SUBMERGED VEGETATION MONITORING PROGRAM FOR NC

Jud Kenworthy, CCFHR, NCCOS, NOS, NOAA
Beaufort, NC

1. Establish the framework for designing and implementing a state-wide benthic vegetation monitoring program

2. Illustrate some examples of existing monitoring programs

3. Make some specific recommendations on the approach and design, including the cost in $$$.

4. Provide you with some background information on SAV – why we need a monitoring program!

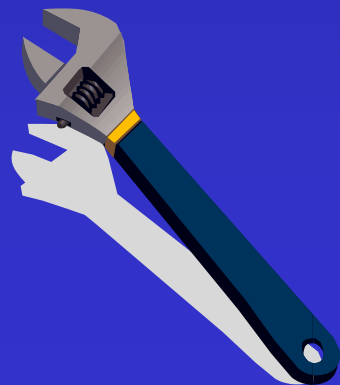
WHY MONITOR SAV RESOURCES?

Inventory species abundance and distribution

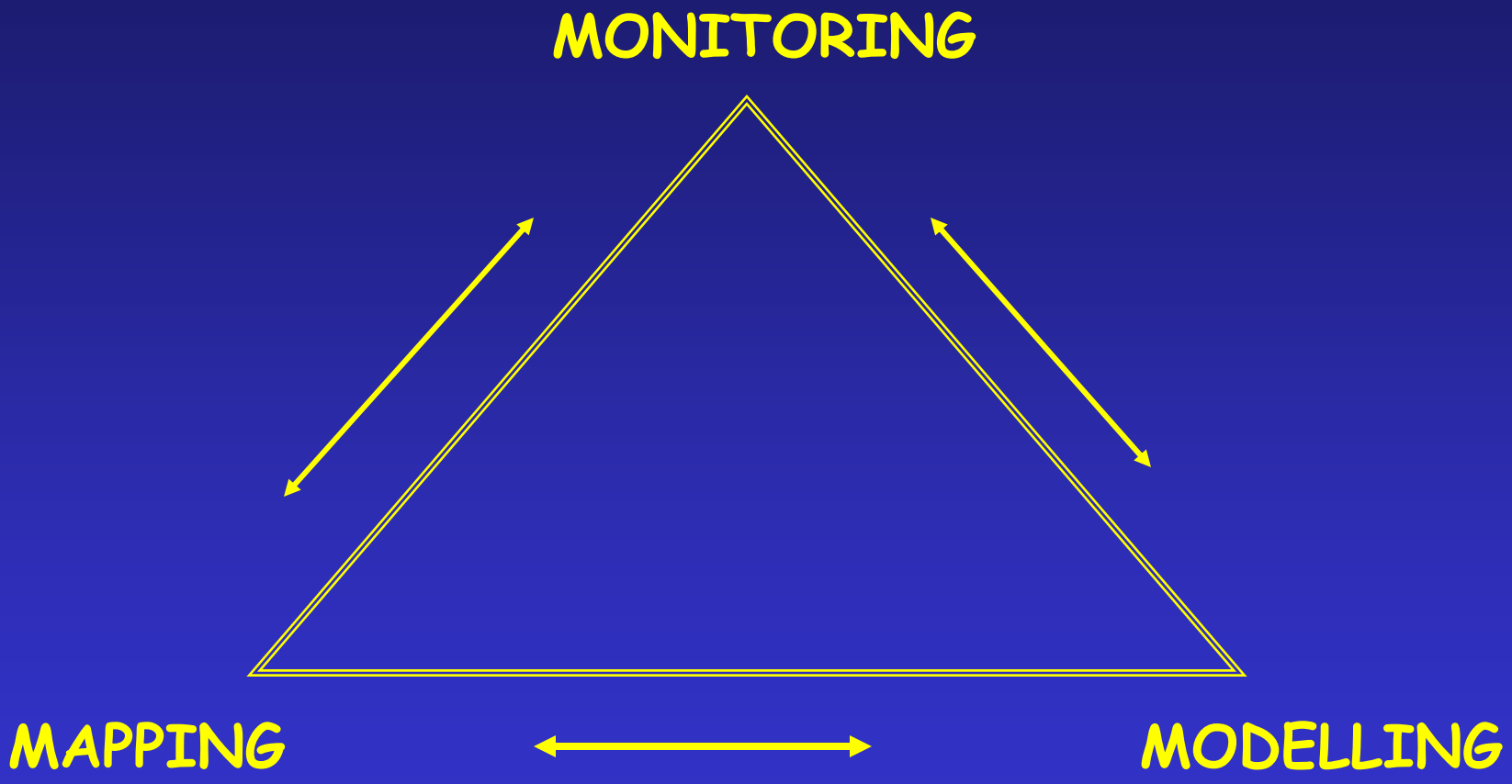
Detect the status and trend of the resource

