Casco Bay Workshop

Larval Transport, Settlement and Nurseries

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Overview

Which Species?

- **Commercial**
- **Invasives**

What's known about larval transport, settlement?

Where are their nurseries, adult habitats?

How do we monitor them?

Commercially Valuable Species

Lobsters

Rock crabs

Soft shell clams

Mussels

Bait worms

Sea urchins

Periwinkles

Introduced/ Invasive Species

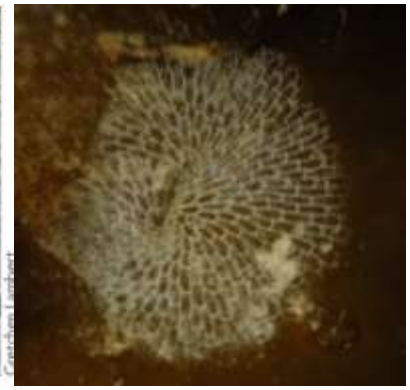
Sea squirts

Bryozoans

Woods Hole Science Center, USGS

Didemnum vexillum, a harmful colonial tunicate that has invaded Casco Bay waters.

Botrylloides violaceus, an invasive colonial tunicate or "sea squirt" found in Casco Bay.

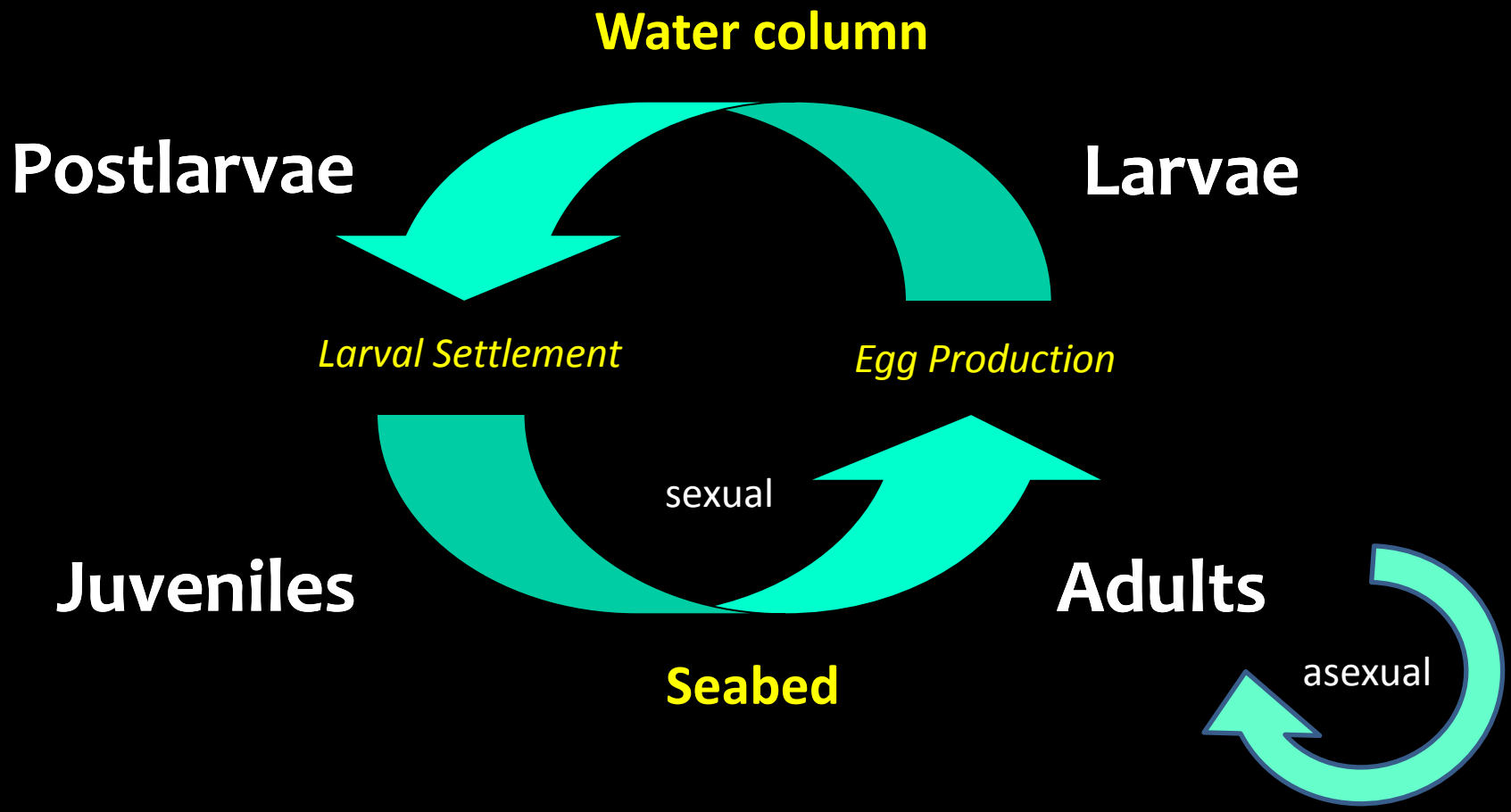


Green crab

Asian shore crab

Mitten crab? – not yet!

Life Cycles


Water column
Postlarvae
Larvae
Larval Settlement
Egg Production
sexual
Juveniles
Adults
Seabed
asexual

Clam Flats in Casco Bay

Brunswick
Freeport
North Yarmouth
Yarmouth
Cumberland
Cousins Island
Falmouth
Chebeague Island
Phippsburg
Harpswell
Portland
Long Island
Peaks Island

