Update on Untrawlable Survey Research in RACE

Research Goals – long term

1) Map untrawlable regions within the survey area
2) Estimate rockfish abundance in untrawlable areas

<u>Objective for FY19</u>

Design a GOA-wide index survey for rockfish species in untrawlable habitat that can be run in parallel to the current trawl and longline surveys and provide data on trends and size structure for stock assessors.

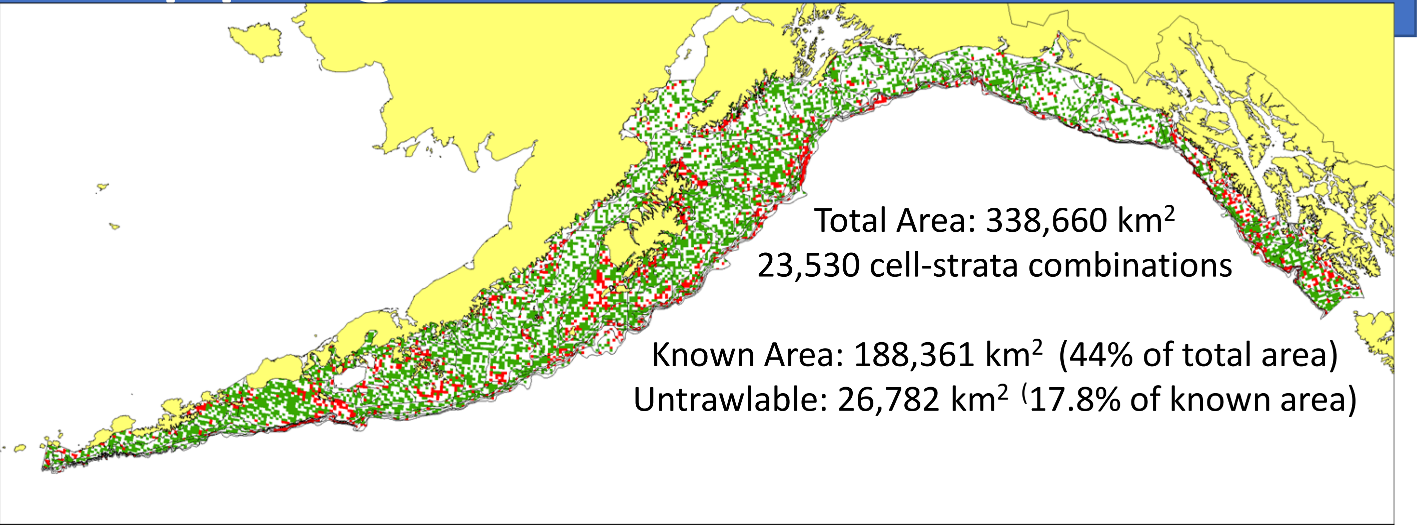
How big is the problem (how much untrawlable area is there)?

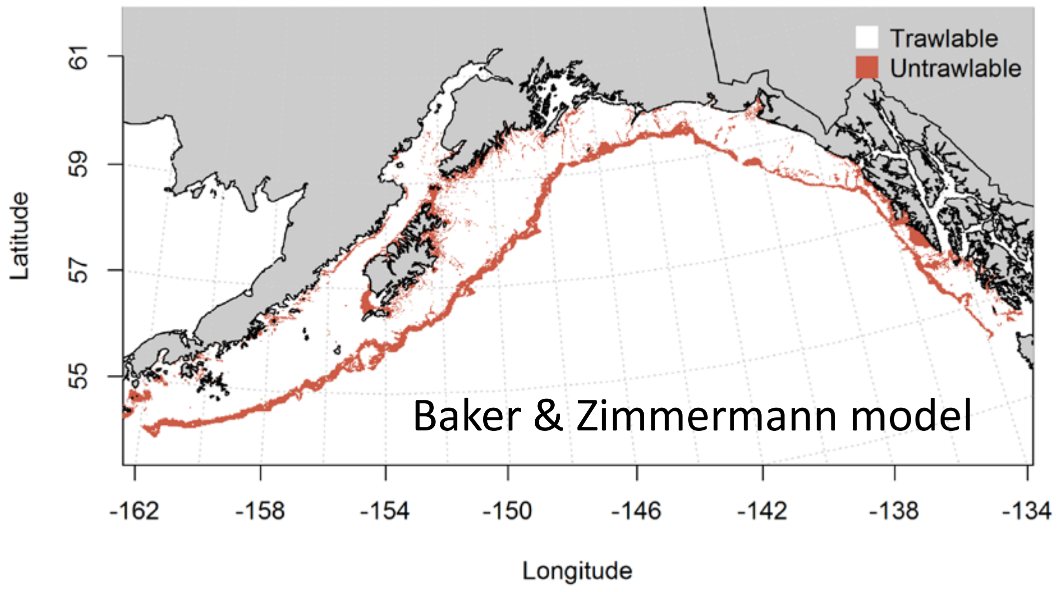
What have we done so far?

Untrawlable Habitat Strategic Initiative results

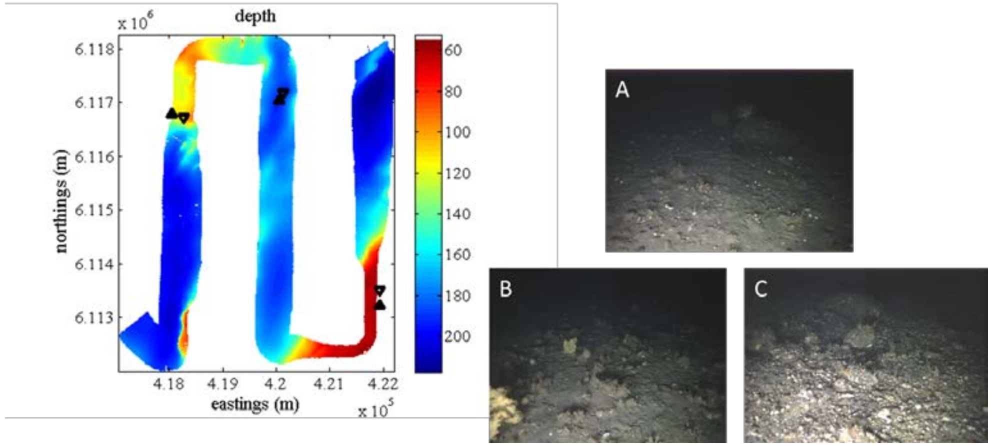
What works/doesn't work?

How Big Is The Problem? Mapping Untrawlable Areas





Stienessen & Pirtle



Ongoing Projects

Trawlability grid (Palsson, Von Szalay)

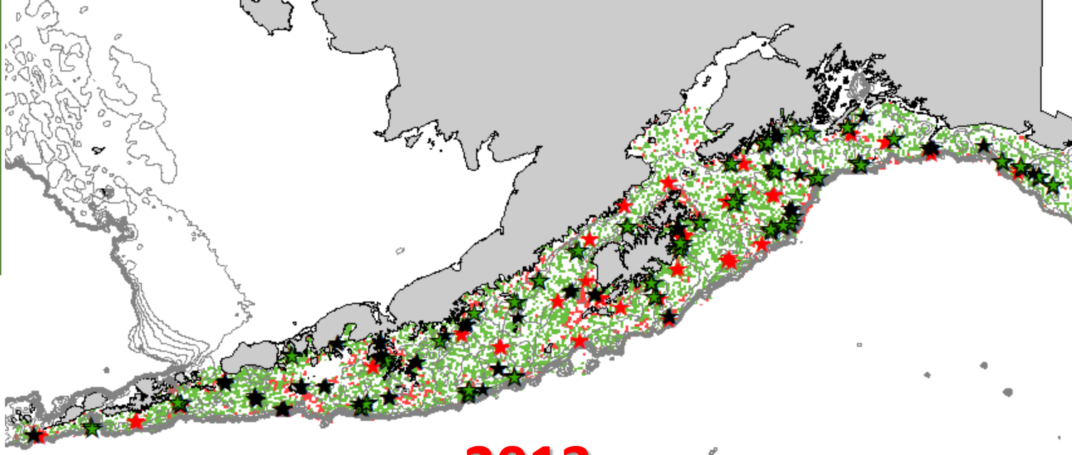
Modeling – Smooth Sheets (Baker, Zimmermann)

Modeling – ES60 (Von Szalay, Jorgensen)

Modeling – ME70 (Stienessen, Pirtle)

Mapping – Multibeam (McConnaughey)

