

Incubation strategies of selected duck species

Summary of the PhD. thesis

Avian incubation is an energetically demanding process. It holds true especially for uniparental incubators in which all incubation efforts are restricted to one individual. All ducks species breeding in northern hemisphere are representatives of birds with uniparental care. High demands of clutch formation and incubation make from ducks perfect model for testing factors influencing parent investment decisions. On the other hand parental investment to actual breeding attempt depends on many factors including breeding season duration, food supply, female's age, risk of predation or result of previous nesting attempt. So investigation of this complex problematic is extremely difficult.

This thesis is focused on the most important phase of breeding cycle – incubation of clutch. Clutch incubation is associated with high energy cost to maintenance optimal temperature conditions for developing embryos. Moreover incubation process can has large effect on female's body mass because of reduction of feeding time. Incubation strategy of success female include many partial tactic reducing predation risk of clutch and incubating female or eggs cooling. The incubation strategies of three ducks species were investigated in this thesis – Mallard (*Anas platyrhynchos*), Common Pochard (*Aythya ferina*) and Tufted Duck (*Aythya fuligula*). Mallard is primarily ground-nesting species inhabiting banks of water bodies and wetlands, and thus suffer a lot from mammalian and avian predation. Common Pochard and Tufted Duck are primarily overwater nester and thus its nests are presumably less susceptible to predation. Nowadays all three species are nesting together in fish pond islands but evolution of incubation strategy was probably influenced by level of nest predation in primary nesting habitats.

The aim of the first chapter is description of factors effect trade-off between restrictive feeding time and clutch incubation cost. The nest site selection can strong influence the probability of nest predation so one chapter attend to factors determining Common Pochard nest predation along a wetland gradient. The next two chapters describe another antipredation tactics involve risk-taking behaviour and sleep-vigilance pattern in incubation females and the effect of nest visibility. The resting chapters describing behaviour of Tufted Duck females during a parasitic event and egg recognition ability of females Common Pochard during incorporation of unrelated eggs into a clutch. Our results provide some new information about incubation behaviour of three duck species breeding in central Europea and showed a important effect of food supply and nest cover on behaviour of incubation females.

Klvaňa, P., Hořák, D., Musil, P. & Albrecht, T. Nest attendance patterns of three European duck species.

The aim of this study was to investigate incubation rhythm of three European ground nesting duck species that differ in body mass – Mallard (*Anas platyrhynchos*), Common Pochard (*Aythya ferina*) and Tufted Duck (*Aythya fuligula*). Field work was carried out during 2002-2006 in Třebonsko Biosphere Reserve, Czech Republic. Our results show that Common Pochard females exhibited the significantly higher nest attentiveness (92%) than two other species (90%). Frequency of recesses also differed among species being highest in Tufted Ducks and lowest in Mallards. Tufted Ducks left the nest mostly during the day-time, while Mallard females took recesses mainly during night-time. Common Pochards show no significant preference for any part of the day. We found no significant effect of body mass on nest attentiveness in Mallards and Pochards. However, body mass was negatively related to nest attentiveness in Tufted Ducks. Our results imply that high incubation constancy might lead to depletion of internal body reserves which possibly caused low body mass at the end of incubation period in Tufted Duck. High incubation demand in Tufted Duck probably explains location of majority of recesses to day-time period when egg cooling rate is lower. In contrast, Mallard (relatively larger species) in which incubation demands are probably not so high can concentrate feeding activity to night-time and thus lower the risk of clutch predation.

Albrecht, T., Hořák, D., Kreisinger, J., Weidinger, K., Klvaňa, P. & Michot, T. C. 2006. Factors determining Pochard nest predation along a wetland gradient. *Journal of Wildlife Management* 70:784-791.

Waterfowl management on breeding grounds focuses on improving nest success, but few studies have compared waterfowl nest success and factors affecting nest survival along a wetland gradient and simultaneously identified nest predators. We monitored nests ($n = 195$) of Common Pochards (*Aythya ferina*) in Trebon Basin Biosphere Reserve, Czech Republic, during 1999-2002. Daily nest survival rates DSRs, logistic-exposure) declined from island (0.985, 95% confidence interval, 0.978-0.991) to overwater (0.962, 0.950-0.971) and terrestrial (0.844, 0.759-0.904) nests. The most parsimonious model for DSRs included habitat class (DSRs: island > overwater > terrestrial) and nest visibility. Nest survival was improved by reduced nest visibility, increased water depth, and increased distance from the nest to habitat edge in littoral habitats. On islands, nest success increased with advancing date and increased distance to open water. A model of constant nest survival best explained the data for terrestrial nests. There were no observer effects on DSRs in any habitat. In 2003, artificial nests ($n = 180$; 120 contained a wax-filled egg) were deployed on study plots. The model that best explained variation in DSRs for artificial nests included only 1 variable: habitat class (DSRs: island > overwater > terrestrial). Mammalian predation of artificial nests (by foxes [*Vulpes vulpes*] and martens [*Martes* spp.]) was more likely in terrestrial habitats than in littoral habitats or on islands. By contrast, corvids and marsh harriers (*Circus aeruginosus*) prevailed among predators of overwater and island nests.

