

# **Effectiveness, Operation and Maintenance, and Costs for a Barrier Net System for Impingement Reduction at the Chalk Point Station**

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# Topics Covered

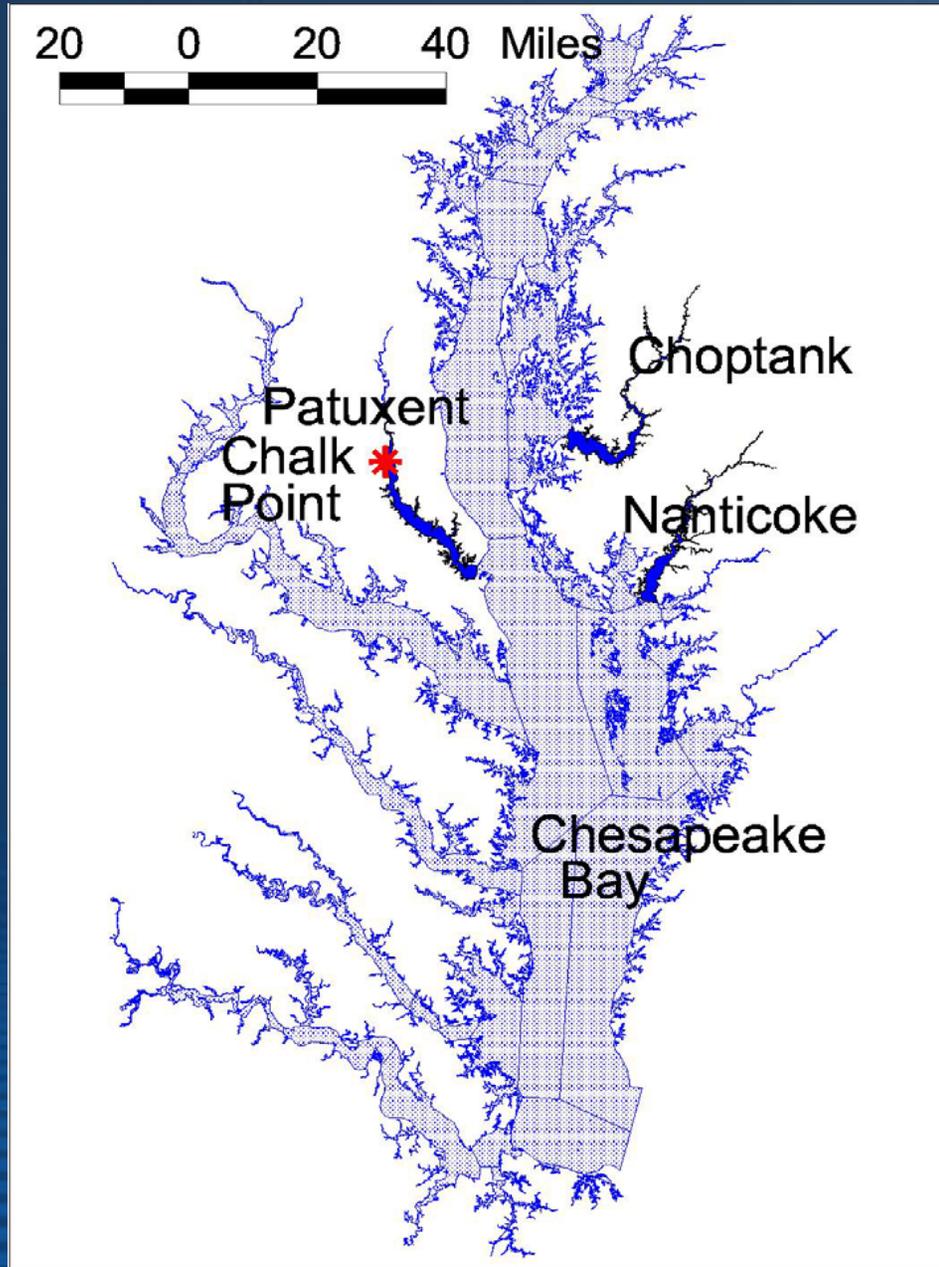
Location and Design

Operation and Maintenance

Effectiveness

Capital and O&M Costs

