

# **Polybrominated Diphenyl Ethers (PBDEs) in Fish from the Delaware Estuary**

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Delaware DNREC**

# Acknowledgements

- Coauthors:
  - Gary Buchanan, NJDEP
  - Bruce Ruppel, NJDEP
- Data:
  - DNREC
  - NJDEP
  - Jeff Ashley, Phil U and ANS (eel data)
  - Ron Hites, Indiana University (salmon data)
  - Sonya Lunder, EWG (SF Bay striped bass data)
- Mapping:
  - Dave Wolanski, DNREC

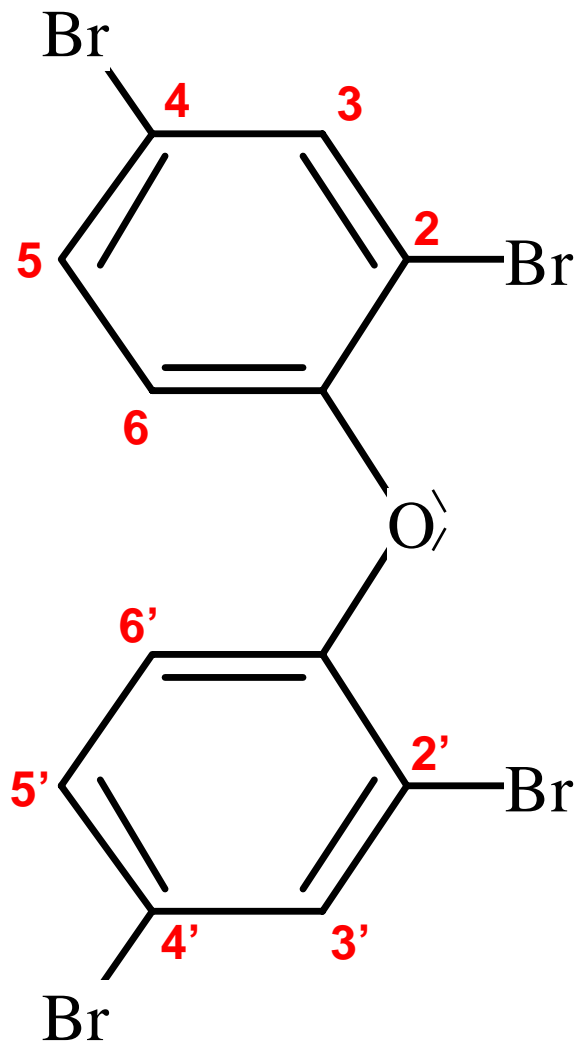
# Presentation Topics

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- **PBDE basics (structure, properties, uses, and distribution)**
- Sample description
- PBDE results
- Comparison to other results
- Future research

# PBDE Structure & Properties

## 2,2',4,4'-Tetrabromodiphenyl Ether (BDE-47)



- Organohalogenes
- $C_{12}H_{10-x}Br_xO$  ( $X=1-10$ )  
209 possible congeners
- Hydrophobic, (leads to increased partitioning into organic phases).
- P-C properties vary with # and position of bromines (experimental data are sparse).

# Uses and Distribution

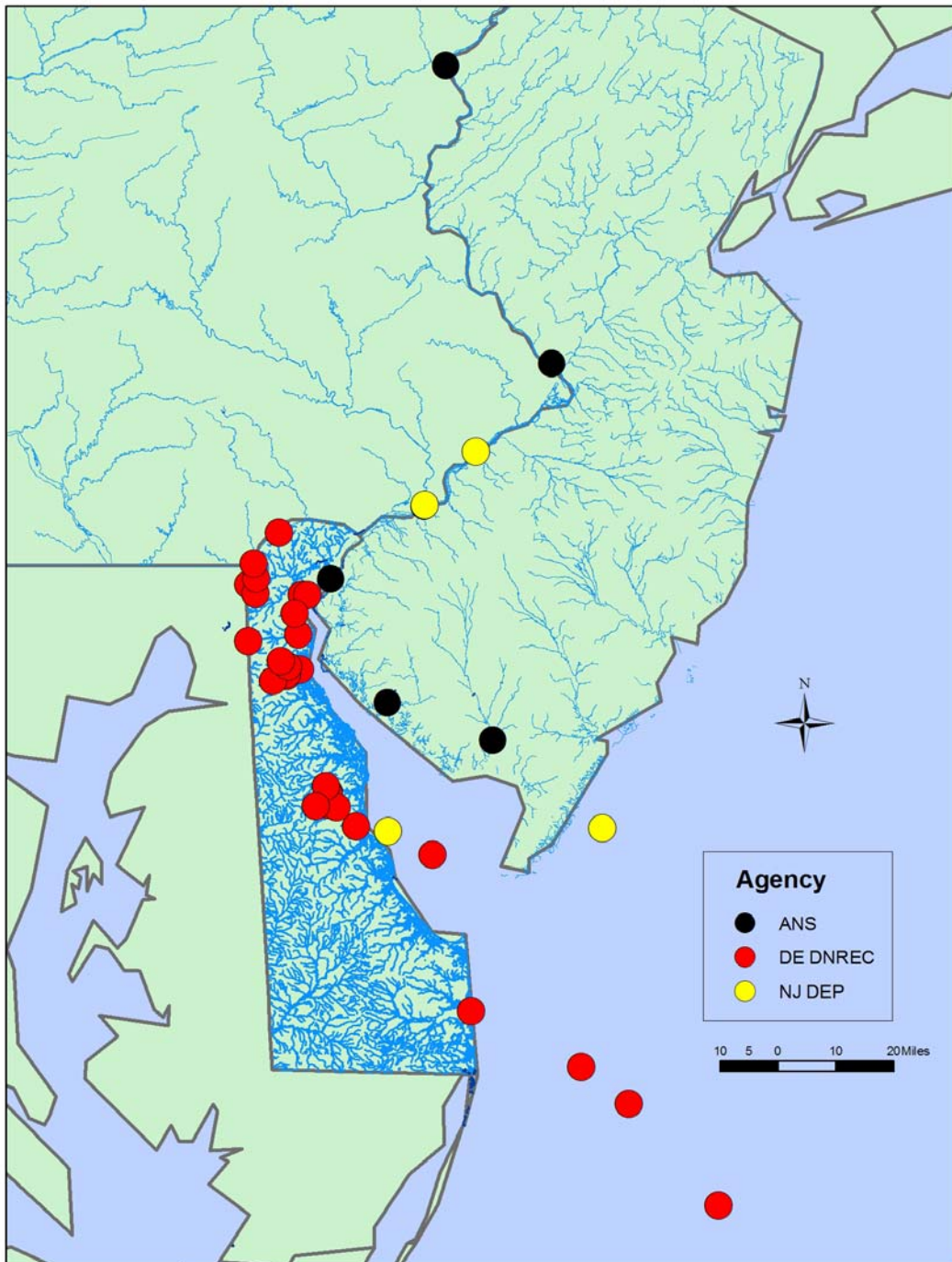
- Introduced ~30 yrs ago. Currently considered an 'emerging contaminant'.
- In 1000s of consumer products as flame retardants (e.g., foam in seating, textiles, circuit boards, wire coating, etc.).
- Widely distributed in the global environment (people, bears, whales, fish, algae, air, water, ww, sludge, soil, sediment, & house dust). Increasing US trends; falling European trends.
- Manufacturing bans (penta and octa-BDE).

