Using a Small ROV to Estimate the Abundance of Sensitive Rockfishes and Benthic Marine Fishes in a Broad-Scale Regional Survey

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Puget Sound rockfish populations in decline
Traditional assessment tools not appropriate for sensitive populations or difficult habitats
WDFW videographic methods
  - drop- camera
    • limited to 37 m depth
  - Inspection-class ROVs
    • 2004, 2005 – pilot surveys of San Juan Channel
    • 2008, 2010-11, region-wide, San Juan Islands
ESA Listed Rockfish

Yelloweye

Bocaccio

Threatened

Canary

Endangered
Non-lethal sampling

Seaeye Falcon

WDFW R/V Molluscan
2008 ROV Survey

- San Juan Islands
- Habitat map of study area from MBES
- Limited to rock habitats
- Stratified-random design
  - Depth stratified along 20 fathom contour
  - Randomly selected start points
- Daytime sampling only
- Minimum transect distance of 250 m
Multibeam imagery
Interpreted MBES and backscatter
2008 ROV Survey final map
2008 Results

• 207 transects
• Rock encountered on 100% of transects conducted on geophysical map
• Rock encountered on 82% of transects conducted on WDFW low-res map
• Pop. estimates for 42 bottomfish species
  – 11 rockfish species
• SEs from 8-14% for most common species
2008 Copper and Quillback locations
2008 Yelloweye rockfish locations
2008 Population estimates

Thousands

Copper: 14% SE
Quillback: 11% SE
Yelloweye: 25% SE
2010 ROV Survey

- San Juan Islands (same as 2008)
- All habitat types included
- Stratified-Systematic grid
  - stratified by area based on distribution of yelloweye rockfish seen in 2008
- 24-hour sampling
  - 24-hour study conducted to account for diurnal differences in sampling
  - Transects run for 30 minutes regardless of direction
- Stereological analysis
  - Control for “edge effect” bias
Stereology

- “the spatial interpretation of sections”
- The science of estimating higher dimensional information from lower dimensional samples
- Systematic Random Sampling (SRS)
  - Reduced variance when compared to Simple Random Sampling
  - Method is unbiased as long as the sampling set is chosen in a random manner
2010 ROV Survey Stations

East: n = 64 (3 AS)
West: n = 116 (5 AS)
2010-11 Results

• 180 transects (172 primary, 8 adaptive)
• All habitats sampled
• Encounter rates for most common rockfish similar to 2008 on comparable habitats
• Rockfish species distributions consistent with 2008 but fewer species encountered
• Changes in ROV lighting configuration allowed for improved imaging of flatfish and small (<15 cm) bottomfish
Yelloweye rockfish

• 2008
  – 39 individuals on 25 transects
  – All juveniles and sub-adults (<40 cm)
  – Population estimate = 47,407 (24% SE)
  – All sightings on steep, complex rock

• 2010-11
  – 14 individuals on 10 transects
  – All juveniles and sub-adults (<40 cm)
  – All sightings on steep, complex rock
2008 and 2010 YEYE locations
Conclusions

- Small ROVs are an excellent tool for sampling in non-trawlable habitats
- Ability to image uncommon and rare species validates the use of ROVs for monitoring and assessment
- Repeatable surveys
- Technological additions (DVL, HD video, ranging system) will improve our ability to image fish and produce accurate population estimates
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