

GALIANO CONSERVANCY ASSOCIATION



# Rockfish populations around Galiano Island

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Freedom to Swim: Research Component for  
Rockfish Recovery Project



**2013**

## **Executive Summary**

Rockfish (*Sebastes*), of the Scorpionfish family, are unique to the Pacific Northwest. As of 2012 there are 8 species listed as threatened or of special concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Canary, Quillback and Yellowmouth rockfish are listed as 'threatened'; Rougheye Type I, Rougheye Type II, Darkblotched, Longspine Thornyhead, and Yelloweye (outside waters and inside waters populations) rockfish are listed as 'special concern'. Both species of Rougheye and both populations of Yelloweye rockfish are also listed under the Species At Risk Act as 'special concern'.

These predatory fish can live at great depths, and tend to live very long lives of 80 or more years (Lamb and Edgell, 2010). These factors, when combined with their primarily territorial lifestyles, have made them particularly susceptible to overharvest. There is a strong need to protect these species with enforced no-take marine protected areas, and we can only hope that recent conservation efforts will be enough to recover some of the most depleted populations (Lamb and Edgell, 2010; McConnell and Dinnel, 2002).

In the late 1980s the commercial rockfish fishery boomed, which led to a series of management responses in the 1990s to attempt to recover the rapidly depleting stocks in BC (Yamanaka and Logan, 2010). This also occurred in the US as a direct result of pressure on the salmon stocks - fishermen were urged to divert their attentions to bottom fish (McConnell and Dinnel, 2002). The rapid declines that followed led to management restrictions in Puget Sound (Palsson et al., 2009) as well as in BC. Due to these declines from overfishing, Fisheries and Oceans Canada implemented a series of catch quotas, monitoring programs and conservation areas in the early 2000s (Yamanaka and Logan, 2010).

The State of California was one of the first areas in the Pacific Northwest to implement marine protected areas beginning in 1999 and is still refining and expanding them today (Cal. Dept. of Fish and Game, 2008). Though the process has been slow, Canada has now implemented 164 Rockfish Conservation Areas (RCAs) with limited harvest in BC (Marliave and Challenger, 2009; Yamanaka and Logan, 2010) and Washington State has been laying the groundwork for several marine protected areas since the 1990s (McConnell and Dinnel, 2002).

Galiano Island is in close proximity to five RCAs, three of which have boundaries that follow its shoreline, totaling approximately 40% of the island's waterfront. No independent surveys of the RCAs have been carried out around Galiano prior to this

study, though some Reef Environmental Education Foundation (REEF) volunteer biodiversity surveys have been done in the area (REEF database, 2012). Fisheries and Oceans Canada (DFO) performed some Remote Operated Vehicle (ROV) surveys in a portion of one of the RCAs adjacent to Galiano, and this data was used as background information for survey site selection.

The Galiano Conservancy Association initiated the Freedom to Swim – Rockfish Recovery Project in 2011/2012 to collect baseline data on the current status of rockfish populations around Galiano Island. The purpose of collecting this data was to determine whether the RCAs are having positive effects on the populations at this point, and to inform conservation efforts for recovering rockfish populations in BC. We conducted dive and video surveys in the Trincomali Channel RCA (Area 17), the Gossip Shoals RCA (Area 18/Area 29) and in two areas outside of the RCAs: one near the north and one near the south end of the island.

Our surveys found that at least 5 species of rockfish are present in the waters surrounding Galiano, though there is primarily representation of only two of these species: Quillback and Copper rockfish. We did find rockfish present at every survey site, and believe it is possible for rockfish populations to recover over time if current regulations are respected.

It is of interest to note that a large area of one of the RCAs does not contain viable rockfish habitat, and that the survey area with the highest rockfish abundance was located outside of this RCA and is not currently protected from fishing.

This baseline survey will help to build an information base to inform future monitoring efforts around Galiano and other inside waters in the region. This project serves as an example for similar areas that have not yet been surveyed. The data collected may be used to inform policy makers and current management tools, and will be vital in informing grassroots rockfish recovery efforts. The Galiano Conservancy began outreach efforts during the project, both on Galiano and in surrounding communities. It is our opinion that increased public awareness and understanding of rockfish biology, rockfish decline and Rockfish Conservation Area legislation is necessary for the recovery of rockfish populations in the region.

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***Detailed information on site locations and associated rockfish numbers has been removed from this version of the report. If you would like to use the detailed data for scientific purposes, please contact the Galiano Conservancy at [biologist@galianoconservancy.ca](mailto:biologist@galianoconservancy.ca)***

Special thanks to Mountain Equipment Co-op for supporting this project.



## Introduction

Rockfish species in BC are managed under two major areas: inside waters (protected waters east of Vancouver Island, including the Strait of Georgia) and outside waters (west of Vancouver Island and the north and central BC coast), and within each area are grouped into “inshore” or “offshore” categories based on their life histories (Yamanaka and Logan, 2010). The inshore rockfish consist of the commercial rockfish species that are generally found closer to shore and at shallower depths, and are targeted by hook and line fisheries. Inshore rockfish species include the Copper (*Sebastes caurinus*), Quillback (*S. maliger*), China (*S. nebulosis*), Tiger (*S. nigrocinctus*), Black (*S. melanops*) and the highly valued Yelloweye (*S. ruberrimus*) rockfish (Yamanaka and Logan, 2010). Several other species have been found in the Strait of Georgia including Puget Sound (*S. emphaeus*), Brown (*S. auriculatus*) and Yellowtail (*S. flavidus*) rockfish. These species, as well as the juveniles of several deeper dwelling species, are the most likely to be seen at depths accessible to SCUBA divers (Lamb and Edgell, 2010).

An inshore rockfish conservation strategy was specifically implemented in Canada to address the heavily targeted hook and line industry, and to address the ineffective use of catch quotas in managing rockfish populations, due to their unique life histories (Yamanaka and Logan, 2010). The implementation of Rockfish Conservation Areas in these inshore areas was recognition that new management approaches were needed to recover rockfish populations. At the time of implementation, many areas lacked data on rockfish abundance, relying primarily on habitat data from side scan sonar. The viability of many of the RCAs has not been verified, and some boundaries were altered during early implementation, based on a lack of rockfish in the chosen areas (Marliave and Challenger, 2009).

Though many actions have been taken, recreational hook and line fishing remains the least monitored, and it is difficult to say whether regulations are being followed (COSEWIC, 2008). In Washington, recreational fishing of rockfish far exceeds that of commercial fishing, and has done so since the 1970s (Palsson et al., 2009). In BC this is likely to be true as well; however there is not enough data on recreational harvest numbers to make this comparison. The Galiano Conservancy began to address this problem during this project through research and community outreach.

The three Rockfish Conservation Areas (RCAs) that border Galiano Island are the Trincomali Channel RCA (Fisheries Management Area 17), the Gossip Shoals RCA (Area 29-4 joining to Area 18), and the Pebble Beach Marine Reserve RCA (Area 29).

The Trincomali Channel RCA is the largest of the three, extending from Gray's Peninsula north to Spotlight Cove (Figure 1 - Appendix). The Galiano Conservancy performed dive surveys with video to gather much needed data on the status of the RCAs and baseline rockfish abundance around Galiano for long term monitoring purposes. Through our research we also aim to raise awareness and gather on the ground support for rockfish protection.

