

Responses of Fishes and Benthic Invertebrates to Beach Nourishment Operations on the Atlantic Coast of New Jersey



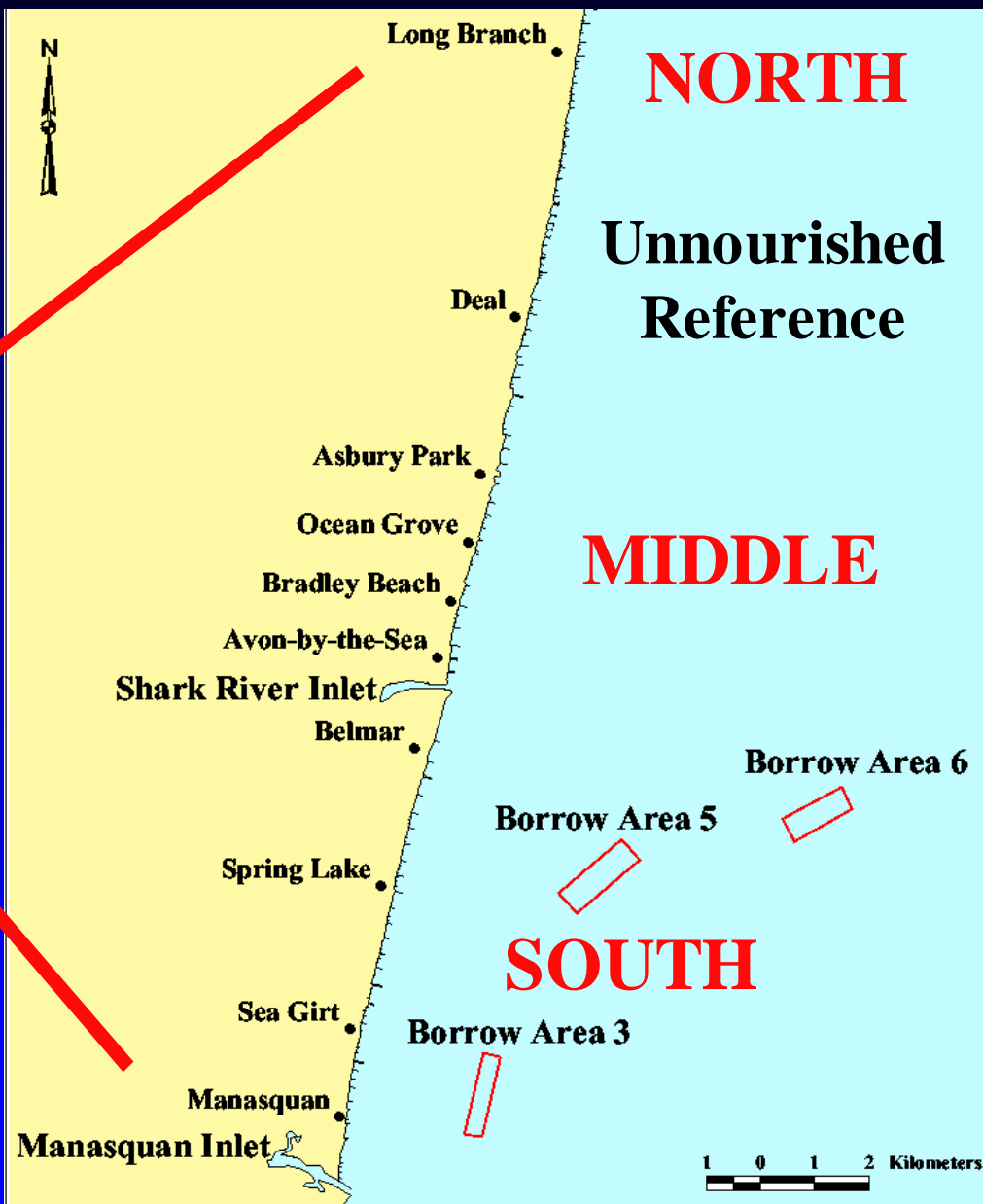
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USACE New York District

STUDY AREA



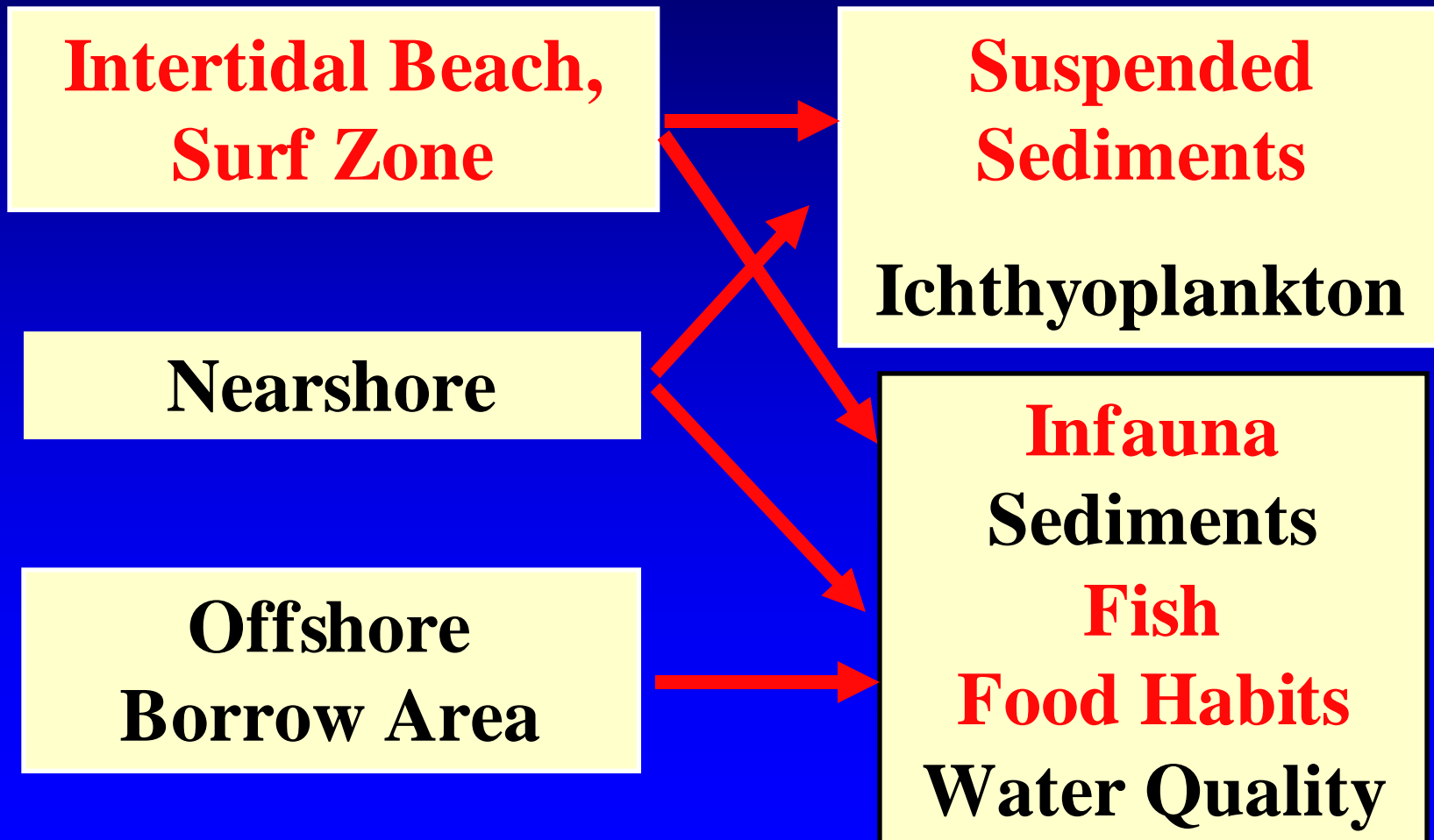
Project Facts

- USACE, NMFS, NJDEP, USFWS, EPA
- Project area 15.9 km
- 6.2 million m³ sand
- Schedule
 - Pilot study (94)
 - 3 yrs pre-construction (94-96)
 - Placement in 1997 (South) and 1999 (Middle)
 - 2 yrs post-construction (98-00)

