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Seasonal and age dependent variations in meat yield of abu mullet (*Planiliza abu* (Heckel, 1843)) from Orontes River

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Abstract: Investigation on the seasonal and age dependent meat yield of *Planiliza abu* has been carried out on 299 specimens collected from Orontes River between April 2012 and March 2013. Analysis of meat yield was based on the calculation of the ratio between the body weight and the weight of organs or body parts e.g. head, fins, and internal organs. Average meat yield was found to be 65.51% and head weight was 16.54% of the body weight. Weight ratios of fin, internal organs and other parts including gonads of the fish to body weight found as 2.47%, 11.74% and 3.74%, respectively. Age dependent average meat yields have varied from 63.34% at age 0 to 70.68% at age IV. Therefore, it can be concluded that average meat yield (productivity) increases with the age. Seasonal productivity was minimum in winter ($63.16 \pm 1.51\%$) and maximum in autumn ($66.41 \pm 0.43\%$). Moreover, there were strong correlations between body weight and head weight, and the weight of internal organs, and meat yield, and correlations were determined as 0.9283, 0.8354 and 0.9668, respectively.

Keywords: *Planiliza abu*, meat yield, Orontes River, Hatay.

Introduction

Abu mullet, *Planiliza abu*, is the only freshwater representative of this genus. Besides Euphrates and Tigris Rivers, *P. abu* is found in Orontes River (Özcan, 2013). This species is an exotic (alien) species for the River Orontes and Yalçın-Özdilek (2003) claimed that this species introduced to this river by human around the year 2000. In addition, it is commercially important due to its high economic importance (Abd et al., 2009).

The Orontes River (Asi in Turkish and Arabic) is the main river draining to the Levant coastline of the Mediterranean Sea. The Orontes River is an important freshwater resource of the Eastern Mediterranean region and 380 km long in total. The river rises from Lebanon and crosses Syria before running into the Mediterranean Sea in Samandağ, a town of the Hatay Province, Turkey. The length of the river in Turkey is 94 km and it passes through Antakya (Antioch), the central town of Hatay. The tributaries of Orontes River are Karasu, Afrin, Büyük Karaçay and Küçük Karaçay streams in Turkish boundaries (Özcan et al., 2012). The aim of this study is to provide information on the meat yield of *P. abu*

inhabiting Orontes River Basin.

Materials and Methods

This study was carried out using specimens collected monthly for 12 months from April 2012 to March 2013. Specimens were collected either by electrofishing or using fishing nets. Specimens were transported into the laboratory prior to length and weight measurements. Fork lengths of the specimens were measured with 1 mm precision. Likewise total weight (TW), head weight (HW), internal organ weight (IOW), gonad weight (GW) and fin weight (FW) were measured at 0.01 g precision using a sensitive electronic scale.

Dissection and weight measurements of the body parts and organs were carried out after scaling of specimens intact. Internal organs except gonads were weighed following abdominal dissection of the specimens. Dissection of heads and fins were also realized meticulously for measurements. Carcass weight was determined by weighing fish remaining after the dissection of body parts and organs, and meat yield (%) was calculated by determining the ratio of the weight of

Table 1. Descriptive statistics of weight of *Planiliza abu*.

Measurements Ratios	Min	Max	Mean±SD
TW (g)	0.30	66.40	11.79±0.71
HW (g)	0.06	9.35	1.68±0.09
FW (g)	0.02	1.91	0.32±0.03
CW (g)	0.20	44.5	8.70±0.69
IOW (g)	0.02	9.75	1.53±0.10
Fork Length (cm)	3.7	18.5	10.0±0.20
HW/TW (%)	8.19	30.43	16.54±0.40
FW/TW (%)	0.82	6.67	2.47±0.12
IOW/TW (%)	3.64	27.17	11.74±0.25
Meat Yield (%)	46.15	75.38	65.51±0.69
CW/TW			

Table 2. Age dependent meat yield and proportions of body parts and organs of *Planiliza abu*.

