ORNIS SVECICA 22: 3–8, 2012

Behaviour and survival of Common Guillemot *Uria aalge* chicks at departure from a nest site in the Baltic Sea

Beteenden och överlevnadschanser för sillgrissleungar Uria aalge *i Östersjön när de lämnar sina boplatser*

MÅNS HJERNQUIST, BJÖRN HJERNQUIST & MÅRTEN B. HJERNQUIST

Abstract

Common Guillemots *Uria aalge* often breed high up in cliffs, forcing the juveniles to jump down to the beach or sea sea when leaving their nests. We studied survival of Common Guillemot chicks at time of nest departure on the island Lilla Karlsö in the Baltic Sea. All jumps were conducted either together with one of the parents, or, more commonly, the parent flew down shortly before the chick jumped. At this point, the parent was always found waiting for the chick directly underneath the nest, either on the beach or in the water, and never farther out than five meters if there was no beach below the cliff. If separated, all observed parents and juveniles reunited within one minute and then swam close together out to sea. Juvenile mortality was very low, only 0.5% in 2011, with 2 of 426 chicks dying. In both cases hitting a lower cliff ledge caused the mortality. No case of predation was observed. The high survival rates are most likely due to the chicks' close proximity to their male parent at all times.

Måns Hjernquist, Sproge Snoder 806, 623 44 Klintehamn, Sweden.
Björn Hjernquist, Sproge Snoder 808, 623 44 Klintehamn, Sweden.
Mårten B. Hjernquist, Animal Ecology/IEE, Uppsala University, Norbyvägen 18D, 752 36 Uppsala, Sweden. E-mail: marten@hjernquist.se.

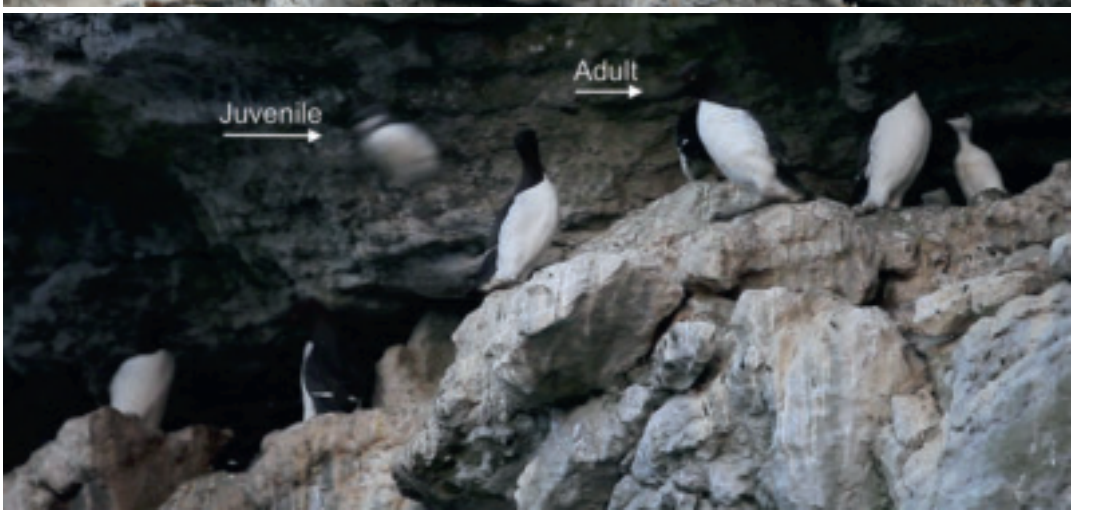
Received 15 November 2011, Accepted 13 January 2012, Editor : J. Waldenström

Introduction

Auks, *Alcidae,* are known for the extreme variation in age and body mass at which offspring leave the nest site (e.g. Sealy 1973, Gaston 1985, Gaston & Jones 1998). Three strategies exist. Precocial alcids leave the nest 2–4 days after hatching and are cared for at sea by both parents. Semiprecocial alcids leave after 25–75 days and are independent of their parents when they leave the nest, weighing between 50% and 100% of an adult's body mass. An intermediate strategy is used by Common Guillemot *Uria aalge,* Brünnich's Guillemot *Uria lomvia* and Razorbill *Alca torda*. Juveniles of these three auk species depart to the sea together with their male parent at 15–35 days of age, weighing only 12–30% of adult body mass (e.g. Sealy 1973, Gaston 1985, Gaston & Jones 1998). The underlying selective forces for these strategies are most likely shaped by trade-offs between mortality and growth at nest sites and at sea (e.g. Lack 1968, Sealy 1973, Gaston 1985, Gaston & Jones 1998).