# Topics

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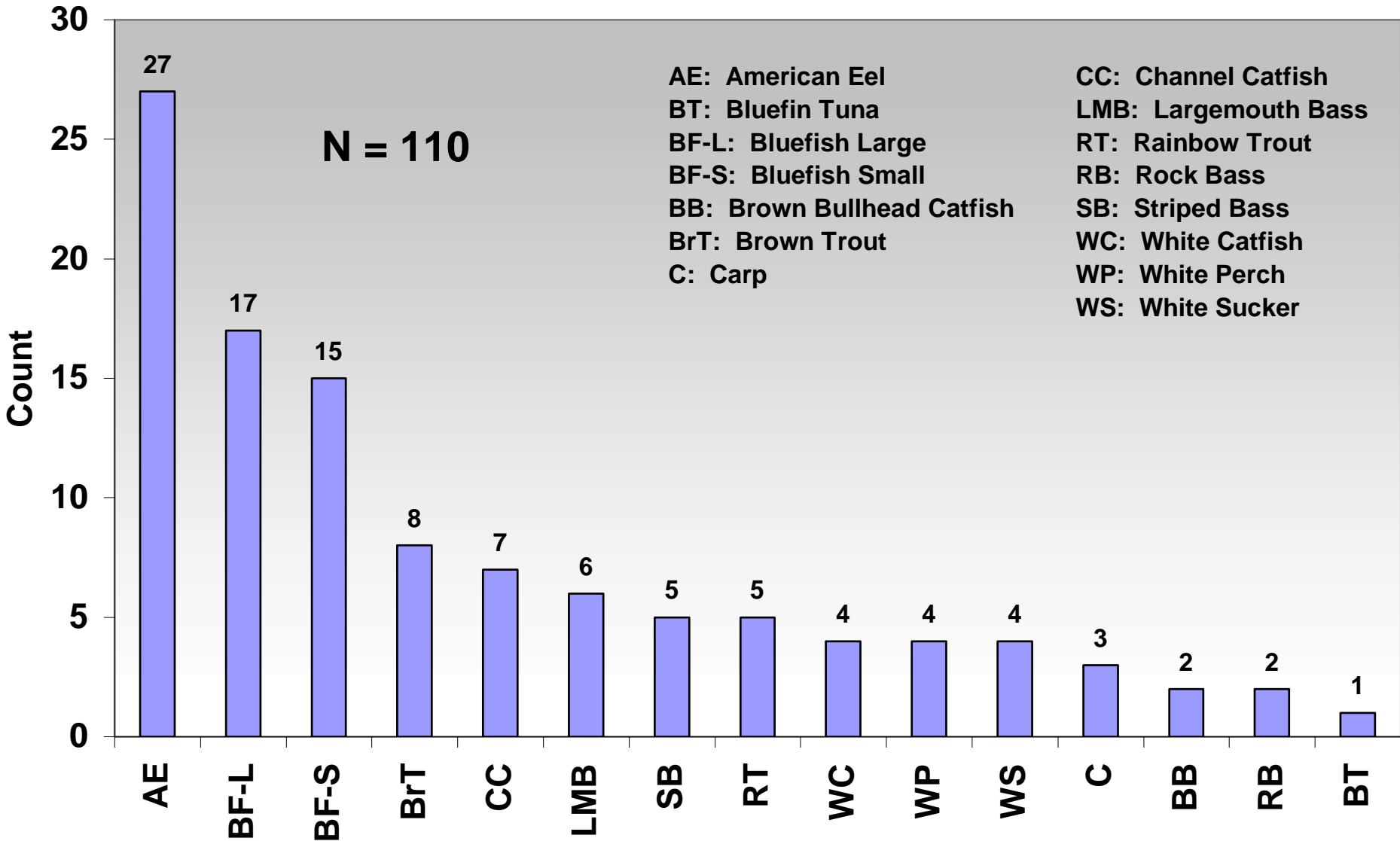
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# Fish Sampling for PBDEs



- 110 samples
- 38 locations
- 14 species
- Collected 9/03-11/05 (except 14 archived eel samples from 1998)

# Samples for PBDE Analysis by Fish Species



# Pending Data

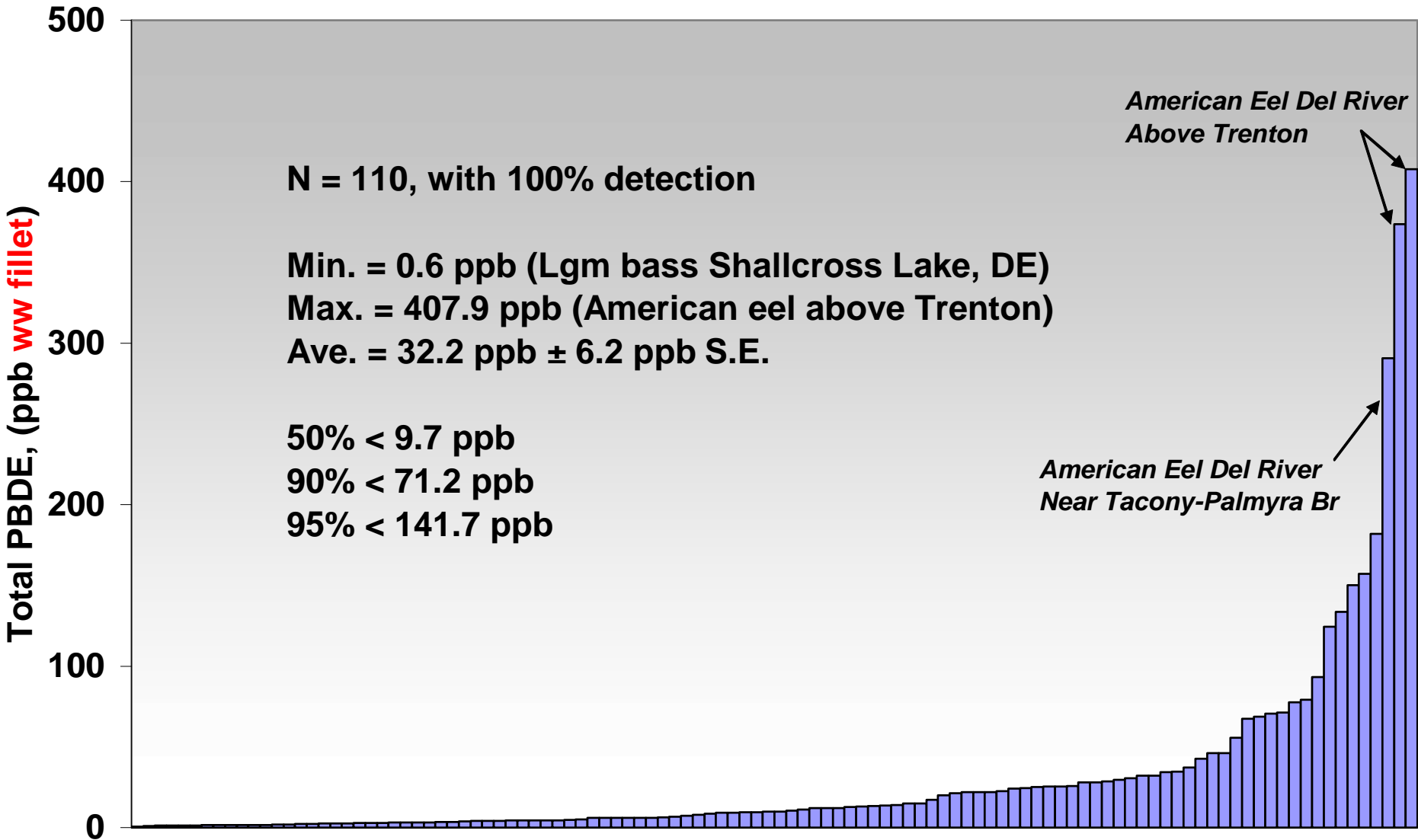
- DRBC: channel catfish & white perch from mainstem Estuary + smallmouth bass & white sucker non-tidal mainstem.
- DNREC: striped bass, Atlantic croaker, tautog, and black sea bass.
- ANS: trophic transfer study in Tinicum Marsh (PA Sea Grant project).
- NJDEP: subset from monitoring program.