# Location of Chalk Point Station



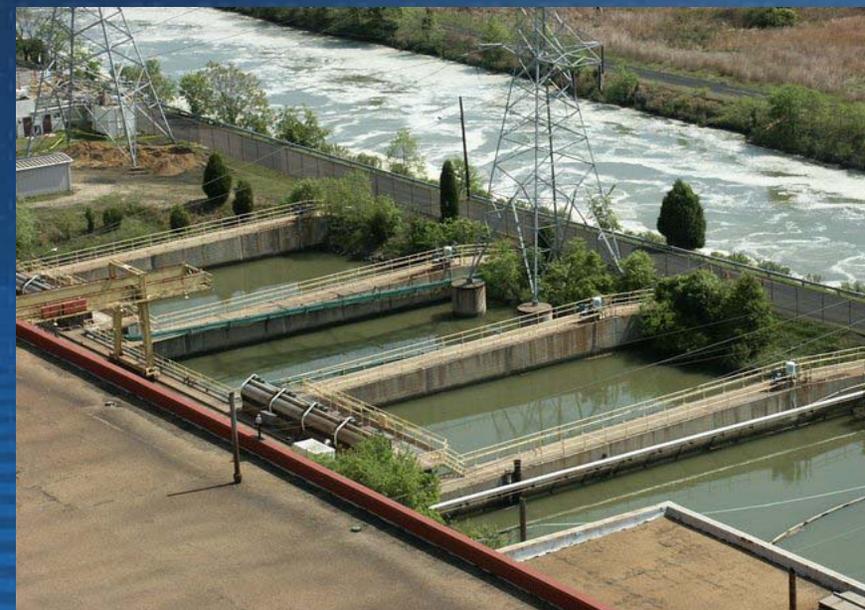
# Chalk Point Generating Station



# Location of Chalk Point Generating Station



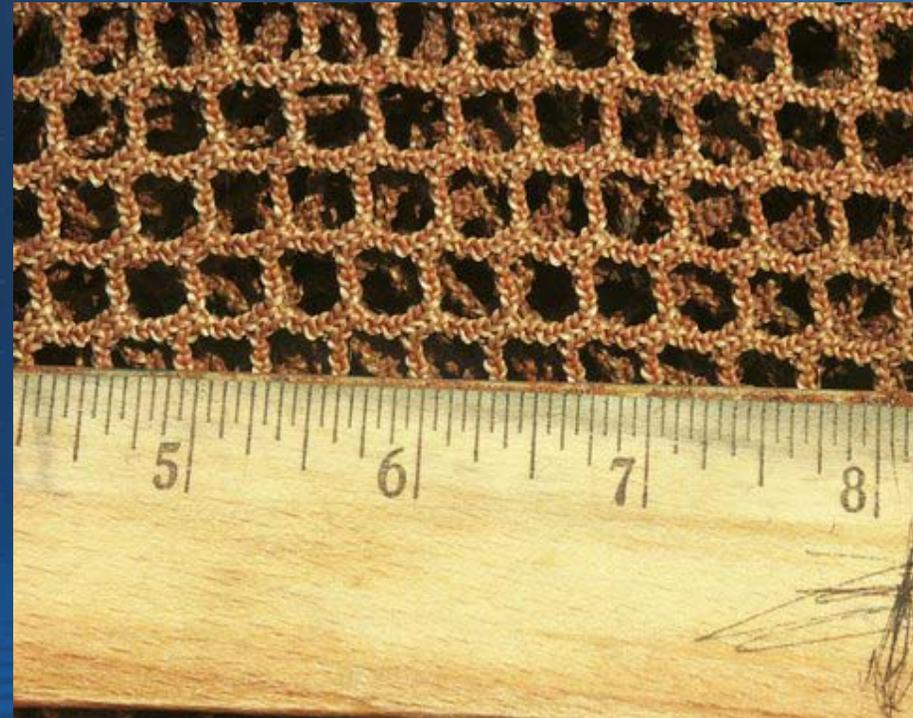
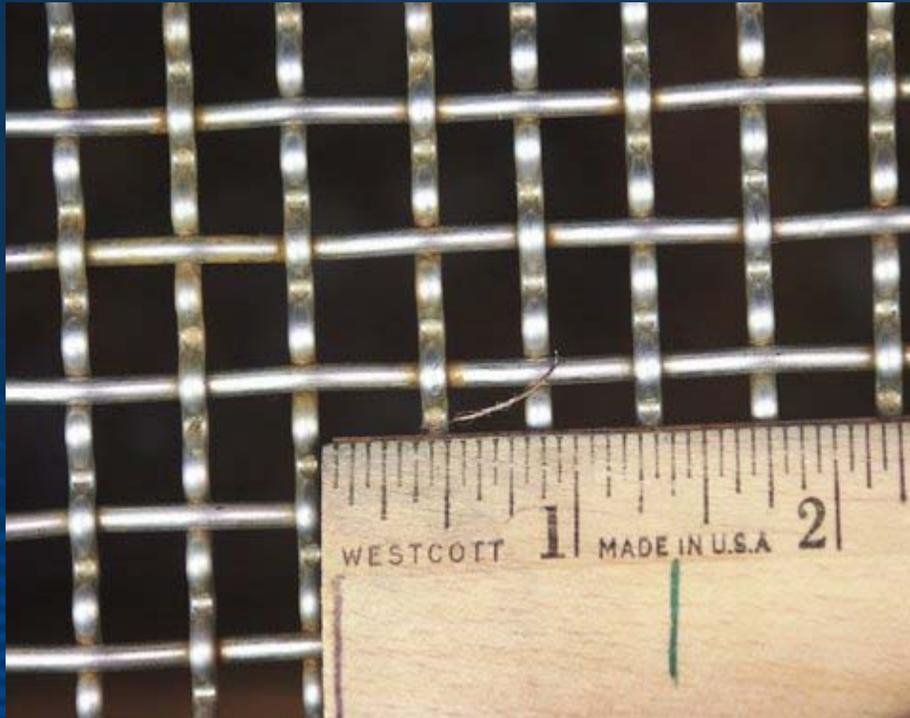
- 2 once through Units
- Units 1 & 2 are 330 MWe ea
- Two 125,000 gpm pumps/Unit
- 3 ft. avg. tide range
- Salinities ~5-7pptwinter/spring and ~15-17 ppt summer/fall



