

### The importance of size data for fishery-independent ecosystem monitoring

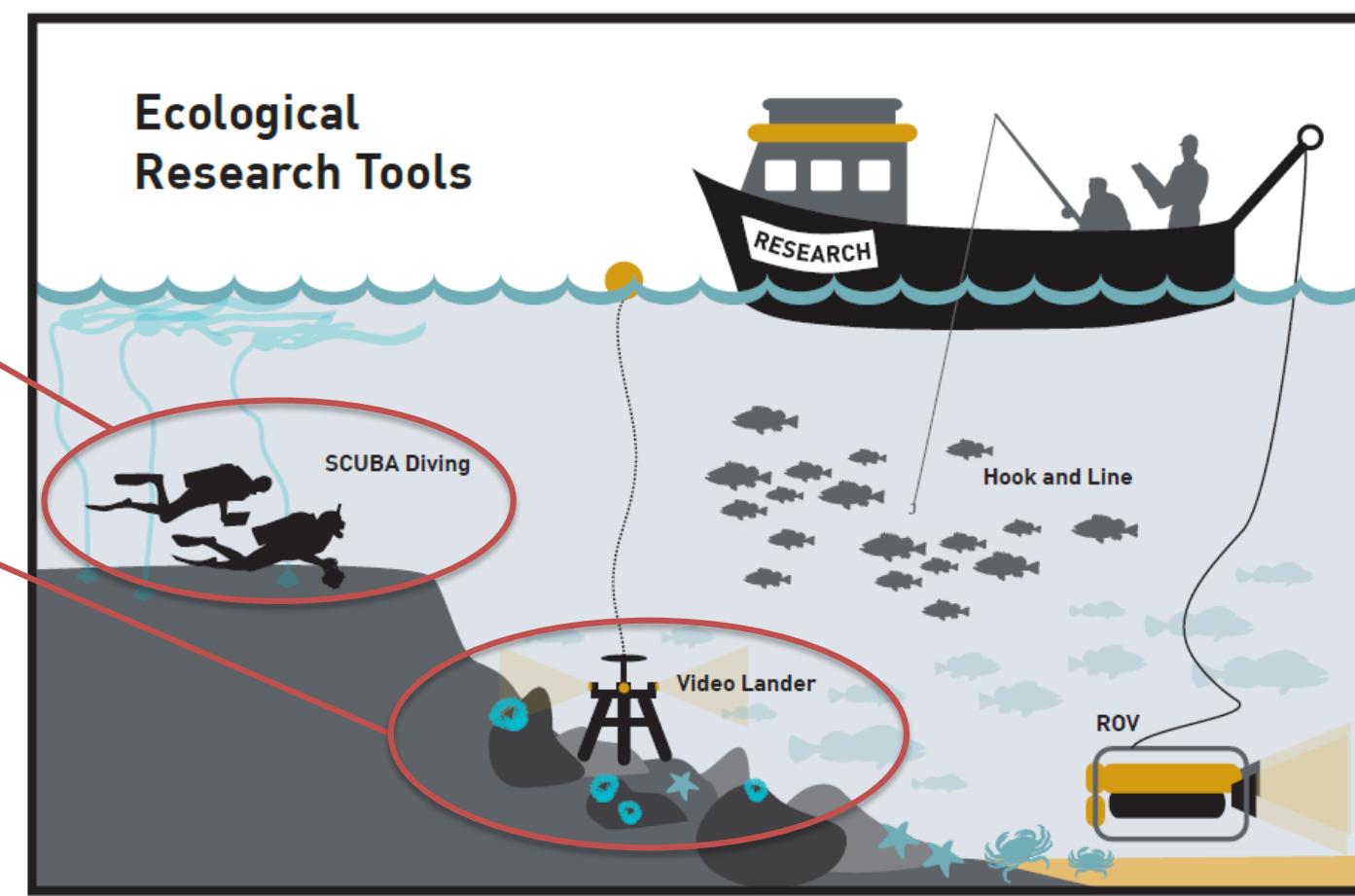
Oregon Marine Reserve's Program uses four core monitoring tools. The goals of this pilot project are to build upon existing tools to generate more precise estimates of fish size. Specifically, we aim to:

- 1) improve accuracy of size data from SCUBA surveys
- 2) develop stereo video to obtain size data from landers

