

Demonstration of an Autonomous Glider Red Grouper Observing Utility Program - DAGROUP

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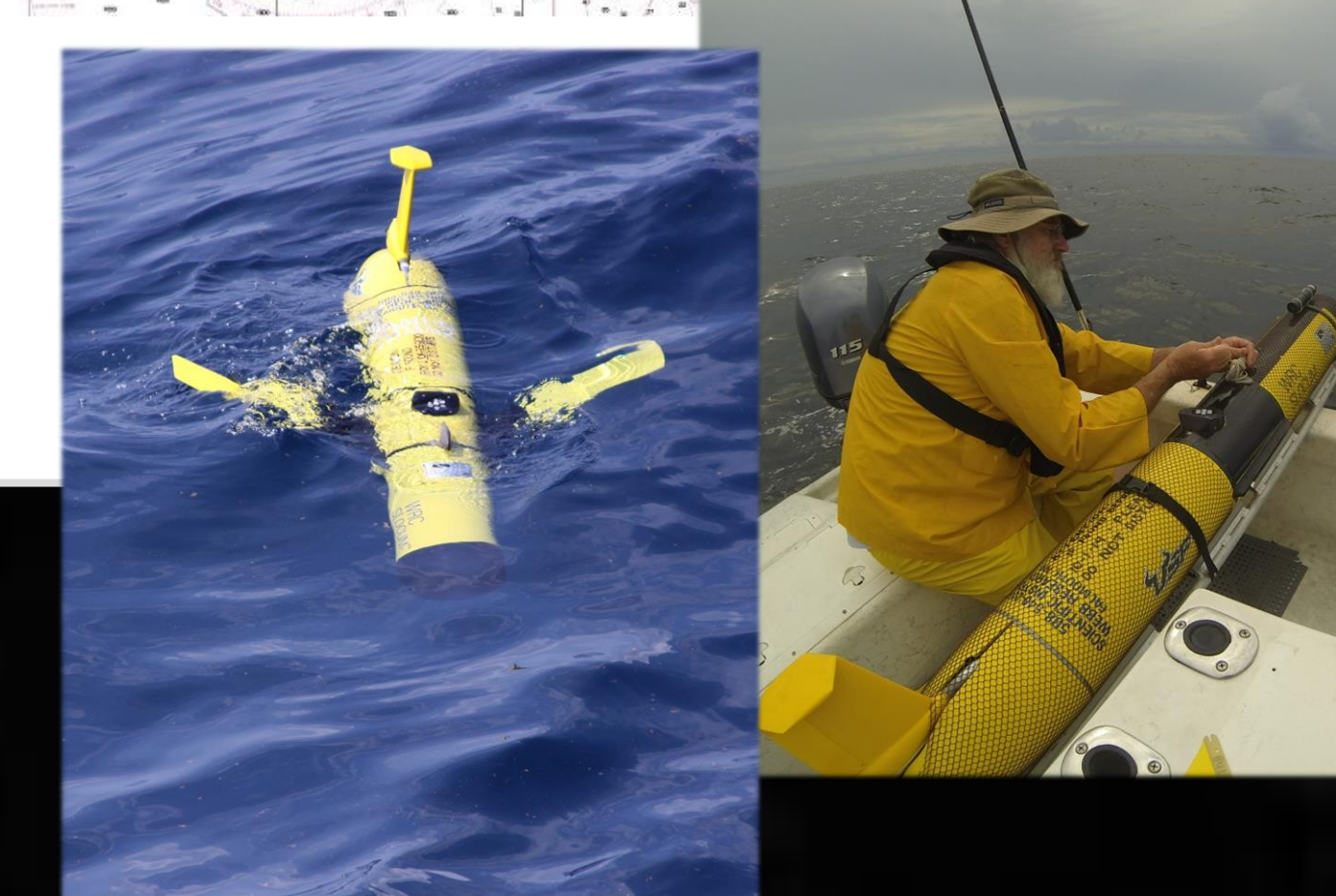
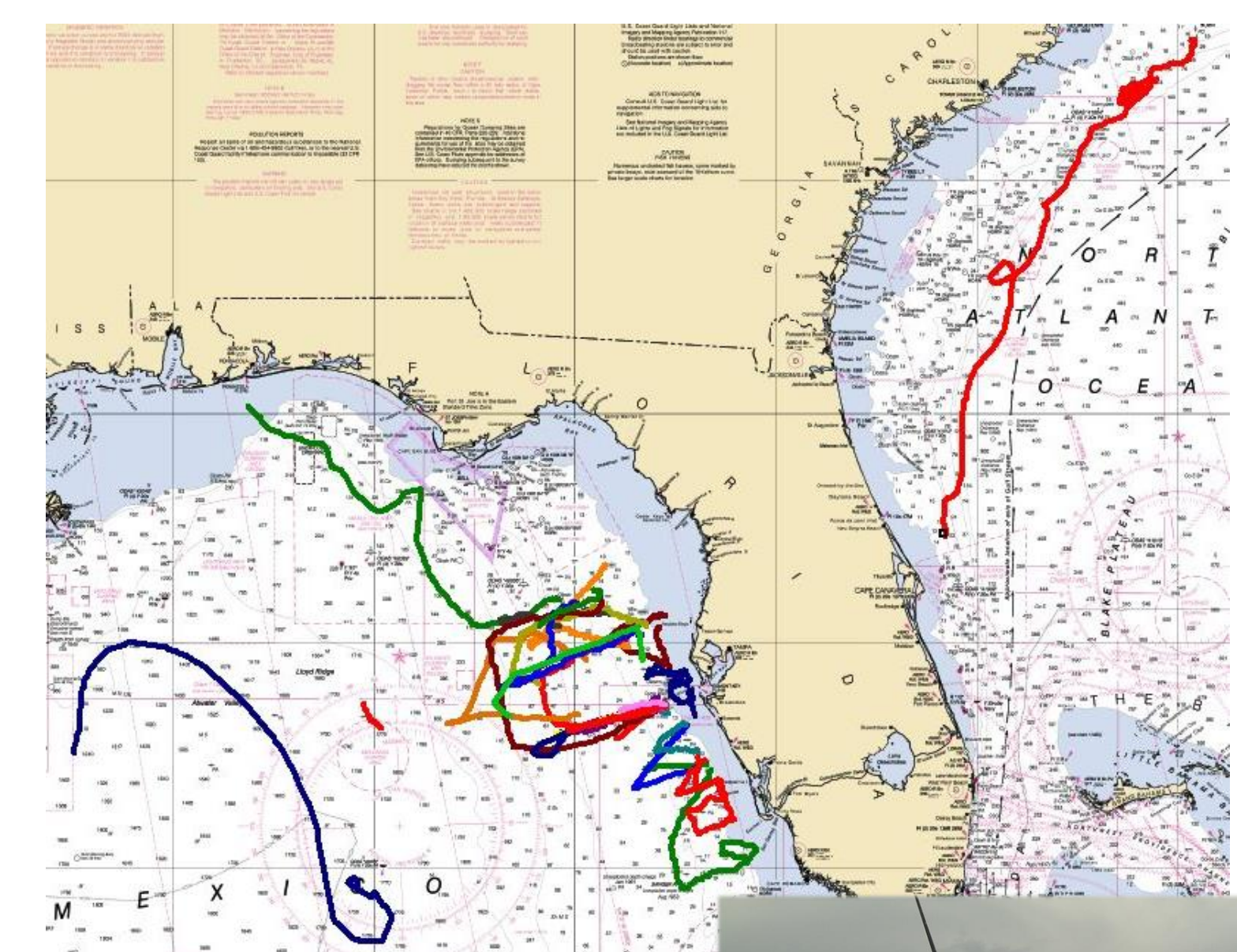
