BIOMONITORING OF SEAGRASS HABITAT IN NEW JERSEY'S COASTAL BAYS

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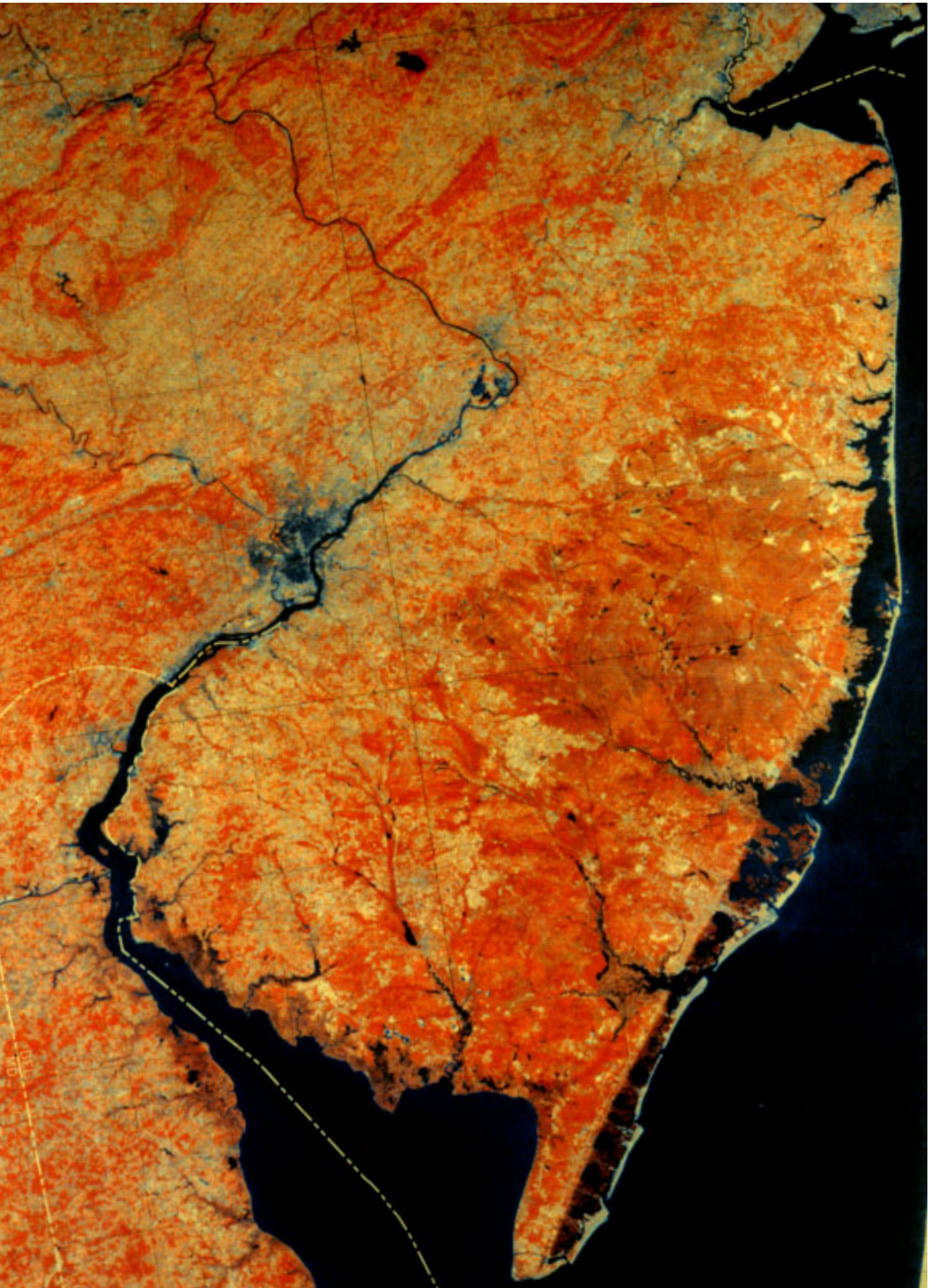
RUTGERS
MARINE & COASTAL
SCIENCES