## Design and Construction

- **Double Barrier Net System**
  - Outer net is 671 ft., supported by 51 pilings and has a mesh size of 1.5 in. stretch mesh
  - Inner net is 533 ft., supported by 40 pilings and has 3/4in. stretch mesh. Inner net 100 ft. inside outer net
- Each barrier net is 300 ft. long and 27 ft. deep. Three nets used for outer net and two for inner net.
- Inner net has a 4 ft. 3/4in. stretch mesh skirt that is 380 ft long deployed in the center of the pilings

# Mesh Size Travelling Screen vs. Mesh Size Inner Barrier Net



# Current Operation and Maintenance Practices



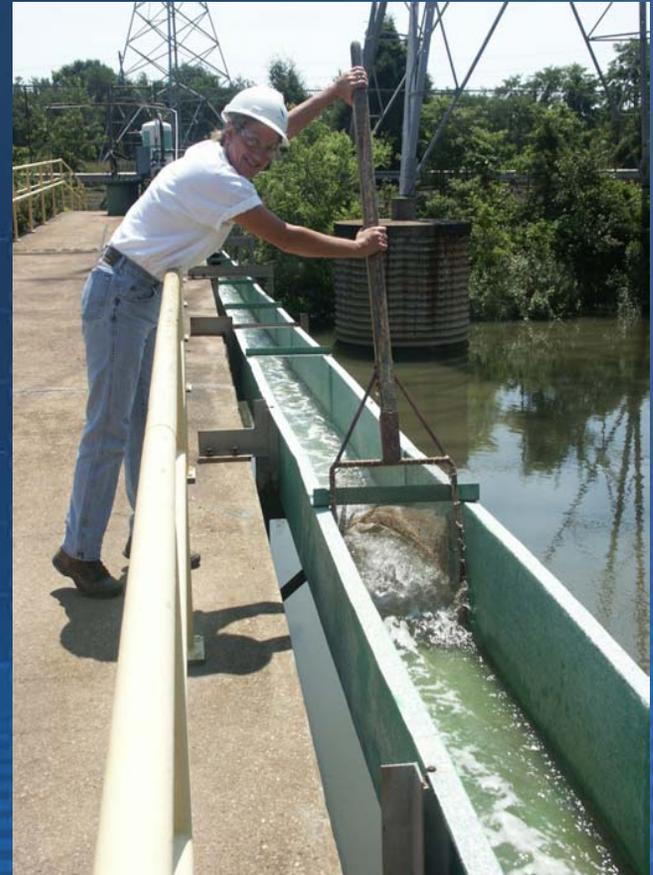
- **Net changed once to twice per week in summer and every other week the rest of the year**
  - Net located in a high fouling environment (primarily the colonial hydroid, *Garvia franciscana*)
  - Jellyfish can accumulate on net in summer and leaves are heavy in the fall
  - Net changes done by a local waterman and a diving inspection is performed to ensure the net is properly deployed on the bottom.
- **Net removed for 2 weeks in fall to allow menhaden inside the net to escape.**
- **Top of nets submerged 3 ft below the water for 6 weeks in winter to prevent ice damage.**

# Effectiveness Evaluation



## Baseline:

- **Baseline sampling conducted June 1976 - September 1977**
- **2 Samples taken every 28 hrs for 6 days followed by 2 or 3 days of no sampling, throughout the study period.**
- **Procedure involved rotation of the screens to clear them of any impinged organisms and taking .5 hr. sample from the screenwash sluiceway**