What have we done so far? Acoustic-Optic Surveys (2009-2017)



- Pilot project on Snakehead bank in 2009 to determine feasibility
- Opportunistic surveys of BT “Trawlable” and “Untrawlable” grids using acoustics (splitbeam and multibeam) and lowered stereo cameras
- Assess substrate type/trawlability and rockfish ID/abundance
- Conducted during summer GOA walleye pollock AT survey
- Primarily nighttime operations

2013

36 grids surveyed

- **18 trawlable,11 untrawlable**

63 Lowered Stereo Camera deployments

2015

45 grids surveyed

- **18 trawlable, 19 untrawlable**

89 Lowered Stereo camera deployments

2017

29 grids surveyed

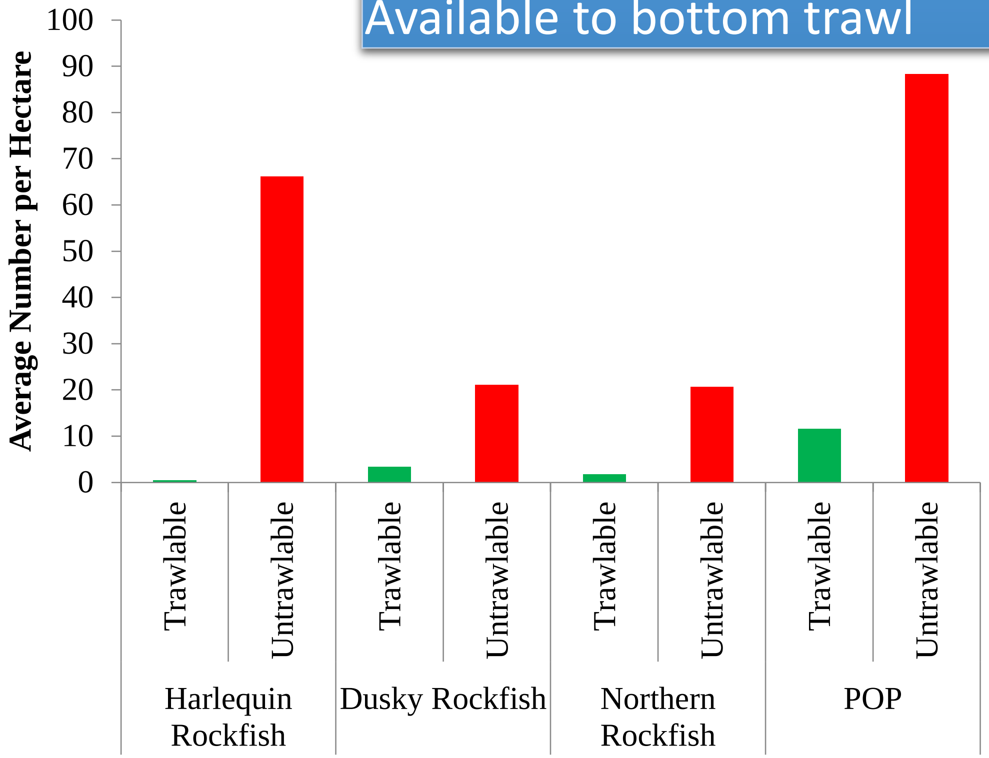
- **16 trawlable, 13 untrawlable**

88 Lowered Stereo camera deployments

Availability to bottom trawl survey

What have we done so far?
Q Estimation (HAIP Project – 2013 & 2015)

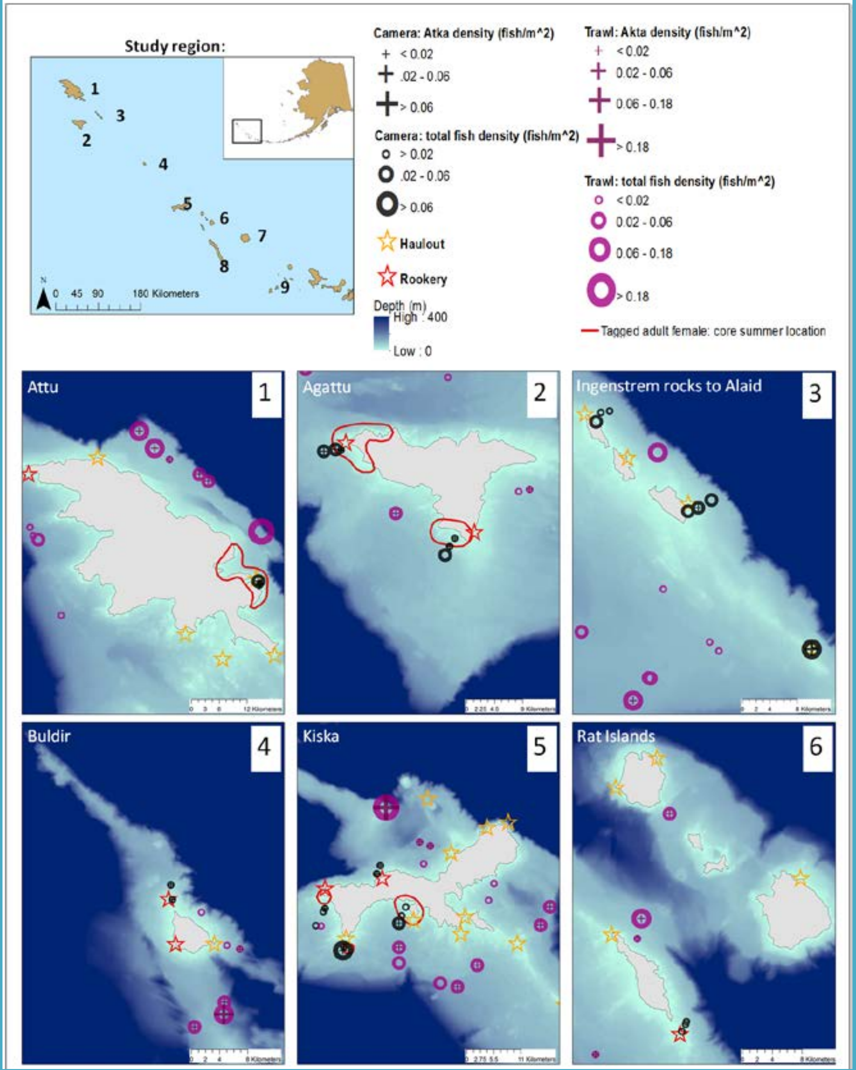
Species	Harlequin RF	Dusky RF	Northern RF	POP
Trawlable Density (#/ha)	0.45	3.46	1.74	11.57
Untrawlable Density (#/ha)	66.15	21.05	20.63	88.36
Available to bottom trawl	6.0%	40.7%	37.3%	52.0%



- Based on trawlability as determined from camera images
- Indication of the availability of select species to the bottom trawl

