2008 Brominated Flame Retardant Study

Objective:
Determine if alternative flame retardants are accumulating in SF Estuary sediments and biota

- Sediments (2007)
- Harbor seal blubber (2007-2008)
- Bird eggs (2008)
- Sport fish (2006)
- Bivalves (2008)

Sport Fish analyzed for BFRs

- 14 samples total
- 6 white croaker (2 South Bay, 2 Oakland, 2 San Pablo Bay)
- 8 shiner surfperch (2 South Bay, 2 Oakland, 2 SF waterfront, 2 Berkeley)

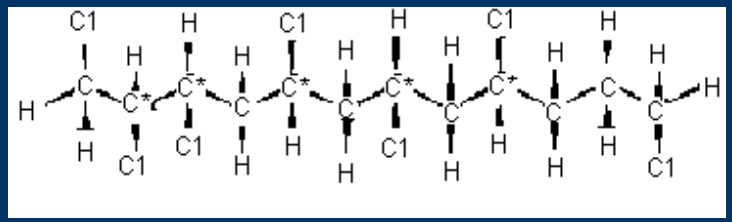
Target analytes

PBDEs
Hexabromocyclododecane (HBCD)
Tetrabromobisphenol-A (TBBPA)
Decabromodiphenylethane (DBDPE)
1,2-Bis(2,4,6 tribromophenoxy) ethane (BTBPE)
Pentabromoethylbenzene (PBEB)
Hexabromobenzene (HBB)
Dechlorane Plus®
Di(2-ethylhexyl) tetrabromophthalate (TBPH)
2-ethylhexyl 2,3,4,5-tetrabromobenzoate (TBB)

BFRs in Sport Fish

Analyte	Range (ng/g wet wt)
PBDEs	25-125
Hexabromocyclododecane (HBCD)	< 1.1
Tetrabromobisphenol-A (TBBPA)	To be measured
Di(2-ethylhexyl) tetrabromophthalate (TBPH)	To be measured
2-ethylhexyl 2,3,4,5-tetrabromobenzoate (TBB)	< 1.2
1,2-Bis(2,4,6 tribromophenoxy) ethane (BTBPE)	< 0.07
Pentabromoethylbenzene (PBEB)	< 0.02
Hexabromobenzene (HBB)	< 0.2
syn-Dechlorane Plus®	< 0.03
anti-Dechlorane Plus®	< 0.05
Decabromodiphenylethane (DBDPE)	To be measured

Chlorinated Paraffins/Chlorinated n-Alkanes



- C_{10} to C_{30} technical mixtures
- 30 to 70% Cl^- by mass
- Primary uses: high temperature lubricants in metal working machinery, flame retardants in plastics
- Minor uses: additives in sealants, adhesives, paints, rubber
- Largest group of high molecular weight Cl hydrocarbons in commercial use
- Used since 1930s, declined after 1980s
- Bioaccumulative (log K_{ow} 5.9-8.1)
- Ubiquitous
- Persistent, toxic, long-range transport
- Environmental fate, transport unknown

Chlorinated Paraffins/Chlorinated n-Alkanes

Commercial formulations:

short (C_{10}-C_{13}), medium (C_{14}-C_{17}), long (C_{20}-C_{30})

Short-chain chlorinated paraffins

- Most extensive use
- Highest potential for env. release because of open use
- Highest toxicity

Listings

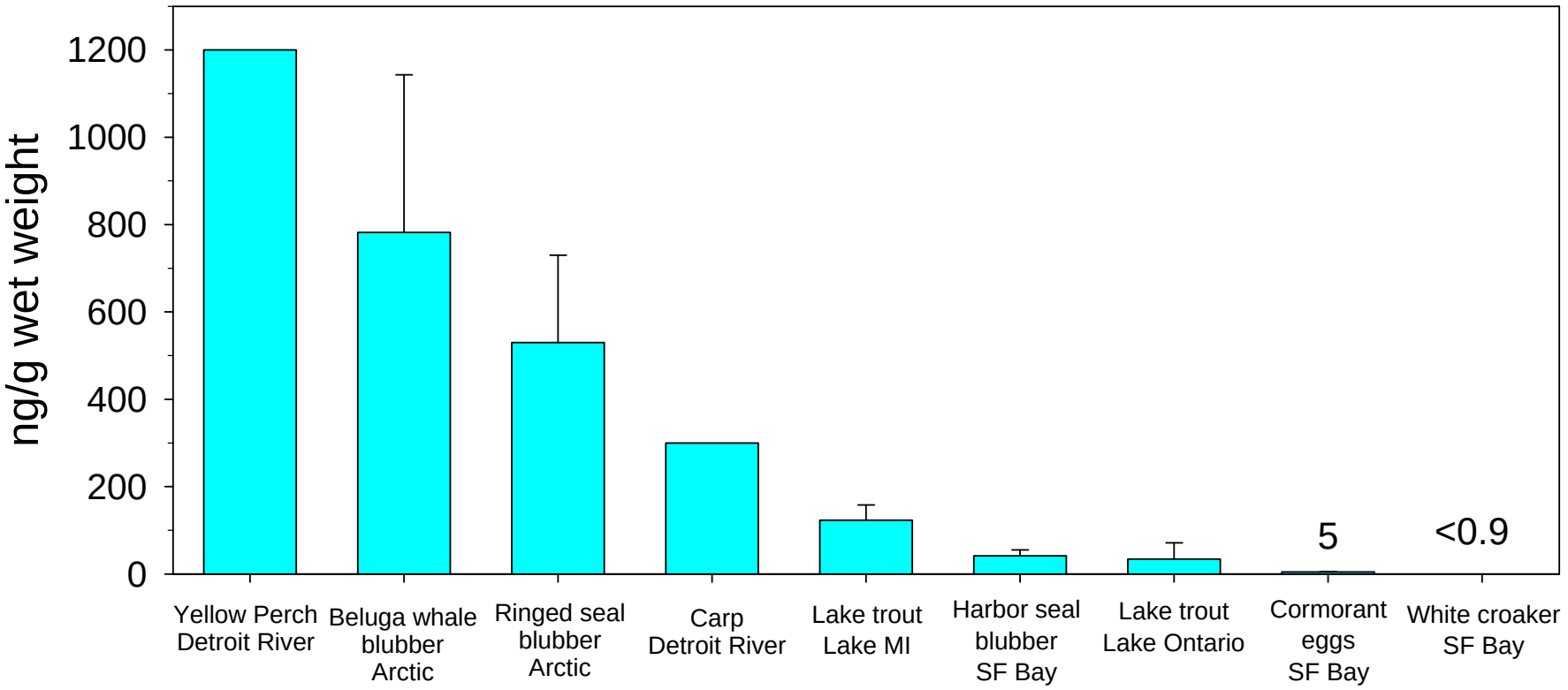
- EPA Toxic Release Inventory
- Priority toxic substances (Canadian Env. Protection Act)
- Priority hazardous substance (EU)
- HPV chemicals in late 1990s

Concern for SF Bay?

Short-chain chlorinated paraffins

- Gregg Tomy (Canadian Dept of Fisheries and Oceans)
- White croaker from Oakland (1), South Bay (2) in 2006
- Cormorant eggs from 3 sites (1 comp/site) in 2006
- Harbor seal blubber (3 sites) in 2007

Chlorinated Paraffins in SF Bay Wildlife Compared to Other Locations



SF Bay samples: Surrogate standard quantifiable in fish only (148, 65 and 119%)