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Puffin harvesting and survival at Nólsoy, The Faeroes

Fångstens omfattning och överlevnaden hos lunnefåglar på Nólsoy, Färöarna

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Abstract

At least 10,000 Puffins *Fratercula arctica* are taken annually at the Nólsoy colony by fowling. This figure probably exceeds the recruitment rate and may cause gradual decrease of the colony size. Continuous decline (since 1900) of the number of breeding birds as well as shrinking of the colony area suggest long-lasting overexploitation. The collapse of the local population is probably delayed only by immigration of immature Puffins from the large Icelandic population. We recovered 37 (20.1%) of 184 Puffin fledglings ringed in 1997 at Nólsoy colony. All rings originated from birds caught by fowlers operating on Nólsoy (34 birds) and on other Faeroe islands (3 birds). First Puffins were fowled at colony in 1999, 54%

in 2000 (3 yrs old), and the last bird in 2003 as 6 yrs old. Puffins which had been harvested, i.e. those which survived at least 2 years, were on average larger and heavier at fledging than the rest of the ringed chicks. Most of them originated from early broods. Our data suggest that adult Puffins breeding earlier produce better quality offspring that survive in higher proportion.

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Introduction

The Puffin *Fratercula arctica* is a typical long-living seabird with a low reproductive potential (single egg, delayed age of breeding). Hence, it can be very vulnerable to environmental changes and human impact (Gaston & Jones 1998, Lowther et al. 2002). Many Puffin colonies have declined in the last decades due to natural or human-induced causes (Evans & Nettleship 1985, Harris & Birkhead 1985, Anker-Nilssen 1987, Barrett & Rikardsen 1992, Harris & Wanless 2004). In some parts of the range, large numbers of Puffins are killed for human consumption, e.g. ca 150,000 birds are killed each year in Iceland (Petersen 1982, The Environment and Food Agency of Iceland). Such exploitation has also been practised for ages in the Faeroes.

Hunting for Puffins in the Nólsoy colony takes place in July and August when adult birds are feeding their chicks (all rings were recovered between 6 July and 16 August). There are twelve stone shelters (catching sites), situated along the sea-colony line at a distance of 100–200 m, hiding the fowlers from birds arriving from the sea. Six to ten of them are chosen each day by lot and used between 8–14 h, when birds come back from the feeding grounds.

An experienced fowler usually catches ca 100 Puffins a day, i.e. 6–10 fowlers catch up to 800 Puffins a day. Depending on weather conditions this figure fluctuates considerably, but in total at least ten thousand birds is caught per season (J-K. Jensen, unpubl. data). When netting, fowlers try to select non-breeding immature birds as they circle over the colony. Adult birds carrying food for nestlings are spared (Norrevang 1977). This practice of selection has mainly an economic purpose but also favour a more sustained harvest. Today people in the Faeroes are not dependent upon seabirds for survival and the fowled birds are only served as delicacies.

There is no study in the literature evaluating the impact of the annual Puffin harvest, mainly due to lack of data on basic population parameters in the huge, often uncountable colonies, e.g. in the Westmann Islands (Iceland) (Evans & Nettleship 1985, Harris & Wanless 1991). The Nólsoy colony seems to be very suitable to such evaluation as it is small and accurate harvesting data for a long period are available.

The purpose of the present study was to use ringing recovery data to assess: (1) survival to breeding in relation to timing of fledging; (2) mortality rate caused by fowling, and finally (3) the effect of present harvesting rate on the status of the Nólsoy

colony. The Nólsoy colony is seen as a case study reflecting the situation on the Faeroes, where there is an urgent need to review existing regulations from the point of view of Puffin conservation and management of the fowling.

Material and methods

Field studies were carried out from 6–16 August 1997 on Nólsoy Island (61° 59' N, 06° 38' W), and covered the fledging period of young birds (9 nights: 7/8–15/16 August). The Nólsoy colony consisting of 35,000–50,000 breeding pairs of Atlantic Puffins (*L. Stempniewicz*, J.K. Jensen, unpubl. data) is situated on the SE part of the island, about 8 km from the village. Neither large gulls nor any other predators were seen during the study. Hence, predation was considered insignificant in the colony during the study period. Young Puffins leaving the colony on the wing were caught in two mist nets (24×4.5 m., mesh-size 3.0 cm), and those walking to the seashore were collected in a net barrier (200×1.0 m., mesh-size 2.0 cm) across the route they used to reach the sea. Nets were checked every hour, starting at 21.00 p.m. and ending at 07.00 a.m. Since the Nólsoy colony is situated on more or less level ground, the great majority of young birds (98%) were caught walking to the sea (Stempniewicz 1998, Stempniewicz & Iliszko 2002). A total of 184 fledglings were caught, ringed, weighed to the nearest 2.0 g, and their wing (maximum chord), tail, culmen and tarsus lengths were measured to

the nearest 0.5 mm. Fledglings were released on the beach immediately after the measurements had been taken. Fledging period was divided into three 3-night parts (early: 7/8, 8/9, 9/10; middle: 10/11, 11/12, 12/13; and late: 13/14, 14/15, 15/16 August).