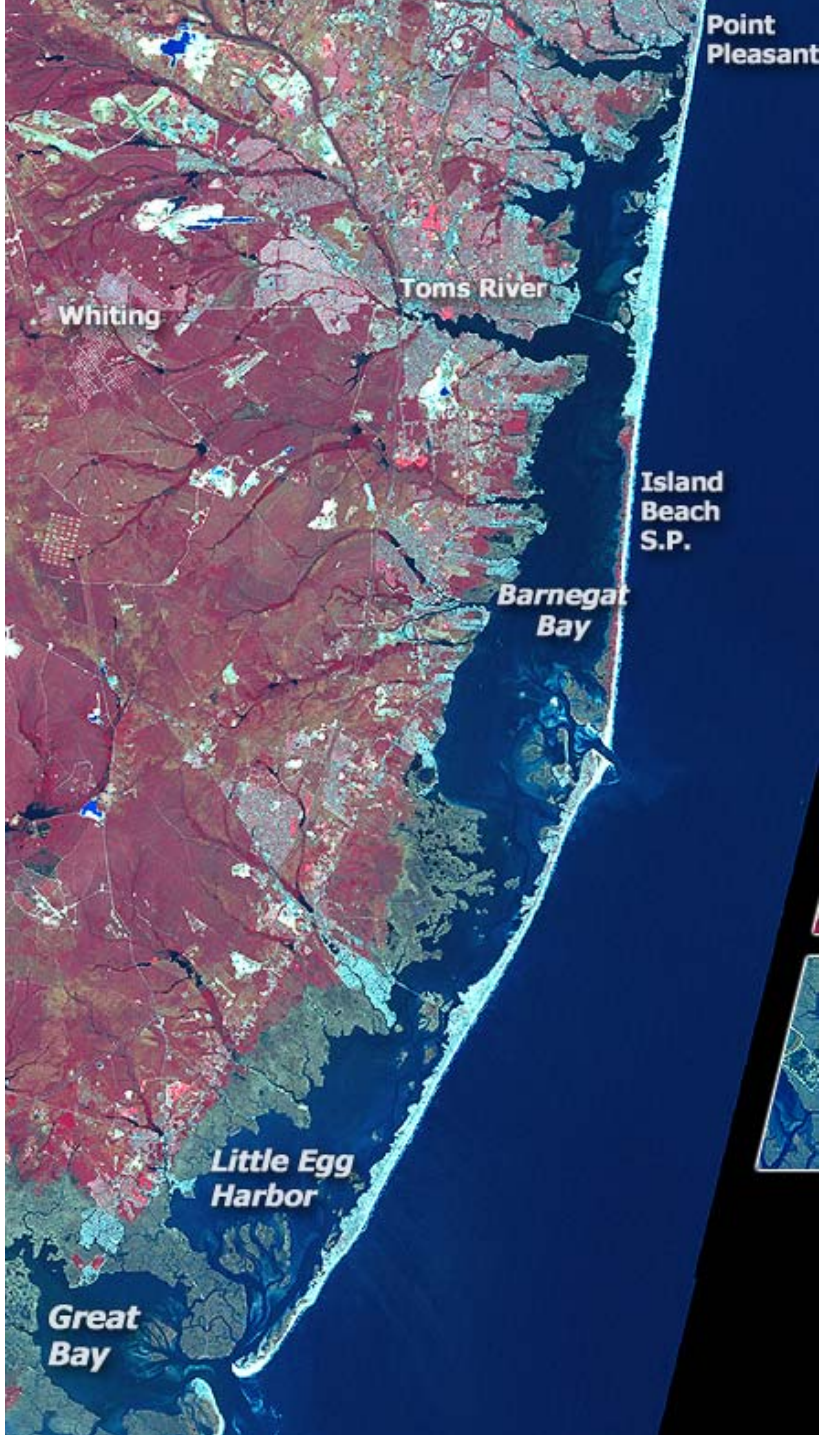
Coastal Diversity

-

Barrier Islands and Headlands

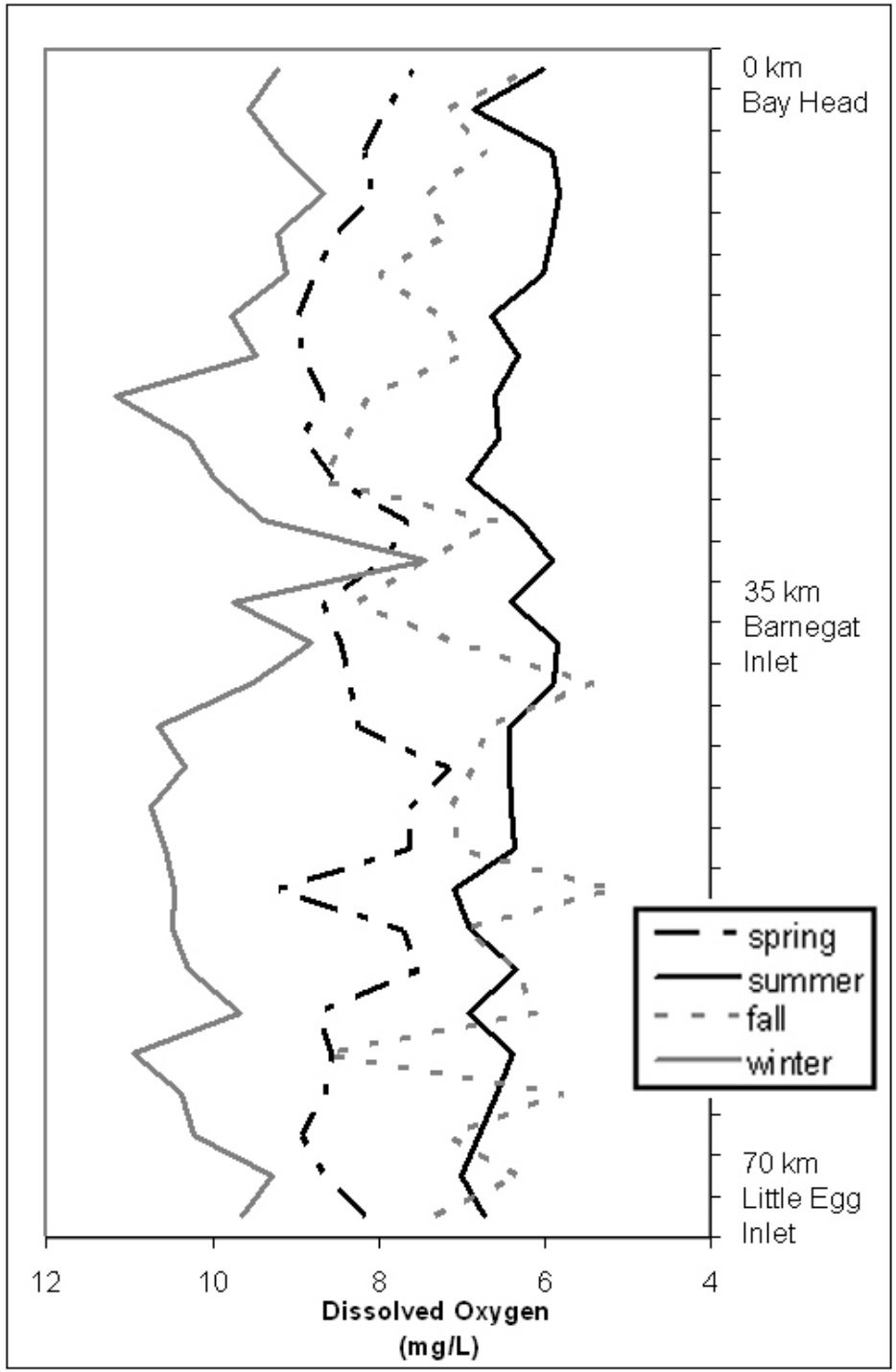
-

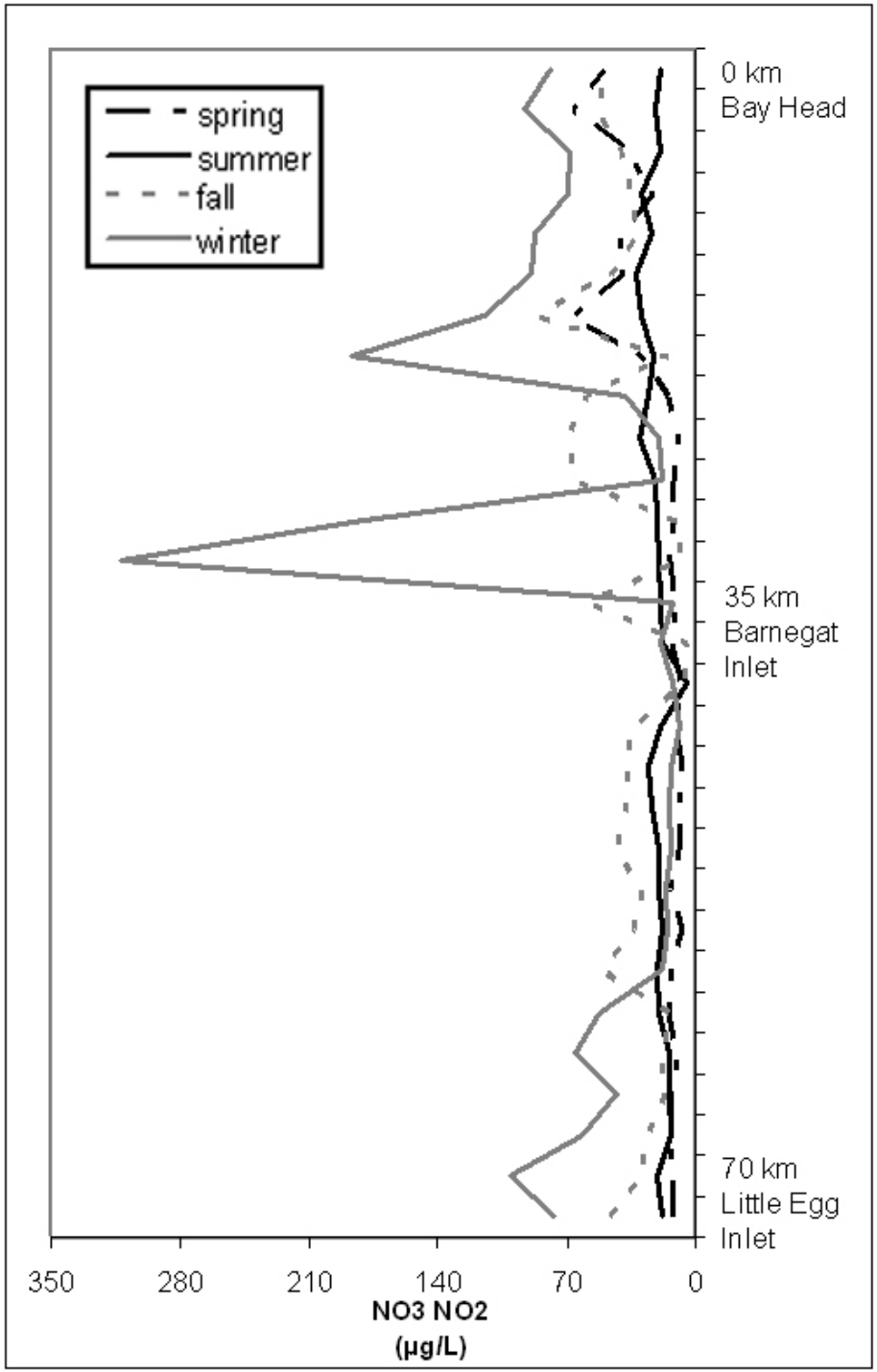
Coastal Watersheds

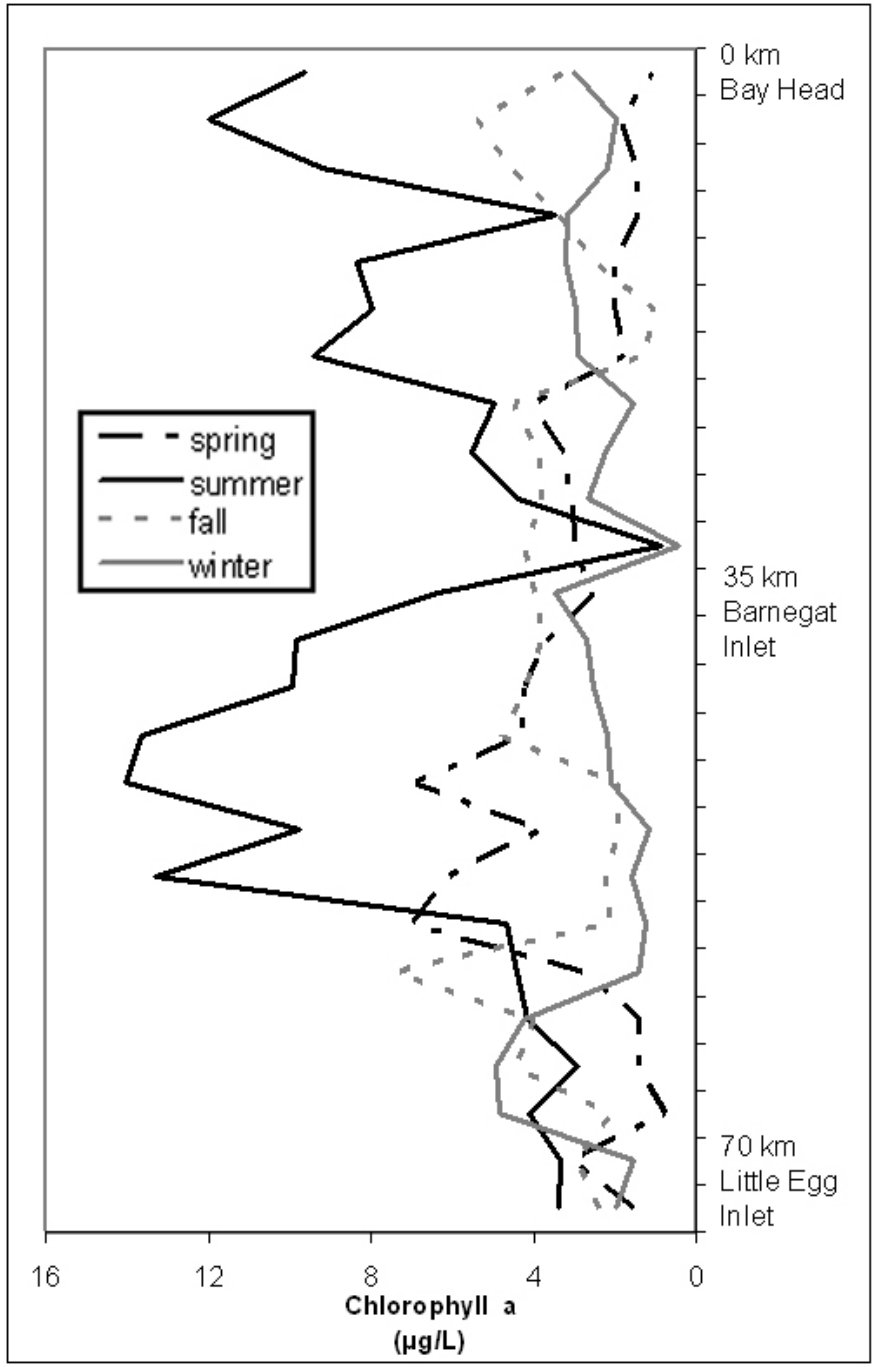

Point
Pleasant
Toms River
Whiting
Island
Beach
S.P.
Barnegat
Bay
Little Egg
Harbor
Great
Bay

PHYSICAL-CHEMICAL CONDITIONS

- Temperature Range (-1.5-30°C)
- Salinity Range (~12-32‰)
- Semidiurnal Tides/Vertically Well-Mixed
- Tidal Range (<0.5-1.5 m)/Currents (<0.5-1.5 m/s)
- Residence Time (25-74 days)


0 km
Bay Head
35 km
Barnegat
Inlet
70 km
Little Egg
Inlet
spring
summer
fall
winter
12
10
8
6
4
Dissolved Oxygen
(mg/L)


spring
summer
fall
winter
0 km
Bay Head
35 km
Barnegat
Inlet
70 km
Little Egg
Inlet
350
280
210
140
70
0
NO3 NO2
(µg/L)


0 km
Bay Head
35 km
Barnegat
Inlet
70 km
Little Egg
Inlet
spring
summer
fall
winter
16
12
8
4
0
Chlorophyll a
(µg/L)

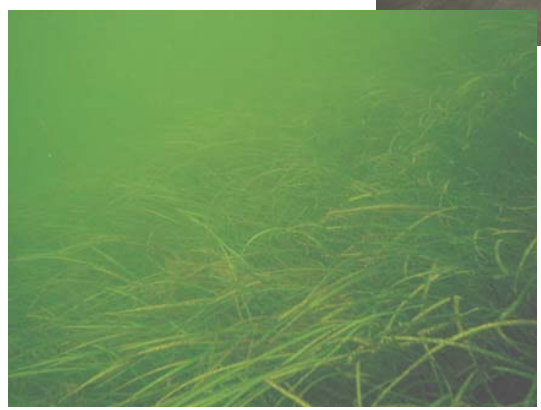
HABITATS

- Upland Forest (640 km²)

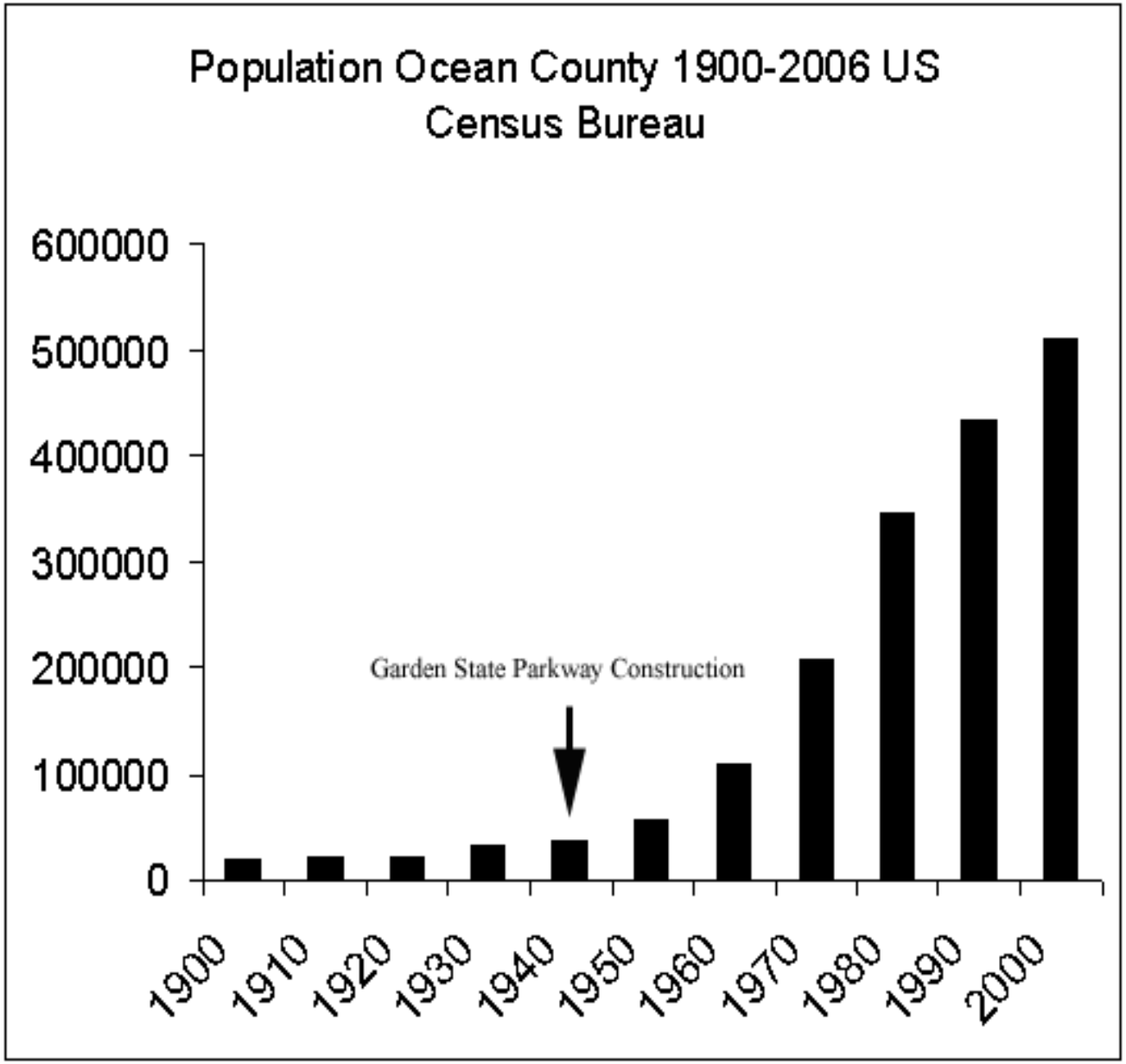
- Wetlands (329 km²)

- Developed (525 km²)

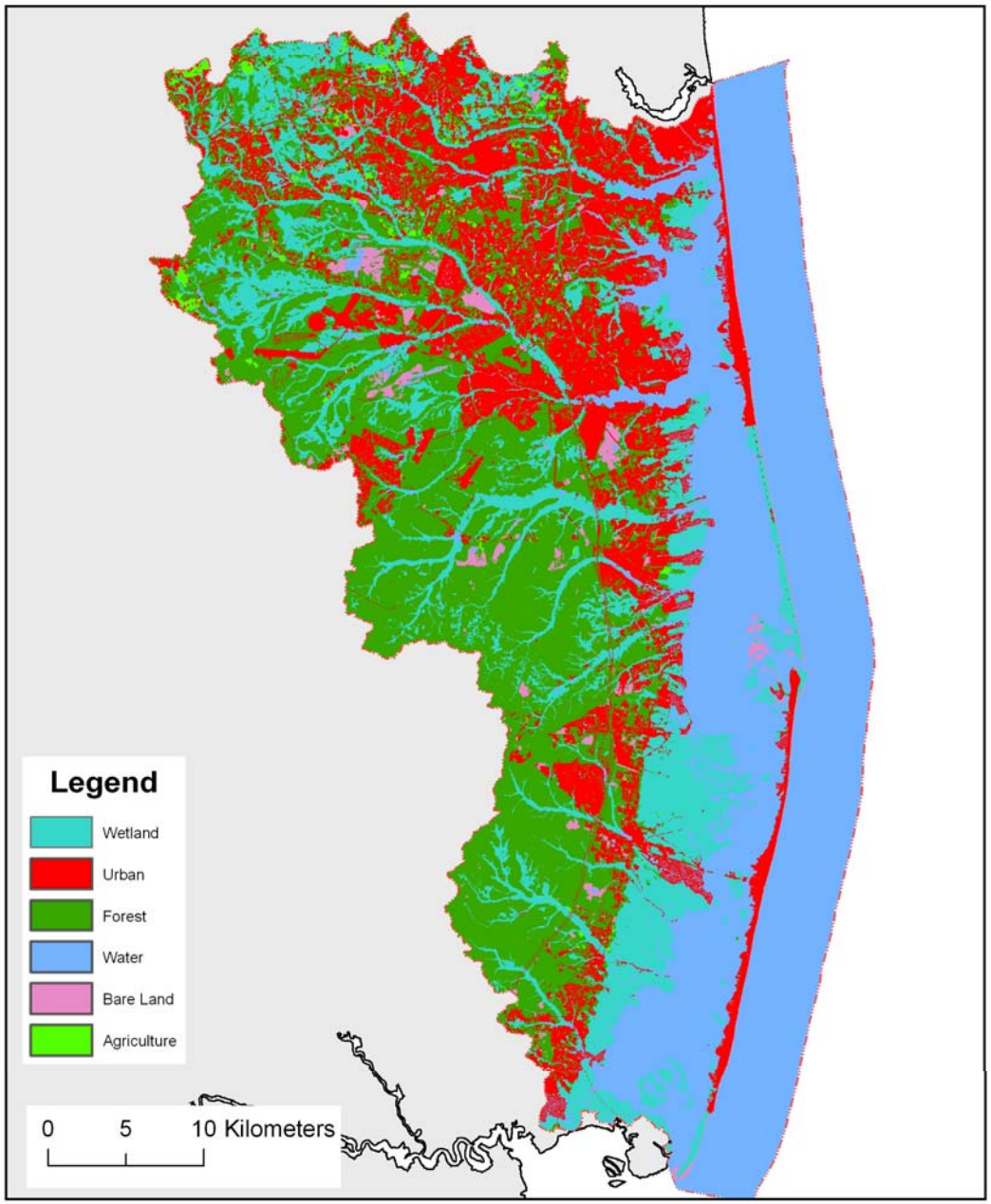
- Estuary (280 km²)



