

Circumstantial evidence of effect of trout farming on length-weight relations of native fish species: *Barbus oligolepis* (Battalgil, 1941) and *Squalius cii* (Richardson, 1857)

Abstract

This study was carried out to reveal how the aquaculture activities, located near the stream bed, effect the length-weight relations of native freshwater fish. Fish samples were collected on monthly for one year on the Kocabaş Stream (Çanakkale), a trout farm constructed next to stream. Fish specimens were collected from up and down sections of the trout farm and control station selected from another branch of the stream by electrofishing between August 2015-July 2016. The growth type sign; b value in length-weight relationship indicates that both species are in positive allometry at the down station and isometric growth at the upper station. Fish farm might affect the growth type of both species positively due to contribution of extra food resources originated from the farm via discharge of waste water of trout farm at the down section. However, this hypothesis should be tested by proper growth parameters of the fish species.

Keywords: aquaculture, b value, allometric growth, kocabas stream

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Selin Ertürk Gürkan, Şükran Yalçın Özdilek
Department of Biology, Çanakkale Onsekiz Mart University, Arts & Sciences Faculty, Turkey

Correspondence: Selin Ertürk Gürkan, Department of Biology, Çanakkale Onsekiz Mart University, Turkey, Tel 90 2862180018-2660, Email slnetrk@hotmail.com, srturk@comu.edu.tr

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Introduction

It is known that fish farms are a significant source of nutrients for the aquatic environment.^{1,2} Especially in aquaculture regions, many studies have been made on the introduction of farm derived feed that mostly prepared using protein riched native fish.³⁻⁶ The particulates formed by the disintegration of nutrients and organic solids, uneaten pellets and stools released during aquaculture; causing the native fish species and other animals to be fed into the aquaculture field.⁷⁻¹⁰ The accumulation of organic matter under the cages during aquaculture has been shown to cause changes in the benthic and phytoplankton communities such as abundance, dominance and species diversity.^{11,12}

Barbus oligolepis is a bentopelagic species that lives in freshwater. Just pouring the southern coast of the Marmara Sea in Turkey Nilufer Stream, Kocaçay Ulubat Lake, Lake Manyas, Tea Susurluk, Han River, it is distributed in streams and lakes as Narlıçay. They are often found in fast-flowing waters.¹³ When the stomach contents analysis of *B. oligolepis* species was analyzed, it was observed that they consume mostly macro-invertebrates.^{14,15} *Squalius cii* shows distribution in Europe, Asia and in Turkey has spilled rivers in the southern coast of the Marmara Sea. The substrate structure prefers habitats with pebbles, rocks and some silt. Most individuals are seen in isolated water pools left in the stream bed towards the end of summer.¹⁶ When the stomach contents analysis of *S. cii* species was analyzed, it was observed that they consume mostly macroinvertebrate species.^{14,15} It was observed that native fish species around an aquaculture farm were fed with farm-derived feed when studies were conducted.¹⁷⁻²² But no study has been found on whether this feed additive affects the height-weight relationship of indigenous fish species.

The aim of the study is to determine the effects of farm-derived feed that entered to stream ecosystem on the native fish populations height-weight relations. On this scope, this study was carried out

around a trout farm that located on Kocabas Stream in Çanakkale, NW, Turkey.

Material and methods

The study was completed on Kocabaş Stream in the Biga Peninsula in northwestern Turkey (Figure 1). The sampling stations were selected from upstream (upper station) and the downstream (down station) of the trout farm that established next to the Kocabaş Stream. As a control station, a control zone was selected from situated on the branch of the stream without fish farm (Figure 2). Between August 2015 and July 2016, fish samples were collected by electro shocking for each region (excluding January) in the designated areas. The collected fish samples were first brought to the laboratory in cold chain and identified according to the "Turkey Freshwater Fish".²³

Each sample placed on the millimeter paper was photographed with a Nikon Coolpix S2800 model camera at the same height using a mechanism. Then weighed with a balance operating at $\pm 0,01g$ accuracy and conventional morphometric measurements with 25 metric features were performed with compass ($\pm 1mm$). Regression curves were obtained by using the equation below for each species caught from the stations to establish the relationship between height and weight. The value b in the equation defines the growth type of the fish and is influenced by habitat conditions.²⁴

$$W = a x L^b$$

Studies conducted in this area are considered to show allometric growth with a difference of 3, where the b value shows isometric growth when b is about 3. The measured b values differed from 3 (isometric growth) by Pauly t test according to the following formula.²⁵

