# Developing Holistic Management for the Snapper Grouper Fishery

Council Staff
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## Introduction

A holistic approach for managing the Snapper Grouper Fishery will begin with multiphase public input process that will occur from June 2022 to June 2024. The goal of the initial phase is to develop and evaluate different management approaches and compare how well the approaches achieve management objectives. Fisheries and resource managers around the world are using management strategy evaluation (MSE) framework (Punt et al. 2016, Duthie et al. 2018)[1] to address complex management issues. For example, an MSE was developed for several stocks in California to inform managers as the state was adjusting their Master Plan for Fisheries (Hordyk et al. 2017). The results of the MSE included a suite of best-performing management strategies for the evaluated species while considering the regulatory environment.

In basic terms, an MSE is a framework to evaluate tradeoffs among management approaches and uncertainties associated with the management strategy (Punt et al. 2016). MSEs have several components including a set of management objectives, a set of performance criteria related to the objectives, a set of management strategies, operating models to calculate the performance of management strategies, and evaluation models to compare the management strategies (Kaplan et al. 2021). The first three components of an MSE come from stakeholder and manager input and the last two components are developed by a modelling team based on the input. MSEs have been used to investigate a variety of issues in fisheries management: catch level scenarios, data collection methods, social and economic aspects of a fishery, and ecosystem impacts. However, MSEs are not limited to managing fisheries and have been developed to manage other natural resources. In the following case study addressing duck hunting, the objectives were to simulate 1) how hunting activity would develop spatially and 2) how the development would adjust to agricultural and ecological constraints of the area.

## Case Study

As mentioned before, MSEs can be used to evaluate different natural resource management strategies. In the following example, an MSE was used to evaluate different land uses relative to a suite of objectives (Mathevet et al. 2003). The example focuses on using land for farming or leasing for duck hunting and different strategies for both land uses under two different scenarios. The different strategies were developed for farmers and hunters. The farmers strategies were options to choose leasing part of their land to duck hunters as an additional source of income based on the agriculture market conditions, fees for leasing, and cost associated with leasing. The hunter strategies were options to select land to lease based on the conditions of the farm, fees for leasing, and duck population. Therefore, strategies selected by the farmer could impact the choice of the hunters and vice-versa. The modelers tested a high profit single crop farming scenario that provided additional habitat for ducks and low profit farming scenario with multiple crops to test if hunting would contribute to the maintenance of the farm in down farming periods.

[1] Online resources to conduct an MSE can be found at openMSE, FLR package in R, GSME package in R.

Farmers were surveyed to understand their preferred strategy based on profits, historical farming practices, and location of the property (**Figure 1**). Hunters were surveyed to determine how much they were willing to pay, type of hunt club they preferred, and satisfaction of the hunt. The responses of the survey were used to determine how farming strategies and hunting strategies would change over 60 years. The changes in these strategies in turn impacted the duck population and the changes in the duck population were modelled as well.

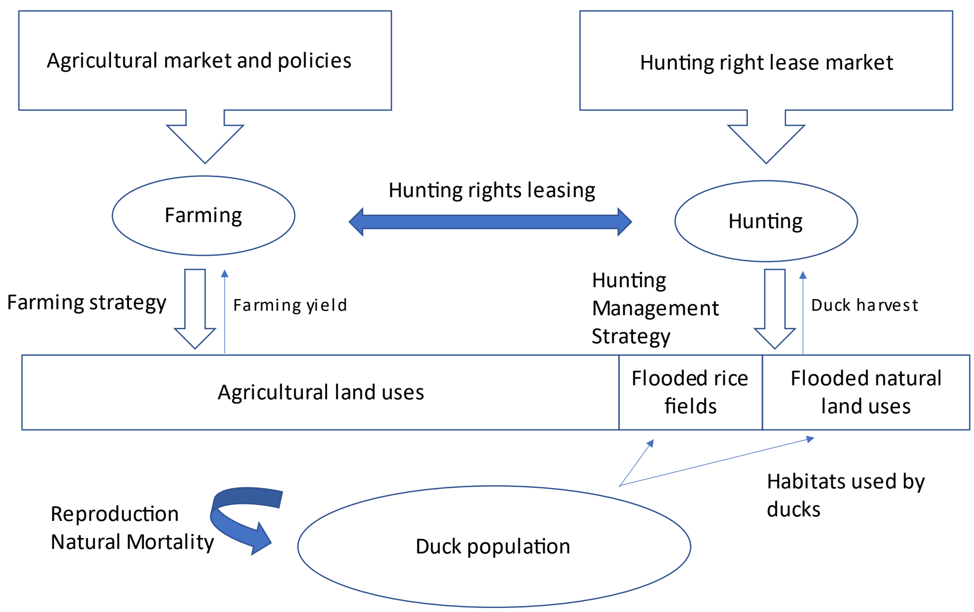


**Figure 1**. Conceptual diagram of inputs into a management strategy evaluation for land use described in Mathevet et al. (2003). The model predicts the duck population based on the farming strategy selected as well as other objectives to evaluate including farming yield and duck harvest.

