

# **ESA-listed rockfishes working group meeting**

POV-data

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5/25/2021

# ROV surveys

- 2008 San Juan Islands
- 2010 San Juan Islands
- 2015-16 Puget Sound
- 2018 San Juan Islands
- 2018 Vector Survey (Strait of Georgia)
- 2018 Gulf Islands Survey

# Uses of ROV data for 5-year review

- As an index of abundance for assessment model
  - Single time point of absolute abundance across entire DPS (as in the case of Hood Canal)
  - Time series of abundances from the same geographic area (as in the case of the San Juan Islands)
- As an index of abundance to compare with reference points from the assessment model
- To stress how repeated ROV surveys would allow us to track population dynamics without needing to do a formal assessment

# What is the selectivity of ROV surveys?

Key to contextualizing abundance estimates

- What types of individuals are seen by the ROV?
- What proportion of these individuals are seen by the ROV?

# Calculating abundance

The mean stratum density ( $\bar{D}_s$ ) for a given taxon was the sum of the individual transect densities divided by the number of transects ( $N_s$ ):

$$\bar{D}_s = \frac{\sum_{i=1}^N D_i}{N_s}$$

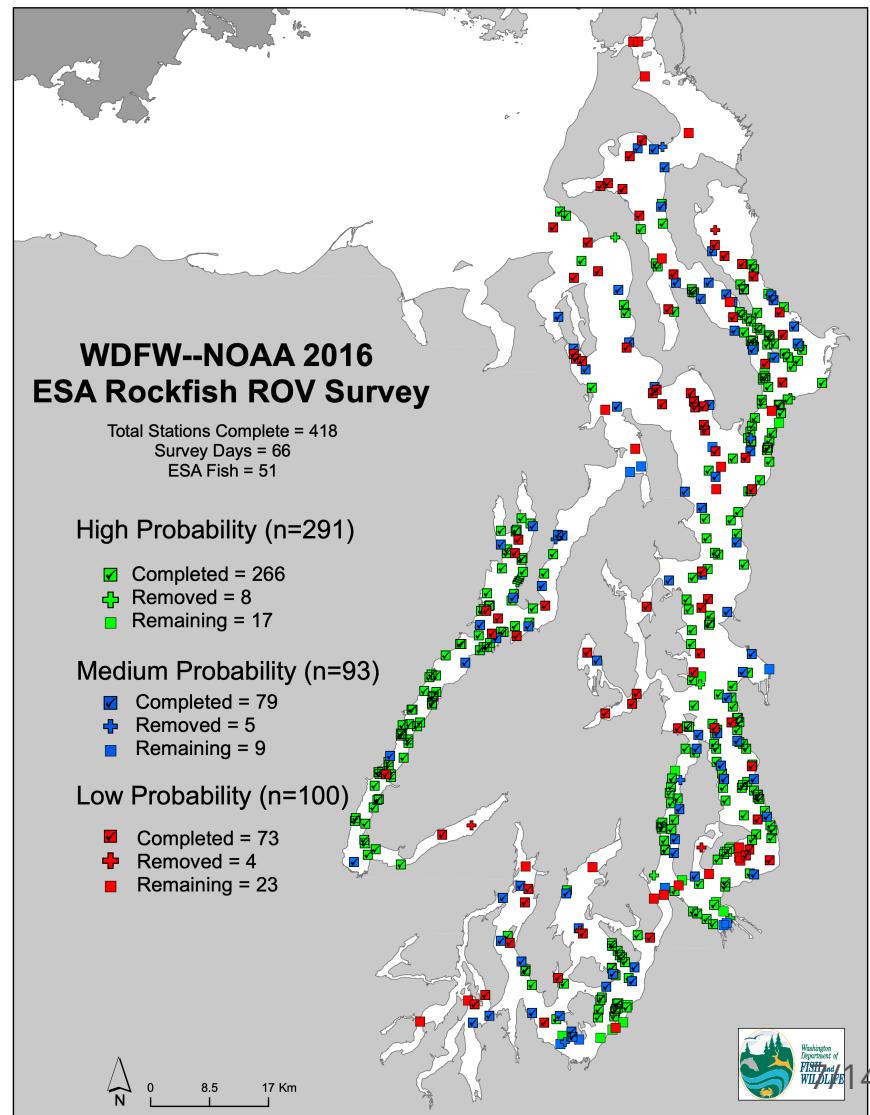
