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UNDERWATER SCIENCE PRODUCTS AND  
MARKET

# Scientific Applications and New Platforms

18/09/2019





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# Scientific Applications

Fishery research/management



- Fish Quantity
- Fish size
- Fish behaviour
- Fish habitat mapping (submerged vegetation, bottom types)
- Fish passage
- Industrial users
  - Before, during and after field development
  - Blue economy assumes sustainable use of the oceanspace, must be quantified



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# Scientific Applications

## Ecosystem Monitoring



- Fish Quantity
- Fish size
- Fish behaviour
- Fish habitat mapping (submerged vegetation, bottom types)
- + other biology, from small to large
- + interaction between different trophic layers
- + Currents and how they influence the ecosystem







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# Scientific Applications

Ocean Currents mapping

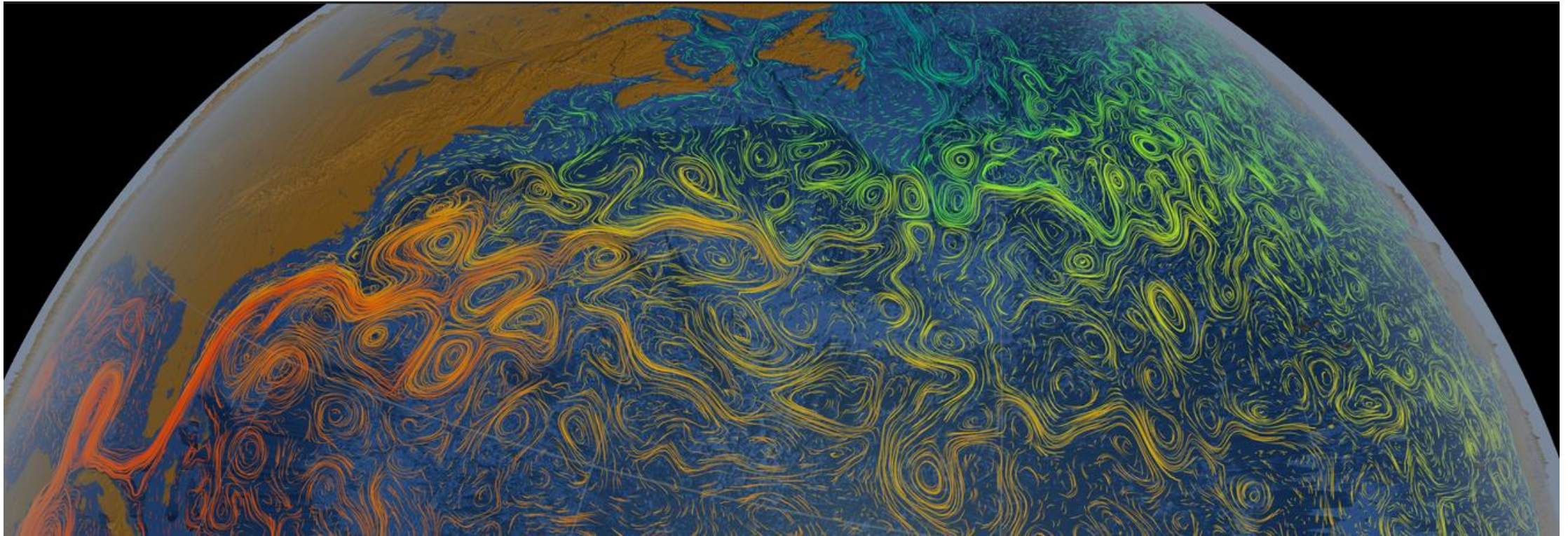


Image: NASA

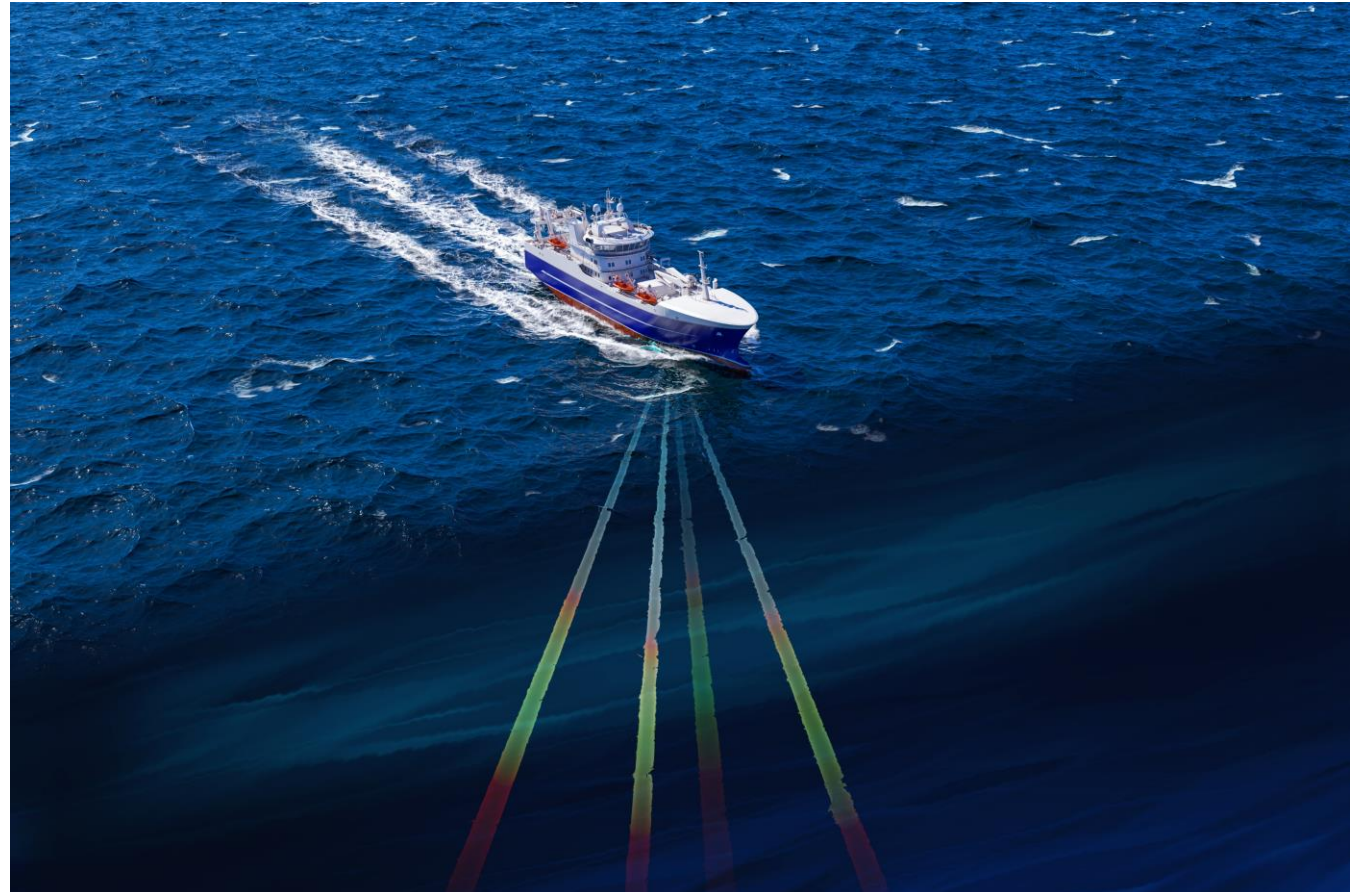


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# Scientific Applications

## Currents mapping

- **Ocean current measurements**
  - Purpose: Measure currents (speed and direction, velocity) as a function of depth (or range)
    - To determine how organisms nutrients and other biological and chemical constituents are transported throughout the ocean
    - To understand heat transportations in the oceans (climate change)
    - To improve models for currents used for various forms of forecasts.
- Key Users: Oceanographic Institutions and Universities (such as WHOI, SCRIPS, GEOMAR) and National Marine Institutes (NOAA, IFREMER, IMR, NERC, CSIRO)
- **Other applications for ADCP:**
- Fishing operations
  - Purpose: To measure ocean currents layers for efficient fishing operations.
- River discharge and Hydrology
- Current measurements for efficient vessel operations
- And many more..