Monitoring Components

Area

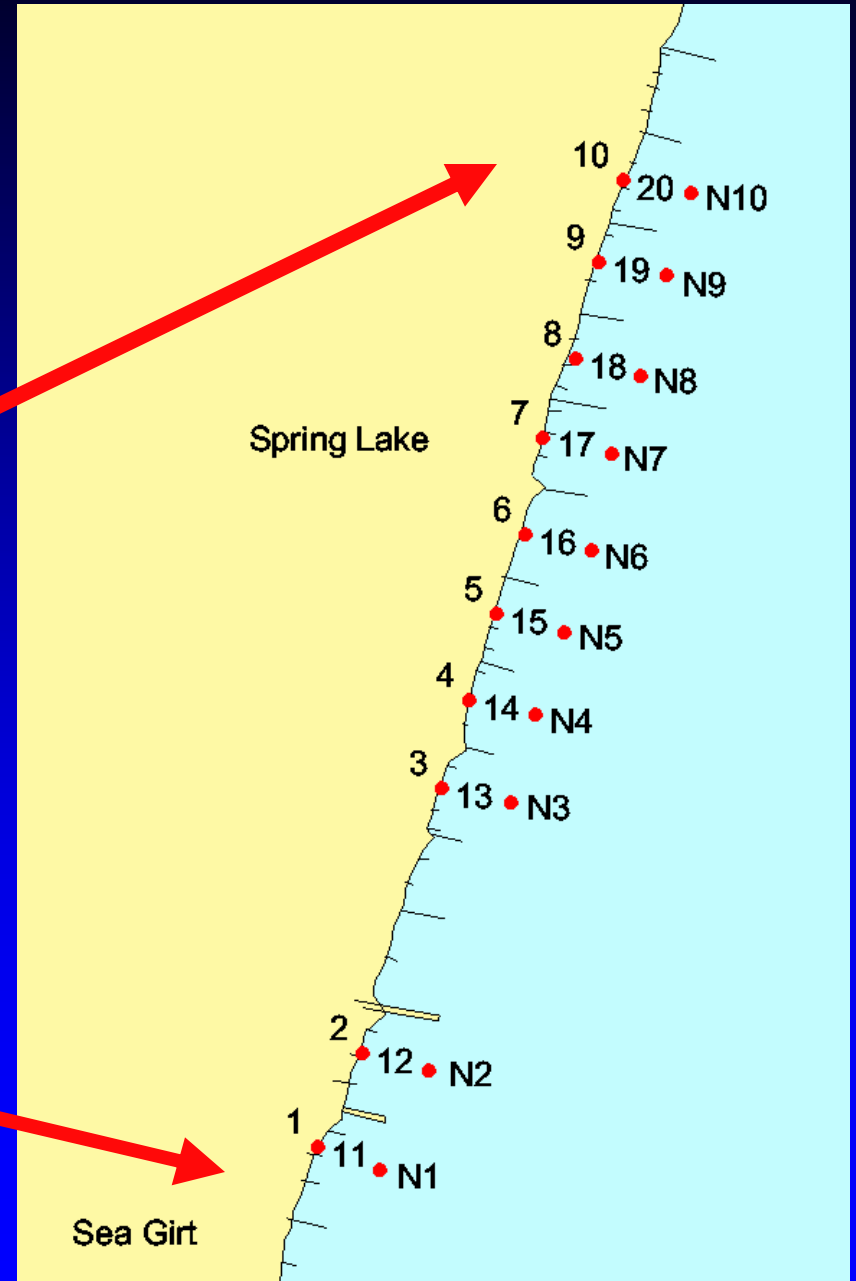
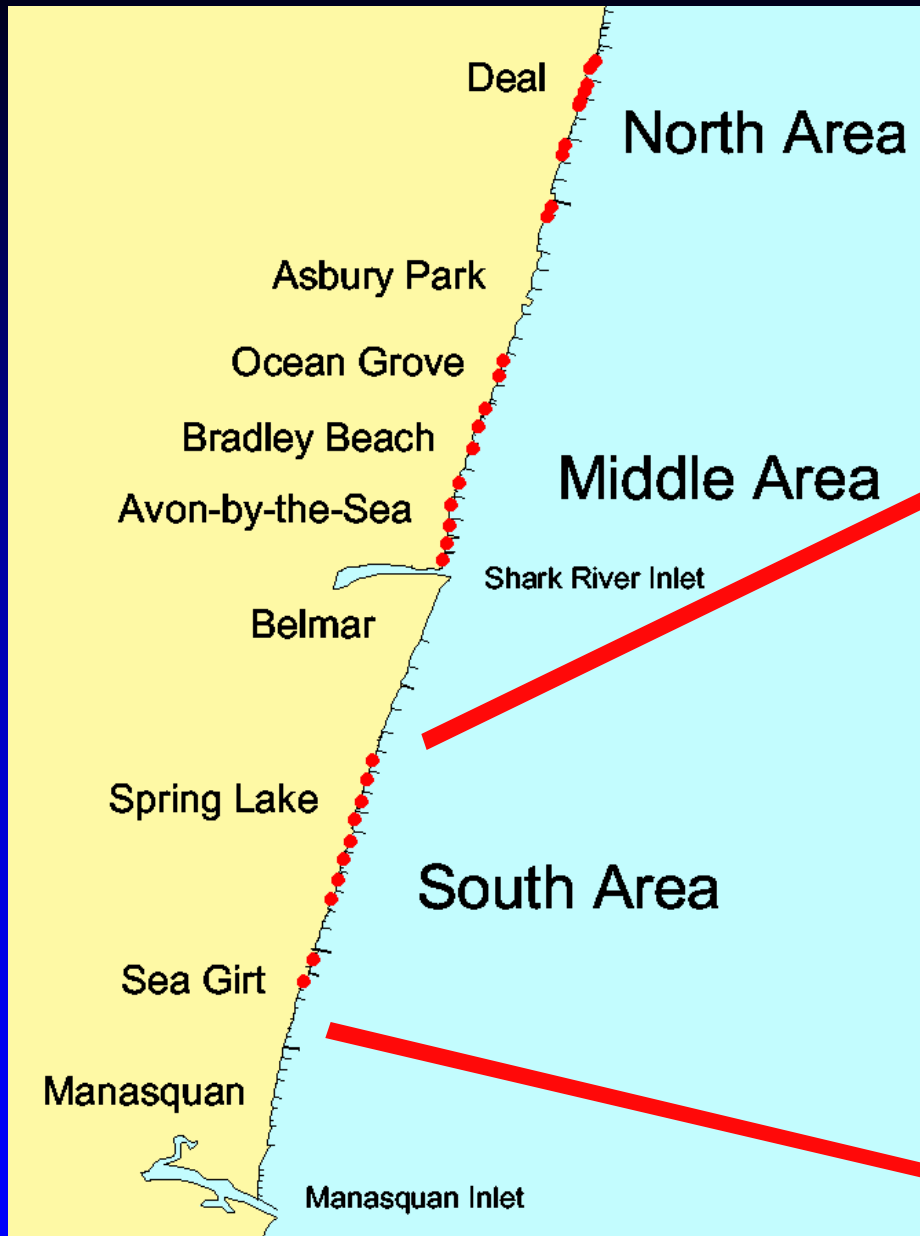
Component



Benthic Monitoring

- **Infauna & Sediments**
 - **Long-term (Biannual -May & Sept)**
 - **Intertidal & Offshore (94-00)**
 - **Nearshore (95-00)**
 - **Short-term (Monthly)**
 - **During Construction, 1997 & 1999**
 - **Intertidal (MLW) only**

