

## MONITORING STUDIES FOR THE *HIRUDO MEDICINALIS* POPULATIONS IN TURKEY (2003-2006)

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**ABSTRACT:** This study is carried out in order to learn more about and regularly monitor the current population of *Hirudo medicinalis* (medicinal leech) which is traded internationally within the scope of CITES Convention to which our country is also a party, and to determine the annual export quota of it. In this regard, 18 different wetlands with important potential of *Hirudo medicinalis* is examined. Of all, Kızılırmak Delta and Yeşilirmak Delta are the lands where virtually all medicinal leeches exported from Turkey are gathered. The examined wetlands were scanned for habitats that can involve medicinal leech and especially shallow wetlands with intense surface and underwater macrophyte vegetation are preferred. The amounts of *Hirudo medicinalis* caught in certain periods in these wetlands were analyzed and compared in terms of density.

**KEY WORDS:** *Hirudo medicinalis*, Wetlands, Population.

Leeches have been used in India since 5th century B.C. for medical purposes and the systematic basis of treating patients with leeches date back to the Roman Empire. The cuts made by the blood sucking leeches were first used as a method of accelerating blood flow was used in this period. While the leech continues to suck blood without disturbing the patient, the blood flows out in rhythmic waves. In the following centuries the doctors used leeches against nearly all disorders and illnesses. Leech use demonstrated an important development in the 19th century. Researchers calculated that at the beginning of the last century leeches sucked out 84000 liters of blood annually only in Paris (Kasperek, 1994). Leech use, however, decreased at the beginning of the 20th century and in recent years it revived with the natural medicine trend. In addition, *Hirudo medicinalis* use is also applied in traditional treatment.

In 1903 a group of scientists led by Jacob Friedrich Franz managed to isolate the substance in the *Hirudo medicinalis* excretion that inhibits the coagulation of blood. This substance is called 'hirudin'. In 1950s this substance was characterized as trombin-specific inhibitor and in 1960s it was began to be used by the pharmaceutical industry as raw material in the production of medicine that includes *Hirudo medicinalis* extract. Its basic areas of application are open wounds with or without haematoma, superficial inflammation in the veins, hemorrhoids, perianal thrombosis and anal eczemas. Application of their active agent through drugs rather than direct application of *Hirudo medicinalis* caused an increase in the demand toward medicinal leech in Europe. Especially in late 1960s and early 1970s many drugs involving hirudin were produced.

In the 18<sup>th</sup> and 19<sup>th</sup> centuries the *Hirudo medicinalis* population in Central Europe was not sufficient for large demands. The high increase in commercial

collection led to a decrease in the population of *Hirudo medicinalis* and even their extinction in many regions. The drainage and pollution in *Hirudo medicinalis* habitats were also important factors in their population's decrease. This decline in the population in Europe led the way for importation of *Hirudo medicinalis* from other regions. *Hirudo medicinalis* was begun to be imported from especially Anatolia, Northern Africa, and Russia. Today *Hirudo medicinalis* populations are now wide enough to meet commercial purposes in many European countries. Therefore, most Central European countries import *Hirudo medicinalis* to meet their needs. Living or non-living leeches are exported from Turkey to European countries. It was observed that the quota was quite high in the first years of exportation and this was had serious harmful effects on the natural populations (Kasperek et al., 2000; Demirsoy et al., 2001).

Due to the danger of extinction for *Hirudo medicinalis* populations and the wide international trade of these species, in 1987 England offered *Hirudo medicinalis* to be listed in the Annex II of Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and with the decision of the CITES Committee it was included in Annex II.

*Hirudo medicinalis*, was also included in the list in Annex III of Bern Convention on the Conservation of European Wildlife and Natural Habitats. This convention laid it as a condition that any activity carried out for profit should be arranged in a way that will enable the populations to survive. Although Annex III is a list that covers all the animals which are not included in Annex II, parties should be careful about having the control regulations about the species in Annex III when necessary (Lyster, 1985).