## **Research Methods**

### *Dive transects*

Surveys were carried out from July, 2012 through September, 2012. We followed experienced surveyor methods (PhD candidate Dana Haggarty, pers. comm.) and DFO protocol (Lynne Yamanaka, pers. comm.) as closely as possible for our purposes. At each site two dives were performed, spaced well apart from each other within the site. For each dive (sub-site), two 30m transects were surveyed – one at approximately 20m (60ft) depth and one at approximately 10m (30ft) depth. The transect line was laid parallel to the rocky reef/shoreline and 1m on either side of the transect line and 1m into the water column above the transect line was surveyed for rockfish, associated species and habitat (transect volume = 30m x 2m x 1m). The first diver lay the transect tape and surveyed for fish, estimating the length of each rockfish seen to the nearest centimeter, and noting abundance of other fish species. The divers were trained to estimate the length of fish by practicing with laminated colour prints of rockfish of known lengths, until an accuracy of 90-100% was reached. They also re-checked their perspective from time to time by comparing the size of their hand to the fish, following the example of Marliave and Challenger.

The second diver recorded habitat data and associated species data using a data sheet or video. It is important to note that the divers were not taxonomic experts, and some observations were changed after video review and guidebook consultation. In cases of uncertainty, organisms were recorded at a higher taxonomic level or not recorded at all. At the end of the 30m transect tape both divers swam back to the start, reeling in the tape. At the start point, the divers ascended to the second depth (approximately 30ft), and lay a new transect running parallel to the shore in the opposite direction of the initial transect, following the same methods. In this way a 60m length of the shore was surveyed at each sub-site at two different depths.

### *Site selection*

Rockfish survey sites of approximately 500m of shoreline were chosen based on management classification (Rockfish Conservation Area or non-RCA) habitat

(selected sites with high complexity and relief, specifically looked for boulders based on Marliave and Challenger's 2009 model), and local knowledge (sites of known rockfish presence). The sites were chosen in this way for both RCA and non-RCA sites to limit the variables between sites in order to attribute any differences in rockfish populations to the management classification.

We targeted 6 rocky reef sites: 4 within Rockfish Conservation Areas (RCAs), and 2 outside of RCAs. One of the 4 RCA sites, Pebble Beach Marine Reserve (Area 29), we did not survey due to time constraints (dives began later in the year than planned due to a staff changeover) and severe weather. Also in RCA area 18 we completed a single dive as opposed to two dives in the site due to weather constraints. In total we surveyed 5 sites successfully: 3 sites within 2 RCAs and 2 sites outside of RCAs.

In the Trincomali Channel RCA we decided to do two sites (4 dives) as the RCA is so large, however it is of note that three dives in the southern portion of the RCA all yielded sandy bottom habitat with little to no rockfish potential.

#### *Site Descriptions*

#### **Rockfish Conservation Area 17: Trincomali Channel**

##### Site 1: North

Trinc site 1 had steep rocky walls with some boulders, and a high complexity. This site was subject to high currents both at the surface and at depth. Bull kelp (*Nereocystis leutkeana*) forest pockets were dispersed throughout the site, providing habitat potential for settling juvenile fish. The primary biocover at this site was "encrusting", meaning a variety of carpet-like organisms that colonize the rocks, including coralline algae, barnacles, bryozoans and tubeworms. Many of the rocks appeared heavily grazed at this site, with mainly barnacle scars left behind.

##### Site 2: South (mid)

Situated in relatively open water between Salt Spring Island and Galiano Island in the Trincomali Channel, site 2 is subject to high currents and some wave action. This site had steep rocky walls with some boulders, which leveled off dropping off again. The shallow rocks were dominated by a Bull kelp (*Nereocystis leutkeana*) forest, while the deeper rocks were dominated by encrusting organisms and patches of Fringed sieve kelp (*Agarum fimbriatum*). The kelp forests provide potential shelter and a settling advantage for juvenile fish, and the complex rock at greater depths provides habitat for larger fish.

## **Rockfish Conservation Area 18/29: Gossip Shoals and Mayne Island**

### Site 1

This site is adjacent to very high current areas, though during our dive there was almost no current experienced at depth despite strong surface currents. The site gradually deepens to approximately 90 feet. Instead of boulders, there were rock formations with cavities, adding to the habitat complexity. This site was dominated by filamentous brown algae and encrusting organisms, including a high abundance of Staghorn bryozoans (*Heteropora sp.*). This site also had a few pockets of Aggregating sponges (*Polymastia sp.*), which we did not see at any other site.

### **Non-RCA sites**

#### Site 1: North

Our first non-RCA site is located near the north end of Galiano in Trincomali Channel and is near a popular area for fishing and crabbing. The area begins as a shallow sand bar with an eelgrass bed, which provides potential habitat for juvenile fish. Beyond this is a Bull kelp forest and rocky point, which becomes a steep wall of bedrock and large boulders. Unfortunately one of our four transects was too near the end of the wall and resulted in mostly sandy bottom habitat. This site is subject to high tidal currents both at the surface and at depth and has very high complexity. The dominant life forms at this site were encrusting organisms. The rocky wall was virtually covered at points with *Corella*, a transparent tunicate, providing interesting habitat potential for small fish.

#### Site 2: South

Our site spanned a corner, with one sub-site near a residential dock, and the other facing an exposed channel. The site was near several pockets of kelp forest, providing high settling potential for juveniles. The south sub-site in particular had a very high complexity, and a man-made cable now covered in anemones and tunicates. The south sub-site is slightly more sheltered than the north sub-site, though the physical habitat between the two was almost identical – steep sloping bedrock with deep crevices and boulders, interspersed with sand bars, and a dominant biocover of encrusting organisms.

#### *Abundance measurements*

Rockfish counts were recorded for each site, and densities were calculated into averages for RCA sites and non-RCA sites. Density per 100m<sup>3</sup> was calculated as # rockfish / volume surveyed x 100. Volume was used instead of area since each transect covered a volume of 60m<sup>3</sup> (30m long x 2m wide x 1m tall). For comparison



purposes, densities were also calculated as # rockfish per hour effort, using the recorded dive times for each survey. These dive times included ascent and descent times, but not safety stops (5 min per dive).

**Results**

During our surveys we saw a total of 189 rockfish representing at least four species around Galiano Island (Table 1). The majority of these fish and species (113 fish representing 4 confirmed species) were seen in the two sites outside of Rockfish Conservation Areas, with 76 fish representing two species seen inside the RCAs (Table 2).

**Table 1.** Total numbers of rockfish seen on surveys around Galiano Island listed by species common name. Adults for all species except Puget Sound rockfish were classified as individuals of 30cm or greater length\*. Puget Sound adults were classified as individuals of 12cm or greater length.

Species	Number of individuals	Number of Adults	Total
Copper	63	26	189
Quillback	98	16	
Yelloweye	1	0	
Puget Sound	15	6	
Unknown	12	1	

On average, in the two Rockfish Conservation Areas surveyed we saw 25 rockfish / 100m<sup>3</sup> compared to 47 rockfish / 100m<sup>3</sup> outside of the RCAs. A further comparison shows an average of almost 30 rockfish per hour effort inside RCAs, and almost 50 outside the RCAs (29.48 rockfish / hour effort and 49.43 rockfish / hour effort, respectively).

