**Appendix: The 2023 Science-Industry Rockfish Research Collaboration in Alaska (SIRRCA) Cooperative Survey**

Madison Hall

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This year marked the third consecutive sampling year for the Science-Industry Rockfish Research Collaboration in Alaska (SIRRCA), which aims to improve assessment models for rockfishes in the Gulf of Alaska by cooperatively collecting minimally standardized data on partnering industry vessels. This specific work is necessary because the Gulf of Alaska (GOA) bottom trawl survey has systematically classified certain habitats as untrawlable and subsequently eliminated these habitats from survey sampling over time. Some rockfish species show preferences for these rough habitats over the smoother, more trawlable habitats that are accessible to the GOA bottom trawl survey (Jones 2021), and this mismatch between surveyed habitat and rockfish-occupied habitat can have negative consequences for the accuracy and precision of assessment models based on GOA bottom trawl survey data (Rooper and Martin 2012).

The label of “untrawlable” is a functional definition describing habitats that are unavailable for the GOA bottom trawl survey to sample using survey gear while maintaining constant bottom contact (von Szalay and Raring 2018). Previous work indicates untrawlable habitats are more likely to have greater depths and slopes (means, ranges, and maxima), higher rugosity, higher substrate hardness, and more rock/reef structures than trawlable habitats (Baker et al. 2019). There has been speculation that estimates of abundance for rockfish species in the GOA are both imprecise and inaccurate because the trawl survey is generally unable to sample in areas where many of these species are most abundant, and habitats are thus not being sampled in proportion to their importance (Rooper and Martin 2012). One potential solution to this problem is to cooperatively collect data in untrawlable habitats with partners in the fishing industry, as industry boats successfully fish many areas that are unavailable to the GOA bottom trawl survey.

Currently, Alaska commercial catch data are included as gross removals in stock assessments, along with some information about fish length, weight, age and sex, as reported by observers and industry participants. However, commercial fishing effort metrics (e.g., catch-per-unit-effort or regional biomass estimates) are rarely included in stock assessments because it is difficult to extract information about trends in abundance from non-standardized commercial fishery effort data (Maunder 2006), even though this effort may occur in areas not covered by a fishery-independent survey. SIRRCA aims to develop a solution for quantifying commercial fishery catch and effort data for several rockfish species, including POP. This work is focused on adding information from untrawlable habitats, aiming to supply valuable data to the stock assessment from areas not able to be sampled in the GOA bottom trawl survey. This cooperatively collected data will serve as a supplemental source of population abundance information and aid in understanding differences in catchability between different habitat types. Additionally, this work can inform how estimates of abundance are impacted by gear implementation in trawlable vs. untrawlable habitats.

Beginning in 2020, the Alaska Fisheries Science Center (AFSC) began pursuing cooperative work with the Gulf of Alaska fishing industry via the Science-Industry Rockfish Research Collaboration in Alaska (SIRRCA). Multi-stakeholder cooperative research programs like SIRRCA are valuable for fishery science; they can improve scientific surveys by sharing knowledge, building public engagement in the scientific process, and laying a foundation of mutual trust between managers and industry (Hartley and Robinson 2006). SIRRCA’s third operational year built upon a strong, cooperative foundation. We believe the success of this project is due to the close involvement of species assessors and the continuous maintenance of relationships between scientists and stakeholders, which are both important components of successful research collaborations (Steins et al. 2019).

SIRRCA sampling in 2023 was covered under a Scientific Research Permit (SRP) issued by the Alaska Fisheries Science Center; this permit was a substantial step forward in the cooperative survey. The SRP supported rigorous data collection on industry vessels by ensuring that fish caught during SIRRCA sampling did not come out of the cooperating company’s quota (with the exception of prohibited species like salmon, crab, and halibut; these prohibited species catch “PSC” species were not afforded any special designation under the 2023 SRP, and were not retained or sold by our industry partners). Critically, this allowed our industry partners to catch fish in proportion to their abundance at randomized, preselected survey stations by removing the fear of catching “choke” species during sampling (i.e. species that the company may not have a large quota to catch, and which might lead to regulatory penalties if caught in large numbers while participating in cooperative SIRRCA sampling). In the absence of such a permit, industry partners might be incentivized to avoid sampling in certain areas that contain these “choke” species, which could bias SIRRCA data and make this data less useful to the assessment models we are trying to improve with this work. Additionally, while SIRRCA prioritizes sampling efficiency for cooperatively collected data, the increased survey sampling levels mean that we cannot process a SIRRCA survey catch at the normal factory processing rates on a catcher-processor, and SIRRCA leadership acknowledges that we have to offset these inefficiencies in order for the cooperative survey to have longevity. In addition to the cost of reduced processing efficiency, there are substantial fuel costs associated with sending partner vessels to the randomly preselected survey sites in order to complete the survey work. Allowing most of the SIRRCA survey fish to be sold by our industry partners under the SRP acts to protect our partners and also helps to offset the costs incurred by our partners when participating in the cooperative survey.