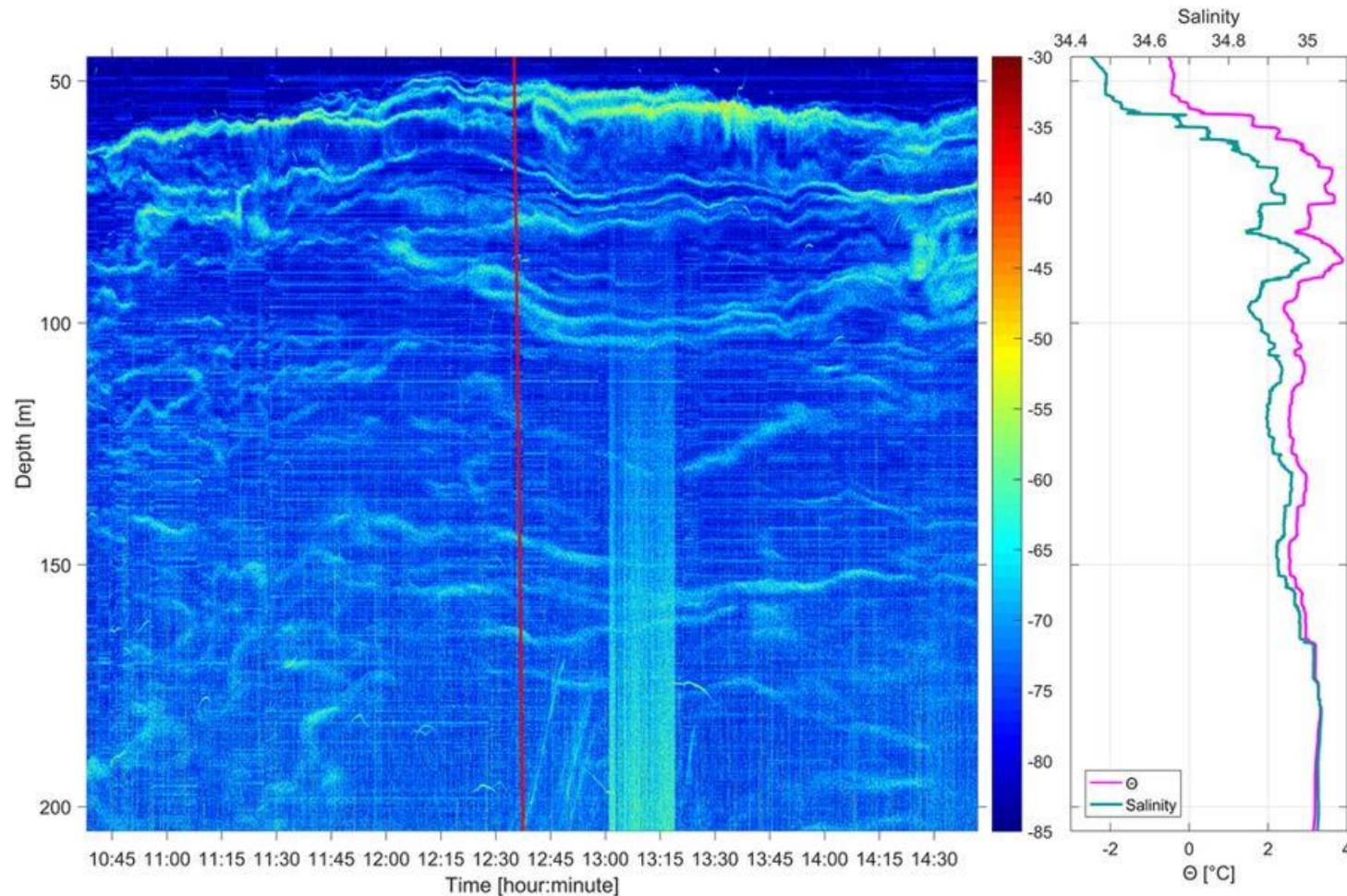




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# Scientific Applications

Oceanography /Acoustic mapping of thermohaline layers



- Warm Atlantic waters has enough energy to melt all Arctic Sea ice within a few years!
- Heat exchange is limited by these layers
- EK80:
  - Range Resolution
  - Frequency spectrum
  - Calibration
  - Sensitivity/dynamic range
- Source of information:

<https://www.nature.com/articles/s41598-017-15486-3/figures/7>

