Blue Catfish in Chesapeake Bay Tributaries: A Synopsis of Current Knowledge

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  - Electrofishing Survey
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- VDGIF
  - Electrofishing Survey
  - Creel Survey
- MDDNR
  - Electrofishing Survey: T. Groves, R. Williams, B. Williams

Overview

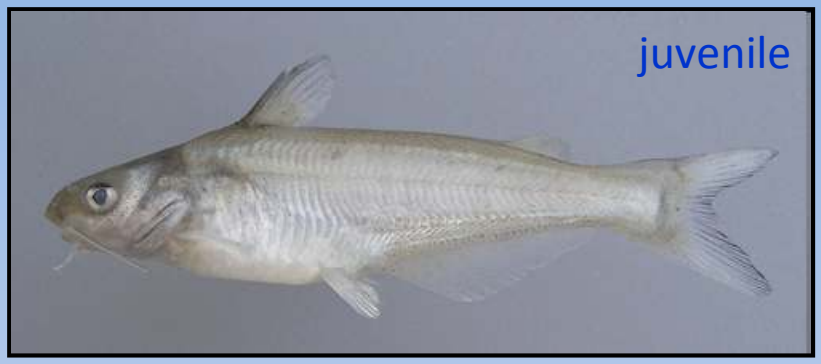
- Introduction
  - General
  - Chesapeake Bay
- Population biology
  - Distribution
  - Abundance
  - Growth / Mortality

Engbretson Underwater Photography

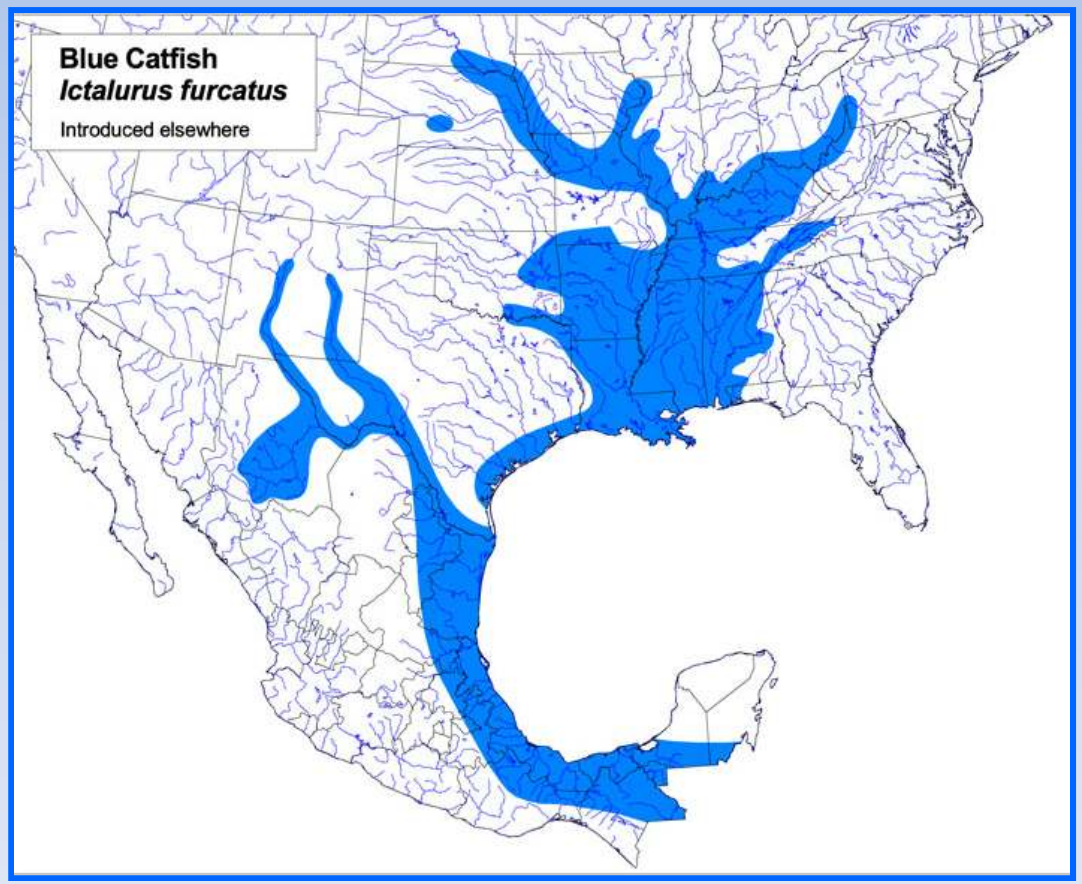
- Community interactions
  - Trophic status and feeding ecology
  - Contaminants
  - Characterization of the fisheries
- Management considerations

Ictalurus furcatus

- Identification
  - Deeply forked tail
  - Silvery-blue color
- Native to
  - Mississippi
  - Missouri
  - Ohio river basins



B. Fisher, FL Museum of Natural History



FL Museum of Natural History

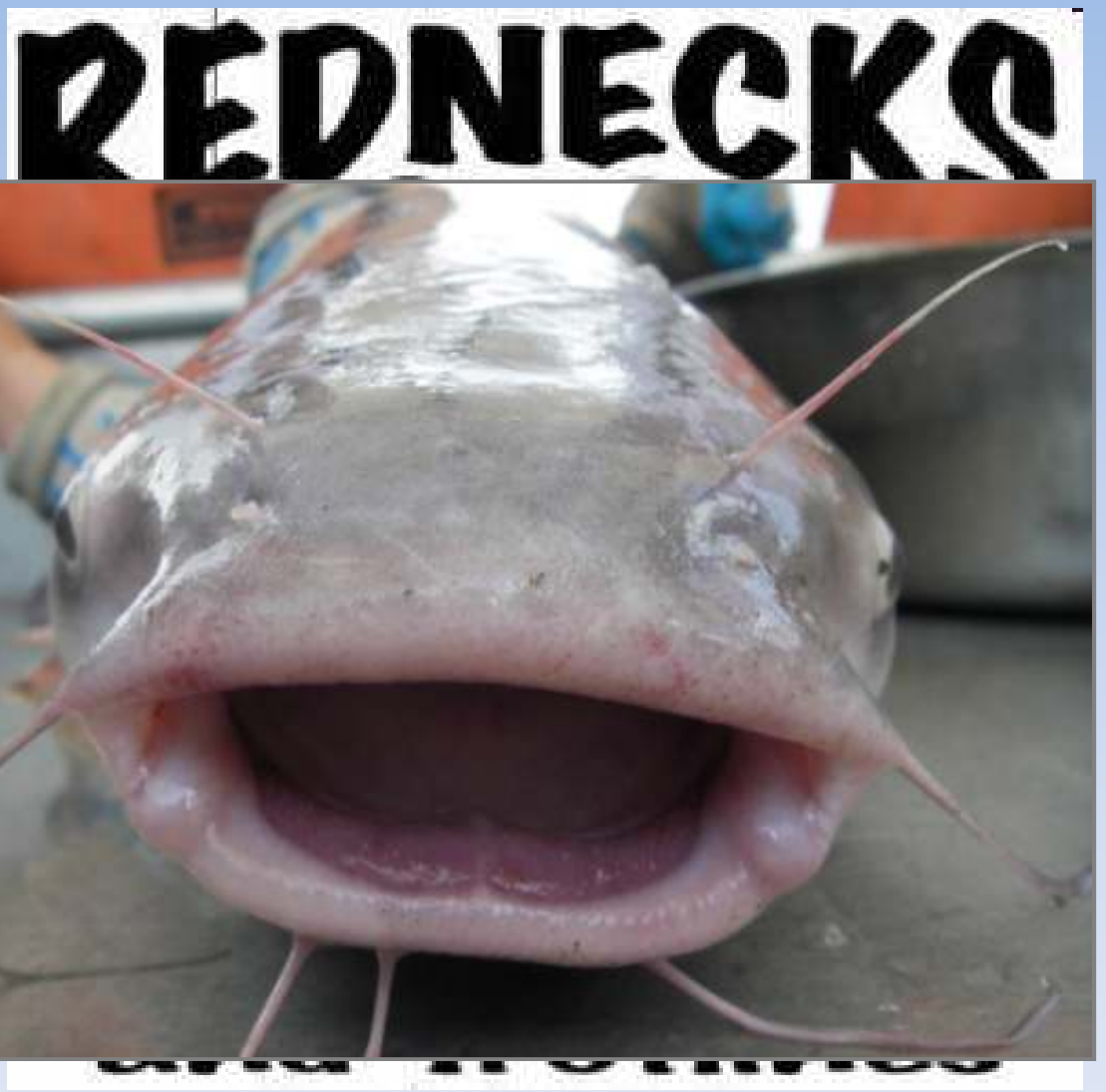
Blue Catfish

- Large, long-lived
  - 165 cm length
  - 45 kg weight
  - 20^{+} yrs age

World Record Blue Catfish
124 lbs (56 kg), 58 inches (147 cm)
Mississippi River (IL) May 2005