Link status and trends to cause and effects

MANAGEMENT TOOL



MANAGEMENT TRIANGLE



PERFORMANCE MEASURE

CHANGE OR LACK OF CHANGE

Δ 20 % in 10 YEARS

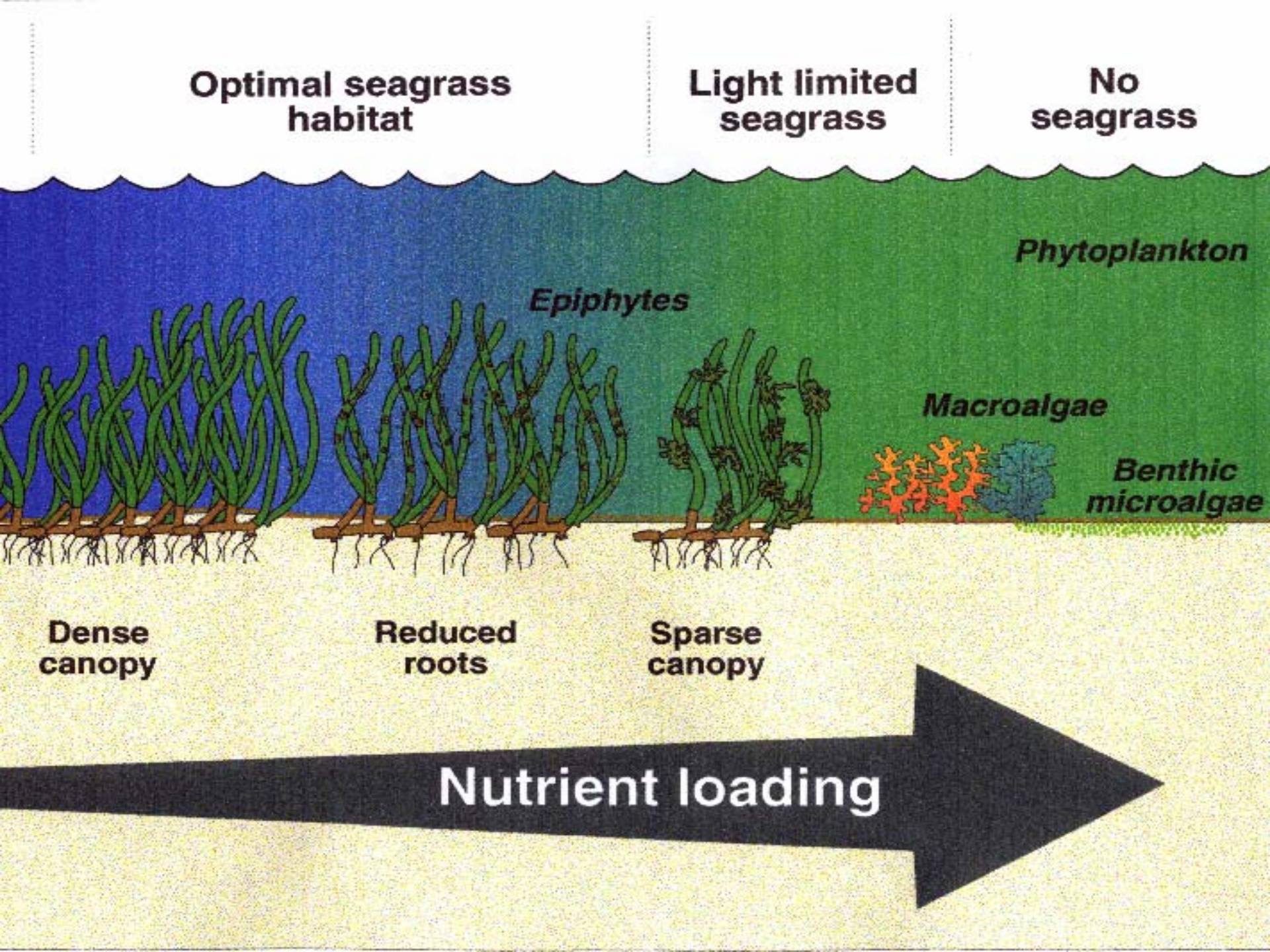
WHY SAV?

SAV as bioindicators

Bioindicator =
Samples of biota which act as an integrator, over time, of contaminant loads on a system (Wilson, 1994).
= Biomarkers
= Biomonitors
= Sentinel Organisms

good bioindicators:

- Widespread distributions
- Responsive to perturbations
- Integrative of environmental conditions
- Important ecological role

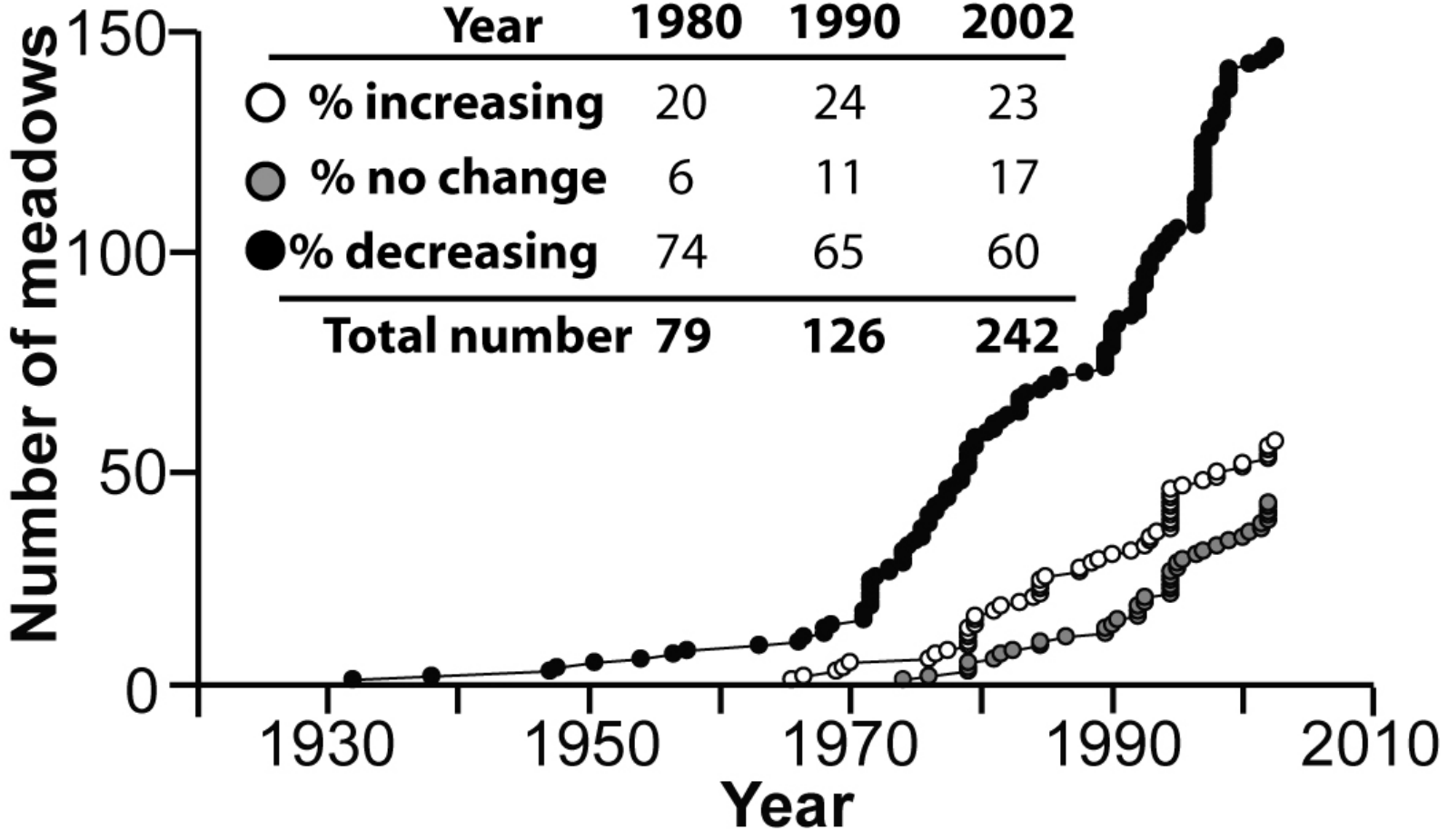

Optimal seagrass habitat
Light limited seagrass
No seagrass
Phytoplankton
Epiphytes
Macroalgae
Benthic microalgae
Dense canopy
Reduced roots
Sparse canopy
Nutrient loading

