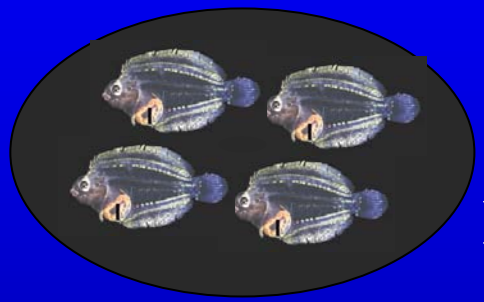
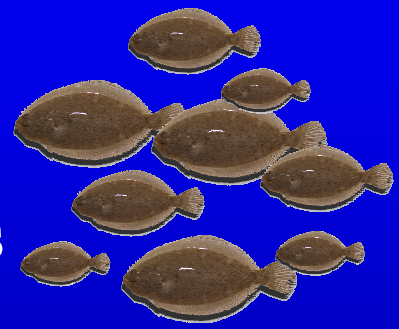
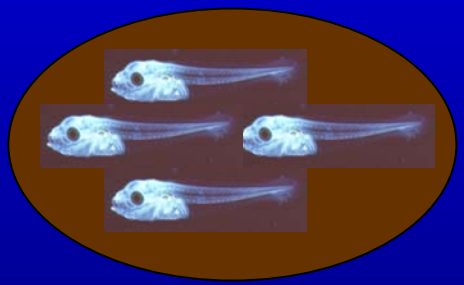
Development of a Juvenile Fish Index to assess water quality in the Inland Bays system: quantifying ingress of larval fishes through Indian River Inlet







Delaware Center for the Inland Bays
STAC meeting
Lewes, DE
Jan. 19, 2007

T. E. Targett and M. P. Rhode
University of Delaware
College of Marine & Earth Studies
Lewes, DE

INDICATORS

- Indicator species are important to management agencies tasked with monitoring and assessing trends in habitat/ecosystem health & quality

- Ideally, it would be possible to use one or more 'charismatic' species of economic and ecological importance and that are visible to the public

- **For the Inland Bays system *ideal* 'charismatic' species are those such as:**

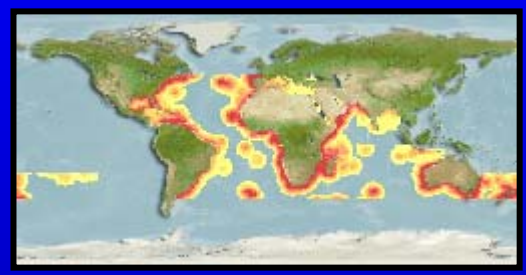
- **Summer flounder**

- **Bluefish**

- **Weakfish**

- **Atlantic croaker**

• <u>However</u>, these species (and most fish species in the Inland Bays) are part of coastwide populations and have life cycles that include portions of the year outside the bays



• Therefore, their abundance in the Inland Bays (and change over time) is to some degree due to the health of the overall coastwide stock and vagaries of larval supply, and <u>not</u> solely to the health & quality of the Inland Bays system

• This problem was considered years ago by the STAC and managers of other systems have similarly had to confront the same issue

• In order to have indicator organism(s) whose population status reflects environmental conditions inside the ecosystem of interest we have had to select resident species that have their entire life cycle there

• For the Inland Bays system, and other regional estuaries, this means fish such as:

• mummichogs and gobies

- First of all
  - These resident species are generally very hardy
  - Tolerant of environmental extremes
  - As such they're not the best indicator organisms

- Secondly
  - There is a disconnect between a) assessment of status and trends in environmental health & quality and b) response of species with economic and ecological importance and that are visible to the public

New Approach: Just-begun CIB Project:

Development of a Juvenile Fish Index to assess water quality in the Inland Bays system: quantifying ingress of larval fishes through Indian River Inlet

We're developing a Juvenile Fish Index (JFI) for several non full-time resident fish species that can be used as an index to assess trends in water quality in the Inland Bays system

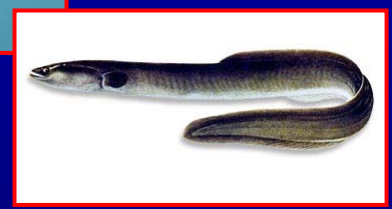
We've chosen:

Summer flounder

Atlantic croaker

Atlantic menhaden

Spot



American eel

- All of these species spawn out on the continental shelf and their larvae enter the Inland Bays system through Indian River Inlet

