DAILY DYNAMICS OF THE ELEMENTS OF MULE DUCKS BEHAVIOR AT A DIFFERENT AGE, BRED IN INTEGRATED FISH PONDS UNDER DIFFERENT NUTRIENT REGIMES. II. AT APPLYING THE SCHEME OF FEEDING WITH PARTIAL RESTRICTION.

ДНЕВНА ДИНАМИКА НА ЕЛЕМЕНТИТЕ НА ПОВЕДЕНИЕТО НА МЮЛАРИ НА РАЗЛИЧНА ВЪЗРАСТ, ОТГЛЕЖДАНИ В ИНТЕГРИРАНИ РИБОВЪДНИ БАСЕЙНИ, ПРИ РАЗЛИЧНИ ХРАНИТЕЛНИ РЕЖИМИ. II. ПРИ ПРИЛАГАНЕ НА СХЕМА ЗА ХРАНЕНЕ С ЧАСТИЧНА РЕСТРИКЦИЯ.

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ABSTRACT

An investigation upon the daily dynamics of the separate elements of mule ducks behavior has been carried out at the Institute of Fisheries and Acuaculture Plovdiv, Bulgaria, applying the schedule of feeding with partial restriction, at conditions of integrated fish-ducks technology. Our investigation has shown that the fishponds have been suitable for mule ducks rearing – the birds have had a good plumage status without demonstrations of cannibalism and aggressiveness. Together with the fattening period advance, ducks have spent less time for feeding and have reacted rather weakly to forage supply; the dry land stay time has been on the account of the fish-pond stay, having in mind that the swimming time has increased, as well as the rest time in the fish-pond together with the advance in age.

Keywords: behavior; fish-cum-duck farming; nutrition; day dynamics; technology

АБСТРАКТ

В Института по рибарство и аквакултури-Пловдив, България е проведено проучване на дневната динамика на отделните елементи на поведението на мюлари при прилагане на схема за хранене с частична рестрикция в условията на интегрирана технология риба-патици. Проучването показа, че рибовъдните басейни са подходящи за отглеждане на мюларите - птиците са с добро състояние на перушината, без прояви на агресивност и канибализъм. С напредване на угоителния период: патетата отделят по-малко време за хранене и по-слабо реагират на залагането на фуража; намалява времето за престой на сушата за сметка на престоя в басейна.

Ключови думи: поведение, интеграция риба-патици, хранене, дневна динамика, технология

DETAILED ABSTRACT

Експериментът беше проведен в Института по рибарство и аквакултури – Пловдив. За интегрирано отглеждане мюларите бяха поставени в ограден с мрежа шаранов угоителен басейн с гъстота 340 бр.ha^{-1}. На дигата на басейна беше изграден лек навес за подслон, като патетата денонощно имаха неограничен достъп до водната площ. Хранилките на рибата бяха оградени с мрежа, за да се ограничи достъпът на патиците. През експерименталния период на всяко пате бяха осигурени средно по 0.200 kg фураж дневно. Храната беше залагана двукратно в денонощието (сутрин и вечер), на дигата на басейна. В условията на експеримента, за хранене на патетата беше използвана схема, в която 50% от търговската смеска със съдържание на енергия 12.2 MJ и суров протеин 18.2%, беше заменена със смеска приготвена в стопанството (при запазване на енергийна и протеинова стойност), на основата на зърнени и слънчогледов шрот, без използване на минерални фуражи и биологично активни вещества. За проучването на поведението и възрастовата динамика на етологичните елементи бяха проведени пет 10-часови наблюдения (от 8 до 18 ч) от края на юли до края на август. Наблюденията се провеждаха с интервали от 7 дни, в периода от 28- до 56– дневна възраст. За регистрация на поведението беше използван групов хронометраж с интервал от 15 min. Поведението на патетата е описано чрез отделни видове активности, разделени на групи– движение на суша, покой на сушата (стоят, лежат), хранене, активно (плуват) и пасивно (лежат) поведение във водата. Мониторингът на поведението на мюларите показва, че е налице значителна динамика на отделните елементи на поведението както в рамките на денонощието, така и през отделните възрастови периоди.. С напредването на угоителния период, патетата отделят по-малко време за хранене и по-слабо реагират на залагането на фуража. Значителна част от деня патетата прекарват на дигата на басейна. Налице е тенденция за намаляване на престоя на сушата за сметка на престоя в басейна. С възрастта патетата повече време отделят както за плуване (максимално време 33.6 min.h^{-1}), така и за почивка в басейна (максимално време 12.9 min.h^{-1}). Рибовъдните басейни осигуряват добри условия за мюларите. Птиците са били с добро състояние на перушината, без прояви на агресивност и канибализъм.

