# WEIGHT GAIN AND DIET CHANGES IN YOUNG BLACKCAPS (*Sylvia atricapilla*)

**Nadejda Zelenova**

## ABSTRACT

Zelenova N. 2001. *Weight gain and diet changes in young Blackcaps (Sylvia atricapilla).* Ring 23, 1-2: 179-189.

3214 young Blackcaps were mist-netted in Rybachy trapping station in autumn seasons 1994-1998. Mean weight of the birds trapped only once, and probably not making a long stopover, was practically constant during the whole season. Birds staying on the trapping place two days or more never gained weight before the middle of September, but later in the season, a significant weight gain during stopover was observed every year.

Diet of Blackcaps in Rybachy was studied by using 549 diet samples of trapped birds. Before the middle of September, remains of 9 fruit and 79 animal species were found in the samples, from 1 to 12 different kinds (median – 3) in each; later – only 7 fruit and 44 animal species, 1 to 15 (median – 4) in each sample. Animal remains predominated before the middle of September, 93.5% samples contained *Diptera* species (76.8% of which were *Chironomidae*), often in large quantity. Later in the season, part of samples with *Diptera* was considerably reduced, but part of samples with fruits increased. 65.2% samples contained Black Elder (*Sambucus nigra*), usually simultaneously with several other fruit and animal species.

The data suggest that total number of consumed species decreases in weight gain period both in the area and in the samples, but the median number of species per sample increases, and Blackcaps gain weight using mixed diet with considerable amount of fruits.

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**Key words:** stopover, weight gain, *Sylvia atricapilla*, diet

## INTRODUCTION

Avian migration requires extra energy for flight. Many birds prepare for migration by accumulating large stores of resources (*e.g.* Odum and Connell 1956, King and Farner 1965). These birds show considerable degree of seasonal fluctuations in body mass. Most of the variations in body mass is due to the deposition of fat, but the body mass gain may be also accompanied by some increase in protein content (Bairlein and Simons 1995). Nevertheless, in small migrating passerines most of the body mass variation is due to the deposition of fat (Biebach 1990).

Migration is normally divided into several flight periods and between these periods the birds have to replenish fat stores at suitable stopover sites. Analyses of fat loads at stopover sites along the migration route may thus be useful for characterising migration strategies (*e.g.* Odum 1958, Blem 1980, Bibby and Green 1981, Lindström 1987). This problem is also central in the network program „Spatio-temporal course, ecology and energetics of Western Palaearctic-African songbird migration", organised by European Science Foundation (Bairlein 1993). Selection of the most profitable diet could be very important for the weight gain.

We used the Blackcap, as a model species for this study. The Blackcap is a common breeding and migrating bird in the south-eastern Baltic area (Tischler 1941). According to the ringing data, local Blackcaps as well as transit birds from the northern populations, which cross the Courish Spit, are wintering in the Southern Europe and Mediterranean region. In general, Blackcaps breeding in northern Europe migrate to East Africa, the Mediterranean area and central Europe (Zink 1977).

In this paper I examine weight changes of Blackcaps during their staying in the surroundings of Rybachy trapping station and the patterns of their diet composition.

## METHODS

As a part of ESF-program, trapping and ringing of Palearctic migrants have been carried out at Rybachy trapping station at the Courish Spit of the Baltic Sea (55°12'N, 20°46'E) since 1994. Birds were trapped by mist-nets in reeds, willow bushes and other brushwood at the coast of the Courish Bay. I analysed weight changes of Blackcaps using ringing data, collected at the Rybachy trapping station during 1994-1998. Information from the ornithological data bank of the Biological station Rybachy (Lobanov, Zelenova, 1999) was used to determine the breeding period of the Blackcap at the Courish Spit, migration time and routes of this species.

Diet samples were taken from mist-netted birds during July-October 1996. Birds captured in mist-nets were kept individually in cloth bags and later measured, weighted to the nearest 0.1 g, ringed and released. Diet samples were obtained either by recovering faeces from the bags or by flushing the digestive tract with water. Samples, obtained by any (or both) of these methods, were stored for later examination in small amounts in 40% alcohol. A total of 549 samples were examined. The relative volume of animal and vegetable matter in the sample was visually estimated to the nearest 10% before they were microscopically examined. All plant food was identified to the species, based on the seeds or the fruit peels, compared with a reference collection of fruits.