# Topics

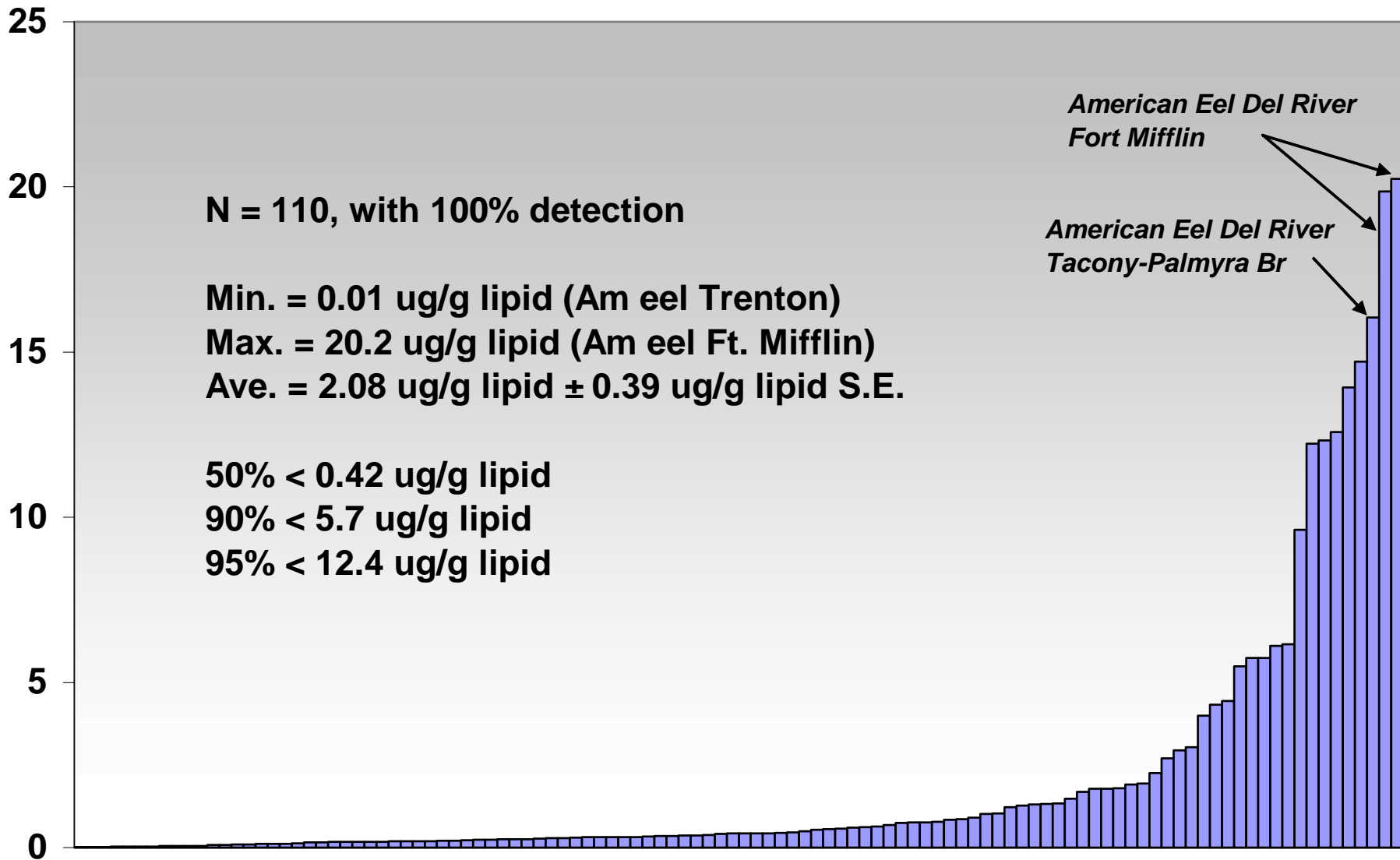
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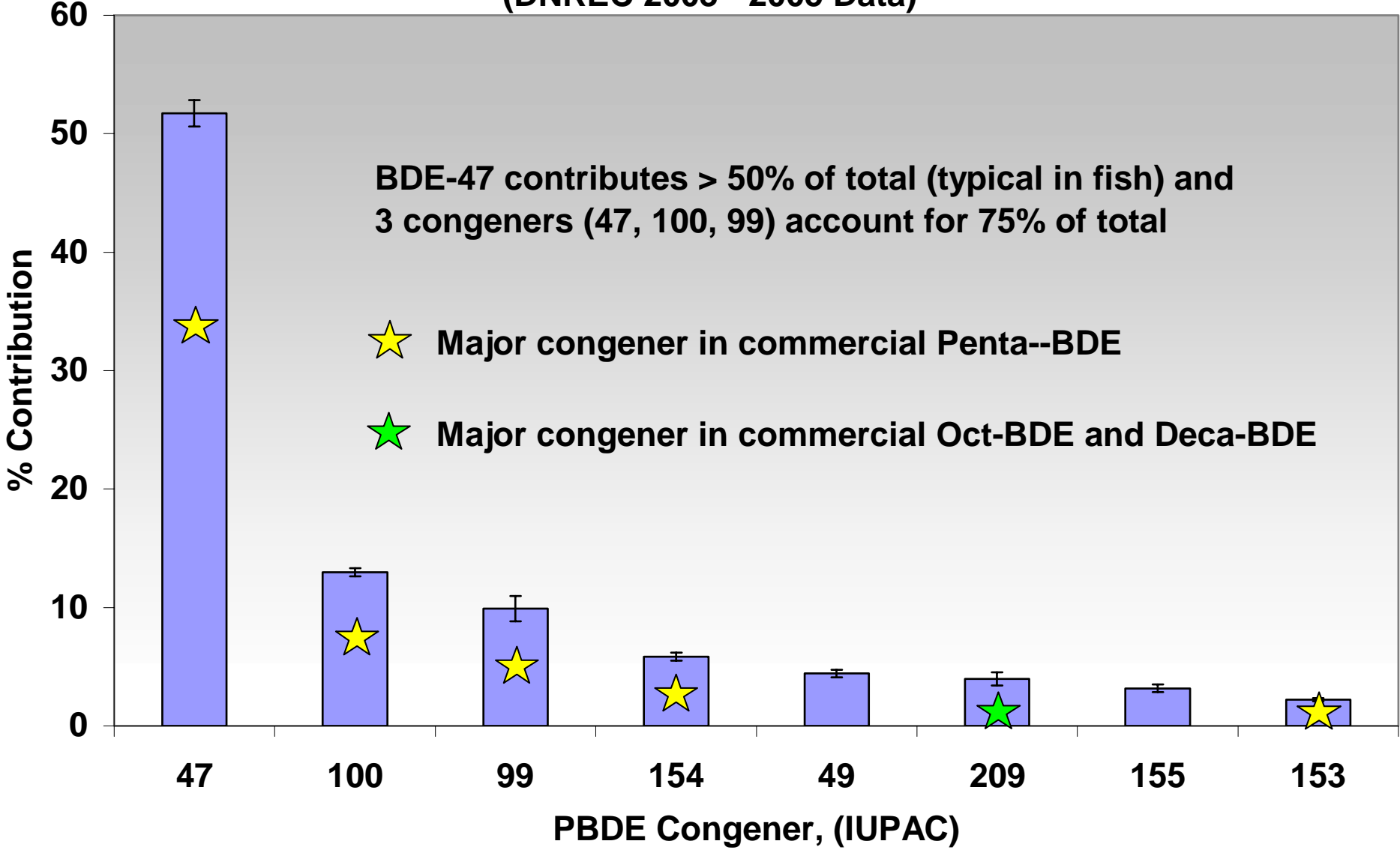
# PBDE in Fish Tissue - DE Estuary + Near Coastal



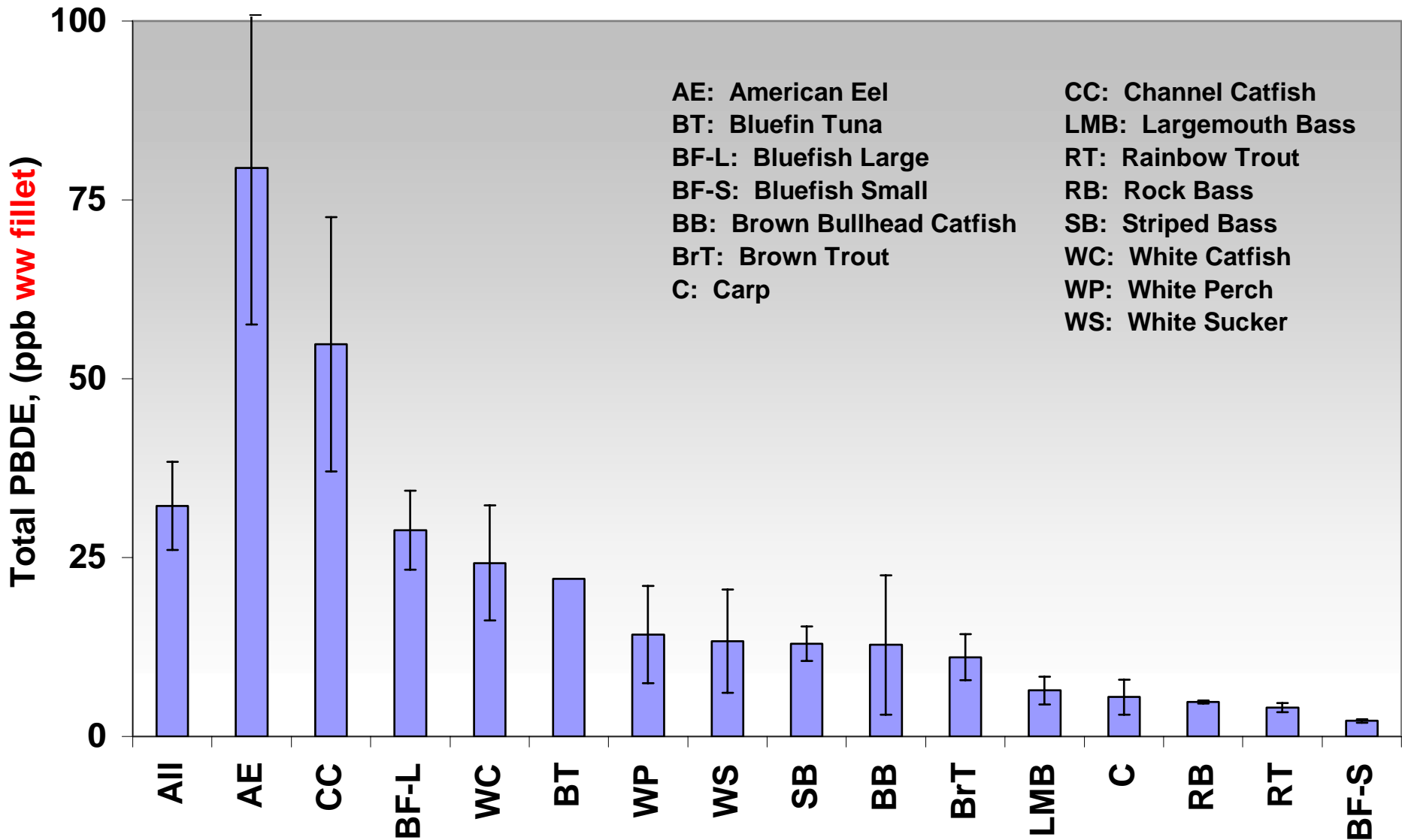
# PBDE in Fish Tissue - DE Estuary + Near Coastal



