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Research Article

Determination of Hatching Performances and Yolk Sac Absorptions in Black Sea Trout (*Salmo trutta labrax* Pallas, 1811)

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Abstract

The goal of this study was to evaluate hatching performance, body and yolk weight at hatching, the growth rate and yolk conversion efficiency during the yolk absorption in Black Sea trout (*Salmo trutta labrax*, Pallas 1811) larvae. In addition, the relationships between length, total wet weight, dry yolk body weights of alevins and degree-days were determined in this study. Our results indicated that the mean dry weights of the body and yolk sac were 2.85 ± 0.87 and 23.92 ± 1.04 mg at hatching and 14.95 ± 1.45 and 1.04 ± 0.90 mg at swim-up stages while the mean wet weight was 17.17 ± 1.67 mg (n = 30) at hatching and reached 104.16 ± 8.18 mg just before the swim-up stage, respectively. The mean body dry matter and water content of the larvae were 46.98% and 53.02% at hatching and 14.84% and 85.16% at swim-up stages, respectively. The growth of larva, yolk sac absorption and yolk conversion efficiency were calculated as 0.49 mg/day, 0.99 mg/day and 0.53, respectively. Data here reported also demonstrated that dry yolk and total larval weights and dry matter of the larvae decreased while dry body weight and water content increased with degree-days. In conclusion, the data will provide benefits for production of Black Sea trout.

Keywords: Black sea trout; *Salmo trutta labrax*; Hatching performances; Yolk conversion efficiency; Growth

Introduction

The Black Sea trout (*Salmo trutta labrax*) is an endemic species of the Eastern Black Sea coast and rivers and also a new species for aquaculture [1]. Recently, *S. t. labrax* were described by Turan *et al.* [2] as *S. coruhensis* [3,4]. On-going debate notwithstanding, *S. t. labrax* is one of five ecotypes within Turkey. However, it has been cultured on a commercial scale in the North America, Europe and Eastern Black Sea region of Turkey in trout farms [5].

The first feeding activities from the outside start at swim-up stage of the larvae. In addition, there is a vestige of yolk at the swimming up stage. The first external feeding in hatcheries starts when over 30% percent larvae reached to swim-up stage. Development and transition stages in fish are important due to sensibility to pathogens, diseases, fasting and environmental factors. Despite all, increase in survival and growth rates could be provided through applicative hatchery management at critical stages [5,6].

Most studies to date have focused on larval development of salmonid species, namely, sea trout [7], brown trout [8,9], Atlantic salmon [10,11], rainbow trout [6,12], brook trout [8,13], brook trout and Arctic charr and their hybrids [14]. On the other hand, there are a few studies about hatching and yolk sac absorption on the Black Sea trout and their hybrids [6,15,16].

The purposes of the present study were to investigate hatching performance, body and yolk weight, the yolk absorption and yolk conversion efficiency of Black Sea trout (*S. t. labrax*). In addition, the specific objective was to assess the correlations between these different parameters.

Material and Methods

S. t. labrax (73 females and 30 males) was obtained from the trout hatchery in the Faculty of Marine Sciences, Karadeniz Technical University (Trabzon, Turkey). The sperm and egg were collected by a gentle abdominal massage. The eggs were incubated in a vertical incubator in triplicate using temperature-controlled. After hatching, about 3000 larvae were randomly divided into triplicate batches. Aerated water in the batches was recirculated and 20% of the water was replaced daily. Temperature was recorded two times a day (8:00-9:00, 16:00-17:00). Monitoring of the eggs and alevins was made. In the eyed-egg stage, the eyes were evidently visible as black spots. In the swim-up stage, 50% of the alevins were started to feed and vigorously swimming up in order to food intake. The dead eggs and larvae were removed and counted each day. Ten larvae were randomly sampled at each sampling period (11 times) at 3 or 4 day intervals from the 133th degree-day (ΣT: sum of daily mean temperatures) when 50% of the larvae had hatched i.e. a total of 110 larvae were used during the study at each cross-types. Thus, larvae were sampled at the 228, 257, 287, 316, 346, 405, 435, 465, and 495 degree-days. Larvae were anesthetized with a benzocaine solution (30mg/l) and fixed in 10% formaldehyde. After a minimum three-week interval, preserved larvae were dissected to separate the yolk sac. Body and yolk were dried at 60°C for 48 h and weighed individually after 48 h [7]. Yolk sac efficiency was calculated as YCE = (Lt - L0)/ (Y0 - Yt) as per Hodson and Blunt [12], where L is

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Table 1: Duration (day) of eyed-egg, hatch and swim-up phases.