The regular observations and visual estimation of fruit amount using five-mark scale recorded fruit supply in the study area. At the same time counting of the remaining fruits (comparing with amount of full-grown not ripe fruits) was made on the selected control branches or plants.

## RESULTS

3214 young Blackcaps were mist-netted in Rybachy trapping station in autumn seasons 1994-1998. Mean weight of the birds trapped only once, and probably not making a long stopover, was practically constant during the whole season.

Birds staying on the trapping place two days or more never gained weight before the middle of September, but later in the season, a significant weight gain during stopover was observed every year (Fig. 1).

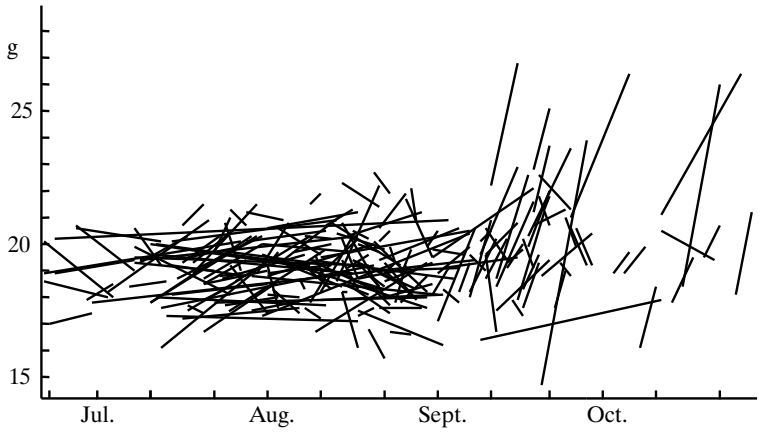


Fig. 1. Body mass changes of first-year Blackcaps during stay in Rybachy in 1996.

Diet of Blackcaps in Rybachy was studied by using 549 diet samples of trapped birds. There was an appreciable variation between dates in the relative abundance of animal and fruit rests in the samples.

In general, 10 fruit species were found in samples, Woody Nightshade (*Salanum dulcamara*) and Black Elder (*Sambucus nigra*) were the most common (Table 1). Animal remains from samples were determined with different level of exactness. Sometimes it was possible to determine type or class only, in other cases – genus or even species. We arranged all the remains into 23 groups shown in Table 2. The most common among animal prey were *Chironomidae* (*Diptera*) and spiders.

Only a small part of samples contained remains of one food species. Most samples included several species, and the number of these species increased in the second part of the season (Table 3).

Proportion of samples containing fruits was increasing continuously from 20% at the beginning of July to 100% in the second part of October (Fig. 2). At the same time, the proportion of samples containing fruits without animals was very low – only 1.85% in the whole of season.

Table 1
Fruit species, found in diet samples of Blackcaps trapped in Rybachy in 1996

| Fruit species | Percent of samples containing this plant |
|---|---|
| *Salanum dulcamara* | 31.5 |
| *Sambucus nigra* | 23.3 |
| not identified plants | 16.1 |
| *Rubus fruticosus* | 13.0 |
| *Rhamnus catarticus* | 10.7 |
| *Sorbus aucuparia* | 8.0 |
| *Padus avium* | 7.0 |
| *Ribes nigrum* | 2.1 |
| *Ribes rubrum* | 1.6 |
| *Rubus idaeus* | 0.8 |
| *Crataegus sp.* | 0.2 |

