A CTD-tag to determine physical microstructure use by marine predators

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Introduction

Marine predators rely entirely on the sea for their food source, which is in turn, highly influenced by oceanic patterns. As the climate changes so does the physical features of the oceans. Therefore, the study of fine-scale linkages between foraging behavior and the physical microstructure are key for understanding the effects of climate change on predators. Such studies can help to define the importance of physical water mass features, such as frontal systems, currents, eddies, or ice edges, to the distribution and abundance of marine predators. Biologgers attached to animals have the potential to capture glimpses of this intricate relationship between predator, prey and hydrological conditions.

We are developing a low-cost multi-sensor biologger that is small enough to attach to small to medium sized predators and is capable of measuring **conductivity, temperature, depth, salinity, acceleration, compass direction, magnetometry, light and GPS location.**

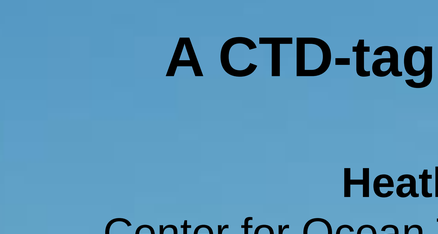


Figure 1. Potential marine predators for the biologger: Magellanic & Adelie penguins.

Materials and methods

Biologger features

- 100 x 44 x 20 mm & 100 g
- Wireless communication
- Rechargeable battery
- 1 GB flash memory
- Module circuit boards
  - Reconfigurable sizes & shapes
  - Additional sensors

Figure 2. Circuit board stacks for two different biologger configurations.

Incorporated in the biologger is a novel CTD sensor board and several commercially available micro-sensors. **Figure 3** shows a packaged biologger with the 8 independent sensors.

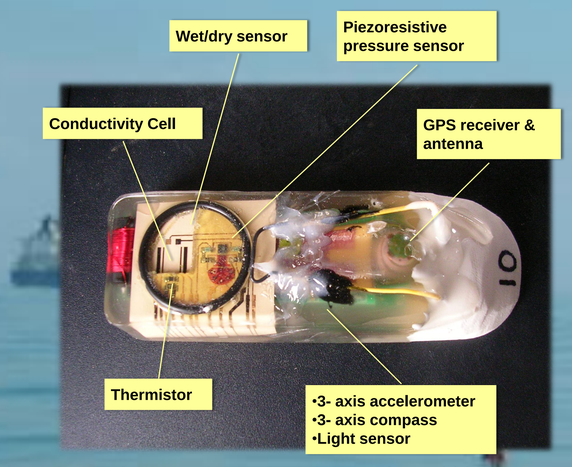


Figure 3. An underwater packaged biologger.

Initial field tests were conducted with a biologger attached to a Bottom Stationing Ocean Profiler (BSOP) which is an autonomous, free drifting vertical profiling vehicle developed at USF COT. The BSOP is equipped with a commercial CTD and records measurements during the ascents and descents. The biologger was programmed to sample CTD every 2.5 seconds while submerged and acquire GPS location data every 30 minutes during surface intervals.

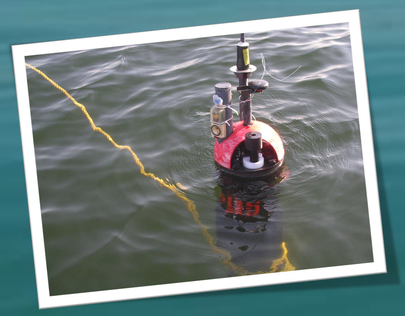


Figure 4. A biologger attached to a surfaced BSOP..

The biologger was turned on at the boat dock then transported by boat to the BSOP in the harbor. Once deployed the instruments completed 2 floating and sinking cycles and then the biologger was removed and transported back to the boat dock.

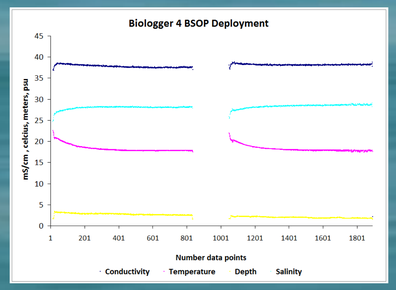
Results

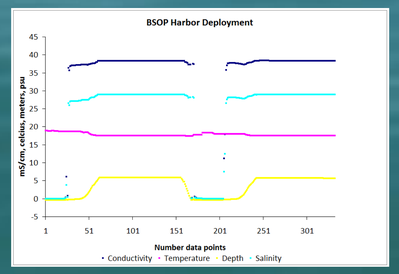
GPS location and CTD measurements were recorded for both instruments.

The biologger had 4 GPS locks during the experiment and are shown in **Figure 5**. Two of the locks were in transit and 2 were on the BSOP. Also shown are the concurrent GPS locations from the BSOP.

Figure 5. A Google Earth image of the GPS coordinates captured by the biologger during the BSOP deployment.

The conductivity, temperature, depth and salinity data from the 2 instruments were plotted and are shown in **Figures 6 & 7.**





Figures 6 & 7. Measured CTD & calculated salinity data for the biologger (top) and BSOP (bottom).

Conclusions

We are developing a low-cost, miniature, multi-sensor biologger for use on marine predators. We have constructed, packaged and conducted initial field tests on the first prototype using a BSOP instrument as a vehicle. Initial results showed that the GPS location data of the 2 instruments were within meters of each other. The biologger conductivity and temperature data resembled the BSOP, but the depth data revealed the biologger pressure sensor was not as sensitive (incorrect compensation resistor).

These initial results show the potential for the low-cost biologger to capture not only significant physical and behavioral data , but also ecological and environmental data if attached to marine predators such as sharks, seals, tuna, manatees, turtles and cetaceans.

Literature cited

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Acknowledgments

We thank P. Dee Boersma and Bill Fraser for penguin information, Chad Lembke , Karen Dreger and Graham Tilbury for BSOP field testing assistance, Joe Kolesar for electrical support, David Mann for academic support, and the COT staff for engineering support. Funding for this project was provided by the Office of Naval Research.

For further information

Please contact *hbroadbent@mail.usf.edu*.
More information on this and related projects can be obtained at *www.marine.usf.edu/COT/.*

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