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ARAŞTIRMA MAKALESİ **RESEARCH PAPER**

Blue crabs (*Callinectes sapidus* Rathbun, 1896): Initial Adaptation Studies (Brachyura: Portunidae)

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Abstract: This study set out to ascertain the growth parameters of the blue crab and investigate any possible adaptations during its six months confinement in an earthen pond. The goal is to get blue crabs used to life in aquaculture. One of the keystones of adaptability, feed kinds, has been studied. The breeding and biological properties of the South Aegean blue crab (*Callinectes sapidus* Rathbun, 1896) were ascertained following the analysis of samples collected in October 2012 and August 2013. Using data from the literature, the adaptation of blue crabs to the earth pond, growth conditions, and morphometric measuremalets are examined. A week passed while the blue crabs adjusted, and during that period, they were seen to start eating. Nine units from the Pond in the Kusadasi/Güzelçamlı area were given to the Ege University Faculty. Out of the twenty surviving crabs, 108 separate experiment groups of crabs were studied in cages.

Keywords: Blue crab, culturing of blue crab, adaptation studies.

Mavi yengeçler (Callinectes sapidus Rathbun, 1896): İlk Adaptasyon Çalışmaları (Brachyura: Portunidae)

***Sorumlu yazar:**
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Öz: Bu çalışma, mavi yengecin büyüme parametrelerini tespit etmek ve toprak havuzda altı ay kalması sırasında olası adaptasyonları araştırmak amacıyla yapılıştır. Amaç mavi yengeçlerin su ürünleri yetiştiriciliğindeki yaşama alışmasını sağlamak ve uyum sağlama yeteneğinin temel taşlarından biri olan yem türleri incelenmiştir. Güney Ege'de mavi yengecin (Callinectes sapidus Rathbun, 1896) üreme ve biyolojik özellikleri Ekim 2012 ve Ağustos 2013'te toplanan örneklerin analizi sonucunda tespit edilmiştir. Literatürden elde edilen veriler kullanılarak mavi yengeçlerin toprak havuza adaptasyonu, büyümesi, büyüme koşulları ve morfometrik ölçümleri incelenir. Mavi yengeçlerin uyum sağlama süreci 1 hafta olup bu süre zarfında yemeye başladıkları görülmüştür. Kuşadası/Güzelçamlı bölgesindeki göletten çıkan 9 anaç Ege Üniversitesi Fakültesi'ne getirildi. Hayatta kalan 20 yengecin dışında 108 deney grubu üzerinde çalışılmıştır.

Anahtar kelimeler: Blue crab, mavi yengeç kültürü, adaptasyon çalışmaları.

INTRODUCTION

Turkey's commercial crab hunter species are mostly blue crabs (*Callinectes sapidus* RATHBUN, 1896). People in the region are spreading the consumption and growing the prevalence, particularly in the Aegean and Mediterranean regions. Point: There were no commercial production activities related to this species of crabs until the 1980s. In the 1980s, certain hints regarding the potential for exporting began to surface, despite the fact that neither the local population nor the interior market desired blue crab meat (Türeli, 1999). In the Mediterranean region, in particular, rising tourism and consumption have led to an increase in blue crab capturing and unintentional overhunting of the

population. In affluent nations, crabs are a valuable aquatic commodity that fetches a relatively high price due to their edible meat quality and economic worth. The developed world has a well-established crab industry. In this industry, crabs are divided into three varieties and processed at distinct stages. Crabmeat, whole crabs, and crab leftovers are all studied. The leftover meat, offal, protein concentrations, and crusts are the crab pieces that we can refer to as residue. Because the waste meat is high in protein and minerals, it is fed to fish, fowl, pigs, and meat. The chitin derived from the shells is used to make chitinase. Chitinase finds application in the textile, ink, glue, and cosmetics industries (Paul and Haefner, 1985). This population is under pressure from hatching, which has been rising in tandem with the consumption period from May to July—blue ginseng's breeding season corresponds with our nation's tourism season. During this time, fertility is highly significant, especially when considering the longevity of female ovine individuals after the female counterparts' lifespans have been taken into account. The goal of this study was to establish blue crab soil ponds for the first time in Turkey and Europe. The feasibility of adapting to the cultivation of a species that has gained new commercial significance for Turkey was examined in the study. In order to gather data, several experiments were set up and measurements were taken.

