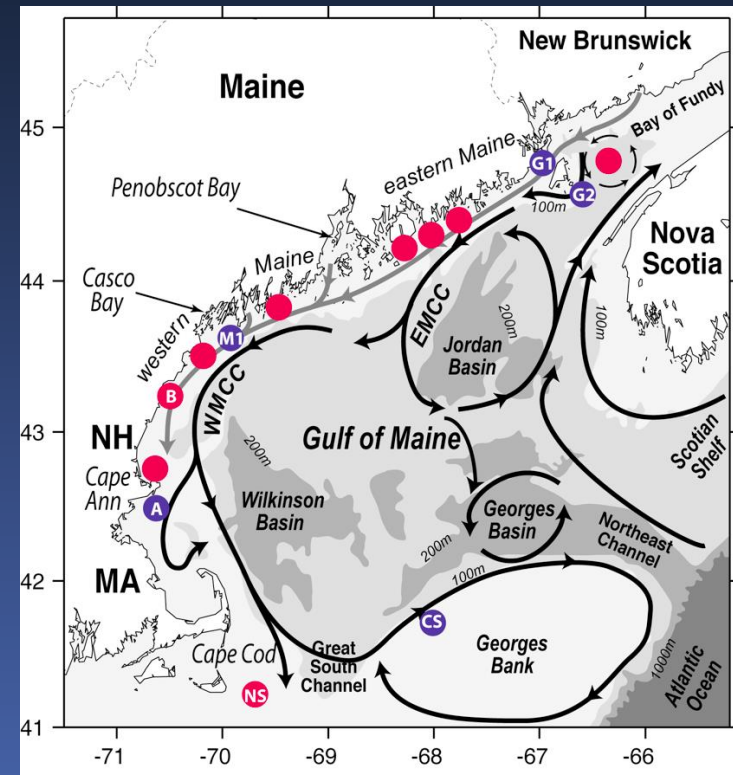
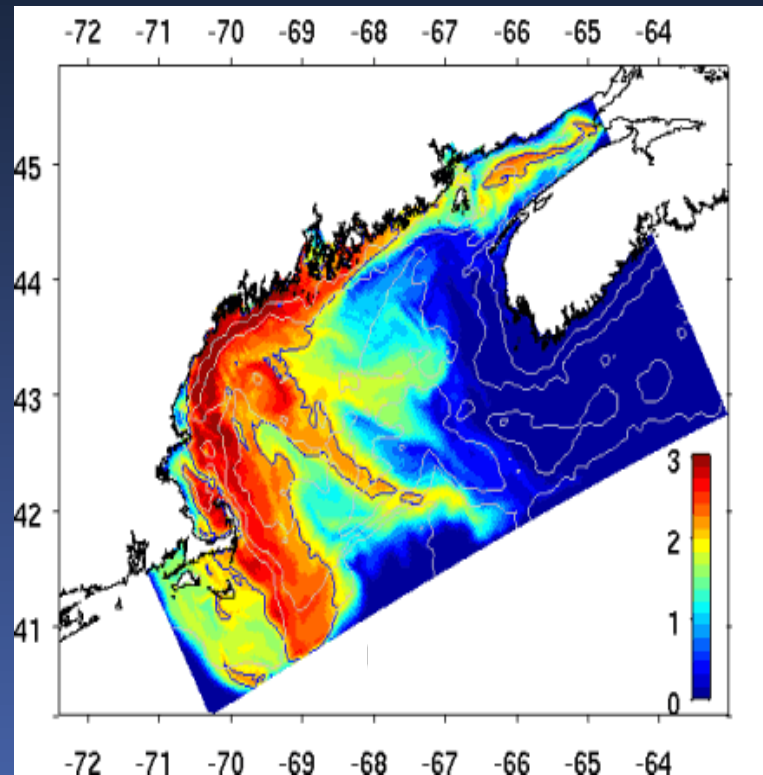