Open Shellfish Flats
Closed Shellfish Flats

Casco Bay Closed Clam Flats

Source: Maine Department of Marine Resources and Casco Bay Estuary Project, 1995

Bivalve Spat Collectors

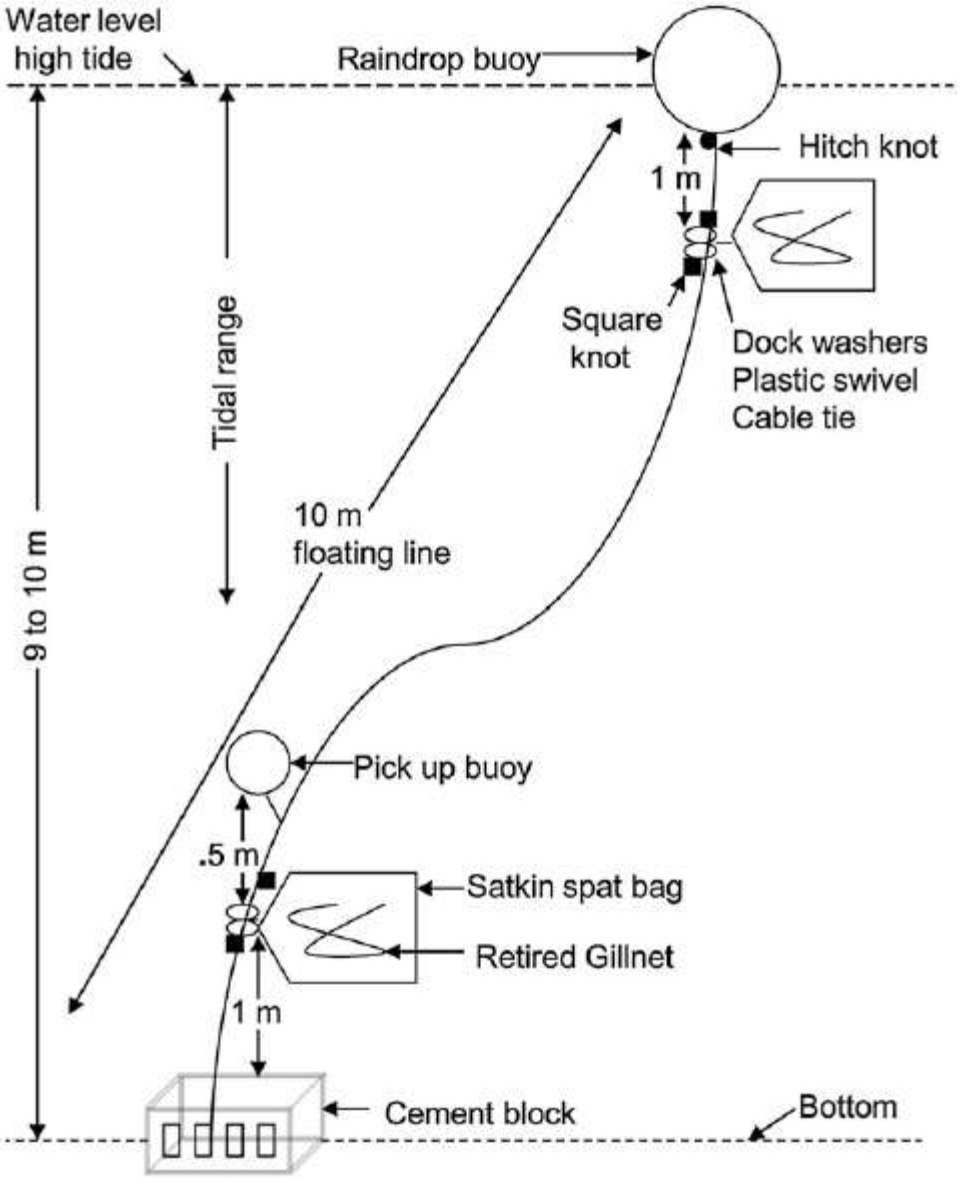


Figure 2. Schematic diagram illustrating the design of a single spat bag sampler.

Vassiliev et al. 2010. J. Shellfish Research 29: 337–346.

