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 when data is unavailable. The Decision Tree, an alternative management strategy, taps fishermen as a resource for collecting scale-appropriate fishery data at minimal cost and integrates marine protected areas into fisheries management. Implementation of the Decision Tree management strategy can improve efficiency and encourage 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 finfish fishery in the Northern Channel Islands.

- The number of fishermen fishing live fish has decreased in recent years, while the price per pound for fish has increased [1]
- 30% of active fishermen in the South Coast nearshore fishery made landings in the Santa Barbara port complex in 2008 [2]
- Santa Barbara fishermen land 24% of grass rockfish and 11% of cabezon landed in California
- The grass rockfish fishery is considered data poor, while the cabezon fishery is data moderate [3]

Survey of Santa Barbara Nearshore Fishery

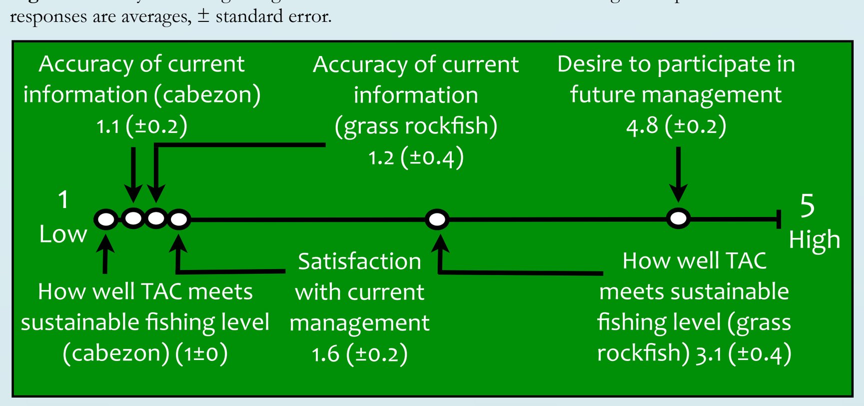
Methods: An interview-style survey was conducted with 7 fishermen (44% of the fishery) in the nearshore live fish fishery in Santa Barbara. Survey goals were to:

- 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 (35%) fishing grass rockfish and cabezon than in previous years. Survey results indicate that fishermen:

- Are dissatisfied with management of the nearshore live finfish fishery
- Believe the information used to assess the stock and assign catch levels is inaccurate
- Would like to participate in fisheries management (Fig. 1)

Figure 1. Survey results regarding fishermen satisfaction with current management practices. All responses are averages, ± standard error.



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

- Status Quo-UCSB is primary motivation and funding source
- Data do not inform management decisions
- Foundation for other scenarios

Association

- Loose association of fishermen
- University researchers involved in onboard sampling in reserves and data analysis
- Fishermen 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

	Knowledge Sharing	Access to Outside Funding Opportunities	Research Set Aside (RSA)	TAC Allocation	Resource Pooling	Recognition by CA Dept. of Fish & Game (CDFG)	Data Collectors Benefit	Entire Fishery Benefits
University Funded Collaborative Research	✓						✓	
Association	✓	✓	✓				✓	✓
Cooperative	✓	✓	✓	✓	✓	✓	✓	✓