Blue Catfish

- Feeding strategy
  - Opportunistic
  - Generalist



VIMS trawl survey

catfishbaitsoap.com

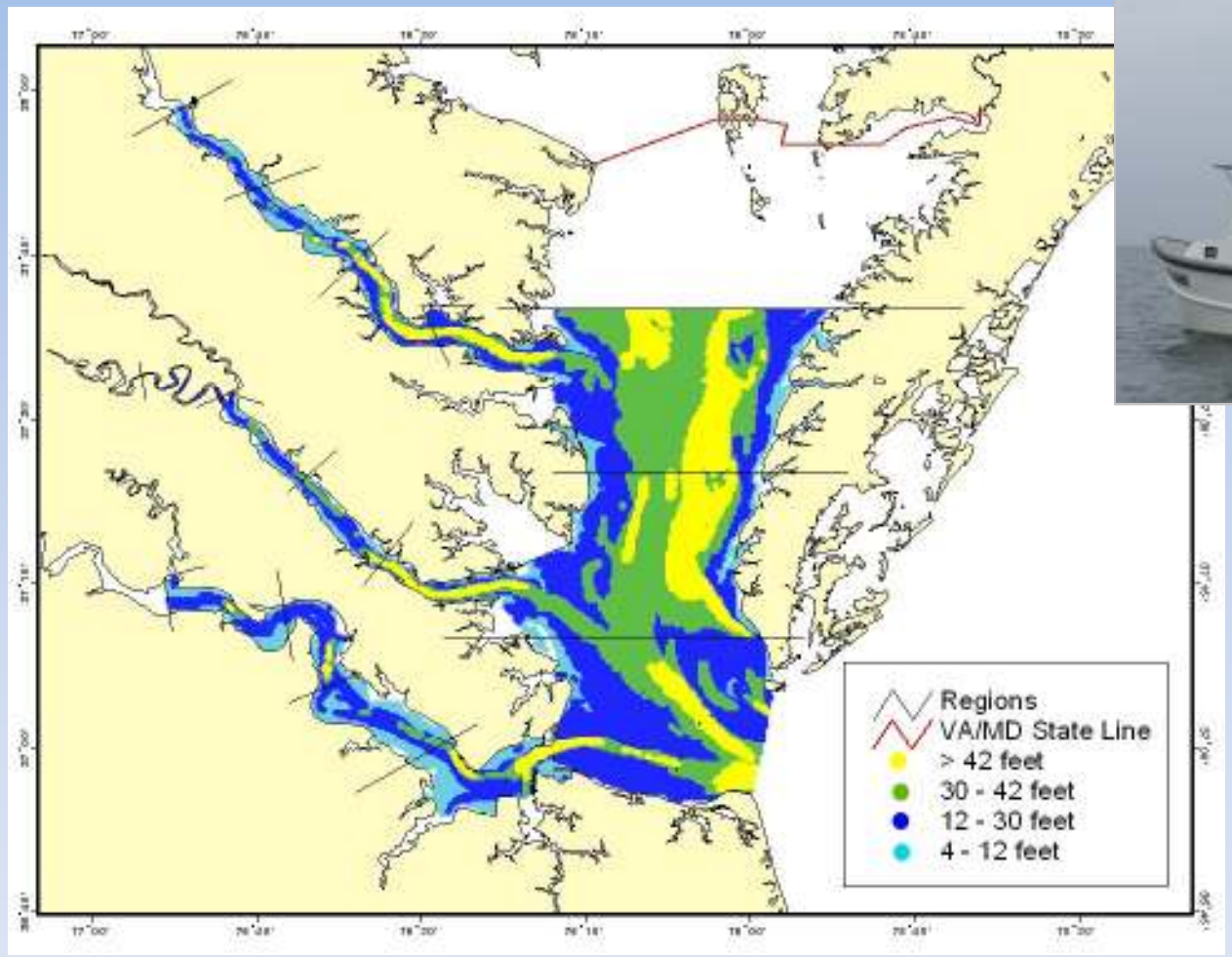
What About Blue Catfish in The Chesapeake Bay Region?

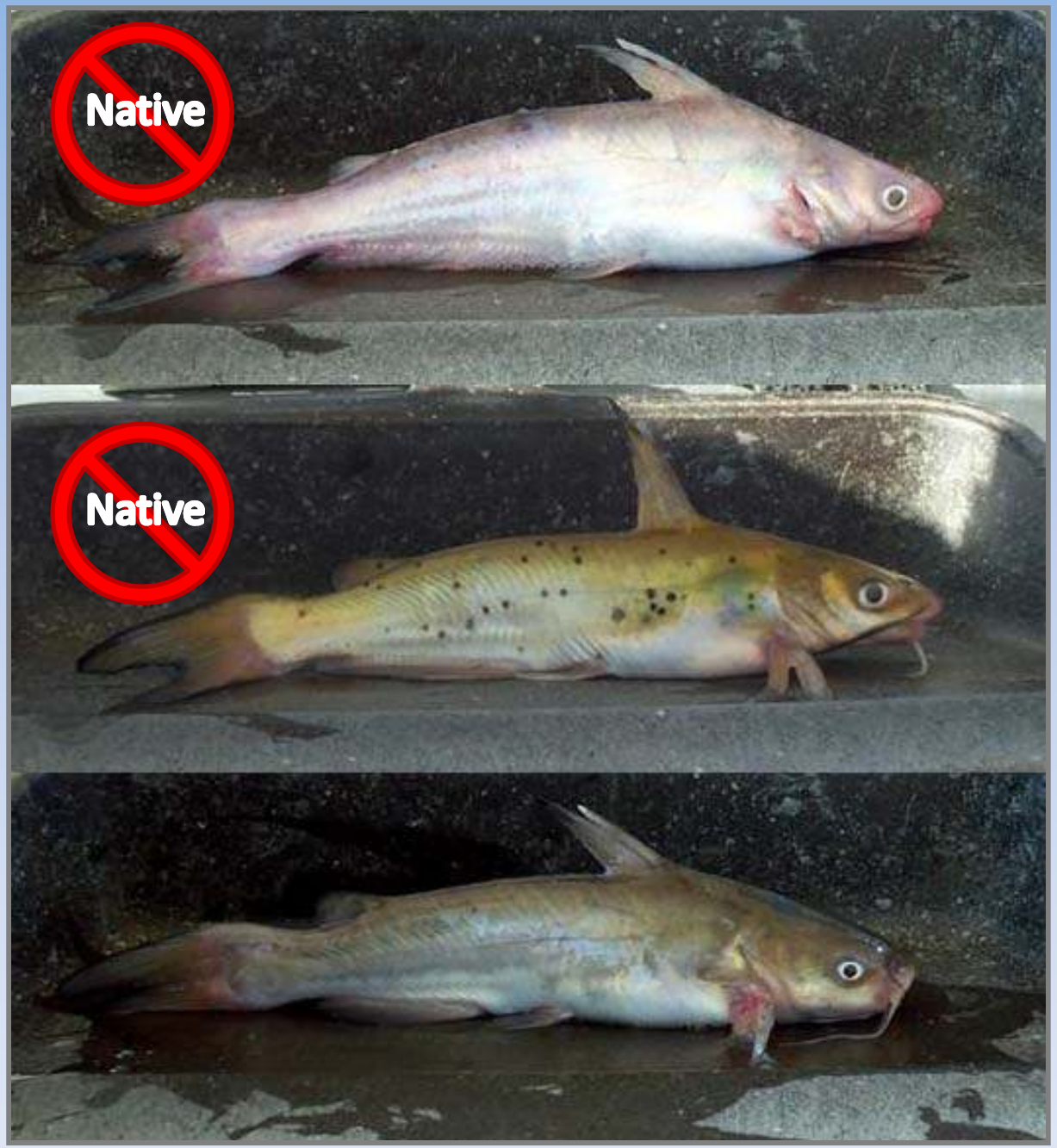
aqualandpetsplus.com

Long-Term, Fishery-Independent, Multi-Species Surveys

- Changes in population abundance
- Changes in spatial distribution of species
- Appearance and establishment of non-native species

VIMS Juvenile Fish Trawl Survey





- **Blue catfish**
  30 or more anal fin rays
  straight-edged anal fin

- **Channel catfish**
  24-29 anal fin rays
  rounded anal fin

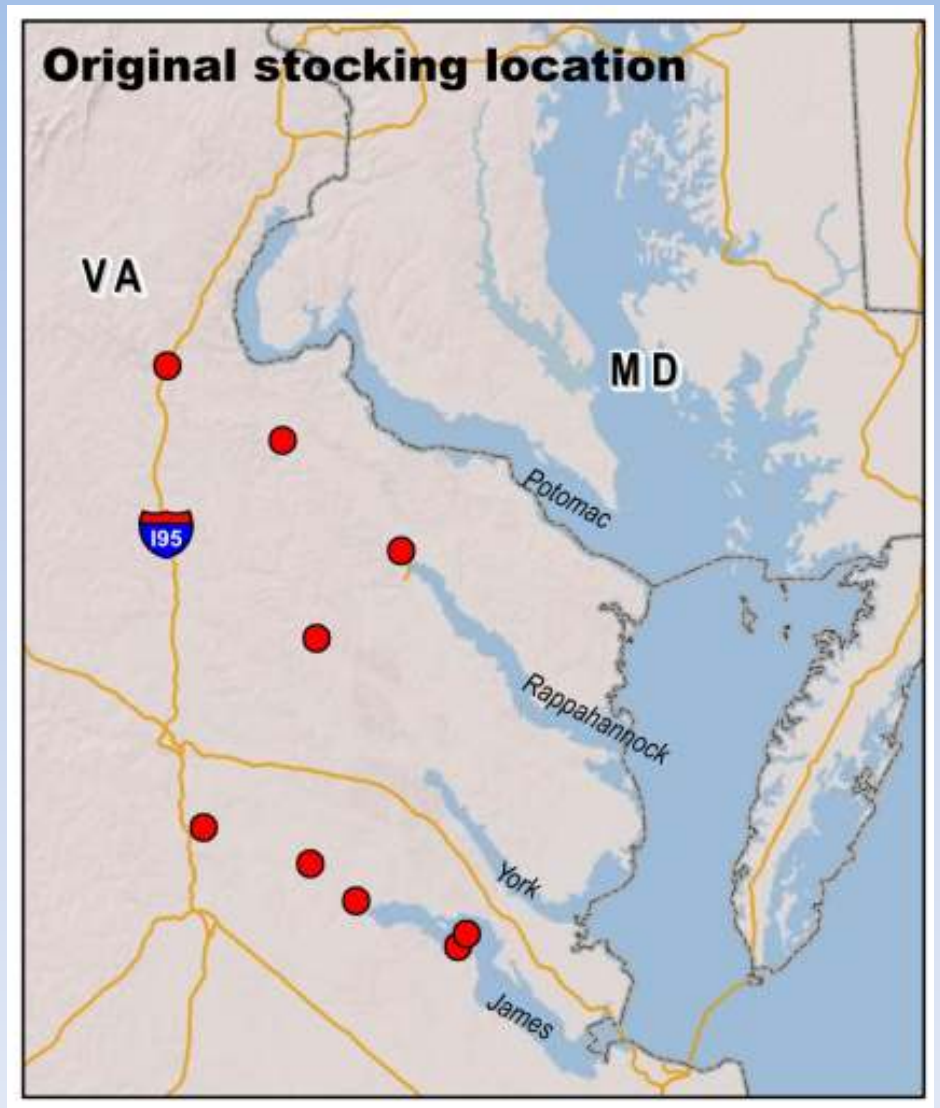
- **White catfish**
  19-23 anal fin rays
  rounded anal fin

