Baltic Marine Environment Protection Commission

Working Group on the State of the Environment and Nature Conservation

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Note that this document was submitted after the established deadline. It will be decided by the Meeting whether the document can be discussed or is postponed to the next meeting.

Background

STATE&CONSERVATION 11-2019 invited EG MAMA, through the addition of tasks to the ToRs of the group, to discuss how a Precautionary Approach Level for the individual seal populations (Management Units) or something similar can be modelled or otherwise determined (e.g. by expert assessment). If a separate project is required for this purpose, a project description should be drawn up. EG MAMA 14-2020 considered this at the meeting 22-24 September 2020, and prepared a statement intersessional, as included in this document.

Action requested

The Meeting is invited to take note of the information on setting Precautionary Approach Levels (PAL) as provided by EG MAMA.

Determining Precautionary Approach Level in Baltic Seals

The precautionary approach level (PAL) is defined as the population abundance level where productivity is maximized. In other words, this is the level of abundance just before density dependent effects set in and reduce the productivity of a population. This is the theoretical inflection point at which a population will go from the exponential growth phase to an asymptotic growth phase. When the population is above PAL, the abundance will grow towards the carrying capacity of the environment (K) with a declining rate (in the absence of further pressures). The PAL for seals is expected to be in the range of 50-80% of K.

According to Recommendation 27-28/2, a priority area of HELCOM SEAL EG (now HELCOM EG MAMA) is to quantify Limit Reference Level (LRL), PAL and Target Reference Level (TRL) for Baltic seal populations. These levels guide the management of seals in the HELCOM area according to Recommendation 27-28/2. In 2015, EG MAMA (then SEAL EG) commented that "it is not possible to define a Precautionary Approach Level until the populations are close to carrying capacity". This led to the proposal of SEAL EG in 2016 to that the issue with defining PAL should be mentioned in the evaluation of Recommendation 27/28-2.

Both K and PAL are related to the (limiting) resources available for the completion of the life cycle of the individuals of the relevant species. As the quantity and quality of ecological resources fluctuate, K and PAL are dynamic and prone to changes in time and space.

Recognising that TRL cannot be defined with a confidence that would be useful in applied management, EG MAMA can point to three approaches through which inference regarding PAL could theoretically be achieved:

1) Ecosystem models can be used for estimation of carrying capacity. This has provided useful results for some marine organisms at lower trophic levels. However, for top predators of complex marine ecosystems, our information on trophic interactions and abundances is too inaccurate and/or scarce to produce models with sufficient confidence for population management and conservation purposes.
2) Modelling of population growth trajectories can be used to estimate K and PAL. To do this, the population abundance needs to be above PAL, as the asymptote cannot be estimated when the growth is still in the exponential phase. The longer past PAL, the more accurately PAL and K can be estimated. When PAL is reached, the initial decreases in growth rate will be minimal, but more profound the closer the population is to K. This is the background for the previous statement from EG MAMA that PAL can only be defined retrospectively, when a population is close to K. Further complicating factors in this regard are the fluctuations of the ecosystem, spatial variations and behaviour of the seals. As an example, Kauhala et al. (2017; 2019) demonstrated that fluctuations in prey quality affected the body condition and reproductive rate of grey seals in the northern Baltic, which are clear indications of density dependence. At the same time, in the southern Baltic, grey seals from the same population are far from fully recolonising their former range (Galatius et al. in press). Thus, at the same time, density dependent effects are occurring in one part of the population range, while there are untapped resources in other parts. As grey seals are philopatric, it may take decades before their distribution accurately reflects resource availability and, as a consequence, population growth will be slower than expected from a simplistic modelling exercise. It is important to note that when examining the population growth rate as a function of maximal productivity or approaching carrying capacity, the roles of several other potential factors affecting the growth rate must be considered and understood. For example, human-induced mortality in seal populations, like hunting and bycatch can affect the growth rate of the population. Their effect is, however, independent of the density-dependent processes in the population and cannot be taken as signs of PAL or approaching K. Furthermore, detection of a change in population growth rate takes several years due to interannual variations in abundance estimates (Svensson et al. 2011). This obviously

complicates determination of PAL and K and raises uncertainties, even in the light of decreasing population growth rates.

3) Inferences from estimates of historic abundance: Historic abundances have been estimated for harbour seals, grey seals and ringed seals in the HELCOM area (Heide-Jørgensen and Härkönen 1988; Harding and Härkönen 1999). Such estimates may reflect already depleted states rather than historic levels of K (Olsen et al. 2018) and current carrying capacity is likely to be much lower than historic levels due to significant changes in the Baltic Sea ecosystem. Nevertheless, such estimates provide indications of potential levels of K, particularly if aims for future environmental status such as the Baltic Sea Action Plan are fulfilled.

References

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