Parameter	Eyed-egg stages	Hatching	Swim-up
Day	25	39	62
D-D	233± 2.3 (193-263)	366±2.7 (315-401)	595±43 (477-651)
°C	9.3±0.9 (7.7-10.5)	9.4±0.9 (8.1-10.3)	9.6±0.7 (7.7-10.5)

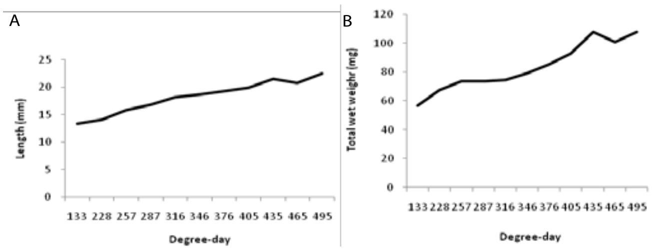

Figure 1: Gains in (a) length and (b) wet weight of Black sea trout larvae raised in freshwater.

dry larvae weight, Y is yolk sac dry weight, and t is day. The dry yolk sac consumption rate (mg/day) was determined as YCR = (Y0 - Yt)/t, daily length growth rate (mm/day), LGR = (lengtht - length0)/t, daily weight growth rate (mg/day), WGR = (wtt - wt0)/t; and development index as KD = 10(wet wt$^{1/3}$)/length [11].

Results and Discussion

Egg size of Black Sea trout was 4.67 ± 0.46 mm. Incubation water temperature was 9.5 ± 0.5°C (8.6-10.2°C). The eggs were eyed at 233 day degree (25 days) and hatched after 39 days (366 day degree) (Table 1). Length and total wet weight (Figure 1), dry larva weights (Figure 2), and dry yolk weights (Figure 2) of Black Sea trout showed linear relationship with degree-days (ranged 228-495). Dry yolk weight decreased although length, total wet weight and dry body weight increased. Among the linear regression parameters were significantly differences, excluding length slope.

Length and weight increasing and growth rates, daily yolk sac consumption and yolk sac efficiency values were determined as 0.40mm/day, 2.21mg/day, 0.99mg/day, and 0.53 for Black Sea trout. Some features reported from different trout species and comparisons with the present study results are presented in Table 2.

Characteristics of embryonic and larval development stages vary from species to species in Salmonids as well as genetic condition, incubation temperature. Başçınar *et al.* [16] demonstrated that the eggs hatched after 43 days. Başçınar *et al.* [5] determined that the diameter of Black sea trout eggs was 4.6 ± 0.02 mm (4.5-4.7) and the fertilized eggs of Black sea trout were eyed at 201-306 day degree (17-24 days) and hatched after 35-41 days (388-443 day-degree) at the temperature of 9.9 ± 1.3°C. Alp *et al.* [17] found that the eggs were eyed at 215 day degree (25 days) and hatched after 53 days (440 day-degree) at the temperature of 8.21°C. In present study, egg size of Black sea trout was 4.67 ± 0.46 mm and the eggs were eyed at 233 day degree (25 days) and hatched after 39 days (366 day degree) at the temperature of 8.1-10.3°C.

Wet weight of larvae at hatching was 17.17 ± 1.67 mg and reached 104.16 ± 8.18 mg just before the swim-up stage. It might be due to egg size and incubation period.

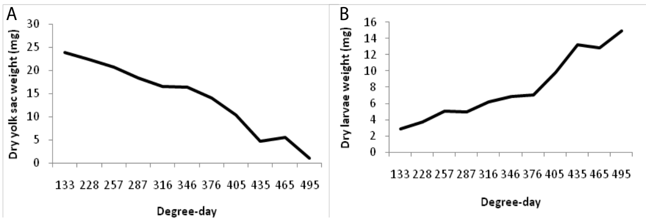

Figure 2: Relationship between degree-day and (a) yolk-sac weight and dry larvae weight (b) in Black sea trout alevins.