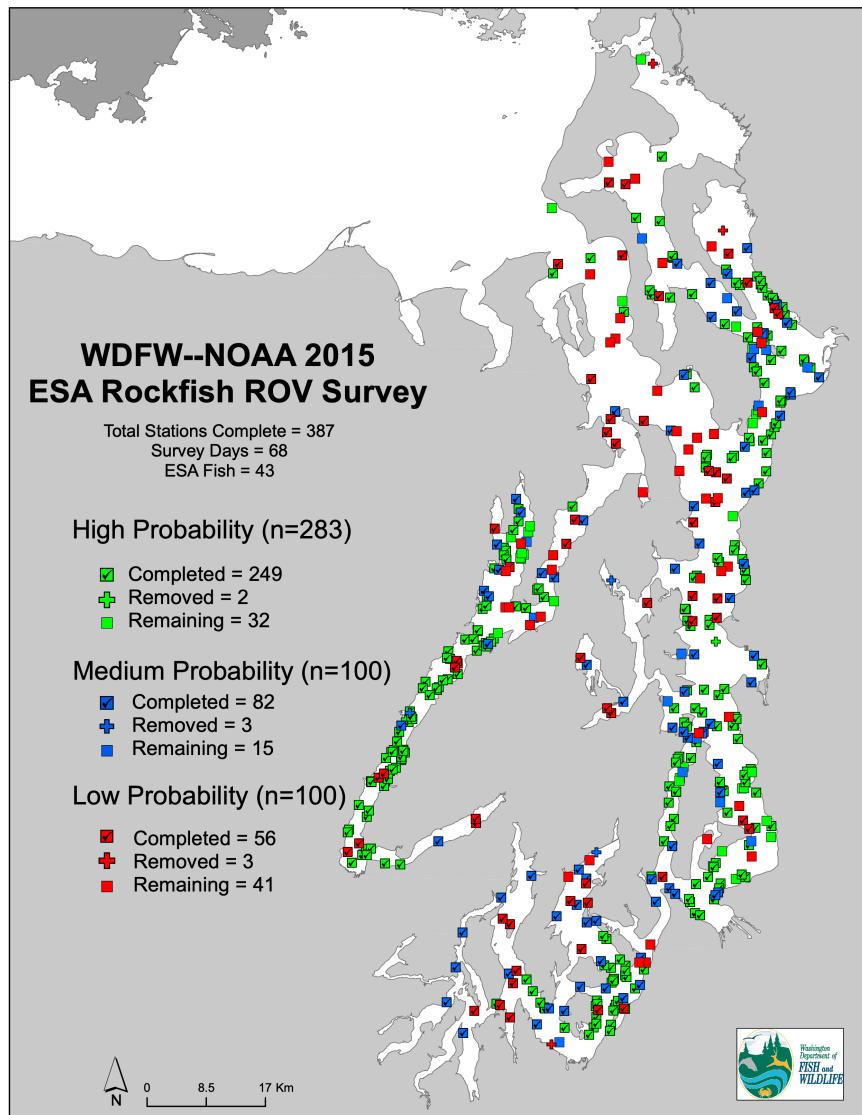
Total abundance ( $P$ ) in numbers of individuals was the product of the stratum surface area ( $SA_s$ ) and the mean taxon density ( $\bar{D}_s$ ), with variance calculated as the product of the square of the surface area and the variance of mean stratum density:

$$P_s = SA_s \bar{D}_s; Var(P_s) = SA_s^2 Var(\bar{D}_s)$$

# Maximum entropy models

- Machine learning method used to predict habitat suitability for target species
- Maximum entropy used for 2015-16 Puget Sound, 2018 SJI, 2018 Gulf Islands, and 2018 Vector Surveys
- Habitat suitability determined based on combination of previous occurrences and habitat characteristics/variables
  - Previous occurrences: Yelloweye and canary for 2015-16 Puget Sound Survey, only Yelloweye for other surveys
  - Habitat variables: Depth, roughness, and bottom current speed
- Output from maximum entropy model: probability distribution (PD) map for each species, where each cell is assigned a probability of suitable habitat (not fish presence) based on the retained input variables.
  - Different strata determined by ranges of probabilities
- 2018 Vector Survey (Strait of Georgia) included different habitat variables (?)

