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Policy Scenario Analysis: A Methodological Overview

Policy Scenario Analysis: a methodological overview

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Contents

Executive Summary

Scenario analysis is a widely-used tool to assist with strategic planning. This report considers its use in fisheries policy. The aim is to provide useful and useable insights to fisheries policy-makers (and to other stakeholders and interested parties).

In general, a scenario is a combination of a set of circumstances and policy actions. Scenarios have to be developed in a way that is useful to address the policy problem so that they can then be analysed to determine what results are likely to follow for a given set of drivers.

The approach should reveal hidden weaknesses in policy, thereby increase its coherence and reducing unexpected negative impacts. The biggest challenge facing PSA is to identify the real needs of policy-makers, when policy-makers may not themselves know what they need to know, or may not know how to describe the information that they really want, or may be confused as to what they are really trying to achieve.

One advantage of PSA is that it requires very specific consideration of the timescale and scope of the analysis and the identification of the stakeholders.

PSA generally proceeds by constructing a baseline "business-as-usual" scenario which is then compared with some kind of "optimal" scenario based on the possibilities that the fish resource offers and working back to the policy implications. A third scenario might then be included which identifies some kind of intermediate situation that is considered desirable for some reason.

The baseline scenario is built around free and open access, although this scenario also describes many other common situations in fisheries where the access issue is not addressed adequately. The scenario can be quantified and the benefits and risks identified.

The optimum scenario brings the inherent value of the resource, the resource rent, to the fore. In doing this, analysis of the scenario will show a much wider range of benefits from fish resource exploitation.

An essential pre-requisite to the construction of the scenarios will be the development of a set of fishery management units that provide the link between the fish resources and their users.

These scenarios are generic and can be applied to all fisheries. The ease of application will depend on the nature of the fish resource concerned. The most difficult case is probably internationally-shared fish resources such as the principal market tunas. For this reason, it is suggested that the approach should be applied first to some of the neritic tunas. Success in this latter case would realise substantial value for the coastal states concerned and will result in the development of fisheries management expertise that will be invaluable in addressing the former case.

Preamble

This report is the first of two dealing with the topic of Policy Scenario Analysis (PSA). This report discusses the generic approach and the following report (project report no 10) suggests how it might be applied within the OPP – Bay of Bengal project.

As shown in section 1 of this report, PSA is a tool that is used in many sectors of the economy. The aim here is to discuss its application in the fisheries context.

It is important to stress at the outset that PSA cannot provide the "right" answer to the question of how best to exploit a nation's fish resources. What it does is to provide policy-makers and other stakeholders with insights into the likely impact of different exploitation patterns under different institutional arrangements.

That said, the generic approach presented here does build upon international best practice in fisheries management and on very well-established bioeconomic theory. A few countries are now leading the world in pioneering reforms in the way that their fish resources are perceived and exploited which is delivering far greater benefits than previously whilst respecting the ecological sustainability constraint. One important result is that the fisheries sector is integrated far more effectively into the wider economy than was previously the case.

With the remarkable economic growth now being observed in India and the other BoBP countries, it is an opportune moment to consider the role of fish resources in these countries and whether it is appropriate to seek to adapt these pioneering efforts to the Indian context.

Reform has come from a number of different directions and has involved a wide range of stakeholders, including in particular policy-makers, fish harvesters and post-harvest actors as well as the research community and numerous non-governmental organisations. PSA provides a way to bring this diverse group together.

One important element is to address the problem from the point of view of the resource and not the set of actors who happen to be exploiting the resource at a particular time. Once this different viewpoint is taken, it becomes apparent that the potential impact of fish resources is much wider than suggested by traditional indicators, such as fishing-related GDP and fishery sector employment. In fact, it turns out that these indicators undersell fisheries in a very substantial way which negatively affects the way that the sector is perceived macro-economically and the budgets that are allocated to it by the typical budgetary allocation processes.

More importantly, once the potential of the sector is fully appreciated, it is possible to identify the extent to which the sector could deliver more and discuss what reform measures may be appropriate in order to deliver a greater proportion of it. Ultimately, in line with the OPP goals, the aim is to develop business plans that will identify the pay-off to reform and the investments needed to achieve it.

1.0 Introduction

Policy scenario analysis (PSA) can assist policy-makers by investigating the implications of different policy options. The aim of such analysis is to enable the options to be explored within a "simulation" framework prior to their implementation in real world policy.

This purpose of this paper is to discuss the methodology that might be used to undertake such analysis in the case of Oceans Partnership Project (OPP) – Bay of Bengal.

The paper begins in section 2 by outlining the basics of PSA. It then discusses in section 3 how the analysis can be applied to fisheries establishing generic baseline and optimum scenarios. The key indicators are suggested for each of the scenarios indentifying how these may have to change between the two.

Section 4 considers the general problem of whether the main requirement in fisheries policy is sectoral development or some kind of transition to a new model, or scenario, for the exploitation of fish resources.

Section 5 considers the issues in using PSA in the case of internationally-shared fish resources whilst section 6 looks at resources under sole coastal state responsibility.

