

*Andrzej WITKOWSKI*

THE SPAWNING RUN OF THE HUCHEN *HUCHO HUCHO* (L.)  
AND ITS ANALYSIS

ANALIZA WĘDRÓWKI TARŁOWEJ GŁOWACICY *HUCHO HUCHO* (L.)

Museum of Natural History  
Wrocław University

The huchen in the Dunajec river basin begin their spawning migration and spawning at the end of the 1th decade of April (2–3 weeks after snow has melted), when the water temperature is 7–8°C. The spawners migrate in the night, with the largest and oldest individuals appearing first in the tributaries. With time the size of the subsequently spawning fishes becomes smaller and smaller. The migration intensity depends on the temperature of the water and its levels in the spawning streams.

INTRODUCTION

In the past several score of years the huchen has been introduced into many rivers, both in Europe and on other continents (Northern Africa, N. America). Yet, according to Holčík et al. (1984), the introduction proved effective only in about 20% of the cases. The species was first introduced into the Dunajec river basin in 1966, and thanks to the annual stocking, at present there is quite a numerous population there. This makes it possible to consider the introduction as effective (Witkowski, Kowalewski 1980, 1988).

The recent studies on the species in new habitat conditions have shown that it has not changed significantly its behaviour (Witkowski, Błachuta 1980, Witkowski, Kokurewicz 1981, Witkowski, Kowalewski 1983/1984, Witkowski et al. 1983/1984, 1985). The biology of the huchen – the largest species of the salmonids (Holčík et al. 1984) – is quite well known. This is witnessed by four monographs on it: Ivaška (1951). Prawochenski, Kołder (1968), Harsányi (1982), Holčík et al. (1984) and many papers, published recently. Yet many aspects of its biology should still be investigated.

Thus, comparatively little information exists on the onset of the spawning migration, the structure of the spawning population, the share of both sexes and the influence of

some abiotic factors both in the autochthonic rivers and in those to which it was introduced. This paper is to study those aspects on the basis of the Dunajec population.

### MATERIAL AND METHODS

The study on the huchen spawning migration in the Dunajec River basin was conducted over 10 years. In this paper the data from 1983–1985 are mainly presented