In our country, Gülen et al. (1997) made a study about detecting Turkey's Hirudinea fauna, *Hirudo medicinalis* being in the first place, and they carried out population studies at several lakes in the Marmara Region. Besides, Artüz (1990) carried out studies on leech production. Again Artüz (1997) made biological studies about the *Hirudo medicinalis* in Gala, Terkos, Bolu and premises and Samsun region. Kasperek (1994) carried out studies on Turkey's medicinal leech population and potential. *Hirudo medicinalis* is listed in fauna studies about medicinal leeches or toxicological studies about these creatures were carried out (Özbek & Sarı, 2007; Sağlam & Şahin, 2006). On the other hand, Kasperek et al. (2000) examined the natural habitats where *Hirudo medicinalis* lives in Turkey and carried out the first comprehensive study on the *Hirudo medicinalis* population of these areas. Demirsoy et al. (2001) found important results about the reproduction biology of *Hirudo medicinalis* in their natural habitats in Turkey.

## MATERIAL AND METHOD

This study was carried out between August 2003 and June 2006 by making research through the wetlands that are important in *Hirudo medicinalis* and located on the west part of the Anatolia Diagonal.

Among the 34 wetlands detected to contain *Hirudo medicinalis* taking the Kasperek et al. (2000) study as a basis, 18 of them were examined in detail as they were more important than others. These wetlands were chosen because they have important *Hirudo medicinalis* population as well as being areas where commercial medicinal leech collection is done (Fig. 1). In this regard, the population density and size of the wetland (appropriate leech habitat in the wetland) were taken as basis and wetlands were classified according to their importance.

In these wetlands that are appropriate for leeches were scanned and especially shallow areas with intense surface and underwater macrophyte vegetation were preferred. The lake water was stirred in order to attract the attention of the medicinal leeches and the leeches that react to the current were hand picked (with plastic gloves on) and placed in cloth bags and bottles (Elliot & Tullett, 1986; Kasperek et al., 2000). In order to have information about the medicinal leech density, the activity of leech collection was continued for an hour at the same spot and the collected total amount of leech was used as an indicator of abundance. The productivity of collection depends on many different factors like environmental conditions (air, water temperature, etc.), habitats (habitat size, vegetation type, etc.), and personal experience of the collector. Nevertheless, this method is proved to be appropriate for detecting the leech population in certain areas at least on a semi-quantitative basis (Elliot & Tullett, 1986; Kasperek et al., 2000). Repeated trials made at the same spots yielded similar results.

## RESULTS

Areas with important medicinal leech potential in Turkey were evaluated primarily taking previous studies into consideration. The *Hirudo medicinalis* content of these areas were tried to be detected with studies made in different times.

In Western Anatolia, *Hirudo medicinalis* was found in 34 of 53 scanned wetlands. *Hirudo medicinalis* could not be found in salty lakes and near salty water, the lakes that dried during the study, and areas surrounded by peat beds which can be inappropriate because of humic acid. In addition, no leeches were found in the Çukurova region due to of zoo-geographic and environmental factors (Ağyatan Lake, Akyatan Lake) (Kasperek et al., 2000).

According to the results of the study, primary areas with *Hirudo medicinalis* are listed as follows in order of importance. *Hirudo medicinalis* densities of the sampling areas according to dates are given in Figures 2a,b,c.

### **Wetland with the highest amount of *Hirudo medicinalis* in Turkey:**

- Karamuk Marshes
- Işıklı Lake
- Karagöl Wetland / Sinop
- Kızılırmak Delta: Sarıköy
- Eber Lake
- Kızılırmak Delta: Balıklıgöl
- Kızılırmak Delta: Uzungöl
- Kızılırmak Delta: Bedeş Marshes
- Yeşilirmak Delta: Akgöl
- Manyas Lake
- Efteni Lake
- Kızılırmak Delta: Çernek Lake
- Kızılırmak Delta: Karaboğaz
- Gala Lake
- Kızılırmak Delta: Doyran Reeds
- Beyşehir Lake
- Uluabat (Apolyant Lake)
- Sultan Marshes

There is serious commercial leech collection only in Kızılırmak and Yeşilirmak Deltas among the eighteen wetlands with the highest amount of leech. In other wetlands leech is either collected irregularly or not collected at all.

