Seaweed (Macroalgae) Monitoring in Rehoboth Bay and Indian River Bay Delaware: Status Update

Presented by: Robin M. Tyler

May 11, 2012

Meeting of the Delaware Inland Bays STAC

Photo: Buzz Henifin

ACKNOWLEDGEMENTS

Funding:	**Center for the Inland Bays**	
	DNREC	
Project Team:	**Robin Tyler ***	**DNREC, Water Resources**
	Chris Bason	**Center for the Inland Bays**
	Larry Tush	**Center for the Inland Bays**

* Principal Investigator

1) Why monitor seaweed?

2) Don’t we monitor enough factors already to determine how the Inland Bays are doing?

1) Seaweed can be a prominent factor influencing ecological character and health, and it is not accounted for in water testing.

2) Omitting seaweed from environmental monitoring may lead to a false interpretation of ecological character and health.


Photo: Melanie Tymes


Photo: Robin Tyler

The Two Sides of Seaweed

Gracilaria sp. **covered with epifaunal organisms. Rehoboth Bay, Delaware July 1999.**

Photo: Robin Tyler

Nuisance Ulva washed onshore in Rehoboth Bay, Delaware, Late 1990's

Photo: Unknown


WMDT News
File: April 18, 2012

Objectives

1) Refine a **practical** seaweed sampling approach for the Inland Bays and similar shallow waters that can be used routinely over the long-term to track changes in type, distribution and abundance.

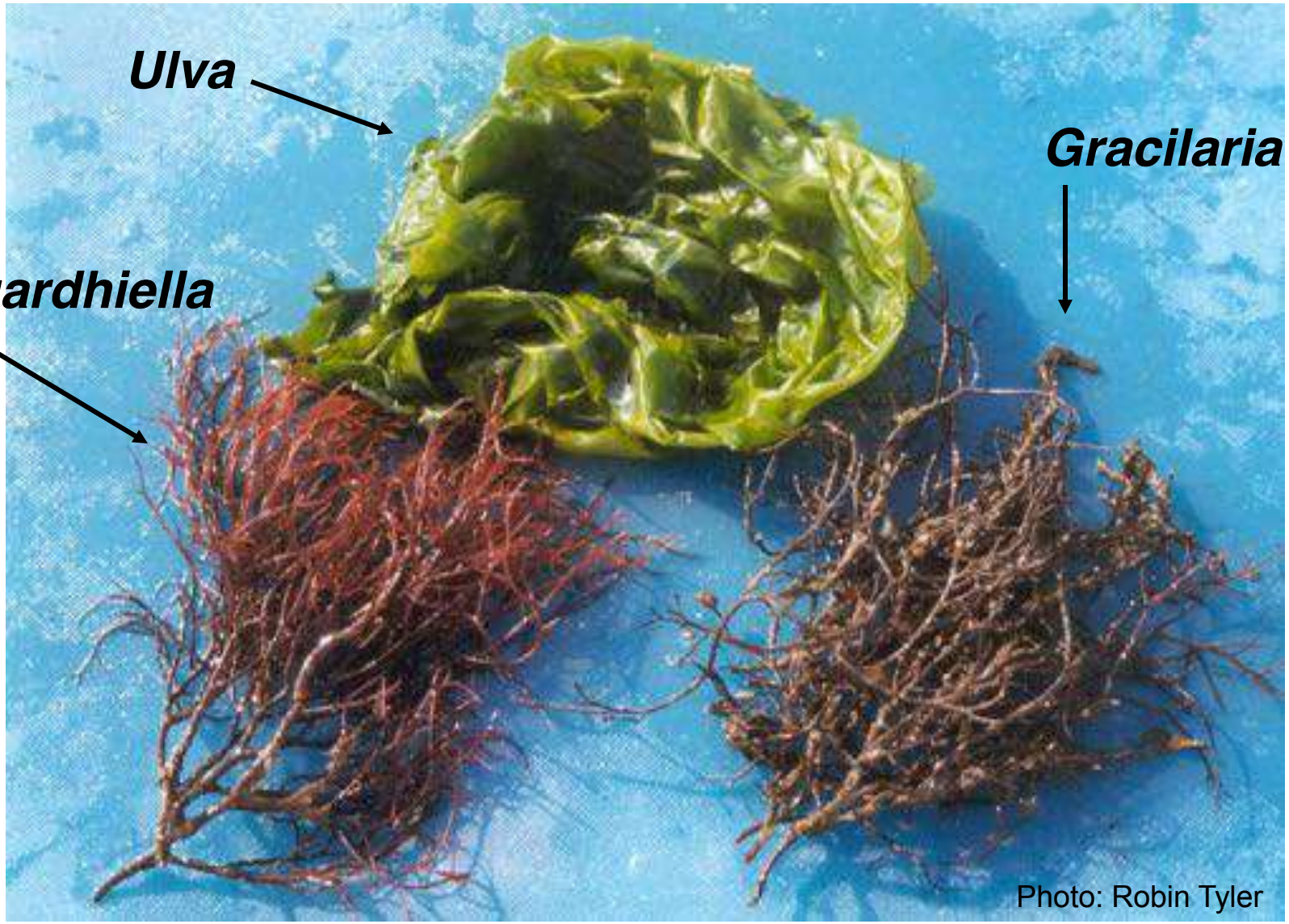
2) Compare current dominant seaweed types, distribution and abundance with previous studies.

General Identification Terms

Finely Bushy Red Seaweeds	Ceramium
Coarsely Bush Red Seaweeds	Agardhiella Gracilaria
Green Seaweeds	Ulva
Filamentous Algae	Chaetomorpha