# 2015-16 Puget Sound Survey



# 2015-16 Puget Sound

## non-Hood Canal

- Survey strata: "High" (>50%), "Medium" (25-50%), "Low" (<25%)
  - High stratum
    - 363 transects
    - 9,288 hectares
    - 25 yelloweye
  - Medium + Low strata
    - 244 transects
    - 1,058,427 hectares
    - 0 yelloweye
- Population estimate: 6,285 (CV = 29.5%)

## Hood Canal

- Survey strata: "High" (>50%), "Medium" (25-50%), "Low" (<25%)
  - High stratum
    - 152 transects
    - 4,486 hectares
    - 37 yelloweye
  - Medium + Low strata
    - 46 transects
    - 120,637 hectares
    - 0 yelloweye
- Population estimate: 14,699 (CV = 22.9%)

# 2008 SJI ROV survey

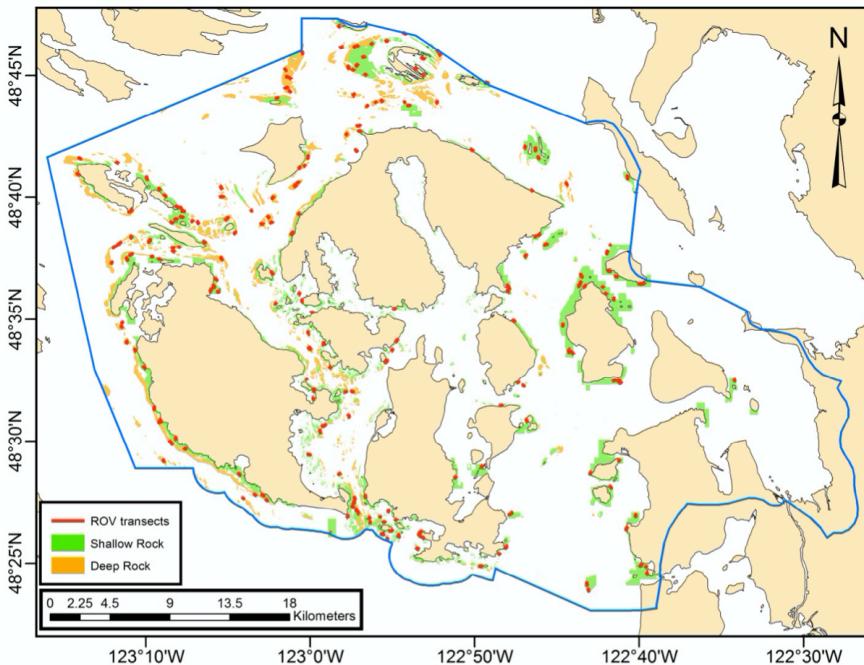


Figure 2. Rocky habitat polygons of the San Juan Islands interpreted from backscatter data from multi-beam sonar systems and previous nearshore rocky surveys conducted by the Washington Department of Fish and Wildlife. ROV transect paths are shown in red.

- Rocky habitat identified using MBES (multibeam echosounder)
- Survey strata: "Shallow rock" and "Deep rock"
  - Shallow rock
    - 136 transects
    - 7,860 hectares
    - 1 yelloweye
  - Deep rock
    - 71 transects
    - 4,150 hectares
    - 38 yelloweye
- Population estimate: 47,407 (CV = 24.8%)

