

Aspects of the foraging niche of Great Tits *Parus major*, Blue Tits *Parus caeruleus* and Long-tailed Tits *Aegithalos caudatus* in a mediterranean wood

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Abstract - Relationships between the foraging niches of Great Tits, Blue Tits and Long-tailed Tits in a mediterranean wood were studied throughout the course of a whole year. Heterospecific flocks were not observed. The three species showed a marked preference for deciduous oaks while feeding. The Great Tit feeds preferentially on the ground during almost the entire year; only in spring does its preference for trees increase. When feeding on trees, it shows no preference for site. It prefers branches of medium size, except in spring when it prefers small sized branches. During its foraging activity, the Blue Tit dislikes the ground and concentrates on the outermost edges of trees, on the middle and outer parts of branches; the preferred branches are small. The Long-tailed Tit feeds almost exclusively from trees, except in spring when it feeds also from bushes. The localization and the diameter of the trees preferred by Long-tailed and Blue Tits are very similar, except in spring when the Long-tailed Tit goes to lower branches and uses medium sized branches. We conclude that the Blue and Long-tailed Tits overlap widely, while the Great Tit has a low overlap with the other two species.

Key words: *Aegithalos caudatus*, foraging niche, mediterranean wood, *Parus caeruleus*, *Parus major*.

Niche relationships in tree foraging Passerines, have been studied with particular accuracy especially between Tits, because the activity is relatively easy to observe in the field. This ease is due to the fact that the feeding sites are generally visible and distinguishable according to various parameters (species of tree, height from ground, distance from trunk etc.) and because Tits are widespread and feed continuously (Alatalo 1982a). Many studies on this subject have been carried out in Central and Northern Europe (Alerstam et al. 1974, Betts 1955, Colquhoun & Morley 1943, Edington & Edington 1972, Gibb 1954, Haftorn 1956, Hartley 1953, Ludescher 1973, Nilsson & Alerstam 1976, Ulfstrand 1962, 1976, Ulfstrand & Nilsson 1976). Other studies on the niches of Paridae and Aegithalidae have emphasized the reciprocal influence exerted by the presence of differing species within heterospecific flocks in the choice of foraging site (Alatalo 1981, Herrera 1979, Hogstad 1978, Laurent 1984, Morse 1978, Rolando 1981, 1982, 1983, Rolando & Robotti 1985). Niche studies on Paridae in a mediterranean biotope are scarce (Farina 1983, Herrera 1978, 1979).

Our research describes the seasonal variations of the foraging niche in the Great Tit *Parus major*, in the Blue Tit *Parus caeruleus* and in the Long-tailed Tit *Aegithalos caudatus* in a mediterranean wood.

STUDY AREA AND METHODS

We collected data for two years (from May 1982 to April 1984) in the World Wildlife Fund Natural Oasis "Bosco di Palo" in Ladispoli (Rome), Italy, which is situated on the coast, 38 km north of Rome (41°56'N-12°05'E). The study area consists of a coppice that is 40 years old and 60 ha wide. The prevailing arboreal species is *Quercus cerris* (75.6%); other trees are: *Q. ilex* (16.7%), *Q. pubescens* (2.7%), and in low percentages, *Ulmus minor* (1.0%), *Arbutus unedo* (0.5%), *Acer campestre* (0.3%) and *Sorbus torminalis* (0.2%).

