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NASH EQUILIBRIUM CAN RESOLVE CONFLICTING MAXIMUM SUSTAINABLE YIELDS IN MULTISPECIES FISHERIES MANAGEMENT

Niclas Norrström, Michele Casini, Noél M.A. Holmgren

The current fisheries management goals set by the European Commission states that fish stocks should be harvested to deliver maximum sustainable yields (MSY) and simultaneously, management should take ecosystem considerations into account. This creates unsolved trade-offs for the management of the stocks.

Here we explore one solution to MSY conflicts through the game theoretic concept of Nash equilibrium (NE). This equilibrium exists when no single player can get a higher reward given that the strategies of the other players are unchanged. The Nash equilibrium is here defined in a fisheries context as a multispecies-MSY (MS-MSY) target: none of the stocks can produce a higher yield by altering fishing mortality (F), given fixed Fs of the other stocks. The NE can be a single solution with an F for each species (FNE), or ranges of F-values.

As a case study, we have developed a Multispecies Interaction Stochastic Operative Model (MSI-SOM), which contains a SOM for each of the three dominant species of the Baltic Sea, the predator cod (*Gadus morhua*), and its prey herring (*Clupea harengus*), and sprat (*Sprattus sprattus*). The MSI-SOM incorporates environmental pressures on recruitment and body growth. We present the FNE solution in relation to SS reference points, with regards to fishing mortality, yield and SSB. In addition, the sensitivity of the FNE reference points to intra- and interspecific competition are presented.

Keywords: cod, herring, sprat, Baltic Sea, Multispecies, MSY, reference points

Corresponding author: Niclas Norrström, School of Bioscience, University of Skövde, tel: +46 500 448653; email: niclas.norrstrom@his.se