In situ, autonomous monitoring of toxic algal blooms in the Gulf of Maine



Don Anderson
Woods Hole Oceanographic Institution





DANGER

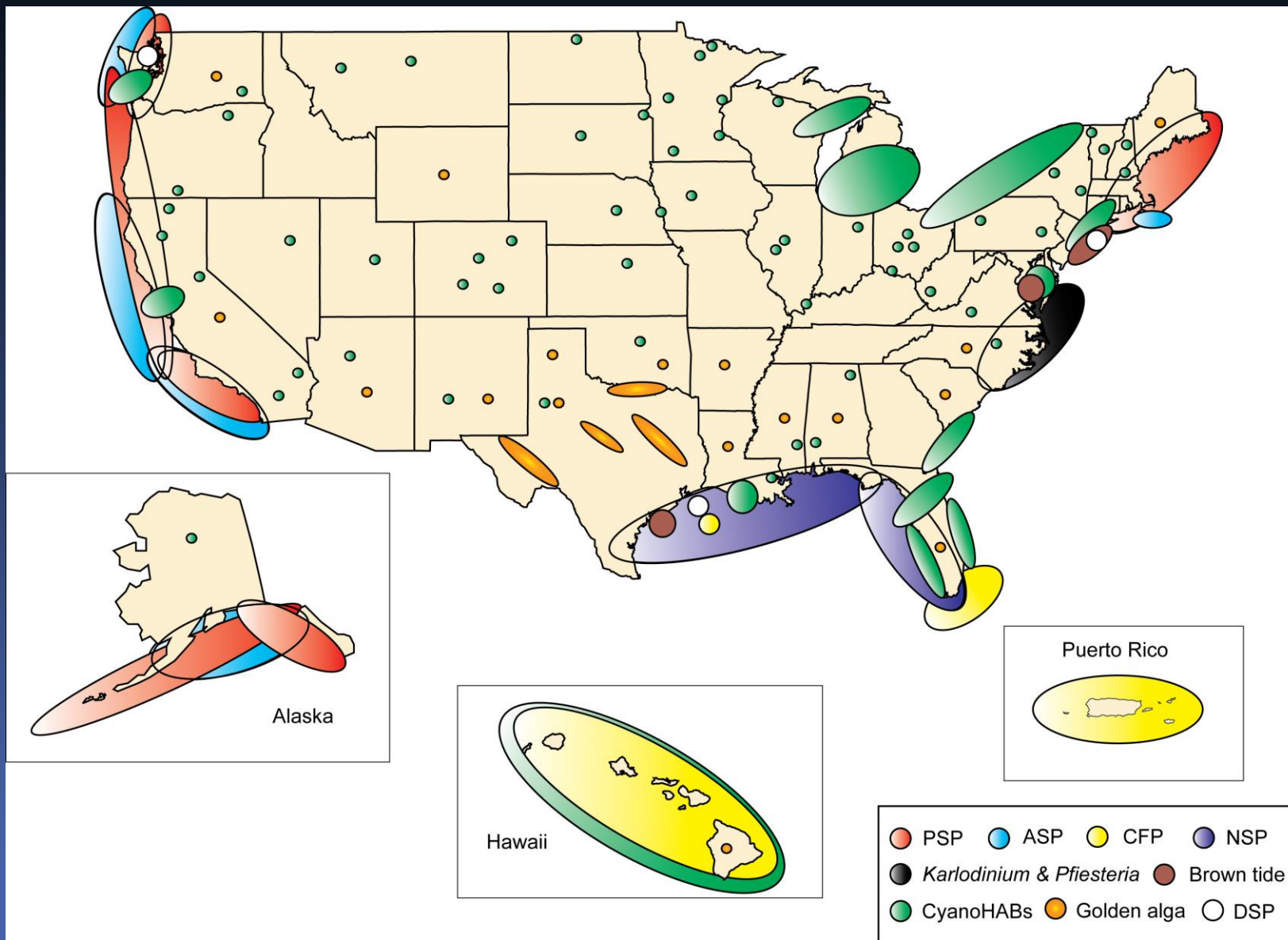
Area Closed