Rings obtained from the Puffins killed by fowlers were collected by J-K. Jensen and sent to Copenhagen Ringing Centre, Zoological Museum, Copenhagen, Denmark.

Results

In the years 1999–2003, 37 (20,1%) of the 184 Puffin fledglings ringed in 1997 were captured by fowlers. Thirtyfour birds were caught at the natal colony and three birds in other colonies on the Faeroe Islands (Sandoy, Fugloy and Mikines). These birds were aged 2 years (8), 3 years (20, i.e. 54,1%), 4 years (6), 5 years (2) and 6 years (1); Figure 1).

Significantly more recaptured immature Puffins left the colony during the first stage of the fledging and less than predicted during the final part of the fledging period ($\chi^2=6,098$, $P<0,05$, $df=2$; when middle group excluded, $\chi^2=4,815$, $P<0,03$, $df=1$) (Table 1).

Puffins recaptured by fowlers, i.e. those which survived at least two years, had significantly longer wings and were heavier at fledging than the rest of the ringed chicks (Table 2).

Discussion

Timing of fledging, fledgling quality and post-fledging survival

In some seabird species, heavier and fatter fledglings originating from early broods survive in higher proportion (Perrins et al. 1973, Nisbet & Drury 1972, Parsons et al. 1976). In the Razorbill *Alca torda* and Common Guillemot *Uria aalge* however, no such relationship was found (Lloyd 1979, Hedgren 1981). Safe colony leaving and reaching abundant feeding grounds by young inexperienced seabirds is time and energy consuming. Therefore, their chances of survival will depend largely on their fat reserves (Hatch 1983, Gaston 1985, Stempniewicz 1995). In an earlier paper (Stempniewicz & Iliszko 2002) we found that at both Bleiksøy (NW Norway) and Nólsoy, young Puffins that had left the colony during the first part of the fledging period were bigger and heavier. Our present data supports the hypothesis that adult Puffins breeding earlier produce better quality offspring that survive in higher proportion to adulthood.

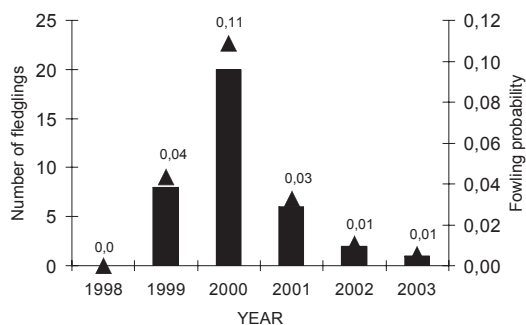


Figure 1. Number (histogram) and probability of being fowled (triangle) of Puffins ringed as fledglings in 1997 ($N=184$) and fowled (recaptured) in the successive years (fowling effort was constant in the years of capture).

Antal (staplar; Number of fledglings) och sannolikhet att fångas (trianglar; Fowling probability) för lunnefåglar som märkts som ungar 1997 ($N=184$) och återfångade olika år därefter (fångstintensiteten var konstant varje år).

Table 1. Number of young Puffins leaving the colony in 1997 during three distinguished stages of fledging and number and proportion of them recovered (fowled) in 1999–2003.

Antal unga lunnefåglar som lämnade kolonin 1997 under tre olika delar av uthoppningsperioden samt antal och andel av dem som återfångades 1999–2003.

Stage of fledging <i>Utflygningsstadium</i>	Fledged <i>Flygga</i>		N fowled
	Number <i>Antal</i>	Proportion <i>Andel %</i>	<i>Antal åter-fångade</i>
Beginning <i>Början</i>	69	24.6	17
Middle <i>Mitten</i>	61	19.7	12
Final <i>Slutet</i>	54	14.8	8
In total <i>Totalt</i>	184		37

Table 2. Body size and mass at fledging of young Puffins surviving at least 2 years (fowled) and of the remaining ringed birds (significant differences are bolded, t-test, $p < 0.05$).

