### Examples of Argos Use in Support of Fisheries Research, Management, Enforcement, and Safety

RGOS

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### Argos -

Provide a unique, worldwide location and data collection system dedicated to studying and protecting the environment

### NOAA -

To guide the use and protection of ocean and coastal resources, and conduct research to improve understanding and stewardship of the environment

### **NOAA Fisheries -**

To ensure the productivity and sustainability of fisheries and fishing communities through science-based decision-making... and to recover and conserve protected resources including whales, turtles, and salmon



# **Platforms and Applications**

#### **Ships** Autonomous Ocean Robots Safety Activity Tracking Oceanographic Research • Fishing (VMS) • Shipping <u>Wildlife</u> Behavior/Habitat Use • **Buoys/Floats** Bycatch Monitoring Weather ٠ **Ecosystem Science** Maritime Forecasts **Emergency Response** Spills Storm Tracking

## Key Characteristics of Argos Telemetry

- Global coverage especially over polar regions
- Location services are independent of GPS positions are calculated by computing the Doppler shift on the transmitter signals
- Very low power to reach Low Earth Orbiting (LEO) satellites, allowing highly miniaturized transmitters (<3 gm)</li>
- Burst transmissions (1/8 sec) without handshake requirement yields data and locations in difficult applications – critical for marine applications
- No viable alternatives currently available for many projects



# Examples

- Monitoring Water Quality to Support Shellfish Growers in the Pacific Northwest
- Wildlife and Vessel Monitoring to Help Protect Vulnerable Species along the Eastern Seaboard and Combat Illegal Fishing
- Extreme Ocean Condition and Weather Monitoring and Forecasting in the Gulf of Mexico



# Argos-linked oceanographic instruments support shellfish growers in the Pacific Northwest

- Washington State has more than 300 shellfish farms accounting for 25% of the total domestic production and an annual value exceeding \$108M
- Monitoring water conditions is critical to reduce loss and ensure human health
- Unfavorable conditions can cause shellfish mortalities, increased bacteria, harmful algal blooms, and potential illness for consumers
  - High temperature
  - Low salinity
  - Extreme dissolved oxygen (too high or low)
  - High turbidity
  - Low chlorophyll
  - Extreme pH (too high or low)
- In 2010 unfavorable water conditions resulted in a state-declared 'oyster emergency'





# Northwest Association of Networked Ocean Observing Systems (NANOOS) Shellfish Growers App

Welcome to the Shellfish Growers app.



Providing observation and forecast information for shellfish growers.

This successful partnership among shellfish growers, tribal, state and local agencies, and regional shellfish managers provides vital data for understanding and coping with changing ocean conditions















### Tracking Wildlife with Satellite Telemetry





- Miniaturized Argos transmitters are used to track a range of species
- A recent study summarized satellite tracking data for >2600 individuals from 50 marine species worldwide
- Data are used to understand habitat use patterns, establish seasonal management areas for protected species, and study overlap with fishing and vessel traffic



A. M. M. Sequeira et al. PNAS 2018;115:12:3072-3077

### Tracking Vessels with Satellite Telemetry

- The Vessel Monitoring System (VMS) was implemented to help monitor and manage fisheries
- Vessels worldwide carry Argos satellite transmitters
- Fishery managers can detect potential conflicts between industrial and smallscale fishing activities
- Real-time observation of ship positions and activities enables detection of Illegal, Unregulated and Unreported (IUU) fishing



 Pew Charitable Trusts estimates that 1 in 5 fish sold in restaurants or shops has been caught illegally, worth more than \$23B annually



### Merging Wildlife and Vessel Data to Help Save Right Whales Along the Eastern Seaboard



A L L I A N C E

- Based on more than 20 years of sightings and data relayed through satellite-linked tags and acoustic listening buoys, scientists have identified North Atlantic right whale critical habitat
- The intersection of whale "zones" and vessel traffic provides the basis for seasonal and dynamic management areas to reduce strike risk and allow whales and ships to share the same waters
- Movement of the traffic zone by just 12 degrees north of Cape Cod Bay reduces the risk of ship strikes to whales by 58 to 81%

### Extreme Weather Forecasting in the Gulf of Mexico

- Dozens of satellite-linked buoys, floats and vessels provide real-time oceanographic and atmospheric measurements
- Data are used in models to forecast tidal flow, current speed and direction, surface wind speed and direction, wave height, and harmful algal blooms among other oceanographic conditions
- The Gulf of Mexico Coastal Ocean Observing System (GCOOS) provides early warning of extreme events to mariners, coastal residents and offshore workers
- Forecasts are critical to ensure safety and minimize economic losses
- Hurricane Katrina in 2005 was one of the deadliest and most costly hurricanes claiming 1200 lives and costing \$160B
- Hurricane Harvey in 2017 claimed about 100 lives and cost \$125B









### Hurricane Forecasting

- Observations of the inner regions of hurricanes are difficult to obtain, yet essential for emergency preparedness
- Recently developed weather balloons released in swarms can measure hurricane dynamics for up to a week and transmit wind speed and trajectory data through the Argos system
- Argos transmitters are ideal due to extremely low mass and power requirements and their proven reliability in difficult atmospheric environments
- A simulation shows accurate tracking of Hurricane Katrina's path





Sources: Meneghello et al. 2017; Bewley and Meneghello 2016

# In Summary...

- Argos platforms are unique in that they are very low power, can be miniaturized, communicate quickly without a handshake, provide locations without GPS, and perform well under extreme conditions
- A wide range of applications rely on Argos helping to ensure public safety, support lawful fisheries, and conserve biodiversity
- Argos transmitters are currently used on more than 4,000 meteorological/oceanographic monitoring platforms
- More than 8,000 animals are currently being tracked with miniaturized Argos telemeters
- Worldwide there are about 18,000 active platforms with no viable alternatives currently available for many applications









## Questions?

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