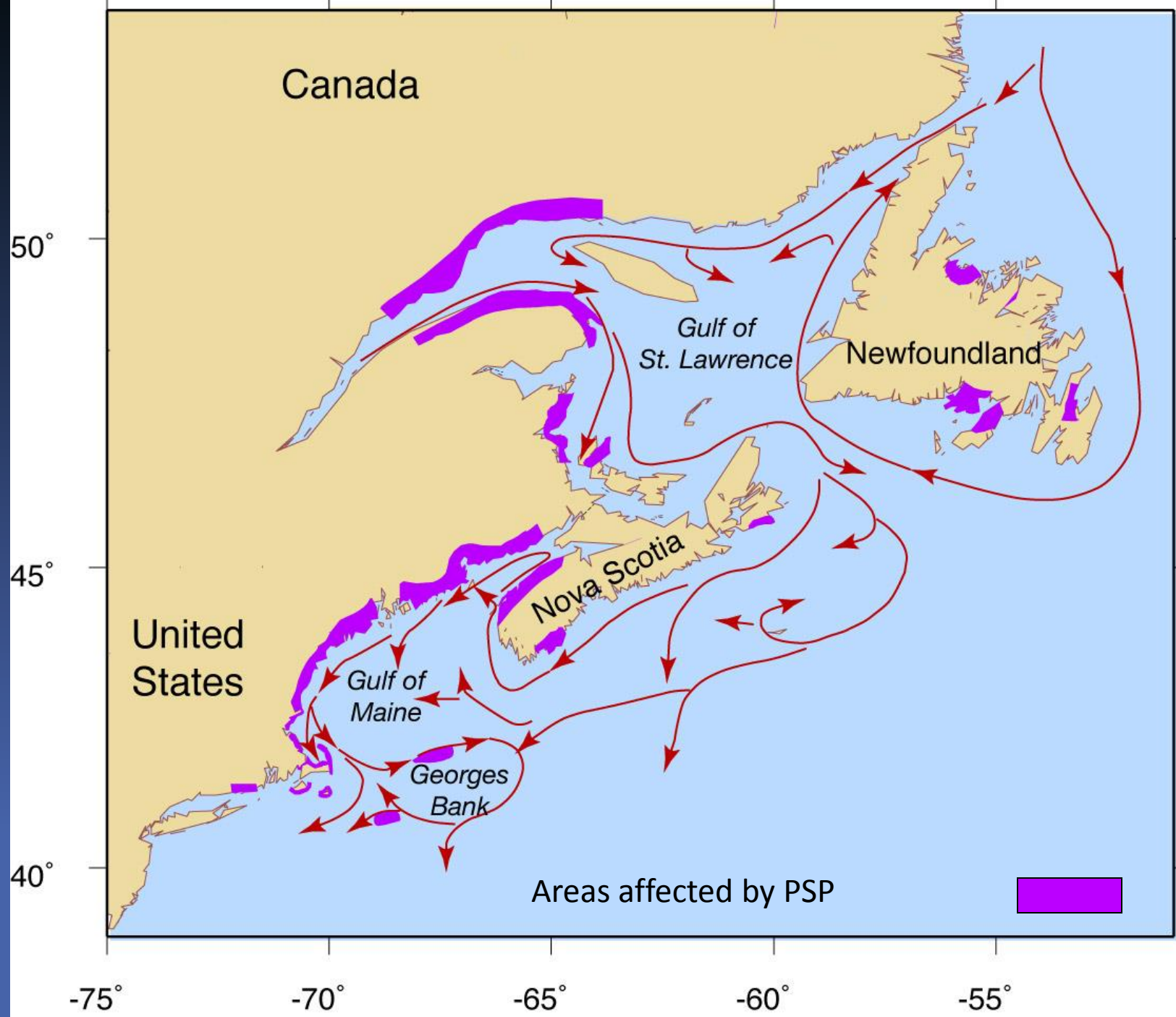
Shellfish (oysters, clams, mussels and other bivalve molluscs) in the area described below contain paralytic toxins and are not safe for use as food.