Section 7 concludes the report.

2.0 The basics of policy scenario analysis

Scenario analysis is a tool that is widely used to assist with strategic planning in a variety of business and policy settings. Some applications are extremely complex bringing in a broad range of known or anticipated facts to describe a situation and then considering how various drivers (social, technical, economic, environmental, and political (STEEP) trends) may impact on that situation going forward. One difficulty is that the model may become as complicated as the real world that it is attempting to emulate making interpretation of the results rather difficult.

In using scenario analysis to assess fisheries policy, our aim is to focus on key issues to keep the model tractable and provide useful and useable insights to policy-makers (and to other stakeholders and interested parties).

One important aspect of policy scenario analysis (PSA) is to bring policy-makers to recognise that many factors may combine in complex ways to create unexpected or undesirable outcomes. As a result, policies that appear to be logical when evaluated on their own terms may not have the anticipated results when implemented within the system as it exists at a particular time. Policy success may require that certain conditions are first fulfilled within the system or that actions are undertaken in a particular sequence. Moreover, certain variables that the policy-maker may see as objectives may in fact be outcomes of a particular set of arrangements and identifying what these are will be crucial for policy success.

In fisheries, PSA can also bring help to convey the message that well-meaning policies may not simply fail to succeed, they may make the situation worse. The history of fisheries policy around the world is littered with examples of this conundrum.

2.1 Purpose of the scenarios

A scenario is a combination of a set of circumstances and policy actions. This scenario can then be analysed to determine what results are likely to follow for a given set of drivers. It is important to note that no action also constitutes a policy stance.

Scenarios have to be developed by the analyst in a way that is useful to address the policy problem. There is no right or wrong answer, at least as concerns the selection of scenarios. The key point is to enable the identification of hidden weaknesses in the policy approach and methods. Such weaknesses can then be addressed or at the very least the full consequences of policy decisions can be anticipated in advance. One pervasive difficulty in fisheries policy is the failure to take into account the dynamics of the complete system when making decisions. As a consequence, policy decisions taken in one arena may undermine desired outcomes in another. To take a simple but common example, fisheries policy in many countries seeks to promote employment in small-scale or so-called artisanal fishing activities. At the same time, policy may seek to modernise the sector for instance by promoting the motorisation of small-scale fishing vessels. Other things being equal, a policy of capital development is likely to lead to labour substitution and hence less employment so that the latter policy runs counter to the former.

By revealing these hidden weaknesses in advance, policy analysis can increase policy coherence and reduce the unexpected negative impact of some policies. Regrettably far too often PSA serves to explain the policy errors that have led to undesirable outcomes – for instance, the widespread overfishing of the world's fish resources despite conservation being the foundation stone of fisheries policy almost everywhere.

The biggest challenge facing PSA is to identify the real needs of policy-makers, when policy-makers may not themselves know what they need to know, or may not know how to describe the information that they really want, or may be confused as to what they are really trying to achieve.

One common way of undertaking PSA is to develop games that enable policy-makers to undertake policy experiments and observe their likely effects without having to implement them in practice. Existing fisheries games tend to more effective at communicating some messages than others. They tend to be at their most effective in explaining how overfishing develops. Although this is helpful because policy-makers can recognise the problem in a simulated world rather than the real one, sadly the vast majority of the world's fish stocks are already fully- to over-exploited so that the real world experience ought to be sufficient.

PSA, whether using games or other types of analysis, should nonetheless enable policy-makers to learn from other people's mistakes (and their own) whilst limiting the risk of real-life failures.

2.2 The key questions

Once the scenarios to be examined have been identified, a generic set of questions can be addressed, although the method is flexible so that additional issues can be incorporated as required.

It is important to set the time and scope of the analysis. Various time-scales are likely to be of interest. One difficulty is that the political cycle may tend to bias the focus towards the immediate or short-run impacts of policy decisions and yet the most important elements may involve long-run payoffs. This may be particularly the case for valuable, overexploited, long-lived fish species where a substantial period of time may be required for the fish stock to recover. Also for political reasons, the scope of interest is likely to be biased towards the fishing sector itself rather than towards wider considerations. PSA may be useful therefore to draw attention towards long-run payoffs from the wider macroeconomic and social perspective.

This leads immediately into the next question: who are the major stakeholders? Once again those involved in the fishing activity are likely to be seen as the key stakeholders. PSA however will draw attention to the need to distinguish between the owners of the resource and the exploiters or users. Failure to make this distinction often leads the Government authorities to focus their attention on the fishing activity itself giving the users a kind of double stake in the game.

A third question is to map the key trends and driving forces that are likely to be of importance in the foreseeable future. It may not be easy to integrate these into the analysis but they should at least be recognised. Without trying to anticipate all such factors, important issues might include the way in which the demographics of the tuna market are changing with many aging consumers in Japan, and the way in which the attractiveness of fishing as an employment opportunity changes as an economy develops.

