

Fluctuations of Cod (*Gadus morhua*) Year-class Strength in the North Atlantic in Relation to the Spawning Stock Biomass and Survival Conditions*

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Abstract

Year-class abundance fluctuations in fish populations are known to reflect reproduction conditions and survival during early life on the one hand and parental stock dynamics on the other. Year-class abundance fluctuations are estimated either on the basis of comparison between absolute year-class abundance at a given age in different years or by relating relative abundance to the average abundance of a year-class during the defined long-time period.

This paper makes an attempt to apply cod (*Gadus morhua*) year-class abundance dynamics to estimates of fluctuations and to compare trends in different populations with the aim of obtaining formation on early life conditions of some cod populations in the North Atlantic.

Long-time series of spawning stock biomass and year-class strength fluctuations at age 3 were analyzed in the northeastern Arctic cod, Faroe Plateau cod, West Greenland and Icelandic cod, Labrador and northern Newfoundland Bank (Div. 2J+3KL) cod and Grand Bank (Subdiv. 3Ps) cod. The ratio of 3-year-olds to the spawning stock biomass in the year when they were born was regarded as a modified survival condition index. The survival condition index of different populations was compared in the western North Atlantic and the eastern North Atlantic.

Survival rate (S) was obtained as the ratio between the abundance of 3-year-olds (R) and spawning stock biomass (P) in the year when they were born:

$$S = R/P,$$

where S is taken in terms of fish abundance per 1 ton of spawning stock.

The greatest magnitude of year-class survival rate fluctuations was observed in the West Greenland cod and the lowest one was typical of Greenland cod. Faroe Plateau cod and Subdiv. 3Ps cod demonstrated relatively narrow range of changes of survival rate. The highest survival rate as averaged for a long-time series was recorded in the northeastern Arctic cod. The next was the West Greenland cod. The northeastern Arctic cod showed the highest geometric mean and mode of survival rate whereas the lowest mode was found in the West Greenland cod. The most significant variations of this parameter were typical of the West Greenland cod immediately followed by northeastern Arctic cod.

Assuming that survival rate indicates early-life conditions for a given generation, the wide range of fluctuations of the parameters in West Greenland and northeastern Arctic cod points to the exposure of these populations to extreme environmental factors demanding species specific adaptations during early life.

Key words: Abundance, Atlantic Ocean (North), biomass, cod, *Gadus morhua*

* The full report of this study is found in *NAFO SCR Doc.*, No. 91/116, Serial. No. N2009.

