

# Towards Understanding the Impacts of *Didemnum vexillum*

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Photos: G. Lambert

# Overview of presentation

- Climate change and introduced species
- *Didemnum vexillum* natural history and impacts
- Goals and objectives of project
- Preliminary results
- Next efforts



Photos: G. Lambert, L Harris

# Climate change and invaders

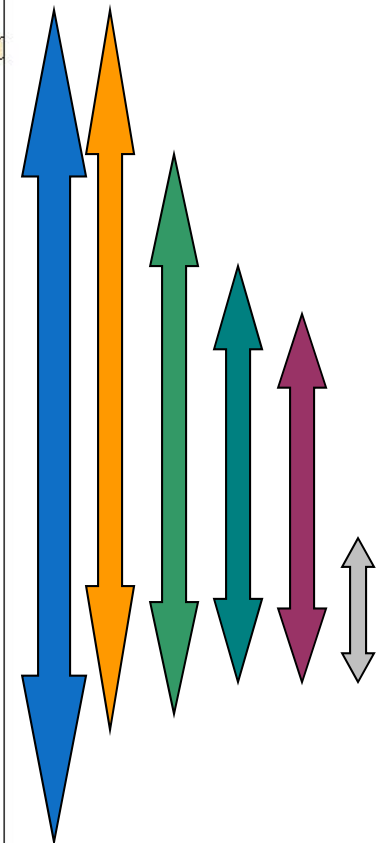
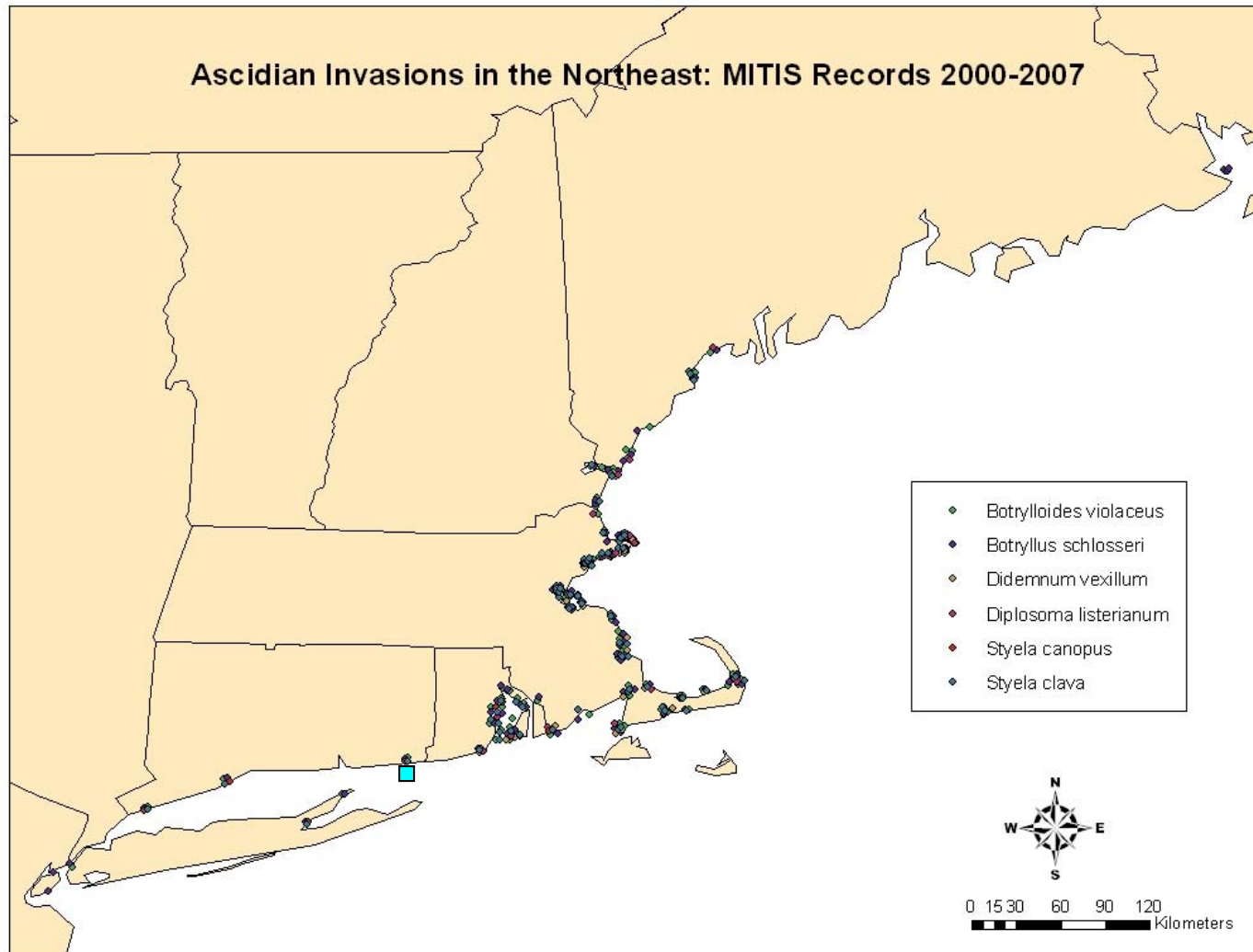
*Of 17 species of ascidians in fouling communities; 9 are non-native and 3 are cryptogenic or unknown origin*

