

# Spatial Analysis of BC Rockfish Conservation Areas with Interpreted Seafloor Maps and Groundfish Research Data

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## Abstract

The Department of Fisheries and Oceans Canada manages 164 Rockfish along the coast of British Columbia, protecting a total area of 4847.2 km<sup>2</sup>. Due to the unique life history of many rockfish species (long lifespan, slow to reach sexual maturity, specific habitat requirements) they are particularly susceptible to overfishing. These conservation areas remain a vital component in the management of the 38 rockfish species present in BC waters, and are expected to contribute to the Canadian Federal Government's 2011 at the UN Conference on Biodiversity to protect 5% of coastal water by 2017 and 10% by 2020.

In support of this goal, as well as recent efforts to evaluate these RCAs under the Strategic Program for Ecosystem-Based Research and Advice (SPERA), the efficacy of these areas has been reassessed and scored; this project furthers these efforts by using GIS techniques to analyse the habitat within their current boundaries and look at potential future expansions and alterations.

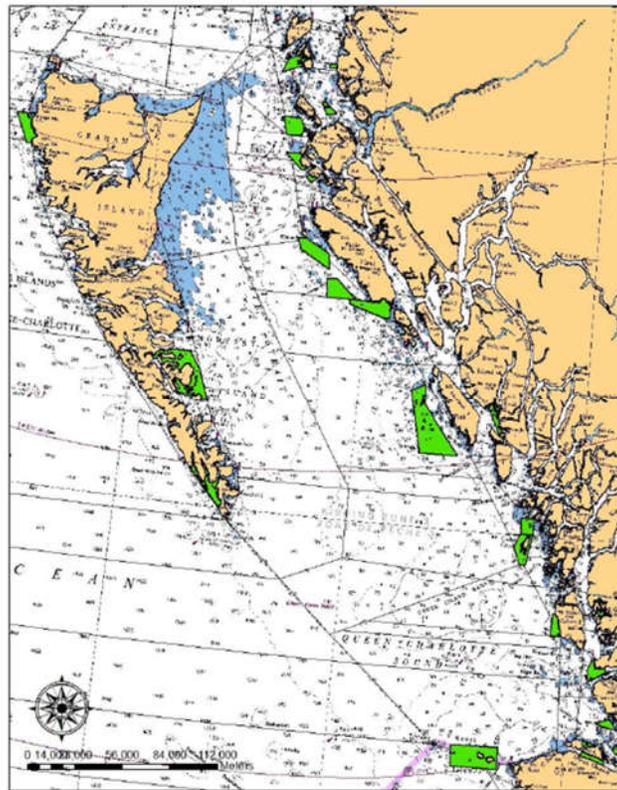


Figure 1. Examples of Rockfish Conservation Areas along the central coast of BC.

# Background & Objectives

## Client Background

As stated in the official mandate, the Department of Fisheries and Oceans has the lead federal role in managing Canada's fisheries and safeguarding its waters. Through sound science, forward-looking policy, and operational and service excellence, Fisheries and Oceans Canada works collaboratively toward the following three strategic outcomes:

- A clean and healthy environment and sustainable aquatic ecosystems through habitat protection, oceans management, and ecosystems research;
- Strong economic growth in our marine and fisheries sectors by supporting exports and advancing safe maritime trade; and
- Innovation through research in expanding sectors such as aquaculture and biotechnology.

The project falls into DFO's much larger Strategic Program for Ecosystem-Based Research and Advice (SPERA), which is in its third and final year of summarizing the effectiveness of Rockfish Conservation Areas.

*“(SPERA) supports objectives with research projects and scientific tool development which support national priorities for managing ecosystems in our domestic waters. Projects address key issues, such as scientific guidance on the avoidance of benthic impacts; science support for mitigating by-catch and tools to help manage biological diversity in Canadian waters.*

*SPERA funds projects by DFO researchers which:*

- *Assess the ecosystem impacts of human activities;*
- *Assess and report on ecosystems and*
- *Develop tools to implement the ecosystem approach to management.”*

## Project Background

This analysis of British Columbia's Rockfish Conservation Areas is a result of the Canadian Federal Government's commitments to the United Nations regarding protection of coastal marine environments. As part of the 2011 Strategic Plan for Biodiversity (Aichi Target 11) Canada has committed to conservation targets of protecting 5 percent of Canada's marine and coastal areas by 2017 and 10 percent by 2020.