MATERIAL AND METHOD

The research began in July, when blue crabs spawn, and adaption trials were conducted until December. The work was done in Egeberk Water Products' Aydin Kuşadası Guzelcamli Lake. Sea bass and sea bream are being raised in operation. The project team has been given access to a harvested empty ground pond for blue crab work by cleaning the surrounding area and the pond. A 50 x 70 m rectangular ground pond with a depth of 1-2 m is available from the firm.

The cages were submerged in 1.5-meter-deep clay basins. The terrain is grassy and vegetal. The experiment is linked to the operator's pond via the pond. To stop live crabs from entering or leaving, a channel wire grid is put in place. The operator used a dozer on a regular basis to clean the reed beds that were sprouting on the pond's edge. The fish in any malener to the trial region during the investigation. No live broadcast has been attempted. The research area utilized aerators during the summer months, particularly at night when the oxygen capacity decreased from 5–6 mg/lt to 4 mg/lt. A 200- mm diameter PVC pipe was used to supply fresh water to the pond both in the summer and the winter.

Trial Cages by Method Square cages measuring 0.5 cm and 2 m in height and 4 m in width were made for the study and fitted with green wire mesh. Steel wires that were one meter high were fused together. Green plastic coating wire was laid in the 1 m area at the top. Every cage was made in the same amount. The soil is put into the pond, and there are a total of nine experimaletal cages.

Supplying Method of the Blue Crabs: The procedures given to the crabs in the study varied from one another. The juveniles were collected by hand and tiny scoop from the shallow edges of the bay, while the adult individuals were retrieved from the fishing line, the trap, and the lambs by the bucket. With the aid of a bucket, egg females were captured in July and August without endangering the individuals, particularly in cases where water was entering the pond from the sea. Using a white led light, juvenile individuals were gathered from under rocks, grass, and netting pieces.

Figure 1 shows how to utilize a foldable trap with two input compartmalets that are fitted with green amish nets that have a 1 cm mesh aperture that makes it simple for mature individuals to enter.

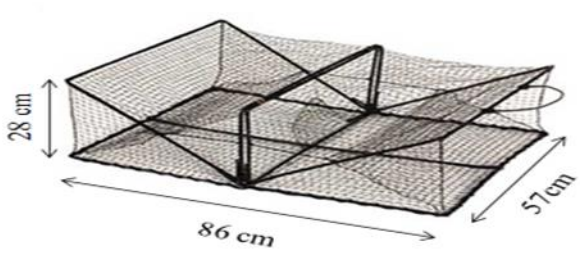

Figure 1. Cage Example and Research Trap (Square Pinter).

To keep the trap from dissipating, the float and the pet bottles are attached in a floating fashion. Thirty traps in all, with fifteen escape holes, were set free separately from one another.

Blue crabs that were captured in Pinter-style cages were converted to aquaculture by setting up the cages in 50 by 70-meter pools at a depth of one to two meters.

Feeding and Stocking: The study's methods included using nine wire cages in all, including three test groups with three repetitions, beginning in October. Different kinds of feed were used to feed each experimaletal group. In every experimaletal group, twelve juvenile individuals (3 individuals per m^2) were stocked. Fish waste was fed to group 1, crushed pellet feed (The Kuşadası company of Söke provided them with fish feed of the Söke Yem brand, which is high in protein and Omega-3) plus grass combination was fed to group 2, and abattoir leftovers were fed to group 3. Feeding was done every day at noon. The feeding rates that Thach (2009) utilized for the sand crab were considered in the study. Ten to fifteen percent of each cage's total weight is fed after stocking.