Table 2
Groups of animal prey found in diet samples of Blackcaps in Rybachy in 1996

| Group of animals | Percent of samples containing this group |
|---|---|
| *Diptera – Chironomidae* | 64.1 |
| *Aranea* | 29.1 |
| *Insecta ind.* | 21.2 |
| *Coleoptera* | 20.6 |
| *Aphidoidea* | 19.4 |
| *Hymenoptera - Parasitica* | 17.9 |
| *Diptera (not Chironomidae)* | 15.5 |
| *Hemiptera* | 7.2 |
| *Insecta larva (except Lepidoptera)* | 5.4 |
| *Lepidoptera larva* | 4.5 |
| *Hymenoptera - Symphita* | 2.9 |
| *Acarina* | 2.9 |
| *Insecta eggs* | 2.7 |
| *Pseudoscorpionidae* | 2.5 |
| *Hymenoptera - Formicidae* | 2.1 |
| *Cicadidae* | 1.9 |
| *Myriapoda* | 1.6 |
| *Psocoptera* | 1.0 |
| *Opiliones* | 0.8 |
| *Odonata* | 0.4 |
| *Neuroptera* | 0.2 |
| *Lepidoptera* | 0.2 |
| *Hymenoptera - Aculeata* | 0.2 |

Table 3
Amount of samples with the different number of food species. Class that contains the median value is shown as grey; if the median value fell between two classes, both of them are coloured.

| Number of species in a sample: | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| July | 1st decade | 3 | 5 | 2 | 2 | 3 | 1 | | | | | | |
| | 2nd decade | 1 | 3 | 2 | 2 | | | | | | | | |
| | 3rd decade | 1 | 8 | 4 | 1 | | 3 | | | | | | |
| August | 1st decade | 1 | 11 | 14 | 6 | 3 | 1 | 1 | | | | | |
| | 2nd decade | 6 | 20 | 18 | 8 | 4 | 6 | 4 | 3 | | 1 | 1 | |
| | 3rd decade | 6 | 28 | 21 | 32 | 8 | 4 | 1 | 1 | 2 | | 1 | |
| September | 1st decade | 4 | 19 | 17 | 20 | 6 | 6 | 4 | 4 | 1 | 1 | | |
| | 2nd decade | 3 | 4 | 7 | 14 | 4 | 3 | 1 | 2 | | | | |
| | 3rd decade | 1 | 9 | 10 | 4 | 7 | 5 | 5 | 1 | | 1 | | 1 |
| October | 1st decade | 5 | 13 | 8 | 9 | | 10 | 8 | 1 | | | 1 | |
| | 2nd decade | | 1 | 1 | 1 | 1 | 1 | | 1 | | | | |
| | 3rd decade | | 4 | | 1 | | 2 | | | | | | |

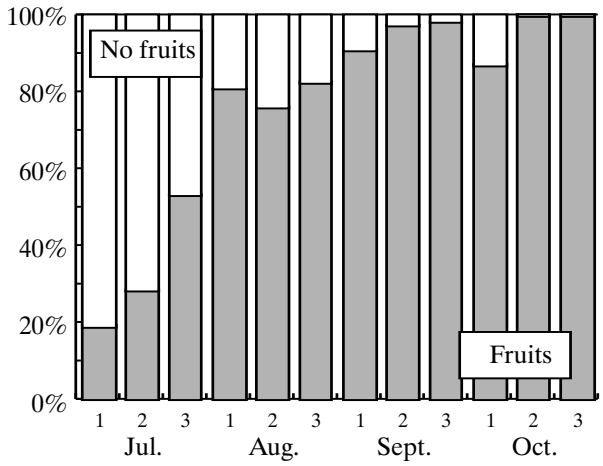


Fig. 2. Share of food samples with fruits

If we compare total amount of fruit species found during each 10-days period, with amount of fruit species in each sample, an interesting tendency can be found. During the greatest fruit diversity in nature during August, the samples contain mainly only one fruit species. At the second part of the season, total amount of available fruit species declines, but proportion of samples containing several fruit species increases (Fig. 3). This tendency was also visible (but not so pronounced) for the animal pray, at least in the level of groups we selected (Fig. 3). The data sug-