The average density is 489 trees per hectare. The undergrowth is composed of such typical species of Mediterranean scrub as: *Phillyrea* spp. (33.4%), *Myrtus communis* (17.9%), *Pistacia lentiscus* (13.7%), *Rubus ulmifolius* (9.4%), *Ruscus aculeatus* (8.6%), *Viburnum tinus* (7.1%), *Ulmus minor* (2.5%), *Fraxinus ornus* (1.4%), *Erica arborea* (1.2%), *Ligustrum vulgare* (1.0%), *Laurus nobilis* (0.8%), *Crataegus monogyna* (0.8%), *Arbutus unedo* (0.4%), *Rhamnus alaternus* (0.4%), *Prunus spinosa* (0.4%), *Quercus ilex* (0.4%), *Rosa* sp. (0.2%) and *Pirus* sp. (0.2%). All data on vegetation are from Fraicelli & Sarrocco (1984). The climate, typically mediterranean features hot summers (highest average monthly temperature registered during the study period: 21.7°C, August 1983) and mild winters (lowest monthly average temperature: 6.4°C, January 1984); there are two distinct periods of rainfall in spring and autumn. Meteorological data were obtained at a small meteorological station situated inside the Oasis. The data were collected at a frequency of four visits per week, the timing of which was distributed throughout the course of the day so as to cater for possible variations in behaviour. The visits were also arranged so as to reflect weather conditions. The influence of weather on the feeding behaviour and the foraging niche of some species, especially of Passeriformes and Paridae, has been significantly reported (Alatalo 1982b, Grubb 1975, 1978). Each time we observed a single individual feeding, we took the following data: feeding site (ground, bush or tree); if tree, its species; localization, dividing the tree vertically into quarters and horizontally into four ground zones (the trunk, and the areas lying beneath the inner central and outer parts of branches). Moreover, we divided the 12 sites thus localized into 3 differing branch diameter classes (less than 0.5 cm, 0.5 to 5 cm and greater than 5 cm). We observed 36 sites on branches, 4 sites on trunks and a each for bush and ground (total 42 sites). For vertical division of the tree see Hogstad (1978), for horizontal, Morse (1978). As regards branch diameter, we followed Herrera (1978, 1979). We paid particular attention to the higher layers of vegetation when leaves were present, to offset poor visibility. In the absence of leaves and acorns, it was impossible to distinguish the two species of deciduous oak (*Quercus cerris* and *Q. pubescens*) in winter. We reported the location of all the feeding individuals observed; they repeatedly fed on the same tree, were considered only once; the same individual observed pecking repeatedly on near trees was reported less than three times to avoid the influence of individual features on our data. We calculated the evenness index: $J = H'/H'_{max}$ (Lloyd & Ghelardi 1964, Pielou 1966) (H' = niche width, H'_{max} = maximum width that the niche would have if every feeding site were used in the same way, that is to say in the absence of any kind of specialization). Niche width was calculated with the Shannon index: $H' = - \sum p_i \log p_i$ (Shannon & Weaver 1949) (p_i = percentage of individuals observed in site i). Evenness index (J) is 1 when the niche width is at its maximum, and it decreases proportionally as the level of specialization increases until the value 0 when only one site is used (maximum specialization). As regards niche overlap between the species examined, we adopted the overlap index:

$$R_0 = \frac{\sum (x_i + y_i) \log (x_i + y_i) - \sum x_i \log x_i - \sum y_i \log y_i}{(X + Y) \log (X + Y) - X \log X - Y \log Y} \quad (\text{Horn 1966})$$

(x_i = number of observations on the species x in the site i , y_i = number of observations of the species y in the site i , X = the overall number of observations on the species x , Y = the overall number of observations on the species y). This index varies between 0 (absence of niche overlap) and 1 (overall overlap). All data were grouped into quarters according to the climatic uniformity prevailing within each quarter.

RESULTS

We collected 1480 observations, 739 concerning Great Tits; 387 concerning Blue Tits and 354 Long-tailed Tits. In Tab. I we report the number of observations divided into quarters. Almost all the observations were made on isolated individuals; the highly

TABLE I. Number of observations made on each species in each quarter.

Months:	J-F-M	A-M-J	J-A-S	O-N-D	Total
Great Tit	111	143	203	282	739
Blue Tit	143	75	70	99	387
Long-tailed Tit	110	40	111	93	354
Total	364	258	384	474	1480

