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Why is the Water Rail *Rallus aquaticus* a very scarce breeder north of 61° N?

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Abstract

Along a transect from just north of Uppsala (c. 60° N) to Luleå (c. 65°30' N), the eastern coast of Sweden, we searched for Water Rails *Rallus aquaticus*. Rails were found at four of twenty-four visited sites, the northernmost site at 61°08' N. The reason for the absence of rails further north we assume to be a transition of the marsh vegetation from one dominated by dense *Phragmites australis* and *Carex elata* with a layer of shallow water above the bottom to one dominated by *Potentilla palustris* and increasing amount of Sphagnaceae and Polytrichaceae mosses without any water above the vegetation mat. The former vegetation, high and dense but with open space at the bottom, provide both shelter and nest sites and permit the rails to move easily without being exposed to predators. The latter vegetation is too dense and too low for the rails to be able to move without exposing themselves to predators.

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Introduction

The Water Rail *Rallus aquaticus* is a specialized "wading" bird, a species highly adapted to a semi-aquatic life in dense marsh vegetation. The breeding distribution of this species is especially associated with eutrophic water bodies with vegetation of *Phragmites australis*, *Carex* species, *Cladium mariscus*, *Juncus* species, and *Sparganium erectum* (Cramp & Simmons 1980, Hagemeijer & Blair 1997, Svensson et al. 1999, De Kroon & Mommers 2002). The breeding habitat has a typical physiognomy and structure (texture) created by the dead stems and leaves, which provide important shelter predominantly in spring before the growth of new vegetation. The breeding rails also prefer a soil substrate with a layer of shallow water among the stems. A dry soil substrate is a restricting factor (De Kroon 1999).

During the industrial revolution in the 19th and 20th centuries, most inland water bodies, both lakes and rivers (waterways), were regulated in order to stabilise water level fluctuations, and usually the water levels were lowered, canals were dug, and roads and railways were constructed. This was particularly done for transport of goods by barges, boats and trains, but also in order to fight malaria mosquitoes (*Anopheles*) and to create new land for agriculture. These transformations were carried out everywhere in Europe. In connection with this, people dispersed everywhere, including agricultural people.

The effects of all these transformations, in Sweden too (Eutrophication of soil and water – Swedish EPA, Swedish EnviroNet 2002), were amongst others: (1) Fragmentation and degradation of natural landscapes and habitats for flora and fauna; (2) Increased loading of nutrients in eutrophic, mesotrophic, and oligotrophic waters by agriculture, sewage from cities (nitrogen and phosphorous), and waste water from industries; and (3) Expansion of *Phragmites australis* (Common Reed) in new banks and finally the increase of areas with reed beds/belts.

Because of all these developments the population of the Water Rail increased in range and numbers during the late 19th century, also in Sweden (Curry-Lindahl 1960, Cramp & Simmons 1980, Svensson et al. 1999). The distribution area of breeding rails successively reached north of 61° N in Scandinavia and Russia (Voous 1960, Cramp & Simmons 1980, Potapov & Flint 1989, Hagemeijer & Blair 1997).

According to the distribution map of breeding Water Rails in Sweden (Svensson et al. 1999, page 151), the species is scarce north of 61° N. In the four coastal provinces of Hälsingland, Medelpad, Ångermanland, and Västerbotten, which cover the latitudes between 61°N and the northern limit of the range of occasional records of the rail at about 65° N, about 820 atlas squares were well surveyed.

Breeding was "confirmed" in only one of them. Breeding was considered "probable" in fifteen (1.8 %) and "possible" in nineteen (2.3%). Both these figures drop to only about one percent if squares that were not well surveyed are included too. For two provinces, Medelpad (Hedvall & Hägglund 1989) and Västerbotten (Olsson & Wiklund 1999) regional summaries of the occurrence of the Water Rail are available. In Medelpad there is only one spring or summer record from before 1950, seven records in 1950–1967, and eleven records in 1968–1988. Breeding has not yet been confirmed and only at one coastal site was the rail found in more than one year. In Västerbotten there are only 13 records from before 1975, and 35 records in 1975–1997. It is not found every year, and it has been recorded in more than one year at only three sites.