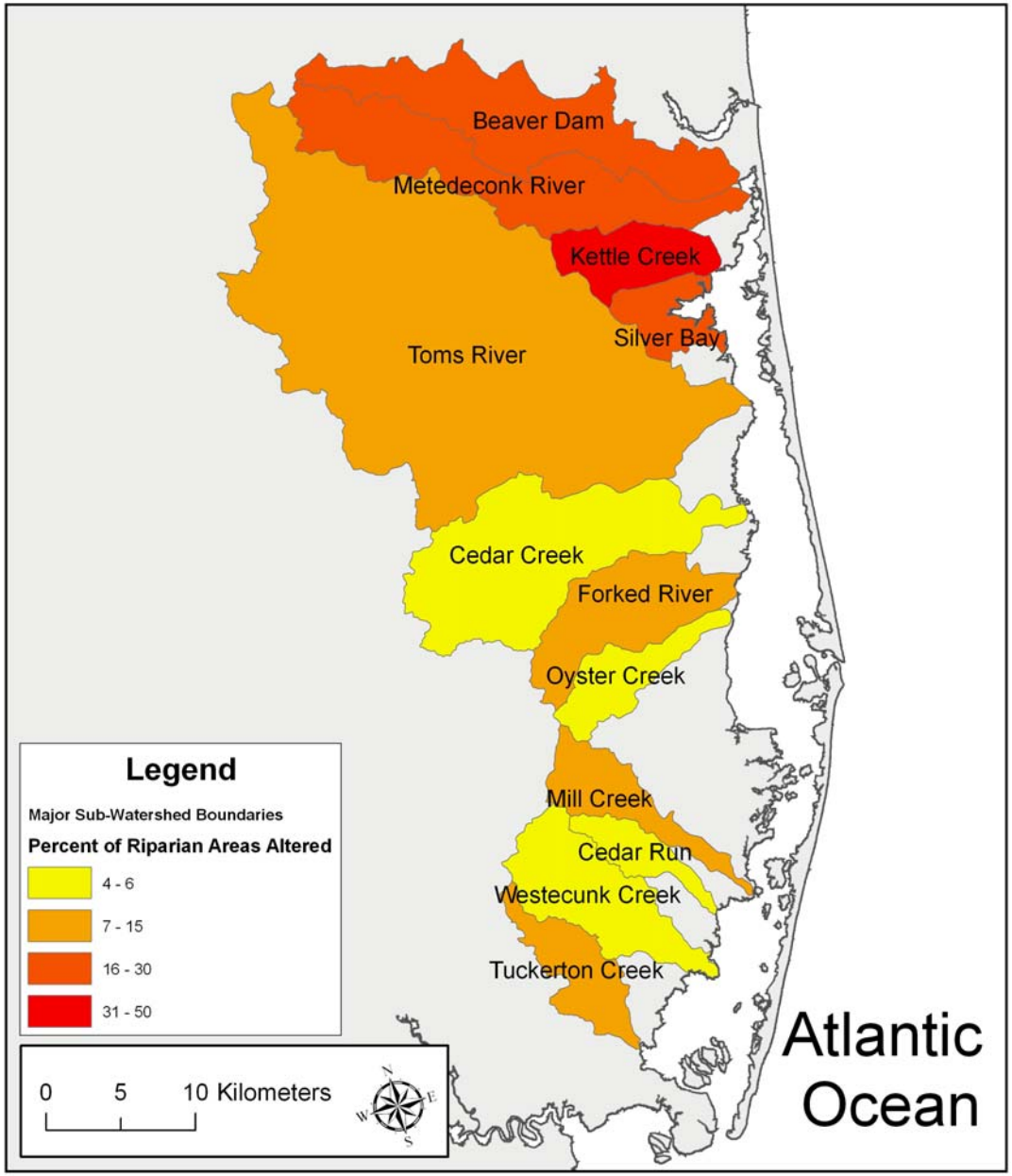
- Seagrass (20 km²)


Population Ocean County 1900-2006 US Census Bureau
600000
500000
400000
300000
200000
100000
0
Garden State Parkway Construction
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000

Land Cover Type 2006 for the Barnegat Bay Watershed

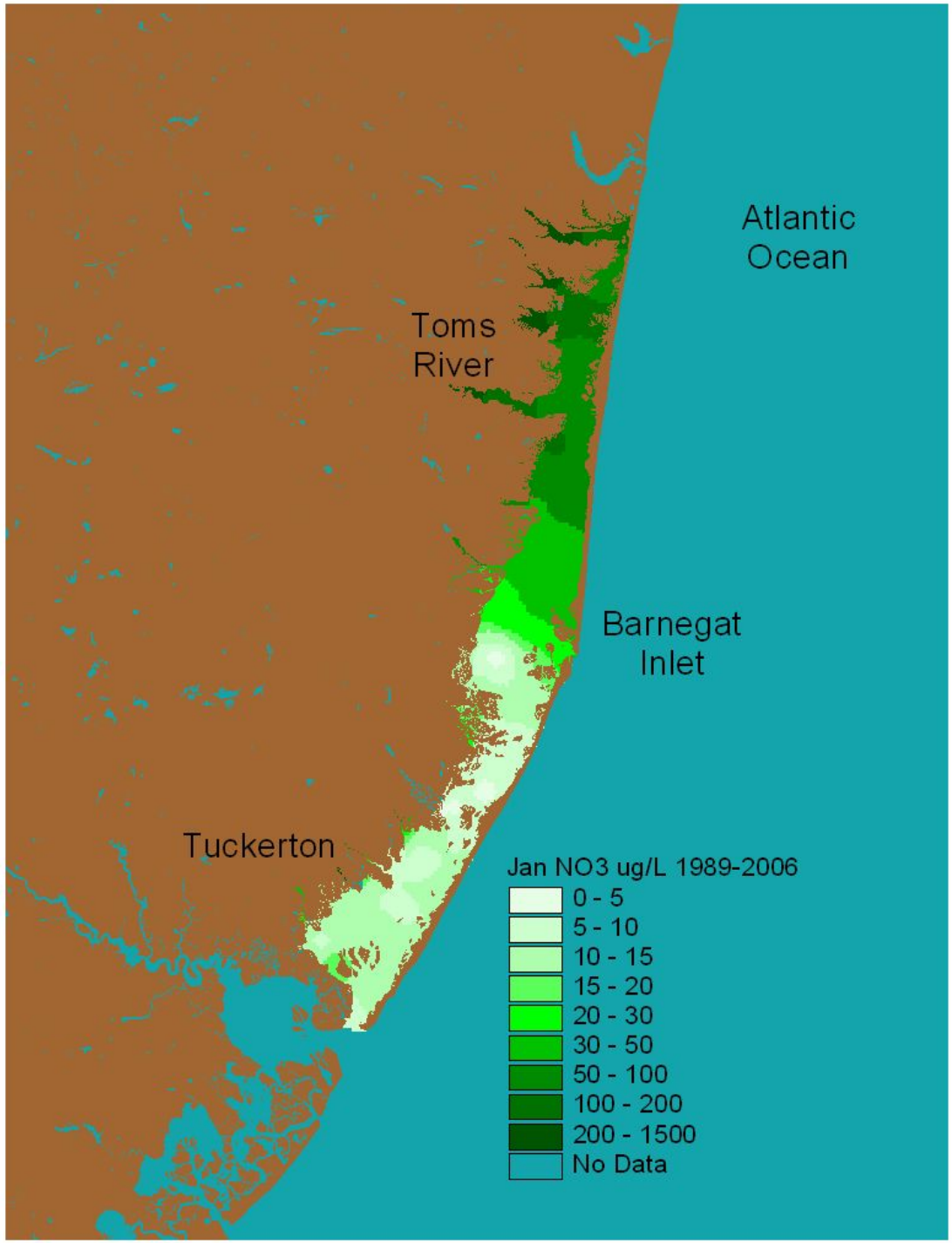


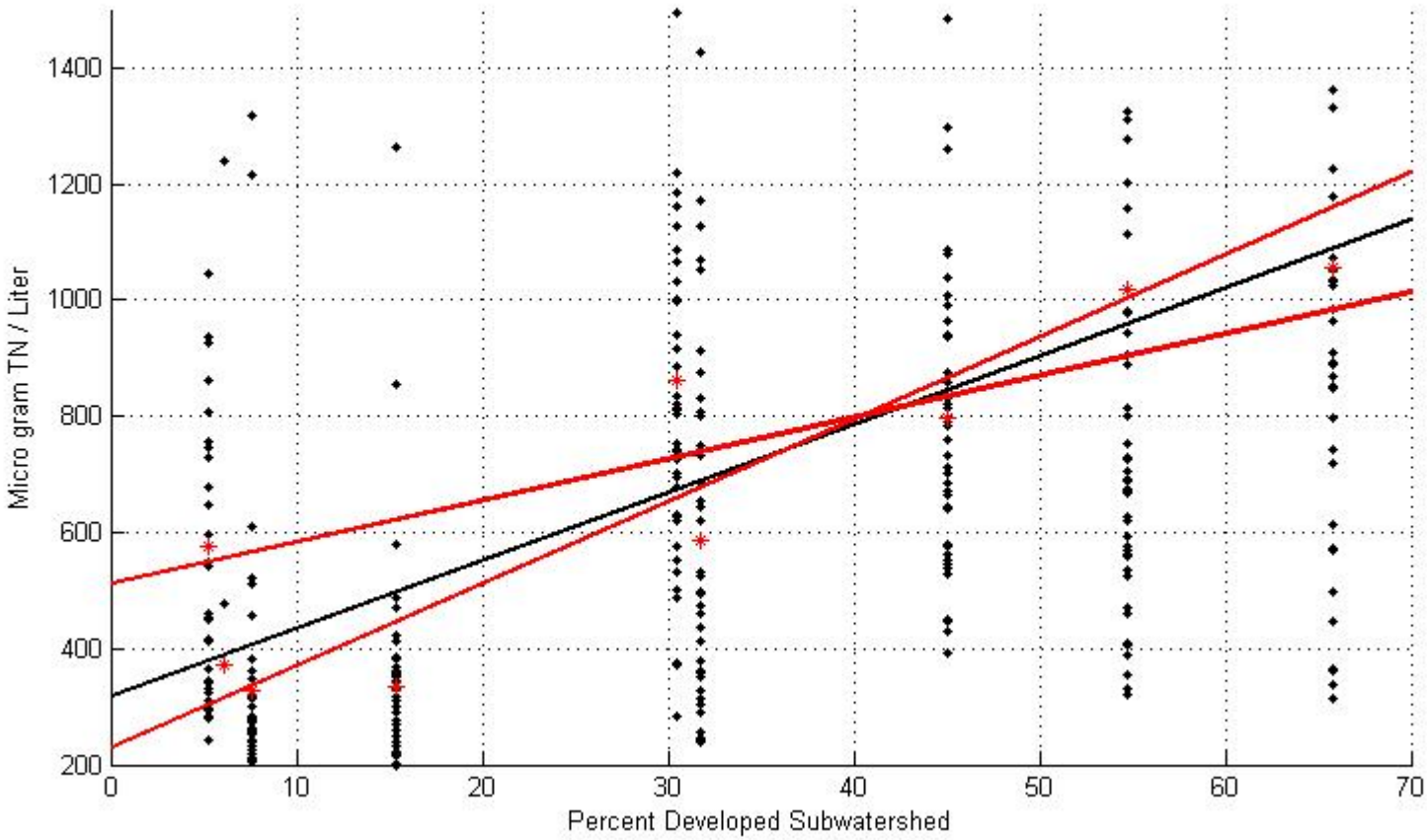
Percent Altered Riparian Zones



NITROGEN LOADING

- ~790,000 kg/yr
- ~50% Surface Runoff
- ~39% Atmospheric Deposition
- ~11% Groundwater Discharges


Atlantic
Ocean
Toms
River
Barnegat
Inlet
Tuckerton
Jan NO3 ug/L 1989-2006
0 - 5
5 - 10
10 - 15
15 - 20
20 - 30
30 - 50
50 - 100
100 - 200
200 - 1500
No Data


Micro gram TN / Liter
1400
1200
1000
800
600
400
200
0
10
20
30
40
50
60
70
Percent Developed Subwatershed

NITROGEN ENRICHMENT

Total Nitrogen (~20-80 μM)

NO_3^- and NO_2^- (< 4 μM)

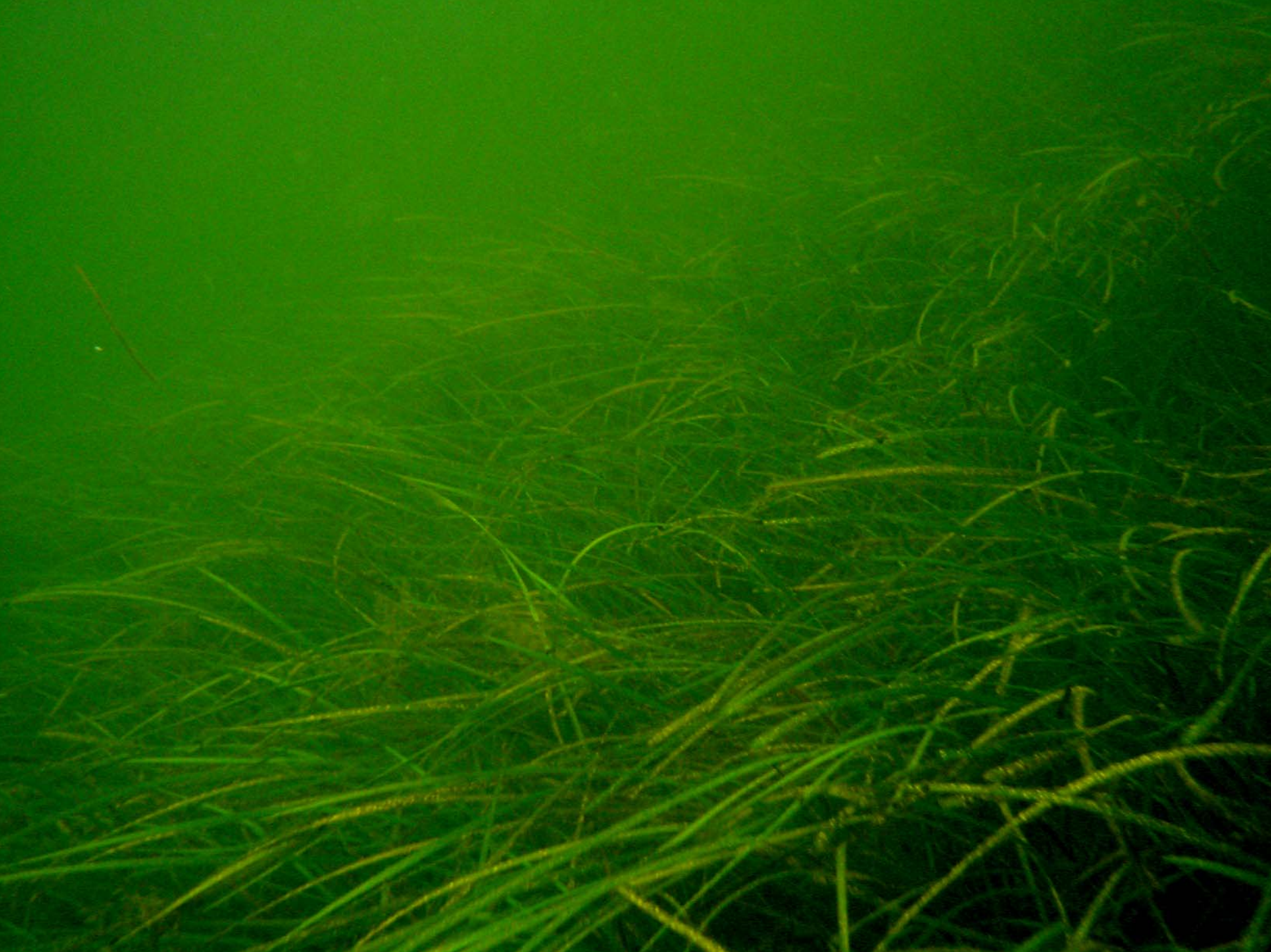
NH_4^+ (< 3 μM)

