Advancing Technology to Identify *Didemnum* in Support of Fisheries

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Overview: The Problem

- *Didemnum vexillum*, an invasive sea squirt threatens ecosystems and fisheries
  - Growing over fouling organisms
  - Found on Georges Bank, a productive groundfish and scallop fishery area
- Extent of *Didemnum* spatial coverage and impacts on Georges Bank is unknown
  - Use an Autonomous Underwater Vehicles (AUV) platform to document spatial coverage
- Results from a survey in Georges Bank
  - Future Directions
*Didemnum* sp. found during Dalian Rapid Assessment Survey

Portion of *Didemnum* sp. colony

Spicules found within *Didemnum* sp.
Didemnum vexillum:

Identified in US during 2000 Rapid Assessment Survey; Valentine et al. reported it in Georges Bank in 2002

- Vectors: aquaculture, fouling; ballast water

- Reported in: US east and west coasts, Australia, New Zealand, Europe, Japan

- Compound Sea Squirt
  - reproduces sexually and asexually;
  - releases larvae July to November;
  - larvae settle within 2 hours of release;
  - fragments may reattach

G. Lambert, 2005
**Didemnum** growth in nearshore area

Environmental conditions:
-1°C-24°C; ~29-35 psu;
Optimal growth between 6-24°C
4-6°C colony regresses

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Valentine et al.
2007
Summary of issues – Biological and technical

- **Invasive characteristics**
  - Aggressive and overgrows most species,
  - No confirmed major predator,
  - Toxic compounds (didemnidides and low pH),
  - Dominant biomass in some habitats

- **Impacts**
  - Need to document and quantify impacts, spread, esp. its effects on fisheries and native biota
  - Concern for groundfish and scallop fisheries in Georges Bank

- **Data needs**
  - Need data on spatial coverage and habitat availability
  - Information on impacts to specific fisheries
  - Data to support and test predictive models
Vulnerability at life history stages

- Larvae – currents
- Recruitment
  - Substrate selection
  - Settlement success
  - Direct inhibition
- Post settlement
  - Smothering
  - Resource competition – food,
  - Reduced predation
  - Growth
  - Fishing pressure – direction/ *Didemnum*
- Reproduction
  - Decrease in population fecundity
  - Decrease in fertilization success
Short-term objectives for surveying *Didemnum* on Georges Bank

- **Sensors for detecting *Didemnum***
  - Optical surveys limited to small areas for sampling (relative to the size of George Bank)
  - Limited information from current surveys

- **Use of AUVs to conduct surveys of *Didemnum* on the sea floor**
  - Operate from vessels without tether
  - Navigate accurately
  - Can carry a variety of payloads (e.g. cameras, sonar, environmental sensors)
  - Maintain altitude

- **Explore an acoustic technology to conduct faster, more comprehensive surveys**
  - DIDSON, dual operating features
  - 1.1 and 1.8 mHz, 25 m range, can cover 25 sq m/s
  - Potential coverage is 0.5 sq km/d, compared to a optical camera with ~0.05 sq km/d

- **Compare acoustic and optical imaging systems**

- **Identify spatial coverage of *Didemnum* (and identify other species present)**
Odyssey IV

- Midsize AUV, ~1,000 lb, 2x1x1.5m, can dive to 6000m, hover capable with speeds to 2.5 m/s
Launching, Diving, Navigating
Preliminary data

- Northwest closed area 2; with 10 runs with suitable photographs

- Most successful when drifting with current;

- Observed *Didemnum*, but not as prolific or abundant as reported in earlier reports
Selected AUV tracks
Bottom images taken approximately 2 m off the sea floor: Georges Bank, July 2008
AUVs maintained with 2-2.5 m altitude throughout cruise

Acoustic imaging did not produce results needed for size of patches, organisms

Percentage of frames with one or more colonies with *Didemnum*
Depth profiles of temperature and salinity
Georges Bank

Temperature (°C)
Salinity (psu)

July 18, 2008
July 19, 2008
Future Directions

AUV research
- Seeking new sensors
- Modifying AUV to better record data

Didemnum/Georges Bank – Research needs
- Continue mapping and surveying
- Impacts on fisheries
- Model development
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Potential *Didemnum* habitat in Georges Bank

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