These results demonstrate that Turkey's *Hirudo medicinalis* population is not utilized completely and regularly. The studies carried out among local leech collectors and leech traders have shown that 90% of the exported medicinal leech is collected in Kızılırmak and Yeşilirmak Deltas located on the Black Sea coast. While wetlands like Işıklı Lake, Karamık Marshes, Eber Lake etc. have important commercial potential, medicinal leech is not collected from the areas due to low demand.

### **Karamuk Marshes**

Karamuk Marshes have a great potential of *Hirudo medicinalis*. The whole wetland is nearly covered with underwater and surface macrophyte vegetation. Besides, the water is shallow in the reeds and this is quite an available condition for medicinal leeches. The collected data showed that Karamuk Marshes is one of the most important wetlands for *Hirudo medicinalis*. Despite this high potential, commercial collection of leech is not carried out comprehensively in Karamuk Marshes. It was detected that in previous years there was a small-size (300-350kg. annually) collection but recently this activity has completely ceased due to lack of demand.

### **Işıklı Lake**

In Işıklı Lake, the part that should be focused and examined in terms of medicinal leech population is the area called Gököl where there are rotund marshes. This area has quite appropriate habitats for leeches. The abundance of cattle in the area is an important advantage for the feeding of medicinal leech. Işıklı Lake is close to Karamuk Marshes and just like the reeds, there was collection activity in previous years but it stopped in recent years. It is recorded that in 1994 a collection company collected 70 kg. medicinal leech (Kasperek, 1994).

### **Karagöl Marshes / Sinop**

The whole surface area of Karagöl Marshes is covered with macrophyte. Although it has a relatively small surface area, it has quite an important potential of *Hirudo medicinalis*. Collectors that operate around Samsun use Karagöl Marshes intensively.

### **Kızılırmak Delta**

The condition of *Hirudo medicinalis* in Kızılırmak Delta was previously stated by Kasperek et al. (2000) and Kasperek (1994). These studies inform us that the area has quite a high population of *Hirudo medicinalis*. This current study also reveals that in Turkey nearly all exported leeches are collected from this site. Due to this importance of Kızılırmak Delta studies were carried out in 7 different stations in the area and 8 different field studies were realized for examining the seasonal change in *Hirudo medicinalis* population.

### **Eber Lake**

Eber Gölü has an appropriate habitat for *Hirudo medicinalis* that reaches out to a wide area. This lake is nearly covered with intense macrofits and it has a high *Hirudo medicinalis* population. However, just like other Central Anatolian lakes, Eber Gölü lacks commercial collecting, too. It is known that companies used to collect medicinal leeches in Eber Lake until 5 or 6 years ago.

### **Yeşilirmak Delta**

Samplings were made from Simenit-Akgöl water complex representing the Yeşilirmak Delta which is considered important for *Hirudo medicinalis*. These

two lakes are connected and it is an important site for *Hirudo medicinalis*. Collectors come from Bafra and Samsun to commercial collecting.

#### **Manyas Lake**

In Manyas Lake, the appropriate habitat for *Hirudo medicinalis* is quite small compared to the size of the lake. Medicinal Leeches could be collected only in the samplings made in reedy areas in certain coastlines.

#### **Efteni Lake**

Although Efteni Lake is a small wetland, it contains high amounts of *Hirudo medicinalis*. This is closely related with the macrofit structure of the lake surface. The whole lake surface is covered with *Pragmites australis* and underwater plants that are quite appropriate for *Hirudo medicinalis* are dominant.

#### **Gala Lake**

While this site was an area with comprehensive leech collecting in previous years, this activity has diminished recently. An export company located in Thrace used to meet its *Hirudo medicinalis* need from this lake but in recent years because of efficiency problems they turned towards Samsun and premises. While Gala Lake involves appropriate habitats for *Hirudo medicinalis*, excessive pollution from the Meriç River has created a great threat on leeches as well as other living things. It is known that there is a great decline in *Hirudo medicinalis* population because of this.

