



## Phenology of the medicinal leech, *Hirudo medicinalis* L., in north-western Turkey

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Received 23 August 2000; in revised form 7 May 2001; accepted 20 June 2001

**Key words:** population assessment, seasonal occurrence, phenology

### Abstract

The seasonal occurrence of medicinal leeches was studied at two lakes in the Black Sea coastland of north-western Turkey. The number of leeches attracted by a collector per hour was taken as an indicator for population density. Leeches were most abundant in May/June, and were almost absent during the cold season (November – March). Leeches with a weight of less than 1 g occurred principally between July and October with a peak in July. It is thought that these individuals represent newly hatched leeches. Although both study areas are close to each other, significant differences were found in respect to mean leech size and the seasonal frequency of leeches (both total number and certain age classes). It is suggested that leech biology is greatly dependent on factors such as microclimate and the availability of hosts, and no general conclusions on phenology can be drawn. There is therefore no scientific basis for restricting commercial leech collecting to certain months of the year.

### Introduction

The biology of the medicinal leech (*Hirudo medicinalis*, L.) has been studied in detail mostly in the laboratory (see overview by Sawyer, 1986). Despite the considerable public interest in this species through its use in traditional therapy, scientific research, and the production of pharmaceutical remedies, little is known about its biology under natural conditions. Several breeding programmes have been run in e.g. the United Kingdom, Germany, Russia and the Ukraine, but these were confined to the laboratory or to controlled semi-natural environments. The observations in these situations are hardly applicable to wild populations.

Our knowledge of the biology, ecology and status of the medicinal leech is therefore scanty. Some scattered results in the literature have been summar-

ised by Herter (1968), but most observations are of an anecdotal nature and the overall picture remains incomplete.

The medicinal leech is under threat throughout the world (IUCN, 1993; Council of Europe, 1998; Kasperek et al., 2000), with the destruction of habitats and over-collecting being the main reasons for its decline. In particular, large numbers of leeches are still collected annually in particular in Turkey and some Balkan countries (Wells & Coombes, 1987; Kasperek, 1994). For the sustainable management of leech populations, seasonal restrictions of collecting activities have to be considered, but due to the lack of information on the phenology of these populations there is still no scientific basis for such a course.

The objective of this study was to examine the seasonal numerical and weight changes in populations of the medicinal leech in order to contribute to our

knowledge of leech biology and to determine whether there are sensitive periods during which commercial collecting should be restricted.

### Study area

For the study of seasonal aspects of the medicinal leech, two populations were selected in the western Black Sea region of Turkey.

#### *Efteni Gölü (Lake Efteni)*

Efteni Gölü is a tectonic lake south-west of Düzce in the province of Bolu (40° 46' N, 31° 03' E) at an altitude of 118 m a.s.l. It is shallow with a depth of up to 2.0 m. The surface area is strongly dependent on the water level and varies between 4000 and 6000 ha. Efteni Gölü can be characterised as a eutrophic freshwater lake. It collects water from a large catchment area; it is mainly fed by the Uğurlu stream and ground water, and has an outlet which discharges into the Küçük Melen Stream. Most of the lake is covered with marsh vegetation, in particular with common reed (*Phragmites australis*). Salinity is extremely low: an electric conductivity between 583 and 650  $\mu\text{mhos/cm}$  was found at various measuring points in November 1997. Dissolved oxygen varied at that time between 6.70 and 8.67 mg/l (at water temperatures between 7.0 °C and 22.0 °C) and the pH between 7.30 and 8.01. Cattle breeding is very abundant around the lake. Fishing is carried out – but only with fishing lines. When compared with earlier data, the surface area of the lake has decreased considerably in recent years since the construction of a dam on the Uğurlu Stream. The lake has a rich wildlife and is particularly important for resting waterbirds in autumn and winter. The area has been protected as a Strict Nature Reserve.

#### *Poyrazlar Gölü (Lake Poyrazlar)*

The lake is an alluvial barrier lake situated north of Adapazarı in the province of Sakarya (40° 53' N, 30° 24' E) at an altitude of 10 m a.s.l. Maximum depth is 4 m, and the total surface area is 300 ha. It is a freshwater lake which is fed mainly by rainfall and underground sources. It has no outlet. In particular, the north-eastern shores of the lake are covered with marsh vegetation. The lake and its surroundings, which are covered by forests and meadows, are used for recreational purposes.