- Northward movement of all species, natives and non-natives
- Change in communities, but not possible to predict what those changes will be; ascidians are highly successful invaders in New England
- 30 year study in NH, shows non-native compound ascidians dominate fouling communities
  - Open space from ascidian regression in winter
  - Early recruitment by non-natives prevents native species (sponges, mussels) from settling (Dijkstra and Harris, MEPS 387:71-80, 2009)

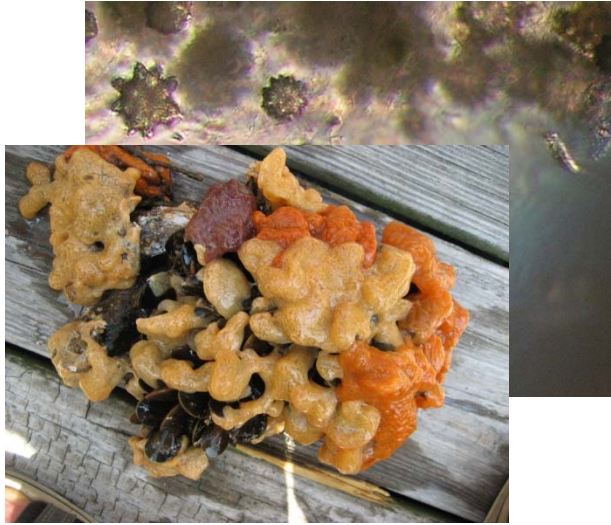


G. Lambert

*B. schlosseri*, *B. violaceus* ■ *Didemnum vexillum* ■ *Styela clava* ■ *Asciidiella aspersa* ■ *Diplosoma listerianum* ■ *Styela canopus* ■ *Clavelina lepadiformis* ■

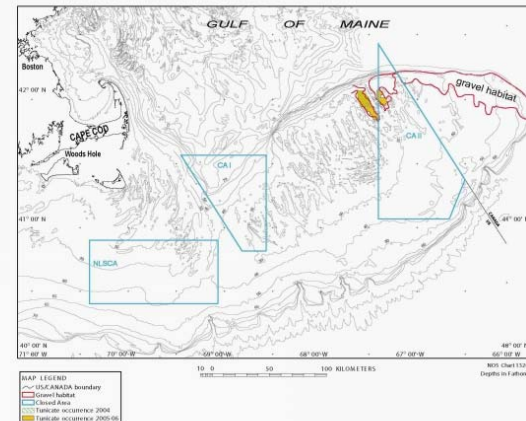


# *Didemnum vexillum*



- *Didemnum* an aggressive sea squirt that reproduces sexually and asexually.
- Perceived threat to aquaculture, fisheries, scallops
- Overgrows most sessile organisms
- Limited predators – possibly due to toxic compounds, spicules, poor nutritional value