Source: K.L. Gosner. Peterson's Field Guide, Atlantic Seashore

Three dominant genera of seaweed in Indian River Bay and Rehoboth Bay, Delaware



Ceramium – The Black Algae

Photo: Chris Bason


WMDT News
File: April 18, 2012
Filamentous Algae


Photo: Chris Bason

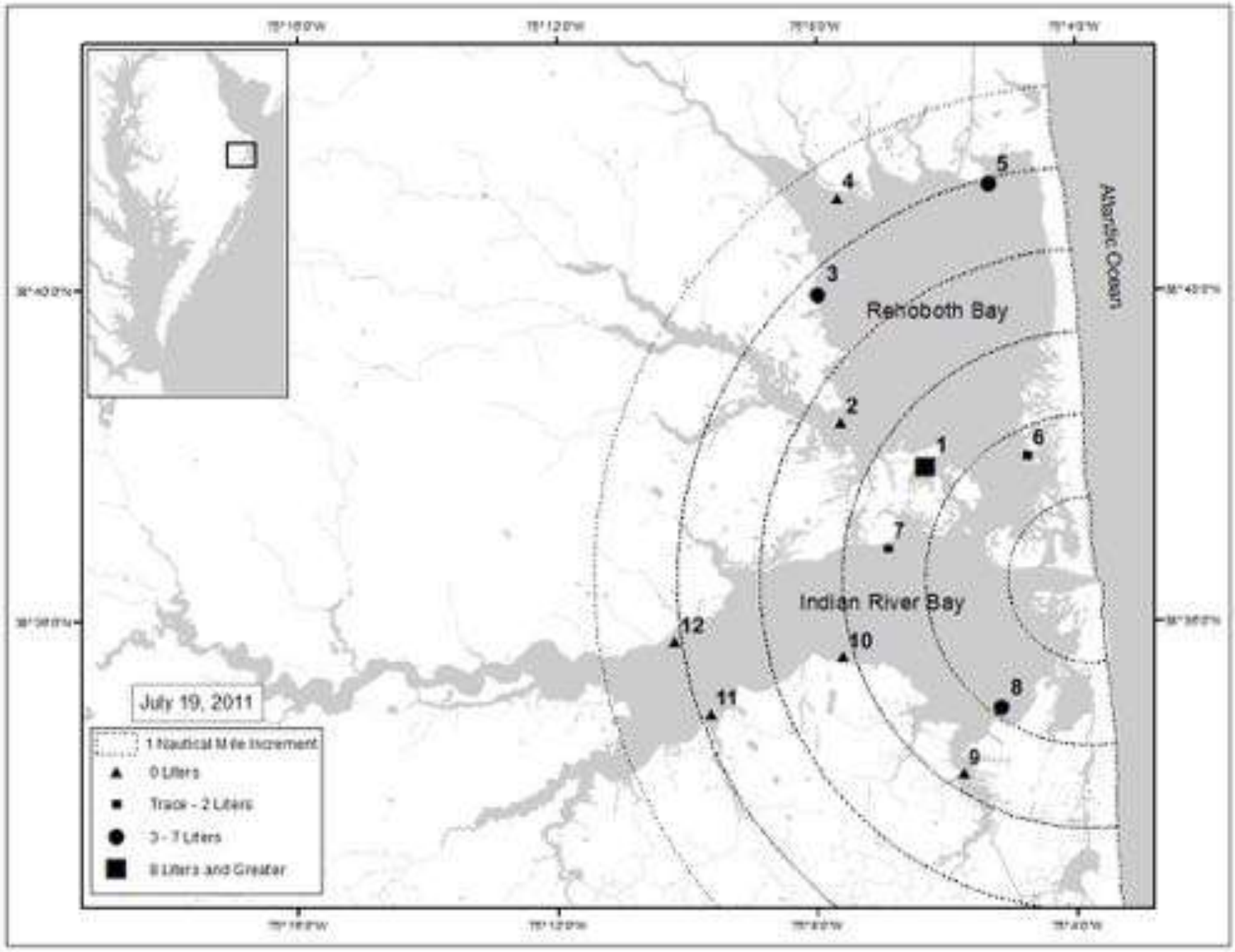

Photo: Chris Bason

Methods

Seaweed collected using a small grappling hook

Total wet volume measured in sieve bucket, sorted and % composition estimated visually

Photos: Robin Tyler


Atlantic Ocean
Rehoboth Bay
Indian River Bay
1
2
3
4
5
6
7
8
9
10
11
12
July 19, 2011
1 Nautical Mile Increment
0 Liters
Trace - 2 Liters
3 - 7 Liters
8 Liters and Greater

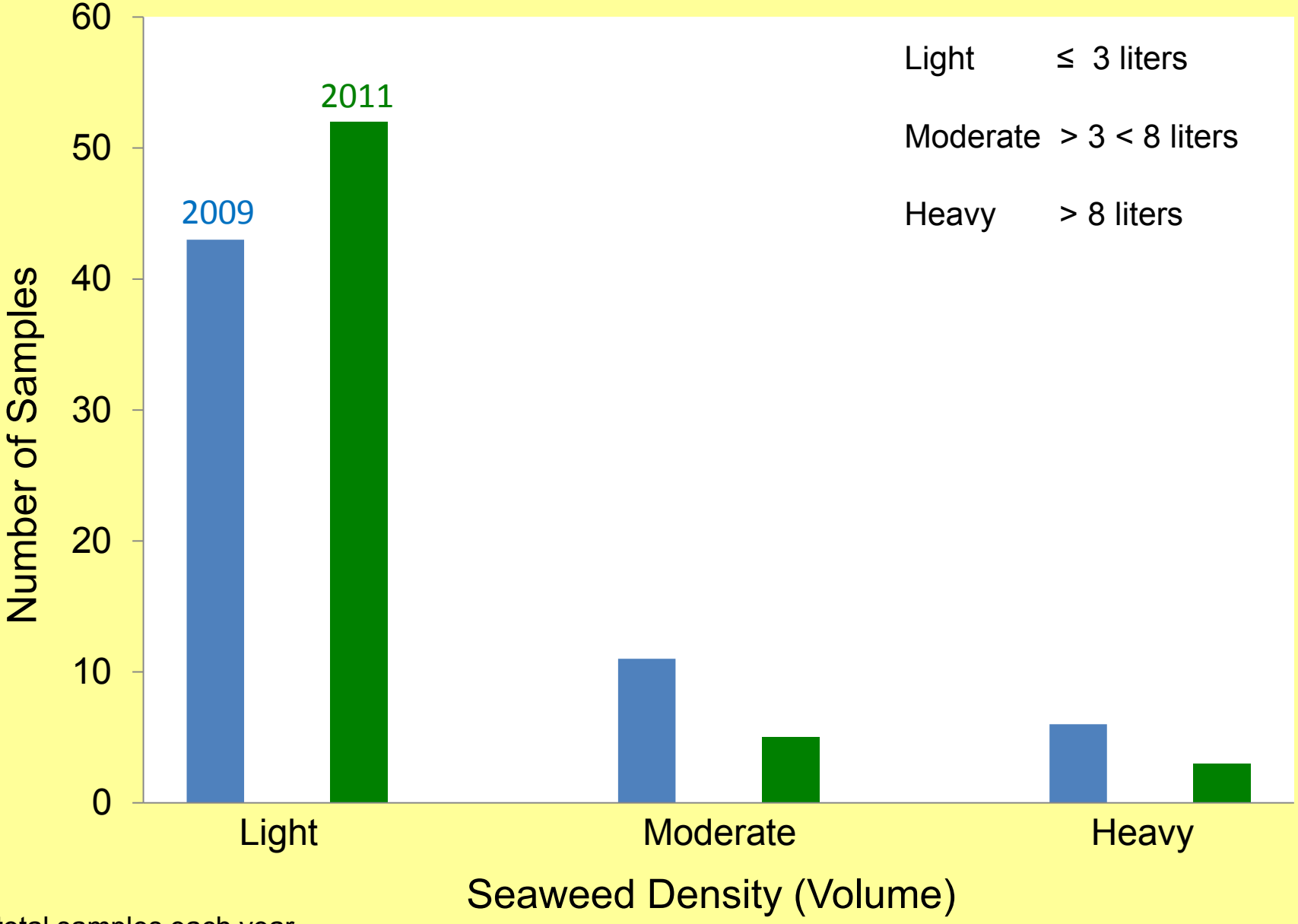
Results

Main Findings

1) There was less seaweed observed in both bays in 2011 as compared to 2009, mainly due to a reduction in Ceramium.

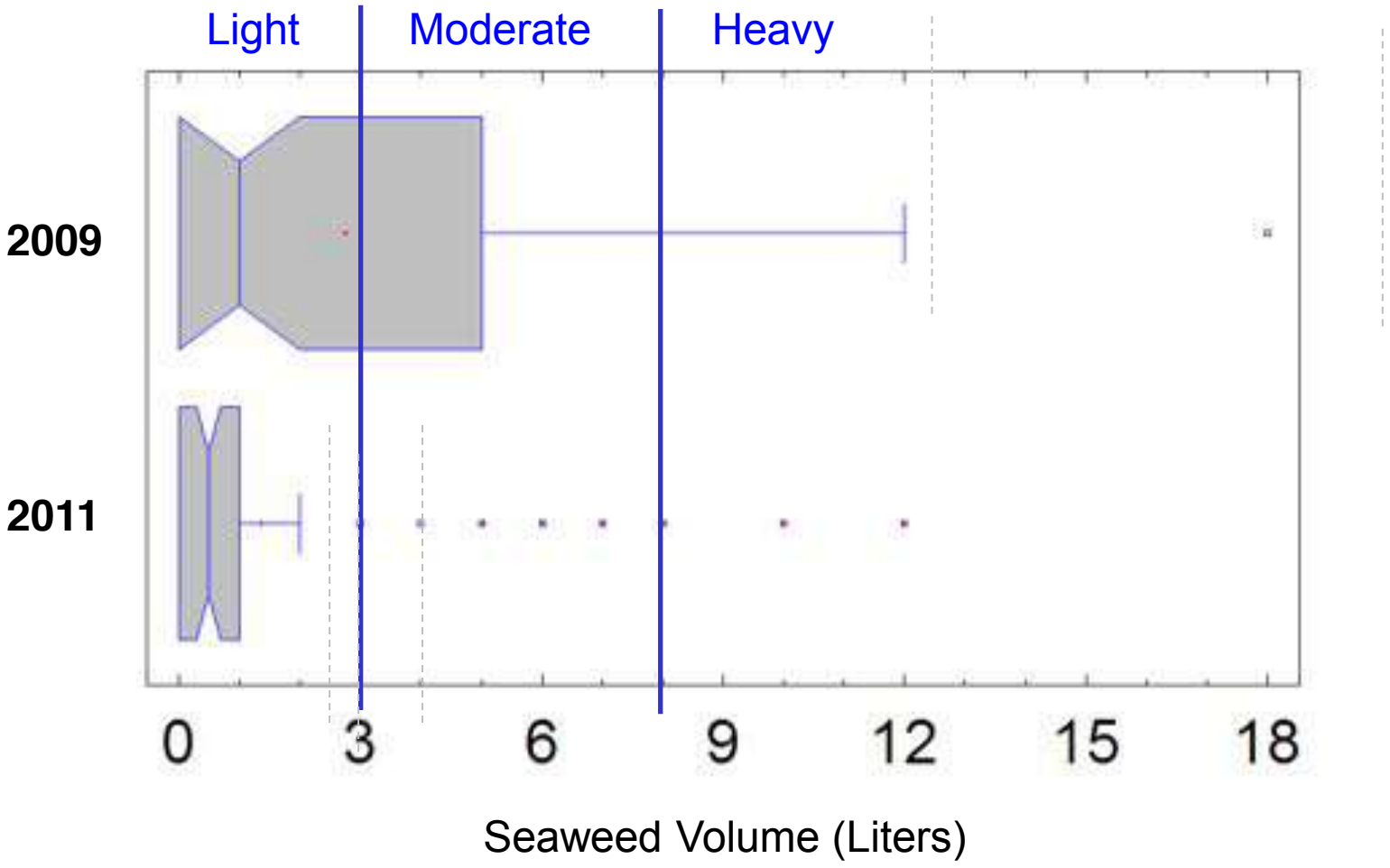
2) During 2011 the most abundant seaweed type was Gracilaria – Ceramium most abundant in 2009.

