Legacy and Emerging Contaminants in San Francisco Bay Sport Fish, 2003

RMP
REGIONAL MONITORING PROGRAM FOR TRACE SUBSTANCES

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ABSTRACT

The Regional Monitoring Program for Trace Substances monitors sport fish in San Francisco Bay every three years. In 2003, concentrations of PCBs (as total Aroclors), mercury, selenium, dieldrin, and total DDTs exceeded human health screening values (SV) in some sport fish species. Leopard shark, striped bass, white sturgeon, California halibut, and brown smoothhound shark had the highest number of SV exceedances for mercury. Shiner surfperch, striped bass, white croaker, white sturgeon, and jacksmelt had the highest number of SV exceedances for PCBs. Maximum PCB concentrations in shiner surfperch, white croaker, and white sturgeon approached 500-600 ppb wet weight (ww). One anchovy composite from the South Bay had the highest PCB concentration (607 ppb ww) of any species sampled and was also high in DDTs and PBDEs (total). DDT concentrations (lipid normalized) measured in 2003 in shiner surfperch, leopard shark, and white croaker were significantly lower than in previous years. In addition to legacy contaminants, PBDEs were also measured in 2003. The highest PBDE concentrations were found in shiner surfperch, striped bass, white croaker, and white sturgeon. Maximum PBDE concentrations of 79 ppb ww were found in a white sturgeon composite from the South Bay.

SAMPLING AND ANALYTICAL METHODS

Sport fish were collected from San Francisco Bay from May through September, 2003. Seven Status and Trends (S&T) species were sampled and eight new special study fish were also sampled. Fish were caught using gill nets, hook and line, or otter trawling. Mercury was analyzed by Atomic Spectroscopy using a Perkin Elmer Flow Injection Mercury System (FIMS-100 – Method DFG SOP-103), Se was analyzed using Inductively Coupled Plasma-atomic Emission Spectrometry (ICP-AES – Method EPA 200.7), and MeHg was analyzed using a Cold Vapor Atomic Flouresence Spectrophotometer (CVAF – Method SOP CALFED.D03). Total As was analyzed using Stabilized Temperature Platform Graphite Furnace Atomic Absorption Spectrometry (STP-GFAA – Method SW-7060A) and inorganic As was analyzed using Hydride Generation Qurtz Furnace Atomic Absorption Spectrometry (HGQFAA – Method EPA 1632A). PCBs, PBDEs and organochlorine pesticides were extracted with methylene chloride:acetone (50:50) using pressurized fluid extraction (PFE) and extracts cleaned using gel permeation chromatography and fractionated using Florisil. Extracts were then analyzed by dual column (DB-5 and DB-17) gas chromatography with electron capture detection.

Screening Value	Mercury 0.30 ug/g ww	Total PCBs 20 ng/g ww	Total DDT 100 ng/g ww	Total Chlordanes 30 ng/g ww	Dieldrin 2 ng/g ww
Anchovy	0/2	2/2	0/2	0/2	1/2
Barred Surfperch	1/1	1/1	NA	NA	NA
Black Surfperch	0/3	0/3	NA	NA	NA
Brown Rockfish	0/3	3/3	NA	NA	NA
California Halibut	4/6	0/2	0/2	0/2	0/2
Chinook Salmon	0/2	0/2	NA	NA	NA
Diamond Turbot	0/1	0/1	NA	NA	NA
Herring	0/1	1/1	0/1	0/1	0/1
Jacksmelt	0/4	3/4	0/4	0/4	0/4
Leopard Shark	15/15	2/9	0/9	0/9	0/9
Sardine	0/1	1/1	0/1	0/1	0/1
Shiner Surfperch	0/14	14/14	0/14	0/14	0/14
Smoothhound Shark	8/9	1/3	NA	NA	NA
Starry Flounder	0/2	1/2	NA	NA	NA
Striped Bass	17/25	7/7	0/7	0/7	0/7
Walleye Surfperch	0/2	2/2	NA	NA	NA
White Croaker	2/11	11/11	0/11	0/11	5/11
White Sturgeon	6/7	3/4	1/4	0/4	2/4
All Species	49/51	52/72	1/55	0/55	8/55

TABLE 1

% **below** screening value
% **above** screening value
NA = Not analyzed

RESULTS – HUMAN HEALTH

(SEE TABLE 1)