Factors determining reproductive success in auks have been studied intensively during incubation and chick rearing periods, but less so during fledgling and post-nest departure. The lack of studies focused on post-nest departure is obviously due to the difficulties associated with studying auks at sea compared to at the nest site. However, assessing reproductive parameters up to departure may not be good measures of subsequent recruitment to the population (Spear & Nur 1994). For example, the body mass of juvenile Common Guillemots at departure from the breeding colony is not related to survival neither in the Baltic Sea (Hedgren 1981) nor in the North Sea (Harris et al. 1992, Harris et al. 2007). Furthermore, in Brünnich's Guillemots Gilchrist & Gaston (1997) showed that factors at departure had great significance for juvenile survival. These factors, for instance cliff ledge characteristics and time the juvenile is separated from its parents, are expected to be equally important for Common Guillemots and Razorbills given that these species all have strategies intermediate between precocial and semiprecocial and that they have very similar breeding biology to Brünnich's Guillemots.

When juvenile Common Guillemots depart from the nest, they cannot fly as they have not yet developed flight feathers, only primary and secondary coverts (e.g. Sealy 1973, Gilchrist & Gaston



The breeding ledges 10 and 30 meters above the sea shore, and a young taking the leap and walking with a parent to the water.
Häckningshyllorna 10 och 30 meter över stranden samt en unge som just hoppar och sedan följer en förälder till vattnet.

1997). Common Guillemots typically breed in dense colonies, often on exposed cliff ledges where they lay a single egg that is incubated for 33 days (s.d. 1.4–2.1; Gaston & Jones 1998). Nest sites can be located several hundred meters above ground or water. A few days before the juvenile departs, adult provisioning rates decrease or even cease, causing the juvenile to slow growth and to lose weight (Birkhead 1977, Hatchwell 1991, Barrett 2010). When the juveniles depart, they are led to the sea by one of the parents, most likely the male (e.g. Varoujean et al. 1979, Gaston & Jones 1998). If nesting on high-lying sites, chicks jump while flapping their wings and spreading their webbed feet, thereby falling, or gliding if wind conditions are right. They conduct this jump either together with, followed by, or with the parent waiting below. When the parent and juvenile reunite, they swim close together out to sea, departing together from the breeding site (e.g. Sealy 1973, Harris & Birkhead 1985, Gilchrist & Gaston 1997, Gaston & Jones 1998). The parent cares for the juvenile for about two month after departure (Varoujean et al. 1979).

There are several factors affecting a juvenile's likelihood of survival at this stage (e.g. Gilchrist & Gaston 1997). Despite the fact that most juveniles depart after dark or when light intensity is at a minimum, there is still a risk of predation (Gaston & Jones 1998). Not all nest sites allow a clear way to the shore and there may be ledges below the breeding ledge hindering a clear jump. Failing to reunite with its parent after a jump has been shown to cause an increased risk of juvenile mortality (Gilchrist & Gaston 1997). There are two reasons for this. First, juveniles without parents experience higher predation rates by e.g. gulls. However, predation events are generally rare even when juveniles fail to reunite with their parent immediately (Gilchrist & Gaston 1997 and references therein). Second, adult birds sometimes form groups that mobs unattended juveniles and juveniles that are departing together with their male parent. In fact, Gilchrist & Gaston (1997) showed that only 76.3% of juvenile Brünnich's Guillemots reunited with their parents and departed safely to sea. As many as 23.7% did not reunite quickly enough and therefore died, of which 11% was due to predation and 89% due to conspecific aggressiveness. Adult aggressive behaviour towards juveniles is observed also in Common Guillemots (Greenwood 1964, Harris & Birkhead 1985, Gaston & Jones 1998, pers.obs.), but the occurrence and specific behaviour likely varies depending on colony characteristics. Gilchrist & Gaston (1997) determined that the most important factor influencing departure success was whether the chick immediately reunited with the male parent or not, as only 21% of the juveniles that were separated later reunited. If the breeding site is situated so that the juvenile must cross a long beach or slope, the importance of predation is elevated (e.g. Williams 1975, Hatch 1983, Gaston & Jones 1998 and references therein).