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\* Based on COSEWIC status report (2009) for Quillback, Lea et al. (1999) for Copper, and Beckmann et al. (1998) for Puget Sound rockfish. The Yelloweye seen had clear juvenile markings, as well as being within this size range. It is worth noting that the Vancouver Aquarium community survey program classifies all fish >20cm as adults.

**Table 2.** Total numbers of rockfish seen on surveys in Rockfish Conservation Areas around Galiano Island listed by species common name. Adults were classified as individuals of 30cm or greater length.\*

Species	Number of individuals	Number of Adults	Total
Copper	29	11	76
Quillback	47	13	

Overall, the site with the highest rockfish abundance and diversity was a non-RCA site, with a total of 81 rockfish seen representing 4 species (data tables available upon request). This equates to roughly 75 fish seen per hour effort at this site (75.15 rockfish / hour effort), an average two and a half times greater than the RCA average and more than one and a half times greater than the total non-RCA average.

We noted a variety of other species associated with the habitat at our sites, which may be important in noting food webs, estimating the health of a site, and providing supporting information for marine protected areas in the sense that many species other than rockfish may benefit from a no-take zone. For simplicity, we have shown all species seen during the surveys in a single list (Table 3).

**Table 3.** Associated species recorded during all rockfish surveys. Species are listed alphabetically by common name, with the scientific name following. All species are identified to the lowest (most specific) taxonomic level possible.

Species recorded in rockfish habitat

- Aggregated Nipple or Vase sponge (*Polymastia sp.*)
- Armoured sea cucumber (*Psolus chitonoides*)
- Barnacles (*Balanus sp.*)
- Blackeye Goby (*Rhinogobiops nicholsii*)
- Blood star (*Henricia leviuscula*)
- Blue topsnail (*Calliostoma ligatum*)
- Brooding anemone (*Epiactis lisbethae*)
- Bull kelp (*Nereocystis luetkeana*)
- Burrowing anemone (*Pachycerianthus fimbriatus*)
- Cabezón (*Scorpaenichthys marmoratus*)
- California sea cucumber (*Parastichopus californicus*)

\* Based on COSEWIC status report (2009) for Quillback and Lea et al. (1999) for Copper. It is worth noting that the Vancouver Aquarium community survey program classifies all fish >20cm as adults.

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**Species recorded in rockfish habitat**

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Clown doris (*Triopha catalinae*)  
Coonstripe shrimp (*Pandalus danae*)  
Coralline algae (*Rhodophyta*)  
Crescent gunnel (*Pholis laeta*)  
Cushion star (*Pteraster tesselatus*)  
Dahlia anemone (*Urticina crassicornis*)  
Daisy brittle star (*Ophiopholis aculeata*)  
Embedded Sea Fir Hydroids (*Thuiaria sp.*)  
Encrusting red algae (*Rhodophyta*)  
False jingle shell (*Pododesmus macrochisma*)  
Feather star (*Florometra serratissima*)  
Filamentous brown algae (*Ochrophyta*)  
Foliose green algae (*Chlorophyta*)  
Foliose red algae (*Rhodophyta*)  
Fried egg jelly (*Phacellophora camtschatica*)  
Fringed filament worm (*Dodecaceria fewkesi*)  
Fringed sieve kelp (*Agarum fimbriatum*)  
Frosted nudibranch (*Dirona albolineata*)  
Giant acorn barnacle (*Balanus nubilus*)  
Giant green anemone (*Anthopleura xanthogrammica*)  
Giant nudibranch (*Dendronotus iris*)  
Giant plumose anemone (*Metridium farcimen*)  
Graceful decorator crab (*Oregonia gracilis*)  
Green urchin (*Strongylocentrus droebachiensis*)  
Grey brittle star (*Ophiura lutkeni*)  
Hermit crab (*Pagurus sp.*)  
Herring (*Clupeidae*)  
Kelp Greenling (*Hexagrammos decagrammus*)  
Kelp Perch (*Brachyistius frenatus*)  
Laminaria kelp (*Laminaria sp.*)  
Leafy Hornmouth (*Ceratostoma foliatum*)  
Leather star (*Dermasterias imbricata*)  
Lined chiton (*Tonicella lineata*)  
Lingcod (*Ophiodon elongatus*)  
Long Ray Star (*Stylasterias forreri*)  
Longfin Sculpin (*Jordania zonope*)  
Moon jelly (*Aurelia labiata*)  
Mossy chiton (*Mopalia muscosa*)  
Morning sun star (*Solaster dawsoni*)  
Mottled sea star (*Evasterias troschellii*)  
Nanaimo nudibranch (*Acanthodoris columbina*)  
Northern kelp crab (*Pugettia producta*)  
Ochre star (*Pisaster ochraceus*)  
Orange cup coral (*Balanophyllia elegans*)  
Orange sea cucumber (*Cucumaria miniata*)  
Orange sea pen (*Ptilosarcus gurneyi*)  
Orange social tunicate (*Metandrocarpa taylori*)  
Painted Greenling (*Oxylebius pictus*)

### Species recorded in rockfish habitat

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Painted star (*Orthasterias koehleri*)  
Parasol Bryozoan (*Caulibugula californica*)  
Peanut sea squirt (*Styella gibbsii*)  
Pile perch (*Damalichthys vacca*)  
Pink sea star (*Pisaster brevispinus*)  
Puget sound king crab (*Lopholithodes mandtii*)  
Purple urchin (*Strongylocentrotus purpuratus*)  
Red rock crab (*Cancer productus*)  
Red urchin (*Strongylocentrotus franciscanus*)  
Rock scallop (*Crassadoma gigantea*)  
Sea grapes (*Botryocladia pseudodichotoma*)  
Sea Lemon (*Anisodoris nobilis*)  
Shiny orange sea squirt (*Cnemidocarpa finmarkiensis*)  
Short plumose anemone (*Metridium senile*)  
Small pink anemone (*Sp. unknown*)  
Speckled sanddab (*Citharichthys stigmaeus*)  
Sponges (*Porifera*)  
Staghorn bryozoan (*Heteropora sp.*)  
Stalked hairy tunicate (*Boltenia villosa*)  
Striped seaperch (*Embiotoca lateralis*)  
Striped sun star (*Solaster stimpsoni*)  
Sunflower star (*Pycnopodia helianthoides*)  
Swimming scallop (*Chlamys sp.*)  
Transparent sea squirt (*Corella sp.*)  
Transparent sea squirt (*Corella willmeriana*)  
Tubesnouts (*Aulorhynchus flavidus*)  
Vermillion star (*Mediaster aequalis*)  
White nudibranch (*Doris odhneri*)  
White/stiff-footed sea cucumber (*Eupentacta quinquesemita*)  
Wine-glass hydroid (*Obelia spp.*)  
Yellow margin doris (*Cadlina luteomarginata*)

### Discussion and Conclusions

Our surveys found that there are at least 4 species of rockfish around Galiano Island, which mainly consist of Quillback and Copper rockfish. The most abundant species seen was Quillback, which is listed as “threatened” by COSEWIC. The presence of both juvenile and adult fish suggests active reproduction and recruitment in the area. We had hoped to see juveniles of more species, and will continue monitoring in the future with the hope of increasing abundances.

