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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Background

- 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

Threatened

Canary

Bocaccio

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 Transect locations

ROV transects  N = 207
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

![Bar graph showing population estimates for Copper, Quillback, and Yelloweye species. The Copper species has the highest estimate with 14% SE, the Quillback has 11% SE, and the Yelloweye has 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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