VDGIF Electrofishing Surveys

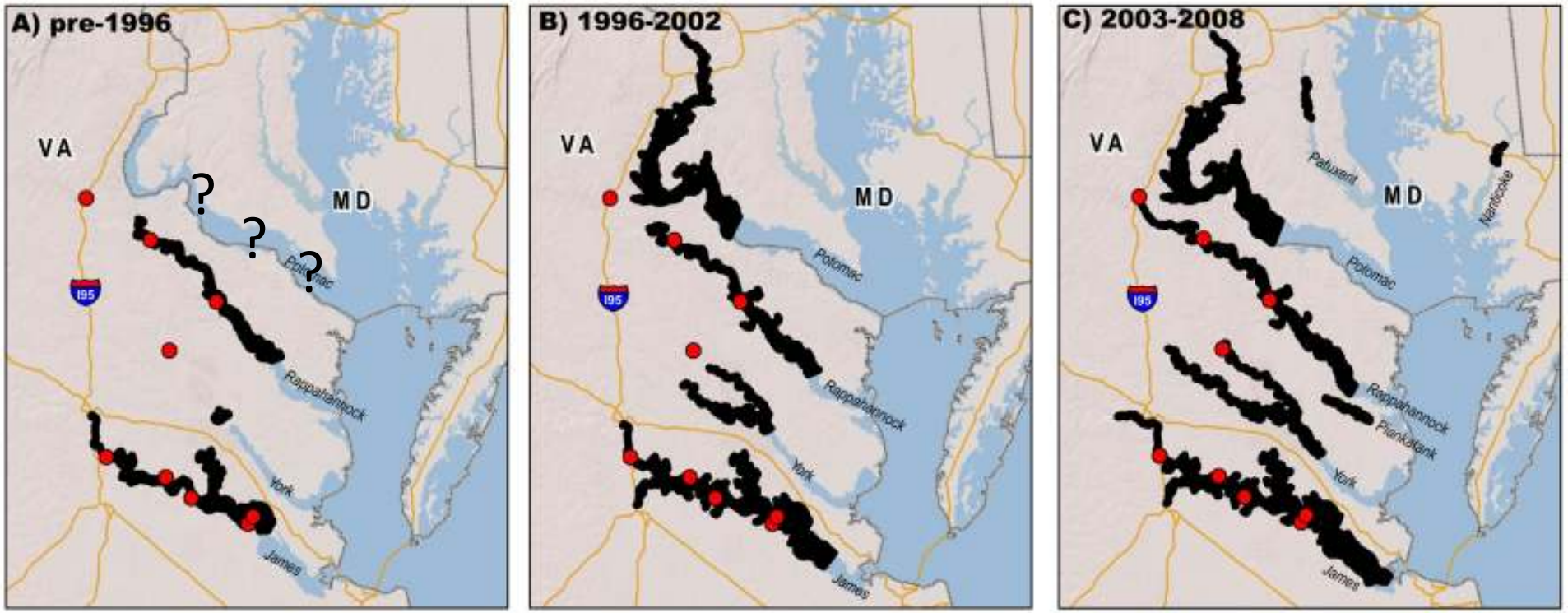
Spatial Distribution

Stocking of Chesapeake Bay Tributaries

- Mid-1970s
  - Rappahannock
  - James
- 1985
  - York



Habitat: Distribution



- Note: pre-1996 data lacking for Potomac River
- Spread coincided with abundance peaks
- Range expansion
  - Natural movement (Edmonds 2006)
  - Recreational fishers
- Susquehanna River

Habitat: Colonization Rates

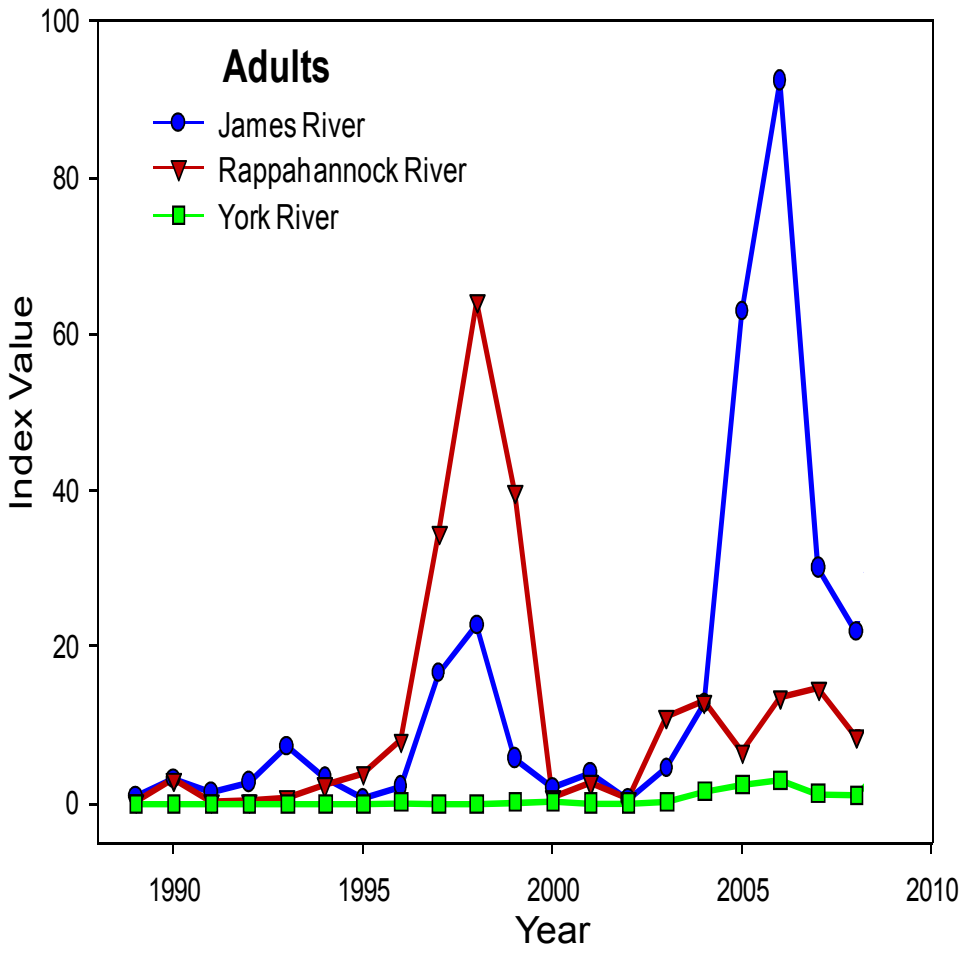
- What is the proximal stimulus for the observed down-estuary range expansion of blue catfish in coastal tributaries?
  - Understanding how & when individuals colonize new areas may be applied to newly established populations in other rivers for predicting & managing spreading episodes
- E.g., what is the influence of environmental conditions?
  - Can we use storm events to predict future spreading episodes?