- There were no screening value exceedances for chlordanes (total) for any species monitored.
- The dieldrin screening value was only exceeded for white croaker (45% of samples), white sturgeon (50% of samples) and anchovy (50% of samples).
- The DDT screening value was only exceeded in a white sturgeon sample from the South Bay. This fish was also high in Aroclors, PBDEs and dieldrin.
- Mercury continued to have many species above the human health guidelines. All of the leopard sharks and 89% of the brown smoothhound sharks exceeded the screening value while 68% of striped bass, 86% of white sturgeon, and 67% of California halibut were above the screening value. Most special study species (except for brown smoothhound shark and barred surfperch) had no exceedances of the mercury screening value.
- The PCB screening value was exceeded for many species including shiner surfperch (100%), striped bass (100%), white sturgeon (75%), and white croaker (100%). Many new species screened for contaminants were above the PCB screening value including anchovy (100%), barred surfperch (100%), brown rockfish (100%), pacific herring (100%), sardine (100%), and walleye surfperch (100%).
- 43% of the white sturgeon sampled exceeded the selenium screening value of 2 ug/g ww.
- There is currently no screening value available for assessing human health risks due to ingestion of polybrominated diphenyl ethers (PBDEs). PBDEs were highest in white sturgeon (max 79 ppb ww), white croaker (max 51 ppb ww), and anchovy (max 64 ppb ww) and were lower in leopard shark, jacksmelt, and Pacific herring (FIGURE 1).

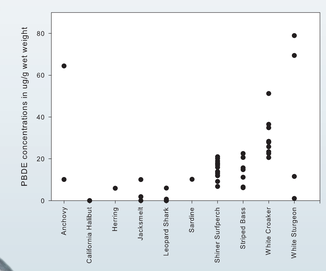

FIGURE 1
PBDE concentrations in 2003 samples in ppb wet weight.

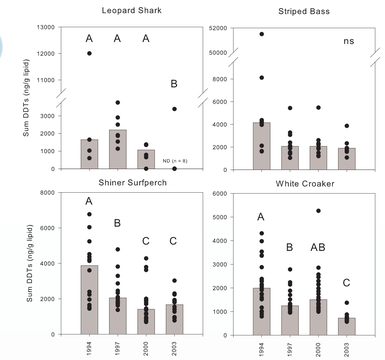

FIGURE 2
Long-term trends in DDT lipid weight concentrations in sport fish species from San Francisco Bay. Capital letters denote statistically significant differences in years (ANOVA, p<0.001), ns denotes no statistically significant difference.

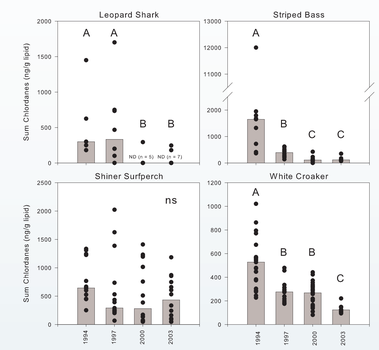

FIGURE 3
Long-term trends in chlordane lipid weight concentrations in sport fish species from San Francisco Bay. Capital letters denote statistically significant differences in years (ANOVA, p<0.001), ns denotes no statistically significant difference.

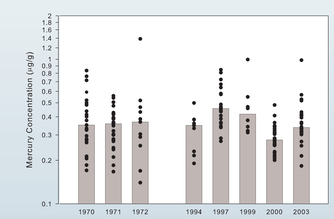

FIGURE 4
Mercury concentrations in ug/g wet weight in striped bass from 1970-2003. Concentrations expressed as an average for a 55 cm fish. Data from the RMP have been combined with other studies.

RESULTS – LONG TERM TRENDS

- DDTs, on a lipid weight basis, were significantly lower (p<0.05) in 2003 for leopard shark, shiner surfperch, and white croaker compared to earlier sampling years (FIGURE 2). No significant differences in wet weight based data were observed.
- Chlordanes, on a lipid weight basis, were significantly lower in 2003 (p<0.05) for leopard shark, striped bass, and white croaker compared to earlier sampling years (FIGURE 3). No significant differences in wet weight based data were observed.
- There were no increasing or decreasing trends in PCB concentrations for leopard shark, striped bass, shiner surfperch or white croaker on a lipid or wet weight basis for the period of RMP monitoring (1994-2003).
- There has been no decline in mercury concentrations in striped bass over the period of record (1970-2003) (FIGURE 4).

DISCUSSION

Legacy contaminants continue to be above human health guidelines for many Bay species. Some legacy pestcides (DDT and chlordanes) were lower in Bay fish in comparison to earlier sampling years. Other contaminants such as mercury and PCBs have not shown any long-term trends in any of the species sampled. Some of the species sampled for the first time in 2003 also had some mercury and/or PCB screening value exceedances (anchovy, barred surfperch, brown rockfish, and smoothhound shark). Black surfperch, Chinook salmon, and diamond turbot did not have any exceedances of the mercury or PCB screening value. Additional sampling of these three species would help determine whether these species are good alternatives for sport fish consumers. Emerging contaminants such as PBDEs were also found in many Bay fish. PBDE concentrations were generally an order or magnitude lower than the maximum PCB concentrations.

ACKNOWLEDGEMENTS

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FOR MORE INFORMATION

Visit our web site at: http://www.sfei.org/rmp/index.html or contact Jennifer Hunt (jhunt@sfei.org).

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