# 2010 SJI ROV survey

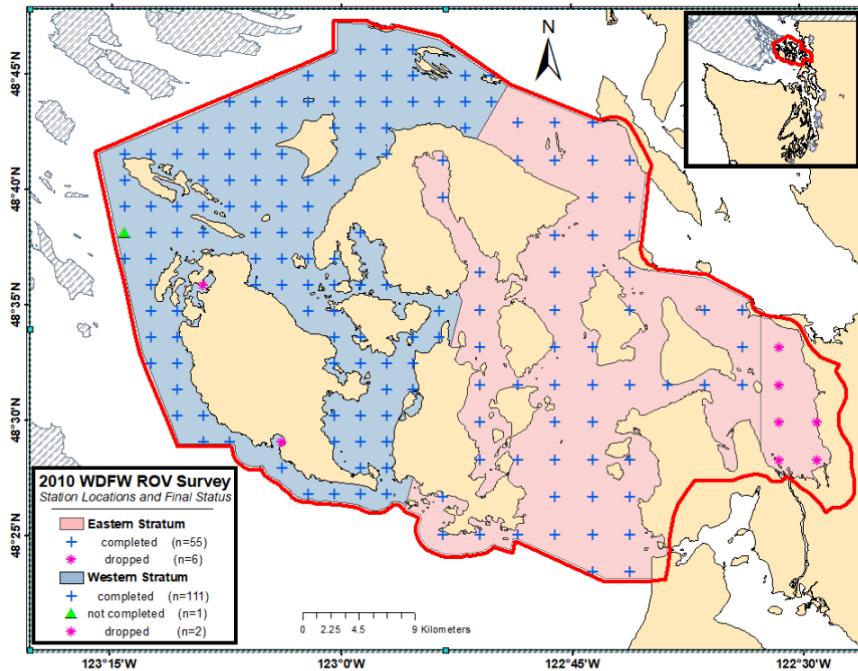
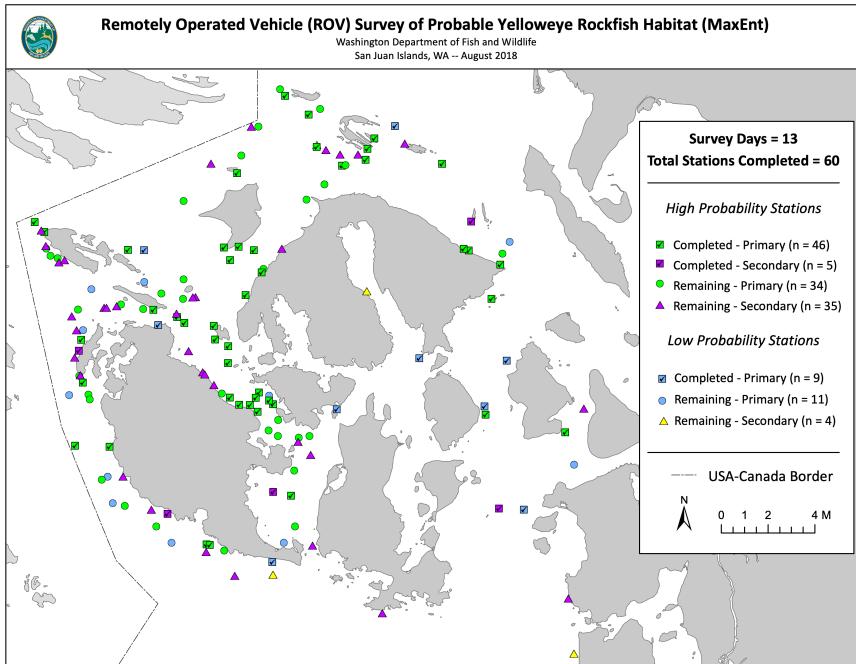


Figure 2. Locations of ROV transects in the 2010 survey of the San Juan Islands (SJI), WA.