INTRODUCTION

When applying intensive rearing the highly productive hybrids of birds are fed on balanced full-ration mixtures in order to reach the maximum levels of productivity. The good use of the free-range farm areas is the primary goal under extensive and semi-intensive rearing of the birds. According to Horsted [6] high-producing birds have a huge capacity for finding and utilizing considerable amounts of feed items from a cultivated forage area.

In the integrated systems fish-cum-ducks the fish-ponds ensure additional sources of energy, protein, biologically active substances to the ducks. The question is to what extent the sources can be assimilated and how to stimulate their maximum assimilation. De Vries [3] has noted that in contrast to the intensive systems, the domestic birds behavior at free-range rearing has not been investigated well. The behavior of birds, reared at free-range systems, is an important part of researches currently [6; 9; 10 etc.]. In this tendency, birds behavior at different feeding approaches of extensive rearing is rather interesting. Nielsen et al. [11] have established that broilers fed on lower-energy ration, have spent more time on free-range areas in front of the buildings, than those fed on high-energy rations. Christensen and Nielsen [2] have not established increase of foraging activity in search for food at calcium insufficiency in broilers ration when bred at free-range areas.

In this study we have set the aim to investigate the daily dynamics of the separate elements of mule ducks behavior, applying partial restriction feeding schedule at conditions of integrated fish-cum-ducks rearing and its change during the different age periods.

MATERIALS AND METHODS

The experiment has been carried out at the Institute of Fisheries and Aquacultures, Plovdiv. For the purpose of integrated rearing the mule ducks have been placed in a net enclosure of carp-fattening pond with density of 340 p-ces.ha^{-1}, on the pond dike of which a light shelter has been built for accommodation of ducks. The ducks have had at their disposal an unlimited access to the aqua-area all day and night long. The fish feeding-troughs have been net-enclosed to limit the access of ducks to it.

During the experimental period, each duck has received 0.200 kg at an average of forage daily. The food has been supplied twice day and night (in the morning and in the evening) on the dike of the fish-pond. At conditions of the experiment, a schedule has been used for ducks nutrition, in which 50% of the factory-made mixture with energy content of 12.2MJ and raw protein of 18.2% has been replaced by mixture prepared in the farm (preserving the energy and protein value) on the basis of grain and sunflower groats, without using mineral forages and

biologically active substances.

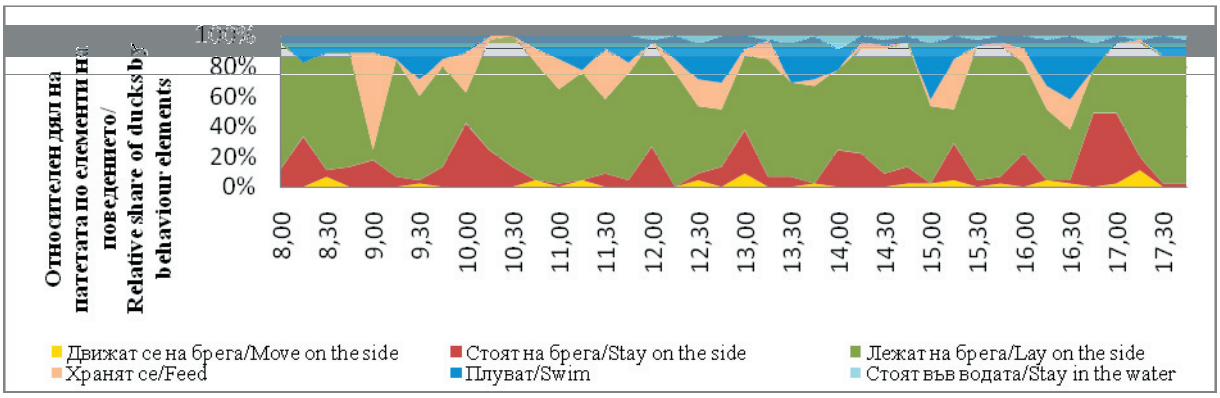
For the purpose of investigating the behavior and age dynamics of ethological elements five 10-hours` observations (from 8 a.m. till 6 p.m.) have been carried out from the end of July till the end of August. The observations have been carried out at 7 days` intervals within the period 28-days`-56-days` age. In order to register the behavior group timing with 15 min interval has been used. Ducks behavior has been described by means of separate types of activities divided into groups – motion on dry land, at rest on dry land (standing, lying), nutrition, active (swimming) and passive (lying) behavior in the water [4].

