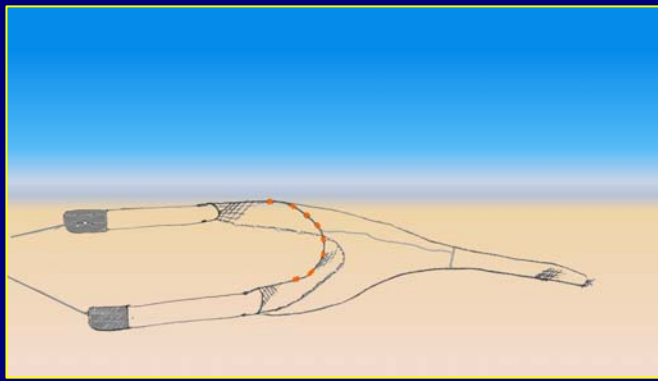


# Bottom trawl sampling of fish and invertebrates in the Delaware Estuary – getting the word out



**Stewart F. Michels & Michael J. Greco**  
**Delaware Division of Fish & Wildlife**  
**89 Kings Highway**  
**Dover DE 19901**



- **30-foot trawl survey**

- Conducted 1966-71; 1979-84; 1990-present

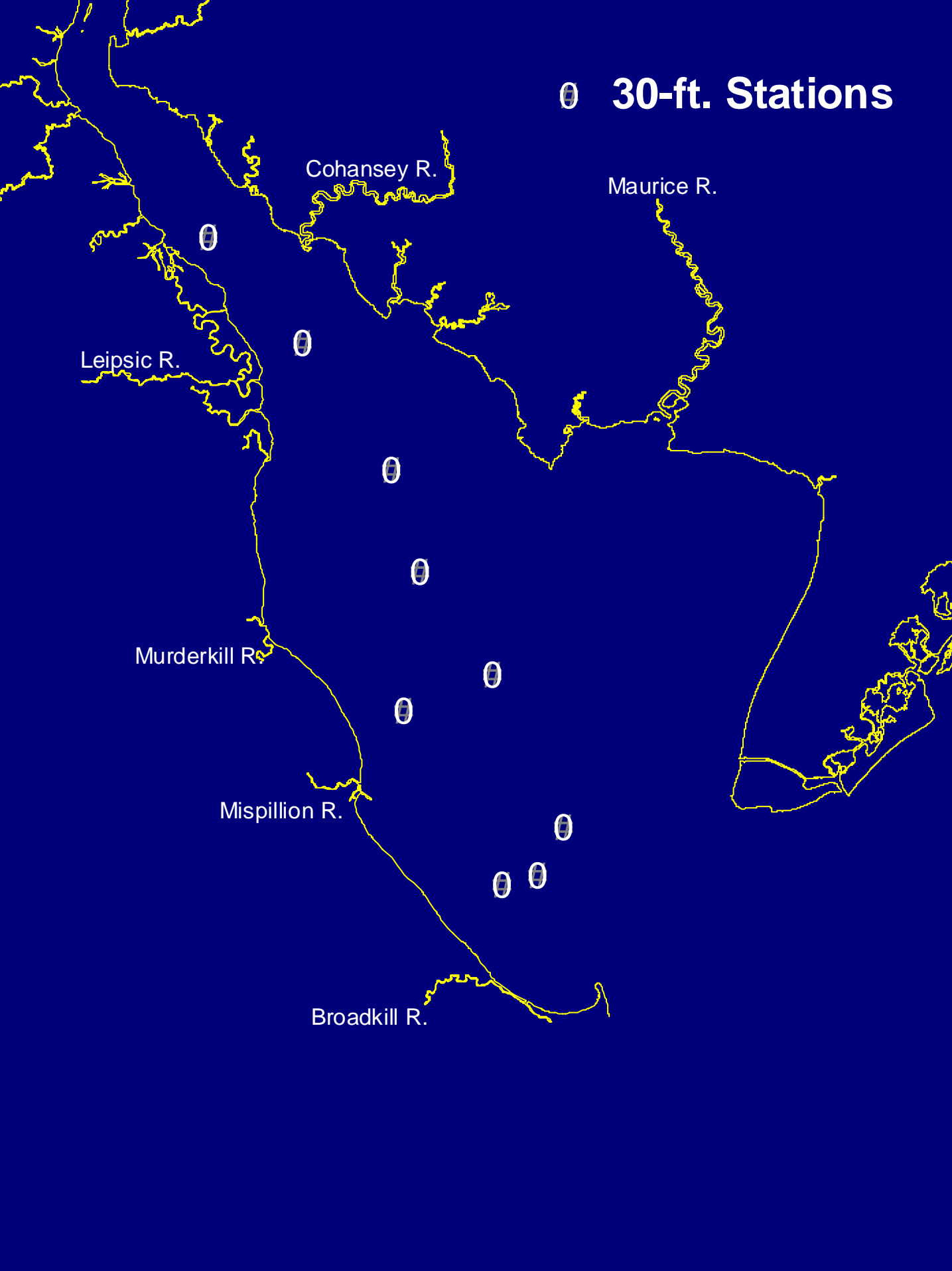
- Gear

- 30-foot headrope
    - 3-inch stretch mesh
    - 2-inch cod
    - 4.5 x 2.3 foot doors
    - 40-foot leglines

- Vessels

- 1966 “Wolverine” a 47-ft stern trawler