The species of rockfish that we recorded as “unknown” are likely one of the species already recorded, but we did not feel confident enough in our identification of them to label them in this report. Some of the fish were caught on a segment of video, and we will be seeking advice from rockfish professionals to help in their identification. We saw a sixth species, Yellowtail rockfish, on a dive that was outside of our survey

transect at our northern non-RCA site. We did not include these fish in our survey counts, but feel it is important to note their presence around Galiano Island. Since our survey completed, we have also noted a few Brown rockfish around Galiano, during free dives that were not recorded as part of our data set.

We found rockfish at all of our sites, and the site with the highest densities and diversity was a non-RCA site. This is intriguing because one of our transects at this site was primarily on sandy bottom, in poor rockfish habitat, so potentially our numbers could have been higher. Volunteer REEF surveys at this site have found Tiger, Quillback, Copper and Puget Sound rockfish (REEF, 2012). This suggests still higher biodiversity at this site, and it raises the question of whether some areas that are currently outside of RCAs should be considered for protection.

Interestingly, management restrictions for the hook and line industry for inshore rockfishes were instigated to mitigate the pressure primarily put on Yelloweye and Quillback rockfish (Yamanaka and Logan, 2010). During our surveys we noticed Quillback regularly, which may suggest some recovery as a result of these management decisions. We saw only a single Yelloweye, however, which was quite brilliant to behold with its bright red colouration and two vibrant white “racing stripes”. This discrepancy could be due to a combination of factors. Yelloweye tend to inhabit deeper waters than Quillback, and it is possible that during the time of our surveys even juveniles had moved to water beyond our survey depth. Yelloweye grow larger and are typically more heavily targeted by fishermen than Quillback, though both species have been identified as being targeted (COSEWIC, 2008; Yamanaka and Logan, 2010). Yelloweye rockfish are one of the largest species (reaching up to 90 cm) and have thus been sought after by recent commercial fisheries as well as by First Nations for some time, more so than Quillback. Even among rockfish they are particularly slow to develop and long lived (aged to 115 years in BC, with a generation time of 66 years), so will take longer to recover than Quillback (COSEWIC, 2008). Finally, mid-water commercial trawling is still allowed even in Rockfish Conservation Areas, and it is possible that Yelloweye remain a higher incidental catch than Quillback in these fisheries.

Yelloweye rockfish are listed under COSEWIC and in the Species At Risk Act (SARA) as “special concern” and may be an important ecosystem modifier – helping to structure nearshore reef ecosystems (COSEWIC, 2008). They are the species most commonly sold to restaurants as “Red Snapper”, a misnomer. It is encouraging that we saw at least one Yelloweye during our surveys, but unfortunate that it was outside of RCA boundaries. Through personal discussion with local community

members, it was learned that during this summer three adult Yelloweye were caught in close proximity to our sighting of the juvenile, off of our survey site. This is both encouraging and discouraging, as it demonstrates that there are adult Yelloweye present near Galiano, and that local fishermen are not aware of the daily catch limit (currently 1 rockfish) or of the importance of reducing pressure on these fish.

At this time there appear to be more rockfish outside of Rockfish Conservation Areas than there are within the RCAs (47 rockfish / 100m<sup>3</sup> compared to 25 rockfish / 100m<sup>3</sup> in the RCAs). This could be due to a number of factors, including sample size, the time of RCA implementation, RCA boundary selection, intentional poaching, unintentional illegal fishing, or external factors such as predation, pollution and marine debris.

Though our sites were all selected to be as similar as possible, there were many things that we could not know until we descended into the water. It is important to remember that the extremely high numbers at one non-RCA site bumped up the average for the non-RCA sites, and that this number could theoretically level out with a higher number of sample sites. By averaging the numbers of rockfish seen across the total volume surveyed, we can reduce the sampling bias of individual transects, but the difference compared to all our other survey sites was great enough to be noteworthy for that site.

The Edmond's Water Park marine protected area in Washington is an example of the efficacy of MPAs, demonstrating both increased numbers and higher reproductive rates for the rockfish within the protected area (McConnell and Dinnel, 2002). Monitoring at Edmond's Water Park did not occur until 20 years after its implementation, which may be an important factor in considering comparisons with our surveys, which are occurring only 5 years after the implementation of the RCAs. Since rockfish are so long lived, it may take decades for there to be any detectable difference in abundance in BCs RCAs; the Quillback estimated generation time, for example, is over 30 years (COSEWIC, 2009). Our hope is that existing rockfish will continue to produce young annually, and that the resulting juvenile fish will be detectable in a shorter time frame.

We noted during our surveys that a large portion of the south end of the Trincomali Channel RCA contained little suitable rockfish habitat. During the process of creating Rockfish Conservation Areas a lot of data was needed to support the selection of appropriate areas. Some of the selections, which may have been adapted to work

well with social input, were found to be ineffective in protecting rockfish and RCA boundaries were modified in 2007 as a result (Marliave and Challenger, 2009). It is possible that the Trincomali Channel RCA and other RCA boundaries are not ideal for the ecological purposes of preserving rockfish, a plausible situation given the large amount of area that would have had to be surveyed in detail as well as the other factors involved in designating RCA boundaries. An attractive idea from our perspective would be to consider shifting this RCA boundary north, which we feel would encompass a larger area of high quality rockfish habitat.

There is some chance of intentional fishing within the RCAs, with the perspective that they are more likely to contain fish. This does not seem to be a large concern on Galiano in particular, given that commercial fisheries are fairly strictly regulated, and that the majority of community members we had the opportunity to speak with seemed unaware of the RCAs in general. It is our belief that there is hook and line fishing occurring within RCAs, but that it is primarily not intentional. There has been little public outreach done to raise awareness and promote the respect of Rockfish Conservation Areas. Fisheries and Oceans Canada has excellent information available on their web site, however most boaters in the Strait of Georgia region do not have access to the Internet, and it is often difficult to find access even on land. Galiano Island in particular receives thousands of boaters and fishers throughout the year, but has only a single location that provides public access to computers and Internet, which is a considerable distance from the marina.

We have predominantly noticed from our surveys and from discussions with local fishermen and members of the community that recreational fishermen and boaters are not aware of RCA boundaries, and therefore the RCAs do not appear to be actively providing sanctuary for rockfish populations at this time. It is vital now that outreach be done, and with governmental organizations stretched thin, it is an important task to be taken up by non-governmental conservation groups.

Another factor that may be contributing to low abundance in some of the RCAs is pollution and marine debris. The eastern shores of Galiano lie directly across the Strait of Georgia from Vancouver, and currents carry silt and water straight across from the Fraser River. It is possible that pollution may be having some effect on rockfish abundance, though we have not done any studies to verify this. It is important to encourage best practices for coastal development throughout the region, which is part of what the Galiano Conservancy is doing by supporting the proposal of a National Marine Conservation Area in the Strait of Georgia and through our outreach programs.

