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The establishment of a breeding population of Smew *Mergellus albellus* in an atypical habitat on the Atlantic coast of Norway

Etableringen av en hekkebestand av Salskrake Mergellus albellus *i et atypiske habitat på den norske Atlanterhavskysten.*

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Abstract

In recent years, the Smew *Mergellus albellus* has established a breeding population of minimum 15 pairs on the coastal islands in Vikna municipality (65° N, 11° E) in Central Norway. As a result, the current breeding distribution of Smew extends throughout northern Eurasia, from the Atlantic Ocean to the Pacific Ocean. The habitat in Vikna is quite different from that of the coniferous taiga zone, and the population is probably ground-nesting. We suggest that the westward range expansion, and the ability to adapt to another habitat than the coniferous taiga zone, can make the Smew better able to cope with future impacts of global climatic change than predicted by present models.

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Introduction

The breeding range of the Smew *Mergellus albellus* extends across northern Eurasia from northeastern parts of Fennoscandia, throughout Russia, and eastwards to the Pacific Ocean (del Hoyo et al. 1992, Snow & Perrins 1998, Kear 2005). It is usually considered a taiga species, strongly associated with the coniferous taiga zone. The Smew normally nests in tree cavities but also readily uses artificial nest boxes, and the northern border of the breeding distribution closely matches that of Black Woodpecker *Dryocopus martius* (del Hoyo et al. 1992, Snow & Perrins 1998). It is sparse in most of the breeding range, and the European population of Smew is currently considered as 'Vulnerable' with an estimated size of 5300–8400 breeding pairs (BirdLife International 2004).

The Smew colonised Northern Scandinavia during the second half of the 19th century (Haftorn 1971). Throughout most of the 20th century, it was one of the rarest breeding birds in Scandinavia. However, during the last three decades the Swedish population has increased strongly, from roughly 100 pairs in the 1980s, to a present population of approximately 1600 pairs (Ottosson et al. 2012). The first breeding in Norway was recorded in the eastern part of the county of Finnmark (69° N, 29° E), close to the Russian border, in 1925 (Haftorn 1971). During the remainder of the 20th century, the Norwegian population was restricted to this area, with a population estimated at 10–20 pairs (Snow & Perrins 1998, BirdLife International 2004).

In 2003, a pair of Smew bred on one of the coastal islands in Vikna municipality (65° N, 11° E) in Central Norway, and since then a few pairs have nested annually on these islands (Værnesbranden 2006, P.I. Værnesbranden pers. comm.). The establishment of a breeding population of Smew in this area was most unexpected, since the habitat on these coastal islands is quite different from that of the coniferous taiga zone. The objective of the current study was a complete mapping of this population of Smew inhabiting the extreme western fringe of its breeding range. Based on our findings we describe novel aspects of the habitat selection and breeding biology of Smew.

Study area and methods

Vikna municipality consists of a huge number of islands and islets with a total land area of 312 km^2 (Figure 1). The three main islands, Inner-Vikna,

Mellom-Vikna and Ytter-Vikna constitute 70 % of the land area. The landscape consists of a mosaic of bare rock surfaces, moors and mires, patches of cultivated land, some woodland areas, and numerous small lakes and ponds. The patches of wooded areas consist mainly of low-growth pine *Pinus sylvestris*, birch *Betula pubescens* and aspen *Populus tremula*.

A total of 54 water bodies, large enough to be potentially suitable habitats for Smew, occur in Vikna. These are all situated on the three main islands, and range in size from small ponds (<0.01 km^2) to lakes with a surface area of roughly 0.9 km^2 (Figure 2). All 54 water bodies were investigated twice a year by four observers during the following periods: 8–14 May in 2011–2014 (except in 2013 when no surveys were performed) and 24–28 June in 2011–2014. In May the aim was to count the total number of Smew present before the females start incubating, while in June the main aim was to search for broods.

In order to increase the availability of possible nesting places 20 nest boxes, with a hole diameter of 110 mm, were erected in the breeding area in March 2012. They were erected in trees, 2–5 m above ground level, less than 20 m from the edge of the water bodies most frequently used by Smew. The bottom of the nest boxes was filled with a 15 cm layer of fine wood shavings. In the subsequent breeding seasons (2012–2014) the nest boxes were checked in late June.

