


CHARACTERISTICS OF MEAT PRODUCTIVITY IN CHUB, *Squalius cephalus* (L., 1758) FROM UPPER AKÇAY RIVER, BUYUK MENDERES BASIN (TURKEY)


Hüseyin ŞAŞI*

Fisheries Faculty, Mugla Sıtkı Kocman University, Turkey, hsasi@mu.edu.tr

 <https://orcid.org/0000-0003-2734-3671>

Mohammed SAIDU,

Fisheries Faculty, Mugla Sıtkı Kocman University, Turkey, gidagida21@gmail.com

 <https://orcid.org/0000-0001-7338-2693>

Received: 26.10.2017, Accepted: 16.05.2018

*Corresponding author

Research Article

DOI: 10.22531/muglajsci.346772

Abstract

The meat productivity of chub (*Squalius cephalus*) and the relationship between various organs of the body were determined after catching 153 fish samples from upper Akçay River, South Aegean Region between June 2012 and May 2013. In this study, the following results are obtained; percentage of head weight 16.00%, visceral weight 9.90%, fins weigh 6.30% and Meat productivity 67.10%. Depending on their age between I and VII, chub population meat efficiency percent was determined as 64.44; 66.86; 70.63; 71.73; 71.31; 71.01 and 67.60 respectively. These results show that meat production increased as the age increases. It was later proposed to catch fish that have reach maturity age and are larger than 16,20cm length. Results showed that meat productivity of fish was increased after age V. in this river.

Keywords: *Squalius cephalus*, Chub, Meat productivity, body ratio, Akçay River, Muğla

BÜYÜK MENDERES HAVZASI AKÇAY'IN ÜST KISMINDAKİ TATLISU KEFALİ, *Squalius cephalus* (L., 1758) ET VERİMLİLİĞİ ÖZELLİKLERİ (TÜRKİYE)

Öz

Bu çalışmada Güney Ege Bölgesi'nde Büyük Menderes havzasındaki Akçay'ın üst kısımlarından yakalanan 153 adet tatlısu kefali (*Squalius cephalus*)'nin et verimliliği ile çeşitli vücut organları arasındaki ilişkiler incelenmiştir. Bu tür yörede ekonomik öneme sahiptir. Yapılan araştırma sonucunda, yüzdelik olarak ortalama baş ağırlığı oranı %16.00; iç organların ağırlığı %9.90; yüzgeç ağırlığı %6.30 ve et verimliliği %67.10 olarak bulunmuştur. Tatlısu kefali popülasyonunun I-VII yaşları arasındaki et verimliliği, yüzde olarak sırasıyla 64.44; 66.86; 70.63; 71.73; 71.31; 71.01 ve 67.60 olarak belirlenmiştir. Buna göre, yaş arttıkça et verimliliğinin de arttığı görülmektedir. Balıkların eşeyssel olgunluğa eriştikten sonra 16.20 cm'ye ulaştıktan sonra yakalanması önerilebilir. Çalışma sonuçları bu nehirde yakalanan balıkların et verimliliğinin V. yaşından sonra arttığını göstermiştir.

Anahtar Kelimeler: *Squalius cephalus*, Tatlısu kefali, Et verimliliği, Vücut oranları, Akçay, Muğla

Cite

Şaşı, H., Saidu, M., (2018). "Characteristics of meat productivity in chub, *Squalius Cephalus* (L., 1758) from upper Akçay river, Büyük Menderes basin (Turkey)", *Mugla Journal of Science and Technology*, 4(1), 1-5.

1. Introduction

The chub, *Squalius cephalus* (L., 1758) is distributed Turkey wide in inland waters (Lakes and rivers). From the South Aegean region; *S. cephalus* is a native fish species from Akçay River (Buyuk Menderes Basin) that is locally consume [1].

Chub (*Squalius cephalus*) is among the Cyprinidae family and also one of the most common species in Anatolian freshwater. *Squalius cephalus* (Linnaeus, 1758) can be found in Europe, Black Sea, and Caspian Sea basin. Chub is benthopelagic and potamodromous [2].

Squalius cephalus is dominant with other native species, *Acatobrama mirabilis* in the upper Akçay River [3]. The chub populations are abundant in running water like Lakes, Barbel zone, riffles, pools and dams [1, 4, 5], because the species have high ecological tolerance [2].

