BREN SCHOOL OF ENVIRONMENTAL SCIENCE & MANAGEMENT
UNIVERSITY OF CALIFORNIA SANTA BARBARA

GROUP PROJECT BRIEF

Economic Viability and Sustainable Management of a California Red Abalone Fishing Cooperative

Client: California Abalone Association

<u>Project Members:</u>
Heather Hodges
Dan Ovando
Josh Uecker
Ariel Jacobs
Kristen Bor

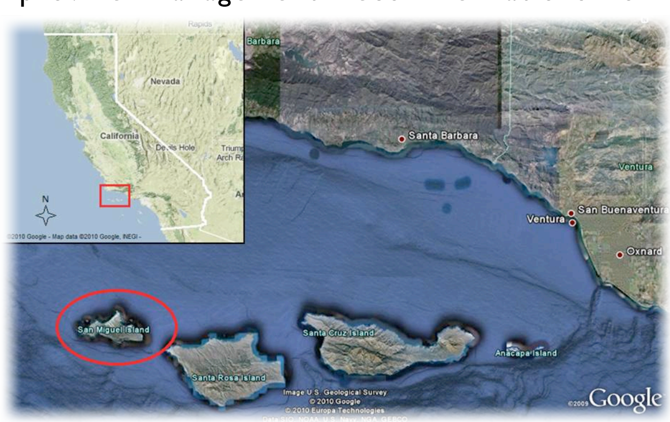
<u>Faculty Advisor:</u>
Dr. Chris Costello

On the web at http://fiesta.bren.ucsb.edu/~abalone/ *Spring 2010*

Overview

This project provides analyses and recommendations to support the economic viability and sustainable management of a proposed commercial abalone fishing cooperative at San Miguel Island (SMI), California. A statewide moratorium has been in place on the commercial take of red abalone since 1997. Evidence suggests that the population at SMI may now be capable of sustaining fishing effort (1,2), leading the California Fish and Game Commission to consider reopening a commercial fishery on an experimental basis at this location.

In response, our client, the California Abalone Association (CAA), has developed a plan for a cooperative fishery that, through a co-management agreement with government managers, would provide members with dedicated access to a portion of the red abalone stock at SMI. Building from the CAA's initial plan, we conducted an economic viability analysis of the proposed fishing cooperative, taking into account uncertainty in both financial and ecological factors. We also drew from cooperative fishery case studies around the world in order to provide management recommendations for improving the economic, ecological, and social well-being of the potential cooperative fishery.



Location of proposed abalone fishery

Project Background

The common-pool nature of marine fisheries frequently leads to misaligned economic incentives, often resulting in increased fishing effort, declining fish stocks and larger economic costs (3, 4, 5). These issues are commonly implicated in the collapse of California abalone stocks (6). Catch-share management systems, such as cooperatives, have been demonstrated to remedy the inefficiencies of open-access fisheries that resulted in the closure of the California abalone industry (7).

<u>Evidence shows cooperatives can:</u>
- Reduce the "race to fish"
- Increase stewardship
- Improve health of stock
- Increase fishery value
- Increase demand for better science

For this reason, a cooperative structure is being considered as a management option for this experimental fishery. An abalone cooperative has the potential to improve existing data, contribute to enforcement, and serve as an example of innovative fisheries management. However, in order for this potential fishery to be approved, some indication of the economic potential and capability for sustainable management is needed. In order to address this challenge, this project analyzed the economic viability of the proposed catch-share fishery and researched cooperative management practices intended to help ensure long-term success and sustainability of this fishery.

General Approach

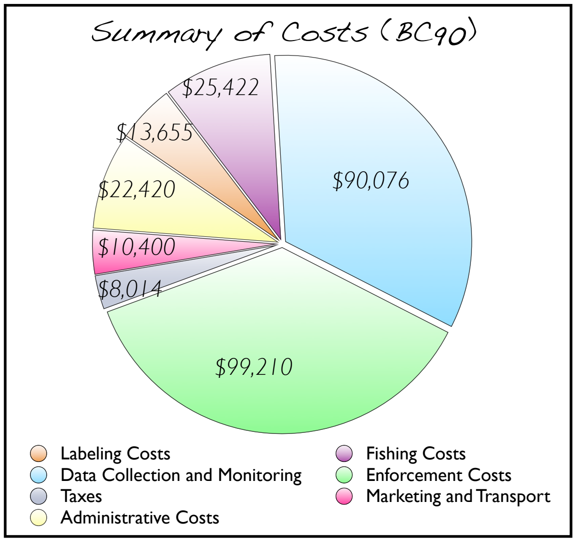
- ✳ Examine cooperative's costs and benefits over 15 years
- ✳ Incorporate environmental and economic uncertainty
- ✳ Make recommendations for cooperative structure

