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Effects of spatial aggregation of nests on population recruitment: the case of a small population of Atlantic salmon

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In natural populations, individuals are often distributed in such a way that aggregation increases at some places, and decreases at others (Hoare et al. 2004, Broly et al. 2012). Aggregation may modify ecological processes acting at individual level such as breeding interactions or competition, and affect population demography (Chesson & Neuhauser 2002, Murrell et al. 2002). Including aggregation data into stock-recruitment relationships is expected to improve estimations of recruitment, but also to test the effects of aggregation on population recruitment.

Spatial aggregation of Atlantic salmon (*Salmo salar*) nests is expected to diminish recruitment through density-dependent mortality unless females aggregate in the best breeding sites (Hendry et al. 2001, Tentelier et al. 2016), and leads to steadier recruitment under hypothesis that females select safest breeding sites (Gauthey et al. 2017).

Yearly nest mapping in the small Atlantic salmon population of the Nivelle (France) was used to compute spatial aggregation under different scales (Lloyd 1967). This aggregation was incorporated in different stock-recruitment models, linking egg density to juvenile density over a 30 years period. Heteroscedastic hierarchical models without stock were also fitted to check whether accounting for the stock is important when testing the effect of aggregation on recruitment. We found that population recruitment was not impaired by aggregation of nests, whereas aggregation diminished the variability of population recruitment. In addition, stock-recruitment models provided better estimates than models ignoring the stock.

The originality of this work was to use local distribution to compute aggregation at different scales and add it in different stock-recruitment relationships. Altogether, our results indicated that salmon females select breeding sites on environmental risk and on habitat quality. In addition, our results suggest that females first aggregate in best sites increasing aggregation at a low number of breeders, but spread out in sites of low quality when population size increases. These results are consistent with previous studies on salmon (Hendry et al. 2001, Gauthey et al. 2017). Finally, we demonstrated that incorporating ecological data in stock-recruitment models is relevant to improve our understanding of demographic processes.

References

Broly P, Mullier R, Deneubourg J-L, Devigne C (2012) Aggregation in woodlice: social interaction and density effects. ZooKeys 176:133–144
Chesson P, Neuhauser C (2002) Intraspecific aggregation and species coexistence. Trends Ecol Evol 17:210–211
Gauthey Z, Lang M, Elosegi A, Tentelier C, Rives J, Labonne J (2017) Brown trout spawning habitat selection and its effects on egg survival. Ecol Freshw Fish 26:133–140
Hendry AP, Berg OK, Quinn TP (2001) Breeding location choice in salmon: causes (habitat, competition, body size, energy stores) and consequences (life span, energy stores). Oikos 93:407–418
Hoare D., Couzin I., Godin J-G., Krause J (2004) Context-dependent group size choice in fish. Anim Behav 67:155–164
Lloyd M (1967) Mean crowding. J Anim Ecol 36:1–30