Lobster *Life History*

5-9 weeks

Water column

Postlarvae

Larvae

Larval Settlement

Egg Production

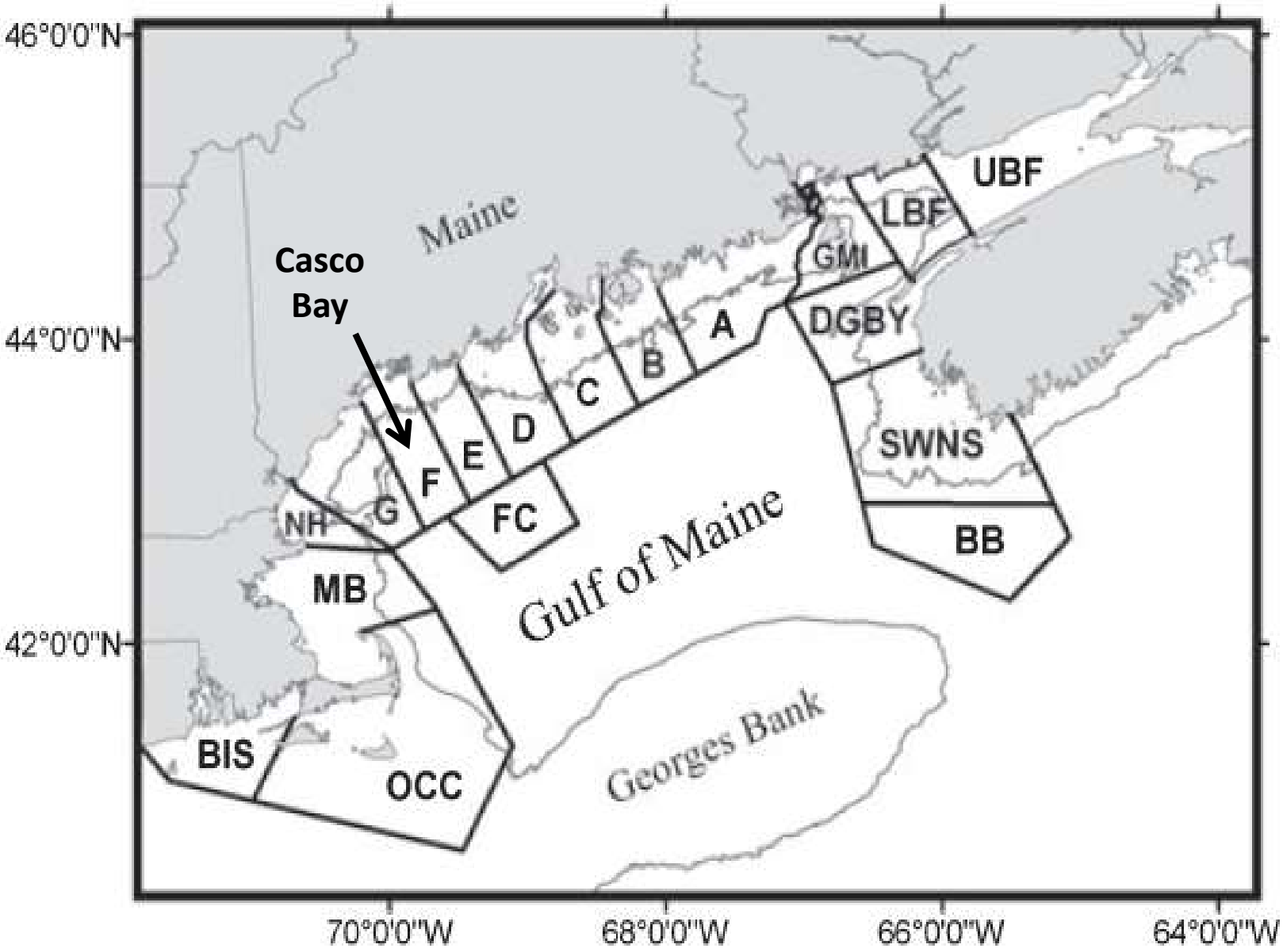
Juveniles

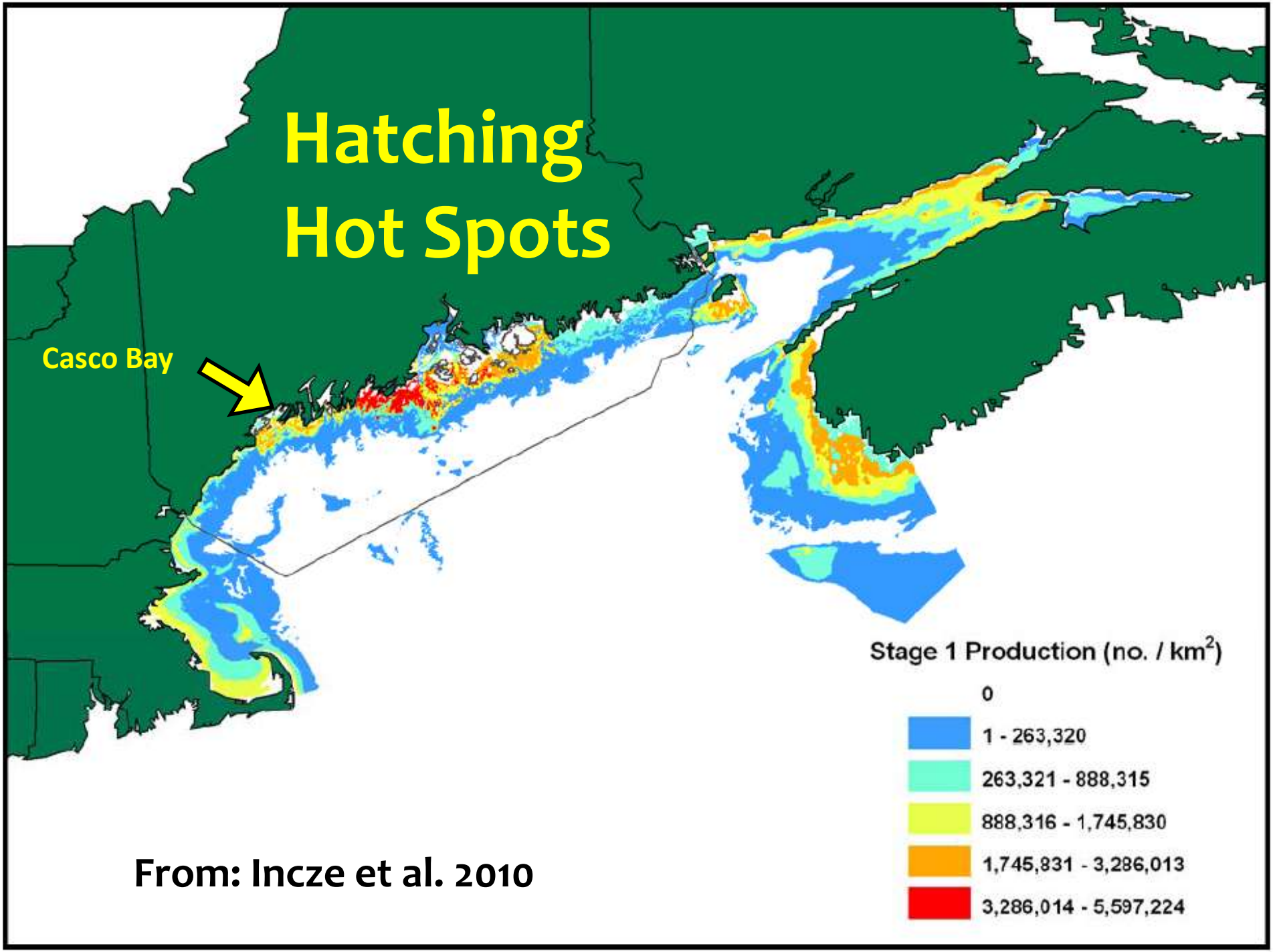
Adults

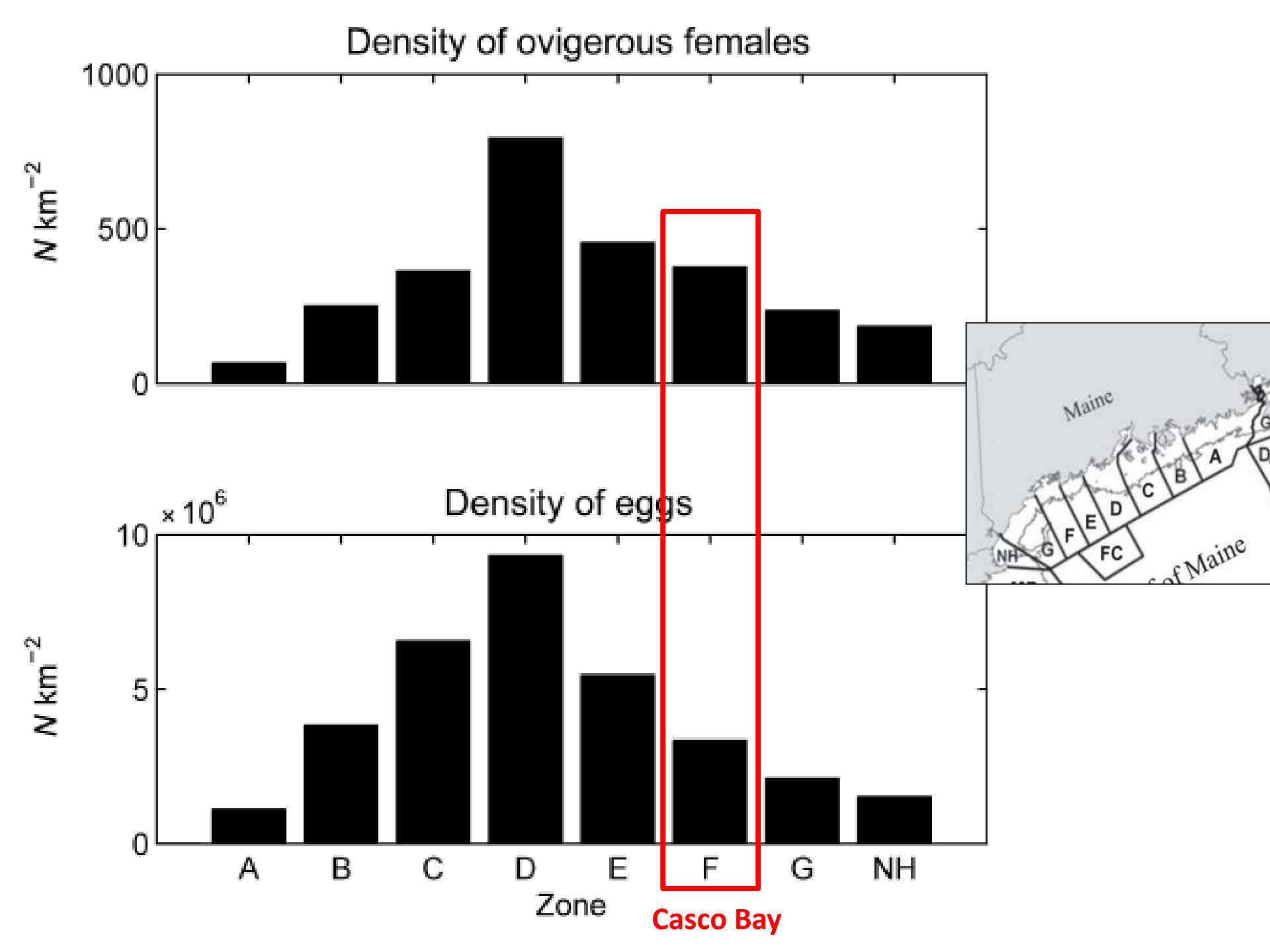
Seabed

5-9 Years

Biophysical Modeling Domain – Xue et al. 2008, Incze et al. 2010

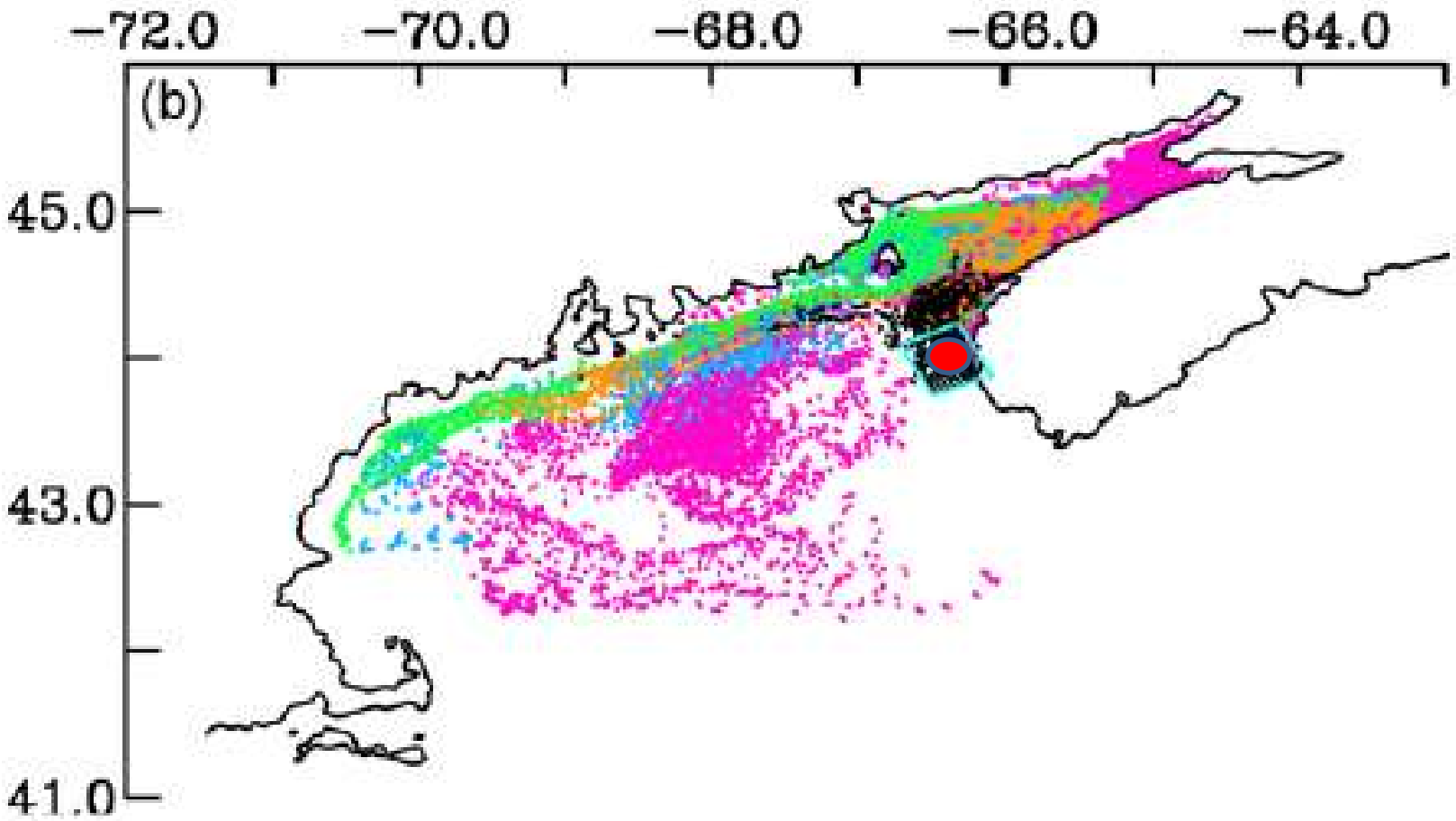