Kroppsstorlek och massa vid utflygningen för unga lunnefåglar som överlevt minst 2 år (fångade) och för övriga ringmärkta fåglar (signifikanta skillnader med feta siffror, t-test, $p < 0.05$)

	Fowled <i>Fångade</i>	Other <i>Övriga</i>
wing <i>vinge</i> (mm)	136,6 $\pm$ 0,68 (37)	135,2 $\pm$ 0,41 (147)
tail <i>stjärt</i> (mm)	36,6 $\pm$ 0,33 (37)	36,3 $\pm$ 0,14 (147)
bill <i>näbb</i> (mm)	28,7 $\pm$ 0,20 (37)	28,5 $\pm$ 0,10 (147)
tarsus <i>tars</i> (mm)	26,9 $\pm$ 0,19 (37)	26,6 $\pm$ 0,09 (147)
mass <i>massa</i> (g)	234,9 $\pm$ 3,63 (37)	226,5 $\pm$ 2,01 (147)

Population status and harvesting management

Puffin population parameters have been relatively well studied (Pedersen 1976, Ashcroft 1979, Harris 1983, Harris & Birkhead 1985, Harris & Wanless 1991, Mavor et al. 2004, Harris et al. 2005). However, all such studies have been carried out in the non-harvested colonies. Moreover, population parameters fluctuate between years and areas. Annual survival of juveniles and adults are most probably considerably higher in non-exploited populations comparing with those characterising colonies where traditional fowling activity takes place during the breeding season.

For the reasons mentioned above substituting population parameters obtained elsewhere is risky and we have given up calculating direct values of the replacement difference (annual recruitment minus adult mortality) for the Nólsoy colony. Taking into consideration additional mortality of the immature and adult birds caused by fowling, survival of young birds to breeding age should be decreased by 20,1% (this paper), and annual adult mortality increased by 7% (proportion of adults in catches; Petersen 1982). Then, it is possible that annual puffin harvest (c. 10,000 birds) causes that the number

of decreasing adults exceeds the number of young birds recruited to breeding. Such situation makes replacement balance impossible. It is possible but no evidence is available that population collapse is delayed by notable immigration of immature puffins from the neighbouring large Icelandic population.

Since 1900 a continuous decline in the number of breeding birds and shrinking of the Urðini colony area have been observed, suggesting serious over-exploitation of the local population. According to historical sources (J-K. Jensen, unpubl. data), during the first half of the 20th century Puffin harvesting at Nólsoy was more intensive than today. In 1908, the highest known number of ca 35,000 birds killed by fowlers was recorded. About 4000–5000 Puffins were caught annually in the years 1988–1994. Later, this figure gradually increased to 8198 birds in 1996, 6976 in 1997, 8140 in 1998 and 13,305 in 1999 (Ivan Holm & Rene Hansen, pers. comm.). There are evident signs of long-term heavy utilisation of the colony, which former range was much larger. Today, the colony is situated in the most inaccessible site at the end of the coast making breeding possible, and there is no room to recede.

Puffins on the Faeroes are threatened not only

by humans but also by rats, which are responsible for major declines in many colonies. Most colonies on the Faeroes have already been "discovered" and damaged by rats. A relatively large distance separating the Urðini colony and the village and harbour on Nólsoy (12 km) fortunately makes it difficult for rats to reach the colony area and survive for the whole year.

We believe that the maintenance of a stable population (balance between mortality and recruitment) is fully possible by substantially reducing the yearly harvest and thus adjusting it to the level of recruitment size. To avoid or at least reduce catching breeding birds, which proportion among fowled puffins in the Westmann Islands was estimated by Petersen (1982) to 7%, we recommend shortening for 10 days (delaying the start and earlier finishing) of the hunting period. At the beginning of the nestling period a considerable proportion of birds still incubates their eggs and visits the colony with no food and is threatened by fowlers as non-breeding birds. A somewhat similar situation is observed during the fledging period, when parent birds visit the colony for several days after their chicks had already left the burrows.

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Sammanfattning

Lunnefåglar har lång livslängd och långsam föryngring (ett ägg och sen könsmodnad). Därför är de känsliga för miljöförändringar. Många lunnekolonier har minskat under senare tid både av naturliga skäl och genom mänsklig påverkan. På vissa håll dödas stora mängder lunnefåglar för konsumtion. På Island dödas årligen 150.000 lunnar och samma tradition har sedan länge funnits på Färöarna.

I kolonin på Nólsoy sker jakten i juli och augusti

när de gamla fåglarna matar sina ungar. Här finns tolv stengömslen utplacerade 100–200 meter från varandra. Sex till tio av dem fördelas genom lottning och används dagligen åtta till fjorton timmar. Dessa sex till tio fångstmän fångar upp till 800 lunnar dagligen. Normalt fångas minst tio tusen lunnar per säsong. Fångsten har ingen betydelse för befolkningens överlevnad längre och fåglarna serveras endast som delikatess.