2.3 Defining the scenarios

Generally speaking, only a few scenarios are constructed. In the fisheries case, the most useful approach seems to be to construct a baseline scenario which sets out some kind of “business-as-usual” either with no policy or with current policies. This can be compared with some kind of “optimal” scenario based on the possibilities that the resource offers and working back to the policy implications. A third scenario might then be included which identifies some kind of intermediate situation that is considered desirable for some reason.

Each scenario must be written out to enable understanding of what has happened and the reasons for it. As mentioned, the most difficult thing is when the scenario identifies important information or conclusions that policy-makers were unaware that they needed. In the fisheries case, without any doubt the element that most corresponds to this problem concerns the central role played by fish resource rents in all scenarios, although for different reasons. Policy-makers tend to be unaware of the concept and hence have no way to understand that it is these rents that are undermining their best intentions on the one hand and that set the economic scope for policy outcomes on the other.

The scenarios will enable research needs to be identified. A common difficulty in fisheries is that information on the basis economic parameters is available only on a sporadic basis usually as the result of studies being undertaken from time to time giving a series of snapshots that may be very far apart. Developing, or attempting to develop, the scenarios will help to identify where information needs to be collected either at all or in a different way.

The scenarios should be quantified in their key variables. However, this may require a significant amount of work. The best approach may be to use bench-marking techniques to obtain some idea of the potential payoff in different fisheries under different policies and then decide if it is worth while investing in developing more sophisticated evaluations.

The ultimate aim is to move towards decision scenarios. If the scenarios successfully identify the fundamental issues facing the exploitation of fish resources, then they should inform decisions being made by policy-makers and also by users of the resource and other stakeholders.

2.4 Limits of PSA

PSA is a useful tool because it creates awareness of possibilities. But in dealing with the future, it does not give analysts a crystal ball. It does not provide a magic solution to the problem of uncertainty – for instance it is known that some fish stocks have suffered catastrophic collapses in the past when they were not exploited by man.

PSA does not by itself lead to any change. It needs to feed into the decision-making processes. Depending on how the purpose is perceived it may be necessary to spend as much time understanding these processes as it is on developing, analysing and updating the scenarios. This will be especially the case if the purpose is to effect change rather than just point to its possibilities.

It is also important to avoid taking the scenarios too literally. They will and should not describe static outcomes but should try to capture dynamic processes. This can be a very difficult challenge. For instance, we have stressed already (and will stress again) the importance of resource rents. Estimating such rents is a difficult technical challenge but the key point is that they are not some fixed amount waiting to be collected but are a dynamic construct whose value can be grown (or shrunk) according to many factors.

3.0 Outline of the scenarios for fisheries policy analysis

3.1 Fishery management units (FMUs)

The starting point of the analysis will be to define an appropriate set of FMUs. This is a crucial step because these units provide the essential link between the fish resources and their users. Too often in fisheries, policy decisions are made that focus simply on the hoped-for impact on users without assessing how the fish resources will be impacted.

A fishery management unit is a combination of a fish resource (or set of fish resources), the actors exploiting that resource and the space within which the exploitation takes place.

A first challenge in undertaking scenario analysis is therefore be to agree on some working definitions of FMUs. The definitions adopted should allow for reasonable stability even though it should be recognised that an FMU is not necessarily fixed and is likely to evolve over time in response to changes in exploitation patterns or resource distribution.

The typical approach is to choose a limited number of FMUs on a pilot basis, perhaps because the units are of particular importance or because they are the ones about which the most is known or because they appear to represent a workable challenge that have a good chance of success. This latter point is important because where new ideas and approaches are being trialled, failure often sets things back for a long period of time.

The development of bio-economic models can then be undertaken for the pilot FMUs. Such models can be of varying complexity depending on information availability and the characteristics of the FMU. However, even relatively simple models can be helpful for policy analysis, especially because the more complex models, although allowing for more detailed analysis, generally tend to validate the conclusions of the simpler versions at least for the aggregates of most interest to policy makers.

A second requirement will therefore be to review information available for the pilot FMUs to see what kind of models might be constructed reasonably quickly and what kind of information collection or research programmes might be useful for the future. Bio-economic models as their names suggest combine biological and economic models in order to examine fishery performance under different regimes. A key issue is the ability to construct a sustainable yield relationship for the fish resource. This can then be combined with economic information on the price of fish and catching costs to construct a basic model. As modelling progresses, the most promising approach is to develop a series of inter-linked modules, each of which can be developed further as and when information allows.

If bioeconomic models on an FMU basis cannot be constructed immediately, more aggregated analyses can be used in the short term. One approach is to use broad fish resource classes e.g. demersal, small pelagic, cephalopods and crustaceans. Working within such a framework would enable initial estimates to be made of some key aggregates but would be of far less use in practical fisheries management.

At an even more aggregate level, it is possible to assess the potential return to fish resources as a group. This is more or less the situation concerning the tuna rent estimates that are currently available.

What can be done in practice will depend on the information that is available so it is expected that the policy scenario analysis will generate both some analysis of policy and some contributions to proposals to improve information collection in the future.