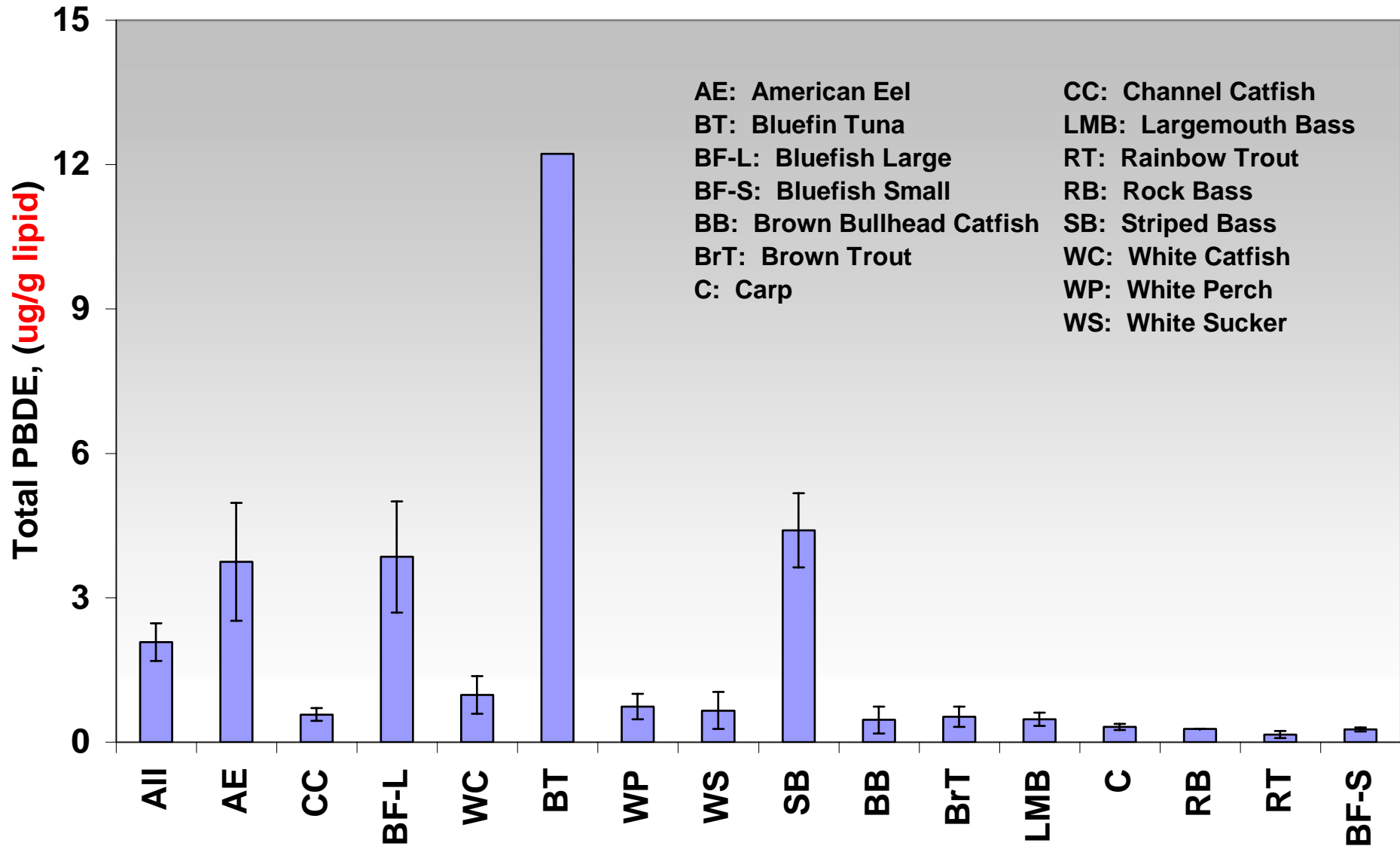
# % Contribution of PBDE Congeners to Total PBDE (DNREC 2003 - 2005 Data)