    - 1990 “Ringgold Bros.” a 65-ft Eastern-rigged trawling system
    - 2002 “First State” a 62-ft stern trawler

# 0 30-ft. Stations





- March through December
- 20-minute tows
- Approximately 1 NM
- Basic water chemistry
- 50 individuals/tow of each spp measured
- Aggregate weights by spp
- Age selected spp
  - Otoliths
  - Scales





- **17-foot trawl survey**

- Conducted 1978-present

- Gear

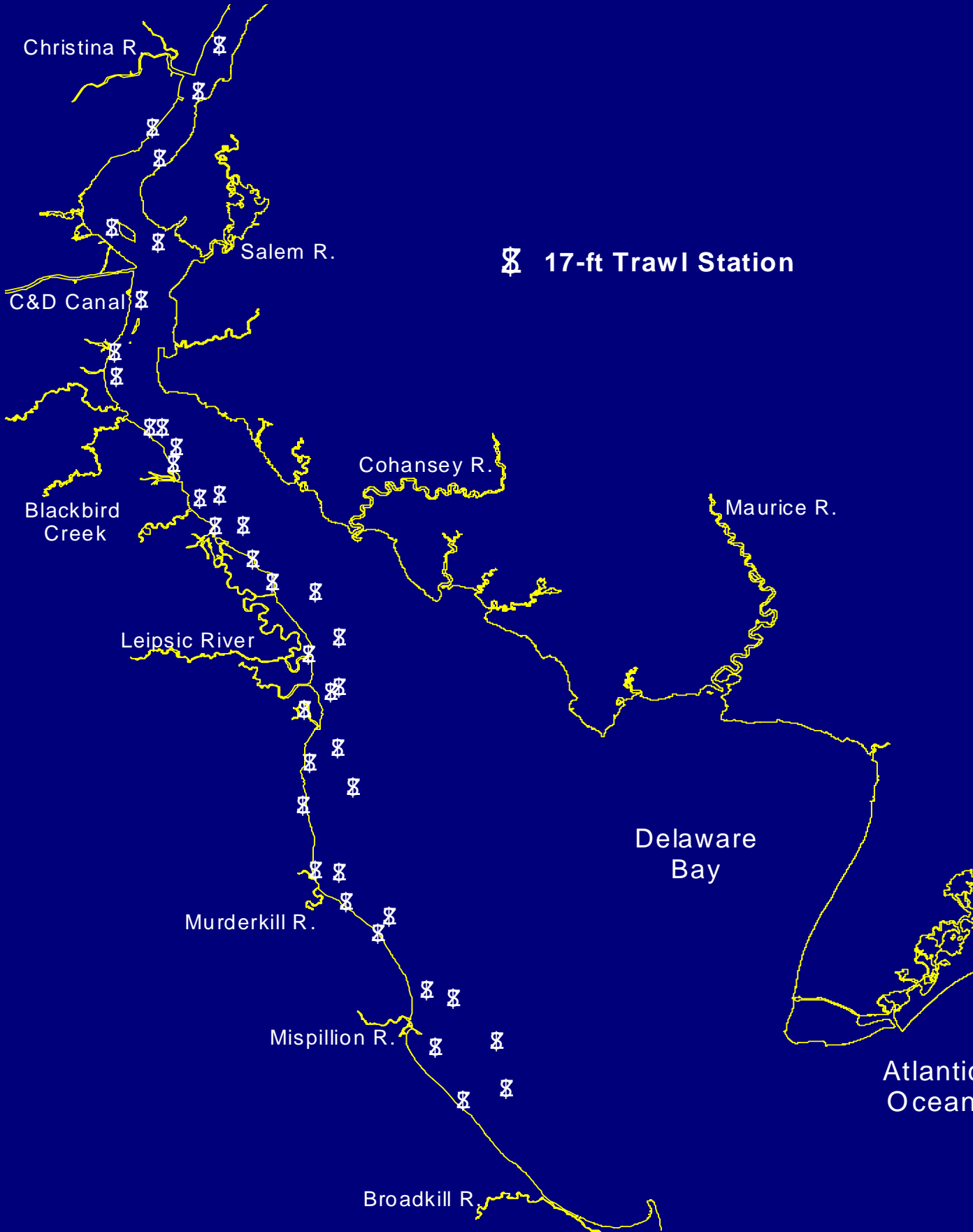
- 17-foot headrope
- 1.5-inch stretch mesh
- 0.5-inch knotless stretch mesh liner