TON (10x) > TIN

Highly Eutrophic System

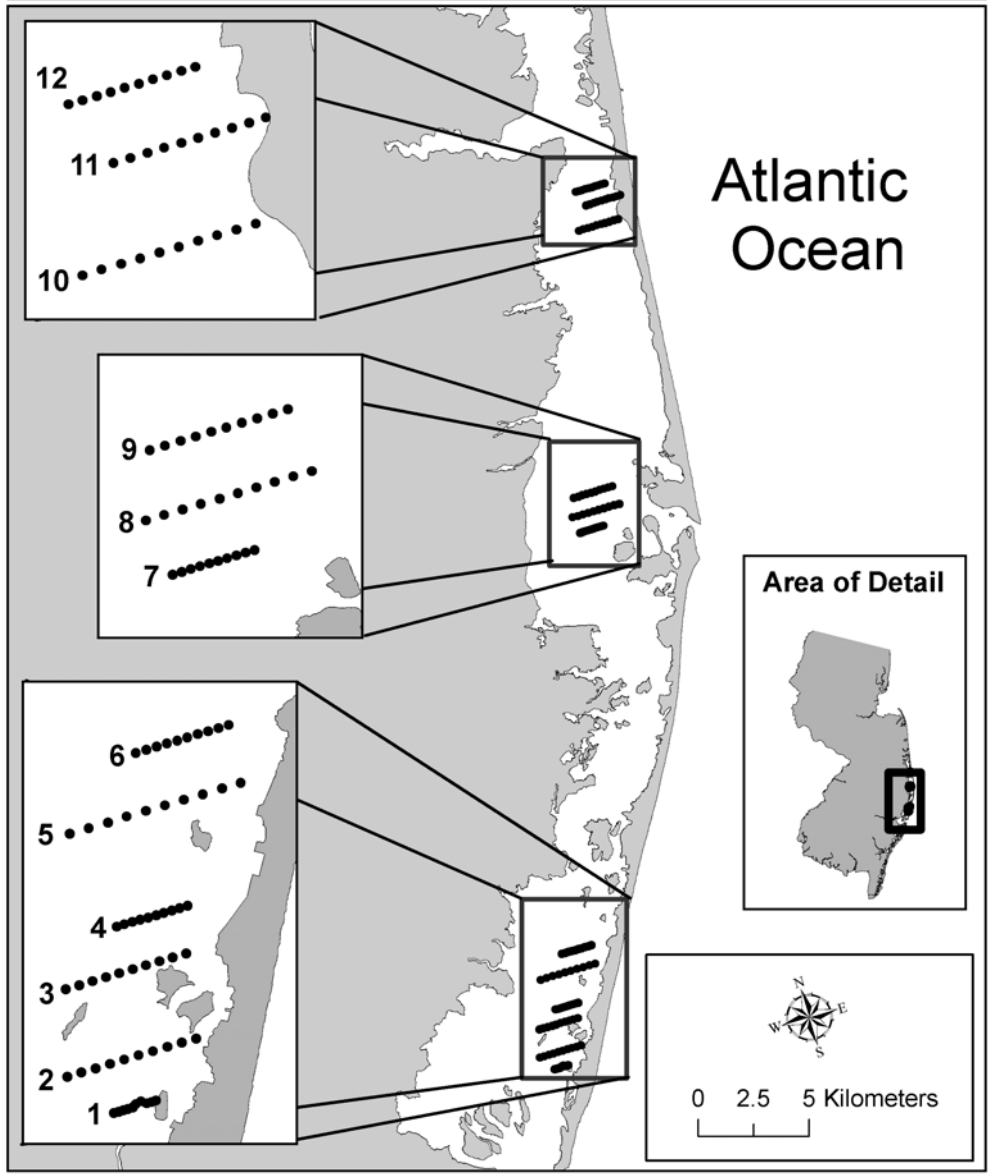
ASSESSMENT PARAMETERS

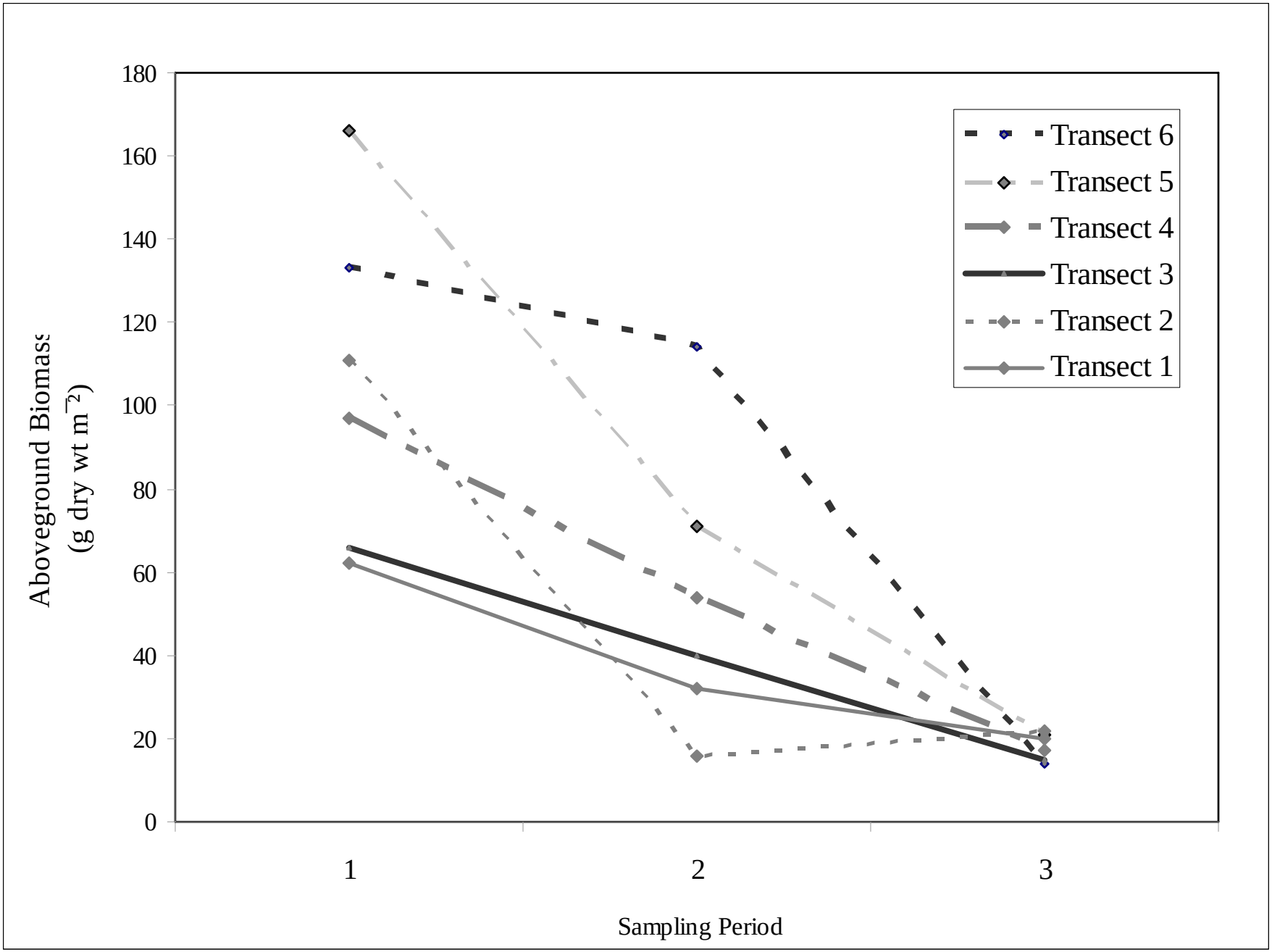
1. Chlorophyll a
2. Dissolved Oxygen
3. Nuisance/Toxic Algal Blooms
4. Macroalgal Abundance/Biomass
5. Epiphytic Algal Growth
6. Seagrass Habitat (Biomass, Shoot Density, Blade Length)
7. Fisheries (Shellfish)