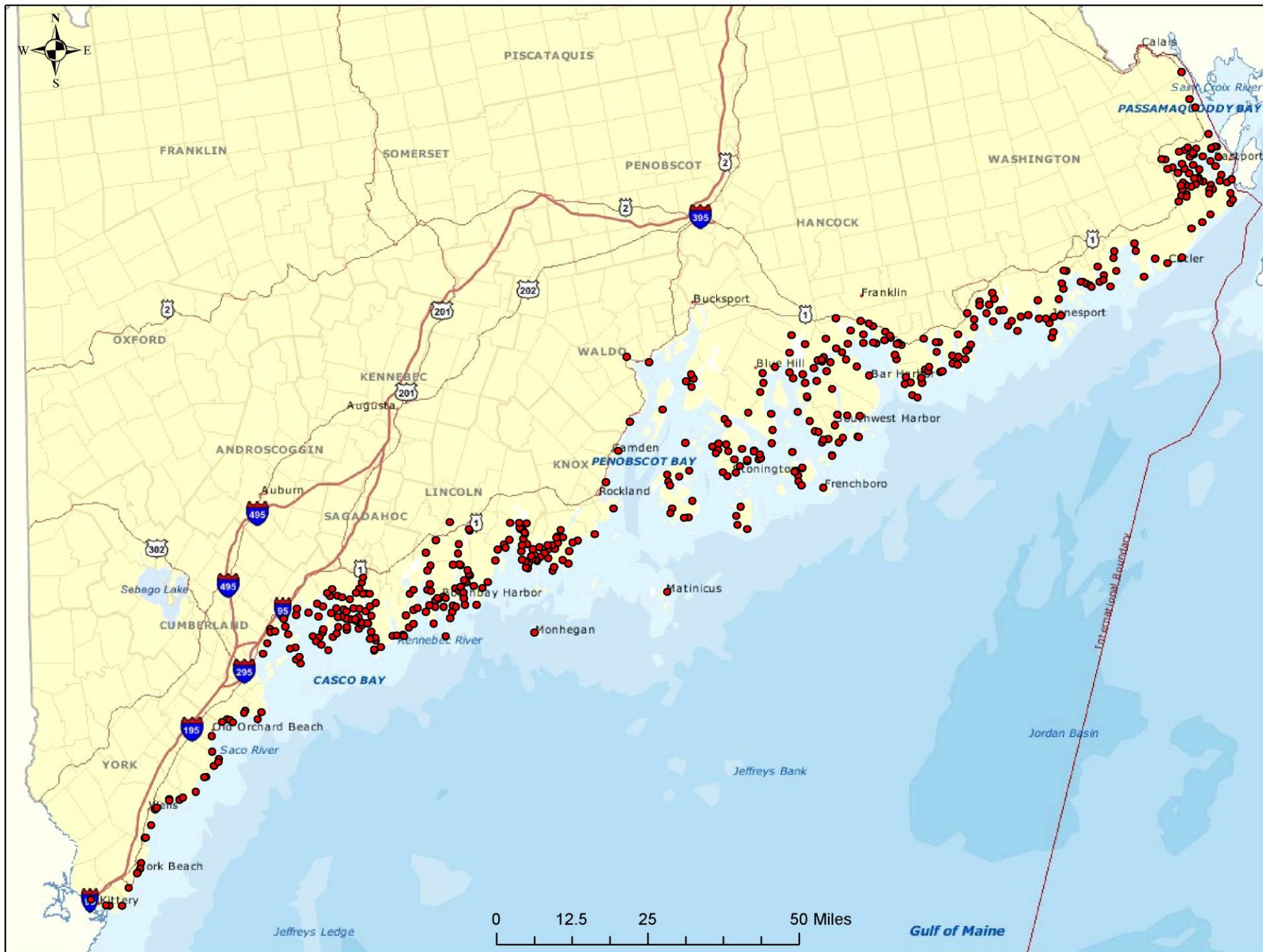
Secteur

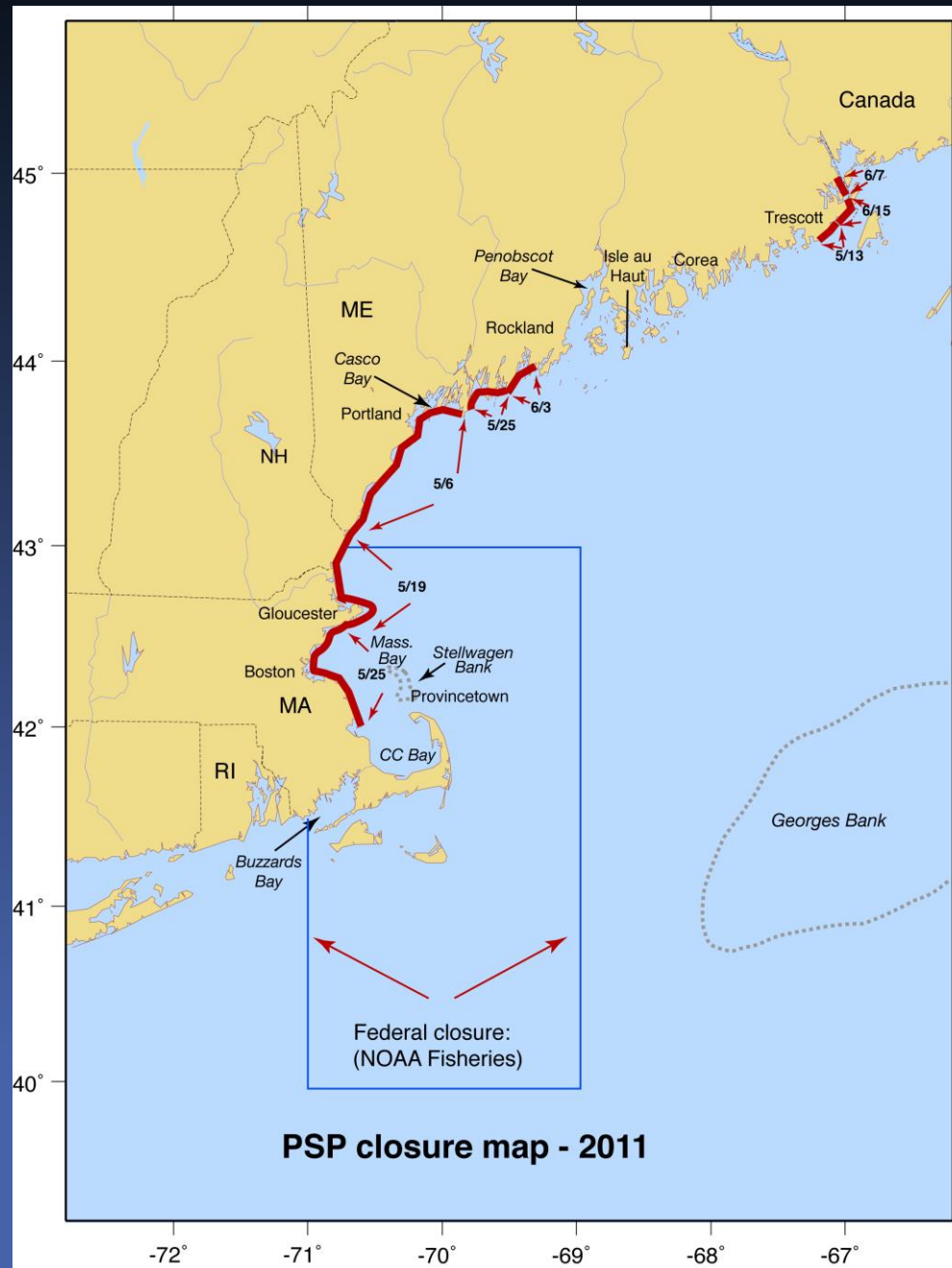
Les mollusques (moules et autres bivalves) provenant de la zone décrite ci-après contiennent des toxines paralysantes et ne conviennent pas à la consommation.