Benefits, Costs, & Base-Case Analysis

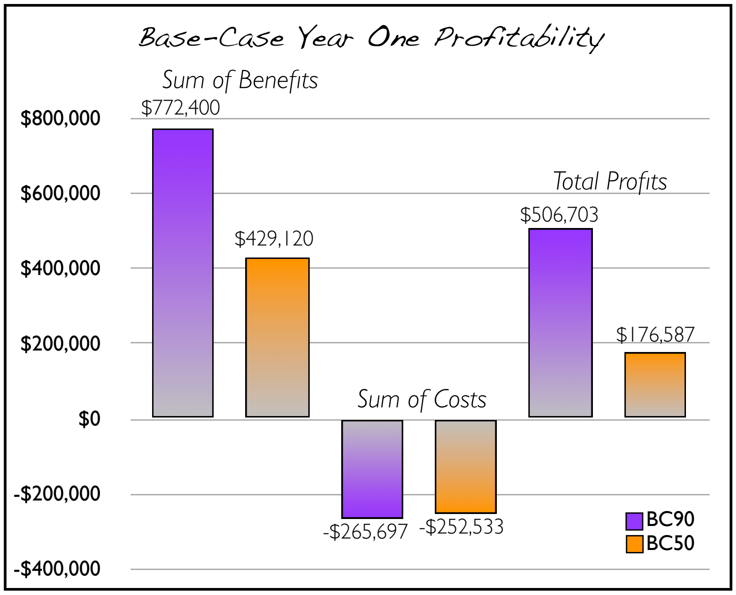
For the first phase of our analysis we identified potential benefits and costs to the cooperative. In order to calculate revenues, we had to develop estimates for the market price of wild red abalone, as no such product is currently available in the United States. To accomplish this we used data from the farmed abalone market, as well as price estimates provided by seafood distributors and restaurants, in order to calculate possible market values for wild caught red abalone, resulting in a mean price of $23.03/lb.

We used the initial operating plan proposed by the CAA in conjunction with information provided by fishery enforcement agencies, scientists, case studies, and fishery managers in order to develop possible costs. These were then categorized into costs for labeling, fishing, data collection and monitoring, enforcement, taxes, marketing and transport, and administrative needs. Interviews as well as market and literature research were used to determine the magnitude of each of these expenses. We developed precise values for costs where possible. In instances of uncertainty, we used a range of plausible costs. Potential harvest-dependent costs (such as fishing expenses and landing taxes) were converted into a function of the total catch in a given year.

Having calculated these values, we conducted an initial analysis of economic viability under two base-case scenarios, in which best estimate values of costs and benefits were used. These base-cases represent two possible management scenarios: one in which the total allowable catch (TAC) is allocated 90% to the cooperative and 10% to the recreational sector (BC90), and one in which the TAC is split 50%-50% between the two sectors (BC50).



Using annual harvests of 9,655 abalone for BC90 and 5,364 for BC50, we found both of these base cases to be economically viable in the first year of the fishery's operation. BC90 yields first year total profits to the cooperative of $506,703, while BC50 results in a value $176,587.



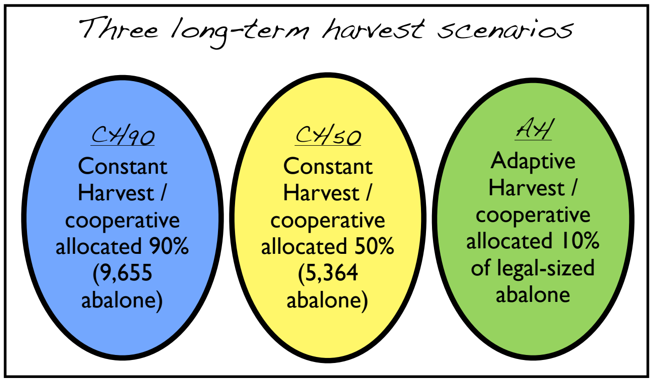
Population Modeling & Risk Assessment

Our base case results provide initial evidence of the economic viability of the cooperative. However, in order to assess the long-term potential of this fishery, some measure of the abalone population dynamics at SMI is needed. The only population model of SMI abalone available at the time of this study was not of applicable scale or perspective. As a result, we developed a stage-structured matrix population model, based on published studies (8,9,10) and survey results, to simulate the dynamics of the abalone stock at SMI over time. Environmental uncertainty was incorporated through the use of historic trends in bottom water temperatures at SMI. Water temperature was utilized as a proxy for environmental health, as it directly impacts a number of factors vital to the growth and survival of red abalone populations.