3.2 Using the approach: the fundamentals

Diagram 1 below shows in graphical format the generic output from a bioeconomic model. In practice, the challenge is to put meaningful numbers on to the different curves. Nonetheless the generic model helps to discuss some of the issues.

The curve labelled “Revenue” comprises the Sustainable Yield curve for the fishery multiplied by the price of fish. Assuming that the price of fish does not change with the quantity landed, the shape of the revenue curve is determined by the SY curve, as is the case here. (Note: the SY curve presented here emerges from a so-called Schaefer model. However, the general shape of the SY curve is very similar regardless of the kind of model used, especially on the left hand side, i.e. effort levels less than MSY, which is the one most of interest for policy.)

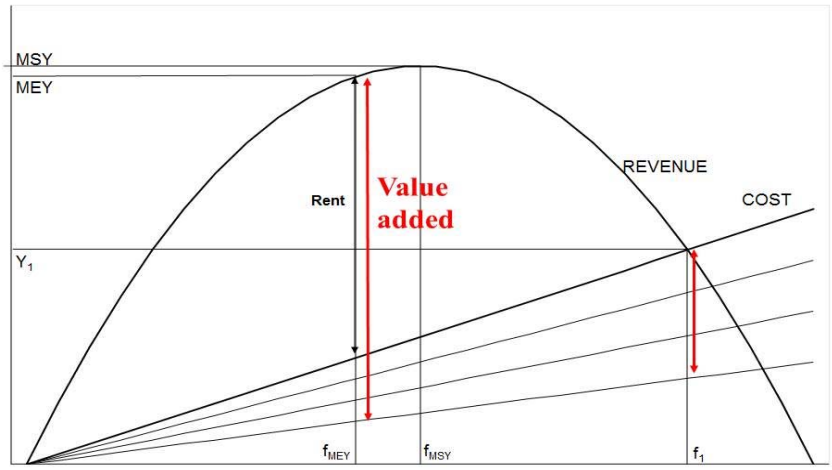

Diagram 1: Performance of the fishery with different fishing effort levels

The Cost curve shows the cost of producing fishing effort on the assumption that each (standardised) unit of fishing effort costs the same so that cost increases linearly with the amount of effort.
If the fishery is exploited under conditions of free and open access, then fishing effort will increase to f_1. This gives one benchmark against which to compare the performance of fisheries policy.

Exploiting the fishery at the point of Maximum Economic Efficiency (or Maximum Economic Yield – MEY) will maximise the sustainable wealth generated by the fish resource. This gives a second benchmark against which to assess the performance of policy measures.

In developing policy scenario analysis, there is need to build understanding of the nature and level of sustainable benefits that the exploitation of fish resources is capable of generating and why these benefits will not be generated under certain institutional arrangements. A discussion of the two benchmarks may be helpful in this regard.

3.3 The baseline scenario

The benchmark of free and open access to the resource will provide the baseline scenario. It has wider generic use than this however because the same results will be achieved, at least in the economic dimensions, by limited policy frameworks that do not adequately address the access issue, for instance, commonly-found licensing schemes that are essentially vessel registration processes. So long as applicants meet the process requirements, their vessel will be registered so that there is no real

control over vessel numbers, and even if there is there will be nothing to stop fishing effort from increasing as a result of individual vessels operating more intensively.

Under free and open access conditions, the fish catching sector is essentially left to its own devices in terms of the level and composition (labour versus capital) of fishing effort deployed.

The result will be that fishing effort will expand to the point f_1 on diagram 1. At this point, revenue equals cost for the fishery so that the fish resource is producing zero net wealth. However, some returns will still be earned by the factors of production involved so that the fishery will still produce some value-added.

To explain this more fully, diagram 2 breaks down fishing costs so that a GDP analysis can be carried out from a value-added perspective. (There are a number of theoretically-equivalent ways of calculating GDP. One method is to deduct the costs of intermediate goods consumed in the production process and then sum the value-added. Diagram 2 below uses that approach.)

Assuming for simplicity that all fishing costs are proportional, then as fishing effort increases so does the amount that enterprises use in terms of intermediate inputs as does the amount that they pay out in taxes, salaries and profits. The latter element is often a source of confusion but the idea is simple. If a fishing enterprise (or any enterprise for that matter) does not earn a "normal" level of profit then it will not be able to continue functioning in the long term so the payment of this amount represents a cost.

Each of these elements is a component of value added.

Referring back to the diagram 1 above, it is clear then that at the open access level, the fishery will produce a small amount of value added. And enterprises will just earn normal profits.