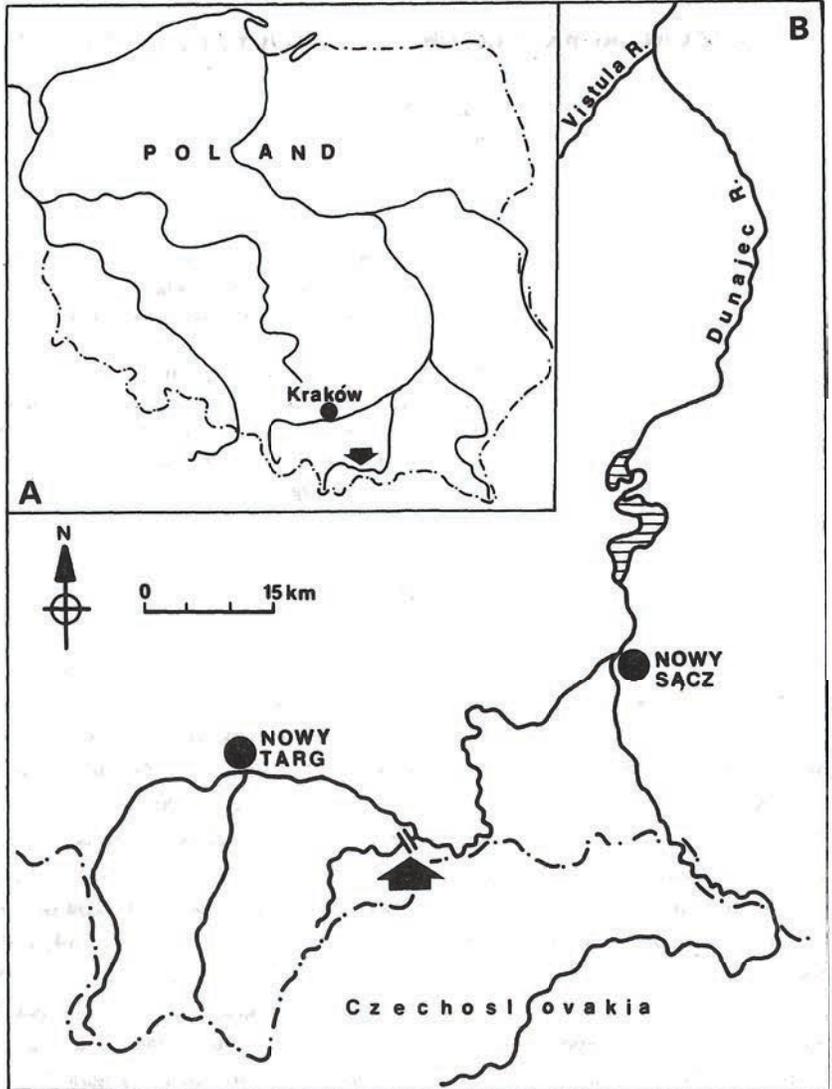


Fig. 1. Map of the investigation area in the Dunajec river basin

from the Niedziczanka stream (Fig. 1). The physiographic and physiochemical characteristics of this relatively short (15.3 km) Dunajec tributary can be found in Witkowski and Kowalewski (1988).

Among several tributaries into which the species goes every year to spawn, the largest numbers could be found in the Niedziczanka. The stream was also chosen because in 1980 it was dammed some 80 m from the mouth with a high step which the spawners could not overcome.

Every year the studies were begun at the end of March, i.e. at the moment when the snow cover had melted in the lower parts of the mountains (to the altitude of 800 m a.s.l.) and water was 4–5°C warm, and they were continued till the last days of April. When there was a long and cold spring, they were continued even until mid-May.

Fishing by means of an electric apparatus was carried every day, between 9 and 10 o'clock. The small depth (0.8 m) and width (max. 8 m) of the stream, good water transparency, and the efficiency of the fishing team ensured that all the fishes were caught. At that time water temperature was measured in the Niedziczanka, as were water levels. All the fishes caught were brought to the Fishing Station at Łopuszna, where they were measured, weighed, the sex was determined, and scales were taken for age analysis.

## RESULTS

### 1. Time of upstream run of huchen

The onset of the huchen spawning run depends on water temperature both in the Dunajec River and in its spawning tributaries. In 1983–1985 the first-spawners were caught on the 8th, 11th and 7th of April, when water temperature in the Niedziczanka at noon was respectively 8.2, 8.7 and 9.8°C. In some years the huchen appeared on the spawning sites, e.g. in 1977, when the first male was caught as early as March 25 and water was 9°C. As a rule, the first huchen were seen in the Niedziczanka in the middle or at the end of the grayling spawning migration (Witkowski, Kowalewski 1987), which was after several, or a dozen of, days of clear warming. Then maximum daily temperatures of the air were from 12 to 18°C. In the Dunajec basin the phenological indicator of the huchen spawning migration onset was the peak of blooming of *Tussilago farfara* L. and the appearance of the first leaves in *Alnus* sp. At the end of the migration *Caltha palustris* L. and *Primula officinalis* (L.) were in full bloom.

The onset of the migration and its duration also depend on water temperature. When spring was very warm the migration and spawning ceased after a few days. Thus, in 1983, the huchen migrated to the Niedziczanka only for 6 days and the average water temperature was 8.4°C. In 1984 and 1985, the average temperatures were 7.5 and 7.2°C for 10 days. In the years when snow lied long, and spring was cold, the migration was prolonged, lasting even 1.5 months, e.g. in 1978 the last spawners were seen on May 14.

From my observations, it follows that huchen go from the Dunajec to the streams in the night, which is supported by the results of catches of April 1983. At that period the

catches were made twice a day – in the morning between 9<sup>00</sup> and 10<sup>00</sup> and in the evening between 17<sup>00</sup> and 18<sup>30</sup>. As a rule there were huchen in the morning catches, while on the same days they were absent in the evening.

## 2. Influence of water temperature and other factors on the intensity of migration

In figure 2 the intensity of the spawning migration is shown, as depending on water temperature in the Niedziczanka. The largest fishes appeared in its mouth section when water temperature was warmest (above 7–8°C) or 1–2 days later, even though water was somewhat colder. This shows that warmer water in the spawning streams is a factor stimulating and attracting sexually mature huchen, which go into them from the colder Dunajec. Nearly throughout this whole period was the water in the Niedziczanka 1–2°C warmer than that in the Dunajec at noon. After noon and in the evening the differences were even greater, from 5 to 7°C. Such large differences were noted particularly on sunny days, when the shallow and open streams warmed very quickly.

