

## **The economic repercussions of fisheries-induced evolution**

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### **Abstract**

Human-induced changes in life-history traits have been observed for many harvested populations, with a component of those changes being attributed to an evolutionary (i.e., genetic) response. Most notably, fish stocks that experience high fishing mortality show a tendency to mature earlier and at a smaller size. Some have suggested that fisheries-induced evolution could affect the fishery's yield and therefore have economic repercussions for society. Yet, this has not been formally investigated. We use data from 1932 to 2005 to develop a bio-economic model specifically for Northeast Arctic cod that allows us to compare the economic yield in scenarios with and without evolution of key life-history traits. We also compare a "business as usual" scenario where fishing continues at its current pace, with a scenario in which harvest is controlled through an optimal control rule. Our model predicts that fisheries-induced evolution decreases economic yield if fishing mortality rates continue at their current high levels. We also find that maximum economic yield is achieved at a considerably lower fishing mortality than what the stock has historically experienced. At this lower mortality, fisheries-induced evolution is less pronounced and actually increases the spawning stock biomass and economic yield. Overall, we find that evolutionary and non-evolutionary models recommend similar harvesting rates and the overriding message is that higher economic yield can be obtained by lower harvest rates irrespective of whether evolution occurs or not.