RESULTS AND DISCUSSION

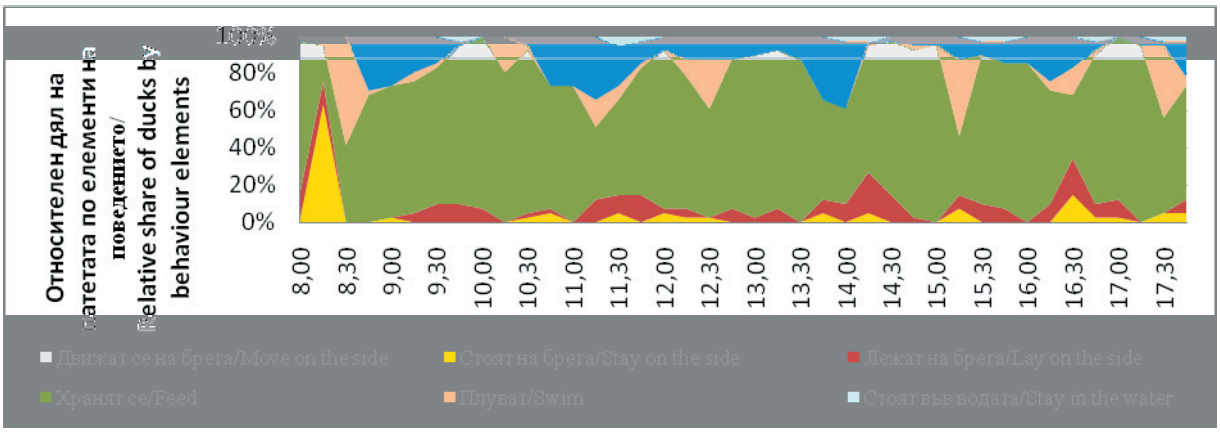
The mule ducks behavioral monitoring has shown that there is a considerable dynamics of the separate behavioral elements within the framework of day and night, as well as during the separate age periods (Table 1; Fig. 1-5).

When studying the behaviour of ducks (A. americana), Michot et al. [8] also established a relationship between the activities and the daytime hours, the interdependencies varying during the period of observation. In some periods the fowl preferred to feed in the morning, while in other periods – in the afternoon. The time of the day also influenced swimming.

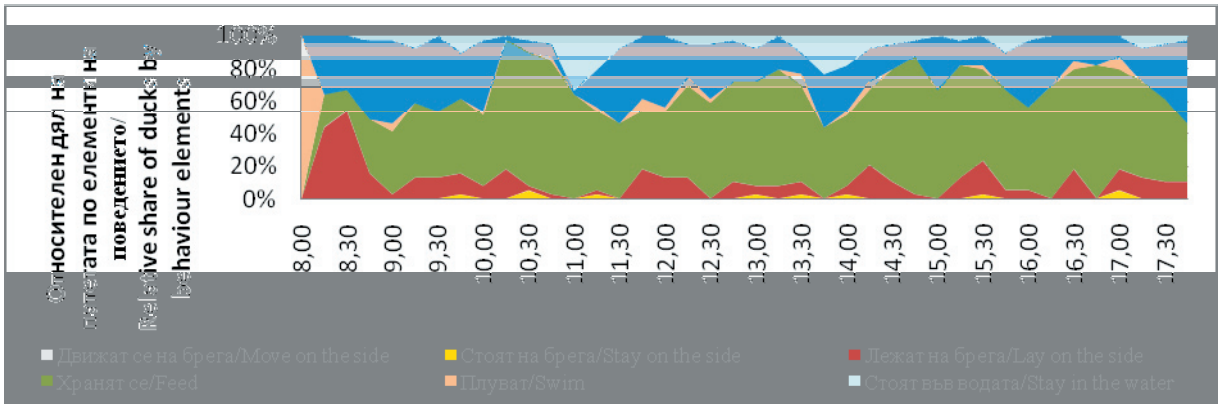
The ducks have entered the fish-pond from the first day after they have been transferred. The first behavioral monitoring has been carried out on the second day after the ducks have been transferred to the fish-pond. In all hour periods, during the main part of the day the ducks have stayed on dry land, the greatest relative share has been occupied by time for lying (42.2-72.8%). The birds have moved comparatively little – 0.33 to 2 min per hour. A considerable reaction to forage supply has been registered in the morning, when a maximum number of feeding ducks – 64.4% has been registered, although the same has been observed during the whole period of monitoring. During the whole monitoring, with the