Some bio-ecological characteristics of various chub populations was studied in some areas of Turkey [6-11] and Europe [12-14].

Chub meat productivity is economically important for the benefit of the people in the region. There are more marketing opportunities when compared with other species. Few spikelet's, meaty fish are more commonly held in markets due to high meat efficiency and quality. The price of fish is determined according to the species. There is an extra charge for cattle and sheep meat if it's above 50% [15,16].

From other studies conducted on meat productivity; Celikkale [17] compared the total body weight of various organs in cultured carp with that of other agricultural animals, Ozdemir [18]. Tigris scraper, *Capoeta capoeta umbla* (Heckel, 1843) in Elazig-Hazar Lake, meat productivity, Ozdemir and Temizer [16], carp, *Cyprinus carpio* in Cildir Lake, Sasi [19], chub,

Squalius cephalus and Sasi [20], bergama barb, *Capoeta bergamae* in Topcam Dam Lake.

Chub has an economic important to the local people in the region. This study concentrates more on meat productivity and its characteristics. The relationship between head, internal organ, fin weight, carcass weight and body weight of *Squalius cephalus* were calculated in other to know the meat productivity of the species.

2. Materials and Method

The study was carried out in upper Akçay River from 3 different districts (Esençay, Goktepe, Camoluk) of Aydın and Muğla provinces (Figure 1). Samples were collected monthly between June, 2012 and May, 2013 by the use of seine net and electro-fishing. The nets and electro-shocker were randomly sampled leaving the various parts of the River suitable for fishery. The 153 fish Samples were group according to their ages; I. age 15, II age 44, III. age 38, IV. age 27, V. age 18, IV. age 7 and VII. age 4 individual.

The fish samples retrieved from the river were reserved under 4-5% formalin solution in cold room. The samples were measured using fork length (cm, LF) with a 0.1 mm precision ruler. Total body, head, internal organ and fin weights were measured with electronic scales with a sensitivity of 0.01 g. The caudal, dorsal, ventral, pectoral, anal fins and head region are carefully cut with a sharp lancet. The internal organs were removed by opening the abdomen and chest of the fish. Age prediction was determined by microscopic examination of scales, which were collected above the lateral line of the fish [21].

For meat efficiency, head, internal organs and fins weight were weigh individually and proportionally to total weight [15].

Fork size (LF): The fork size of each fish was determined on a 1 mm precision measuring bench.

Body weight (WT): Indicates the total weight of the fish. Each individual's weight was recorded by weighing with a precision scale of 0.01 g.

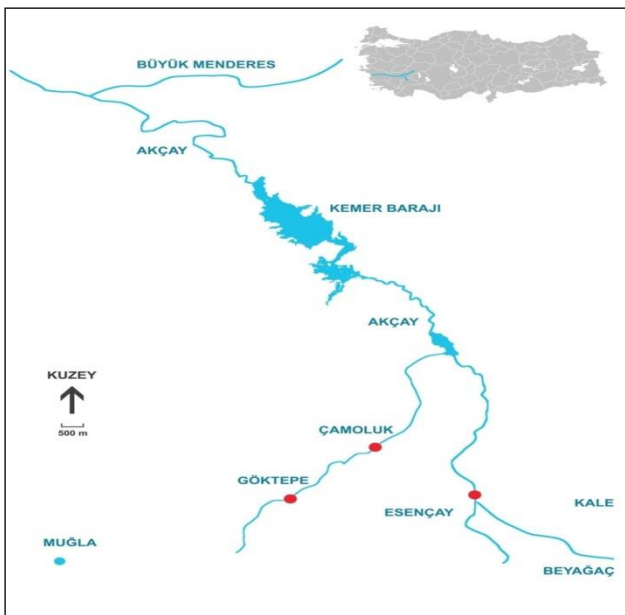


Figure 1. Study area in Upper Akçay River.

Head weight (HeadW): The head's operculum were cut with a sharp lancet and measured on a precision scales with a scale of 0, 01.

Internal organs weight (VisW): The samples were measured on a precision scales with a sensitivity scale of 0, 01 after the abdominal and chest regions is opened and internal organs are extracted.

Fin weight (FinW): Pectoral, ventral, dorsal, anal and caudal fins were cut with a sharp blade and the weight of all fins was determined with a scale of 0.01 gr.