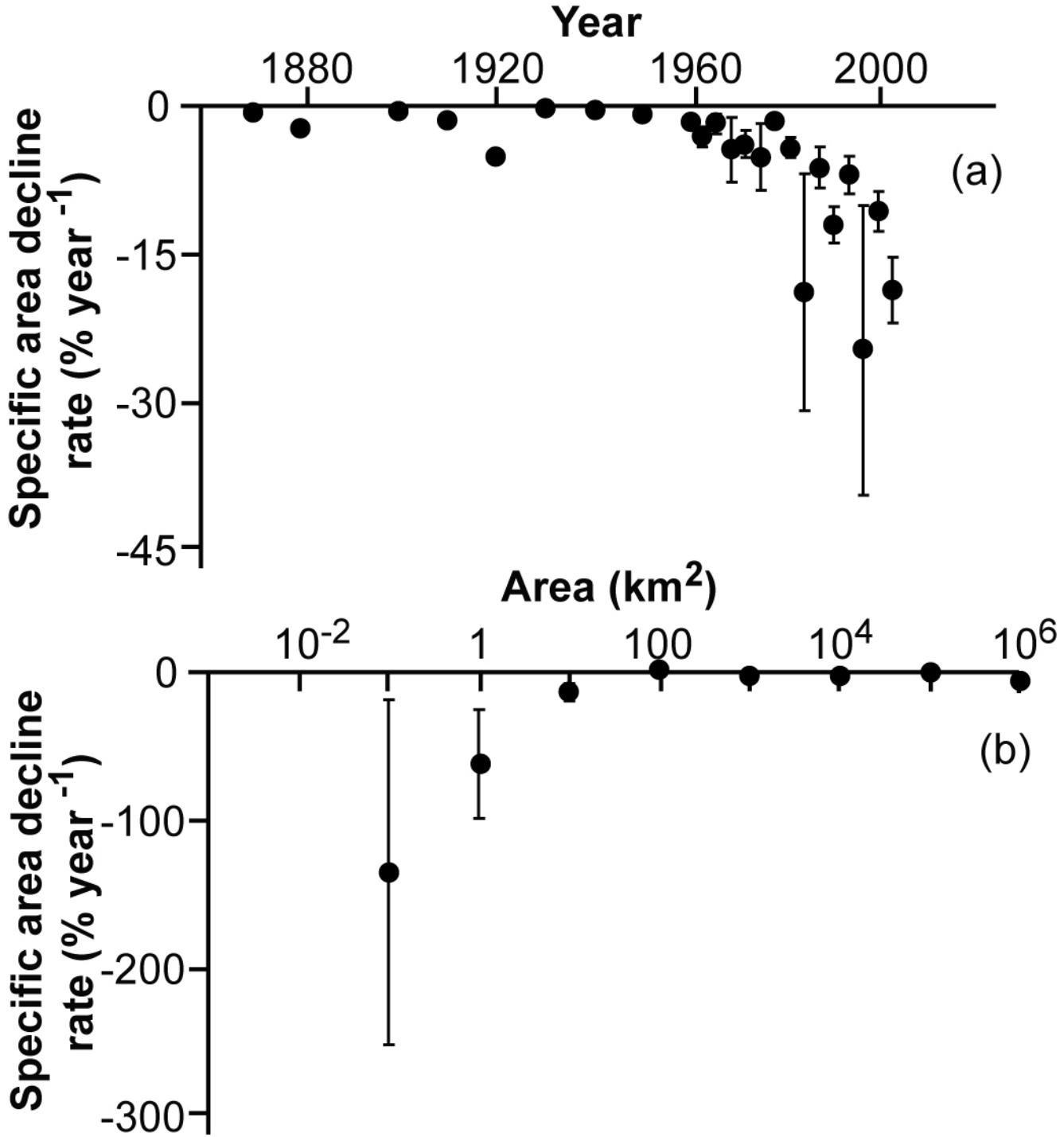
A Global Crisis for Seagrass Ecosystems ?

Orth, Robert J., Tim J.B. Carruthers, William C. Dennison, Carlos M. Duarte, James W. Fourqurean, Kenneth L. Heck, Jr., A Randall Hughes, Gary A. Hendrick, W. Judson Kenworthy, Suzanne Olyarnik, Fred T. Short, Michelle Waycott, and Susan L. Williams. 2006. A global crisis for seagrass ecosystems. Bioscience 56:987-996.

SENSE OF URGENCY!

Year	1980	1990	2002
% increasing	20	24	23
% no change	6	11	17
% decreasing	74	65	60
Total number	**79**	**126**	**242**




Year
1880
1920
1960
2000
0
-15
-30
-45
Specific area decline rate (% year -1)
(a)
Area (km2)
10-2
1
100
10^4
10^6
0
-100
-200
-300
Specific area decline rate (% year -1)
(b)

CHESAPEAKE BAY

For 2006, 23,941 hectares (59,160 acres) of SAV were mapped in Chesapeake Bay and its tributaries.
However, in 2005 a portion of the Bay was not flown due to adverse weather in the spring and summer; therefore, portions of the James River were not fully mapped in 2005.
All direct comparisons to 2005 in the report are restricted to only those regions that were mapped in both years. For comparison purposes, partial totals for 2006 have been computed for CBP segments, Bay zones, and the entire Bay using only those regions mapped for both years.
Notable changes in SAV distribution were measured between 2005 and 2006. SAV decreased 25% from 31,671 ha (78,263 ac) in 2005 to 23,903 ha (59,068 ac) in 2006 in the regions mapped for both years.
SAV decreased in all three (Upper, Middle and Lower) geographic zones delineated for Chesapeake Bay. In 2006, SAV increased in 13, decreased in 41, and remained unvegetated in 24 of the 78 CBP segments

WHY MONITOR IN NC ?

SOME BASIC FACTS !

HOW MUCH IS THERE ?

200,000 ACRES

679,746 ACRES < 2m

DYNAMICS ?

HOW IS IT CHANGING ?

SAV Distribution in North Carolina	
Eastern Pamlico Sound	90,000 acres (36,421.71 ha)
Core Sound	19,938 acres (8,068.62 ha)
Albemarle Sound	4,439 acres (1,796.39 ha)
Croatan-Roanoke sounds	926 acres (374.74 ha)
Neuse River estuary	91 acres (36.83 ha)
Pamlico River estuary	378 acres (152.97 ha)
Western Pamlico Sound	83 acres (33.58 ha)

Table 4.3. Estimated spatial coverage of submerged aquatic vegetation in coastal waters of mid- and south Atlantic states.

