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SeeStar:

A Multi-Purpose, Modular, Underwater Imaging System

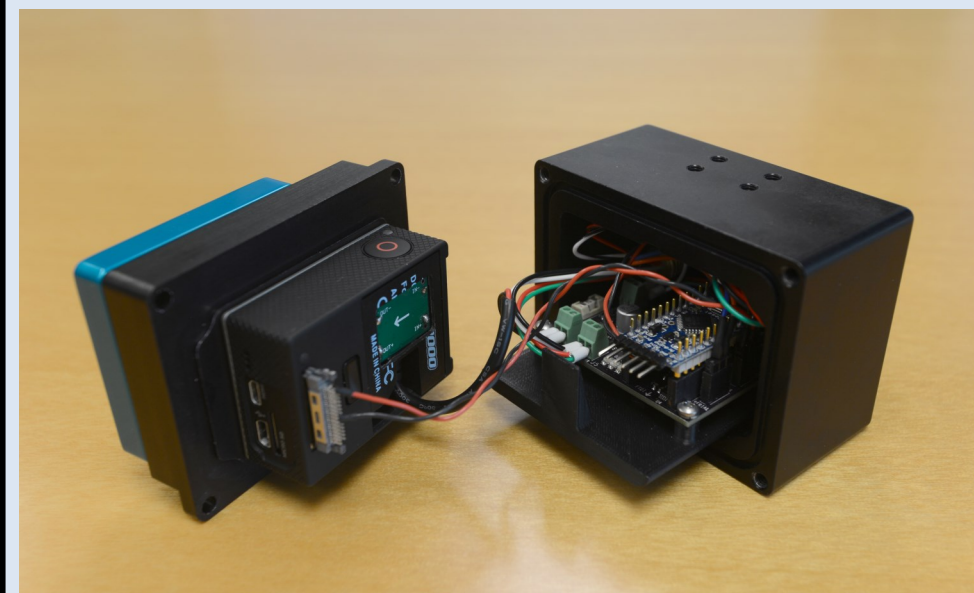
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Danelle Cline, Steven H.D. Haddock

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What is SeeStar?

- Multi-platform imaging system
- GoPro Hero 3/3+
- Low cost (<\$3000)
- Easy to fabricate / operate
- Open source design
- Easily adaptable
- Depth rating: 300m or 1500m
- Able to resolve 10cm targets at 1m target distance
- Rechargeable battery good for 2900 images (4500mAh)
- Autonomous or tethered operation



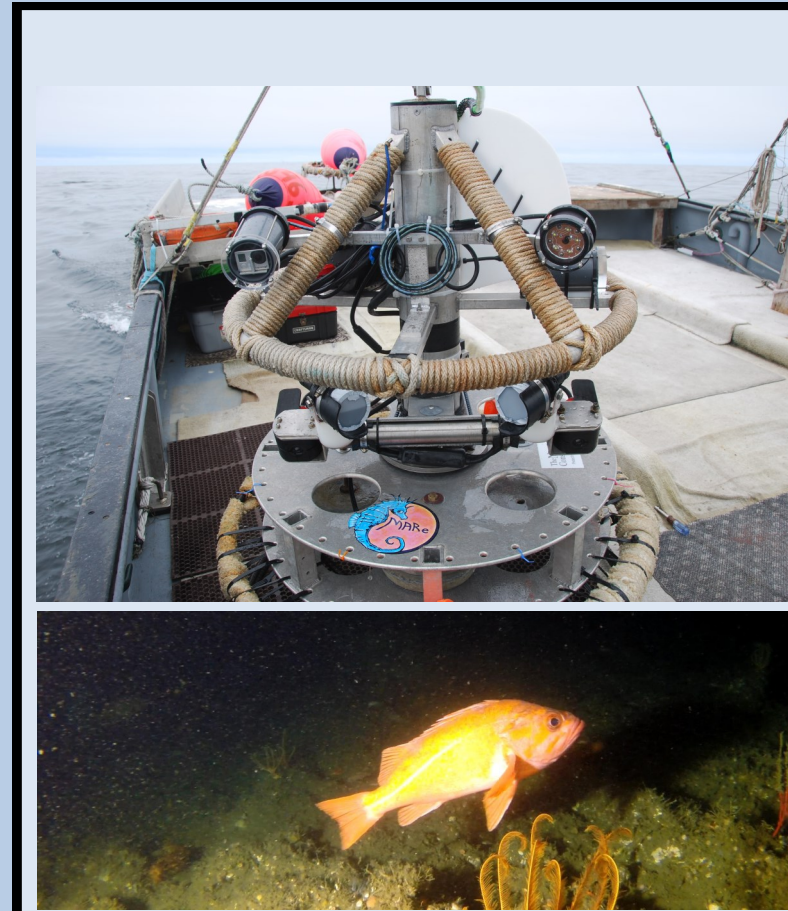
- Still images or video
- Lighting: 2000 or 3700 lumens
- V1.0 released in 2014
- V2.0 to be released in 3Q 2015
- V2.0 based on Arduino Pro-Mini

California Wetfish Producers Association



The California Wetfish Producers Association has deployed a SeeStar system to locate and track the growth of squid eggs on the seafloor and squid larvae in the water column.