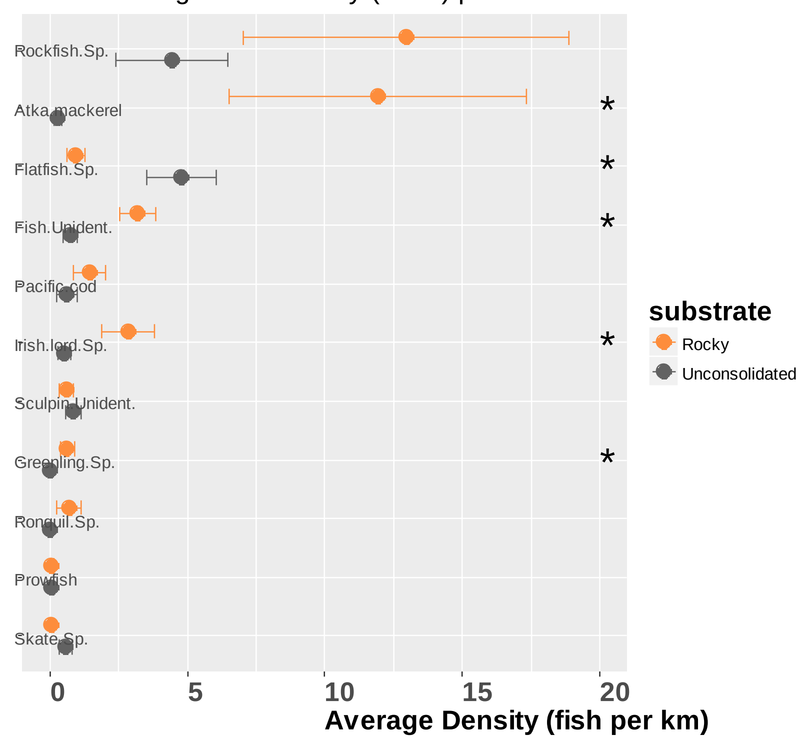
Preliminary Analysis

Comparison of Density Estimates: Camera System and Trawl Survey

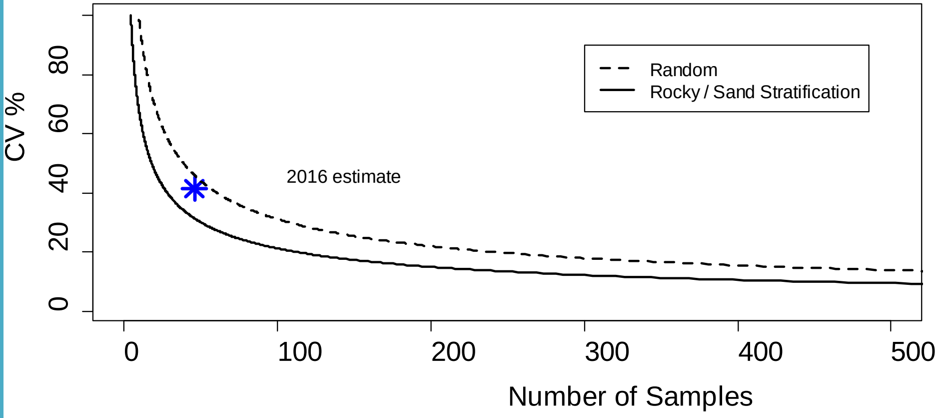


Density Estimates by Habitat Type

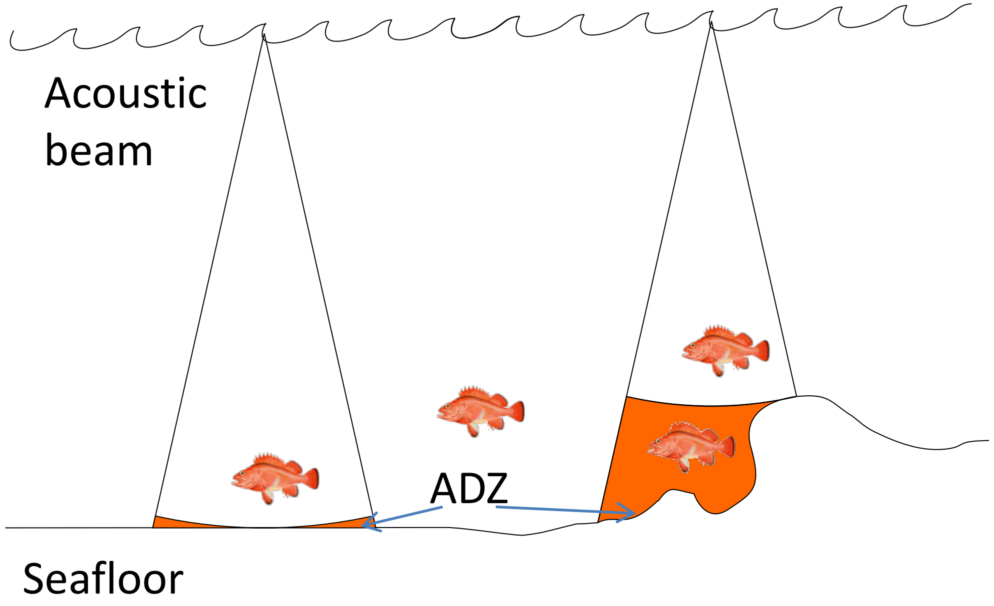
Average Fish Density (□SE) per km



Sample size Estimates for Atka Mackerel



Assessing fish distribution in the Acoustic Dead Zone (ADZ)



Problem is much greater in high relief and sloping seafloor conditions

Size of the ADZ currently cannot be estimated from the acoustics

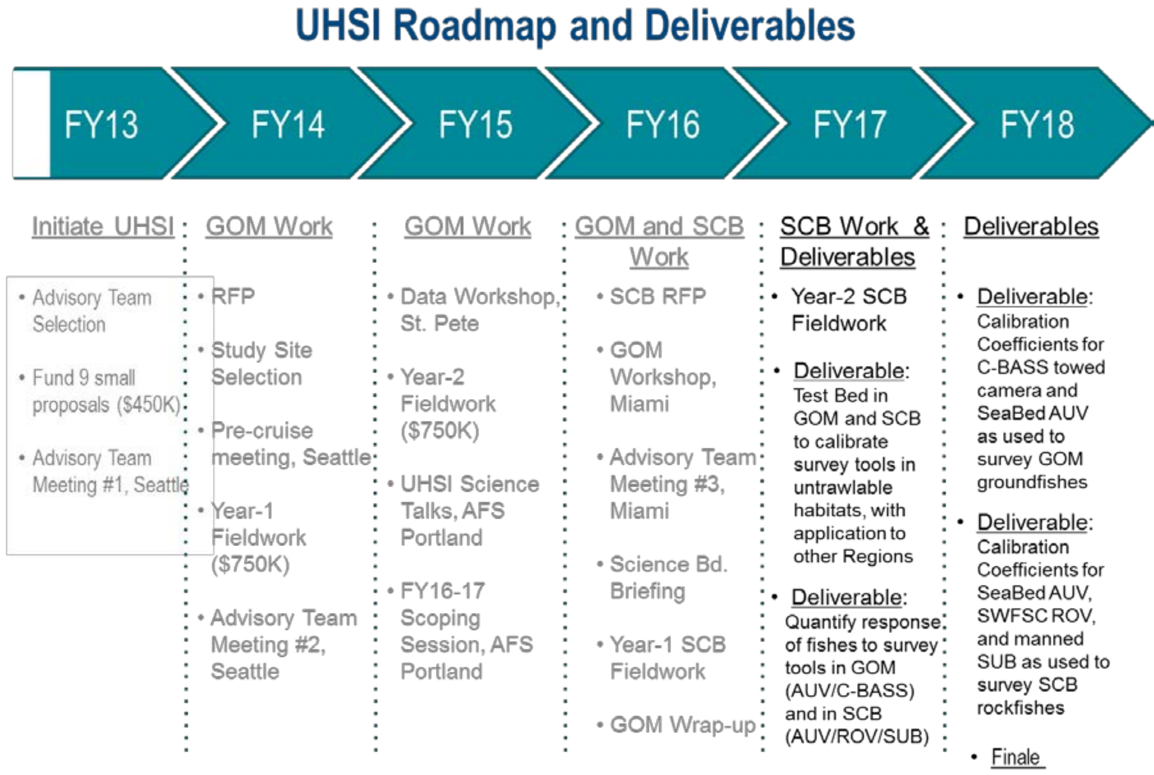
Fish distribution within the ADZ is unknown

Theoretical ADZ can be estimated for a flat smooth seafloor

Gear Efficiency/Behavior

Untrawlable Habitat Strategic Initiative

1. Assess the behavior of fish to the introduction of novel gears in the environment.
2. Estimate the change in local density attributed to a transiting vehicle.
3. Estimate the sampling efficiency and survey capabilities of each vehicle.
4. Calculate platform and species specific sighting functions.
5. Evaluate the effectiveness of the test-bed method of experimentation.
6. Vehicle and sampling recommendations



NOAA FISHERIES

https://www.youtube.com/watch?v=RjzC1Dgh17A

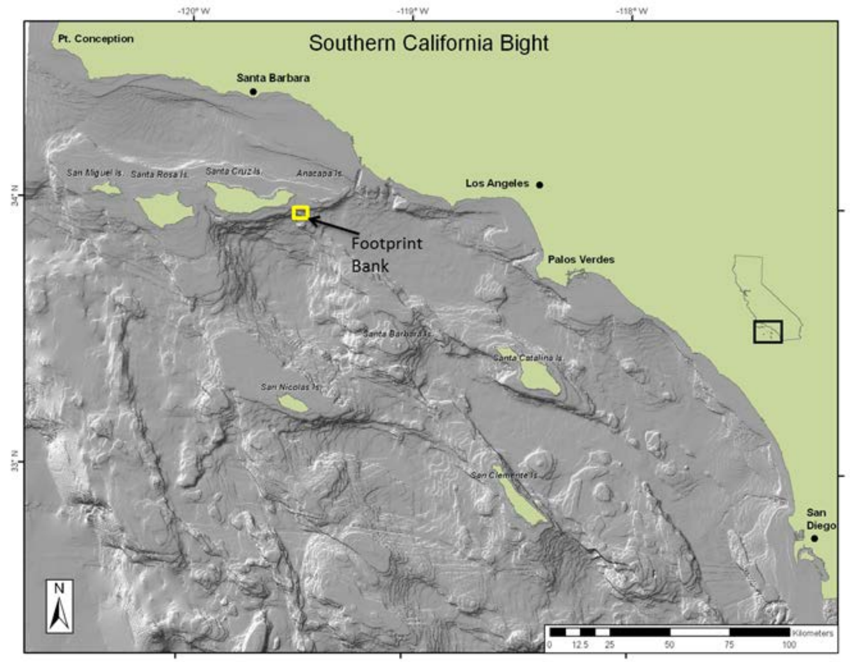
UHSI Year-1 Southern California Bight Test Bed Experiment

