

NEW RESEARCH: ENDANGERED PEREGRINE FALCONS SHOW HIGHEST TOXIC “DECA” LEVELS EVER REPORTED (March 2007)

Summary:

Since 1990, the New England Field Office of the U.S. Fish and Wildlife Service has been coordinating the monitoring, banding of young and collection of unhatched eggs of peregrine falcons (*Falco peregrinus*) nesting in the northeastern United States. Between 1990 and 2006, more than 150 peregrine eggs were collected from the six New England states during nest site visits and more than 100 that were obtained during 1996-2005 were provided to the Virginia Institute of Marine Sciences for the purpose of PBDE and other analyses. Of those 100+ eggs, 8 (7 from NH and 1 from ME) were recently analyzed by Dr. Hooper at California Environmental Protection Agency's Environmental Chemistry Laboratory. Wing Goodale from the Biodiversity Research Institute reviewed the data and provided the following analysis.

Analysis:

- The results from the analysis of the peregrine eggs indicate the following pattern of PBDE congeners levels $207 < 47 < 100 < 154 < 183 < 209 < 99 < 153$. Six out of eight of the eggs had BDE-209 levels below 1020 ppb while two samples had levels nearly twice as high. The egg with the highest value measured 2020 ppb on a lipid weight basis. **The average value for the eight eggs was 991 ppb.**
- **The levels of deca-BDE recorded in the US peregrine falcon eggs are higher than other studies, and these levels may be the highest reported in North American bird eggs to date. These results also support other studies that found that deca-BDE is bioaccumulating in wildlife** (Sellstrom *et al.* 2001, Verreault *et al.* 2004, Chen *et al.* 2007).¹
- These deca-BDE results are significantly higher than levels recorded in peregrine eggs collected in Sweden (92 ng/g, Sellstrom *et al.* 2001 and up to 430 ng/g, Lindberg *et al.* 2004). The deca-BDE levels found also surpass those recorded in the eggs of kestrels, sparrowhawks, and peregrine falcons from the United Kingdom and Sweden (up to 412 ng/g, de Boer *et al.* 2004) as well as those of South Greenland falcons (up to 250 ng/g, Vorkamp *et al.* 2005).
- **These results also support studies that indicate that deca-BDE may be accumulating at higher levels in the terrestrial food web.** Chen *et al.* (2007) found BDE-209 in 79.4% of their samples from terrestrial feeding birds of prey in China. Deca- has also been found in terrestrially feeding grizzly bear (41.7 ng/g) (Christensen *et al.* 2005) and red fox (760 ng/g) (Voorspoels *et al.* 2006). This is in contrast to the detection of deca-BDE in only 30% of plasma samples and 15% of the eggs from the marine feeding glaucous gull (*Larus hyperboreus*) in Norway (Verreault *et al.* 2004).
- **These results indicate that high trophic level terrestrial predators such as peregrine falcons are bioaccumulating deca-BDE.**

Background Information on Deca Toxicity and its Toxic Breakdown Products:

Low levels of Deca have been shown to cause neurodevelopment toxicity in mice (Viberg *et al.*, 2003). Based on the Viberg study, the Risk Assessment Report prepared on Deca by the European Union found that Deca exposure to the eggs of peregrine falcons in Europe approaches levels of Deca that cause neurodevelopmental toxicity in young mice, without an adequate margin of safety (EU, 2005).

¹ * NOTE: ng/g is equivalent to ppb.

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Deca delays brain development and causes adult learning and behavior problems in lab animals exposed early in life, according to the latest research (Cressey *et al*, 2006). Deca also degrades into other PBDEs that are even more toxic and bioavailable (Stapleton, 2006). Laboratory studies have documented health a variety effects of PBDEs generally, (Darnerud 2003). A dosing study on kestrels found changes in thyroid levels and concluded: “Concentrations of PBDE congeners in wild birds may alter thyroid hormone and vitamin A concentrations, glutathione metabolism and oxidative stress (Ferne *et al*. 2005).”