Apart from the temperature of the water, its levels in the Dunajec tributaries also has a significant influence on the intensity and number of individuals going to spawn, which was particularly clear in the Niedziczanka. When its mouth to the Dunajec was natural, i.e. its width was 6–7 m, and the average depth about 0.5 m, there were quite a lot of huchen. In 1986 and 1987 the mouth was drastically changed by widening it to 12–15 m, which was related to the construction of reservoir dam on the Dunajec at Czorsztyn. Accordingly, the average depth diminished to about 0.15–0.2 m, and this made it impossible for the huchen to go to spawn.

## 3. Sex ratio, size and age

The ratio of males to females was different in various years, but nearly always there were slightly more males. In 1983 and 1984 the ratio was 1.4 : 1 and 2.3 : 1, while in 1985 it was 1 : 1. Most often single males appear at the beginning, which was particularly clearly seen in 1984. Females come later. At that time the fishes go in pairs, as individuals of both sexes were caught at the same place, or at distances of only 2–3 m apart. That a male and female appear at the same place, only 30–50 m away from the main river, seems to show that spawners get together not on the spawning sites but earlier, then going upstream together. In the majority of cases observed, at the end of the spawning migration, single males and females appear again.

The dependence of the size of spawners and the subsequent days of their migration is shown in figs 2 and 3. In the Niedziczanka, the largest specimens appear first, and with time, the size of migrating fishes of both sexes gradually diminishes, with the smallest-first-time spawners – at the end. In the period when my study was made, the total length of males ranged from 58.3 to 109.0 cm ( $\bar{x}$  = 83.2) and that of females from 63.0 to 94.5 cm ( $\bar{x}$  = 83.6). Their weight was, respectively, from 2.1 to 14.2 kg ( $\bar{x}$  = 6.6) and from 2.5 to 8.3 ( $\bar{x}$  = 6.1) kg. Among spawning males individuals with lengths from c. 60 to 100 cm and among females those from 70 to 100 cm were most frequent (Fig. 4).

At the start and in the middle of the spawning migration, the size of males and females

was similar, while at the end there were often considerable differences – a large females was accompanied by a small male, or a large male was near a female half his size. Probably most fishes have companions of adequate size, at first, and the rest of individuals match accidentally.

The fishes spawning in the Niedziczanka represented nine age groups: 4 to 12 years. The youngest males, spawning for the first time, were 4 ( $3^+$ ) years old, the oldest – 12 ( $11^+$ ). The females mature sexually a year later and spawn for the first time in their fifth year ( $4^+$ ). The oldest individuals were 11 ( $10^+$ ). The observations show that most often the oldest fishes appeared at first at the spawning sites, and later on the number of fishes of younger age group increased.

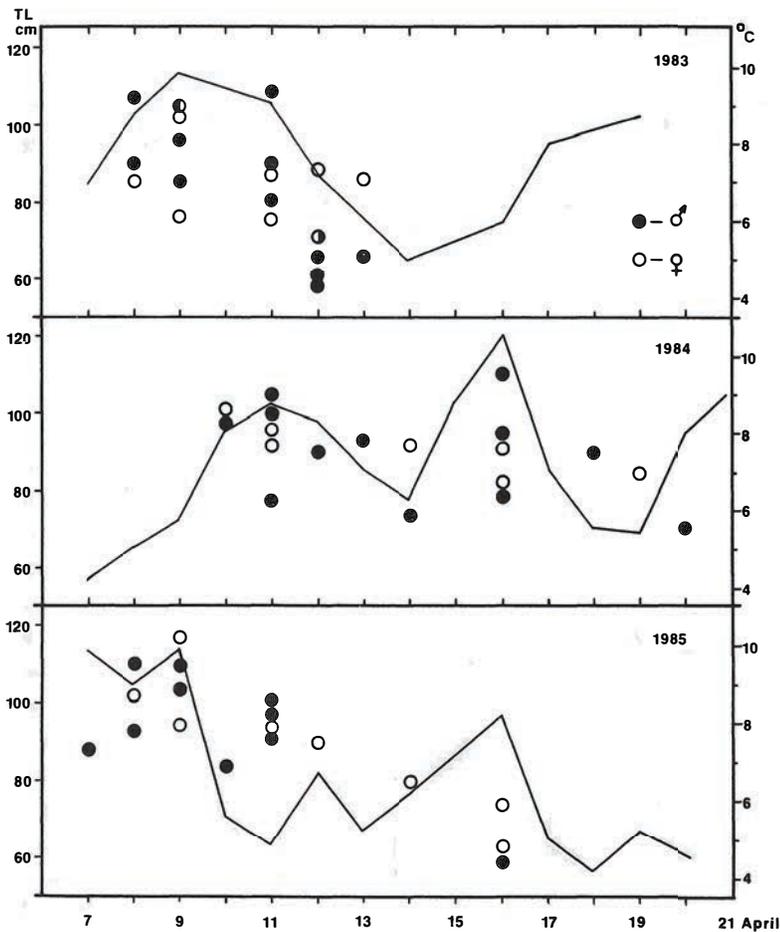


Fig. 2. Dependence between the intensity of the upstream migration of adult huchen in 1983–1985 and the water temperature and time