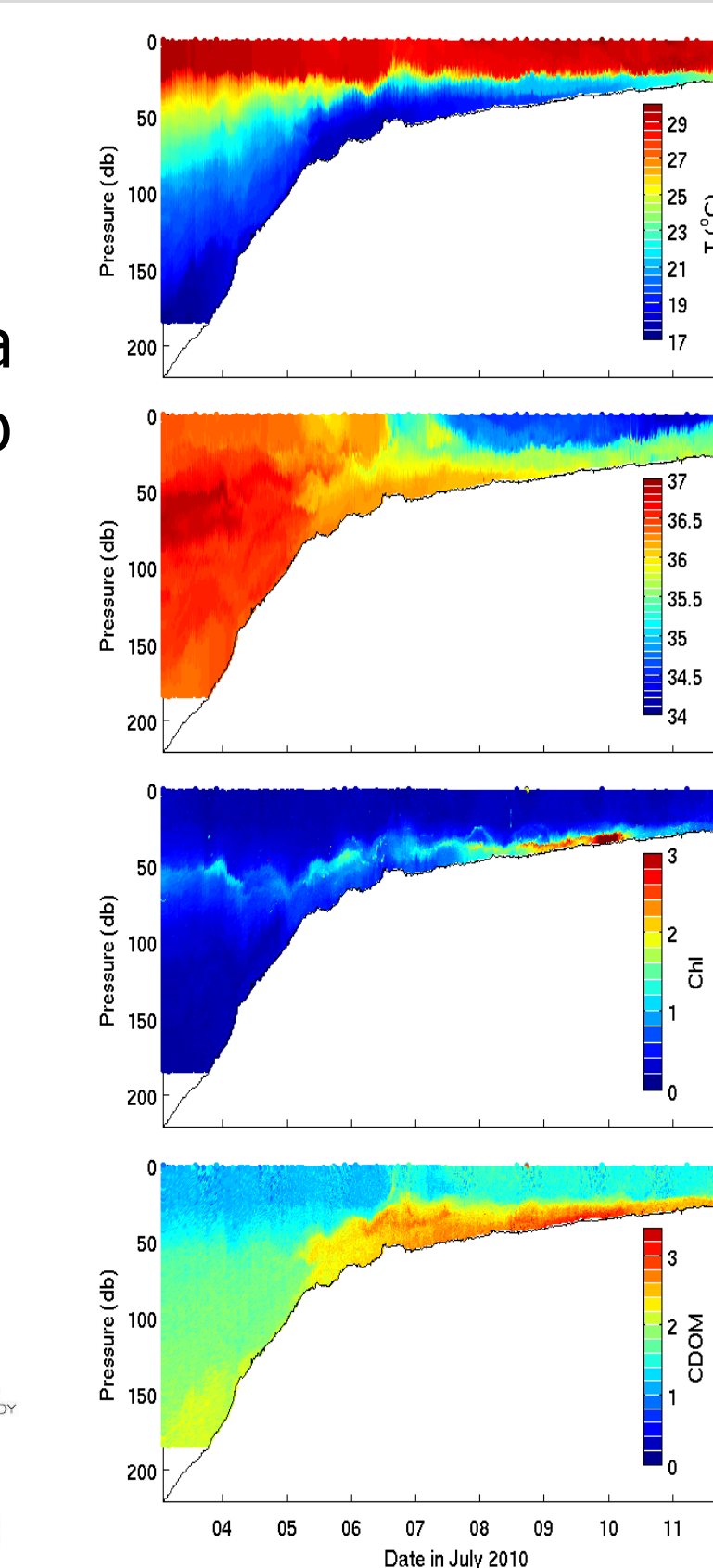
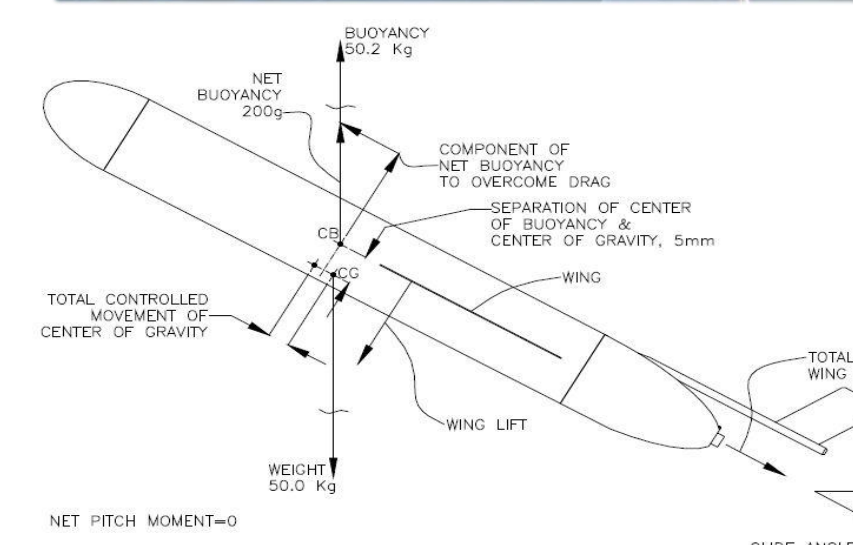
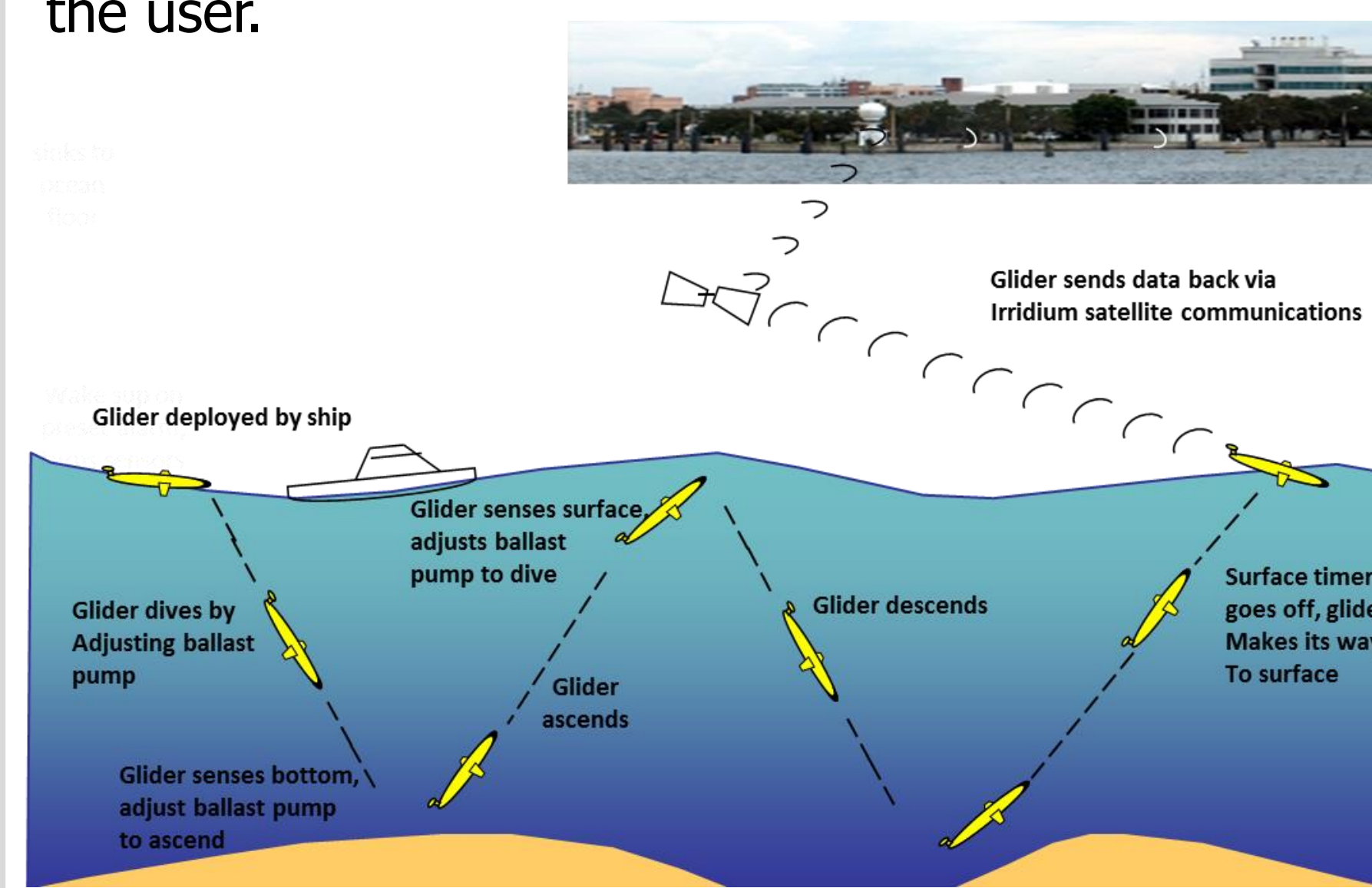