- We're sampling larval fish (weekly) moving into the Inland Bays through Indian River Inlet

- Larval abundance (recruitment) estimates will be used to scale subsequent juvenile abundances estimated by DNREC trawl surveys

- **JFIs for each species will be based on juvenile abundance estimates (available from DNREC the trawl surveys* conducted by John Clark) *scaled to the strength of larval influx* (from our larval fish sampling at Indian River Inlet)**

- **JFI = (# juveniles of species A / # larvae of species A)**

- **More specifically:**

$$\text{JFI} = \frac{\int \#\text{ juveniles of species A caught per min trawling}}{\int \#\text{ larvae of species A caught per } 1000^3}$$

*** in Herring, Love, Pepper, and White Creeks and upper Indian River**

- **This approach gets around the problem of variable coastal populations and variable recruitment affecting estimates of juvenile abundance**

AND ALLOWS

- **‘Scaled’ juvenile abundance to be used to assess status and trends in environmental health & quality for these indicator fishes in the Inland Bays system**

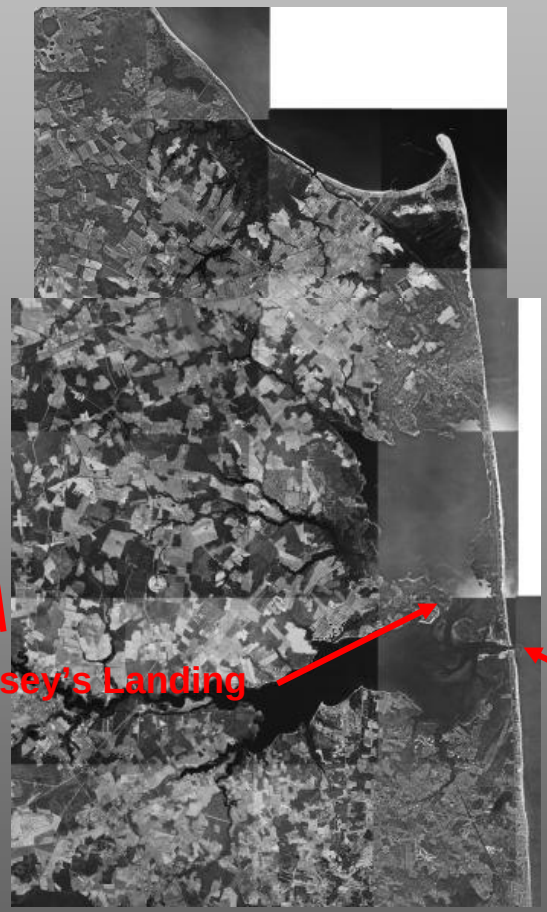
$$JFI = \frac{\int \#\ \text{juveniles of species A caught per min trawling}}{\int \#\ \text{larvae of species A caught per } 1000^3}$$

For example:

- **If JFI values show different temporal patterns than juvenile abundance, this would indicate year-to-year variability in survival within the bays overrides larval supply in determining juvenile abundance**

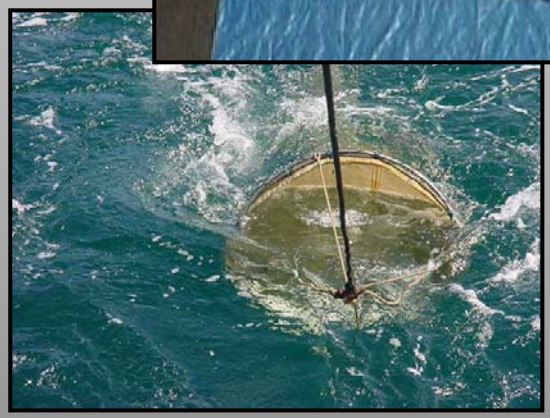
- **Increasing JFI values for a species when juvenile abundance is stable for that species would signal decreased survival in the bays for that particular species**

Indian River Inlet

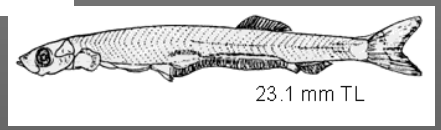


Massey's Landing

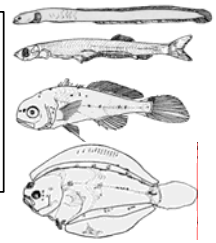
Indian River Inlet



Weekly Sampling – 3 replicate ½ h tows



Larval Fish Abundance



A. rostrata
B.tyrannus
M.undulatus
P.dentatus

1000(#Fish/m^3)