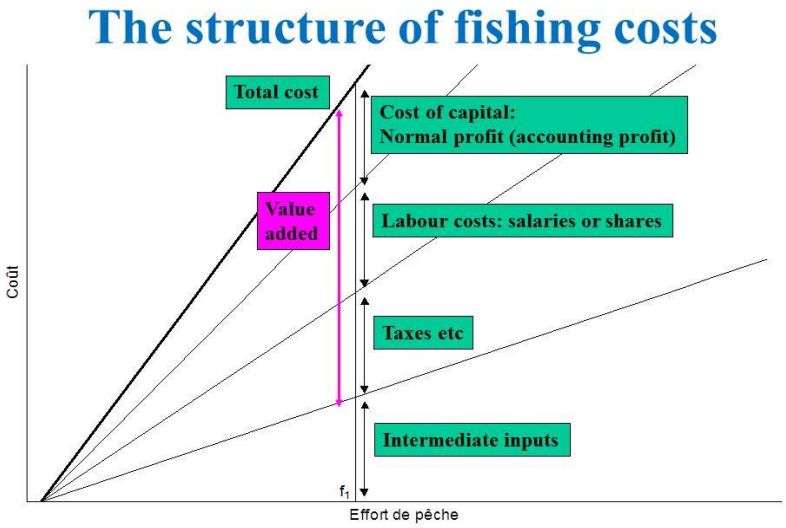

Diagram 2: The structure of fishing costs

A certain amount of employment in fish catching will be created as a result of the fish resource exploitation. But it is important to note that fishing enterprises do not set out to maximise employment; they seek to maximise profit and they will do this by using the least-cost combination of labour and capital in order to achieve a given revenue.

Those employed will also achieve a certain level of livelihood as a result. The level of such livelihoods will depend partly on results in the fishery but in the long run will be determined mainly by alternative available elsewhere in the economy. For a comparable set of skills and risks, workers will not wish to work in fishing for less than they can obtain elsewhere and enterprises will not wish to pay them more.

The scenario can be described in terms of some key variables. These are:

Ecological / biological

- The key indicator in this model will be the state of the fish stock, usually expressed as a percentage of the virgin biomass
- In more complicated models, the average size of fish may also be of interest but this model reasons only in terms of biomass, not individual fish

Harvesting activity

- At the fishing enterprise level: revenues / incomes earned, employment
- For the fishery as a whole: catch achieved, net revenue (resource rent) earned
- At the macroeconomic level: GDP, employment, trade in products

Post-harvest activity

- Other things being equal, impact at this level will depend on the size and quality of the catch being delivered by the harvesting sector
- The key indicators are likely be in terms of macroeconomic impact: GDP, employment, trade in products

A description of the current state of the FMU can be developed against these indicators (and others if appropriate).

The likely impact of proposed policy decisions can be analysed in this scenario.

3.4 The "economic optimum" scenario

The term "economic optimum" is in inverted commas because of course it is the responsibility of policy-makers to define the optimum as they perceive it. They may have to take into account trade-offs that are not apparent to the analyst.

Nonetheless the term economic optimum is appropriate in the sense that over the past fifty or sixty years a very robust qualitative analysis has been developed in fishery bio-economics that gives clear guidance as to the economic potential of fish resources. A number of countries have now begun to

base their fisheries policies on the insights from this analysis and the results have been largely as anticipated even if there has inevitably been learning-by-doing which has fed back into the analysis.

The difference between the two scenarios is that instead of allowing free and open access to the resource, it is postulated that the harvesting activity level is restricted to a level that will maximise resource rents. The difficult question of how to achieve this is left to a subsequent phase; for now the focus is on a comparative analysis of the two scenarios so that policy-makers and other stakeholders can appreciate the true potential of the fish resources within the FMU.

If the fishery is exploited at an effort level corresponding to f_{MEY}, then the first diagram above shows that a substantial resource rent can be generated.

The notion of resource rent is difficult to grasp and it will be an important part of policy scenario analysis to generate understanding of the concept and its importance. One difficulty is that in practice the resource rent potential of a fishery is not a fixed amount but something that can be increased through time. This raises the question of incentives for the private sector to make the investments necessary to achieve such increases.

For the moment, note from diagram 1 that as effort is reduced from f_1 towards f_{MEY} a vertical gap opens between revenue and cost. This gap measures the sustainable resource rent that the fishery is capable of generating at each effort level. This rent arises because the fish resource is valuable and renewable natural capital that is capable of earning a return on a sustainable basis. The difficult challenge for fisheries policy is to identify instruments that will allow this return to be generated sustainably. From the diagram, it is clear that implementing such instruments will substantially increase the gross value added (i.e. the gross contribution to GDP) from fish harvesting.

Note that the f_{MEY} level of exploitation should also ensure that ecological objectives concerning the exploited fish stock itself are met as an outcome although other ecological goals (e.g. protecting non-commercial species or habitat) may require specific measures.

The resource rent share of value-added is crucial for understanding the potential contribution of fish resources to economic growth. In practice therefore policy scenario analysis needs to be undertaken not only with the Fisheries Ministry but also with other Ministries, especially Finance, Economics and Planning, to build understanding of the particular nature of the GDP contribution that the exploitation of fish resources can make.

The analysis of the economic optimum scenario will build initially on the same indicators as in the baseline scenario, giving the basis for an immediate comparison.

But the generation of resource rents will highlight the need for a broader set of indicators than is typically used in fisheries policy.

This is because the resource rents represent what the World Bank has called an "investable surplus". If we are to measure the true impact of fish resources, we need then to consider also this investable surplus.