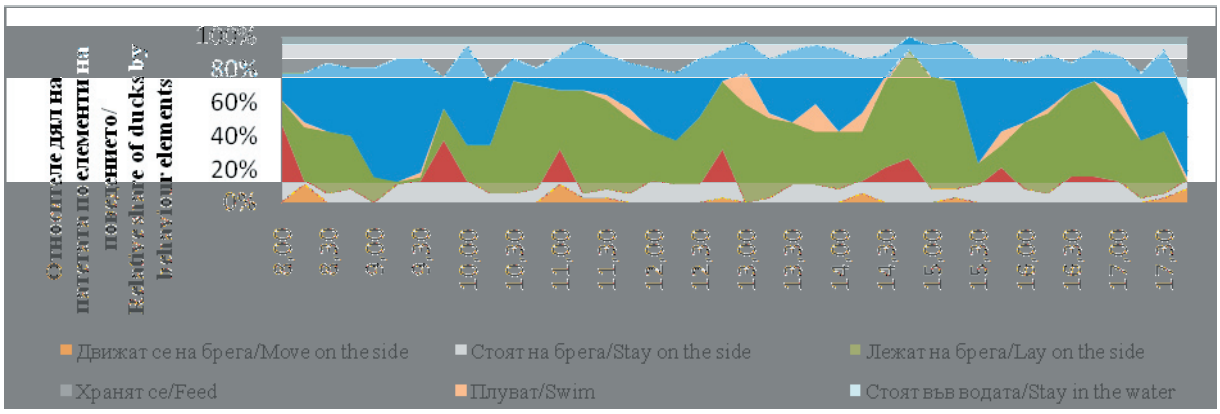
Фигура 1. Динамика на елементите на поведение на мюларите на 4-седмична възраст.
Figure 1. Dynamics of behavior elements of mule ducks at 4 weeks of age



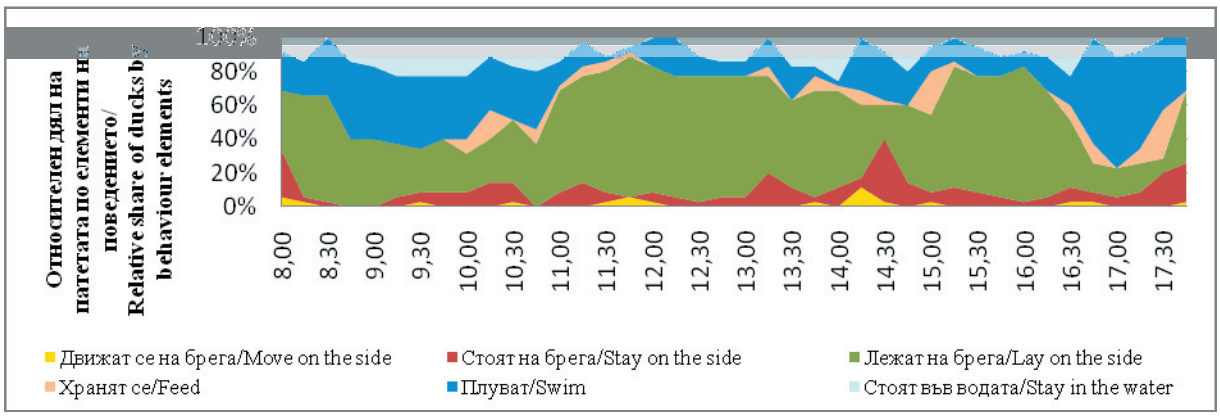
Фигура 2. Динамика на елементите на поведение на мюларите на 5-седмична възраст.
Figure 2. Dynamics of behavior elements of mule ducks at 5 weeks of age



