

4.5% of the sum of the BDE-47, -99 and -100 concentrations. For 2004, the two highest concentrations of  $\alpha$ -HBCD in the gull eggs were found at the two most westerly of the Great Lakes sites, Agawa Rock and Gull Island colonies (20 and 12 ng/g ww, respectively). Our findings indicate that mother herring gulls are exposed to HBCD isomers via their diet, there is in ovo transfer to their eggs, ratios among isomer changed over time, and that the HBCD concentration have been increasing at all sites over time.

**21 Current levels of the top market demand brominated flame retardants (TBBPA, HBCDs, and PBDEs) in humans and marine predators from the United States.** B. Johnson-restrepo, K. Kannan, Environmental Health Science, School of Public Health -State University of New York, Albany, NY; K. Kannan, Wadsworth Center, New York State Department of Health, Albany, NY; B. Johnson-restrepo, Environmental and Computational Chemistry Group at Department of Chemistry, University of Cartagena, Cartagena, Bolivar, COLOMBIA; D.H. Adams, Cape Canaveral Scientific, Inc., Melbourne Beach, FL. Concentrations of tetrabromobisphenol A (TBBPA) and  $\alpha$ -,  $\beta$ -, and  $\gamma$ - isomers of hexabromocyclododecane (HBCD) were determined by liquid chromatography-tandem mass spectrometry (LC-ESI-MS/MS) in human adipose tissues obtained from New York City, and marine top-level predators - bottlenose dolphin, bull shark, and Atlantic sharpnose shark collected from Florida coasts. The overall mean concentrations (mean  $\pm$  SD) of TBBPA and HBCD were 0.0479  $\pm$  0.102 and 0.333  $\pm$  0.571 ng/g lipid wt in human tissues, 1.2  $\pm$  3 and 7.38  $\pm$  18 ng/g lipid wt in bottlenose dolphin blubber, 9.5  $\pm$  12 and 77.7  $\pm$  128 ng/g lipid wt in bull shark muscle, and 0.9  $\pm$  0.5 and 545  $\pm$  88 ng/g lipid wt in Atlantic sharpnose shark muscle. Overall mean concentrations of HBCD were 5-10 fold higher than mean TBBPA concentrations, in all of the samples analyzed. The highest concentrations of TBBPA and HBCD were detected in the bull shark muscle at concentrations of 35.6 and 413 ng/g, lipid wt, respectively. TBBPA and HBCD concentrations were significantly correlated in human adipose tissues and bottlenose dolphin blubber tissues, but not in bull shark muscle tissues. In the human samples, the concentrations of HBCD were 3-4 orders of magnitude lower than the concentrations of polybrominated diphenyl ethers (PBDEs) previously reported for the same set of tissue samples. Concentrations of HBCD in human samples from the U.S. were 1-5 fold lower than the concentrations reported from European countries. HBCD concentrations in bottlenose dolphin from the U.S. were 1-2 orders of magnitude lower than the concentrations reported for other cetacean species from Europe. The present report is the first to determine levels of TBBPA and HBCD in humans, bottlenose dolphins, and sharks from the US.

**22 Shift of PBDE mixtures within a coastal bottlenose dolphin population in relation to life history and dietary exposure.** J.E. Yordy, A. Guichard, J. Kucklick, NIST, Charleston, SC; J.E. Yordy, Medical University of South Carolina, Charleston, SC; R. Wells, B. Balmer, Chicago Zoological Society, c/o Mote Marine Laboratory, Sarasota, FL; L. Schwacke, Cooperative Center for Marine Animal Health, NOAA, Charleston, SC; T. Rowles, Marine Mammal Health and Stranding Response Program, NMFS, Silver Spring, MD. Bottlenose dolphins (BNDs) are long-lived, piscivorous marine mammals which represent apex predators for many coastal ecosystems. As a result, they are vulnerable to accumulating heavy burdens of persistent organohalogen contaminants (POCs), including current-use flame retardant compounds such as the polybrominated diphenyl ethers (PBDEs). Total concentrations of POCs in marine mammals are strongly influenced by diet, gender, and life history traits (i.e., age and reproductive state); however, less is known about how these parameters impact congener specific patterns and contaminant mixtures. To evaluate the role of life history and diet on PBDE concentrations and mixtures in BNDs, blubber (n=107) and milk samples (n=20), along with 3 known BND prey species of fish (n=45), were collected from Sarasota Bay, FL and were analyzed by GC/MS for 28 PBDE congeners. Total PBDE concentrations in BND blubber ranged from 20 ng/g -1500 ng/g, and no relationships between age or body length and PBDE concentrations (ng/g lipid) were detected. However, for both male and female BNDs, as age/length increased, blubber PBDE patterns shifted to contain a greater proportion of higher brominated congeners. Adult female PBDE patterns appeared to be strongly influenced by the selective offloading of lower brominated PBDEs during lactation as evidenced by both blubber and milk congener patterns. For male BNDs, shifts in PBDE mixtures correlated significantly with body length. As the relative proportion of PBDE 47 declined (R<sup>2</sup>=0.38; p<0.001) with length, the proportions of PBDEs 100,

153 and 154 (R<sup>2</sup>=0.37, 0.41, 0.24; p<0.001) increased. Shifts in PBDE patterns with length in male BNDs may be the result of congener-specific differences in metabolism or biomagnification and the influence of diet on PBDE accumulation in BNDs is currently being explored with the analysis of prey species.

