Are we there yet? The impact of reduced composition data on the ability to monitor rebuilding for overfished fish stocks

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ABSTRACT

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# Introduction

Rebuilding overfished stocks requires a reduction in the fishing mortality to a level to would allow the stock biomass to increase. In the United States federally managed stock that are declaring overfished, below their minimum stock size threshold, are mandated to rebuild to target biomass levels in the least amount of time possible accounting for the biology and environmental conditions (SFA 1996). The severity of restrictions on harvest during rebuilding for some stocks can lead to a situation where the ability to collect data becomes limited, where once data-rich stocks become data-limited over a period (of rebuilding) when managers are likely most concerned about stock status.

Data are necessary to determine the extent to which a stock is on track to rebuild within the legally-mandated timeframe. Although limiting harvest to levels below the replacement yield for an overfished stock will allow stock recovery, being able to measure the rate of recovery is still crucial to management, and increased uncertainty due to limited data can impede this process. Additionally, biological data are critical to improve estimates of key parameters within stock assessments (e.g. natural mortality, growth, steepness) and can indicate incoming poor or strong year-classes (recruitment) which can impact estimates of relative stock biomass. Potential improvements in parameter estimates and the ability to detect potential incoming fluctuations in spawning biomass during rebuilding will be restricted when new biological data collection is limited due to harvest restrictions.

Along the U.S. West Coast several overfished rockfish species have experienced large reductions in harvest during rebuilding. One example, yelloweye rockfish, was declared overfished in 2002 which resulted in large reductions in the allowable catch (Methot and Piner, 2002). Similar to other rockfish species on the west coast, yelloweye rockfish was subject to the large catches in the 1980s and early 1990s that were unsustainable. The allowable catch in the first year of rebuilding was approximately 10% of the catch observed four years earlier (Stewart et al., 2009). This species presents and interesting case study. Yelloweye rockfish are encountered infrequently by the main fishery-independent survey due to the sampling method (trawl) and the majority of the information, albeit somewhat limited, comes primarily from fishery samples, both recreational and commercial. During rebuilding, retention has been prohibited in the recreational fishery, and the limited allowed catch has been low enough to create an avoidance behavior by the commercial fishery (Stewart et al, 2009). The most recent assessment cites the limited recent fishery data as a challenge to ‘produce conclusive information about the stock for the foreseeable future’ (Stewart et al., 2009). While yelloweye rockfish may have never been considered traditionally data-rich, since entering rebuilding, the amount of data available for subsequent assessment now more resembles that of a data-limited situation, an attribute that may pose significant challenges for science and management in the future.

There have been numerous simulation studies evaluating the impact of data on the performance of stock assessment methods (e.g. Hilborn 1979, Chen et al. 2003, Yin and Sampson 2004, Magnusson and Hilborn 2007, Wetzel and Punt 2011, Lee et al. 2012). Studies often focus on the ability to estimate either management quantities or biological parameters. However, to date, these studies have not addressed the long-term impact of reduced data on the ability to monitor a stock during rebuilding. This paper simulates an overfished long-lived rockfish stock, common to the U.S. west coast, where harvest and the collection of new data are restricted during rebuilding. The simulation study addresses two main questions; 1) does the increased uncertainty due to limited data impact the ability to correctly detect when an overfished stock has recovered to management target stock size (e.g. rebuilt), and 2) is there a degradation in the model estimates of stock size and the biological parameters when there are limited data?