Three to five percent of the cage's total weight was fed throughout the final two months of the breeding process (beginning in the fourth month). Once a month, a polyester boat is used to enter the pond and use a scoop to help maleage the crab population. Two times a month, the first

experiment group-fed a variety of fish wastes-was required to undergo bottom cleaning.

Assessment and Statics: Following the catching operation, the male and female blue crabs were separated from the adults and their weights were recorded using calibrated scales of 0.01 grams(g) when they were transported into the Urla hamlet. Every morphometric measuremalet was performed on the individuals in the sample. The following measures are included in the study: the Propodal Length of Right and Left Clips (SKPU, SolKPU), the Propodal Width of Right and Left Clips, SolKPG, and Depth (SKPD, SolKPD), the Short Carapace Width (KKG) without lateral ray, the Long Carapace Width with Lateral Light (UKG), the Carapace Length with Frontal Light (KU), and the Width of Abdomale Segmalets (AG).

The highest and lowest values-day and night, summer and winter-were recorded, and the corresponding needs for blue crabs were compared. Information about statistics was calculated using the data that was gathered.

RESULTS

Length of Carapace and Weight Distribution in Blue Crabs the catching operation, which involved capturing 527 adult blue crabs, was conducted from the natural state of the species. The measured lengths of the captured blue crabs were found to be 7.5 cm at the minimum, 20.7 cm at the maximum, and 59 g at the minimum, 600 g at the maximum, with an average length of 15.2 cm and an average weight of 263.37 g.