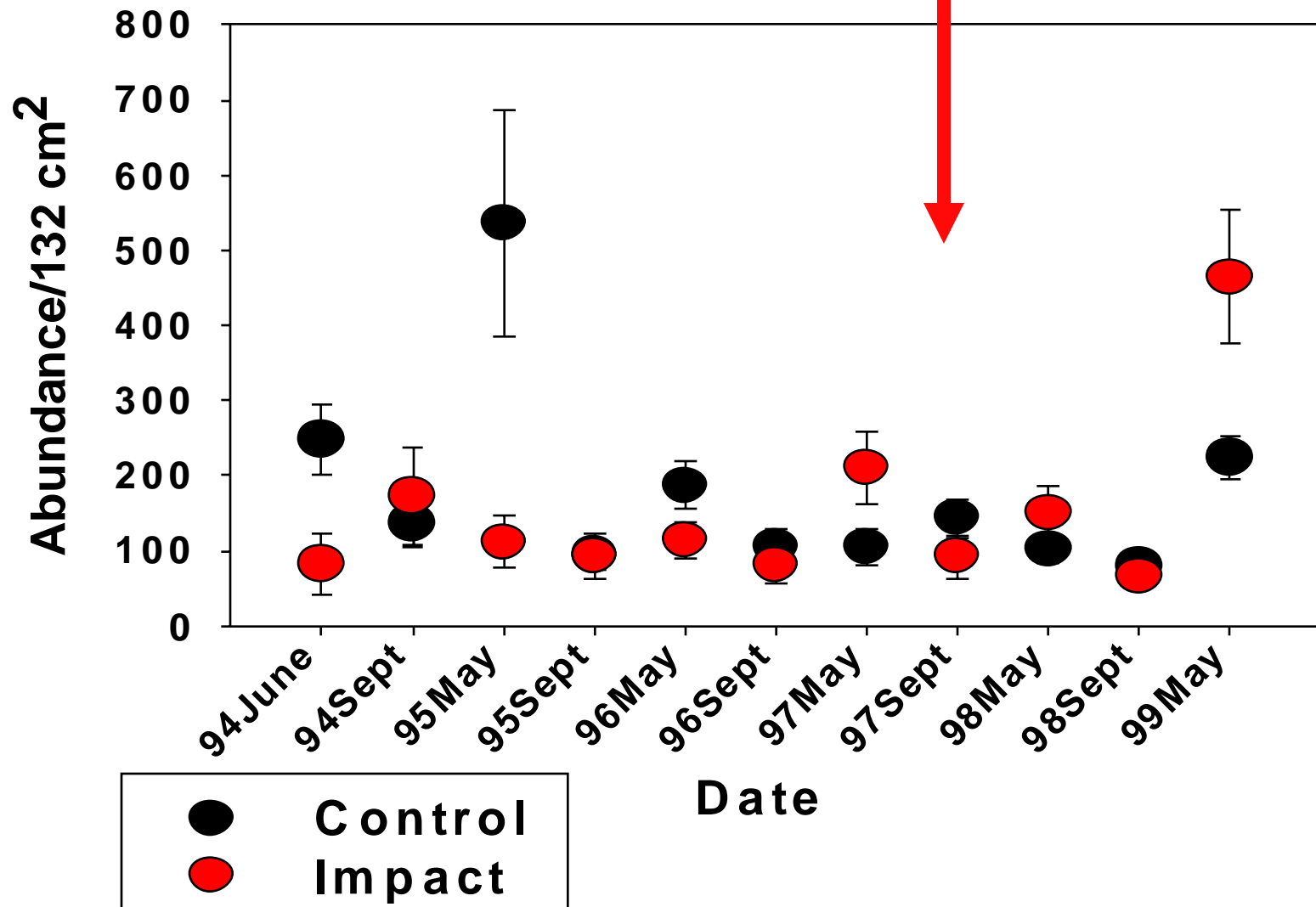




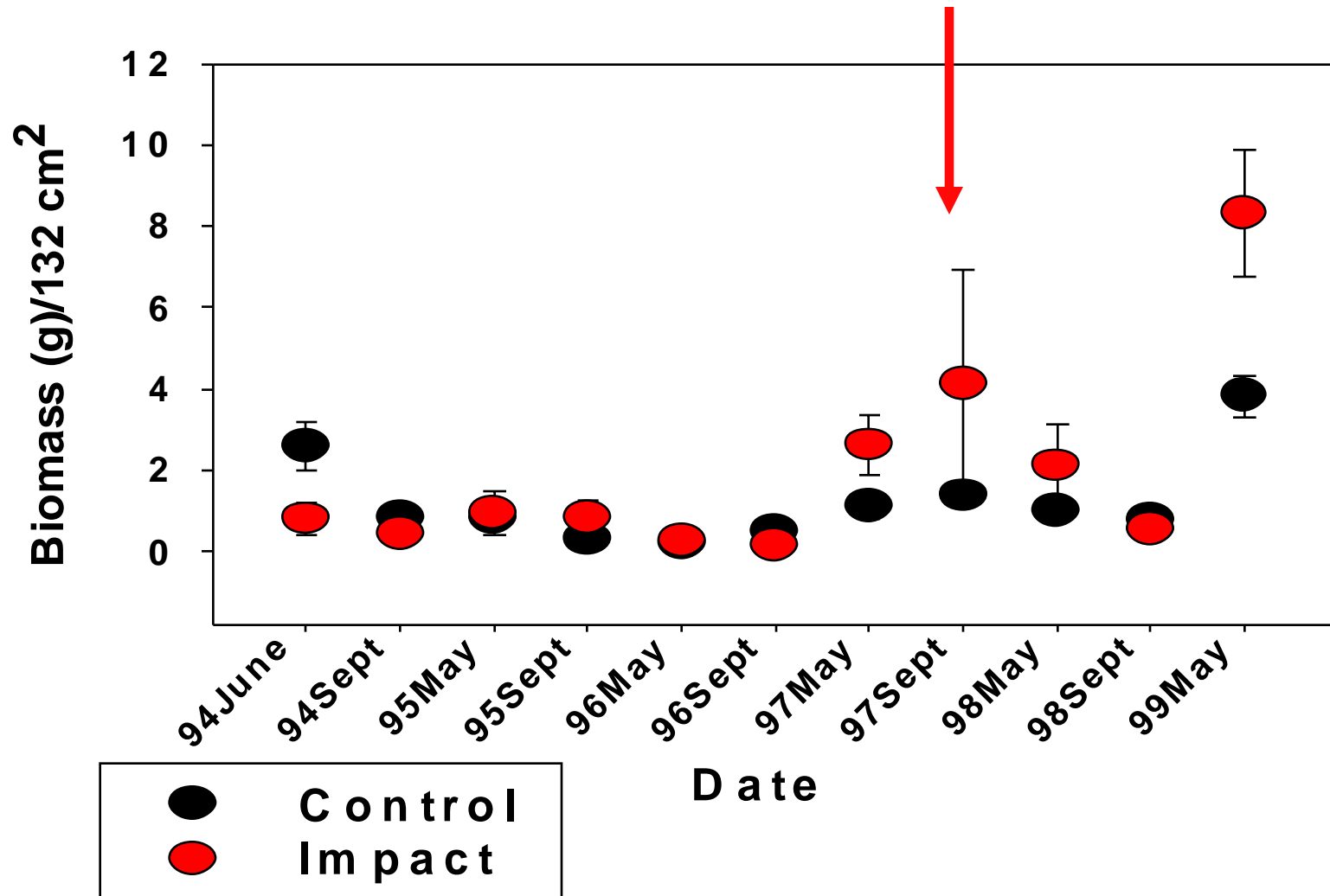
Intertidal Species Composition

Taxa	Before		After		Total %
	Control	Impact	Control	Impact	
Rhynchocoela (LPIL)	136	69	60	81	22.2
<i>Scolecipis squamata</i>	53	69	78	121	16.6
<i>Microphthalmus spp.</i>	27	24	35	8	6.9
Oligochaeta (LPIL)	41	24	15	3	6.7
<i>Protodriloides (LPIL)</i>	6	19	7	4	5.1
<i>Polygordius (LPIL)</i>	1	63	1	2	3.7
<i>Ampelisca abdita</i>	25	4			2.9
<i>Nephtys bucera</i>	14	6			2.7
Pisionidae (LPIL)	10				2.3
Hirudinea (LPIL)	10	7			2.2
<i>Tellina agilis</i>		1	5	16	1.6
<i>Mediomastus ambiseta</i>	11	2			1.4
<i>Emerita talpoida</i>	13	2	3	4	1.3
Archiannelida Family A	2	6			1.1
<i>Donax variabilis</i>			6	2	1.0