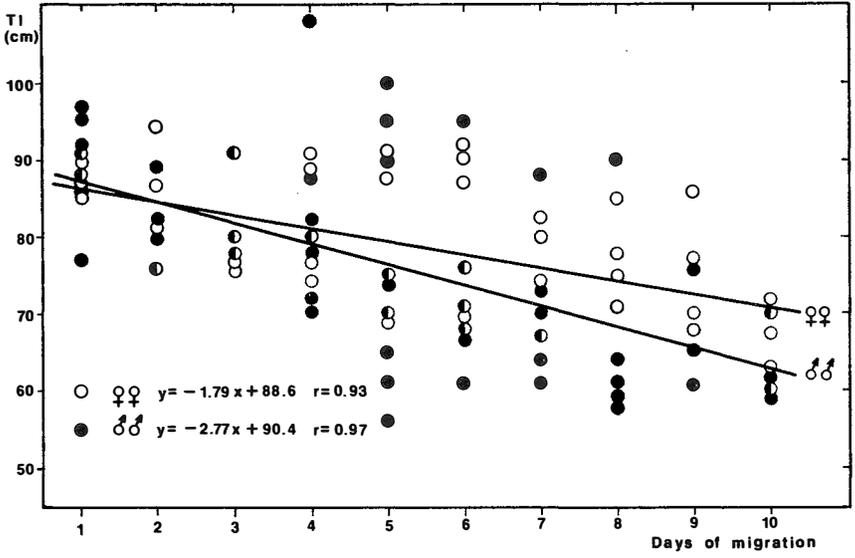


Fig. 3. Relation between the size of the huchen spawners and consecutive days of migration in 1976–1985

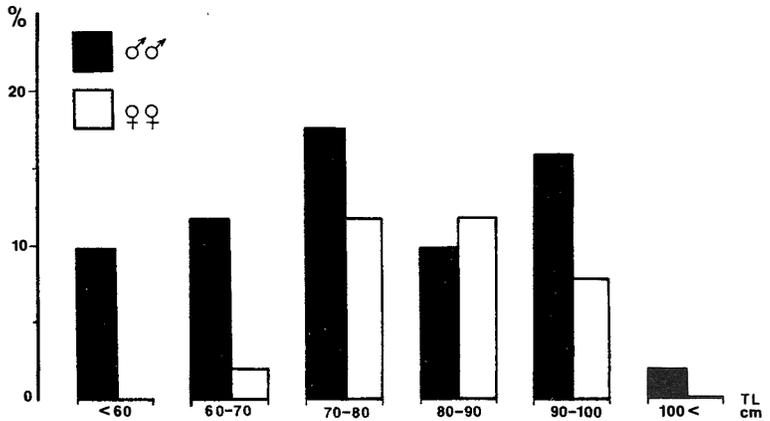


Fig. 4. Length distribution of migrating huchen in the Niedziczanka stream

## DISCUSSION

The huchen, in contrast to the majority of salmonids, spawns in spring. According to Pravdin (1949), Jungwirth (1977), Holčík et al. (1984) and others, the onset of the migration and spawning in *Hucho hucho hucho* and *H.h. taimen* depends on snow melting. In the Slovakian rivers spawning occurs rather regularly 5–6 weeks after that (Holčík et al. 1984). In the south of Europe spawning starts as soon as February and lasts until March (Munda 1935) and in Central Europe it extends from April to mid-May. In this respect, the huchen introduced into the Dunajec basin behave similarly. Most often the migration starts between April 7 and 10, with water 7–8°C warm. Similar observations were made by Kulmatycki (1931) and Vlasova (1959), while Holčík et al. (1984) note that this species starts spawning at water temperature of 6–10°C, Jungwirth (1977) gives the figure at 10°C.

In the middle Dunajec basin, the appearance of the first huchen spawners is rather precisely correlated with the peak of blooming of *Tussilago farfara* and leaf development in *Alnus sp.* This supports earlier phenological observations by Kulmatycki (1931) in the river Czeremosz.