So we will need to extend the scenario somewhat. In developing the scenario further we will need to make a certain number of hypotheses, always remembering that the purpose of policy scenario analysis is not to tell people what to do but to explore the possibilities.

One extreme possibility would be to assume that all of the investable surplus accrues to the Government. There are a number of reasons why this would not be a very good idea in practice and in any case it would be impossible to achieve but for now it is a useful simplification. When developing applied analyses, it will be essential to look beyond this option at what is happening with private sector investments.

Before continuing, one thing needs to be stressed: the main difference between the two scenarios is this investable surplus. In the baseline case, which is the environment within which fisheries policy has typically been developed, no investable surplus has been generated so the issue has never arisen with important consequences for the vision of the sector and the variables used to measure it. Bringing the investable surplus into the equation modifies things substantially.

Let us suppose then that the Government takes this investable surplus and invests it in a road-building programme in the coastal area. The road-building itself will generate some extra GDP and employment which clearly results from the wealth inherent in the nation's fish resources but neither the GDP or the employment will be counted against the fisheries sector. So already we can see that there will be a need to re-consider the interpretation of these indicators.

And of course the traffic along the newly-constructed roads will have all kinds of impacts which have been facilitated by the investment of the fish resource wealth.

The point is that the standard indicators, in particular fishery-sector GDP and employment, vastly undersell the potential of fish resources to contribute to economic development and distract policy-makers by drawing their attention in the wrong direction.

The purpose of policy scenario analysis is to highlight these kinds of major issue where as noted above policy-makers (and others) do not know what they need to know, or may be confused as to what they are really trying to achieve.

4.0 Fisheries development versus fisheries transition

Once fishery management units (FMUs) have been specified it will be possible to use scenario analysis to investigate possible public investment options in the fish harvesting sector.

A key issue will be to obtain reliable information on the status of the fish stocks that comprise the natural resource base of an FMU. This status will be measured against defined reference points.

If the fish stock status exceeds the reference point, then there may be scope for ***fisheries development*** in the sense of public investment to drive the fish harvesting sector forward. As fish resources around the world have been exploited at increasing levels, the number of such opportunities has diminished

but nonetheless they may exist in some cases and where they do they tend to attract the attention of policy-makers.

Such fisheries are often referred to as “under-exploited”. It is important however to examine with care what this term really means and why the situation arises. Otherwise there is a risk that misleading conclusions may be drawn for policy.

Under-exploitation refers only to the fish resource. It says nothing about the other resources (labour and capital) that are involved in the exploitation process. Presumably the enterprises involved in the fishery are unable to see profitable opportunities in fishing at greater levels. The mere fact that the potential exists to increase harvest levels does not necessarily mean that it is worth doing so.

A key policy issue will be to identify the constraints preventing the private sector from increasing its usage of the resource. This will then guide the policy interventions that it may be worth undertaking.

As mentioned, the opportunities for fisheries development are becoming increasingly rare around the world. Far more common is the situation where the current effort level is beyond that required to achieve the reference point, i.e. the resource is overfished. In this case, there may also be scope for public investment to improve fish harvesting but not of the “traditional” kind.

Looking at diagram 1, participants in the harvesting sector might agree that it would be better to operate at f_{MEY} rather than at f_1 but the challenge is how to get from one point to the other. Part of the solution is certainly to be found in the institutional arrangements to be put into place. But even so there may be scope for public investment to assist with the ***fisheries transition***.

Policy scenario analysis can model possible transition trajectories. Simple models tend to propose so-called “bang-bang” approaches which seek to move the fishery to its optimum position as quickly as possible. Depending on the species, this might involve closing the fishery for an extended period of time. Such an approach has many drawbacks, for instance during the closed period fishers may well lose their markets to other fishers or fisheries products, or even to non-fishery products, and such markets may prove very difficult to recover once the fishery is re-opened. For this and other reasons, it is probably better to keep the fishery operating at some level, unless the future of the stock is seriously threatened.

But even if a bang-bang approach is not adopted, the key question remains that investment is needed in the fish stock itself. Some sacrifice in catch must be made now so that the fish stock can re-build and support greater catches in the future.

From a policy viewpoint, the issue is to determine how to fund the investment and sacrifice now in order to get to the more profitable future. If fishers are already the ones making the sacrifice, they may not be in the best position to make the investment. Scope then exists for public investment schemes of different kinds to assist with the recovery and transition process.

Through modelling of different strategies, policy scenario analysis can assist with identifying possible options.

5.0 The case of internationally-shared fish resources

Internationally-shared fish resources do not raise different problems in principle. As with all resources, the basic requirements are:

i. Define the fisheries management unit (FMU)
ii. Define the relative rights and responsibilities of all stakeholders through the allocation of rights to provide incentives to maximise the sustainable value of the resource(s)
iii. Establish a robust legal framework for management measures that will protect and enhance the value of the fishery.

However, in practice, difficulties arise because resource rents are found at the fish stock level but this stock is spread across different coastal state jurisdictions and areas beyond national jurisdiction.