In addition to rockfish, we noted a rich variety of species from coralline algae to lingcod during our surveys. Though we selected our sites to have similar habitat, an overwhelming observation we made was that all of our sites with higher rockfish abundances supported high levels of biodiversity. We observed rockfish taking cover amongst tunicates and seaweeds, and made note of many different creatures that could be food sources for rockfish. We also noted that all the species present in the RCAs potentially benefit from conservation legislations, particularly the other fish species. We have been recording video on most of our dives, and have collected some footage that we hope will help people understand the complexity and magnificence of the underwater ecosystems around Galiano Island.

### **Future Steps**

This research project has provided us with baseline data on rockfish populations around Galiano, which we hope to use as a reference for long term monitoring and as an example for other groups to engage in surveys. We will also provide our findings to management groups and policy makers as appropriate and hope that this work will inform their processes. To date, our findings have been shared with the David Suzuki Foundation, the University of Victoria, and the Strait of Georgia Data Centre.

Our research will help us to address rockfish declines at a community level, and specifically provide outreach to recreational fishing groups. Our next step, funding permitting, will be to implement an outreach campaign on Galiano and in surrounding communities. We encourage any other conservation organizations in the region to do the same, and to collaborate for maximum impact. Our outreach efforts will potentially reduce fishing pressure on rockfish and aid in their recovery.

As a starting point, we suggest clear signage that could be placed on shore to help delineate RCAs would notify and remind fishers that they are in a no hook and line zone. This would also provide a perfect opportunity to engage landowners whose properties back onto an RCA during the process of gaining permissions to mount signage. By educating landowners about the Rockfish Conservation Area that they live in, there is a window to foster stewardship for the RCA and encourage reporting of any illegal fishing in the area.

It is up to us, as people, to make a positive change in our environment.



## Acknowledgements

I would like to acknowledge Dr. Tom Mommsen for his expert advice on site selection, Dana Haggarty for her guidance for our methods and for taking the time to help us survey, Lynne Yamanaka for offering advice and data from DFO survey experiences to aid in our research design, and to Travis Beaulieu my dive buddy, boat driver and videographer who made the surveys possible. I would also like to thank Ken Millard and Barbara Moore for their wisdom and guidance. Funding and In-Kind contributions for this project were graciously provided by Mountain Equipment Co-op, the Galiano Conservancy, Fisheries and Oceans Canada, Dr. Tom Mommsen, and many volunteers.

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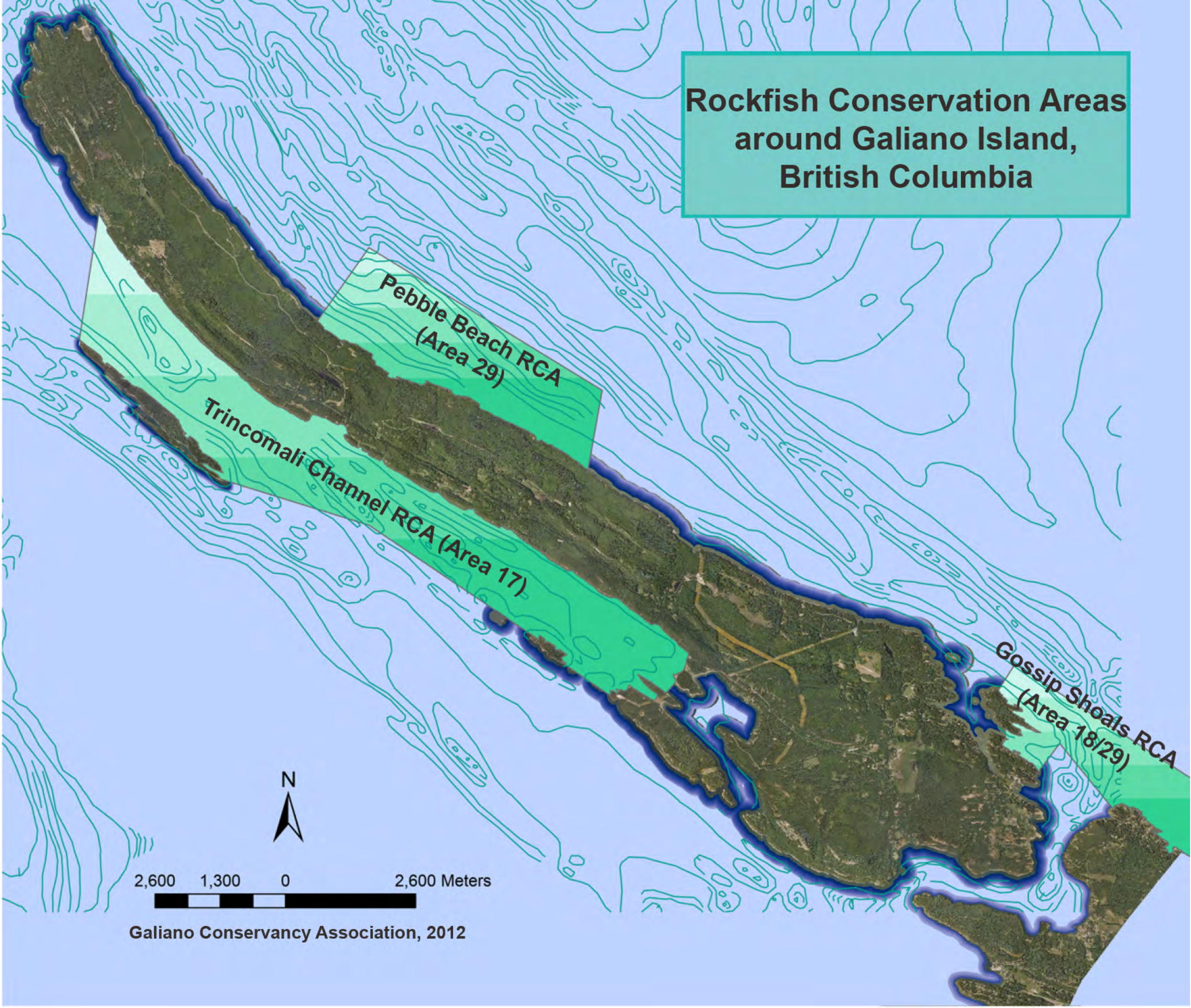
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# Rockfish Conservation Areas around Galiano Island, British Columbia



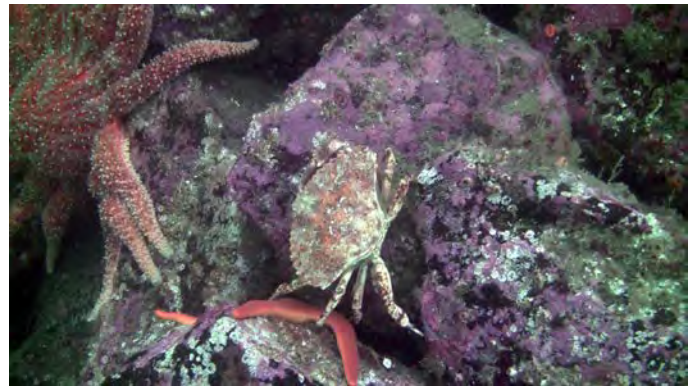
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Galiano Conservancy Association, 2012