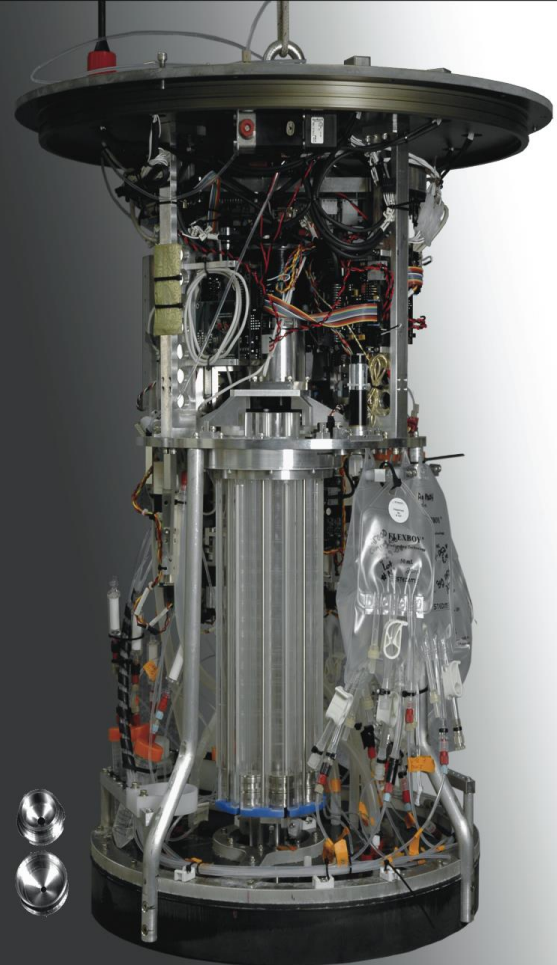






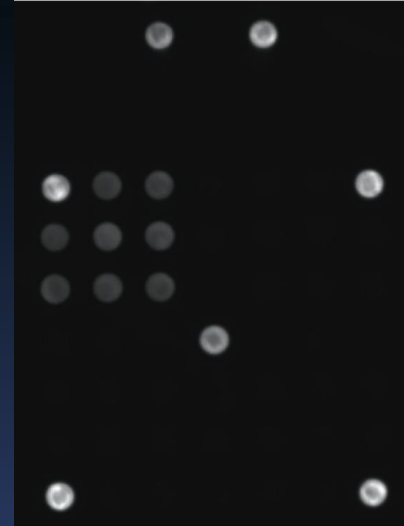
2013 regional closures



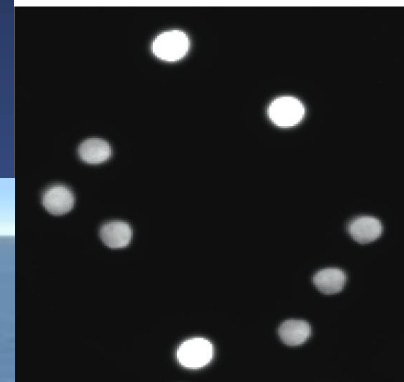


The Environmental Sample Processor (ESP)

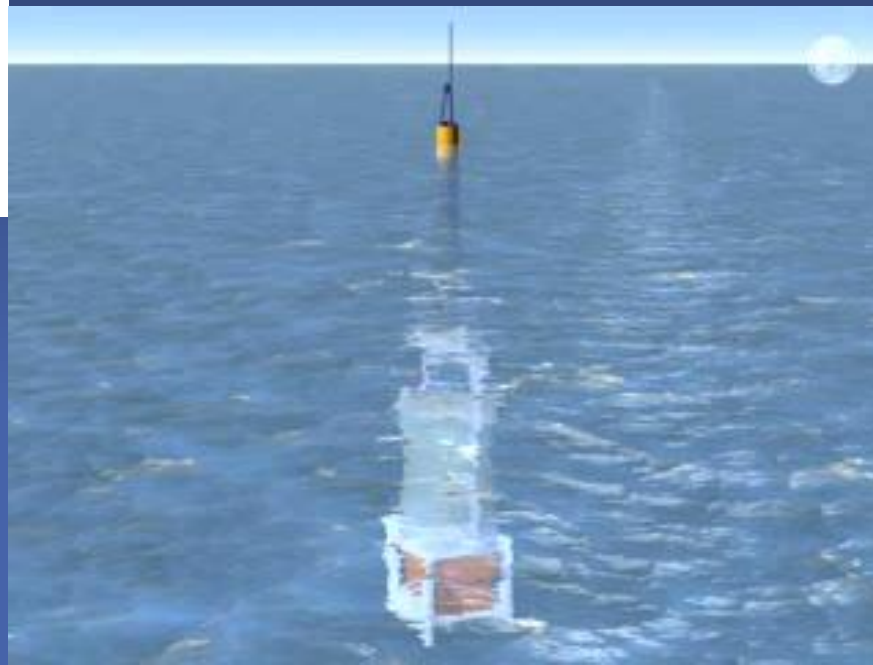
DNA-probe-based cell
identification and
enumeration



HAB species array



HAB toxin array





Progress with ESP deployments in the Gulf of Maine

- ESP now commercially available (Spyglass Biosecurity; McLane Research Laboratories)
- 5 instruments purchased at WHOI through special NSF MRI award; 1 on loan from EPA (intended for NERACOOS someday)
- 4 moorings designed and fabricated
- Freewave and cell-phone communications packages installed and used in 2011, 2012 and 2013
- One instrument deployed 2011, one in 2012, two in 2013
- Exceptional assistance from C. Scholin and MBARI team, and G. Doucette NOS Laboratory, Charleston SC (development of saxitoxin analytical protocol for 2013 deployment)