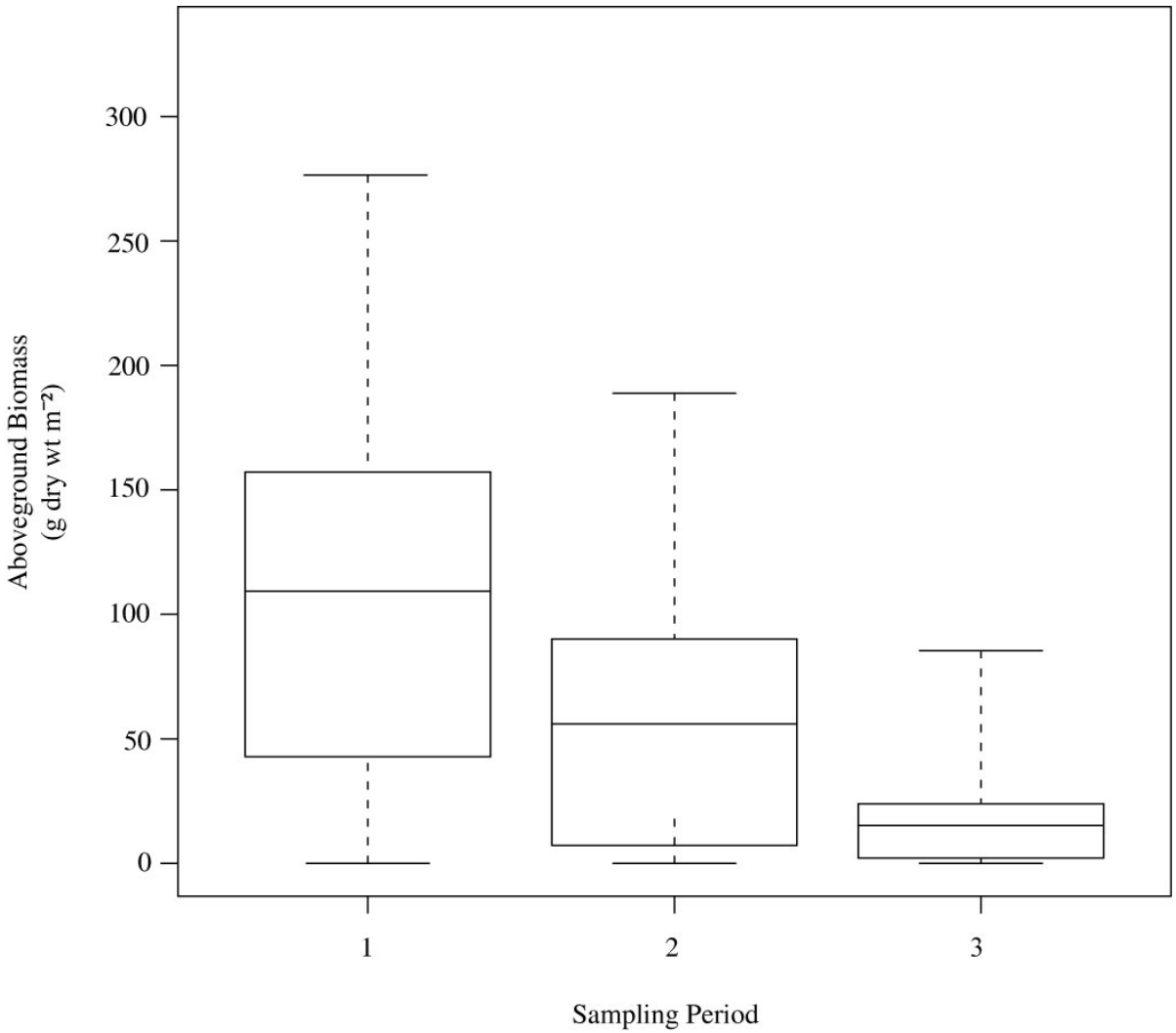


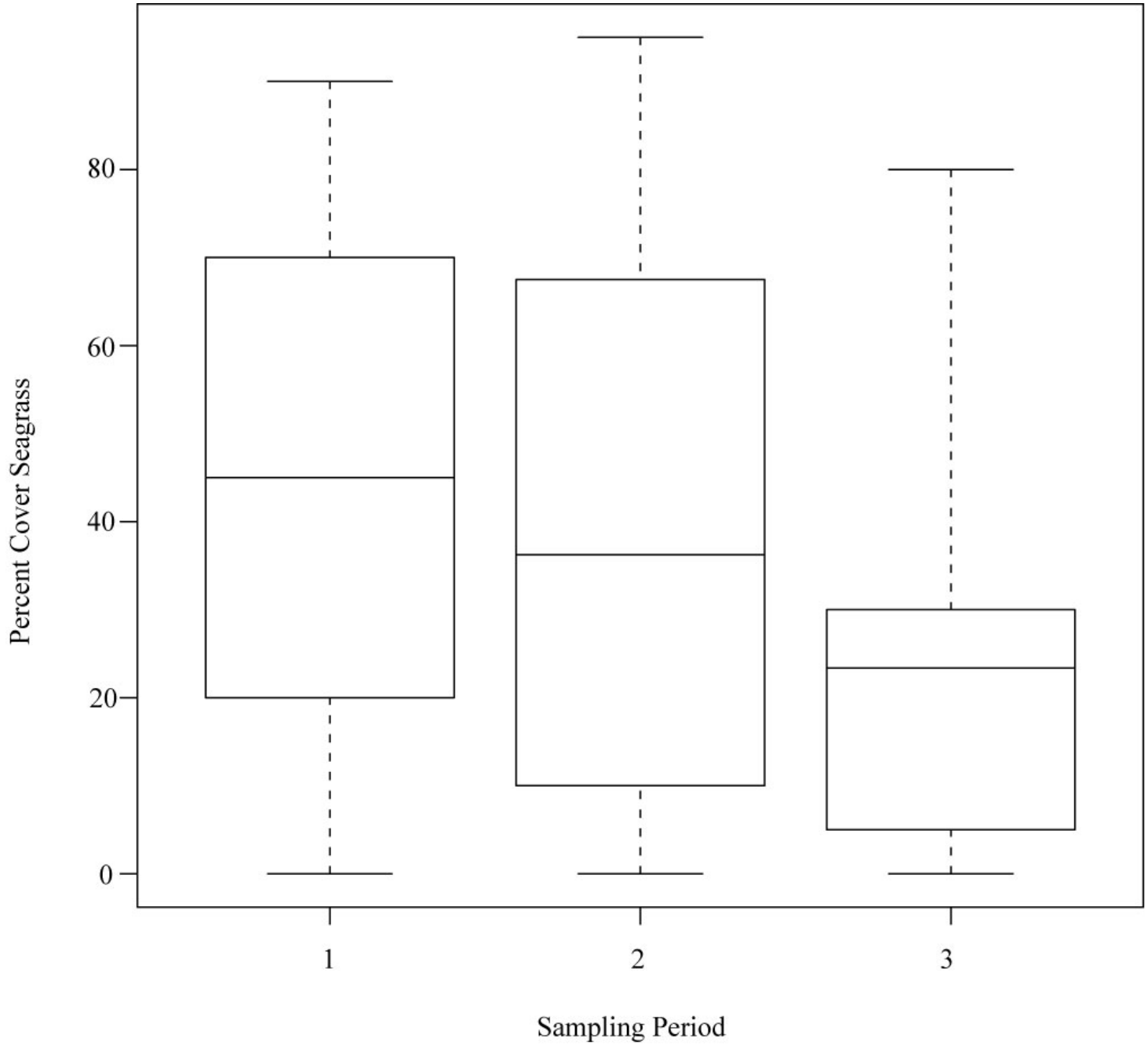
Picture of SAV bed from a boat
Barnegat Bay
Submerged Aquatic
Vegetation Beds
Island Beach State Park
Atlantic Ocean
N
W
E
S
CRSSA
-graphic by Scott Haag & Paul Montesano

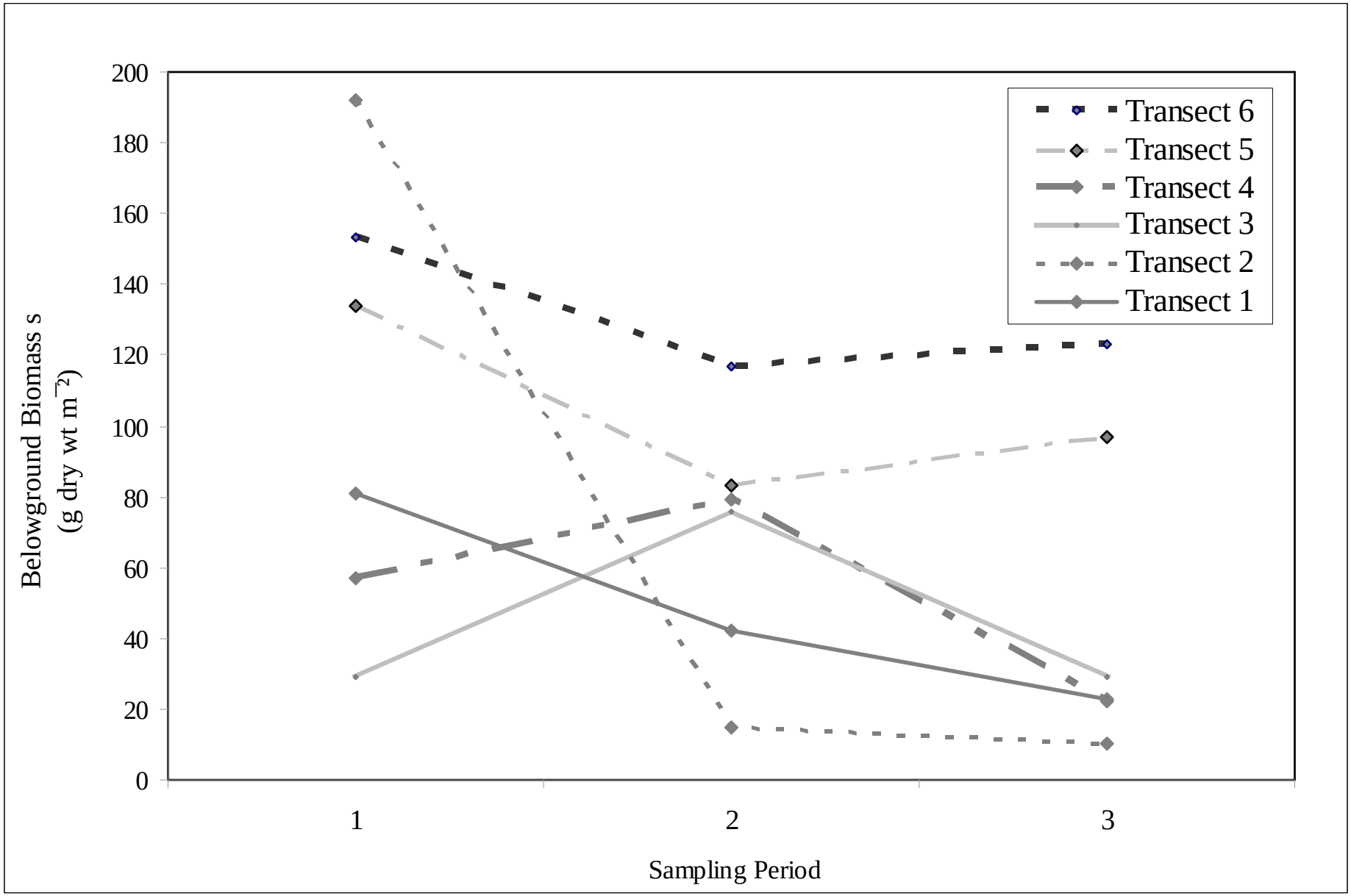
Transects and Sampling Sites

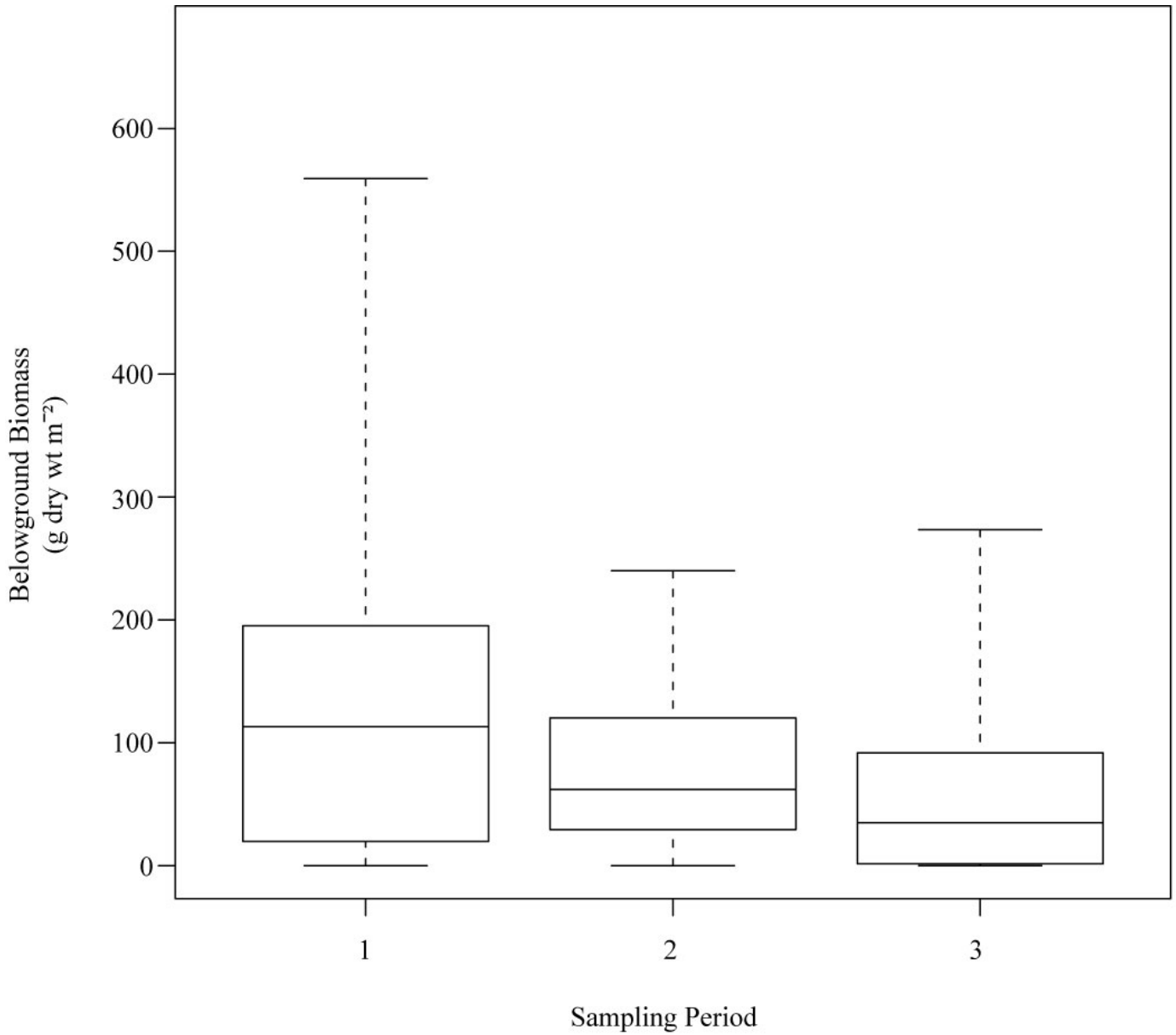


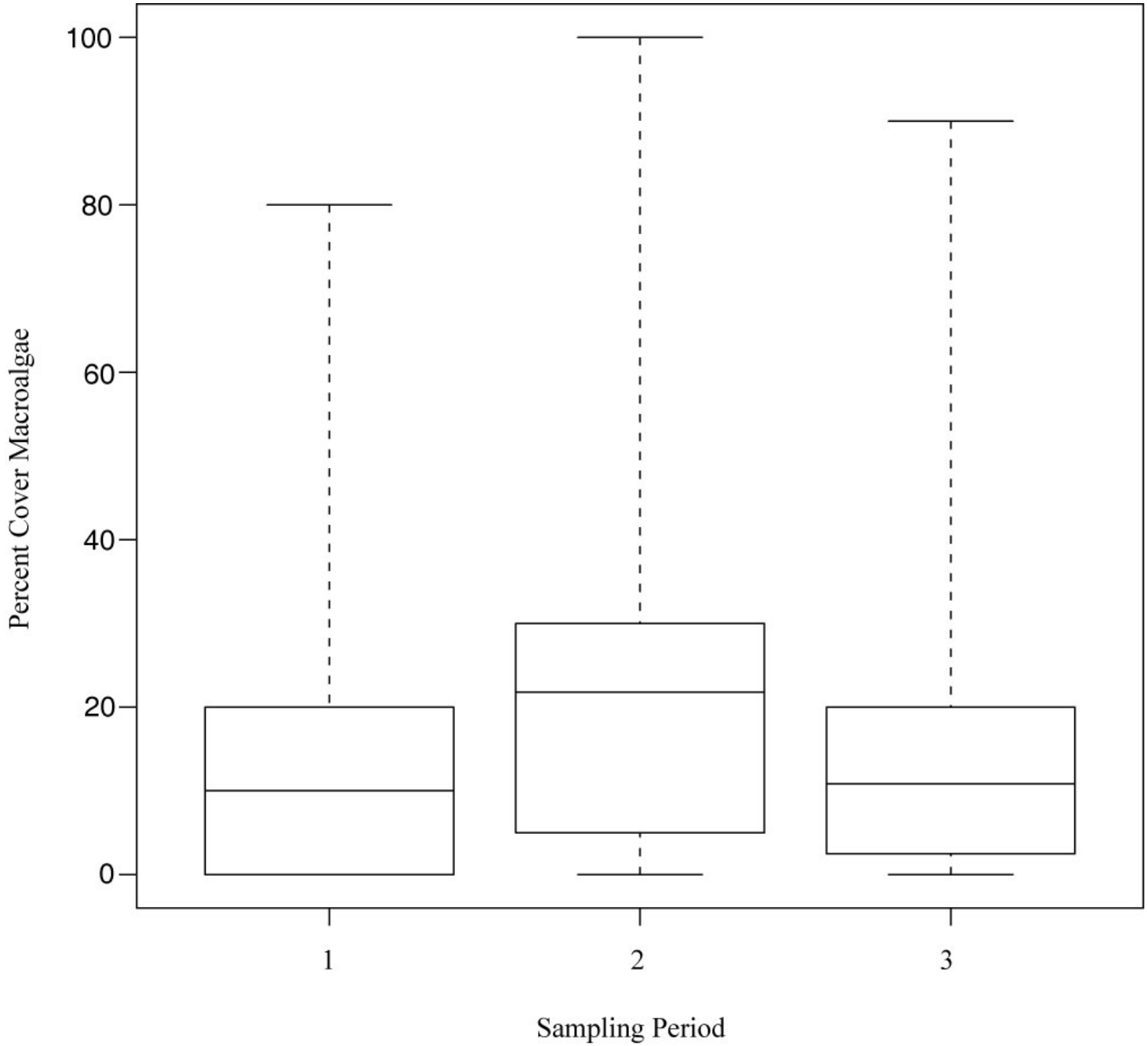

180
160
140
120
100
80
60
40
20
0
Aboveground Biomass
(g dry wt m⁻²)
1
2
3
Sampling Period
Transect 6
Transect 5
Transect 4
Transect 3
Transect 2
Transect 1

