Ann. Zool. Fennici 21: 417-419. 1984

Breeding success of the Red-throated Diver (Gavia stellata) in southern Finland

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Lokki, J. & Eklöf, K. 1984: Breeding success of the Red-throated Diver (Gavia stellata) in southern Finland. — Ann. Zool. Fennici 21: 417-419.

The Red-throated Diver is considered to be a threatened species. Since 1979 the breeding success of about 40 pairs in Häme, southern Finland has been monitored. Nests located on small islets produce more young than nests on shores. Reasons for unsuccessful nesting, including human disturbance, are considered. Our results seem to indicate that the Red-throated Diver population within our study area is on the increase rather than declining. The most probable reason for this is the good breeding success, i.e. 1.15 offspring per pair per year.

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1. Introduction

The Red-throated Diver *Gavia stellata* is considered to be an endangered species in Finland. In Sweden the status of the Red-throated Diver is also followed with concern. The number of pairs of the species nesting in Finland is estimated to be somewhat over 500 — probably 600-800 pairs (Pakarinen & Järvinen 1984). At least 1000 pairs are estimated to breed in Iceland, while about 750 pairs breed in Scotland (Cramp & Simmons 1977). As far as we know, no relevant numbers have been published for the Swedish or Norwegian populations. The decline in numbers has received attention in Finland, Sweden and Norway only.

The Red-throated Diver is long-lived. Accordingly, an increase in the mortality rate of the young individuals becomes manifest in the adult population only after a long period of time. Recovery from a population crash may then be extremely slow. The Red-throated Diver has been included into the list of endangered species because of its rapid decline. This decline has been noted by both professional and amateur ornithologists in Finland (von Haartman et al. 1963, Järvinen 1979).

In ca 1977 the author Eklöf began developing a method for capturing the young Red-throated Divers for ringing. At the same time McIntyre (1977) developed a method for ringing gaviiform birds by attaching a ring to the fourth (innermost) toe of the bird. The method makes it possible to ring Red-throated Divers from a few days old. The intensive ringing effort begun by Eklöf, later in collaboration with Lokki, has yielded data on the breeding success of the species. In the following we shall use our southern Finnish material to estimate the breeding success and production of young (cf. Eklöf 1981). We shall also briefly describe the method of capturing the birds.

2. Material and methods

The Red-throated Diver population followed by us breeds in Häme, southern Finland, so that the northernmost nests followed are at the environs of Tampere, the westernmost ones in the vicinity of Forssa, the southernmost ones at the latitude of Hyvinkää and the easternmost ones near Lahti. We have been unable to follow accurately all of this area and only the central area around Hämeenlinna (61° N, 24° E) has been studied throughly.

Red-throated Divers often nest in aggregations of some pairs on suitable areas provided with bog pools. The nests are located about 1 km apart from each other. Birds of such a loose "colony" forage, at least in part, in the same areas, mainly large lakes.

The material of this study consists of 36 nesting ponds followed in 1979-82. A total of 103 nestings or attempted nestings have been observed at these ponds. We have striven to visit the nesting areas at least twice within the breeding season: during brooding and when the young are about 3-4 weeks old and they have been ringed. We have tried to locate all nests so that the probable cause of nesting failure could be assessed, if there were no young on the pool.

The young are captured with nets specifically made for this purpose. These nets are about 70–90 m long and 7 m deep. They are so constructed that the mesh remains open in the water. The foot rope is of a sinking type but without lead weights and the head rope is provided with floats. There is no danger of the birds drowning while they are caught in the net under water. The size of the mesh is varied according to the size of the young. A size appropriate for larger young measures 60–70 mm. A monofile thread of 0.2 mm is appropriate. The young dive readily when they are chased at the pond and get ensnared in the net when it has been drawn tight.

Table 1. The nesting success of the Red-throated Diver in different years according to the site of the nest. The figure gives the proportion of successful breedings in all observed nests.

Site of the nest	1979	1980	1981	1982	Total
on the shore	5/7	6/10	9/16	11/14	31/47
on an islet	9/10	12/14	11/14	14/18	46/56

3. Results

The Red-throated Diver constructs its nest at the very edge of water. A small islet on the nest pond constitutes a preferred nest site (see also Bergman & Derksen 1977). In our material 56 out of 103 nests were located on islets. The birds always seem to nest on islets if they are available. Table 1 shows the breeding success in the years of our study. The breeding has been considered successful, when it has resulted in at least one young hatched. The breeding success was better on islets than in the shore nests ($\chi^2 = 3.5$, df = 1; $P > 0.05$), although this difference was only tentatively significant.