Literature Cited:

de Boer, J., H. A Leslie, P. E. G Leonards, P. Bersuder, S. Morris, and C. R. Allchin. 2004. Screening and time trend study of decabromodiphenylether and hexabromocyclododecane in birds. In Proceedings of the Third International Workshop on Brominated Flame Retardants (BFR2004); Toronto, ON, Canada;; pp 125-128.

Chen, D., B. Mai, J. Song, Q. Sun, Y. Luo, X. Luo, E. Y. Zeng, and R. C. Hale. 2007. Polybrominated diphenyl ethers in birds of prey from Northern China. *Environmental Science and Technology*. *In press*.

Cressey, M.A., E.A. Reeve, D.C. Rice, and V.P Markowski, Behavioral Impairments Produced by Developmental Exposure to the Flame Retardant decaBDE, presented at the annual meeting of the Behavioral Toxicology Society, September 16-17, 2006.

Christensen, J. R., M. Macduffee, R. W. Macdonald, M. Whiticar, P.S. Ross. 2005. Persisten organic pollutants in British Columbia grizzly bears: consequence of divergent diets. *Environmental Science and Technology* 39:6952-6960.

Darnerud, P. O. 2003. Toxic effects of brominated flame retardants in man and in wildlife. *Environmental International* 29: 841-853.

European Union, 2005. Final draft: Update of the Risk Assessment of bis(pentabromophenyl) ether [decabromodiphenyl ether], RS103_0405_env. <http://ecb.jrc.it/esis/index.php?PGM=ora> (see ID 078, Conclusions).

Ferne, K. J., J. L. Shutt, G. Mayne, D. Hoffman, R. Letcher, K. G. Drouillard, and I. J. Ritchie. 2005. Exposure to polybrominated diphenyl ethers (PBDEs): changes in thyroid, vitamin A, glutathione homeostatis, and oxidative stress in American kestrels (*Falco sparverius*). *Toxicological Sciences* 88: 375-383.

Hellstrom, T. 2000. Brominated flame retardants (PBDE and PBB) in sludge—a problem? The Swedish Water and Wastewater Association report No. M 113 (eng). <http://www.biosolids.org/docs/23481.pdf>

Lindberg, P., U. Sellstrom, L. Haggberg, and C. A. de Wit. 2004. Higher brominated diphenyl ethers and hexabromocyclododecane found in eggs of peregrine falcons (*Falco peregrinus*) breeding in Sweden. *Environmental Science and Technology* 38, 93-96.

Sellstrom, U., P. Lindberg, L. Haggberg, and C. de Wit. 2001. Brominated flame retardants (PBDEs) found in eggs of peregrine falcons (*Falco peregrinus*) breeding in Sweden. Rapport utgiven av Svenska Naturskyddsföreningen I samarbete med TCO-Utveckling AB Stockholm, mars 2001. <http://www.snf.se/pdf/rap-pilgrim-brom.pdf>

Stapleton, H, Brominated Flame Retardants: Assessing DecaBDE Debromination in the Environment, prepared for the EPHA-EN, May 2006. Heather Stapleton, PhD is an Environmental Chemist at Duke University.

Verreault, J., G. W. Gabrielsen, R. J. Letcher, D. D. C. Muir, and S. Chu. 2004. New and established organohalogen contaminants and their metabolites in plasma and eggs of glaucous gulls from Bear Island. SPFO-Report 914/2004. Norwegian Pollution Control Authority. <http://sft.no/publikasjoner/overvaking/2057/ta2057.pdf>

Viberg, H.,A. Fredriksson and P. Eriksson. 2003. Neurotoxicity of different polybrominated diphenyl ethers, including PBDE 209. *Dioxin 2003, Organohalogen Compounds*, 60-65, 2003,

Voorspoels, S., A. Covaci, P. Lepom, S. Escutenaire, and P. Schepens. 2006. Remarkable findings concerning PBDEs in the terrestrial top-predator red fox (*Vulpes vulpes*). *Environmental Science and Technology* 40: 2937-2943.

Vorkamp, K., M. Thomsen, K. Falk, H. Leslie, S. Møller, and P. B. Sørensen. 2005. Temporal development of brominated flame retardants in peregrine falcon (*Falco peregrinus*) eggs from South Greenland (1986-2003). *Environ. Sci. Technol.*, 39, 8199-8206.