Our data indicate that artificial islands and wide strips of littoral vegetation may represent secure breeding habitats for waterfowl because those habitats allow nests to be placed in areas that are not accessible to, or that are avoided by, mammalian predators. Management actions should be aimed at preserving these habitats. This, along with creation of new artificial islands, could help to enhance breeding productivity of pochards and possibly other waterfowl species inhabiting man-made ponds.

Albrecht, T. & Klvaňa, P. 2004. Nest crypsis, reproductive value of a clutch and escape decisions in incubating female mallards *Anas platyrhynchos*. *Ethology* 110:603-613.

In cryptically coloured birds, remaining on the nest despite predator approach (risk-taking) may decrease the likelihood that the nest will be detected and current reproductive attempt lost. By contrast, flushing may immediately reveal the nest location to the predator. Escape decisions of incubating parents should therefore be optimized based on the risk-to-parent/cost of escape equilibrium. Animal prey may assess predation risk depending on a variety of cues, including the camouflage that vegetation provides against the predator. We examined interactive effects of nest crypsis and the current reproductive value of a clutch on flushing distances in incubating mallards (*Anas platyrhynchos*) approached by a human. Our results were consistent with predictions of parental investment theory: flushing distances were inversely correlated with measures of the reproductive value of the current clutch, namely with clutch size, stage of incubation and mean egg volume. Independently of a reproductive value of a clutch, nest concealment explained a significant portion of the variation in flushing distance among females; individual females tended to increase/decrease flushing distances according to change in nest cover. The results further suggest that vegetation concealment greatly influenced the risk of nest detection by local predators, suggesting that vegetation may act as a protective cover for incubating female. A female's ability to delay flushes according to the actual vegetation cover might thus be viewed as an antipredator strategy that reduces premature nest advertising to visually oriented predators. We argue, however, that shorter flying distances from densely covered sites might be maladaptive in areas where a predator's ability to detect incubating female does not rely on visual cues of nests.

Javůrková, V., Hořák, D., Kreisinger, J., Klvaňa, P., & Albrecht, T. Sleep-vigilance pattern in incubating Mallards: the effect of environmental factors and sleeping postures.

Vigilance is a behavioural tactic that allows individuals to control their surroundings and to assess predation risk. In contrast, sleep is unique behavioural state with widely hypothesised restorative and energy-saving functions, but reducing attentiveness and increasing susceptibility to predation. Sleeping birds resolve this conflict by interrupting sleep with short periods of eye opening (termed „scans“) during vigilant

sleep. Although sleeping birds use different sleeping postures (the rest-sleeping and scapular positions), their effect on sleep-vigilance performance has not yet been sufficiently tested. Furthermore, miscellaneous environmental factors may affect the perception of risk and corresponding vigilance level. Here, we investigated the influence of nest vegetation concealment, time of day and sleeping postures on the sleep-vigilance trade-off in incubating Mallards (*Anas platyrhynchos*). We did not find any effect of nest vegetation concealment on the vigilance level of female Mallards, but incubating females adjusted their vigilance to time of day and sleeping postures. Females reduced their total vigilance along with scan frequency and scan length at night, while displaying the opposite pattern during daylight. Females also preferred the rest-sleeping position more during the night compared to the daylight period, and were more vigilant in this position at night. Our data show that visual abilities during different light conditions and sleeping posture, rather than nest vegetation concealment, play an underlying role in antipredator vigilance during sleep in this cryptic ground-nesting bird.

Hořák, D. & Klvaňa, P. 2008. An observation on conspecific egg adoption during a parasitic event in the Tufted Duck (*Aythya fuligula*). *Sylvia* 44:63-66.

We describe behavioural interaction between a brood parasite and a host we observed during a conspecific parasitic event in the Tufted Duck (*Aythya fuligula*). The parasite came to the host nest during morning hours while the host was asleep and incubating a clutch. The host female showed a slightly aggressive response to the intruder (pecking its beak and head) and did not allow the parasite to sit fully at the nest. Within a few minutes, the parasite laid an egg which, due to the inconvenient position of the parasite, dropped out of the nest. When the parasite left, the host female retrieved the egg to the nest. Such behaviour of the host female is in contradiction with her aggression towards the intruder female and provides an opportunity for speculations about the evolution of anti-parasitic responses in ducks. Although a similar pattern of behaviour has been reported in other members of the Aythyini tribe, it has not yet been described in the Tufted Duck.

Hořák, D. & Klvaňa, P. 2009. Alien egg retrieval in Common Pochard: Do females discriminate between conspecific and heterospecific eggs? *Annales Zoologici Fennici* 46:165-170.

Incorporation of unrelated eggs into a clutch by incubating females (egg retrieval), which has an obvious adaptive value when female retrieves her own egg, seems to be also a part of the reproductive tactics related to brood parasitism. In open nesting waterfowl, the parasitic egg remains frequently outside the nest bowl after the parasitic event. Using time-lapse video recorders, we described experimentally the behavioural reaction of the common pochard (*Aythya ferina*) females towards an egg lying beside the nest. We tested whether the females discriminate between conspecific and heterospecific eggs (brown chicken eggs). All 16 experimental females retrieved both conspecific and heterospecific eggs. We found no apparent differences in female

responses towards either egg type. The retrieval of alien eggs can be a result of an imperfect recognition ability of the female, anti-predation defence, or sophisticated tactic related to the brood parasitism. The last explanation seems to be less likely due to imperfect egg recognition abilities in the species.