- Of areas surveyed in Georges Bank, *Didemnum* covers between 60-80% of ~240 sq km<sup>2</sup> of sea floor
- Likely vectors, hulls, ballast and fishing practices



**Special challenge is to identify *Didemnum* quickly on the sea floor in GB where videos and still images only cover a small fraction of the area to evaluate fisheries impacts.**

*Long-term goal is to evaluate geospatial coverage, ecosystem and economic risks, potential to spread, and potential mitigation options*

*Phase 1: Didemnum joint pilot project with USGS and NMFS  
To evaluate potential sensors that can quickly identify  
Didemnum on seafloor in Georges Bank*

- Use multibeam to map portions of Georges Bank using AUV platform
- Test an acoustic (ultrasound) sensor
- Collect environmental data
- Analyze data

## AUVs and sensors

- AUVs can perform at depths
- Odyssey IV, current AUV hovers, carries variety of payloads
- 2-4 kn
- Strobes, optical sensors, CTD, etc.
- Opportunity to spend 2 week on GB aboard the R/V *Bigelow*



**In 1988, first AUV ( 1 m-long) was named SEA SQUIRT!**

# But...in 2008

- *Didemnum* first observed in 2002 in George Bank and found to cover large areas of the sea floor until 2008
- In 2008 it regressed, present in its preferred habitat but smaller colonies; returned in 2009, regressed in 2010
- Is this related to, temperature, predation, climate change or not?