- 1 x 2 foot doors

- 100-foot bridle attached to cable

- Vessels

- 23-foot I/O MonArk tri-hull stern-rigged w/ hydraulic winders
- 1990-2003 23-foot I/O SeaArk V-hull stern-rigged w/ hydraulic winders
- 2004 “First State” a 62-ft stern trawler



Christina R.

Salem R.

 17-ft Trawl Station

C&D Canal

Cohansey R.

Maurice R.

Blackbird  
Creek

Leipsic River

Delaware  
Bay

Murderkill R.

Mispillion R.

Atlantic  
Ocean

Broadkill R.



- April through October
- 10-minute tows
- Approximately 0.5 NM
- Basic water chemistry
- 30 individuals/tow of each spp measured
- YOY and Age 1 determined by length frequencies

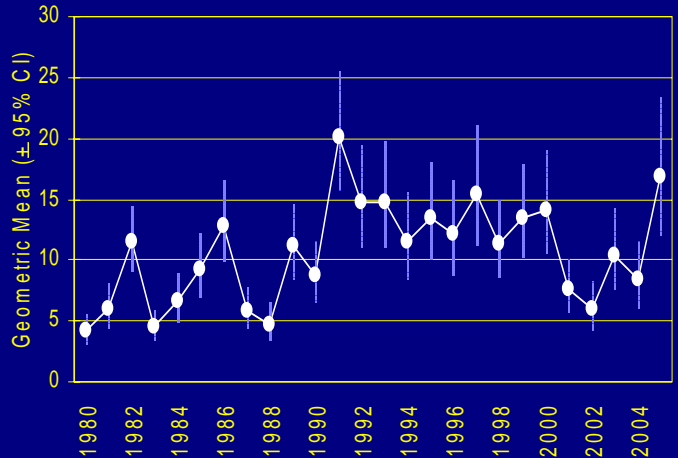


- Surveys are among the longest running fishery-independent surveys along the coast
- Combine for over 300 tows annually
- Over 150 species documented
- Monitor long-term trends in relative abundance