Olsson & Wiklund (1999) say that the nearest permanent breeding site south of Västerbotten is located at Skärjavan, just south of 64 °N, in the northern part of Ångermanland. However, it is not apparent from the report whether breeding has been documented or if the habitat is suitable for breeding. In any case, the extreme rarity of the Water Rail as a potential breeding bird in northern Sweden is well documented. For that reason we asked the question: What might be the reason for breeding Water Rails to be so very scarce north of latitude 61?

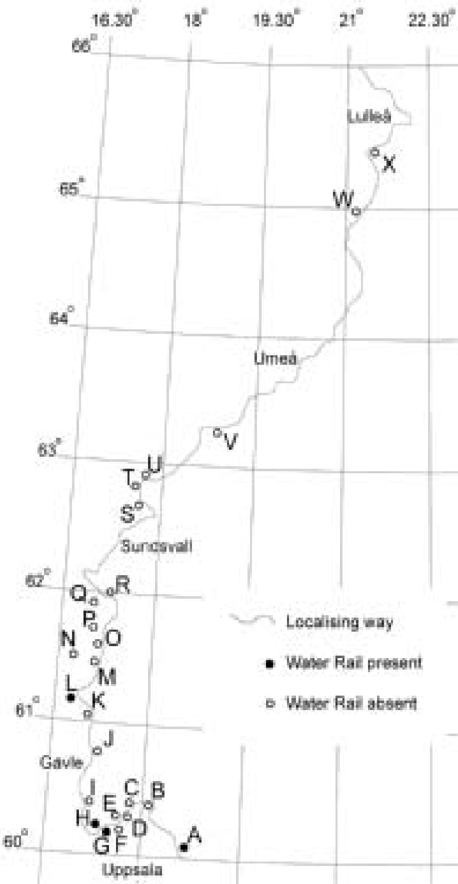

Figure 1. The different arbitrary areas visited in May 2002 in relation to the degrees of latitude and longitude. The letters correspond to those in Table 1.
De olika godtyckligt valda områden som besöktes i maj 2002 I förhållande till bredd- och längdgrad. Bokstäverna motsvarar de i Tabell 1.

Methods

We visited a number of sites in the coastal zone between 60° and 66° N, from about 65 km ENE of Uppsala (Häverö) to Luleå, i.e. in the counties of Uppland, Gästrikland, Hälsingland, Medelpad, Ångermanland, Västerbotten and Norrbotten (Figure 1). For each area we described the different helophyte stands of the water bodies and tried to localise rails. For the manner of localising rails, see De Kroon & Mommers (2002, page 70). We made the survey during the period 8–21 May 2002.

We consider the different visits at a number of arbitrary areas as a reliable sample (see Table 1). We had no previous knowledge about exact locations where the Water Rail is a breeding bird. We had only the information of the distribution map of Svensson et al. (1999, page 151).

Results and discussion

Twenty-four arbitrary areas were visited. In four (17%) separate areas we localised rails, and three of these areas were south of 61°N. In total, we found 12 rails. In six territories we found one rail and in three territories we found three couples. Our results do not conform to the distribution map of Svensson et al.

Table 1. The arbitrarily chosen areas visited in May 2002.The helophyte vegetations are described for each area. The capital letters refer to Figure 1.
De godtyckligt valda områden som besöktes i maj 2002. Helofytvegetationen beskrivs för varje område. De stora bokstäverna hänvisar till Figur 1.