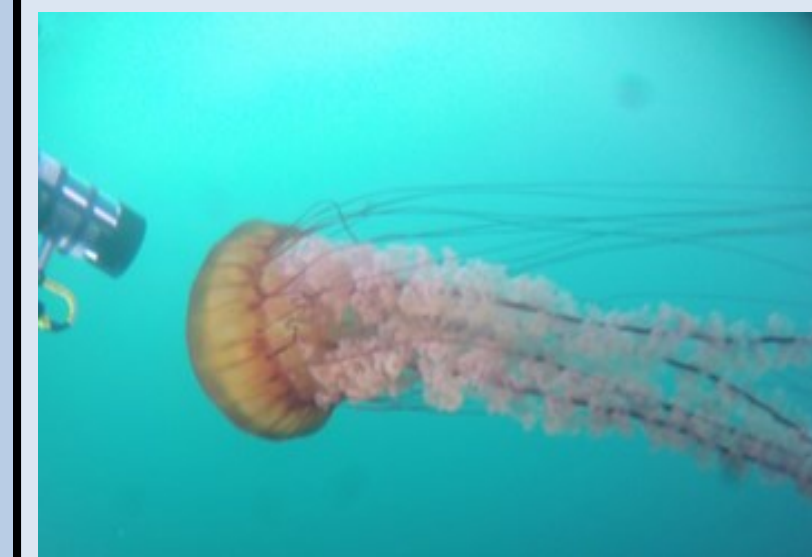
The Nature Conservancy



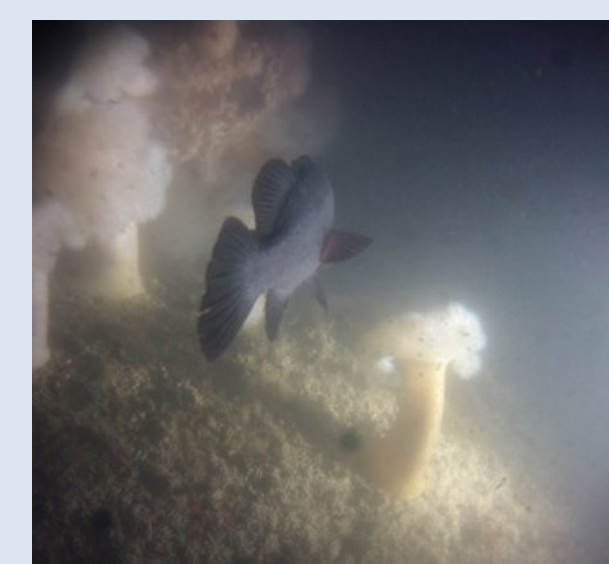
As members of a multi-organizational effort, Mary Gleason of The Nature Conservancy, Rick Starr of MLML, and Tim Maricich of the F/V Donna Kathleen are evaluating a SeeStar system with the intention of incorporating it into their instrumentation suite. They are interested in gathering density, size, and habitat-association data for rockfish and other demersal fish (eg. Lingcod). The initial thrust of their study is on the overfished species in fishery closure areas in federal water, specifically the Rockfish Conservation Area. In the future, similar surveys could be conducted in the state marine protected areas.