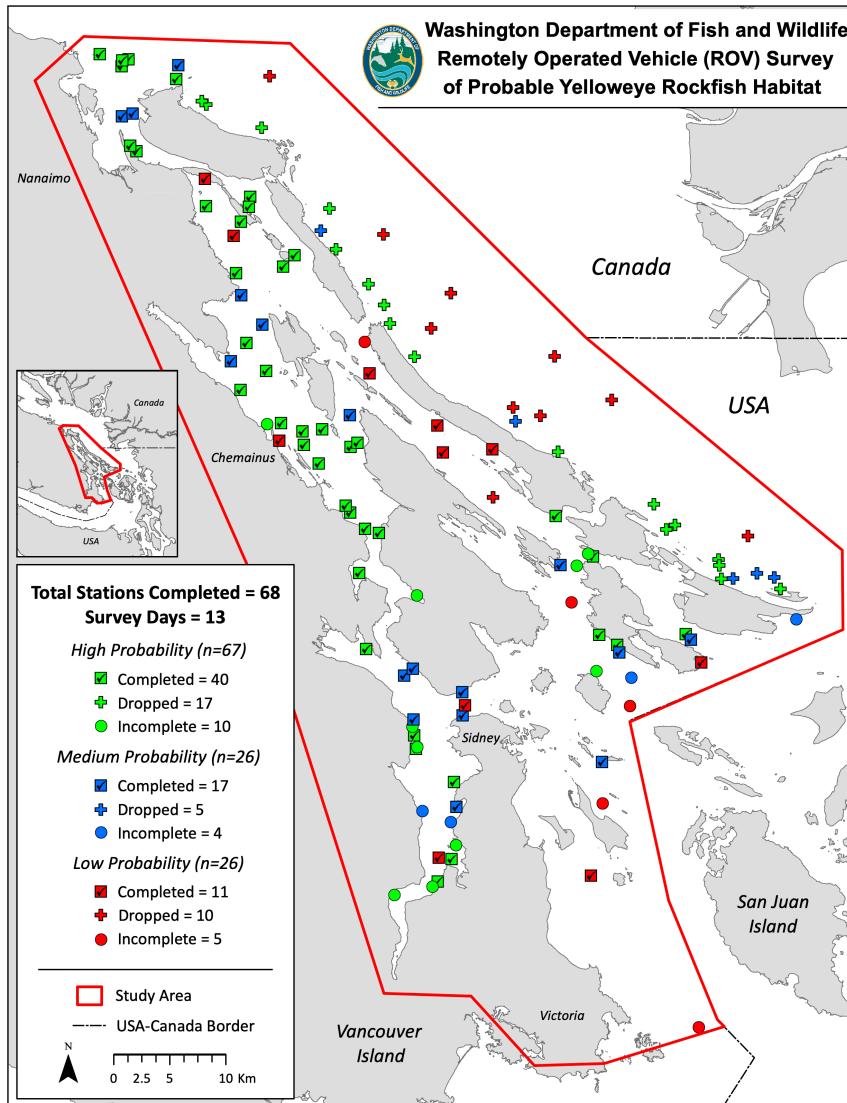
- Systematic grid used to determine transect locations; higher density of transects in Western SJI because of previous observations
- Survey strata: "Eastern SJI" and "Western SJI"
  - Eastern SJI
    - 55 transects
    - 50,850 hectares
    - 0 yelloweye
  - Western SJI
    - 111 transects
    - 53,164 hectares
    - 16 yelloweye
- Population estimate: 114,494 (CV = 44.0%)