Habitat: Colonization Rates

- What is the salinity tolerance of blue catfish?
  - Are fish adapting to or tolerating higher salinity?
  - Are colonizing individuals coming from ‘edge’ habitats or interior habitats?
  - Does salinity tolerance vary by life stage?
- Identifying critical habitats occupied by early life stages can help focus management efforts
  - Eggs, larvae, juveniles

Relative Abundance

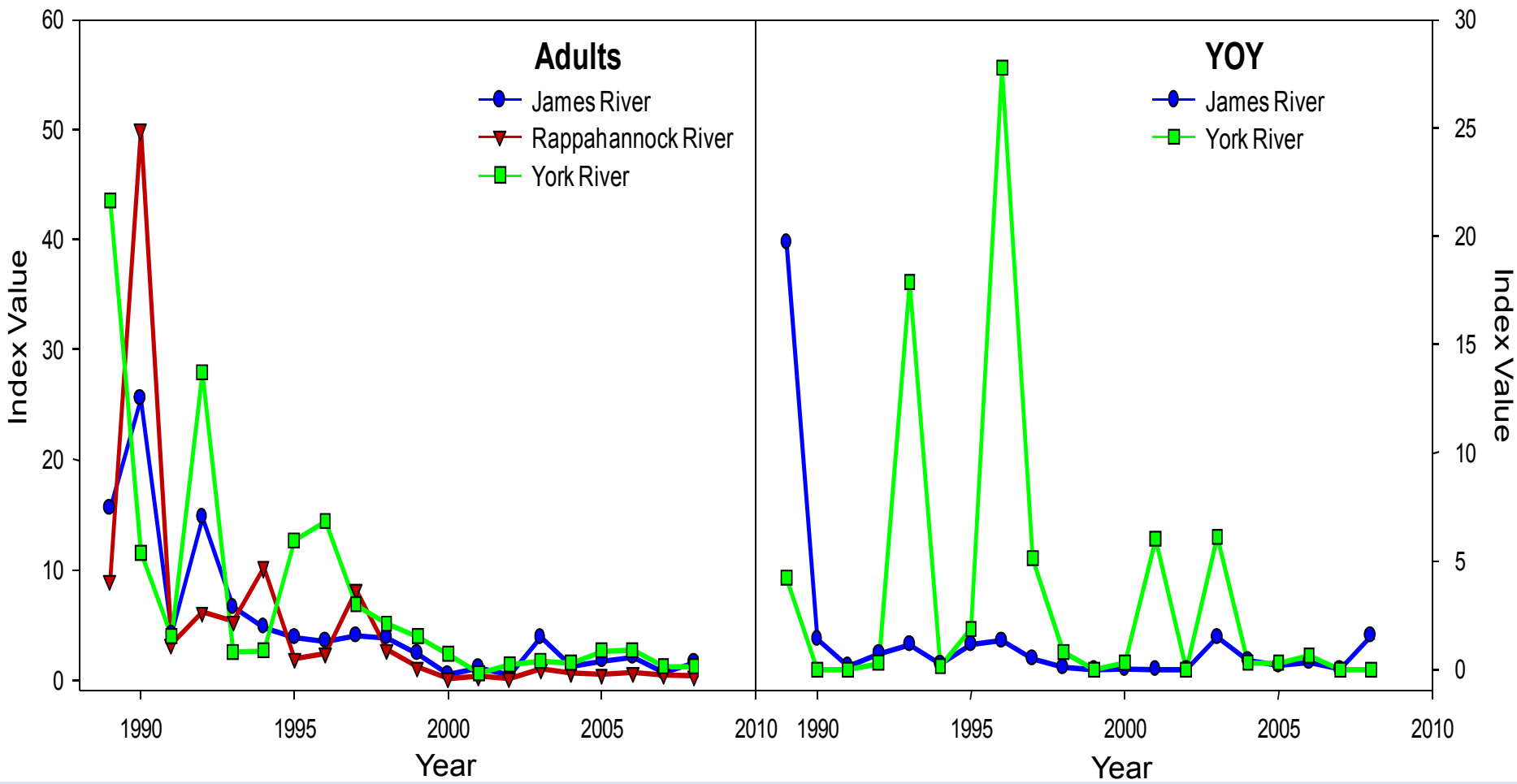
Blue Catfish Relative Abundance



VIMS trawl survey
Delta-based index

0 YOY in York River until 1997

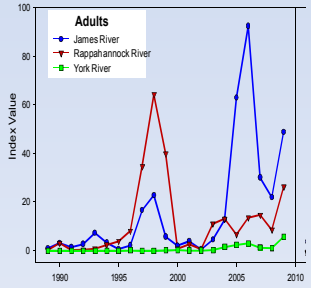
White Catfish Relative Abundance



VIMS trawl survey
Delta-based index

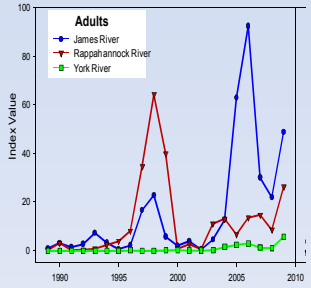
Relative Abundance

- What is the relationship between relative abundance of blue catfish and their range expansion into oligohaline and mesohaline habitats?
- What is the relative importance of estuarine vs tidal freshwater habitats to population dynamics and distribution?
  - What role do estuaries play as spawning & feeding areas?



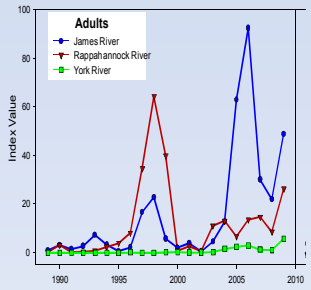
Relative Abundance

- Are abundance trends consistent among sampling domains?
  - Trawl vs electrofishing surveys
  - Validation of relative abundance indices
  - Ensuring a precise index of abundance is necessary to accurately gauge the growth of catfish populations and measure efficacy of management actions



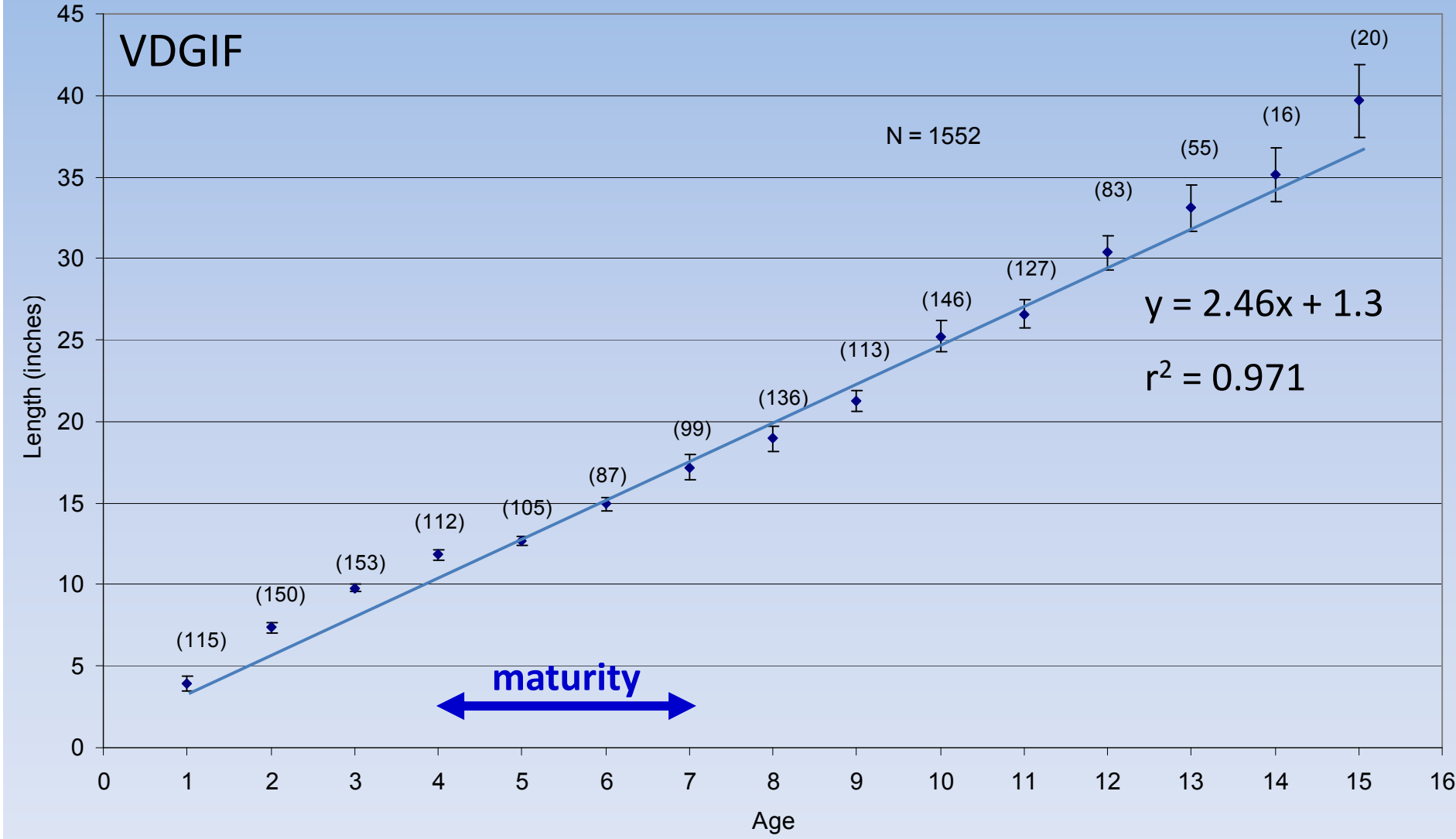
Relative Abundance

- How have blue catfish affected the abundance and distribution of native shellfish and finfish populations (esp. freshwater mussels and white catfish)?
  - Population-level effects of an increasing blue catfish population are not well described, but should be investigated to better understand ecological consequences



