Statewide Nearshore Video-Acoustic Survey
Lessons Learned and Next Steps

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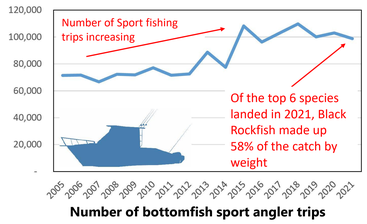
Nearshore Fisheries-Independent Data Needed

WHAT

ODFW tasked with developing a fishery independent survey for semi-pelagic rockfish species (specifically Black Rockfish) in Oregon's nearshore rocky reefs

WHY

- **Improve population estimate for Black Rockfish**
- Current population assessments rely on fishery-dependent data (fishing effort & catch data)
- Managers and industry agree more data is needed to effectively manage
- Sport bottomfishing brings $15-17 million to the coastal economy annually
- Majority of trips target Black Rockfish & effort is increasing



Tailoring Survey Tools to Oregon's Nearshore

Modeled After Black Rockfish Survey in Kodiak Management Area (Tschersich 2015). However, differences in the ecology, habitat, geography, and weather required additional considerations for applying this method in Oregon.

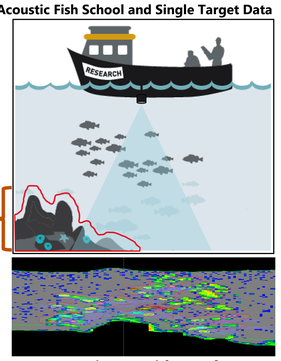
Survey Tool Requirements

1. Non-extractive
2. Sample large area
3. Time/Cost Effective
4. Operable in 5-80 m of water, over rugose habitat

Challenges Faced Surveying Oregon

1. Less than 10% of study area "good" habitat
2. Near bottom acoustic dead zone is a concern in areas with steep topography
3. Black Rockfish found in & above acoustic dead zone
4. Mixed schools: 6 semi-pelagic spp. in study area
5. Boat Logistics: 362 miles of open ocean & limited port stops

Acoustic Fish School and Single Target Data

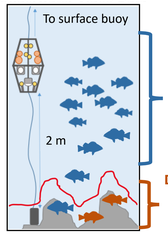


Near Bottom Acoustic Dead Zone: an area where it is difficult to distinguish fish from the seafloor

Acoustics provide a value that can be turned into number of fish

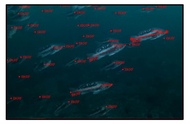
+

Underwater Video Data

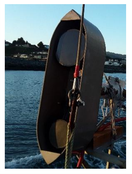


Target Species = Black Rockfish A Semi-Pelagic Rockfish Species found both above and near the seafloor

NON-Target Species = Demersal or Benthic Rockfish Species found exclusively near the seafloor

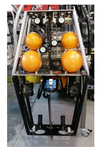


Video provides spp. proportions and lengths



Population Estimate

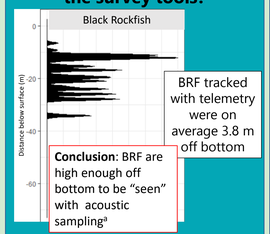
+estimate of uncertainty



Testing Survey Methods - Pilot Studies

Pilot Study Q1 · Does this Survey Method Work for Black Rockfish in Oregon?
To address this, we tested:

Are Black Rockfish "seen" by the survey tools?



BRF tracked with telemetry were on average 3.8 m off bottom

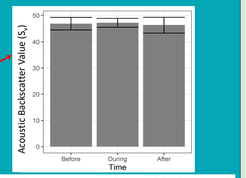
Conclusion: BRF are high enough off bottom to be "seen" with acoustic sampling[a]

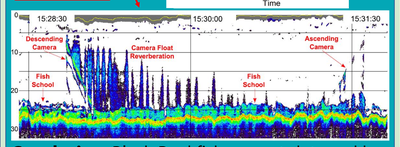
Black Rockfish Counted in Video

- 1351 BRF observed in either the downward-facing or forward-facing cameras
- **Conclusion**: Enough Black Rockfish are "seen" by the (BASSCam)[b]

Do our survey tools influence fish behavior?

Fish behavior monitored with acoustics before, during, and after video camera was deployed





Conclusion: Black Rockfish are not deterred by, or attracted to, the BASSCam or acoustics[b]

Does combining acoustic data with video data produce accurate fish densities?

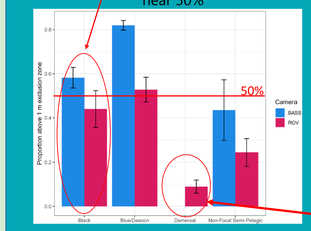
- The combined video-acoustic method tested in this pilot study produced a population estimate of ~1.2 million ± 600,000 Black Rockfish within the study area
- An 11-year-long PIT tagging study, in the same study area, reported 1–2 million Black Rockfish[e]

Conclusion: the combination of acoustics and underwater cameras provides an accurate population estimate[b]

Pilot Study Q2 · What Impact Does the Acoustic Dead Zone Have on Population Estimates?
To address this, we examined the region from 0-1 m above the seafloor:

Proportion of target species occurring in/above acoustic dead zone?