3) Ulva much reduced from historical levels in 2009, reduced farther to trace amount in 2011.

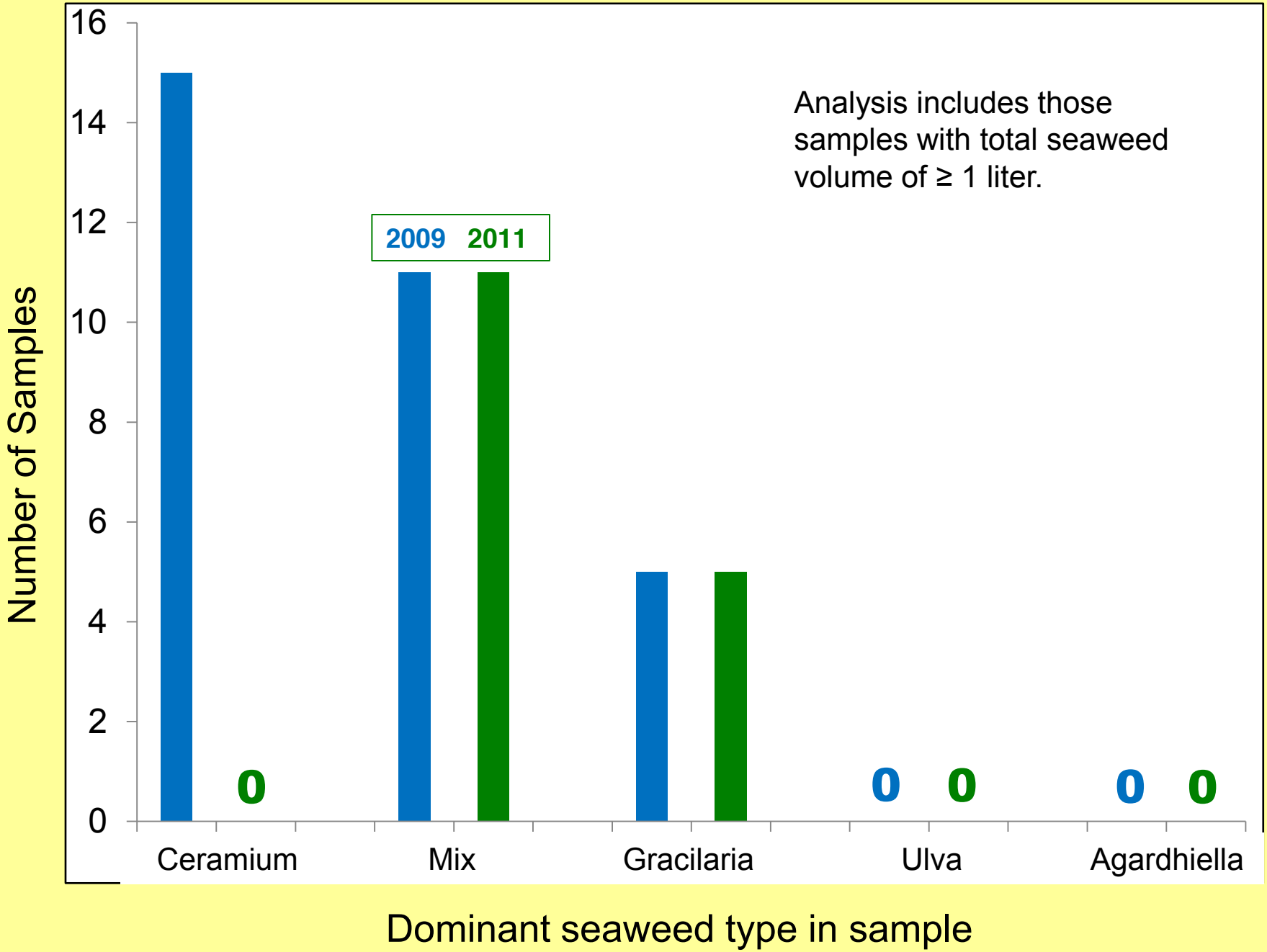


60 total samples each year.

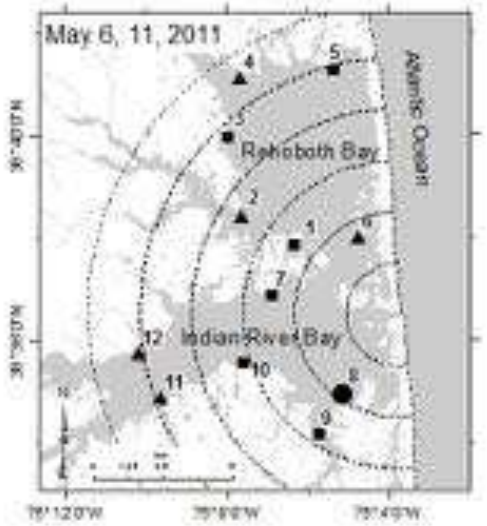
Distributions for seaweed samples collected during 2009 and 2011.

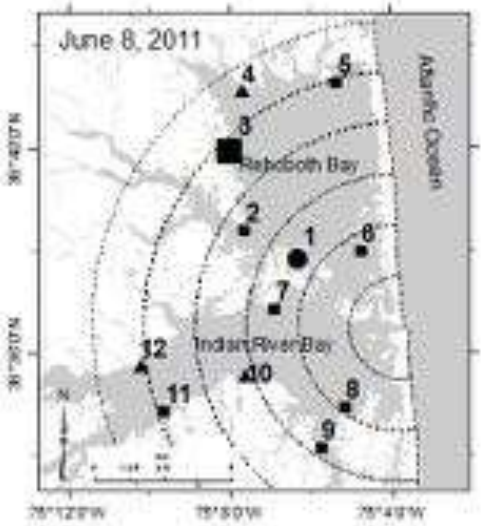


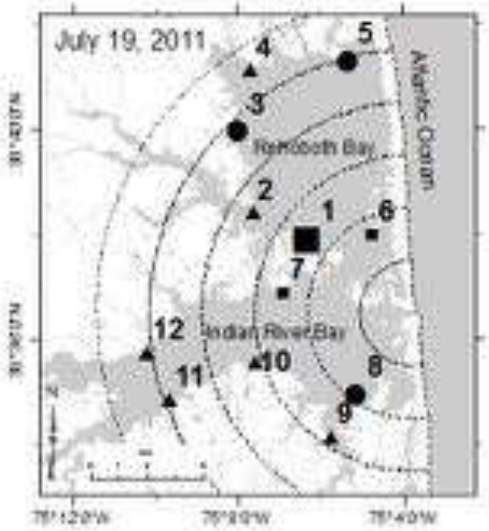
N= 60 samples each summer

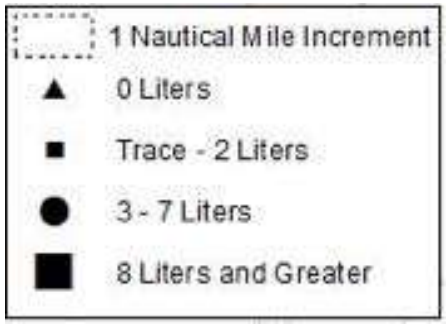

Analysis includes those samples with total seaweed volume of ≥ 1 liter.
2009
2011
Number of Samples
0
2
4
6
8
10
12
14
16
0
0
0
0
Ceramium
Mix
Gracilaria
Ulva
Agardhiella
Dominant seaweed type in sample