2008



2002-2007;2009



# Didemnum growth in nearshore area

Environmental conditions

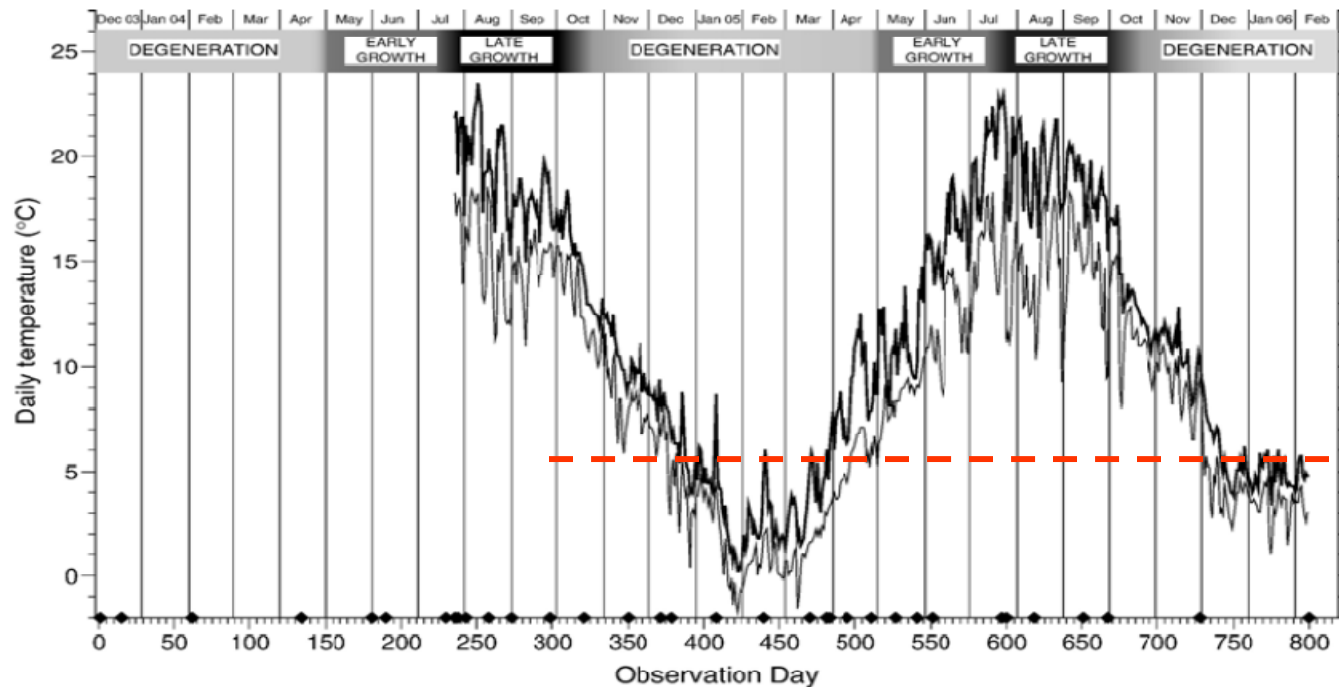
-1 °C - 24 °C

~29 - 35psu

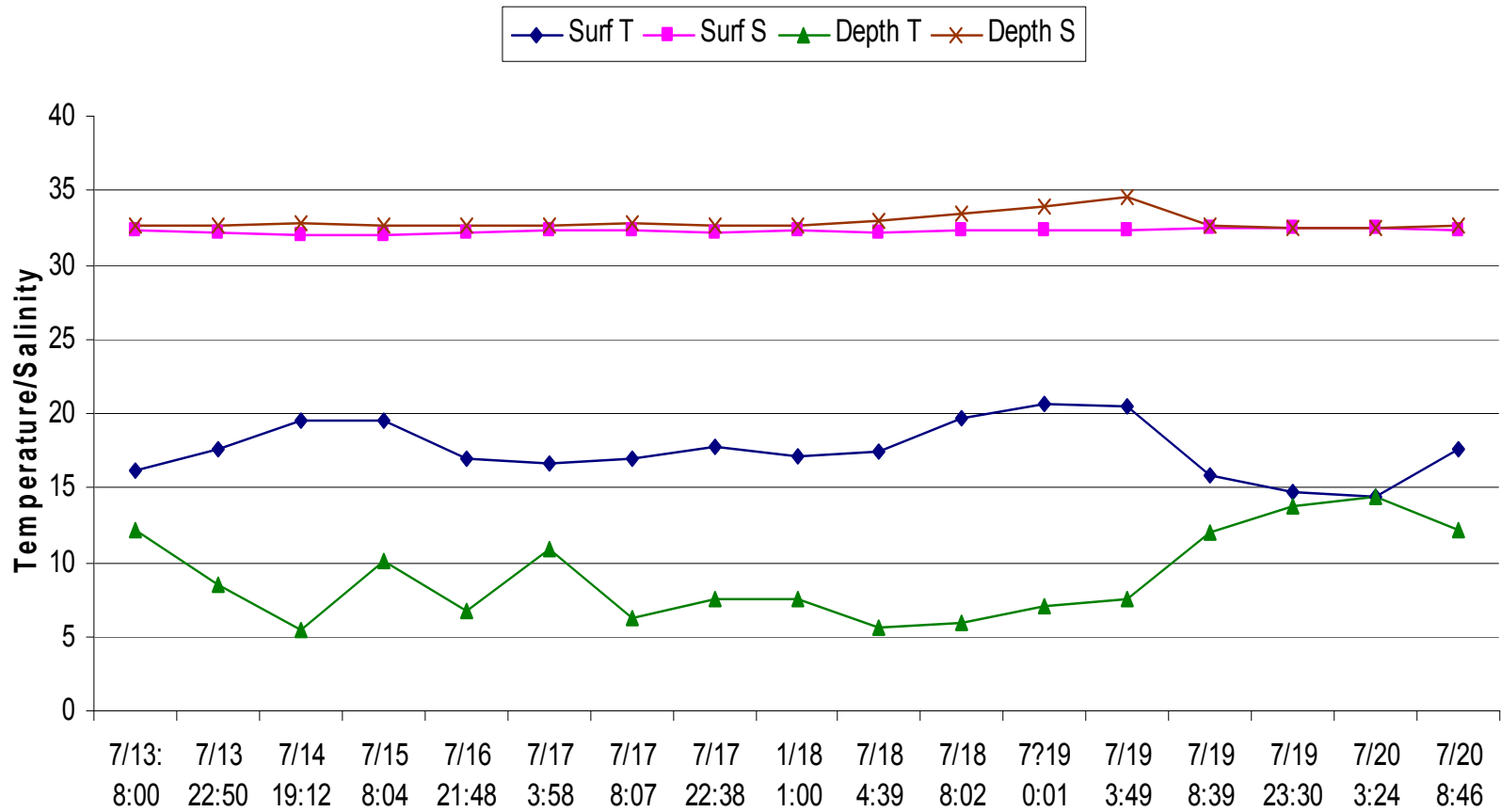
Optimal growth between 6°C - 24 °C

Colony regresses at 4 °C - 6 °C

J J A S O N D J F M A M J J A S O N D J F



# Surface and Depth Temperature and Salinity Georges Bank, July 13-21 2008



Note: data from deeper areas that *Didemnum* colonies surveyed

## Phase 2. Develop and test new sensor and combine with physical and biological data to understand role of *Didemnum* offshore (Initiated this summer)

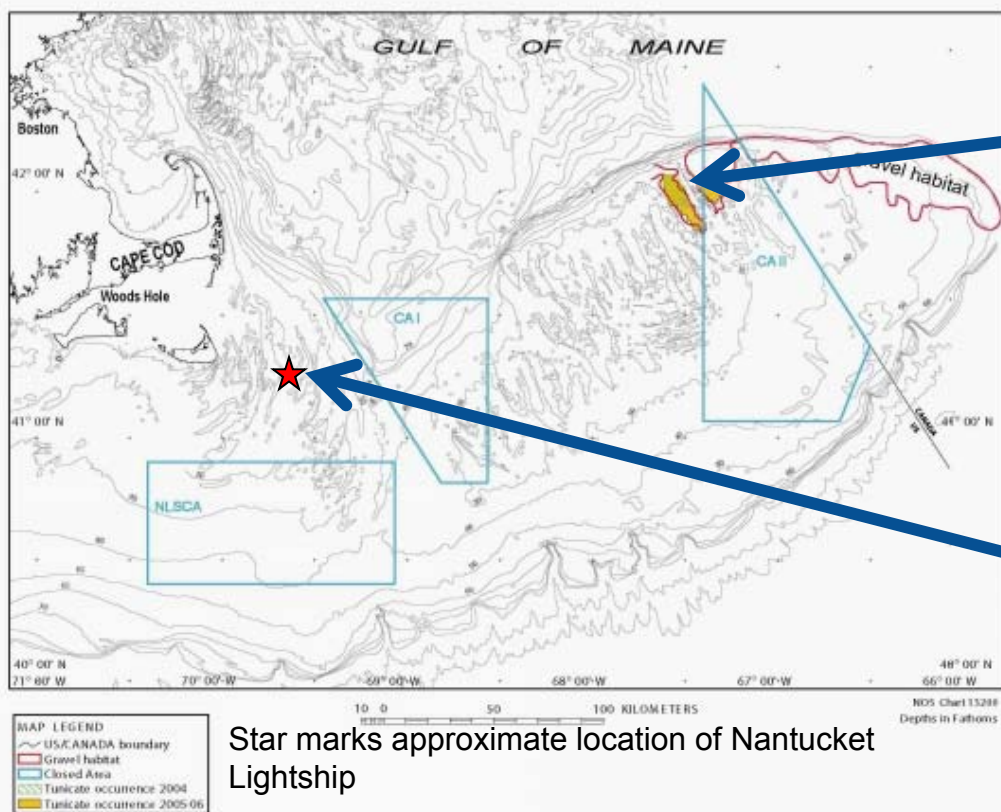
- Test radiometer and reflectance for efficient and accurate detection of *Didemnum* on sea floor using AUV platform
- Evaluate shear stress, breakage, and potential spread of fragments
- Evaluate ecosystem impacts (e.g. its role in scallop and juvenile fish productivity and nearshore habitats).
- Explore options for eradicating or controlling impacts to the ecosystem.
- Develop outreach programs for technology transfer, communicate with stakeholders, and foster collaboration and cooperation among scientists, managers and stakeholders

