

Adult white-tailed sea eagles (*Haliaeetus albicilla*) train their post-fledged young in catching prey

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This article describes two observations from the outer archipelago of SW Finland on how adult white-tailed sea eagles (*Haliaeetus albicilla*) actively train their post-fledged offspring to identify, catch and handle prey outside the nest. This involves synchronised and deliberate behaviour from the adults. Adult-juvenile training may be fundamental, as the food sources are shifting, the competition for abundant food items is strong, and the dependence of alternative prey is increasing.

The white-tailed sea eagle (*Haliaeetus albicilla* Linné 1758) has made a remarkable recovery from having been nearly extinct in Finland around 1970 to a strong and viable population today. A parallel recovery-process has also been recorded for the grey seals in the Baltic Sea region, and simultaneously the population growth of cormorants has been nearly exponential. The competition for food among top predators has thus changed, with cascading effects both from the bottom-up and top-down perspectives, and the eagles have had to adapt to a changing available diet, and to increased intra- and interspecific competition (Hansson et al. 2018). Here we report two intriguing observations from the outer archipelago of SW Finland on how adult white-tailed sea eagles actively train their post-fledged offspring to search and hunt for their prey. The behaviour involves synchronised deliberate behaviour, including vocal and visual signals and cues.

White-tailed sea eagles reach maturity at 5–6 years of age, form lasting pairs, and breed annually with 1–3 eggs that hatch after some 35–40 days. The newly hatched chicks develop fast and are ready to leave the nest after approximately 11 weeks, although they stay around the nest for an

additional 5–6 weeks. In the Finnish Archipelago Sea (northern Baltic Sea) individual semi-independent post-fledging feeding begins in late summer-early autumn (late July – early September), and the family can be seen around their nesting site throughout the autumn (Baloteri-Chiebao et al. 2016, Nuuja 2017).

There is abundant knowledge of the population development in the Finnish coastal and inland areas, as well as of the choice of prey among adult birds in the same region (Sulkava et al. 1999, Stjernberg et al. 2005, Ekblad et al. 2016). Following a period where the white-tailed sea eagle in Finland was almost lost to extinction due to poisoning and hunting, the population has increased steadily since the banning of pollutants such as PCB, DDE/DDT and heavy metals in the early 1970s, as well as banning of hunting the eagles (Helander et al. 2002, Stjernberg et al. 2005), and the recovery of the eagle population in the Baltic Sea regions is seen as a prime example of successful environmental management (Reusch et al. 2018).

The diet of adult individuals consists of a mix of fish, birds and mammals including carcasses (Ekblad et al. 2016). This diversity of food-

sources resembles that of white-tailed sea eagles in other freshwater- and marine regions (Wille & Kampp 1983, Watson et al. 1992, Sulkava et al. 1997, Ekblad et al. 2020). The early diet also plays a significant role in the life-expectancy of the birds (Nebel et al. 2023), underlining the importance of adult-juvenile training in the hunt for prey. After the young-of-the-year individuals leave the nest, they begin training their hunting skills. Having been fed and to some level trained to compete within the brood by the adults while in the nest, they now as post-fledged juveniles need to learn how to catch suitable prey by themselves. This phase in the early post-fledged young sea eagles has to our knowledge not previously been identified, observed, and recorded.

Here we describe direct observations on how an established couple that has returned to the same nest-site over several years actively train their post-fledged young-of-the-year to catch and handle prey outside the nest. The observations were made in August-September 2023 in the outermost part of the Archipelago Sea, SW Finland, adjacent to the island with the nesting site (59°86'N, 22°54'E). The pair had 3 post-fledged young-of-the-year in 2023. Two detailed and specific events are described below. In both cases both adults and all three young-of-the-year birds were present.