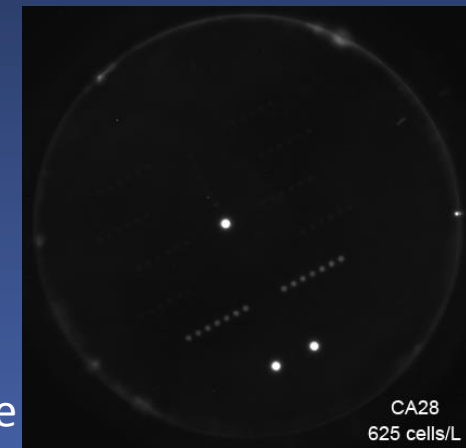
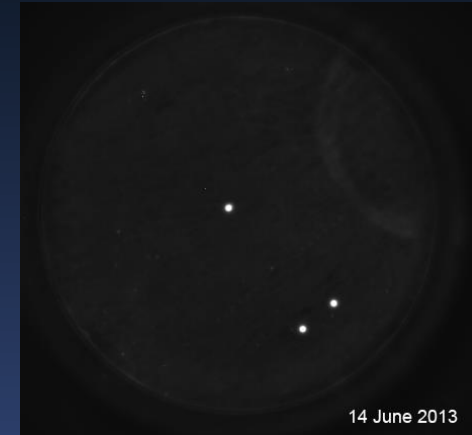
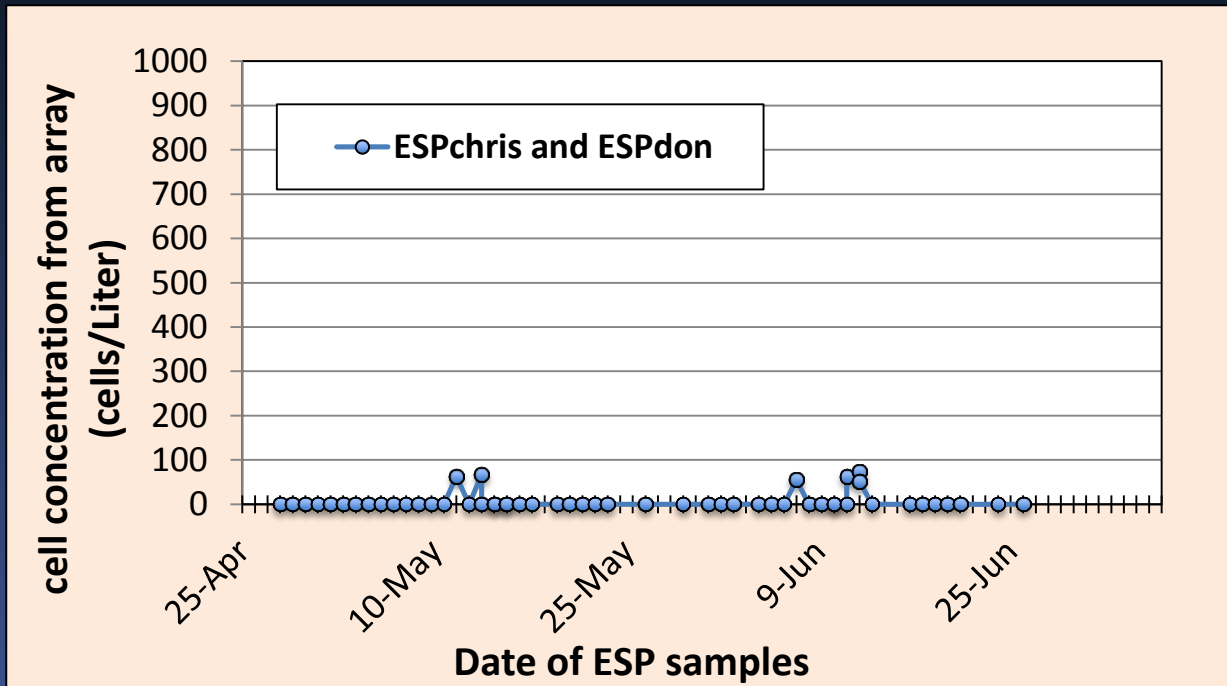


Major Accomplishments in 2013 ESP deployments

- Communication architecture of mooring redesigned
 - Implemented DSL (slow Ethernet) signal from ESP through stretch hose
 - ATT cell phone network linked to WHOI network - no shore station
 - Auxiliary ports for two RS-232 instruments available (CTD & SUNA)
- Successful incorporation of STX protocol onto ESP, but still needs improvement (top Processing Clamp redesign)
- Two successful 30-40 day deployments with full completion of both missions – both ESPs deployed at NERACOOS B -cell phone capability
- Currently building out to 4 ESP moorings for 2014



