Opportunistic Use of a Towed Stereo Video System

Taking Advantage of Pre-existing Platforms During Atka Mackerel Tagging Research

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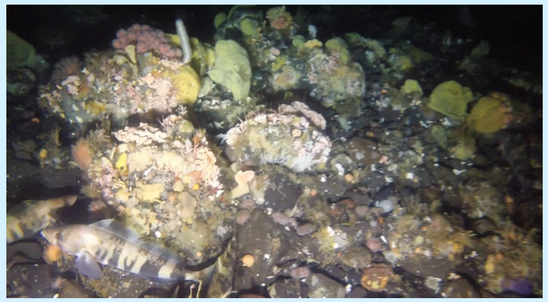


Background

We are developing stereo cameras as a tool to estimate fish density, species composition, and fish length in untrawlable grounds. Our study occurred in Atka mackerel fishing grounds inside and outside Steller sea lion trawl exclusion zones. Our study site was located near Seguam Pass in the Aleutian Islands, Alaska.

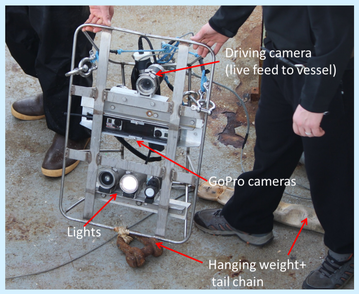
The study was conducted aboard the 220' factory trawler *Seafisher* during a NMFS Atka mackerel tag recovery charter in October 2014.

Camera design and setup

We used stereo GoPro cameras, as these can obtain low-cost accurate fish length estimates (Letessier et al 2015).

Our system included:

- Two GoPro cameras in a custom housing protected in a stainless steel cage
- Commercially available dive lights
- An analog "driving camera" that transmitted a signal to a video monitor at the surface
- A winch and cable that allowed the camera to be raised and lowered to stay near the sea floor



References

Letessier, T.B., Juhel, J-B., Vigliola, L., Meeuwig, J.J. 2015. Low-cost small action cameras in stereo generates accurate underwater measurements of fish. Journal of Experimental Marine Biology and Ecology 466: 120-126.

Williams, K., Rooper, C.N., Towler, R. 2010. Use of stereo camera systems for assessment of rockfish abundance in untrawlable areas and for recording pollock behavior during midwater trawls. Fisheries Bulletin 108: 352-362

Rooper, C.N., Martin, M.H., Butler, J.L., Jones, D.T., Zimmermann, M. 2011. Estimating species and size composition of rockfishes to verify targets in acoustic surveys of untrawlable areas. Fisheries Bulletin 110: 317-331

Acknowledgements

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The recommendations and general content presented in this poster do not necessarily represent the views or official position of the Department of Commerce, the National Oceanic and Atmospheric Administration, or the National Marine Fisheries Service

Objective

Examine the Practicality and Accuracy of a GoPro Stereo Camera System as a Sampling Tool for Atka Mackerel

1. Analyze still pictures for fish species composition, length frequency, and density.
2. Analyze video footage to quantify Atka mackerel avoidance behavior relative to the camera.

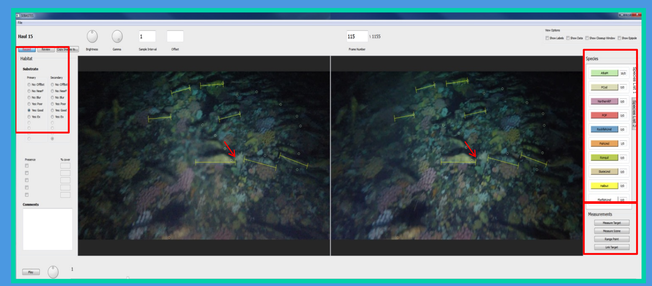


Figure 1. SEBASTES Software. Synchronized images are analyzed using options within the red boxes.

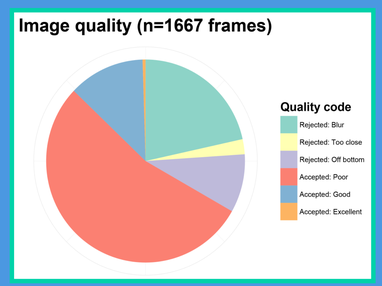


Figure 2. Image quality ratings for images analyzed with SEBASTES software . The majority of images were acceptable but of but poor quality. This may be due to insufficient lighting.

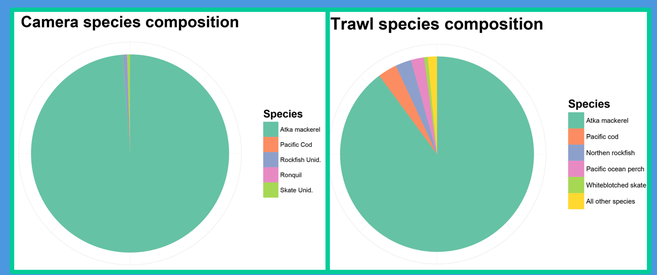


Figure 3. Species composition in camera transects compared to trawl haul. The majority of fish identified in camera transects were Atka mackerel.