The Common Guillemot and Razorbills are found breeding in the Baltic Sea, and although studies have been conducted on the breeding biology in several colonies (e.g. Hedgren 1979, Österblom et al. 2001, Hjernquist & Hjernquist 2010), departure of Common Guillemot juveniles has never previously been studied in detail. Unlike Gilchrist & Gaston's (1997) study, where Guillemots were observed from a distance, thereby avoiding disturbance, most knowledge about departing Common Guillemots in the Baltic Sea comes from projects tagging the juvenile birds with individually marked metal rings at the beach while departing (e.g. Hedgren 1979, Österblom et al. 2001). The juvenile departure process has only been described in sparse detail at Baltic Sea breeding sites (e.g. Hedgren 1979, Österblom et al. 2001) and no observational studies without human disturbance have been published.

Here, we observed juvenile Common Guillemots departing from their nest sites at Lilla Karlsö where about 2500 pairs breed. Observations were made from a distance, not to disturb the birds. We describe the departure of juveniles and factors affecting their survival probabilities while departing.

Methods

The study was conducted at the island of Lilla Karlsö (N 57° 18.800', E 18° 3.800'; WGS 84), near the island of Gotland, which together with Stora Karlsö sustain the only bird cliffs with breeding auks in the Baltic Sea. Eight cliff ledges with more than 600 pairs of breeding Common Guillemots were observed from a distance in a hide or with remote cameras between 27 June and 5 July 2011, the peak days of departure this year. Observations were made between 1800 and 0200 hrs (GMT+1, summertime) as Common Guillemots starts to depart after 1900 hrs and usually stop after midnight in the Baltic Sea (Hedgren 1979, pers. obs.). Weather conditions at nights when juvenile Common Guillemot departs are characterized by calm waters and very little or no wind, which was the case for all observations in this study. Cliff ledges

were situated between 10 and 30 meters above the water line and the rocky beach. All cliffs are vertical and situated either directly at the shoreline or less than 15 meters inland. Several hundred chicks departed each night and the waters below the cliff ledges were full of several hundred adults. We successfully followed 436 juveniles departing from a cliff ledge, to the shore or water, and observed them until they either died or successfully departed together with the male parent from the island out of sight of the observer. We collected data on the location of the Common Guillemot parent when the juvenile jumped from the nest site (classified as either together with the juvenile, on the beach, less than 5 meters out in the water if there was no shore, or more than 5 five meters from the shore), how quickly the juvenile and parent reunited (within one minute, within two minutes, or never), and survival rates of juveniles and causes of mortality during departure.

For more details about the study species and site, see Hjernquist & Hjernquist (2010) and references therein.

Results

The parent departed at the same time as the juvenile from the cliff ledge in 26 out of 436 times (6.0%). This occurred more often (18 out of 26) from ledges situated at the top of the cliff (i.e. 20 meters or higher, $\chi 2 = 3.95$, $P = 0.047$). However, in the majority of the departures (94.0%) the male parent first flew down before the juvenile jumped (410 out of 436) and they reunited very quickly, never exceeding one minute, if the chick survived the fall (99.5% within one minute or never separated, 0% within two minutes and 0.5% never reunited). In all observations when the parent flew down first (410), the parent sat on the beach directly underneath the nest site (84.4%, 346 out of 410) or in the case of no existing beach, in the water directly below the cliff ledge (15.6%, 64 out of 410). Not a single observation was made with an adult further out than five meters from the cliff/shore. In a few cases, adults were observed performing behaviours associated with juvenile departures without any juveniles leaving the nest site, causing the parent to fly back up to the cliff ledge within less than five minutes. It was not clear, judging from our observations, if those few adults actually had a juvenile on the cliff ledge or not. During the departure, both adult and juvenile called out to each other and when the juvenile reunited with its parent this was followed by distinct social behaviours such as circling each other and touching beaks. The parent then led the chick out to sea, swimming very close to each other and continuously socializing.

