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## Winter residence, sex ratio and wing shape of Goldcrests (*Regulus regulus*) and Firecrests (*R. ignicapillus*) on a southern Italian island<sup>1</sup>

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### Introduction

The two tiny warblers, the Goldcrest and the Firecrest overlap in their breeding area in Europe. The former is more northern and prefers coniferous forests and higher altitudes while the latter is more southern in distribution and prefers broad-leaved forests (HARRISON 1982).

In Italy, both species are considered resident and migrant, the Goldcrest restricted to mountain areas during the breeding period. Although there are reports of both species occurring during migrations along the Tirrenian coasts (CASATI 1962, MOLTONI 1968) the numbers ringed are nowhere high. 42 Goldcrests and 126 Firecrests were ringed near Pisa from 1976 to 1983 — with the latter breeding in the area (BENVENUTI, in litt.). Further to the south, in Burano, only 3 Goldcrests and 23 Firecrests were ringed among the 1475 birds caught in the years 1978—1981 (BARDI & BOANO 1981). The Swedish ringing expedition working on Capri, caught 6 Goldcrests and 41 Firecrests between 1956 and 1961 (EDELSTAM et al. 1963).

The Goldcrest is partial migrant, with birds overwintering south of 64° N (HILDEN 1982). Juveniles predominate among migrants (HILDEN 1982) and male prevalence was recorded for migrant Goldcrests in Norway (LIJELD 1982), Sweden (KARLSSON 1980), Finland (HILDEN 1982), the Polish Baltic coast (BUSSE & MACHALSKA 1969) and France (FRELIN & CORNILLON 1974). Data on Firecrest are few, with reports of wintering in Gibraltar (FINLAYSON 1980) and southern France (DEBUSSCHE & ISENMANN 1984).

Both species are exclusively migrant/wintering birds on Vivara. In this paper we report on the winter residence and sex composition of the two species and show that the uneven sex ratio of Goldcrests reported from northern Europe held for the birds ringed on Vivara. However, this inequality was not reflected in the sex composition of the wintering group. Individuals of both species were wintering on the island, the Firecrest more than the Goldcrest. We also present data on wing morphology.

### Material and Methods

Our study site, Vivara, is a 32 ha island of volcanic origin in the Bay of Naples. Its vegetation is composed of macchia, an abandoned olive grove and vineyard, both with strong macchia re-growth. A more detailed description of vegetation see in LÖVEI et al. (1985).

Mist netting was carried out every month for at least five days per month with varying number of mist nets set up at standard netting sites. For a more detailed description

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of ringing activity and measuring methods see also LÖVEI et al. (1985). Wing formula measurements and Wing Shape Index (WSI) calculations (HOLYNSKI 1965, LÖVEI 1983) were started in 1983. Wing shape representation was taken following TIAINEN'S (1982) method.

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## Results and Discussion

### Migration and winter residence

Most individuals of both species were caught at the netting site at the northern part of the plateau where, in the abandoned olive grove, the regrowth of *Erica arborea* was strongest. Visual observation reinforced that both Goldcrests and Firecrests spent most of the time at this well localized spot where tree architecture resembled the coniferous trees most. During the winter of 1983/84, a larger than usual number of birds attempted wintering on the island and probably food resources were not sufficient as many birds were caught or recaptured with minimal fat reserves. However, their numbers did not decrease until January, similarly to other years.

*R. regulus:* No bird was caught before October or after March (Table 1). Highest numbers were recorded in November. 25 % of the birds caught in November were recaptured (Table 1) and most of these was caught, sometimes on several occasions (Fig. 2) after having spent more than a month on the island. Mean length of stay for recaptures ringed in November was 53.8 days (30–72 days, plus one bird which was recaptured only 6 days after ringing).

The only Goldcrest ringed in October and recaptured later, spent one month on the island (23 Oct — 8 Dec). On the other hand, although the percentage of recaptures for birds ringed in December was as high as for those in November (25 %), only one of them was recaptured later than one month after ringing.