Summary

This effort will use cutting edge ocean observing underwater gliders equipped to record water quality variables and fish locations and behaviors. The demonstration will focus on Red Grouper over a seasonal sampling plan within a study area comprising the Gulfstream Natural Gas Pipeline on the West Florida Shelf. Red grouper comprise a large and economically important fishery in the Gulf of Mexico. A key data need for their management is to accurately assess their distribution and how it interacts with fishing pressure to affect the ratio of males to females and productivity. Underwater gliders have demonstrated for over a decade their ability to deliver cost effective data useful for better understanding of the water column structure and its impact on numerous processes such as circulation modeling, harmful algal blooms, hypoxia, and contaminant transport. These water column variables and processes are all relevant to fisheries monitoring, but new technological incorporations to these platforms including acoustic tag receivers, passive acoustic recorders, and echosounders will provide even more data applicable to the assessment of fish ecology.

Underwater Gliders

Underwater gliders are robots capable of autonomously patrolling the ocean for weeks to months at a time. They profile the water column by sinking and floating repeatedly and produce propulsion with wings. While they profile, they collect data about the water column nearly continuously, and periodically send this data back to the user.



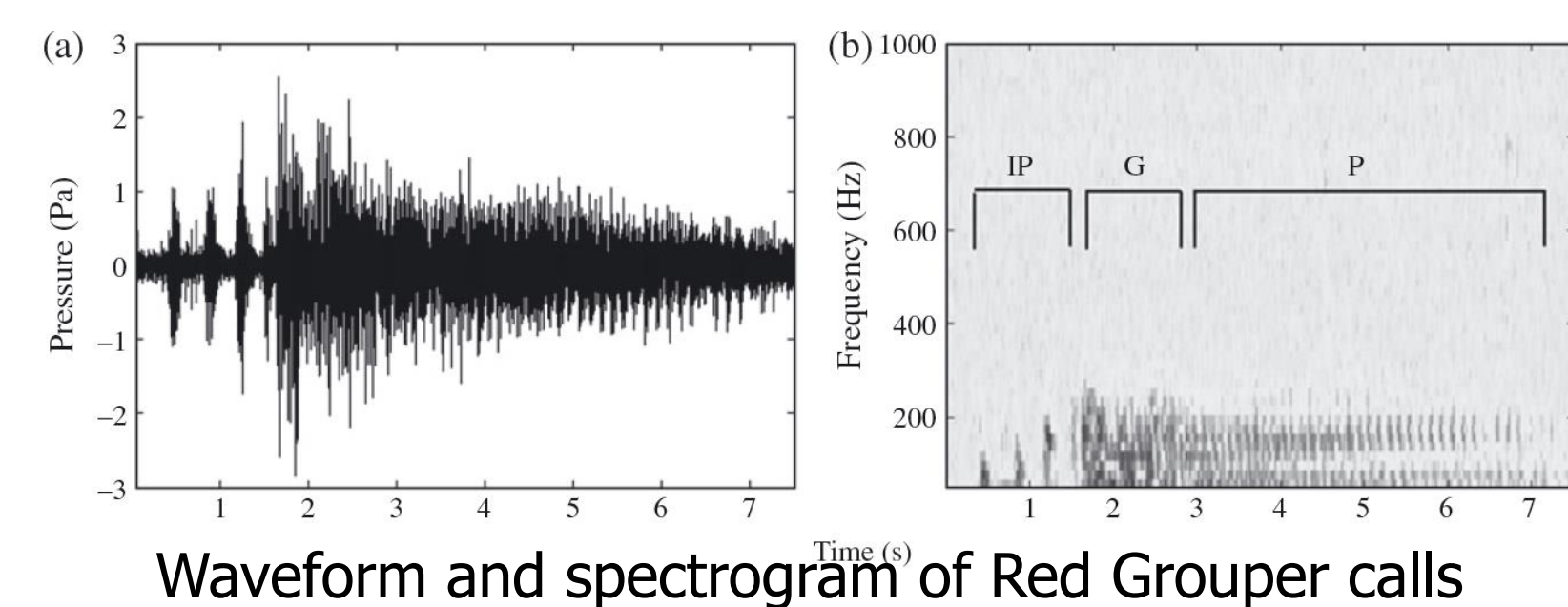
Can robots collect data helpful to stock assessment managers?
We will integrate three acoustic technologies to map and assess Red Grouper populations

Passive Acoustic Monitoring of Fish

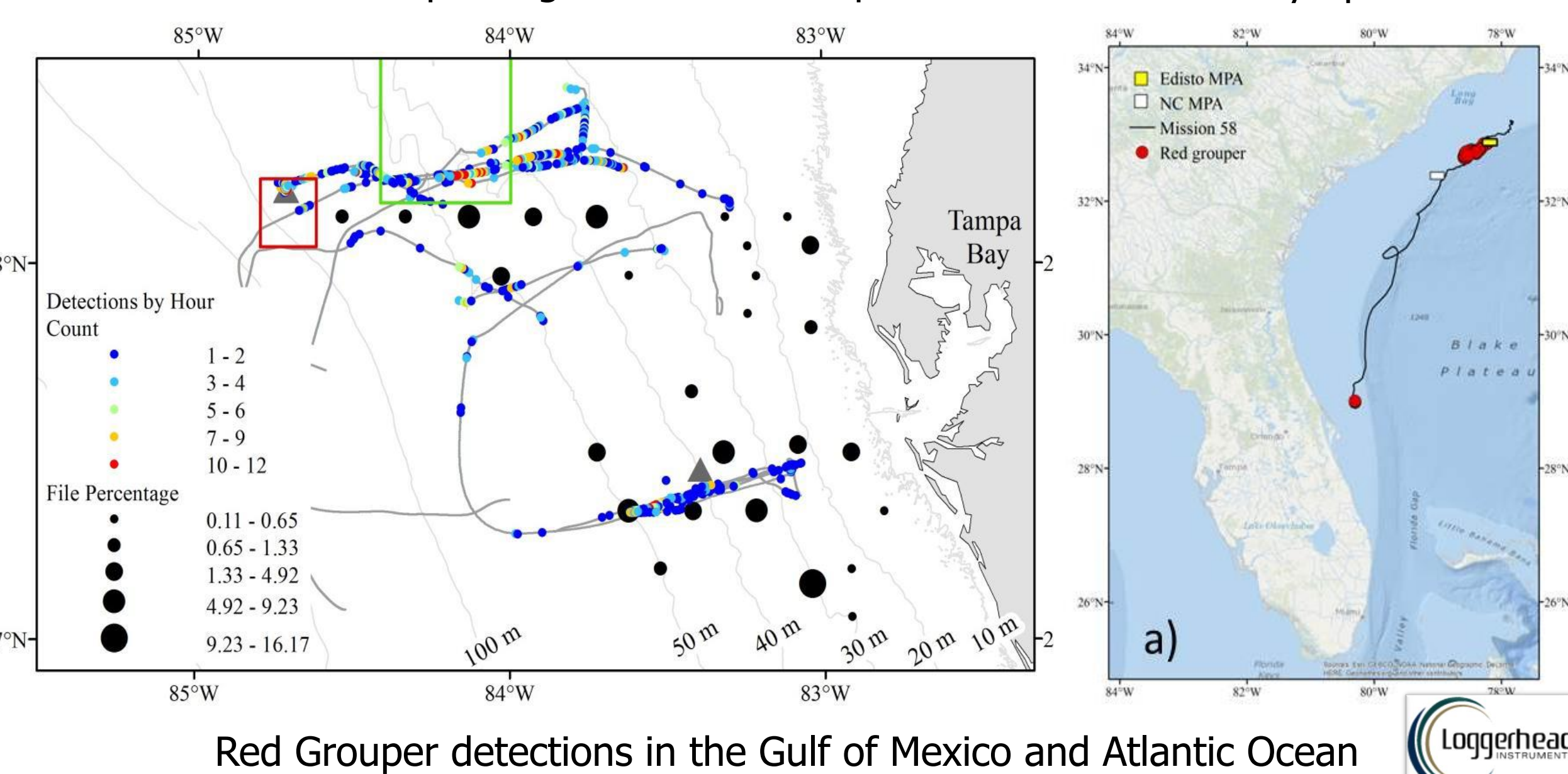
Soniferous fish such as red grouper make distinctive calls and have successfully been mapped in the Gulf of Mexico and along the southeastern Atlantic coast.