The literature has no accurate data on the effect of abiotic factors on the intensity of huchen migration during the whole period of spawning. My studies show the intensity is decisively related to water temperature: in the warmest period more spawners were caught, and a sudden decrease in temperature clearly stops their migration. It was also found that water levels decide on the migration and the number of spawners in the streams. The presence of the huchen was not found in the streams which carry a small amount of water or those with a very shallow mouth section (0.15–0.2 m), even though water temperatures were favourable. This statement is supported by the data of Holčík et al. (1984) who point out that the huchen most often chooses for spawning the stream section with depths from 0.4 to 0.6 m.

According to Jungwirth (1977) and Kulmatycki (1931) the huchen spawns in pairs, and hence the sex ratio is most often 1:1. The same numbers of spawners of both sexes were only found in the Niedziczanka in 1983. In other years males slightly predominated (1.4 : 1 and 2.3 : 1). Other scientists (Vokač 1959, Holčík et al. 1984) also observed male predominance. Ivaška (1951) states that at spawning sites in the Slovakian rivers, male/female ratio is 2–3 : 1, and according to Snafevič and Moščuk (1956), male predominance in the Czeremosz is even greater – 7 : 1. Such disproportions are caused e.g. by the fact that males mature a year earlier than females, while females feed more intensively, particularly when the gonads grow rapidly, so they are more sensitive to angler pressure (Jagoditsch 1930, Witkowski, Kowalewski 1983/ 1984). This is confirmed by the data of Holčík et al. (1984), according to which among 44 huchens caught in 1972–1975 in one of the angling districts in Slovakia, there were 30 females. A similar phenomenon has been observed in the Dunajec basin. Among 73 fish caught during the last few years, there were 40 females and 33 males. The quantitative prevalence of males

over females during the spawning migration has been noted in brown trout (*Salmo trutta m. fario*) and grayling (*Thymallus thymallus*) (Libosvářský 1967, Witkowski, Kowalewski 1988). It should be supposed that an equal proportion (1 : 1) of spawners of both sexes can be found only in populations unexploited by angling.

The presence of spawner pairs noted already in the mouth section of the Niedziczanka seems to confirm Režný (1951), according to whom fishes find their partners two weeks before spawning. Males do not leave their females from that moment, driving away their competitors. Though huchen appear already in pairs in the Niedziczanka, yet at start of the migration, numerous unaccompanied males were noted.

In the Dunajec River basin, the first to spawn were the oldest and the largest individuals. With time, the size and age of subsequent fishes grew as a rule smaller and smaller. Similar observations in the subspecies *H. h. taimen* were made by Bukiriev (1967), while, according to Mišarin and Šutilo (1971), the youngest individuals were the first to spawn.

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*Andrzej Witkowski*

#### ANALIZA WĘDRÓWKI TARŁOWEJ GŁOWACICY *HUCHO HUCHO* (L.)

#### STRESZCZENIE

Obserwacje prowadzone przez okres dziesięciu lat w potoku Niedziczanka, do którego corocznie wstępuje z Dunajca najliczniejsze stado tarlaków. Głowacica w badanym dorzeczu rozpoczyna wędrówkę tarłową i tarło w połowie kwietnia gdy woda osiągnie temperaturę 7–8°C. Gdy wiosna jest zimna okres rozrodu przeciąga się nawet do 1,5 miesiąca. Intensywność wędrówki tarłowej uzależniona jest od temperatury i stanów wody w tarliskowych potokach. W okresach najcieplejszych wpływało najwięcej ryb. Ochłodzenie powoduje zmniejszenie natężenia ciągu tarłowego, a nawet jego całkowite wstrzymanie. Głowacice wędrują na tarło w okresie nocy, a jako pierwsze pojawiają się największe i najstarsze osobniki. W miarę upływu czasu rozmiary jak i wiek kolejno pojawiających się ryb są coraz mniejsze. Liczbowy udział osobników obu płci nie był równy. Odnotowano znaczną przewagę samców. Taki stan rzeczy spowodowany jest prawdopodobnie tym, że samce dojrzewają conajmniej rok wcześniej niż samice jak również większą żarłocznością tych ostatnich, szczególnie w okresie intensywnego wzrostu gonad, przez co są częściej wyławiane przez wędkarzy.

Author's address  
Doc. Dr. Andrzej Witkowski  
Uniwersytet Wrocławski  
Muzeum Przyrodnicze  
ul. Sienkiewicza 21  
50–335 Wrocław  
Polska (Poland)

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