Hatching
Hot Spots
Casco Bay
Stage 1 Production (no. / km^2)
0
1 - 263,320
263,321 - 888,315
888,316 - 1,745,830
1,745,831 - 3,286,013
3,286,014 - 5,597,224
From: Incze et al. 2010

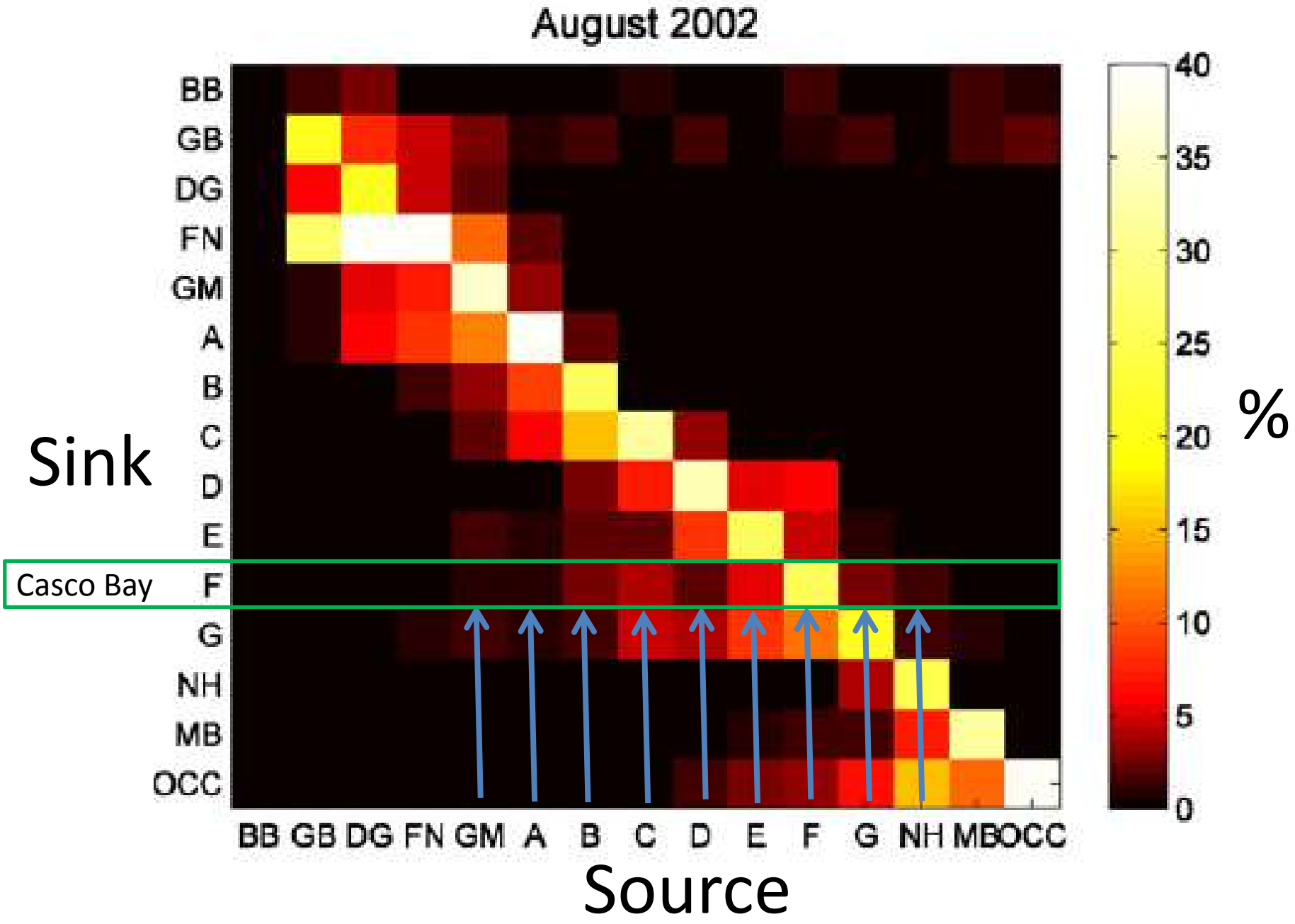

Density of ovigerous females
1000
500
0
N km^{-2}
Density of eggs
× 10^{6}
10
5
0
N km^{-2}
A
B
C
D
E
F
G
NH
Zone
Casco Bay
Maine
NH
G
F
E
D
C
B
A
FC

