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Late-in-life density-dependence: catching smaller fish for higher yields.

Rob van Gemert and Ken H. Andersen

Currently applied descriptions of fish demographics rely on the assumption that density-dependent regulation only affects processes early-in-life, before maturation and before fishing. A process is considered to be density-dependent when it is regulated by population size. Through their influence on vital rates such as growth, reproduction, and mortality, density-dependent processes are key regulators of populations. Almost all current fisheries models and stock assessments are based on the assumption of early-in-life density-dependence, and describe density-dependence solely with the stock-recruitment relationship. Accordingly, almost all fisheries reference points and mesh size regulations are based on this assumption. However, an increasing body of literature reveals that many fish species also experience density-dependent processes in later life, such as density-dependent adult growth. Using a modelling approach, this study shows that for stocks experiencing late-in-life density-dependence, reducing size-at-entry below size at maturation will maximise sustainable yields. Furthermore, distributing fishing mortality over a broader size spectrum will reduce truncation of the stock structure. The results of this study indicate that currently advocated mesh-size regulations may fail to maximise yield for stocks experiencing late-in-life density-dependence. It therefore encourages a re-evaluation of the use of stock-recruitment relationships as the sole means to characterize density-dependence in fish stocks. With many fish stocks recovering due to improved management, a better understanding of density-dependent regulation is increasingly important to ensure both continued recovery and optimal sustainable stock exploitation.

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Contact author:
Rob van Gemert
Centre for Ocean Life, National Institute of Aquatic Resources (DTU-Aqua),
Technical University of Denmark
Jægersborg Alle 1, 2920 Charlottenlund, Denmark
rvge@aqua.dtu.dk
+45 35883396