5 males and 5 females spent more than one month on the island, so, as there is a pronounced sexual dimorphism in the Goldcrest (WILLIAMSON 1974;  $55.1 \pm 1.3$  (38) for males vs.  $53.1 \pm 1.3$  (23) for females in birds caught on Vivara), there was no sign that larger males can establish themselves better than the smaller females. This is even more pronounced when the male surplus is considered (see below). The inequality is still reflected in the sex ratio of all recaptured birds (10 males, 5 females).

Table 1: Monthly catches and recapture rates of Firecrests and Goldcrests caught on Vivara, 1977–1984.

Tab. 1: Monatliche Fänge und Wiederfänge von Winter- und Sommergoldhähnchen auf Vivara von 1977 bis 1984.

	Month of ringing						Total
	Oct	Nov	Dec	Jan	Feb	Mar	
<i>R. ignicapillus</i>							
Caught	10	32	21	5	7	6	82
Recaptured	3	15	7	1	—	2	28
Recaptured after > 1month	1	13	6	1	—	—	21
<i>R. regulus</i>							
Caught	8	36	16	2	—	5	67
Recaptured	1	9	4	1	—	—	15
Recaptured after > 1month	1	8	1	—	—	—	10

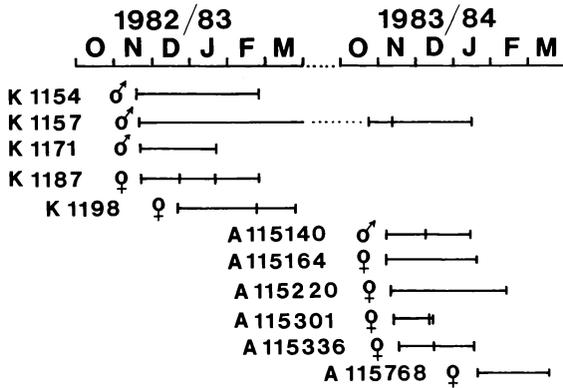


Fig. 1 Recapture histories of individual Firecrests ringed on Vivara, 1982—1984. Numbers preceding each line are the numbers of rings. Vertical lines mark recapture occasions.

Abb. 1: Wiederfänge beringter Sommergoldhähnchen auf Vivara in den Jahren 1982 bis 1984. Die Nummern vor den Linien sind die Ringnummern. Senkrechte Striche markieren Wiederfänge.

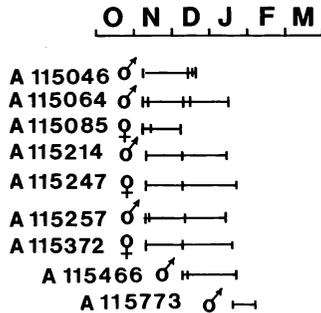


Fig. 2: Recapture histories of individual Goldcrests ringed on Vivara, 1983—1984. Symbols are as on Fig. 1.

Abb. 2: Wiederfänge beringter Wintergoldhähnchen auf Vivara in den Jahren 1983 und 1984. Symbole wie in Abb. 1.

Little migratory activity was observed in the spring, with very few birds caught in March (Table 1).

*R. ignicapillus* More Firecrests than Goldcrests were caught, also between October and March. November was best for Firecrests, too (Table 1) but there was some spring activity as well. While practically only Goldcrests ringed in November were attempting overwintering on the island, Firecrests arriving in November and December were most probable to stay. 46.9 % of all birds ringed in November were recaptured later, most of them several times (Table 1, Fig. 1), while recapture rate was 33.3 % for birds ringed in December. Besides, the same percentage of October-ringed birds was recaptured (one of them was wintering), and even one ringed in January was recaptured in March (17 Jan — 14 March). Mean stay of winter resident birds was 66.3 days (38 — 94 days) for November-ringed birds and 51.2 days (38 — 94 days) for December-ringed ones.

A male, ringed in 20 November 1982 was recaptured 23 October 1983 and two more times that winter, last on 13 January 1984.