Copper rockfish - GCA dive surveys 2012



Sea stars and crabs – GCA dive surveys 2012



Tunicates and Cup corals – GCA dive surveys 2012



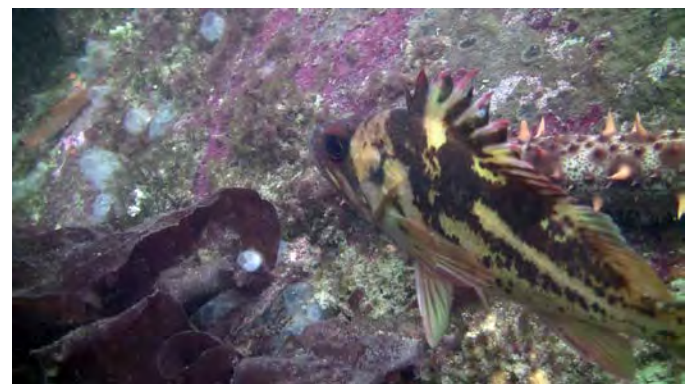
Quillback rockfish with special colours – GCA dive surveys 2012



Lia SCUBA – GCA dive surveys 2012



Lingcod – GCA dive surveys 2012



Copper – looking for lunch? GCA dive surveys 2012



There are:

 **164** Rockfish Conservation Areas (RCAs) on the west coast of Canada,

 **86** in the Strait of Georgia,

 **3** bordering Galiano Island!

# Rockfish Conservation Areas (RCAs) bordering Galiano Island



Scott Stevenson  
Pacific Marine Imaging  
www.8arm.com

True to its name, a rockfish will make a rocky nook its home, and guard it for life.

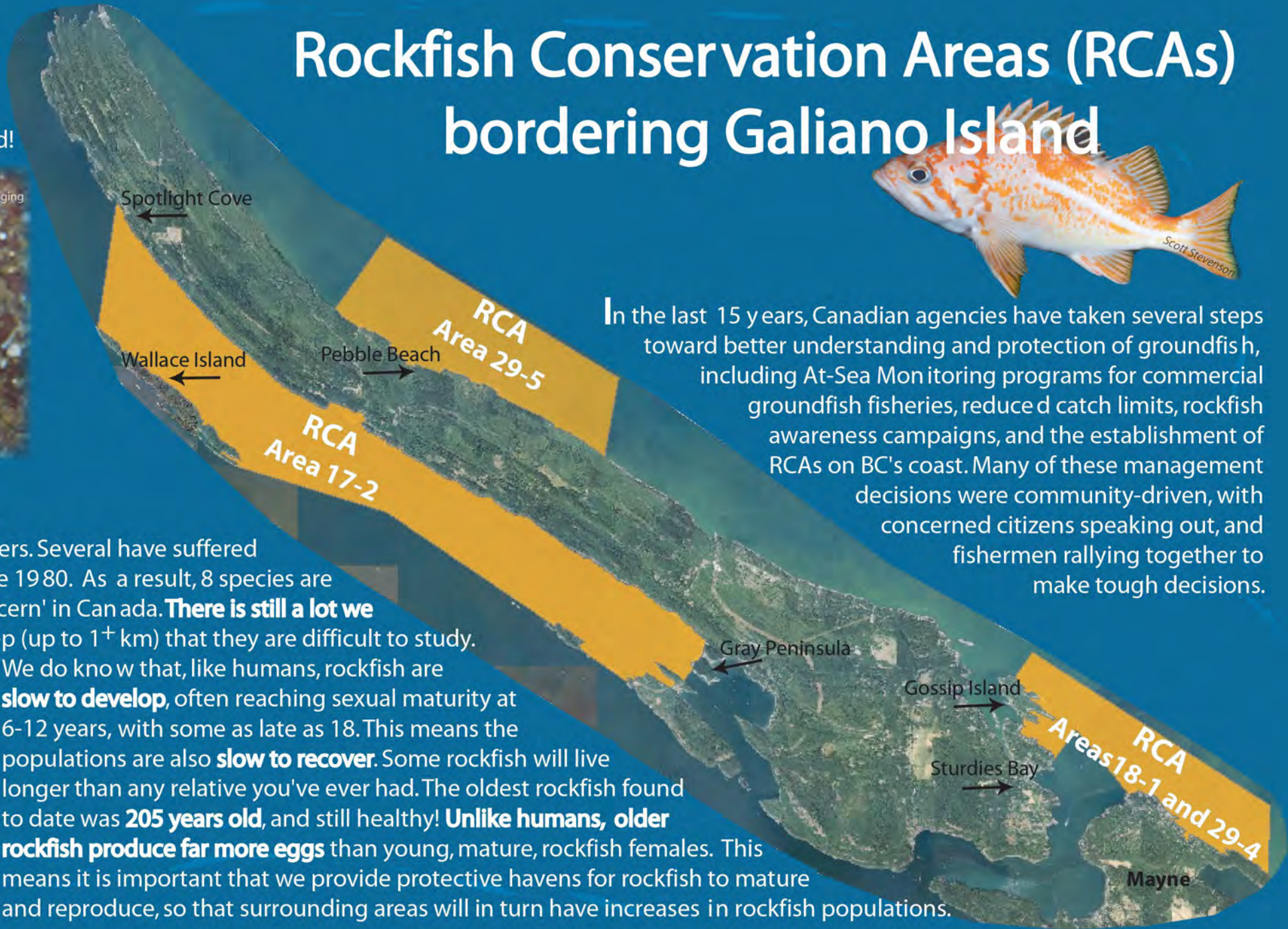
## Rockfish still need your help.

At least 37 species of rockfish live in BC waters. Several have suffered **major population declines (up to 95%)** since 1980. As a result, 8 species are now listed as 'threatened' or of 'special concern' in Canada. **There is still a lot we don't know about rockfish** - they live so deep (up to 1+ km) that they are difficult to study.

We do know that, like humans, rockfish are **slow to develop**, often reaching sexual maturity at 6-12 years, with some as late as 18. This means the populations are also **slow to recover**. Some rockfish will live longer than any relative you've ever had. The oldest rockfish found to date was **205 years old**, and still healthy! **Unlike humans, older rockfish produce far more eggs** than young, mature, rockfish females. This means it is important that we provide protective havens for rockfish to mature and reproduce, so that surrounding areas will in turn have increases in rockfish populations.



Scott Stevenson  
Pacific Marine Imaging  
www.8arm.com



In the last 15 years, Canadian agencies have taken several steps toward better understanding and protection of groundfish, including At-Sea Monitoring programs for commercial groundfish fisheries, reduced catch limits, rockfish awareness campaigns, and the establishment of RCAs on BC's coast. Many of these management decisions were community-driven, with concerned citizens speaking out, and fishermen rallying together to make tough decisions.

It is up to **you** to ensure that you respect RCAs, and do your part to **help these areas truly be protective havens** for rockfish.