Larval Trajectories

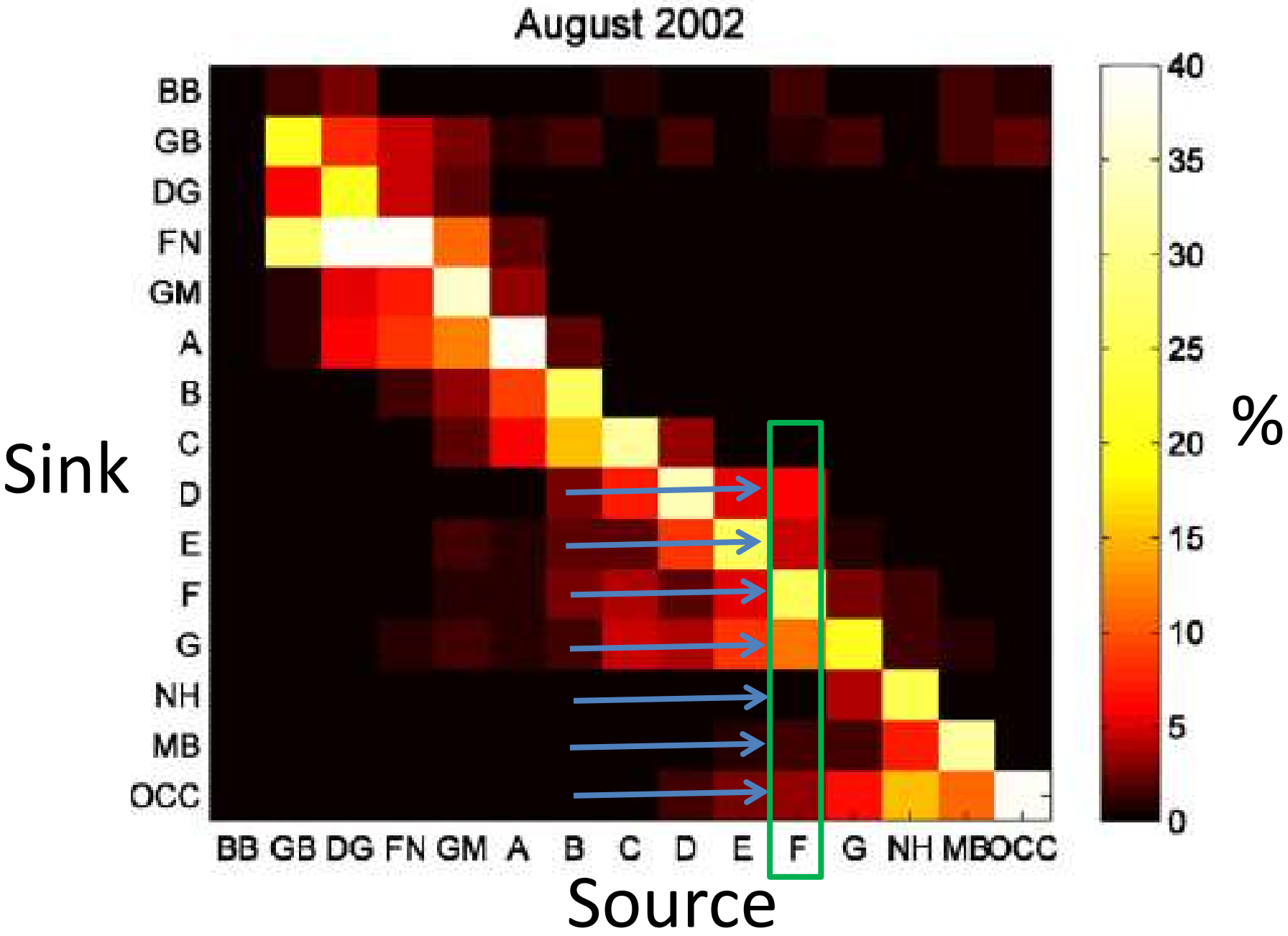
(Xue et al. 2008)



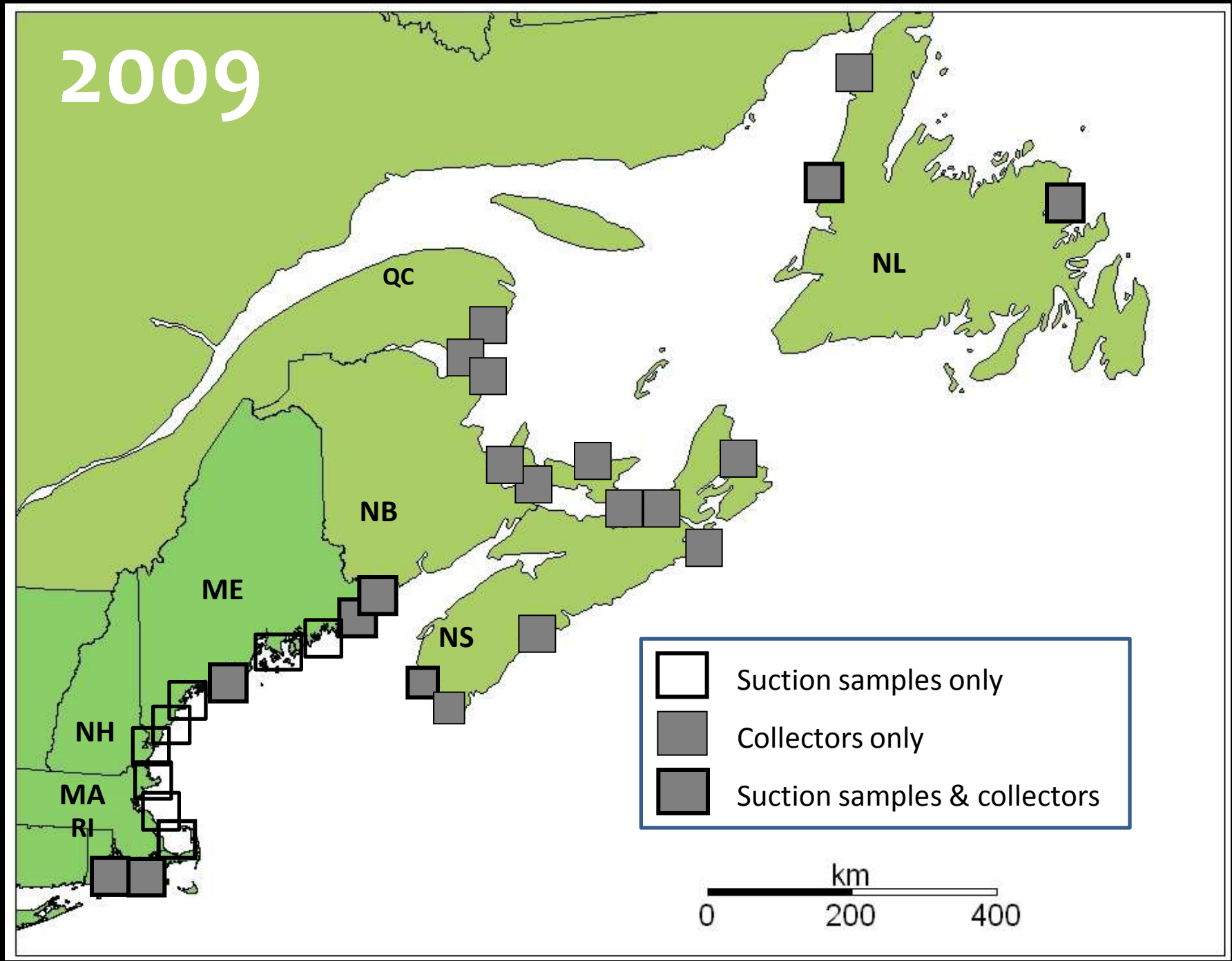
Connectivity Matrix (Xue et al. 2008)