The modelling included factors such as land topography, distance to nature preserve, acres for farming, value of crop, duck population, value of the hunting lease, fee for hunting, as well as other factors. Based on the conditions in the model, different strategies were predicted for the farmers and hunters using the results of input from surveys under the high profit single crop farming and low profit farming scenarios. The two different scenarios can then be compared to each other to evaluate which strategy was best based on predetermined criteria. These criteria included:

- Duck resource
- Hunting harvest
- Harvest/duck
- Agricultural land
- Number of hunters
- Hunting leases
- Individual fee
- Hunting turnover

Land use was then simulated for 60 years to predict the potential outcomes for the farmers, hunters, and ducks under the two scenarios. In this example, when the high profit single crop farming scenario was created, then the duck resource was predicted to increase due to an increase in available habitat. Also, the economic return from hunting leases was predicted to diminish due to little economic incentive to create new hunting leases. When a low profit farming scenario was created, the profits from hunting leases were higher than the farming profits. Therefore, more farmers would choose to modify their property and lease their property for hunting. The additional farms with hunting leases resulted in a lower duck resource and a higher duck harvest rate. Under the low profit farming scenario, duck population was predicted to be half the population size of that under the high profit farming scenario even though the duck population was modelled with similar life history characteristics and climate variations.

Although regulation scenarios were not developed in this example as would be developed in the Snapper Grouper MSE, there are some potential parallels that can be applied to fisheries management. For example, the hunting turnover criteria could be equivalent to maintaining a stable market for commercial fishermen and the duck resource criteria could be a sustainable fish population biomass. A clear difference between the case study and the Snapper Grouper MSE is the Magnuson-Stevens Act requirement to prevent overfishing and rebuild populations. This is a required constraint that would need to be included in the model.

## Snapper Grouper MSE

The Snapper Grouper Fishery MSE will be a public driven process with stakeholders, the Snapper Grouper Advisory Panel (AP), the Scientific and Statistical Committee (SSC), and the Council playing an important role in developing a successful project. These groups will be provided an opportunity to comment on management objectives (what do the stakeholders care about), metrics used in the evaluation (what is important to consider for the management objectives), and management strategy (how to achieve the objectives). MSEs cannot address all issues in a fishery at once but focus on targeted strategies that can be evaluated through a quantitative framework.

The first key piece of information to gather from stakeholders will be the management objectives and evaluation criteria. In this step, stakeholders will identify what is most important to them. Information gathered during port meetings held for the Vision Blueprint Process in 2018 will be used as a starting point to identify management objectives. A range of potential objectives will be collected through scoping with stakeholders using an online survey and the Snapper Grouper AP during their biannual meetings (**Table 1**). The Council will provide recommendations on a suite of management objectives and evaluation criteria to consider for the modelling team. Once the management objectives and criteria for evaluation have been selected, management strategies will be scoped. Input on the management strategies will be scoped similar to the management objectives with input from stakeholders collected through an online survey and input from the Snapper Grouper AP.

The management objectives and evaluation criteria collected through public input will be incorporated into the modelling component of the MSE. An operating model will be developed to quantify potential changes to the fishery and species based on the objectives and criteria selected (**Table 1**). The operating model will have several sub-models within it that can used to describe changes in the biological condition of the stock, the catch rates of different populations, or social and economic conditions of the fishery. A second part of the modelling, also based on public input, will be a management procedure, which is a set of algorithms along with scientific uncertainty to implement the management scenario in the operating model. The management procedure is a simulated approach to describe the changes associated with a management scenario. The output of the modelling will be quantitative measures that can be evaluated to determine if the management scenario meets the predefined objectives and describe which strategy is the "best" strategy among the alternatives considered.

