Lowering Barriers to Alternative Stock Assessments and Collaborative Fisheries Research

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Introduction

United States fisheries are vital economic, cultural, and consumptive resources, whose sustainability is threatened by fishing inefficiencies. These inefficiencies are a product of precautionary management due to a shortage of fisheries data, inappropriate scales of assessment and management, and a lack of collaboration between fishermen, scientists, and managers. Traditional stock assessment methods demand large amounts of data over both time and space, resulting in considerable uncertainty and under-informed management decisions about fish sustainability. The Decision Tree, an alternative management strategy, can benefit fishermen as a resource for collecting scale-appropriate fishery data at minimal cost and integrate marine protected areas into fishery management. Implementation of the Decision Tree management strategy can improve efficiency and enhance the integration of collaborative research with science-based management.

Santa Barbara Nearshore Fishery

The Decision Tree (DT) method is especially useful in fisheries that exhibit sub-population dynamics, such as the nearshore live fishery in the Northern Channel Islands. According to the California Department of Fish and Game (CDFG), the number of fishermen fishing live fish has decreased in recent years, while the price per pound for fish has increased [1].

Survey of Santa Barbara Nearshore Fishery

Methods: An interview-style survey was conducted with 7 fishermen (84% of the fishery) in the nearshore live fish fishery in Santa Barbara. Survey goals were to:
- Obtain demographic information
- Gather input for data collection tools and techniques
- Build working relationships
- Gauge interest in collaborative management

Results: All interviewed fishermen rely on fishing as their only income source. However, they spend less time (75%) fishing near offshore reserves than in previous years. Survey results indicate that fishermen:
- Are disillusioned with management of the nearshore live fish fishery;
- Believe the information used to assess the stock and assign catch levels is inaccurate;
- Desire to participate in fisheries management (Fig. 1);

Fishery Organization Scenarios

Effective implementation of the DT is most efficiently accomplished in conjunction with a cohesive fishery organization, conceptualized as an organic, step-wise process. The scenarios are described below, and Table 1 highlights the advantages of each.

University Funded Collaborative Research
- Sense Ques-UCSB is primary motivation and funding source
- Data are not inform management decisions
- Foundation for other initiatives

Association
- Loose association of fishermen
- University researchers involved in onboard sampling in reserve and data analysis
- Fisheries collect data outside reserves

Cooperative
- Recognized legally as a business or non-profit organization
- Formal agreements to collect data, pay dues, attend regular meetings with formal leadership, and work towards other cooperative goals

Table 1. Benefits of each scenario.

Cooperative
- Pays cooperative djues
- Pay dues, attend regular meetings
- Formal agreements to collect data
- Collect data outside reserves
- Use of computer vision software

Research Question: How can the Decision Tree alternative management strategy be implemented to improve sustainability and profitability in the Santa Barbara nearshore live fish fishery by moving management beyond broad-scale, data-poor, precautionary methods?

The Decision Tree

The Decision Tree (DT) approach to fisheries management utilizes four stages of adaptive analysis to set and refine Total Allowable Catch (TAC) estimates. This collaborative method utilizes fishermen-recorded location, fish size structure, and catch per unit effort data inside and outside of marine reserves to inform managers on biologically significant scales. This MPAs based Decision Tree management strategy has the capacity to:
- Increase data collection at biologically significant scales;
- Minimize the cost of data acquisition by incorporating collection into fishermen workflow;
- Integrate marine protected areas (MPAs) into fisheries assessment and management;
- Enhance collaboration between fishermen, scientists, and managers;
- Transition data-poor fisheries from precautionary to data-rich, science-based management.

Data Collection Technology

Cabezon Size Distribution

Table 2. Inside reserve, outside reserve, and total data collection costs in each of the three scenarios.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Inside Reserve Collection</th>
<th>Outside Reserve Collection</th>
<th>Total Data Collection Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>University Funded Collaborative Research (total qty)</td>
<td>$14,000 (210 sample days x 20 days)</td>
<td>$14,000 (210 sample days x 20 days)</td>
<td>$28,000</td>
</tr>
<tr>
<td>Association</td>
<td>$14,000</td>
<td>$14,000 (210 sample days x 20 days)</td>
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Data Collection Costs

To compare the three scenarios, we chose to look at the value of one hour of fishing time in this fishery and the cost of data collection per sample. Based on common fishing practices, interviews with the fishermen, and talking with UCSB researchers, we determined that:
- One-sample collection takes one hour per day;
- 40 sample days per year, 20 inside reserves and 20 outside reserves, are required [4];

Economic Analysis Results
- The time value of one fishing hour is $95.22
- Year of fishermen-collected data is worth $1,094.40 or 272 lbs of cabezon (Table 2)
- 272 lbs of cabezon is 4.4% of total cabezon state TAC
- CDFG can increase the current TAC by less than 1% to allow fishermen to recover the cost of data collection outside reserves

Conclusion

Reforming management to incorporate fisheries data on biologically appropriate scales is crucial to sustainability and data collection on biologically appropriate scales and data collection on biologically appropriate scales.

The Decision Tree management strategy has the capacity to transition the nearshore live fish fishery from precautionary to science-based management, substantially increasing collaboration between fishery stakeholders and improving economic and biological sustainability.

A cohesive fishery organization activates data collection and assessment goals and distributes management responsibility between managers and local fishermen.

The implementation of the Decision Tree method in California will require an adaptive approach that integrates collaborative science with the management desires of local fishermen and CDFG.