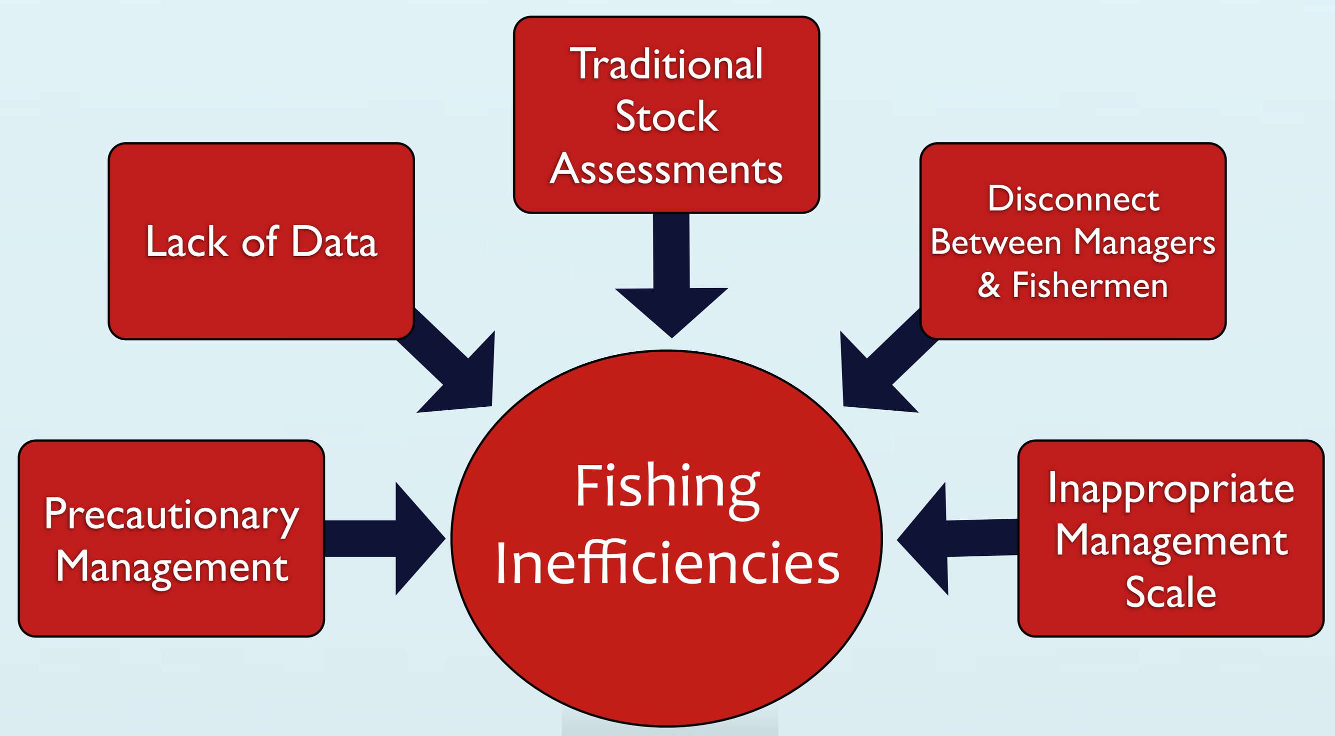
Table 1. Benefits of each scenario.

References:
[1] S. Lucas, *SPC Live Fish Information Bulletin* **16**, 19-25 (2006).
[2] M. Key, Bren School request for nearshore permittee information in southern California (2008).
[3] V.R. Restrepo *et al.*, "Technical Guidance On the Use of Precautionary Approaches to Implementing National Standard 1 of the Magnuson Stevens Fishery Conservation and Management Act" (NOAA Tech. Rep. NMFS-F/SPO-##, 1998).
[4] A. MacCall, paper presented to MPA Reference-Based Working Group, Santa Cruz, CA, July 2008.