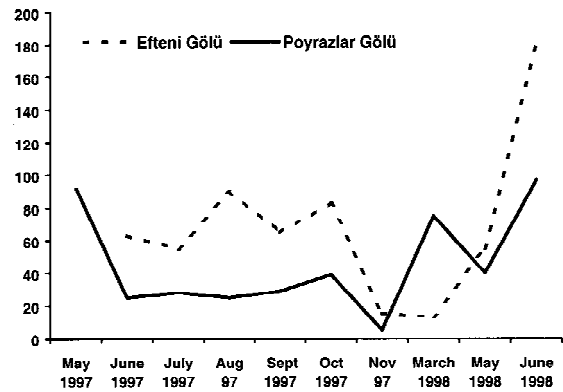


Figure 1. Seasonal fluctuation in the number of medicinal leeches collected under standard conditions at Efteni Gölü and Poyrazlar Gölü in western Turkey.

### Methods

Both lakes were regularly surveyed in 1997 and 1998, with visits at an average of 2-week intervals. Assessment of the population status of this highly mobile parasitic species proved to be difficult. For the purpose of this study, a semi-quantitative method was selected: Samples of leeches were obtained by disturbing the water, which then attracted the animals (see e.g. Elliot & Tullett, 1986). The leeches were collected by hand and put into bags and bottles. For assessing abundance, leeches were collected for one hour, and the number of leeches collected in this period was used as an indicator for the species' abundance. The 'collecting efficiency' was then calculated as the number of leeches collected per hour by a single collector. Even when sampling did not last for exactly 1 h and/or when more than one collector was involved, data were calculated as for the number of leeches per hour and per collector. Each value indicated the leech density.

Leeches were weighed in the field individually with an electronic balance to the nearest 0.1 g. During weighing, care was taken to ensure that no water droplets were attached to the leech's body. For analysis, the leeches were grouped into six weight classes, i.e. <1.0 g, 1.1–2.0 g, 2.1–3.0 g, 3.1–4.0 g, 4.1–5.0 g, and >5.0 g.

### Results

#### *Seasonal variation in numbers*

At Lake Efteni, the leech numbers fluctuated at a relatively high level between June and October 1997,

but numbers were not assessed in May and sharply decreased towards the end of the warm season (Fig. 1). The number of leeches then remained very low from November throughout the cold season, but increased again in May and continued to do so in June.

At Lake Poyrazlar, the number of leeches was high in May 1997, when the study commenced. However, the numbers then decreased and remained steady until October. As in Efteni Gölü, the number of leeches dropped to a low level in November. In 1998, the increase in the number of leeches occurred as early as March, then dropped somewhat in May. Numbers increased to a high level as in the population at Efteni Gölü.

#### *Seasonal variation of the mean weight*

The monthly mean weight of the leeches collected in each lake is given in Table 1. No clear picture can be derived from these figures. The highest mean weight of 3.8 g was obtained at Lake Poyrazlar in June 1997. Mean weight dropped to 1.2 g the following month, but then gradually increased until November. The high mean weight in June may be biased by a single, extremely heavy leech of 15.8 g weight. The increase in mean weight during summer was not confirmed by the results obtained at Lake Efteni. An increase from July to October was followed by a decrease in November (Table 1).

#### *Seasonal appearance of different weight classes*

##### *Lake Efteni*

At Lake Efteni, the number of leeches was almost uniformly distributed over the various weight classes when the study commenced in May 1997 (Fig. 2). Leeches between 2 and 3 g were somewhat more frequent than leeches in other weight classes, but the difference was relatively small. The following month, however, individuals with a weight of <1 g became dominant over all other weight classes. It is thought that this class represents newly-hatched leeches, and that the main hatchling period started in June. The leech frequency in the other weight classes was similar to that of the previous month. The pattern in July very closely resembled the pattern in June, with leeches <1 g being strongly dominant over all other weight groups. In August, the number of leeches in the <1 g and 1–2 g weight classes became almost equal. A possible explanation is that the first leeches born in the year grow and become heavier than 1 g, while a considerable number of leeches is still hatching. The leech

numbers in the other classes showed no differences compared with the previous months. In September, the number of leeches in the 1–2 g weight class somewhat exceeds the number in the <1 g class, but the difference is not significant. In October, leeches <1 g again became dominant over those with a weight of 1–2 g. The same pattern is true for November, but the total number of leeches becomes very low probably due to the falling water temperature in the cold season.

In 1998, leeches between 1 and 2 g were dominant from March to June. In March 1998, the total number of leeches collected was only 12; a temperature of 10 °C and rainy weather may explain the low leech number. As the number of the 1–2 g leeches was relatively high, hatching from eggs had apparently not yet started. In May 1998, the total leech number was similar to May 1997. Leeches in the 1–2 g class were dominant, followed by leeches <1 g. The latter may have been the first hatchlings of the year. Although leeches between 1–2 g were dominant in June, there was also a strong increase in the number of leeches in the <1 g class, probably due to the further input of hatchlings.