Фигура 3. Динамика на елементите на поведение на мюларите на 6-седмична възраст.
Figure 3. Dynamics of behavior elements of mule ducks at 6 weeks of age



Фигура 4. Динамика на елементите на поведение на мюларите на 7-седмична възраст.
Fig. 4. Dynamics of behavior elements of mule ducks at 7 weeks of ag



Фигура 5. Динамика на елементите на поведение на мюларите на 8-седмична възраст.
Fig. 5. Dynamics of behavior elements of mule ducks at 8 weeks of age

exception of a short period of time from 10.15 a.m. till 10.30 a.m. actively swimming mule ducks have been registered in the fish-pond, the maximum number – 42.2% have been registered at 4.30 p.m. Periodically, after 12 a.m. ducks resting in the water have been registered (Fig. 1).

A well-expressed reaction to the morning forage supply has been registered also when monitoring the 5-weeks` old ducks (Fig. 2), when the maximum for the experimental period motion activity on the dike (16.45%) has been accompanied by a high intensity of forage consumption (17.07%). During the remaining time of monitoring the ducks have consumed forage periodically, and within the time of 12.45 a.m. till 2 p.m. they have not been fed. In general, it makes an impression that together with the advance of the fattening period the ducks have spent less time for feeding and have reacted more poorly to forage supply.

In a study on the nutritional behaviour of Pekin ducks, Bley and Bessei [1] established that the number of meals per day decreased with age, while the duration and size of meals as well as the speed of feed intake increased.

At 5-weeks` age during the greater part of the monitoring swimming ducks have been observed, the maximum number - 36.6% has been registered at 2 p.m. In general, the ducks have preferred to rest on the fish-pond dike and the resting time has been 31.5 to 49.0 min. per hour. Rarely, the ducks have rested in the water, the maximum number at a given registration has been 4.9% of the total number of ducks.

At 6-weeks` age (Fig. 3), an increase in mule ducks` preference to water has been observed. During the whole period of monitoring, actively swimming as well as resting in water birds have been registered. The greatest activity in swimming has been registered in the period 9-10 a.m., but during the remaining periods the activity has been as high as 9.2 to 18.5 min. per hour. The maximum number of ducks resting in water – 33.3% has been registered at 11 a.m.

In comparison with the previous period, the feeding time has been reduced. The motion on dry land has been decreased, as well, on the account of the increased motion activity in the water. The tendency for feeding time decrease with the forage supplied, the dry land stay decrease and the stay in water increase has been observed particularly well from the ethogram of mule ducks on 7-weeks` age (Fig. 4). During the whole monitoring, actively swimming and actively resting in the water mule ducks have been observed in the fish-pond, the most considerable number being registered from 9 to 10 a.m. At the age analyzed, the number of ducks in the fish-pond (swimming and resting) during the different hour periods has varied within 8.1 to 86.5%. The maximum resting time on dry land has been reduced to 49.32%. Characteristic for this ethogram is that the ducks have been more active when consuming forage at the early afternoon hours.

At the end of the fattening period, at 8-weeks` age, the ducks` activity in the water has decreased as regards the previous period but has remained comparatively high for the whole monitoring period (Fig. 5). The greatest number of swimming ducks has been registered at the beginning and at the end of the daily monitoring. In comparison with the previous period the feeding and the resting time on the dike of the fish-pond have been increased.

In general, the behavioral ethograms of mule ducks at 4 to 8 weeks` age, bred at integrated fish-cum-ducks system have demonstrated that a considerable part of the day the ducks have spent on the fish-pond dike, with a tendency for decreasing of the stay with the age. Towards 6-weeks` age till the end of rearing, ducks stay in the fish-pond has increased and not only the motion activity has increased but the resting time in the water, as well.

When studying the behaviour of the Pekin ducks under different technological regimes (bath (small pond); trough; nipplebath; shower), Jones, et al. [7] established that even when there was a free access to open water, the ducks spent bathing less than 5% of the total time. That is why the authors suggested that probably it is not necessary to provide the ducks with a permanent access to water for bathing throughout the day. We established in our experiment that the mule ducks could actively use water, especially with aging. At the age of 7-8th weeks swimming at the separate hours of the observation occupied 12.86 to 56.08% of the time.

