Research Document 2019/073

SUMMARY: Assessment of potential impacts of bycatch mortality on the Arctic Cod (*Boreogadus saida*) populations from the Northern (*Pandalus borealis*) and Striped (*Pandalus montagui*) Shrimp fisheries in Shrimp Fishing Areas 1, 2, and 3

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Arctic Cod (*Boreogadus saida*) is considered a key forage species in Arctic marine ecosystems due to its pivotal role in the food web, serving as prey for numerous marine animals (seals, whales, birds, and fishes) and being an important consumer of secondary production (zooplankton). In recent years (i.e., since 2017), shrimp fishing vessels operating in Shrimp Fishing Areas 1 (Baffin Bay) and 3 (Hudson Strait), have occasionally reported large amounts (400–2300 kg per tow) of Arctic Cod bycatch. Fisheries and Oceans Canada (DFO) Resource Management approached DFO Science seeking advice on ecologically and biologically-responsible Arctic Cod removal levels in individual Shrimp Fishing Areas (SFAs) in the north.

This research document reviews the Arctic Cod biology and ecology, considers distributional patterns, and analyzes historical bycatches in the Canadian Eastern Arctic shrimp fisheries. An attempt was made to quantify Arctic Cod population size in the area of interest. Due to the limited data available for this analysis, the ecosystem requirements (i.e., consumption demands of Arctic Cod predators) were used as an indirect estimate of the population size. Based on recent estimates for fish, bird, seal, and whale populations in Baffin Bay/Davis Strait, the Arctic Cod biomass requirement for ecosystem maintenance is greater than 500,000 t Arctic Cod annually, assuming 10% of all Northwest Atlantic marine mammal populations are utilizing the area of interest. While this is considered conservative, it provides a general estimate as to the order of magnitude of the Arctic Cod biomass held in the ecosystem.

By contrasting the size of the estimated Arctic Cod population with the bycatch levels, the assumption was made that the impact of bycatch removal in each Shrimp Fishing Area on the Arctic Cod population is minimal; less than 0.1% of the stock annually based on predators' requirements.With a limited scope of the Arctic Cod biomass data and a high degree of uncertainty surrounding the biomass indices, ecologically and biologically-responsible Arctic Cod removal levels in individual Shrimp Fishing Areas (SFAs) cannot be established at present. Therefore, when amending the conditions of licence in response to the elevated Arctic Cod bycatch which would result in increased removals, caution is advised.