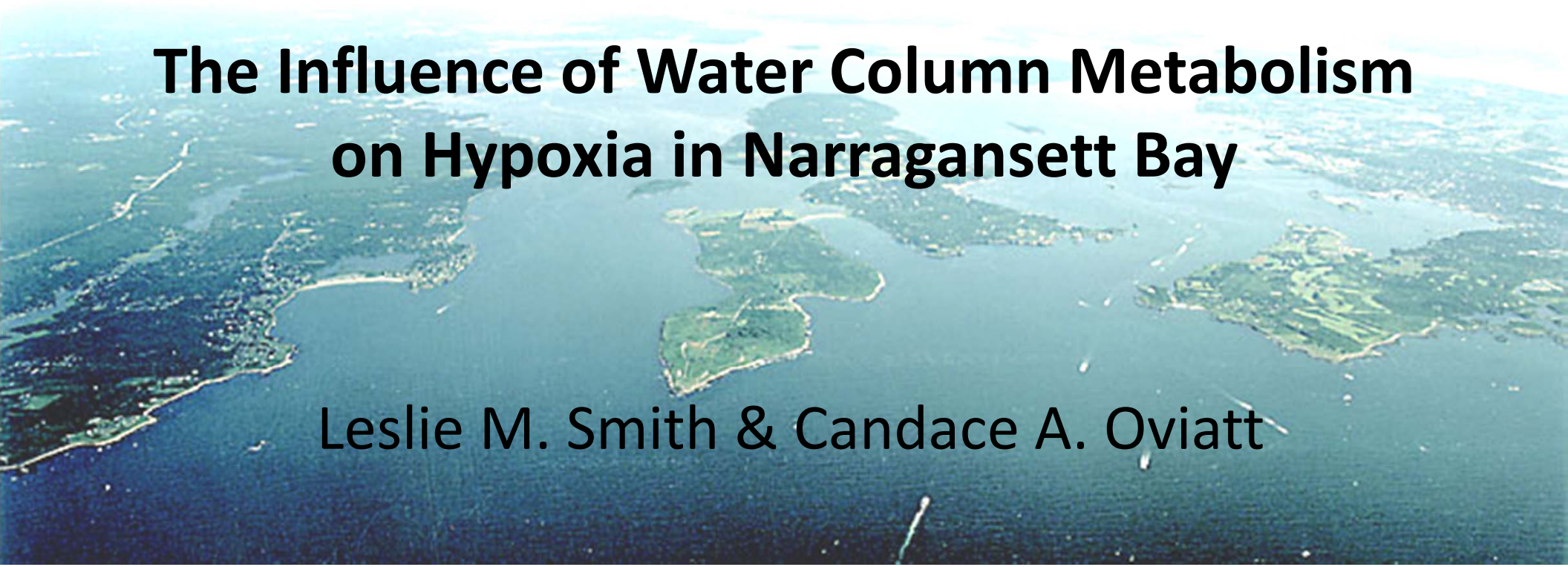


The Influence of Water Column Metabolism on Hypoxia in Narragansett Bay

Leslie M. Smith & Candace A. Oviatt

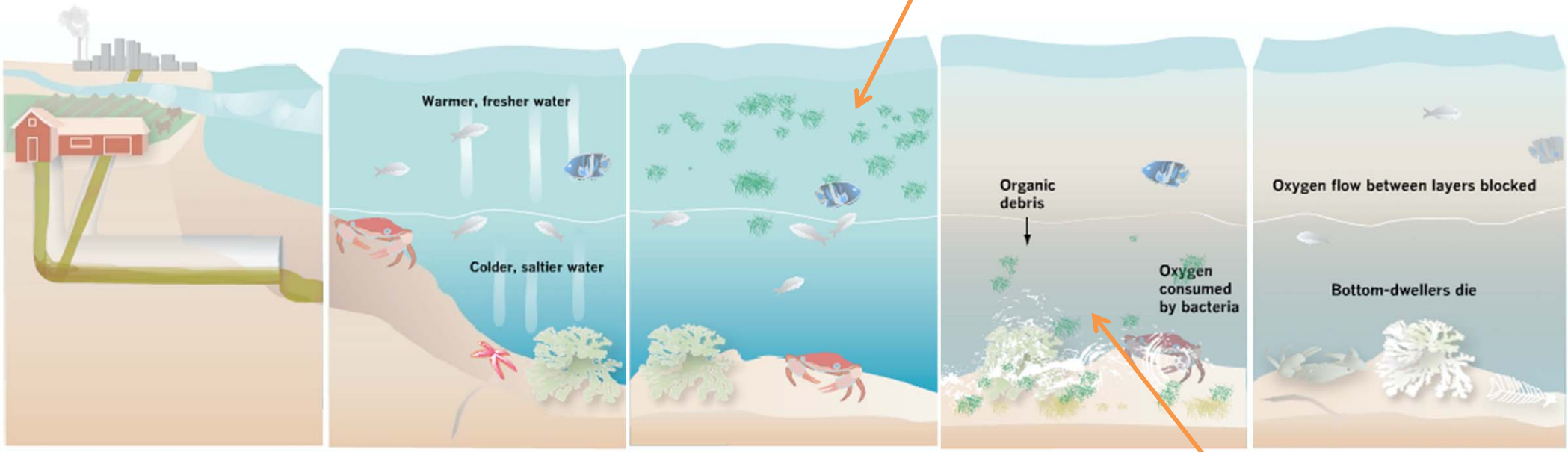
Narragansett Bay Commission Symposium:

A Day on the Upper Bay: Current Monitoring, Research, Source Reduction Progress and Future Challenges

June 16, 2011

Sequence of Hypoxia

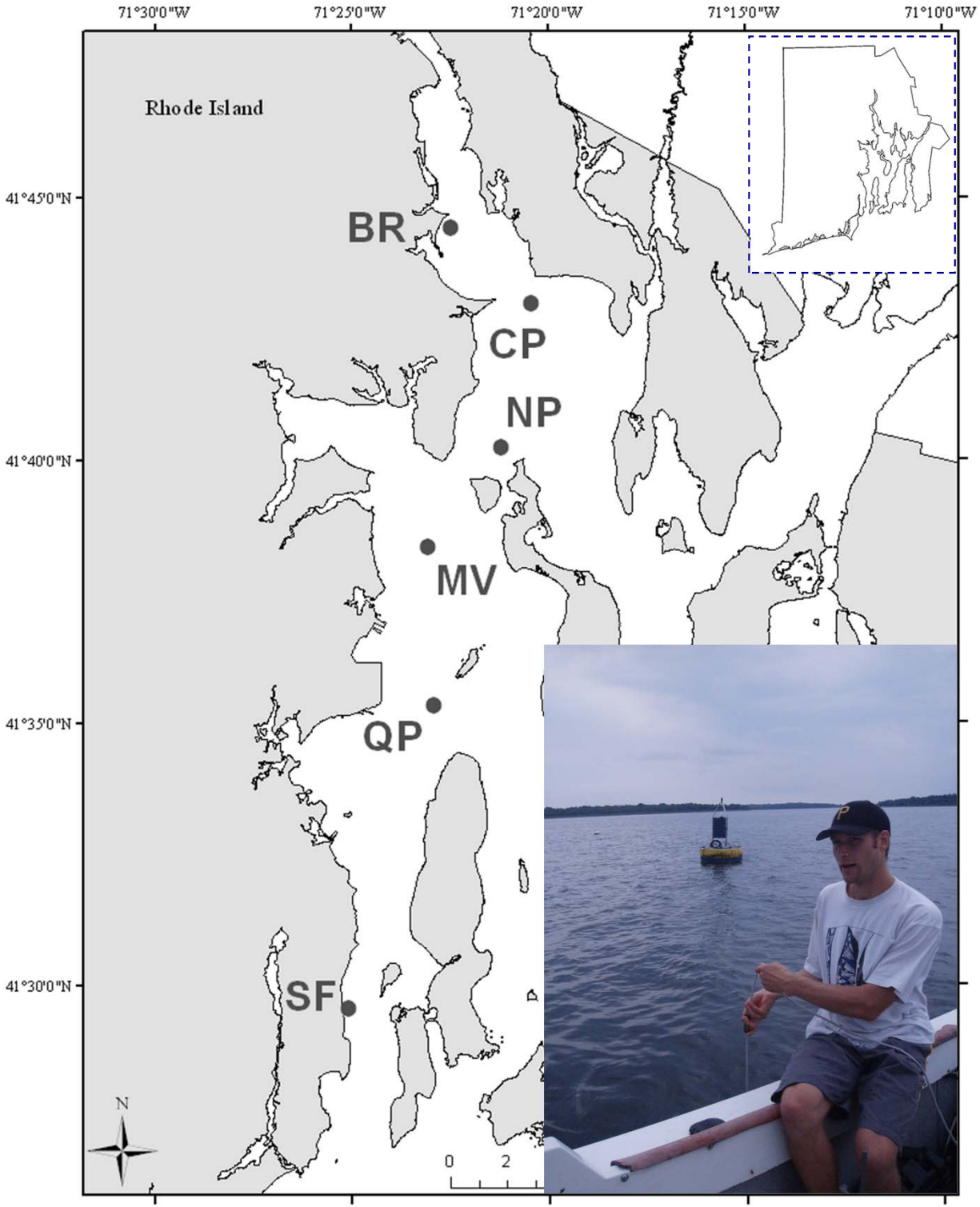
Why is Metabolism Important?