	SAV		
State	acres	hectares	Source
Florida	2,658,290	1,075,772	Sargent et al. (1995)
North Carolina	200,000	80,937	Field et al. 1988 and Orth et al. 1990; cited in Ferguson and Wood (1994)
Chesapeake (VA and MD)	59,300	23,998	Funderburk et al. (1991)

Media

Improving outlook for seagrass could complicate development of some waterfront properties

By Gareth McGrath
Staff Writer

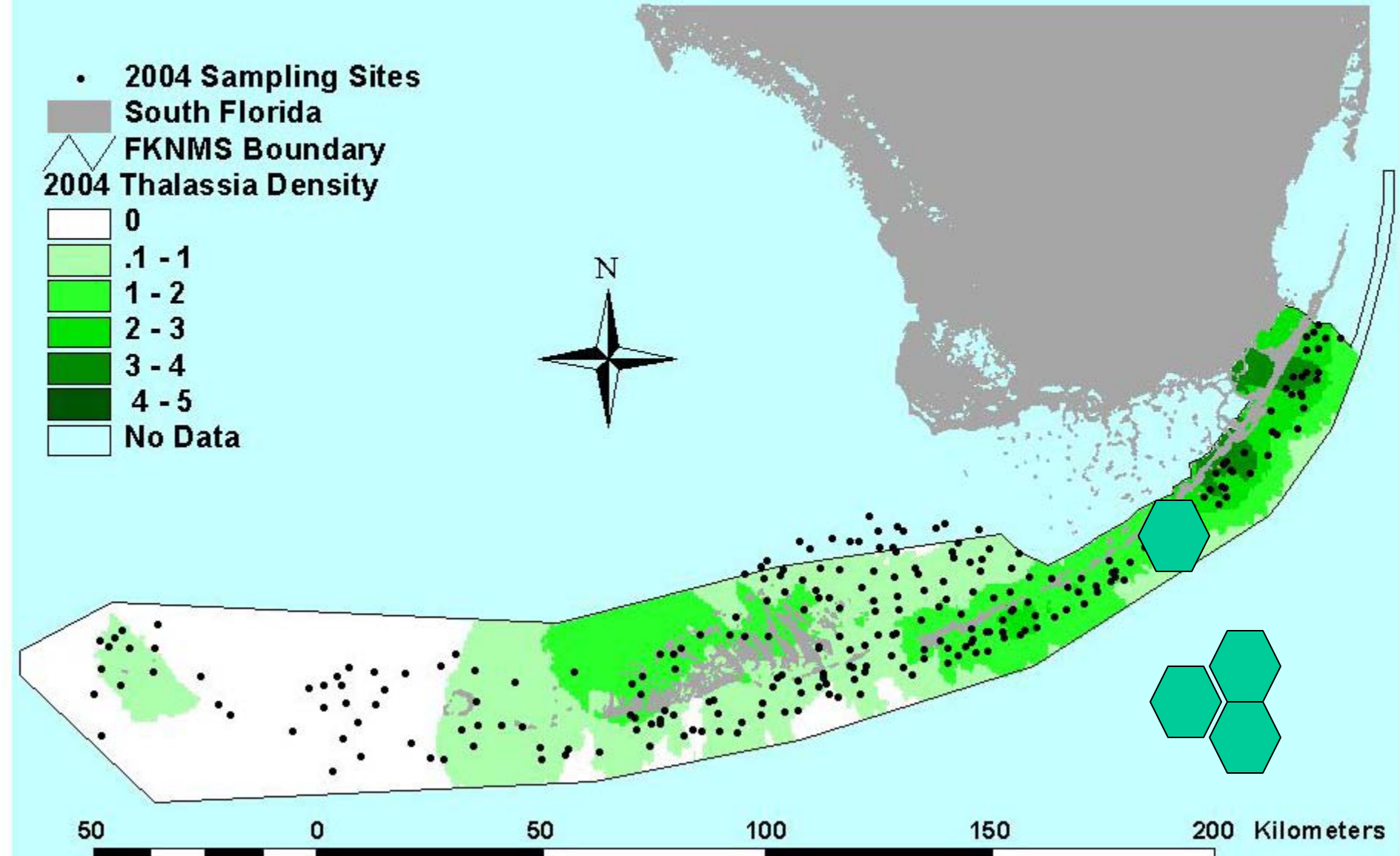
Whether the grasses are recolonizing old habitat or expanding their range, and why, isn't entirely understood by researchers

As seagrasses expand, state considers new rules to protect them

LONG TERM MONITORING

	Size	Longevity	Frequency	Remote sensing	Probabilistic	Synoptic	Fixed transects
Chesapeake Bay		22	A	✓			
MA Embayments		12	5/10 y	✓			
Indian River Lagoon	400 km	14/21	6 m/2y	✓			✓
Florida Keys NMS	19,400 km^2	12	A		✓	✓	
Florida Bay	2000 km^2	13	A		✓	✓	
Puget Sound, WA	4000 km	8	A		✓		
Bermuda Benthic Habitat		3	A		✓	✓	
Seagrass Watch, NE Australia		7	A				✓
Seagrass Net		7	1/4				✓

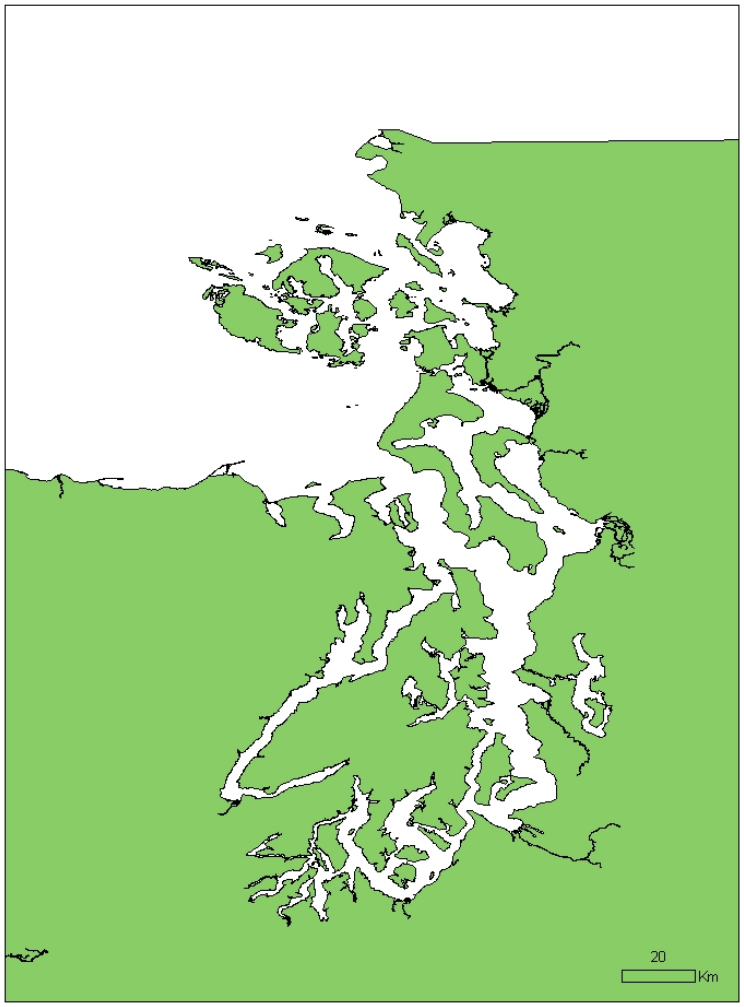
FKNMS


2004 Sampling Sites
South Florida
FKNMS Boundary
2004 Thalassia Density
0
.1 - 1
1 - 2
2 - 3
3 - 4
4 - 5
No Data
N
50
0
50
100
150
200
Kilometers