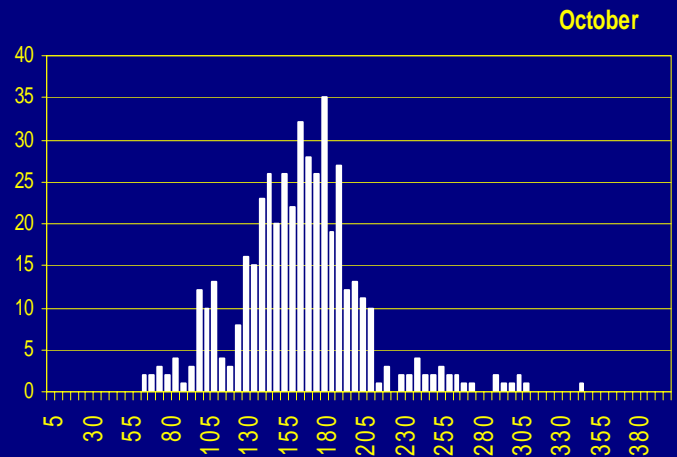
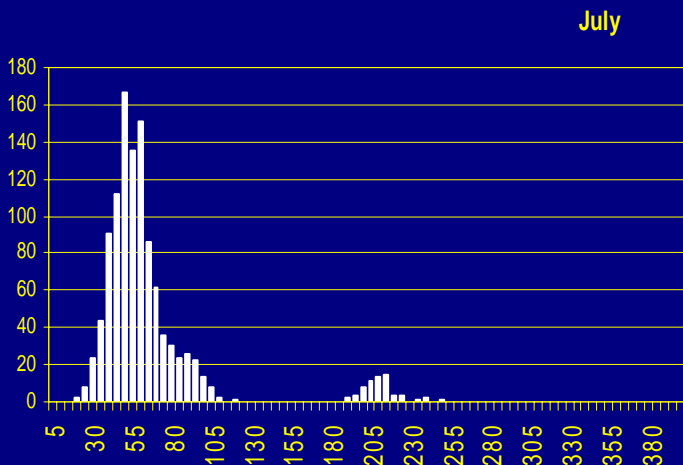
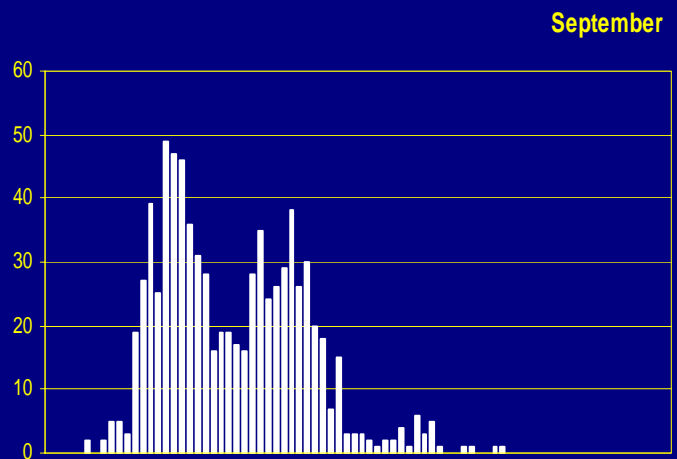
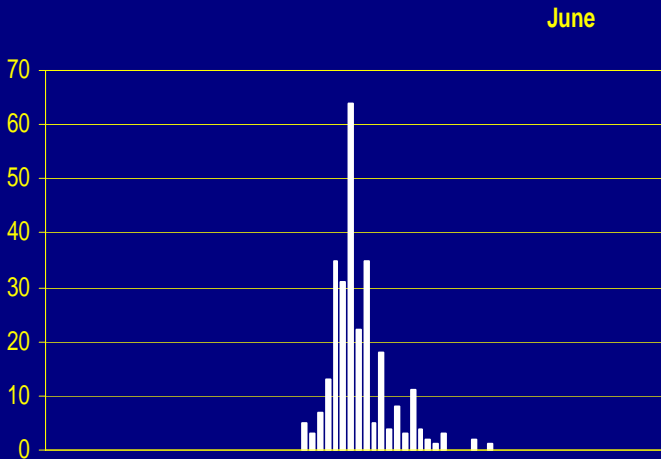
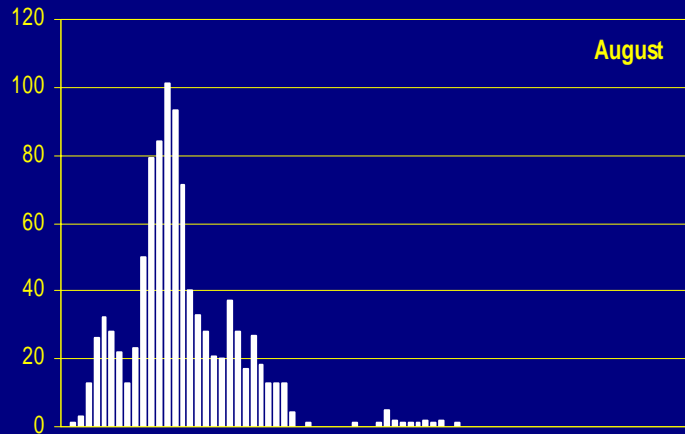
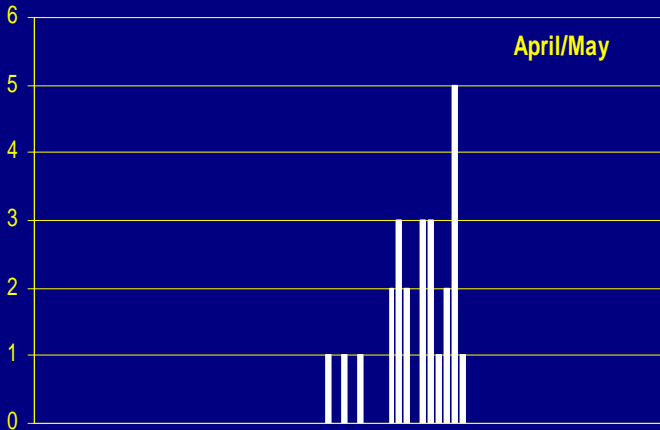