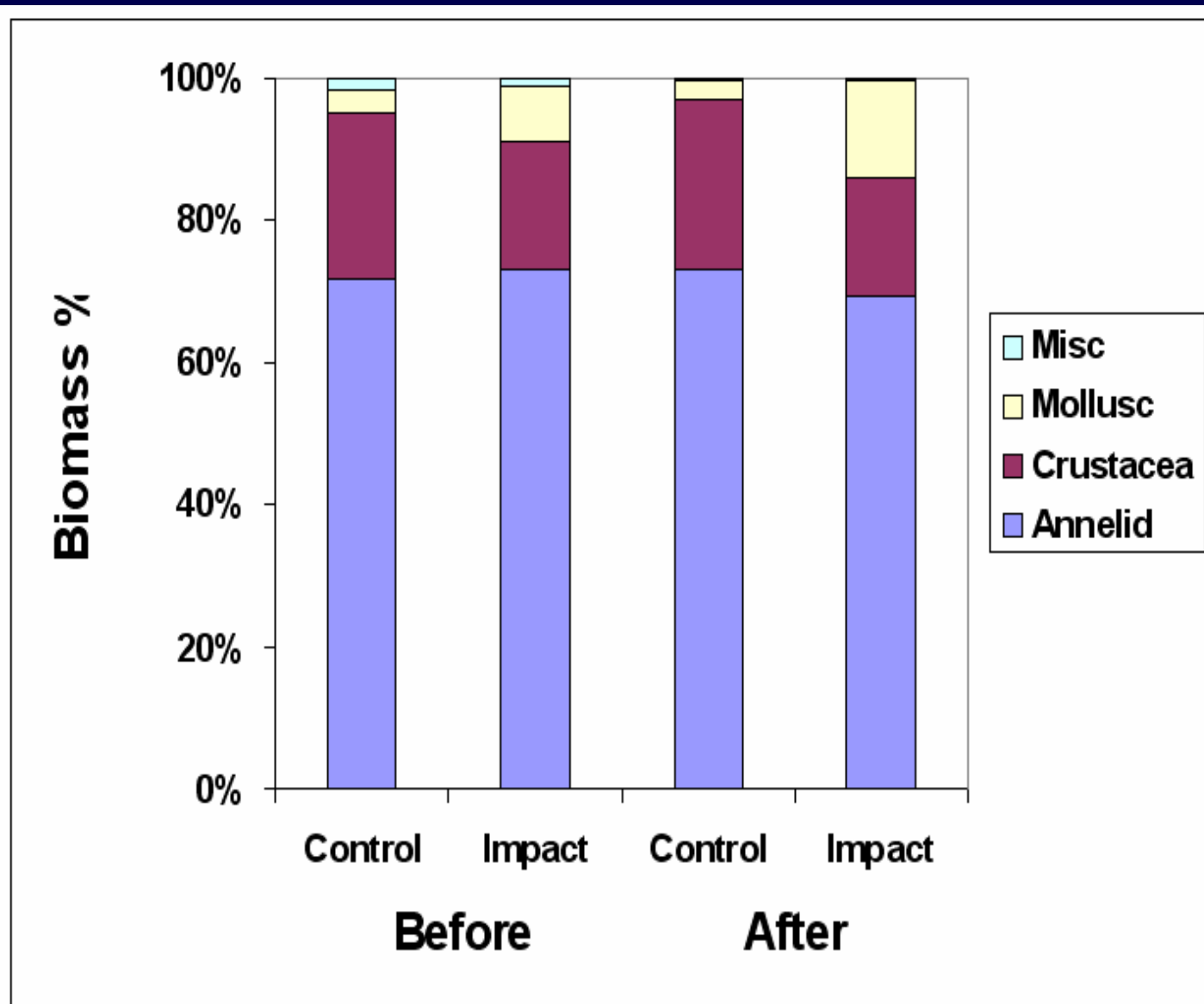
Intertidal Abundance



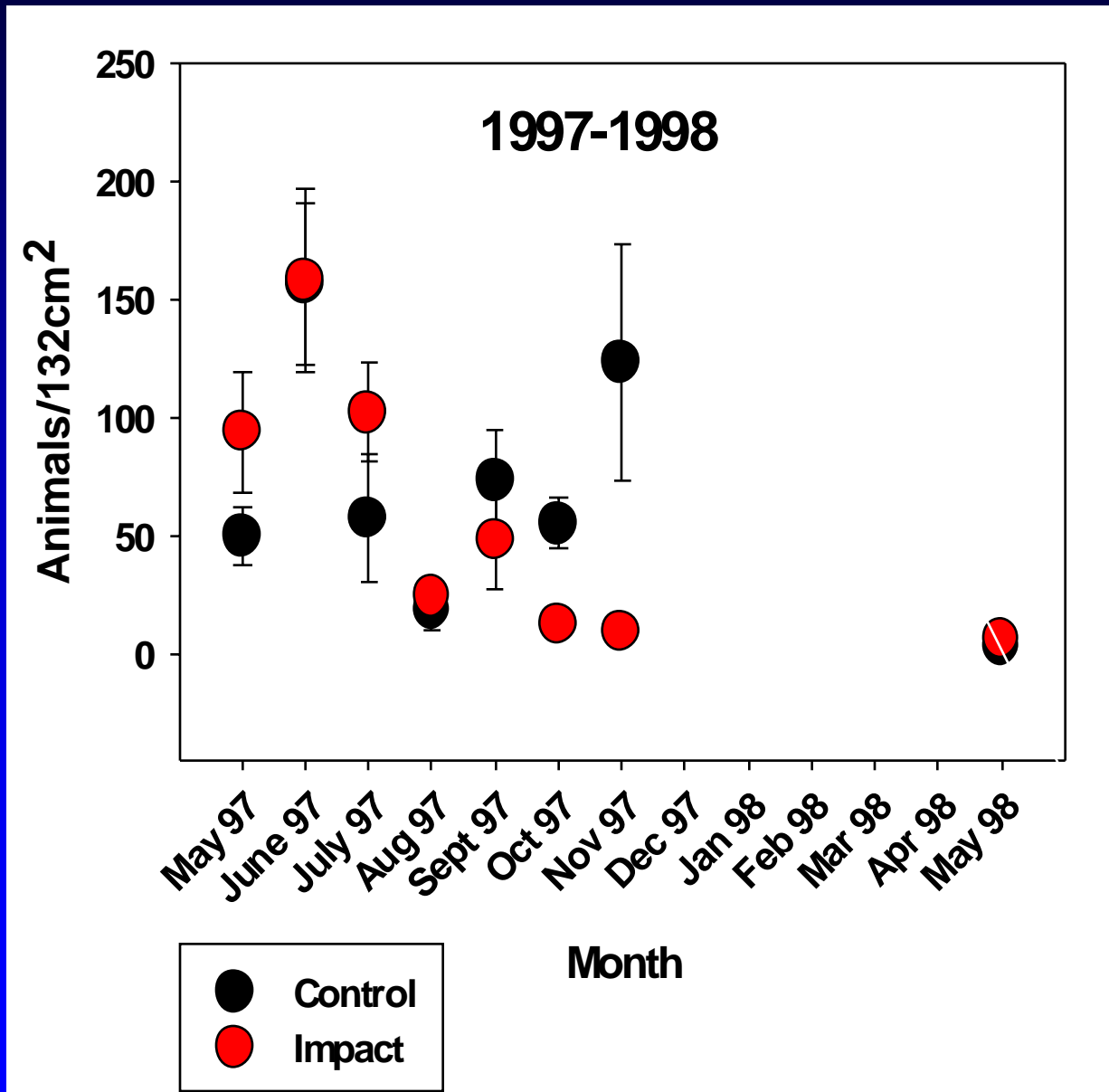
Intertidal Biomass



Intertidal Biomass Composition



Monthly Abundance (1997-1998)



Intertidal Recovery Rates

- **Gorzelany & Nelson** FL <1 mo.
- **Saloman & Naughton** FL 2 mo.
- **Van Dolah et al.** SC 2-3 mo.
- **Jutte et al.** SC 6 mo.
- **Present Study** NJ 6-6.5 mo.
- **Reilly & Bellis** NC >12 mo.
- **Rakocinski et al.** FL >12 mo.

BMP RESULTS

Intertidal Sediments and Benthos

- **Intertidal benthos similar to other mid-Atlantic sandy beach infauna**
- **Infaunal recovery within 6 months in 1997**
- **Impact in 1999-2000 longer lasting (>6.5 mo. recovery)**
- **No obvious long-term impacts**
- **Slightly finer sediment texture due to nourishment**

Turbidity and Suspended Sediments

- **Potential physiological effects**
(e.g., gill abrasion)
- **Potential behavioral effects**
(e.g., plume avoidance)
- **Concentration gradients unreported**
- **Spatial scales unknown**

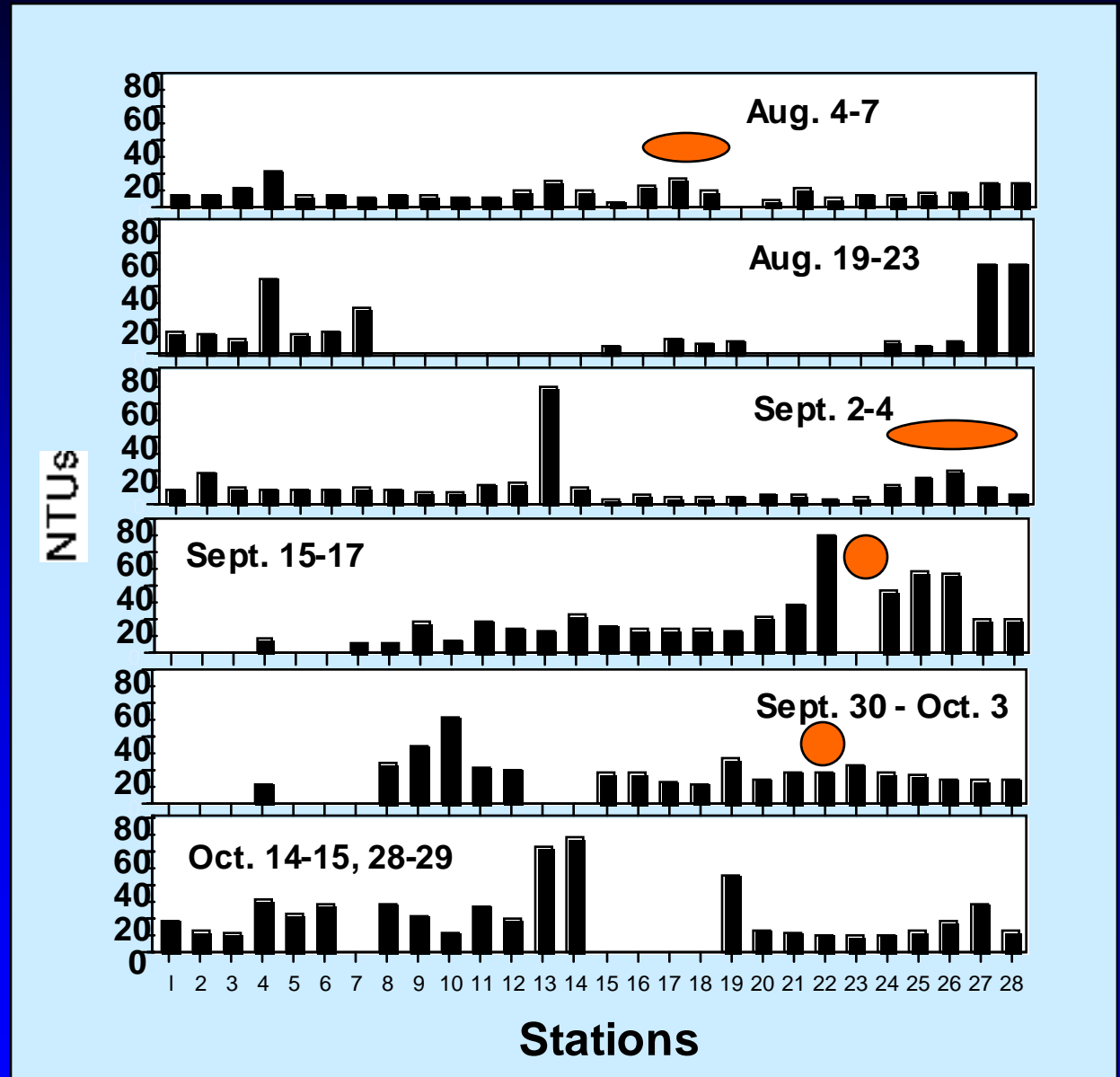


Sampling

- **Turbidity (NTUs) measured synoptically with beach seining and surf zone ichthyoplankton sampling**
- **Suspended sediments (mg/L) measured during dedicated surveys**
 - **Active fill and reference areas**
 - **Following storm front passage**