# Chalk Point Baseline Impingement June 1976 to September 1977

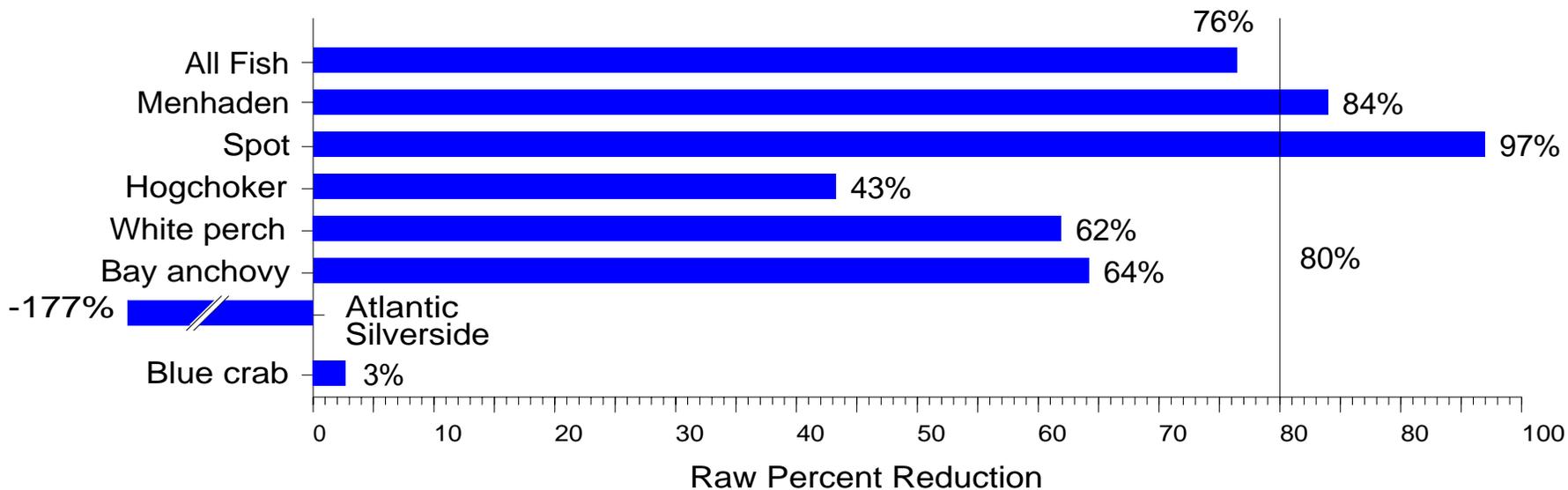
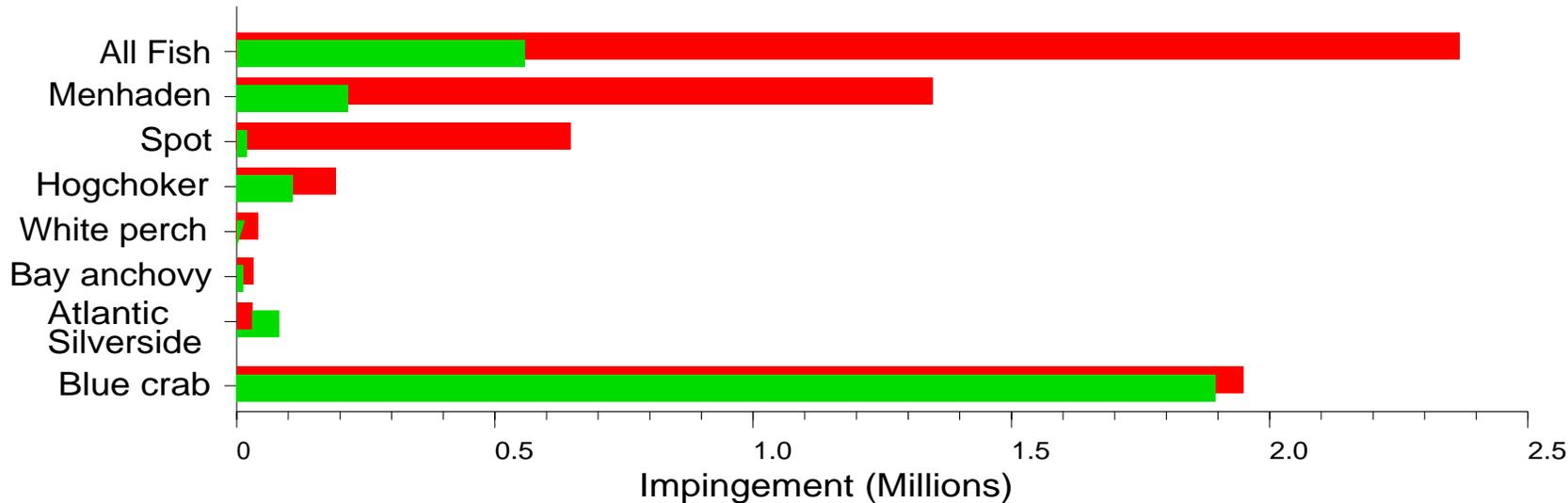


Atlantic menhaden.....	1,347,490
Spot.....	647,016
Hogchoker .....	191,926
White perch.....	41,910
Bay anchovy.....	32,206
Gizzard shad.....	31,026
Atlantic Silverside.....	29,908
Atlantic Croaker.....	14,490
Weakfish.....	8,730
American eel.....	5,790
29 Other finfish species.....	17,832
Total Finfish.....	2,368,324
Blue Crabs.....	1,948,132

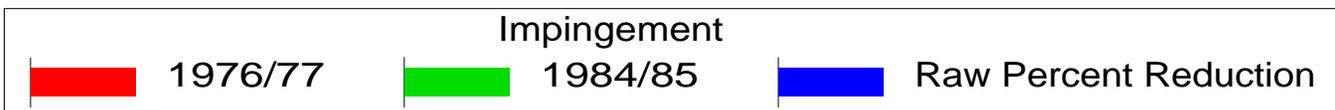
## Effectiveness Evaluation (cont.)

