

# Age and sex structure of auk (*alcidae*) mortality during the *Prestige* oil spill in Galicia, NW Spain, November 2002–April 2003

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The Galician coast (NW Spain) has been affected by several oil tanker accidents over the course of the last 30 years. The last one, on November 19th, 2002, took place when the tanker *Prestige*, operated by a Greek shipping company under a Bahamian flag, sank 130 miles off the coast leaking 77,000 tonnes of fuel in the succeeding months. The generated oil spill extended from northern Portugal to the southern French coast killing between 115,000 to 250,000 seabirds according to various estimates (García et al., 2003; Arcos et al., 2004). Wintering auks made up 84.2% of the casualties, and the species most affected were the common guillemot or murre (*Uria aalge*, 50.9%), razorbill (*Alca torda*, 16.7%) and Atlantic puffin (*Fratercula arctica*, 16.6%) (Camphuysen et al., 2002; García et al., 2003).

From the start of the oil spill a team of biology students from the University of A Coruña (Universidade da Coruña, UDC) were trained in seabird necropsies by expert marine ornithologists from Scotland (MH) and The Netherlands (KC). From November 2002 to April 2003, external aging

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and sexing of the corpses by experienced ringers, as well as necropsies carried out by supervised volunteer students, were done routinely. Priority was given to obtaining age and sex data, since age- and sex-skewed mortality during oil spills can have implications for the demography of breeding seabirds (Martínez-Abraín et al., 2006). It is therefore imperative for any proper oil spill impact assessment to record data on the age and sex structure of the birds affected during these events (Heubeck et al., 2003).

A total of 6,183 seabirds collected from A Coruña province, in Galicia, were processed. This figure represented 27% of the total number of birds ( $n = 23,181$ ; García et al., 2003) recovered during the beached bird surveys performed by volunteers of the Spanish Society of Ornithology (Sociedad Española de Ornitología, SEO) from the coast of northern Portugal to southwestern France.

Post-mortem analyses followed standard procedures (Jones et al., 1982; van Franeker, 1983; Camphuysen, 1995) and included full biometrics, sex and age determination (externally and/or by gonad and *bursa Fabricii* inspection when possible), oil coverage estimation, and assessment of the general physical condition of the birds according to the degree of damage to internal organs. The necropsy component was not done on carcasses in poor condition, and was not done for every carcass on days when bird numbers were excessive.

A total of 2,175 common guillemots were processed, of which 1,768 could be aged. The presence of white tips on underwing coverts were used as the criteria for the identification of hatch-year birds (Camphuysen, 1995; Cadiou et al., 2003). Most (82.2% ;  $n = 1,768$ ) belonged to this age category.

The overall sex ratio (1 : 1.6; M : F) in common guillemots differed significantly from equality in those birds that could be sexed ( $\chi^2_{1} = 46.03$ ;  $P < 0.001$ ;  $n = 922$ ). Sex ratios also differed significantly from equality in hatch-year birds ( $\chi^2_{1} = 14.09$ ;  $P < 0.001$ ;  $n = 741$ ) and after-hatch-year birds ( $\chi^2_{1} = 59.8$ ;  $P < 0.001$ ;  $n = 154$ ).

Post-mortem analyses of razorbills were carried out in 999 individuals. External aging of the birds, based on the development of bill grooves (Camphuysen, 1995), revealed that most were hatch-years (88.7% ;  $n = 925$ ), followed by immatures (7.0%) and adults (5.2%). Sex ratio (1 : 1.6) was significantly different from equality ( $\chi^2_{1} = 9.48$ ;  $P < 0.05$ ;  $n = 186$ ). This significant difference was also found in the sex ratio of hatch-years ( $\chi^2_{1} = 5.37$ ;  $P < 0.05$ ;  $n = 146$ ) and adults ( $\chi^2_{1} = 4.84$ ;  $P < 0.05$ ;  $n = 25$ ), but not of immatures ( $\chi^2_{1} = 1.14$ ;  $P > 0.05$ ;  $n = 14$ ).

A total of 1,814 Atlantic puffins were processed., of which 1,588 could be aged by the number of bill grooves (Petersen, 1976; Harris, 1981). Adults were the main casualties (53.1%;  $n = 1,588$ ), followed by subadult (31%) and hatch-years (16%). The overall sex ratio (1 : 2.2; M:F) was significantly different from equality ( $\chi^2_{1} = 60.38$ ;  $P < 0.001$ ;  $n = 424$ ). Significant differences were also found in adults ( $\chi^2_{1} = 60.38$ ;  $P < 0.001$ ;  $n = 215$ ), subadults ( $\chi^2_{1} = 60.38$ ;  $P < 0.001$ ;  $n = 130$ ) and hatch-year birds ( $\chi^2_{1} = 60.38$ ;  $P < 0.001$ ;  $n = 62$ ).

The results on age and sex structure for the auks affected by the *Prestige* oil spill indicate a strong bias in the region towards females in the three species, confirming previous results found for this

oil spill in the common guillemot (Álvarez and Pajuelo, 2004). This strong sex segregation towards females was not found in previous oil spills occurring in more northern European coastal waters, suggesting that female auks move further away from their breeding colonies during winter. Hatch-year birds were the main casualties for common guillemots and razorbills, but adults were the age group mostly affected in the Atlantic puffin. This suggests a potentially delayed population impact at breeding colonies of the former two species, and an immediate effect in the 2003 breeding season for Atlantic puffin. The fact that adults rather than immatures were the age class more affected by the oil spill in this species suggests that the direct impact on the breeding populations of origin might be greater than in common guillemot and razorbill, despite the larger number of guillemots killed.