# Indices

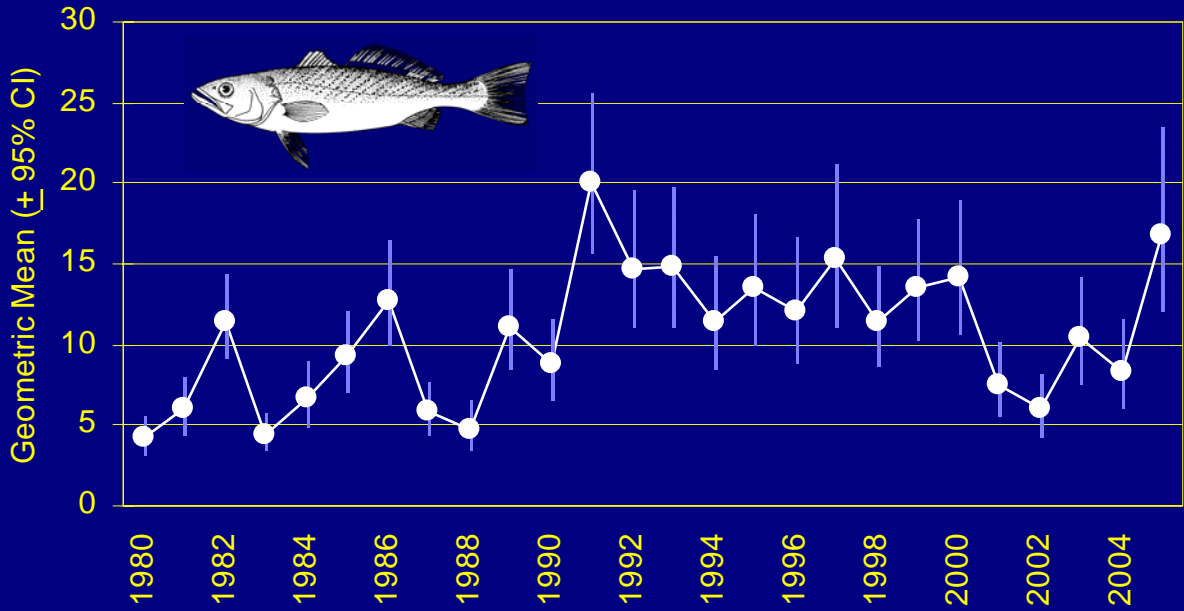
- Weakfish
- Summer flounder
- Striped bass
- Bluefish
- Atlantic croaker
- Spot
- Winter flounder
- White perch
- Black Seabass
- American shad
- Hickory shad
- Atlantic menhaden
- American eel
- Atlantic sturgeon
- Spiny dogfish
- Windowpane
- Butterfish
- Scup
  