#### **Beyşehir Lake**

Beyşehir Lake is Turkey's largest freshwater lake and since its water quality is close to clean water, it is even used for drinking water by the surrounding towns. Environmental pollution in recent years and excessive water use, however, caused important problems in the ecological structure of the lake. This led to a decrease in the water level of the lake and brought appropriate and wide habitats for *Hirudo medicinalis*. In previous years reedy areas were only by the coastline and they were quite limited but as a result of the shoaling in Beyşehir Lake, surface area of the macrofits has fairly widened today. This development which can cause important problems at Beyşehir Lake in the future also brought together appropriate habitats for *Hirudo medicinalis*. Despite all these, *Hirudo medicinalis* habitats are quite small compared to the whole lake surface.

#### **Uluabat Lake**

Although Uluabat Lake is shallow and has a eutrophic character, appropriate habitats for *Hirudo medicinalis* are only by the coastline. An important part of the lake surface is open area and reedy sites are quite small compared to the lake's surface. It is known that commercial leech collection was made in Uluabat Lake in previous years, though not wide scale.

#### **Sultan Reeds**

Sultan Reeds is especially important since it involves areas with quite different ecological characteristics. Salty, bitter and fresh water environments are located within the same basin. *Hirudo medicinalis* could not be found in salty environments in this ecosystem. On the other hand, *Hirudo medicinalis* populations were detected in the fresh water site called Örtülü Akar Marshes. This site is completely covered with underwater and surface macrophyte vegetation. Open surfaces are quite small in this lake and therefore, it is an appropriate habitat for *Hirudo medicinalis*.

### **DISCUSSION**

Among the 34 wetlands detected to contain *Hirudo medicinalis* taking the Kasperek et al. (2000) study as a basis, 18 of them were examined in detail in this

study. These wetlands were chosen because they have important *Hirudo medicinalis* population. In this regard, the population density and size of the wetland (appropriate hirudo habitat in the wetland) were taken as basis and wetlands were classified according to their importance.

At the end of the study it was found that the most important areas in terms of *Hirudo medicinalis* were Karamuk Marshes and Işıklı Lake. They are followed by Karagöl-Sinop and Sarıköy-Kızılırmak Delta (Figure 3). In the study of Kasperek et al. (2000) Karagöl/Sinop is listed at the top in medicinal leech density, Sarıköy-Kızılırmak Delta is second, Karamuk Marshes is third. Işıklı Lake which is in the 9<sup>th</sup> position in terms of density in the study of Kasperek et al. (2000) is in the second place in the current study following the Karamuk Marshes. Eber Lake, when compared to this previous study, remains at the same position and is the sixth most important site. Other important wetlands apart from Kızılırmak and Yeşilirmak Deltas are observed to keep their positions.

The current table reveals that the *Hirudo medicinalis* population in the Kızılırmak Delta has diminished within the last decade. This is a concrete fact that shows the effect of excessive collecting in the region. Considering that Turkey's exported leech is completely collected from this area, the extent of the population pressure on the *Hirudo medicinalis* in Samsun and premises can be better understood. When this study is compared to the data of Kasperek et al. (2000), it can be seen that there is significant overall decrease of *Hirudo medicinalis* in Kızılırmak Delta. On the contrary, medicinal leech population increased in areas where commercial collecting is not done compared to the previous study, especially in Karamuk Marshes and Işıklı Lake. In other areas similar density distribution is noteworthy.

There is serious commercial collection only in Kızılırmak and Yeşilirmak Deltas among the eighteen wetlands with the highest amount of medicinal leech. In other wetlands this species is either collected irregularly or not collected at all.

These results demonstrate that Turkey's *Hirudo medicinalis* population is not utilized completely and regularly. The studies carried out among local collectors and traders have shown that 90% of the exported leech is collected in Kızılırmak and Yeşilirmak Deltas located on the Black Sea coast. While wetlands like Işıklı Lake, Karamuk Marshes, Eber Lake etc. have important commercial potential, *Hirudo medicinalis* is not collected from the areas due to low demand.