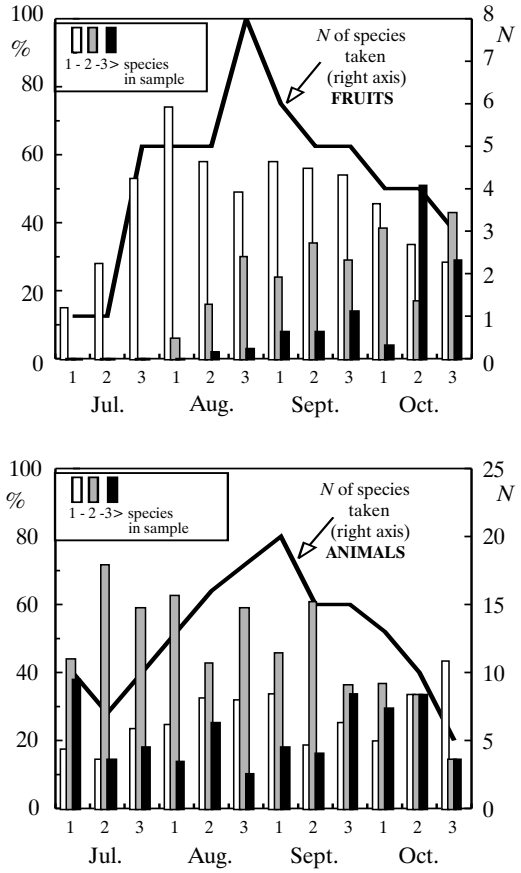


Fig. 3. Comparison of a number of fruit (above) and animal (below) species in samples with total amount of species taken by Blackcaps.

gest that total number of consumed species decreases in weight gain period both in the area and in the samples, but the median number of species per sample increases, and Blackcaps gain weight using mixed diet with considerable amount of fruits.

Black Elder was the most common fruit in samples. It could be found starting from the end of August, and at the end of October, 80% of samples included this species (Fig. 4). Nevertheless, most samples contained Black Elder together with remains of 1-3 other fruit species (Fig. 4). Amount of seeds found in each sample varied from 1 to 35 (median – 4). It shows that birds consume considerable amount of Black Elder (one fruit has two seeds). Woody Nightshade was found in samples from the beginning of July, but it was included into appreciable amount of samples not before the middle of August. Woody Nightshade as only one fruit species included in samples was found mostly at the beginning of the season. Afterwards, proportion of such samples decreased, and from the middle of October, we could find