**References/reading list:**

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DFO website, Aquatic Species At Risk (search rockfish species): <http://www.dfo-mpo.gc.ca/species-especies/index-eng.htm>

**Allowed activities within RCAs:**

- Recreational fishing
- invertebrates by hand picking or dive
  - crab by trap
  - shrimp/prawn by trap
  - smelt by gillnet

- Commercial fishing
- invertebrates by hand picking or dive
  - crab by trap
  - prawn by trap
  - scallops by trawl
  - salmon by seine or gillnet
  - herring by gillnet, seine and spawn-on-kelp
  - sardine by gillnet, seine, and trap
  - smelt by gillnet
  - euphausiid (krill) by mid-water trawl
  - opal squid by seine
  - groundfish by mid-water trawl

Note that **no hook and line fishing** is allowed in Rockfish Conservation Areas



To report a fishing violation to a DFO officer, call **1-800-465-4336**

**What YOU should know about Rockfish Conservation Areas (RCAs) around Galiano Island**



Scott Stevenson  
Pacific Marine Imaging  
[www.8arm.com](http://www.8arm.com)

**It will "rock" your socks off!**





# Rockfish Project



**Galiano Island has 3 Rockfish Conservation Areas (RCAs) bordering it!**

## Did You Know?

Rockfish live so deep under the water that they suffer internal injuries when they are brought up to the surface on a fishing hook, because of the rapid change in pressure. For this reason, you are advised to keep what you catch, and move to a different spot after catching a rockfish!

**WHAT is an RCA?** An area of water that Fisheries and Oceans Canada (DFO) has designated as a no-take zone for rockfish, where you legally cannot do any kind of hook and line fishing. Other fishing, like setting crab and prawn traps, is still allowed.



Vermillion rockfish

## WHY?

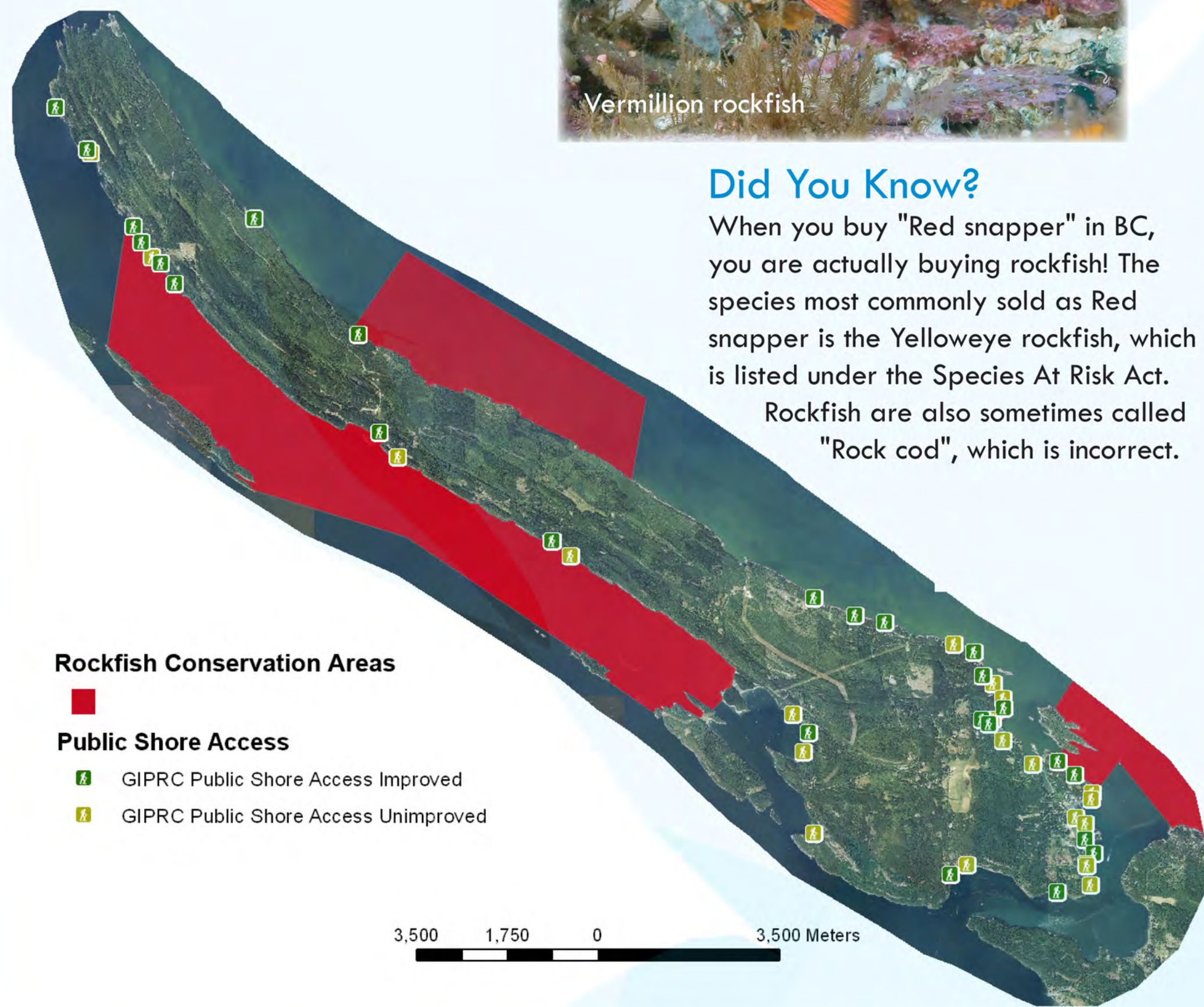
- Several species of rockfish are threatened due to overfishing
- Rockfish take up to 20 years to become sexually mature!
- Rockfish live longer than us - the oldest one found was 205 years old
- Fishermen were not reaching their catch quotas in a year because there were so few rockfish left, especially in the Strait of Georgia
- Reducing catch limits is not effective in restoring rockfish populations - they need a protected area where they can live long and prosper!
- Rockfish aren't just funky looking, they are important parts of the coastal food web - both as voracious predators and as food for others

## WHAT ARE WE DOING?

- In 2007 the DFO established 164 RCAs, with 86 in the Strait of Georgia
- Travis Beaulieu and Lia Chalifour are doing some of the first dive surveys in the 3 RCAs around Galiano for the Galiano Conservancy Association
- The surveys will give us an idea of how many rockfish are here, how many species are represented, and if the RCAs are making a difference yet
- We will also be getting the word out about RCAs and about how cool rockfish really are!

## Did You Know?

When you buy "Red snapper" in BC, you are actually buying rockfish! The species most commonly sold as Red snapper is the Yelloweye rockfish, which is listed under the Species At Risk Act. Rockfish are also sometimes called "Rock cod", which is incorrect.



3 Rockfish Conservation Areas (seen in red on the map above) border Galiano Island, and several more are nearby. Galiano Parks and Recreation has recently installed signs with maps of the RCAs at several shore accesses on Galiano, to help inform would-be fishers to move along to another, legal, fishing area!