Turbidity 1997

 Site of Active
Beach Nourishment





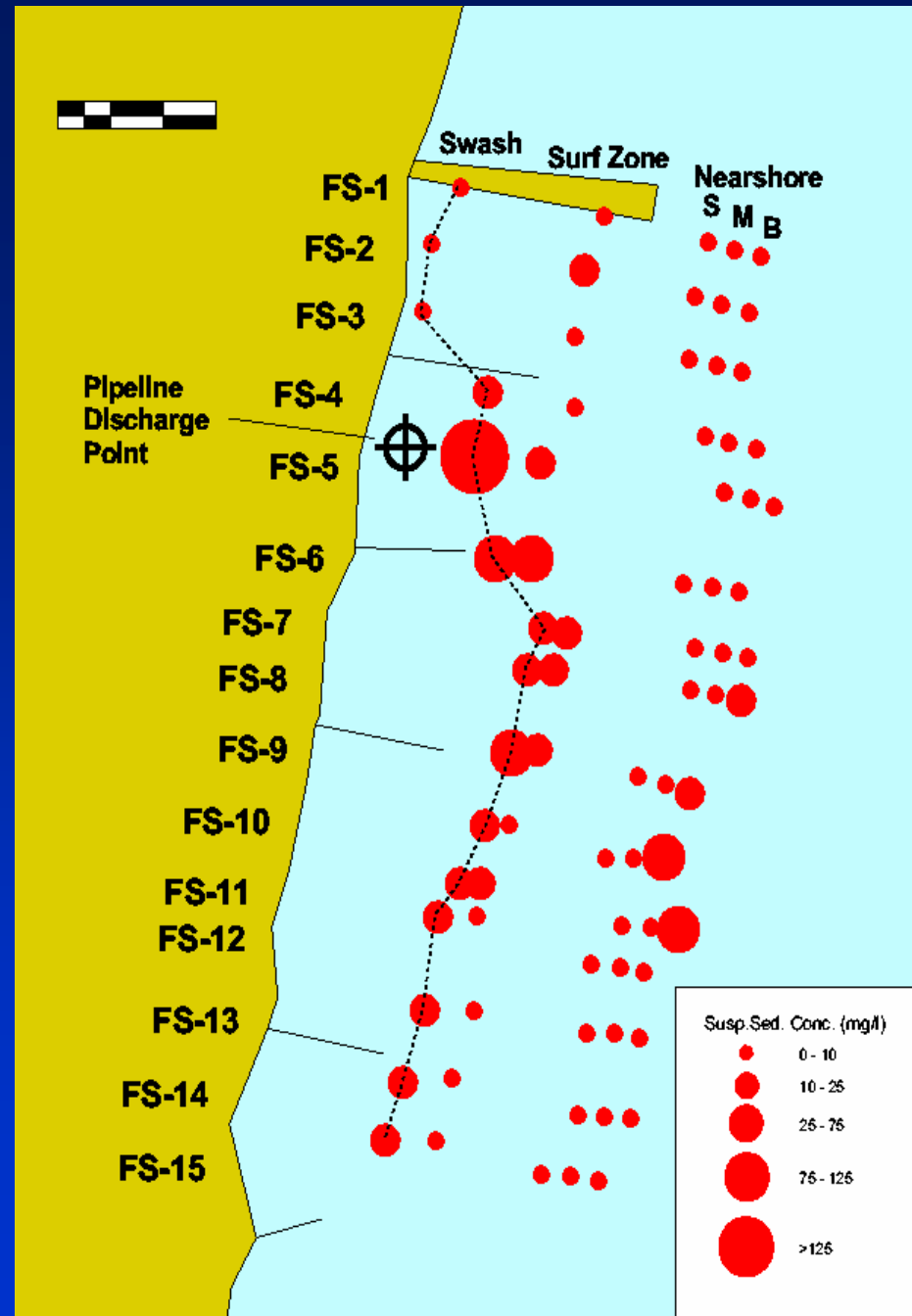
Nearshore

Surf

Swash

Discharge

Suspended Sediments at Active Fill Site, 4 Sept 97



Results: *Turbidity and Suspended Sediments*

- **Turbidity “plume” dynamics dependent on winds & currents**
- **Resuspension of sands distinct from silts**
- **Ambient calm weather TSS ~ 1 to 10 mg/L**
- **Ambient storm TSS ~ 25 to >6,500 mg/L**
- **Short-term effects of fill operations limited to swash zone (<200 mg/L), surf zone (<35 mg/L), and nearshore bottom waters (<35 mg/L) within 500 m of discharge**

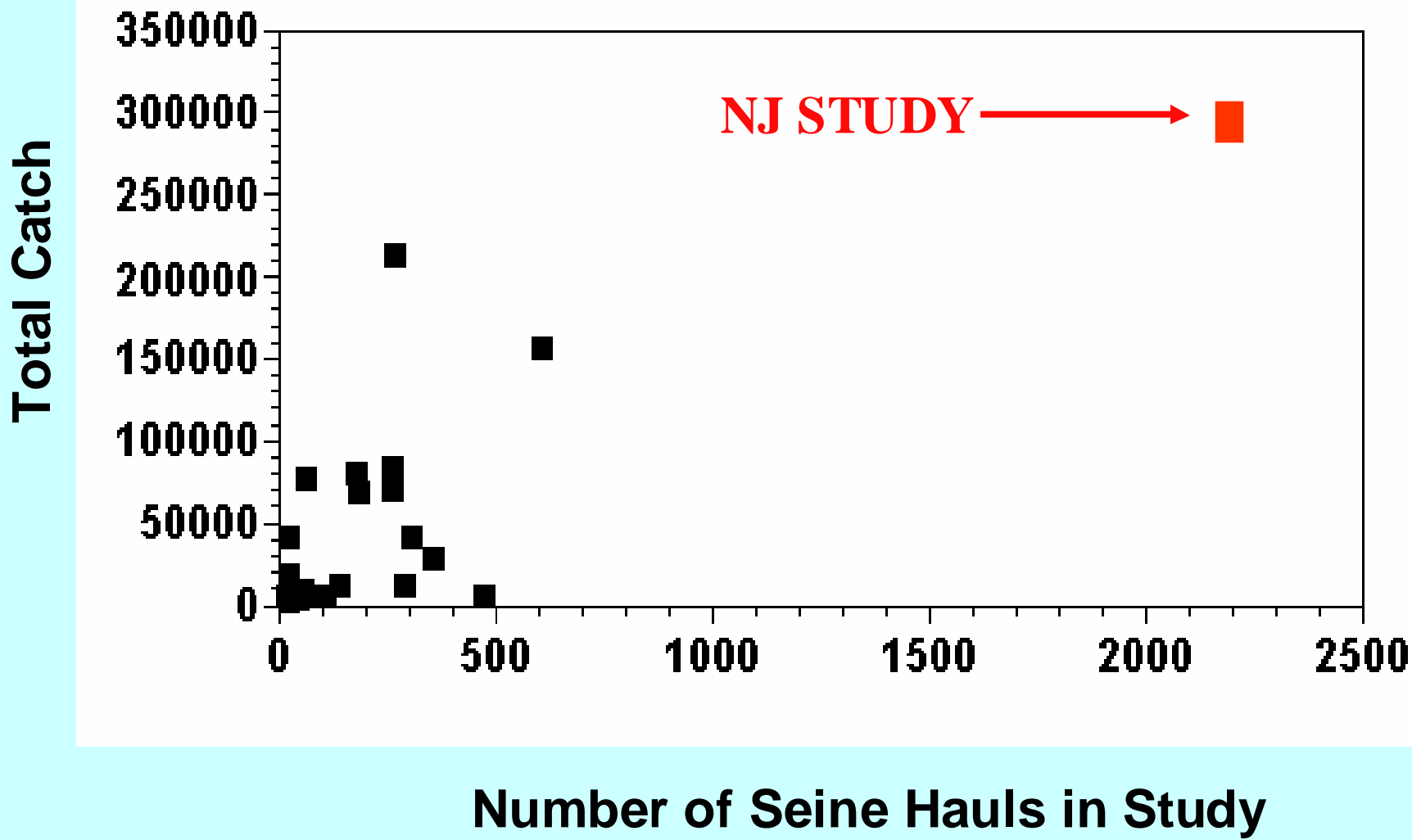
Surf Zone Fishes



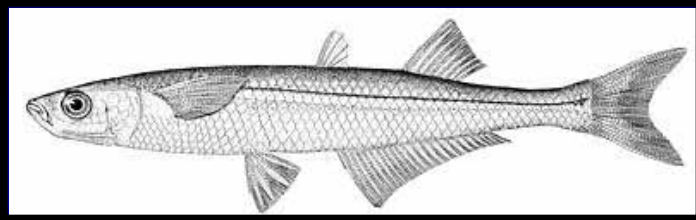
Potential Impacts on Surf Zone Fishes

- Habitat shift (partial burial of groins)
 - Change in fish assemblage composition or distribution relative to groins
- Physical Impacts (e.g., turbidity)
 - Evidence of fish mortality or morbidity
 - Decline in fish abundance in the nourished area
- Reduced benthic prey availability
 - Change in prey type or biomass