Results

In May 2011–2014 the number of females varied from 13 to 16 and the number of males from 12 to 15, while in June the number of females varied between 7 and 16 (Table 1). Except for three males seen together in a lake in June 2013, no males were observed in late June. Smews were recorded in 25 of the investigated water bodies, and these were restricted to an area totalling 79 km^2. These water

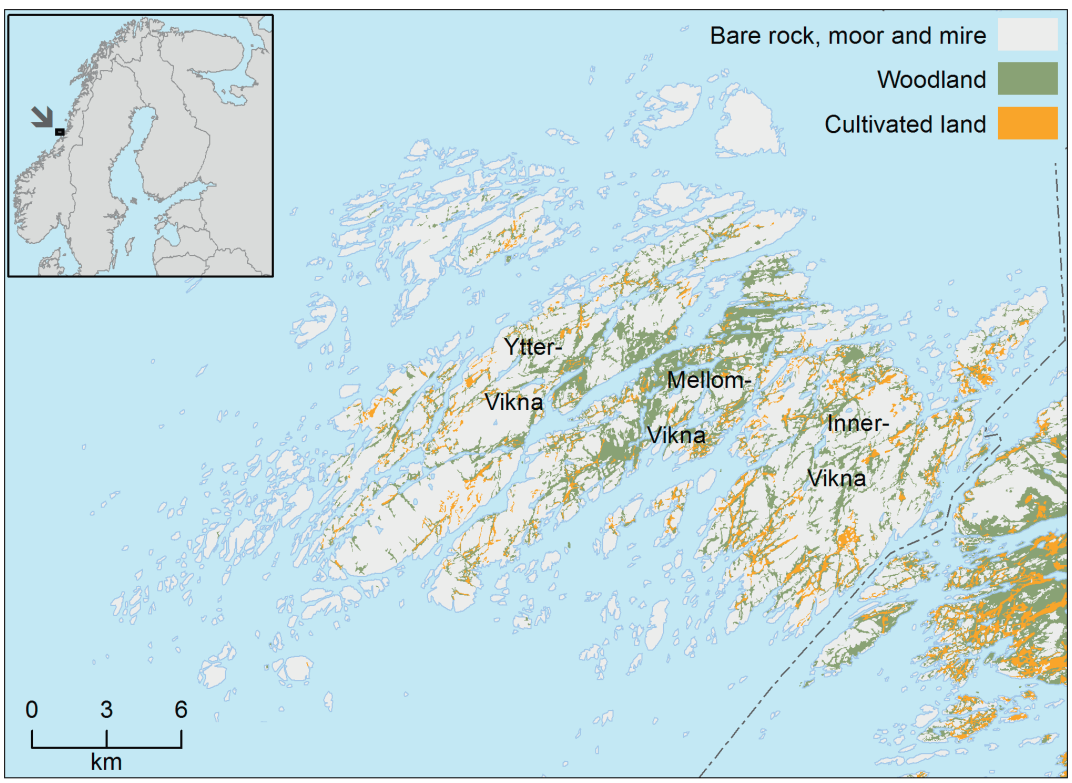

Figure 1. The study area Vikna municipality in Central Norway is an archipelago consisting of a huge number of islands and islets. Bare rock surfaces, moors and mires dominate the landscape. Inserted map shows the geographical position of Vikna. *Undersøkelsesområdet Vikna kommune i Midt-Norge består av et stort antall øyer og holmer. Nakent fjell, kystlynghei og myr dominerer landskapet. Oversiktskartet viser den geografiske plasseringen til Vikna.*

Figure 2. Examples of typical Smew *Mergellus albellus* breeding habitats on the costal islands in Vikna municipality in Central Norway.
Eksempler på typiske hekkehabitat for Salskrake Mergellus albellus på kystøyer *i Vikna kommune i Midt-Norge.*

bodies were situated at altitudes of 3–12 m a.s.l., and based on visual assessments of the aquatic vegetation 16 were classified as eutrophic, whereas the remaining nine were classified as oligotrophic.