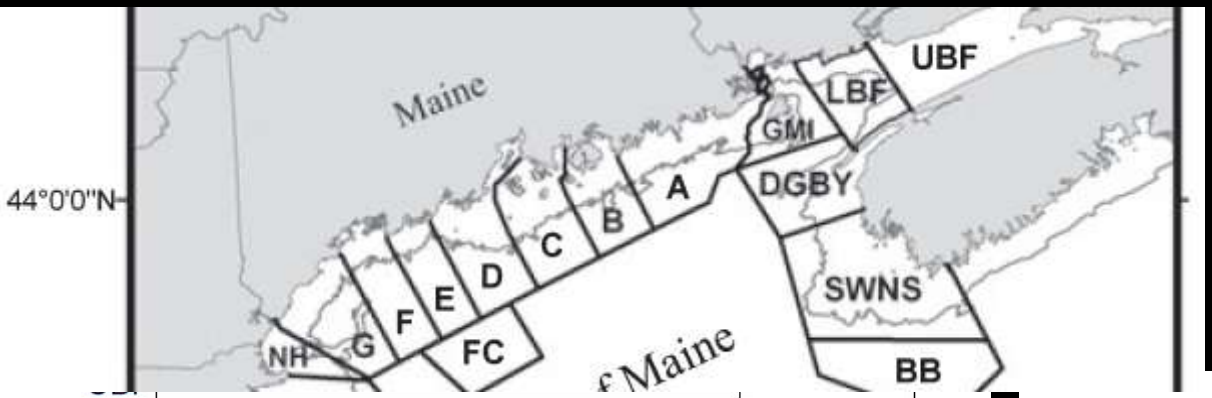


Connectivity Matrix (Xue et al. 2008)