Together with the age advance the mule ducks have been fed on the food supplied on the fish-pond dikes for a shorter period of time. We should underline that there are good conditions for living of mule ducks in the fish-ponds. That is exceedingly important as the abnormal behaviour makes raising of mule ducks problematic [5]. In our experiment the feathers of the ducks were in good condition. Under the conditions of our experiment the fowls have been with a good plumage status. No demonstrations of cannibalism and aggressiveness have been observed.

CONCLUSION

The daily dynamics of behavioral elements of mule ducks bred in fish-ponds has been cleared, by applying a schedule of partial restriction. The fish-ponds have been suitable for mule ducks rearing. The fowls have had a good plumage status, without demonstrations of

Таблица 1. Часова динамика на елементите на поведението на мюларите на различна възраст
Table 1. Hour dynamics of behavior elements of mule ducks at different age

Час Hour	Елементи на поведението / Behaviour elements											
	На сушата / on the side								В басейна / in the water			
	Движат се/ Move on the side		Стоят/ Stay on the side		Лежат/ Lay on the side		Хранят се/ Feed		Плуват/ Swim		Лежат/ Stay in the water	
	min.h^{-1}	%	min.h^{-1}	%	min.h^{-1}	%	min.h^{-1}	%	min.h^{-1}	%	min.h^{-1}	%
4- седмична възраст												
8-9	1.00	1.67	9.33	15.56	43.00	71.67	0.00	0.00	6.67	11.11	0.00	0.00
9-10	0.33	0.56	6.00	10.00	31.00	51.67	12.00	20.00	10.67	17.78	0.00	0.00
10-11	0.67	1.11	12.00	20.00	38.67	64.44	5.67	9.44	3.00	5.00	0.00	0.00
11-12	0.67	1.11	2.33	3.89	38.00	63.33	9.33	15.56	9.67	16.11	0.00	0.00
12-13	0.67	1.11	6.67	11.11	34.00	56.67	6.67	11.11	11.00	18.33	1.00	1.67
13-14	1.67	2.78	6.33	10.56	38.00	63.33	3.33	5.56	9.67	16.11	1.00	1.67
14-15	0.33	0.56	10.00	16.67	43.00	71.67	1.00	1.67	4.00	6.67	1.67	2.78
15-16	1.33	2.22	5.00	8.33	37.33	62.22	6.00	10.00	9.33	15.56	1.00	1.67
16-17	1.00	1.67	11.00	18.33	25.33	42.22	6.67	11.11	15.00	25.00	1.00	1.67
17-18	2.00	3.33	9.00	15.00	43.67	72.78	0.33	0.56	4.33	7.22	0.67	1.11
5-седмична възраст												
8-9	9.90	16.46	4.00	6.71	31.50	52.44	10.20	17.07	4.40	7.32	0.00	0.00
9-10	0.40	0.61	3.70	6.10	45.00	75.00	1.10	1.83	9.50	15.85	0.40	0.61
10-11	1.10	1.83	1.80	3.05	49.00	81.71	3.30	5.49	4.80	7.93	0.00	0.00
11-12	0.70	1.22	5.50	9.15	34.80	57.93	3.70	6.10	14.30	23.78	1.10	1.83
12-13	1.50	2.44	2.20	3.66	44.30	73.78	5.50	9.15	6.60	10.98	0.00	0.00
13-14	0.70	1.22	2.60	4.27	47.20	78.66	0.00	0.00	9.50	15.85	0.00	0.00
14-15	0.70	1.22	7.30	12.20	43.90	73.17	0.70	1.22	6.60	10.98	0.70	1.22
15-16	1.10	1.83	3.70	6.10	42.80	71.34	6.20	10.37	5.50	9.15	0.70	1.22
16-17	2.60	4.27	5.50	9.15	39.10	65.24	3.30	5.49	9.10	15.24	0.40	0.61
17-18	1.8	3.05	2.6	4.27	44.3	73.78	6.6	10.98	4	6.71	0.7	1.22
6-седмична възраст												
8-9	0.00	0.00	16.90	28.21	10.00	16.67	15.00	25.00	17.70	29.49	0.40	0.64
