

# Rockfish Conservation Areas in the Salish Sea: Compliance and Community-Based Initiatives

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## Abstract

This study examined Rockfish Conservation Areas (RCAs) within the Southern Strait of Georgia, British Columbia and assessed the efficacy of outreach and education initiatives by a local NGO (The Galiano Conservancy Association). With a focus on compliance, this study used community-based education, camera monitoring, and structured recreational fisher interviews as methods. Community-based education initiatives were conducted in conjunction with the Galiano Conservancy Association (GCA) through awareness posters and maps and outreach booths at events throughout the summer. From May to August 2015, there were approximately 65 people or more who discussed rockfish conservation with a representative of the GCA at these community events. Camera monitoring was used to identify instances of confirmed or suspected non-compliance, which displayed 55 suspected fishing incidents within RCAs. Lastly, structured recreational fisher interviews were conducted to assess knowledge of RCA existence and regulations throughout the peak fishing season (July-August). Eighty-eight percent of survey participants thought that there was a need for rockfish conservation in British Columbia, with 52% suggesting education. Using these methodologies, my findings showed a lack of RCA knowledge within the recreational fishing community, which is affecting compliance within these areas. This lack of RCA knowledge calls for an increase in community-based education and outreach, such as the initiatives being done by the Galiano Conservancy Association in the Southern Strait of Georgia.

## Introduction

Marine Protected Areas (MPAs) are conservation tools that protect marine ecosystems from overfishing and other impacts. MPAs can vary from restrictive no-take areas, to areas meant for sustainable resource consumption (Ban, McDougall, Beck, Salomon, & Cripps, 2014). Upon witnessing the collapse of several fisheries throughout the world, many have come to look for conservation measures such as MPAs (Halpern, 2003; Jamieson & Levings, 2011). MPAs are unique tools in marine conservation efforts as they

provide ecosystems with much needed protection, particularly for critical areas and threatened species (Allison, Lubchenco, & Carr, 1998). These areas are found to be especially advantageous for low-mobility species such as rockfish (Ban et al., 2014), because they allow non-migratory species targeted by fisheries to spend most of their lives protected, and therefore enhance populations with their borders (Dayton, Sala, Tegner, & Thrush, 2000).

There are 37 species of Rockfish (*Sebastes*) in British Columbia, eight of which are listed as either 'threatened' or of 'special concern' by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Chalifour, 2013). Rockfish have several biophysical characteristics that make them sensitive to overfishing. Some of these characteristics include; late sexual maturation (between 12-18 years), increased fecundity as females age, the tendency towards territorial behavior, as well susceptibility of barotrauma when brought to the surface too quickly (Lancaster & Ban, 2015). High mortality is often felt when rockfish are discarded, due to decompression effects (Yamanaka & Logan, 2010). These species are inclined to overfishing because of such biophysical characteristics, creating mutual concern from citizens and NGOs alike. This concern later instigated the implementation of Rockfish Conservation Areas (RCAs) throughout British Columbia between 2003 and 2007 (DFO, 2014).

There are 164 Rockfish Conservation Areas (RCAs) established throughout British Columbia's waters, designed to lessen future rockfish population declines (DFO, 2014). However, RCAs are not considered the same as MPAs since they were not designated using the same legislation, but through the Fisheries Act (Haggarty, 2013). They prohibit hook-and-line fishing, allowing some other fishing activities to continue (e.g., crab and prawn trapping). Population numbers should theoretically be increasing within these conservation areas, although studies have shown mixed results (Haggarty, 2013). Most studies evaluating the effectiveness of RCAs have not shown differences between populations within and outside the conservation areas, implying that fishers may not be following regulations (Haggarty, 2013).

A recent study conducted at the University of Victoria has shown that "25.5% of recreational fishers had never heard of RCAs and ~60% were unsure of RCA locations," with a total non-compliance rate of 23% (Lancaster & Ban, 2015, p.4). This limited

knowledge of RCAs and accompanying low compliance may be affecting the functioning of the conservation areas (Haggarty, 2013). If compliance is low and recreational fishers don't obey the regulations, conservation areas themselves do little to protect populations (Arias, 2015). Understanding fisher compliance is critically important for the successful management of conservation areas and therefore, this study focuses on compliance within RCAs (Arias, 2015).

The purpose of this study was to assess the efficacy of outreach and awareness initiatives by a local NGO (Galiano Conservancy Association) on compliance of recreational fishers within RCAs. This research was a partnership between the University of Victoria and the Galiano Conservancy Association (GCA), a local non-profit environmental organization based on Galiano Island in the southern Gulf Islands, British Columbia, Canada. Outreach and awareness initiatives by GCA included awareness posters, permanent signage, inserts in the local newspaper, and attendance at community events. Effectiveness of outreach was assessed through several methods during the peak fishing season (June-August) 2015: camera monitoring of RCAs to identify non-compliance, surveys with recreational fishers.

## **Methodology**

Education and outreach methods were conducted in conjunction with the Galiano Conservancy Association, and assessment of RCA compliance adapted methods developed by Lancaster (2015) to study compliance within RCAs, using camera monitoring and surveys with recreational fishers.

### **Community-Based Education and Outreach**

As part of a project funded by the Habitat Stewardship Program (HSP), GCA and the Valdes Island Conservancy (VIC) have developed maps, posters, pamphlets, and articles focusing on RCA awareness. Several organizations around the region have used these as tools of education.

Awareness posters (Appendix A) and maps (Figure 1) have been posted at locations around Galiano Island, Valdes Island, Victoria, Metro Vancouver and have also been sent out to a variety of partner organizations including: World Fisheries Trust, Reef Environmental Education Foundation, Shaw Ocean Discovery Centre, Georgia Strait Alliance, CPAWS, Rockfish Divers, Saltspring Island Conservancy, and several others. Two posters were developed as well as small local maps zoomed in on Galiano and Valdes Islands, which show surrounding RCA boundaries. Larger regional maps (Sidney to Gabriola Island) were also developed and distributed.