Observation 1. Early one evening in August the two adult eagles and their three young-of-the-year offspring were sitting on a small islet some 200 m off the observation-point. Between them and the observation-point a school of goosanders (*Mergus merganser*) with 6–8 adults and roughly 30 chicks were swimming on the calm sea surface 50 m away from the observation-point. As on a given signal (a clear sound made by one of the adult birds) the 5 eagles flew up and flew at low height (10–15 m above sea surface) straight towards the goosanders. The adult goosanders tried to herd their sub-adult offspring to a tight school. The 5 eagles hovered above the goosanders, and in a synchronized manoeuvre and on a given signal (a loud squeaky sound) both adults dove and caught a subadult goosander each. They then flew straight up some 10–15 m, and again giving out loud vocal signals, they both actively threw their prey down to the surface, thus stunning or invalidating their prey. After this the adults gave vocal signals to their offspring, which then attacked

the two immobile prey items at the surface. One caught a prey and flew up on a cliff close to the observation-point. The other two had a brief competition over the second prey, until one of them flew up and landed close to the first one with its prey. The third young eagle flew some 50 m further and landed in a small pine tree, where it sat and observed its siblings with their meals. The adults landed a short distance away, one on each side, where they sat as if observing their young, and simultaneously being on lookout for potential threats. The entire family remained this way until the prey were consumed. Remarkably, neither the adults nor their offspring seemed to pay attention to the observer. The adult eagles remained on the island until dark, whereas the yearlings disappeared out of sight after their meal.

Observation 2. A few days later (first week of September 2023) a similar organized display was repeated, this time so that only one of the adults carried a prey and flew in over a small island where it – again giving a clear vocal signal while doing so – actively threw its freshly caught prey (an unidentified seabird), this time onto bare cliffs in a small opening in the woodland vegetation on the island. The adults circled the site, and the young competed for the prey as they had done during the previous session.

The adult white-tailed sea eagles thus displayed an orchestrated and synchronized behaviour for training their post-fledged offspring to identify, catch and compete for prey.

To our knowledge this behaviour has not previously been described for the white-tailed sea eagle. During the first two to three months as post-fledged, the young-of-the-year of most raptors are still actively fed by the adults, often so that food is brought to the nest (Slagsvold et al. 2010). Gradually, the offspring must become self-sufficient in their hunting, and their chances of survival and success can be expected to increase through this active parental teaching behaviour (Bustamante & Hiraldo 1989, Bustamante 1993).

Training offspring to hunt for food is a well-known and described pattern in predatory mammals (e.g. Jenny & Zuberbühler 2005) and even in fish (Reid et al. 2010), but studies of similar behaviour in raptors are scarce, although it is well documented that the adults gradually leave their post-fledged offspring to compete for intact

prey organisms at or close to the nesting sites, including observations on parent-offspring competition (Trivers 1974, Hiraldo et al. 1989, López-Idiáquez et al. 2018).

The behaviour displayed by this established pair of white-tailed sea eagles shows that the gradual phase of becoming independent from the adults can be facilitated and speeded up by actively training the young birds to identify and catch their own prey. We suggest that this behaviour may be fundamental, as the potential food sources are shifting, the competition for several food sources is strong (Hansson et al. 2018), and the dependence of alternative prey is increasing in the area of observation (Nebel et al. 2023), from the previously preferred fish (such as northern pike, *Esox Lucius*) to seabirds (eider ducks *Somateria molissima*, goosanders *M. merganser*, and several others, with the cormorant *Phalacrocorax carbo* currently becoming a common prey as the cormorant colonies expand (Ekblad et al. 2016). Adapting to rapidly changing environmental conditions, such as those driven by global climate change and thus altered ecosystem functioning, may in part be facilitated through active adult-juvenile interactions as described here.