9-10	0.40	0.64	6.20	10.26	25.80	42.95	0.80	1.28	23.80	39.74	3.10	5.13
10-11	0.80	1.28	4.60	7.69	43.10	71.79	0.80	1.28	9.20	15.38	1.50	2.56
11-12	0.40	0.64	3.10	5.13	29.20	48.72	1.50	2.56	16.50	27.56	9.20	15.38
12-13	0.00	0.00	5.40	8.97	32.70	54.49	1.50	2.56	18.50	30.77	1.90	3.21
13-14	0.80	1.28	3.10	5.13	35.80	59.62	1.20	1.92	13.10	21.79	6.20	10.26
14-15	0.40	0.64	5.80	9.62	36.50	60.90	1.20	1.92	11.20	18.59	5.00	8.33
15-16	0.40	0.64	5.80	9.62	38.10	63.46	0.40	0.64	13.50	22.44	1.90	3.21
16-17	0.00	0.00	3.50	5.77	39.60	66.03	0.80	1.28	15.80	26.28	0.40	0.64
17-18	0.80	1.28	6.90	11.54	31.20	51.92	1.20	1.92	17.70	29.49	2.30	3.85
7-седмична възраст												
8-9	1.60	2.70	9.70	16.22	17.40	29.05	0.40	0.68	19.10	31.76	11.80	19.59
9-10	0.00	0.00	9.30	15.54	6.10	10.14	0.40	0.68	33.60	56.08	10.50	17.57
10-11	0.00	0.00	4.90	8.11	27.20	45.27	0.00	0.00	18.20	30.41	9.70	16.22
11-12	2.40	4.05	5.30	8.78	29.60	49.32	1.20	2.03	15.40	25.68	6.10	10.14
12-13	0.40	0.68	9.70	16.22	20.70	34.46	0.00	0.00	19.90	33.11	9.30	15.54
13-14	0.00	0.00	3.60	6.08	26.80	44.59	5.70	9.46	19.50	32.43	4.50	7.43
14-15	0.80	1.35	9.70	16.22	27.20	45.27	2.00	3.38	15.40	25.68	4.90	8.11
15-16	0.40	0.68	6.90	11.49	23.90	39.86	1.20	2.03	22.30	37.16	5.30	8.78
16-17	0.00	0.00	6.90	11.00	29.60	49.32	0.40	0.68	15.40	25.68	7.70	12.84
17-18	1.60	2.70	3.60	6.08	17.40	29.05	1.60	2.70	23.90	39.86	11.80	19.59
8-седмична възраст												
8-9	1.30	2.14	5.10	8.57	29.60	49.29	0.00	0.00	18.40	30.71	5.60	9.29
9-10	0.40	0.71	3.00	5.00	19.30	32.14	0.00	0.00	24.40	40.71	12.90	21.43
10-11	0.40	0.71	5.10	8.57	18.40	30.71	5.10	8.57	20.10	33.57	10.70	17.86
11-12	1.30	2.14	4.30	7.14	41.60	69.29	2.60	4.29	5.10	8.57	5.10	8.57
12-13	0.40	0.71	3.00	5.00	43.70	72.86	0.00	0.00	9.00	15.00	3.90	6.43
13-14	0.40	0.71	6.00	10.00	36.40	60.71	2.10	3.57	7.70	12.86	7.30	12.14
14-15	2.10	3.57	10.30	17.14	24.90	41.43	2.10	3.57	12.40	20.71	8.10	13.57
15-16	0.40	0.71	4.70	7.86	38.60	64.29	4.30	7.14	8.60	14.29	3.40	5.71
16-17	0.90	1.43	3.40	5.71	30.00	50.00	3.00	5.00	16.30	27.14	6.40	10.71
17-18	0.40	0.71	8.60	14.29	12.90	21.43	5.60	9.29	29.60	49.29	3.00	5.00

cannibalism and aggressiveness. As regards behavior, a considerable dynamics of the separate elements can be seen, both within the day and night round, as well as during the separate age periods. Together with the fattening period advance, ducks have spent less time for feeding and have reacted rather weakly to forage supply. A significant part of the day the ducks have spent on the fish-pond dike. There has been a tendency for decrease of dry land stay on the account of the stay in the fish-pond. Together with the age advance the ducks have spent more time for swimming (max time 33.6 $min.h^{-1}$), as well as for resting in the fish-pond (max time 12.9 $min.h^{-1}$).

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