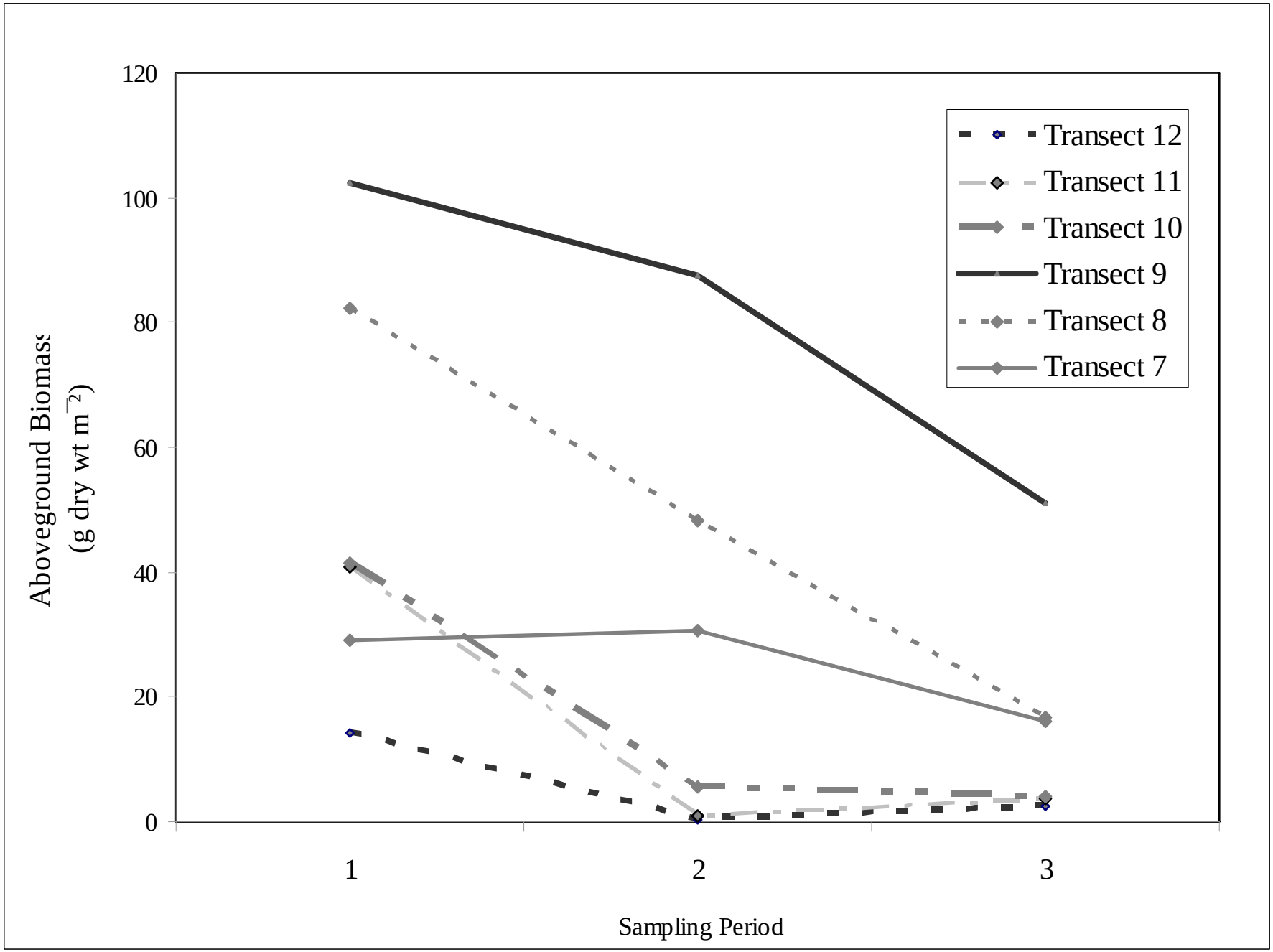

Aboveground Biomass
(g dry wt m⁻²)
300
250
200
150
100
50
0
1
2
3
Sampling Period

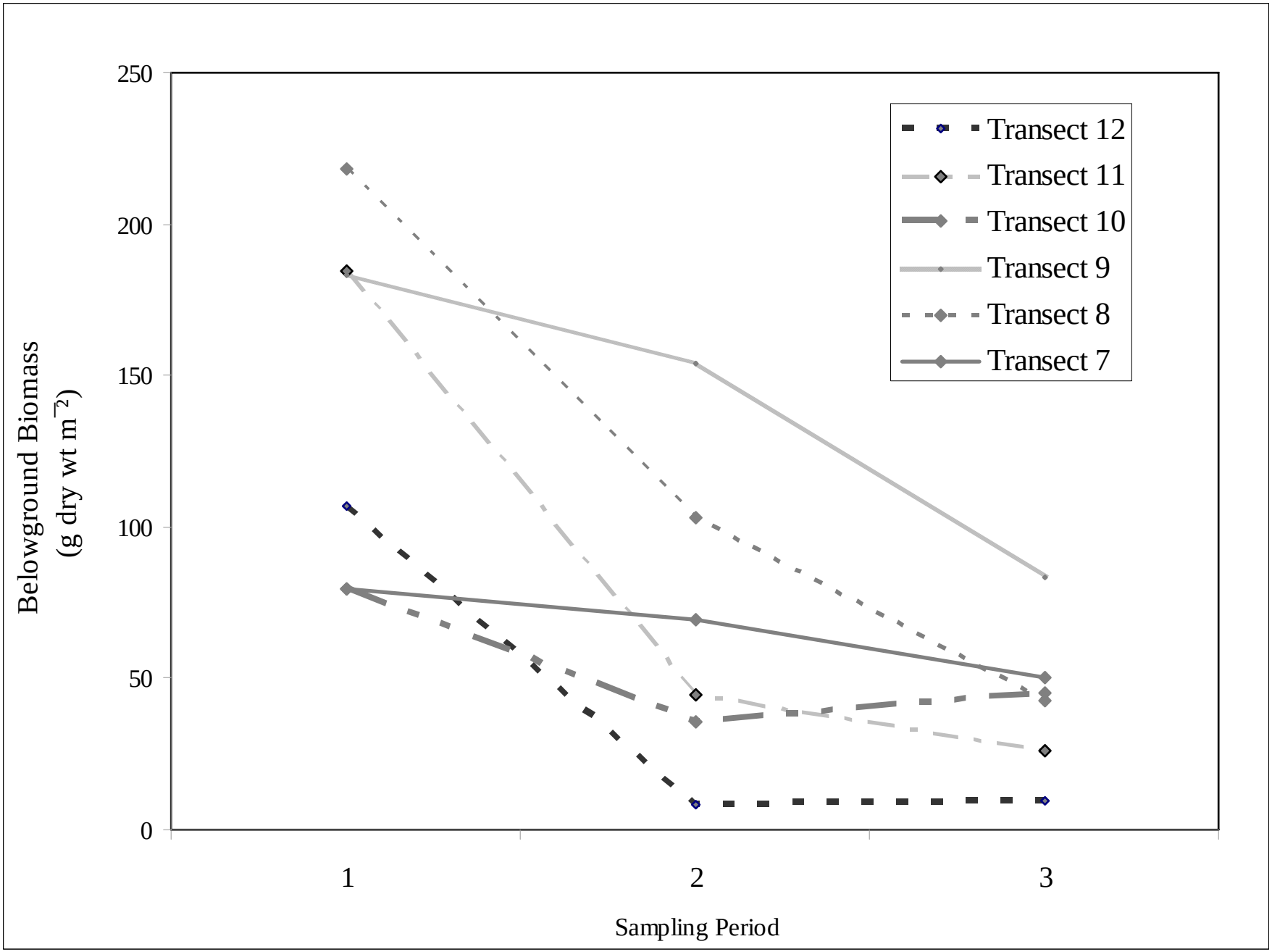

Percent Cover Seagrass
0
20
40
60
80
1
2
3
Sampling Period

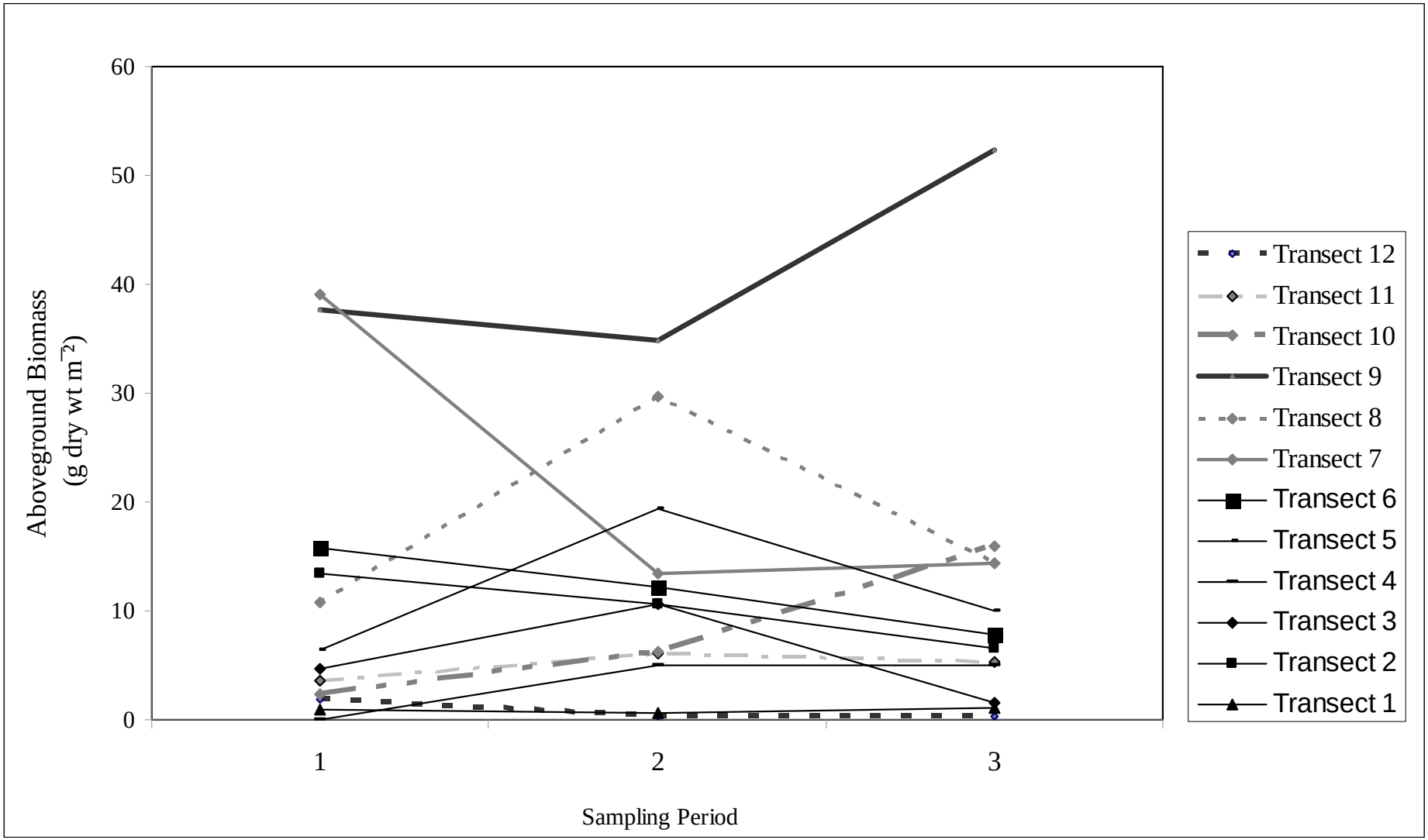

Transect 6
Transect 5
Transect 4
Transect 3
Transect 2
Transect 1
Belowground Biomass s
(g dry wt m^{-2})
200
180
160
140
120
100
80
60
40
20
0
1
2
3
Sampling Period

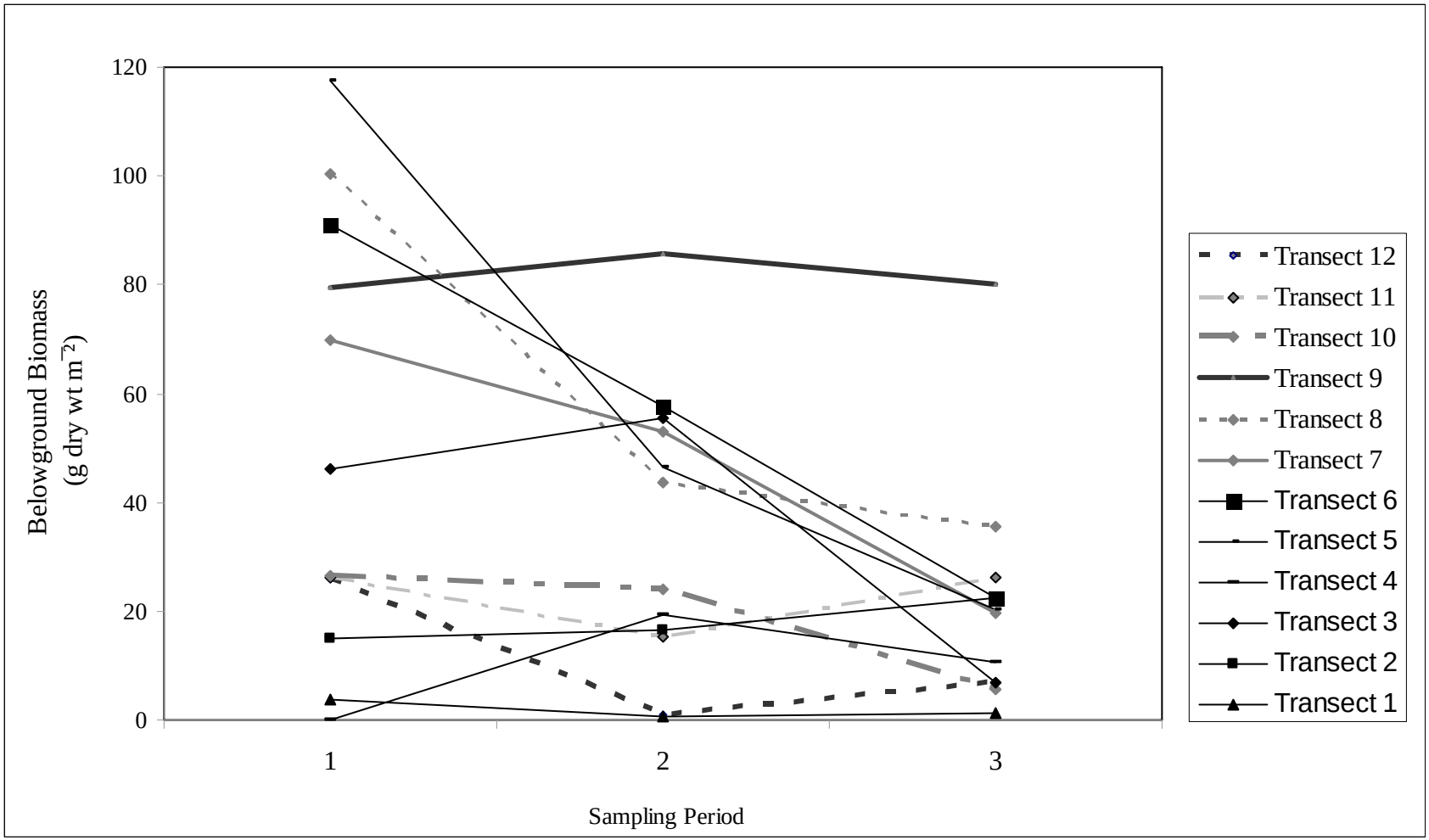

600
500
400
300
200
100
0
Belowground Biomass
(g dry wt m⁻²)
1
2
3
Sampling Period