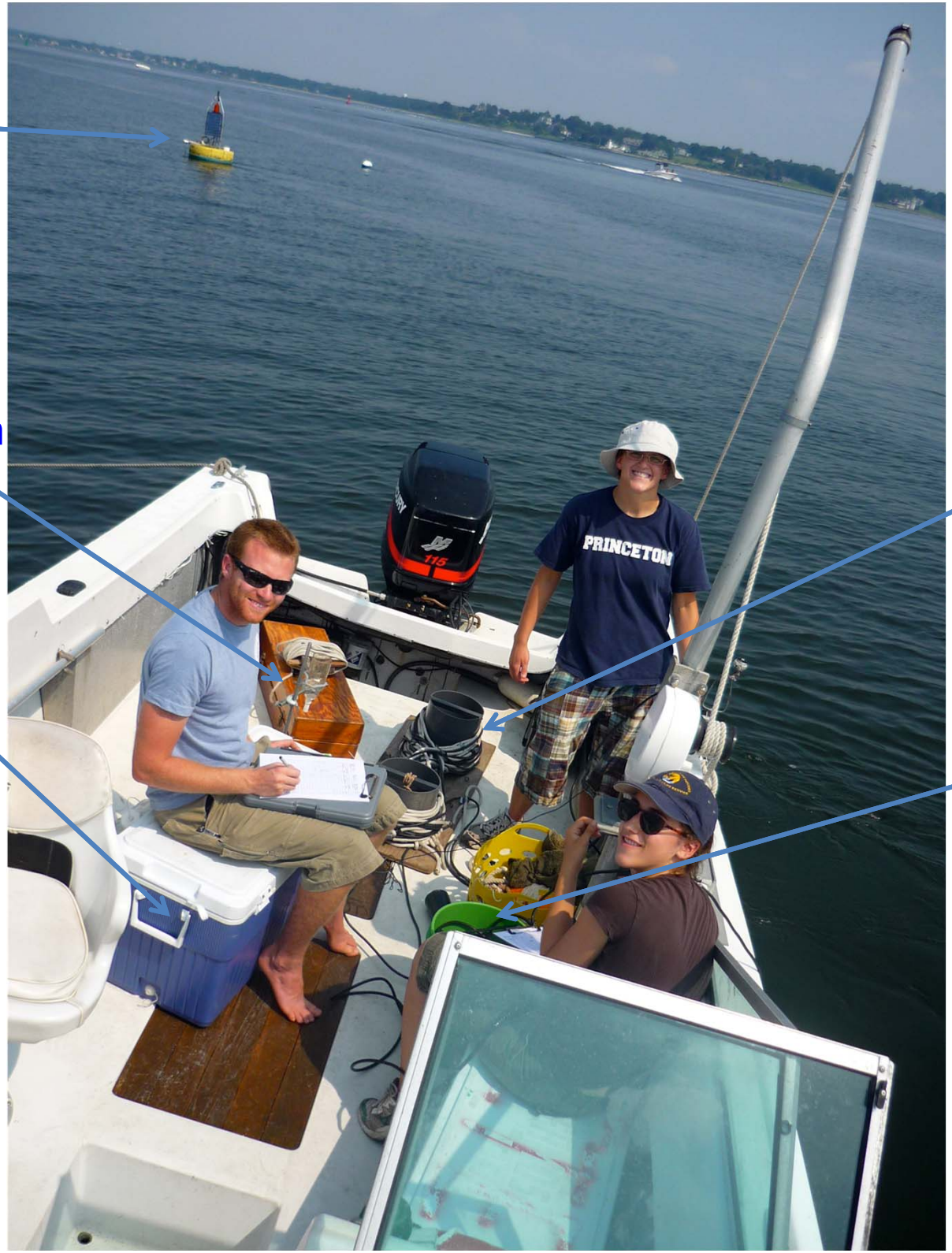
Primary Production

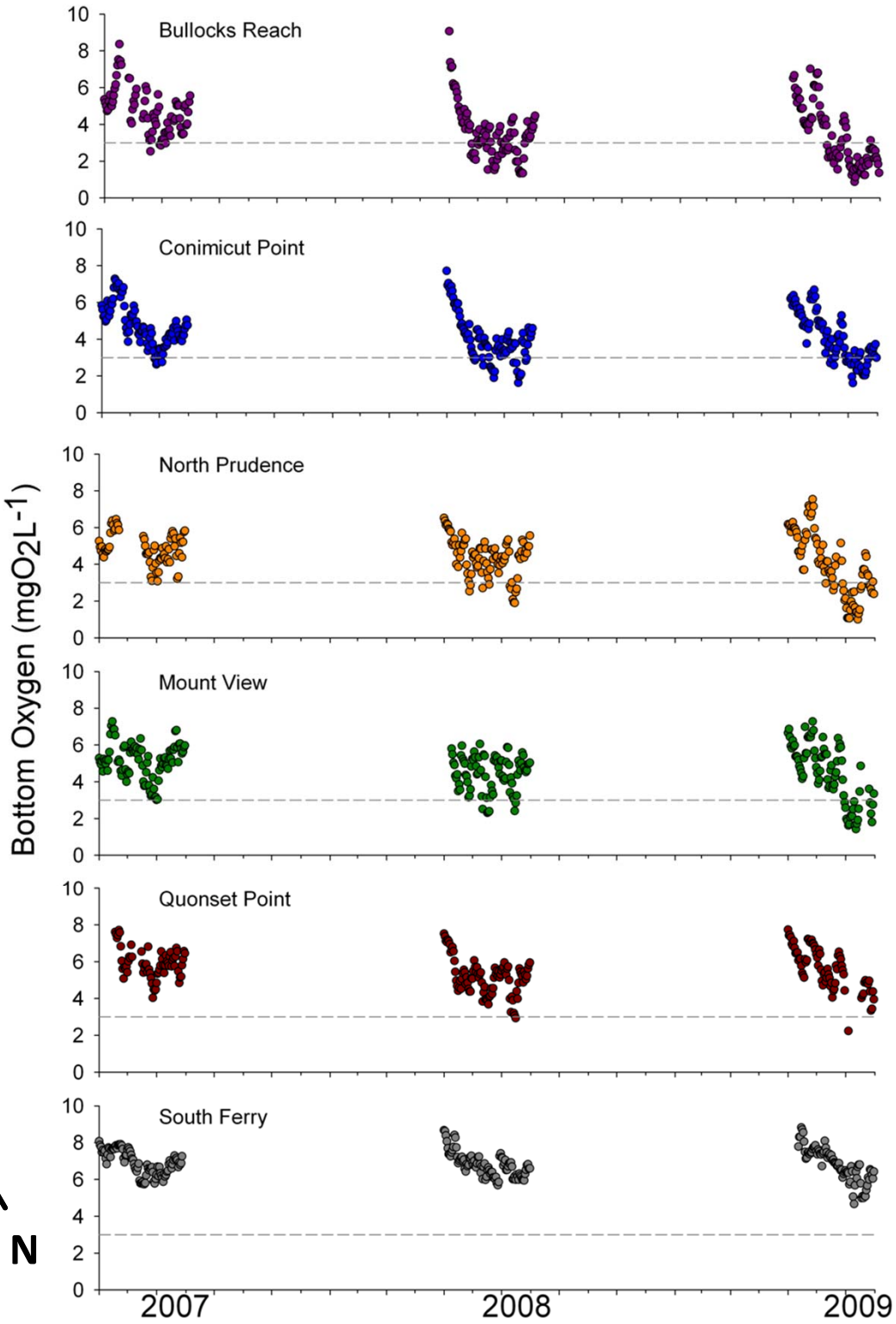
Respiration

"Birth of a dead zone"
LA Times series "Altered Oceans"
Weiss, K.R. and U.L. McFarling, 2006



www.netstate.com
http://www.qsl.net/g3yrc/radio-online/USA/usa-map.gif


Buoy Data Collection
Water Collection and Filtering
Dark Storage of Carboys
Light Meter Profiles
YSI Profiles
PRINCETON
115