Glider mounted hydrophone



Waveform and spectrogram of Red Grouper calls



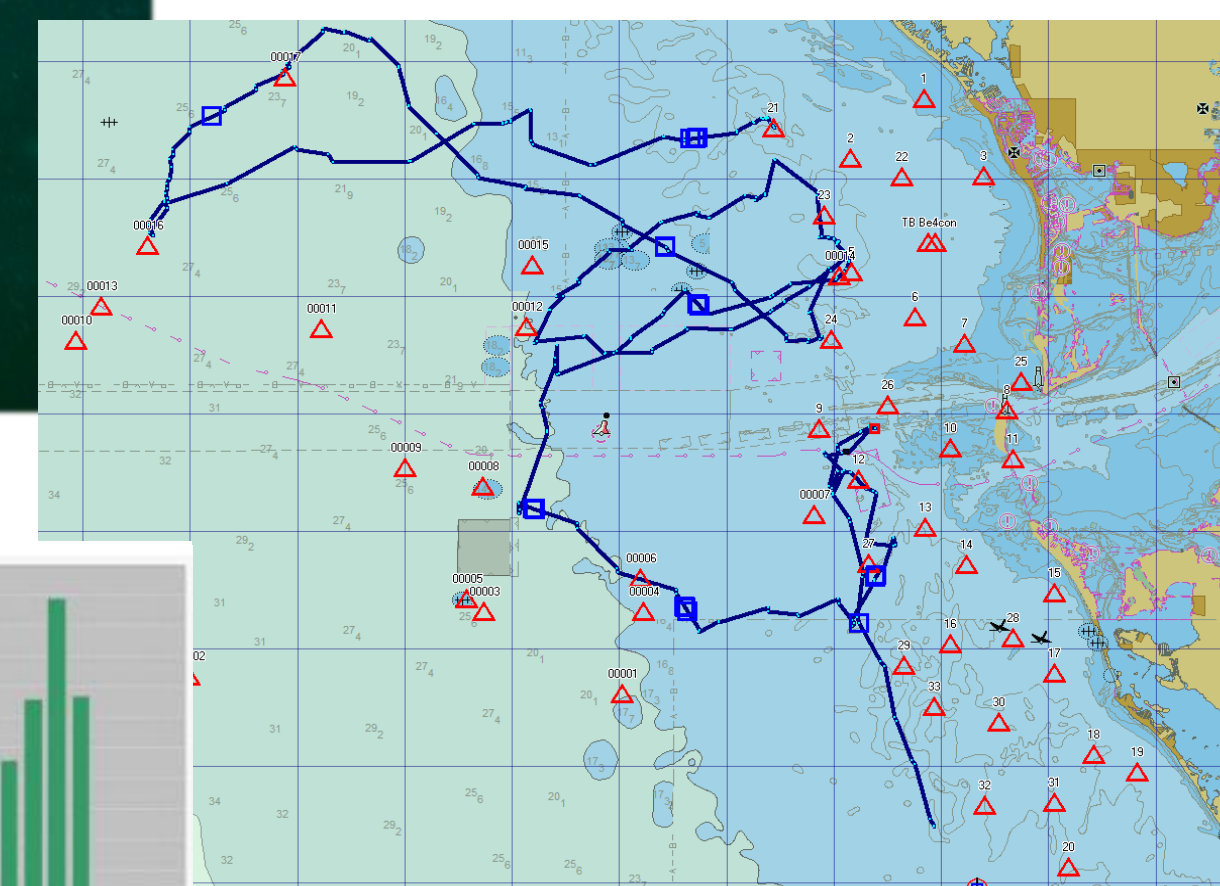
Red Grouper detections in the Gulf of Mexico and Atlantic Ocean