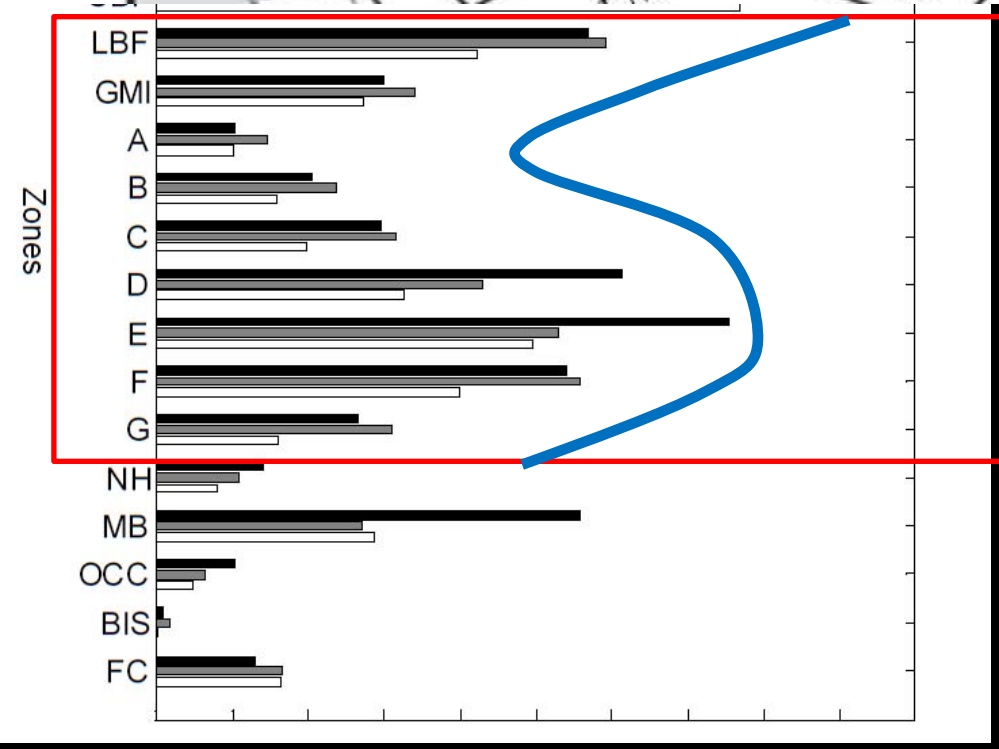


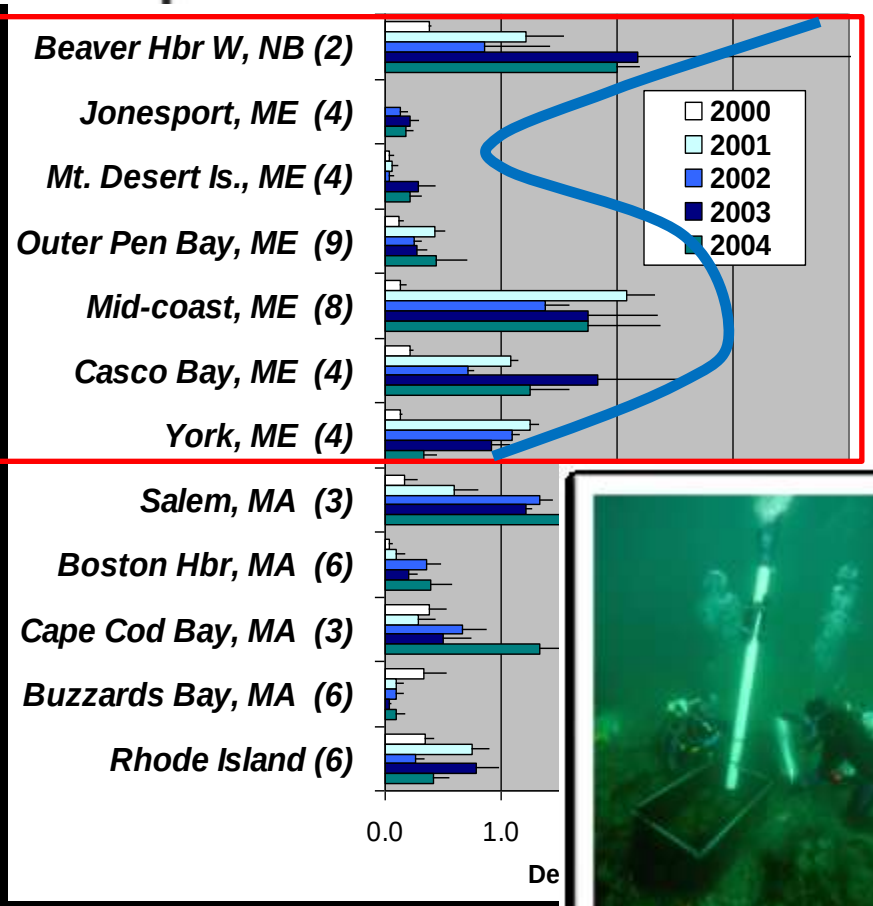
Monitoring Lobster Nurseries


2009
QC
NL
NB
ME
NS
NH
MA
RI
Suction samples only
Collectors only
Suction samples & collectors
km
0
200
400



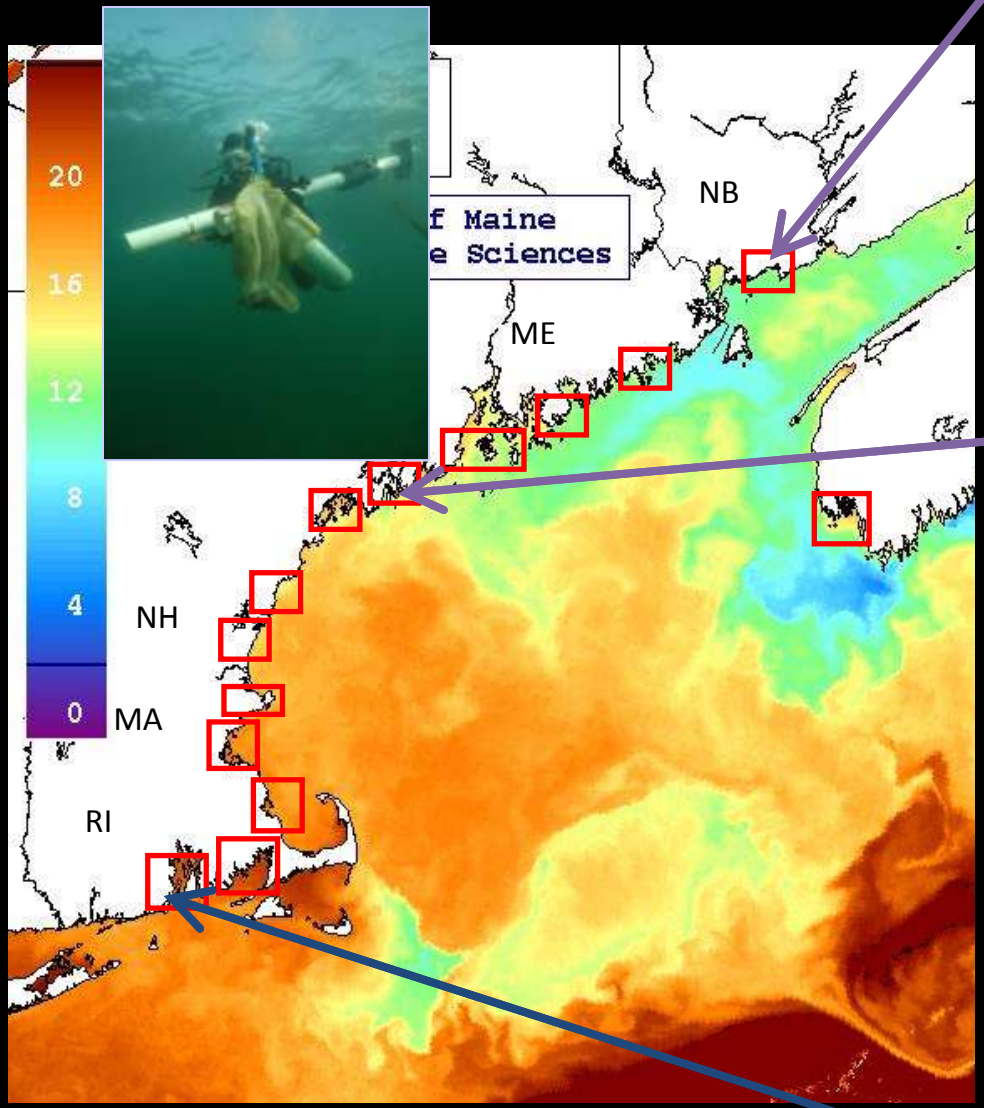
Observed

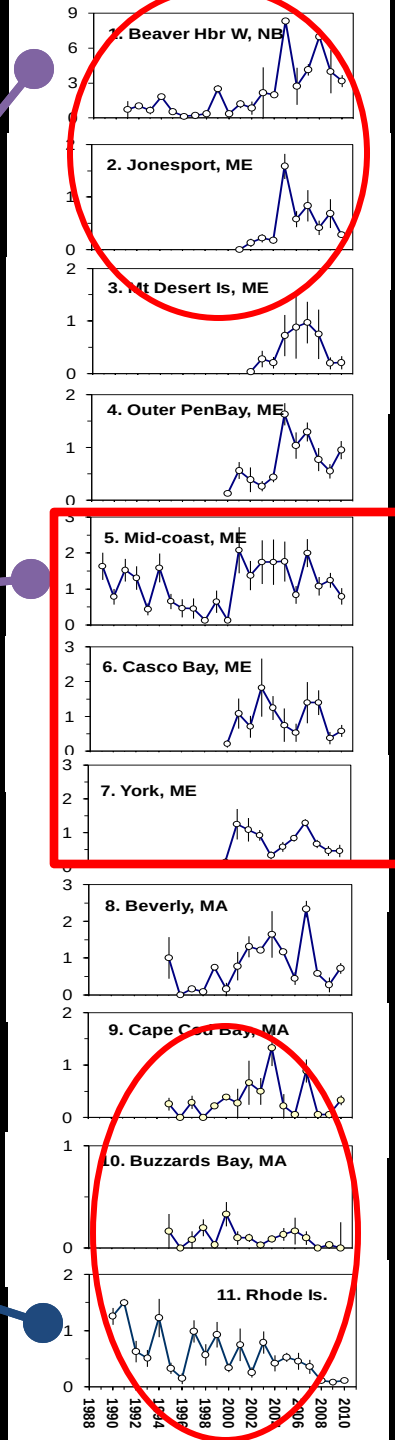




Model Predicted

Regional Time Series >10 yrs





Beaver Hbr, NB

Jonesport, ME

Mt. Desert, ME

Pen. Bay, ME

Mid-coast, ME

Casco Bay, ME

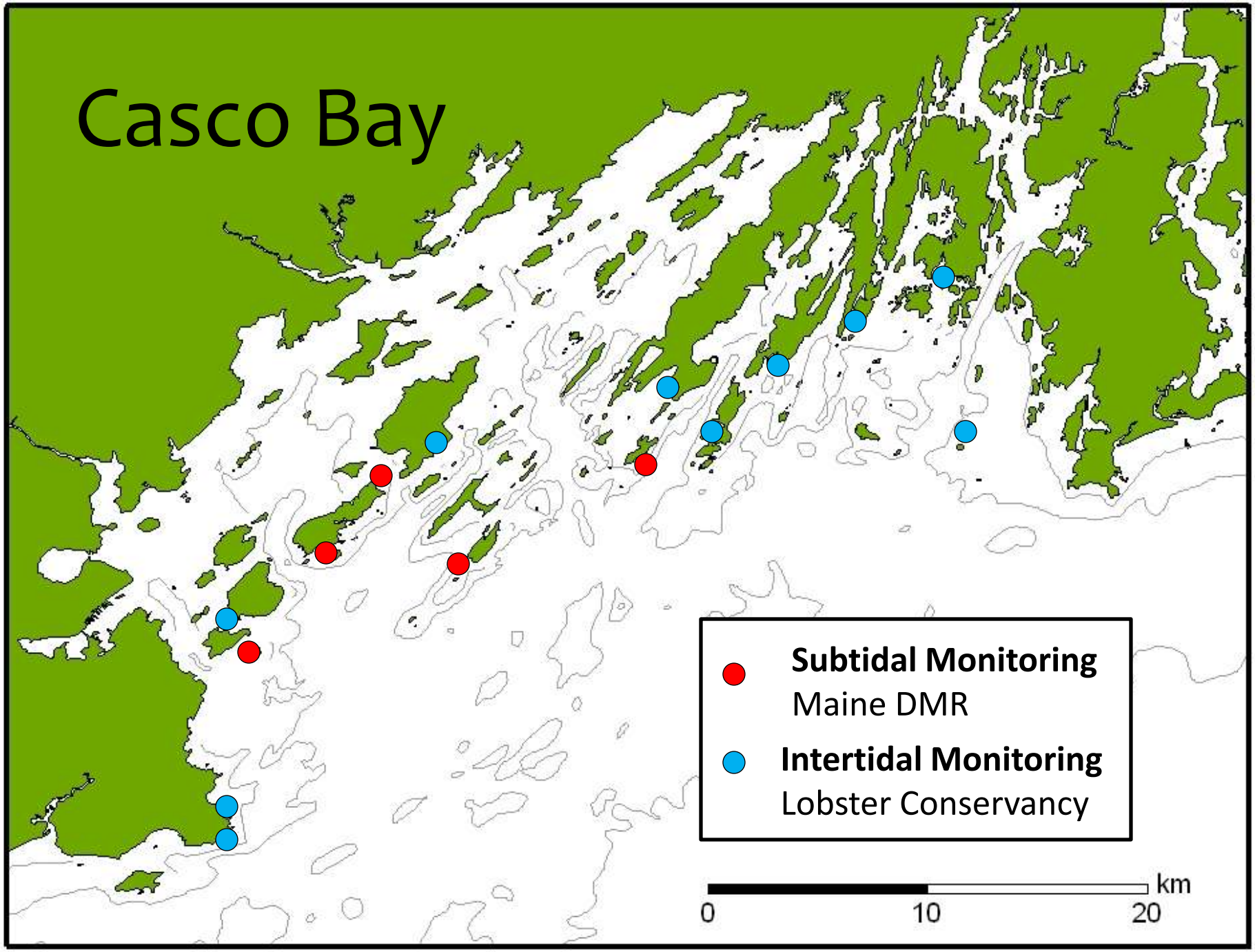
York, ME

Beverly, MA

Cape Cod Bay, MA

Buzzards Bay, MA

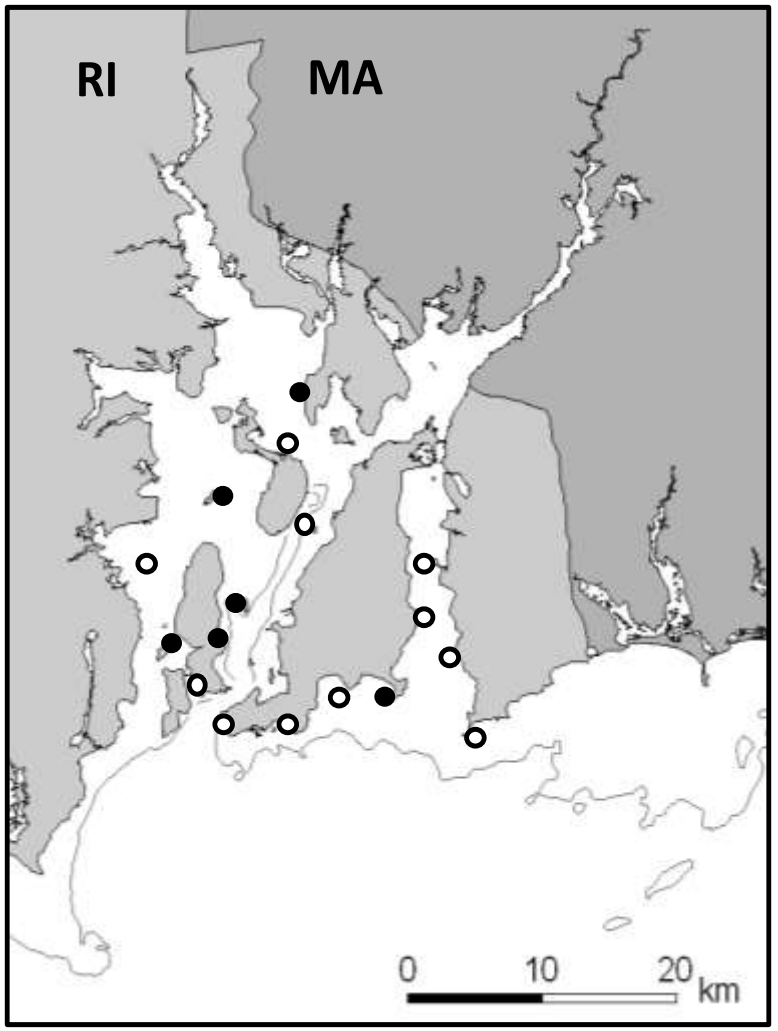
Rhode Island


Casco Bay
Subtidal Monitoring
Maine DMR
Intertidal Monitoring
Lobster Conservancy
0
10
20