# Mean PBDE by Species - DE Estuary + Near Coastal

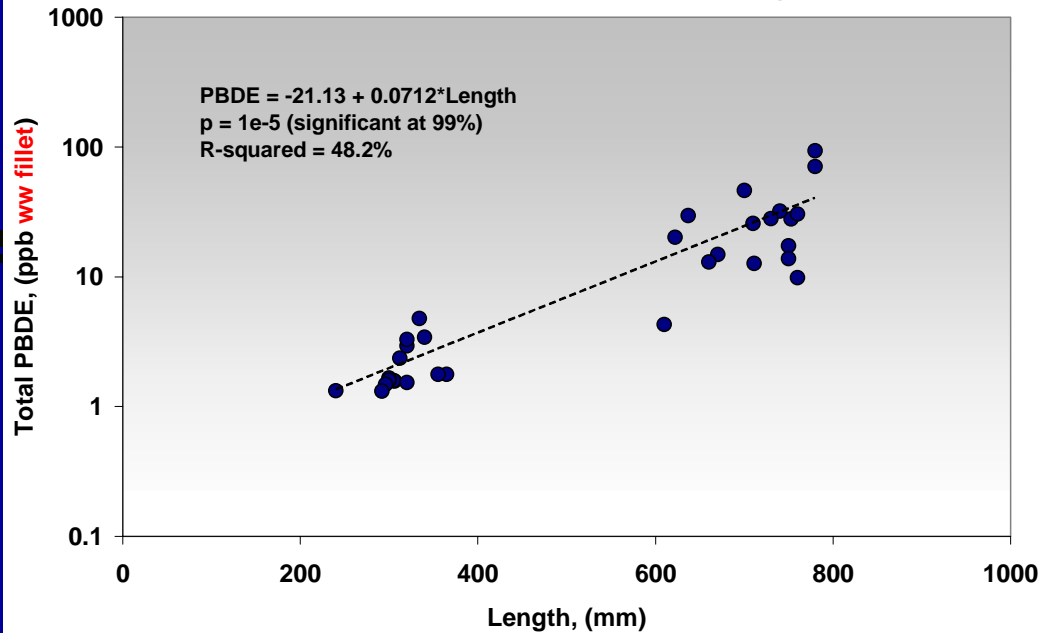


# Mean PBDE by Species - DE Estuary + Near Coastal



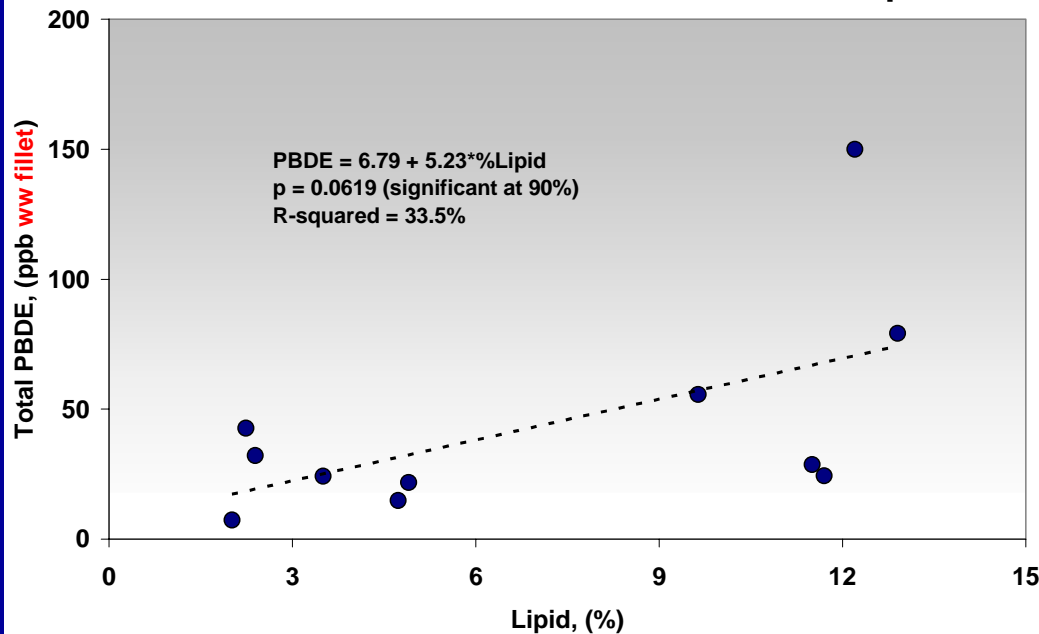
# PBDE, Length & Lipid

## Total PBDE in Bluefish vs Length

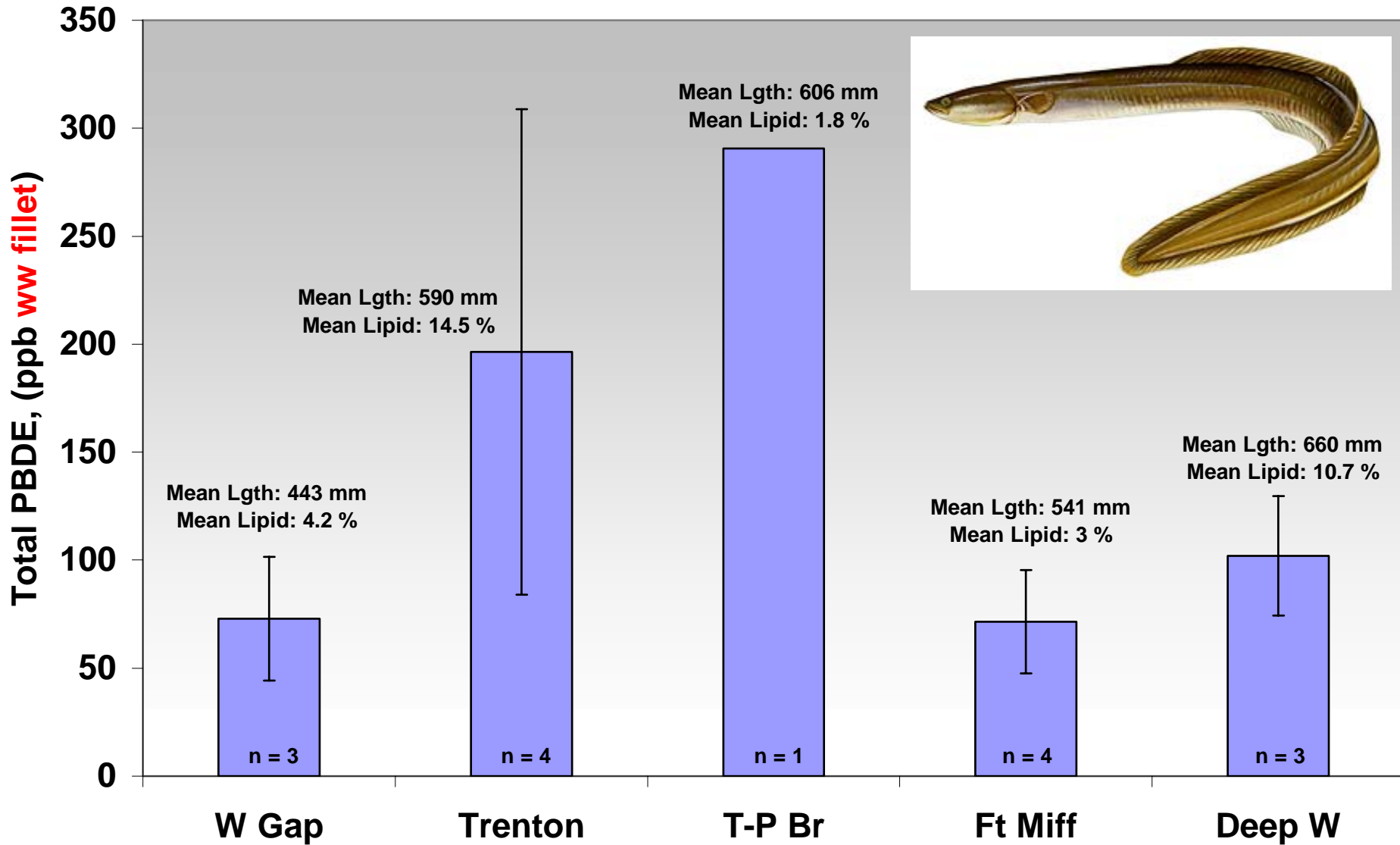


- Significant relation between PBDE & length for bluefish.
- Ditto for PBDE & lipid for channel + white catfish.
- No others.