Many sites with high leech density and large enough to meet the needs of professional businesses have been identified in especially Central Anatolia. These are Karamuk Marshes, Işıklı Lake and Karagöl-Sinop, Manyas Lake, Efteni Lake, Gala Lake, Beyşehir Lake, Uluabat Lake and Sultan Reeds. The study also focused on these wetlands and other examined wetlands revealed either no data on leech density or they were considered to have insufficient potential.

The results of the study demonstrate the negative effects of focusing on a single site for collecting *Hirudo medicinalis* with commercial purposes. The collecting companies should also collect this species from other wetlands with important *Hirudo medicinalis* potential, rather than providing the whole quota from Samsun and premises. Since this will lead to a homogenous distribution of the annual export quota among wetlands, it will decrease the pressure on the populations in certain areas. Therefore, the collecting and exporting companies' developing their infrastructure in a way to collect from other wetlands while filling their quotas is quite important for a sustainable *Hirudo medicinalis* export policy.

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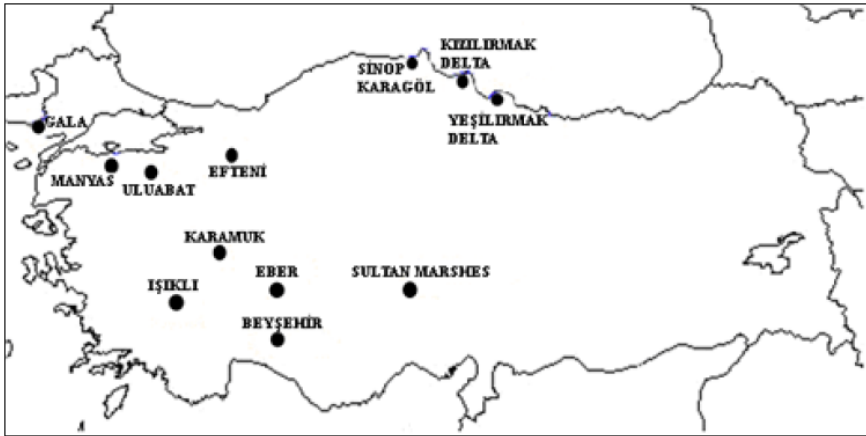


Figure 1. The examined wetlands.