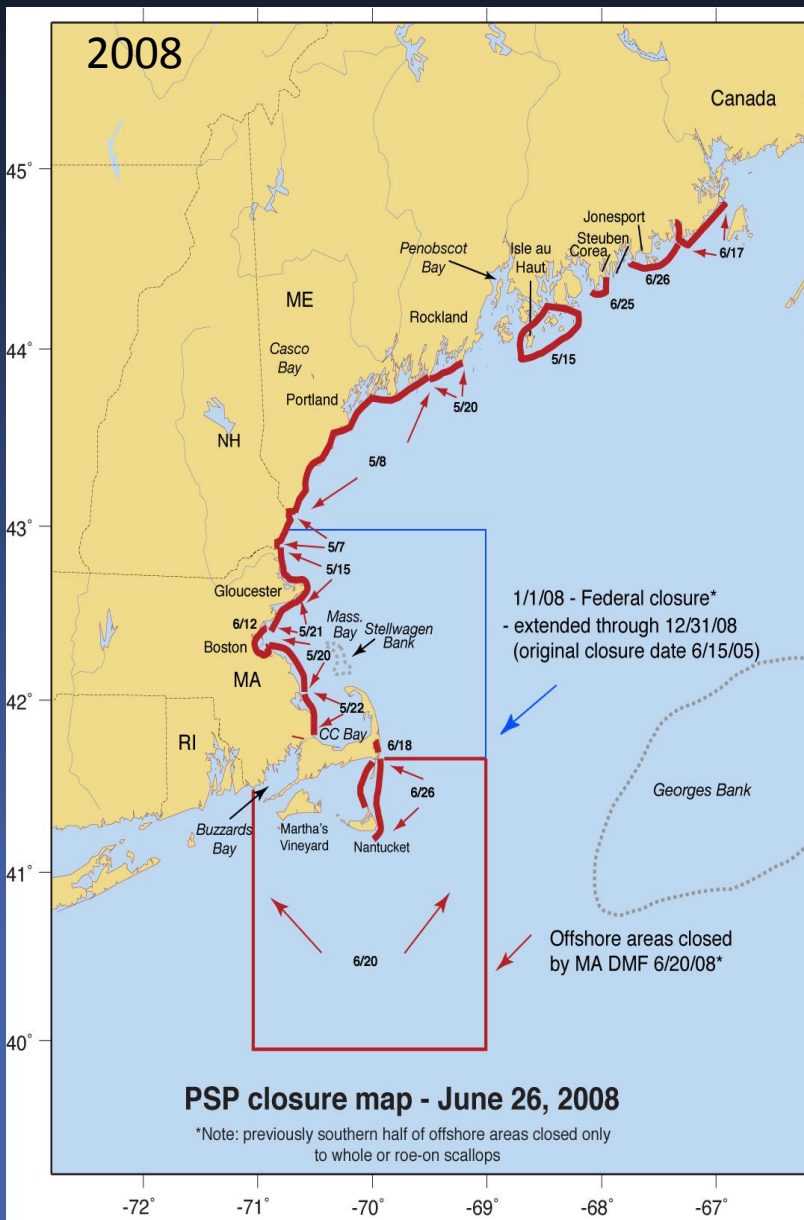
Results: 2013 ESP deployments at NERACOOS B



- Most arrays were negative
- Some arrays were very weakly positive (<100 cells/L)
- Max cell concentration from ground truth cruise ~100 cells/L in June

Conclusions:

- ESP results reflected the very low *A. fundyense* concentrations (consistent with cruise observations and state shellfish toxicity measurements)



Proposed ESP deployments for 2014



4 ESPs available for deployment

3 sites in western GOM

- NERACOOS B – same site as 2013
- NERACOOS E – upstream in coastal flow
- Casco Bay – “hotspot” near shellfish

Time period of deployments in western GOM

- ~45 day duration - limited by batteries
- Early May to mid-June -
- Late April deploy/early July recovery