Bottom Oxygen Variation

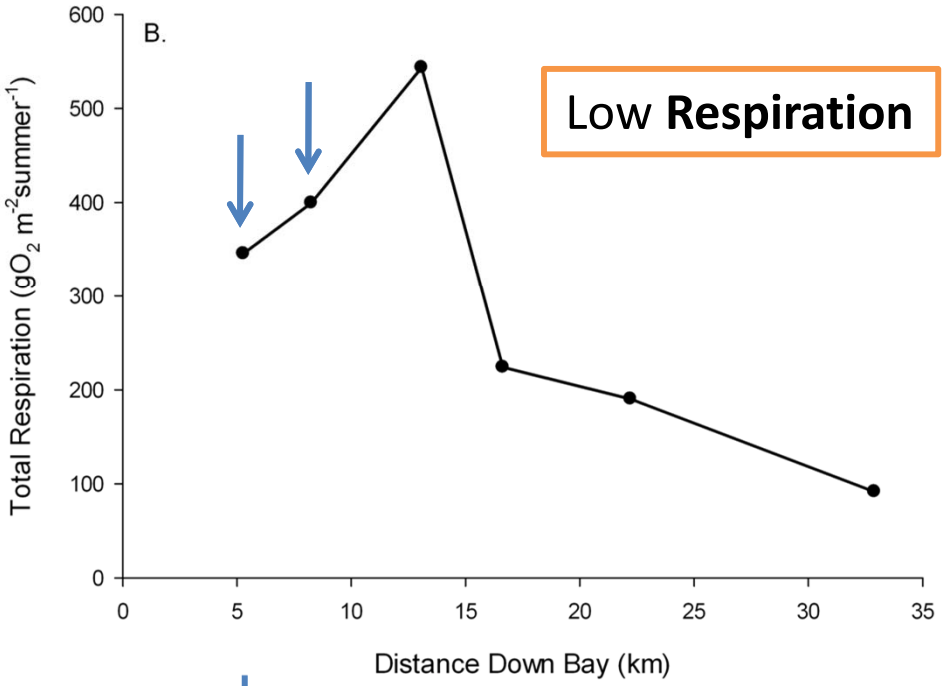
Key Trends:

1. No hypoxia in 2007
2. Several short events in 2008
3. 1 large hypoxic event in 2009
4. No hypoxia in QP & SF

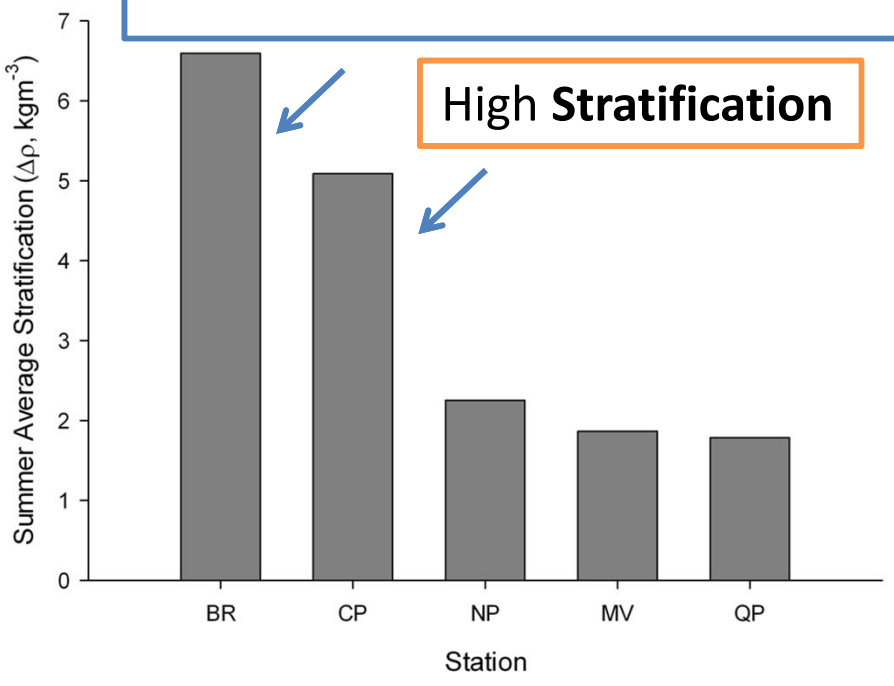
Why are some stations more susceptible to hypoxia than others?