# Scientific Applications

## Seeps (Natural and manmade)

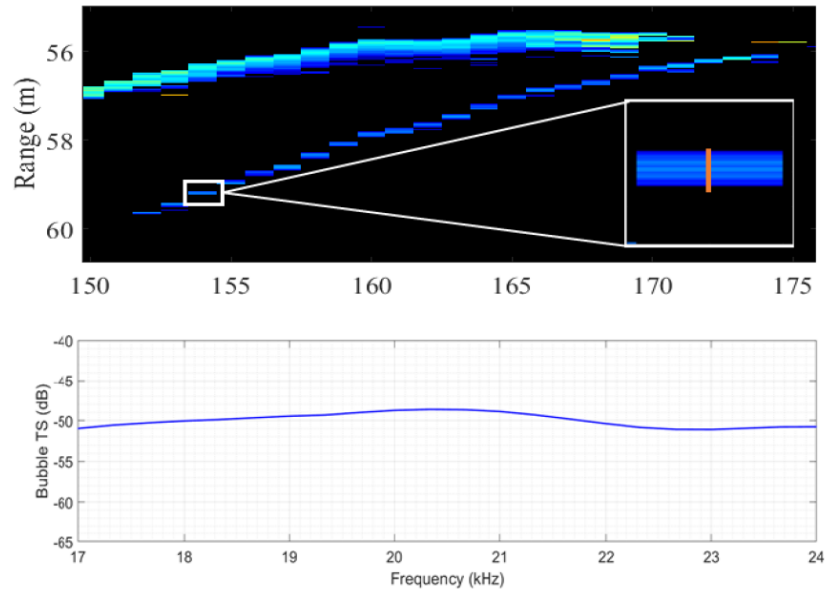


Figure 11. Frequency modulated target strength of a single bubble record.

- EK80:
  - Range Resolution
  - Frequency spectrum
  - Calibration
  - Sensitivity/dynamic range

Source of information:

[http://ushydro2017.thsoa.org/wp-content/uploads/2017/04/Weidner\\_US](http://ushydro2017.thsoa.org/wp-content/uploads/2017/04/Weidner_US)