Engineering Tests

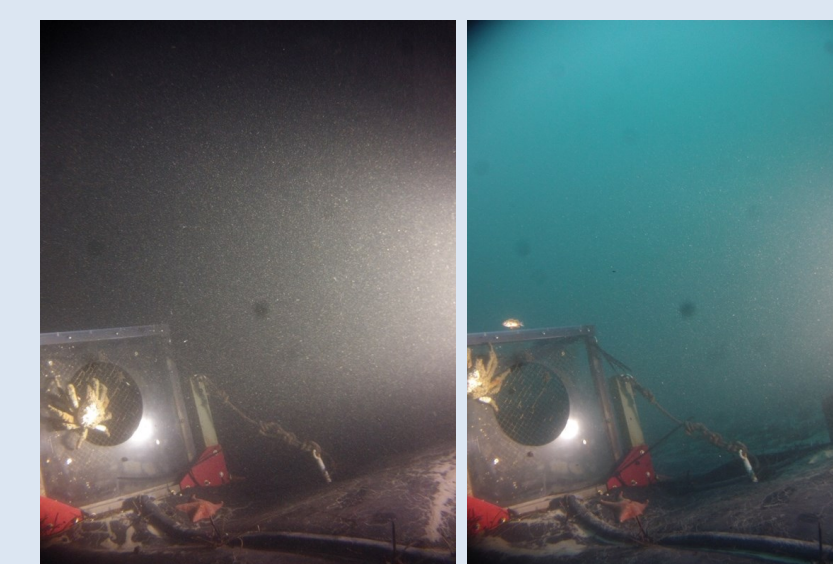
Our initial deployments were focused on verifying that SeeStar met all of our original functional requirements. SeeStar was mounted onto ROV Ventana's midwater tool sled and taken to its maximum operational depth of 300m. SeeStar was also mounted to a simple horizontal bar and deployed to various sites in Monterey Bay including the swFOCE site at Hopkins Marine Station and an abandoned discharge pipe in Moss Landing.



ROV Ventana

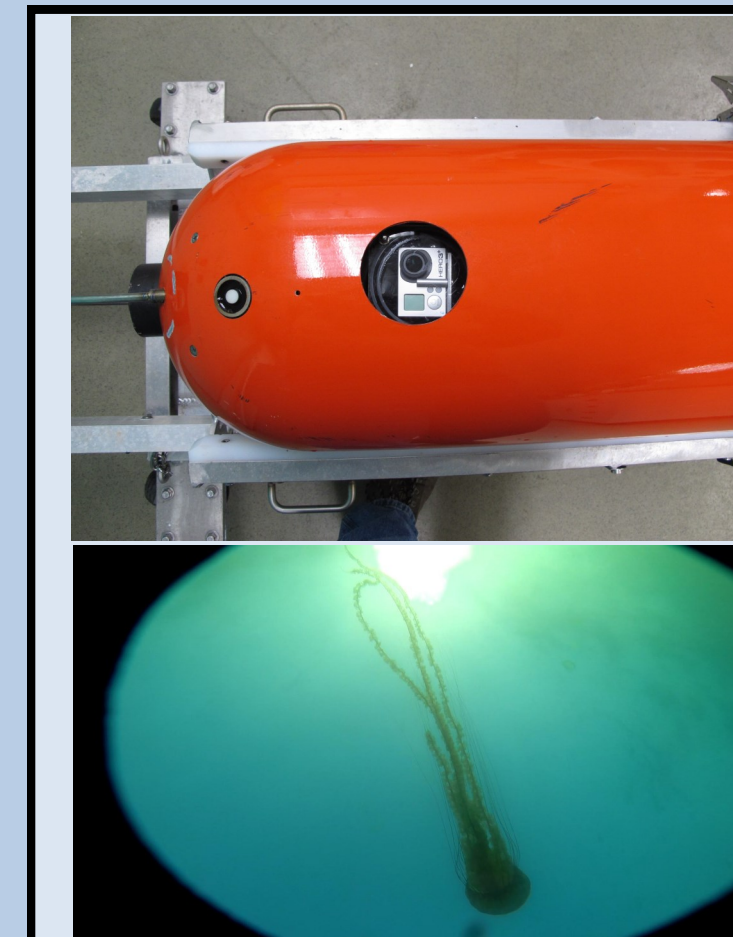


Moss Landing



swFOCE site at HMS

AUV Daphne



A SeeStar system has been integrated onto the Tethys class of AUVs and has been utilized on a number of deployments. In this configuration, SeeStar is tethered to the vehicle. SeeStar is then powered from the vehicle's battery and is controlled by the vehicle's computer, which can trigger the camera as needed. In 2013, SeeStar captured video of the Wave Glider while Daphne was actively tracking it. More recently, SeeStar has been used for zooplankton (eg. Jellyfish) recording as the suite of standard sensors cannot detect these animals.

Wave Glider



In 2015 we plan to deploy a SeeStar system on the Liquid Robotics Wave Glider. Because of the Wave Glider's range and duration, this is the perfect platform to test the long term deployed behavior of SeeStar.

Antarctica Deployment



Stacy Kim of MLML deployed two SeeStar systems in Antarctica in late 2014 to help her study the benthic ecology of two locations near McMurdo Station. Both sites are located under 1 to 2 meters of sea ice and have never been photographed. The first location at Mystery peak is in 40 meters of water and both systems were deployed for 1 month, each taking an image every 20 minutes. The second location, between Tent Island and the Erebus Glacier Tongue, is in 200 meters of water. Both SeeStar systems were again deployed in this location, this time with extended primary lithium battery packs, allowing them to take an image every 20 minutes for 3 months.