Age	N	HW/TW %	IOW/TW %	GW/TW %	FW/TW %	Meat Yield %
0	80	19.88±0.36	9.75±0.43	4.64±0.68	2.39±0.08	63.34±1.37
I	91	16.40±0.24	12.23±0.47	3.96±0.29	2.40±0.06	65.01±0.71
II	85	14.74±0.31	12.67±0.44	3.07±0.47	2.61±0.14	66.91±0.93
III	41	14.17±0.38	12.63±0.69	3.38±0.66	2.70±0.05	67.12±0.51
IV	2	14.12±0.65	12.12±0.75	0.59±0.39	2.49±0.12	70.68±1.21

carcass to the weight of the whole fish.

Otolith reading was performed to determine the age of fish. Sagittal otoliths of specimens were cleaned with distilled water, and then, placed in a petri dish containing 1:1 distilled water and glycerin. Age reading was carried out using stereomicroscope equipped with the overhead light. Descriptive statistics; minimum (Min) and maximum (Max) values, mean (M) and standard deviation (SD) of analyses has been given in Table 1.

Results

The proportion of the body parts and organs revealed that head comprised %16.54 of total weight (Table 1). Internal organs, gonads and fins were %11.74%, 3.74% and 2.47% of the weight, respectively. Remaining 65.51% was the meat yield of *P. abu*.

Age dependent average meat yield of the individuals of *P. abu* varied between 63.34% for age 0 and 70.68% for age IV and it was vise versa for head weight ratio with 14.12% for age IV and 19.88% for age 0 (Table 2). The proportion of the internal organs was the highest (12.67%) at age II while it was the lowest (9.75%) at age 0. FW/TW ratio ranged from 2.39% (age 0) to 2.70% (age III). The proportion of the gonads was the most fluctuating parameter. It was 4.64% of the total weight at age 0. Whereas the lowest value for gonad weight ratio (0.59%) was obtained at age IV. Figure 1 shows that the meat yield

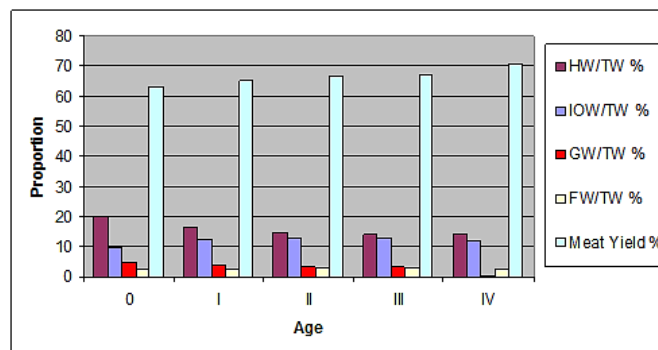


Figure 1. Age dependent meat yield and proportions of body part of *Planiliza abu*.

of *P. abu* increases with the age (Table 2).

Seasonal variations in the meat yield and proportions of body parts of *P. abu* inhabiting in Turkish part of Orontes (Asi) summarized in Table 2. Accordingly, seasonal variation in meat yield (between 63.16% in winter and 66.41% in spring) was similar to that of the head weight/total weight (16.03% and 17.71%, respectively). The rate of internal organs was the highest (15.24%) in spring and reached to the lowest value (9.61%) in autumn. In contrast, the proportion of the weight of fins to total body weight was the lowest (2.36%) in spring and the highest (2.65%) in autumn. The ratio of the gonads was the most fluctuating parameter as it was the same in age dependent proportions. The results of seasonal variation regarding the ratio of gonad weight

Table 3. Seasonal variations of meat yield and proportions of *Planiliza abu*.

Seasons	N	HW/TW %	IOW/TW %	GW/TW %	FW/TW %	Meat Yield %
Spring	56	16.09±0.48	15.24±0.59	0.43±0.65	2.36±0.05	65.88±0.43
Summer	62	16.50±0.30	11.93±0.65	4.23±0.81	2.37±0.11	64.97±0.91
Autumn	71	17.71±0.38	9.61±0.45	3.62±0.33	2.65±0.45	66.41±0.43
Winter	110	16.03±0.37	11.22±0.26	7.06±0.27	2.53±0.06	63.16±1.51