Using this matrix model, we simulated the abalone population at SMI over a 15 year time horizon under three harvest scenarios; no harvest (NH), constant harvest (CH), and adaptive harvest (AH). The NH model tested the viability of our modeled population. General fisheries modeling theory suggests that in the absence of fishing pressure, a population should grow or remain stable (providing the absence of extenuating environmental impacts) (11). Our NH scenario shows an annual rate of growth commensurate with the annual rate of growth suggested by survey data conducted by CDFG at SMI. Having performed this check, we used the CH and AH models to estimate the risk of fishery closure over time. We defined the fishery as being closed if the total population of reproductively mature abalone in any given year drops below the current levels at SMI. Once such an event occurs, we assume that the fishery is permanently shut down. While this represents a stringent standard for fishery closure, given the apprehension about this proposed fishery, we believe this to be a reasonable approach. Using this rule, our model provided a probability of the cooperative remaining open each year over a 15 year time horizon.

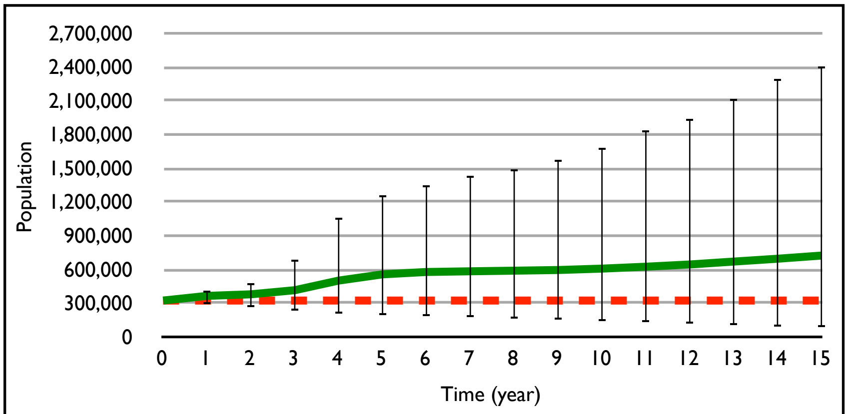
Long-term Economic Viability Analysis

We used our calculated risk of fishery closure in conjunction with full ranges of our calculated benefits and costs in order to conduct a complete economic viability analysis of the cooperative over a 15 year time horizon. For this approach, we utilized a Monte Carlo sensitivity analysis model. This method uses randomized combinations of possible costs and benefits in order to simulate the profitability of the fishery under a complete array of scenarios, from worst-case (lowest market value, highest operating costs) to best-case (highest market value, lowest operating costs). We ran this model under three scenarios, constant harvest with a 90%-10% split of the TAC between the cooperative and recreational fishers (CH90), constant harvest with a 50%-50% split of the TAC between the cooperative and the recreational fishers (CH50), and an adaptive harvest scenario (AH). CH90 corresponded with an annual catch of 9,655 abalone and CH50 with 5,364 abalone. The AH annual catch was calculated as 10% of the mean legal abalone population predicted by our population model.



Using this method, we calculated the net present value (NPV) of the fishery over 15 years, with yearly profits scaled in proportion to a discount rate and our calculated risk of fishery closure. Our results provide 95% confidence intervals for the NPV of our three scenarios over the time span of our model. The mean cumulative profits calculated for the first year of the cooperatives operation were $334,843 (CH50), $724,491 (CH90), and $715,420 (AH). In the long term, CH50 provides a substantially lower NPV than CH90 or AH. CH90 and AH50 do not provide statistically different NPVs. However, the AH scenario shows the potential for larger annual profits.

Finally, while the AH, CH90, and CH50 scenarios represent three possible divisions of the TAC, they do not represent all possible allocations of catch to the cooperative. In order to allow for the informed discussion of potential harvest to be provided to the cooperative, we calculated the minimum amount of catch that would be needed in order for the cooperative to remain