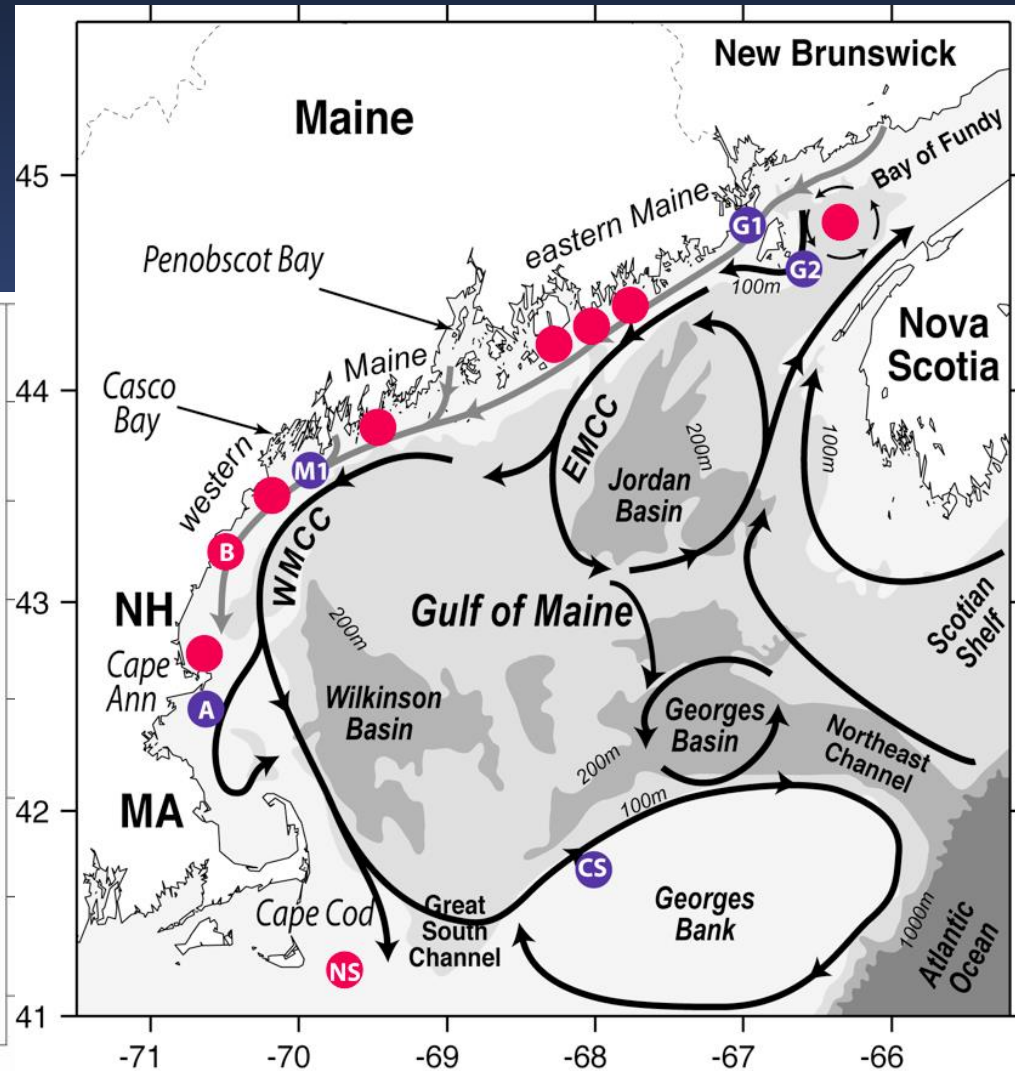
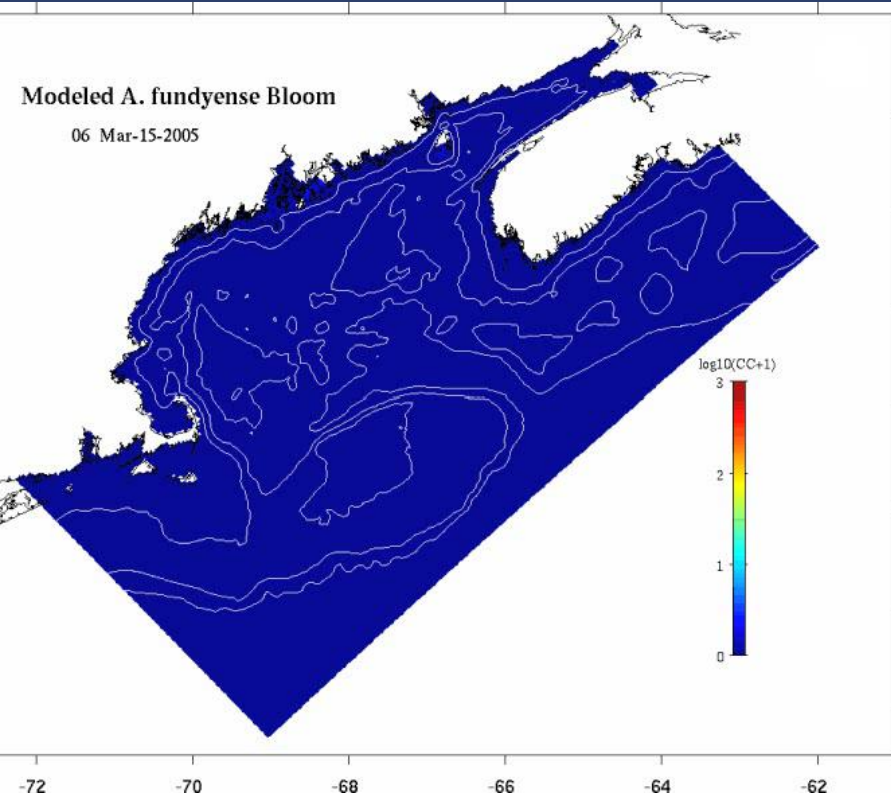
Sample frequency

- 5 times per week for HABs
- 1-2 times per week for STX – TBD

4th ESP option

- back-up if one ESP fails
- extend duration at one site

A vision for the future – ESP
HAB sensors moored in the
Gulf of Maine, providing
near-real time data in
support of an NOS
operational HAB forecast
system for the Gulf of Maine.



Technical issues - Transition of ESPs to operational use

- *Extend duration of ESP deployments (currently ~45 days with ~40 assays onboard)*
 - *Reduce power consumption – e.g., power switching and/or Ethernet stretch hose*
 - *Upgrade battery configuration with more D-cells/deployment*
 - *Consider rechargeable batteries using solar or wind power systems*
 - *“short” Puck redesign (more pucks into carousel) with lower reagent volumes*
- *Verify, validate, and modify HAB cell and toxin (STX) measurements to accurately characterize bloom toxicity*
- *Collect data on ESP’s robustness and improve current design to increase reliability and serviceability*
- *Upgrade GOM HAB forecasting capability using ESPs*
 - *Conduct Observing System Simulation Experiments (OSSEs)*
 - *Evaluate HAB forecast model performance with the ESP data streams*
- *Integrate the ESP data stream into user-friendly (data visualization) products*

Acknowledgments

- US EPA
- IOOS Program Office
- NSF MRI program
- NOAA CSCOR program
(MERHAB, ECOHAB)
- NOS Charleston
(Doucette)