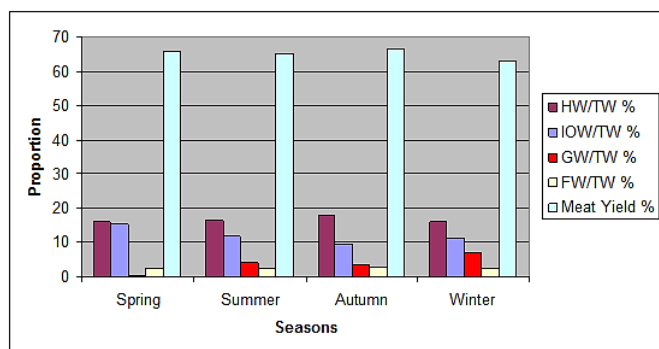


Figure 2. Seasonal changes in meat yield and proportions in *Planiliza abu*.

revealed that the gonads were almost empty (0.43% of the total weight) in spring and reached to 7.06% in winter (Table 3).

Based on the results, the seasonal variations in the proportions of fins and head were rather low in compare to the variations in the meat yield and the rate of internal organs (Fig. 2). While the meat yield is high in spring; a decrease was obvious in summer. The consequent increase in autumn was followed by a drop to the lowest value in winter. The weight of the gonads was the most varying parameter and a sudden drop, most possibly due to spawning, was observed in spring after a peak in winter. Calculation of correlations has revealed that there were strong positive correlations between total body weight and the parts and organs of *P. abu*. The correlation with head weight found to be $r^2=0.9694$ ($y=0.1621x+0.0469$). The value was $r^2=0.9242$ ($y=0.1506x-0.0691$) for the weight of internal organs. It was $r^2=0.9652$ ($y=0.0155x+0.0135$) for fins ratio and the correlation with gonad weight was found to be $r^2=0.8732$ ($y=0.0159x+1.3664$). Moreover, a strong positive correlation was also found between total body weight and meat yield ($y=0.6427x+0.0586$; $r^2=0.9499$).

Discussion

Meat yield of *P. abu* was found to be $65.51\pm0.33\%$ of total body weight. This ratio was similar to those of freshwater

fish species of Turkey (Table 4) such as *Barbus capito pectoralis* (Duman et al., 2003), *Chondrostoma meandrense* (Özcan and Balık, 2006), *Capoeta bergamae* (Şaşı, 2009) and *Capoeta umbla* (Kurt-Kaya et al., 2013). However, Zencir and Korkmaz (2004) reported a higher average meat yield for *Tinca tinca*. Meat was considerably lower for *Alburnus orontis* (Bozkurt et al., 2006), *Oncorhynchus mykiss* (Aydın et al., 2009), *Squalius cephalus* (Karaton and Gürel-İnanlı, 2011), *Capoeta trutta* (Kurt-Kaya et al., 2013) and *Carassius gibelio* (Dağtekin and Baştürk, 2014). Differences in average meat yield can be attributed to the species, habitat and available resources. Nevertheless, meat yield was usually found to be more than 50% of total weight of the species except in the case of *C. gibelio*.

It was found that the meat yield of *P. abu* increased with the age and varied from 63.34% at age 0 to 70.68 at age IV. Zencir and Korkmaz (2004) reported that that the meat yield of *T. tinca* inhabiting Beyşehir Lake was 54.34% and 54.60% for I year-old males and females, respectively. The meat yield at age VI was 62.40% for males and 62.42% for females. Meat yield of *O. mykiss* inhabiting Euphrates River ranged from 56.57% at the age of age II to 61.47% at the age of V (Aydın et al., 2009). Şaşı (2009) reported the meat yield of *C. bergamae* of Topçam Dam Lake as 65.21% at age I and 67.62% for age V. Karaton and Gürel-İnanlı (2011) found that the values were between 57.50% (age II) and 61.63% (age VIII) for *S. cephalus* inhabiting Keban dam lake. Kurt-Kaya et al. (2013) reported that *Capoeta trutta* and *C. umbla* living in Uzunçayır Dam Lake exhibited lowest meat yield (56.61% and 54.65%, respectively) at age I. However, maximum yield observed at age XI for the first species and at age VII for the second species, and the values were 60.08% and 59.50%, respectively. Based on the results, that the meat yield increases in *P. abu* in parallel to the increasing age.