Acoustic Tag Telemetry of Fish

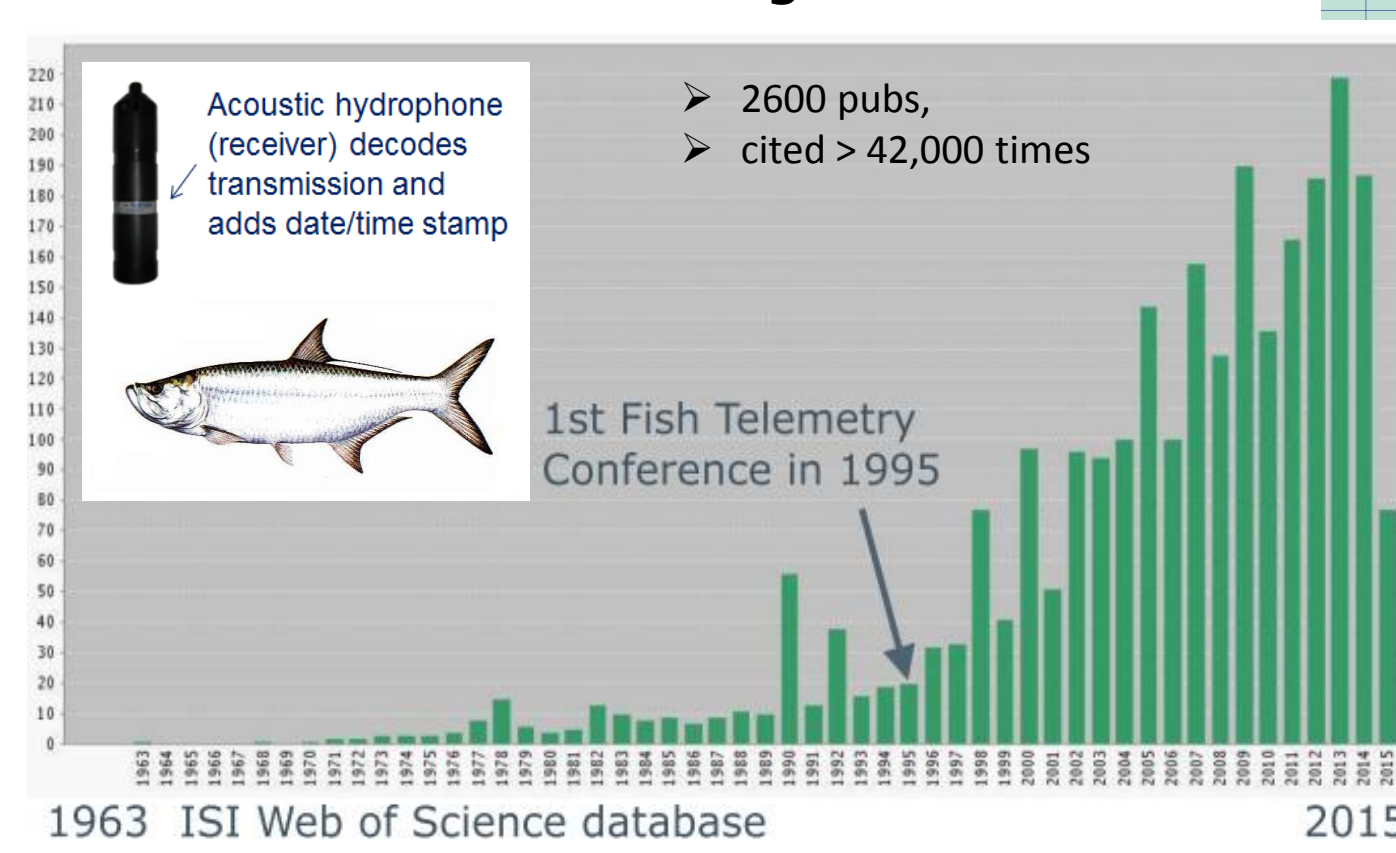


Glider mounted tag receiver

Fish tagged with acoustic tags that act as a beacon can be detected and tracked by receivers, providing new insight into the movements and ecology of many species.



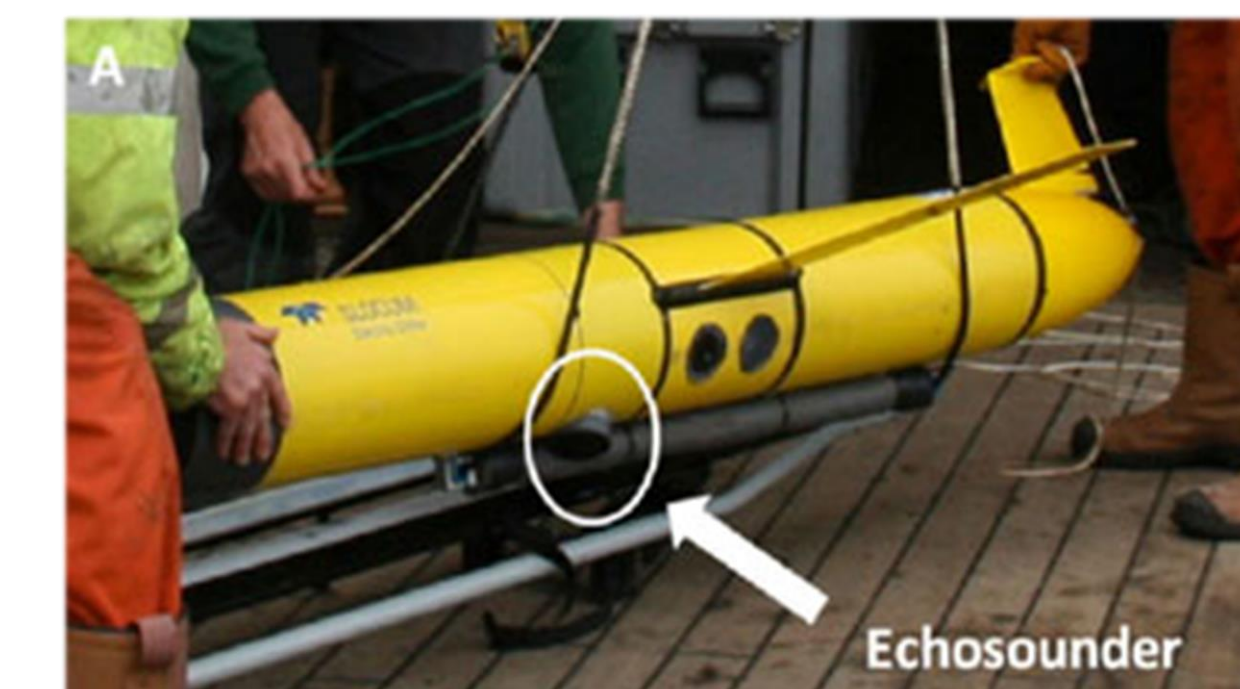
Stationary tag receivers (red) and glider based tag receiver in use to track Red Drum off of Tampa Bay