Carcass weight (CaW): The internal organs (together with gonads), head, fins and the remaining part were evaluated in calculating meat yield.

Meat Yield (%), from total body weight, head, internal organ and fins weight were first removed before measuring carcass.

It is benefited by the fact that it is practically and sufficiently healthy at the age of determination [22]. From this study the mean values (Avg.) and standard deviation (SD) obtained are given

3. Results

2.1. Meat Efficiency

S. cephalus population determines the meat productivity of carcass weight. The head and fins of the fish were cut, the internal organs removed and the weight ratio of every part was calculated (Table 1).

The mean percentage weights of *S. cephalus* population, without separating from the bones are found to be carcass weight 67.10%. Internal organ weight 9.90%, Head weight 16.00% and fin weight 6.30%.

Table 1. Meat productivity in *S. cephalus* population from upper Akçay River.

Body part	Min.	Max.	Avg.±SD
Total weight (WT, g)	4.60	109,70	56,80±74.80
Head weight (HeadW, g)	0.70	15.40	8.10±10.40
Visceral weight (VisW, g)	0.70	10.00	5.20±6.80
Fin weight (FinW, g)	0.20	6.80	3.50±4.60
Carcass weight (CaW, g)	2.60	76.60	39.60±52.40
HeadW./ WT (%)	14.00	17.90	16.00±2.80
VisW./ WT (%)	9.10	10.60	9.90±1.10
FinW / WT (%)	4.50	6.50	6.30±0.10
CaW / WT (%)	56.00	69.80	67.10±3.80

2.2. Some Organ Weights and Length of Age

According to age characteristic, the fish samples were characterized in accordance to minimum, maximum, average values of body size, head, internal organ and fin weights in grams (g) and fork length of *Squalius cephalus* in upper Akçay River (Table 2).

the I-VII age groups of *S cephalus* average values changed in lengths 7,25-20,10 cm, body weights 7,35-98,03 g, head weights 1,13-13,69 g, internal weights 0,81-8,76, fin weights 0.47-6.06 and carcass weights 4.73-66.27 g. respectively.

Table 2. Meat productivity in *S. cephalus* population from upper Akcay River.

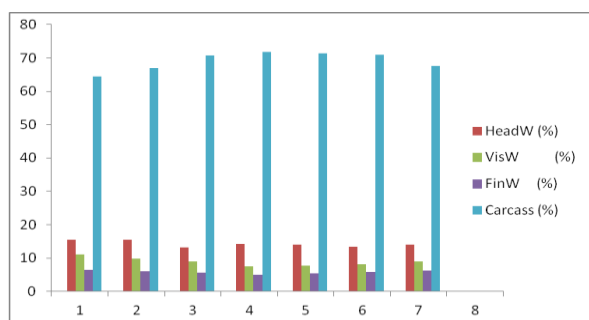
Age	N	LF ± SD (min-max) (cm)	WT±SD (min-max) (g)	HeadW±SD (min-max.) (g)	ViscW±SD (min-max.) (g)	FinW±SD (min-max) (g)	CaW±SD (min-max.) (g)
I	15	7.25±0.803 (6.1-8.6)	7.35±2.397 (3.96-10.46)	1.13±0.299 (0.71-1.60)	0.81±0.225 (0.42-1.30)	0.47±0.160 (0.21-0.78)	4.73±0.059 (2.55-7.40)
II	44	10.04±0.574 (9.1-11.2)	16.50±7.517 (10..87-21.90)	2.54±0.707 (1.80-3.06)	1.62±0.707 (0.70-2.56)	1.01±0.537 (0.52-1.51)	11.03±0.606 (6.59-15.50)
III	38	12.1±0.530 (11.2-13.0)	27.37±3.530 (20.92-34.70)	3.62±0.589 (2.65-4.84)	2.45±0.327 (1.87-3.16)	1.53±0.249 (1.00-2.10)	19.33±2.216 (14.48-24.28)
IV	27	14.1±0.743 (12.8-15.4)	44.55±7.835 (33.58-63.82)	6.32±1.115 (4.45-8.30)	3.34±0.619 (2.22-3.34)	2.27±0.442 (1.53-3.91)	31.95±6.376 (23.93-45.10)
V	18	16.21±0.738 (15.3-17.9)	63.31±6.425 (53.20-75.38)	8.92±0.648 (7.90-10.00)	4.83±0.616 (3.46-6.27)	3.48±0.382 (2.82-4.10)	45.15±7.796 (36.33-53.91)
VI	7	18.27±0.364 (17.9-19.0)	79.99±4.101 (74.60-85.90)	10.66±1.328 (9.50-12.90)	6.60±0.627 (5.65-7.36)	4.68±0.239 (4.38-5.10)	56.81±2.044 (53.35-60.86)
VII	4	20.10±0.493 (19.5-20.6)	98.03±8.899 (88.14-109.7)	13.69±1.420 (12.13-15.4)	8.76±0.875 (8.00-10.00)	6.06±0.522 (5.61-6.80)	66.27±0.493 (61.29-70.39)