GCA and the Valdes Island Conservancy (VIC) have developed ten permanent RCA signs that have been posted at water access locations around both Galiano and Valdes Islands (Figure 2). These signs are large (3 x 4 feet), metal, and are permanently posted. Seven of these signs have been developed with information presenting a 'You Are Here' marking, the location of the closest RCA, images of local rockfish species, as well as a list of permitted activities. These signs are situated at the following locations: Montague Harbour Public Dock, Retreat Cove Dock, Montague Harbour Marina, Spanish Hills, Whaler Bay, Montague Harbour BC Parks dock, and Kendrick Island Marina. These docks are managed by several different organizations including the Capital Regional District, BC Parks, and Whaler Bay Harbour Authority. This made it challenging to receive consent from all in a timely manner. Therefore signs weren't posted until the end of the 2015 peak fishing season even though there were multiple efforts to post them earlier. The remaining 3 signs were developed with text and no maps to be seen from boaters on the water.

Event	Date
<b>Camera monitoring began</b>	June 11, 2015
GCA's Annual General Meeting	June 6, 2015
Canada Day Jamboree	July 1, 2015
UVic Fish Panel Discussion	July 5, 2015
Fiesta	August 1, 2015
Saturna Island SIMRES Bioblitz	August 5, 2015
<b>Camera monitoring ended</b>	August 21, 2015

Table 1. Timeline of outreach events and camera monitoring from June – August 2015. All events took place on Galiano Island unless indicated otherwise.

Outreach booths containing RCA information at community events were a large aspect of GCA's education and outreach this summer. Maps, posters and handouts were distributed in order to help raise awareness regarding RCAs at five events throughout the summer including: GCA's Annual General Meeting, the Galiano Jamboree, a UVic field course fish panel discussion, the Saturna Island Bioblitz and the Galiano Island Fiesta (Table 1).

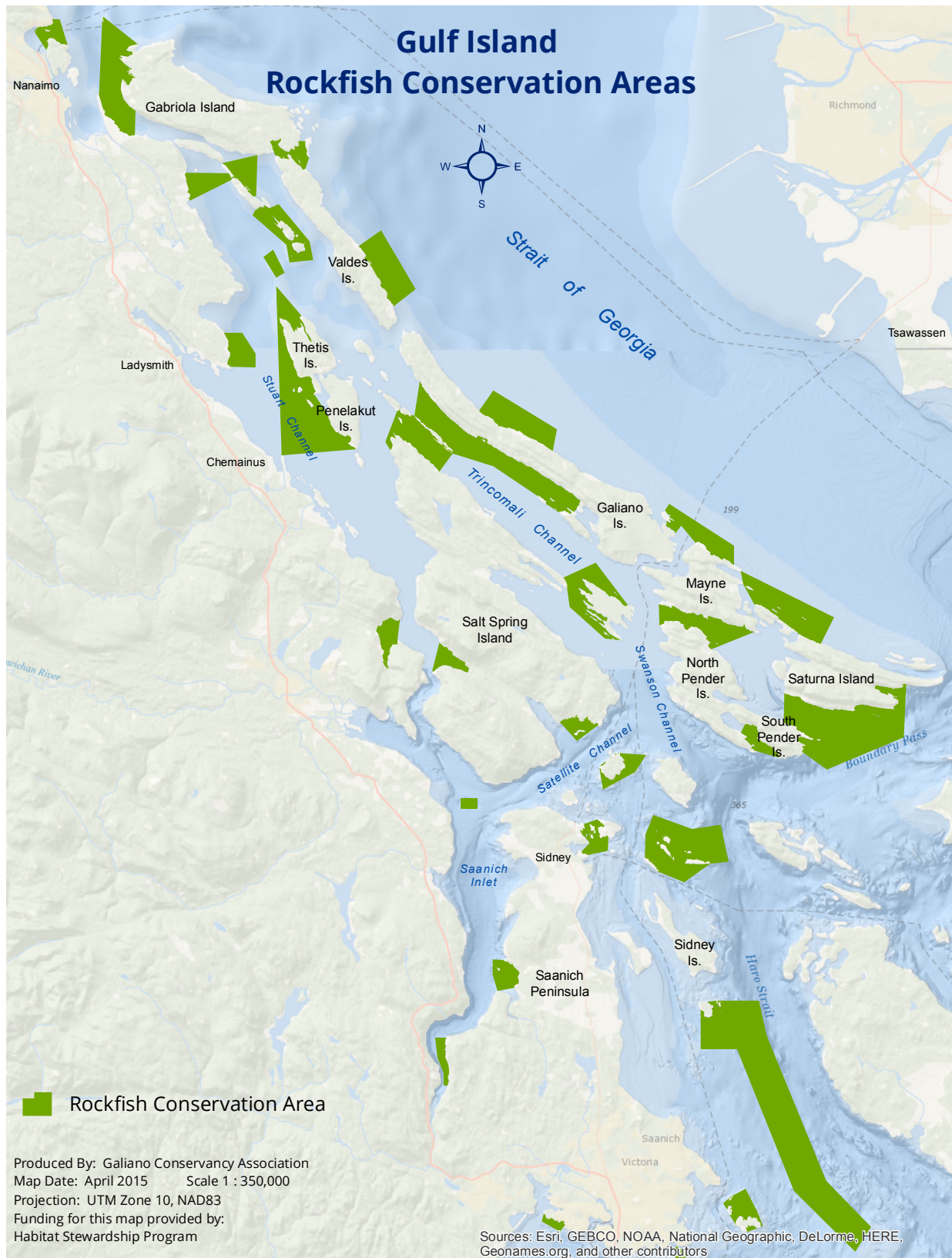


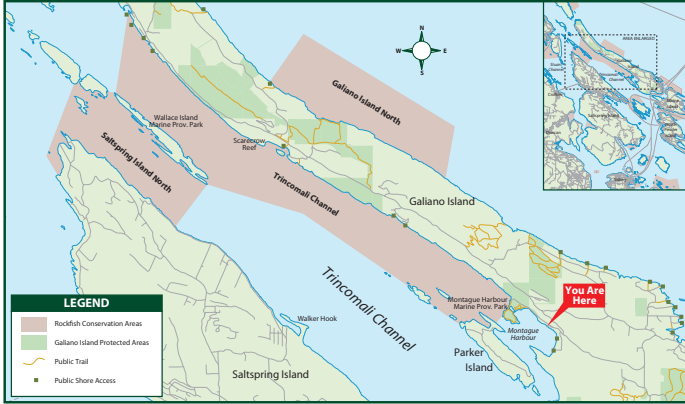
Figure 1. Regional map of RCAs in the Southern Strait of Georgia developed by the Galiano Conservancy Association. The green patches represent Rockfish Conservation Areas in the Strait.