### Post Net Deployment Effectiveness Evaluation:

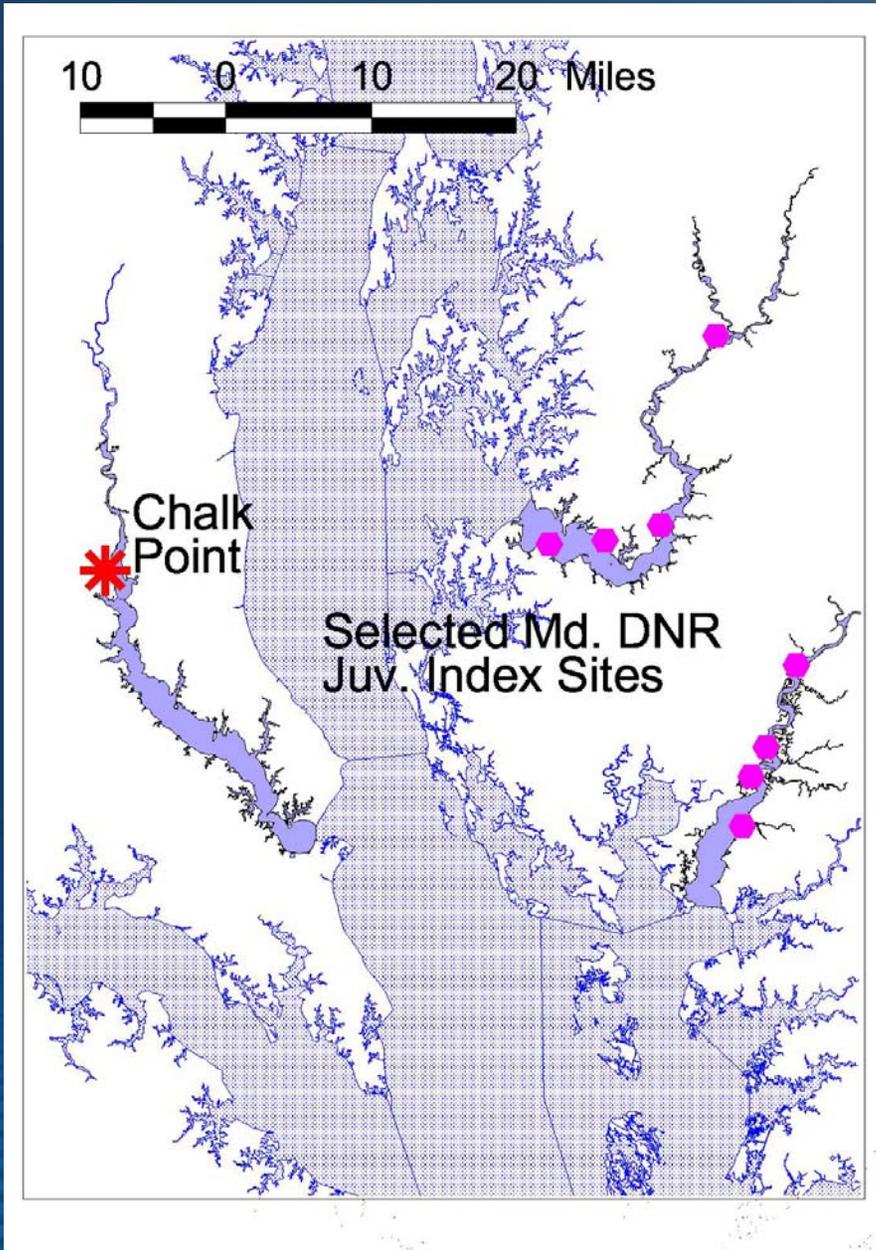
- **Two Methods Used:**
  1. **Daily census - Screens rotated each day and all impinged organisms collected**
  2. **Once per week sample - Rotate and clear screens and collect two .5 hr sample while screens are rotating. One .5 hr sample collected during the day and one at night.**
- **For performance effectiveness evaluation the once per week sample used for comparison to 76/77**