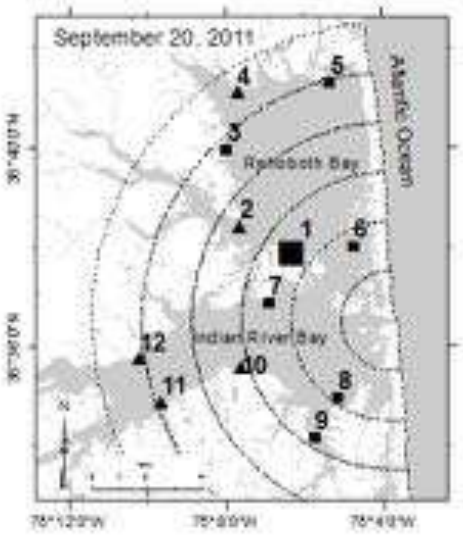
2011 - 12 Fixed Sites

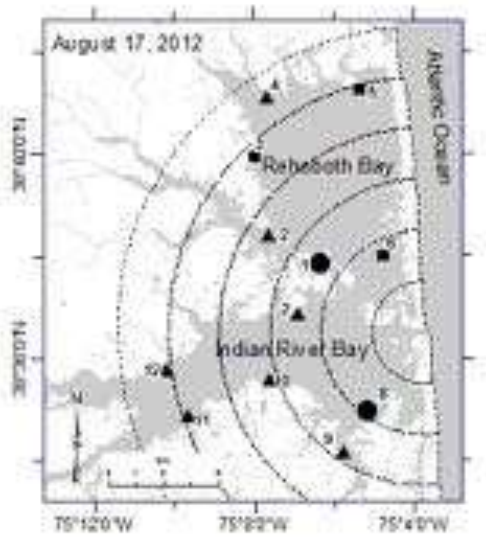




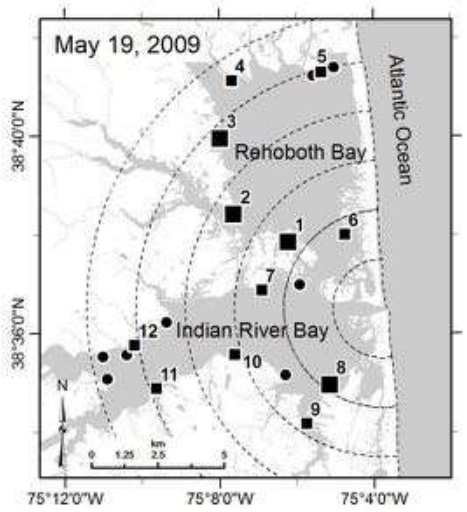


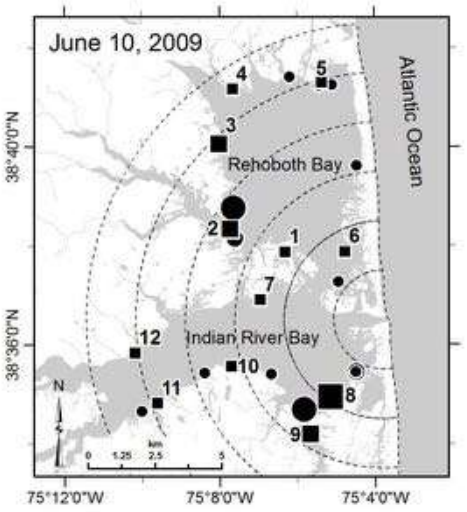


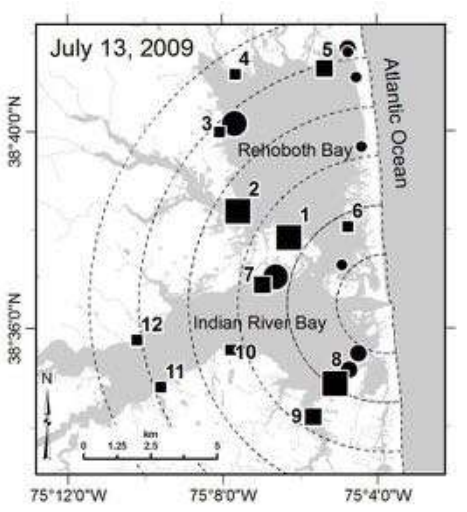


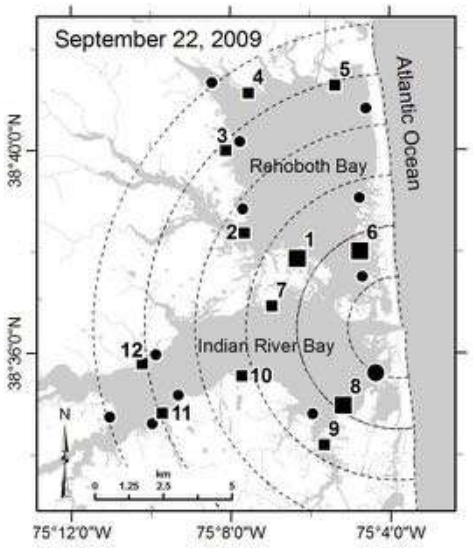


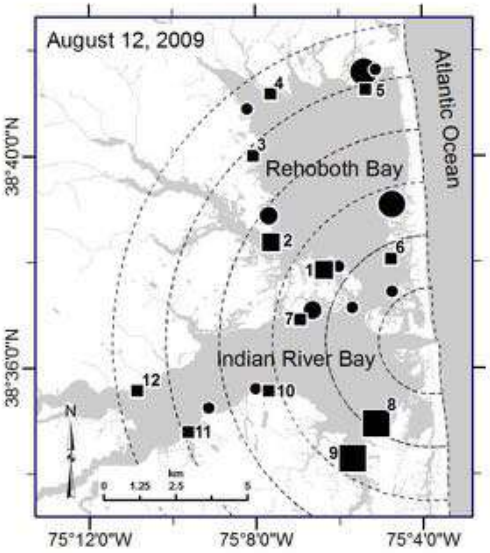
2009 - 12 Fixed Sites + Random Sites

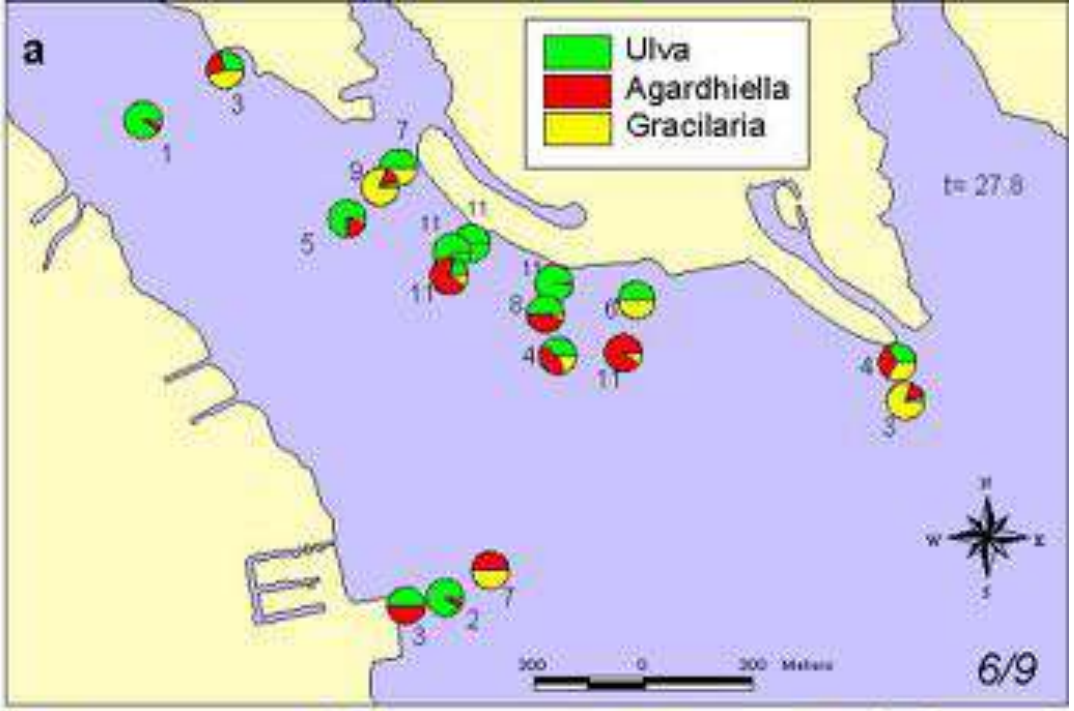


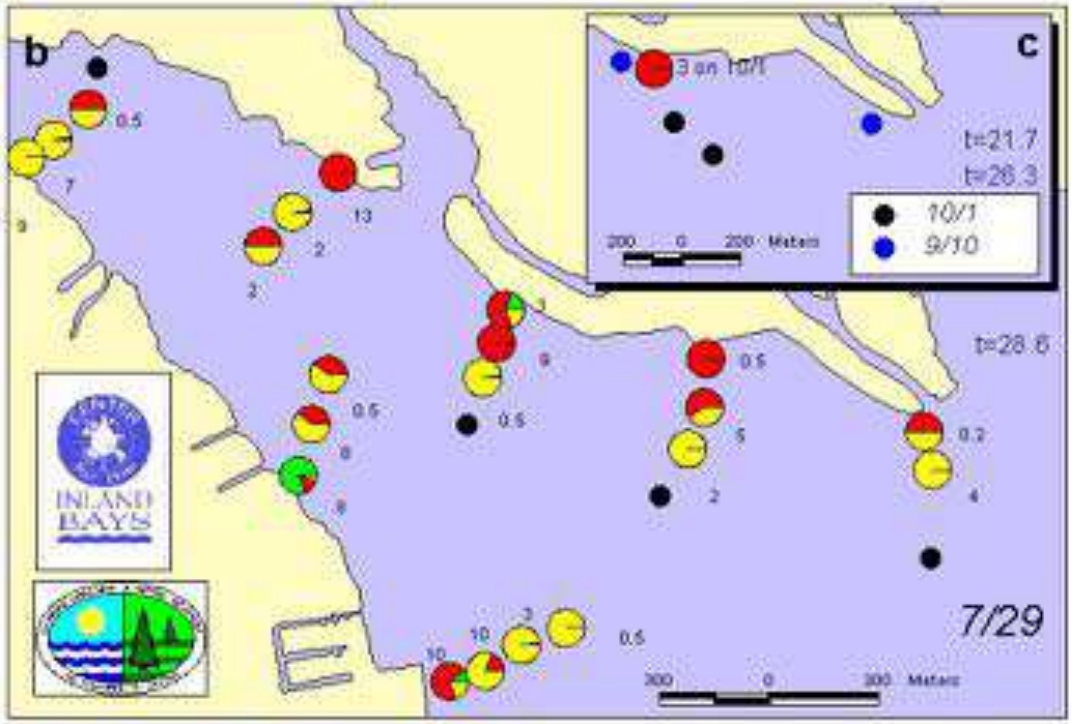




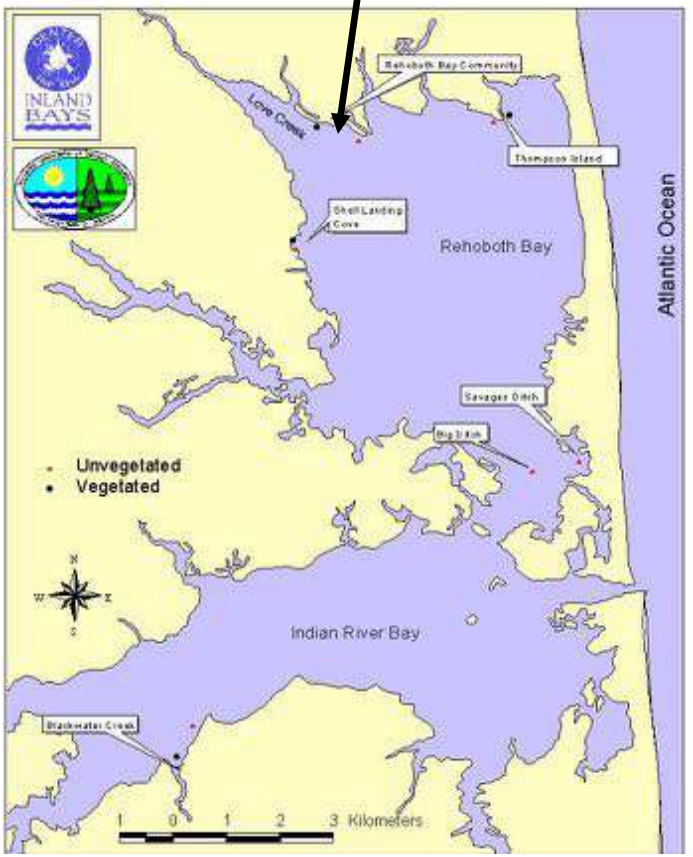


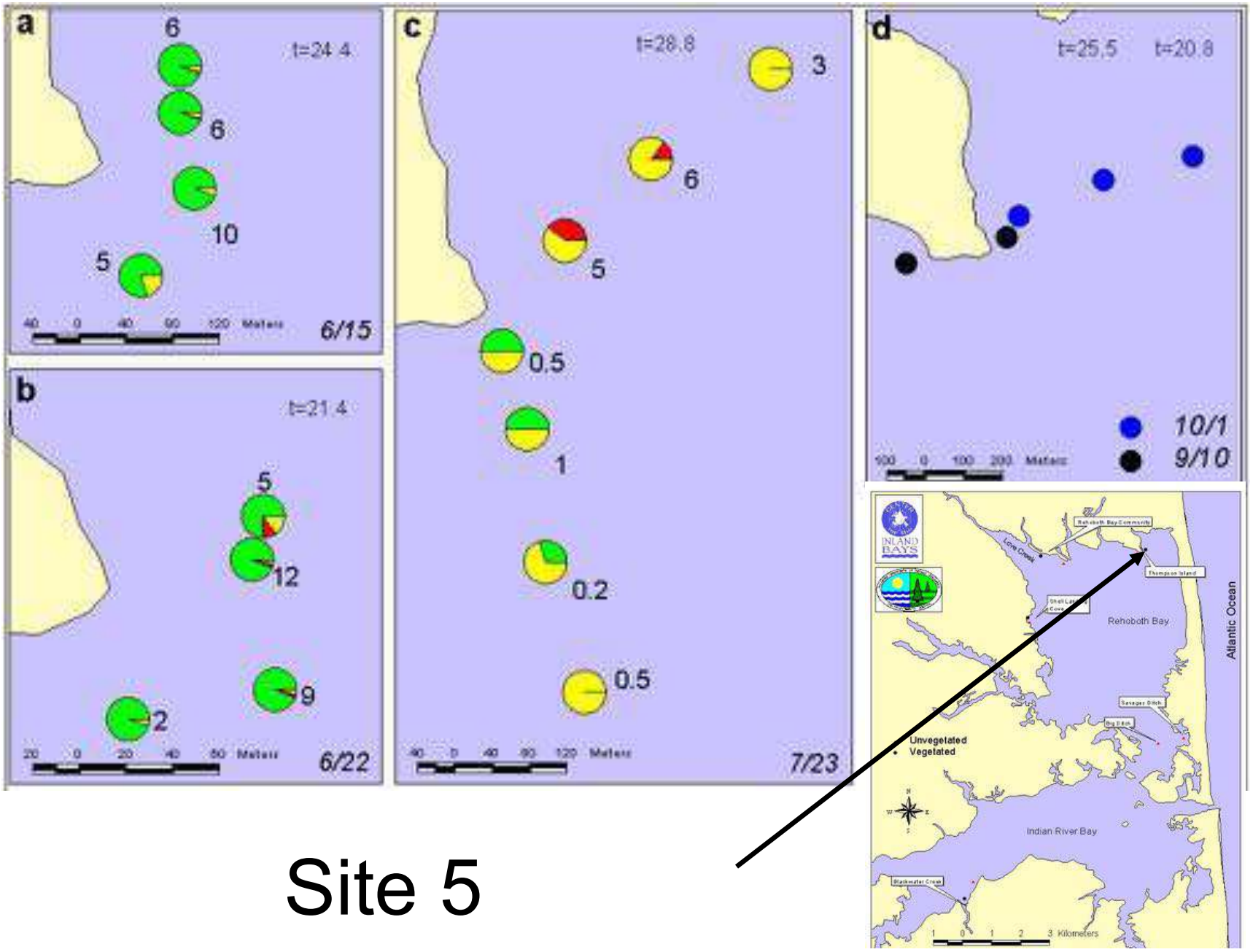



a
Ulva
Agardhiella
Gracilaria
t= 27.8
6/9

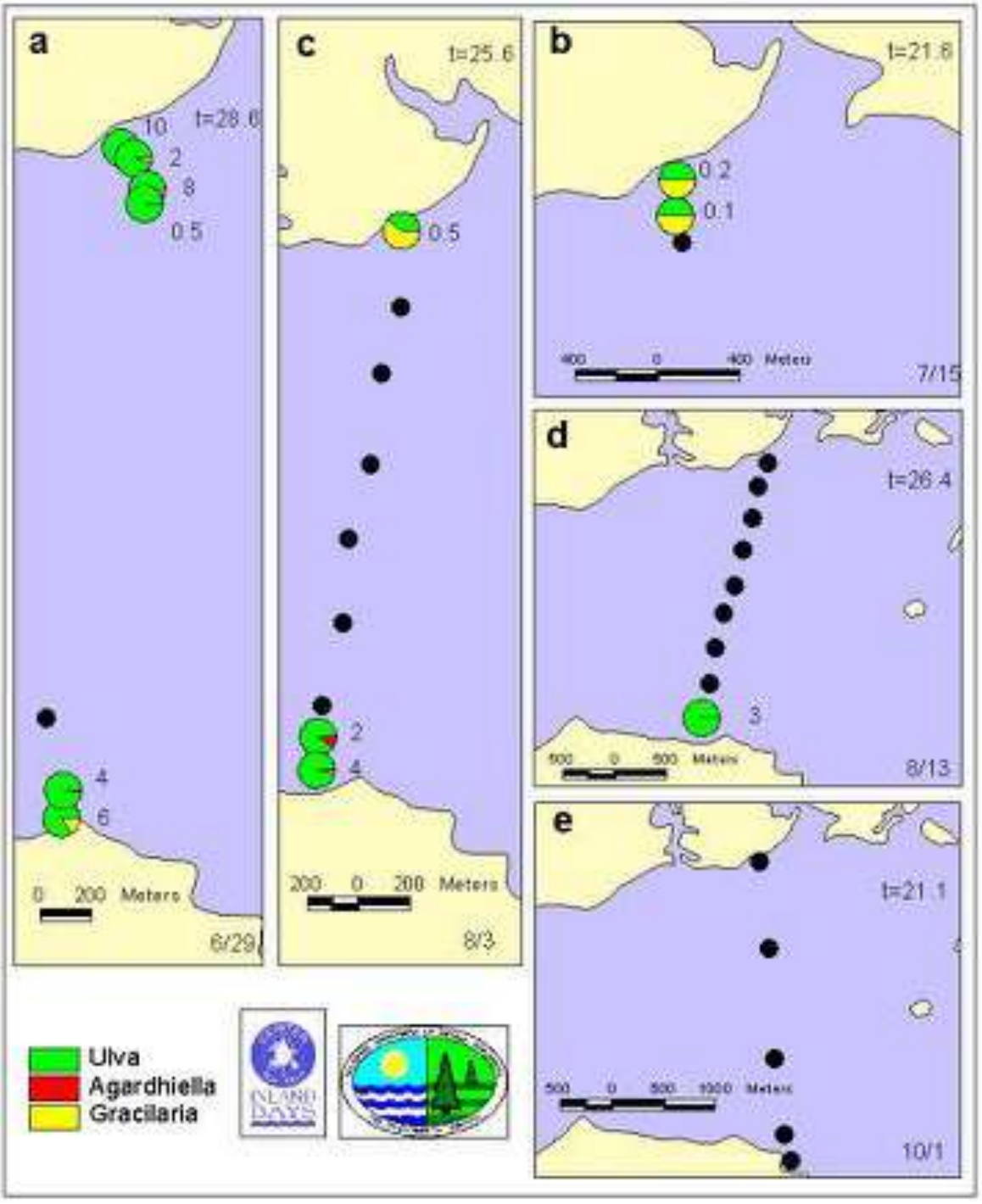

b
c
3 on 10/1
t=21.7
t=26.3
10/1
9/10
t=28.6
7/29

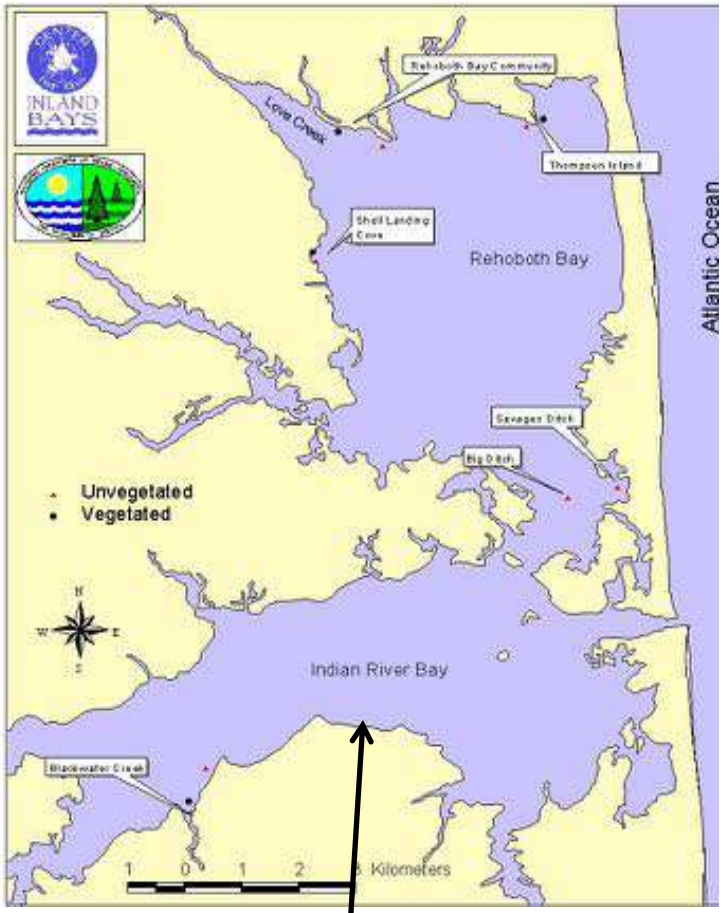
Site 4


Rehoboth Bay
Atlantic Ocean
Indian River Bay
Unvegetated
Vegetated
Kilometers

