IUCN OTTER SPECIALIST GROUP BULLETIN
VOLUME 16 ISSUE 2 PAGES 97 - 101

Citation: **Harding, L. (1999)**Contaminants in Otter, Mink and Marten in British Colombia *IUCN Otter Spec. Group Bull*. **16(2):** 97 - 101

CONTAMINANTS IN OTTER, MINK AND MARTEN IN BRITISH COLUMBIA

Lee Harding

2339 Sumpter Drive, Coquitlam, British Columbia, CANADA V3J 6Y3

Abstract: As a continuation of studies of mustelids on the Columbia and Fraser River systems in north-western North America, chlorinated hydrocarbon and trace metal contamination of mink, marten and river otter were assessed in relation to physiological and reproductive measures of condition. Mink, marten and river otter were collected during the winters 1994/95 and 1995/96 from commercial trappers. Necropsies included evaluation of the following biological parameters: sex, body mass and length, age, thymus, heart, liver, lung, spleen, pancreas, kidney, gonad, omentum, adrenal gland and baculum (in males) masses, baculum length, and stomach contents. Livers were analysed, individually or in pools, for residues of organochlorine (OC) pesticides, polychlorinated biphenyls (PCBs), dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs). Contamination levels were relatively low compared to those documented in other North American populations, although they ranged higher than those detected during an earlier survey (1990-92) of these regional populations. Nutritional condition varied slightly amongst collection regions, but showed no relationships with contaminant burdens. Specifically, mink from the upper Fraser River appeared to have less fat stores (evaluated by stomach contents and omentum mass), but also showed some of the lowest OC contamination levels observed. Similarly, a few individuals with enlarged livers and kidneys had unremarkable contamination profiles. Although a few individuals with gross abnormalities of reproductive systems did not show high levels of contamination, there was a significant negative correlation between Aroclor 1260 concentrations and baculum length in juvenile mink. The influence of baculum length on reproductive success is unknown, but given similar associations found in juvenile otter from Oregon, the incidence of smaller baculum size and its influence on reproduction needs to be further characterized in a larger subset of these populations. Also, the bias against collection of females introduced by using commercial traps may underestimate the true contaminant burden in the subset most likely to show detrimental reproductive effects. Other means of collecting breeding-age females should be explored.

Chlorinated hydrocarbon and trace metal contamination of mink (*Mustela vison*), marten (*Martes americana*) and river otter (*Lutra canadensis)* were assessed in relation to physiological and reproductive measures of condition. Specimens were collected during the winters 1994/95 and 1995/96 from commercial trappers. Necropsies included evaluation of the following biological parameters: sex, body mass and length, age, thymus, heart, liver, lung, spleen, pancreas, kidney, gonad, omentum, adrenal gland and baculum (in males) masses, baculum length, and stomach contents. Livers were analysed, individually or in pools, for residues of organochlorine (OC) pesticides, polychlorinated biphenyls (PCBs), dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs).

Reproductive tract abnormalities were seen in a few male mink and otter. In one mink and one otter, a testicle had not descended into the scrotum, but was instead located in the inguinal canal. The latter otter was also missing a kidney on the same side as the undescended testicle. In two male mink, no testes or bacula were found. Another otter was missing one testicle, and had an under-developed second testicle. No abnormalities were seen in the reproductive tracts of the females. Of the two female mink and four female otter known to be of breeding age, only one otter was pregnant. She carried two foetuses measuring 6 cm from crown to rump and weighing 9.9 and 10.5 g.