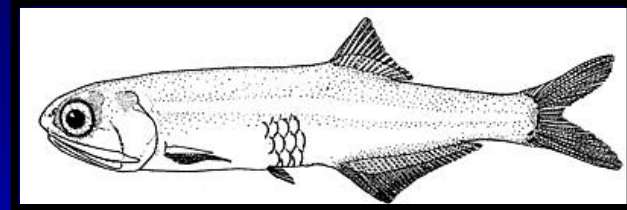
Comparison of Effort to Other Studies



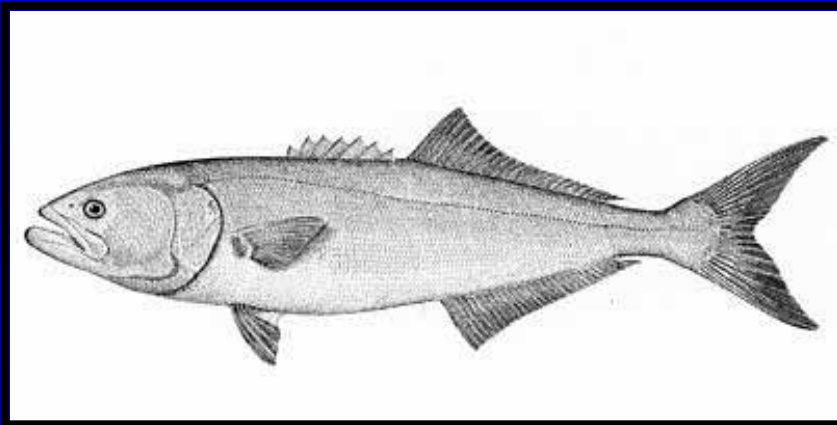
Dominant Surf Zone Fishes



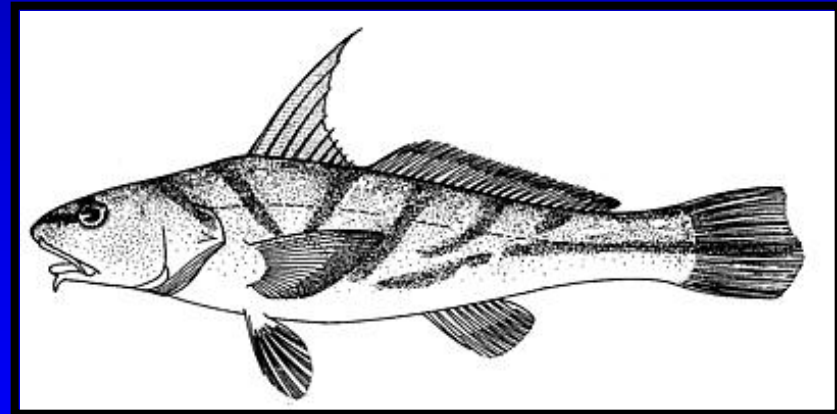
Silversides



Anchovies



Bluefish

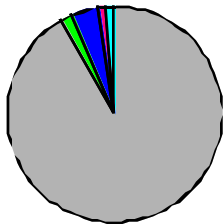


Northern Kingfish

Species Composition

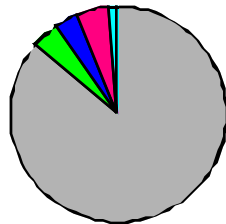
Silversides
 Kingfish
 Bluefish
 Anchovies
 Other