The fisheries management problem has therefore to be addressed at two levels (at least):

- at a supra-national level which is coherent with the scope of the fish resource
- at a national level determining strategy within the supra-national framework and with respect to the national allocation (explicit or implicit) that derives there from.

5.1 Supra-national issues

At the supra-national level, scenario analysis can be undertaken to identify what is at stake, the minimum requirements for cooperation and the possibilities in more extensive frameworks.

Initial work[1] has already provided some useful insights. Table 1 summarises the current stock status for the principal market tunas.

Species	MSY	Current	Status
Albacore	47,600	40,981	Probably fully exploited
Bigeye tuna	132,000	100,231	Probably fully exploited
Yellowfin tuna	421,000	430,327	Overexploited
Skipjack tuna	684,000	432,467	Probably not fully exploited

Table 1: Current and potential principal market tuna catch

Table 1 shows clearly how important it is for members of the IOTC to realise that the future does not lie in ever-increasing catches. The principal market tunas in the region are almost all either overfished or fully exploited. Only the lower-valued skipjacks offer some scope to increase catch as shown in the table below.

[1] A Neiland (2016) "CHARACTERISATION OF THE FISHERIES SECTOR IN THE INDIAN OCEAN: With Particular Reference to Tuna Fisheries in the Bay of Bengal: (i) Environmental and Economic aspects"

However, they also need to realise that this does not mean that they cannot obtain greater returns from the exploitation of these resources; far from it. The future lies in extracting more value from the given catches available and ensuring that these catches do not decline.

The very preliminary estimates in Table 2 suggest that the rent potential of the tuna resources in the Indian Ocean is well in excess of US$ 1 billion per annum. These estimates are almost certainly on the low side because they ignore potential market gains that might follow reformed arrangements.

Realising these potential rents will require reform at the level of the Indian Ocean Tuna Commission (IOTC), the relevant Regional Fishery Management Organisation (RFMO). Given the very large number of countries (46 or so) exploiting the Indian Ocean, this represents a big challenge but the potential payoff is clearly very large.

Species	Price (FAO Globefish)	MSY value (US$ millions)	Rent potential at MSY (US$ millions)
Albacore	2,500 USD/tonne	119	47.6
Bigeye tuna	12,000 USD/tonne	1,584	633.6
Yellowfin tuna	2,500 USD/tonne	1,053	421.0
Skipjack tuna	1,000 USD/tonne	684	273.6

Table 2: Preliminary rent estimate for principal market tunas[2]

In the case of internationally-shared fish resources, there are relatively few examples of success around the world. One case is provided by the International Pacific Halibut Commission (IPHC). The work of this Commission has been crucial in conserving the very valuable halibut stocks and enabling the members of the Commission to extract rents from their sustainable exploitation. This agreement demonstrates what appear to be the minimum requirements for success:

- a regional organisation (or agreement) that sets overall catch limits each year (or season)
- an agreement on how to divide these catches between members
- compliance by members in respecting their catch allocations.

Although it would certainly be profitable to look more closely at the IPHC management arrangements, the case provides limited insights for the Indian Ocean because it involves only two member States (USA and Canada) and a single species (halibut). This may be compared to the Indian Ocean Tuna Commission which has 32 Commission Contracting Parties (Members) and 4 Commission Cooperating Non-Contracting Parties (CNCP) and is responsible for the management of tuna and tuna-like species in the Indian Ocean. One scenario that might be considered would be to re-structure IOTC to bring more focus on to the resources and reduce the number of members per resource.

[2] Same source.

The recent World Bank report on Trade in Fishing Services[3] notes that:

> *"The difficulty of ensuring sustainable cooperation increases with the number of participants. Where more than a few participants are involved, sub-coalitions become an important part of finding a solution. According to the compensation principle, it is the player with the most at stake who should dominate and then be prepared to compensate the other players. This is in effect what happened in the Pacific Islands region through the formation of the Parties to the Nauru Agreement (PNA) sub-coalition."*

Reviewing how the Western Pacific islands have extracted rents from their tuna resources is likely to provide more insights than the IPHC case. But even here there are important differences with the Indian Ocean. In developing scenarios, the key will be to draw on generically relevant results that can be tuned to the Indian Ocean case. The development of so-called sub-coalitions noted above is one area where it would be helpful to explore the implications of different solutions.

It is interesting to note that the arrangements in the Western Pacific emerged outside of the Regional Fisheries Management Organisation (RFMO) structure and in a sense are now being fed back into that structure. One difficult political question is whether RFMOs can ever provide radical solutions to the fisheries management problem or whether such solutions will have to be sought through the development of coalitions outside of the RFMO structure.

The structure and weaknesses of RFMOs in general certainly suggest that radical change will be difficult at the least to implement from within. Because RFMOs are international bodies bringing together countries sharing a practical and/or financial interest in the management and conservation of fish stocks in a particular geographical area, their membership includes both coastal States, whose waters are home to at least part of an identified fish stock, and the distant water fishing nations (DWFN) fishing that stock. The problem is that this approach confounds the issues of ownership and exploitation of the resource. Unravelling these two elements will be essential in resolving the problem of internationally-shared fish resources and the development of scenarios looking at how this might be done would be instructive.