Legend

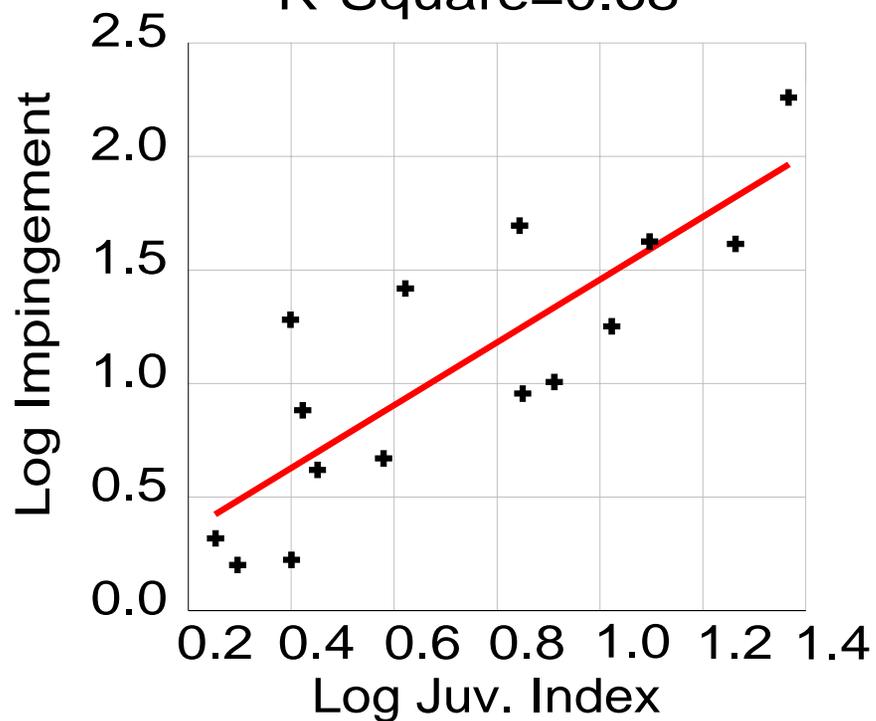


# Location of MDNR Juvenile Index Survey Sites in Relation to the Chalk Point Station



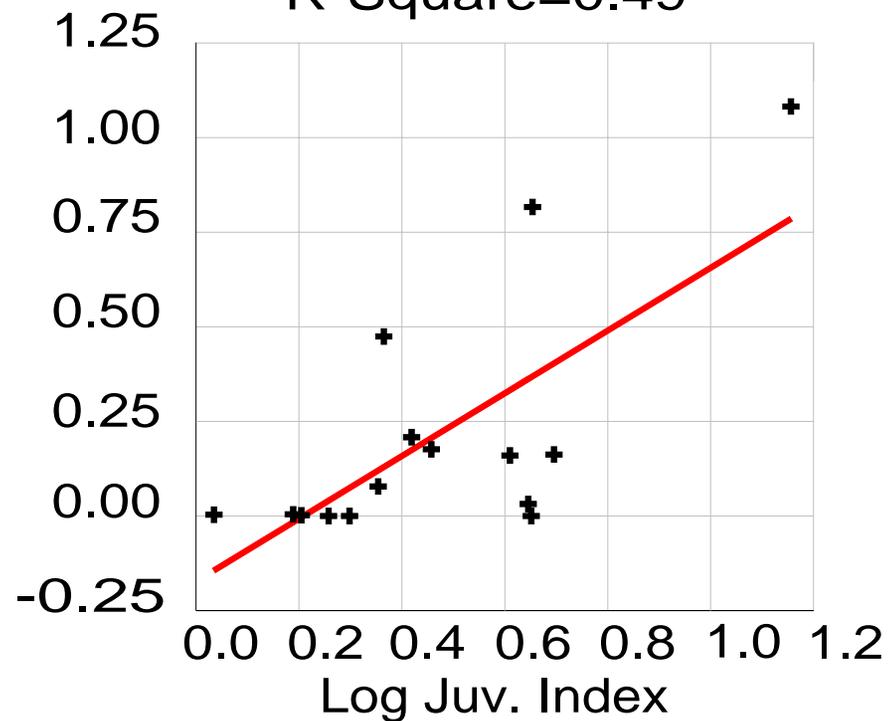
### Atlantic Menhaden

R-Square=0.68



### Spot

R-Square=0.49



# Procedure for Adjusting Impingement Results Based on State Juvenile Index

## Example Adjustment Calculation for Atlantic menhaden

**Step 1 - Estimate expected post barrier net impingement based on juvenile index:**

$$\frac{1,347,490 \text{ (76 imp)}}{16.178 \text{ (ji 76)}} * \frac{15.588 \text{ (ji 84)}}{16.178 \text{ (ji 76)}} = 1,298,348 \text{ (exp 84 imp)}$$

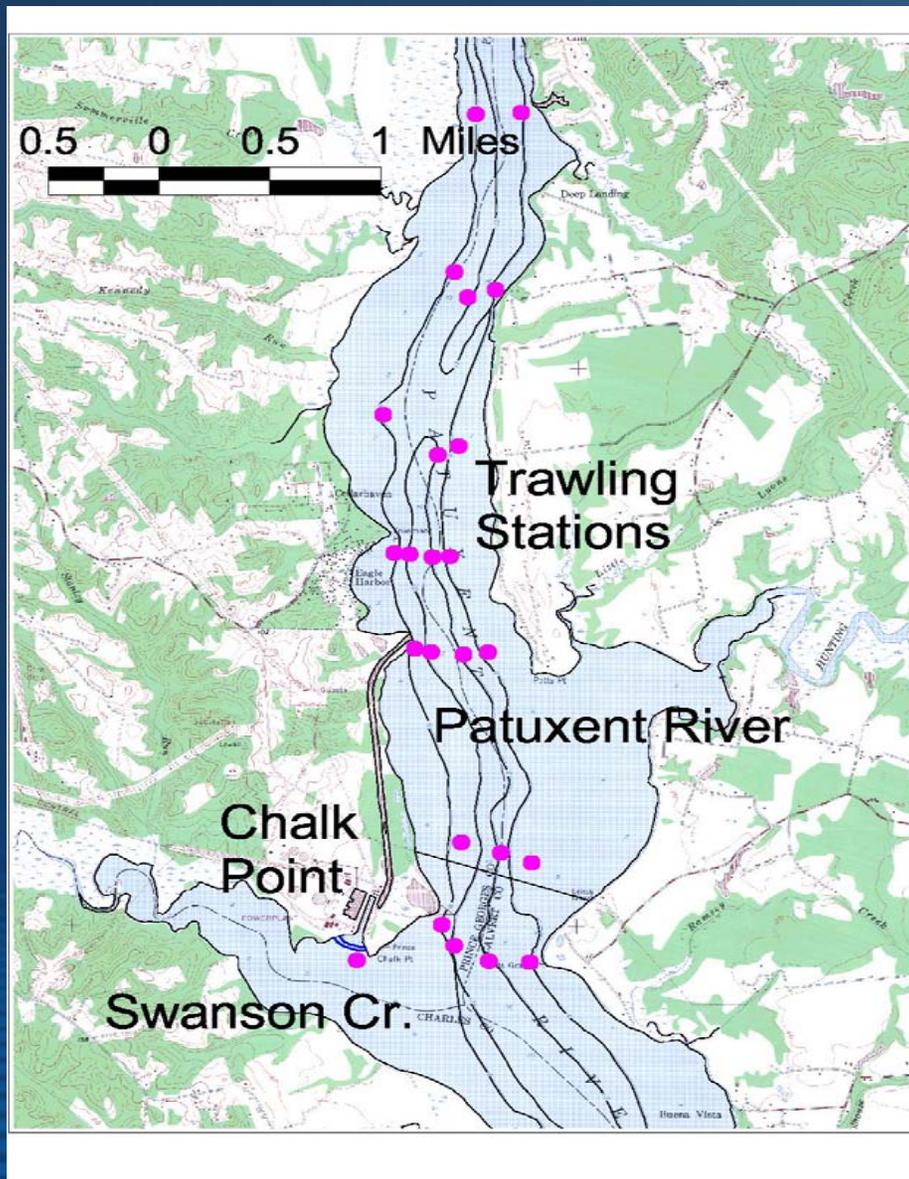
**Step 2 - Calculate % reduction of actual impingement from expected impingement:**

$$\frac{1,298,348 \text{ (exp 84 imp)} - 216,006 \text{ (act 84 imp)}}{1,298,348 \text{ (exp 84 imp)}} = 83\%$$