The yolk size is affected by different factors such as incubation temperature and period, egg and larva size, and the nutrition and livestock of brood fish and it also varies from species to species. In addition, amount of yolk at hatching affects to larvae size. On the other hand, there is no consensus on the relationship between the size of larva and amount of yolk. Dumas *et al.* [14] reported that the yolk weight was 12.26mg for brook charr (*S. fontinalis*). In contrast, Hodson and Blunt [12] stated that this value was 31 mg for rainbow trout. In this study, the dry yolk weight at hatching was determined as 23.92 ± 1.04 mg for Black Sea trout larvae.

As documented in previous studies, a decrease in dry matter was at hatching and before swim up stage for Atlantic salmon, rainbow trout [6,10,12]. In this study, the dry body weights at hatching and before swim up stage were determined as 2.85 ± 0.87 (46.98% of total wet weight) and 14.95 ± 1.45 (14.84% of total wet weight), respectively. The present results agree with these reports. The decrease may be explained by increasing the water content of the body towards the swim-up stage for ease buoyancy.

The values of YCE vary between 0.4 and 0.8 [12]. The values for Salmo species are ranged from 0.41 to 0.70 at 10°C. Dumas *et al.*[14] and Başçınar *et al.* [13] determined that the YCE value was 0.65 for brook trout at 8-13 °C and 0.50 for brook trout at 4.5-13°C. Başçınar *et al.* [5] stated that the YCE values were 0.76, 0.41 and 0.46 for Black sea trout, brook trout and their hybrids, respectively. Hansen [7] reported values ranging from 0.46 to 0.68 at 7-8.5°C for *S. trutta*. In our study, the YCE was 0.53 on a dry weight basis.

As reported in previous studies, development index value was "2" approximately when alevins were a maximum weight [11,18] and development index values increased with increasing water temperature [19]. KD values determined due to importance for the first feeding [6]. Başçınar *et al.* [16] determined that development index values in alevins were 1.98 and 1.99 at 5°C and 9°C in *S. t. labrax*. In present study, development index was calculated as 2.11 and the present result agree with the data.

Conclusion

In conclusion, based on the data obtained within the context of this study, dry yolk and total larval weights and dry matter of the larvae decreased. Additionally, dry body weight and water content increased with degree-days. These results might be helpful for further comparative studies and in developing efficient hatchery management programs. In addition, information on yolk sac absorption and hatching performance of this species would contribute to knowledge of management of the stocks.

Table 2: Summary of some characteristics reported from trout and comparisons with the present study results.

Species	Eyed-egg stages (days)	Hatching (days)	Dry yolk weight (mg)	YCE	Development index	Researcher
Salvelinus fontinalis			12.26	0.65		Dumas et al. [14]
Salmo salar					2	Peterson and Martin-Robichaud [11]
Salvelinus fontinalis				0.5		Başçınar et al. [13]
S. t. labrax		43			1.98-1.99	Başçınar et al. [16]
S. t. labrax	17-24	35-41		0.41-0.76		Başçınar et al. [5]
S. t. macrostigma	25	53				Alp et al. [17]
S. abanticus	27	54	18.47	0.64	2.09	Kocabas et al. [18]
S. t. caspius	26	44	10.67	0.6	2.05	Kocabas et al. [18]
S. t. labrax	25	39	23.92	0.53	2.11	In this study

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References

1. Tabak İ, Aksungur M, Zengin M, Yılmaz C, Aksungur N, Alkan A, et al. Research of bio-ecological specialty and culture features of Black Sea trout (*Salmo trutta labrax*). Final Report, Ministry of Agriculture and Rural Affairs, Project No: TAGEM/HAYSUD/12/01/07, Trabzon, 2001.

2. Turan D, Kottelat M, Engin S. Two new species of trouts, resident and migratory, sympatric in streams of northern Anatolia (Salmoniformes: Salmonidae). Ichthyol Explor Freshw. 2009; 20: 289-384.

3. Can E, Kutluyer F, Delihasan Sonay F, Köse Ö. The use of kefir as potential probiotic in Çoruh trout (*Salmo coruhensis*): Effects on growth performance and immunoglobulin (IgM) levels. Afr J Biotechnol. 2012; 11: 7775-7780.

4. Seyhaneyildiz Can S, Kutluyer F, Can E, Kayiş Ş, Delihasan Sonay F, Köse Ö, et al. Effect of dietary kefir on the digestive and liver enzymes activities, and glucose level of Coruh trout, *Salmo coruhensis* (Actinopterygii: Salmoniformes: Salmonidae). Acta Ichthyol Piscat. 2014; 44: 167-170.