**Table 1**. Conceptual flow diagram of an MSE adopted from Goethel et al. (2018). MSEs are an iterative approach and may not directly flow from 1 to 8.

| **Category** | **MSE Steps** | **Participants Roles** | |
|---|---|---|---|
| | | Stakeholders, AP, and Managers | MSE Working Group |
| Scoping | 1. Identify participants | AP and develop webpages to solicit public input | Create MSE Working Group and SSC working group |
| | 2. Identify management objectives and quantitative performance criteria | Describe important management objectives and evaluation criteria | Gather information on management objectives and evaluation criteria |
| | 3. Identify uncertainties to be evaluated in robustness testing | Provide feedback on uncertainties | Develop methods to describe uncertainty based on above |
| Technical | 4. Develop operating model and implementation models | Evaluate the general configuration of operating model and implementing model | Develop analytical tools |
| | 5. Parameterize and condition operating model | | SSC Working Group aid in parameterizing model |
| Scoping | 6. Identify candidate management strategy | Propose a set of management strategies | Provide guidance on range |
| Technical | 7. Simulation test | Provide feedback as needed | Conduct analyses |
| Evaluation | 8. Summarize performance of evaluation and revisit as needed | Review and provide feedback on presenting results | Develop summaries and graphics |

Participants/Groups

**Stakeholders** – comments to develop management objectives and criteria to evaluate the objectives

**Snapper Grouper AP** – comments to develop management objectives and criteria to evaluate the strategy

**SSC** – reviews the model during development and methods to quantify impacts used to evaluate management approaches

**SSC Working Group** – aid in the development of the MSE and will meet regularly with MSE Working Group (see below).

**Council** – provides final recommendations on strategies to consider and criteria to evaluate

**MSE Contractor** – Responsible for developing the model. Selected through a Request for Proposal process

**MSE Working Group** – Council staff (Science Staff, Biologist, Economist, Social Scientist), contractor, SEFSC (Modeler, Ecologist, Economist/Social Scientist), SERO (Biologist, Economist, Social Scientist), and MSE Contractor

**Meeting Facilitator** – Contract facilitator to lead the discussions on management strategy and evaluation criteria. Present at AP and Council meetings

## Costs Estimate

Approximately $150,000 per year and $300,000 total.
The project will require an MSE Contractor (post-doc hired through a university) for two years, Meeting Facilitator to facilitate Snapper Grouper AP and Council discussion, meetings and travel, as well as SSC and Council stipend. Costs were developed based on conversations with researchers that have conducted MSEs in the past.

## Timeline

Very Preliminary Public Input Timeline

<table>
<tr><th>Month</th><th>2022</th><th>2023</th><th>2024</th></tr>
<tr><td>January</td><td rowspan="2">Staff release RFP</td><td rowspan="3">Public comment solicitation on evaluation metrics</td><td></td></tr>
<tr><td>February</td><td></td></tr>
<tr><td>March</td><td>Staff select RFP</td><td></td></tr>
<tr><td>April</td><td></td><td>AP refines evaluation metrics</td><td>Draft evaluation presented to AP</td></tr>
<tr><td>May</td><td></td><td></td><td></td></tr>
<tr><td>June</td><td></td><td>Council reviews evaluation metrics and management objectives</td><td>Final evaluation presented to the Council</td></tr>
<tr><td>July</td><td rowspan="3">Public comment solicitation on management objectives</td><td rowspan="3">Public comment solicitation on management strategy</td><td></td></tr>
<tr><td>August</td><td></td></tr>
<tr><td>September</td><td></td></tr>
<tr><td>October</td><td>AP refines management objectives</td><td>AP reviews refines management strategy</td><td></td></tr>
<tr><td>November</td><td></td><td></td><td></td></tr>
<tr><td>December</td><td>Council selects management objectives to consider</td><td>Council recommends management strategy</td><td></td></tr>
</table>

Very Preliminary Modeling Timeline

<table>
<tr><th>Month</th><th>2022</th><th>2023</th><th>2024</th></tr>
<tr><td>January</td><td rowspan="6">See public input timeline</td><td rowspan="3">Operating model and implementing model completed</td><td></td></tr>
<tr><td>February</td><td></td></tr>
<tr><td>March</td><td></td></tr>
<tr><td>April</td><td>Evaluation metrics presented to SSC and AP for input</td><td>Draft MSE presented to AP</td></tr>
<tr><td>May</td><td></td><td></td></tr>
<tr><td>June</td><td>Evaluation metrics presented to Council for input</td><td>Final MSE presented to the Council and report finalized</td></tr>
<tr><td>July</td><td rowspan="3">Operating Model developed and begin implementation model development</td><td rowspan="3">Operating model and implementation model with metrics presented during Seminar Series</td><td></td></tr>
<tr><td>August</td><td></td></tr>
<tr><td>September</td><td></td></tr>
<tr><td>October</td><td>Model presented to gather SSC and AP input on management objectives</td><td>AP and SSC provide input on the model and select management strategies</td><td></td></tr>
<tr><td>November</td><td></td><td></td><td></td></tr>
<tr><td>December</td><td>Model presented to Council to gather input on management objectives</td><td>Council final approval on suite of management strategies</td><td></td></tr>
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## Literature Cited


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