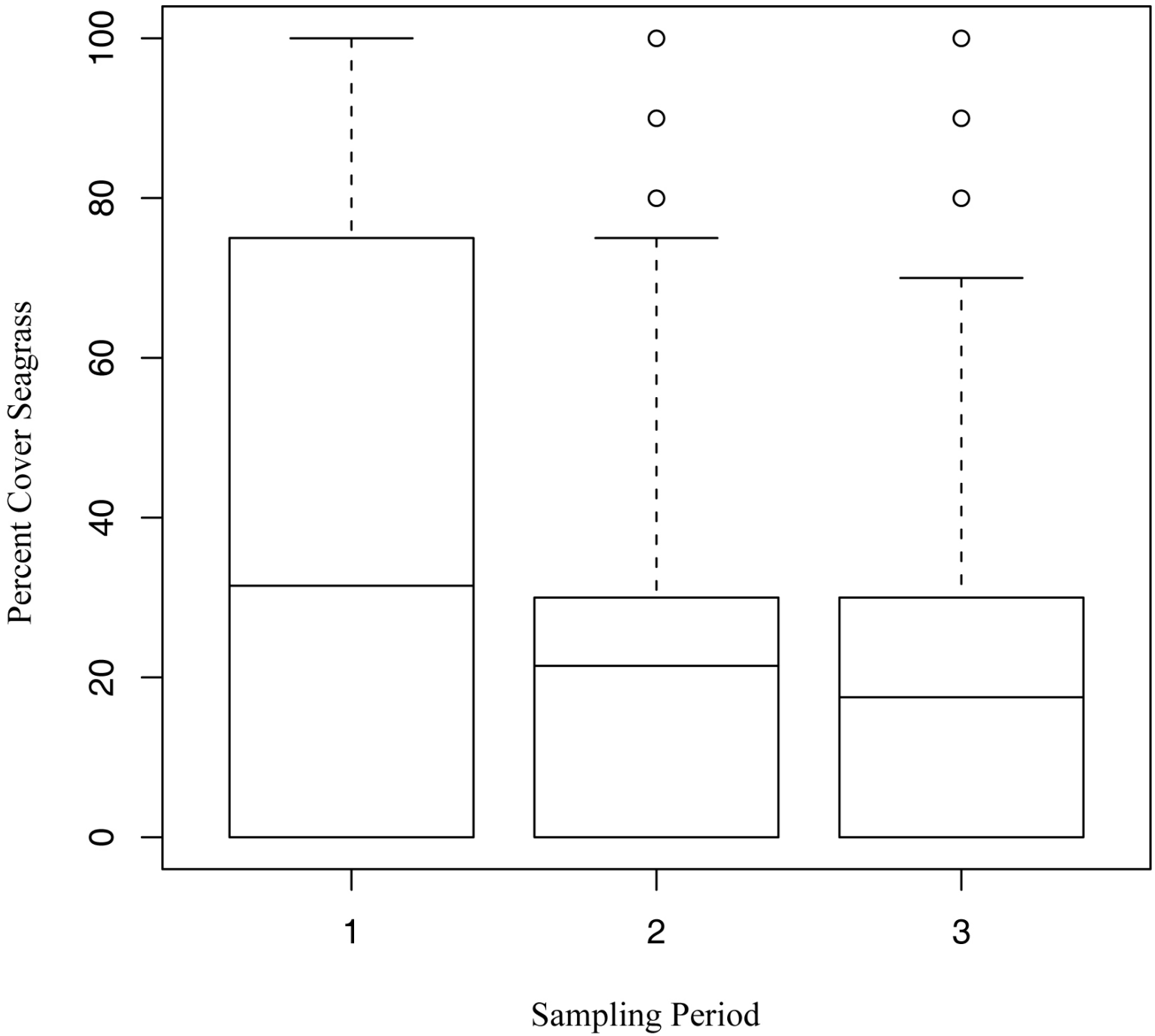

100
80
60
40
20
0
Percent Cover Macroalgae
1
2
3
Sampling Period

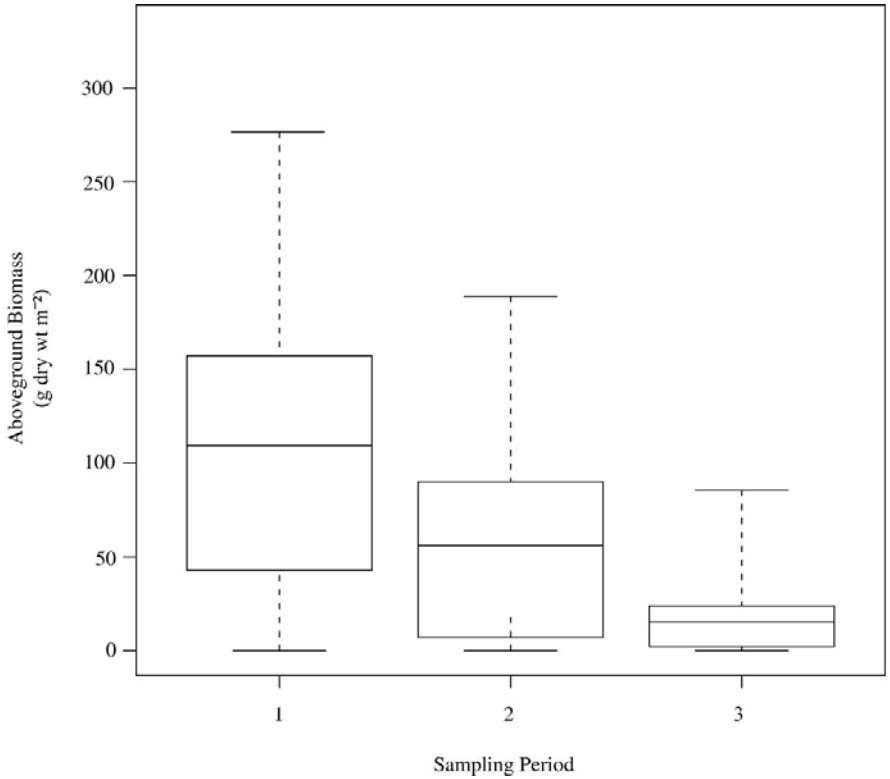

120
100
80
60
40
20
0
Aboveground Biomass
(g dry wt m-2)
1
2
3
Sampling Period
Transect 12
Transect 11
Transect 10
Transect 9
Transect 8
Transect 7

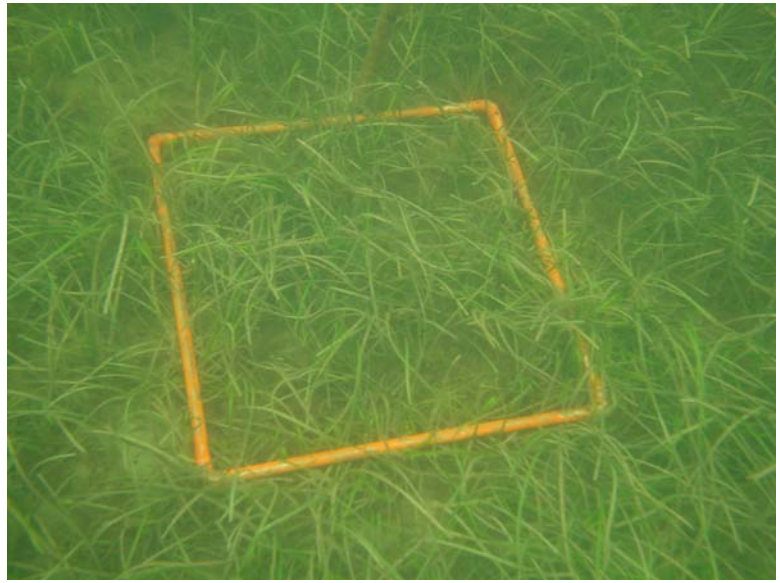

250
200
150
100
50
0
Belowground Biomass
(g dry wt m⁻²)
1
2
3
Sampling Period
Transect 12
Transect 11
Transect 10
Transect 9
Transect 8
Transect 7

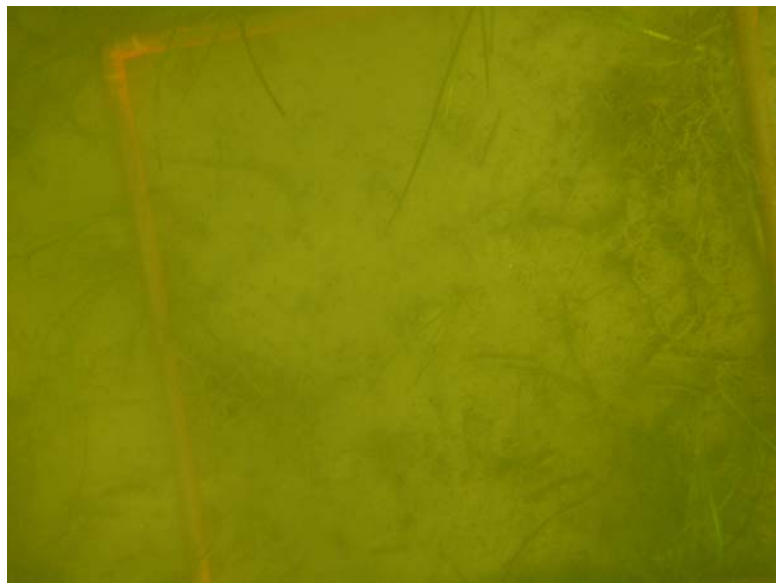

60
50
40
30
20
10
0
Aboveground Biomass
(g dry wt m-2)
1
2
3
Sampling Period
Transect 12
Transect 11
Transect 10
Transect 9
Transect 8
Transect 7
Transect 6
Transect 5
Transect 4
Transect 3
Transect 2
Transect 1


120
100
80
60
40
20
0
Belowground Biomass
(g dry wt m-2)
1
2
3
Sampling Period
Transect 12
Transect 11
Transect 10
Transect 9
Transect 8
Transect 7
Transect 6
Transect 5
Transect 4
Transect 3
Transect 2
Transect 1


Percent Cover Seagrass
0
20
40
60
80
100
1
2
3
Sampling Period


Aboveground Biomass
(g dry wt m⁻²)
300
250
200
150
100
50
0
1
2
3
Sampling Period





SEAGRASS LOSS 2004-2006

- Aboveground Biomass
  (Reduced ~50-88%)
- Belowground Biomass
  (Reduced ~50-59%)
- Percent Cover
  (Decreased 28.9%)
- Shoot Density
  (Decreased 21.1%)
- Blade Length
  (Decreased 42.2%)

Eelgrass Epiphytes

Phytoplankton Production

$0 – 500\ g\ C\ m^{-2}\ yr^{-1}$

Phytoplankton Shift in Species Composition

Diatoms to Dinoflagellates and Microflagellates

Phytoplankton Blooms

Brown Tides (1995, 1997, 1999-2002)

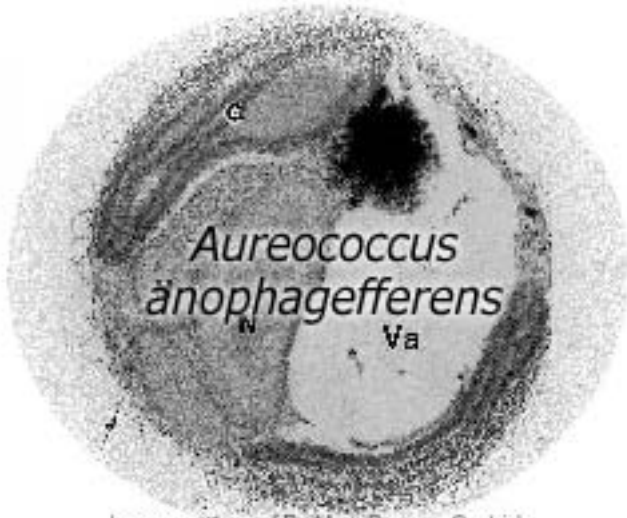


Image courtesy of Dr. Mary Downes Gastrich

Sea Lettuce

BENTHIC MACROALGAE

- Chlorophyta: ***Chaetomorpha, Cladophora, Enteromorpha, Ulva***

- Rhodophyta: ***Agardhiella, Ceramium, Champia, Gracilaria, Lomentaria, Polysiphonia, Spyridia***