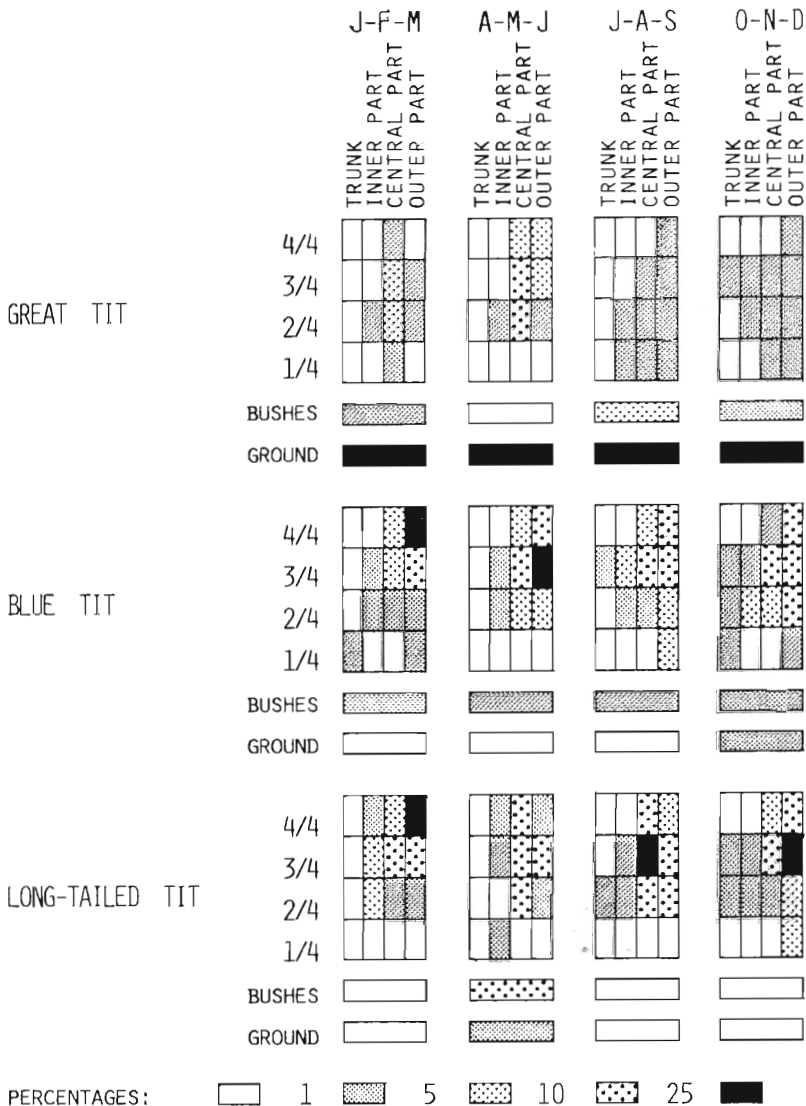


FIGURE 1. Percentages of the observations on the foraging activity of the three species in different sites, divided into quarters.

TABLE II. Values of the J evenness for each species in each quarter.

Months:	J-F-M	A-M-J	J-A-S	O-N-D	Mean
Great Tit	0.49	0.56	0.47	0.36	0.47
Blue Tit	0.57	0.54	0.72	0.70	0.63
Long-tailed Tit	0.64	0.67	0.67	0.62	0.65

TABLE III. Niche overlap index R_0 values for each species in each quarter.

Months:	J-F-M	A-M-J	J-A-S	O-N-D	Mean
Great Tit - Blue Tit	0.37	0.59	0.39	0.41	0.43
Great Tit - Long-tailed Tit	0.43	0.65	0.34	0.33	0.44
Blue Tit - Long-tailed Tit	0.84	0.65	0.73	0.87	0.77
Great Tit - Blue and Long-tailed Tit	0.40	0.64	0.38	0.37	0.45
Blue Tit - Great and Long-tailed Tit	0.69	0.65	0.64	0.67	0.66
Long-tailed Tit - Great and Blue Tit	0.77	0.72	0.55	0.61	0.66