Examine Summer 2009

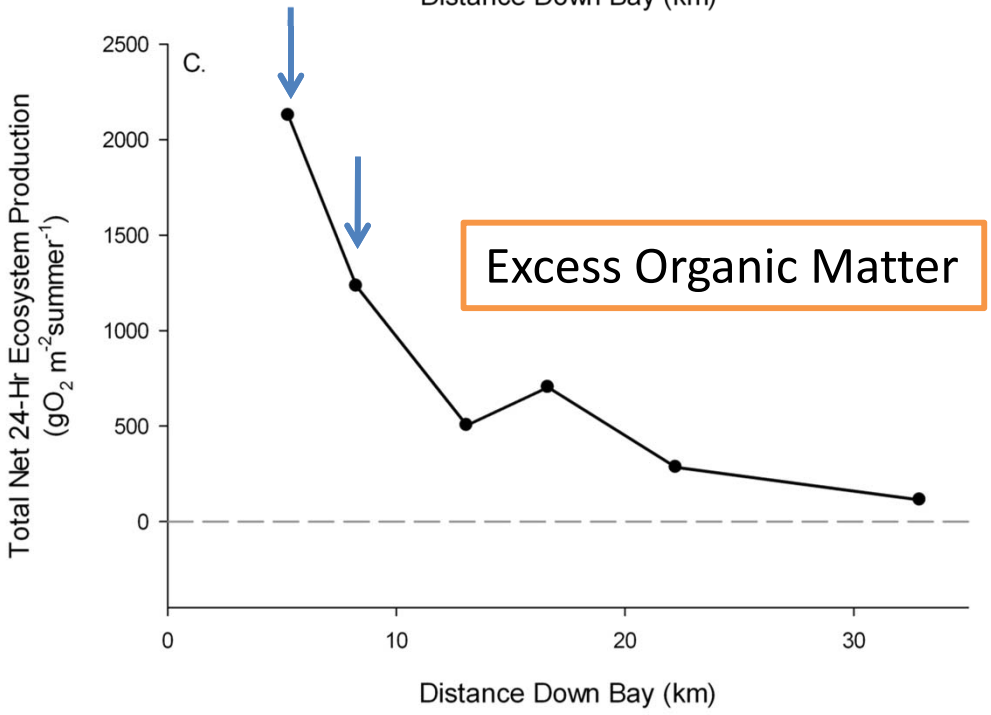
Providence River



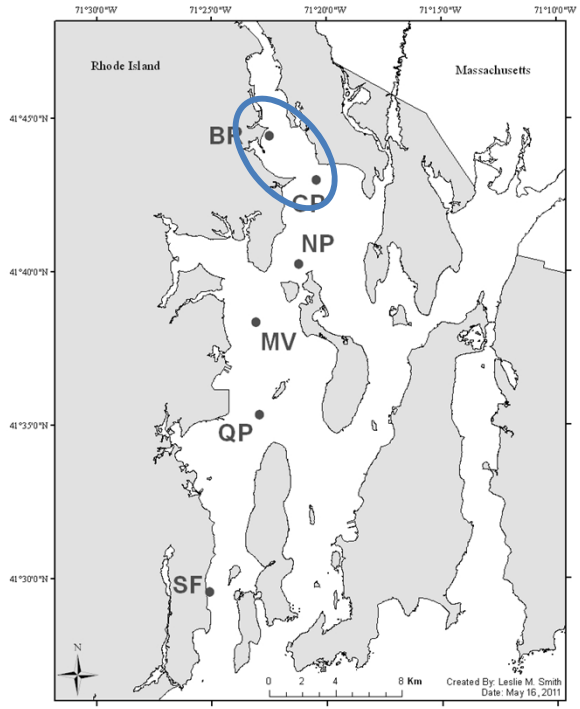
Low **Respiration**



High **Stratification**

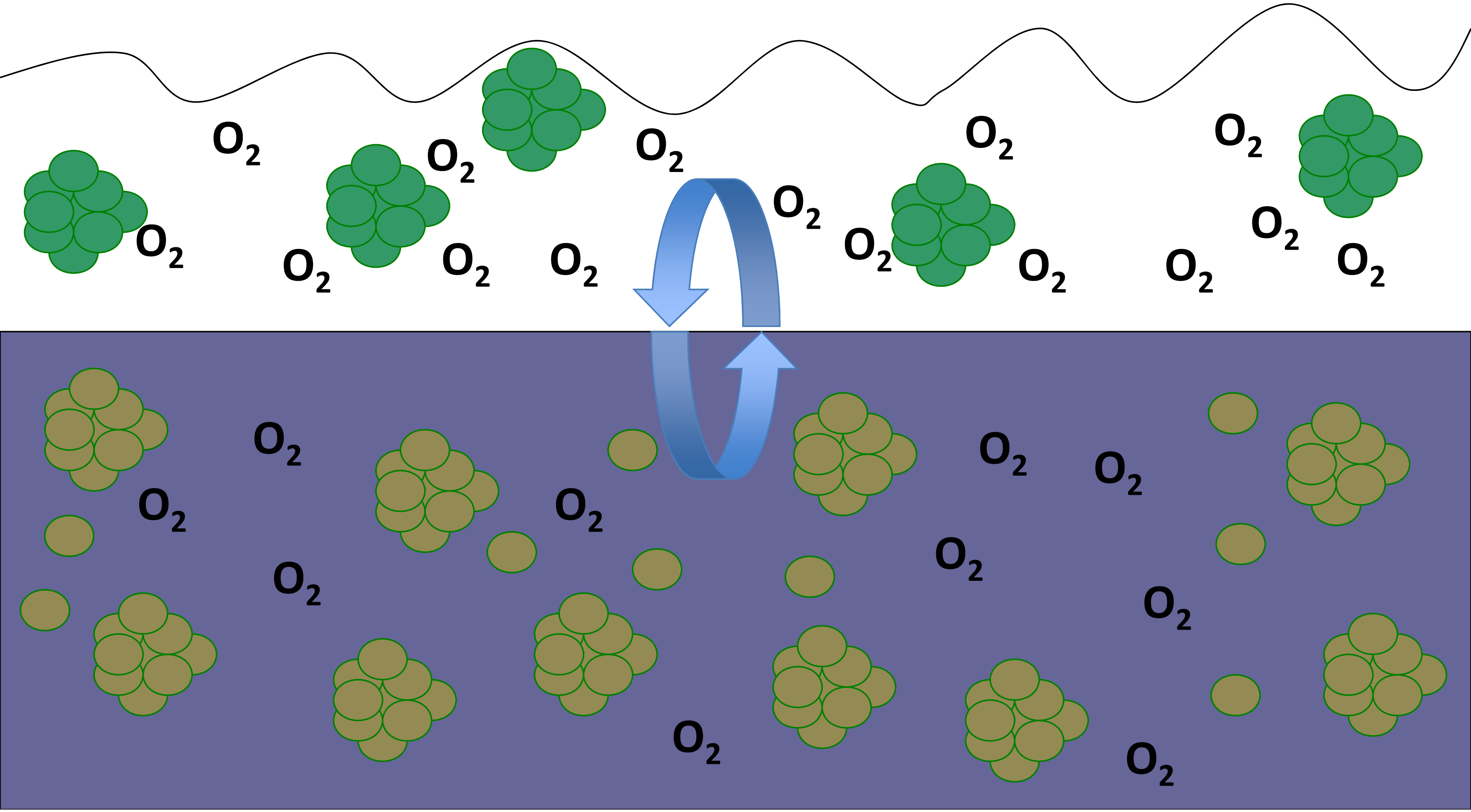


Excess Organic Matter

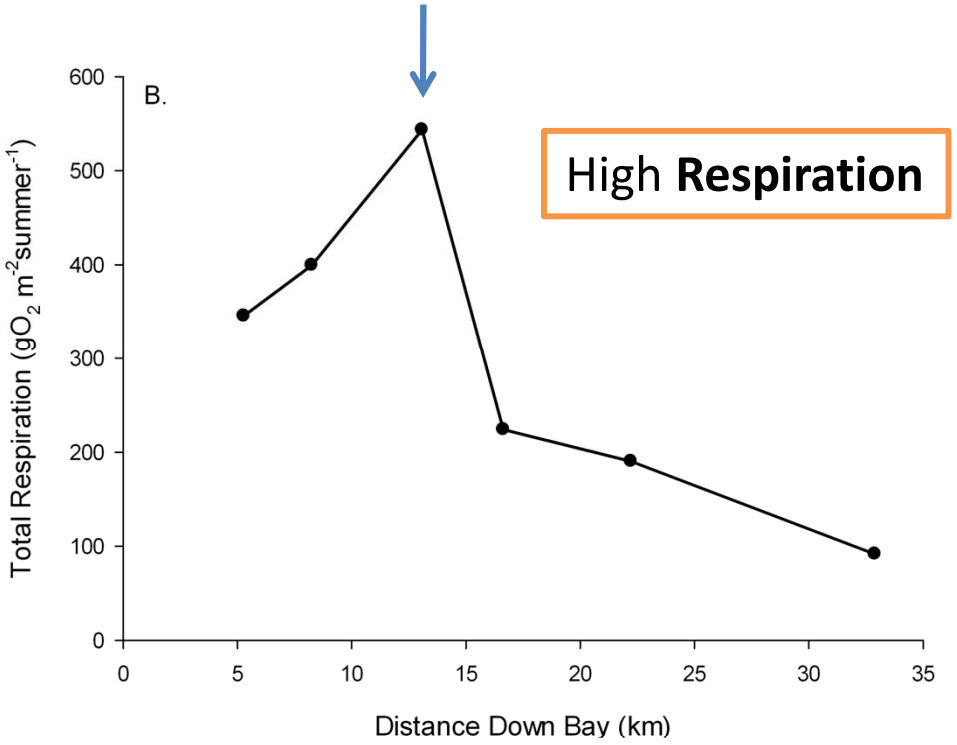


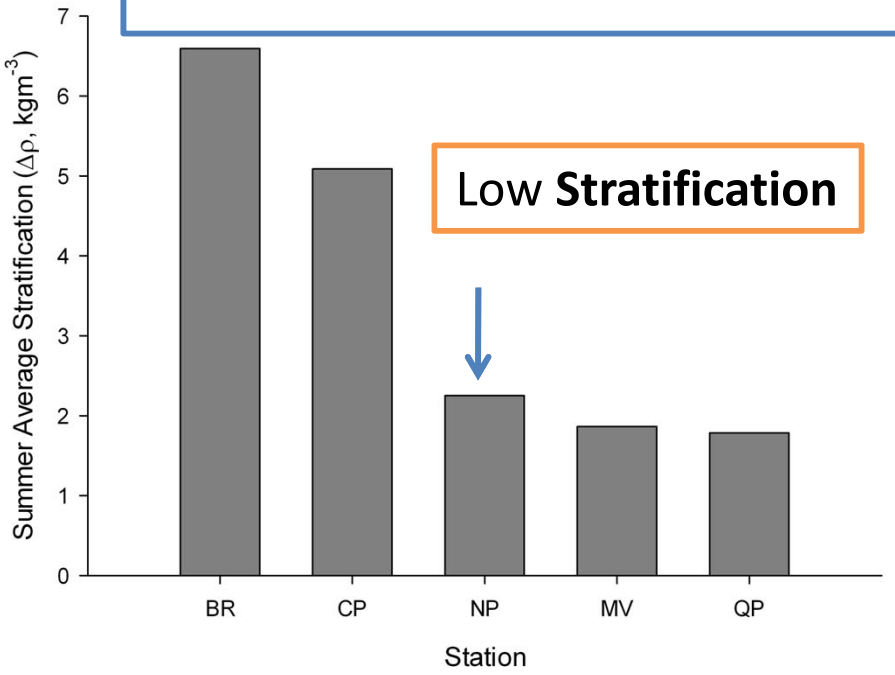