Sites with Water Rails *Lokaler med vattenrall*

A. Bergbofjärden and Lövfjärden, 10 km NE of Hallstavik (*Phragmites* mires). 8 and 9 May.
E. Western side of Vendelsjön north of Örbyhus slott (*Phragmites* belt). 11 May.
H. NW of Hällholmen, Tämnaren, north-eastern side, nature reserve Iggelbo (*Phragmites* border). 12 May.
L. Northwestern part of Hunsbosjön, 21 km SW of Söderhamn (*Phragmites* border). 14 May.

Sites without Water Rails *Lokaler utan vattenrall*

B. Southern part of Södra Åsjön, 6 km W of Forsmark (local *Phragmites* borders). 10 May.
C. Northeastern side of Bruksdammen, NW of Forsmark (lake with local *Phragmites* borders). 10 May.
D. Parts of Finnsjön, south of Kastudden and at Skeppsviken, 15 km WSW of Forsmark (narrow *Phragmites* borders). 10 May.
F. Nymdängen and Risön, 1–2 km west of Finnsjön (fragmentary thin helophyte stands). 11 May.
G. Eastern part of Kyrksjön at Tegelsmora north of Örbyhus (*Phragmites* belt). 11 May.
I. Small bay east of Hedesunda church (tall-herb fens border). 13 May.
J. Western part of Hillesjön, near Hille, c. 7 km north of Gävle (*Phragmites* border). 13 May.
K. Nydammen west of Överhammaren c. 2 km west of Axmar bruk (small lake, part of Skärjån river area, fragmentary thin helophyte stands). 14 May.
M. Northern part of Skenstaviken, 5 km north of Söderhamn (*Phragmites* belt). 14 May.
N. Southern half of Långbrosbodsjön, 14 km SW of Enånger (fragmentary, thin helophyte (*Phragmites*) stands). 14 May.
O. Western shores of Norasjön and Hedsjön, 5–9 km SE of Enånger (too fragmentary thin helophyte stands). 15 May.
P. Grängsjön, 11 km west of Enånger (thin helophyte stands). 15 May.
Q. Southeastern part of Storsjön, between Ölsund and Lumnäs, c. 5 km W of Iggesund (*Phragmites/ Palustris potentilla* border). 16 May.
R. Northwestern part of Orrsjön, 5 km NE of Bergsjö (thin *Phragmites/Palustris potentilla* border). 16 May.
S. Both sides of the road between Nabben and Uland (*Phragmites/Palustris potentilla* mires). 17 May.
T. Selasjön, 15 km SW of Kramfors (too fragmentary thin helophyte stands). 17 May.
U. Ytter-Hansjön, 9 km SW of Kramfors (too fragmentary thin helophyte stands). 19 May.
V. The shores of Nördviken and Näsviken, northern part of Idbyfjärden, NE of Örnsköldsvik (small *Phragmites* border, *Alnus* forest). 19 May.
W. Vitsjön, 6 km north of Byske (fragmentary thin helophyte stands). 20 May.
X. Eastern side of road E4, 6 km NW of Piteå (*Phragmites* belt). 21 May.

(1999, page 151) in this part of Sweden, since we were not able to localise any rails north of 61°08'N (Figure 1).

The localised rails were staying in a vegetation of *Phragmites australis* and *Carex elata* along a border of marsh forest and brushwood (*Myrica gale, Salix* species).

Hunsbosjön (61.08.N) was the northernmost site. Here we heard one Water Rail with territorial behaviour (high announcement-call with a grumble; De Kroon & Mommers 2002). In addition, he was easy to hear running in the water as a reaction to playback, time after time. He was staying in a reed border (north side of the lake) between open water and brushwood, and he moved along a stretch of about 200 m. We didn't hear any other rail, so we assume it was a territorial male that was still alone.

The state of swamps and mires with and without rails

We have tried to summarize characteristic properties of the sites where we found and where we did not find rails in Table 2.

In the neighbourhood of most lakes with reed borders or reed belts there were variable agriculture areas with good deep drained fields and meadows (sites E, G, J, L, X in Figure 1). In the course of many years the water has been enriched with nutrients from the farms (nitrate nitrogen of muck, fertilizer).