- Blue crabs
- Horseshoe crabs



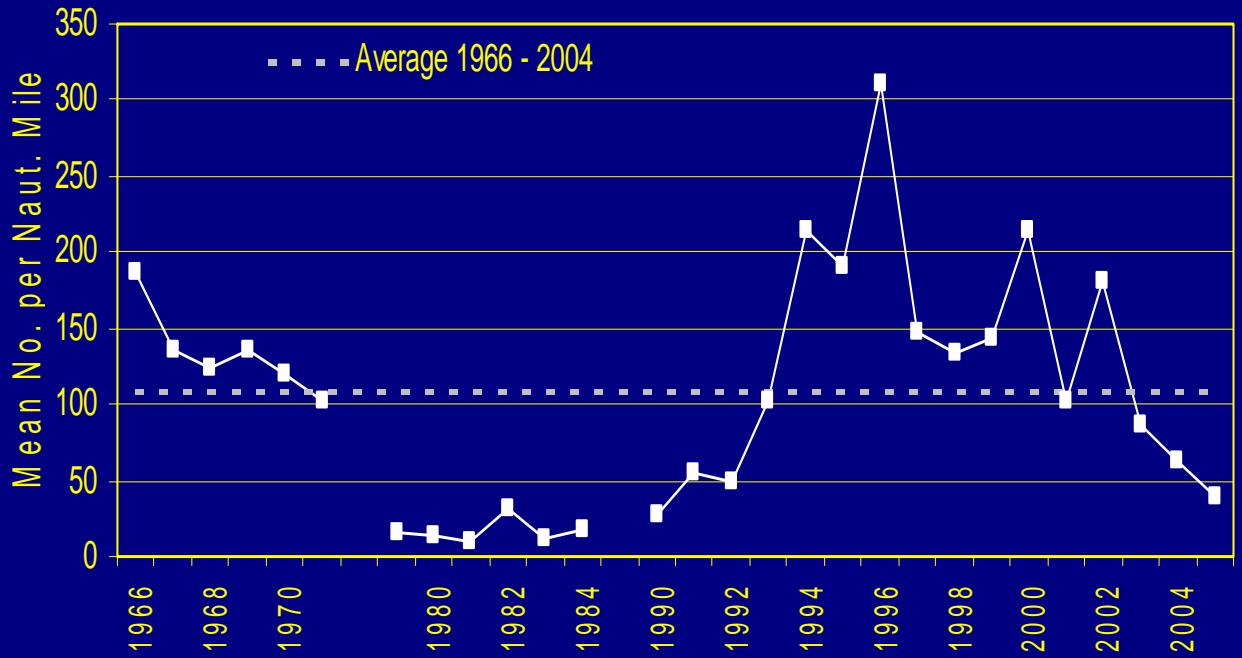
# YOY Length-frequency



# YOY Weakfish



# Weakfish



# Weakfish Catch-at-Age

Table 1-23. Weakfish catch at age matrix from the Delaware 30-foot trawl survey. Catch expressed as number per nautical mile.