Table 2 gives the number of young of ringing age for Red-throated Divers nesting in the two fashions in consecutive years. The number gives the eventual number of young that take to the wing, because they are ringed at the age of several weeks. We have not observed any mortality between ringing and fledgling.

When all of the material is pooled, the breeding success is 1.15 young per commenced nesting. A comparison of shore nesting and islet-nesting Red-throated Divers yields a significantly better breeding success for islet-nesting birds ($t = 2.03$, df = 101; $P < 0.05$).

4. Discussion

An inspection of Tables 1 and 2 shows clear-cut differences between years. In particular, the year 1981 was remarkable in that breeding success and production of young on islet nests were high in comparison with shore nests. In the late June of 1981 very heavy rains fell on our study area. The rains caused a flooding of small forest and bog ponds so that the water lever rose by 20–30 cm. Eggs were drowned on many localities. This resulted in nesting failure, as the birds continued brooding perished for a longtime. Eggs were not drowned on islets, as most islets used by Red-throated Divers float and may follow any changes in the water level.

Another important reason for breeding failure was human disturbance. Many of the ponds studied by us are favoured swimming and fishing pools. As the birds are unaccustomed to man, they leave their nests and the eggs remain under the scorching sun or they become excessively cooled in cold weather. They are also exposed to predators. Predation has been observed to be an important cause of nest destruction (Cyrus 1975, Bundy 1976, Sage 1976). In most cases the failed nests reveal the reason for disturbance; human footprints on the moss. Most naturally small islets can not be reached by fishermen and consequently nesting failures are rarer on them. In Norway Haga (1980) has considered the reasons for nesting failure and in particular the effect of disturbance by man.

Our material includes several ponds with summer cottages only about one hundred meters from the nest. Nesting, however, succeeds regularly in these conditions. This shows that the Red-throated Divers become accustomed to man, provided that the brooding birds are left alone. This seems to be regularly the case.

The above considerations have given rise to the idea of constructing artificial islets on ponds that otherwise may be disturbed. The idea was originated by the people of the parish of Vesilahti (which is within our study area) and they have succeeded in its execution. The Red-throated Diver population has increased, in fact, within this area in our study period. Merrie (1979) has also succeeded in the construction of artificial islets in Scotland. We have also attempted to make artificial islets but the results are most preliminary.

The production of young in the nests followed by us in the study period has been rather good, 1.15 young per commenced nesting. It

Table 2. The production of young of the Red-throated Diver in different years according to the site of the nest.

Site of the nest	1979	1980	1981	1982	Total
on the shore	1.3	0.9	0.7	1.2	0.98
on an islet	1.3	1.5	1.4	1.0	1.29

was lowest in 1981, 1.03, and highest in 1979, 1.29. Studies made on other areas of the range of the species have given much lower numbers of young. Bundy (1976, 1978) has recorded a production of about 0.4 young per nesting Red-throated Diver pair on Shetland. On the Orkneys Booth (1982) has observed a breeding success of 0.7 young per commenced nesting within the eight-year period of 1973–80. Arvidsson (1981) has studied the Älvsborg population in Sweden. It has produced about 0.8 young in 1979–81, again clearly lower than 1.15 obtained by us. In order to evaluate whether the production of young suffices to maintain the population, one needs data on mortality. Estimating this requires ample ringing returns. We have ringed all young within our study area but have received too few returns to be conclusive. We shall attempt to develop a method for capturing adult birds in order to follow the annual mortality.

Virtually nothing is known of the mortality rate of the Red-throated Diver. So far Red-throated Divers have been so little ringed that mortality data are not available. Nilsson (1977) has estimated that the annual mortality of adult Black-throated Diver *Gavia arctica* is 0.11 in Sweden. This figure is based on ringing returns. In addition, Nilsson estimated that Black-throated Diver population remains balanced when each nesting pair produces 0.5 young per summer. As the mortality rate of the Red-throated Diver is presumably similar to its somewhat larger congener, the breeding success in Häme would imply that the Red-throated Diver population is growing rather than declining in our study area. This conclusion is supported by our observations that pairs have recently begun nesting in localities where the species has not previously bred.

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Received 26.VIII.1983
Printed 16.XI.1984