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GEAR SELECTIVITY IN THE BARRED SAND BASS FISHERY OFF BAJA CALIFORNIA.

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Introduction

The selectivity of fishing gear is a key factor that influences various aspects of the fishing process. By adjusting gear selectivity, fishers can target fish that yield more weight per individual, which can translate into either higher revenue per unit of weight or lower costs due to reduced effort in achieving a specific catch target. From a biological perspective, selectivity helps avoid the capture of small fish that have not yet reproduced, as well as large fish that play a crucial role in producing new recruits for the population. Thus, selecting the right type of gear that optimizes both commercial value and population productivity is essential to achieving sustainable fishing practices.

When a stock is estimated to be exploited beyond a certain reference point, a harvest control rule must reduce fishing intensity in some way. However, this reduction does not necessarily have to come through decreased fishing effort. For instance, if the gear's selectivity is disproportionately removing young fish, which harms recruitment potential, the stock may decline. In such cases, the corrective action should focus on reducing fishing intensity on the most affected segment of the population.

A stock assessment should therefore be able to analyze the impact of the fishery on different age or size groups and propose an optimal size distribution to prevent recruitment overfishing. This analysis should be linked to the harvest control rule to identify corrective actions, such as reducing fishing pressure on certain size classes. If these actions involve gear modifications, an analysis of gear selectivity becomes crucial.

In this context, Pronatura's database indicated that between 2010 and 2013, 40% to 50% of the catch consisted of fish below the estimated size at which 50% of the individuals were mature (L_{50}; see Figure 1).

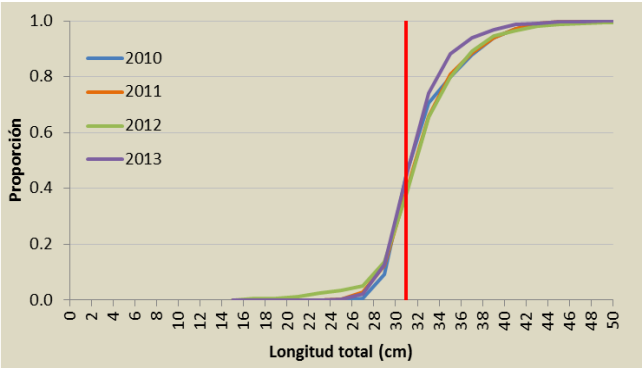

Figure 1. Standardized cumulative size distribution of barred sand bass in the samples obtained by Pronatura Noroeste off the central region of the Baja California Peninsula. The vertical orange line represents the assumed size at L_{50} (31 cm) from dedicated reproductive studies. Figure taken from Alvarez-Flores 2015.

The results of the 2015 stock assessment (Alvarez-Flores 2015) recognized a high level of uncertainty and the possibility that stock abundance was close to the level producing Maximum Sustainable Yield (MSY). Given the absence of dedicated measures to control fishing intensity, it was proposed that preventive actions be implemented, such as seasonal closures and shifting the size distribution towards slightly larger fish.

Considerations for the implementation of a selectivity study

Discussions with government scientists and fishers led to the conclusion that a further study on trap selectivity were necessary. Although a statistically sound sampling design was developed, its execution in the field proved challenging, and the results were limited. It was agreed that the experiment needed to be rethought, and thus it was included in the Fisheries Improvement Project (FIP) work plan.

With the above considerations, the work plan added the objective to conduct further investigations on gear selectivity aimed at shifting the size distribution of fish in the commercial catch towards larger size. The purpose of the proposed work was to create alternatives to the harvest control rule so that, if necessary, a change in gear could be implemented. Having this information in advance is determinant to have the possibility of successfully implementing the use of the new gear as the change may require a significant economic burden. Two different approaches were discussed with fishers, one to test modifications of the actual trap, particularly increasing the size of the entrance gate and to search for alternative entirely different trap designs.

We found no alternative trap designs, significantly different, that could be used in the barred sand bass fishery. Trap changes that involve using a different mesh size are extremely difficult to implement or expensive because manufacturers only have the current mesh size used in the fishery. We could only anticipate a feasible change in the design of the entrance gate that could allow larger fish, which would only address the right side of the distribution curve, but if we cannot allow an increase in the size of the smaller fish to the left of the distribution curve, then we would be increasing fishing mortality of larger fish without reducing the mortality of the smaller fish. Under these circumstances, it is difficult to construct the design of an experiment to determine the proper characteristics of a new trap that yields the desire size distribution. Because the most recent estimated trend of abundance of the barred sea bass indicates that there is only a small probability that the stock is under the target producing MSY, given the considerable costs of producing materials for a new trap design and because we could not develop a proper experimental design, it

was decided to put this experiment on hold until it is essential to do it, or until we find better conditions to prepare a proper experiment. However, this issue is still considered important to be addressed some time in the future, we would not recommend to abandon the matter entirely.