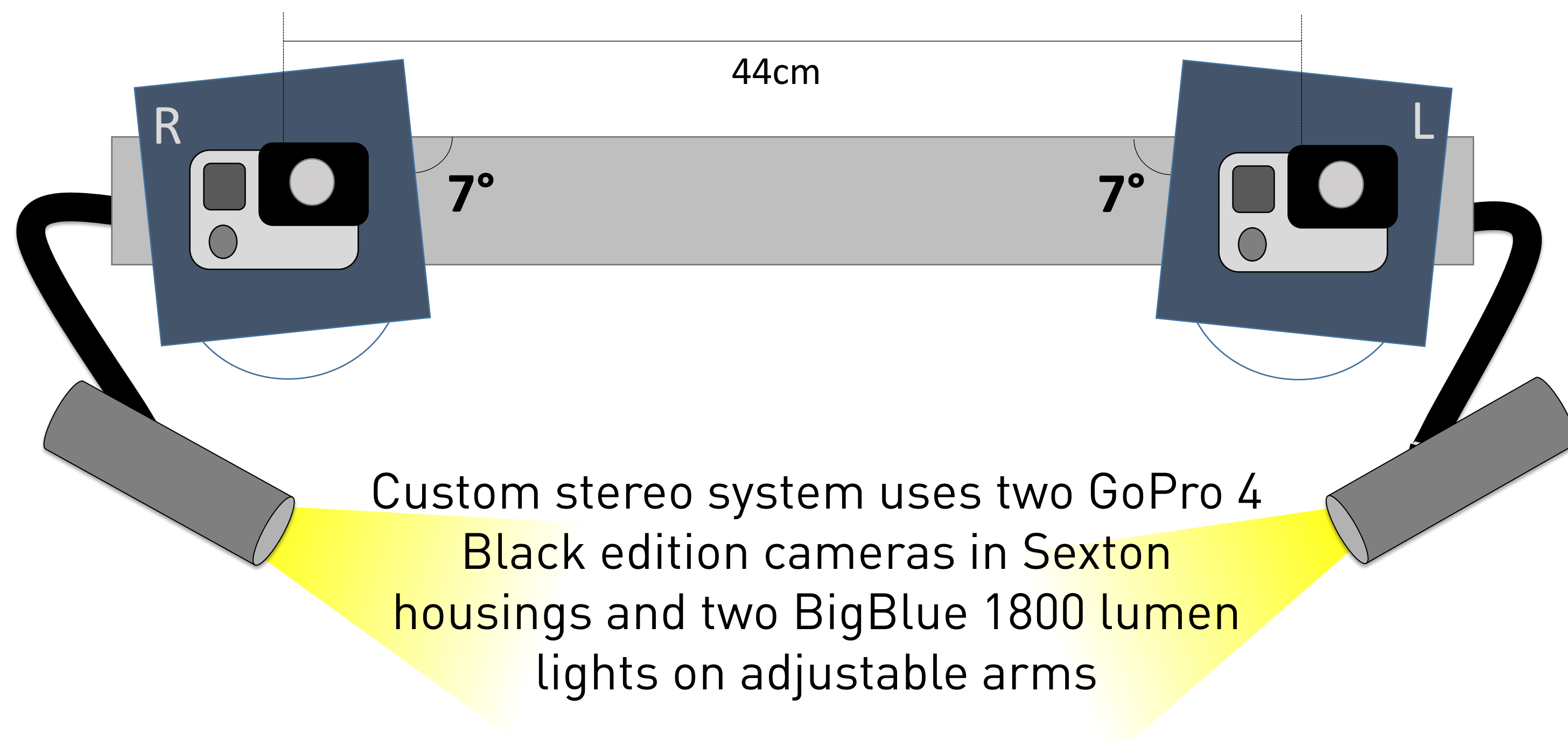
Project Progress:

- ✓ **Build and calibrate a stereo system**
- ✓ **Calculate error values for the stereo video system**

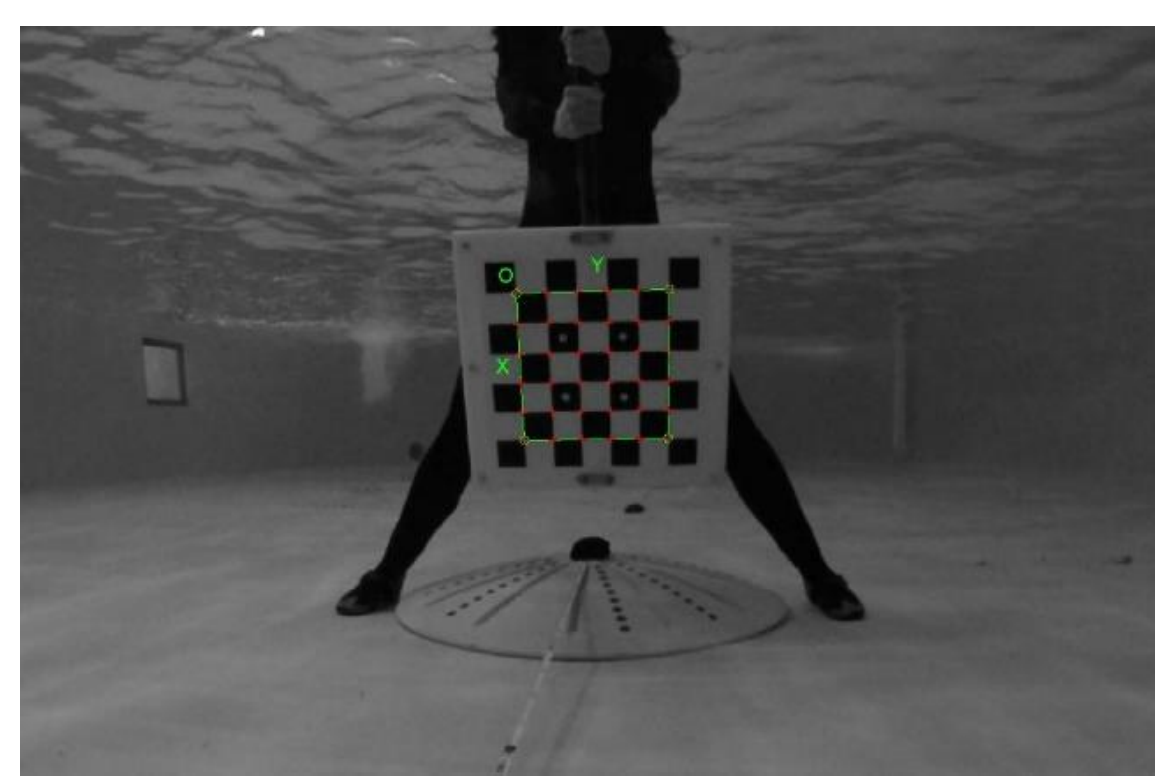
- Compare diver versus stereo estimates of fish size
- Evaluate efficiency of the stereo approach to generate usable data from both platforms