It was reported that total weight was strongly positively correlated with head weight, internal organ

Table 4. Meat yield and proportion of body parts and organs in different fish species.

Author	Location	Species	Size	HW/TW %	IOW/TW %	FW/TW %	Meat Yield %
Duman et al., 2003	Keban Dam Lake	<i>Barbus capito pectoralis</i>	T:101	15.40±0.20	10.20±0.22	3.09±0.06	63.04±0.30
			F:45	15.20±0.28	10.22±0.34	3.14±0.09	62.98±0.46
			M:56	15.56±0.29	10.20±0.29	3.05±0.07	63.08±0.40
Zencir and Korkmaz, 2004	Beyşehir Lake	<i>Tinca tinca</i>	T:200	15.26±0.10	9.01±0.17	2.75±0.03	69.78±0.23
			F:98	15.14±0.14	8.87±0.23	2.71±0.04	70.11±0.33
Bozkurt et al., 2006	Kirmir Creek	<i>Alburnus orontis</i>	M:102	15.38±0.14	9.15±0.24	2.79±0.05	69.47±0.31
			T:80	14.08±0.96	13.60±0.16	13.93±0.54	58.39±0.55
Özcan ve Balık, 2006	Kemer Dam Lake	<i>Chondrostoma meandrense</i>	T:208	11.81±0.44	15.63±1.04	1.99±0.08	66.95±0.95
Aydın et al., 2009	Fırat River	<i>Oncorhynchus mykiss</i>	T:78	9.26-12.93	11.45-16.7	1.04-1.32	56.57-61.8
Şaşı, 2009	Topçam Dam Lake	<i>Capoeta bergamae</i>	T:150	10.70±0.48	12.12±1.57	2.55±0.15	65.49±1.80
Karaton and Gürel İnanlı, 2011	Keban Dam Lake	<i>Squalius cephalus</i>	F:52	16.65±1.67	13.77±3.43	1.85±0.30	55.98±4.70
			M:60	16.12±1.62	11.98±2.18	1.90±0.38	57.63±3.38
Kurt-Kaya et al., 2013	Uzunçayır Dam Lake	<i>Capoeta trutta</i>	T:100	10.65	17.22	2.78	57.57
			T:100	12.42	11.51	2.25	61.92
Dağtekin and Baştürk, 2014	Çıldır Lake	<i>Carassius gibelio</i>	F:29	23.19±0.28	16.79±0.47	10.70±0.17	23.30±0.36
			M:22	26.90±0.42	10.88±0.34	12.68±0.22	24.61±0.40
Present Study	Asi River	<i>Planiliza abu</i>	T:51	24.79±0.43	14.24±0.59	11.55±0.24	23.87±0.39
			T:299	16.54±0.20	11.74±0.25	2.47±0.06	65.51±0.33

T, total; F, female; M, male.

weight and fin weight. Aydın et al. (2009) reported a correlation bigger than $r=0.95$ for *O. mykiss*. Similarly, Dağtekin and Baştürk (2014) also claimed that correlations for *C. gibelio* were strong although their calculations of r^2 ranged between 0.7965 and 0.8904. The result of this study on *P. abu* supports the strong positive relationship between total weight and the weights of body parts and organs of fish species. The correlations for *P. abu* were to be $r^2=0.9694$ for HW/TW, $r^2=0.9242$ for IOW/TW, $r^2=0.9652$ for FW/TW and $r^2=0.8732$ for GW/TW.

As a result of the meat yield of *P. abu*, which was introduced to the River Orontes around the year 2000, was found to suitable for consumption as food. It was also determined that the meat yield increased as the age of fish increased. Hence, this species is highly valuable for the consumption by the local people. A considerable increase after age II suggests that fishing of the species older than II years old is advisable for sustainability and economical value to the fisheries industry. Therefore, it is also advisable that fishing of individuals younger than III years old should be banned. Furthermore, *P. abu* could be an alternative species to be cultured in the future since the meat yield of the species matches with the meat yield of species already under culture.

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