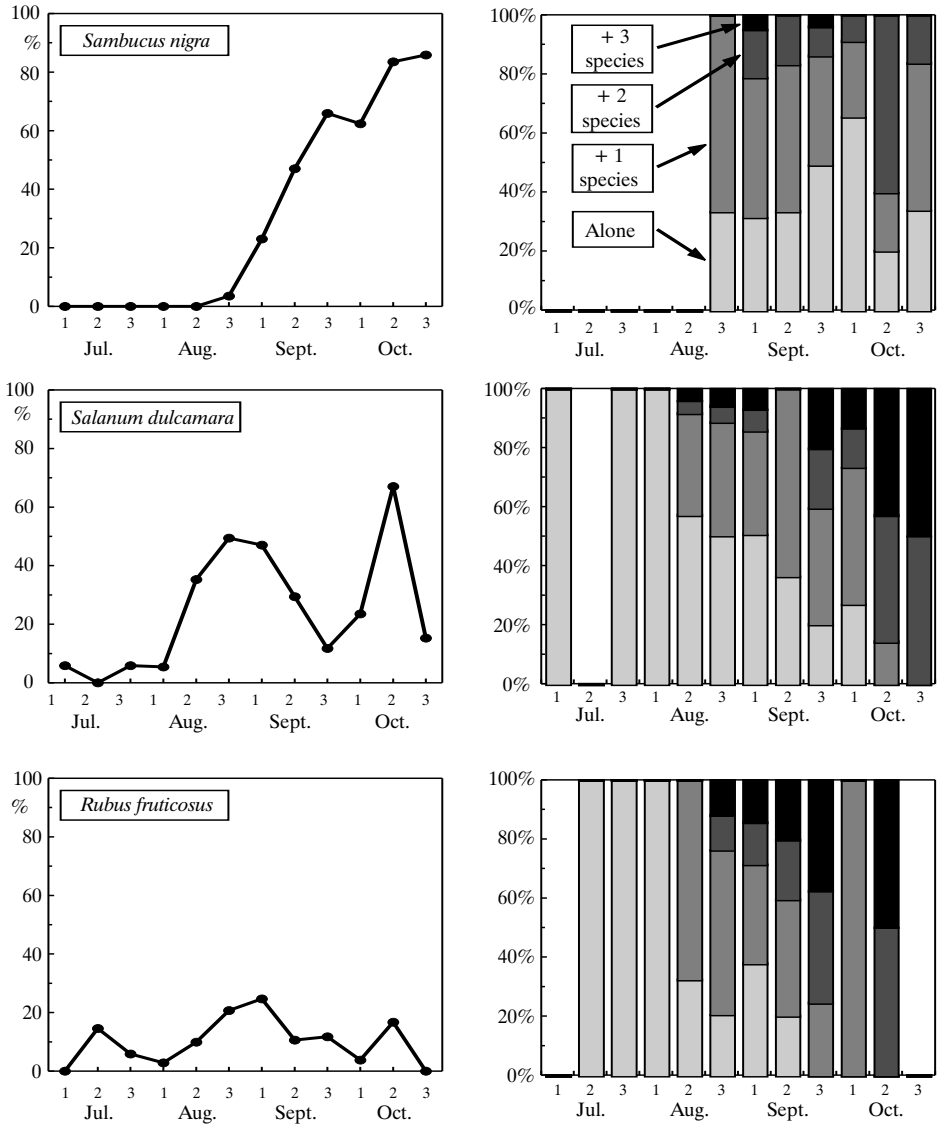


Fig. 4. Share of some fruits in samples in subsequent periods of a season (left) and their association with other fruit species in the sample (right).

Woody Nightshade together with the other fruit species only. The amount of seeds found in each sample varied from 1 to 47 (median – 5). It shows that Blackcaps consume considerable amount of this fruit. Blackberry was found in samples in lower amount comparing with Woody Nightshade or Black Elder. It was often the only plant in samples at the beginning of the season, but at the end of the season, it was found together with other plant species. One to eleven seeds were found in one sample (median – 2). So it seems that Blackcaps eat usually not more than one fruit

per feeding (or peak up parts or pulp of several but not many fruits). The other fruit species were not so numerous, and the amount of seeds found shows that these plants are consumed mostly incidentally.

*Chironomidae* were the most common animal prey of Blackcaps. Figure 5 shows not only the total amount of samples including *Chironomidae*, but also the relative amount of them by three-step scale: (1) no, (2) few (remains of 1-4 insects), (3) many (*Chironomidae* form the most part of sample volume or even are only species in samples). Large amount of *Chironomidae* was found in samples from the beginning of July until the beginning of September. Afterwards, the amount of this prey declined rapidly because of reducing its amount in study area. The last really considerable concentrations of *Chironomidae* were found on 28 August.

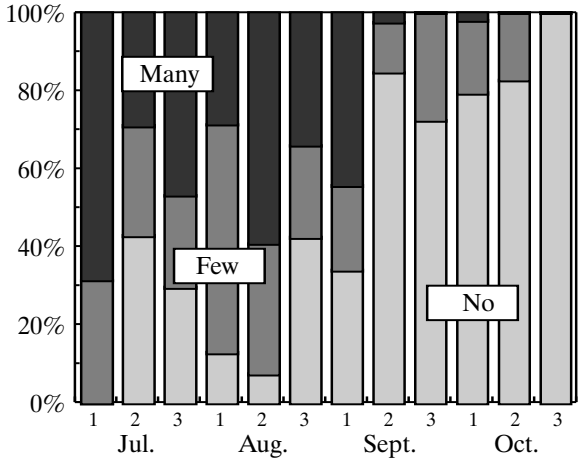


Fig. 5. Occurrence of *Chironomidae* species in food samples.

Spiders were on the second place among animal prey found. Their amount varied during the season (Fig. 6), but sample size did not allow us to compare their variations. Spiders were found usually together with other insects and at the end of season together with fruits also.