2.3. Ratio of Organs to Body Weight and Meat Yield

The percentage ratios (%) of the various organ weights and meat yield capacity of chub to body weight are given in Table 3. The fish samples show differences according to their age groups. Head weight ratios 13.23-15.42%, internal weight ratios 7.49-10.99%, fin weight ratios 5.10-6.37%, and meat efficiency 64.44-71.73% (Table 3 and Fig 2).

Table 3. The percentage of age groups of *S. cephalus* meat efficiency from organs of body weight (%).

Ages	N	HeadW (%)	VisW (%)	FinW (%)	CaW (%)
I	15	15.41	10.99	6.37	64,44
II	44	15.42	9.82	6.14	66,86
III	38	13,23	8.97	5.60	70,63
IV	27	14.19	7.49	5.10	71,73
V	18	14.09	7.63	5.50	71,31
VI	7	13.32	8.25	5.85	71,01
VII	4	13.97	8.94	6.18	67,6

Figure 2. The percentage of body weight of *S. cephalus*, relations between various organs and meat efficiency (%).

4. Discussion and Conclusion

The age distribution of *S. cephalus* population from upper Akcay River change between I and VII.

Part of the fish that can be evaluated is described as the total ratio of meat supply [15], [23]. The fish size change according to species, fishing season and nutrition. During breeding season, the female's gonads increase in number but the meat capacity decrease, after extracting the head, internal organs and fins, 70% of the meat remains.

Akcay River is located in southwestern Turkey; the basin is under temperate climate. Cyprinid species develop healthy in water with a biological characteristic of 20 °C.

The average meat yield of the examined species is around 67.10%, head weight at 16.00%, internal organ weight at 9.90% and fin weight at 6.30%. Aras *et al.* [24] mentioned that the average performance of carcass weight, head weight, internal organ weight and fin weight were found to be 61.44%, 22.32%, 12.78% and 1.51%, respectively, from the study conducted on *C. capoeta umbla* (Heckel, 1843) population in Karasu River. The ratios were found to be different to each other. Celikkale [17] found a meat yield of 56.50% in a study conducted on cultural carp, *C. carpio*. Mirror carp grown in cultural conditions in the Aegean Region, meat yield was determined as 58.40% and in wild carp as 66.30% [25]. Sasi [19] reported that the meat yield of chub (*Leuciscus cephalus* L., 1758) in Topcam Dam Lake to be 62.73%.

Ozdemir and Temizer [16] reported that the average meat yield of carp was 61.53%, head weight 17.56%, internal organ weight 15.85% and the fin weight 3.76% in Cıldır Lake. This shows the values of meat yield and head weight. This result is close to the report we obtained.

The organs weight and body weight increased according to age (Table 2, Figure 2). At I. age meat weight was 4.73 g and at VII. age meat weight was 66.27 g.

S. cephalus meat yield ratios were 64.44% low at I. age while in IV. age the ratio was %71,73 high. This appears to be the highest value of age that was determined. Ikiz *et al.* [26] found that the meat yield of ell (*A. anguilla* L., 1758) in the Aksu Stream varied between 69.04% and 71.85%.

The rate of meat productivity is higher than 70% in fish with small head and internal organs such as trout (Salmonidae), tuna (*Thunnus thynnus*), and ell (*Anguilla anguilla*). In fishes with large head and stomach contents, such as whiting (*Merlangius merlangus*) and carp (*Cyprinus carpio*), meat yield is less than 70% [15].