A total of 19 broods were observed in June in the summers of 2011–2014 (Table 1, Figure 3). The brood size varied from 2 to 13 ducklings, with an average of 5.6 (sd = 3.1) ducklings per brood. None of the nest boxes erected in the breeding area were used by Smew during the study period.

Table 1. Numbers of females, males and broods of Smew Mergellus albellus located in the breeding area in Vikna during surveys in early May and late June 2011–2014. In addition, the numbers of ducklings in each brood are denoted. No survey was performed in May 2013.
Antallet hunner, hanner og ungekull av Salskrake Mergellus albellus registret under kartlegging i Vikna i første halvdel av mai og sent i juni i 2011–2014. I tillegg er antallet unger i hvert kull angitt. Det ble ikke gjennomført kartlegginger i mai 2013.

Year	Month	Females	Males	Broods	Brood size
2011	May	16	12	0	
2012	May	13	12	0	
2013	May	–	–	–	
2014	May	16	15	0	
2011	June	7	0	6	2, 2, 4, 5, 6, 8
2012	June	7	0	3	3, 6, 12
2013	June	12	3	5	2, 6, 7, 9, 13
2014	June	16	0	5	3, 4, 4, 5, 5

Figure 3. One of the Smew *Mergellus albellus* broods recorded in Vikna during surveys in late June (Photo: Kjartan Trana).
Et av salskrake Mergellus albellus *kullene som ble registret i Vikna under kartleggingene i slutten av juni (Photo: Kjartan Trana).*

Discussion

In early May the Smew tend to appear in pairs and are often well exposed on the water bodies. At this time the aquatic vegetation is still sparse and the birds are relatively easy to detect. However, several of the lakes investigated have numerous islets and inlets that are difficult to access, and a few individuals are likely to remain undetected. Based on the surveys in May, we consider the present breeding population of Smew in Vikna to be a minimum of 15 pairs. In late June many of the ponds and lakes used by Smews are overgrown by aquatic plants, and females and broods can be difficult to detect. Additionally, the females are extremely shy and often hide their broods for hours when disturbed (pers. obs.). Thus, we suggest the total number of broods to be somewhat larger than the numbers detected (Table 1). The almost complete absence of males in late June indicates that they leave the breeding area previous to the brood rearing period. At this time they probably move to moulting grounds in nearby sea areas.

Published papers on the breeding biology of Smew are very scarce, and available information is principally summarized in handbooks (del Hoyo et al. 1992, Snow & Perrins 1998, Kear 2005). According to this information the Smew breed in tree cavities and are intimately linked to areas with well-grown trees. Although we have not located any nests in Vikna, we strongly suggest that this population is ground-nesting. Several factors support this judgment: (1) a general lack of well-grown trees in the breeding area; (2) Black Woodpecker, the only European woodpecker large enough to excavate nest cavities for Smew, does not breed in Vikna (Gjershaug et al. 1994, pers. obs.); (3) none of the nest boxes erected in the breeding area were used by Smew during the three subsequent breeding seasons.

According to available literature the usual clutch size of Smew is 7–9 eggs, with an upper limit of 11 eggs (del Hoyo et al. 1992, Snow & Perrins 1998, Kear 2005). Thus, the two largest broods (12 and 13 ducklings) observed in this study might well be a result of conspecific brood amalgamation that is known to occur frequently in several species of Anatidae (Eadie et al. 1988). We judged most of the broods observed in late June to be approximately one week old. This indicates that females start to incubate in late May which is in accordance with the onset of incubation described from Finland and Russia (Snow & Perrins 1998).