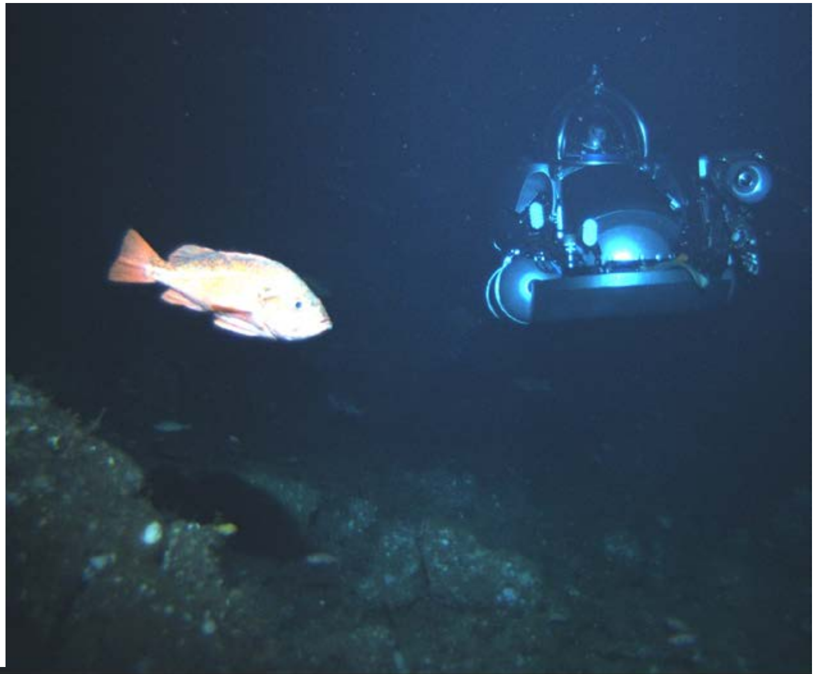
Coordinators: Clarke, Wakefield, Yoklavich

Objective:
To understand the effects of optical and acoustic survey vehicles on the behavior of rockfish species living on or near untrawlable (rocky) deep habitats

Challenges to Rockfish Surveys in Untrawlable Habitats

- Offshore deep water (100-150 m)
- Dark (requires artificial lighting)
- Diverse rocky habitats with patchy spatial distributions
- Diverse assemblage of species, many resembling one another



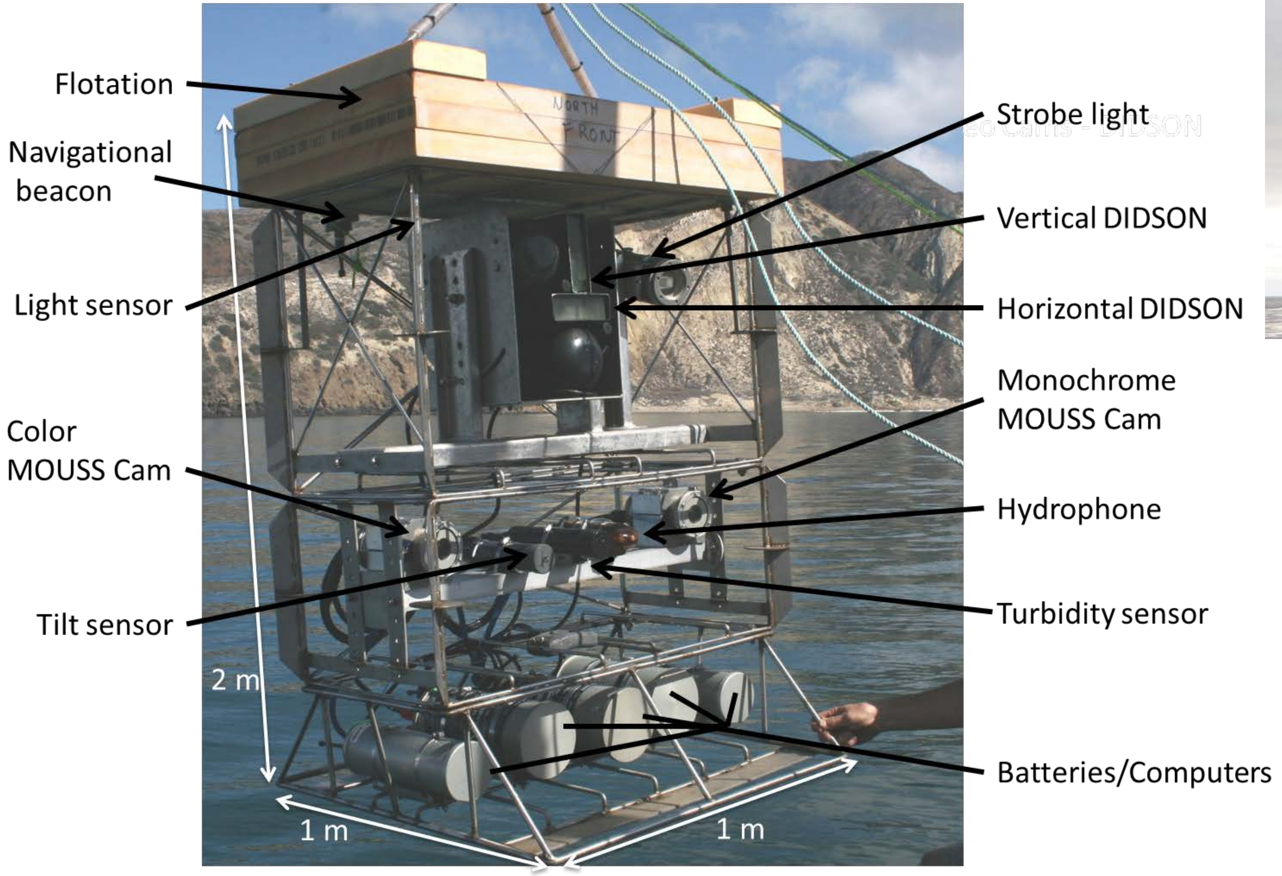


Approach to Quantify Rockfish Reactions to Mobile Survey Gear

October 19-30, 2016: Deploy visual and acoustic cameras on fixed surveillance platforms on top of Bank

- Researchers from SWFSC, NWFSC, SEFSC, AFSC, UCSB
- Use of NOAA R/V *Lasker* and contracted R/V *Velero IV*
- Monitor fish reactions to movement/noise/light associated with mobile survey tools
  - Metric is change in fish behavior and abundance before, during, after passage by mobile tool

