

PCBs, Dioxins, and Pesticides in Farmed Salmon from Maine and Eastern Canada

Abstract

Farmed Atlantic salmon (*Salmo salar*) from Maine and eastern Canada, wild Alaskan Chinook salmon (*Oncorhynchus tshawytscha*), and organically farmed Norwegian salmon samples were analyzed for the presence of polychlorinated biphenyls (PCBs), dioxin-like PCBs, polychlorinated dibenzo-*p*-dioxins (PCDDs), dibenzo-*p*-furans (PCDFs), and chlorinated pesticides. PCDD and PCDF congeners were not detected in >80% of the samples analyzed. Total PCB concentrations (7.2 - 29.5 ng/g, wet weight, ww) in the farmed salmon were significantly higher than those in the wild Alaskan Chinook samples (3.9 - 8.1 ng/g, ww). Concentrations of PCBs, WHO-PCB TEQs, and chlorinated pesticides varied significantly by region. PCB and WHO-PCB TEQ concentrations in farmed salmon from eastern Canada were lower than those reported in samples collected two years earlier, possibly reflecting recent industry efforts to lower contaminant concentrations in feed. Organically farmed Norwegian salmon had the highest concentrations of PCBs (mean: 27 ng/g, ww) and WHO-PCB TEQs (2.85 pg/g, ww); their TEQ values are in the higher range of those reported in farmed salmon from around the world. Removal of skin from salmon fillets resulted in highly variable reductions of lipids and contaminants, and in some skin-off samples, contaminant levels were higher, suggesting that skin removal does not protect the consumer from health risks associated with consumption of farmed salmon. Shaw et al. (2006) Environ. Sci. Technol. 40:5347-5354.



Background

This study analyzed PCBs, dioxin-like PCBs, PCDD/Fs, and chlorinated pesticides in farmed and wild salmon marketed to consumers in the northeastern United States. This is the first study of its kind to compare results from several farms within a specific region. It is also the first to specifically examine contaminant levels in samples with skin on and with skin removed.

- Removal of skin has been reported to reduce contaminant levels in fish. Here we show that removing the skin from fillets does not significantly reduce lipids or contaminant levels (and thus, health risks) because contaminants are sequestered in adipocytes in the flesh of salmon on high-energy diets.
- Our results show that contaminant levels in farmed salmon from eastern Canada may be lower than those reported two years earlier by Hites and co-workers, possibly reflecting industry attempts to lower concentrations in feed.
- We reported that Norwegian farmed salmon marketed as “organic” may contain higher levels of contaminants than conventionally farmed salmon, posing additional issues for the consumer. Later, we discovered that this salmon had been falsely labeled as “organic” and sold (at a higher price) in the US. (See comment/correction in Shaw et al. 2007 ES&T 41:4180).
- The importance of labeling salmon as farmed and identifying the region of origin has been emphasized as a means of helping the consumer limit toxic exposure. However, the considerable variability we found in levels among fish from different farms in the same region suggests that labeling salmon by region may not adequately protect the consumer. Moreover, in some instances, farmed fish may be falsely labeled (as noted above).

Publications resulting from this study:

Shaw, S.D., Brenner, D., Berger, M.L., Carpenter, D.O., Hong, C-S, Kannan, K. (2007). PCBs, PCDD/Fs,

and organochlorine pesticides in farmed Atlantic salmon from Maine, eastern Canada, and Norway, and wild salmon from Alaska (comment/correction). *Environ. Sci. Technol.* 41:4180.

Shaw, S.D., Brenner, D., Berger, M.L., Carpenter, D.O., Hong, C-S, Kannan, K. **(2006)**. PCBs, PCDD/Fs, and organochlorine pesticides in farmed Atlantic salmon from Maine, eastern Canada, and Norway, and wild salmon from Alaska. *Environ. Sci. Technol.* 40:5347-5354.

Shaw, S.D., Brenner, D., Bourakovsky, A., Carpenter, D.O., Kannan, K., Hong, C-S. **(2005)**. PCBs, dioxin-like PCBs and organochlorine pesticides in farmed salmon (*Salmo salar*) from Maine and eastern Canada. *Organohalogen Compounds* 67:1571-1576.

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