5.2 National (coastal state) issues

Similar issues arise at the national level in the coastal states. At present, the dominant approach seems to be to view principal market tunas as providing a development opportunity in the sense of fishing activity itself. For this reason a number of Indian Ocean coastal states appear to be interested in developing their tuna fleets in order to establish their presence at the exploitation level.

This approach is that it is likely to be self-defeating in the aggregate. As Table 1 shows there is almost no scope to increase catch so the new fleets will represent an addition to the overcapacity problem when viewing the fishery as a whole. The free and open access problem outlined above will simply be played out at the international level. Each country will develop similar reasoning about the legitimacy

[3] World Bank (2014) "Trade in Fishing Services" p.12

of its participation in the fishery and the scope for its vessels to take some of the catch but the aggregate result will be the usual more and more vessels taking the same or a decreasing catch.

This is a kind of economic game in which there will ultimately be no winners unless there is cooperation amongst the players. As shown by Table 2, the potential payoff is large.

At the national level therefore the main requirement is to develop scenarios in order to analyse the different possibilities. First, what share of the resource could be considered to belong to the coastal state? There are of course many different ways to address this question. One interesting possibility would be to study the so-called zonal attachment of tunas to the different coastal states as a means of allocating ownership shares[4]. There are many ways in which zonal attachment can be interpreted so different scenarios can be developed. Second, if cooperation is the key, with whom and how should the coastal state cooperate? Western Pacific experience suggests the importance of sub-coalitions outside of the RFMO so the coastal state needs to identify who its partners might be and how the coalition might be constructed. Third, how does the coastal state see long-term exploitation of its share of the resource and what is the expected payoff? Even if this question may be some way in the future, the way in which the coastal state addresses it will already have implications for its fleet development policy. Finally, if the coastal state sees a role in the future for distant-water nations as service-providers in the exploitation of its share of the resource, then it needs to consider how to collaborate with other coastal states who have similar views to develop a common negotiating stance.

6.0 The case of EEZ resources

The issue of internationally-shared fish resources is doubtless the most difficult problem in fisheries management. Not all tuna-like species are internationally shared, in particular the neritic tunas may be manageable as single stocks within a given coastal state EEZ.

Although less valuable than the principal market tunas, reformed management of these species could nonetheless return substantial rents - for instance, Neiland (2016 op cit) estimates total rents for these species to exceed $220 million per annum with kawakawa some $60 million, spanish mackerel $51 million and longtail tuna around $49 million. The situation is all the more urgent because for almost all neritic tunas the stock status is critical.

One other feature of success in the Western Pacific is noteworthy and this is that for a couple of decades the Pacific Island Countries have made substantial investments in their institutional fisheries management capacity, especially in terms of human resources. A similar investment is likely to be required in the Indian Ocean.

Putting these various elements together, it would seem logical to take the case of one or more neritic tunas to develop scenarios with policy-makers to explore the implications of different policy and management approaches using the broad methodological approach outlined in sections 2, 3 and 4 of this report.

[4] See for instance "Allocation of fishing rights in the NEA" Norden Discussion Paper, Nordic Council of Ministers 2015 for a discussion in the North-East Atlantic context

7.0 Conclusions

Scenario analysis is a widely-used tool to assist with strategic planning. The aim here is use it to provide useful and useable insights to fisheries policy-makers (and to other stakeholders and interested parties).

In general, a scenario is a combination of a set of circumstances and policy actions. Scenarios have to be developed in a way that is useful to address the policy problem so that they can then be analysed to determine what results are likely to follow for a given set of drivers.

The approach should reveal hidden weaknesses in policy, thereby increase its coherence and reducing unexpected negative impacts. The biggest challenge facing PSA is to identify the real needs of policy-makers, when policy-makers may not themselves know what they need to know, or may not know how to describe the information that they really want, or may be confused as to what they are really trying to achieve.

One advantage of PSA is that it requires very specific consideration of the timescale and scope of the analysis and the identification of the stakeholders.

PSA generally proceeds by constructing a baseline "business-as-usual" scenario which is then compared with some kind of "optimal" scenario based on the possibilities that the fish resource offers and working back to the policy implications. A third scenario might then be included which identifies some kind of intermediate situation that is considered desirable for some reason.

The baseline scenario is built around free and open access, although this scenario also describes many other common situations in fisheries where the access issue is not addressed adequately. The scenario can be quantified and the benefits and risks identified.

The optimum scenario brings the inherent value of the resource, the resource rent, to the fore. In doing this, analysis of the scenario will show a much wider range of benefits from fish resource exploitation.

These scenarios are generic and can be applied to all fisheries. The ease of application will depend on the nature of the fish resource concerned. The most difficult case is probably internationally-shared fish resources such as the principal market tunas. For this reason, it is suggested that the approach should be applied first to some of the neritic tunas. Success in this latter case would realise substantial value for the coastal states concerned and will result in the development of fisheries management expertise that will be invaluable in addressing the former case.

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