Surveillance Systems: MOUSS-DIDSON Platforms

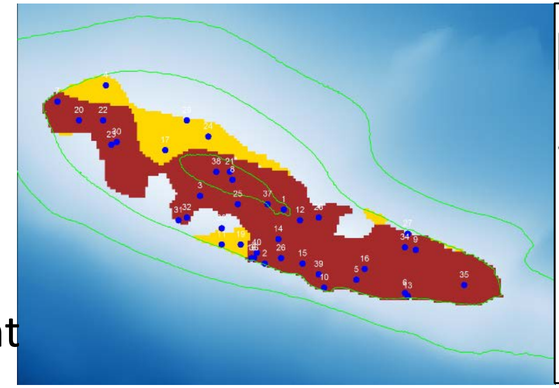


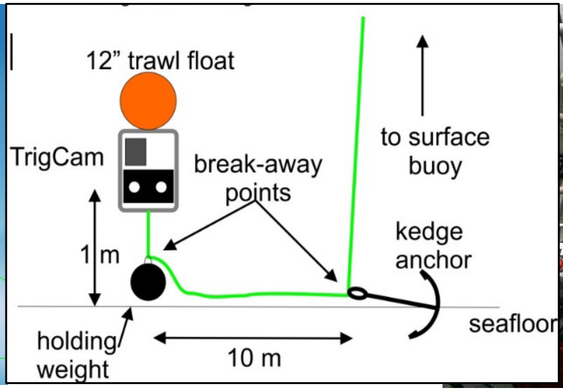

NWFSC PIFSC SeaBED AUV

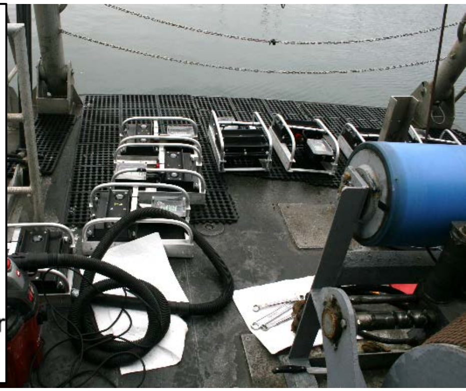

DeepWorker Manned Submersible

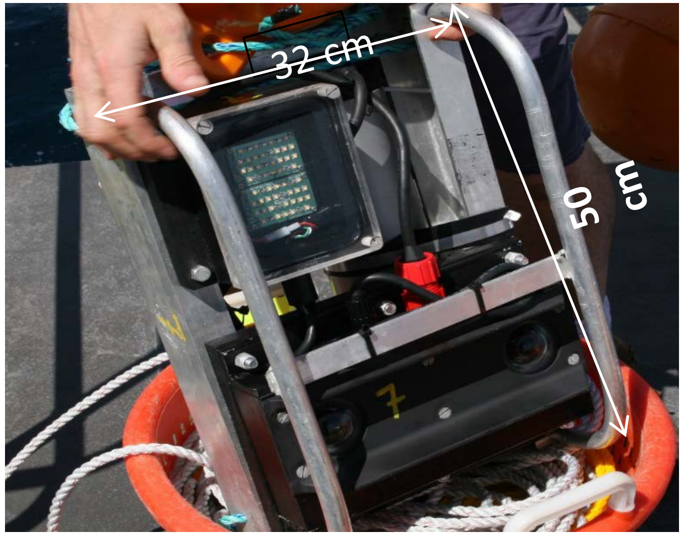
Footprint bank density estimation – Williams/Rooper

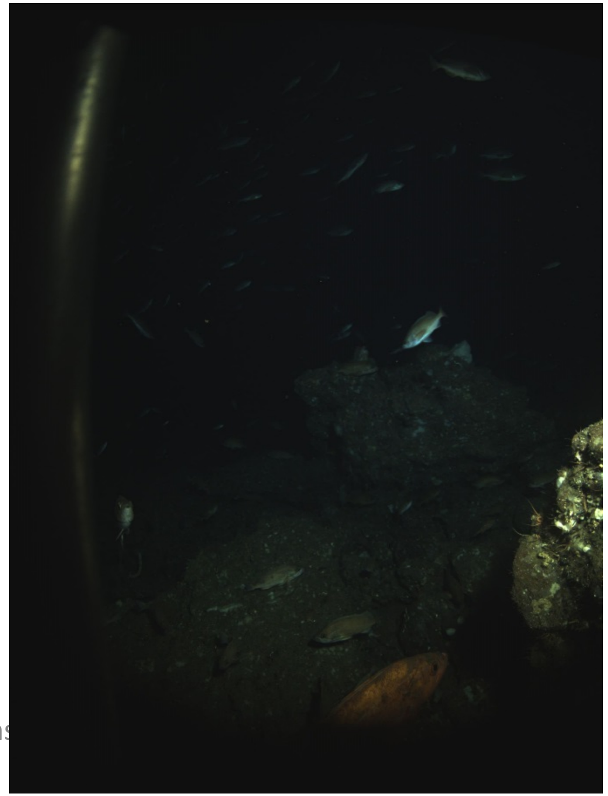
- Nine cameras were built
- Deployments at 26 of 40 randomly selected sites
- Depths from 96-150 m
- 3.5 days of at sea time
- Habitats from Cobble to High Relief Bedrock
- Soak times from 3 to 17 hours including overnight
- Many rockfish were observed





