

Management of Commercial Fisheries Bycatch, with Emphasis on Lake Trout Fisheries of the Upper Great Lakes

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Abstract.—We investigated the collective published record on the significance and management of commercial fisheries bycatch at both global and Great Lakes regional scales to: 1) to identify elements of Great Lakes ecosystems that are especially vulnerable as fisheries bycatch; and 2) identify opportunities to minimize incidental catch of sensitive species in Great Lakes commercial fishing gear. The majority of the world's harvestable fisheries are fully- or over-exploited, and approximately a third of the global catch is composed of bycatch and discards. Bycatch can be characterized as the incidental catch of organisms that were not targeted in a given fishing effort. Significant levels of bycatch can contribute to overharvest. Therefore, it is essential to characterize bycatch when assessing impacts of fishing. Bycatch is not always measured; failure to measure bycatch can result in underestimation of fishing mortality and thus, overestimation of quotas available for harvest. Responsible fishing practices are being encouraged worldwide and most of these efforts have focused on reducing or eliminating the amount of bycatch associated with harvest of targeted species. The magnitude of the bycatch problem is typically proportional to fishing effort. In many cases, effort exceeds what is necessary to harvest sustainable yields of target species; thus, reduction of effort is often the single most effective tool in reducing bycatch. Other methods of managing bycatch include: development and use of more selective gear, prohibiting retention of bycatch, and use of incentives and penalties in quota management. Great Lakes fisheries have mirrored the global pattern of overfishing. Recovery programs for collapsed fish populations have necessitated restrictive harvest controls. Lake whitefish *Coregonus clupeaformis* populations have recovered, but lake trout *Salvelinus namaycush* are far from rehabilitated in lakes Ontario, Erie, Michigan,

and Huron. Lake trout are the native keystone species of the upper Great Lakes, are the subject of immense rehabilitation efforts, and have vulnerability similar to lake whitefish to leading gear types used in Great Lakes commercial fisheries. Efforts to limit commercial fishing to more selective gear types have been only partially successful. Bycatch of lake trout in large-mesh gill nets set for lake whitefish has exceeded lake trout harvest quotas in some management units. The selectivity of gill nets is difficult to manipulate, especially when target and nontarget fish are of similar size and overlap in spatial distribution, as is the case with lake trout and lake whitefish. Trap nets are effective in catching lake whitefish and are less lethal to the catch than gill nets. Commercial bycatch, combined with targeted fishing for lake trout (recreational and commercial) and depredation by sea lampreys *Petromyzon marinus*, has contributed to the delayed rehabilitation of self-sustaining lake trout fisheries. Thus, we conclude that the widespread use of nonselective gear types such as gill nets in Great Lakes commercial fisheries is inappropriate in an era of shared resources and ecosystem-level rehabilitation efforts.