n = 15,390

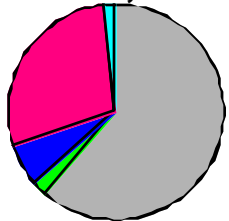


R 1995 BN

n = 17,647

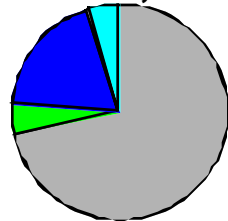


n = 29,546



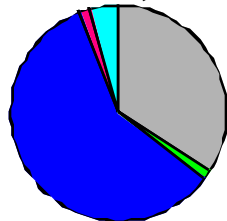
R 1996 BN

n = 10,138



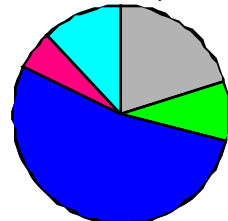
Baseline

n = 43,952



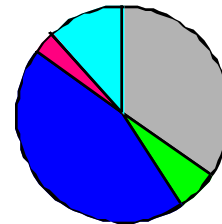
R 1997 BN

n = 23,402



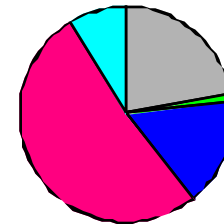
Nourishment

n = 28,064

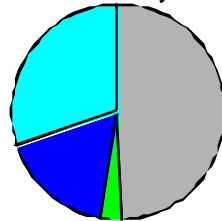


R 1998 BN

n = 45,696

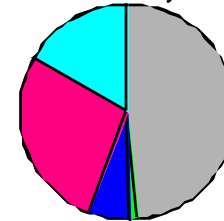


n = 21,662



R 1999 BN

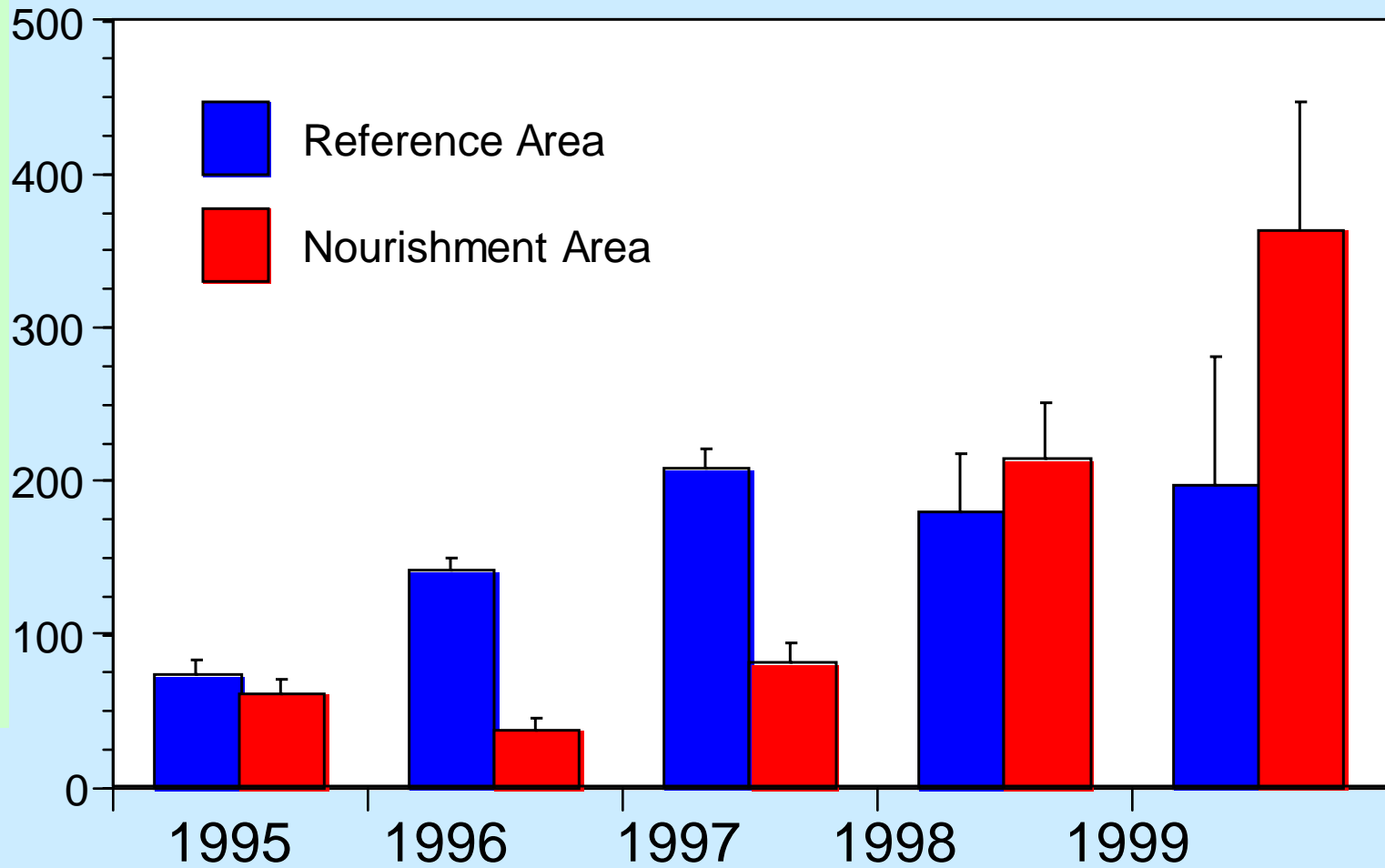
n = 60,811



Post-Nourishment

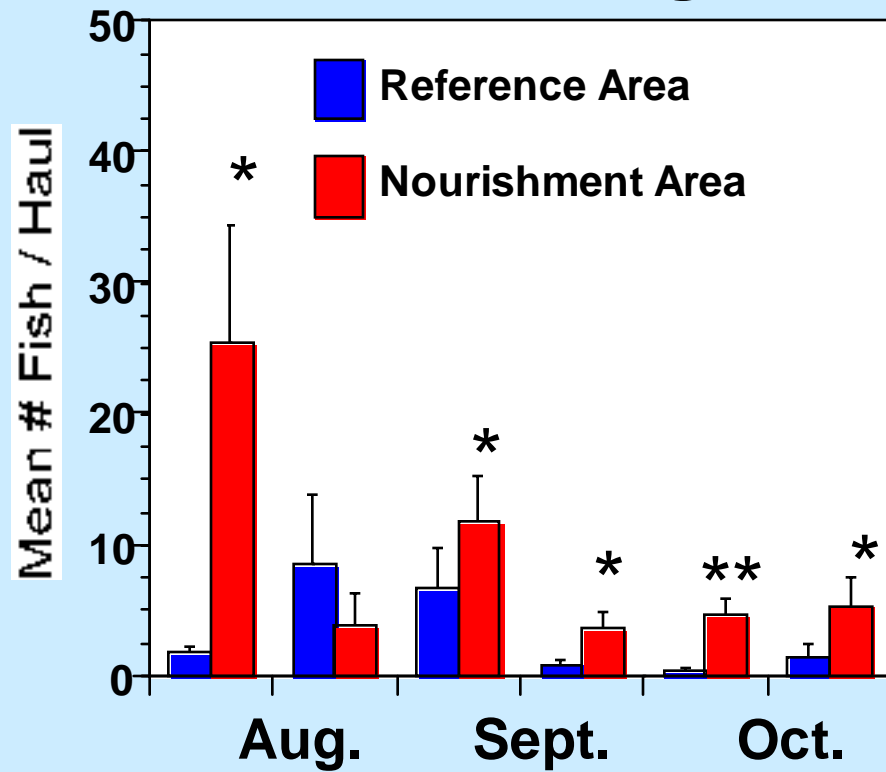
FISH ABUNDANCE

Mean # Fish/Haul

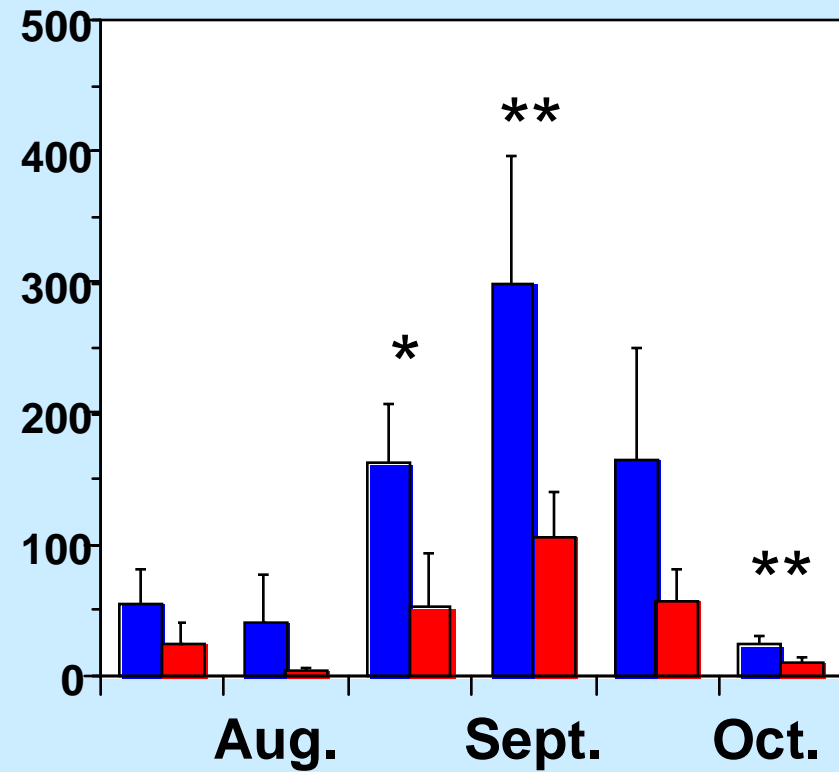


Fish Abundance - 1997

Northern Kingfish



Bluefish

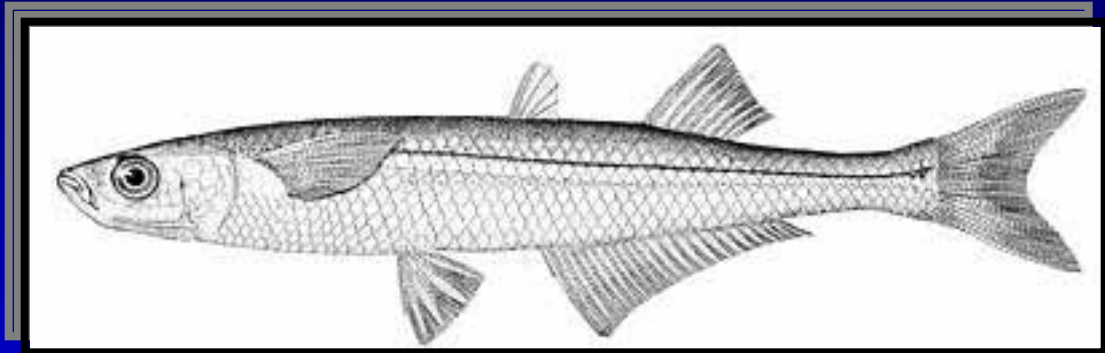


Results: Fish Distributions Relative to Beach Nourishment

- **Bluefish avoid active nourishment sites**
- **Northern kingfish attracted to areas being nourished**
- **Changes not evident one year later**

Fish Food Habits

**Atlantic Silverside (*Menidia menidia*) &
Rough Silverside (*Membras martinica*)**



**Northern Kingfish
(*Menticirrus saxatilis*)**



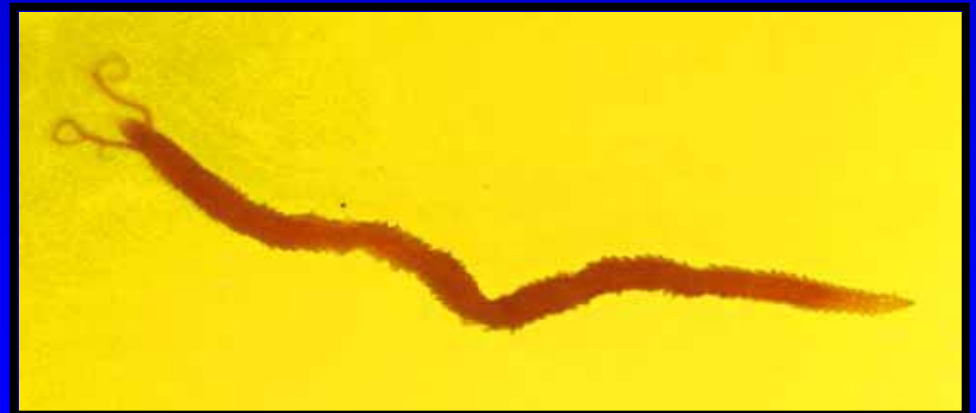
Intertidal Infaunal Prey

Mole Crab
(Emerita talpoida)

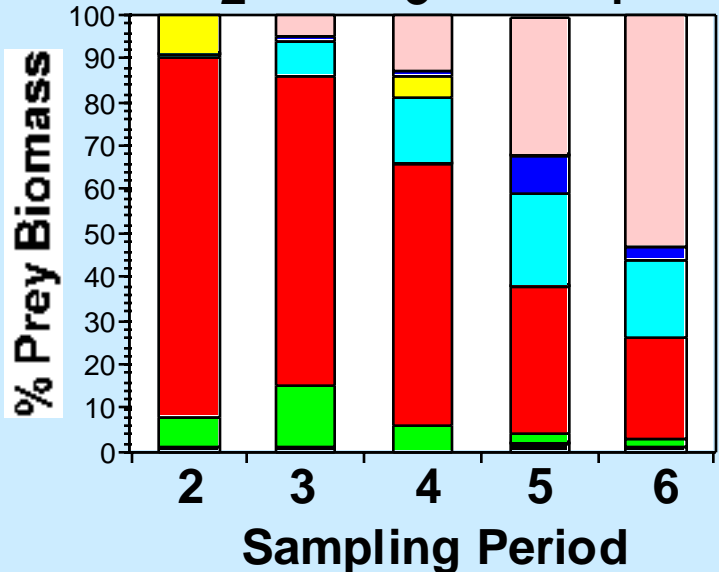
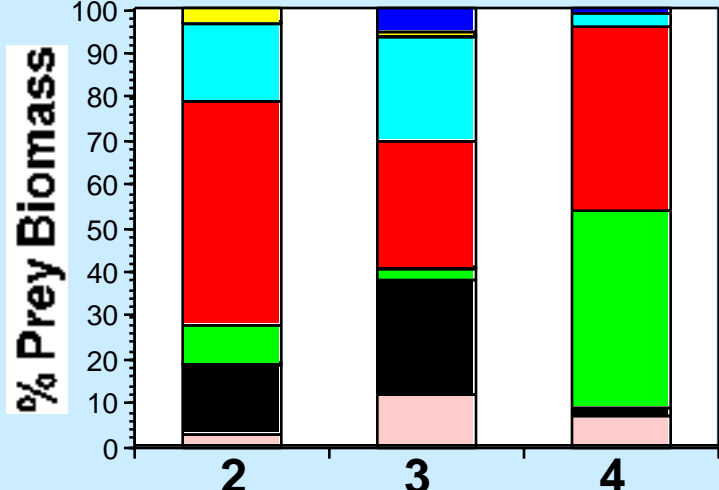