##### *Lake Poyrazlar*

When the survey started at Lake Poyrazlar in May 1997, leeches <1 g were dominant, and remained the dominant weight class until November. Whereas the other weight classes were represented in more or less equal frequencies in May, leeches >5 g became relatively abundant in June. In July, however, this relative abundance was not observed again. Leeches in the 1–2 g weight class were relatively rare throughout, compared to the results obtained at Lake Efteni. They only increased somewhat in August, and became moderately abundant in September and October.

In March 1998, leeches in the 1–2 g class were the dominant group. Whereas the numbers in May were extremely low, no certain dominance was observed; in June, leeches <1 g were by far the most abundant group. In May 1997, there were already many leeches <1 g present, but in 1998, this peak did not occur before June.

In May 1998 Lake Poyrazlar experienced an extremely high rainfall. Rain and flood caused damages to the habitats of all the aquatic animals living in the lake, and apparently also affected the *H. medicinalis* populations. This explains the low number of leeches in May 1998. In June 1998, leech frequency began to

Table 1. Monthly Mean, Minimum and Maximum weights (g) of leeches in Lakes Efteni and Poyrazlar

	Efteni Gölü			Poyrazlar Gölü		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
May 1997	2.9	0.1	8.0	1.6	0.1	11.0
June 1997	1.7	0.1	12.0	3.8	0.2	15.8
July 1997	1.4	0.1	14.0	1.2	0.2	1.3
August 1997	1.7	0.3	12.0	1.4	0.2	6.7
September 1997	1.8	0.3	9.0	2.1	0.3	7.9
October 1997	1.8	0.3	10.8	2.4	0.4	9.9
November 1997	1.5	0.3	5.9	2.7	0.3	8.2
March 1998	2.1	0.9	7.2	2.6	0.5	10.5
May 1998	1.6	0.1	6.0	0.8	0.1	5.3
June 1998	1.2	0.1	7.0	0.9	0.1	6.0

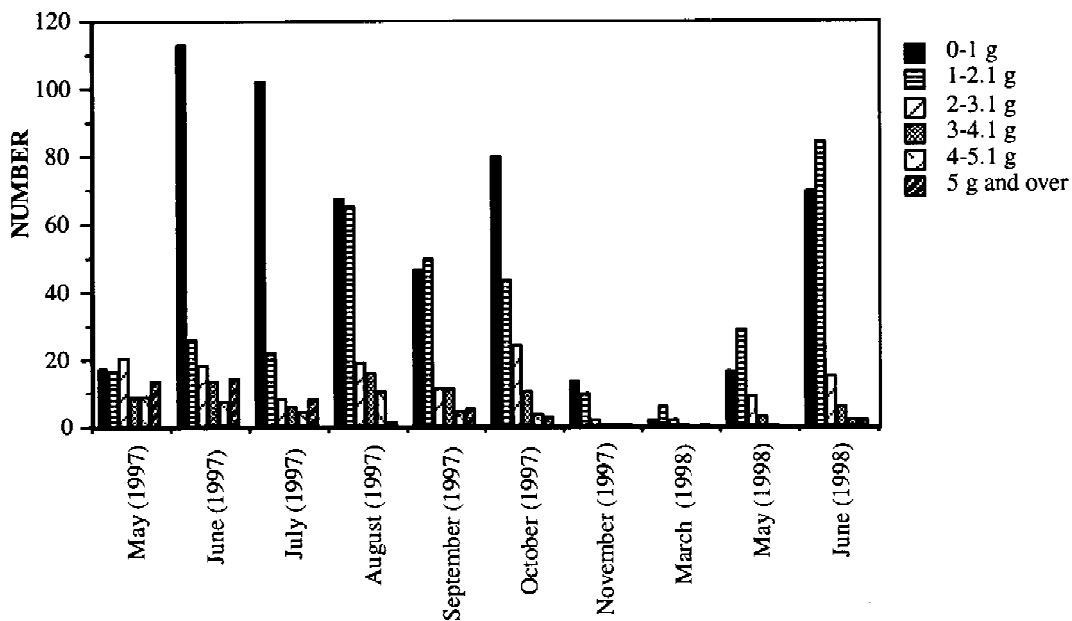


Figure 2. The monthly average number of the leeches collected in various weight classes at Efteni Gölü in 1997–1998.

increase again as a result of improving environmental conditions.

### Discussion

It is striking that larger leeches are much less abundant in Lake Poyrazlar than in Lake Efteni. This can be observed in almost all months of the year (Figs 2 and 3) and is difficult to explain. Cold-blooded host species such as frogs and fish, and also warm-blooded hosts such as cattle, appear to be common in both areas. There is also no commercial leech collecting at these

lakes that might reduce the number of larger individuals. However, no quantitative data are available on the frequency of hosts, and it cannot be ruled out that there are differences between the two areas. Also, microclimate may be one of the factors to be considered when attempting to explain the difference.

