is required to provide policy makers with a clear analysis of the ways in which risk and uncertainty on biological, management and economic variables should be viewed and incorporated into rebuilding plans. These issues are generally acknowledged as areas where due consideration is required. However, in many instances, risk and uncertainty around rebuilding measures are not always communicated effectively to stakeholders. For example, some rebuilding plans may seemingly indicate that fisheries will rebuild to a certain level after a certain number of years with the introduction of conservation measure; however, there is often some level of uncertainty associated with these projections, and there is also probably some level of risk, particularly in cases where climate change or ecosystem shifts may be a factor.

In these cases, it would be crucial to not only reasonably estimate these risks and incorporate the uncertainty in the models, but it would also be essential to articulate them clearly to policy makers and stakeholders alike. This would be with the view to reduce future conflicts or misunderstandings should the projections outlined in rebuilding plans not hold true.

**Dealing with multispecies and mixed stock fisheries:** This is a very complex and contentious issue and it was clear from the discussions that it was one where there is a big demand for sharing of insights and experiences across OECD countries. A distinction is made between the mixed stock and multispecies fishery; the first involves a variety of species caught while only one is targeted while the second is where various species are targeted. The key issue relates to weak stock management, where fisheries are precautionary managed to protect the weakest stock. In these instances, fisheries for healthy stocks may be curtailed given the incidental catch of weaker stocks; in these cases, substantial sacrifices may be required by fishers who are obliged to forgo catch of stronger stocks to protect the weaker stocks.

**Additional research regarding information needs** to address economic aspects for rebuilding fisheries is required. In order to complete a robust bio-economic or economic analysis to support fisheries rebuilding, it is necessary to address data requirements at the outset, as part of the design of statistical data collection tools. Adding a few economic indicators to scientific surveys (e.g. fish size and distribution of catch may be useful information in terms of assessing market impacts) can go a long way in allowing for a meaningful examination of the economic costs and benefits of rebuilding plans.

Furthermore, it is recognized that there would be situations where neither perfect data nor even data would be available. It is precisely in these contexts that an assessment of how to manage data poor fisheries would be required.

### Objective 3.

#### Review the role of institutional arrangements in delivering successful rebuilding programs

The importance of the **role of stakeholders in the rebuilding process** was a recurring theme in the Workshop, regardless of the institutional arrangement. Stakeholder involvement and transparency from the outset is of paramount importance to a successful rebuilding plan; communicating effectively and disseminating information on economic impacts is also crucial. However, it was emphasized that fishers need to be provided with the appropriate incentives for fisheries rebuilding and sustainability of stocks. Currently in many areas, fishers are motivated to fish to the greatest extent possible; if not, another fisher will harvest the available fish and reap the associated benefits. To that end, economic analysis and information can be used to demonstrate the potential benefits from fishing sustainably (e.g. in the form of future harvests, profits) as well as provide transparency on the short term costs that fisheries rebuilding may entail. Stakeholders may also be able to enhance both biological and economic analyses through datasets that they may maintain, and also may validate scientific surveys. Fishers are in a position to supplement data through their own fishing records and may also provide additional information regarding costs and earnings, as well as financial breakeven points. Access to fishers' data would allow for a meaningful assessment of the impacts of various rebuilding measures and scenarios. In this regard, developing **clear decision rules** was also identified as a successful feature of rebuilding plans in that there is a common understanding prior to the implementation of rebuilding measures as to the next suite of actions to be taken if milestones are not achieved. In this approach, agreement is made at the outset as to any ensuing rebuilding measures should targets not be reached by a certain date, as well as identifying when measures could start to relax. This would redefine the way that course corrections are implemented and provide much needed clarity to the process.

**Policy coherence** was discussed throughout the Workshop in terms of assessing the goals and objectives of fisheries policy (biological, social or economic) in light of the overarching objective of sustainable development. The continued development of policies across government departments which together reinforce overall objectives as opposed to those that work at cross purposes was emphasised as a necessary way forward in terms of rebuilding. Specifically, the role of subsidies, the use of fisheries as a form of economic development or as a means to support coastal communities in light of other policy initiatives that could also be applied, require further examination.