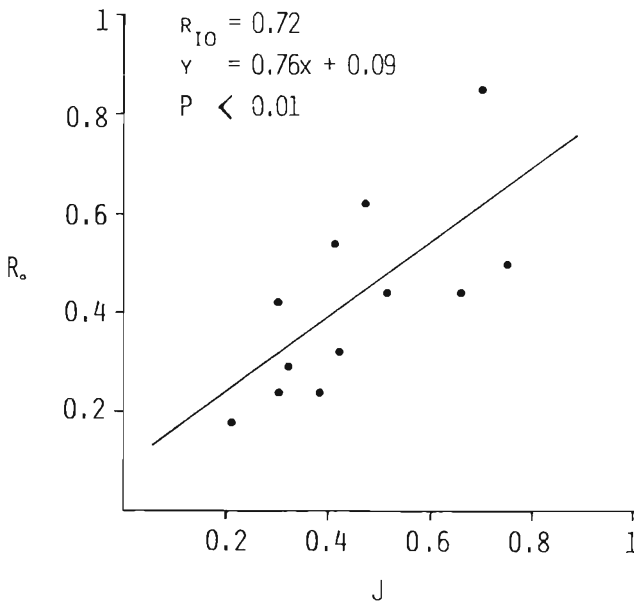
typical Paridae and Aegithalidae flocks, so common in the rest of Europe (Perrins 1979) and quoted in almost all the studies about the foraging niche of such birds, were never observed. Very occasionally, in summer, we observed some little monospecific flocks of Long-tailed Tits. We also calculated the preference percentage in such species for a variety of tree species. Great Tits forage on deciduous oaks 96.77% of the time and on other species of trees for the remaining 3.23%; Blue Tits use deciduous oaks 97.59% and other species 2.41%; Long-tailed Tits prefer deciduous oaks 98.27% of the time and other species 1.73%. The arboreal structure of the examined wood is 78.3% composed of deciduous oaks, the remaining 21.7% of other tree species. Comparing preference with wood composition percentages by χ^2 test always yields a very high statistical significance (Great Tit $\chi^2 = 43.96$, $P < 0.001$; Blue Tit $\chi^2 = 69.95$, $P < 0.001$, Long Tailed Tit $\chi^2 = 71.09$, $P < 0.001$). Since we have a shortage on birds that feed from other than deciduous oaks (which is due both to bird preference and to the feature of the wood), in the following elaboration we shall not consider the other tree species. In Fig. 1 we report the percentages for the utilization of differing feeding sites according to quarters; we did not consider branch sizes because it was difficult to display them graphically. To point out niche difference, it is important to consider all the given variables (Alatalo 1980, Alatalo & Alatalo 1977, May 1975), which in our elaboration we duly did. Evenness index (J) value are reported in Tab. II. In Tab. III we report niche overlap (R) values, comparing each species both separately and collectively with the other two. Throughout the year (divided into months) we checked, using correlation analysis, whether there was a link between niche evenness (J) and overlap index values for each species as compared collectively with the other two. Only for the Great Tit did we obtain a significant link (Fig. 2), while for the Blue Tit ($r = 0.34$) and the Long Tailed Tit ($r = 0.6$) we did not find any statistical significance. In order to verify the possibility of segregation between Great Tits and the other two species in the tree we report (Tabs. IV & V)

TABLE IV. Values of J evenness for each species in each quarter, calculated by leaving out observations on bushes and on the ground.

Months:	J-F-M	A-M-J	J-A-S	O-N-D	Mean
Great Tit	0.77	0.67	0.86	0.91	0.80
Blue Tit	0.61	0.62	0.79	0.75	0.69
Long-tailed Tit	0.69	0.68	0.72	0.68	0.69

TABLE V. Niche overlap index R_o values for each species in each quarter, calculated by leaving out observations on bushes and on the ground.

Months:	J-F-M	A-M-J	J-A-S	O-N-D	Mean
Great Tit - Blue Tit	0.67	0.87	0.83	0.87	0.81
Great Tit - Long-tailed Tit	0.76	0.90	0.74	0.77	0.79
Blue Tit - Long-tailed Tit	0.92	0.79	0.89	0.92	0.88
Great Tit - Blue and Long-tailed Tit	0.73	0.92	0.80	0.85	0.83
Blue Tit - Great and Long-tailed Tit	0.88	0.86	0.93	0.96	0.91
Long-tailed Tit - Great and Blue Tit	0.93	0.88	0.85	0.89	0.89

FIGURE 2. Linear correlation between niche width (J) of the Great Tit, and values of overlap (R_o) of the same species with the other two species.