# Rockfish Conservation Area (RCA)

Absolutely no hook and line fishing permitted in RCAs

Il est strictement interdit de pêcher avec ligne et hameçon dans les RCA

A Partnership of



**Quillback rockfish**  
*Sebastes maliger*



**Copper rockfish**  
*Sebastes caurinus*



**Yelloweye rockfish**  
*Sebastes ruberrimus*



**Tiger rockfish**  
*Sebastes nigrocinctus*

Image: Department of Fisheries and Oceans Canada - Ministère des Pêches et Océans Canada (MPO)

Closest Rockfish Conservation Area (RCA) is the Trincomali Channel RCA

La zone de conservation du sébaste (de l'anglais Rockfish Conservation Area, ou RCA) la plus proche est le RCA du chenal Trincomali

Aboriginal right to fish is not infringed upon

**Permitted recreational fishing activity**

invertebrates by hand picking or dive  
crab, shrimp or prawn by trap  
smelt by gillnet

**Permitted commercial fishing activity**

invertebrates by hand picking or dive  
crab and 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

**Why are they at risk?**

- Inshore rockfish species grow slowly, stay in the same areas, mature late and have long lifespans, taking between 6-12 years to fully mature
- Older rockfish are able to produce larger quantities of eggs, making them a critical aspect of population resilience
- Such characteristics make rockfish extremely vulnerable to overfishing, with populations slow to recover and rebuild following decline
- This matters because rockfish play important roles within the coastal food web as both predators and food for others, and they serve as indicators of the overall health of the system

Source: [www.pac.dfo-mpo.gc.ca](http://www.pac.dfo-mpo.gc.ca)

Ceci ne porte pas atteinte au droit de pêche ancestral des peuples autochtones

**Activités de pêche récréative autorisées**

Capture à la main ou en plongée des invertébrés  
Capture au casier des crabes, crevettes ou crevettes nordiques  
Capture de l'éperlan au filet maillant

**Activités de pêche industrielle autorisées**

Capture à la main ou en plongée des invertébrés  
Capture du crabe au casier  
Capture des crevettes nordiques au casier  
Récolte des pétoncles par chalut  
Capture du saumon au seineur ou filet maillant  
Capture du hareng au filet maillant, au seineur ou récolte d'œufs de hareng su varech  
Capture de sardines au filet maillé, seineur ou au casier  
Capture de l'éperlan au filet maillant  
Capture des euphausiacés (krill) au chalut pélagique  
Capture du calmar opale au seineur  
Capture des poissons de fond au chalut pélagique

**Pourquoi sont-ils considérés en péril ?**

- Les espèces de sébaste en zones côtières ont une très longue durée de vie, demeurent dans le même secteur et ont une maturité tardive, prenant entre 6 et 12 ans à se développer pleinement
- Les sébastes plus âgés peuvent produire une plus grande quantité d'œufs, ce qui fait d'eux un élément essentiel de la résilience de l'espèce.
- Ces caractéristiques font du sébaste une espèce particulièrement vulnérable à la surpêche et les populations se rétablissent lentement suite à un déclin
- Les sébastes jouent un rôle important au sein des réseaux trophiques côtiers, aussi bien à titre de prédateur que de proie pour les autres espèces. Ils servent également d'indicateurs de la santé globale de l'écosystème

Source: [www.pac.dfo-mpo.gc.ca](http://www.pac.dfo-mpo.gc.ca)

Inform others and report violations to DFO at 1-800-465-4336

Project funded by the Habitat Stewardship Program

For more information about this project, go to: [valdes-island-conservancy.org](http://valdes-island-conservancy.org) or [galianoconservancy.ca](http://galianoconservancy.ca)

Informez les autres et signalez toute violation au MPO au numéro suivant : 1-800-465-4336

Un projet financé par le Programme d'intendance de l'habitat (de l'anglais « Habitat Stewardship Program »)

Pour obtenir de plus amples renseignements à ce sujet, veuillez visiter le site Web [valdes-island-conservancy.org](http://valdes-island-conservancy.org) ou [galianoconservancy.ca](http://galianoconservancy.ca)

Figure 2. One of seven permanent RCA signs developed by GCA and Valdes Island Conservancy (VIC) and posted around Galiano and Valdes islands



## Camera Monitoring

Camera monitoring was used to identify instances of confirmed or suspected non-compliance. Four Bushnell Trail Cameras were mounted on land overlooking two RCAs surrounding Galiano Island: Trincomali Channel RCA, and Galiano Island North RCA. Camera locations were chosen based on previous work (Lancaster 2015) and local knowledge of popular fishing spots within RCAs. Camera mounting locations were then chosen based on permissions to place them on public or private land, resulting in four locations: Montague Harbour Marine Provincial Park, Pebble Beach, District Lot 57, and Retreat Island (Figure 3).

Cameras were left in place for an eleven-week period and were locked to trees with a sign providing information about the research project and contact information. All cameras took pictures on five-minute intervals during daylight hours, between 4:30 am to 10:00 pm daily. Pictures were then analyzed to identify fishing events within RCAs. Photos were labeled as “confirmed fishing” when fishing gear, such as rod and line, were clearly identifiable and in use. Images were labeled as “probable fishing” when fishing activity was suspected (e.g., several pictures in a row captured the same boat with no wake, likely jigging; or trolling if the boat was of fishing style and moving slowly). Information regarding location, time of day, and date were recorded along with each labeled photograph.



Figure 3. Map of camera monitoring locations on Galiano Island. Camera locations are labeled from 1-4, representing the most suspected fishing incidences at camera 1 (Montague Harbour) and the least suspected fishing at camera 4 (Pebble Beach). The purple patches represent Rockfish Conservation Areas bordering the island.