Providence River Hypoxia

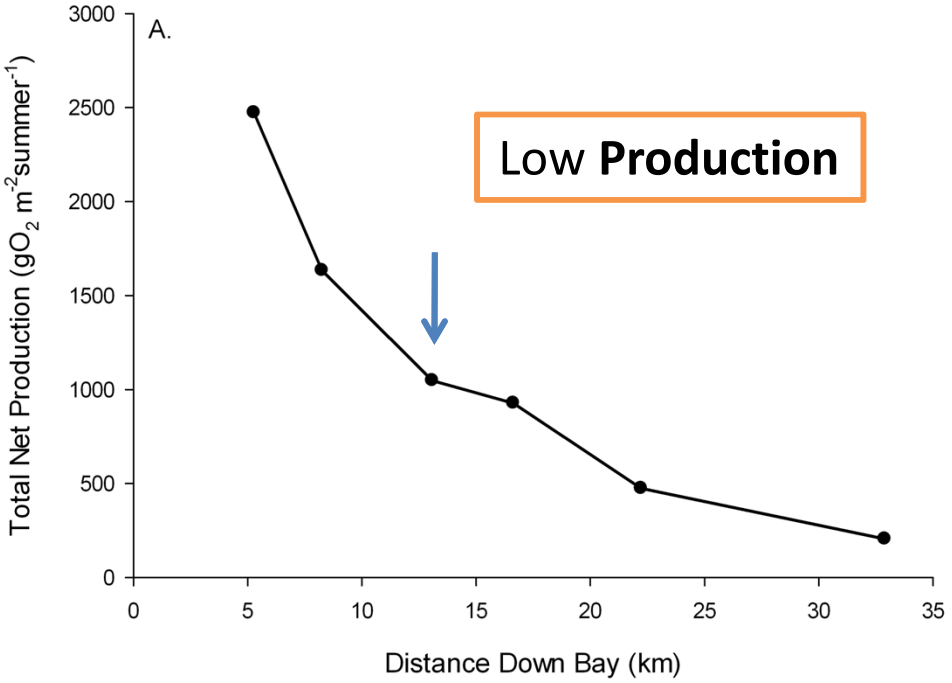
River flow → Stratification → Respiration → Hypoxia

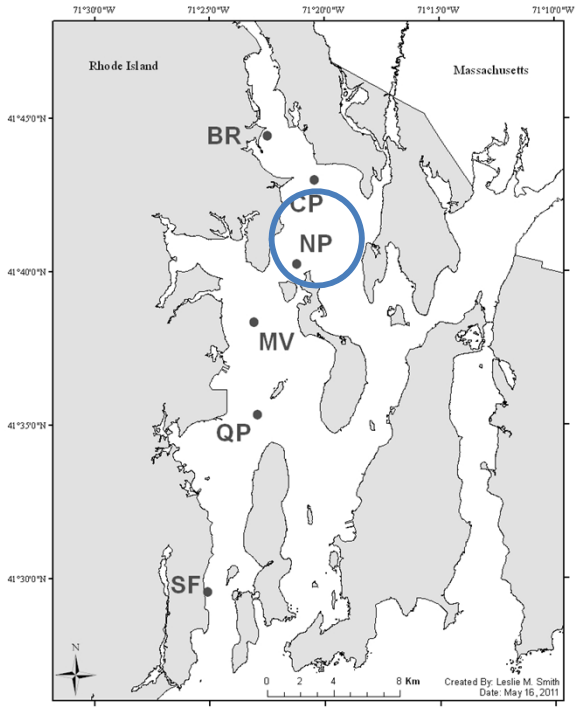


Upper Bay


B.
High Respiration
Total Respiration (gO_2 m^{-2}summer^{-1})
600
500
400
300
200
100
0
0
5
10
15
20
25
30
35
Distance Down Bay (km)