Equal! Two different video tools (ROV and BASSCam) found the proportion of Black Rockfish above and below the dead zone was near 50%

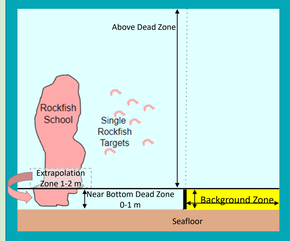


BASSCam Video Example

Bonus: The downward-facing video camera provided similar counts to the ROV, a benthic sampling tool, which means it provides accurate counts of fish located in the dead zone!

Is there "Contamination" from non-target species in the acoustic-based abundance estimate?

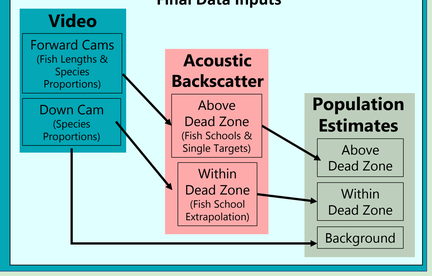
NO! Demersal rockfish observed by the ROV were most likely to be found within 1 m of the seafloor and therefore not a concern for contaminating semi-pelagic species acoustic data



These findings allowed us to provide a "correction" for number of fish missed in the near bottom dead zone

Accounting for the near bottom acoustic dead zone in nearshore rocky reefs is done by extrapolating acoustic fish school data from 1-2 m above bottom into the area 0-1 m above bottom

Final Data Inputs



Oregon's First Statewide Rockfish Survey

Survey Design

- Systematic parallel transects
  - 15 km spacing over all habitat
  - 1 km spacing over rock/cobble/gravel habitat
- Collect video and fish data as schools are encountered
- Conduct CTD casts throughout survey area
- Deploy smaller survey vessel when shallow end of transect is not accessible to primary survey vessel

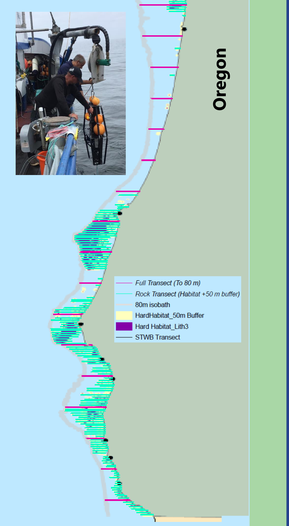
Survey Method Approved by Fisheries Management Council

Population Estimate will be incorporated into Stock Assessment

Statewide Black Rockfish Population Estimate

	Estimate	CV
Above Dead Zone	10,207,655	54
Within Dead Zone	2,126,307	88
Background	365,786	98
Combined	12,995,459	46

54 Sea Days
298 Transects
4,570 km Acoustic Data
642 Video Drops
55 Fishing Stations
779 Fish Caught
281 CTD Casts



Lessons Learned

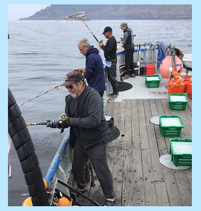
- **Combination of underwater video data and acoustics is an efficient and accurate method for sampling Black Rockfish IF:**
- In addition to primary survey vessel, a small boat (<25') is used to sample shallow/high relief reefs
- Underwater video system includes downward-facing camera to account for the acoustic dead zone because acoustic sampling cannot "see" fish close to the seafloor
- Both 38 kHz and 200 kHz acoustic transducers are used
- Fish samples are obtained to provide length-weight relationship required for population assessment
- Acoustic & Video data post-processing steps are streamlined

Next Steps

- **2022: Methods approved by the Pacific Fisheries Management Council SSC review committee**
- **2023: Population Estimate incorporated into the Black Rockfish Stock Assessment**

Future Survey Improvements

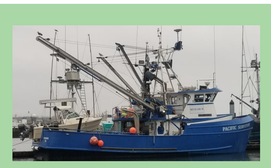
- Repeat the survey! Replicating the survey will increase our understanding of how to interpret the results
- Improve calibrations. Due to adverse sea conditions, calibrating acoustic equipment in Oregon water has never been done. The SSC recommends future
- Acoustic Target Strength values used in our population estimate calculations were derived from a variety of fish species. Future estimates will be more accurate if we can determine Target Strength values specific to Black Rockfish



References

a. Tschersich, P. 2015. Hydroacoustic survey of black rockfish abundance and distribution operational plan for the Afognak and northeast districts of the Kodiak management area, 2015. Alaska Department
b. Rasmuson LK (2021) Susceptibility of five species of rockfish (Sebastes spp.) to different survey gears inferred from high resolution behavioral data. Oregon Dept. of Fish and Wildlife, Salem.
c. Rasmuson LK, Fields SA, Blume MTO, Lawrence KA, Rankin PS (2022) Combined video-hydroacoustic survey of nearshore semi-pelagic rockfish in untrawlable habitats. ICES J Mar Scifsab245.
d. Rasmuson LK, Marion SR, Fields SA, Blume MTO, Lawrence KA, Rankin PS (2022) Influence of near bottom fish distribution on the efficacy of a combined hydroacoustic video survey. ICES J Mar Scifsac138.
e. Krutzikowksy, G., Wagman, D. W., and Davis, R. 2019. Annual Progress Report: Population status of Black rockfish in Oregon Coastal waters. Oregon Department of Fish and Wildlife Marine Resources Program, Newport, OR. 19 pp.

MRP Website



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