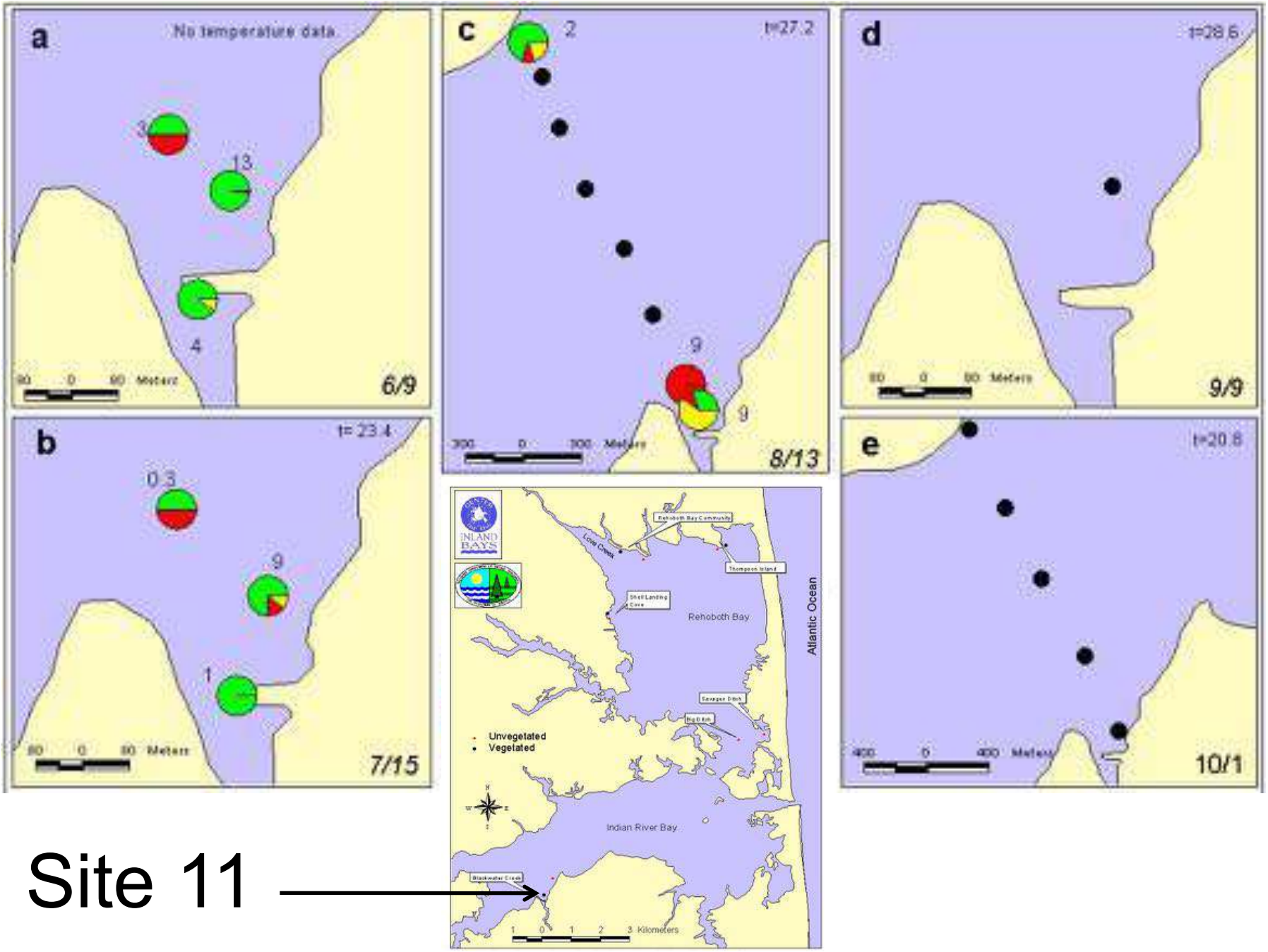

a
6
6
10
5
t=24.4
6/15
b
t=21.4
5
12
9
2
6/22
c
t=28.8
3
6
5
0.5
1
0.2
0.5
7/23
d
t=25.5
t=20.8
10/1
9/10
Unvegetated
Vegetated
Rehoboth Bay
Indian River Bay
Atlantic Ocean

Site 5

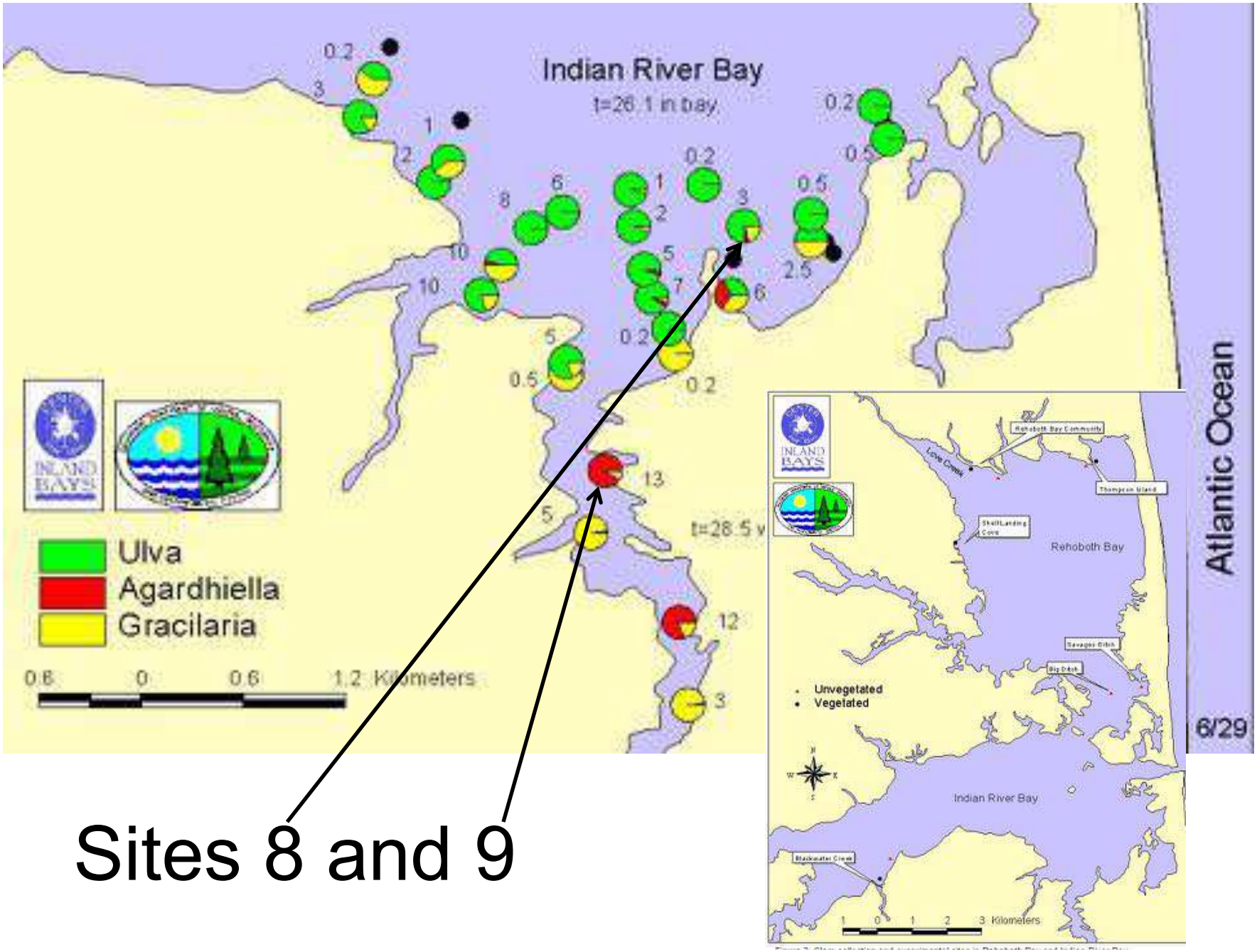

a
t=28.6
10
2
8
0.5
4
6
0 200 Meters
6/29
c
t=25.6
0.5
2
4
200 0 200 Meters
8/3
b
t=21.8
0.2
0.1
400 0 400 Meters
7/15
d
t=26.4
3
500 0 500 Meters
8/13
e
t=21.1
500 0 500 1000 Meters
10/1
Ulva
Agardhiella
Gracilaria


Rehoboth Bay Community
Love Creek
Thompson Island
Shell Landing Cove
Rehoboth Bay
Atlantic Ocean
Savages Ditch
Big Ditch
Unvegetated
Vegetated
Indian River Bay
Blackwater Creek
1 0 1 2 Kilometers

Site 10


a
No temperature data
2
13
4
80 0 80 Meters
6/9
b
t= 23.4
0.3
9
1
80 0 80 Meters
7/15
c
2
t=27.2
9
9
300 0 300 Meters
8/13