In 2023, SIRRCA tows were again conducted in stations defined by the ALASKA FISHERIES SCIENCE CENTER GOA bottom trawl survey grid (5km X 5km grid cells) and the distribution of the sampling burden was decided by captains on the final participating industry vessels. Approximately 2.7% of all possible NMFS survey stations are selected for the official GOA bottom trawl survey in a given two-boat year; the SIRRCA survey design sampled untrawlable cells at close to this rate in the 2023 data collection season, selecting 45 experimental/untrawlable cells for sampling (1719 (i.e. the number of defined untrawlable stations) \*0.027 = 46.4 stations). The sampling in untrawlable habitats, called “experimental tows” aimed to collect rockfish biomass information in these previously unsampled habitats.

In addition to the untrawlable habitat stations, we planned to complete 15 calibration stations in order to calibrate the SIRRCA vessels to the survey vessels and make sense of the SIRRCA catches from the experimental tows. Two tows were planned within each calibration cell: the first calibration tow was conducted in smooth habitats and followed a GOA bottom trawl survey path as close in time and space as possible, the second calibration tow path was chosen by the captain and aimed to calibrate in rougher habitats within that same cell. Station selection protocol was different for the two haul types. For calibration tows, cells were ranked according to the number of times that cell has been successfully sampled by the GOA bottom trawl survey in previous years and the historical proportion of catches from survey data for our species of interest; the captain’s final calibration station selection was opportunistic but informed by this information. During the survey, SIRRCA scientists and the captain collectively decided which calibration station to sample based on 1) the information in the provided maps and 2) the proximity of the station to the vessel’s normal fishing operations. For experimental tows, the industry’s normal summer fishing grounds across the Gulf of Alaska were plotted, and we eliminated (1) bottom trawl survey strata where the industry does not regularly fish, and (2) bottom trawl survey strata between where the proportion of biomass for our target rockfish species was less than 10% (as estimated by recent bottom trawl surveys). Finally, 45 experimental cells were selected using a stratified random design from the remaining 5 bottom trawl survey strata. The number of experimental stations allocated to each of these strata was directly proportional to the number of untrawlable stations in each stratum divided by the total number of untrawlable stations in all considered strata.

As in the pilot year of 2021, sampling in 2023 was conducted by a team of 2 SIRRCA scientists in the months of June, July and August concurrent with the Gulf of Alaska bottom trawl survey. These scientists were contracted, certified observers hired using project funds from a National Cooperative Research Program grant and collectively they spent 100 days at sea. Sampling was conducted on 3 partnering catcher-processor vessels using many, but not all, aspects of GOA bottom trawl survey tows; aspects of sampling design that remained consistent between GOA bottom trawl survey and SIRRCA survey tows included duration (15 minutes), speed (2.8 – 3.2 knots), and contact with the seafloor (constant bottom contact maintained for duration of the tow). On-board sampling of SIRRCA hauls was markedly different than typical GOA bottom trawl survey sampling in order to maximize sampling efficiency on partnering vessels. SIRRCA sampling was conducted in the factory of the catcher-processor vessels. Within each cooperative research haul we precisely measured the total weight of POP, northern and dusky rockfish by separating these fish from the rest of the haul into baskets by species and recording the weight of all baskets. Baskets were then haphazardly selected throughout the processing of the haul, and individuals within this subset of single-species baskets were counted and lengthed to ensure that count and length data was collected for at least 200 individuals of our 3 species of interest within each haul. If fewer than 200 individuals existed within a cooperative research haul, then our scientists whole-hauled for those species (i.e. all individuals of that species were counted, lengthed, and weighed).