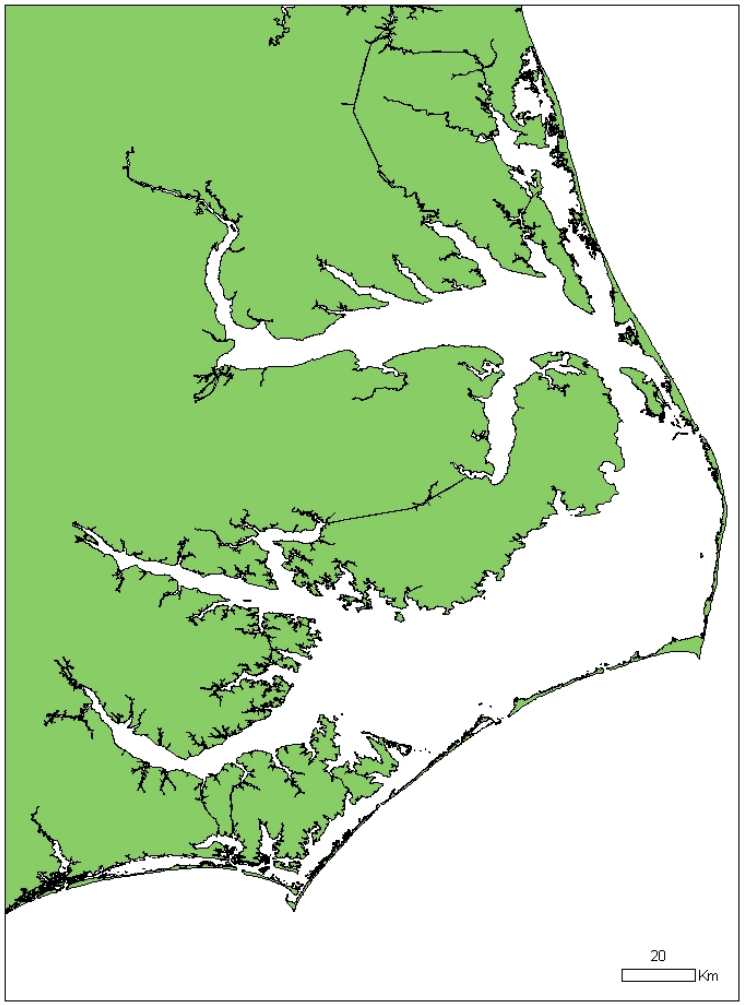
LONG TERM MONITORING

	Size	Longevity	Frequency	Remote sensing	Probabilistic	Synoptic	Fixed transects
Chesapeake Bay		22	A	✓			
MA Embayments		12	5 y	✓			
Indian River Lagoon	400 km	14/21	6 m/2y	✓			✓
Florida Keys NMS	19,400 km^2	12	A		✓	✓	
Florida Bay	2000 km^2	13	A		✓	✓	
Puget Sound, WA	4000 km	8	A		✓		
Bermuda Benthic Habitat		3	A		✓	✓	
Seagrass Watch, NE Australia		7	A				✓
Seagrass Net		7	1/4				✓