Two juveniles out of 436 died during the departure (0.5%). In both cases, death was due to hitting a cliff ledge a few meters down during the descent and thereby losing control over the jump. We assumed the juveniles to have died, as they were seemingly lifeless during the entire observational period that lasted for several hours. The survival rate during departure, measured as a juvenile leaving the colony and together with its parent, swimming out of sight (several hundred meters outside the colony), was very high (99.5%). No predation from gulls (*Larus* spp.) was observed even though approximately 50 pairs of Great Black-backed Gulls *Larus marinus*, 1200 pairs of Herring Gull *Larus argentatus* and 130 pairs of Lesser Black-backed Gulls *Larus fuscus* were breeding on the island within close proximity to the Common Guillemot colony.

Discussion

Nearly all observed juvenile Common Guillemots survived the jump of the breeding cliff, landed on the beach or directly in the water and thereafter departed successfully together with their parent. The mortality related to the actual jump was only 0.5%, similar to that in other colonies (1.3%) studied in the Baltic Sea (Hedgren 1979). The small differences are most likely due to variation in the likelihood of a clear jump among different cliff ledges and colonies. However, this is the first time survival rates during the entire departure process are estimated in the Baltic Sea and no comparisons between this study and other colonies in the Baltic Sea are therefore possible at this point. Juvenile Common Guillemot departure from the studied breeding colony closely resembles the description based on observations from other breeding sites outside of the Baltic Sea (e.g. Greenwood 1964, Sealy 1973, Varoujean et al. 1979, Harris & Birkhead 1985, Gilchrist & Gaston 1997, Gaston & Jones 1998). The juveniles were never separated from their parent for more than one minute; they either jumped together from the cliff ledge, or, more commonly, the parent flew down just before the chick jumped and waited for a very short time, before they were reunited and together departed from the breeding colony. Groups of adult birds that we observed aggregating on the water were not waiting for juveniles to jump, supporting observations from other colonies of both Brünnich's and Com-

mon Guillemots (e.g. Gilchrist & Gaston 1997, Greenwood 1964, Harris & Birkhead 1985, Gaston & Jones 1998 and references therein). It has been suggested that such groups can consist of sub-adult birds that are not breeding and adults that have failed or lost a juvenile (Gilchrist & Gaston 1997, Harris & Birkhead 1985). Although other studies have shown that such groups can attack juveniles and kill them (Gilchrist & Gaston 1997, Harris & Birkhead 1985), we did not observe any juveniles being killed by other adults, although we did frequently observe groups of adults harassing the parent and its juvenile while swimming away from the colony. The lack of mortality caused by conspecific aggressiveness is probably explained by juveniles not being separated from the adult parent, as well as due to groups of adults being relatively small, mostly fewer than ten birds. Gilchrist & Gaston (1997) showed that juveniles that had a defending parent could successfully and safely leave the colony and that only larger mobs of adults (more than ten individuals) could separate the juvenile from the parent. It is therefore likely that intrinsic factors, such as colony characteristics, as well as extrinsic factors affect the group size of mobs and mobbing behaviours, influencing juvenile survival at departure from the colony.

On Lilla Karlsö, gulls are the only potential predators of juvenile Common Guillemots; yet, no predation was observed. Absence of predation has been recorded at other colonies as well (Greenwood 1964), and could be explained by several factors. At Lilla Karlsö, it could be because juveniles were never separated from their male parent, although studies have shown that predation from gulls on unattended juveniles is very low and the success rate of gulls attacking juveniles is also very low (e.g. Gilchrist & Gaston 1997, Gaston & Jones 1998 and references therein). Williams (1975) showed that predation rates were lower when chicks jumped directly into the water (0.6–2.2%) compared to when they were hampered by difficult terrain (17.5%). Chicks on Lilla Karlsö either jumped directly into the water or onto the beach a few meters from the shoreline, which could be an additional explanation for the absence of predation.