Vital Rates: Growth & Mortality

Mean Length at Age (+/- 95% CI)
Tidal James River, 2002 – 2008 Data



Mean Weight at Age (+/- 95% CI)
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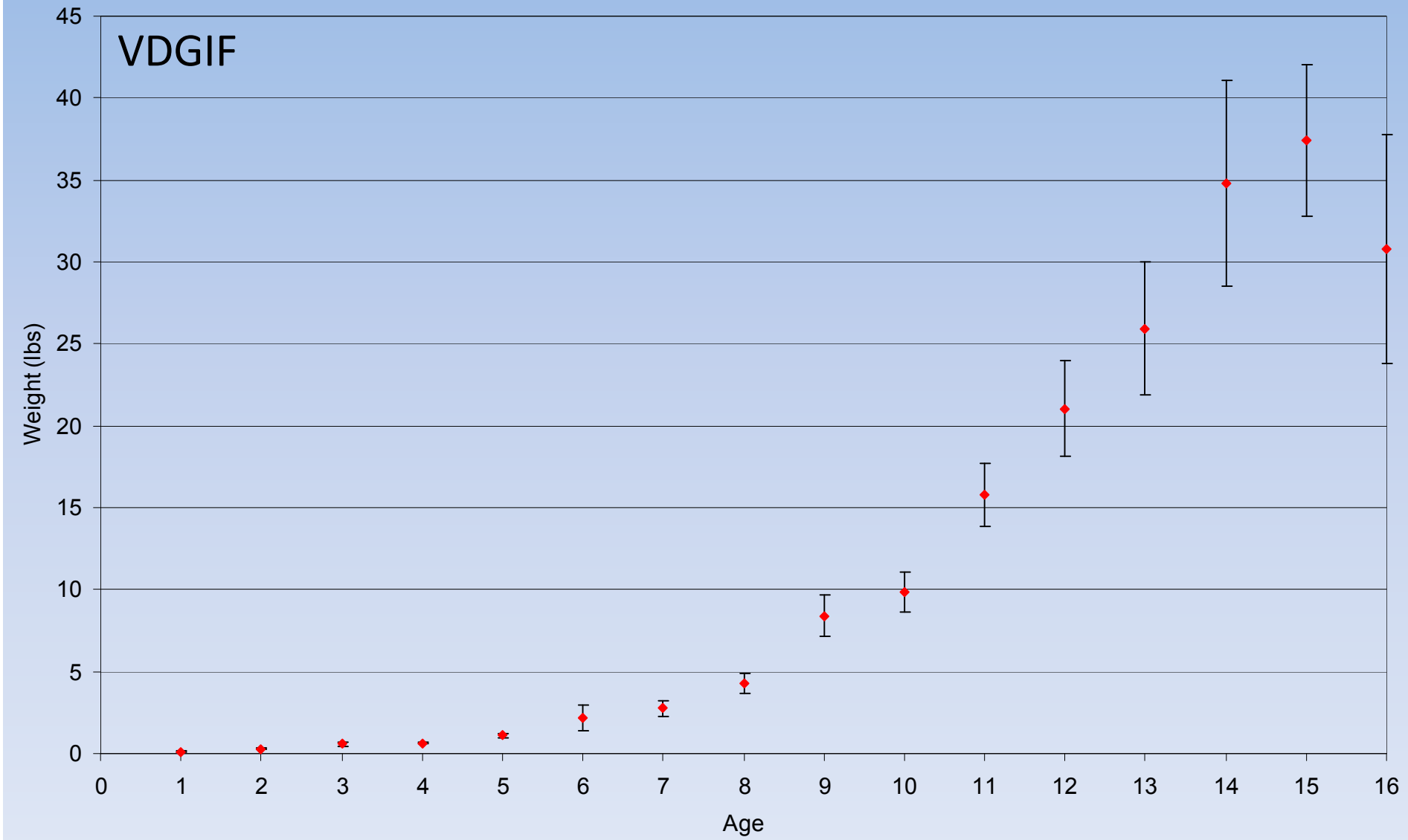


Total Annual Mortality (%)

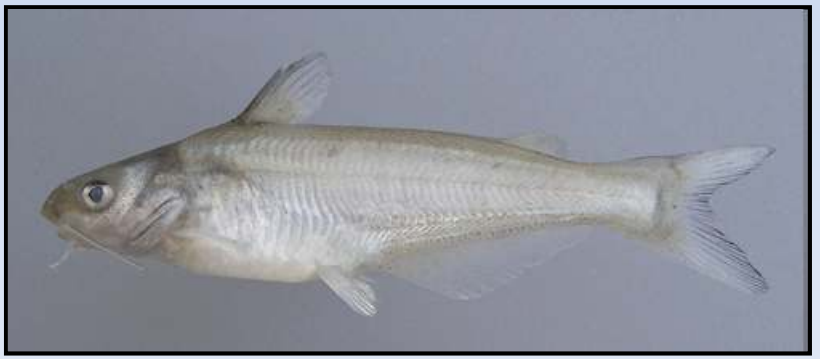
Age (yr)	James River	Rappahannock River
1 – 8	11.9	22.7
9+	31.8	42.0

- Variation in **recruitment** and differences in **annual mortality rates** suggest population structure among rivers

Total mortality (Z) estimated using catch curves, VDGIF

Vital Rates: Growth & Mortality

- Are populations in each tributary unique with respect to vital rates?
  - Identify appropriate management units



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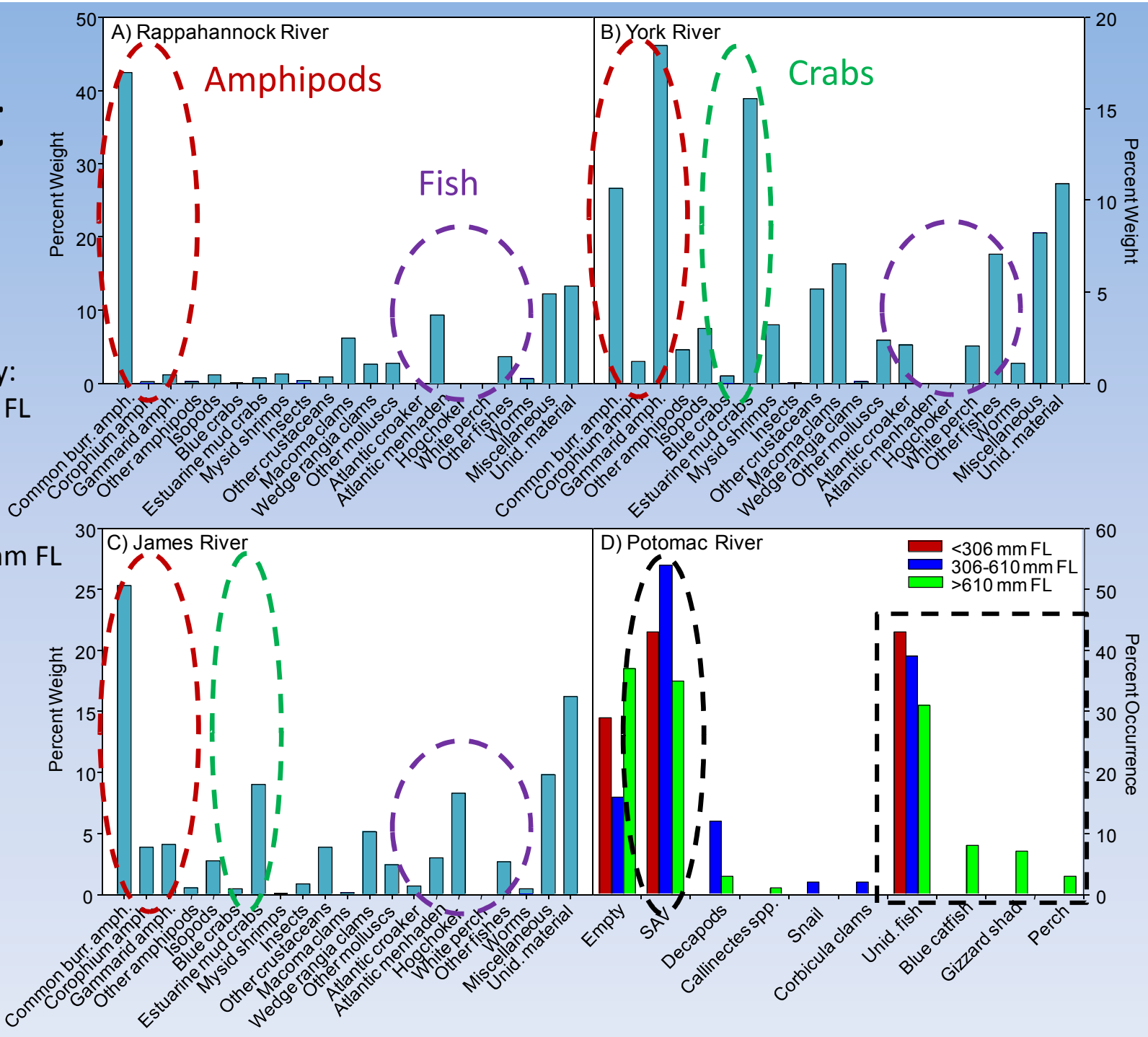
Feeding Ecology