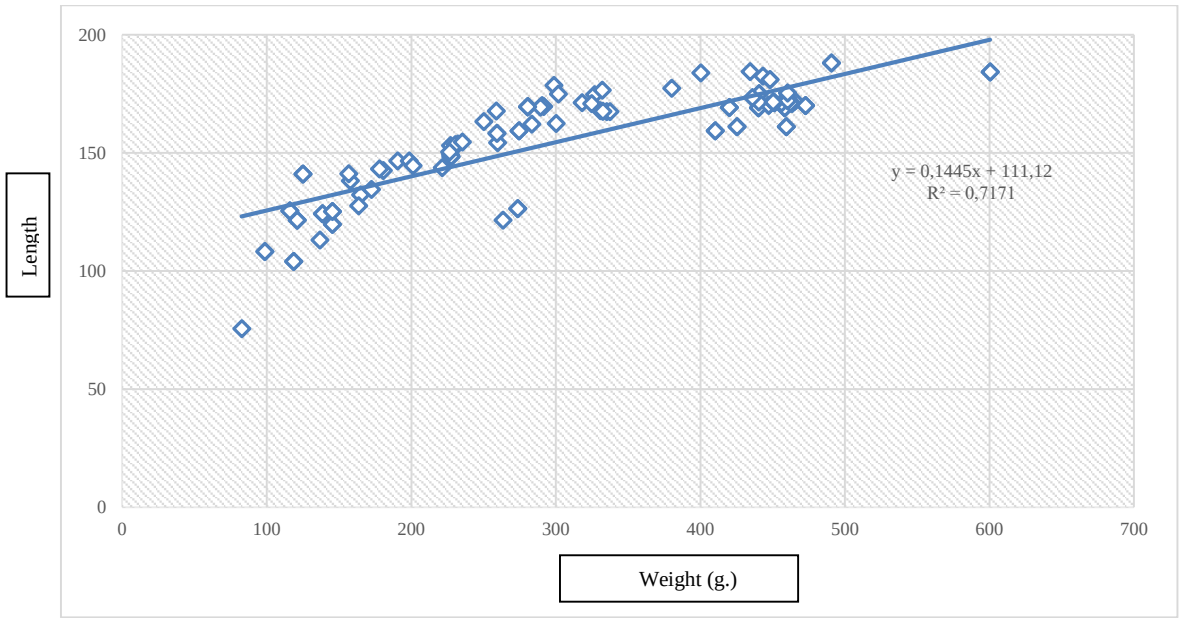

Figure 2. Length and Weight Graph For Male Blue Crabs

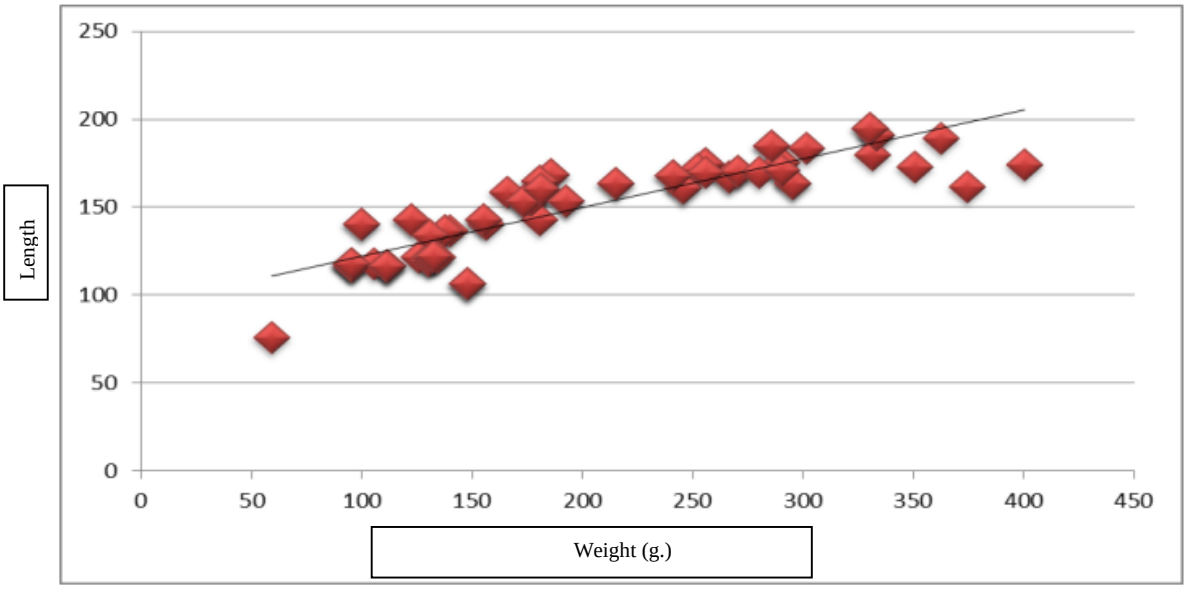

Figure 3. Length and Weight Graph For Female Blue Crabs.

Following an analysis of the blue crabs' length frequencies (Table 1**)**, 11.5–12.4 cm and 16.5–(cm) SKPU SKPG SKPD SolKPU SolKPG Sol KPD AG Average number of females: 8.22 1.91 2.26 8.13 1.68 2.23 4.88 **(**Figure 3**),** Male: Average: 6.91 1.52 1.91 6.94 1.55 1.93 4.79 The majority of the 9 17.4 cm length groups fell below the required hunting height of 13 cm carapace width (Figure 2)

Table 1. Mean Values Related to Abnormal Wideness and Pliers of Adult Individuals.

(cm)	SKPU	SKPG	SKPD	SolKPU	SolKPG	Sol KPD	AG
Female (avr.)	8.22	1.91	2.26	8.13	1.68	2.23	4.88
Male (avr.)	6.91	1.52	1.91	6.94	1.55	1.93	4.79

Of the 577 adult individuals detained, 265 are female and 312 are male. We procured 108 young blue crabs for use in separate aquaculture investigations.

Three experimental groups were comprised of 108 blue crabs, 54 of which were female, 54 of which were male. After six months of aquaculture, twenty individuals were still alive. Eight male and twelve female make up the study. At six months, the survival rate was estimated to be 18.52%. The average weight was determined to be 201.66 ± 36.88 g, and the average length was 15.26 ± 1.14 cm. The 6-month experiment resulted in a mean length rise of 13.26 cm and a mean weight gain of 190.36 g. A total of 88 crab deaths were noted in all research groups. The highest mortality was observed in the third group, which was fed abattoir leftovers .