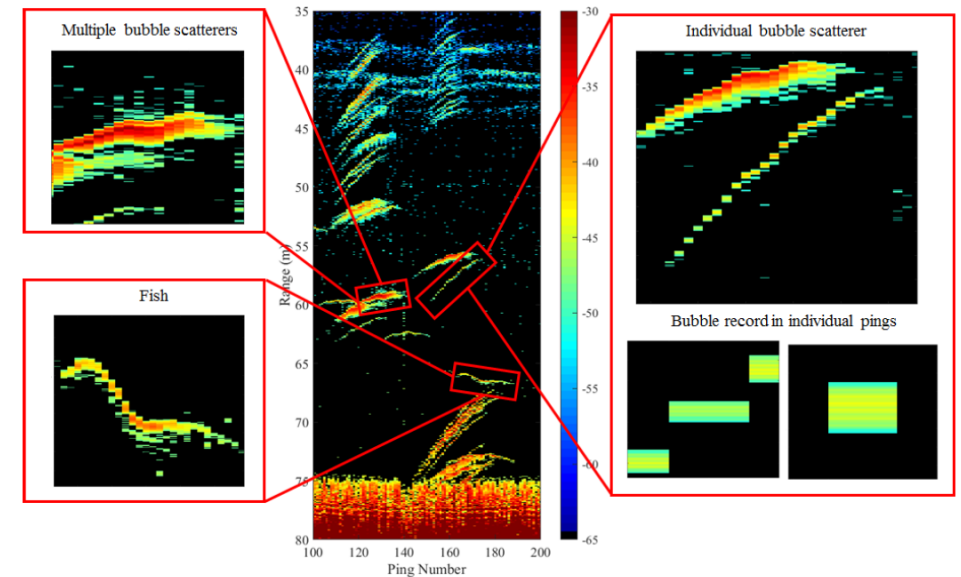


Figure 4. Seep data from August 25, 2014 (center), individual bubble scatterer (right), multi-bubble scatterer and fish (left).





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# Scientific Platforms

## Research Vessels



- Research Vessels will continue to be important platforms
  - KM Subsea scope 30-50 MNOK on vessel mounted systems on each vessel
  - EK/ME/MS/SU/CS/PX
  - Vessels will act as floating hubs for robotics as well as sampling stations
  - Vessel operation and handling systems multiplies potential Kongsberg scope

Image owned by REV Ocean







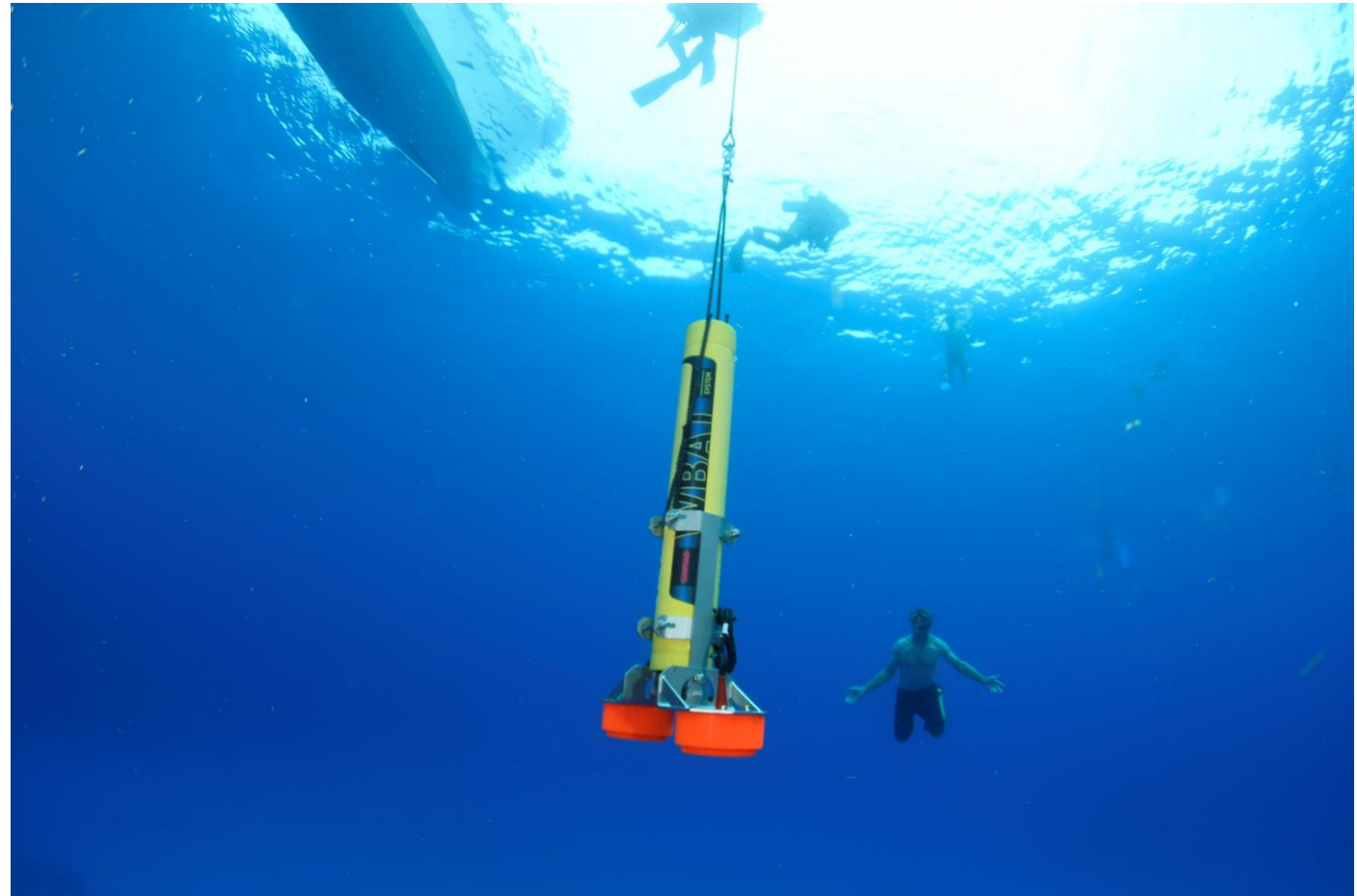
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# Scientific Platforms

