

Effect of the timing of spring thaw on the breeding performance in two sympatric waterbird species



Céline Arzel¹, Lisa Dessborn^{2,5},

Petri Nummi³, Hannu Pöysä⁴, Johan Elmberg², Kjell Sjöberg⁵

Contact: celine_arzel@yahoo.fr; lisa.dessborn@hkr.se



Background

At northern latitudes, climate change might impact the breeding outcome of waterbirds through changes in spring thaw dates. Ice break up dictates the access to breeding lakes, hence influencing access to resources and potentially reproductive success. Species migrating shorter distances, and which thus spend the winter closer to breeding grounds, could be assumed to have more reliable cues about the earliness of spring on breeding grounds than birds migrating longer distance. Shorter distance migrants are more likely to adapt to environmental conditions on the breeding ground than longer distance migrants which have to cope with weather constraints and local resource accessibility along their migratory path. We predicted that the species with the longer migration distance (Teal) would i) have less flexible breeding phenology, ii) experience a more reduced breeding success in years of early ice break up than the short-distance migrant (Mallard). We investigate effects of spring phenology on the timing of breeding and breeding success in two sympatric duck species with similar breeding habitats requirements but differing in migration patterns.

Method

From 1988 to 2009, waterfowl surveys have been conducted at Evo, Finland, a boreal catchment dominated by oligotrophic lakes. Ice break up dates were based on data from an average-sized lake. Teal (*Anas crecca*), and Mallard (*Anas platyrhynchos*) are two common duck species in the area. Teals migration distance between the wintering and breeding ground is four times longer than Mallards. Brood age class was estimated in the field allowing us to back-calculate their hatching dates.

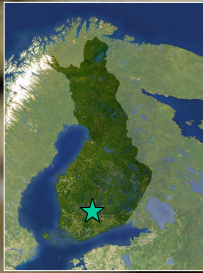


Fig 1. Location of the study area in Southern Finland: Evo watershed



Fig. 2. Estimation of brood age class in the field

Results:

- Mallards breed earlier than teals (LMM; slope \pm se = -12.205 ± 1.635 , $t = -7.47$, 95% CI = $-15.696 - -9.086$, $n = 250$) respectively 75.4 ± 0.5 days and 88.4 ± 0.3 days after the vernal equinox.

- Ice break up varied greatly (from 14th April to 9th May). Hatching date was earlier in years with an early spring thaw in both species (LMM; Teal: slope \pm se = 0.367 ± 0.144 , $t = 2.550$, 95% CI = $0.050 - 0.663$, $n = 141$; Mallard: slope \pm se = 0.725 ± 0.200 , $t = 3.631$, 95% CI = $0.345 - 1.129$, $n = 109$, Fig. 3).

- Nevertheless in early springs teals broods hatched relatively later than in late springs as compared to mallards (LMM; slope \pm se = -10.476 ± 1.627 , $t = -6.44$, 95% CI = $-13.236 - -6.982$)

- Annual mean number of ducklings per brood tended to decrease with early ice break up date in both species but especially teals (LM, teals: $F_{(1,20)} = 5.286$, $r^2 = 0.209$, slope \pm se = -0.063 ± 0.027 , 95% CI = $0.009 - 0.116$; mallards: $F_{(1,20)} = 1.121$, $r^2 = 0.053$, slope \pm SD = -0.043 ± 0.041 , 95% CI = $-0.042 - 0.128$)

- Brood sizes tend to be lower when the time span between the ice break up date and the hatching date increases in both species (Table 1), meaning when there is an increased delay before egg laying.

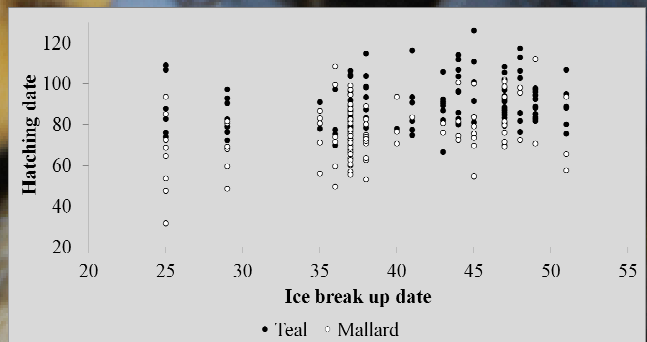


Figure 3. Hatching date in relation to ice break up date. Dates are given as days from the vernal equinox.

Species	Intercept \pm se	Slope \pm se	z	P
Teal	1.481 ± 0.047	-0.011 ± 0.004	-2.941	0.003
Mallard	1.658 ± 0.050	-0.010 ± 0.004	-2.92	0.004

Table 1. Results of Poisson mixed models assessing the relationship between brood size and time span between ice break up and hatching date (standardized) in Teal and Mallard. Age class (nested within year) and year were set as random factors. $N = 140$ for Teal and 106 for Mallard.

Discussion

Although both our study species do show a clear flexibility in breeding phenology, as they both breed earlier in early springs, breeding success of both species tend instead to be negatively affected by early spring thaw, especially for the longer distance migrant: Teal. In this context it should be noted that many climate change projections for northern Europe include earlier springs. Despite the fact that earlier springs may be more detrimental to teals due to its longer migration distance, our study suggest that mallards as well might suffer from spring advancement. Both species tended to have an increased delay before egg laying in early springs. A longer delay tended to affect negatively the production of ducklings in both species. A decrease in reproductive output of Fennoscandian ducks should be of great concern as it is the most important region in Europe in terms of waterfowl production.

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1 Sect. of Ecology, University of Turku, Finland, 2 Aquatic Biology and Chemistry, Kristianstad University, Sweden, 3 Dept. of Forest Science, University of Helsinki, Finland 4 Finnish Game and Fisheries Research Inst., Joensuu, Finland, 5 Dept. of Wildlife, Fish and Environmental Studies, SLU Umeå, Sweden