km

Lobsters in Estuaries

Narragansett Bay

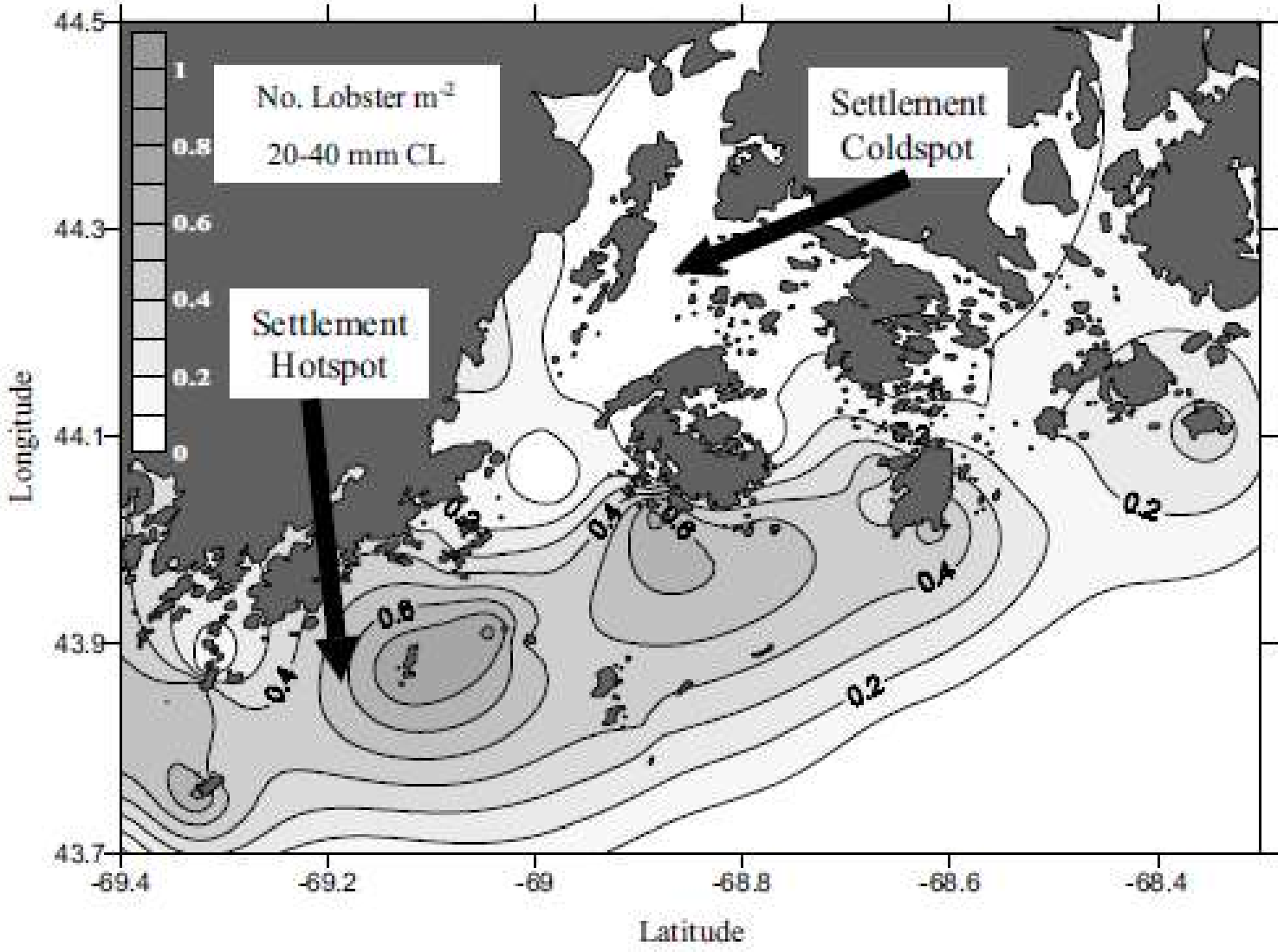
Wahle (1993)



Lobsters in Estuaries

Penobscot Bay

Steneck & Wilson (2001)



True & Manning Dye Tracing Model Animation

http://www.norwich.edu/about/news/2008/050208-cascoBayDyeMovie.html

Recap/ Conclusions

- Both “Good” & “Bad” species have 2-phase life cycles
- Sampling protocols for different taxa well developed.
- Species distributions throughout Casco Bay not well described.
- Population surveys should be coupled with hydrographic survey.
- Circulation modeling should incorporate larval behavior, development.
- Scale of dispersal varies by species.
- Don’t ignore other dispersal vectors (asexual, human, etc)