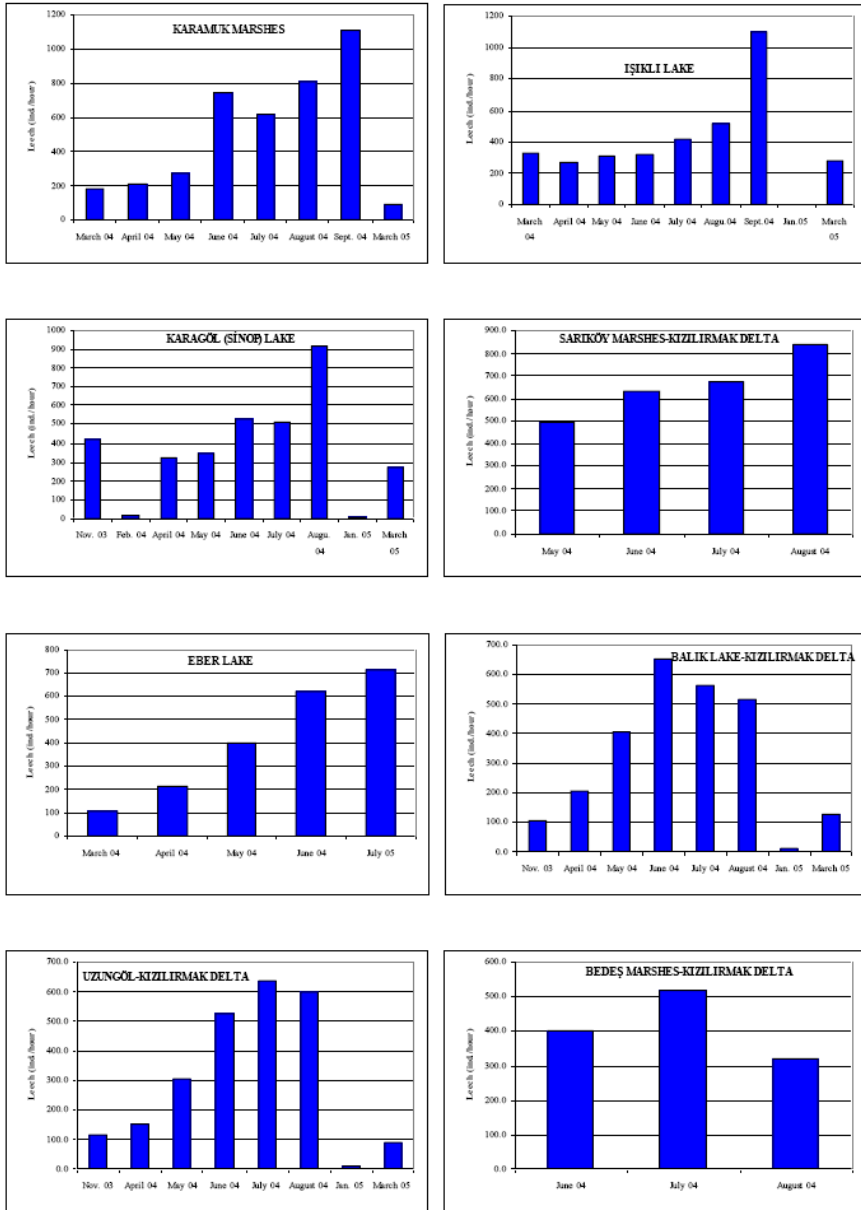


Figure 2a. Population Density of Medicinal Leeches according to mounts and wetlands (1 person/1 hour).