## Structured Recreational Fisher Surveys

Surveys with recreational fishers were conducted to assess knowledge of RCA existence and regulations throughout the peak fishing season (July-August). The survey contained questions on fishing patterns, general rockfish conservation, sensitive randomized responses, general demographics, and open questions. Prior to the survey being conducted, a letter of information of implied consent was shown and the individual was given a copy to take home for their records. Once the fisher had consented, the survey would take between 10-15 minutes. Fishing maps and charts were provided in order to create a more interactive interview and also to show boundaries of conservation areas in locations of interest to the individual fisher. Although the survey (Appendix B) was based on previous work (Lancaster 2015) it had been adapted to relate specifically to the GCA. This was done in order to assess outreach and education methods used throughout the season. In total, twenty-five interviews were conducted at water access locations around the island.

Surveys conducted at the Montague Harbour boat launch and Montague Marina were also used to raise RCA awareness amongst recreational fishers. They helped provide much needed information regarding RCA regulations and boundaries. However, many individuals were hesitant to partake in the survey due to lack of time, which made it challenging to get a large sample size.

## Results

### Community-Based Education and Outreach

Community-based education and outreach in conjunction with the Galiano Conservancy Association were a large aspect of this research. The main events attended throughout the summer included the Canada Day Jamboree, the UVic Fish Panel Discussion, the Saturna Island SIMRES Bioblitz, and the August long-weekend Fiesta. Throughout the summer, there were approximately 65 people or more who discussed rockfish

conservation with a representative of the GCA at these community events. Most were given either maps or brochures that provided information regarding RCAs and some even took extras for family or friends.

### **Galiano Conservancy Association Outreach Awareness**

A question in the survey specifically aimed to assess the awareness of the Galiano Conservancy and the outreach they conducted throughout the summer of 2015. 24% of survey participants responded that they had seen GCA posters and outreach materials at a variety of locations around the island. Below, Table 2 presents the location where participants had seen GCA materials and where they were living at the time of survey completion.

<b>Material location</b>	<b>Where participant resides</b>
Montague Marina	Vancouver, BC
Don't remember	Vancouver, BC
Montague Marina and Sturdies Bay	Galiano Island, BC
Facebook	Gabriola Island, BC
Daystar Market	Comox Valley, BC
Montague Marina	Victoria, BC

Table 2. Responses of where GCA outreach materials had been seen on the island and where participants were residing at the time of survey.

### **Camera Monitoring**

From June 11<sup>th</sup> to August 21<sup>st</sup>, 2015, there were 46,102 pictures taken by four monitoring cameras on Galiano Island. Three cameras (Montague Harbour, Lot 57, and Retreat Island) overlooked the Trincomali Channel RCA, due to the large area that this RCA covers. The fourth camera, located at the Pebble Beach Reserve on the Northeast side of the island, overlooked the Galiano North RCA. By analyzing these photos, 55 suspected fishing

incidents within the RCAs monitored have been calculated. The camera with the largest number of fishing incidents (n=37) was located at District Lot 57, overlooking the Trincomali Channel RCA, followed by Retreat Island, also overlooking the Trincomali Channel RCA (n=16) (Table 3). The camera at Pebble Beach, overlooking the Galiano Island North RCA, and Montague Harbour (Trincomali Channel RCA) had 1 suspected fishing activity each. No photos demonstrated confirmed fishing incidents, as most boats were too far from the shoreline.

<b>Camera Location</b>	<b>Number of Suspected Fishing Incidents</b>	<b>Number of Confirmed Fishing Incidents</b>	<b>RCAs Overlooked</b>
1) District Lot 57	37	0	Trincomali Channel
2) Retreat Island	16	0	Trincomali Channel
3) Montague Harbour	1	0	Trincomali Channel
4) Pebble Beach Reserve	1	0	Galiano Island North
Total	55	0	

Table 3. Data retrieved from monitoring cameras throughout the summer showing numbers of suspected fishing incidents

## Structured Recreational Fisher Surveys

Twenty-five structured surveys were conducted with recreational fishers throughout the summer (June-August, 2015) on Galiano Island. The survey (Appendix B) included a series of short questions and some open-ended questions to obtain feedback from individual fishers. One of the open-ended questions asked participants why they thought some fishers still fish in RCAs. Answers varied from 'ignorance,' to 'unaware' or 'uneducated,' with many mentioning 'stupidity.' The majority of those surveyed shared

their opinions that people simply 'don't care.' Overall, it was stated several times from different individuals that there was a perceived lack of awareness in the recreational fishing community regarding RCAs. A summary of survey responses is provided in Appendix C.

Fisher recommendations for improvements of rockfish awareness ranged from fines, to education in schools, to GPS boat units including RCA locations, or even an app developed to show RCA boundaries for those using their phones while on the water. Another interesting recommendation included the designation of buoys with symbols showing where RCA boundaries were located. As most RCAs are odd shapes and sizes, it can be difficult for fishers to know exactly where they are located, making it even more challenging to comply to RCA restrictions. As presented below in figure 5, most survey participants were uncertain about RCA locations, with only 32% stating confidence in their existing knowledge of RCA boundaries.