## Unmanned Science platforms



- Drones and robotics will increase availability of science data and lowering the cost of collecting them.
- Alternative science platforms will be the basis for future growth.
- Market include both KM Subsea platforms (USV, AUV, Glider) as well as platforms provided by other companies
- EK80 family: «suited for any platform»





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# Science Platforms

## The Research vessel Svea/SLU



- Built at Armon (Spain) this year
- SLU now formally a University, but also carries out fishery survey tasks for the government
- Vessel mounted Simrad systems:
  - EK80 6-pack
  - ME70 with bathymetric option
  - MS70
  - SX90
  - CS90
  - PX Wireless system
- TD50 is central in the operation







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# Science Platforms

The «other stuff» for the same research vessel



- Fishery research vessels often have the need to extend their measurements in extent and time
- This particular group added 3 WBT tubes and 5 depth rated transducers to a MacArtney towed platform for the delivery
- They also purchased a Sailbuoy with WBT Mini, although independently of the vessel project.







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# Science Platforms

## Unmanned Surface Vessels



- Huge potential
- EK80 WBT Mini
- Sounder sized platforms provide for larger payloads



Images courtesy of Saildrone, AutoNaut & XOcean





# Science Platforms

## Autonomous Underwater Vessels

Image: Kelly Benoit-Bird/MBARI



- Several user initiatives to integrate EK80 on AUV's
- WBT Mini allows for more compact installation and lower power consumption

