Estimating Sustainable Fish Productivity: Effect on Remediation Goals at Contaminated Sediment Sites

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Background/Objectives. Fish consumption rates are one of, if not the, most critical assumptions when deriving remediation goals at contaminated sediment sites. To be protective of the populations that consume fish, high-end fish consumption rates are often used when deriving remediation goals with no, or at best little, consideration of whether that site can sustainably produce fish at the assumed fish consumption rate. This presentation reviews and summarizes fish productivity information and then presents examples of how that information can be applied to development of remediation goals at contaminated sediment sites.

Approach/Activities. Fisheries biologists have developed estimates of sustainable productivity for a range of waters throughout the United States. That information can be combined with the area of fishable waters at and adjacent contaminated sediment sites to estimate sustainable production of edible-sized fish. This presentation reviews and summarizes the results of a large-scale study of production data for 100 fish populations from 38 lakes and reservoirs in geographically diverse locations, including lakes that ranged from oligotrophic (poor in nutrients) to hypereutrophic (rich in nutrients), that can be used to determine fish population dynamics and to develop estimates of the fraction of the standing fish biomass can be removed sustainably (Downing, J.A. and C. Plante 1993, Production of fish populations in lakes. Canadian Journal of Fisheries and Aquatic Sciences. 50:110-120.). The estimates of sustainable production of edible sized fish were combined with assumptions of preparation of fish meals and the size of contaminated sediment sites to develop a range of fish consumption rates that could be sustained for the long-term (i.e., years).

Results/Lessons Learned. Fish productivity data indicate that more than 85% of the lakes had sustainable yields of less than 15% of the total mass of fish in the lake, that the majority of sustainable fish population yields in lakes were less than 1 kilogram per hectare per year (kg/ha-year), more than 90% were less than 4 kg/ha-year and that sustainable yield generally appears to be approximately 10% of the fish production of a lake. These sustainable production findings combined with a range of fish meal preparation methods (e.g., consumption of fillets only or both fillets and whole fish) lead to sustainable consumption rates of edible portions of fish ranging from about 1 to 5 grams of fish per hectare per day. The range of sustainable consumption rates per hectare can be combined with the size of a contaminated sediment site to estimate the total amount of edible fish that can be produced and consumed from a site, leading to maximum fish consumption rates that are sustainable and upon which to base sediment remediation goals. Finally, examples of estimates of population risk (i.e., the potential number of cancers in the exposed population) were developed by combining sustainable production rates, site size, concentration of contaminants in fish and toxicity. Such estimates provide risk managers perspective about the benefits realized by cleanup of contaminated sediment sites.