PUGET SOUND – SIMILAR PHYSIOGRAPHY

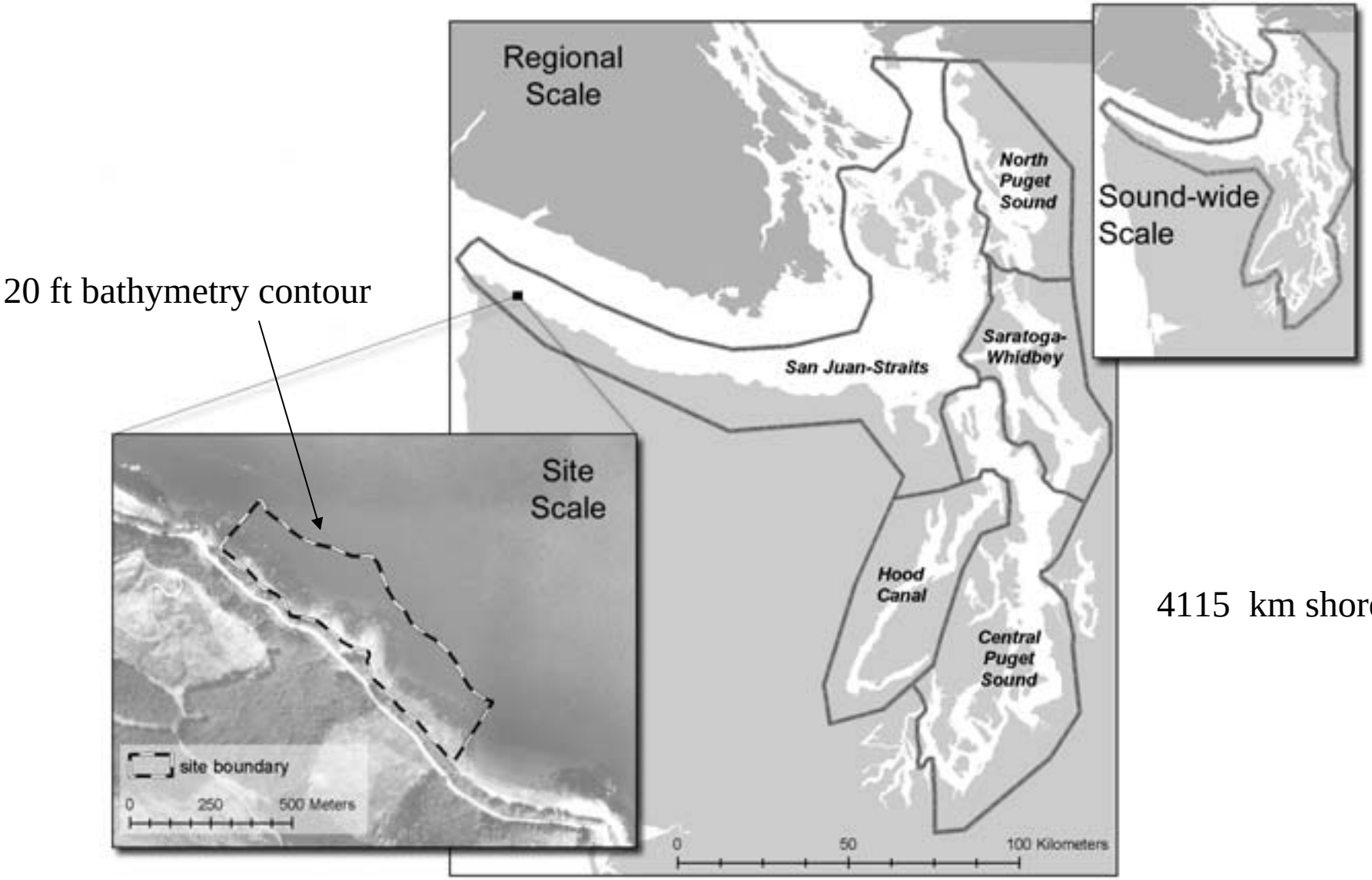


4000 km



> 4000 km

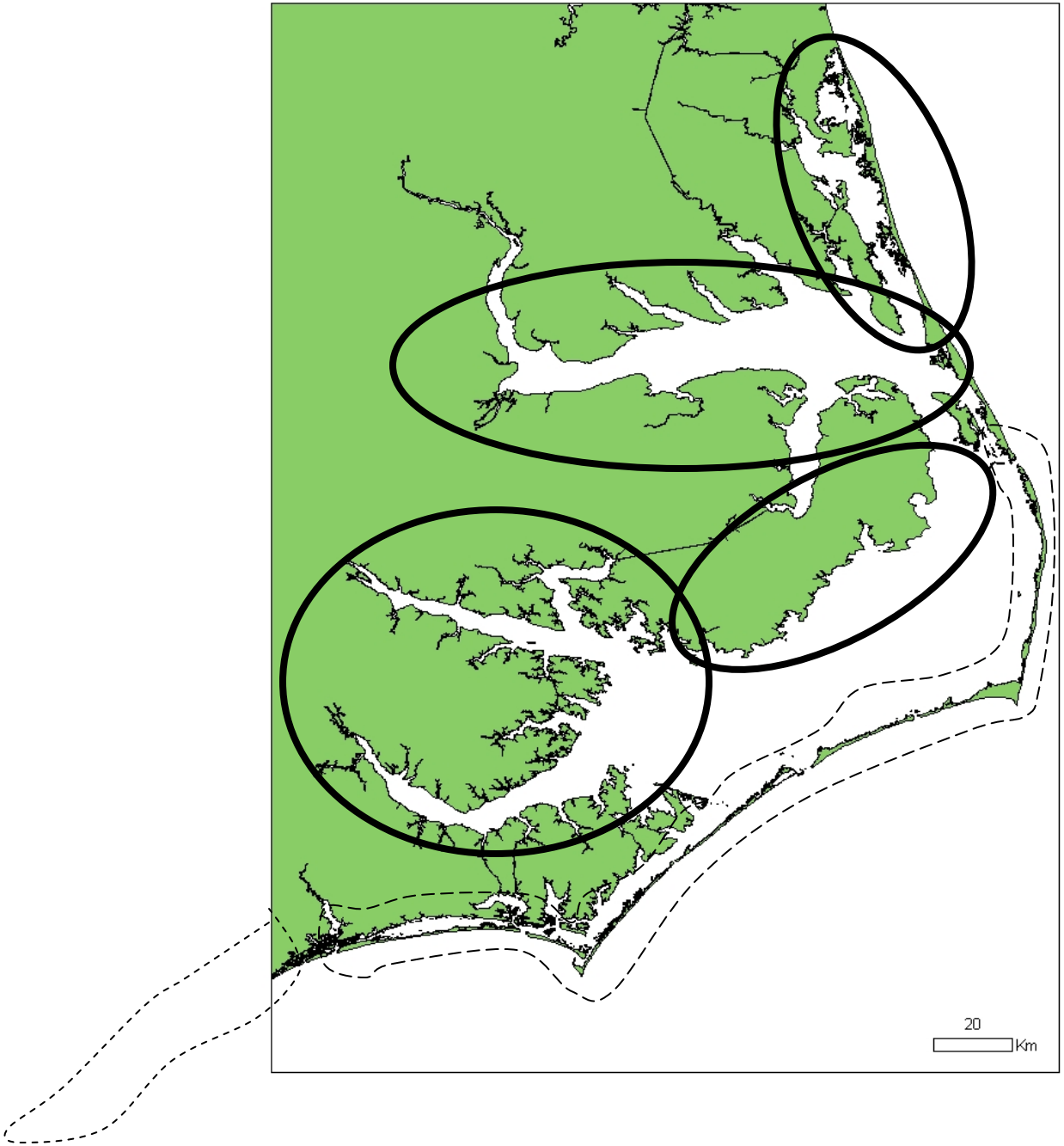
PUGET SOUND



20 ft bathymetry contour

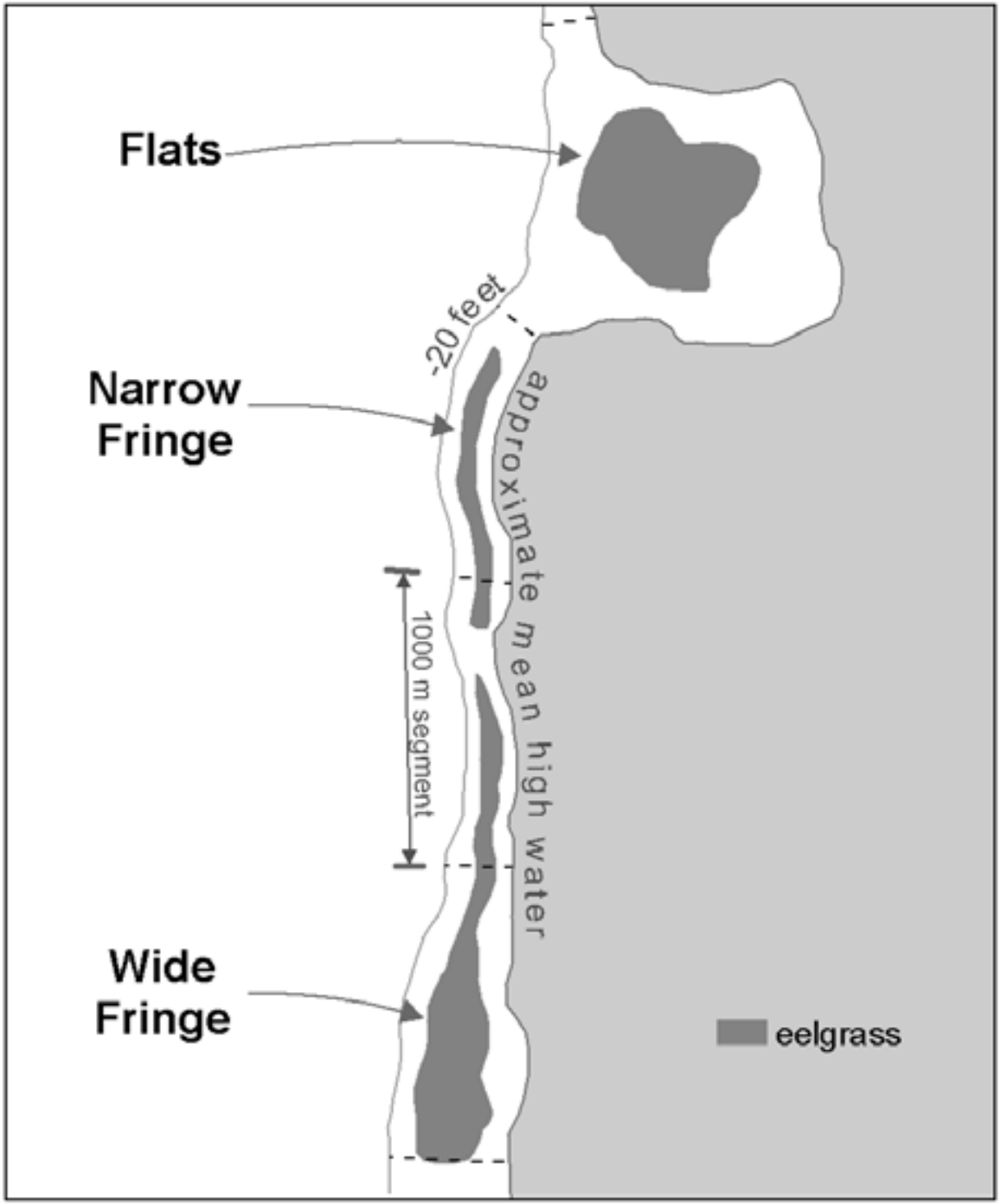
4115 km shoreline

NC REGIONS



73 Flats

2396 Fringe



1000 m segments

75 / year

SAMPLING TECHNIQUE

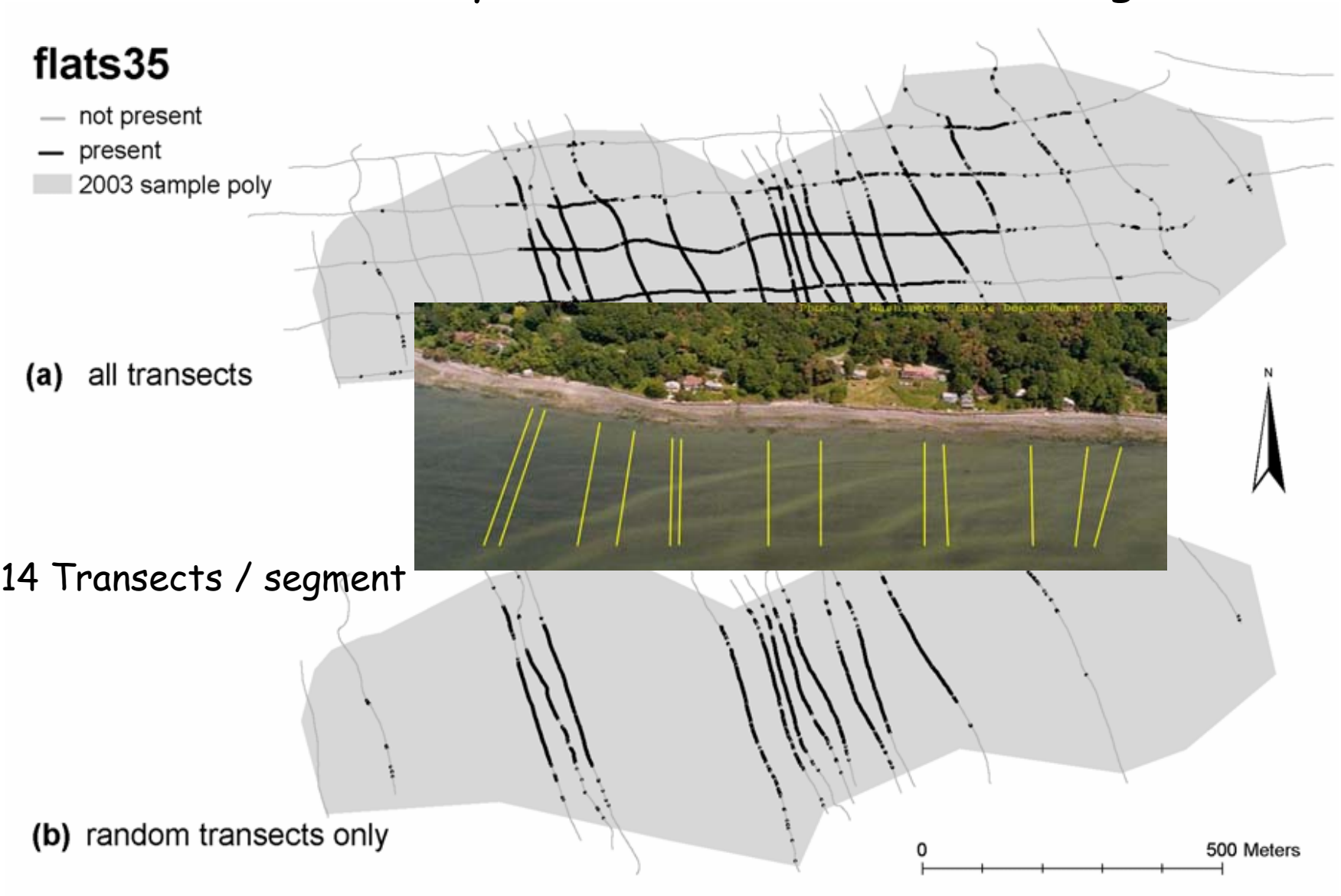
Modified line-intercept method with videography

Sample presence / absence (annually)

Random sampling with rotation (75/y)

20 % of the sample sites are replaced each year

Randomly select 75 of the 1000m segments



Takes about 55 days

Equipment	Manufacturer/Model
Differential GPS	Trimble AgGPS 132 (sub-meter accuracy)
Depth Sounders	BioSonics DE 4000 system (including Dell laptop computer with Submerged Aquatic Vegetation software)
Garmin FishFinder 250	

Underwater Cameras (2) SplashCam Deep Blue Pro Color (Ocean Systems, Inc.)