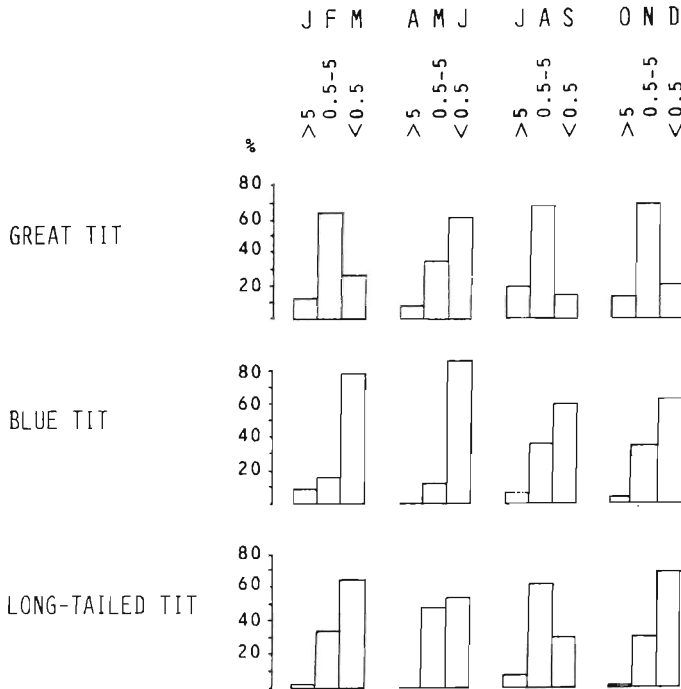


FIGURE 3. Percentage of observations, for each species in each quarter, made on branches divided into diameter classes.

J and R_0 values respectively, leaving out bush and ground observations. As regards branch diameters in Fig. 3 we report the preference percentages for each of the three species in quarters of the years.

DISCUSSION

One peculiarity of the selected study area is the complete absence of heterospecific flocks; they are present in every area where observations on Paridae and Aegithalidae have been made, especially during the winter. Such flocks probably serve to increase feeding efficiency and/or to reduce vulnerability to predation (Herrera 1979, Krebs & Barnard 1980, Krebs et al. 1972, Morse 1977, 1978). With our data it is very difficult to provide an explanation for the absence of flocks in Palo wood; furthermore such a topic should be studied specifically. The mildness of the winter climate in a Mediterranean habitat, with its consequently greater trophic resources does not explain why, in geographically neighbouring areas, with similar climate and vegetation (i.e. the Castelporziano estate), heterospecific flocks have been observed several times (Gustin, personal communication). Herrera (1979) pointed out the existence of differences in feeding site exploitation between isolated individuals and individuals in flocks. Alatalo (1981) pointed out further differentiations in feeding behaviour in relation to the specific composition of the flock. The absence of flocks partly explains why, during data collection, we never observed intraspecific or interspecific hostility; in any case no attacks were observed even when individuals of

the same or of different species had casual meetings whilst foraging. As regards the choice of differing tree species, it is clear that the three bird species have a marked preference, statistically proven, for deciduous oaks. The risk of underestimating the individuals foraging on *Quercus ilex* (a non-deciduous tree), whose foliage makes for poor visibility, was compensated by particular attention to such individuals. One of the reasons for this feeding preference is the presence of a great number of phytophagous arthropodes on the branches of deciduous oaks; *Q. ilex*, which is a typical Mediterranean species, has particularly hard leaves, with which to face strong insolation and salty winds, and it has remarkable quantity of tannin in both its foliage and its bark (see Polunin 1977). Deciduous trees that are not oaks compose such negligible percentage of the wood that they ought not to affect the results of our research.

The Great Tit. As Fig. 1 shows, the Great Tit always shows a marked preference for the ground as its feeding site. Only in the April-May-June quarter do more than 10% feed on trees, which probably depends on increased trophic availability in the trees during the first half of April; this in turn is due to the hatching of various species of moths, mostly Tortricidae, which live in tree foliage as larvae until mid May, when they become pupae (Hartley 1953).