Gear constituted the major sampling design difference between SIRRCA tows and GOA bottom trawl survey tows, as cooperative research tows were conducted using industry-owned and maintained nets that differ substantially from the government owned and maintained nets used in the survey. To account for these differences, SIRRCA completed 30 tows in 15 stations (2 tows per station) in order to calibrate the fishing power and selectivity of the industry gear to the survey gear. Additionally, SIRRCA completed tows in 43 untrawlable habitat stations in order to incorporate rockfish biomass data from these previously unsampled habitats, bringing the total number of tows from the 2023 SIRRCA survey to 73 (Figure 1). Hauls from the 2023 cooperative survey totaled >143 mt for all species with >104 mt being our 3 rockfish species of interest (Table 1). SIRRCA scientists recorded over 11K POP lengths and >60 mt of POP over the course of the 2023 survey (Table 2).

We plan to conduct sampling concurrent with the GOA bottom trawl survey again in 2025, and to then begin assessing the utility of this data in official assessment models with the assessment authors. In the short term, we hope the data we collect will be useful in the assessment process by informing a prior on catchability. In the longer term, we hope the length and biomass data collected will be useful in the assessment process by facilitating the development of a separate index of relative rockfish abundance from untrawlable habitats, or by building a blended index of abundance using SIRRCA data and GOA bottom trawl survey data. We plan to explore the various options for blending SIRRCA and survey data in forthcoming presentations and publications. We hope that our project will add to the recent efforts on behalf of scientists at the AFSC to understand differences in seafloor characteristics and fish densities between trawlable and untrawlable habitats (Baker et al. 2019, Jones et al. 2021, Steinessen et al. 2021) and that the continuation of cooperatively collected data will improve the accuracy and precision of future POP assessments.

*SIRRCA Principal Investigators:* Madison Hall, AFSC; Pete Hulson, AFSC; Stan Kotwicki, AFSC; Mark Zimmermann, AFSC; Brad Harris, Alaska Pacific University; John Gauvin, Alaska Seafood Cooperative; Julie Bonney, Alaska Groundfish Data Bank.

Literature Cited

Baker, M., W. Palsson, M. Zimmermann, C. Rooper. 2019. Model of trawlable area using benthic terrain and oceanographic variables - Informing survey design and habitat maps in the Gulf of Alaska. Fisheries Oceanography. 28: 629-657.

Hartley, T., and R. Robinson. 2006. Emergence of multi-stakeholder-driven cooperative research in the Northwest Atlantic: The case of the Northeast Consortium. Marine Policy, 30: 580-592.

Jones, D., C. Rooper, C. Wilson, P. Spencer, D. Hanselman, R. Wilborn, 2021. Estimates of availability and catchability for select rockfish species based on acoustic-optic surveys in the Gulf of Alaska. Fisheries Research. 236: 105848.

Maunder, M.N., Sibert, J.R. Fonteneau, A., Hampton, J., Kleiber, P., and Harley, S.J. 2006. Interpreting catch per unit effort data to assess the status of individual stocks and communities. ICES Journal of Marine Science, 63: 1373-1385

Rooper, C., M. Martin. 2012. Comparison of habitat-based indices of abundance with fishery-independent biomass estimates from bottom trawl surveys. Fishery Bulletin 110: 21-35.

Steins, N., M. Kraan, K. van der Reijden, F. Quirijns, W. van Broekhoven, J. Poos. 2019. Integrating collaborative research in marine science: Recommendations from an evaluation of evolving science-industry partnerships in Dutch demersal fisheries. Fish and Fisheries, 21(1): 146-161.

Stienessen, S., C. Rooper, T. Webe, D. Jones, J. Pirtle, C. Wilson. 2021. Comparison of model types for prediction of seafloor trawlability in the Gulf of Alaska by using multibeam sonar data. Fishery Bulletin. 119: 184-196.

von Szalay, P. G., and N. W. Raring. 2018. Data Report: 2017 Gulf of Alaska bottom trawl survey. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-374, 260 p.

Zimmermann, M. 2003. Calculation of untrawlable areas within the boundaries of a bottom trawl survey. Canadian Journal of Fisheries and Aquatic Science 60: 657–669.