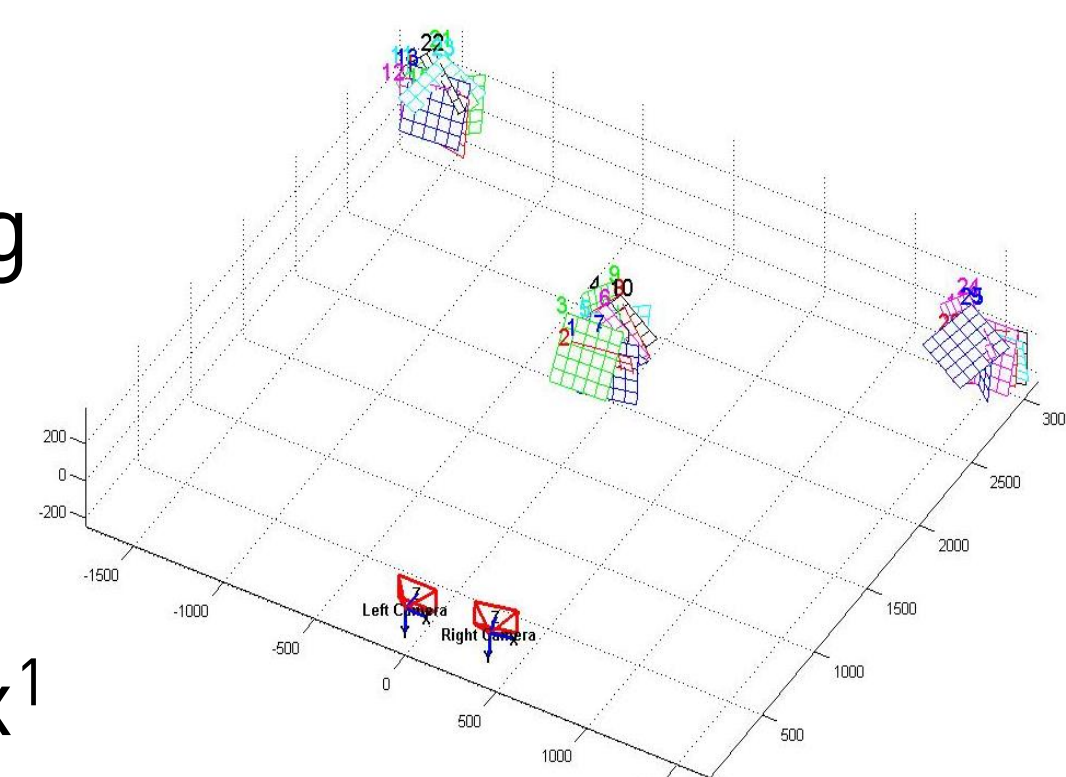
### Construction



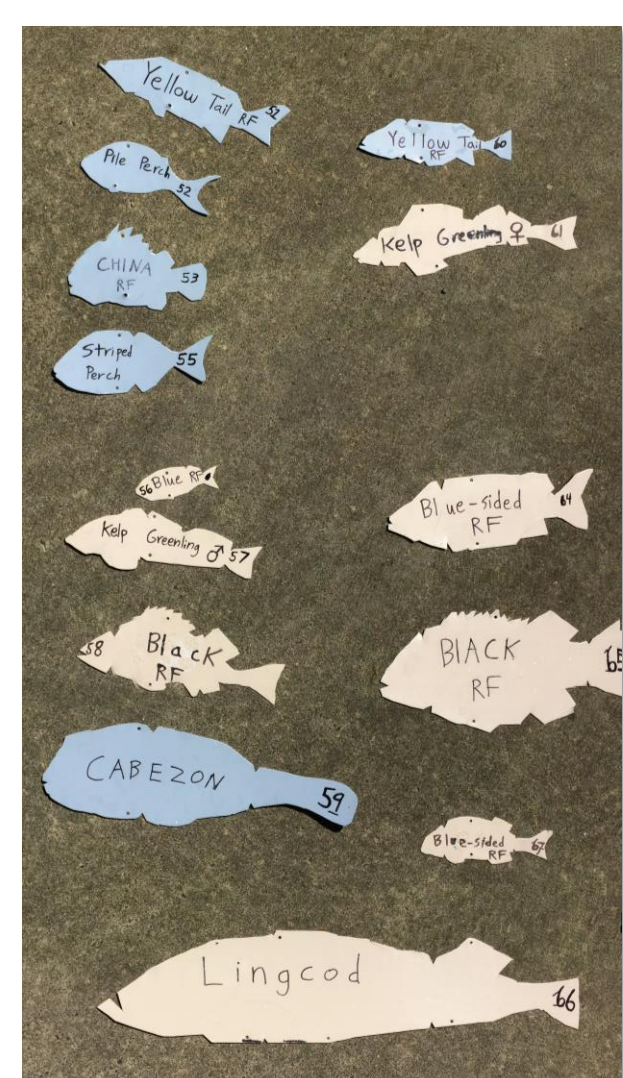
### Calibration



System is calibrated using a 42x42cm checkerboard and the Calib MatLab Toolbox<sup>1</sup>