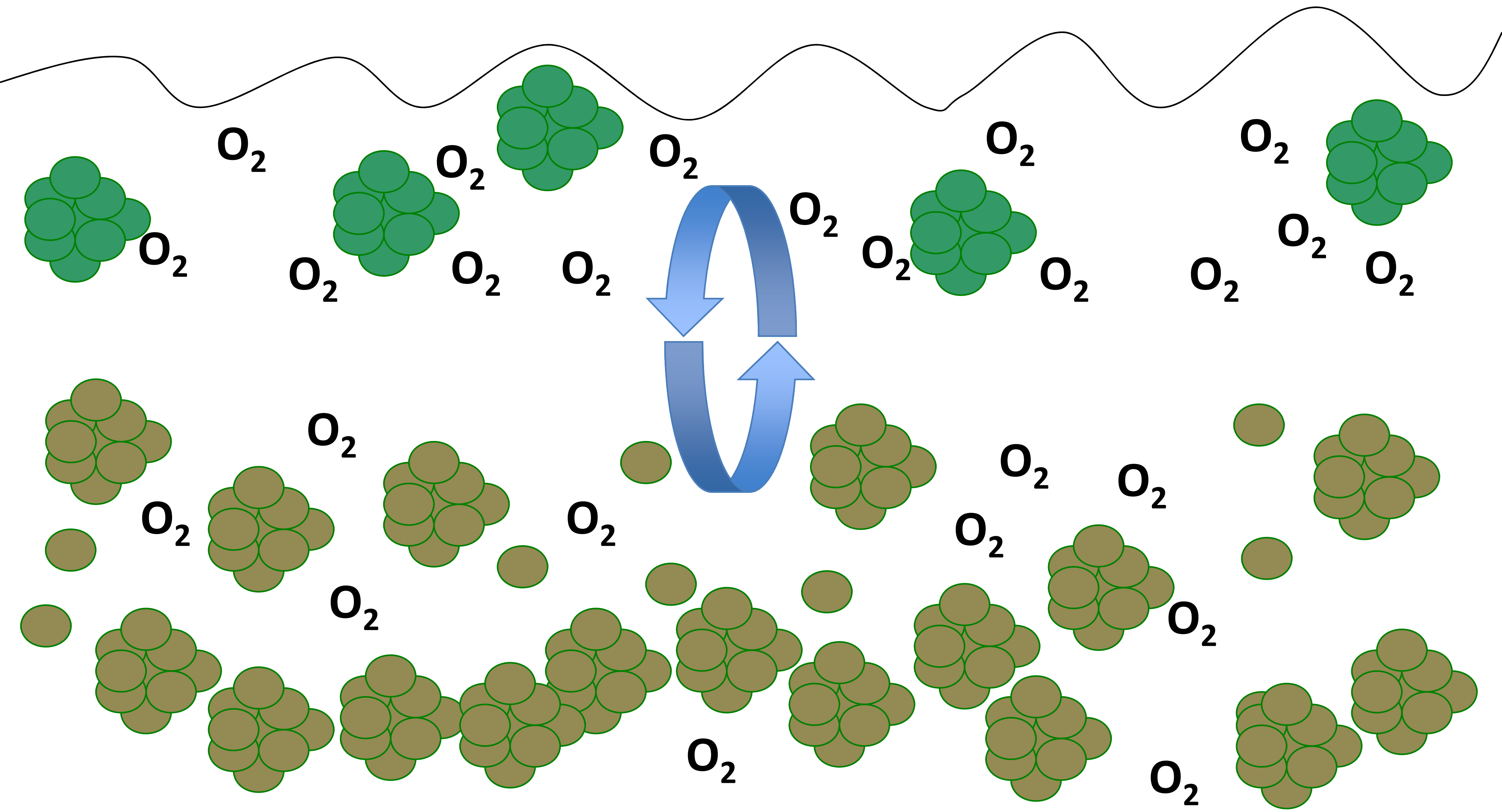

Low Stratification
Summer Average Stratification (Δρ, kgm^{-3})
7
6
5
4
3
2
1
0
BR
CP
NP
MV
QP
Station


A.
Low Production
Total Net Production (gO_2 m^{-2}summer^{-1})
3000
2500
2000
1500
1000
500
0
0
5
10
15
20
25
30
35
Distance Down Bay (km)

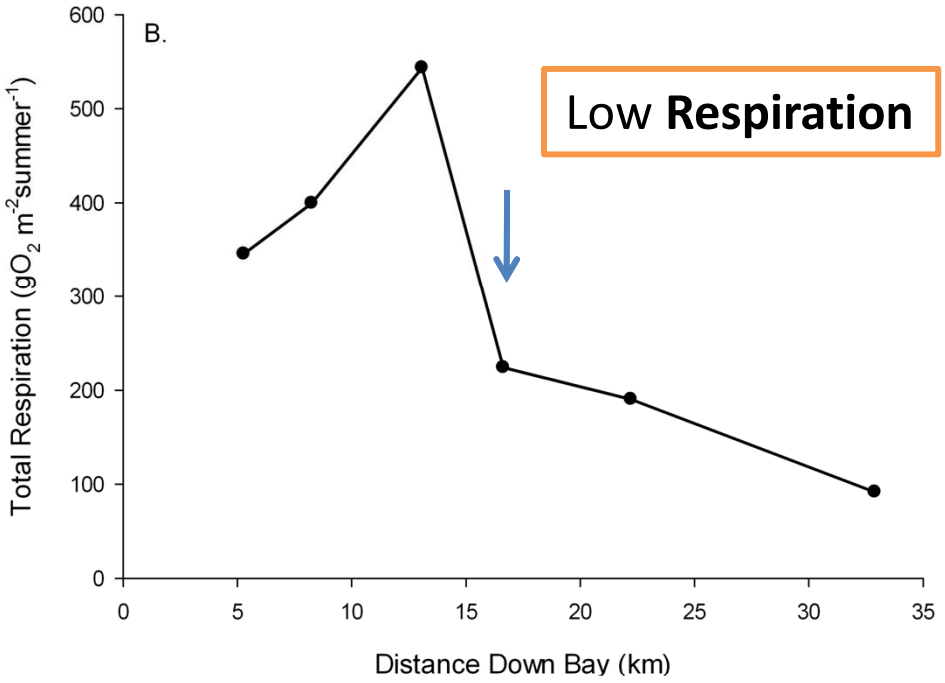

Rhode Island
Massachusetts
BR
CP
NP
MV
QP
SF
41°45'0"N
41°40'0"N
41°35'0"N
41°30'0"N
71°30'0"W
71°25'0"W
71°20'0"W
71°15'0"W
71°10'0"W
N
0
2
4
8 Km
Created By: Leslie M. Smith
Date: May 16, 2011

Upper Bay Hypoxia

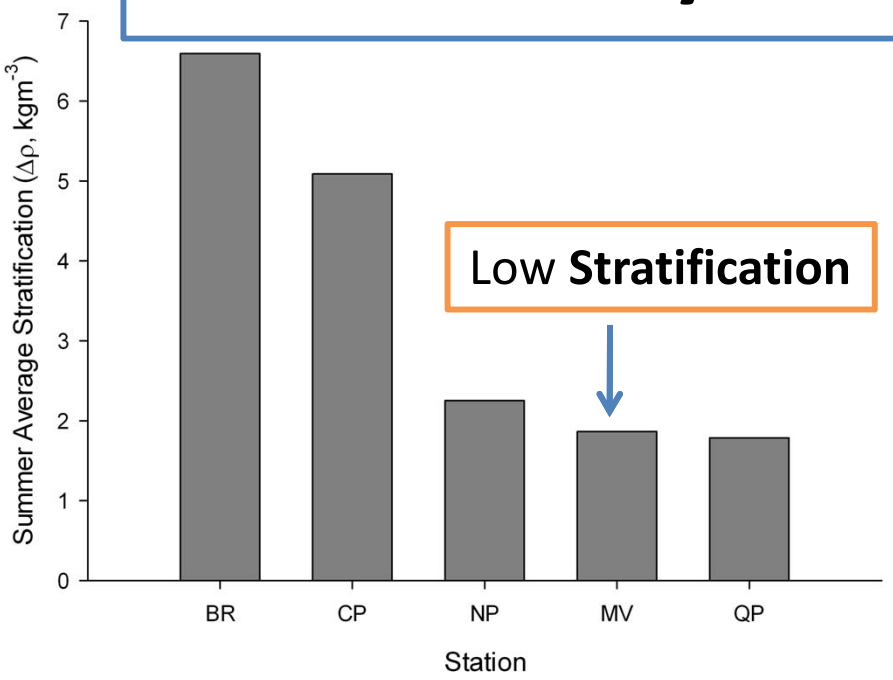
Advection of Organic Matter → Respiration → Hypoxia