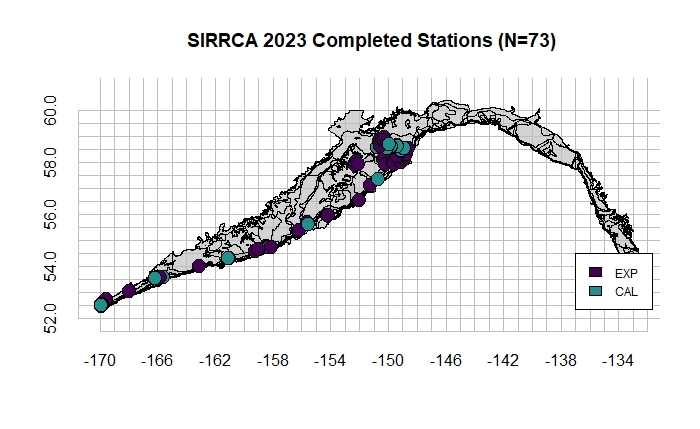


Figure 1: A map of the 73 completed 2023 SIRRCA survey stations. “EXP” = experimental stations where tows were conducted in untrawlable habitats and “CAL” = calibration where tows were conducted in trawlable habitats.

Table 1: Total rockfish weights for our 3 species of interest (Pacific Ocean perch, dusky rockfish and northern rockfish) summed across all 73 tows in the 2023 SIRRCA survey.

|  |  |
| --- | --- |
| **Species** | **Weight (mt)** |
| Pacific Ocean perch | 60.28 |
| Dusky rockfish | 37.43 |
| Northern rockfish | 7.25 |
| ALL | 104.97 |