This group saw a total of 48 individual deaths throughout the course of the 6-month experiment. In the two groups (crushed pellet + grass), a total of 25 deaths were noted, whereas the first group (fish wastes) saw the deaths of 15 individuals. In the third group all individuals deaths.

DISCUSSION AND CONCLUSION

In a 20-day aquaculture run of *Scylla paramamosain* in the Sarawak region of South Asia, Clive P. Keenan (1997) found that the density of 10 individuals/m2 in a 9 m^2 cage was 85% of the 20-day survival rate. For every ten blue crab juveniles that were caught, the minimum and maximum weight and height values were used, with a feeding rate of 5%.

Scylla olivacea and *Scylla tranquebarica* species were the juvenile individuals weighed 10-100 g. in the 8000 m^2 soil pond with an inventory density of 10 individuals / m^2 and a 30-day aquaculture trial with a 70-90% survival rate. Offal and food scraps were utilized in the study, and the feeding rate was roughly 2.5 percent. The Indonesian region of Semarang served as the study's location.

Juvenile individuals were weighed between 10 and 100 g. In this Aydın Kuşadası investigation, the stock density of 3 individuals/m^2 in a 4 m^2 cage containing a *C. sapidus* line in a dirt pond resulted in an 87% first-30-day survival rate. The survival percentage at six months was found to be 18.52%. The average weight of the juvenile individuals was 10 g. Use of fish waste results in a feeding rate of 10% to 15%. About 4,000,000 larvae from two egg-bearing adults in the pond were grown in an aquarium as part of our research. Despite routine monitoring of factors including nutrition, temperature, and salinity, mass fatalities of the larvae have happened. It is necessary to have synchronized and controlled larvae production and incubation. It was found in this study that adult subjects had acclimated to the lab environment. However, it has been noted that young individuals, like those in the Millikin (1978) study, have issues with eating and sickness. Male individuals were discovered to be caught in pond sections with lesser salinity, whereas female individuals were more common in locations where water flow was particularly focused from the pond to the sea, according to our field research. Particularly in backyard regions where under ground water is more diversified, male individuals have been discovered. In this study, it was shown that crabs in pond cages fed only once a day grew quickly. Additionally, the study discovered that crabs of comparable size were lighter than crabs raised in ponds outside of cages.

108 juvenile individuals, 0.34% salinity, and 6 individuals after 6 months were grown in our work. The subjects' average length growth was found to be 13.26 cm. A rate that is similar to the study's loss rate was discovered by Zohar et al. (2008).

This study demonstrated how challenging and ineffective it is to raise blue crabs in earthen ponds, both in terms of feeding and control. Among the foods we employ, pellet feed has become the most effective way to feed blue crabs in earthen ponds.

Thus, funding for these aquaculture investigations is necessary. Encouraging these kinds of paths is a critical step for aquaculture.

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Competing interest: The author declares no conflict of interest: the funders had no role in the study's design, in the collection, analysis, or interpretation of data, in the writing of the manuscript, or in the decision to publish the results.

***Ethics declarations*:** No ethical issues related to the use of animals in the performed analyses were involved. Ethical review and approval were waived for this study, due to the crabs not requiring authorization for experimental procedures, as can be verified at: < https://www.eregulations.com/maryland/fishing/blue-crabs-atlantic#:~:text=Minimum%20Size%20Limits%20(measured%20from%20tip%20to%20tip%20of%20spikes)&text=Soft%20crabs%E2%80%943%C2%BD%20inches.&text=April%201%E2%80%93July%2014%E2%80%943%C2%BC,31%E2%80%943 > [Accessed on 31 January 2023]; and: https://www.eregulations.com/maryland/fishing/blue-crabs-chesapeake-bay [Accessed on 31 January 2023].

Approval for animal experiments: The author confirms that all experiments were performed in accordance with relevant named guidelines and regulations. The author also confirms that he complied with the ARRIVE guidelines.

Data availability statement: The datasets generated during, and/or analysed during the current study are available from the author on reasonable request.

Informed Consent Statement: "Not applicable."

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