Rockfish photographs graciously donated by Scott Stevenson, an underwater photographer based out of Victoria, BC



Lia Chalifour (left) is now conducting dive surveys with Travis Beaulieu (bottom right) to see how many rockfish we have left in Galiano waters, and if there is a difference between RCAs and waters open to fishing



A curious rockfish seen on one of our surveys  
 Photo by Travis Beaulieu



**Top:** A colourful China rockfish perches on matching yellow sponge

**Left:** A juvenile Quillback rockfish takes refuge inside a sponge

**Right:** A juvenile Yelloweye rockfish (also known locally as "Red snapper") will have to find another rocky crevice to call home - this one is taken by a wolf eel!



For more information, or if you would like to volunteer, please contact Lia at [biologist@galianoconservancy.ca](mailto:biologist@galianoconservancy.ca), or call the Galiano Conservancy Association at 250-539-2424!

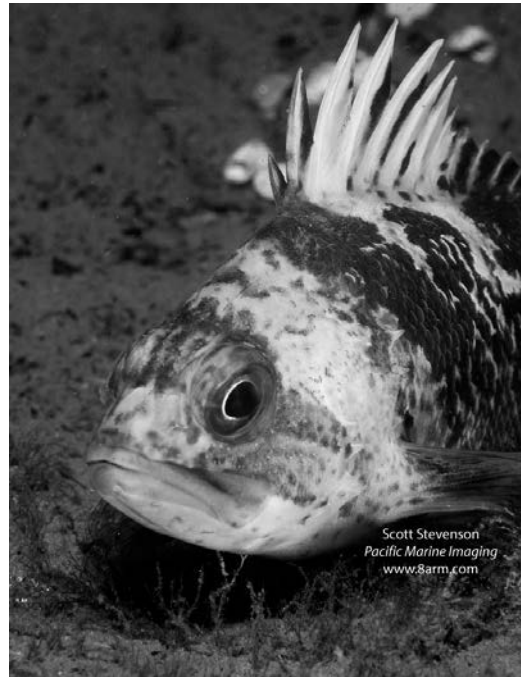


Scott Stevenson  
 Pacific Marine Imaging  
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## Creatures of the Deep – Rockfish (*Sebastes sp.*)

For the small amount of information that we know about rockfish (of the Scorpionfish family, sometimes called “rock cod”), we seem to have formed some pretty strong opinions about them. I recall a story that my mother told me about her first “West Coast fishing” experience. She was in a canoe, with my dad, and was manning the fishing rod while he paddled them out into the bay. With a stroke of luck, she had a fish on the line! She reeled it up, using all her strength – but then it broke the surface... A monster of the deep, this fish shared NO resemblance with the salmon, trout and occasional bass she had seen in her lifetime. Spines poked out in all directions, its mouth gaped wide and a ‘tongue’ lolled out to the side. Its large eyes bulged against the unnaturally bright colours of its leathery skin. She shrieked and threw it away – rod, reel, and fish – back to the deep from whence it came. My father, needless to say, was not too pleased with the scenario. Then again, neither was my mom.



These are the images most people have of rockfish – large heads, sharp spines that leave a nasty wound (they are mildly venomous), bulging eyes and gaping mouths with a bloated ‘tongue.’ The tongue of course, is actually their stomach, which has been forced out of their mouths by their bloated swim bladder. This happens because of the pressure change caused by pulling them up from the depths (for this reason, you are now advised by the DFO to keep any rockfish you catch, as they aren’t likely to survive a release). I am inclined to think that these images have influenced how we managed rockfish in the past – it was a sort of victory to conquer these creatures of the deep, and their tasty flesh added to the prize!

Andy Lamb, a renowned fish enthusiast, pointed out that the translation of the rockfish genus name “*Sebastes*” means “Magnificent”. They truly are magnificent creatures – they come in a variety of colours and patterns that give any tropical fish a run for its money. Vibrant oranges, reds, and yellows, mottled greens and tiger stripes decorate these proud predators. Rockfish mothers carry their eggs around until they hatch, releasing larvae that float around for a few months before settling into the shallows, in eelgrass beds and kelp forests. As they grow larger, they begin to move to deeper habitats. Sometimes, if an adult finds a nice cozy rock to call home, it may stay relatively shallow – though we don’t see these large adults very often anymore, as they’ve been harvested by “conquerors of the deep”. Some rockfish adults can live at depths greater than a kilometer down. In fact, two newly discovered species (the Shortspine Thornyhead and Longspine Thornyhead) were only found after our trawl fleets were forced to fish deeper in order to come up with their catch quotas (the Longspine Thornyhead is now a species at risk in Canada).

Around the time of the salmon industry decline in the late 1980s, the commercial and recreational rockfish fishery began to boom. And then bust.

An estimated 75-98% of the rockfish that originally lived in the Strait of Georgia (in this context, the Strait of Georgia includes all waters between Vancouver Island and the mainland) have now been fished out, and those remaining can still be fished – though



legislation around this fishery has been greatly increased. In 2007 the efforts of rockfish lobbyists and the DFO culminated into the establishment of 164 Rockfish Conservation Areas, 86 of which are in the Strait of Georgia. These conservation areas are our hope to re-establish the once thriving rockfish populations in our area.

In 1997 the Alaska Department of Fish and Game did an aging study on rockfish coming in off fishing boats, and determined that 16% of the fish being eaten by you and I were over 50 years old. These old fish are extremely important to the rockfish populations, as they actually produce more young with age. Longer-lived adults also make rockfish more resilient than other species to changes in the environment, such as climate change. The youngest stages of an animal's life are almost always the most susceptible to environmental fluctuations – by living longer, the adult rockfish can “ride out” some of these changes, and continue producing young, so that eventually they will release larvae into favourable conditions. The oldest rockfish found to date was 205 years old, a Rougheyeye (*S. aleutianus*) who would have been cozing up in a crevice before Fort Victoria was established, before BC became a Canadian province, before Emily Carr, long before rockfish were commercially harvested, before climate change was ever discussed, and certainly before anyone reading this article was born.

Rockfish make up an important part of the oceanic food chain, contributing to the food of many other fish, birds, and mammals throughout their lifecycle, and acting as ‘top-down managers’ as they grow into predatory adults. Their food varies from species to species, and depending on size, and includes a range of krill, crabs, shrimp, other fish, and smaller rockfish.

Though rockfish can be quite tasty, keep in mind that after you get through all the spines and scales, only 21-33% of the total weight of the fish is harvestable as skinless fillets, and they only have a freezer life of about 4 months. To avoid over-harvesting rockfish when you go out on your next fishing trip, target other species first (e.g. keep your hook off the bottom, even when fishing for lingcod and halibut), so that you can keep any accidental rockfish that you hook. If you pull up a couple rockfish right away, suck it up and move along, because you don't want to deplete an area and exceed your daily catch (current daily limit in the Strait of Georgia is 1; possession limit is 2)!

For more information:

Search “rockfish” on the DFO website: [www.dfo-mpo.gc.ca](http://www.dfo-mpo.gc.ca)

Get the Alaska Sea Grant brochure for anglers:

<http://seagrant.uaf.edu/bookstore/pubs/SG-ED-40.html>

Keep an eye out for local brochures, surveys, presentations and media on rockfish around Galiano Island – this is my project for the next several months!

Contact Lia at [biologist@galianoconservancy.ca](mailto:biologist@galianoconservancy.ca); 250-539-2424