Due to the large area of coastline that will need to be set aside in order to meet this commitment, it is expected that the newly protected habitat will take a variety of forms, one of which being the current and potentially expanded RCAs.

Much of the groundwork for this project was completed in the doctoral thesis of Dana Haggarty (An Evaluation of the Effectiveness of Rockfish Conservation Areas in British Columbia, 2015), who built the random forest habitat model, as well as the coast-wide substrate model used for the bulk of this analysis. Using bathymetric data captured by the Canadian Hydrographic Service, her model reclassified the ocean floor of coastal British Columbia into a binary raster identifying all areas of rocky-reef habitat suitable for Rockfish species.

RCA Statistics	Area of Rockfish	
	Total Area (km <sup>2</sup> )	Habitat (km <sup>2</sup> )
Number of RCAs	164	
Total Area	4847.2	2060.3
Total Inside	1518.5	897.4
Total Outside	3328.7	1162.9
Mean/Median Size	29.6/10.8	
Standard Deviation	61.2	
Minimum Size	0.12	
Maximum Size	509.1	

Figure 2. Background summary of current RCAs

## Data

The current boundaries of the RCAs were set using what is now considered outdated bathymetric data, much of which had a resolution of 100m. As could be expected, this has led to certain RCAs failing to protect the rockfish habitat in the intended manner or to the degree expected. With new technology and data collection, much of BC's ocean floor has been mapped more recently with a resolution of 20m (and 5m in certain inlets). This significant increase in detail has led to the need to re-evaluate the current RCAs in order to further improve them.

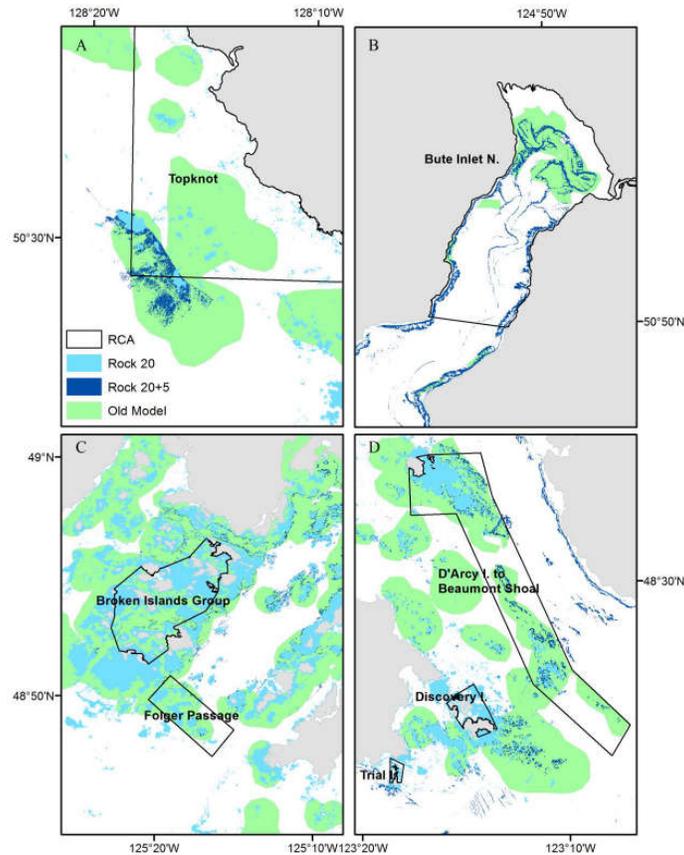


Figure 3. Example of change in detail based on 100m, 20m and 5m resolution bathymetric data.