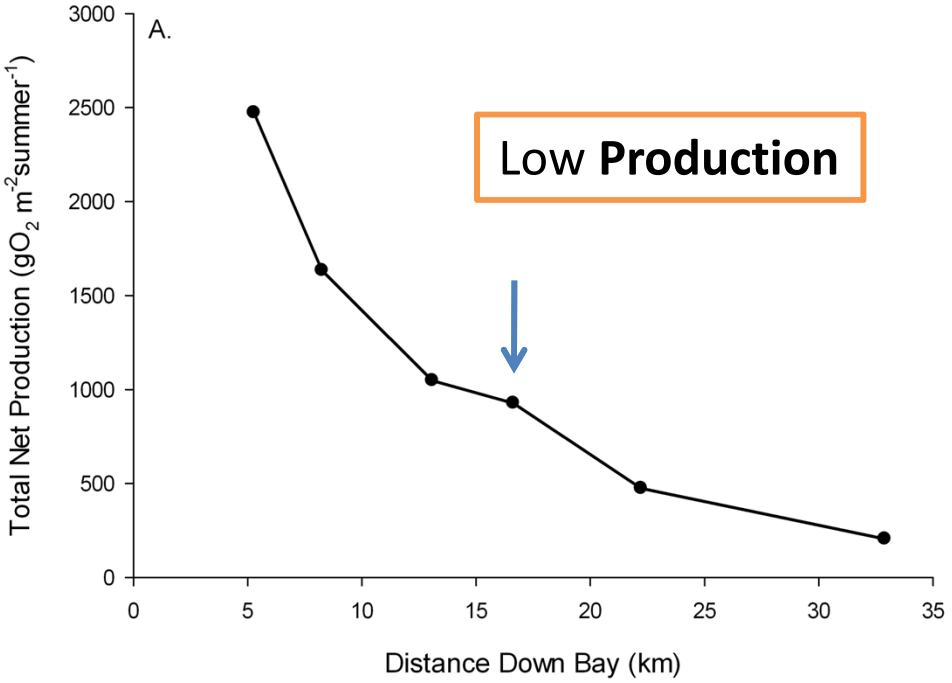
Mid Bay



Low **Respiration**

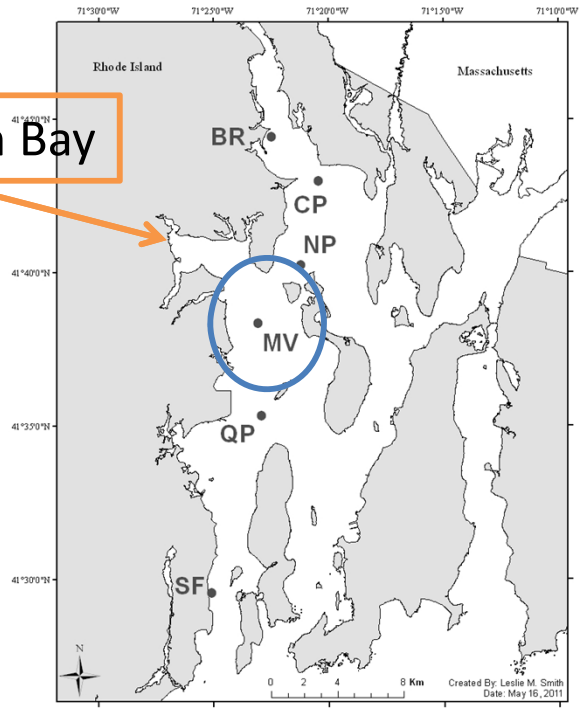


Low **Stratification**



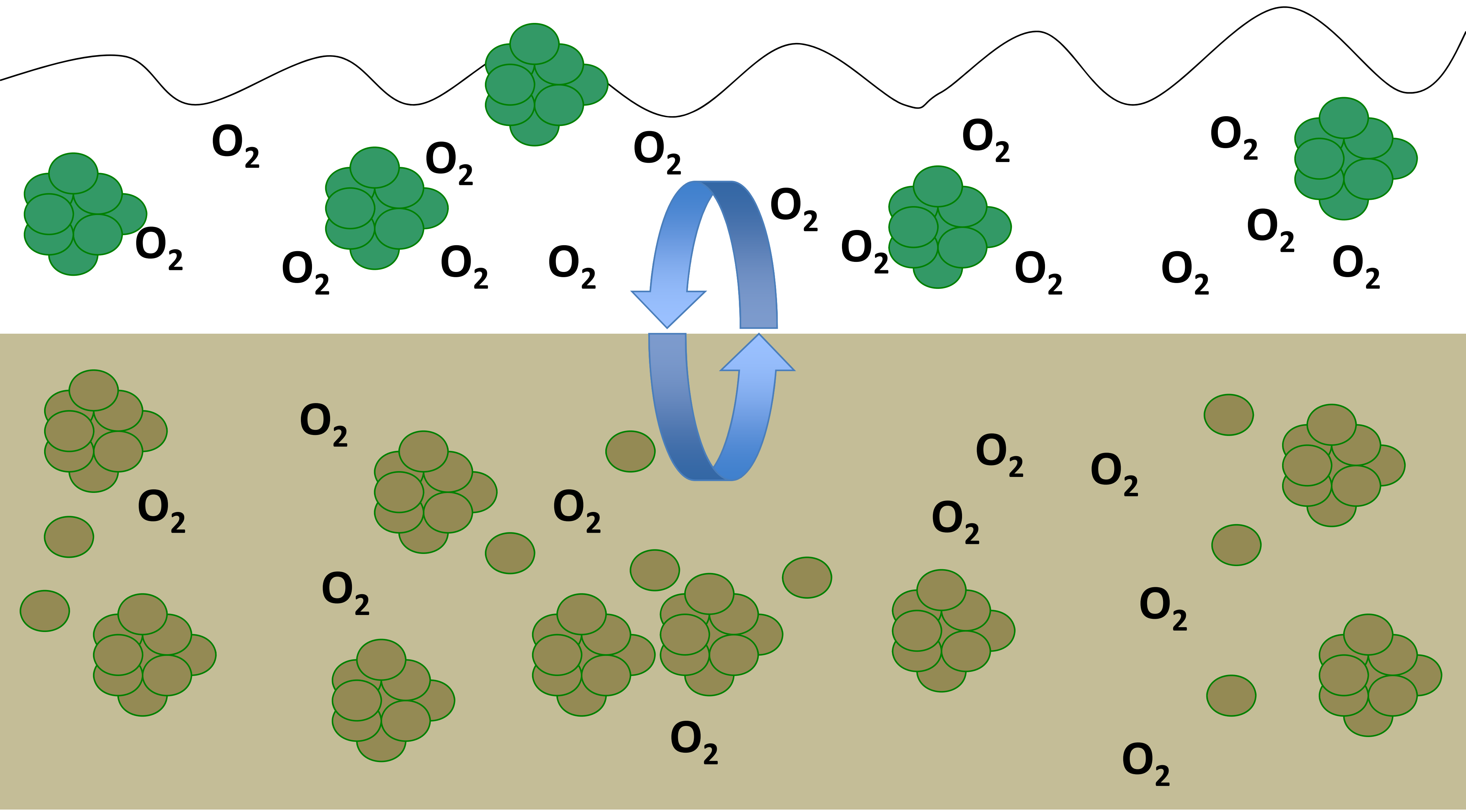
Low **Production**

Greenwich Bay

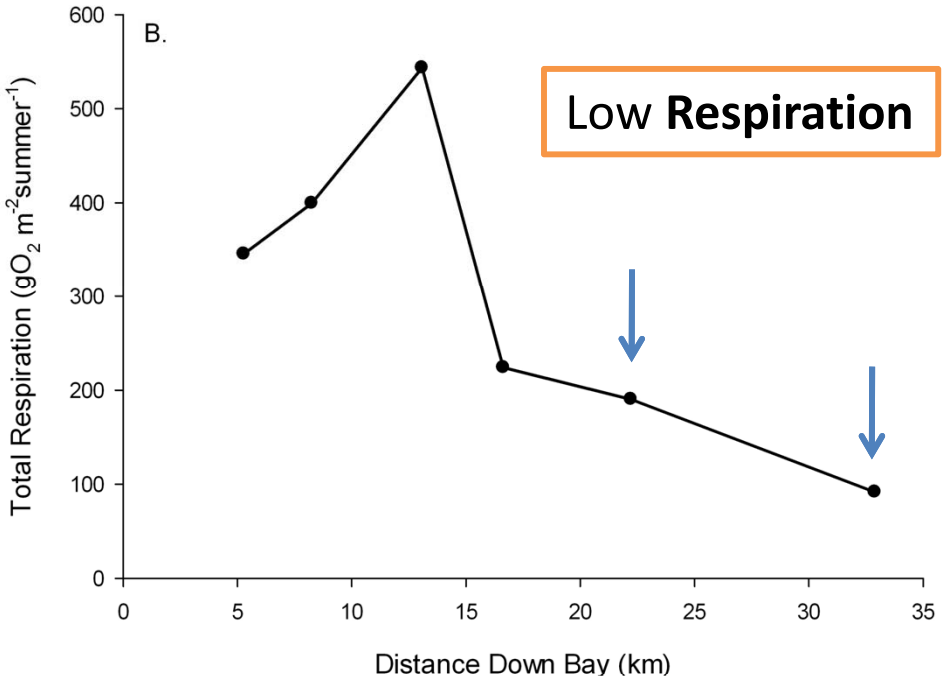


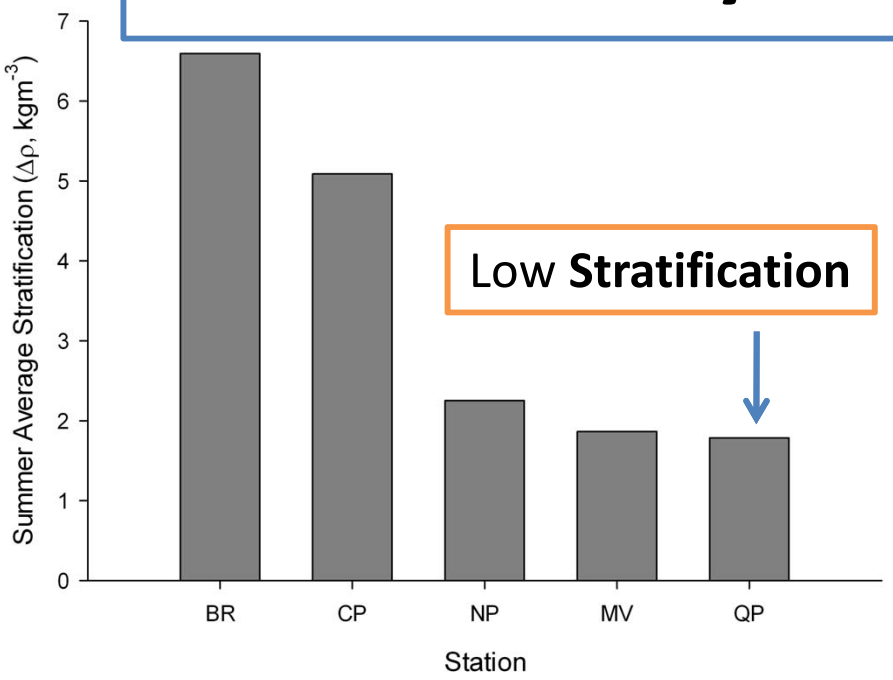
Mid Bay Hypoxia

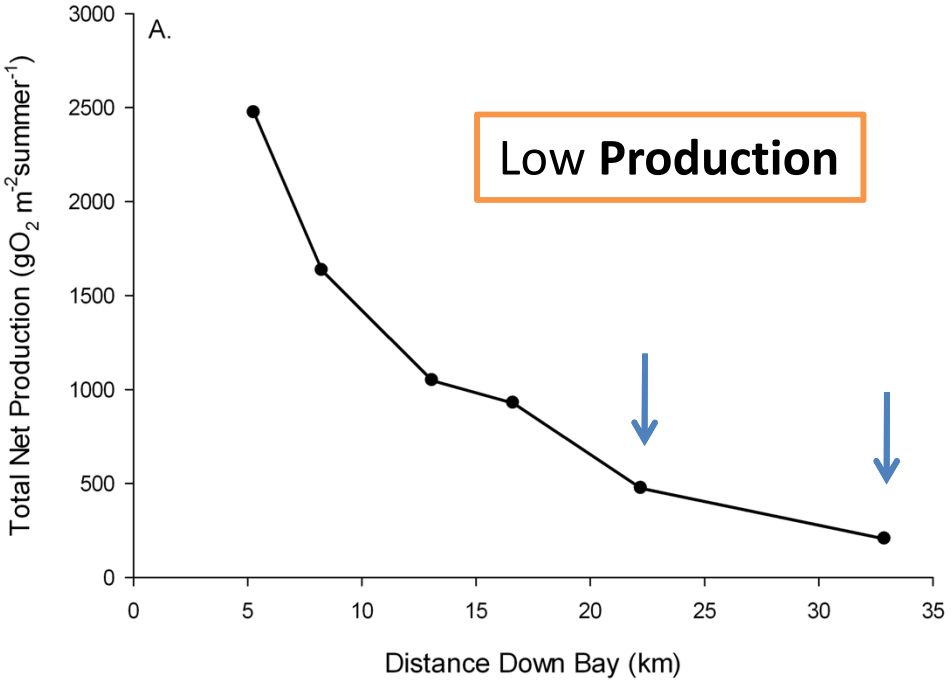
Advection of Hypoxic Water → Hypoxia

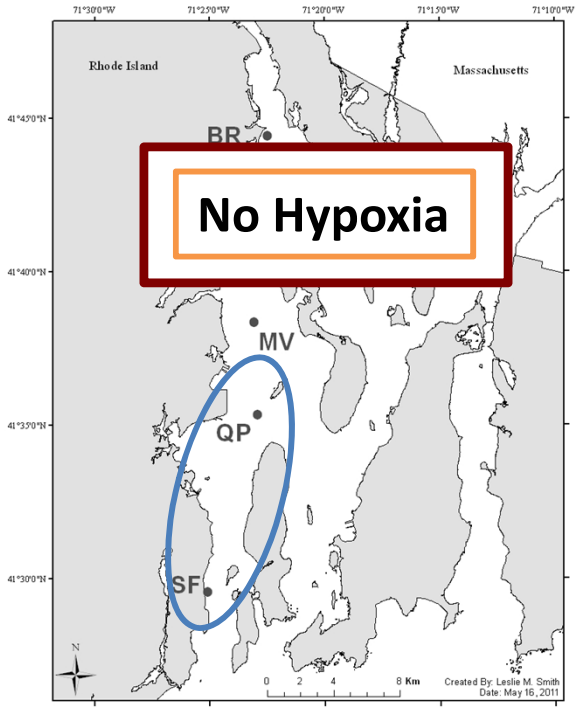


Lower Bay


B.
Low Respiration
Total Respiration (gO_2 m^{-2}summer^{-1})
Distance Down Bay (km)


Low Stratification
Summer Average Stratification ($\Delta\rho$, kgm^{-3})
BR
CP
NP
MV
QP
Station