The population of *S. cephalus*, is abundant in South Aegean region. It was found to grow up to 109.70 g weight and 20.10 cm in the study area. While the mean weight of 27.37 g and the mean weight of carcass (19.33g) was found at III. age, at age IV the weights reached 44.55 g with average weights of 31.95 g respectively. They could grow up to 308.80 g weight and 26.00 cm in Topcam Dam Lake [20].

In previous study, it was suggested that the chub population in the region reached its sexual maturity between age III and IV. It has been proposed to catch fish longer than 16, 20 cm in height after reaching maturity age. In addition, the exploitation rate of this population is found 45% by Sasi and Ozay [3].

The river is suitable for the development of chub population and meat productivity, but meat productivity is less than lentic habitats. In this River implementation of V. age fish will increase meat productivity. It would be appropriate to use this method more economically.

5. Acknowledgment

The authors wish to thank the Mugla Sitki Kocman University Research Fund (BAP-12/88) supporting the study. Also, Thanks to Mr. Recai Genc to help in field collecting fish samples.

6. References

- [1] Geldiay, R. and Balık, S., *Türkiye Tatlısu Balıkları*, Ege Üniv. Su Ürünleri Fak. Yayın No: 46, II. Baskı, İzmir, 532 p., 1996.
- [2] Kottelat, M. and Freyhof, J., *Handbook of European Freshwater Fishes*, The World Conservation Union (IUCN), Switzerland, 646 p., 2007.
- [3] Sasi, H., and Ozay, S., "Investigation of Bio-Ecological Characteristics of European chub (*Squalius cephalus* L., 1758) in Akcay River", *Mugla Sitki Kocman University, BAP Project 12/88*, Mugla, 100 p., 2014.
- [4] Slastenenko, E., "Fish Fauna in Black Sea Basin", *Et ve Balık Kurumu Umum Müdürlüğü Yayınları*, Ankara, 711 p., 1956.
- [5] Sasi, H. and Balık, S., "Age, growth and sex ratio of chub (*Leuciscus cephalus* L., 1758) in Topçam Dam Lake (Aydın, Turkey)", *Ege Journal of Fisheries and Aquatic Sciences*, 20, 503-515, 2003.
- [6] Unlu, E. and Balci, K., "Savur Cayı'nda Yaşayan Bazı Cyprinidae (Pisces) Eşeyssel Olgunluk Yaşı, Yumurtlama Dönemi ve Yumurta Verimi Uzerine Bir Araştırma", *Ege Univ. Egitiminin 10. Yilinda Su Urunleri Sempozyumu*, İzmir, pp. 347-356, 1991.
- [7] Yerli, S.V., Çalışkan, M. and Canbolat, A.F., "Cıldır Gölü (Ardahan)'ndeki *Leuciscus cephalus*'un büyüme ölçütleri üzerine incelemeler", *Turkish Journal of Zoology*, 23, 271-278, 1999.
- [8] Kalkan, E., Yilmaz, M. and Erdemli, A.U., (2005). Some biological properties of the *Leuciscus cephalus* (L., 1758) population living in Karakaya Dam Lake in Malatya (Turkey). *Turkish Journal of Veterinary and Animal Science*, 29, 49-58.
- [9] Koc, H.T., Erdogan, Z., Tinkci, M. and Treer, T., "Age, growth and reproductive characteristics of chub, *Leuciscus cephalus* (L., 1758) in the İkizcetepeler Dam Lake (Balıkesir, Turkey)", *Journal of Applied Ichthyology*, 23, 19-24, 2007.
- [10] Bostancı, D. and Polat, N., (2009). Age Determination and Some Population Characteristics of Chub (*Squalius cephalus* L., 1758) in the Camlıdere Dam Lake (Ankara, Turkey). *Turkish Journal of Science & Technology*, 4,1, 25-30.
