Western Horse Mackerel: Natural Mortality and CPR data

Information for WebEx, 18 February 2016

José De Oliveira

Natural Mortality:

The Working Group on Multispecies Assessment Methods (WGSAM) provided estimates of total mortality for horse mackerel in ICES Subarea IV. The estimates are made up of predation, fishing and unexplained mortality, listed in Table 1. One noticeable feature of these estimates is the high level of unexplained mortality (i.e. not linked to predation or fishing). Another feature is that they pertain to ICES subarea IV, which covers part of the North Sea stock, and only a small portion of the western stock (i.e. that which occupies Division IVa in the final two quarters of the year); although they cover neither stock fully, these estimates are more relevant to the North Sea stock than to the western stock.

Similar estimates for the Celtic Sea do exist, but they have not received the same amount of scrutiny as the key run for the North Sea given in Table 1, and are as yet unpublished.

Table 1. Mortality estimates for horse mackerel from the North Sea Ecosim with Ecopath (EwE) model key run (ICES 2016), for ICES Subarea IV.

Year	predation	fishing	unexplained	total
1991	0.086	0.100	0.694	0.881
1992	0.087	0.117	0.691	0.895
1993	0.085	0.104	0.695	0.884
1994	0.081	0.120	0.696	0.896
1995	0.077	0.178	0.700	0.955
1996	0.074	0.130	0.695	0.899
1997	0.070	0.281	0.709	1.060
1998	0.071	0.238	0.703	1.011
1999	0.074	0.266	0.706	1.045
2000	0.072	0.158	0.699	0.928
2001	0.070	0.182	0.702	0.954
2002	0.062	0.126	0.698	0.886
2003	0.064	0.111	0.694	0.870
2004	0.061	0.091	0.690	0.842
2005	0.063	0.099	0.688	0.850
2006	0.068	0.060	0.691	0.819
2007	0.068	0.059	0.694	0.822
2008	0.070	0.071	0.698	0.839
2009	0.074	0.083	0.703	0.861
2010	0.078	0.135	0.712	0.924
2011	0.078	0.129	0.713	0.920
2012	0.077	0.157	0.716	0.950
2013	0.077	0.175	0.717	0.970

Continuous Plankton Recorder (CPR) Data:

CPR data are available for several species, including horse mackerel (both stocks), for the period 1948-2005 (Edwards 2011). These data have also been analysed for the northeast Atlantic (NEA) stock of mackerel in the North Sea in order to generate a larval index that accounts for catchability as well as both spatial and temporal autocorrelation (Jansen *et al*. 2012). To date, such data has not been included in the assessment for NEA mackerel, although WGWIDE intends to examine, as part of the next benchmark for NEA mackerel, whether a larval index derived from CPR data could be used to supplement the triennial egg survey (ICES 2015).

There are efforts currently underway (and being discussed within a small group of participants from WGWIDE and WGMEGS) to include, in the same model, both egg survey data (stage 1 egg density) and CPR data (Thomas Brunel pers. commn):

- Egg survey and CPR data are combined for the western spawning component; CPR routes both partially overlap with the egg survey coverage, and extend to areas not covered by the egg survey e.g. western Channel, or Irish/Celtic Seas.
- The model suggests that there is some spawning occurring in areas not covered by the survey.
- The model provides a framework to incorporate the information from the CPR data to extrapolate egg density to areas not covered by the survey when calculating the total egg production, which is then converted into SSB.

There are notable challenges, however, when using CPR data for NEA mackerel (Thomas Brunel pers. commn):

- With CPR data, it should be noted that when sampling larvae, substantial drift and mortality occur after spawning. In order to combine stage 1 egg density distributions with larvae distributions, some back calculation of the trajectories and mortality is therefore needed; the current model estimates a coefficient for mortality, but still assumes that the larvae sampled by the CPR haven't drifted.
- The egg survey, by looking at very young eggs, provides a snapshot of egg production at a given time. In contrast, the CPR data, by looking at larvae of different sizes, can be considered to represent an integral over time of egg production.
- The model fit shows that even in areas of high egg density, there is still a probability of 50% that no larvae are found in the CPR data. This could be due to the relatively limited volume of water sampled by the CPR.
- One major difference with Jansen et al. (2012) is that the CPR coverage is much denser in the North Sea, where the whole area is covered; for the western areas, there are only a few routes crossing the spawning area, and the coverage from the CPR is sparser.

To date, no similar analysis that involve CPR data has been carried out for horse mackerel. Furthermore, if CPR data are to contribute to assessments on an ongoing basis, the compilation of CPR data (through analysis of samples) should be brought up to date (the most recent estimates date back to 2005) and continued in future.

References:

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