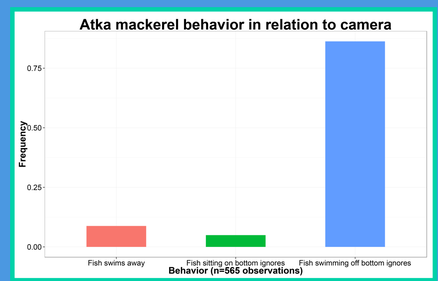


Figure 4. Frequency of Atka mackerel behavior patterns in camera transects.

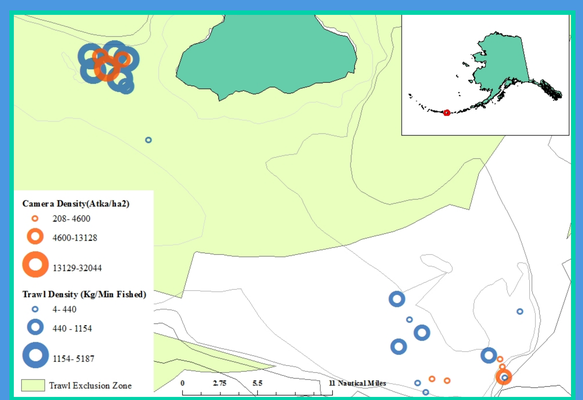


Figure 5. Relative Atka mackerel densities for camera transects (fish/ha^2) and trawl hauls (kg/min fished).

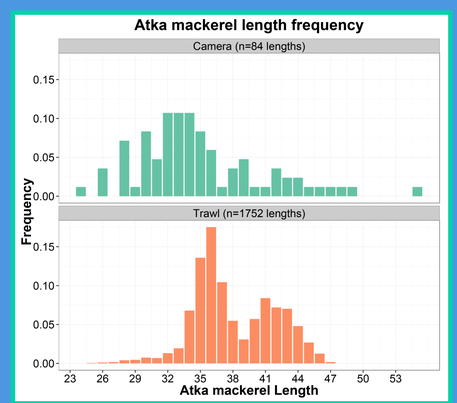
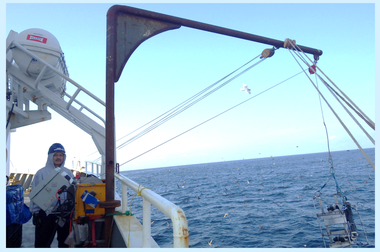


Figure 6. Atka length frequencies of camera transects and trawl hauls. The camera transect show a mode at 33 cm with fewer large fish, whereas the trawl hauls show a mode at 36 cm and a mode for larger fish at 42 cm.



Phil Dang preparing the camera system for deployment

Methods

Field collection:

- We conducted 15-minute video transects. Locations were opportunistically selected near trawl hauls

Image Analysis:

- We used synchronized videos cut into still images at 5-second intervals to avoid double-counting fish.
- Fish were counted and identified to the lowest possible taxonomic level using SEBASTES software (Williams et al 2010; Figure 1). Fish fork length was measured when possible.
- Fish behavior was categorized using custom AFSC Videologger software. Behaviors were noted at an average of every 3 seconds per video transect (n=2 transects).

Comparison with nearby trawl hauls:

- Species composition, length frequency, and density were compared between trawl and camera collections.
- Camera transect fish density was measured as fish/hectare^2 using methods described in Rooper et al 2011. Trawl catch-per-unit-effort (CPUE) was calculated as the weight of fish captured (kg) per minute fished. These measures of density are not directly comparable, so we grouped both measures into 3 relative size categories for visual comparison .
- Unidentified fish in the camera transects were extrapolated to the proportions of identified fish per transect for density estimation and species composition.

Results

- Although we obtained 1667 images from 8 camera transects, 33% could not be analyzed due to low image quality (Fig. 2).
- Camera transects did not identify to the same taxonomic level as trawl hauls and encountered fewer low-density species (Fig. 3).
- 88% of Atka mackerel appeared to ignore the camera (i.e. they did not actively swim away) (Fig. 4).
- Areas of high and low Atka mackerel density were consistently identified between camera transects and trawl hauls (Fig. 5).
- Camera transect length frequencies appear shorter than those from spatially and temporally close trawl hauls (Fig. 6).

Conclusion

We were able to conduct transects with our camera system using existing NMFS survey platforms. Our system enabled us to estimate fish density, species composition, and fish length. We then compared these estimates to those from spatially and temporally close trawl hauls.

Improved image quality will be necessary for more precise species identification from our camera system. Fish density trends were consistent between camera and trawl methods. However, fish lengths were underestimated in our camera transects.