Reserves in Reverse: The recent change in access status of Stornetta Ranch and the resulting effect on red abalone (*Haliotis rufescens)* populations

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INTRODUCTION

Stornetta Ranch, in Mendocino, CA, historically consisted of 1711 acres with 2.5 miles of coastline. Until recently, there was virtually no public access to this stretch of coastline, making it a *de facto* reserve. In 2004, this property was purchased by a consortium (The Nature Conservancy, The State Coastal Conservancy, U.S. Fish and Wildlife Service, and The State of California Wildlife Conservation Board), to be administered by the Bureau of Land Management.

In 2004, the Multi-Agency Rocky Intertidal Network (MARINe), Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO), and California Department of Fish and Game conducted an intertidal survey of the marine resources on the property. Findings included a large population of unharvested red abalone (*Haliotis rufescens*). Coastal access of Stornetta Ranch was opened to the public in 2005 and harvesting of abalone immediately began. PISCO initiated a long term monitoring study of these abalone populations in 2005 to determine the effects of harvesting. In order to establish the relationship between harvest pressure and ease of accessibility, permanent plots vary in distance from the coastal access point (Figure 1). Within each plot the abundance and size (mm) of red abalone are recorded.

When Stornetta Ranch was opened to the public in 2005, harvesting of abalone immediately began.

Map of California showing privately owned coastal lands that have recently changed to public access. Effective management of these areas is critical to conserving marine resources.

Abalone are easily injured when pried off the rock substrate. Incidental mortality occurs when these abalone are not of legal size, are discarded, and consequently die from their injuries. Empty sublegal (<178mm) shells found in plot 2 (above left) are an example of incidental mortality due to harvest practices. The loss of these sublegal, protected abalone is of particular concern because they have the greatest impact on population growth (Rogers-Bennett and Leaf 2006). Minimizing these losses through the use of interpretive displays, educational programs, and stringent enforcement should be a priority to policy makers statewide.

ABUNDANCE AND SIZE DISTRIBUTION

In 2005, nearly 25% of the abalone in the plots were legal sized (>178mm), most of which were found in the least accessible plot (plot 3, Figures 1 and 2). In fact, none were found in plot 1, the most accessible plot. In 2006 only about 5% of the abalone were legal sized, a drop due primarily to the loss of the legal sized individuals in plot 3 (Figure 2). This decline is likely due to an expansion of harvest pressure (i.e. fishing) into more remote areas. In 2005 the largest abalone found was 240mm, but in 2006 the largest size was 200mm. Furthermore, the number of sublegal sized abalone was lower in plots 1 and 2.

FECUNDITY

Fecundity of abalone increases exponentially with size (Hobday and Tegner 2002) and size frequency data can be used to calculate the fecundity. The data from 2005 indicate that total fecundity decreases with ease of access (Figure 3). Total fecundity was lower in 2006 in all plots, but much more so in plot 3. Abalone are slow to reach reproductive maturity, and analyses using age-structured models (Leaf 2005) show that recovery from only one year of harvest will take 20 years (Figure 4).

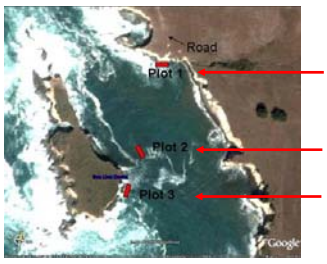


Figure 1. Three permanent intertidal plots vary in the distance from the coastal access point (Road):
•Plot 1 = easily accessible (highest harvest potential)
•Plot 2 = moderately accessible (intermediate harvest potential)
•Plot 3 = difficult to access (lowest harvest potential)

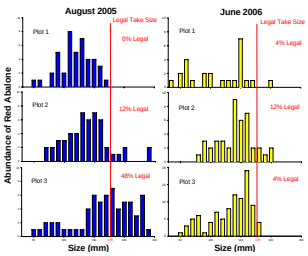


Figure 2. Size distribution of red abalone in the three plots, 2005-2006. Red bar indicates minimum legal take size. Note different scale for Plot 3 data in 2006.

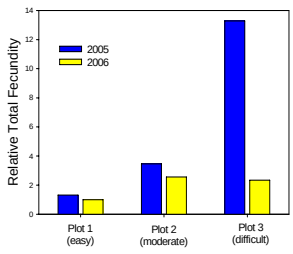


Figure 3. Fecundity of the red abalone populations in the three plots in 2005 and 2006. Accessibility to fishing ranged from easy (Plot 1) to difficult (Plot 3).

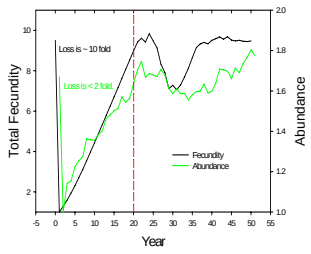
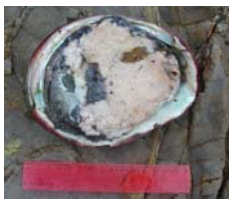


Figure 4. Model of recovery time of red abalone from intense harvesting. Lines are generated using an age structured model with 2005 data from plot 3 (initial, pre-harvest conditions) and plot 1 (post-harvest). Dashed line denotes year when population will approach pre-fished conditions.

SUMMARY AND IMPLICATIONS

The change in access status at Stornetta Ranch dramatically altered the red abalone population. Specifically, there has been a large decline in the number of legal sized individuals, especially those in the largest size classes. Because abalone are dioecious, broadcast spawners, high densities of fecund abalone are required for successful reproduction. Low densities coupled with slow growth results in delayed recovery or even further decline of the population, making the species vulnerable to over-fishing. A key result of this study is that the time to recovery is 20 fold that of the time it took for the harvestable population to collapse. There is also evidence that sublegal individuals are being injured and killed due to incidental mortality. Close monitoring of these populations will provide insight for sustainable management policy. As more private lands are transferred to state management, policy makers must balance protection of marine resources with public access.



Dead, sublegal sized Red Abalone (*Haliotis rufescens*) from Stornetta with obvious signs of fishing injury. Red Abalone are a long-lived, slow growing species, making them highly susceptible to incidental mortality and over-fishing.

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For more information on monitoring efforts see **http://piscoweb.org** and **http://www.marine.gov**