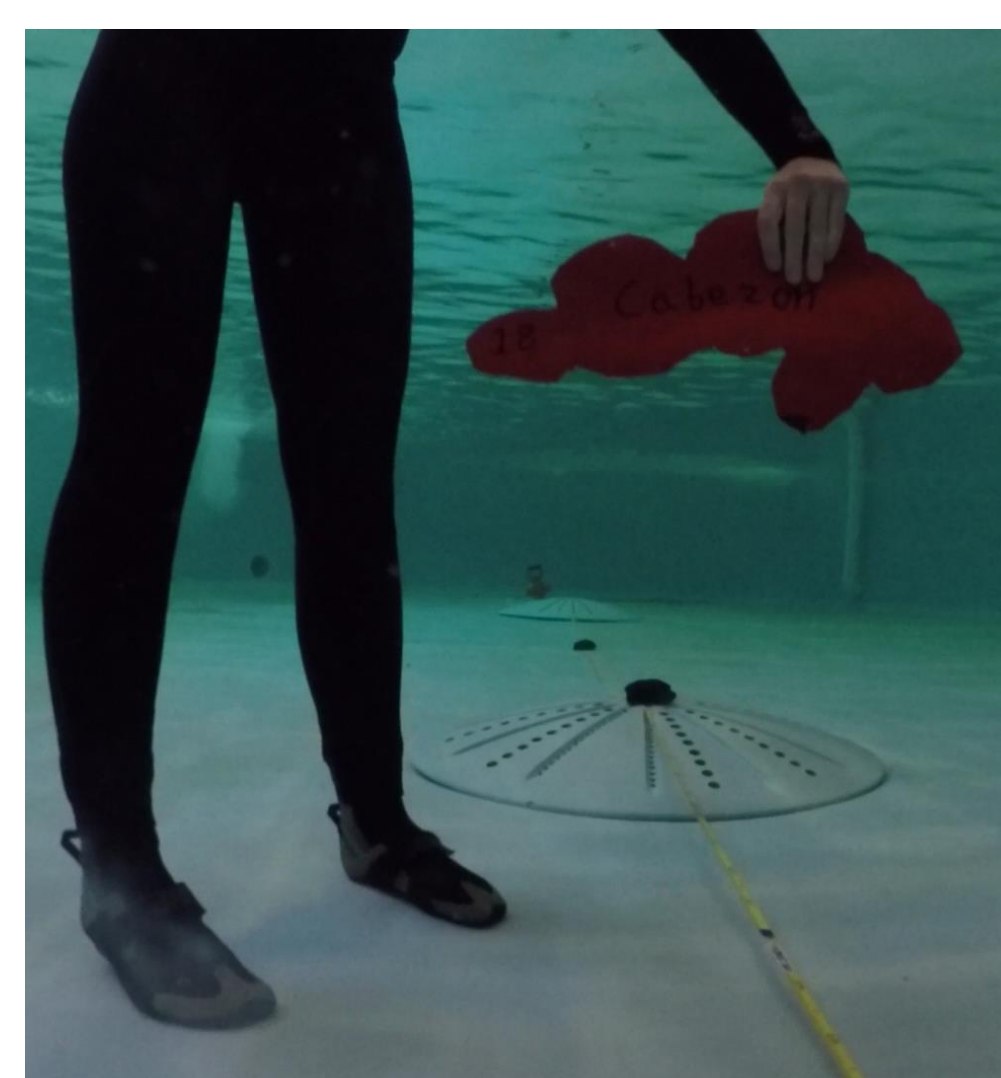
### Error testing



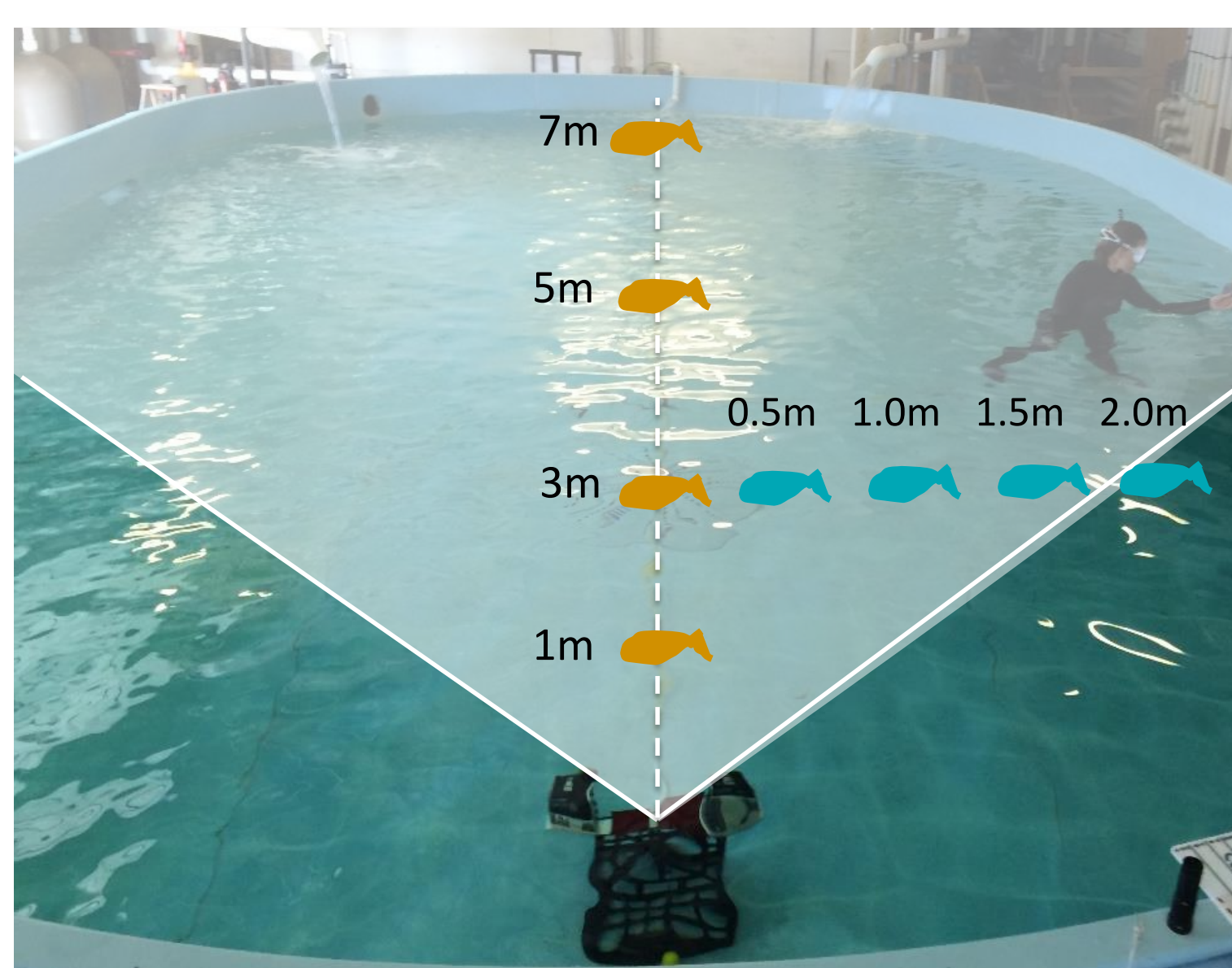
Sizing error was evaluated in a pool using 52 plastic fishes of known sizes ranging 5 to 91cm

Size measurement were made in the program SEBASTES<sup>2</sup> (custom Python GUI)

Error=|true size-estimated size|



Error was standardized by true fish size for analysis. **Target error ≤10%.**