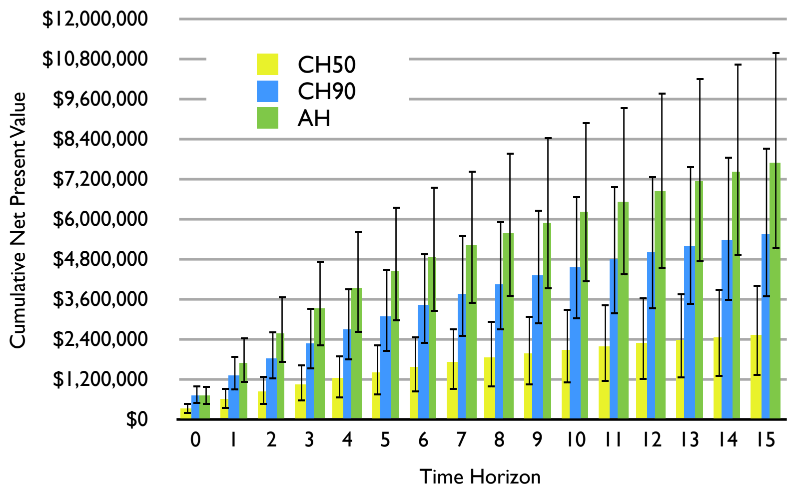


Growth of reproductive abalone under CH scenario as determined by the matrix population model The solid line represents the mean population growth, with the 95% confidence intervals indicated by the black bars. The red dashed line is the current reproductive population.

economically viable. We determined that a minimum annual catch of 3,260 abalone is needed in order to ensure that the cooperative is able to offset its operational costs. Below this value, our results indicate that the economic viability of the fishery becomes compromised, and the ability of the cooperative to support needs such as enforcement and data collection is diminished.

Recommendations for Cooperative Management

We developed a set of recommendations for the management of the cooperative, based on a survey of the other catch-share fisheries around the globe.



Cumulative net present value of the fishery over a 15 year time horizon. Black bars represent 95% confidence intervals.

1. Closely monitor population and adjust harvest based on small-scale adaptive management approach
2. Minimize poaching risk through the use of tracing systems, self-enforcement, and cooperation with government authorities.
3. Collaborate with the scientific community to improve knowledge of abalone population dynamics.
4. Reduce membership size using a transferable share system along with guidelines to maintain equity
5. Adopt strong internal management guidelines to improve efficiency and ease management operations.
6. Use a rotational harvest system to prevent localized abalone depletion.
7. Spatially isolate the commercial and recreational harvest areas to increase accountability.
8. Coordinate marketing to increase the value of harvest.
9. Keep an open dialogue with the community to increase trust.

Conclusions

The results of our analysis indicate that a commercial abalone fishing cooperative at SMI is economically viable under a wide array of potential scenarios. However, our findings show more than the profitability of a business enterprise. By calculating the economic potential of this venture, we provide a tangible measure of the value to the CAA of sustainably managing the abalone stock at SMI. In addition, our economic viability analysis provides an assessment of the ability of a cooperative fishery to financially support both enforcement and data collection efforts for the SMI red abalone. Numerous cooperative fisheries around the world have demonstrated this pattern of dedicated-access incentives for fishers leading to improved science and management for the fishery as a whole. The positive result of our economic viability analysis suggests that this pattern could be a reality for the SMI red abalone fishery as well.

Our findings show that an abalone fishing cooperative at SMI could be economically, ecologically, and socially beneficial. As such, if an abalone fishery is to be opened at SMI, we recommend that it be in the form of a cooperative. This method of catch-share management stands to provide the greatest benefit to both the resource and the community. While great care must be taken in the design and management of the cooperative, this potential fishery presents an opportunity to begin a new form of fisheries management in California. In doing so, this cooperative can demonstrate a system for the sustainable use and community management of marine resources.

References

1.D. Butterworth, H. Gorfine, S. Schroeter, E. Weber, *in (La Jolla, California, 2009)*
2.Prince, S. Valencia, (2009).
3.R. Hilborn, *et al., Rev. Fish Biol. Fish.* **15**, 191 (2005).
4.D. Pauly, *et al. Phil. Trans. R.S.B.* **360**, 5 (2005).
5.D. Pauly, *et al. Nature.* **418**, 689 (2002).
6.K.A. Karpov, *et al. in Workshop on Rebuilding Abalone Stocks in British Columbia.* pp. 11-24 (2000).
7.C. Costello *et al. Science.* **321**, 1678 (2008).
8.A. J. Hobday, M. J. Tegner, *Reports of California Cooperative Oceanic Fisheries Investigations* **43**, 74–96 (2002).
9.L. Rogers-Bennett, R. T. Leaf, *Ecological Applications* **16**, 213–224 (2006).
10.L. I. Vilchis et al., *Ecological Applications* **15**, 469–480 (2005).
11.J. M. Cope, A. E. Punt, Length-Based Reference Points for Data-Limited Situations: Applications and Restrictions (Berkeley, 2009).

Acknowledgements

The Bren School of Environmental Science and Management, the Sustainable Fisheries Group, the James S. Bower Foundation, the California Abalone Association, Dr. Chris Costello, Dr. Robert Deacon, Dr. Hunter Lenihan, Chuck Cook, Dr. Bruce Kendall, Sarah Valencia, Jono Wilson, Tal Ben-Horin, Matt Kay, Dr. Jenn Caselle, PISCO