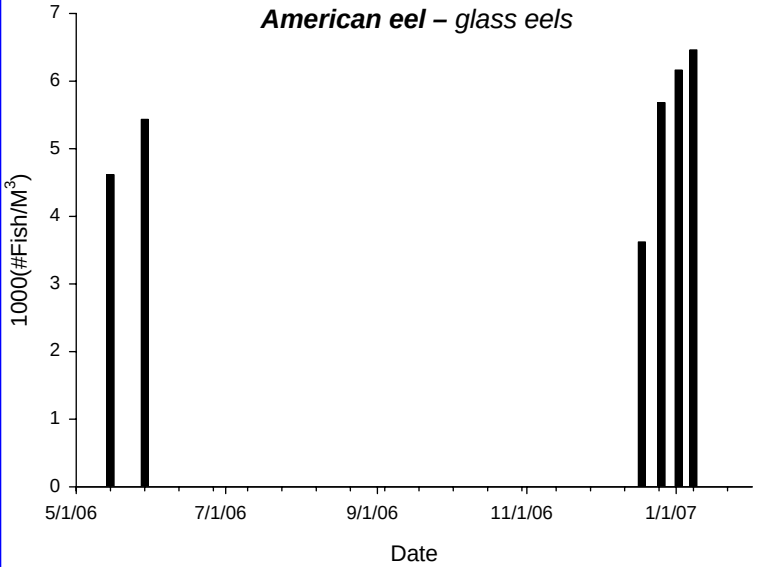
50000
40000
30000
20000
10000
0

5/1/06
7/1/06
9/1/06
11/1/06
1/1/07

Date

Anguilla rostrata

***American eel** – glass eels*

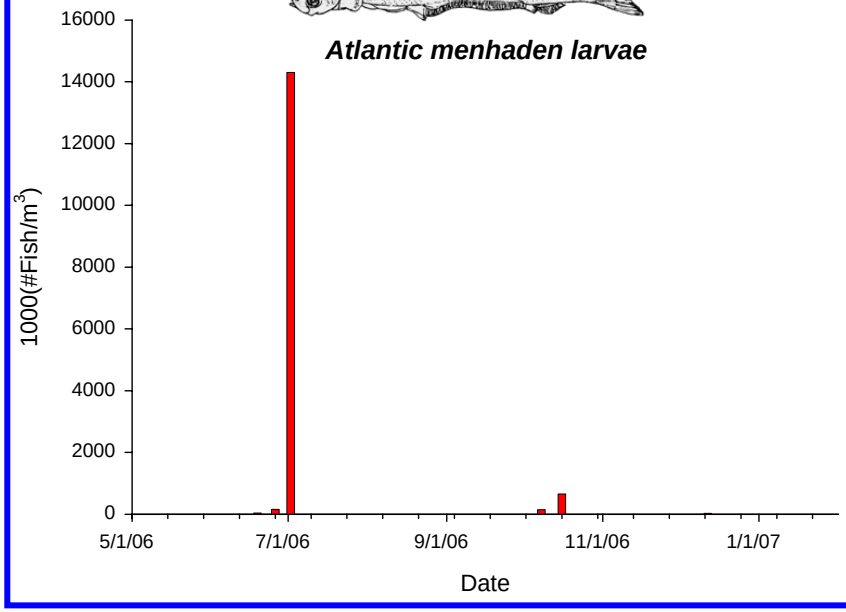


Micropogonias undulatus

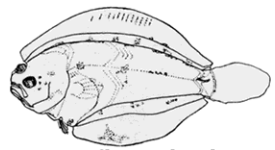
Atlantic croaker larvae

Brevoortia tyrannus

Atlantic menhaden larvae



Paralichthys dentatus



Summer flounder larvae

Interestingly, I just learned that colleagues in NC have arrived at the same conclusion and are using this technique in Pamlico Sound, NC

In Conclusion

- **This approach generates annual JFI measures (indices) for each of the target fish species that can be used in conjunction with water quality indices (e.g. dissolved oxygen, secchi disk depth, dissolved organic nitrogen and phosphorous, chlorophyll a, suspended solids) from the Inland Bays Citizen Monitoring Program to assess water quality in the Inland Bays**

- **This work will help link water quality directly to fish abundance patterns and allow assessment of potential impacts of changes in water quality indices (or combinations of indices) on fishes in the Inland Bays.**