Table 2. Vegetation and hydrology of swamps and mires with and without Water Rails.
Vegetation och hydrologi för kärr och myrar med och utan vattenrallar.

With rails *Med rallar*	Without rails *Utan rallar*
Lake practically overgrown with *Phragmites*. Only a (narrow) border of *Phragmites* on bank side. *Phragmites australis* dominance. *Carex elata* dominance. *Salix* marsh forest border along *Phragmites* belt. *Myrica gale* brushwood border along *Phragmites* belt. Shallow water (20–30 cm) on substrate. Helophytes area > 10x2 m.	Too thin helophytes (including *Phragmites*) vegetation. Vegetation too short (< 50 cm). *Potentilla palustris* amid helophytes (including *Phragmites*). *Potentilla palustris* dominance. Sphagnaceae and Polytrichaceae moss species. Soil substrate not inundated. Vegetation mat not inundated. Area of helophytes < 10x2 m.
Sjö nästan täckt av vass. *Endast en (smal) bård av vass längs strandkanten.* *Bladvass dominerar.* *Carex hudsonii dominerar.* *Sumpskog av viden gränsar mot vassbältet.* *Pors gränsar till vassbältet.* *20–30 cm grunt vatten över botten.* *Arealen helofyter större än 10x2 m.*	*För gles helofytvegetation.* *För kort vegetation (<50 cm).* *Kråkklöver bland helofyterna.* *Kråkklöver dominerar.* Arter av vitmossor och Polytrichaceae mossor *Bottensubstratet ej under vatten.* *Flytande vegetationsmatta ej under vatten.* *Helofytarealen mindre än 10x2 m.*

Therefore many lakes had changed successively into swamps and reed beds of *Phragmites australis* by succession sequences and cropping. Sometimes the floating vegetation had grown into a thick mat that rose completely above the water surface, and the vegetation mat was not inundated. Since shallow water above the vegetation mat is important for breeding rails, this is a negative factor. At sites where this situation was actually present, we did not localize any rails.

We observed, at most visited sites between Gävle and Luleå, that the vegetation of helophytes first dominated by *Phragmites australis* and *Carex elata* then slowly changed into fens with a more open or thin *Phragmites australis* cover with an under-storey of a generally small amount of *Potentilla palustris*. Successively further to the north the sites became first dominated by *Potentilla palustris* with some reed still present, at some places mixed with Sphagnaceae and Polytrichaceae moss species. The vegetation layer was thick, but denser and shorter, so that both the accessibility for the rails to move and the cover of view by predators decreased. Thus, there was no open vegetation just above the layer of shallow water and no shelter effect. This change of vegetation and the beginning of peat formation is typical for the circumpolar plant communities abundantly distributed at these latitudes all around the northern hemisphere in connection with water bodies which are mesotrophic or oligotrophic. *Phragmites australis* does not have any great tolerance to oligotrophic conditions. Occasionally and isolated, it grows on banks in bog areas enriched with nitrogen.

We visited some lakes with forest all around them. These lakes had along the shores only local and too fragmentary and thin stands of helophytes, for example some *Carex* species, *Equisetum fluviatile*, *Menyanthes trifoliata*, *Eriophorum angustifolium*.

Conclusion

The occurrence of the Water Rail in Sweden is connected with eutrophic water, growth of helophytes, particularly *Phragmites australis*, in particular habitats influenced by agricultural activities (nitrogen) all around the lakes. The fact that we did not discover any Water Rails north of 61°08'N, we ascribe to the transition of the habitat from one dominated by *Phragmites australi*s in the south to one dominated by *Potentilla palustris*, Sphagnaceae and Polytrichaceae moss species in the north. The latter species had only scattered occurrence at the southern study sites but further to the north the habitats were dominated by these species. By this change of vegetation structure the important factors "cover of view" and "potential nest site" are insufficient.

