Long-term health monitoring and survival rates of skates (*Rajidae*) caught as bycatch

Hensgens Rens[1,2], Lemey Laura[1], Van Bogaert Noémi[1], Uhlmann Sven[1], Torreele Els[1], Walker Paddy[2] and Bangma Okka

[1] Research Institute for Agriculture, Fisheries and Food (ILVO), Fisheries and Aquatic Production, Ostend, Belgium., Ankerstraat 1, 8400 Oostende, Belgium
E-mail: rens.hensgens@hvhl.nl
[2] Van Hall Larenstein, Agora 1, 8934 CJ Leeuwarden, The Netherlands
[3] Wageningen University and Research (WUR), Droevendaalsesteeg 4, 6708 PB Wageningen, The Netherlands

One of the main aims of the INTERREG – 2 Seas project "SUMARiS" (Sustainable Management of rays and skates) is to quantify vitality, injury and survival rates of four different skate species (thornback ray - Raja clavata, spotted ray - Raja montagui, undulate ray - Raja undulata and blonde ray - Raja brachyura) discarded by English Channel and North Sea active and passive gear fisheries. During seatrips on-board of Belgian commercial beam-and ottertrawlers, skates were randomly selected from the catch and evaluated for vitality, reflex responsiveness and extent of injury using the Reflex Action Mortality Predictor (RAMP) method. A selection of these sampled rays was monitored ex situ for a 3-week period. During this period, survival and health parameters were monitored, such as weight development, spiracle opening rate per minute, burying behaviour, etc. The results of the first trip with an ottertrawl showed an immediate at vessel mortality of 5.7% (n= 209) and a delayed mortality of 50% (n=8) after the 3 week monitoring period. The skates that died during the 3-week period, showed an average weight loss of 8 %, while the skates that survived gained an average weight of 6%. Looking at the results from the first beam trawl trip, a delayed mortality of 40% (n=20) was observed. From the total of the 8 deceased rays, 4 rays belonged to vitality class C (= "poor"), and 4 to vitality class B (= "good/fair"). A weight loss of 4.8% (n=12) was observed for the surviving skates, while the control skates had a weight gain of 4.8% (n=5). During the 3 week monitoring period, the spiracle movement rate was on average 25.42 per minute and showed no difference between the vitality classes. The control skates had an average spiracle opening rate of 31.4 per minute. The immediate and delayed mortality percentages which have been calculated are in line with previous research which showed that immediate mortality was generally lower than the delayed mortality (Schram & Molenaar, 2018). The spiracle opening rate of the control rays is in accordance with the mean of 30 openings per minute reported by Hughes (1959), while test rays seem to have a slightly lower rate (~25/min). Our study also shows that a sufficiently long monitoring period is necessary to allow the delayed mortality to asymptote. Further analysis of the data will show the effects of different environmental, technical and biological factors on both types of mortality using modelling in R statistical software. The outcomes of this thesis will deliver important insights for (inter)national decision makers and fishery managers on whether an exemption on the landing obligation should be granted for these skate species.

References

- Schram, E., & Molenaar, P. (2018). *Discards survival probabilities of flatfish and rays in North Sea pulse- trawl fisheries.* IJmuiden: Wageningen Marine Research.
- Hughes, G.M. (1959). *The mechanism of gill ventilation in the dogfish and skate.* Cambridge: University of Cambridge.

Keywords: Landing obligation; Discard mortality; Survival; Elasmobranches; Bycatch