Q1: Does error vary with fish size (at 3m from camera) or video reviewer?

Q2: Does error increase as fish are moved further (1, 3, 5, 7m) from the camera?

Q3: Does error increase as fish are moved off-center (0.5, 1.0, 1.5, 2.0m) of the camera field of view?

### Defining the survey area

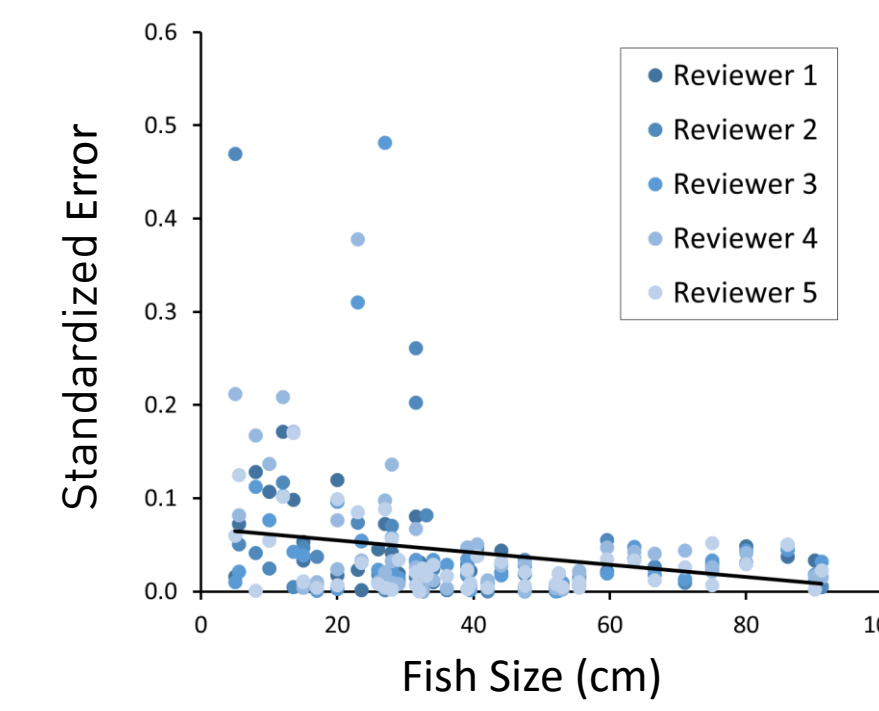
#### A1: Fish size error does not change with fish size