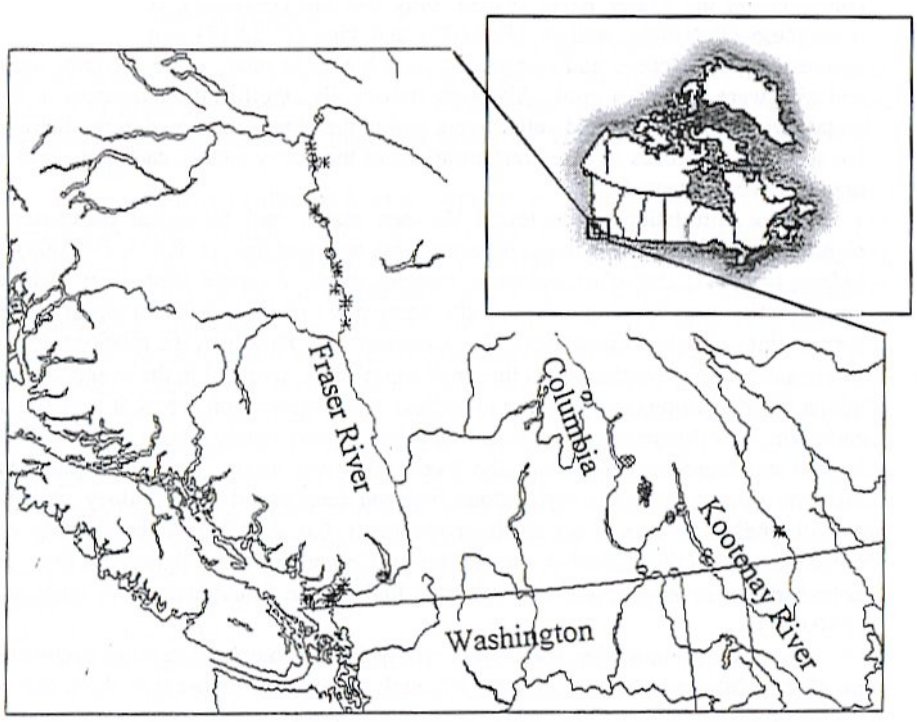

Figure 1: Study Area

Three mink showed other lesions not associated with reproductive organs. One male mink had a healed umbilical infection with some associated abdominal adhesions. Another mink had a thickened, scarred area on the mucosa of its stomach, while a third had an enlarged, haemorrhagic mesenteric lymph node.

The individual organochlorine scans by the Environment Canada laboratory found dieldrin, *p,p*-DDD, *p,p*-DDE and Aroclor 1260 in several mink, and heptachlor epoxide, *p,p*-DDE and Aroclor 1260 in several otter. Aldrin, endosulfan I and II, endrin, heptachlor, and Aroclors 1221, 1232, 1242, 1016, 1254, and 1262 were not detected in any liver samples. One mink from the upper Fraser River had relatively high hepatic concentrations of DDE and Aroclor 1260, while two mink from the lower Fraser were less contaminated with a suite of compounds. In general, hepatic burdens of detectable pesticides and PCBs in mink ranged slightly higher than those found in mink from the upper Fraser River in an earlier, related. In Marten livers, no organochlorine residues were detectable.

The six mink livers analysed by a private laboratory (low resolution) showed very low levels of pesticides and PCBs, and no detectable PCDDs or PCDFs. One mink from the Kootenay River and one from the lower Fraser River showed some elevations in DDE, oxychlordane, and PCB contamination. The pesticides heptachlor epoxide and hexachlorobenzene were consistently detected at low levels. With the exception of the coplanar PCBs 77 and 126, hepatic organochlorine concentrations in these mink were much lower than concentrations in otter from the same regions. Concentrations of PCBs 77 and 126 were up to several thousands pg/g higher in mink liver compared to otter liver on a lipid weight basis.

Otter showed relatively high concentrations of DDE (up to 110 ng/g ww or 3056 ng/g lipid weight/lw) and, occasionally, other pesticides like endosulfan, hexachlorobenzene, and oxychlordane, by high resolution GC/MS. In addition, a female otter, from the lower Columbia River contained relatively high hepatic burdens of PCBs, particularly congeners 138 (4615 ng/g lw), 153 (5769 ng/g lw), and 180 (7308 ng/g lw). Otter composites collected from the lower Fraser River had the highest concentrations of PCDDs and PCDFs, especially OCDD (a - 1860 pg/g lw; b - 6923 pg/g lw). Otter from the Kootenay and lower Columbia River regions had the highest concentrations of coplanar PCB 169 (KOT - 2667 pg/g lw; LCO - 1231 pg/g lw).

Patterns of PCB contamination varied between the two aquatic species and also within a species, amongst regions. Mink had detectable concentrations of CBs 18, 22, and 56/60 (all <1 ng/g), whereas otter did not. Conversely, otter had detectable concentrations of CBs 31, 84, 89, 151, 141, 137, 177,

171/202, 191, 201, 196/203, 189, 195/208, 207, 205, 206, 209, and 169, while mink did not. In particular, CBs 31, 196/203, 195/208, and 206 were all present in concentrations >10 ng/g in otter; also, the presence of the coplanar CB-169 in otter and not mink is significant, because of the higher toxicity associated with the *non-ortho* congener family to which it belongs. The dominant congeners in mink were 180>138>153>118, while the otter CB profiles were dominated by 153>138>180>170. Within the six mink analysed, the Kootenay River mink showed five congeners not present in the lower Fraser River mink (70/76, 101, 87, 110, and 149), while the latter showed one congener (156) not present in the Kootenay mink. Otter from the upper Fraser River had only 15 of the most dominant congeners, while those from the lower Fraser River were only lacking 13 of the 54 congeners analysed for. Apart from these differences in contamination level, otter from the upper Columbia River lacked congeners 44, 151, 141, and 171/202, and otter from the Kootenay River lacked congener 49, all present in otter collected from other regions. Since otter were composite samples, it is difficult to determine the consistency of these differences.

Metal concentrations in tissues of mink, river and marten otter were generally low and within the range of values reported for ranch and wild populations. A small number of differences among collection areas, sexes and species were detected, and the river otter collected below the metal smelter at Trail, B.C. showed elevated lead concentrations.