- Phaeophyta: ***Sphacelaria***

PLANT METRICS

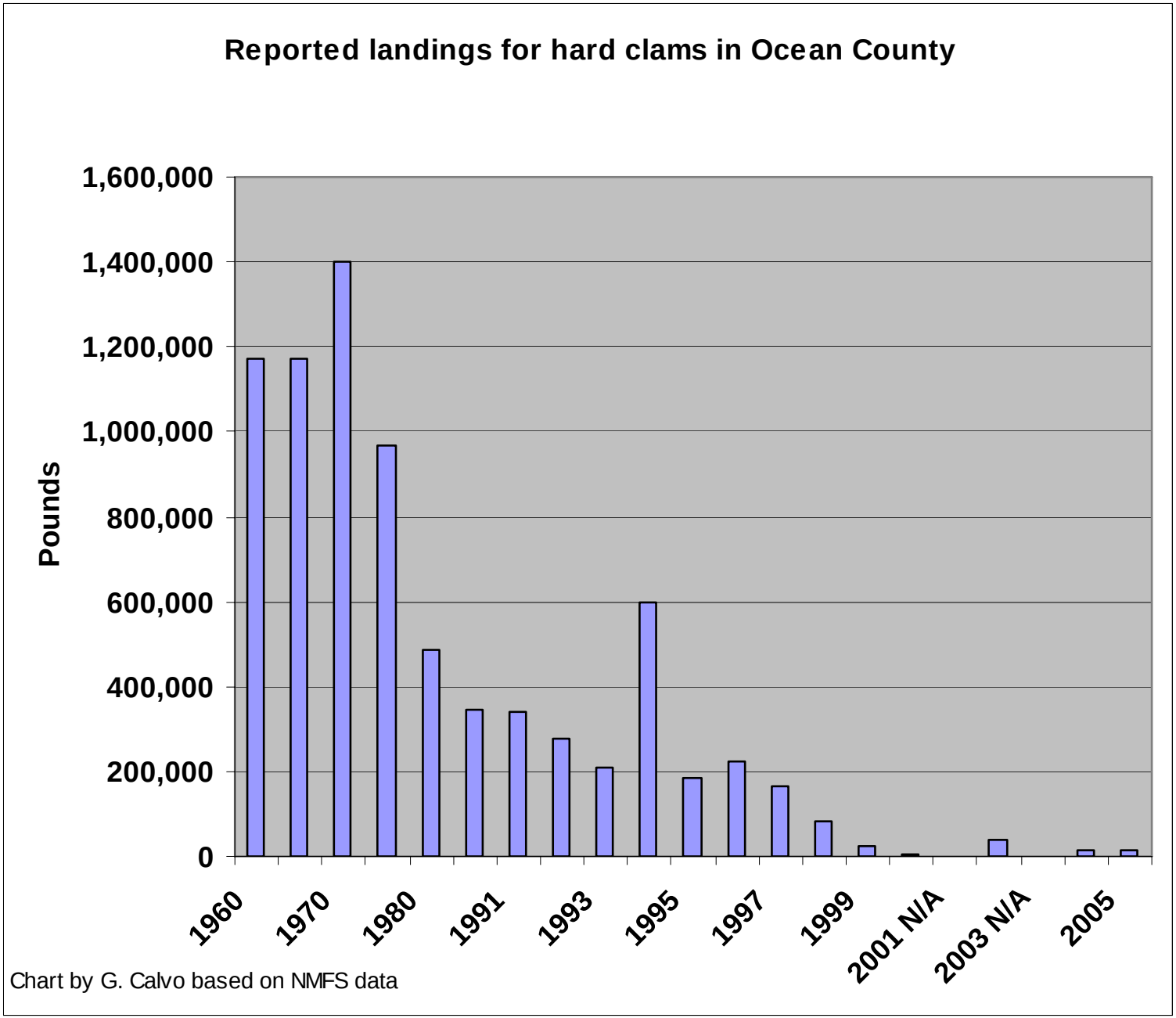
- *Zostera marina* (Shoot Density)
  300-1200 shoots m^{-2}

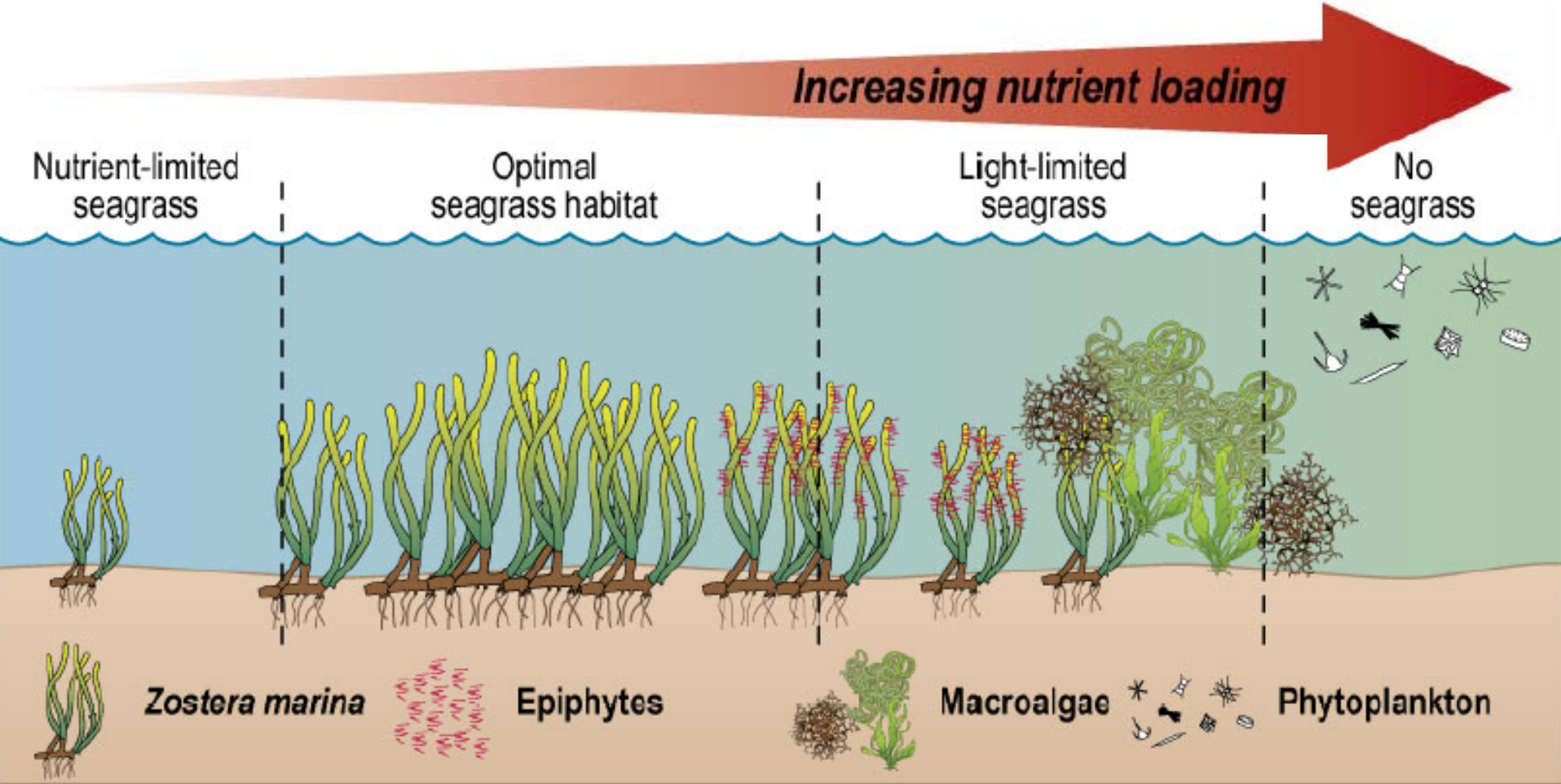
- *Zostera marina* (Biomass)
  50-200 g AFDW m^{-2}

- Macroalgae (Biomass)
  1-30 g AFDW m^{-2}

- Macroalgae (Blooms)
  > 400 g AFDW m^{-2}

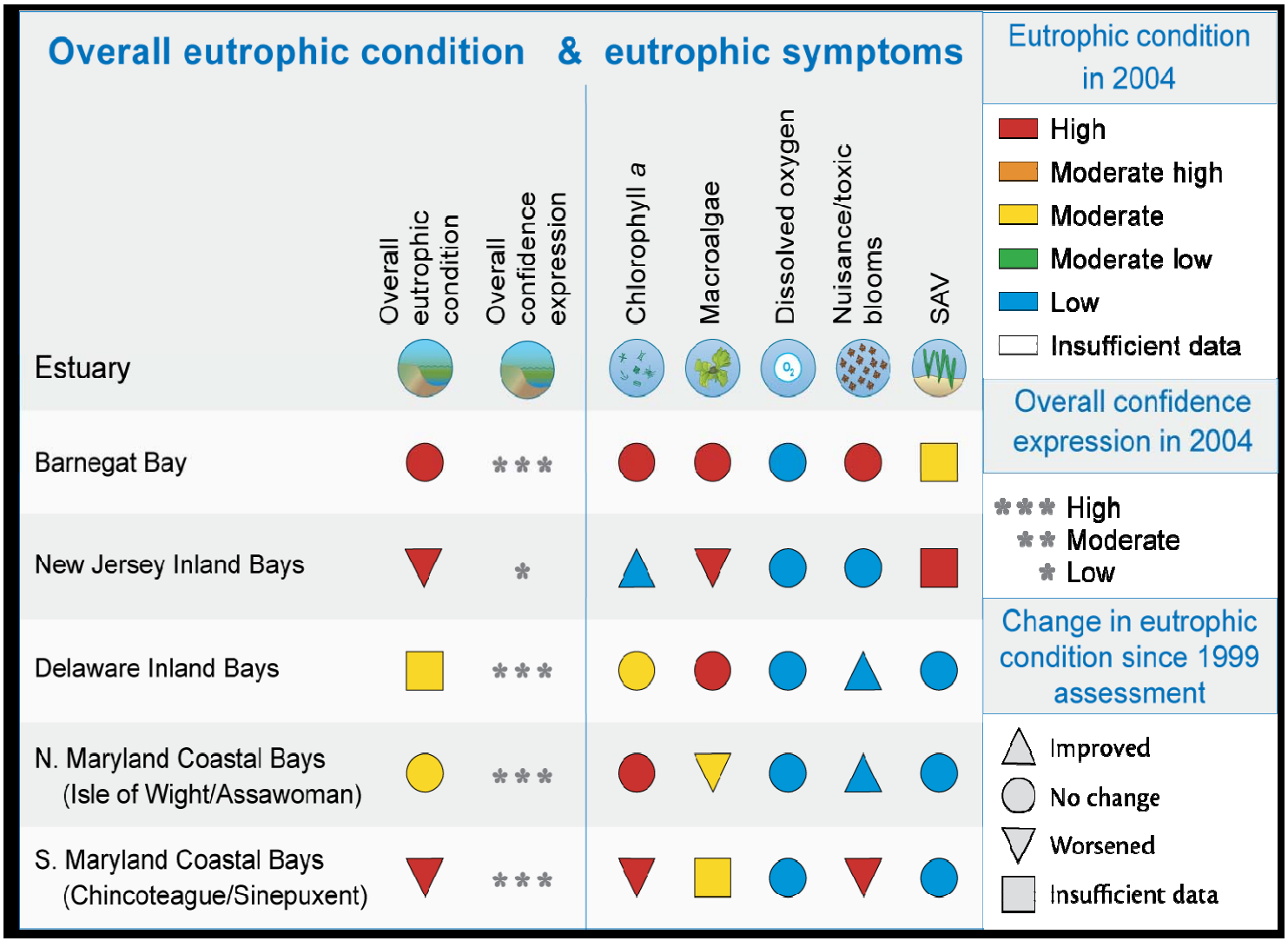
- Chlorophyll *a*
  10-18 $\mu g\ l^{-1}$


Reported landings for hard clams in Ocean County
Pounds
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
1960
1970
1980
1991
1993
1995
1997
1999
2001 N/A
2003 N/A
2005
Chart by G. Calvo based on NMFS data

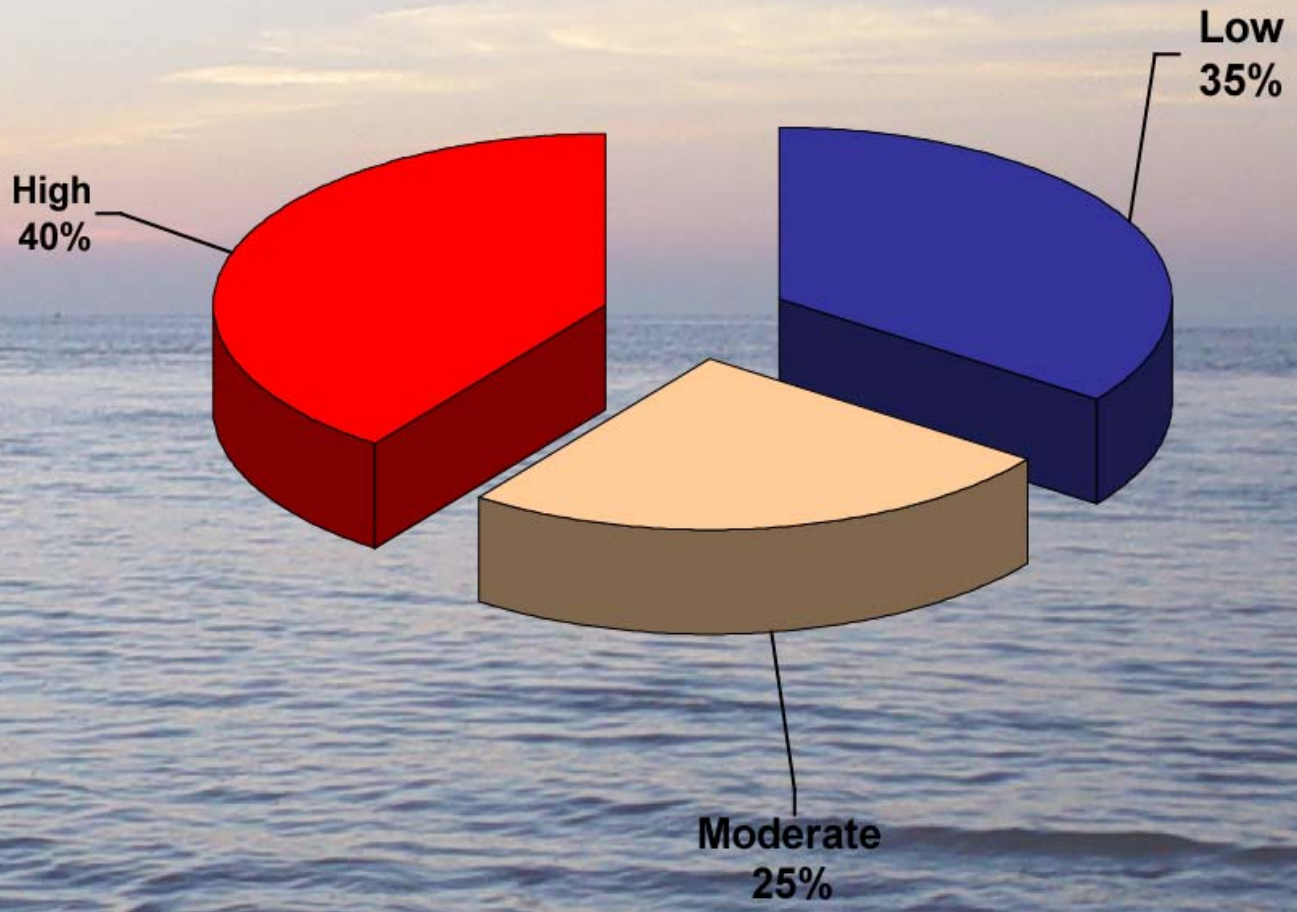


	Sinepuxent Bay	South Chincoteague Bay	North Chincoteague Bay	Isle of Wight Bay	Newport Bay	Assawoman Bay	St. Martin River
% seagrass	77	76		24	37	34	6
WQI	0.80 (0.09)	0.82 (0.04)	0.50 (0.13)	0.39 (0.09)	0.30 (0.08)	0.29 (0.04)	0.33 (0.05)

Mid-Atlantic Lagoon Systems



Eutrophication



The End