Again, wintering males did not outnumber females.

Sex ratio

Sex ratio for Goldcrests was male-biased as reported from northern Europe: 42 males and 25 females were ringed. When looking at recaptures, this holds for all recaptures (10 males vs. 5 females) but does not when considering wintering birds: no inequality was found (5 males, 5 females).

More even sex ratio than for Goldcrests was found for Firecrests: 44 males and 38 females were ringed, with 15 males and 13 females recaptured. No prevalence for either sex was found among wintering birds.

Wing shape

Wing shape reconstruction is shown on Fig. 3. Both sexes had similar wing profiles. There is little difference between the two species although the wing of Goldcrests seems to be more pointed, which can also be seen in the WSI values (Table 2).

For the Goldcrest, there was little monthly change in the mean WSI. WSI showed little change when all captures (even recaptures from previous months) were included.

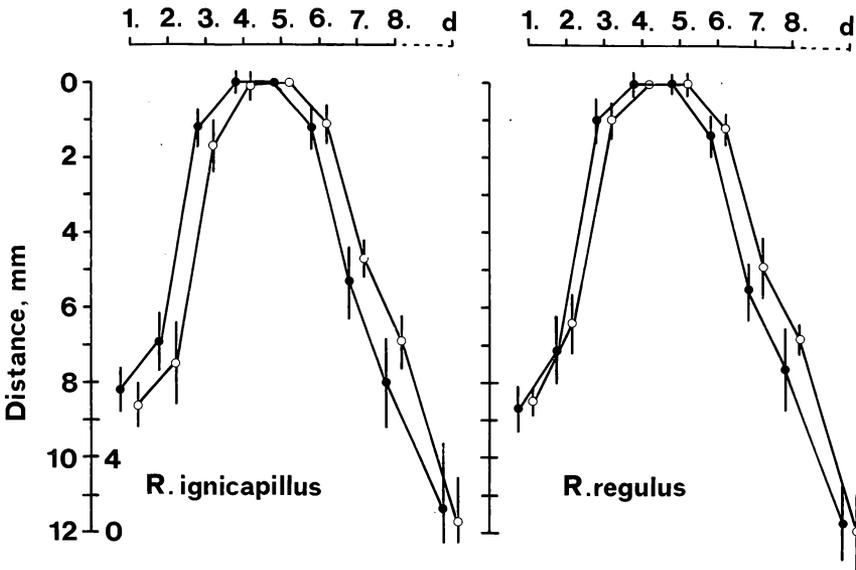


Fig. 3: Reconstruction of the wing profiles of Firecrests and Goldcrests caught on Vivara during the winter 1983–1984. Mean distance of the 1st primary from the tip of primary coverts (scale on the right of „y“ axis) and mean distances of the 2nd–8th primaries and the 1st secondary (denoted „d“) from the tip of the wing (scale on the left of „y“ axis). Dots: data from male birds, circles: females. Vertical bars show  $\pm$  S.D.

Abb. 3: Wiedergabe der Flügelprofile von Sommer- und Wintergoldhähnchen, die während des Winters 1983/84 auf Vivara gefangen wurden. Es werden angegeben: die mittlere Entfernung zwischen der Spitze der ersten Handschwinge und längsten Handdecke (Skala rechts auf der y-Achse) sowie der mittlere Abstand der 2. bis 8. Handschwingspitze und der ersten Armschwingspitze zur Flügelspitze (Skala links auf der y-Achse). Punkte: Daten von ♂, Kreise: Daten von ♀. Die senkrechten Striche geben die Standardabweichung an.

Table 2: Monthly variations in Wing Shape Index (WSI) values of Firecrests and Goldcrests, caught on Vivara, between October, 1983 and March, 1984. Data are means  $\pm$  S. D. (n). When numbers of birds caught were  $< 5$  mean only was calculated and individual values were put into parentheses. Recaptures were included once in a month, even when recaptured several times in that month.