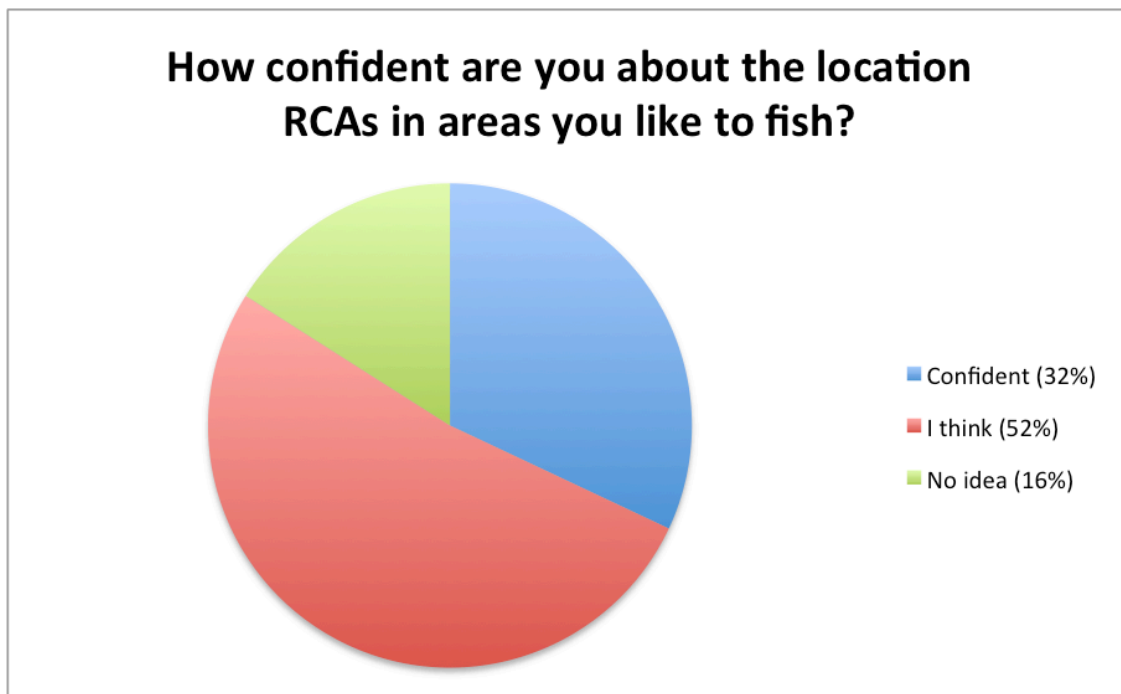


Figure 4. Pie chart representing participant responses to the question regarding certainty of RCA locations

When asked how many rockfish a recreational fisher is permitted to catch per day in the Salish Sea, 40% answered either incorrectly or that they were simply unsure. When

asked what recreational fishing activities were allowed in RCAs, 68% of individuals responded incorrectly with several activities that are not permitted. 88% of survey respondents thought that there was a need for rockfish conservation in British Columbia and when asked whether RCAs in BC were an effective conservation tool, 64% responded yes. However, 38% of this 64% thought that RCAs would be much more effective with increased limitations and enforcement measures. A summary of survey responses is provided in Appendix B.

## Discussion

Non-compliance continues to challenge the objectives of spatial fisheries management and marine protected areas worldwide (Read, West, Haste, & Jordan, 2011), and therefore understanding fisher compliance is critical for its sustainable management (Arias, 2015). This research considered compliance rates, overall awareness, and feedback from recreational fishers regarding Rockfish Conservation areas, in order to summarize key avenues for increasing awareness of RCAs, and therefore compliance within them.

This study showed that, although the majority of people have *heard* of RCAs, many do not understand their importance and the regulations within them. There was an overall lack of awareness regarding rockfish and the troubles they face. A study by Kritzer (2004) argued that noncompliance might take away the positive effects of marine conservation areas, for both conservation and fisheries management (p. 1028). Furthermore, Read et al. (2011) emphasized the importance of encouraging voluntary compliance within marine conservation areas as more important than enforcement. Although enforcement is critical, if the public is involved in the development, designation, and continued management of conservation areas, voluntary compliance should increase (Read et al. 2011). With such involvement comes an improved understanding of the importance and regulations of these areas, with a greater likelihood of acceptance and adherence to such regulations (Read et al., 2011). Since “noncompliance can also be an important determinant of whether predicted and realized benefits equate,” it should be accounted for when measuring conservation area success (Kritzer, 2004, p.1029).

## **Community-Based Education and Outreach**

Studies on marine conservation conducted worldwide have focused on the need for increased education and outreach initiatives (Arias, 2015; Lancaster & Ban, 2015; Haggarty, 2013). A survey conducted with fishers in Australia's Great Barrier Reef has shown that 17% of fishers believed ignorance to be a large noncompliance factor, with 5% directly mentioning education as a factor encouraging compliance (Arias, 2015). A study conducted by the David Suzuki Foundation has shown that recreational fishing effort in RCAs has not changed since before the establishment in 2003 and later in 2011 (Haggarty, 2013). Haggarty argues that this continued fishing effort may be affecting the efficiency of RCAs and that education and outreach should be improved for this to progress.

Outreach at community events provided the GCA the opportunity to converse with the general public about rockfish conservation in a fun and lighthearted environment. A rockfish puppet made by a local artist was a great tool for bringing not only adults to the booth but children and youth as well. Although it is essential to raise awareness within the local fishing community, it is also important to discuss with others in the community who may or may not be recreational fishers. Community-Based education and outreach at a variety of events were found to be an effective time to discuss and brainstorm with individuals from all over.

Since enforcement of RCA regulations is minimal, voluntary compliance of individual fishers is crucial. Information must be readily available and accessible for all. One of the best ways to do so is by discussing the underlying issues with individuals in person and providing them with the information to comply with the regulations on their own. By engaging and educating the general public, we are providing them with the opportunity to get involved and make their own well-informed decisions.

## **Camera Monitoring**

Although insight of fishing activity within marine conservation areas can be gained through camera monitoring, there are several limitations with this methodology. The effectiveness of monitoring cameras around Galiano Island was highly contingent on a



number of factors. One key limitation of camera monitoring is the small field of view of the cameras. RCAs cover 4846.2 km<sup>2</sup> of the coast, with some of them spanning several kilometers alone (Lancaster & Ban, 2015). It is not possible to monitor an entire RCA using this methodology, as the camera's field of view is incapable of capturing the entire area. For example, the camera at Lot 57 has shown relatively high potential fishing incidences, and therefore low compliance, within the conservation area. However, the camera located at Montague Harbour, also overlooking the same RCA, has shown very low potential fishing incidences and therefore, high compliance rates. These cameras only provide small fragments of much larger areas, and it is sometimes difficult to assess whether a lack of fisher activity, such as at Montague Harbour, is due to a camera location that is capturing an inactive section of an otherwise active area or vice versa. Much consideration needs to be taken when choosing camera locations. As these cameras only capture a small section of a larger area, this will greatly affect the data retrieved by the cameras and the conclusions pulled from this data.