ANCOVA ( $F_{9,245} = 1.01$ ,  $p = 0.43$ )

VIDEO REVIEWER  $p = 0.56$

ACTUAL SIZE  $p = 0.01$

REVIEWER\*SIZE  $p = 0.98$



Error does not differ among reviewers or fish size.

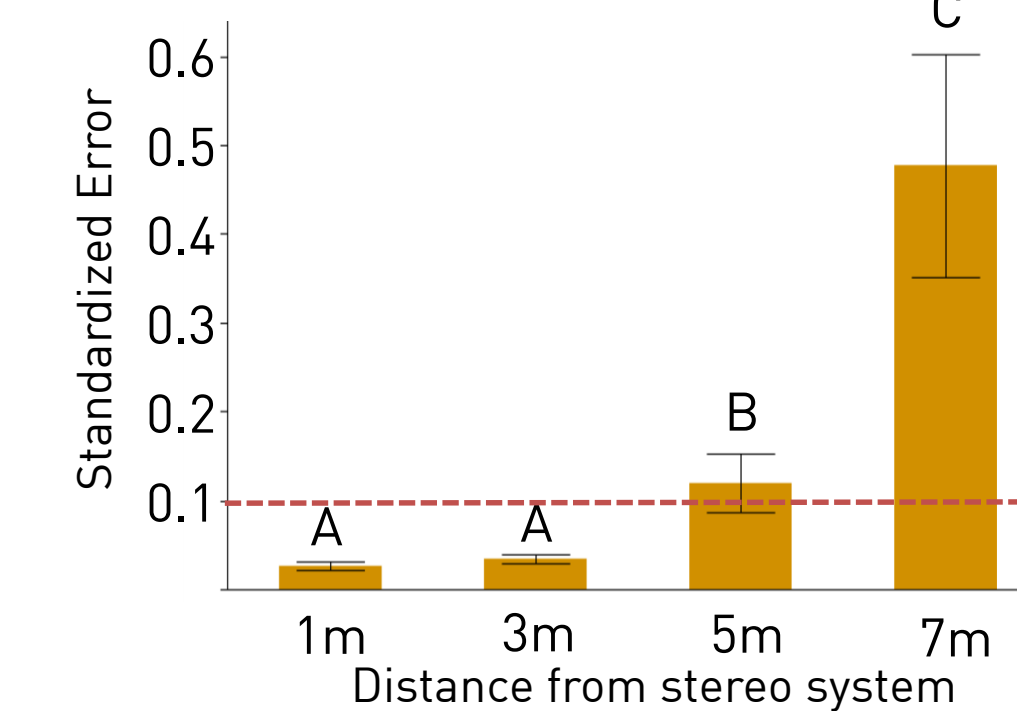
#### A2: Fish size error increases with distance

ANCOVA ( $F_{7,203} = 15.86$ ,  $p < 0.01$ )

DISTANCE  $p < 0.01$

ACTUAL SIZE  $p < 0.01$

DISTANCE\*SIZE  $p = 0.10$



Fishes >5m from the camera are not considered for sizing.

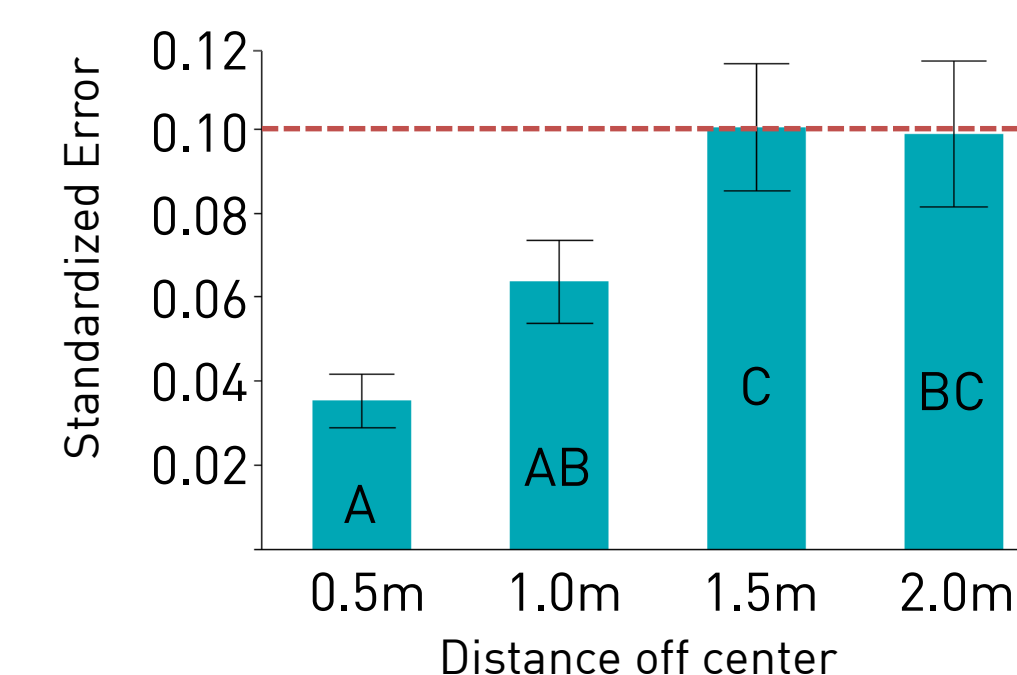
#### A3: Fish size error increases with distance off center