The Decision Tree

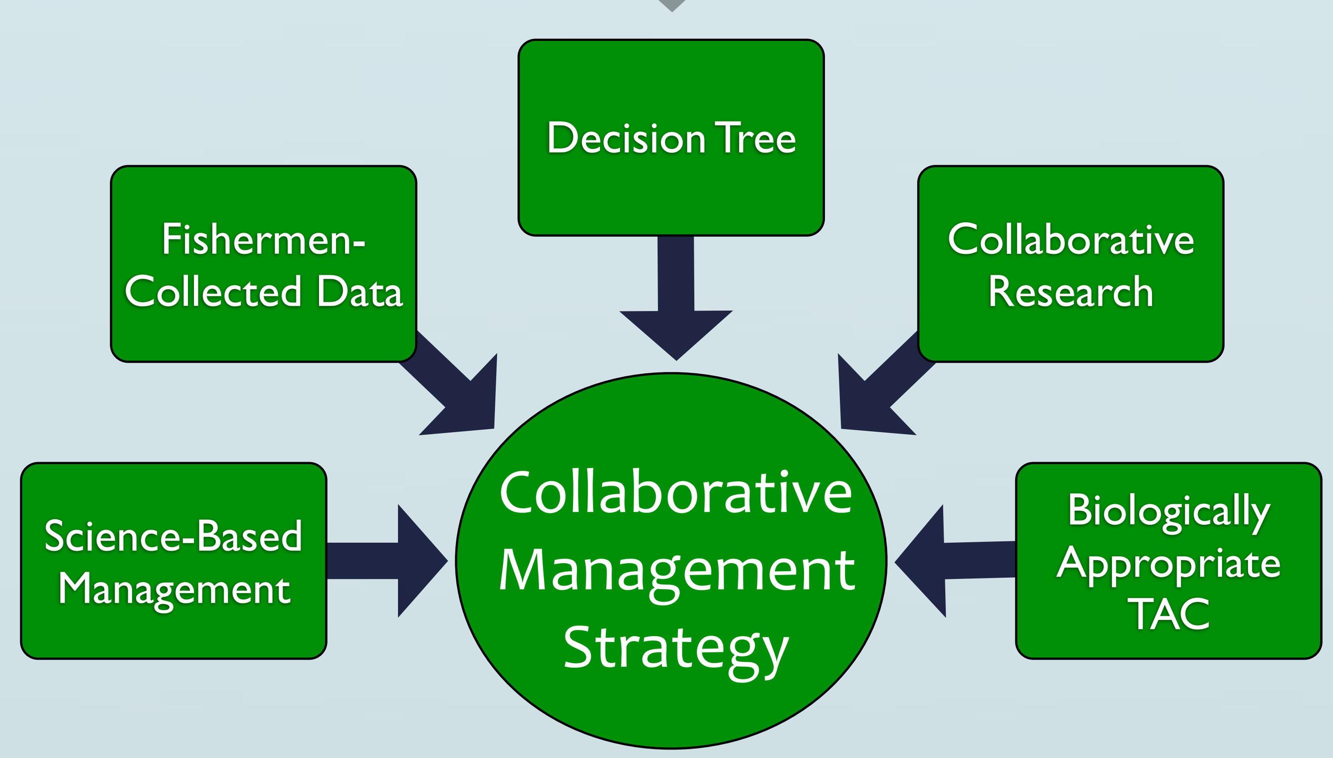
The Decision Tree (DT) approach to fisheries management utilizes four stages of adaptive analysis to set and refine Total Allowable Catch (TAC) estimates. This collaborative method utilizes fishermen-recorded location, fish size structure, and catch per unit effort data inside and outside of marine reserves, to inform managers on biologically significant scales. This MPA-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, and
- Transition data-poor fisheries from precautionary to data-rich, science-based management



Research Question:

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



Data Collection Technology

We developed a set of solutions designed to meet both fishermen requirements for data security and the DT's requirements for data volume, precision, and integrity. Population size structure samples must include throwbacks, which represent a significant portion of overall catch (Fig. 2). We developed two sampling technology/methodologies: one for skiffs, and another for boats:

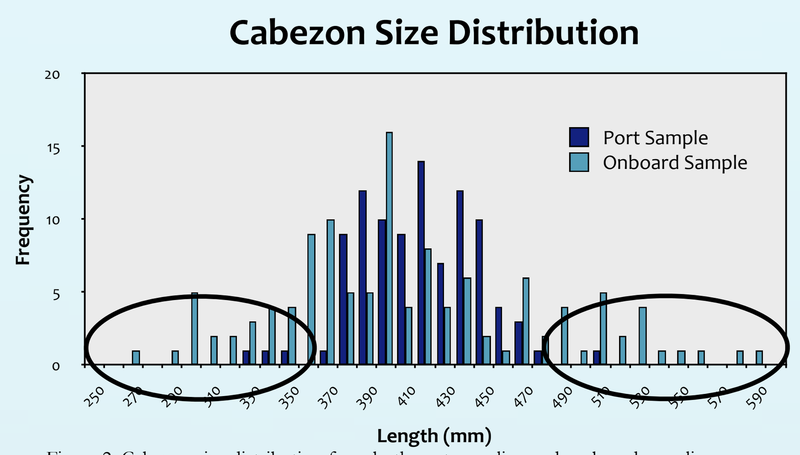


Figure 2. Cabezon size distribution from both port sampling and on-board sampling. The circles highlight data that are missed when data is only gathered via port sampling.

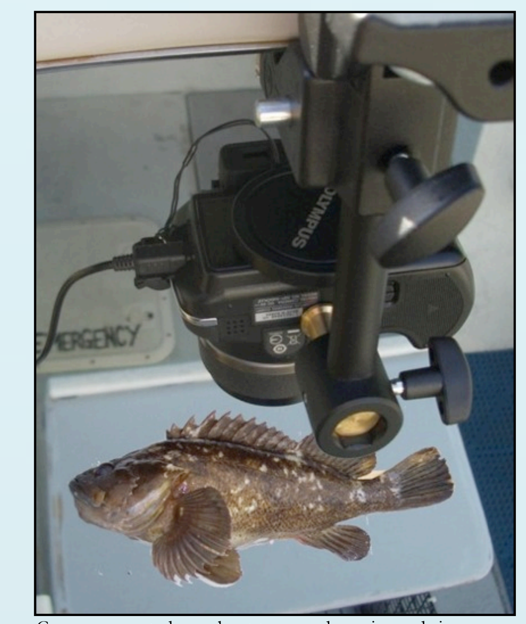
As of February 2009, this method is currently being field tested by two fishery members.

Our **skiff-based** solution:

- Length, date, and time marked on removable PVC inserts
- Inserts coupled to GPS data collected with onboard GPS units
- Fixed cost for the fish board is minimal (~$30), while basic GPS units costs less than $100

Our **boat-based** solution:

- Mounted on cabin roof ledge, facing downward to a worktable where fish are photographed prior to hull storage
- Species length, time, and location data coupled to images manually or automated with computer vision software and GPS
- Total one-time cost for camera plus GPS logging hardware is approximately $500 per boat



Camera mounted on a boat to record species and size.

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 within each scenario. Based on common fishing practices, interviews with the fishermen, and talking with UCSB researchers, we determined that:

- Onboard data 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**
- 1 year of fishermen-collected data is worth $1,904.40 or 272 lbs of cabezon (Table 2)
- 272 lbs of cabezon is **0.46%** of total cabezon state TAC
- CDFG can increase the current TAC by less than 1% to allow fishermen to recoup the costs of data collection outside reserves

Scenario	Inside Reserve Collection	Outside Reserve Collection	Total Data Collection Costs
University Funded Collaborative Research (status quo)	$24,000 ($1200/day x 20 days)	$24,000 ($1200/day x 20 days)	$48,000
Association	$24,000 ($1200/day x 20 days)	$1,904.40 ($95.22/day x 20 days)	$25,904.90
Cooperative	$24,000 ($1200/day x 20 days)	$1,904.40 ($95.22/day x 20 days)	$25,904.90

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

Conclusion

- Reforming management to incorporate fisheries data on biologically appropriate scales is crucial to sustainably manage California's nearshore finfish fishery
- The Decision Tree management strategy has the capacity to transition the nearshore finfish fishery from precautionary to science-based management, simultaneously increasing collaboration between fishery stakeholders and improving economic and biological sustainability
- A cohesive fishery organization achieves 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

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