# 2018 SJI ROV survey



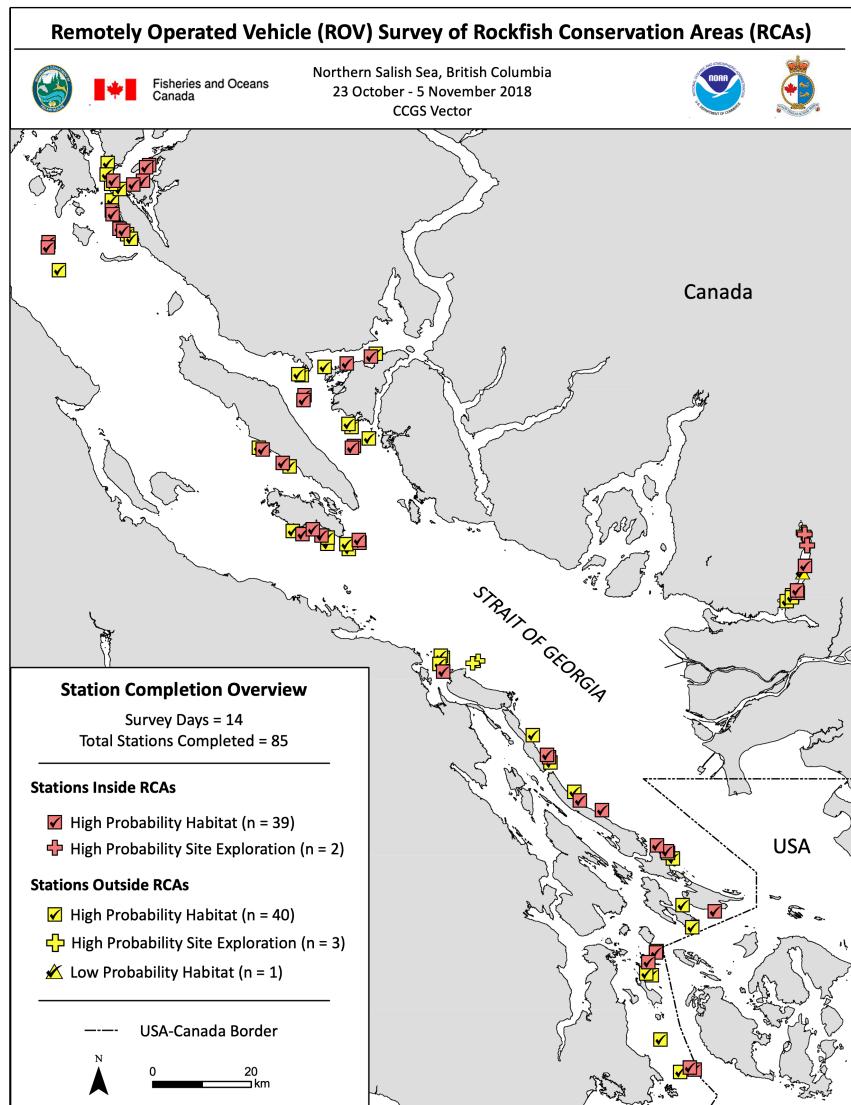
- Maximum entropy model
- Survey strata: “High” (>25%) and “Low” (<25%)
  - High stratum
    - 51 transects
    - 6,036 hectares
    - 14 yelloweye
  - Low stratum
    - 9 transects
    - 102,115 hectares
    - 0 yelloweye
- Population estimate: 19,059 (CV = 33.4%)

# 2018 Gulf Islands survey



- Maximum entropy model
- Survey strata: "High" (>50%), "Medium" (25-50%), "Low" (<25%)
  - High stratum
    - 40 transects
    - 6,070 hectares
    - 49 yelloweye
  - Medium stratum
    - 17 transects
    - 21,462 hectares
    - 4 yelloweye
  - Low stratum
    - 11 transects
    - 76,206 hectares
    - 0 yelloweye
- Population estimates:
  - High stratum: 83,783 (CV = 34.3%)
  - Medium stratum: 58,887 (CV = 71.8%)

# 2018 Vector survey



- Maximum entropy model
- Survey strata: "High", "Low"
  - High stratum
    - 84 transects
    - 92,031 hectares
    - 198 yelloweye
  - Low stratum
    - 1 transect
    - 816,993 hectares
    - 0 yelloweye
- Population estimate: 1,613,716 (CV = 14.3%)

# ROV abundance results

<b>survey</b>	<b>area</b>	<b>year</b>	<b>abundance</b>	<b>CV</b>
2008 San Juan Islands	San Juan Islands	2008	47,407	25
2010 San Juan Islands	San Juan Islands	2010	114,494	33
2015-16 Puget Sound	Puget Sound Proper (excluding Hood Canal)	2015, 2016	6,285	29
2015-16 Puget Sound	Hood Canal	2015, 2016	14,699	23
2018 San Juan Islands	San Juan Islands	2018	19,059	33
2018 Gulf Islands - High Stratum	Gulf Islands (Inside)	2018	83,783	34
2018 Gulf Islands - Medium Stratum	Gulf Islands (Inside)	2018	58,887	72
2018 Vector	Strait of Georgia (CA)	2018	1,613,716	14