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Delayed Recruitment of First Natives

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Introduction

Strong pressure exists on wetlands as a consequence of urbanisation, agriculture, fish farming, industry, hunting, recreation, forestry or military activities. As a result, the birds breeding sites are regularly destroyed or abandoned. However, new colonies can potentially emerge to compensate lost ones. As such, we can identify four critical aspects essential for new colonies formation: 1) Natal or breeding dispersal (De le Court & Aguilera 1997, El Hamoui *et al.* this volume); 2) suitable new sites that provide protection from disturbance and feeding grounds (Marion, this issue); 3) colony growth and 4) stabilization. Here we focused on the Eurasian Spoonbill *Platalea leucorodia* Camargue colony located in Southern France that is growing exponentially (Blanchon *et al.* this volume) to document the process of colonization. Specifically, we quantified early-life demographic parameters and compared them with those from older new born colony from Italy.

Methods

Estimating early-life survival and recruitment are challenging due to younger age classes that dispersed broadly and young individuals that are not sighted before recruiting. To this end, we used a multi-event capture-recapture model to estimate age at first breeding. We took into account the survival and imperfect detection of breeders, and tested for time and density effects. We applied the model to long-term resighting data of more than 2,500 Eurasian Spoonbills ringed in the Camargue over the last ten years. The results were compared with published literature from Italian and Dutch colonies.

Results and Discussion

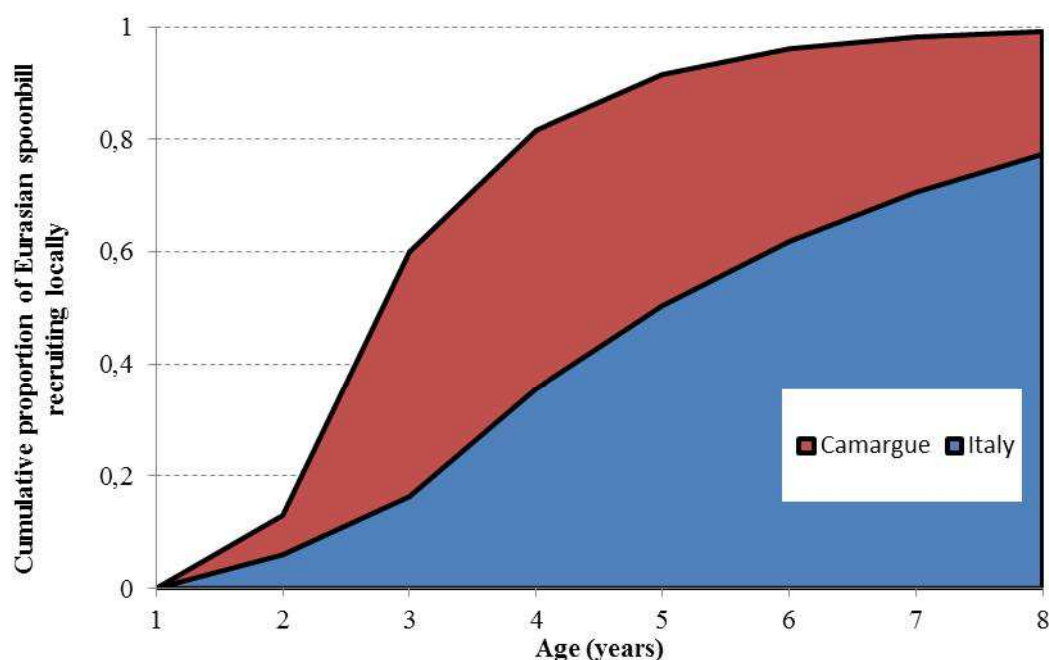
We found that the probability of surviving the first year (0.33; 95CI [0.24-0.45]) and the probability of surviving after surviving their first year (0.90; 95CI[0.81-0.95]) are in agreement with other studies on the species (Lok, Overdijk & Piersma 2015; Tenan *et al.* 2017).



More interestingly, recruiting was null until the local population reached a threshold of 200 breeding pairs, six years after the first ringing of fledglings in the colony. It means that until reaching this threshold, it is likely that the colony was growing as a result of immigration. Indeed, Tenan *et al.* (2017) suggested that settlement decision (local recruitment and immigration) is affected by the abundance of conspecifics. In larger colonies, Spoonbills find higher chance to meet suitable mates, and colony size may also be an indicator of habitat quality.

After reaching a colony size of 200 breeding pairs, local recruitment was occurring at a very early age, with 13% 95CI[5%-24%] of two-year-old Spoonbills recruiting locally (Bauchau, Horn & Overdijk 1998). Local recruitment occurred far more rapidly than the new-born colony located in the Po delta, North East Italy (Figure 1).

Figure 1. Cumulative proportion of breeders across age classes within two separate populations (Camargue in red and Italy in blue). Data from Italy are extracted from Tenan *et al.* (2017)



Conclusions

Colony growth is the result of both immigration process and local recruitment. We showed here that local recruitment in Camargue is crucial from the moment the colony reached a threshold of approximately 200 breeding pairs. By contrast, in the Po Delta, immigration is the primary driver of the population growth, contributing more than local recruitment (Tenan *et al.* 2017). There, breeding pairs distribute in 2 to 4 sites, distant 10-32 km each, occupying small spots of suitable nesting habitat located in strictly protected areas and any of these sub-colonies has never reached the threshold of 200 pairs. We can hypothesize that Camargue habitat is very attractive and no density-dependent process occurred yet, leading to the absence of competition among age classes for access to breeding.

After a phase of growing population, stabilization of the colony occurs with density-dependent processes that take place and limit breeding accessibility to suitable breeding site to early breeders. Those processes have been well documented in the Wadden sea by Lok *et al.* (2013) and Oudman *et al.* (2017).



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