Diet

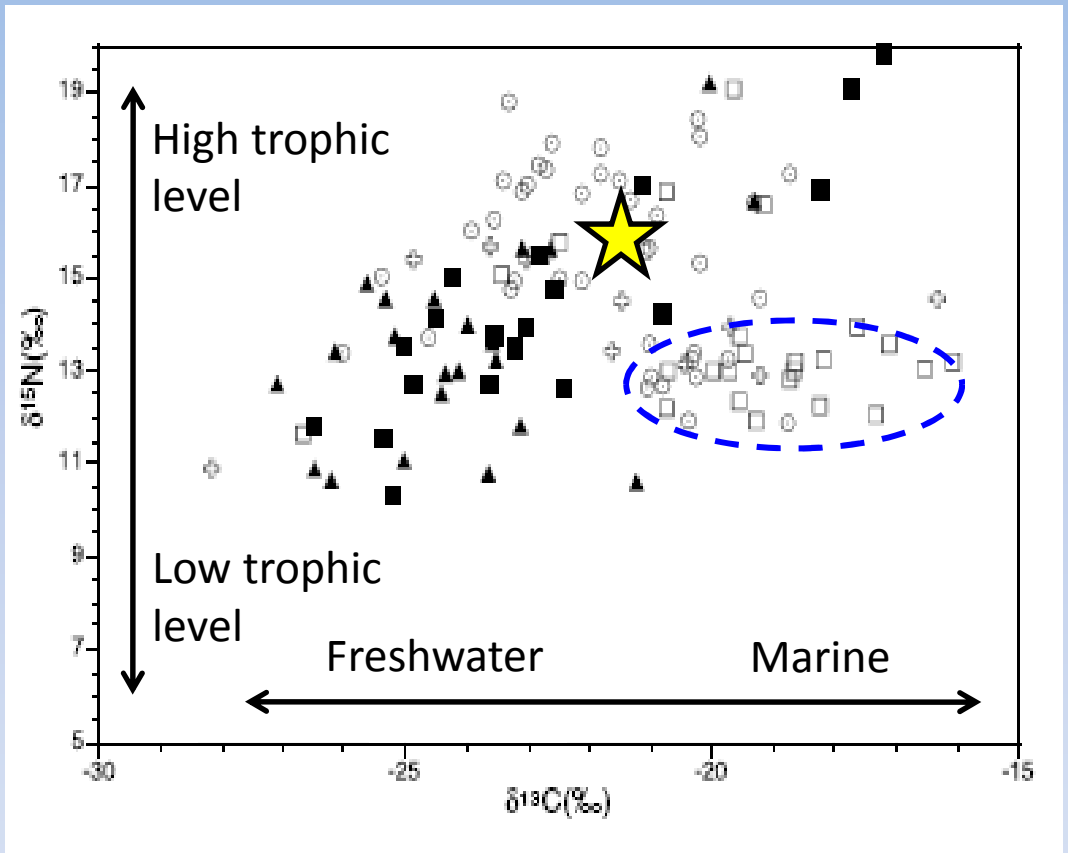
Trawl survey:
48-630 mm FL

Potomac:
101-1100 mm FL



Food Web: Trophic Ecology

- Top predators
  - Elevated ^{15}N and ^{34}S
- High proportion of marine-derived carbon from spawning alosines



(adapted from MacAvoy et al. 2009)

Key Predators of Blue Catfish

- Bald eagle

- Osprey

(Viverette et al. 2007)

- Larger blue catfish

- Humans

Feeding Ecology

- How do blue catfish diets vary seasonally, regionally, and with size?
  - low (0-6 ppt) vs high (6-18 ppt) salinity habitats
  - shallow (<4 ft) habitats
- What is role of blue catfish in aiding the spread of non-indigenous freshwater bivalves (Asian clam, *Corbicula fluminea*)?
  - Minimize negative effect of expanding blue catfish populations on other aquatic species

Feeding Ecology

- What is the condition of fish and how does environmental variability affect energetics (particularly fecundity)?
  - Dominant species by weight and number in large stretches of rivers

Bioaccumulation of Contaminants

Contaminants in Blue Catfish

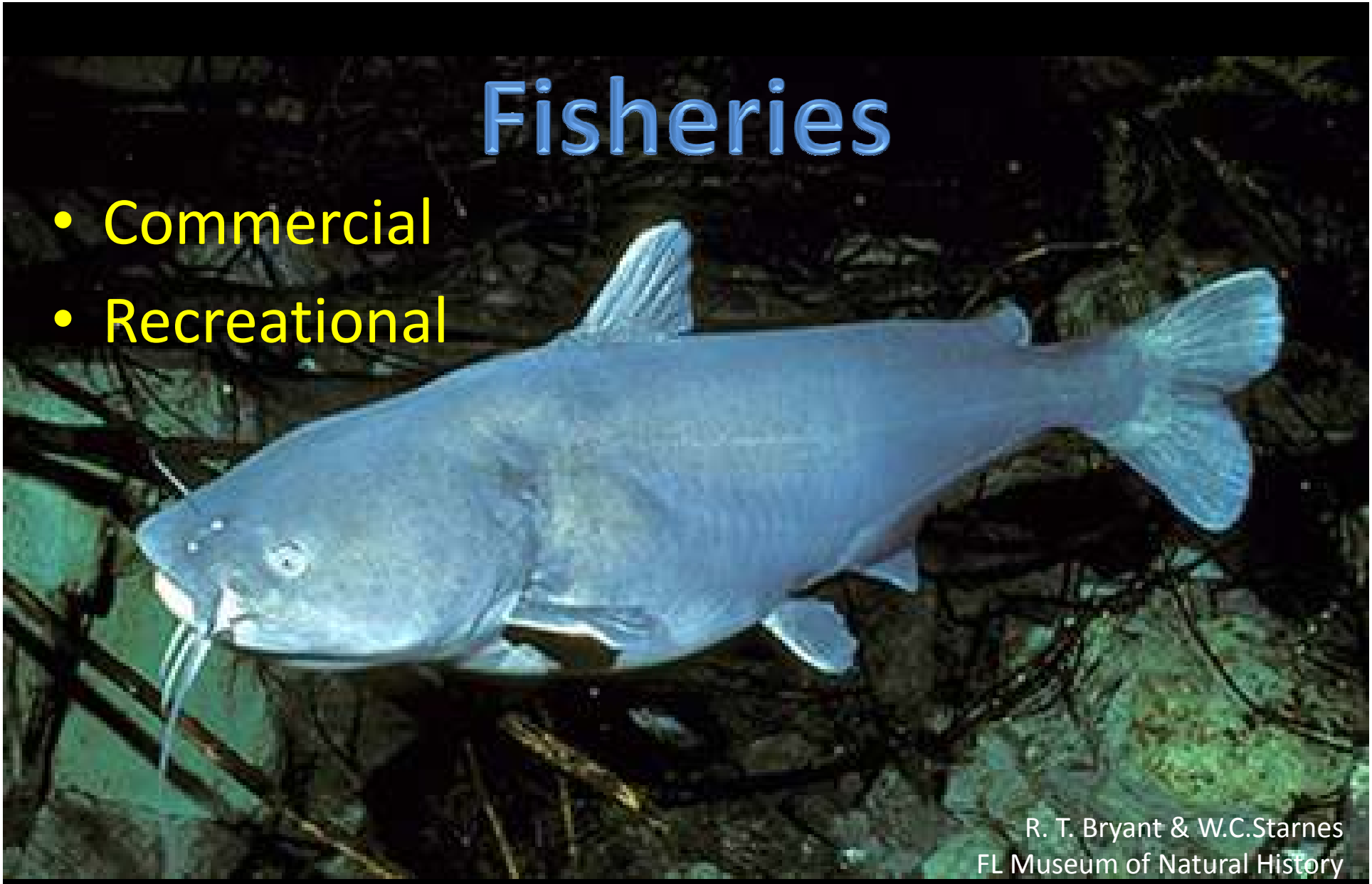
- Tidal James River:
  - PCBs, organotin compounds (e.g., TBT), DDE
  - Concentrations of PCBs in edible fillet positively correlated with size
    - Majority of fish > 600 mm TL (23.6”) exceeded 2 ppm, the FDA action level for PCB
    - [PCB] in fish < 200 mm TL (7.9”) were consistently < 2 ppm
  - Mercury risk assessment indicated no increased health risks from consumption of blue catfish from James and York rivers
- Concerns about consumption of fish > 813 mm (32”)
  - PCBs, Hg, and other contaminants (VA Dept of Health)

Bioaccumulation of Contaminants

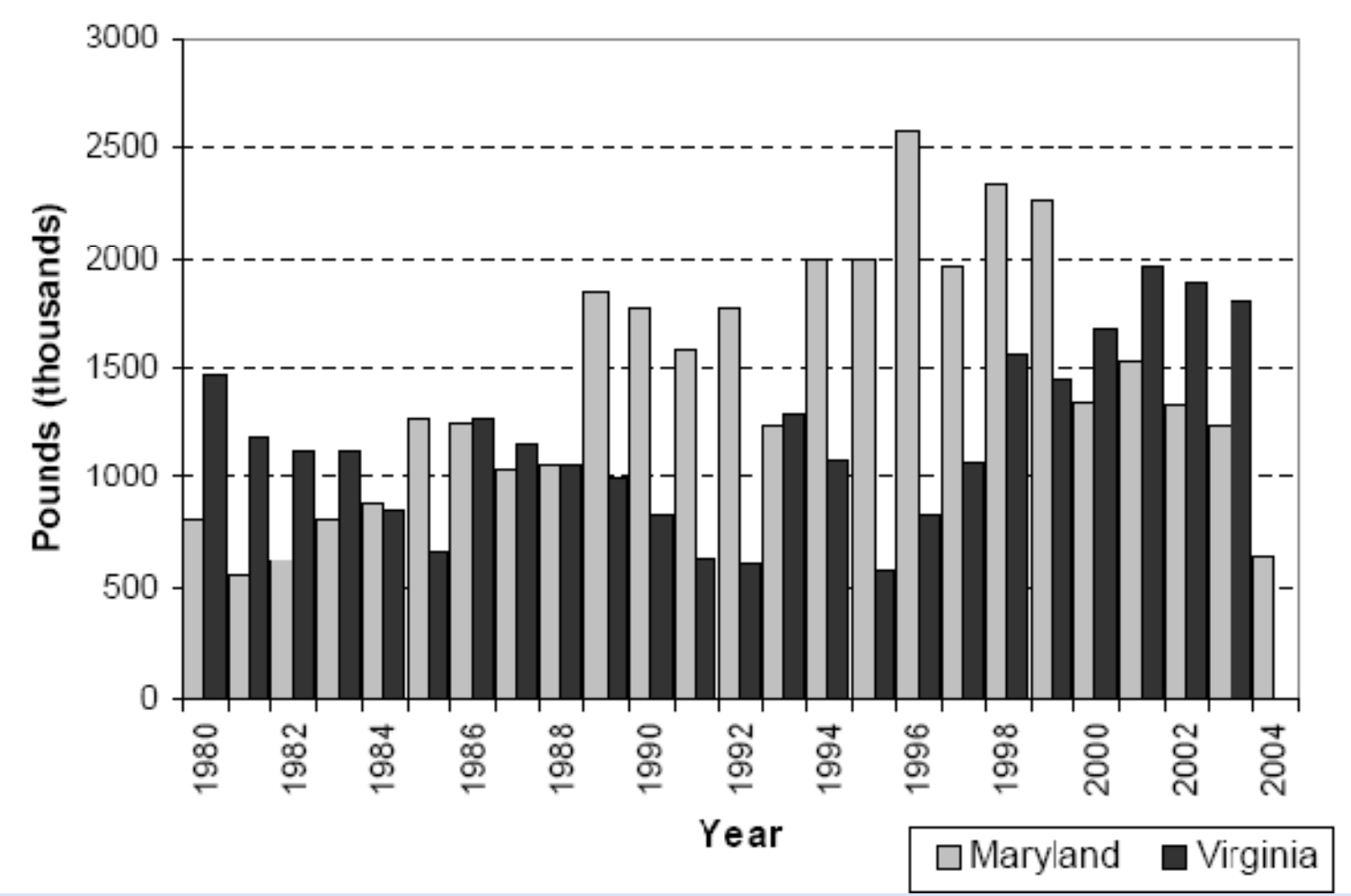
- Are harvest fisheries limited by susceptibility of individual fish to bioaccumulate toxic substances?
  - Contemporary information on the contaminant burden of fish <32” is lacking
  - Information on PCBs, TBT, and Hg in all sizes of blue catfish is needed to address consumption risks based on size limits
    - Multiple size classes to represent sizes of fish typically consumed by anglers