d
t=28.6
80 0 80 Meters
9/9
e
t=20.8
400 0 400 Meters
10/1
INLAND BAYS
Rehoboth Bay Community
Lewes Creek
Thompson Island
Shell Landing Cove
Rehoboth Bay
Savages Ditch
Big Ditch
Atlantic Ocean
Unvegetated
Vegetated
Indian River Bay
Blackwater Creek
1 0 1 2 3 Kilometers

Site 11 →


Indian River Bay
t=26.1 in bay
t=28.5 v
Atlantic Ocean
Ulva
Agardhiella
Gracilaria
0.6 0 0.6 1.2 Kilometers
Unvegetated
Vegetated
Rehoboth Bay
Indian River Bay
3 Kilometers
6/29

Sites 8 and 9

Discussion

Main Findings - 2009

1) The dominant seaweed in 2009 was Ceramium as compared to a dominant mix of Agardhiella, Gracilaria and Ulva in 1999.

2) Overall, there appeared to be less seaweed in both bays in 2009 as compared to 1999.

3) In 2009 seaweed was light to absent over the entire summer in some areas of both bays, where in 1999 it was heavy there at some time during the summer.

Main Findings - 2011

1) There was less seaweed observed in both bays in 2011 as compared to 2009, mainly due to a reduction in Ceramium.

2) During 2011 the most abundant seaweed type was Gracilaria – Ceramium most abundant in 2009.

3) Ulva much reduced from historical levels in 2009, reduced farther to trace amount in 2011.

Worldwide Issue

Delaware - Inland Bays

China - Qingdao

France - Brittany Coast

Almost 100 places in Brittany have toxic seaweed

More beaches could be shut in northwestern France due to health fears over toxic seaweed, conservationists warned on Monday, after it emerged that algae have spread to almost 100 sites in Brittany.

The places under threat include some of the area's most popular resorts.

