



Fisheries-induced evolution

FinE is an international research project investigating the prevalence and consequence of evolutionary changes caused by fishing in European waters. FinE is developing new scientific tools required for monitoring and forecasting evolutionary changes to manage Europe's fisheries. This three-year project, funded by the European Commission, has a consortium of 18 different partners.

www.iiasa.ac.at/Research/EEP/FinE

The Evolutionary Dimension of Modern Fishing

Worldwide, commercial fishing maximally exploits or overexploits three-quarters of fish stocks. Wasteful practices and ineffective enforcement of fishing quotas are contributing to this. But commercial fishing not only reduces the number of fish, it also changes their heritable features. This previously overlooked evolutionary dimension of modern fishing has unexpected consequences for economic

yields and for the ecological stability and recovery potential of exploited fish stocks.

Fisheries-induced Evolution Can Be Fast

Evolutionary processes have long been thought of as being too slow to impinge on the management of fish populations. Not so. Commercial fishing practices strongly advantage certain features, such as slower growth and earlier maturation, so that the speed of the fish's evolution is greatly accelerated. Smaller fish avoid being caught by staying under nets' mesh size for longer. Fish that reproduce when they are smaller and younger will reproduce more often than fish that mature later, as chances of surviving until maturation age are so low. Under such pressures, many commercially exploited fish stocks have shown changes suggestive of rapid evolution.

Consequences of Fisheries-induced Evolution

Fish maturing earlier in life can have serious implications for sustainable yield,

stock stability, and recovery potential. Early-maturing fish divert much energy to relatively inefficient reproduction. Consequently, they grow less, which is detrimental to the yield extractable from a stock. They also contribute far less eggs than older and larger individuals would and so render a stock more vulnerable to environmental fluctuations and less capable of recovering from over-exploitation. In 1992 the northern cod stock collapsed in one of the worst disasters of modern fishing. A negative trend in the size of cod at maturation could have been detected seven years before the collapse with a confidence of more than 80%.

An Evolutionary Approach to Fisheries Management

To avoid further undesired fisheries-induced evolution, a new generation of fisheries scientists and managers will need to adopt an evolutionary sound management approach. FinE is developing the needed tools.

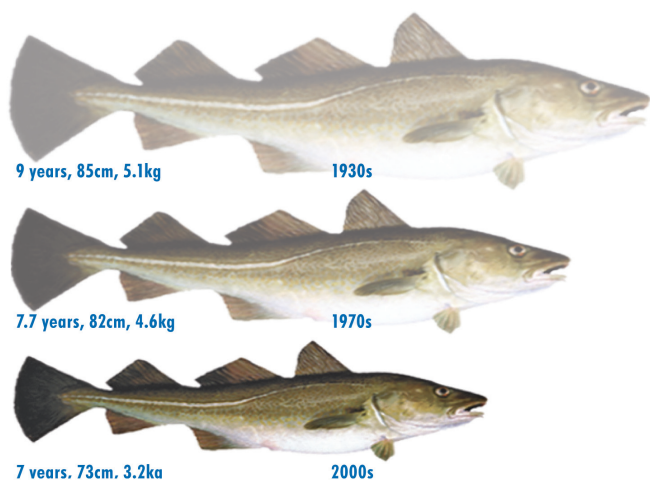


Figure 1: Illustrating the effects of fisheries-induced evolution, the age, size, and weight of first-time spawners have fallen dramatically in Northeast Arctic cod.

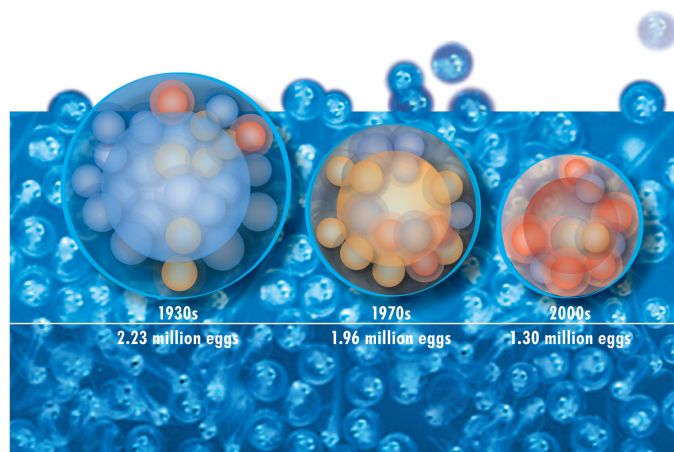


Figure 2: First-time spawners produce fewer offspring. When females of Northeast Arctic cod spawn for the first time, they produce far fewer eggs today than they did decades ago.

Participating Countries: Austria, Belgium, Canada, Denmark, Finland, France, Germany, Iceland, Ireland, Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom

Project Coordination: Dr. Ulf Dieckmann, International Institute for Applied Systems Analysis, Laxenburg, Austria
 Email: dieckmann@iiasa.ac.at • Phone: +43 2236 807 231 • Web: www.iiasa.ac.at/Research/EEP/FinE