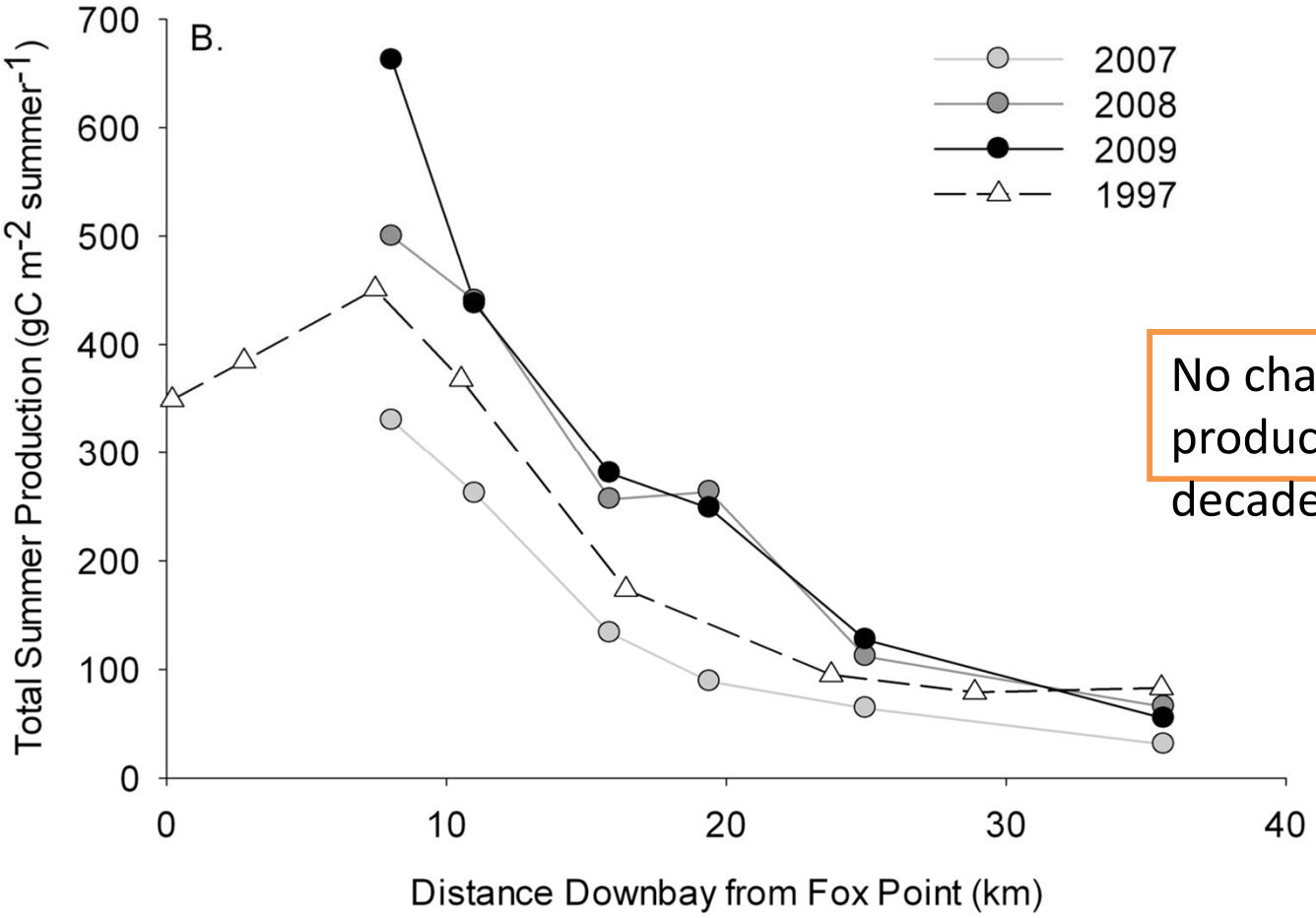

A.
Low Production
Total Net Production (gO_2 m^{-2}summer^{-1})
Distance Down Bay (km)


No Hypoxia
Rhode Island
Massachusetts
BR
MV
QP
SF

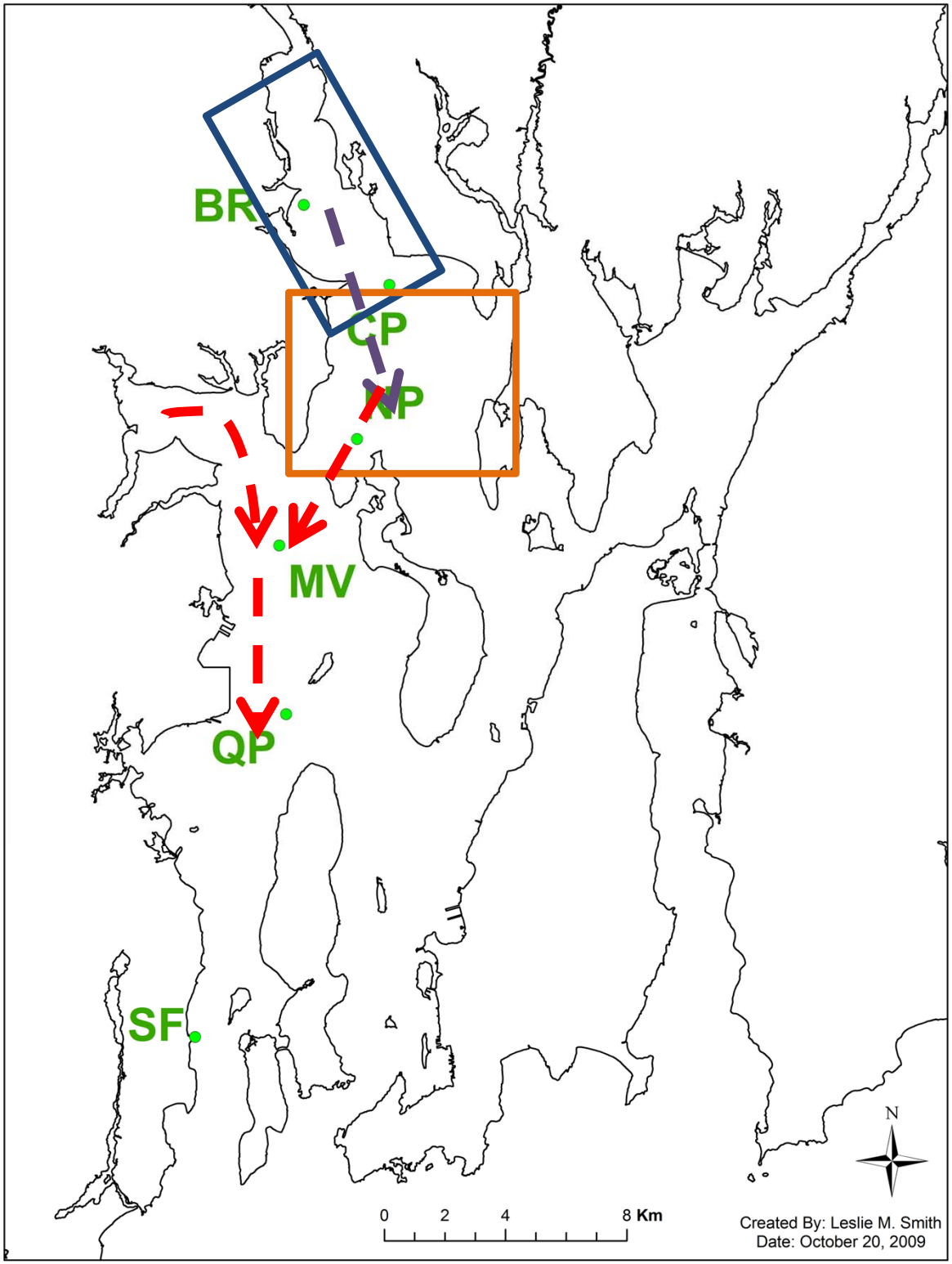
Summary

- Providence River has high **Production** and low **Respiration**; **Stratification** controls **Hypoxia**
- Upper Bay **Hypoxia** controlled by **Advection** of organic matter from **Providence River** yielding elevated **Respiration**
- Mid Bay receives **Hypoxic** water from **Greenwich Bay** and the **Upper Bay**
- Lower Bay has low **Stratification**, low **Respiration**, low **Production**, low influence of **Advection**: **No Hypoxia**

Historical Production



No change in summer production rates over the last decade



Advection

Excess Production
Low Respiration

Excess Organic Matter

Low Production
Excess Respiration

Advection of
Low Oxygen
Water

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Buoys

- Heather Stoffel
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- Angelo Liberti

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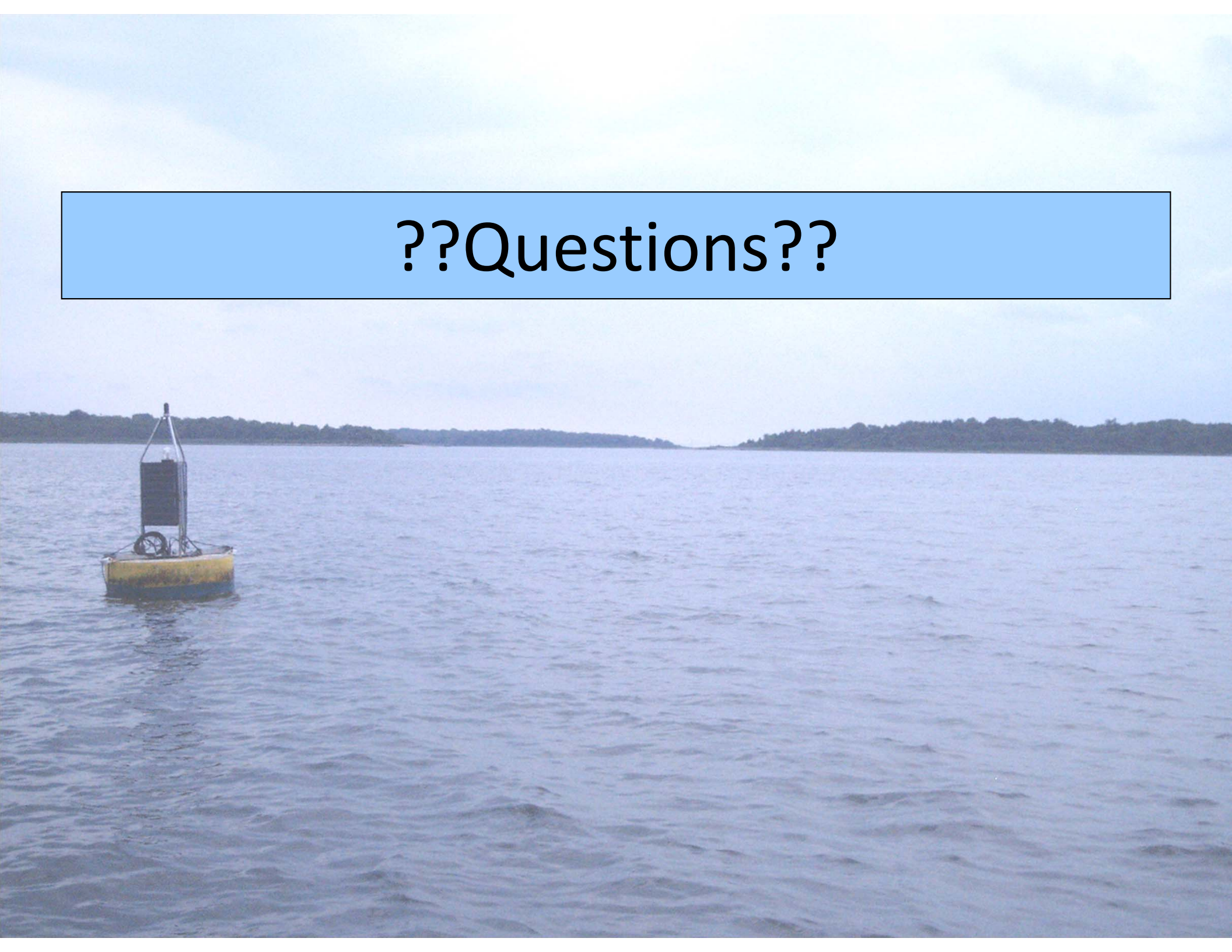
??Questions??