| Year | 0     | I     | II    | III   | IV    | V     | VI   | VII  | VIII | Total  |
|------|-------|-------|-------|-------|-------|-------|------|------|------|--------|
| 1991 | 22.76 | 27.16 | 3.63  | 0.64  | 0     | 0     | 0    | 0    | 0    | 54.19  |
| 1992 | 24.77 | 21.15 | 2.61  | 0.04  | 0.03  | 0     | 0    | 0    | 0    | 48.6   |
| 1993 | 21.4  | 50.3  | 25.4  | 3.9   | 0.5   | 0     | 0    | 0    | 0    | 101.5  |
| 1994 | 8.6   | 113.5 | 68.5  | 23.6  | 0.9   | 0     | 0    | 0    | 0    | 214.2  |
| 1995 | 41.1  | 75.3  | 53.5  | 15.7  | 5.4   | 0.1   | 0    | 0    | 0    | 191.1  |
| 1996 | 77.3  | 44    | 48.3  | 111.2 | 23.8  | 6.4   | 0.1  | 0    | 0    | 311.1  |
| 1997 | 36.44 | 33.41 | 25    | 13.87 | 34.6  | 2.96  | 0.47 | 0    | 0    | 146.75 |
| 1998 | 31.83 | 23.38 | 24.64 | 20.39 | 11.61 | 20.72 | 1.27 | 0.06 | 0    | 133.9  |
| 1999 | 50.85 | 42.07 | 20.17 | 17.03 | 6.74  | 2.59  | 3.66 | 0.3  | 0.06 | 143.47 |
| 2000 | 35.13 | 97.85 | 50.38 | 23.64 | 5.74  | 0.66  | 0.38 | 0.47 | 0.09 | 214.34 |
| 2001 | 21.58 | 13.11 | 42.63 | 18.77 | 5.53  | 0.57  | 0.09 | 0    | 0    | 102.28 |
| 2002 | 35.14 | 89.35 | 23.32 | 27.97 | 3.94  | 0.4   | 0    | 0    | 0    | 180.02 |
| 2003 | 20.23 | 50.16 | 13.98 | 1.22  | 0.42  | 0     | 0    | 0    | 0    | 86.02  |
| 2004 | 14.34 | 26.36 | 22.41 | 0.11  | 0     | 0     | 0    | 0    | 0    | 63.22  |
| 2005 | 10.16 | 12.07 | 14.54 | 2.39  | 0     | 0     | 0    | 0    | 0    | 39.15  |

## Relative Mortality



Weakfish Relative Abundance  
(Mean Catch / Tow)