**23 Tissue Distribution of Polybrominated Diphenyl Ethers in Freshwater and Seawater Fish.** E.Y. Zeng, Y. Guo, X. Meng, H. Tang, State Key Laboratory of Organic Geochemistry, Guangzhou Institute of Geochemistry, Guangzhou, China; Y. Guo, X. Meng, H. Tang, Graduate School, Chinese Academy of Sciences, Beijing, China. Fish tissues from three different fish farming types (freshwater farmed, seawater farmed, and seawater wild fish), including skin, gills, gastrointestinal tract (GIT), liver and muscle, were analyzed for polybrominated diphenyl ethers (PBDEs). In general, the dry weight based concentrations of  $\Sigma$ 10PBDEs (sum of BDE-28, -47, -66, -85, -99, -100, -138, -153, -154, and -183) in fish tissues followed the sequence of liver > gill > skin > GIT and muscle. The BDE congener profiles varied with fish species. For example, seawater fish contained higher abundances of BDE-99 and lower abundances of BDE-28 (relative to  $\Sigma$ 10PBDEs). BDE-209 was detected in 37.4% of the total 187 samples, and this ratio may have actually been underestimated because the reporting limit for BDE-209 was considerably higher than those for other congeners. BDE-209 was the dominant BDE congener in skin and GIT, and less abundant in gills, muscle and liver. Except for skin, no significant difference in BDE-209 lipid-normalized concentrations was observed among fish tissues. These results suggest that BDE-209 is highly bioaccumulative in the fish species under investigation, somewhat inconsistent with the results from most previous studies that reported low bioaccumulative potential of BDE-209. This difference may have been partly due to the much higher detection limits for BDE-209, which was not adequately considered in many previous studies. Combined with the likelihood that BDE-209 can be debrominated into lower brominated congeners that tend to be more toxic than BDE-209, the high bioaccumulative potential of BDE-209 could pose prolonged health risk to the ecological environment as BDE-209 is still in use worldwide. Keywords: Polybrominated diphenyl ethers; Fish tissue; Bioaccumulative potential; BDE-209

**24 Polybrominated Diphenyl Ethers in Peregrine Falcon (Falco peregrinus) Eggs from Northeastern U.S.** D. Chen, M.J. LaGuardia, E. Harvey, R.C. Hale, Virginia Institution of Marine Science, Gloucester Point, VA; M. Amaral, U.S. Fish and Wildlife Service, Concord, NH; K. Wohlfort, National Wildlife Federation, Montpelier, VT. Little data have been published on polybrominated diphenyl ethers (PBDEs) in North American birds. Over 100 addled peregrine falcon eggs from nests in Massachusetts, Connecticut, Vermont, New Hampshire and Rhode Island were analyzed for PBDEs. Eggs were obtained from April 1996 to June 2006. BDE-153 and -99 were the dominate congeners in the majority of samples, similar to other recent studies on terrestrial raptor species around the world. However, we also observed significant contributions by hepta (BDE-183), octa (-197 and -196), nona (-207) and deca (-209) congeners. In a few samples, BDE-183 was the dominant congener, with concentrations exceeding 10 mg/kg lipid weight. BDE-197, -196 and -207 were detected in over 75% of total samples, with levels up to 10, 5 and 4 mg/kg, respectively. In addition, three other octa and nona congeners (BDE-201, -203 and -208) were frequently encountered. BDE-209 was detected in more than 60% of samples. Extremely high BDE-209 levels (> 13 mg/kg lipid weight) were found in the eggs collected from one of the most frequently occupied nesting sites in New Hampshire, a cliff in a state park. These results indicated that BDE-209 can be bioaccumulated in terrestrial birds of prey to substantial levels and transferred to eggs. The nona congeners detected may be derived from the metabolism of BDE-209 within the birds or their prey items, or photochemical/microbe-mediated degradation of BDE-209 under specific environmental conditions.

**25 Polybrominated diphenyl ethers (PBDEs) in the food chain of the European hedgehog (Erinaceus europaeus).** F. Vermeulen, H. D'Havé, L. Bervoets, R. Blust, W. De Coen, Biology, Universiteit Antwerpen, Antwerpen, Belgium; N. Van den brink, Alterra, Wageningen, Netherlands; A. Covaci, H. Neels, Toxicological Centre, Universiteit Antwerpen, Antwerpen, Belgium. Polybrominated diphenyl ethers (PBDEs) are commonly used as flame retardants in a variety of polymer resins and plastics. Exposure experiments with lab-grown animals (e.g. rats) showed that PBDEs affect behaviour, liver