Image: OceanScan-MST LAUV

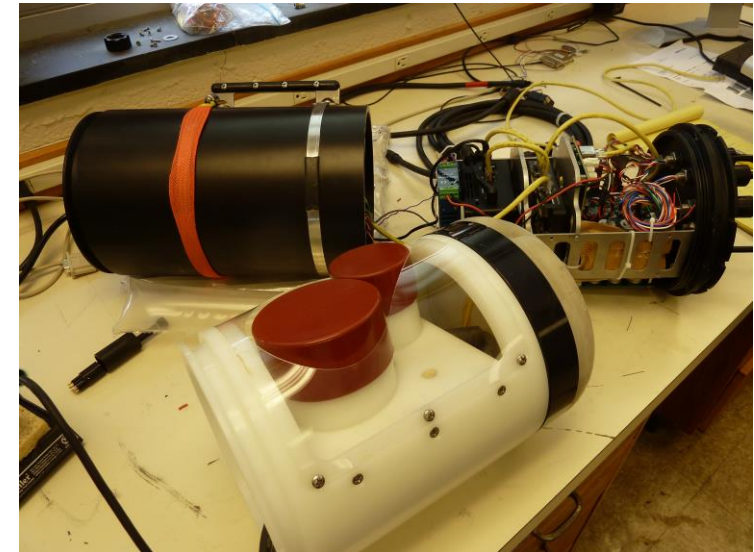


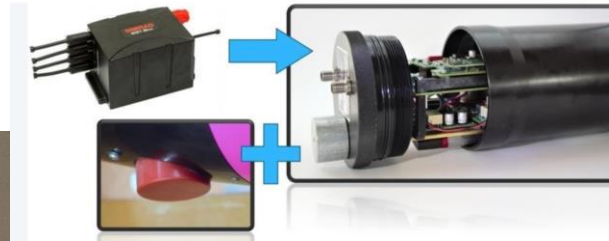
Image: And one Lawery/WHOI



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# Science Platforms

## Underwater Gliders



- **Left:** A team fronted by Kelly Benoit-Bird have recently integrated the WBT Mini onto the Slocum glider with great success. Another team fronted by Boswell/FIU is now doing the same.
- **Top:** Dan Hayes have integrated an adapted version of the WBT Mini onto the KM 1000 meter Seaglider
- **Soon:** EK80 on the larger shallow water Seatlider





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# Science Platforms

## Underwater Gliders





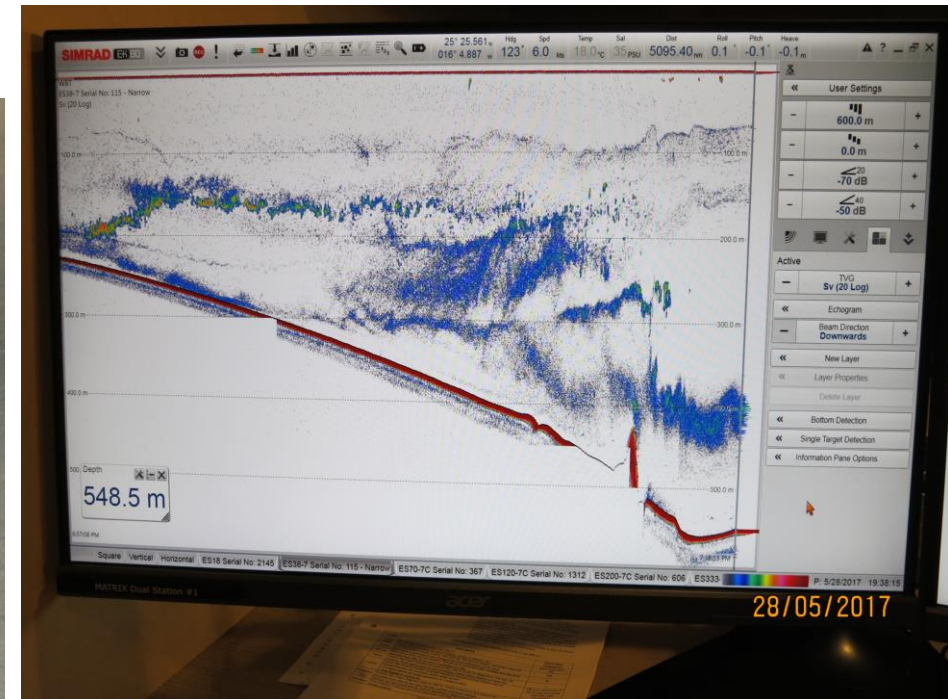
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# Science Platforms & Application

## Deep Scattering layers



- Future source of marine proteins
- Resources needs to be understood and mapped
- Surface vessels do mapping
- Alternative platforms for inspection