- [11] Innal, D., "Population Structures and Some Growth Properties of Three Cyprinid Species [*Squalius cephalus* (Linnaeus, 1758); *Tinca tinca* (Linnaeus, 1758) and *Alburnus escherichii* Steindachner, 1897] Living in Camkoru Pond (Ankara-Turkey)", *Kafkas Univ Vet Fak Der.,16 (Suppl-B)*, 297-304, 2010.
- [12] Treer, T., Habekovic, D., Safner, R., Kolak, A. and Anicic, I., "Length-mass relationship in chub (*Leuciscus cephalus*) from five Croatian Rivers", *Agriculturae Conspectus Scientificus*, 64, 137-142, 1999.
- [13] Markovic, G., Simic, V., Ostojic, A. and Simic, S., "The diet of *Leuciscus cephalus* L. in the reservoir Medjuvsje (Western Morava, Serbia)", *Acta Agriculturae Serbica*, 8, 75-81, 2003.
- [14] Raikova-Petrova, G., Hamwi, N. and Petrov, I., "Spawning, Sex Ratio and Relationship between Fecundity, Length, Weight and Age of Chub (*Squalius cephalus* L., 1758) in the Middle Stream of Iskar River (Bulgaria)", *Acta Zool. Bulg.*, 64,2, 191-197, 2012.
- [15] Anıl, N., Nizamoğlu, M. ve Doğruer, Y., "Balıklarda Grading Sisteminin Geliştirilmesi ve Kalite Kontrolünün Tespiti Üzerinde Çalışmaları", *S. Ü. Vet. Fak. Derg.* 4 (1), 238-249, 1989.
- [16] Ozdemir, N. ve Temizer, A., "Cıldır Gölünde Yaşayan Sazanların (*Cyprinus carpio* L. 1758) Et Verimi İle İlgili Bir Araştırma", *Fırat Üniv. XI. Ulusal Biyoloji Kongresi*, Elazığ, pp. 175-178, 1992.
- [17] Celikkale, M. S., *Kültür Sazanlarında çeşitli organların toplam vücut ağırlığındaki oranları, yenilebilir kısmın miktarı ve diğer ekonomik içsu balıkları ve tarım hayvanları ile karşılaştırılması*, TÜBİTAK IV. Bilim Kong. Veteriner ve Hay. Araşt. Grub. Teb., Tübitak Yayın No: 389, V.H.A.G. Seri No: 10, Ankara, 1978.
- [18] Ozdemir, N., "Elazığ-Hazar Gölü'nde Yaşayan *Capoeta capoeta umbla* (Heckel, 1843)'nın Et Verimi İle İlgili Özellikleri", *E. Ü. Faculty of Science Journal Series B, Suppl.*, 2, 149-161, 1983.
- [19] Sasi, H., "Güney Ege Bölgesi'ndeki Tatlısu Kefalinin (*Leuciscus cephalus* L. 1758) Et Verimi İle İlgili Özellikler", *Istanbul Üniv., Su Ürünleri Dergisi*, 17, 1-7, 2004.
- [20] Sasi, H., "Güney Ege Bölgesi'ndeki Topcam Baraj Gölü'nde Yaşayan Siraz Balığının (*Capoeta bergamae* Karaman, 1969) Et Veriminin Belirlenmesi", *Ege Üniv., Su Ürünleri Dergisi*, 26,1, 35-38, 2009.
- [21] Lagler, K.F., *Freshwater Fishery Biology*. W.M.C. Brown Company, Iowa, USA, 1956.
- [22] Ekingen, G. ve Polat, N., "Age Determination and Length-Weight Relations of *Capoeta capoeta umbla* (Heckel) in Lake Keban", *Doğa Tr. J. of Zooloji Der.*, 11,1 : 5-15, 1987.
- [23] Gulyavuz, H. ve Altinkurt, A., *Besin İşleme Teknolojisi*. M.E.B. Basımevi, İstanbul, 320 p., 1991.
- [24] Aras, S., Yanar, M. and Bircan, R., *Karasu Irmağı'nda Yaşayan Capoeta capoeta umbla (Heckel,1843)'nın Et Verimi ile Çeşitli Vücut Organları Arasındaki İlişkiler*, Atatürk üniversitesi, Ziraat Fak., Erzurum, pp. 106-115, 1992.
- [25] Albaz, A. G. ve Hoşsucu, H., "Gölmarmara Sazanı (*Cyprinus carpio* L.) ve Aynalı Sazan (*Cyprinus carpio* L. var: Royal)'ın Ege Bölgesi Kültür Koşullarında Verim Özellikleri Üzerinde Araştırmaları", *Doğa Bil. Der.*, Seri: D, 4 (3), 1980.
- [26] İkiz, R., Gülyavuz, H. ve Küçük, F., Aksu Çayı'ndaki Yılan Balıklarının (*Anguilla anguilla* L., 1758) Eterinin Kimyasal Yapısı Üzerine Bir Araştırma, *Tr. J. of Zoology*, 171-175, 1994.