$$t = \frac{Sd_{\log L} |b-3|}{Sd_{\log L} \sqrt{1-r}} \sqrt{n-2}$$

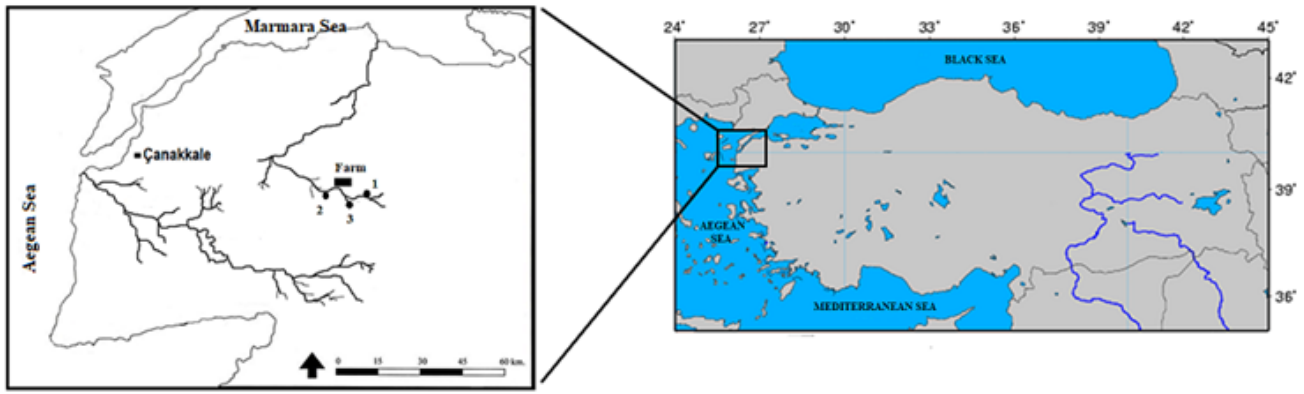


Figure 1 Map of the study area.

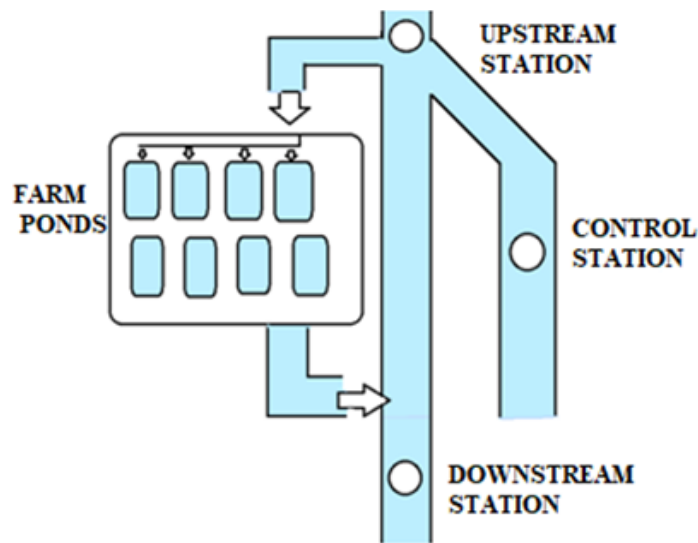


Figure 2 Schematic presentation of the study area.

Results

Populations belong to *B. oligolepis* and *S. cii* were caught on Kocabaş Stream. Populations belong to both species were found in the upper and down stations, whereas only *S. cii* was found in the control station. When *B. oligolepis* samples captured from Kocabaş Stream

were evaluated, *b* values were found to be 3.17 in the upper station and 3.31 in the down station (Figure 3). In the samples evaluated by Pauly t test, the value of *b* at the lower station is statistically different from 3 ($P < 0.05$). It can be said that *B. oligolepis* individuals caught from the Kocabaş Stream exhibited an isometric growth in the upper station and a positive allometric growth in the down station.