ANCOVA ( $F_{7,196} = 8.37$ ,  $p < 0.01$ )

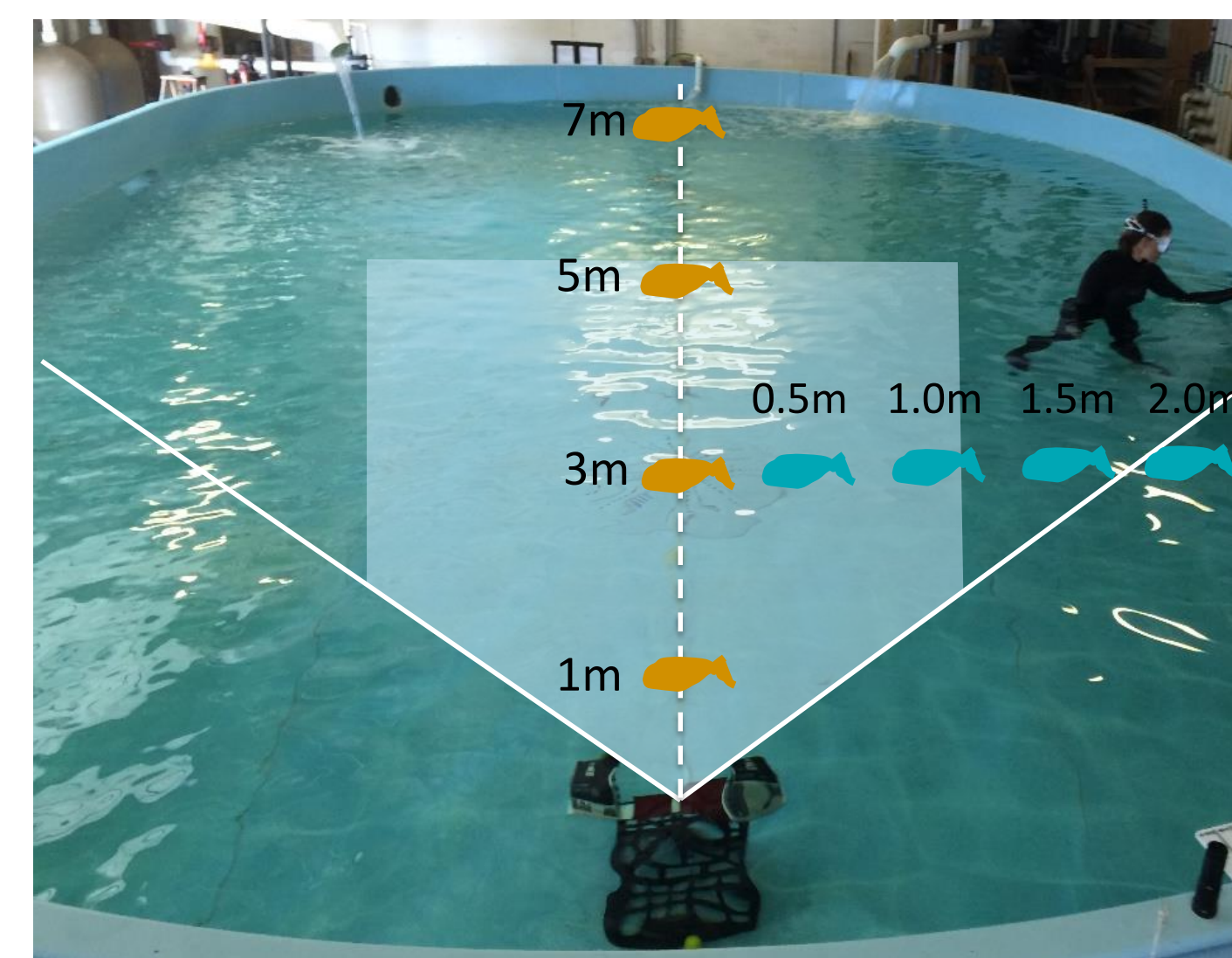
OFF-CENTER  $p < 0.01$

ACTUAL SIZE  $p < 0.01$

OFF-CENTER\*SIZE  $p = 0.14$



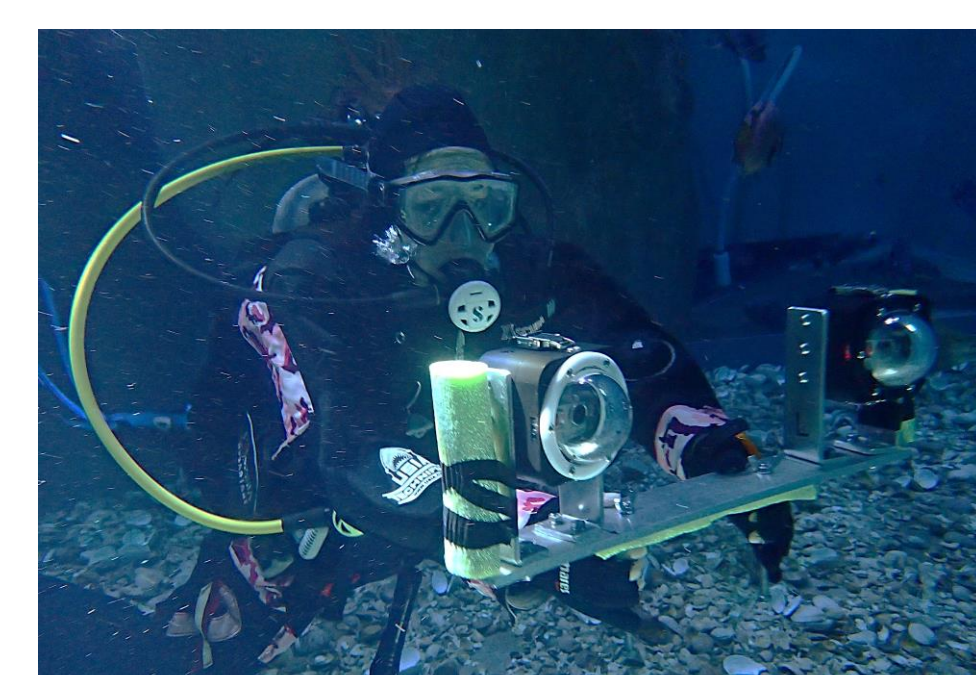
Fishes <1.5 m off center are not considered for sizing.



To minimize measurement error, only fishes within **1m** on either side of the center and not more than **5m** distance are sized.

[Survey area represented in the white polygon in the figure.]

### Next Up: Evaluating system utility in long-term ecological monitoring



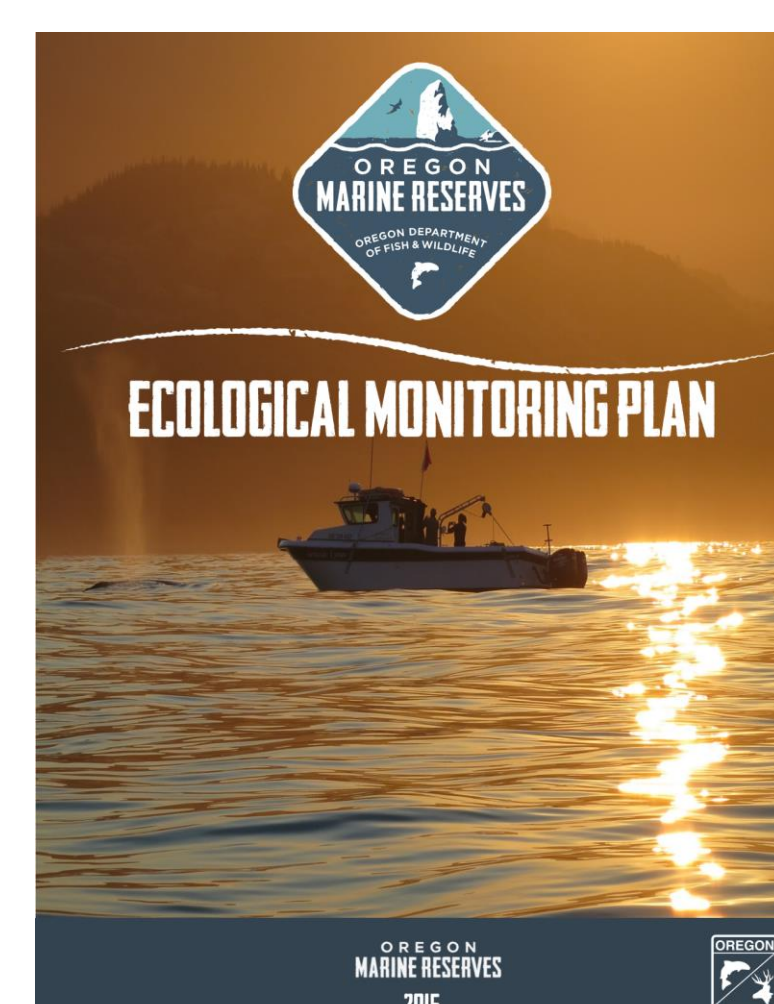
Comparison of diver fish size estimation and stereo video measurements:

- Species richness
- Abundance
- Proportion of sizable fishes observed



Incorporation of stereo technology into existing video lander surveys:

- Proportion of sizable fishes observed



Recommendations to Oregon's Marine Reserves Ecological Monitoring Plan:

- Feasibility of changing to stereo protocols
- Workload for data processing
- Incorporation of fish size data in long-term monitoring goals