Mink and marten collected from the Kootenay-Columbia River system exhibited significantly different kidney levels of cadmium (P=0.032), magnesium (P=0.011), manganese (P=0.015), mercury (P=0.007), potassium (P=0.03), strontium (P=0.003), and zinc (P=0.03). Mink had higher concentrations of the heavy metals, cadmium, mercury and strontium, while marten had higher concentrations of magnesium, manganese, potassium and zinc. The higher concentrations of mercury in mink may reflect their aquatic prey, because of methylation of mercury in sediments and uptake in aquatic biota, as opposed to the terrestrial prey of martens. Northern squafish (*Ptychocheilus oregonensis*) and walleye (*Stizostedion vitreum*) from the lower Columbia had means of 0.48 - 0.62 μg/g ww mercury and 0.21 -0.40 μg/g ww mercury, respectively, while whitefish (*Prosopium williamsoni*) from the lower Columbia had significantly elevated mercury levels (mean of 0.069 μg/g ww) compared to fish from the Slocan River (0.033 μg/g ww). These values are low compared to a mean of 0.11 μg/g ww in whitefish muscle from 54 uncontaminated lakes throughtout B.C.

Kidney cadmium concentrations in mink collected from the Kootenay River were above those from the lower Fraser River during this study (P=0.012). However, the Kootenay mink, with an average cadmium concentration of 3.6 mg/g ww, were not likely to be experiencing any toxic effects from this level of contamination. Although cadmium toxicity is not well documented in mustelids, studies with other mammals suggest that renal dysfunction occurs at kidney concentrations around 40 to 200 mg/g ww.

Kidney mercury concentrations were also high in Kootenay mink compared to those from the lower Fraser River. The maximum value detected in mink from this study was 6.68 mg/g dry weight (2.27 mg/g ww).

In addition to cadmium and mercury regional differences, mink from the Kootenay River had higher levels of iron (P=0.002), and lower levels of magnesium (p=0.045) and manganese (P=0.01) than mink from the lower Fraser River, but values are still likely not sufficient to produce toxic effects in affected mink.

In six mink collected from the lower Fraser River, approximately half of the compounds tested were preferentially partitioned to one or the other of the two organs assessed. Cadmium levels were greater in the kidney (P<0.001), while copper (P=0.046), iron (P=0.001), manganese (P<0.001), magnesium (P=0.002) and zinc (P=0.002) levels were greater in the liver. Tissue concentrations of calcium, chromium, lead, mercury and sodium did not differ.

When liver concentrations of metals in livers of mink and river otter were compared on the Fraser River system, only calcium (P<0.001), copper (P=0.039), manganese (P=0.009), sodium (P=0.032) and zinc (P=0.017) concentrations were species-specific. Copper and manganese were higher in otter, while calcium, sodium and zinc were higher in mink. Although statistically significant, differences in these metals were not extreme and values were within the ranges described in the literature. No species differences in liver concentrations of the heavy metals, cadmium, lead and mercury, were detected.

When correlations were tested between metals and biological parameters, a significant association was found between mink age, and liver (r=0.636, *P*=0.003) and kidney (r=0.841, *P*=0.036) cadmium concentrations. Average adult liver cadmium concentration was 0.55 mg/g dry weight, compared to 0.09 and 0.13 mg/g dry weight for yearlings (1 yr) and juveniles (<1 yr), respectively. However, the relationship must be considered with caution given the small sample size involved in the evaluation (two adults, three yearlings and fourteen juveniles). If the association is real, it suggests that cadmium may bioaccumulate in this species. Unfortunately, those mink with the highest cadmium concentrations, the Kootenay River group, were not aged. There were no other significant correlations between metals and liver, kidney or spleen somatic indices or age or sex in either species (r<0.6, *P*>0.05). A female river otter collected near a lead smelter on the lower Columbia River showed a liver lead concentration several orders of magnitude higher than individuals from other areas (*P*<0.001).

Overall, contamination levels were relatively low compared to those documented in other North American populations, although they ranged higher than those detected during an earlier survey (1990-92) of these regional populations. Nutritional condition varied slightly amongst collection regions, but showed no relationships with contaminant burdens. Similarly, a few individuals with enlarged livers and kidneys had unremarkable contamination profiles. Although a few individuals with gross abnormalities of reproductive systems did not show high levels of contamination, there was a significant negative correlation between Aroclor 1260 concentrations and baculum length in juvenile mink. The influence of baculum length on reproductive success is unknown, but given similar associations found in juvenile otter from Oregon, the incidence of smaller baculum size and its influence on reproduction needs to be further characterized in a larger subset of these populations. Also, the bias against collection of females introduced by using commercial traps may underestimate the true contaminant burden in the subset most likely to show detrimental reproductive effects. Other means of collecting breeding-age females should be explored.

REFERENCES

Harding, L.E., Harris, M.L., Stephen, C.R., Elliott, J.E. 1999. Reproductive and morphological condition of mink (*Mustela vison)* and river otter, (*Lutra canadensis)* in relation to chlorinated hydrocarbon contamination. Environ. Health Persp. **107**, 141-147.

Harding, L.E., Harris, M.L., Elliott, J.E. 1998. Heavy and trace metals in wild mink (*Mustela vison)* and river otter, (*Lutra canadensis)* captured on rivers receiving metals discharges. J. Env. Contam. Toxicol. **61**, 600-607.