During the 19th and the first half of the 20th century the number of Smews declined considerably in Eastern Europe and the breeding range showed a marked northward contraction, mainly due to habitat loss and degradation (Vinogradov 1994, Kear 2005). Models used to simulate the future impacts of global warming predict a considerable northward contraction of the breeding range of Smew, as well as many other 'taiga species' (Huntley et al. 2006, 2007). With this in mind it is interesting to note that the Smew has shown a considerable westward expansion in Fennoscandia during the last thirty years. Similar expansions in westerly direction have also recently been reported for two other taiga species, the Great Grey Owl *Strix nebulosa* (Solheim 2009, Berg et al. 2011) and Red-flanked Bluetail *Tarsiger cyanurus* (Mikkola & Rajasärkkä 2014). Why has Smew expanded its breeding range in a westward direction? One possible explanation is that this expansion is a secondary effect of the increasing number of Smew wintering in Scandinavia. In Sweden, the number of wintering Smews has increased nearly 10-fold since the 1970s, because of a climate-driven redistribution of the European wintering population (Nilsson 2008, Pavón-Jordán et al. 2015). At present, the Norwegian breeding population of Smew is estimated to be 50–250 pairs, and due to increasing numbers also in Sweden, it has been downgraded from 'Endangered' to 'Vulnerable' in the national red list (Kålås et al. 2010).

Cavity-nesting is normal, if not obligatory, in several species of Anatidae (Kear 2003). The establishment of a breeding population of Common Goldeneye *Bucephala clangula* in Scotland was clearly promoted through provision of nest boxes (Dennis & Dowe 1984). Probably due to the lack

of suitable nest-cavities, the Common Goldeneye, which is otherwise widely distributed in Scandinavia, does not breed in Vikna (Gjershaug et al. 1994, pers. obs.). However, some degree of adaptability is known among cavity-nesting ducks. In North America, Barrow's Goldeneyes *Bucephala islandica* nest in cavities made by woodpeckers, while they on Iceland use crevices in the lava rock (Kear 2003, 2005). It is also known that the Goosander *Mergus merganser* occasionally uses cavities in the ground and consequently can inhabit treeless areas (Kear 2003). We suggest that the Smews inhabiting Vikna are imprinted on natal nest sites other than tree-cavities, since they show no apparent interest for the nest boxes provided. The current westward range expansion, and the ability to adapt to another habitat than the taiga zone, can make the Smew better able to cope with future impacts of global climatic change than predicted by present models (Huntley et al. 2007).

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Sammanfattning

Salskraken hekker i nordlige deler av Fennoskandia, og videre gjennom Russland hvor den finnes helt øst til Stillehavet. Utbredelsen er sterkt knyttet til det nordlige barskogbeltet, og den blir gjerne omtalt som en taiga-art. Reiret plasseres i hulrom i trær, ofte gamle reir av spillkråke, eller i rugekasser dersom slike er tilgjengelig. Innenfor hele hekkeområdet regnes salskraken som fåtallig, og den europeiske bestanden er estimert til 5300–8400 par.

I Skandinavia etablerte salskraken seg som hekkefugl i siste halvdel av 1800-tallet. Gjennom det meste av 1900-tallet ble den regnet som en svært sjelden hekkefugl både i Sverige og Norge. Den

svenske hekkebestanden har imidlertid økt markant den siste 30 års perioden. På 1980-tallet ble bestanden anslått til ca. 100 par, mens dagens bestand er estimert til ca. 1600 par. I Norge ble salskrake første gang påvist hekkende i 1925, i Pasvik, nær grensen mot Russland. Gjennom hele 1900-tallet var den norske hekkebestanden begrenset til de østlige delene av Finnmark fylke med en estimert bestand på 10–20 par.

I 2003 ble et par salskrake registrert hekkende i Vikna i Nord-Trøndelag, og siden da har noen få par hekket årlig på øyer i denne kystkommunen. Dette var overraskende siden habitatet på disse kystøyene er svært forskjellig fra den nordlige barskogssonen hvor salskraken ellers hekker. Formålet med denne undersøkelsen var å gjennomføre en fullstendig kartlegging av hekkebestanden av salskrake i Vikna. Basert på disse undersøkelsene beskriver vi hittil ukjente sider ved salskrakens habitatvalg og hekkebiologi.

Vikna er en kystkommune i Nord-Trøndelag som består av ca. 6000 øyer, holmer og skjær. Det samlede landarealet er 312 km^2, hvorav de tre største øyene, Inner-Vikna, Mellom-Vikna og Ytter-Vikna, utgjør ca. 70 % av landarealet. Vikna er et typisk norsk kystlandskap, og består hovedsakelig av nakent fjell, kystlynghei og myr. På de tre største øyene finnes det i tillegg mange små områder med dyrket mark, en del småvokst blandingsskog, og mange innsjøer, tjern og dammer.

