Using triggered cameras to determine fish behavior in rocky, untrawlable areas

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Background
In Alaska, rockfish assessments rely on abundance indices derived from bottom trawl surveys. Because rockfishes tend to inhabit rocky, rugged areas, and thus untrawlable areas, bottom trawl indices of rockfish abundance can be biased and imprecise. Optical-acoustic surveys for semi-pelagic species hold promise for producing abundance indices from these untrawlable areas, but the response of rockfish to optical samplers and survey vessels must be accounted for. Acoustic measurements are limited by the inability to see fish near the bottom, and the proportion of fishes that are limited by the inability to see fish near the bottom, and the proportion of fishes that are limited by the inability to see fish near the bottom, and the proportion of fishes that are.

Objectives
Conduct multiple, 12-hr. deployments of motion-triggered cameras in a rocky reef during day and night. Observe density and vertical distributions of fishes thought a diel cycle. Determine what proportion of fish of different species cannot be sampled by acoustics because they are near or on-bottom.

Study Area
Zhemchug Ridges, Eastern Bering Sea, July 2014

Methods
Triggered camera systems
- Cameras were designed to take a picture when animals are present. After image is taken system waits 5 minutes before checking for fish presence
- Low cost consumer grade stereo cameras
- Red strobe (trigger evaluation) and white strobe (image collection) arrays
- Standard Dungeness crab commercial rig (line, buoy, pot puller)
- Sacrificial deployment base

Image processing
- Used Sebastes stereo analysis software (Williams & Towler)
- Fish identified, measured, and counted in each image pair

Stereo data analysis
- Height off the seafloor was determined by projecting a 3-D bottom profile onto the image

Results
758 image frames analyzed, resulting in 4283 targets, 713 of which were measured

Fish species observed
- Most numerous category was unidentified Rockfishes (Fish were identifiable to about 2.5 m from the camera)
- Of identifiable fish, Northern Rockfish and Cod were the most numerous
- The majority of observations came from two units (# 2 and 3) indicating uneven fish distribution on the ridge

Diurnal pattern
- Three activity modes were detected, at sunrise, early-morning, and early afternoon
- Fish composition changed throughout out the day, overall maximum density was observed 2.5 hours after sunrise.

Length of rockfish analyzed
- Mean fish sizes in images were smaller than trawl data from surrounding areas for all species except Cod
- Fish were identifiable to about 2.5 m

Fish density relative to camera location
- Example analysis for Northern Rockfish shows diversity of distributions observed at different cameras/stations
- Fish detected out to a range of 4.5 m

Conclusions
- Triggered stationary stereo cameras provide a range of information on fish behavior and distribution despite small sampling volumes
- Fish exhibited strong species-specific diel patterns in density
- Highest densities of fish observed are likely within the acoustic “dead zone”
- The scale of vertical fish migration seen in acoustic data was not as apparent in image based density estimates
- Peaks in camera fish density may line up with minimum acoustic density – multiple acoustic passes would be required to confirm

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