Fisheries

- Commercial
- Recreational



“Catfish” Commercial Landings MD & VA



Fish pots, fyke nets, haul seines, pound nets

Recreational & Trophy Fisheries

- 28% of all FW anglers target catfish
  - 7.0 million catfish anglers (7.7 million saltwater anglers)
- VA state record fish from James River: 102.25 lbs
- MD discontinued angler awards for blue catfish

Photo: L. D. Scarborough, Jr.

Fisheries

- What level of removal is required to reduce population densities, and how might this be achieved?
  - We do not know the feasibility of reducing blue catfish population abundance
- What sustains the trophy fishery?
  - Are fish recaptured multiple times?
  - What are the survival rates of larger fish?


VIMS trawl survey

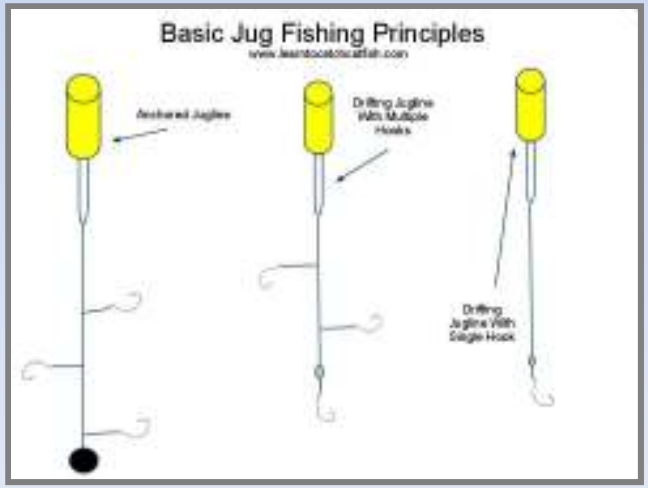
Fisheries

- What strategies may be considered to ensure continuation of both trophy fisheries and food-fish fisheries in tidal tributaries?
  - Can these goals be obtained simultaneously?


VIMS trawl survey

Management Considerations – 1a

- Recognize that eradication of established populations is not feasible
  - Little information on response of blue catfish to eradication or control attempts
    - Jug lines effectively sample large blue catfish
      - larger than those collected by electrofishing or gillnets
  - Lessons from flathead catfish

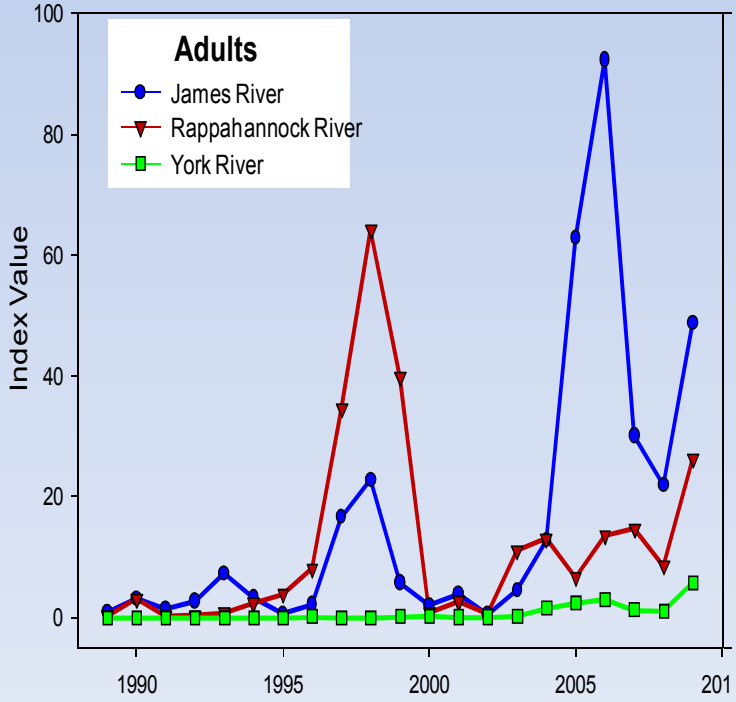


Management Considerations – 1b

- Recognize that eradication of established populations is not feasible
  - Flathead catfish:
    - Age & size structure of small populations may be altered by heavy fishing pressure (flathead populations)
    - Hand fisheries ('noodling') are effective in removing larger, mature fish from small populations (flathead)
    - Repeated EF removals are effective for some newly established populations (flathead)
      - But populations respond by earlier maturity and higher recruitment
      - AND, repeated EF removals are unsustainable

Management Considerations - 2

- Recognize population differences among blue catfish in tidal tributaries
  - Abundance, recruitment, mortality, & growth vary among rivers



Management Considerations - 3

- Promote commercial fisheries for ‘small’ blue catfish
  - Without a stock assessment, it is difficult to identify sustainable harvest levels
  - EF catch rates exceed levels reported for any catfish species by an order of magnitude
  - Consider maximum size limits to minimize human exposure to contaminants
    - Differences between federal and state action levels?