Det saknas studier över vilken inverkan fångst har på bestånden, främst beroende på svårigheten att få grundläggande populationsdata i de stora oöverskådliga kolonierna på Island. Nólsoy-kolonin föreföll lämplig för en sådan studie eftersom den är liten och det finns tillförlitliga data rörande fångstens omfattning. Syftet med denna studie var att (1) studera ungarnas överlevnad från olika delar av utflygningsperioden, (2) dödligheten orsakad av fångsten samt (3) effekten av fångsten på kolonins storlek och utveckling.

Material och metoder

Fältarbetet genomfördes under nio nätter 7/8–15/16 augusti 1997 på Nólsoy och omfattade ungarnas utflygningsperiod. Kolonin omfattar 35.000–50.000 häckande par och ligger 8 km från byn. Det fanns inga predatorer närvarande under fältarbetet. Enstaka flygande ungfåglar fångades i spegelnät men de flesta promenerade till stranden och togs vid en nätbarriär. Totalt var det 184 fåglar som ringmärktes, vägdes och mättes och som omedelbart därefter släpptes på stranden.

Resultat

Åren 1999–2003 fångades 37 (20,1%) av de 184 ungar som märktes 1997. Trettiofyra fåglar fångades i födelsekolonin och tre fåglar i andra kolonier på Färöarna. Dessa fåglar var 2 år gamla (8), 3 år (20, d.v.s. 54%), 4 år (6), 5 år (2) och 6 år (1 fågel); se Figur 1). Signifikant fler återfångster erhöles från den första delen av utflygningsperioden 1997 och signifikant färre från en sista delen (Tabell 1). De fåglar som återfångades hade signifikant längre vingar och var tyngre vid utflygningen än de fåglar som aldrig återfångades (Tabell 2).

Diskussion

Hos vissa sjöfåglar är de tidigaste ungarna tyngre och fetare och överlever bättre. Men hos tordmule och sillgrissla har man inte funnit något sådant

samband. Eftersom det är energi- och tidkrävande för ungarna att lämna kolonin och ta sig till goda födosöksområden, beror deras överlevnad till stor del på vilka fettreserver de har. För lunnefågel har vi tidigare funnit att fåglar som häckar tidigast producerar ungar med största fettlagren, och denna studie bekräftar detta resultat.

Eftersom vi saknar populationsparametrar kan vi inte göra en direkt beräkning av vilken effekt fångstens omfattning har på populationsutvecklingen i Nólsoy-kolonin. Men om vi räknar med att den extra dödlighet hos unga och adulta fåglar som fångsten innebär, skulle överlevnaden för unga minska med 20% (denna uppsats) och vidare kan de gamla fåglarnas dödlighet anses öka med 7% (andelen gamla i fångsten enligt tidigare studie). Det är därför möjligt att de 10.000 fåglar som dödas varje år är fler än vad som rekryteras lokalt. Det är därför också möjligt fast inte bevisat att en populationskrasch undviks bara genom ett årligt tillskott av ungfåglar från de stora närliggande isländska bestånden.

Sedan 1900 har det varit en fortlöpande nedgång i koloni vid Urðini vilket indikerar lokal överexploatering. Enligt historiska källor var uttaget i Nólsoy större i början av nittonhundratalet än det är i dag; 35.000 fåglar dödades 1908. Åren 1988–1994 låg uttaget på 4000–5000 fåglar, men sedan har det skett en ökning till över 13.000 fåglar 1999. Tecknen på överexploatering är nu tämligen tydliga och kolonin har också minskat i areal så att häckningarna nu är belägna längst ut på de mest otillgängliga delarna.

Färöarnas lunnefåglar hotas inte bara av mänsklig exploatering utan och av råttor, som är huvudorsaken till förlusterna i vissa kolonier. Endast avstånd och otillgänglighet har hittills räddat en del kolonier från råttorna genom att dessa inte klarar sig året om.

Vi tror att det är möjligt att balansera dödlighet och rekrytering för lunnefåglarna genom att ordentligt reducera människans fångstuttag till en nivå som stämmer med ungfågelproduktionen. För att undvika att fånga adulta häckningsdugliga fåglar rekommenderar vi att man förkortar fångstperioden med tio dagar. I början av den nuvarande fångstperioden är det en stor andel av fåglarna som fortfarande ruvar ägg och besöker kolonin utan föda i näbbarna. Dessa hotas av fångstmännen eftersom de tolkar dessa fåglar som yngre, icke häckande individer. Samma sak sker i slutet då fåglar som redan fått ut sina ungar besöker kolonin under flera dagar och också tas för icke häckande individer.