5. Başçınar N, Kocabaş M, Atasaral Şahin Ş, Okumuş İ. Comparison of hatching performances and yolk sac absorptions of black sea trout (*Salmo trutta labrax* Pallas, 1811), brook trout (Salvelinus fontinalis Mitchill, 1814) and their hybrids. Kafkas Univ Vet Fak Derg. 2010; 16: 205-209.

6. Başçınar N. Effect of low salinity on yolk sac absorption and alevin wet weight of rainbow trout larvae (*Oncorhynchus mykiss*). Isr J Aquacult Bamid. 2010; 62: 116-121.

7. Hansen T. Artificial hatching substrate: Effect on yolk absorption, mortality and growth during first feeding of sea trout (*Salmo trutta*). Aquaculture. 1985; 46: 275-285.

8. Kocaman EM, Bayir A, Sirkecioğlu AN, Bayir M, Yanik T, Arslan H. Comparison of hatchery performances of rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta fario*) and brook trout (*Salvelinus fontinalis*) under the same environmental conditions. J Anim Vet Adv. 2009; 8: 1429-1431.

9. Demir O, Gülle İ, Gümüş E, Küçük F, Günlü A, Kepenek K. Some reproductive features of brown trout (*Salmo trutta macrostigma* Dumeril, 1858) and its larval development under culture conditions. Pak Vet J. 2010; 2074-7764.

10. Hansen TJ, Møller D. Yolk absorption, yolk sac constrictions, mortality and growth during first feeding of Atlantic salmon (*Salmo salar*) incubated on astro-turf. Can J Fish Aquat Sci. 1985; 42: 1073-1078.

11. Peterson RH, Martin-Robichaud DJ. Yolk utilization by Atlantic salmon (*Salmo salar L.*) alevins in response to temperature and substrate. Aquacult Eng. 1995; 14: 85-99.

12. Hodson PV, Blunt BR. The effect of time from hatch on the yolk conversion efficiency of rainbow trout (*Salmo gairdneri*). J Fish Biol. 1986; 29: 37-46.

13. Başçınar N, Okumuş İ, Serezli R. The development of brook trout (*Salvelinus fontinalis* Mitchill, 1814) embryos during yolk sac period. Turk J Zool. 2003; 27: 227-230.

14. Dumas Sİ, Blanc JM, Audet de la Noüe JC. Variation in yolk absorption and early growth of brook charr, *Salvelinus fontinalis* (Mitchill), Arctic charr, *Salvelinus alpinus* (L.), and their hybrids. Aquac Res. 1995; 26: 759-764.

15. Başçınar N, Aksungur N, Çakmak E. Yolk sac consumption and growth rates of black sea trout alevins (*Salmo trutta labrax* Pallas, 1811) at three different water temperature regimes. Ege Uni J Fish Aquatic Sci. 2005; 22: 403-406.

16. Başçınar N, Çakmak E, Aksungur N. Length increasing, maximum alevin weight, and development indices of black sea trout alevins (*Salmo trutta labrax* PALLAS 1811) in three different water temperature regimes. S.D.Ü. Eğirdir Su Ürün Fak Derg. 2008; 4: 29-37.

17. Alp A, Erer M, Kamalak A. Eggs Incubation, early development and growth in frys of brown trout (*Salmo trutta macrostigma*) and Black Sea trout (*Salmo trutta labrax*). Turkish J Fish Aquat Sci. 2010; 10: 387-394.

18. Kocabas M, Bascınar N, Sahin SA, Kutluyer F, Aksu O. Hatching performance and yolk sac absorption of Abant trout (*Salmo abanticus*, T., 1954). Sci Res Essays. 2011; 6: 4946-4949.

19. Rombough PJ. Growth, aerobic metabolism, and dissolved oxygen requirements of embryos and alevins of steelhead, *Salmo gairdneri*. Can J Zool.1988; 66: 651-660.

Citation: Kocabaş M, Başçinar N, Sahin SA and Kutluyer F. Determination of Hatching Performances and Yolk Sac Absorptions in Black Sea Trout (*Salmo trutta labrax* Pallas, 1811). Austin Biol. 2016; 1(1): 1003.