## Total PBDE in Channel+White Catfish vs Lipid



# Mean PBDE in American Eel - DE River Mainstem

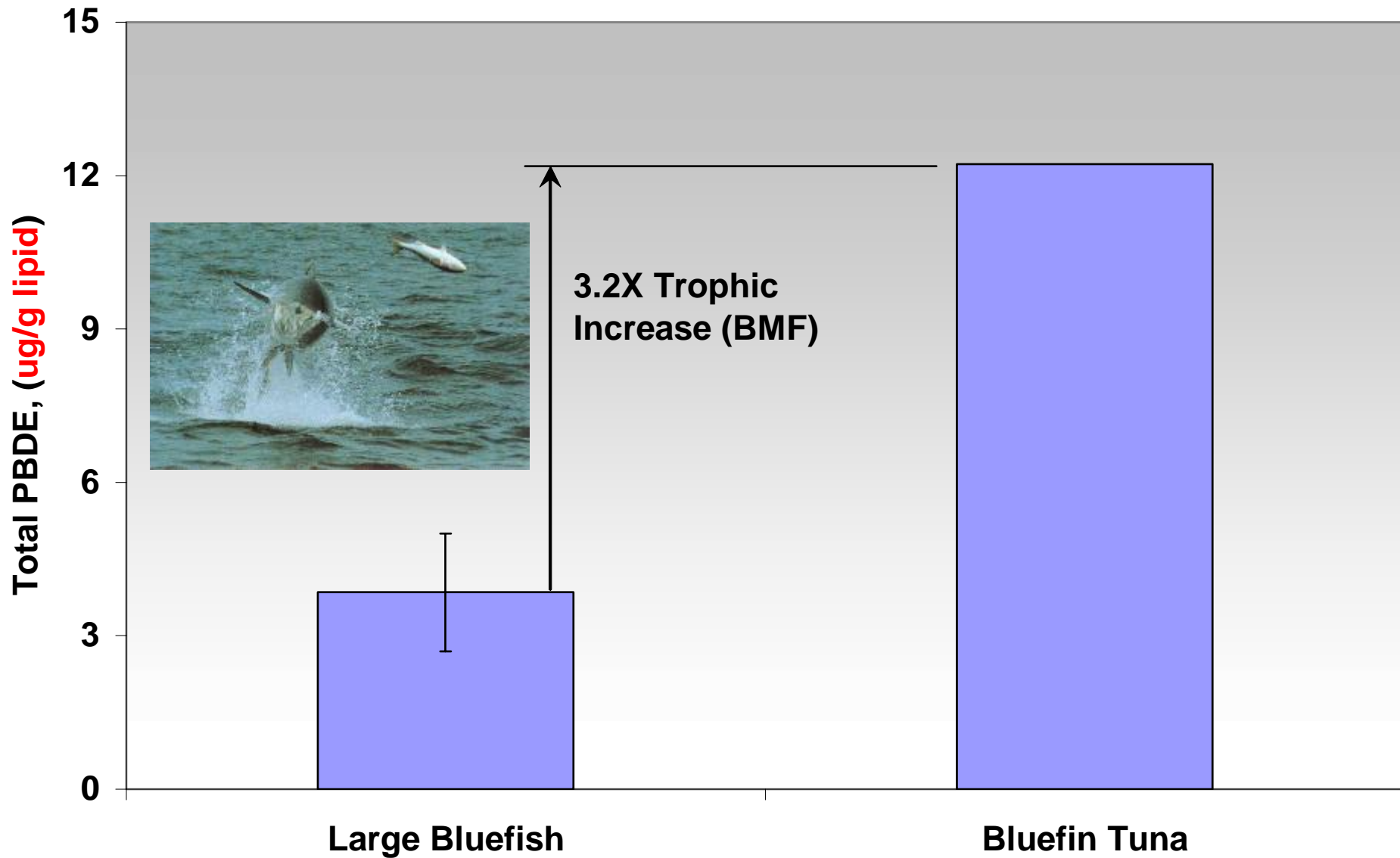


# The Big Tuna

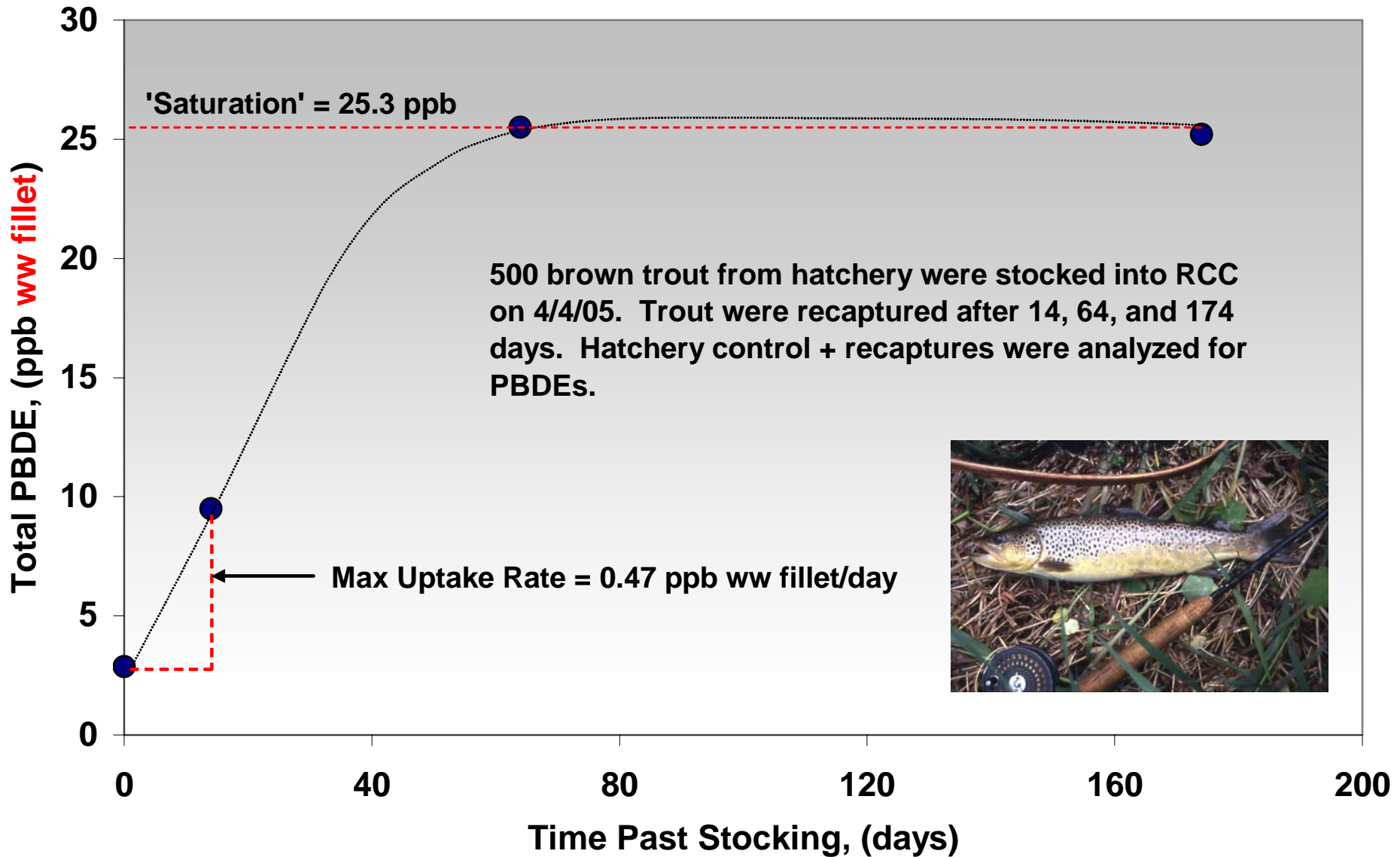


- Species: Bluefin Tuna
- 873 pounds
- 9' 6" long; 6' 6" girth
- Caught July 2, 2005
- Hot Dog Canyon (~40 miles E of IR Inlet)
- New DE Record (by > 500 pounds).
- Age from charts: 30 yrs +/- 10 yrs.

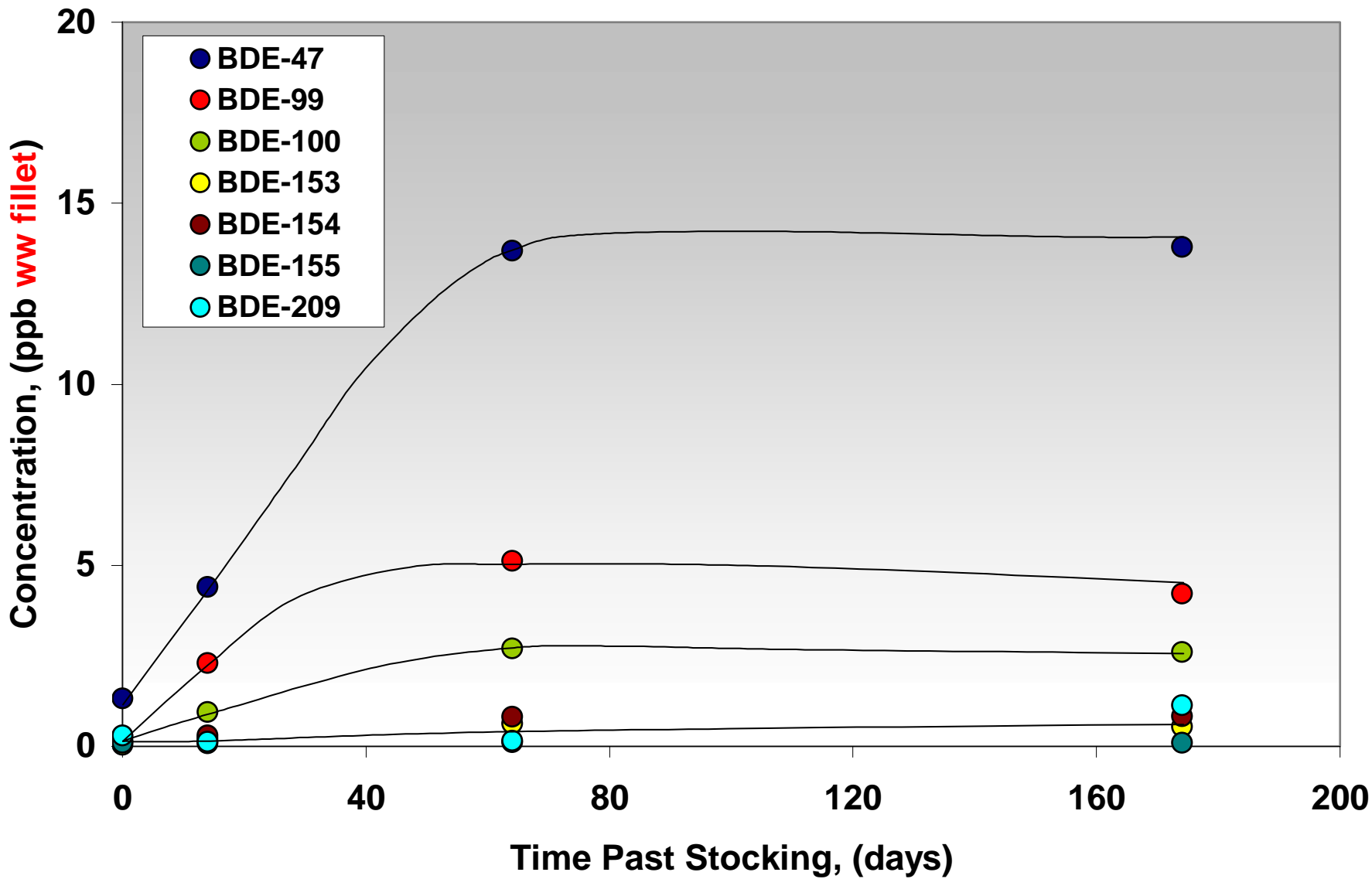
# Trophic Increase of PBDE in Coastal Foodchain



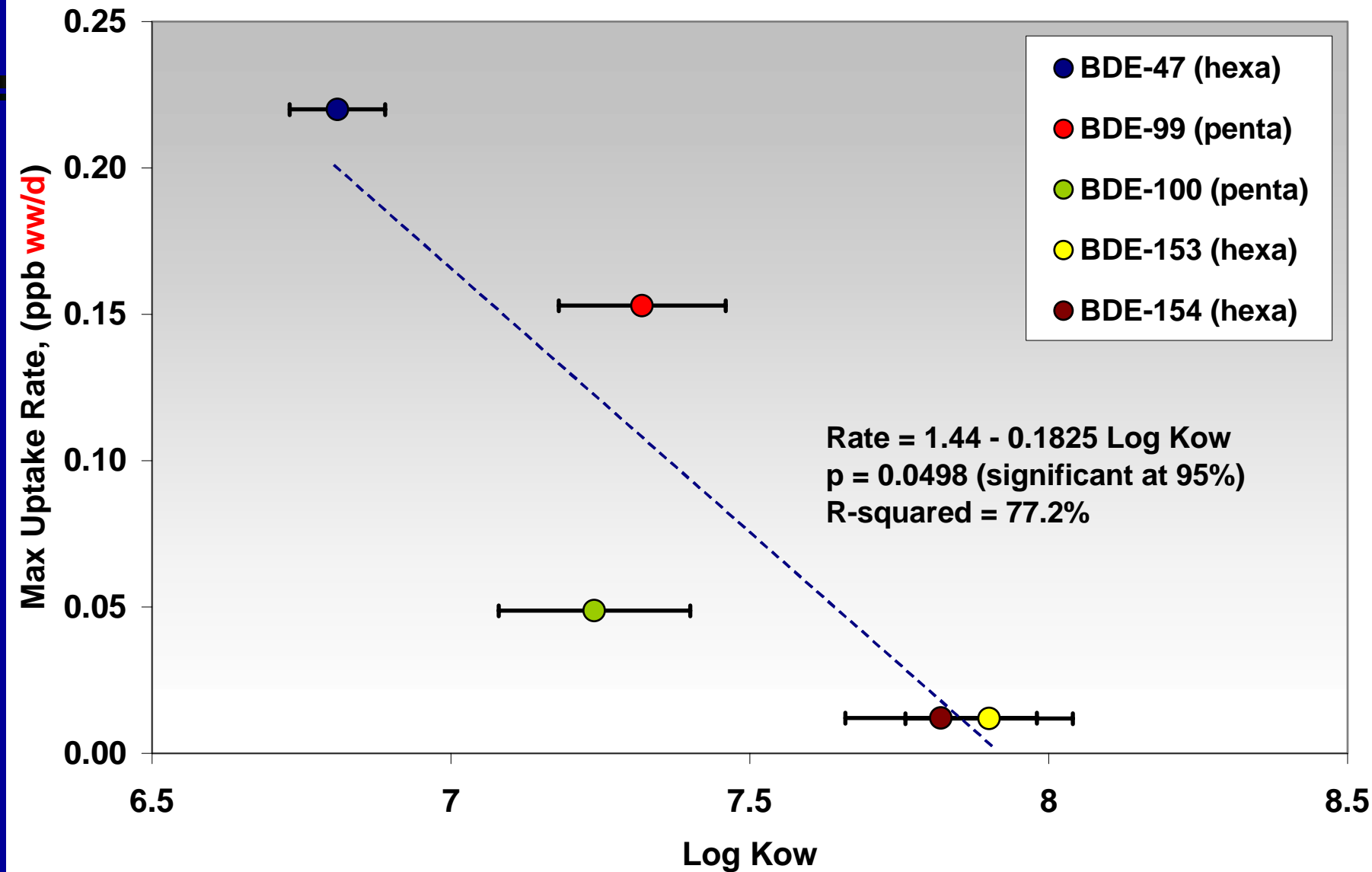
# PBDE Uptake in Stocked Trout - Red Clay Creek