Tab. 2: Monatliche Variationen des Flügelformindex bei Winter- und Sommergoldhähnchen auf Vivara von Oktober 1983 bis März 1984. Die Daten sind Mittelwerte  $\pm$  Standardabweichung. Die Zahl der Vögel steht in Klammern. Wenn weniger als fünf Vögel gefangen wurden, werden nur der Mittelwert angegeben und in Klammern die individuellen Werte.

Month, year	Wing Shape Index			
	<i>R. ignicapillus</i>		<i>R. regulus</i>	
	Newly ringed birds	Recaptures included	Newly ringed birds	Recaptures included
Oct, 83	13.94 (16.4,16.4,9.1)	13.13 (10.7)	8.12 (10.9,7.4,7.3,6.9)	—
Nov, 83	7.76 $\pm$ 2.09 (11)	8.65 $\pm$ 3.11 (13)	11.31 $\pm$ 2.94 (23)	—
Dec, 83	9.15 $\pm$ 2.90 (5)	9.01 $\pm$ 2.62 (8)	11.14 $\pm$ 3.52 (12)	11.38 $\pm$ 3.59 (19)
Jan, 84	10.10 (16.4,3.9)	9.44 $\pm$ 3.14 (12)	9.09	12.83 $\pm$ 3.01 (7)
Feb, 84	11.54	12.07 (12.6)	—	9.09
Mar, 83	3.85	—	—	—
Mar, 84	3.77	—	—	—

WSI of Firecrests varied more between months. When recaptures included, changes became less pronounced (see rows Nov-Dec-Jan). This can mean that sedentary birds had a more rounded wing than vagrant or migrant ones did. However, variation was too large to make any statistical test meaningful.

### Conclusion

We conclude that both species showed winter residence on Vivara, the Firecrest more than the Goldcrest did. Sex ratio of Goldcrests was male-biased as reported from farther north but this disappeared when the sex of wintering birds was compared. The higher WSI of Goldcrests fitted into the knowledge that it breeds more to the north than the Firecrest. On the other hand, wintering Firecrests tended to have more rounded wing than those which were not recaptured.

Future work on population morphology on the breeding grounds combined with behavioural work on the wintering areas, we think, would allow a better understanding of the two species' migration and wintering.

### Summary

67 Goldcrests and 82 Firecrests were ringed on the southern Italian island of Vivara, Bay of Naples, between October 1977 and March 1984. Most birds were ringed in November and December. Recapture rate was high: 15 Goldcrests were recaptured, 9 of them after at least one

month on the island. Firecrests were even more sedentary: of the 28 recaptures, 21 stayed on the island for more than one month. Sex ratio was male-biased in both species: 42 male vs. 25 female Goldcrests and 44 male vs. 38 female Firecrests were caught. Wing Shape Index tended to increase during winter for Firecrests and no change was detected for Goldcrests.

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## Zusammenfassung

Winteraufenthalt, Geschlechtsverhältnis und Flügelform von Winter- und Sommergoldhähnchen (*Regulus regulus*, *R. ignicapillus*) auf einer süditalienischen Insel

Auf der süditalienischen Insel Vivara in der Bucht von Neapel wurden von Oktober 1977 bis März 1984 67 Wintergoldhähnchen und 82 Sommergoldhähnchen beringt, die meisten im November und Dezember. Die Wiederfangrate war hoch: 15 Wintergoldhähnchen wurden erneut gefangen, neun von ihnen nach wenigstens einem Monat Inselaufenthalt. Sommergoldhähnchen waren sogar noch ortstreuer: Von den 28 Wiederfänglingen blieben 21 länger als einen Monat auf der Insel. Das Geschlechter-Verhältnis war bei beiden Arten zugunsten der ♂ verschoben: Es wurden 42 ♂ und 25 ♀ vom Wintergoldhähnchen und 44 ♂ und 38 ♀ vom Sommergoldhähnchen gefangen. Der Flügelformindex tendierte beim Sommergoldhähnchen dazu, während des Winters größer zu werden, während beim Wintergoldhähnchen keine Änderung festgestellt wurde.

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