Furthermore, this study did not differentiate between non-compliant fishers and those who have the right to fish in these areas (e.g. First Nations). Aboriginal right to fish is not inhibited by RCAs, and this study was unable to take these considerations into account (DFO, 2014). It was impossible to determine how many boats labeled as 'non-compliant' were in fact, Indigenous fishers and allowed to fish within these areas.

### **Structured Recreational Fisher Interviews**

This study demonstrated the relatively low knowledge of recreational fishers regarding RCAs. These findings correspond with Lancaster and Ban's research that showed about 60% of survey participants were unsure of RCA locations (2015). Furthermore, 24% of people surveyed had never heard of RCAs, which is comparable to Lancaster and Ban's (2015) research showing that 25.5% had never heard of RCAs. Having discussed this lack of awareness regarding RCAs in the recreational fishing community with the individuals surveyed, Lancaster and Ban's findings were found to coincide with this study in more ways than one. If there is an overall lack of awareness about the existence of RCAs, then how is it

expected that individuals should know the details regarding regulations and locations of these conservation areas?

Feedback from survey participants presented a variety of opinions and recommendations for the future awareness of RCAs. Most individuals surveyed hoped to see stricter monitoring, as well as increased education and awareness in coming years. However, many were unaware of the local initiatives currently occurring in the region concerning rockfish awareness. With 76% of participants stating that they had not seen GCA's outreach materials, the data argues that a larger scale of awareness is much needed. However, most of the individuals interviewed were not from Galiano Island, therefore, it is less likely that they would have seen GCA posters and outreach materials. In the future, more priority might be put into off-island outreach, although this is challenging for an organization like GCA, being based on an island. Increased emphasis could also be placed on Galiano's tourist locations, including Montague Marina and surrounding area. Many boaters come into the marina and only leave to go to the pub or stock up on small groceries at the marina general store. With a lack of transportation, it is often difficult for boaters to go to the market or other locations on island, therefore posters at Montague Marina should be monitored regularly, as well as other areas in the neighborhood, including the public dock next door and the BC Parks dock and Nature House down the road.

The relatively low knowledge of RCA regulations is exhibited in the responses to several survey questions, including the one asking what sorts of activities are allowed within an RCA, with 68% of survey respondents answering incorrectly. Most included either Salmon by rod and line or Halibut by rod and line in their responses, as they did not realize that all rod and line fishing is closed within an RCA (DFO, 2014). Furthermore, with 40% of participants responding incorrectly to the question regarding daily individual fishing limits of rockfish in the Salish Sea, this lack of RCA knowledge becomes further apparent. Either there is a lack of knowledge regarding RCAs in the fishing community, or individuals are simply not worried about disobeying the regulations due to the minimal enforcement in the region.

By continuing and increasing community-based education and outreach, such as the initiatives conducted by the GCA, awareness and compliance of RCAs will likely increase. In

turn, we are not only striving for the increased performance of these RCAs but more importantly, we are striving for healthier marine ecosystems in British Columbia.

## Works Cited

Allison, G. W., J. Lubchenco, and M. H. Carr. (1998). Marine Reserves are Necessary but not Sufficient for Marine Conservation. *Ecological Applications* 8(1):S79-S92.

Arias, A. (2015). Understanding and managing compliance in the nature conservation context. *J. Environmental Management* 153, 134–143.  
doi:10.1016/j.jenvman.2015.02.013.

Ban, N. C., McDougall, C., Beck, M., Salomon, A. K., & Cripps, K. (2014). Applying empirical estimates of marine protected area effectiveness to assess conservation plans in British Columbia, Canada. *Biological Conservation*, 180:134-148.  
doi:10.1016/j.biocon.2014.09.037

Chalifour, L (2013). Rockfish populations around Galiano Island – Freedom to Swim: Research Component for Rockfish Recovery Project. *Galiano Conservancy Association*.

DFO. (2014). Rockfish Conservation Areas (RCAs) - Pacific Region. *Fisheries and Oceans Canada*. <http://www.pac.dfo-mpo.gc.ca/fm-gp/maps-cartes/rca-acis/index-eng.html>

Dayton, P.K., E. Sala, M.J. Tegner, and S. Thrush. (2000). Marine reserves: parks, baselines, and fishery enhancement. *Bulletin of Marine Science* 66(3), 617-634.

Haggarty, D. (2013). Rockfish Conservation Areas in BC: Our Current State of Knowledge. *David Suzuki Foundation*.

Halpern, B. S. (2003). The impact of marine reserves: Do reserves work and does reserve size matter? *Ecological Applications* 13(1):S117-S137.

- Lancaster, D., Ban, N. C. (2015). University of Victoria (B.C.). School of Environmental Studies. Conservation and compliance: A quantitative assessment of recreational fisher compliance in rockfish conservation areas. Victoria, British Columbia: University of Victoria.
- Read, A.D., R.J. West, M. Haste, A. Jordan. (2011). Optimizing voluntary compliance in marine protected areas: A comparison of recreational fisher and enforcement officer perspectives using multi-criteria analysis. *Journal of Environmental Management* 92, 2558–2567. doi:10.1016/j.jenvman.2011.05.022
- Jamieson, G. S., & Levings, C. O. (2001). Marine protected areas in Canada—implications for both conservation and fisheries management. *Canadian Journal Of Fisheries & Aquatic Sciences*, 58(1), 138.
- Kritzer, J. P. (2004). Effects of Noncompliance on the Success of Alternative Designs of Marine Protected-Area Networks for Conservation and Fisheries Management. *Conservation Biology*, 18(4), 1021-1031. doi:10.1111/j.1523-1739.2004.00022.x
- Yamanaka, K. L., and Logan, G. (2010). Developing British Columbia's Inshore Rockfish Conservation Strategy, Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science, 2:1, 28-46

Appendix A: Poster developed and distributed as part of outreach for RCA awareness project



# ROCKFISH VANISH IN STRAIT OF GEORGIA

## SURPRISED BY THIS HEADLINE?

Our region's marine environments are experiencing unsustainable levels of fishing and use pressures. With every passing day, they are one step closer to collapse. The ecosystems around us are incredibly diverse and vibrant, but have been in continual decline following decades of intense human use and activity. **They can't bounce back if we don't give them a chance.**

Rockfish Conservation Areas (RCAs) have been implemented throughout the Strait of Georgia to help protect sensitive rockfish populations, but these areas remain under pressure.