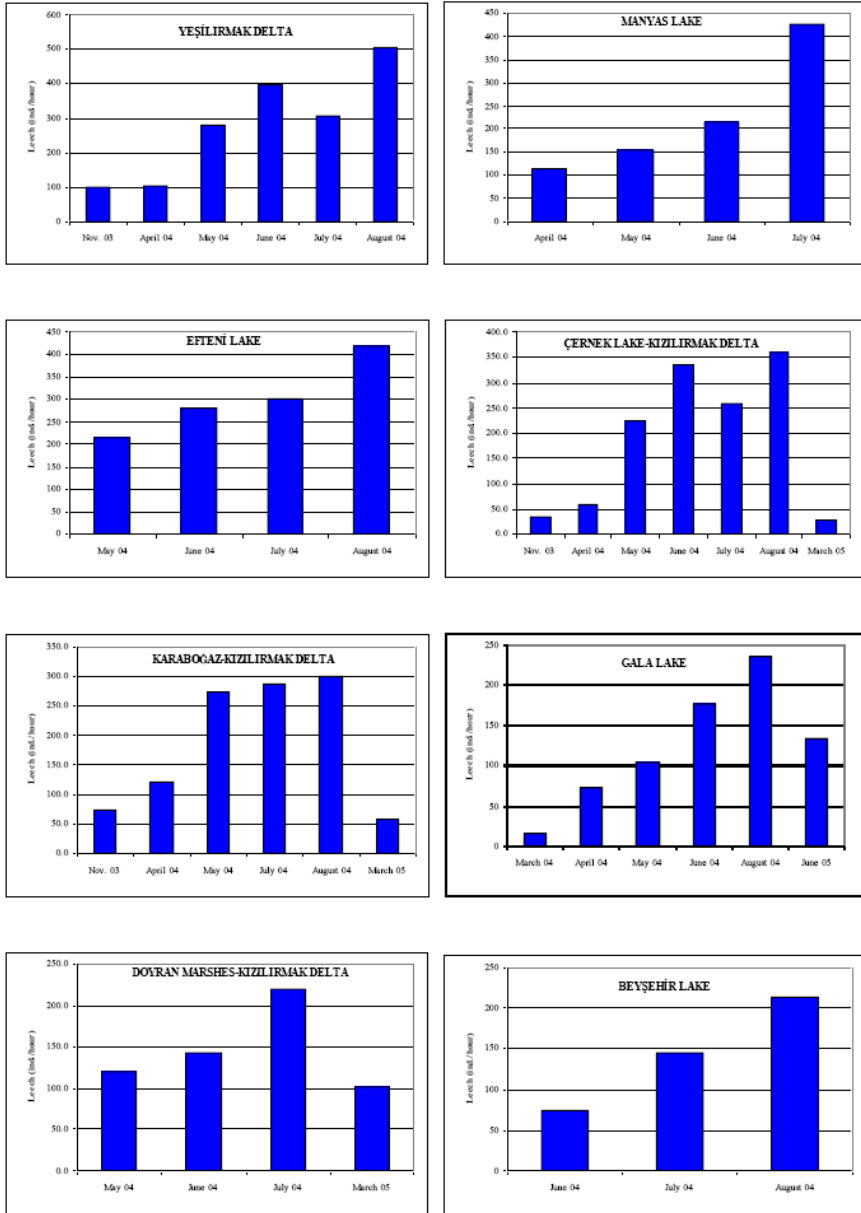


Figure 2b. Population Density of Medicinal Leeches according to mounts and wetlands (1 person/1 hour).

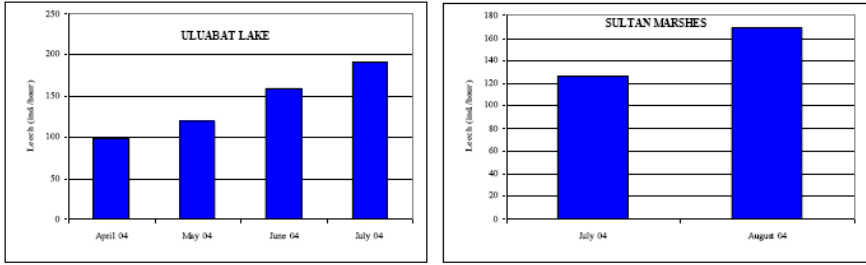


Figure 2c. Population Density of Medicinal Leeches according to mounts and wetlands (1 person/1 hour).

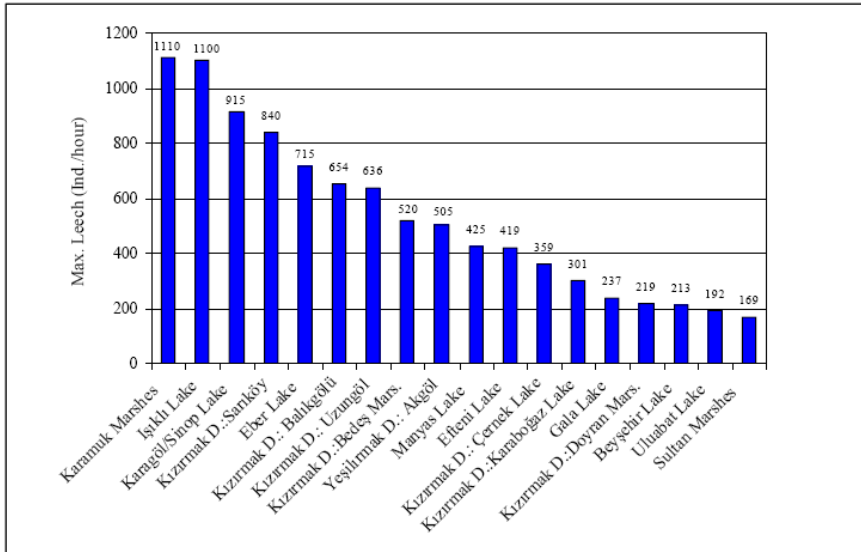


Figure 3. Maximum *Hirudo medicinalis* amounts according to wetlands (1 person/1 hour).