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A Bayesian network approach to predict survival of caught-and-released fish

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Quantifying the survival probability of caught-and-released aquatic organisms during commercial or recreational fishing is necessary to improve predictions of stock status and to inform fisheries management, especially when implementing major policy initiatives such as the European Landing Obligation. However, traditional methods to assess such mortalities via captive monitoring or tagging are expensive, difficult to standardise, and often cannot attribute causality to mortalities, especially where data are few (e.g. involving rare species). As a complementary method, we propose a Bayesian network approach that integrates selected life-history traits and key intrinsic and extrinsic parameters to model risks and ultimately predict survival probabilities. Such an approach is based on drafting and agreeing upon known relationships between traits and factors such as the duration of gear deployments, water and air temperatures, fish size, air exposure and published records of discard mortality. These relationships can be used to then build a learning algorithm which attributes causality via conditional probabilities. To identify relationships, an initial influence diagram of relevant traits and factors was developed during a participatory modelling session in an expert workshop for developing methods for estimating discard survival (ICES WKMEDS). The outcome was a fuzzy cognitive map created with the mentalmodeler.org freeware. In the next step, the qualitative map will be transferred and quantitatively parameterized in Netica—a software programme for Bayesian network analysis using a reiterative process. Here, we present a first alpha model. Should this work be successful, this system may prove to be an inexpensive decision support tool for fisheries managers.

Keywords: unaccounted post-release mortality; fuzzy logic; discard ban

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