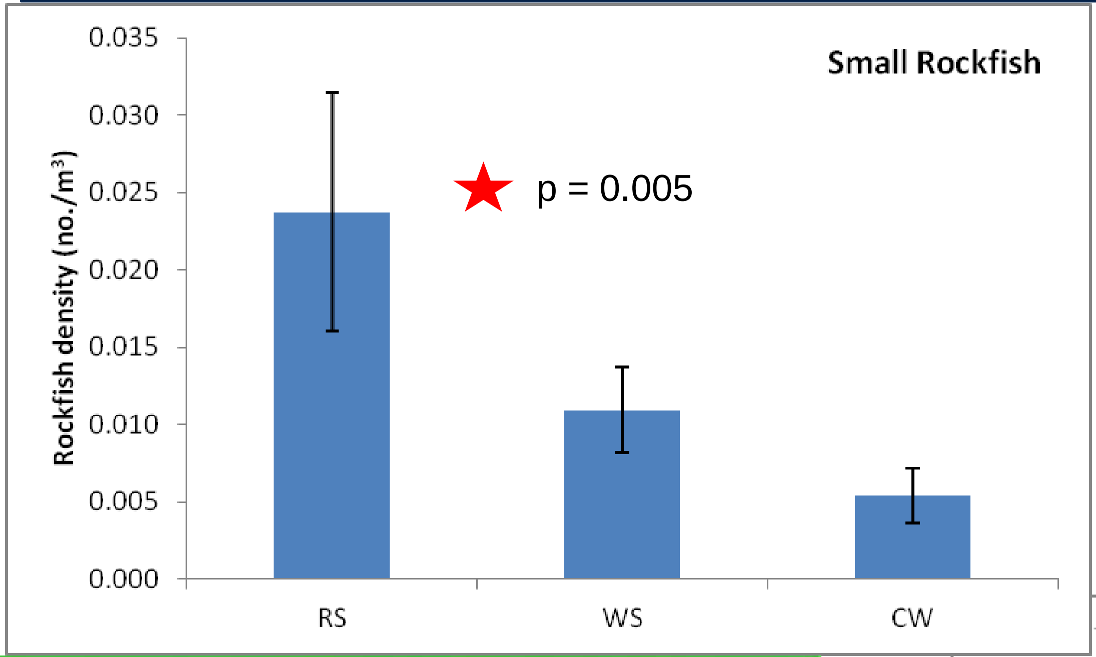




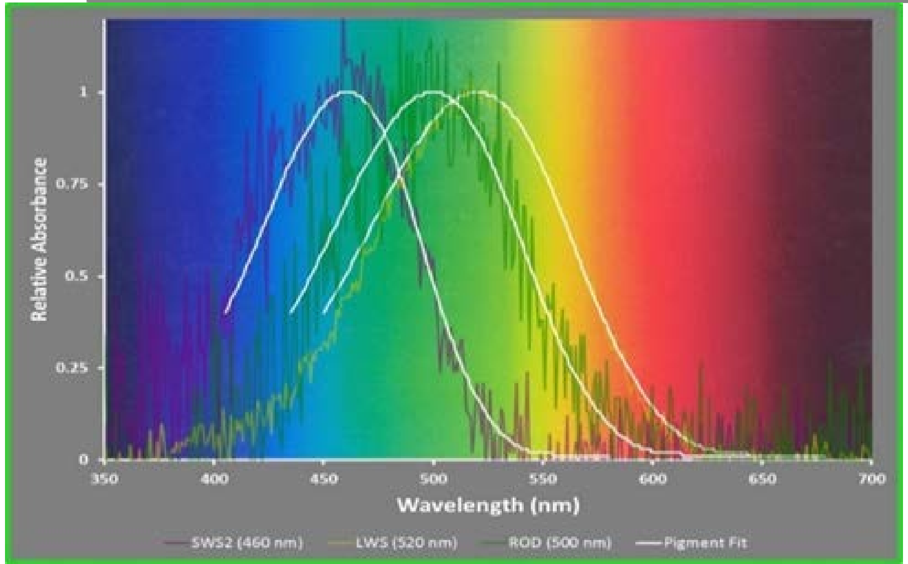


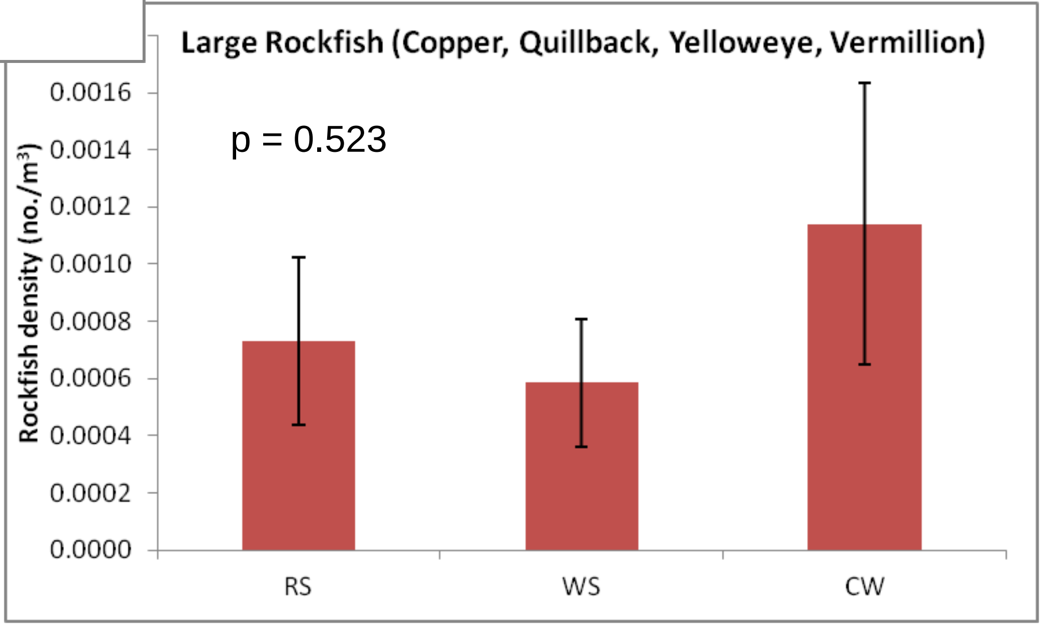
Results: Rockfish Density

Treatments = Red strobe (RS), white strobe (WS), constant white (CW)

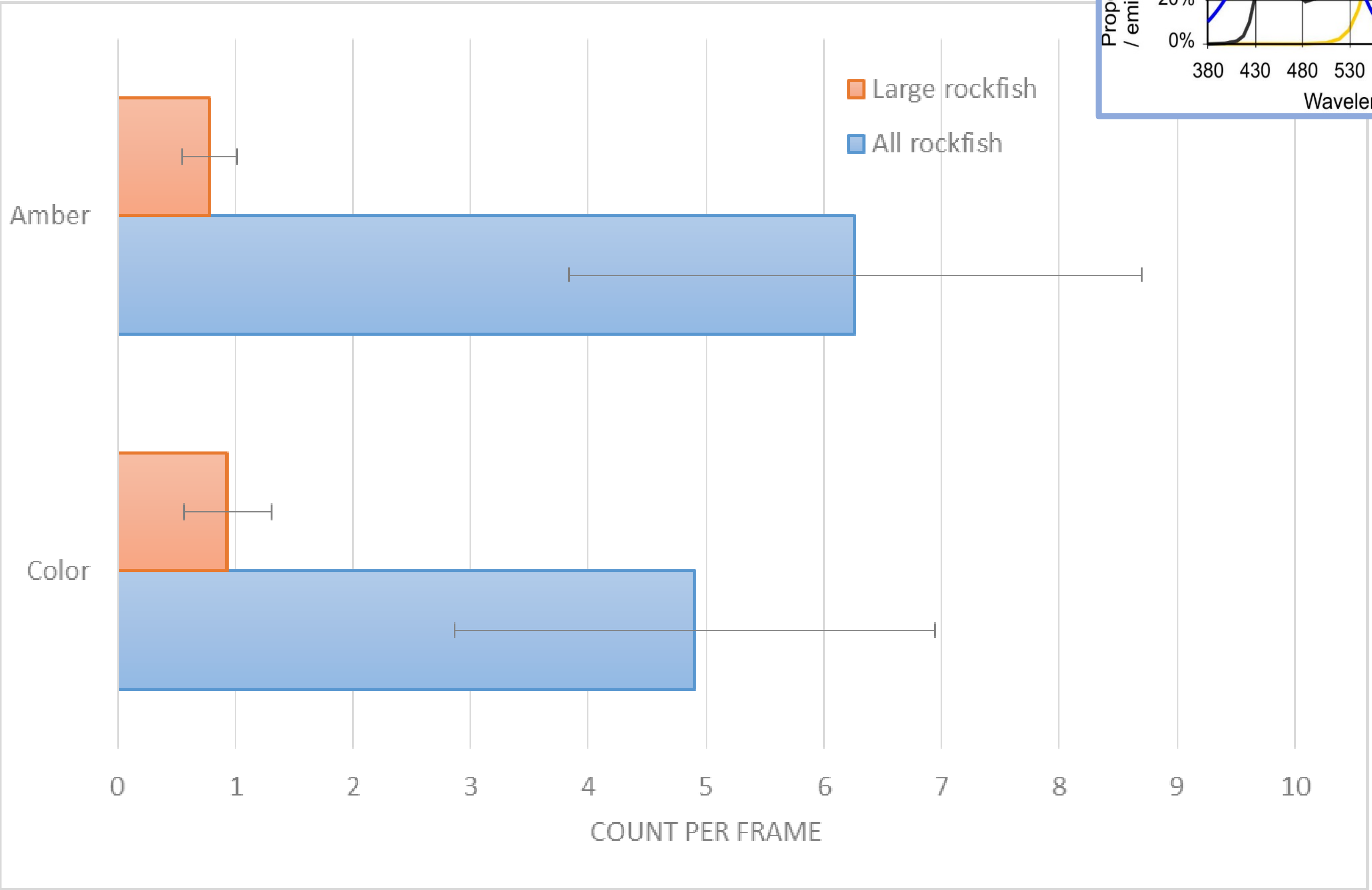


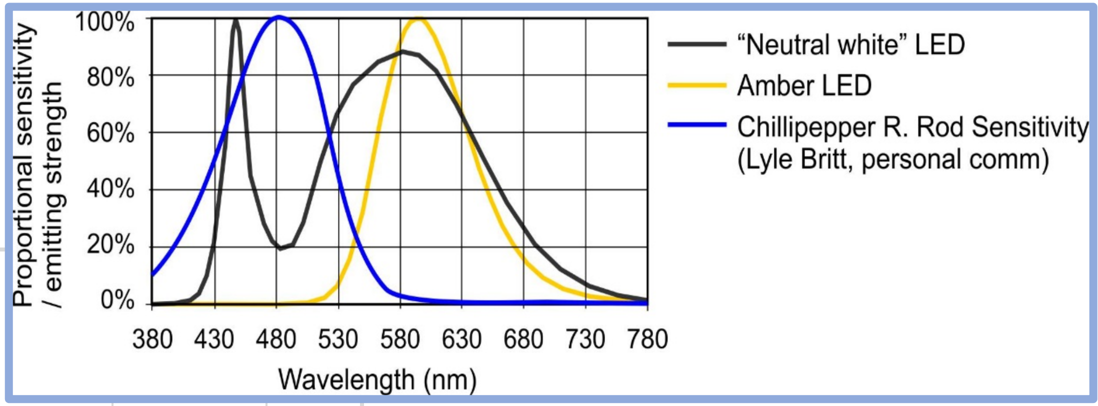
Post-hoc
RS & WS > CW





Lighting comparisons





- Differences not significant
- Probably a bit larger FOV with mono cameras/amber lights
- Need to correct for habitat type and possibly time of day
- Tending towards white