Growth in the use of acoustic telemetry tags

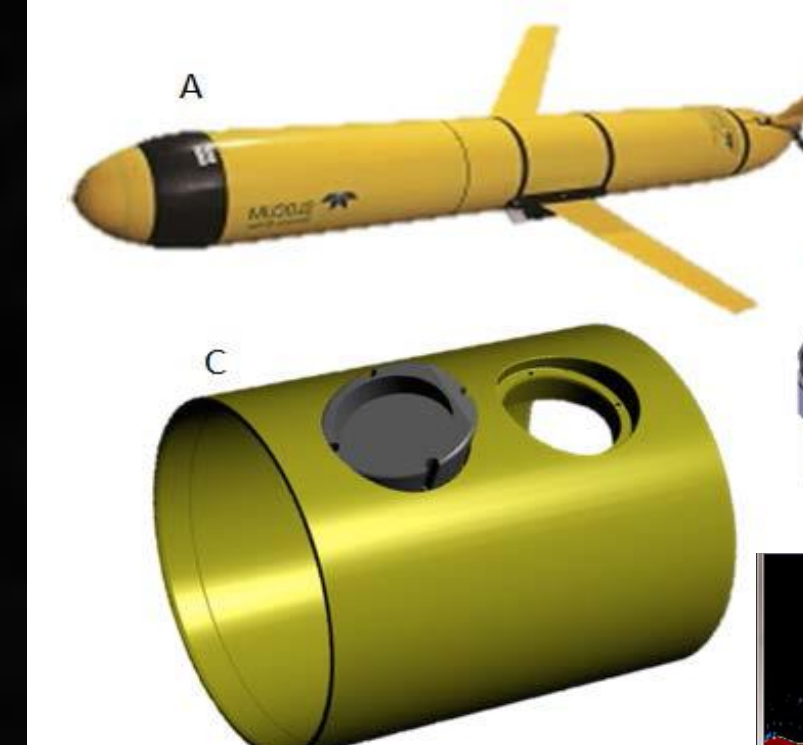
Echosounders on Gliders

Echosounders are high resolution sonars capable of detecting water column biomass and even individual fish.

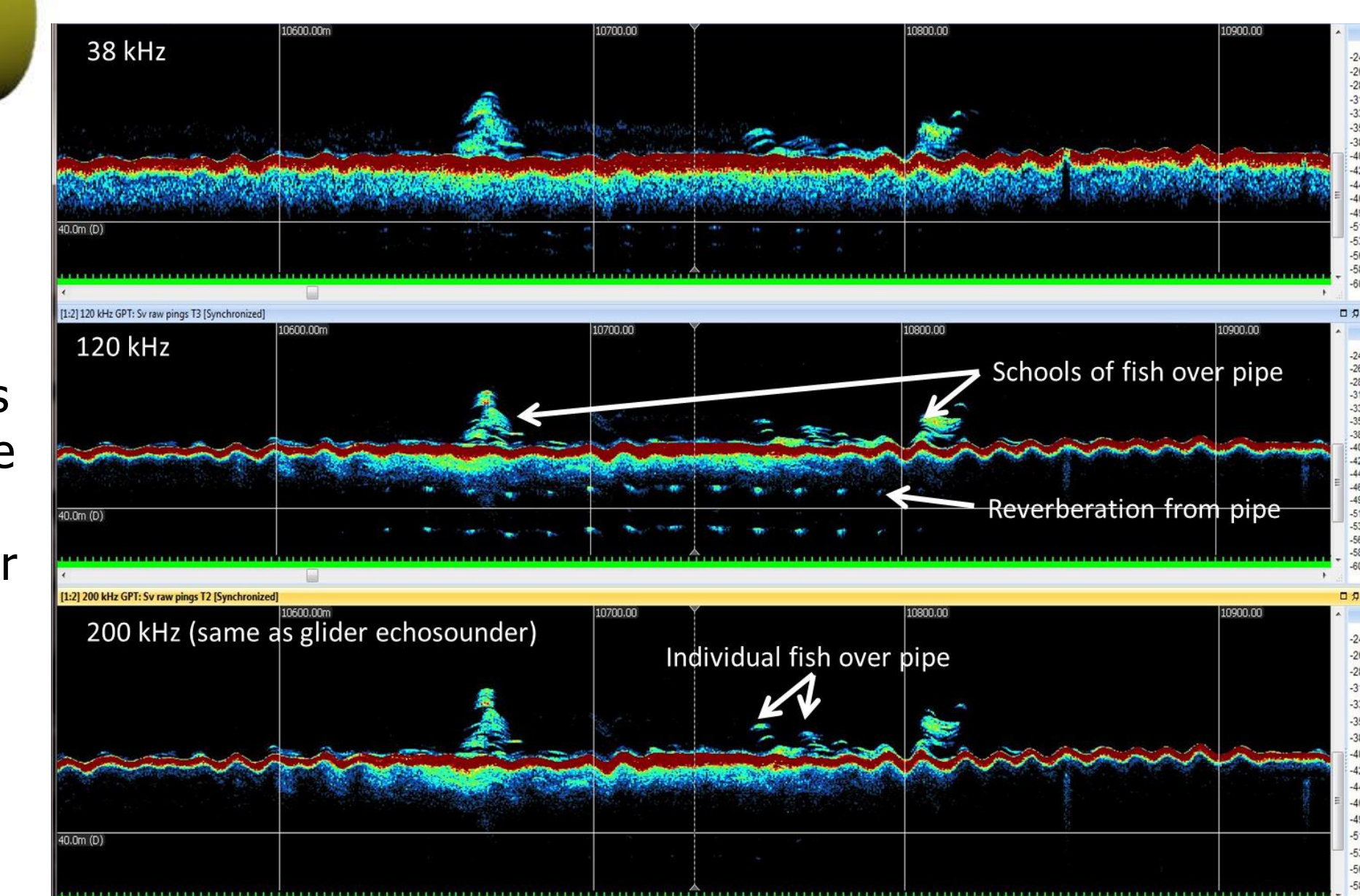
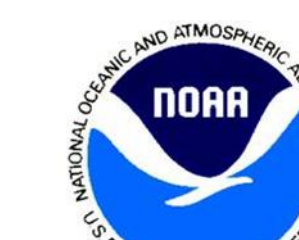