In general, before the middle of September, remains of 9 fruit and 79 animal species were found in the samples, from 1 to 12 different kinds (median – 3) in each; later – only 7 fruit and 44 animal species, 1 to 15 (median – 4) in each sample. Animal remains predominated before the middle of September, 93.5% samples contained *Diptera* species (76.8% of them were *Chironomidae*), often in large quantity. Later in the season, part of samples with *Diptera* was considerably reduced, but part of samples with fruits increased. 65.2% samples contained Black Elder, usually simultaneously with several other fruit and animal species.

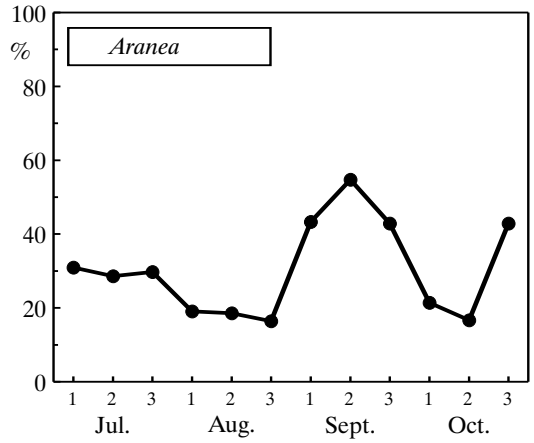


Fig. 6. Frequency of spiders in the food samples.

## DISCUSSION

The Blackcap has long breeding period at the Courish Spit. Direct breeding observations as well as trapping data of females with incubation patch correspondent to the breeding or feeding of fledglings (according to Vinogradova *et al.* 1976) allow to mark this period from the beginning of May to the middle of August. Therefore, when first-year birds from early broods finish their moult, deposit considerable amount of fat and start to migrate, nestlings from last (or second) broods just now leave their nests or start their post-juvenal moult. It is practically impossible to separate local Blackcaps from migrants according to the time of trapping only. It is also difficult to explain observed weight gain in the second part of the season by the appearance of migrating birds only. Ring recoveries from wintering Blackcaps are not numerous, but they allow us to propose that some local birds can start to migrate much earlier than in the middle of September. Thus, bird with ring „MOSKWA O871407" was ringed in Rybachy on 31 August 1997 and found in Netherlands on 22 September 1997, bird „MOSKWA O072627" was ringed at the Courish Spit on 10 September 1982 and found in Cyprus on 27 November 1982, bird „MOSKWA X908622" was ringed at the Courish Spit on 17 July 1960 and found in Cyprus on 5 October 1960. There is only one bird ringed abroad and trapped at the Courish Spit in the same year – bird with ring „LJUBLJANA A794024", ringed in Slovenia on 25 September 1996 and found in Rybachy on 13 October 1996.

Several reasons could explain the observed weight gain. One of them is the change of available fruit and prey composition. Maximal fruiting of the Black Elder starts in the middle of September. There is much evidence of the importance of Black Elder for the fat accumulation of various migrants. Bairlein (1996a) shows

that increase of fat reserves in the Garden Warbler (*Sylvia borin*) is possible while using diet containing animals and fruits, but if the birds receive only one fruit species as the food, increase of fat reserves is possible only if Black Elder or figs are used. The other possible reason is decrease of feed competition between Blackcap and other species that use nearly the same diet, mainly the Garden Warbler. Composition of the Garden Warbler diet at the Courish Spit and level of competition between these two species is a matter for further researches. Endogenous changes in diet preferences (Berthold 1976a) and food utilisation (Bairlein 1996b) play also an important role.

The results reported here demonstrate that Blackcaps relay heavily on *Chironomidae* in the first part of the season, on the Black Elder in the second part, and include most other species only as a minor element of their diets.

The data do not allow to do any quantitative estimations of fruit consumption. It is well known that seeds are passed by birds faster than pulp (Levey 1986), and a serious bias would have been introduced in the analysis if the fruit species had been identified relying only on the seeds present.

Diet differences of birds, depending of their physiological characteristics, age and stay length in the trapping area, is a subject for the future investigations.

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