Funded by Northeast Sea Grant Consortium

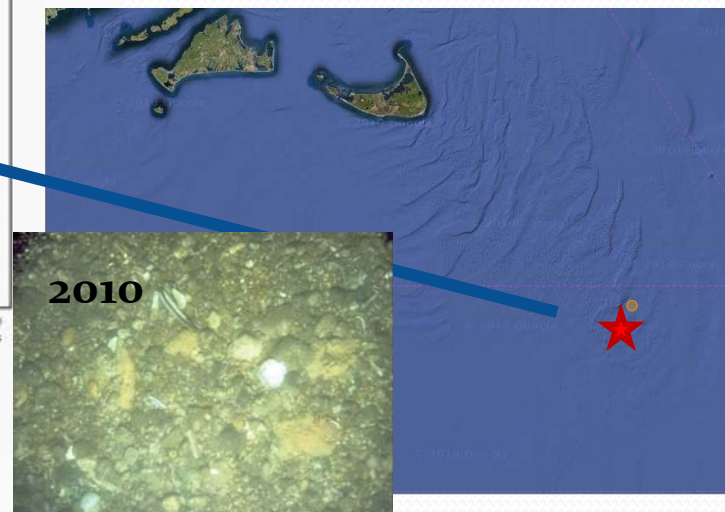
Researchers: Emmanuel Boss, U Maine, Bob Whitlatch, U Conn, AUV Lab

Scott Gallagher et al. (MIT Sea Grant)

# Distribution of *Didemnum vexillum* in Georges Bank, productive scallop and juvenile groundfish habitat



P. Valentine, USGS

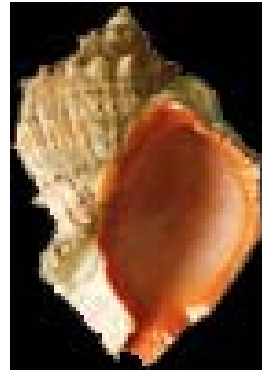


# Preliminary findings

- *Didemnum* dies back periodically; is it climate related?
  - Low temperatures, predation, genetic
  - Need to explore relation to changes in currents, temperature
- Age of colonies, calcium carbonate, and shear forces can fragment *Didemnum* (Whitlatch, Gallagher)
  - Spread from fishing activities needs to be investigated
- Reflectance from *Didemnum* is unique compared to other spectra, but has not been tested in deep waters and larger patches (Boss)
- Developing method for segmenting *Didemnum* from irregular shapes (Gallagher)
- Exploring mats as refuge for prey from fish (Whitlatch)
- Eradication as an option – Biobullets tested in New Zealand (Aldrich)

## Future efforts

- Evaluate changes in deep water currents and temperatures in NW Georges Bank
- Changes in community structure, predation
- Work with fishermen on observations
- Follow warm water species over time



*Rapana venosa* currently in the Chesapeake Bay.

Photo: R. Mann



*Synidotea laevidorsalis*



*Grateloupia turuturu*

Photo: Villard-Bohnsack

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