**Boating:** Dropping anchor or emptying bilge tanks can cause significant damage to underwater ecosystems. Know what's under you before you drop anchor, and bring waste to disposal facilities.

**Recreational Fishing:** Stay informed, and stay alert to where you are fishing and know what the rules are. Plan your next fishing trip with this in mind.

Some rockfish populations have **dropped by over 75% within a generation** - let's bring them back so that our children and their children can experience these creatures beyond a photograph.

Project funded by the Habitat Stewardship Program

For more information about this project, contact us at [development@galianoconservancy.ca](mailto:development@galianoconservancy.ca) or go to [www.valdes-island-conservancy.org/](http://www.valdes-island-conservancy.org/)



## Appendix B: Recreational fisher survey used for this study

### Rockfish Conservation Survey

***By completing and submitting this questionnaire, YOUR FREE AND INFORMED CONSENT IS IMPLIED and indicates that you understand the conditions of participation in this study and that you have had the opportunity to have your questions answered by the researchers***

#### Section 1: Fishing Patterns

*These questions ask about your fishing habits and your involvement in the activities relating to recreational fishing.*

1. How many years have you been recreationally fishing?  
(# of years) \_\_\_\_\_
  
2. In the past 2 years, approximately how many days did you go fishing?  
(# of days) \_\_\_\_\_
  
3. In the past 2 years, approximately what percent of your fishing time did you specifically fish for rockfish?  
(% of time fishing rockfish) \_\_\_\_\_
  
4. In the past 2 years, approximately how many rockfish have you accidentally caught while fishing for something else? (*e.g., Salmon*)  
(# of rockfish) \_\_\_\_\_
  
5. If you accidentally caught rockfish in the past 2 years, what percent of the time did you release it? (*If you have not accidentally caught rockfish in the past 2 years, circle "Does not apply".*)  
(% of time released) \_\_\_\_\_ Does Not Apply
  
6. If you released accidentally caught rockfish in the past 2 years, what percent of the time did you descend them back to depth? (*If you have not accidentally caught rockfish in the past 2 years, circle "Does not apply".*)  
(% of time descended) \_\_\_\_\_ Does Not Apply

**Section 2: Rockfish conservation.**

*These questions ask about your knowledge of rockfish conservation measures.*

7. Where do you usually get your information on fishing regulations, closures, and protected areas? (*e.g. Sport Fish Advisory Board, Angling Association, Department of Fisheries and Oceans*)

(Source of information) \_\_\_\_\_ Does Not Apply

8. Had you ever heard of the Rockfish Conservation Areas in British Columbia before beginning this survey?

Yes

No

9. Where did you initially hear about B.C.'s Rockfish Conservation Areas?

(Source of information) \_\_\_\_\_ Don't remember Does Not Apply

10. The Galiano Conservancy Association is doing outreach about Rockfish Conservation Areas this summer. Have you seen any of their materials? If so, which one(s), and where did you see them?

(Materials/events) \_\_\_\_\_ (Where) \_\_\_\_\_ Does Not Apply

11. Did you participate in consultations on the Rockfish Conservation Areas and/or the Rockfish Conservation Strategy?

Yes

No

12. According to Canadian fisheries regulations, how many rockfish do you think you are permitted to catch per day in the Salish Sea (*Strait of Georgia, Puget Sound and Strait of Juan de Fuca*)?

(# of rockfish per day) \_\_\_\_\_

13. What kind of recreational fishing activity do you think is permitted in Rockfish Conservation Areas? (*Circle all that apply*)

- Halibut by rod and line
- Rockfish by rod and line
- Lingcod by rod and line
- Salmon by rod and line (jigging, trolling, and mooching)
- Prawn by trap
- Crab by trap or hand picking
- Spearfishing
- Smelt by gillnet
- Netting (throw, and haul)
- Not sure



14. How confident are you about the location of the Rockfish Conservation Areas in the places you like to fish? *(Circle one)*

- I'm confident I know where the boundaries are.
- I think I know where the boundaries are.
- I have no idea where the boundaries are.

***Researcher will outline permitted fishing activities and provide charts of Rockfish Conservation Areas***

15. In the past 2 years, have you ever accidentally fished, using prohibited techniques, in a Rockfish Conservation Area?

Yes                      No

16. Do you personally know anyone who has intentionally fished, using prohibited techniques, in a Rockfish Conservation Area in the last 2 years?

Yes                      No

**Section 3: Randomized Response**

***Please use the instructions on the plastic cup to answer the following question***

17. In the last 2 years, have you ever intentionally fished, using prohibited techniques, in a Rockfish Conservation Area?

Yes                      No

**Section 4: Demographic Questions**

18. Gender

Female      Male

19. Age (*years*)

Under 20      20-35                      36-50                      51-65                      Over 65

20. Do you identify as First Nations (Aboriginal)?

Yes      No

21. Where do you currently live?

City/Town \_\_\_\_\_

Province/State/Region \_\_\_\_\_

Country \_\_\_\_\_

### **Section 5: Open Questions**

22. Do you think there is a need for rockfish conservation in British Columbia?

23. What do you think are the best ways to improve rockfish conservation in general?

24. Why do you think some recreational fishers fish in Rockfish Conservation Areas?

25. What do you think is the best way to stop recreational fishers from intentionally fishing in Rockfish Conservation Areas?

26. What do you think is the best way to stop recreational fishers from accidentally fishing in Rockfish Conservation Areas?