Ringed recoveries of auks killed during the spill were mostly of birds ringed at colonies on the west coasts of Britain and in Ireland (Moreno-Opo et al., 2003; Grantham, 2004), and wing lengths of most adults of the three species (Table 1) agreed with those recorded from birds at colonies within this latitudinal range (Cramp 1985; Jones 1988). Both the results obtained on sex and age structure of wintering auks in Galician shelf waters, as well as of their origin, can also be of interest for the definition of Important Seabird Areas in the Northeastern Atlantic. Additionally, knowing the origin of most of the auks allows biologists to do post-spill monitoring in appropriate regions where potentially impacted populations occur.

**Table 1: Wing measurements for adult auks collected during the *Prestige* oil spill (November, 2002 – April, 2003) according to sex**

	Number in sample	Mean	Standard error	range
<b>Common Guillemot</b>				
Males (After-Hatch-Year Birds)	28	196.2	3.9	189-204
Females (After-Hatch-Year Birds)	110	198.5	4.7	187-210
<b>Razorbill</b>				
Males (adults)	5	195.0	3.5	191-199
Females (adults)	12	198.3	6.6	181-206
<b>Atlantic Puffin</b>				
Males (adults)	45	159.3	0.6	149-167
Females (adults)	116	156.4	0.4	143-168

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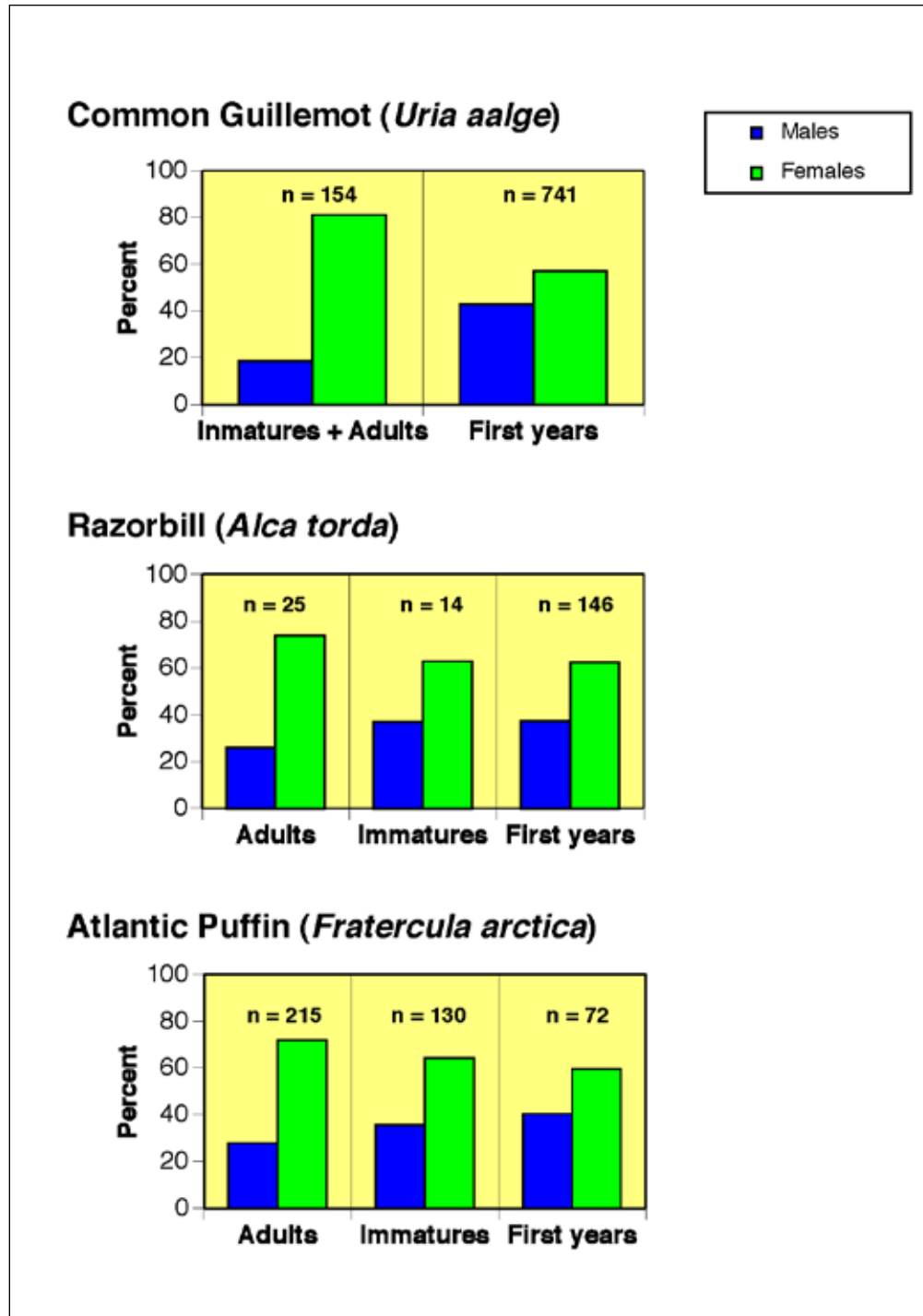


Figure 1. Age and sex composition of auks collected during the Prestige oil spill (November, 2002 – April, 2003)