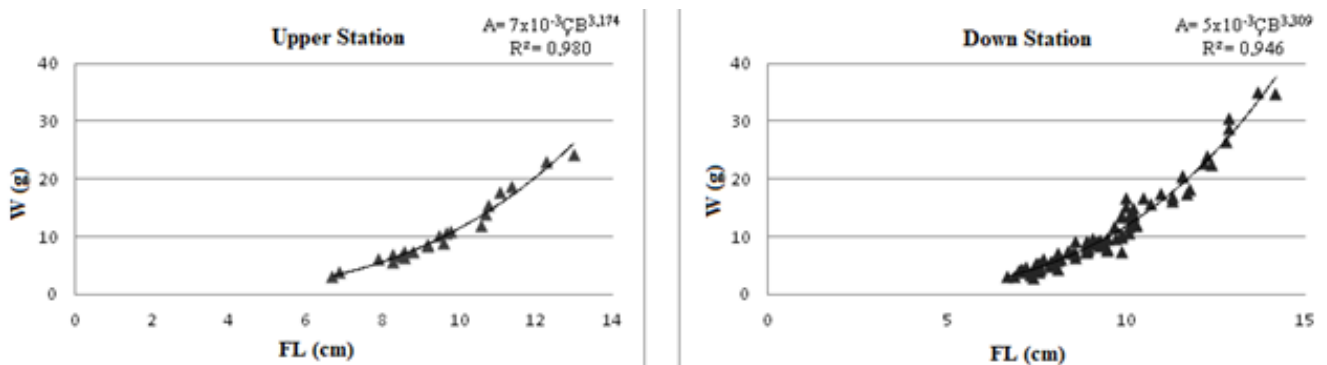


Figure 3 Height-weight distribution of *B. oligolepis* populations caught from stations.

The b values of the *S. cii* samples taken from the Kocabaş Stream were found to be 3.41 in the upper station, 3.21 in the down station and 3.13 in the control station (Figure 4). The b value of the population in the down station is statistically different from 3 ($P < 0.05$). It is

possible to talk about an isometric growth for the individuals in the other stations and an allometric growth for the individuals in the down station.

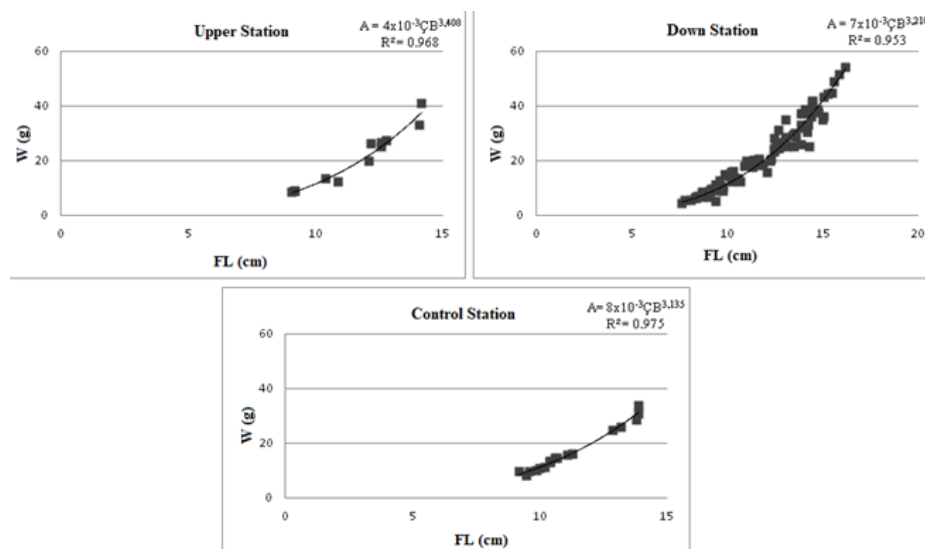


Figure 4 Height-weight distribution of *S. cii* populations caught from stations.

Discussion

A total of 125 specimens belonging to *B. oligolepis* and 131 specimens belonging to *S. cii* were determined. The effects of aquaculture on some parameters of growth of river fishes were evaluated with the findings of height-weight distributions. For *B. oligolepis* and *S. cii*, b value in down station was found to be different from 3. In the down station where the food sources and also the farm-derived feed are most abundant, the positive allometric growth exhibits that the species were indicative of the absence of food stress.

It has been reported that b values can vary interspecies, and that the same species can show variation according to gender, age, feeding style, habitat used and climatic changes.²⁶ The previous study of height-weight relationship with *B. oligolepis* populations was not found. It was determined that b value of the *S. cii* populations caught from Kocabaş stations was higher than the value found in the previous height-weight relation study.²⁷

It has been observed that the inedible feeds of the cultured fish are potential food sources for both natural fish species and other living beings (such as macro-organisms) in the environment, and that the growth rate of the individuals fed with these feeds is different from those fed the natural food sources.^{28,29} The positive allometric growth seen in the individuals of the species caught in the river system affected by the aquaculture activities suggests that these individuals were fed by farm-based feed or groups feeding on this feed.

Conflicts of interest

The author declares that there is no conflict of interest.

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