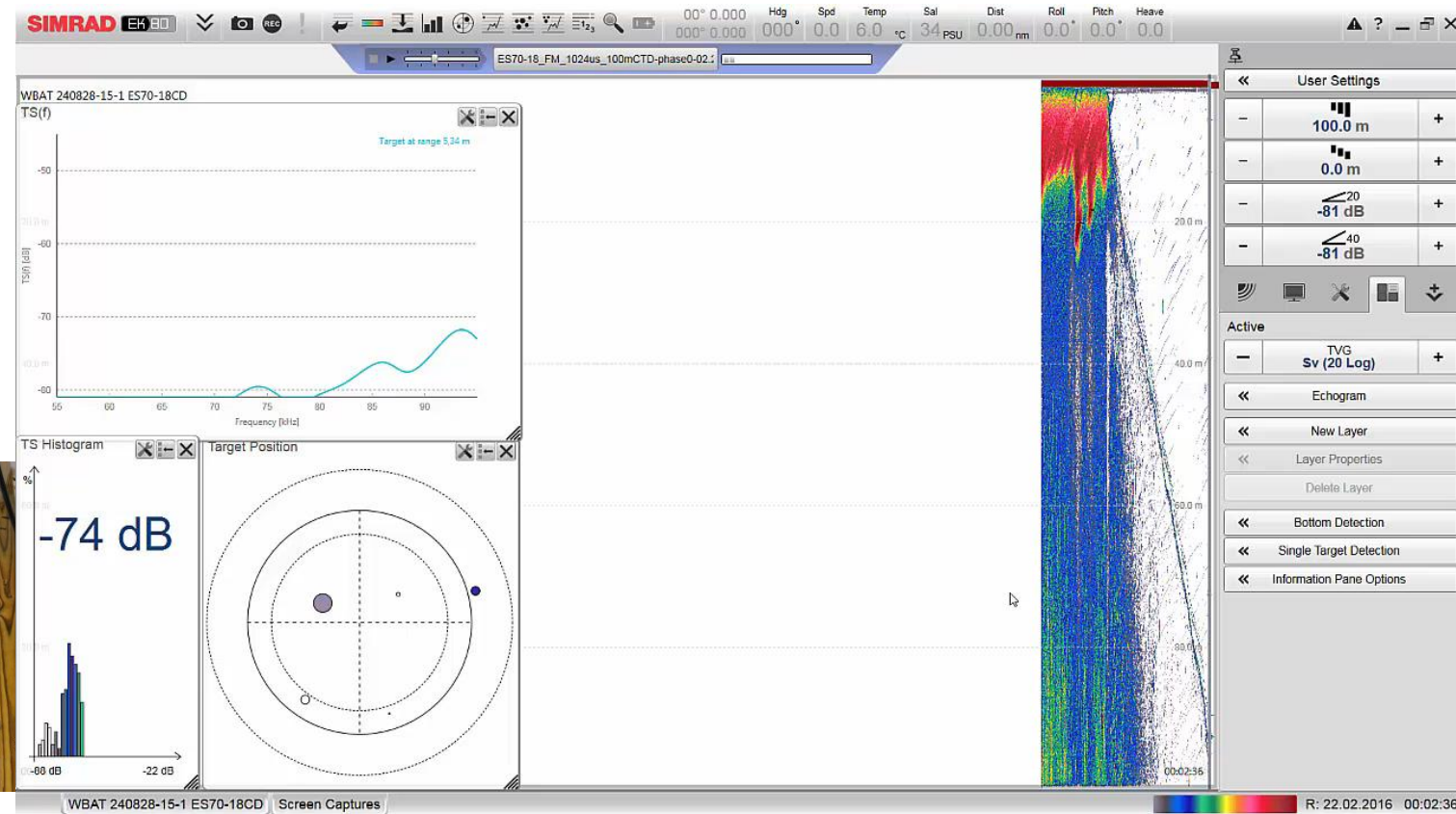
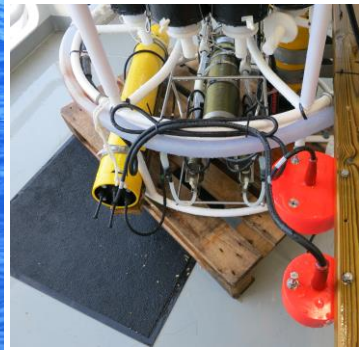
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# Science Platforms & Application

## Deep Scattering layers



- Example: WBAT on CTD, but also AUV/Glider etc.
- Reach layers with higher frequencies
- Extreme resolution







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**SIMRAD**  
**SWWC**  
ATHENS 2019