Lasers	Deep Sea Power & Light
Underwater Light	Deep Sea Power & Light RiteLite (500 watt)

Navigation Software Hypack Max

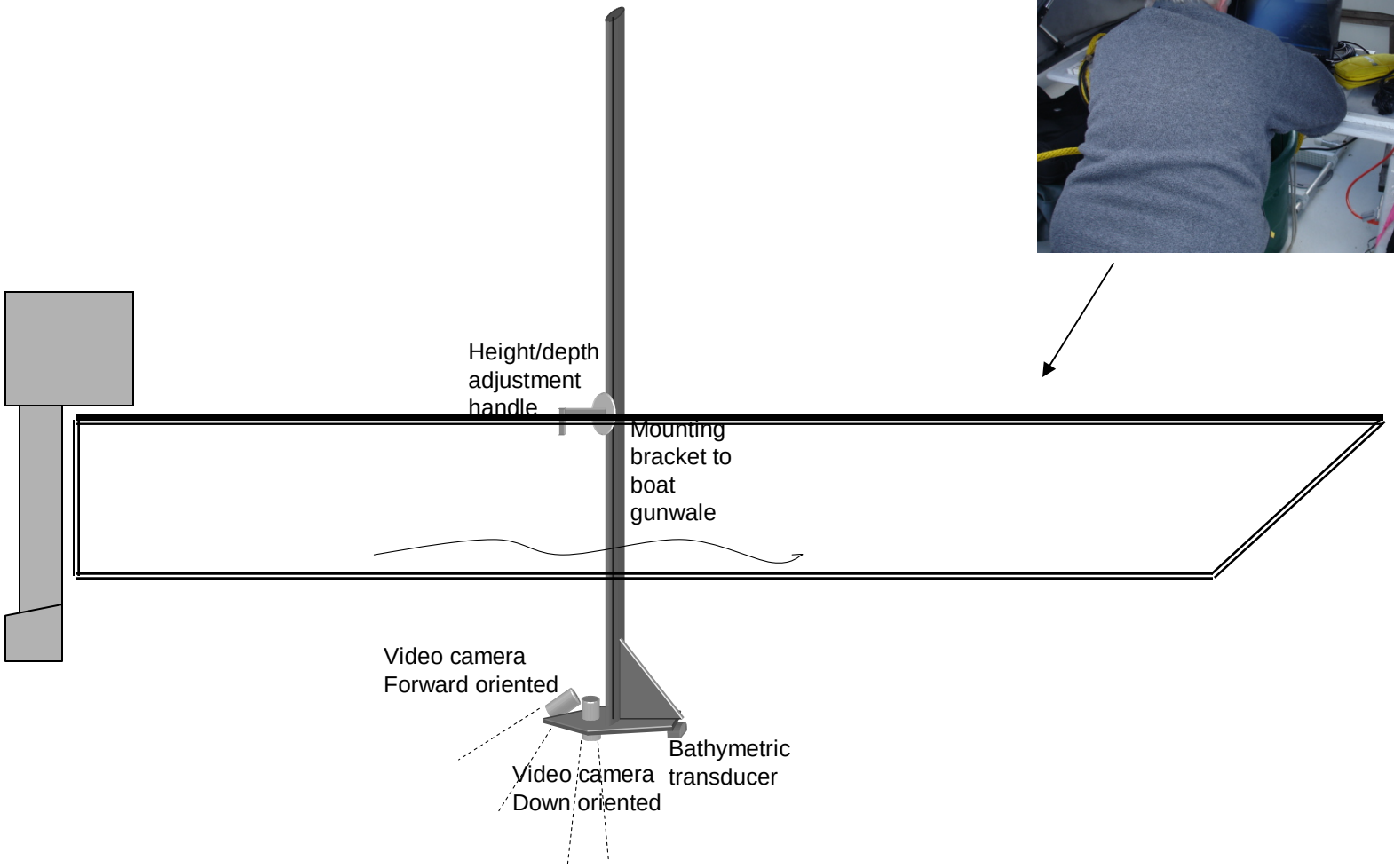
Video Overlay Controller Intuitive Circuits TimeFrame

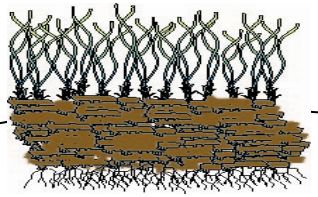
DVD Recorder Sony RDR-GX7

Digital Video Recorder Sony DVR-TRV310

Digital8 Camcorder


RESEARCH


Height/depth
adjustment
handle
Mounting
bracket to
boat
gunwale
Video camera
Forward oriented
Bathymetric
transducer
Video camera
Down oriented



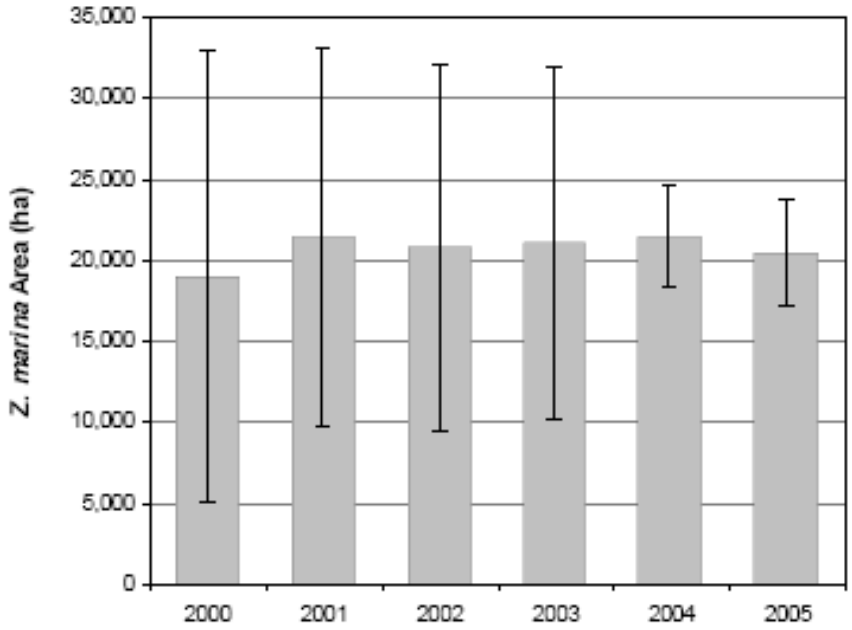


Figure 3-1. Estimates of total *Z. marina* area in the study area, 2000-2005. Error bars are 95% confidence intervals.

COST

THE TEAM

Full time biologist – project leader

Two technicians – full time field staff/reporting

Two technicians – part time 6 mos / data processing

Consulting staff – part time statistician, ecologist

EQUIPMENT

Vessel, data acquisition, data processing/analyses

Total Cost		$692,000.00
MRC contract (includes boat, 2 staff and all equipment)		$325,000.00
Travel (vehicle, hotels, per diem etc)		$18,000.00
Temporary staff		$80,000.00
Technicians (2 @ 6 months each)	1.00	
Permanent Staff		$250,000.00
a) Scientist - intro level	0.50	
b) Scientist - seagrass ecologist	0.70	
c) Scientist - quantitative ecologist	0.30	
d) Scientist - supervisory role/administrative	0.10	
Misc expenses		$25,000.00

ECONOMIC VALUE

$8,000 - $28,000 $acre^{-1}$

200,000 acres

$ 1.6 billion

STEWARDSHIP

BOOSTER CLUB