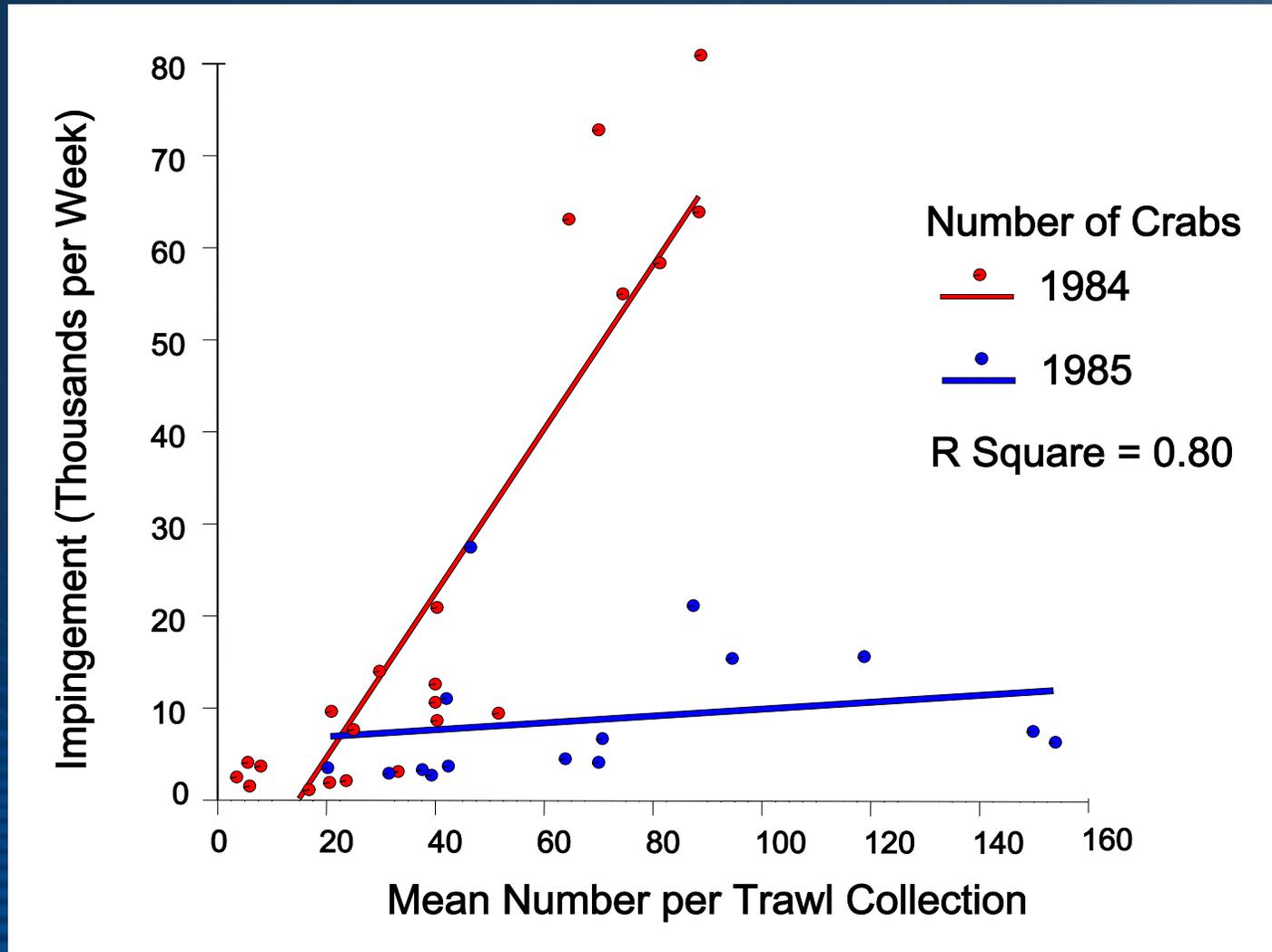
## Barrier Net Differences 1984 vs. 1985

Change/Difference	1984	1985
# Barrier Nets	1	2
Mesh Size	1.5 in. Stretch Mesh	1.5 in. Stretch Mesh outer and 3/4in. stretch mesh inner
Sealing Skirt	None	380 ft. X 4 ft. 3/4in. stretch along bottom of inner net
Sealing Net Deployment	None	Net deployed 15ft. in front of pilings for 6-8 ft drape on substrate
Results of Diving Inspections	11 of 19 dives found gaps along bottom of net	3 of 29 dives found gaps of outer net only