# Kinetic Uptake of PBDE Congeners in Brown Trout



# Maximum Uptake Rate vs Log Kow

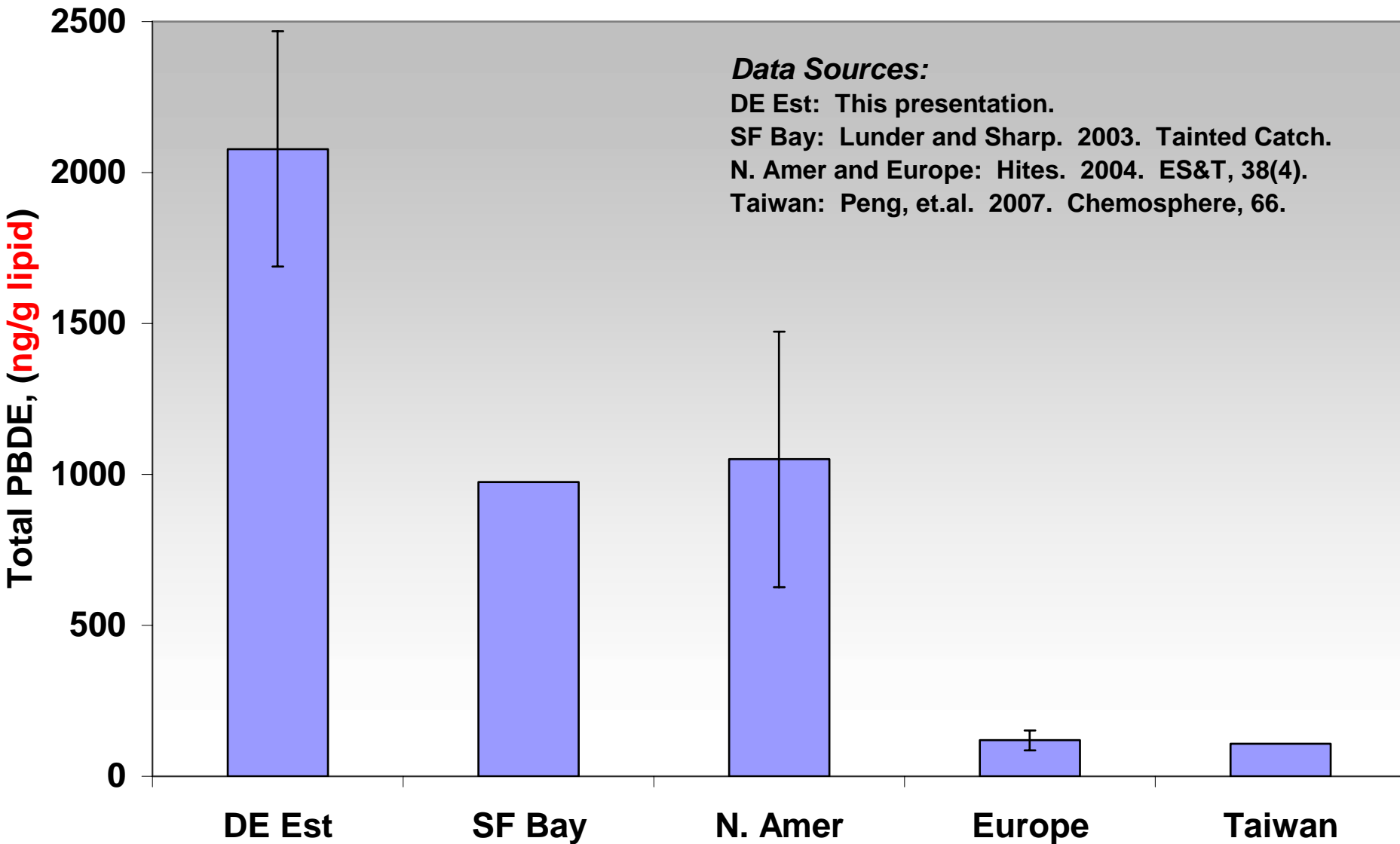


# Topics

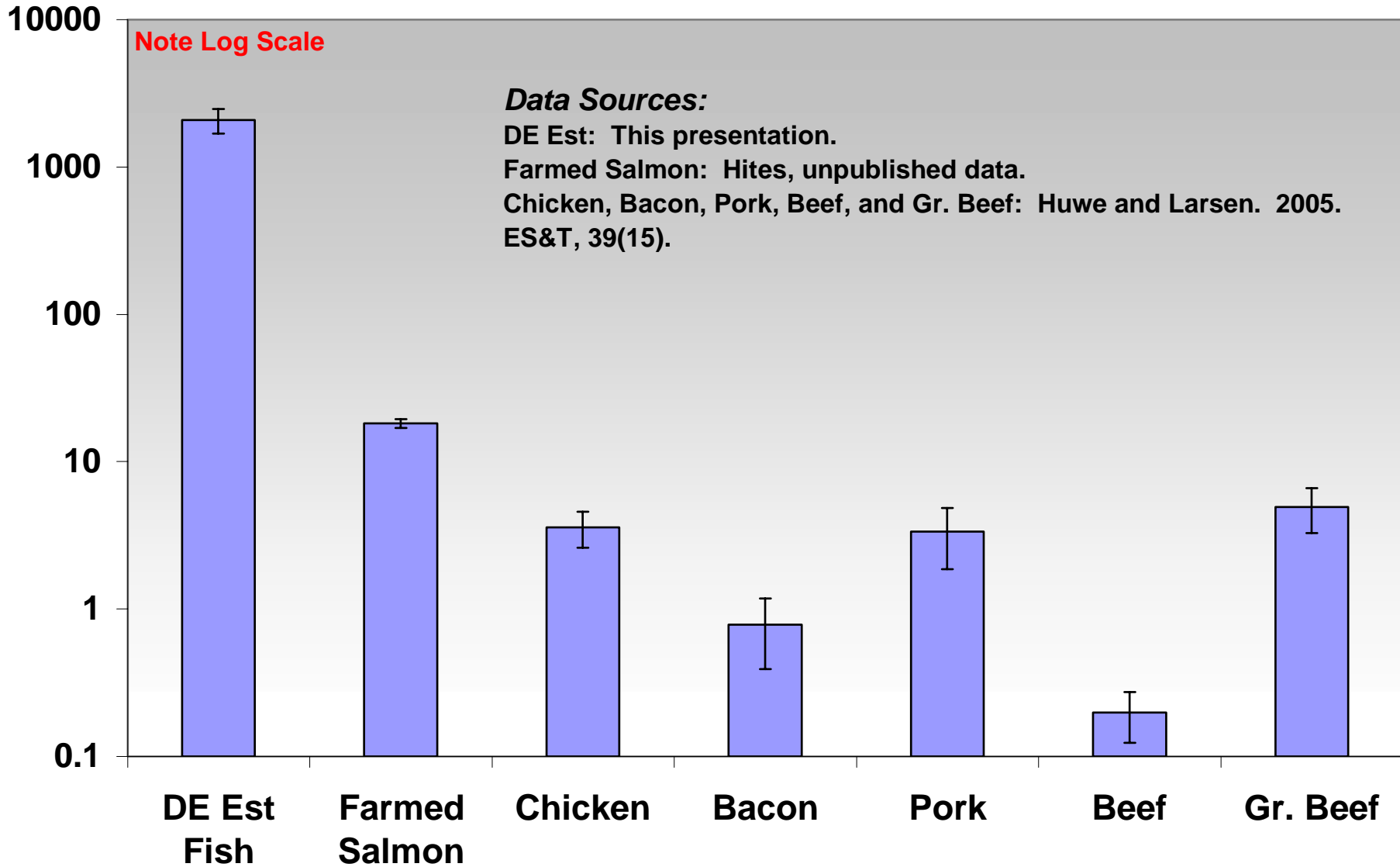
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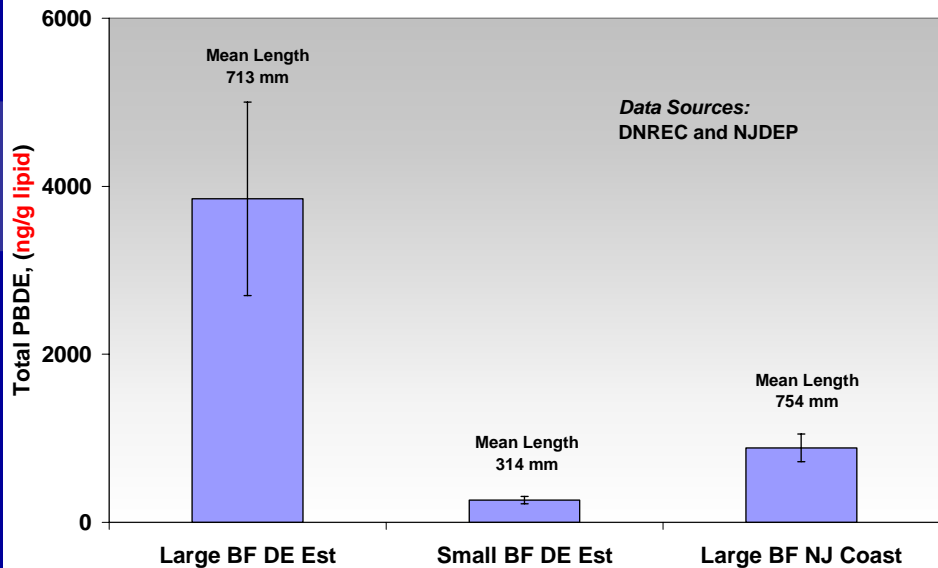
# Mean PBDE in DE Estuary Fish vs. Fish Elsewhere