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References

- Balotari-Chiebao, F., Villers, A., Ijäs, A., Ovaskainen, O., Repka, S. & Laaksonen, T. 2016: Post-fledging movements of white-tailed eagles: conservation implications for wind-energy development. – *Ambio* 45: 831–840.
- Bustamante, J. 1993: Post-fledging dependence period and development of flight and hunting behaviour in the Red Kite *Milvus milvus*. – *Bird Study* 40: 181–188.
- Bustamante, J. & Hiraldo, F. 1989: Post-fledging dependence period and maturation of flight skills in the Black Kite *Milvus migrans*. – *Bird Study* 36: 199–204.
- Ekblad, C.M.S., Sulkava, S., Stjernberg, T.G. & Laaksonen, T.K. 2016: Landscape-scale gradients and temporal changes in the prey species of the white-tailed eagle (*Haliaeetus albicilla*). – *Annales Zoologici Fennici* 53: 228–240.
- Ekblad, C., Tikkanen, H., Sulkava, S. & Laaksonen, T. 2020: Diet and breeding habitat preferences of White-tailed Eagles in a northern inland environment. – *Polar Biology* 43: 2071–2084.
- Hansson, S., Bergström, U., Bonsdorff, E., Härkönen, T., Jepsen, N., Kautsky, L., Lundström, K., Lunneryd, S.G., Ovegård, M., Salmi, J., Sendek, D. & Vetemaa, M. 2018: Competition for the fish – fish extraction from the Baltic Sea by humans, aquatic mammals, and birds. – *ICES Journal of Marine Science* 75: 999–1008.
- Helander, B., Olsson, M., Bignert, A., Asplund, L. & Litzén, K. 2002: The role of DDE, PCB, coplanar PCB and egg-shell parameters for reproduction in the White-tailed Sea Eagle *Haliaeetus albicilla* in Sweden. – *Ambio* 31: 386–403.
- Hiraldo, F., Delibes, M. & Estrella, R.R. 1989: Observations of a zone-tailed hawk family during the post fledging period. – *Journal of Raptor Research* 23: 103–106.
- Jenny, D. & Zuberbühler, K. 2005: Hunting behaviour in West African forest leopards. – *African Journal of Ecology* 43: 197–200.
- López-Idiáquez, D., Vergara, P., Fargallo, J.A. & Martínez-Padilla, J. 2018: Providing longer postfledging periods increases offspring survival at the expense of future fecundity. – *PLoS One* 13(9):e0203152.
- Nebel, C., Ekblad, C., Balotari-Chiebao, F., Penttinen, I., Stjernberg, T. & Laaksonen, T. 2023: Early-life diet specificity is associated with long-lasting differences in apparent survival in a generalist predator. – *Journal of Animal Ecology* 92: 850–862.
- Nuuja, I. (ed.) 2017: Merikotkien puolesta – WWF:n merikotkatyöryhmän vuosikymmenten taival. – 123 p. WWF Finland.
- Reid, A.L., Seebacher, F. & Ward, A.J. W. 2010: Learning to hunt: the role of experience in predator success. – *Behaviour* 147: 223–233.
- Reusch, T.B.H., Dierking, J., Andersson, H.C., Bonsdorff, E., Carstensen, J., Casini, M., Czajkowski, M., Hasler, B., Hinsby, K., Hyytiäinen, K., Johannesson, K., Jomaa, S., Jormalainen, V., Kuosa, H., Kurland, S., Laikre, L., MacKenzie, B.R., Margonski, P., Melzner, F., Oesterwind, D., Ojaveer, H., Refsgaard, J.C., Sandström, A., Schearz, G., Tonderski, K., Winder, M. & Zandersen, M. 2018: The Baltic Sea as a time machine for the future coastal ocean. – *Science Advances* 4:eaar8195.
- Slagsvold, T., Sonerud, G.A., Grønlien, H.E. & Stige, L. C. 2010: Prey handling in raptors in relation to their morphology and feeding niches. – *Journal of Avian Biology* 41: 488–497.
- Stjernberg, T., Koivusaari, J., Högmänder, J., Ollila, T. & Ekblom, H. 2005: Population trends and breeding success of the white-tailed sea eagle *Haliaeetus albicilla* in Finland, 1970–2005. – *Status of Raptor Populations in Eastern Fennoscandia. Workshop proceedings*, p. 151–159.
- Sulkava, S., Tornberg, R. & Koivusaari, J. 1997: Diet of the white-tailed eagle *Haliaeetus albicilla* in Finland. – *Ornis Fennica* 74: 65–78.
- Trivers, R.L. 1974: Parent-offspring conflict. – *American Zoologist* 14: 249–264.
- Watson, J., Leitch, A.F. & Broad, R.A. 1992: The diet of the sea eagle *Haliaeetus albicilla* and golden eagle *Aquila chrysaetos* in western Scotland. – *Ibis* 134: 27–31.
- Wille, F. & Kampp, K. 1983: Food of the white-tailed eagle *Haliaeetus albicilla* in Greenland. – *Ecography* 6: 81–88.