Til sammen ble 54 innsjøer, tjern og dammer kartlagt hvert år innenfor følgende tidsperioder: 8.–14. mai i 2011–2014 (med unntak av i 2013 hvor kartlegging ikke ble gjennomført), og 24.–28. juni i 2011–2014. For å øke salskrakenes tilgang til potensielle reirhull, ble det i mars 2012 satt opp 20 rugekasser ved de viktigste hekkelokalitetene. Disse kassene ble kontrollert i slutten av juni i de tre påfølgende hekkesesongene.

I mai 2011–2014 varierte antallet hunner fra 13 til 16, og antallet hanner fra 12 til 15. Tilsvarende ble det i slutten av juni 2011–2014 registret mellom 7 og 16 hunner i hekkeområdet. Med unntak av tre hanner, som ble observert i flokk i juni 2013, ble hanner ikke registrert under kartleggingsperiodene i juni. Det ble totalt registrert 19 ungekull i hekkesesongene 2011–2014. Ungekullene varierte i størrelse fra 2 til 13 unger med et gjennomsnitt på 5,6 unger pr. kull. Ingen av de 20 rugekassene, som ble etablert i hekkeområdet vinteren 2012, ble benyttet av salskrake i de tre påfølgende hekkesesongene.

Tidlig i mai er salskrakene i Vikna relativt lett å registrere. På denne tiden er planteveksten i vannene begrenset, og fuglene ligger ofte godt eksponert på vannene. Mange av vannene har imidlertid tallrike holmer og bukter, og vi antar at noen individer ikke ble registrert under kartleggingene. Basert på resultatene fra kartleggingene i mai anslår vi dagens hekkebestand i Vikna til minimum 15 par. I juni er det kraftig plantevekst i mange av de eutrofe vannene, og på den tiden kan hunner og kull være svært vanskelig å oppdage. Derfor er den årlige produksjonen av ungekull trolig noe større enn det som ble registrert i denne undersøkelsen.

Selv om vi ikke har klart å lokalisere reir av salskraker på Vikna er det flere faktorer som sterkt indikerer at denne bestanden har tilpasset seg til å hekke i hulrom på bakken. 1. Skogen på Vikna består i all hovedsak av trær med en diameter som er for liten for en hulerugende art som salskrake. 2. Spillkråke, den eneste hackspetten som kan lage store nok reirhull til salskrake, hekker ikke på Vikna. 3. Ingen av rugekassene etablert i hekkeområdene ble benyttet av salskrake i de tre påfølgende hekkesesongene. Slike adaptasjoner til bakkehekking i skogløse habitater er tidligere beskrevet også for andre arter av andefugler som primært hekker i hule trær.

De siste åra er det utviklet modeller for å simulere effekter av klimaendringer på hekkebestander av fugl. For salskrake indikerer disse modellene en nordlig forflytting av hekkeområdene, og også en kraftig reduksjon i det samlede utbredelsesområdet. Som en kontrast til disse modellene har antallet hekkende salskraker økt markant i Skandinavia de siste tiårene, og bestanden har ekspandert vestover. Et sentralt spørsmål er hvorfor salskraker viser en slik ekspansjon. En mulig forklaring på ekspansjonen er et mildere vinterklima som har ført til en markant redistribusjon av bestandene av salskrake som overvintrer i Europa. I Sverige er antallet overvintrende salskraker omtrent tidoblet siden 1970-tallet. Ekspansjonen av hekkebestandene i Sverige og Norge kan derfor være en sekundær effekt av de økende overvintringsbestandene. Det er også interessant å notere at en ekspansjon vestover nylig er registrert for to andre typiske taiga-arter, blåstjärt og lappuggla. Ekspansjonen av salskrake i Skandinavia, og evnen til å tilpasse seg andre habitater enn det nordlige barskogsbeltet, betyr at den kan være bedre i stand til å motstå framtidige effekter av global oppvarming enn det dagens klimamodeller indikerer.