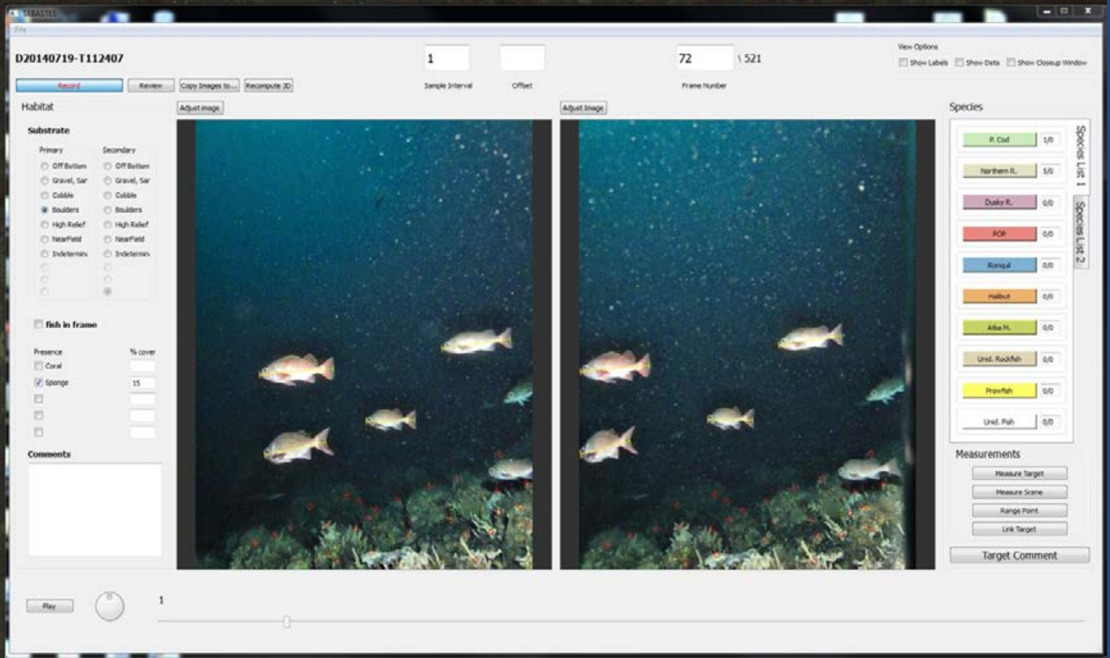
Survey design/analysis methods

Untrawlable habitat surveying methods

- Stationary cameras
- Volumetric density estimation
- Automated image processing

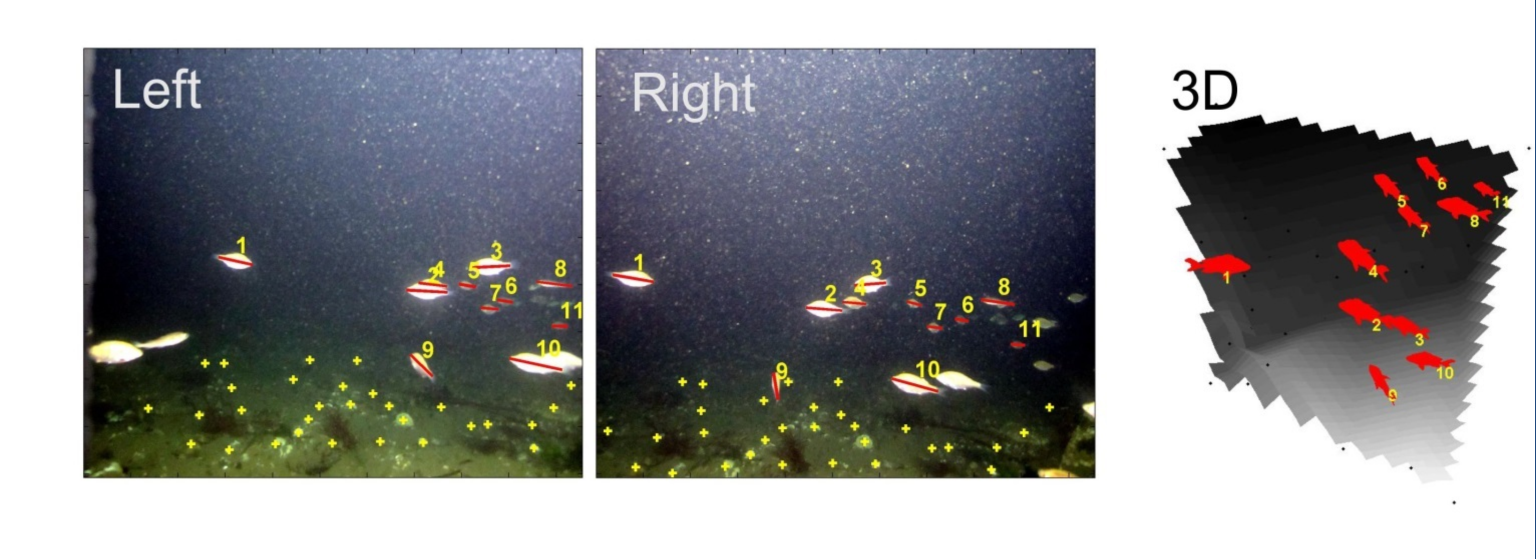
Stereo data analysis – SEBASTES software

- Fish counts by species
- Habitat assessment
- Accurate length measurements
- Fish position/orientation



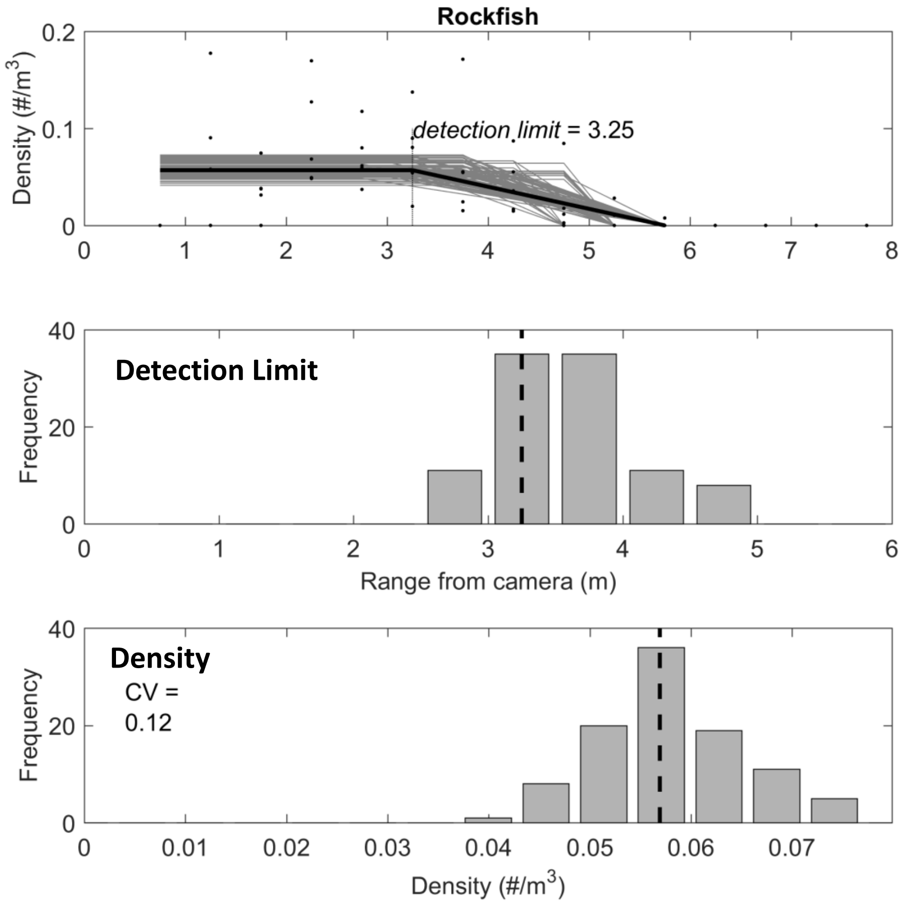
Volumetric density estimation from stereo cameras

- Reconstruct 3D positions of fish and seafloor from stereo image analysis
- Estimate joint-camera imaging volume that is "above ground"
- Estimate fish range-detection loss function



Volumetric density estimation from stereo cameras

- Compute density by range using previous approach
- Estimating the “detection limit” where density starts to drop off
- Intercept is “true” density
- Variance estimate by bootsrap