French Prime Minister Francois Fillon has announced his government will pay for cleaning French beaches polluted by a toxic seaweed.

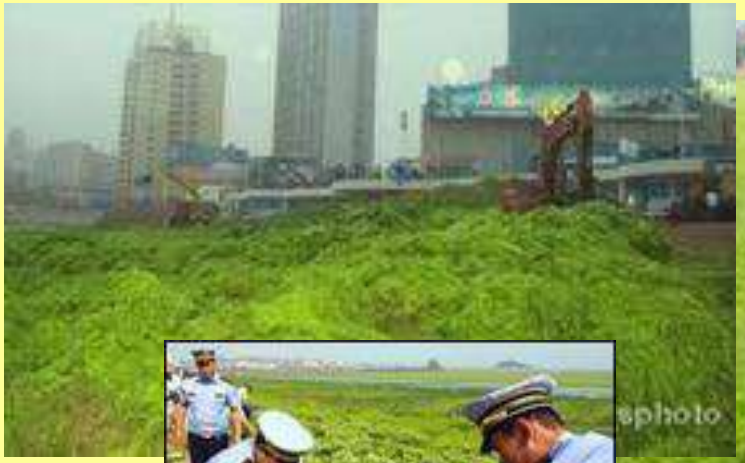
Source: Google Search – Seaweed Brittany Coast

Seaweed suspected in French death …driver died in July after carrying three truckloads of sea lettuce away from the beaches where it has been decaying, releasing poisonous gas.

……a horse-rider was rendered unconscious and his mount died after slipping on the algae late last month, apparently after inhaling toxic gas released by the rotting seaweed.

Behind the scenes at the 2008 Summer Olympics

Source: Google Search of China and seaweed



Source: Google Search of China and seaweed

Algae encroaches on Chinese waters ahead of Olympics

China's efforts to offer a "greener" Summer Olympics in Beijing has taken on a whole new meaning, as the sea where the Games' sailing events will be held has been overrun by algae.

About 10,000 volunteers are scooping up the green goo by hand in Qingdao, a port town on China's east coast, while the army has deployed hundreds of soldiers to do the same. More than 1,000 fishing and other vessels are collecting the thick algae with nets, in hopes of clearing the area of algae by July 15.

Already, 155 tonnes have been hauled away

Some Chinese officials and experts have blamed warmer seas, winds from the south and an "exotic" strain of algae from farther down the coast for the algae. Others suggest it is a result of pollution, which deposits excessive nutrients in the water and causes algae to grow at abnormal rates.

It was first detected in May and is so thick and ropey that one member of the U.S. sailing team said she and her teammates think of it as land.

Source: Google Search – Seaweed China

Red Algae Crisis - - What Do We Do Now?

City of Sanibel, Florida

Rhode Island – Newport

Turning the tide on seaweed
Newport hopes 9-ton vehicle can clean up beach, bring crowds back

It has long been an unsightly red stain on this world-renowned headland of exclusive yacht clubs, oceanfront mansions, and immaculate tennis lawns.

For decades, Newport has mulled ways to get rid of the seaweed.

The red stuff is actually several kinds of algae, including Ceramium, Polysiphonia, and Chondrus Crispus,

“Over the course of the season it just gets horrible,’’ said the city manager

Questions Going Forward - 2009

1) Can the Citizen Monitoring Program add the “hook” method of seaweed sampling to its’ current group of monitoring activities. This type of sampling is not a good fit for the existing State water monitoring program.

2) Is the apparent shift in seaweed dominance from a mix of Agardhiella, Gracilaria and Ulva in 1999 to Ceramium in 2009 real, or an anomaly that will reverse itself in the near future?

3) If Ceramium is to be the dominant alga of the future how does it rate as habitat and nuisance versus previous dominants.

4) Is the apparent reduction in overall seaweed abundance real and if so what are the reasons for the decline?

5) Why has all seaweed declined so much in northern Rehoboth Bay and western Indian River Bay.

Questions Going Forward - Now

1) How is the Citizen Monitoring Program taking to adding the “hook” method of seaweed sampling to its’ current group of monitoring activities.

2) Is the apparent shift in seaweed dominance from a mix of Agardhiella, Gracilaria and Ulva in 1999 to Ceramium in 2009 real, or an anomaly that will reverse itself in the near future?

3) If Ceramium is to be the dominant alga of the future how does it rate as habitat and nuisance versus previous dominants.

4) Is the apparent reduction in overall seaweed abundance real and if so what are the reasons for the decline?

5) Why has all seaweed declined so much in northern Rehoboth Bay and western Indian River Bay.

Recommendation

Monitor seaweed (type and volume) at selected sites multiple times per year between May and September. This may prove to be an essential **indicator** of system response to ongoing pollution abatement efforts.

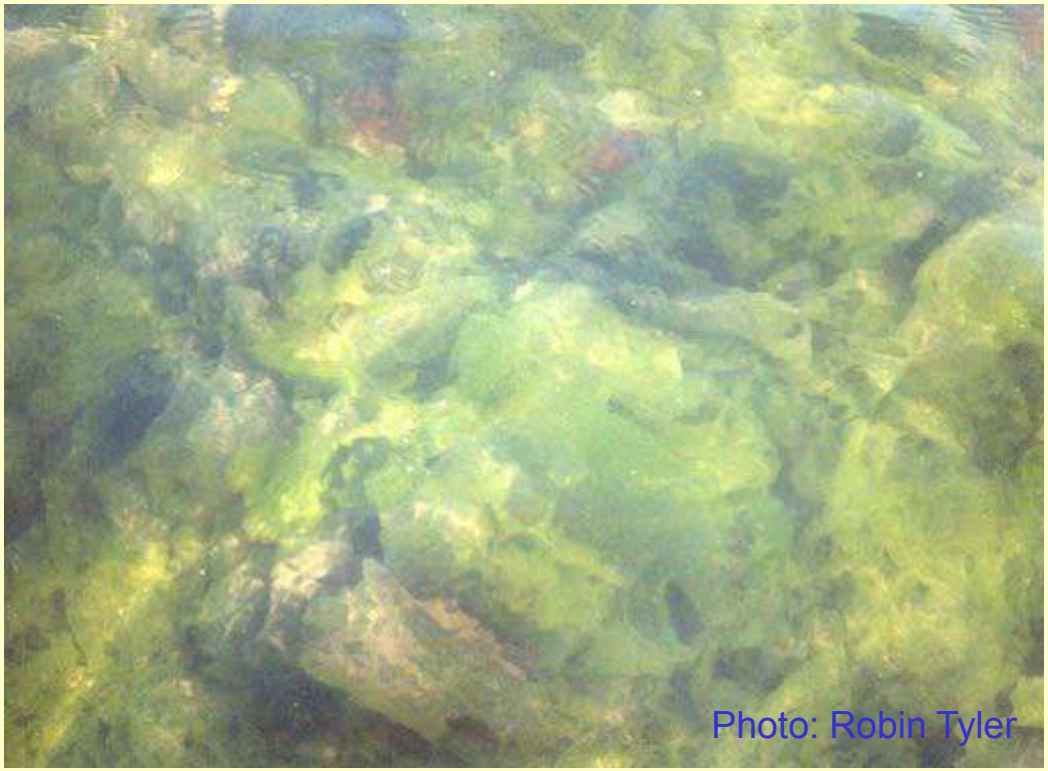


Photo: Robin Tyler

A Bigger Picture

Big, tasty and stupid makes for a short life Mr. Brant

DEPARTMENT OF THE INTERIOR

INFORMATION SERVICE

BUREAU OF BIOLOGICAL SURVEY
For Release MONDAY, JUNE 17, **1940**

SPORTSMEN HOPE SEA LETTUCE WILL BRING BACK BRANT, BUT BIRDS RESPOND SLOWLY

When sportsmen and ornithologists began receiving reports that the Atlantic brant, the migratory waterfowl that was almost wiped out by the disappearance of eelgrass along the Atlantic seaboard, was eating sea lettuce as a substitute for its favorite food, there was hope that the food problem of this bird had been solved. Recent reports from observers of the Bureau of Biological Survey, United States Department of the Interior, however, indicate that eelgrass is still the brant's favorite vegetation and sea lettuce a poor substitute.

The sudden and nearly complete dying out of eelgrass along most of the American and European Atlantic coasts some 10 years ago was one of the most startling biological phenomena in recent times. Botanists agree that such rapidity of destruction and spread of the plant epidemic had previously been unknown in botanical history,


Photo: Melanie Tymes