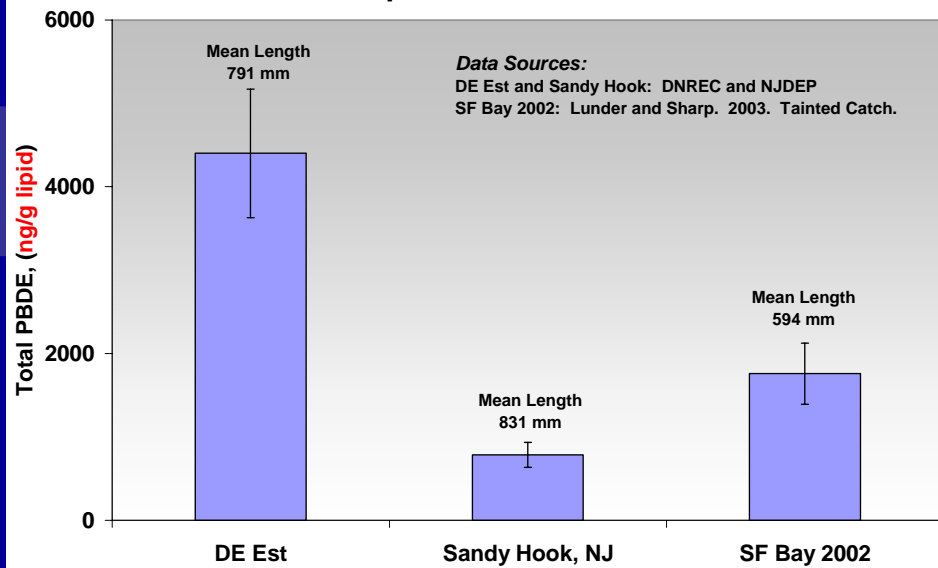
# Mean PBDE in DE Estuary Fish vs. U.S. Meats



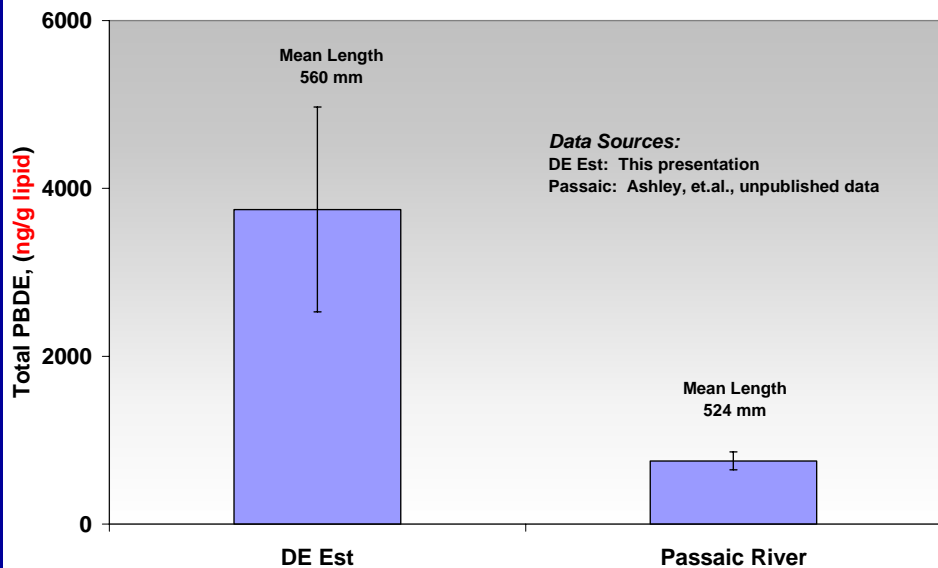
### Mean PBDE in Bluefish DE Est vs. NJ Coast



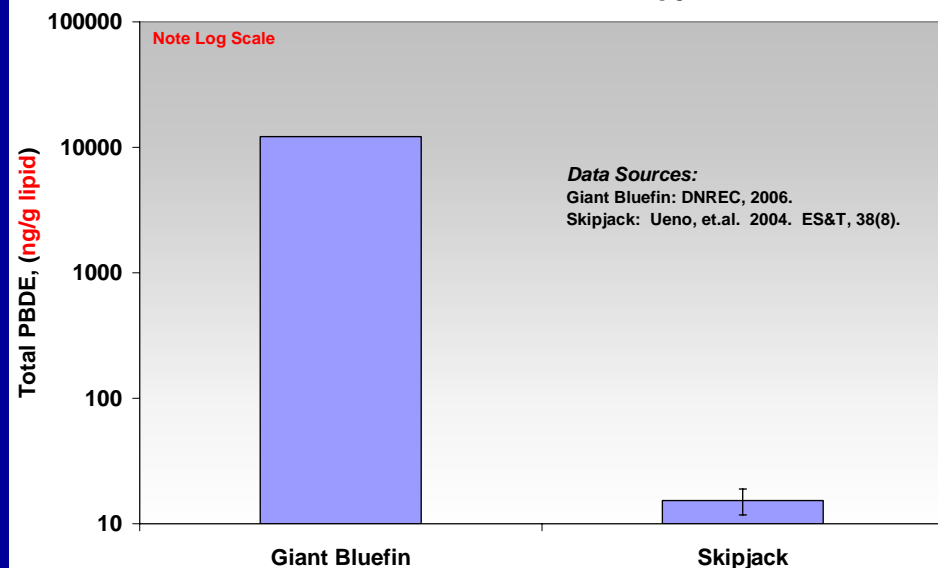
### Mean PBDE in Striped Bass DE Est vs. Elsewhere



### PBDE in American Eel Del Estuary vs Passaic R.



### PBDE in Giant Bluefin Tuna vs. Skipjack Tuna



# Summary of Results

- Total PBDE in DE Estuary fish: 0.6 – 407.9 ppb ww fillet (0.01 – 20.2 ug/g lipid). Mean = 32.2 ppb ww (2.08 ug/g lipid).
- BDE-47 > 100 > 99 > 154 > 49 > 209, with BDE-47 contributing ~50% of total.
- PBDE in bluefish increases with length and increases in catfish with lipid.
- BMF = 3.2 between large bluefish and giant bluefin tuna.
- Uptake in stocked trout is congener-specific and decreases as  $K_{ow}$  increases.
- Total PBDE in DE Estuary fish is greater, on ave., than in fish elsewhere. DE Estuary fish >> other U.S. meats.

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# Future

- Review new data when available (DRBC, DNREC, ANS, NJDEP & others).
- Continue to collaborate and share data.
- After EPA IRIS tox reports updated, perform risk assessment and revisit fish advisories.
- If truly a problem, assess sources, fate & transport, and trophic transfer.
- Monitor trends.

**Thank You**

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