The results presented in this study are based on data from 2011. The same pattern has been apparent in other years as well in the same colony (own observations). In conclusion, we found that juvenile Common Guillemots depart from the colony in a similar way to what is described in colonies outside of the Baltic Sea (Gaston & Jones 1998 and references therein). However, they do not depart according to the general description found in Swedish media and popular scientific literature. Common Guillemot departure is often described as an event where the male parent is waiting out at sea, up to several hundred meters away from the shore, and where the juvenile swims out and reunites with the male parent in the open water, sometimes several hours or the following day after jumping from the cliff ledge (e.g. Wirdheim 2008, Kihlberg 2011). We also observed a very high success rate of departing juveniles, probably due to juveniles never being separated from their parent. These results provide insights to factors affecting juvenile to adult survival and will therefore contribute to an understanding of the determinants of reproductive success and the dynamics of Common Guillemot populations in the Baltic Sea.

Acknowledgments

We would like to thank A. Rice, and two anonymous referees for helpful comments. The Swedish Society of Nature Conservation owns the island of Lilla Karlsö and this study is a part of the environmental monitoring program that is conducted there.

References

Barrett, R.T. 2010. Recent decline in body condition of departing Common Guillemots *Uria aalge* at Hornøya, North Norway. *Ornis Norvegica* 33: 49–55.

Birkhead, T.R. 1977. The effects of habitat and density on breeding success in the Common Guillemot, *Uria aalge. Journal of Animal Ecology* 46: 751–764.

Gaston, A.J. 1985. Development of the young in the Atlantic *Alcidae*. Pp. 319–354 in *The Atlantic Alcidae: the evolution, distribution and breeding biology of the auks inhabiting the Atlantic Ocean and adjacent waters* (Nettleship, D.N. & Birkhead, T.R., eds.). Academic Press, London.

Gaston, A.J. & Jones I.L. 1998. *The Auks*. Oxford University Press, Oxford.

Gilchrist, H.G. & Gaston, A.J. 1997. Factors affecting the success of colony departure by Thick-billed Murre chicks. *The Condor* 99: 345–352.

Greenwood, J. 1964. The fledging of the Guillemot, *Uria aalge,* with notes on Razorbill, *Alca torda*. *Ibis* 106: 469–481.

Harris, M.P. & Birkhead, T.R. 1985. Breeding ecology of Atlantic *Alcidae*. Pp. 155–204 in *The Atlantic Alcidae: the evolution, distribution and breeding biology of the auks inhabiting the Atlantic Ocean and adjacent waters* (Nettleship, D.N. & Birkhead, T.R., eds.) Academic Press, London.

Harris, M.P., Frederiksen, M. & Wanless, S. 2007. Within- and between-year variation in the juvenile survival of Common Guillemots *Uria aalge*. *Ibis* 149: 472–481.

Harris, M.P., Halley, D.J. & Wanless, S. 1992. The post-fledging survival of young Guillemots *Uria aalge* in relation