A comparison was made of the seasonal occurrence of leeches in the <1 g weight category, which are supposed to be hatchlings of the year. In Figure 4, it can be seen that the number of leeches in this weight class increases strongly between May and June, and reaches its maximum in July. This pattern was observed in both lakes. The number then de-

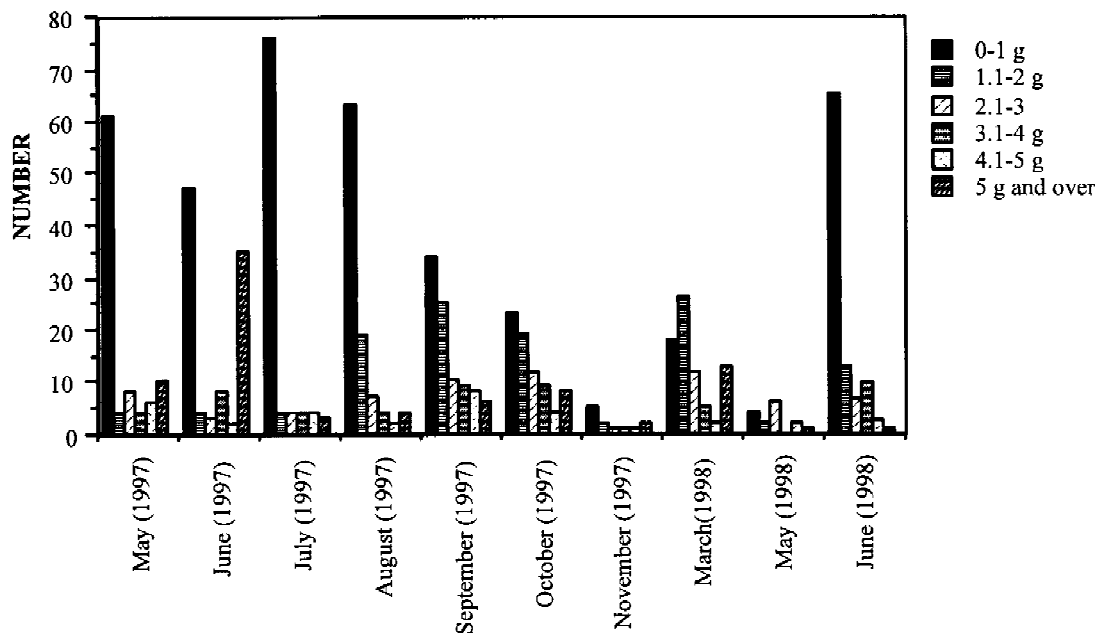


Figure 3. The monthly average number of the leeches collected in various weight classes at Poyrazlar Gölü 1997–1998.

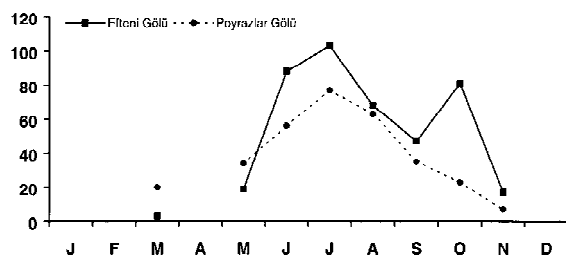


Figure 4. Seasonal frequency of medicinal leeches with a weight < 1 g at Efteni Gölü and Poyrazlar Gölü in 1997 and 1998. For those months for which data from both years were available, mean values were used.

creases gradually until November. Exceptionally in Lake Efteni, there was a slight increase in October. In both lakes, the main hatching period is thus from June to August. If one also takes the months with somewhat lower numbers of hatchlings into account, the hatching season may be determined as from May to October.

During the study period, it was observed that the temperature during the main hatching season at both lakes was above 18 °C, mostly above 20 °C. It is thought that temperature is a major factor influencing the number of hatchlings present. At both lakes, there are rains throughout the year. Summer precipitation was high particularly in August and September 1997. No correlation between rainfall and leech phenology was found.

Turkey is the most important exporting country of medicinal leeches worldwide (Kasperek 1994). In order to protect natural leech populations from over-collecting, the Government of Turkey has restricted the collecting period to certain months of the year, though the collecting seasons vary somewhat from year to year. The results of this study do not substantiate this regulation. As leeches of < 2 g weigh are not usually collected, it does not seem logical to restrict collecting activities to certain months.

#### Acknowledgements

This report is the product of joint efforts by the pharmaceutical company Sanofi-Synthelabo SA, Geneva, and the German Scientific CITES Authority (Bundesamt für Naturschutz, BfN). We wish to thank in particular Mr Max Frey and Mr Harald Martens for their continuous encouragement, support and advice, Mr Bernd Brosthaus and Mrs Birgit Heinze for help in various ways, and Mr Adrian Pont for checking the English language of the manuscript. Funding was provided by Sanofi-Synthelabo SA.

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