Table 2: Preliminary data for Pacific Ocean perch from 2023 SIRRCA cooperative survey hauls. For each haul this includes the Gulf of Alaska bottom trawl survey grid station number, the haul date, haul type (where EX = experimental/untrawlable, C1 and C2 are calibration tows), the total weight of POP (kg), and the number of POP lengths recorded. All SIRRCA tows were conducted at speeds between 2.8 - 3.2 knots, for a total duration of 15 mins, and with constant contact of gear with the seafloor.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Haul #** | **Station** | **Date** | **Haul Type** | **Weight (kg)** | **# Lengths** |
| 1 | 215-133 | 06/19/2023 | EX | 580.18 | 380 |
| 2 | 214-130 | 06/19/2023 | EX | 72.24 | 84 |
| 3 | 217-130 | 06/19/2023 | EX | 1304.61 | 204 |
| 4 | 238-135 | 06/24/2023 | EX | 1416.62 | 345 |
| 5 | 240-136 | 06/24/2023 | EX | 3113.92 | 323 |
| 6 | 240-130 | 06/24/2023 | EX | 702.62 | 346 |
| 7 | 246-132 | 06/25/2023 | EX | 437.70 | 203 |
| 8 | 247-130 | 06/25/2023 | EX | 43.80 | 70 |
| 9 | 253-132 | 06/25/2023 | EX | 73.79 | 97 |
| 10 | 256-134 | 06/25/2023 | EX | 30.73 | 40 |
| 11 | 254-136 | 06/25/2023 | EX | 8.92 | 12 |
| 12 | 254-138 | 06/25/2023 | EX | 12.39 | 16 |
| 13 | 251-137 | 06/25/2023 | EX | 2.33 | 11 |
| 14 | 250-137 | 06/25/2023 | EX | 0 | 0 |
| 15 | 257-139 | 06/26/2023 | EX | 10.57 | 15 |
| 16 | 259-144 | 06/26/2023 | EX | 51.55 | 89 |
| 17 | 253-142 | 06/27/2023 | C1 | 245.04 | 351 |
| 18 | 253-142 | 06/27/2023 | C2 | 6.90 | 10 |
| 19 | 255-144 | 06/27/2023 | C1 | 2.24 | 4 |
| 20 | 255-144 | 06/27/2023 | C2 | 2.62 | 4 |
| 21 | 251-146 | 06/27/2023 | C1 | 3.84 | 0 |
| 22 | 251-146 | 06/27/2023 | C2 | 1.72 | 2 |
| 23 | 251-145 | 06/27/2023 | C1 | 0.58 | 1 |
| 24 | 251-145 | 06/27/2023 | C2 | 2.56 | 2 |
| 25 | 241-144 | 06/27/2023 | C1 | 902.01 | 254 |
| 26 | 241-144 | 06/27/2023 | C2 | 795.49 | 216 |
| 27 | 140-59 | 07/04/2023 | EX | 402.19 | 587 |
| 28 | 141-58 | 07/04/2023 | EX | 55.46 | 92 |
| 29 | 142-58 | 07/04/2023 | C1 | 371.27 | 375 |
| 30 | 142-58 | 07/04/2023 | C2 | 115.76 | 163 |
| 31 | 144-59 | 07/04/2023 | EX | 1519.89 | 339 |
| 32 | 167-73 | 07/06/2023 | EX | 382.77 | 205 |
| 33 | 167-74 | 07/06/2023 | EX | 1707.01 | 257 |
| 34 | 174-81 | 07/07/2023 | EX | 1683.77 | 270 |
| 35 | 175-79 | 07/07/2023 | C1 | 70.42 | 91 |
| 36 | 175-79 | 07/07/2023 | C2 | 41.84 | 52 |
| 37 | 191-87 | 07/08/2023 | EX | 1.22 | 0 |
| 38 | 192-87 | 07/08/2023 | EX | 537.23 | 269 |
| 39 | 218-100 | 07/09/2023 | EX | 1657.48 | 231 |
| 40 | 227-113 | 07/09/2023 | EX | 10208.42 | 216 |
| 41 | 234-118 | 07/09/2023 | C1 | 217.11 | 236 |
| 42 | 234-118 | 07/09/2023 | C2 | 74.70 | 96 |
| 43 | 233-145 | 07/11/2023 | C1 | 3585.78 | 211 |
| 44 | 233-145 | 07/11/2023 | C2 | 5466.90 | 232 |
| 45 | 234-150 | 07/11/2023 | EX | 3080.69 | 242 |
| 46 | 236-146 | 07/12/2023 | EX | 44.40 | 52 |
| 47 | 235-151 | 07/12/2023 | EX | 2918.14 | 197 |
| 48 | 237-151 | 07/12/2023 | EX | 2180.04 | 222 |
| 49 | 239-153 | 07/12/2023 | EX | 830.51 | 303 |
| 50 | 239-150 | 07/12/2023 | EX | 428.60 | 237 |
| 51 | 241-149 | 07/12/2023 | EX | 81.34 | 105 |
| 52 | 243-147 | 07/12/2023 | C1 | 2023.42 | 226 |
| 53 | 243-147 | 07/12/2023 | C2 | 1516.62 | 247 |
| 54 | 25-17 | 07/24/2023 | EX | 16.23 | 20 |
| 55 | 5-10 | 07/24/2023 | EX | 1.97 | 3 |
| 56 | 2-5 | 07/26/2023 | EX | 2010.46 | 246 |
| 57 | 1-5 | 07/26/2023 | EX | 205.30 | 333 |
| 58 | 1-4 | 07/26/2023 | C1 | 2949.96 | 246 |
| 59 | 1-4 | 07/26/2023 | C2 | 1713.80 | 207 |
| 60 | 48-28 | 07/27/2023 | C1 | 78.36 | 89 |
| 61 | 48-28 | 07/27/2023 | C2 | 119.94 | 150 |
| 62 | 49-29 | 07/27/2023 | EX | 11.80 | 12 |
| 63 | 53-31 | 07/28/2023 | C1 | 2.08 | 0 |
| 64 | 53-31 | 07/28/2023 | C2 | 670.16 | 201 |
| 65 | 51-31 | 07/28/2023 | EX | 77.88 | 199 |
| 66 | 46-30 | 07/28/2023 | C1 | 254.48 | 289 |
| 67 | 46-30 | 07/28/2023 | C2 | 764.86 | 231 |
| 68 | 84-41 | 07/29/2023 | EX | 18.60 | 35 |
| 69 | 130-55 | 07/31/2023 | EX | 25.68 | 45 |
| 70 | 131-55 | 07/31/2023 | EX | 7.32 | 17 |
| 71 | 133-56 | 07/31/2023 | EX | 3.82 | 13 |
| 72 | 108-49 | 08/01/2023 | C1 | 240.32 | 335 |
| 73 | 108-49 | 08/01/2023 | C2 | 81.52 | 114 |
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