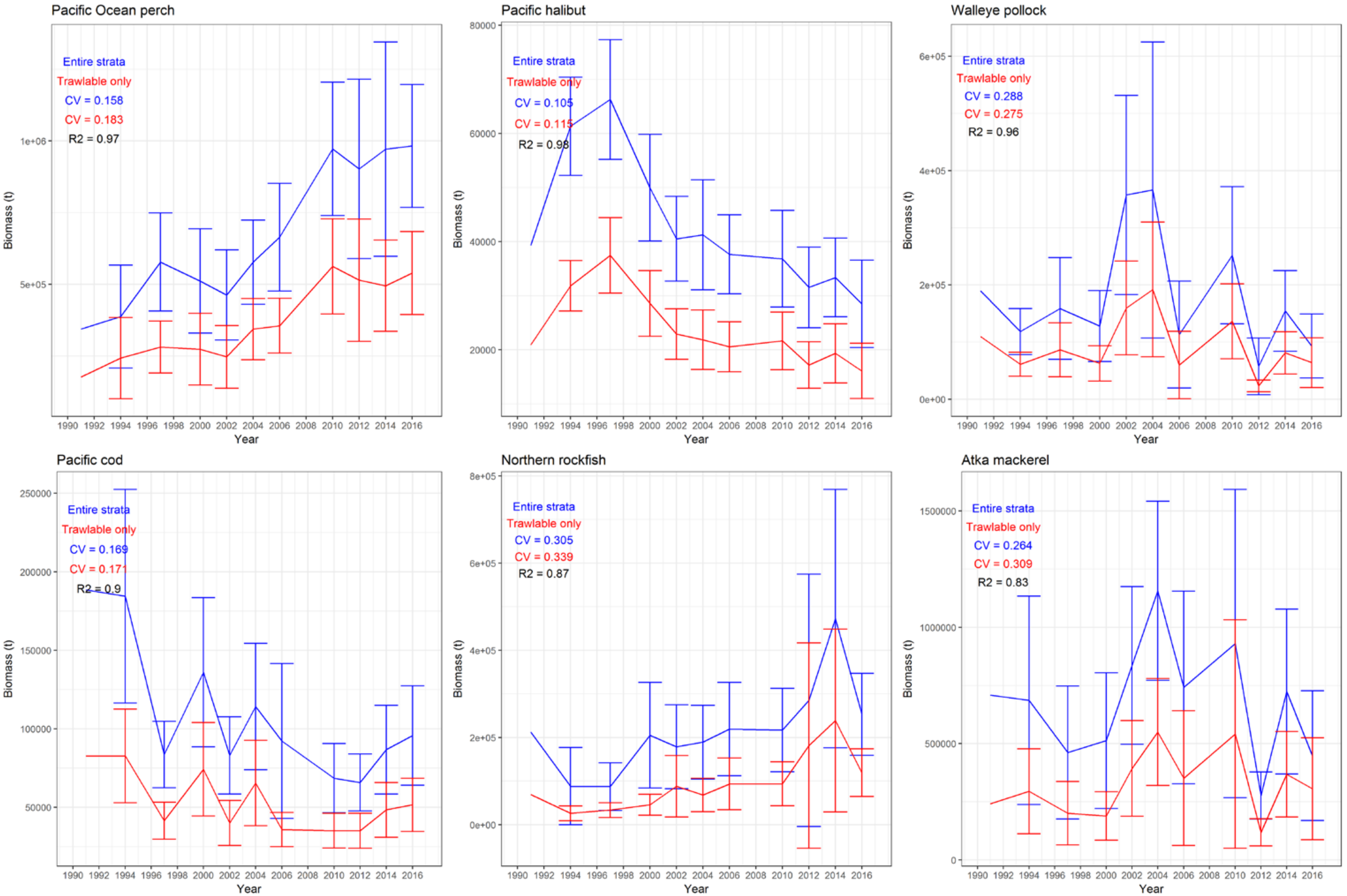
DPM fish detection for video with tracking (SWFSC)

Automated image processing

- Great potential for solving analysis “bottleneck”
- Trade-offs in accuracy and efficiency
- Accuracy is a moving target with continual improvements
- Will always require humans in the loop

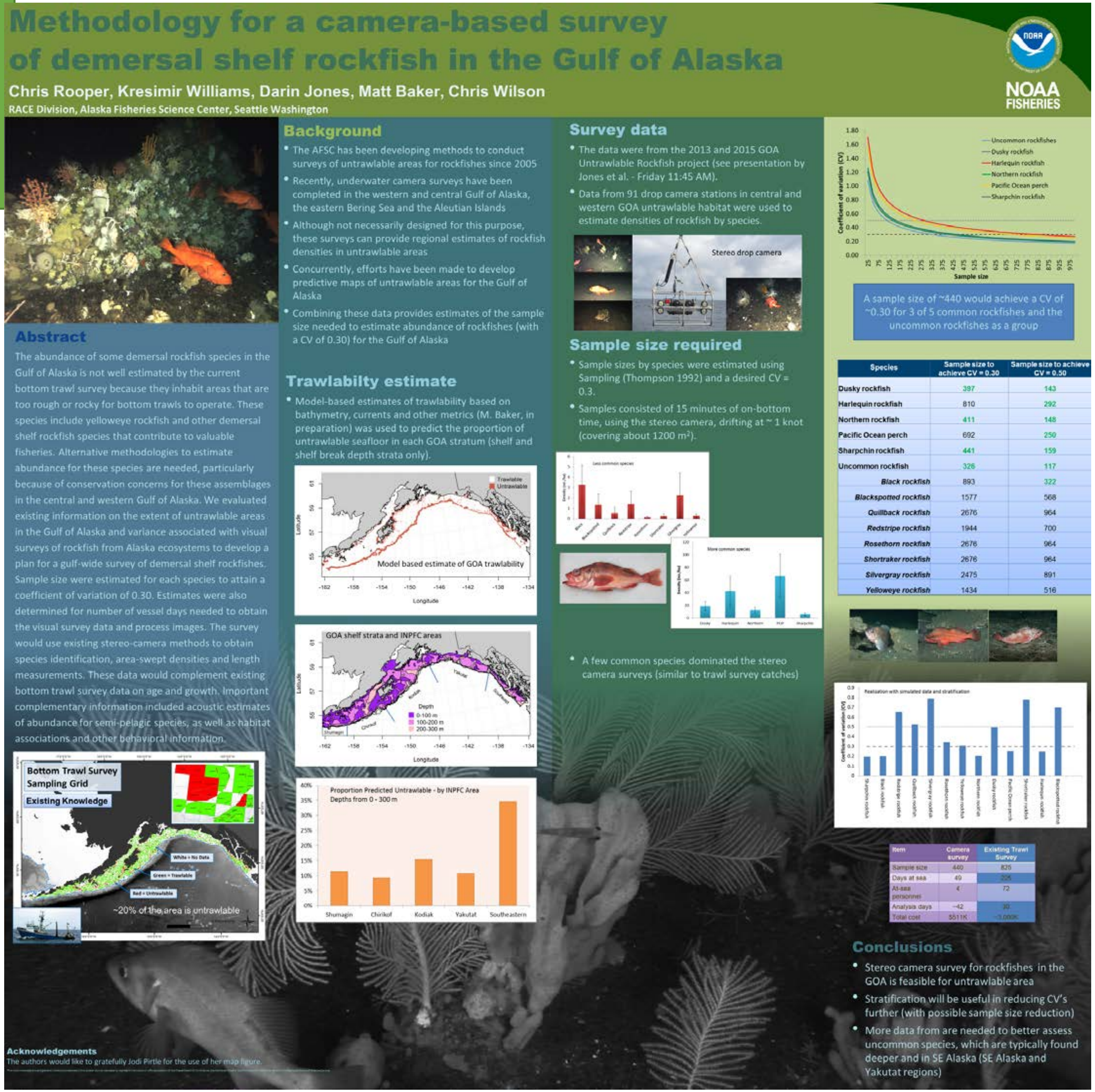
Accounting for UT areas in the AI survey

- Not much change in trend (estimates highly correlated)
- CV's slightly larger for trawlable only
- Estimates for most species about ½ of current (~53% Untrawlable)



What have we done so far? Sample Size Estimation for DropCam Survey

- ~ 440 to 2500 transects depending on the target species/area



Summary Research in Trawl Survey(?) Parlance

<u>Acoustic-optic assessment</u>

- Zhemchug
- Snakehead
- GOA AT Surveys (2013-2017)
- Footprint Bank study - UHSI

<u>Availability to trawl survey</u>

- Snakehead
- Q estimation project
- Aleutians SSL project
- Diel behavior studies

<u>Gear efficiency/Behavior</u>

- Puget sound RF lighting project
- Vision project
- UHSI vehicle response
- Dead zone projects
- Footprint study

<u>Survey Design/Analysis</u>

- Image processing automation
- Sample size estimates
- Q estimation project
- Volumetric density estimation
- Aleutian untrawlable area effect study

<u>Conclusion</u>

We know something about a lot of these things

What are we proposing for survey Topics for Friday Discussion

- Acoustic-optic methods
- Towed camera transects
- Complemented by TrigCam experiments to get at some of the remaining questions

What we need to decide

- Ideally random placement of stations/transects/acoustics into untrawlable areas – is this feasible
- Sample design (stratified random only untrawlable or both)
- Others?