## Client Deliverables

### RCA Analysis

Due to the extensive consultation process with the various stakeholders (First Nations, Commercial Fisheries, Recreational Fisheries, etc.), rather than redesigning every RCA, we determined it was best to simply make examples of the various reasons RCAs might need to be improved. The reef models were masked using bathymetric data to better suite the actual useable rockfish habitat (previous models included depths <5m as usable, despite it being extremely unlikely to be used by rockfish). This resulted in a lower habitat total than previous models predicted, however we feel they better reflect the state of rockfish habitat in British Columbia.

A series of summary maps were produced, each aimed at improving a different aspect of the RCA (i.e. total area, total habitat percentage, reef isolation score).

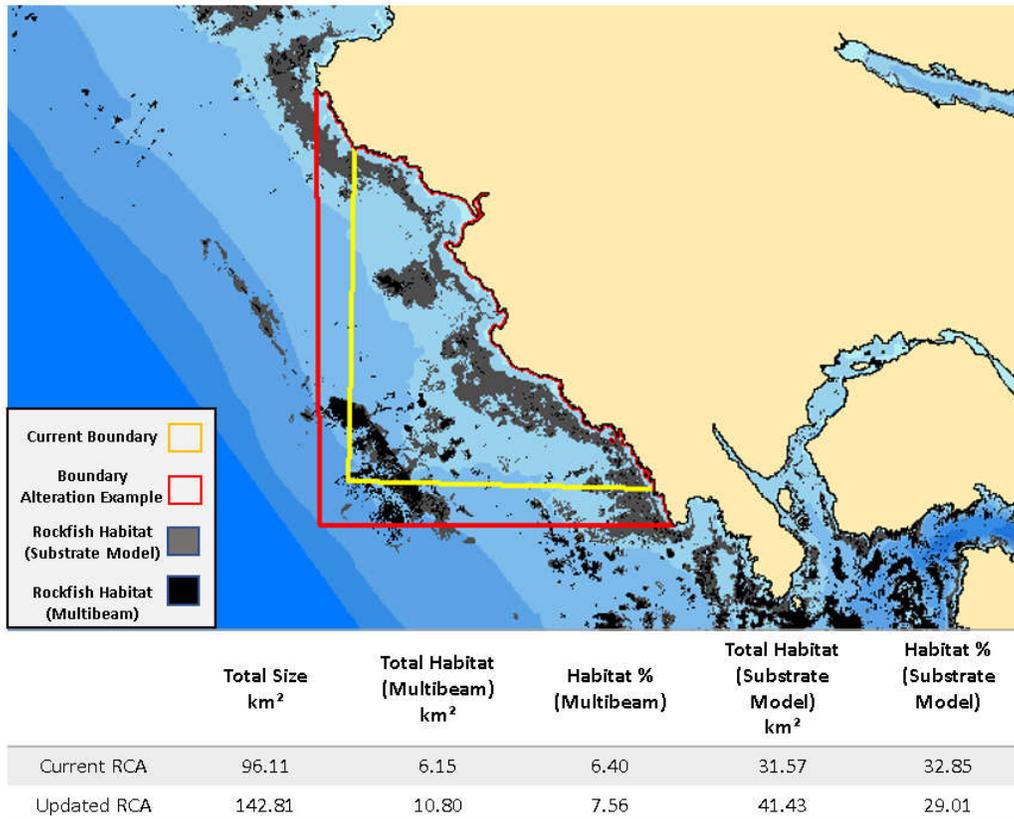


Figure 4. The Topknot RCA example, aimed at improving the reef isolation score by better encompassing the large reef in the south-western corner to ensure full habitat protection.

### **Analysis of Historical Fisheries Data**

Due to this data being protected by the Canadian Federal Government, discussion of this aspect of the project is limited. The overall goal of this section was to summarize all historical fishing events that have taken place within Rockfish Conservation Areas, dating by 10 years (when the final RCAs were put in place).

This data will be used to determine whether or not particular RCAs will be eligible for inclusion the Aichi Target 11 protected areas. Due to current treaties with the First Nations communities of BC certain fisheries activity is currently allowable by law, so while RCAs are largely protected from fisheries pressure, there still exists a certain degree of pressure.