**Managing the transition** is a key area that merits additional research and consideration. Specifically, the matter of how policy makers and fisheries managers address issues of transition when major changes to the fisheries are undertaken to support rebuilding efforts. In particular, the role of stakeholder involvement, distributional effects, compensation strategies, coherence with social, tax and regional development policies, post-rebuilding management are aspects that require consideration during the design of rebuilding plans. Specifically, it is clear that using the fisheries to address social, economic as well as biological objectives leads to conflict amongst these options. For instance, a fishery organized around a social goal may lead to a policy of maximising employment at the expense of maximising profitability and increased pressure on the

resource to maintain jobs. In that regard, it becomes important to recognize that there are other agencies that are more suited to dealing with those issues.

#### **Objective 4.**

##### **Review selected country and international experiences in rebuilding fisheries.**

The session on **rebuilding fisheries in RFMOs** outlined the broad difficulties faced by such international organizations in the development of rebuilding plans. Fisheries rebuilding within RFMOs face specific challenges given issues such as unregulated fishing, the emergence of new players and the free rider dilemma, as well as reporting and enforcement challenges. Nevertheless, there have been notable successes such as Atlantic swordfish that can yield valuable lessons in the management of depleted stocks in such a context. Participants also discussed management beyond the EEZ and that consideration should be given to dividing up the rest of the ocean – essentially extending the EEZ beyond 200 miles - to enable national jurisdictions to exercise control over all areas.

The example of the International Commission for the Conservation of Atlantic Tunas (ICCAT) management of the Atlantic swordfish stocks provided a case of a rebuilt fishery. ICCAT's objective is to sustain fisheries at levels which allow for the greatest sustainable harvest for food and other purposes, by maintaining stocks at the MSY level. To that end, ICCAT has instituted a transparent process with respect to scientific data; all member countries to this RFMO may present data, and advice is widely available. Management and rebuilding of the stock have not only resulted through stringent measures that have increased over time, but also to the fact that catches have generally been below the set total allowable catches; in addition, swordfish lends itself to rebuilding given its species characteristics such as relatively widespread populations coupled with various spawning areas and comparatively rapid growth. Challenges to the rebuilding process were identified as maintaining TACs with the scientific advice. For example, as the stock was showing signs of recovery in 2008, the TAC was set higher than advised; the results of this action are unknown to date. The treatment of MSY as a target reference point rather than an upper bound means that it is possible to inadvertently exceed this point without necessarily overfishing, as recruitment naturally fluctuates. Furthermore, possible distinctions among populations at units smaller than the current management units, indicates that perhaps a finer scale level of management may be required.

## **Conclusion**

As indicated in previously, this Workshop was intended to scope the economic and institutional issues associated with rebuilding, identify key areas of agreement and those requiring further research.

The Workshop confirmed that the role of economics in fisheries rebuilding is crucial to clearly identify and evaluate rebuilding options and to setting targets, objectives and measures. The participation of various stakeholders early in the design and development of rebuilding plans is imperative, as has been demonstrated throughout the case studies that were presented. A co-management or shared stewardship approach allows for a collaborative decision-making process increasing the level of buy in through all stakeholders. It was also emphasized that the underlying stock conditions and the surrounding environment must be favourable for rebuilding to occur; for example, an adequate amount of suitable habitat must be available for stocks to re-establish themselves. There was also considerable debate and discussion on how economic analysis

and information can be integrated in decision-making processes in a clear and transparent manner; it became evident that to do so successfully requires early consideration of economic factors during the development of biological surveys to the design and implementation of rebuilding plans. Rights based management approaches was identified through various case studies as an approach that has led to successful rebuilding, by instituting a vested interest in maintaining a sustainable resource.

There was overall consensus that methods to provide the appropriate incentives to all stakeholders in combination with clear decision rules would lead to more effective rebuilding programs and improved fisheries management in general. The challenge now is to appreciate what progress is being made towards implementing rebuilding plans and achieving their goals in light of various national and international commitments by examining current approaches and by demonstrating how economic factors are integrated in the decision making process, as a complement to biological assessments and stakeholder input.