to hatching date and growth. *Ibis* 134: 335–339.
Hatchwell, B.J. 1991. An experimental study of the effects of timing of breeding on the reproductive success of Common Guillemots (*Uria aalge*). *Journal of Animal Ecology* 60: 721–736.
Hatch, S.A. 1983. The fledging of Common and Thick-billed Murres on Middleton Island, Alaska. *Journal of Field Ornithology* 54: 266–274.
Hedgren, S. 1979. Seasonal variation in fledging weight of Guillemots *Uria aalge*. *Ibis* 121: 356–361.
Hedgren, S. 1981. Effects of fledging weight and time of fledging on survival of Guillemot *Uria aalge* chicks. *Ornis Scandinavica* 12: 51–54.
Hjernquist, M.B. & Hjernquist, B. 2010. The effects of quantity and quality of prey on population fluctuations in three seabird species. *Bird Study* 57: 19–25.
Kihlberg, J. 2011. Fånga en fågel på Stora Karlsö. *Dagens Nyheter* (29-05-2011) (http://www.dn.se/resor/sverige/sma-faglar-pa-stora-karlso). In Swedish.
Lack, D.1968. *Ecological adaptations for breeding in birds.* Methuen, London.
Sealy, S.G. 1973. Adaptive significance of post-hatching development patterns and growth rates in the *Alcidae*. *Ornis Scandinavica* 4: 113–121.
Spear, L. & Nur, N. 1994. Brood size, hatching order and hatching date-effects on four life-history stages from hatching to recruitment, in Western Gulls. *Journal of Animal Ecology* 63: 283–298.
Varoujean, D.H., Sanders, S.D., Graybill, M.R. & Spears, L.B. 1979. Aspects of Common Murre breeding biology. *Pacific Seabird Group Bulletin* 6: 28.
Williams, A.J. 1975. Guillemot fledging and predation on Bear Island. *Ornis Scandinavica* 6: 117–124.
Wirdheim, A. 2008. Grisslenatt – ett besök hos sillgrisslorna på Stora Karlsö. *Vår Fågelvärld* 5: 8–14. In Swedish.
Österblom, H., Bignert, A., Fransson, T & Olsson, O. 2001. A decrease in fledging body mass in common guillemot Uria aalge chicks in the Baltic Sea. *Marine Ecology Progress Series* 224: 305–309.

Sammanfattning

När sillgrissleungarna lämnar sin boplats kan de inte flyga eftersom deras vingpennor ännu inte börjat växa ut och de har uppnått en vikt på endast 12–30% av en vuxens fågel (t.ex. Greenwood 1964, Sealy 1973, Gaston 1985, Gaston & Jones 1998). Om de häckar på en lågt belägen plats följer hanen ungen ut till vattnet och vidare ut till havs där han tar hand om ungen i ytterligare ca två månader. Om boplatsen är belägen högre upp måste ungen hoppa ner till marken eller vattnet, ett fall som i Östersjön kan vara på flera tiotals meter. Beskrivningen av hur denna process går till har inte tidigare studerats för sillgrisslor som häckar i Östersjön, men den beskrivs i media och populärvetenskapen som att hanen väntar ute på vattnet, ibland flera hundra meter ut, och att ungen och hanen återförenas där ute, ibland flera timmar eller dagen efter att ungen lämnade boplatsen (t.ex. Wirdheim 2008, Kihlberg 2011). I den här studien har vi studerat händelseförloppet och överlevnaden av ungar när de lämnar boplatsen på Lilla Karlsö. Tvärtemot den populärvetenskapliga beskrivningen är ungen och föräldern aldrig skilda från varandra i mer än högst någon minut. Ungen hoppar tillsammans med föräldern i 6% av fallen, men det varierar med boplatsens läge. I resterande 94% av fallen hoppar ungen själv efter det att föräldern en kort tid innan (15 sekunder till någon minut) flugit ner till stranden/vattnet direkt nedanför klippan. Ungen och föräldern återförenas direkt efter hoppet. Därefter har de ett socialt spel där näbbarna rör varandra och medan de simmar från häckplatsen stannar de ofta upp och simmar i cirklar runt varandra. Under sommaren 2011 då studien genomfördes var ungarnas överlevnad mycket stor då ingen predation noterades och de enda ungarna som dog gjorde det på grund av att de slog i en klipphylla i fallet och därmed föll okontrollerat till marken (2 av 436 observationer). Andra studier från Nordamerika har funnit att överlevnadschanserna för spetsbergsgrissleungar när de lämnar bolokalen är helt beroende av att ungen återförenas med hanen (Gilchrist & Gaston 1997). Om de skiljs åt är det bara 21 % som återförenas och de andra dör. Resultaten från denna studie är viktig eftersom överlevnaden under själva processen att lämna häckplatsen ofta är förbisedd, men är av stor vikt för häckningsframgången och för populationsdynamiska processer.