# 30 - 40

# 40 - 80

# 80 - 190

# 190 - 250



Smyrna River

Leipsic River

Murderkill River

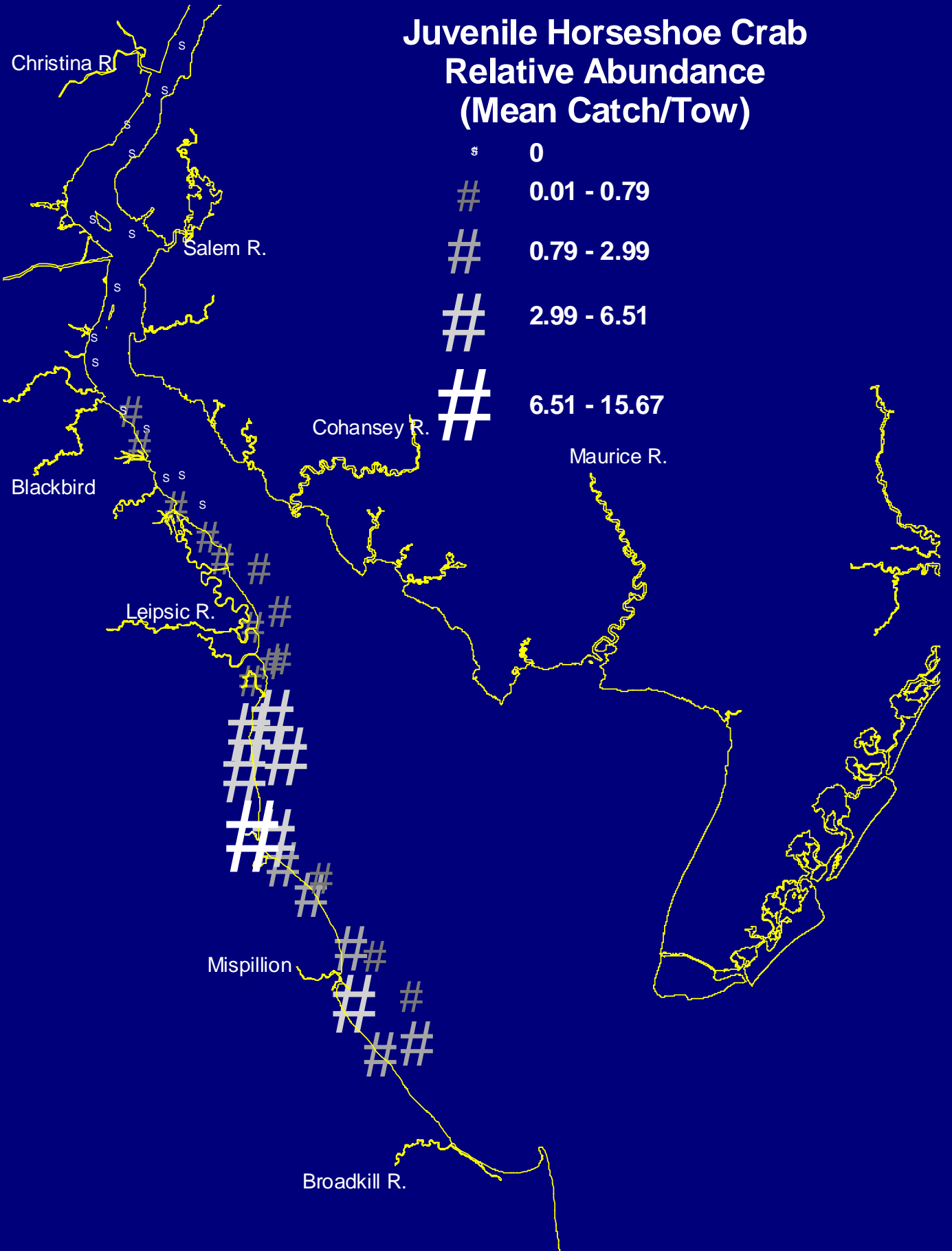
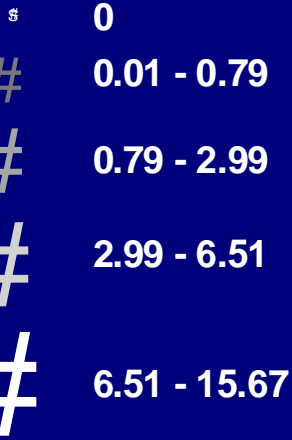
Mispillion River

Broadkill River

Cohansey River

Maurice River

# Juvenile Horseshoe Crab Relative Abundance (Mean Catch/Tow)





- Fishery-independent abundance indices
  - Expensive
  - Less bias
- Identify essential habitat
  - Permitting issues
  - Sanctuaries
- Evaluate impacts of regulations
- Monitor changes in spp assemblages
  - Seasonal
  - Long-term
- Collecting platform
  - Other studies
  - Outreach





# Role for the Partnership?

- Identify similar surveys
  - State agencies
  - Universities
  - Utilities
- Assemble pertinent reports from these surveys and make available online.
  - Relatively low cost initiative
  - Useful to managers, scientists and policy makers
  - Understanding of research needs