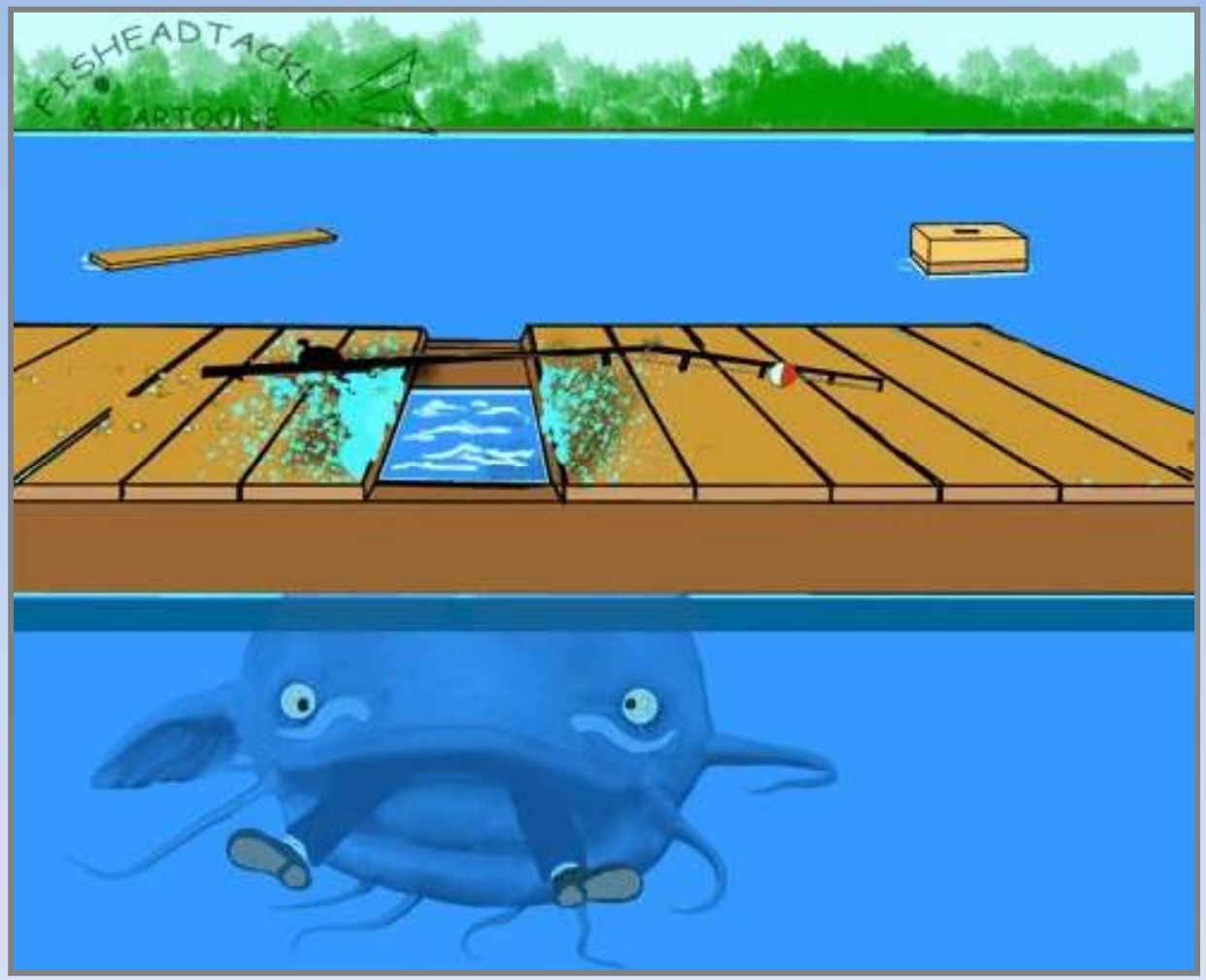
Management Considerations - 4

- Coordinate management of commercial & recreational fisheries
  - Among fisheries management agencies and agencies that administer environmental contaminants programs
  - What is the role of the trophy fishery?
    - Different in MD and VA
    - Upper James nationally recognized

Management Considerations - 5

- Control the spread of blue catfish populations in tidal tributaries
  - Education campaigns
  - Understand necessary environmental conditions that promote spread
    - May help to predict when and where spatial expansions might occur
  - Adaptive regulations that focus harvest activities on colonizing individuals may prove fruitful

Questions?



Blue Catfish Consumption Advisories for VA Waters

- James (PCB)
  - Do not consume blue catfish ≥32”
  - Max of 2 meals/month of blue catfish <32”
- York (Hg)
  - Max of 2 meals/month
- Rappahannock (PCB)
  - Max of 2 meals/month

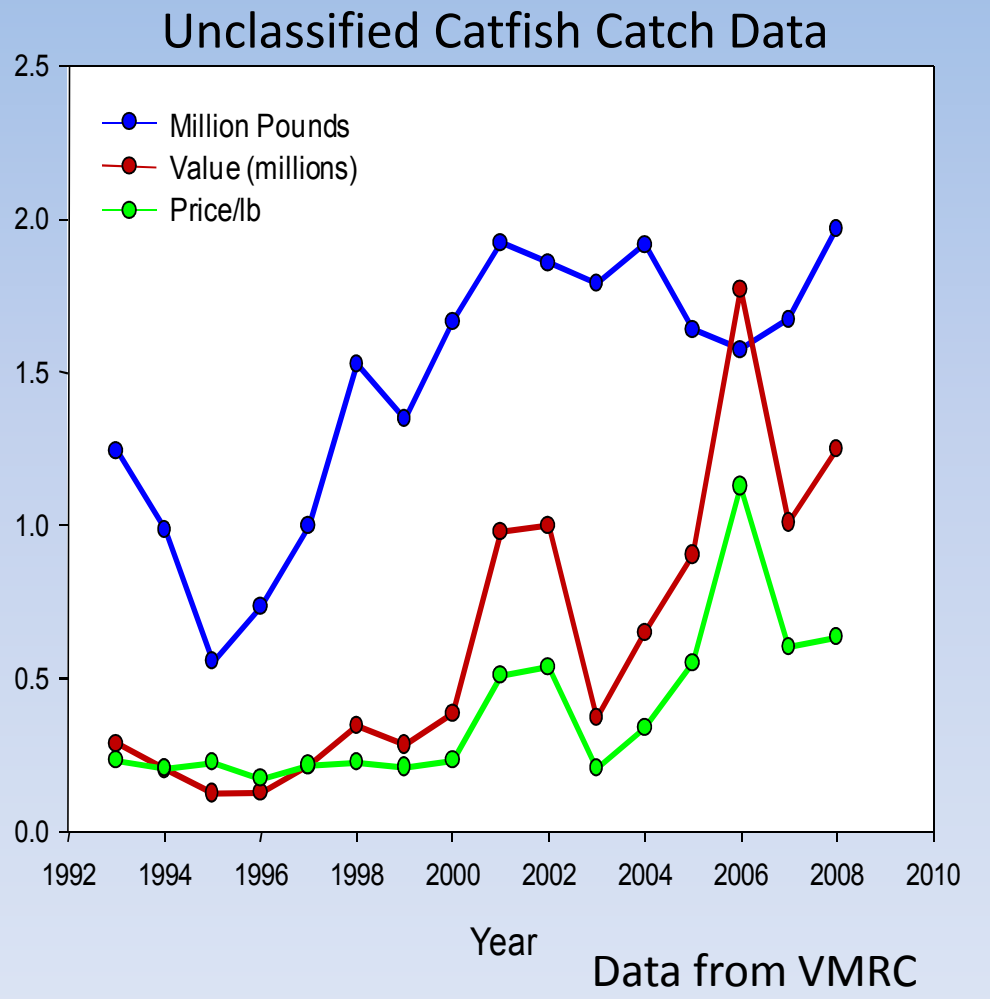

VIMS trawl survey

Use of Estuarine Habitats by Freshwater Fishes

- Estuarine portion of tributaries
  - Higher productivity
  - More complex food webs
- Largemouth bass in Mobile delta (Norris et al. TAFS 2010)
  - Abiotic & biotic factors differed greatly between habitats but growth, condition, and survival were not adversely affected
    - Better growth & condition in downstream reaches: availability of marine-derived food resources?
  - Management implications:
    - fish in oligohaline habitats may exhibit different energetic strategies (hence, growth, recruitment, and survival) and as such, warrant treatment as separate subpopulations

Commercial Harvest, VA

- Blue catfish landings
  - Mid-2000s: 20-30,000 lbs
  - 2008: 160,000 lbs
- Unclassified landings
  - ≈2 million lbs
- Market value
  - $0.21-$1.13 per pound
  - >$0.5 million each year



Data from VMRC

Recreational Fishery, VA

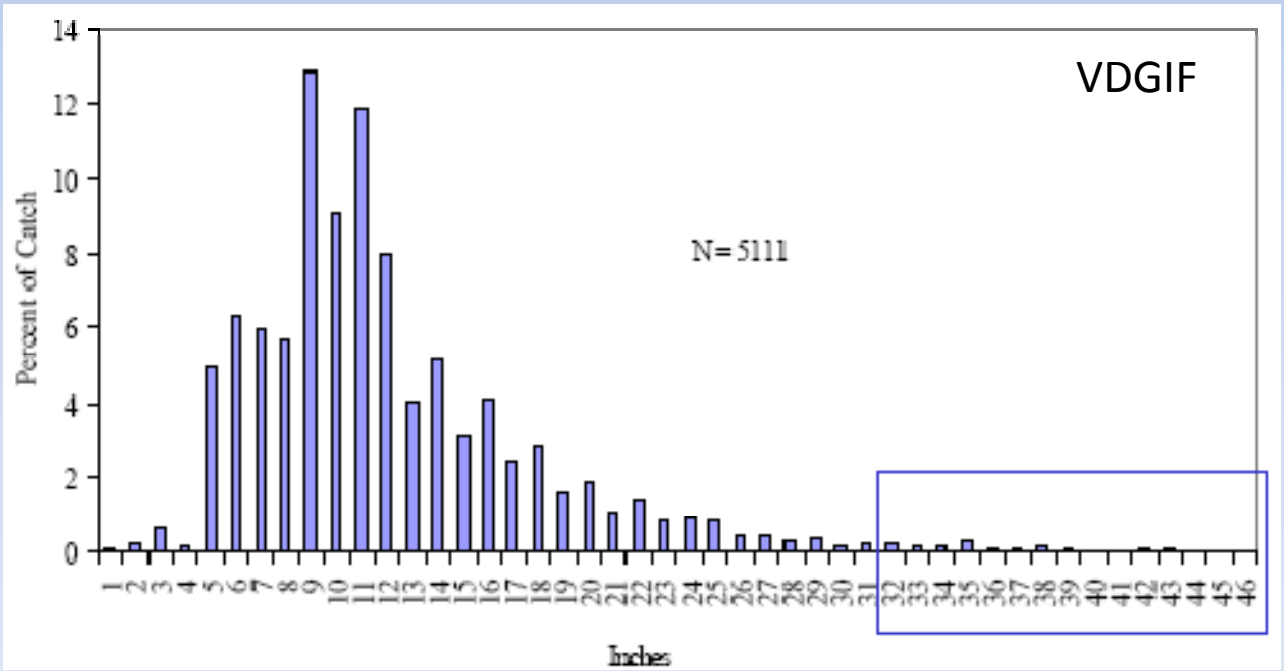
- VDGIF creel survey, James River
  - Mar-Nov 2002
  - 516,038 angler hours
    - 34% of effort at catfish
  - 49.2% targeted trophy fish
- $2.6 million generated by James River catfish fishery
  - Excludes nighttime & bank fishers


VIMS trawl survey

Trophy Fishery in Virginia

- 102.25 lbs = state record fish from James River
  - May 2009
- Trophy fish (>32”) constitute <2% of blue catfish population in the James and <1% in other rivers

Photo: L. D. Scarborough, Jr.



Trophy Fishery in Maryland

- DNR discontinued angler awards for blue catfish
- Concerns with expanding fisheries and contaminants

Trophy Fishery