When the Great Tit feeds in trees, it has no marked preference for the parts herein determined. This is exactly what Gibb (1954), Hartley (1953), Rolando (1982), Rolando & Robotti (1985) and Snow (1949) have already found. As regards the diameter of the branches chosen for foraging (Fig. 3), there is a general tendency to use branches of medium size throughout the year; only in the April-May-June quarter are smaller branches preferred, probably because there are moth larvae on the new leaves. The percentage for ground-feeding Great Tits are higher than those reported on woods not composed of oaks, cfr. Edington & Edington (1972), Hartley (1953), Kiziroglu (1982), Saether (1982) and Ulfstrand (1976). While percentages similar to those found in Palo have been verified by Gibb (1954) in an English deciduous wood, though in different periods of the year, Herrera (1978) in holm-oak wood in the South of Spain has found higher percentages than ours. From these results we can hypothesize that the Great Tit has considerable adaptive flexibility, which allows it to modify its foraging niche in differing habitats according to food supply and potential competitors. Since specialist tree-foraging competitors are present both in oak and in mixed deciduous woods, it would be interesting to evaluate the trophic resources and their distribution in each of these two habitats. From the observations made in Palo wood (Fracicelli & Ruvolo, unpublished) it has been possible to identify a good supply of food on the ground, consisting of Coleoptera larvae Curculionidae, which grow inside acorns and are indeed characteristic of oak woods. Many acorns were found with the characteristic hole made by the Great Tit; distinguishable from the hole made by larvae, because is perfectly circular in shape and reveals clear surrounding scratches, sign of the Great Tit's bill.

From Tab. II it is evident that niche width (calculated with the J evenness index) is greatest in April-May-June, the period in which trees are preferred. The smallest width is registered in October-November-December, when frequency percentages for the ground are at their height. J values referring only to trees (Tab. IV), indicate that in such a microhabitat niches are very wide, confirming that the Great Tit almost exclusively uses the ground.

The Blue Tit. From Fig. 1 it is clear that the Blue Tit almost exclusively uses trees from feeding; it is present on bushes (1-5%) and may only be found on the ground in the October-November-December period (less than 5%). It is relevant to

underline that the latter percentage derives from one, single case out of the 99 observations of the quarter; it can therefore be considered as casual. The absence of the Blue Tit on the ground has also been pointed out by Rolando (1982) and Rolando & Robotti (1985), but in other areas of Europe many authors have found cases of Blue Tits foraging on the ground, albeit in low percentages (Gibb 1954, Hartley 1953, Herrera 1978, Kiziroglu 1982, Morse 1978, Saether 1982). Herrera's observations (1979) undertaken in Southern Spain, distinguished between the Blue Tit as a heterospecific flock-forager and as a solitary-forager and he found them on the ground in respective percentages of 11.6% and 1.4%. From such observations, we suppose that for the Blue Tit, foraging on the ground is a type of behaviour that is related to the grouping into flock, which may in turn be due to the imitation of other species. But such a hypothesis is not confirmed by the observations of Laurent (1984) in France, who never saw the Blue Tit feeding on the ground, despite the grouping of the species in heterospecific flock in this study area; in any case, his data were collected from a mountain conifer wood. Edington & Edington (1972) did not see Blue Tits foraging on the ground in a mixed deciduous wood in England. Other causes for the avoidance by Blue Tits of the ground might the notable abundance of food on trees and the already underlined presence of Great Tits on the ground. Generally speaking, the Blue Tit does not seem to prefer a particular site; the only two cases of feeding percentages that exceed 25% refer to two different sites. On the other hand, the species tends to forage on the outermost edges of trees, on the middle and outer parts of branches, as was also pointed out by Rolando (1982) and Rolando & Robotti (1985). From this point of view, our observations differ from those of Hartley (1953), who states that the Blue Tit is uniformly distributed throughout the whole tree. Morse (1978) also found a marked uniformity in the vertical distribution through trees, but he noticed a concentration on the central part of the branches. Herrera (1979) findings are almost similar to our own since his observations mainly concern the upper part of the trees, but we should not forget that some differences may be due to the fact that his research was carried out in a wood whose trees (*Quercus ilex*) are shorter (max 11.5 m) than those in Palo wood (max 20.8 m, Fraticelli & Sarrocco 1984). Finally, Laurent (1984) found a situation that was similar to ours (Blue Tits feeding in upper branches), but in a conifer wood. As regards branch diameters, the Blue Tit has a marked preference for the smallest branches throughout the year (Fig. 3). Similar data is confirmed by other authors (Gibb 1954, Hartley 1953, Herrera 1978, 1979, Laurent 1984, Morse 1978). Evenness index J values for the Blue Tit (Tab. II) are higher than those for the Great Tit, reflecting less marked specialization. They are relatively uniform throughout the year, even though the values for January to June are lower than for the rest of the year.