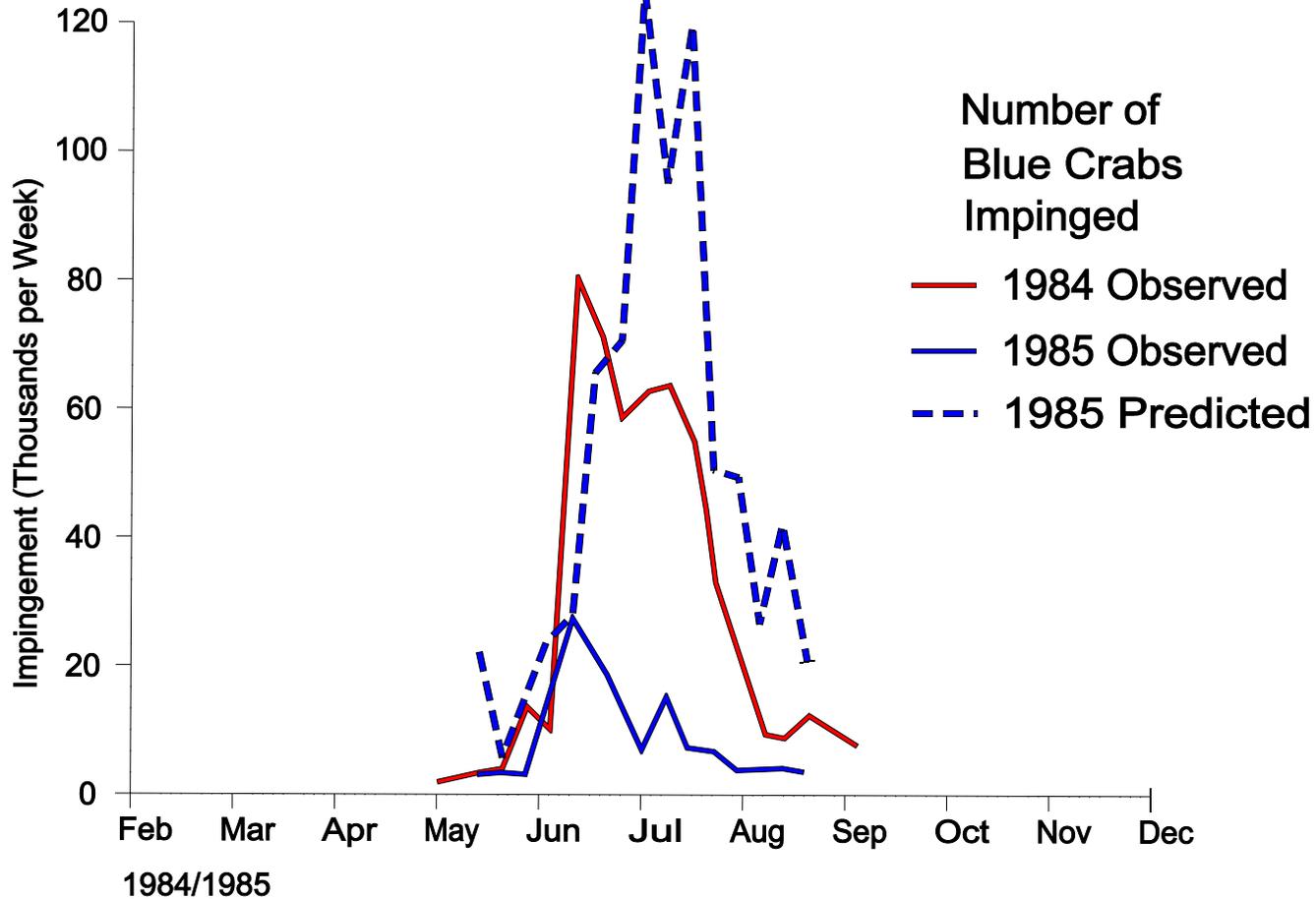
# Chalk Point Benthic Trawl Sampling Locations



# Relationship of Blue Crabs in Trawl Samples to Blue Crab Impingement



# 82% Reduction in Blue Crabs from 84 to 85



# Barrier Net Effectiveness Adjusted for Inter-year Relative Abundance Variability



Species	Impingement Reduction Based on Raw Data	Impingement Reduction Adjusted for Inter-Year Relative Abundance
Blue Crab	3%	82%
Menhaden	84%	83%
Spot	97%	98%+ (*)
Hogchoker	43%	83%
White Perch	62%	95% (*)

\* R squared under .5

# Atlantic Silversides and Bay Anchovies



## Atlantic Silversides

- 91% of the impingement occurred in winter when barrier net was removed
- 57% reduction 84 vs. 85 when barrier net in place
- The facility is now experimenting with year round net deployment

## Bay Anchovy

- 64% reduction 76/77 versus 84/85
- 55% reduction 84 vs. 85



# Capital and O&M Costs for Chalk Point Barrier Net

## Capital Cost:

Capital cost of barrier net deployment in (Primarily cost to install support pilings) ~\$100,000

## Operation and Maintenance Costs:

- Net changing to control fouling & debris and post net change dive inspections \$75,000/yr
- Net replacement panels 3 of 12/yr. \$12,000/yr

# Considerations for Use of a Barrier Net to Under EPA's Phase 2 Proposal

- **Consider addition of an escape route for trapped fish**
- **Consider reducing the net mesh size to provide an entrainment benefit**
- **When determining the calculation baseline consider establishment of an index to account for inter-year variability of major impinged species**
- **Consider complete census impingement monitoring instead of estimating to prevent overestimates**