Methods in Oceanography Suberg, L., 2014. DOI: 10.1016/j.mio.2014.06.002

Glider mounted echosounder



Multifrequency Echosounder Surveys of Gulfstream Pipeline demonstrating the capability of the sonar to detect both fish and structure



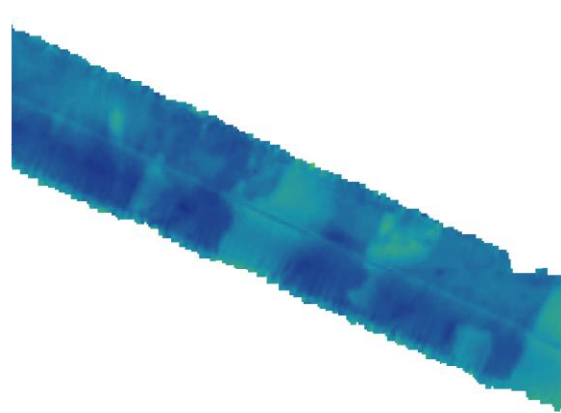
METHODS

- Define a test-bed along the Gulfstream Natural Gas Pipeline using bathymetry maps, past video surveys, and local fisheries knowledge.
- Tag a bunch of Red Grouper
- Deploy an array of stationary acoustically released telemetry receivers and passive acoustic recorders within test range.
- Monitor the region with the glider for a year.
- Periodically sample portions of the transect with shipboard sonars.

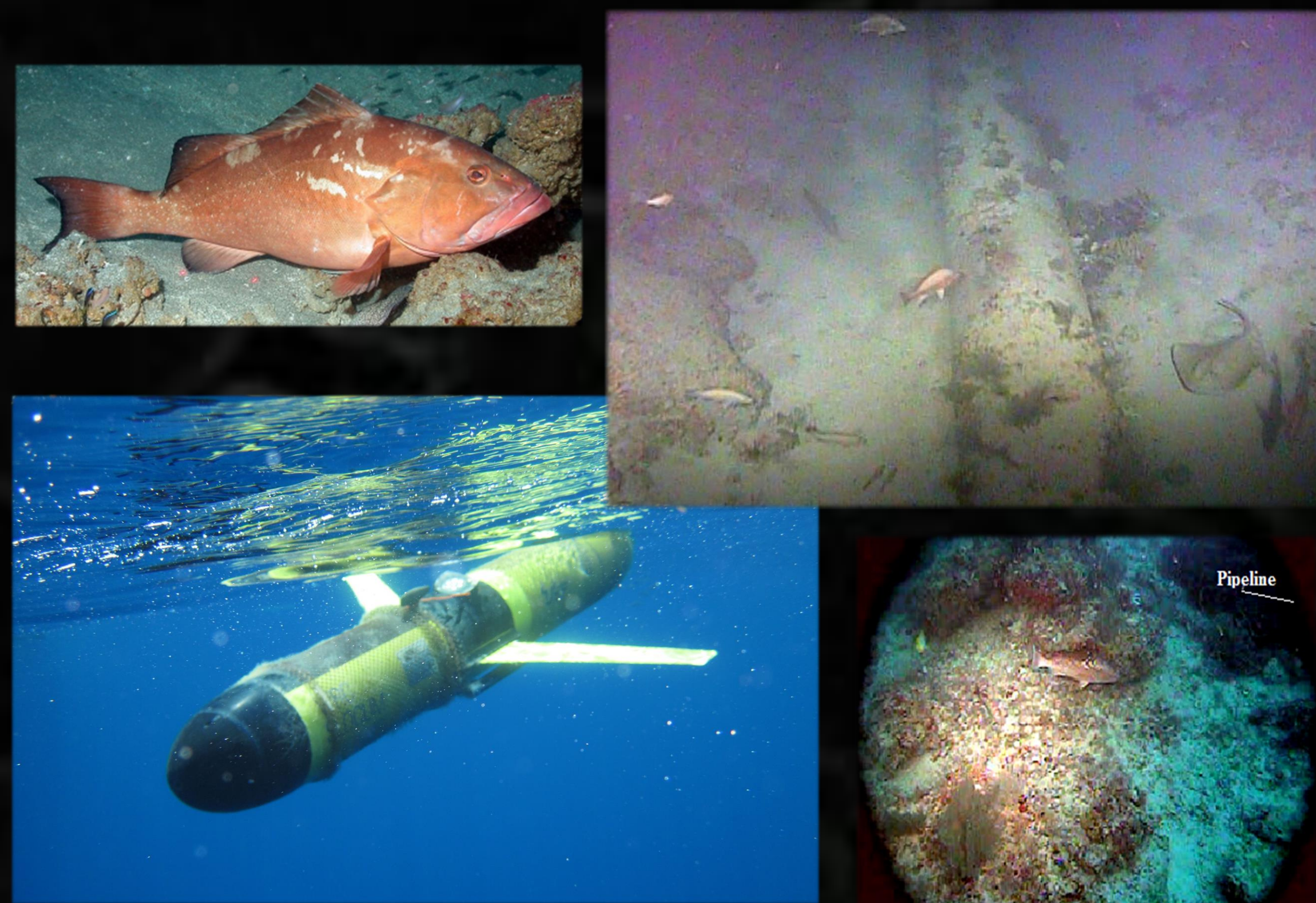


Glider and tagging operations map (above)

Fish tagging surgery (right)



Bathymetry map of a portion of the GNG Pipeline



What Might We Learn?

- How do the glider and fixed receiver detections compare?
- How do the spatial distributions from the three data sources (tagged fish, fish making courtship calls, fish mapped using the echosounder) compare?
- Do red grouper exhibit site fidelity or migration?
- Does red grouper distribution vary temporally?
- Can cost correlations across spatial and temporal scales be compared?
- Can variations in distribution correspond to environmental data? (ChlA, Dissolved Oxygen, Temperature, Circulation)
- Can robots collect data helpful to stock assessment managers?***

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