The Long-tailed Tit. The observations in Fig. 1 show how the Long-tailed Tit forages almost exclusively on trees, except in the April-May-June period. The observations concerning ground-feeding (5%, two observations) are probably best considered as casual, but we cannot say the same for bushes (15%). The interest displayed by the Long-tailed Tit in bushes may be due to the abundance there in of aphides in this season; another explanation for the tendency to seek alternative feeding sites could be the occupation of trees in this period by the Great Tit. Generally speaking, the Long-tailed Tit has a feeding site that is similar to the Blue Tit's, but in the April-May-June period it shows less marked specialization; it is very often seen at low heights (2/4) as well as on bushes. Herrera (1979) found a vertical distribution down the tree that was very similar to that found at Palo; Laurent (1984) found more

marked specialization on high branches. By complete contrast, Hartley (1953) found casual vertical distribution in the same, and Morse (1978) found a concentration of Long-tailed Tits on the lower part of trees but toward the outer part of the branches. As regards the branch diameters (Fig. 3), the Long-tailed Tit shares the Blue Tit's preference in the October to March period, while in the April-May-June period it does not seem to have significant preferences for small or medium sized branches. Foraging on large-sized branches is occasional. All the authors interested in such matters have found a marked preference for small-sized branches (Gibb 1954, Hartley 1953, Herrera 1979, Laurent 1984, Morse 1978). Evenness index J values (Tab. II) show a remarkable constancy throughout the year; they reflect similar niche width to that of the Blue Tit.

Comparison between the three species. Niche overlap index R_o values (Tab. III) show high overlapping between the Blue Tit and the Long-tailed Tit. As regards the Great Tit, individual overlap values and even more notably, collective values, are very low throughout the year and they only show a peak in the April-May-June period. This period coincides with that in which the Great Tit widens its niche to include trees. In order to check the correspondence between niche width and niche overlap with other species, we calculated a correlation between J and R_o values for the whole year and this correlations proved to be statistically significant (Fig. 2). The same correlation was calculated by Ulfstrand (1977) for a conifer wood but he obtained contrasting results. Blue Tit/Long-tailed Tit overlap index values are relatively constant throughout the year. For both species, correlation between J and R_o values did not prove to be statistically significant. The mutual independence of the width of each niche and its reciprocal overlap seems to stem from the fact that the two species are interested in the same feeding sites. The mechanisms that dictate segregation between Blue Tits and Long-tailed Tits are probably to be explained by niche parameters that are different from those considered by ourselves. In terms of the spatial aspect of foraging niche, these parameters could be represented by a different choice of feeding patches (i.e. above or below leaves and little branches, at the bases of leaves etc.). Other differences in the foraging niche may concern aspects other than spatial: feeding segregation may reflect differing preferences for the quality and size of prey. Finally, differences in predation technique may be conceivable. Laurent (1984) hypothesized that Blue Tits and Long-tailed Tits share foraging niches without competition because of environmental factors that keep the numerical level of the two populations low in relation to trophic availability. J niche widths found in our study (Tab. III) show a proportionality between the different species that is similar to that found by Morse (1978) in a mixed deciduous wood in England, although his values for each species are higher. Overlap index R_o values in the study quoted are very similar to those we found (Tab. III) for the pairs: Great Tit - Blue Tit and Blue Tit - Long-tailed Tit; overlap between Great Tits and Long-tailed Tits (species whose niches seem to demonstrate low overlapping in both studies) is lower in the English wood (0.33) than in Palo (0.44). The same situation is borne out by both these studies when comparison is undertaken between the overlap index values of each species and those of the other two as a collective whole; our findings are very similar to Morse's as regards the Blue Tit and the Great Tit, while as regards Long-tailed tit, values are lower in England. In any case, such comparison illustrate the limitations of using different study methods. Such limitations are clearly pointed out by Colwell & Futuyma (1971).