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Sammanfattning

Varför är vattenrallen Rallus aquaticus *en mycket sällsynt häckfågel norr om 61° N?*

Vattenrallen är en art som är starkt anpassad till ett halvakvatiskt liv i tät kärrvegetation. Förekomsten är särskilt knuten till eutrofa vatten med bladvass, halvgräs, ag, tågväxter och stor igelknopp. Häckningsbiotopen präglas av en tät struktur av döda stammar och blad, som ger skydd särskilt på våren innan den nya vegetationen har vuxit upp. Det bör också finnas grunt vatten ovanför bottensubstratet.

Som en följd av bl.a. sjödikningar och eutrofiering av sjöar spred sig rallen norrut under 1800-talet och nådde till slut norr om 61° N i Skandinavien och Ryssland. I området mellan 61° och 65°, d.v.s. i landskapen Hälsingland, Medelpad, Ångermanland och Västerbotten, har rallen dock förblivit mycket sällsynt. På få lokaler uppträder den regelbundet och det är okänt om den häckar eller ej.

Med detta som utgångspunkt besökte vi under perioden 8–20 maj 2002 ett antal lokaler från norra Uppland till Luleå (Tabell 1, Figur 1). I varje område försökte vi bestämma om vattenrallen fanns genom att spela upp dess läten. För varje lokal gjorde vi också en beskrivning av vegetation och vattenförhållanden.

I fyra av totalt 24 besökta lokaler fann vi rall, och det nordligaste av dessa låg vid 61°08' N. Det var i ett vassbälte på Hunbosjöns norra strand, där en ensam rall svarade på vår uppspelning. Rallen sprang fram och tillbaka flera gånger längs en sträcka på 200 meter. Totalt lokaliserade vi 12 rallar. I sex revir fann vi en rall och i tre revir fann vi par. Rallarna uppehöll sig i vegetation av bladvass och bunkestarr längs gränsen till sumpskogar med pors och viden.

Vi har försökt summera de egenskaper som karaktäriserar lokaler där vi påträffade och inte påträffade rallar i Tabell 2. Flera lokaler präglades av jordbruksområden som bidragit till eutrofiering av vattnet. Detta hade ofta lett till att sjön växt igen och förvandlats till ett kärr. Ibland låg den flytande vegetationsmattan över vattenytan, vilket är negativt för rallen. På sådana platser fann vi heller inga rallar.

Längs transekten mellan Gävle och Luleå fann vi att vegetationen av helofyter, som först dominerades av bladvass och bunkestarr, långsamt förändrades till kärr med öppnare och glesa bestånd av bladvass och med begränsat inslag av kråkklöver. Längre norrut blev kråkklöver dominerande med små inslag av vass och med fält av mossor (Sphagnaceae och Polytrichaceae mossor). Vegetationsskiktet var tätare och lägre så att rallarna skulle ha haft svårare att röra sig samtidigt som skyddet mot predatorer hade varit sämre. Denna vegetationsförändring tillsammans med ökande torvbildning är typisk för de cirkumpolära vegetationstyper som finns i kärr på dessa breddgrader. Några av sjöarna vi besökte var helt omgivna av skog och hade alltför glesa helofytbestånd längs stränderna, t.ex. av halvgräs, sjöfräken, vattenklöver och ängsull.

Sammanfattningsvis är vattenrallen i Sverige knuten till eutrofa vatten med högvuxna helofyter, särskilt bladvass, och gärna med kväveläckande jordbruk runt sjön. Att vi inte fann några rallar norr om Hunbosjön tillskriver vi kärrvegetationens övergång från dominans av bladvass med vattenskikt över

botten i söder till dominans av kråkklöver och vitmossor utan vattenskikt längre norrut. Denna strukturförändring innebär att det i norr saknas insynsskydd och lämpliga boplatser.