Amphipod (*Jassa sp.*)

Polychaete
(Scolelepis squamata)



Northern Kingfish Food Habits 1997



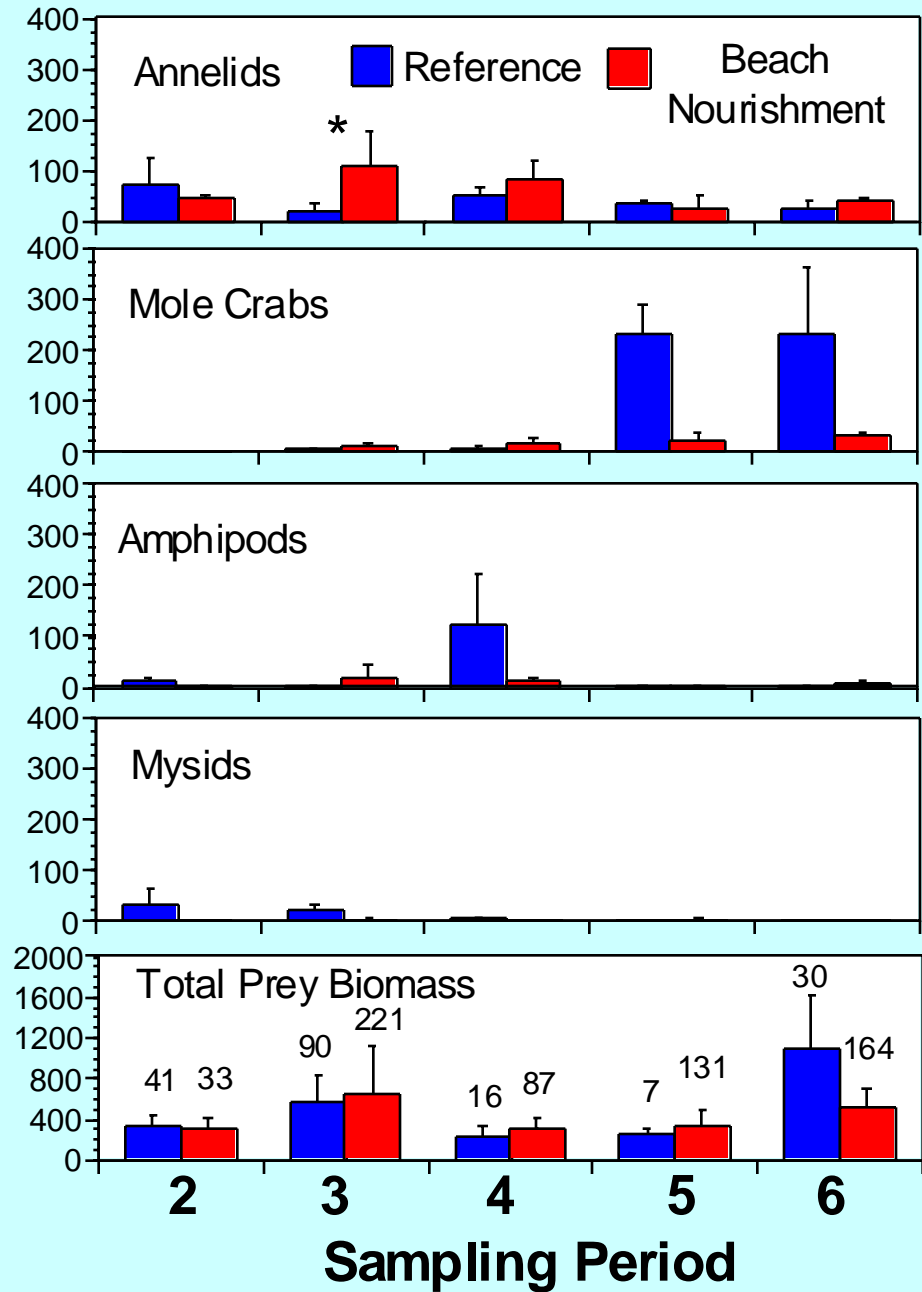
Reference Area

Beach Nourishment Area

Northern Kingfish Prey Biomass 1997



Prey Biomass / Filled Stomach (mg)



Prey Biomass Results - 1997

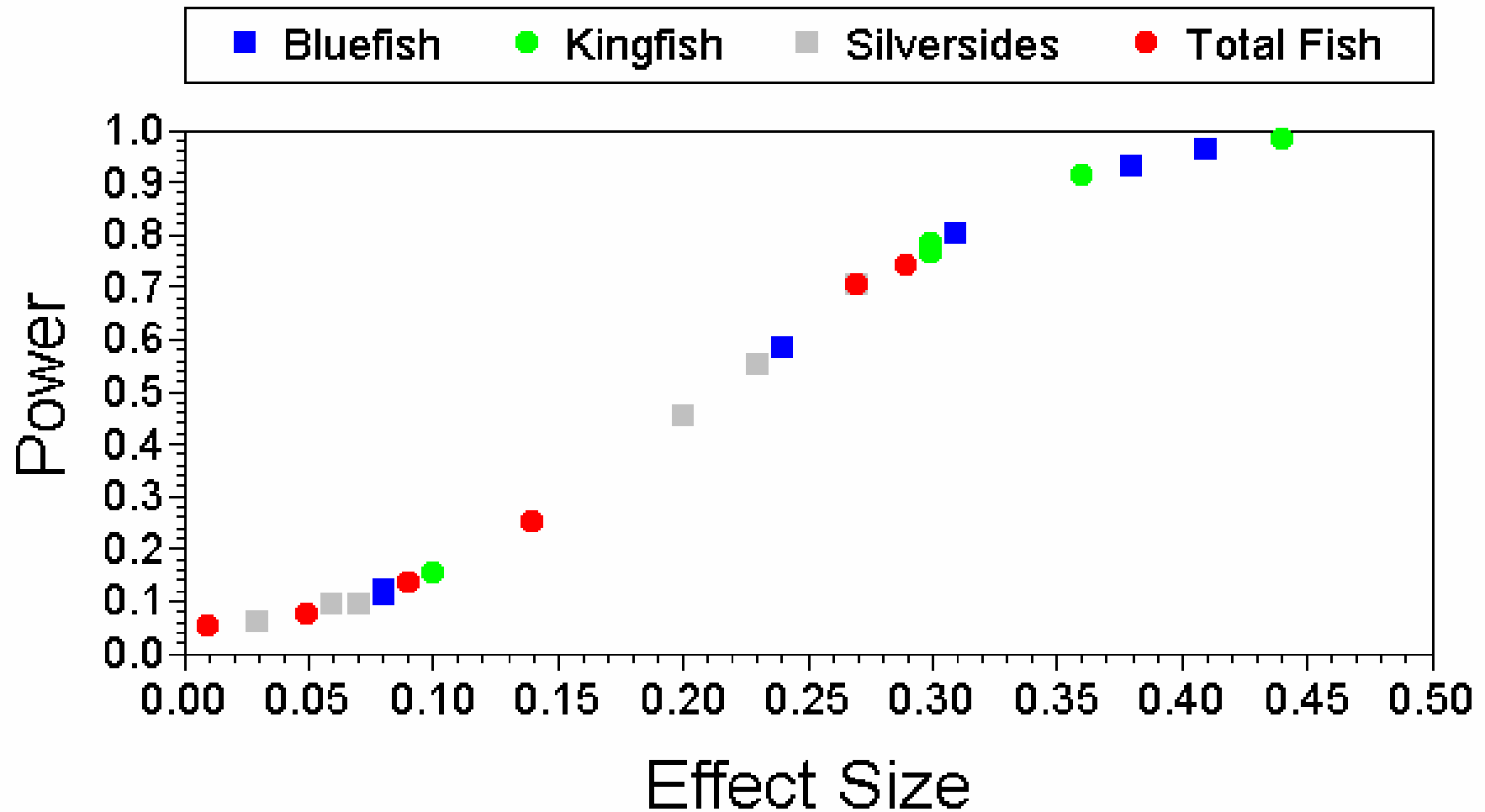
Stomach contents of fish captured at Beach Nourishment stations relative to fish captured at Reference stations

Taxa	1	2	3	4	5	6
Kingfish	No Data	> Annelids	ns	ns	ns	ns
Atlantic Silversides	> Prey Biomass > Amphipods	> Crabs	ns	ns	>Mole crabs	>Mole Crabs >Amphipods > Prey Biomass

Summary of Assessment of Impacts on Surf Zone Fishes

- ✦ No detectable changes in fish abundance linked to nourishment
- ✦ Northern kingfish attracted to nourishment area
- ✦ Bluefish avoid nourishment area
- ✦ No evidence of reduced foraging efficiency by silversides or kingfish in nourishment area

Power Analysis



Lessons for Future Monitoring Efforts

Poor Measures of Potential Impacts

- Changes to fish abundance
- Benthic monitoring only

Better Measures of Potential Impacts

- Target individual species of concern
- Assess the physical condition of fish captured in the vicinity of the plume