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RIASSUNTO

Aspetti della nicchia trofica di Cinciallegra *Parus major*, Cinciarella *Parus caeruleus* e Codibugnolo *Aegithalos caudatus* in un bosco mediterraneo

- Vengono studiate le relazioni di nicchia trofica tra Cinciallegra, Cinciarella e Codibugnolo durante il corso dell'anno in un bosco mediterraneo.
- Quando una di queste tre specie veniva osservata alimentarsi veniva annotato se ciò avveniva a terra, sui cespugli o sugli alberi. Per gli alberi veniva annotata la specie e la posizione dividendoli in 12 settori rispetto all'altezza da terra ed alla distanza dal tronco. Veniva anche registrato il diametro dei rami dove la specie si stava alimentando.
- Nell'area di studio non sono stati notati rami eterospecifici per le tre specie.
- E' stata notata per tutte e tre le specie, durante l'attività trofica, una marcata preferenza per le querce caducifoglie.
- La Cinciallegra preferisce alimentarsi sul terreno durante tutto il corso dell'anno, solamente in primavera frequenta gli alberi in percentuale apprezzabile. Quando si alimenta sugli alberi non mostra preferire siti particolari.
- La Cinciallegra preferisce per tutto l'anno alimentarsi su rami di dimensioni medie escluso in primavera quando si alimenta su rami di piccolo diametro.
- La Cinciarella durante l'attività trofica disdegna il terreno e si concentra nella parte più alta degli alberi, nella parte centrale e distale dei rami.
- La Cinciarella preferisce rami di piccolo diametro per tutto il corso dell'anno.
- Il Codibugnolo preferisce sempre alimentarsi sugli alberi escluso in primavera quando si può rinvenire anche sui cespugli. Per quanto concerne la localizzazione sugli alberi questa specie si comporta in modo simile alla Cinciarella escluso in primavera quando frequenta settori dell'albero più bassi di quelli frequentati da essa.
- Il Codibugnolo ha preferenze nel diametro dei rami simili a quelle della Cinciarella escluso in primavera quando frequenta rami di dimensioni medie.
- La Cinciarella ed il Codibugnolo risultano avere una nicchia trofica notevolmente sovrapposta, mentre la Cinciallegra si sovrappone meno con le altre specie.
- Per la Cinciallegra è stata riscontrata una correlazione positiva tra l'ampiezza di nicchia e la sovrapposizione con le altre specie.

FIG. 1. Percentuali delle osservazioni di attività alimentare nei diversi siti per ogni specie in ciascun trimestre.

FIG. 2. Correlazione lineare, nella Cinciallegra, fra l'ampiezza di nicchia (J) e l'indice di sovrapposizione (R_0) con le altre due specie cumulate.

FIG. 3. Percentuali delle osservazioni per ogni specie in ciascun trimestre sui rami divisi in classi di diametro.

TAB. I. Numero di osservazioni effettuate per ciascuna specie in ciascun trimestre.

TAB. II. Valori dell'indice di uniformità J per ogni specie in ciascun trimestre.

TAB. III. Valori dell'indice di sovrapposizione di nicchia R_0 per ogni specie in ciascun trimestre.

TAB. IV. Valori dell'indice di uniformità J per ogni specie in ciascun trimestre escludendo le osservazioni sui cespugli e sul terreno.

TAB. V. Valori dell'indice di sovrapposizione di nicchia R_0 per ogni specie in ciascun trimestre calcolati escludendo le osservazioni sui cespugli e sul terreno.

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