53. Do you think the Rockfish Conservation Areas are an effective conservation tool?

### Appendix C: Summarized Responses to Recreational Fisher Surveys

Certain questions allowed participants to provide more than one response to survey questions, therefore not all responses add up to 100%

1. How many years have you been recreationally fishing?
  - 40% responded between 1-15 years
  - 20% responded between 16-30 years
  - 12% responded between 31-50 years
  - 24% responded between 51-75 years
  - 4% responded above 75 years
  
2. In the past 2 years, approximately how many days did you go fishing?
  - 68% responded between 1-15 days
  - 24% responded between 16-20 days
  - 4% responded above 30 days
  - 4% responded 0 days
  
3. In the past 2 years, approximately what percent of your fishing time did you specifically fish for rockfish?
  - 44% responded 0% of fishing time
  - 40% responded between 1-50% of fishing time
  - 16% responded between 51-100% of fishing time
  
4. In the past 2 years, approximately how many rockfish have you accidentally caught while fishing for something else?
  - 24% responded 0
  - 40% responded between 1-5 rockfish
  - 36% responded between 6-12 rockfish
  
5. If you accidentally caught rockfish in the past 2 years, what percent of the time did you release it?
  - 44% responded between 80-100%
  - 8% responded between 50-59%
  - 0% responded between 30-49%
  - 24% responded between 0-29%
  - 24% N/A

6. If you released accidentally caught rockfish in the past 2 years, what percent of the time did you descend them back to depth?

- 4% responded that they would descend rockfish back to depth ~5% of the time
- All other respondents either responded that they had no previous knowledge of descending techniques or that they had not accidentally caught rockfish in the past 2 years.

7. Where do you usually get your information on fishing regulations, closures, and protected areas?

- 76% responded 'DFO'
- Others responded marinas, United States fishing regulations, and fishing licensing locations

8. Had you ever heard of RCAs in British Columbia Before beginning this survey?

- 80% responded yes
- 20% responded no

9. Where did you initially hear about B.C.'s Rockfish Conservation Areas?

- 32% - DFO
- 28% - Online
- 16% - Don't remember
- 4% - Fishing license store
- Remaining 20% - Radio, newspaper, other recreational fishers, and fishing regulations

10. The Galiano Conservancy Association is doing outreach about Rockfish Conservation Areas this summer. Have you seen any of their materials? If so, which one(s), and where did you see them?

- 24% responded yes  
Of this 24%:
  - 3 individuals saw materials at the Montague Marina
  - 1 individual also saw materials at Sturdies Bay
  - 1 individual saw information on Facebook
  - 1 individual saw materials at the Daystar Market
  - 1 individual could not remember

11. Did you participate in consultations on the Rockfish Conservation Areas and/or the Rockfish Conservation Strategy?

- 100% responded no

12. According to the Canadian Fisheries regulations, how many rockfish do you think you are permitted to catch per day in the Salish Sea (Strait of Georgia, Puget Sounds and Strait of Juan de Fuca?)

- 60% responded 1 rockfish per day (correct)

- 12% responded 2 rockfish per day
- 4% responded 0 rockfish
- 24% were unsure

13. What kind of recreational fishing activity do you think is permitted in Rockfish Conservation Areas?

- 68% responded with activities that are not permitted (Salmon by rod and line, Halibut by rod and line, spearfishing, etc.)
- 28% responded correctly (Crab by trap or hand picking and Prawn by trap)
- 4% responded with no fishing activities

14. How confident are you about the location of the Rockfish Conservation Areas in the places you like to fish?

- 52% responded 'I think I know where RCA boundaries are'
- 32% responded 'I'm confident I know where RCA boundaries are'
- 16% responded 'I have no idea where RCA boundaries are'

15. In the past 2 years, have you ever accidentally fished, using prohibited techniques, in a Rockfish Conservation Area?

- 72% responded no
- 28% responded yes

16. Do you personally know anyone who has intentionally fished, using prohibited techniques, in a rockfish Conservation Area in the last 2 years?

- 72% responded no
- 28% responded yes

17. In the last 2 years, have you ever intentionally fished, using prohibited techniques, in a Rockfish Conservation Area?

- 12% responded yes

### **Demographic Questions**

18. Gender

- 84% - male
- 16% - female

19. Age (years)

- 48% aged 36-50 years
- 44% aged 51-65 years
- 8% aged over 65 years

20. Do you identify as First Nations/Aboriginal?

- 100% did not identify

21. Where do you currently live?

- 36% - Metro Vancouver (including North Vancouver, Surrey and Langley)
- 20% - Victoria (4% of 20% from Sooke)
- 8% - Washington State
- 4% - Chilliwack
- 16% - Gulf Island residents (4% Galiano, 4% Saltspring, 4% Gabriola, 4% Salish Sea)
- 4% Calgary, Alberta
- 4% Basil, Switzerland
- 8% North Vancouver Island (Comox Valley and Nanaimo)

### **Open Questions**

22. Do you think there is a need for rockfish conservation in British Columbia?

- 88% responded yes
- 12% responded 'probably' or 'don't know'

23. What do you think are the best ways to improve rockfish conservation in general?

- 32% responded 'education'
- 28% responded 'enforcement'
- 12% responded 'fines'
- Others responded: stricter limits, more government funding, education at schools, more outreach, and increased awareness regarding 'overfishing'

24. Why do you think some recreational fishers fish in Rockfish Conservation Areas?

- 36% responded 'unaware' or 'don't know'
- 24% responded that they 'don't care'
- 24% responded 'ignorance'
- 12% responded that there was a 'lack of awareness'
- 4% responded 'dumb'

25. What do you think is the best way to stop recreational fishers from intentionally fishing in Rockfish Conservation Areas?

- 48% responded 'education' and/or 'outreach'
- 32% responded 'fines'
- 20% responded 'enforcement'
- 4% responded 'take their boats'
- 4% suggested 'don't give them their fishing licenses the next year'

- 4% suggested 'a DFO number should be given on maps for boaters to report other non-compliant fishers'

26. What do you think is the best way to stop recreational fishers from accidentally fishing in Rockfish Conservation Areas?

- 52% responded education, outreach, awareness
- 12% responded that people at fishing licensing locations should remind fishers
- 4% responded that there should be water marking buoys to show RCA boundaries
- 4% responded 'peer pressure'
- 4% responded that they don't think it happens often because most fishers are aware
- Others responded more patrolling, education in nautical magazines, or that they were unsure

27. Do you think Rockfish Conservation Areas are an effective conservation tool?

- 64% responded yes (with 38% of this 64% arguing that they would be more effective with better enforcement and increased limitations)
- 36% responded 'how am I supposed to know?' or that they were unsure