# Relative growth of the blue crab Callinectes sapidus in Thermaikos Gulf (Methoni Bay),northern Aegean Sea

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Kosmas Kevrekidis
Decentralised Administration of Macedonia-Thrace, Thessaloniki, Greece
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**SHORT NOTE**

# Relative growth of the blue crab *Callinectes sapidus* in Thermaikos Gulf (Methoni Bay), northern Aegean Sea

Kosmas KEVREKIDIS
*Decentralised Administration of Macedonia-Thrace, Department of Fisheries & Aquaculture*
*Navarinou 28 - Karaoli and Dimitriou, 551 31 Thessaloniki, Greece*
*Corresponding author: kosmkevrekidis@yahoo.gr*

**Abstract:** The relative growth of the blue crab *Callinectes sapidus* was studied in the Thermaikos Gulf, northern Aegean Sea. Three relationships were studied: Body Weight-Carapace Width, Body Weight-Carapace Length and Carapace Width-Carapace Length. A significant differentiation in the growth patterns of the basic somatic variables between the two sexes of the blue crab was assessed.

**Résumé :** *Croissance relative du crabe bleu* Callinectes sapidus *dans le Golfe de Thermaikos (Baie de Methoni), au nord-est de la Mer Egée.* La croissance relative du crabe bleu *Callinectes sapidus* a été étudiée dans la Golfe de Thermaikos au nord de la Mer Égée. Trois relations ont été étudiées, poids somatique-largeur de la carapace, poids somatique-longueur de la carapace et largeur-longueur de la carapace. Une différenciation significative des paramètres de croissance somatique est mise en évidence entre les femelles et les mâles.

*Keywords:* Blue crab ● *Callinectes sapidus* ● Relative growth ● Thermaikos Gulf ● Aegean Sea

## Introduction

The Atlantic blue crab *Callinectes sapidus* Rathbun, 1896, is among the alien decapod crustaceans that have been established in the Mediterranean Sea. In the last decade the species' abundance has significantly increased in the North Aegean Sea (Kevrekidis & Antoniadou, 2018). Available information on relative growth of the species is only known from its native range (e.g., Newcombe et al., 1949a & b; Pullen & Trent, 1970; Olmi & Bishop, 1983) and from the Southeastern Mediterranean Sea (Atar & Seçer, 2003; Gökçe et al., 2006; Sangun et al., 2009; Sumer et al., 2013; Abdel Razek et al., 2016) whereas no information exists from the northern latitudes of the basin. The present study presents the initial data on the relative growth of adult specimens of the blue crab from a population in the northern Aegean Sea that will contribute to our knowledge on the growth of this invasive but valuable species and could be used in the management of its natural stocks.

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## Materials and Methods

Sampling took place from March 2011 to January 2012 in Methoni Bay (Thermaikos Gulf), at bimonthly intervals using fyke nets (mesh size 40 mm). All the collected specimens were transferred to the laboratory and sexed. Crabs of CW < 60 mm were considered juveniles (see Olmi & Bishop, 1983) and excluded from analyses. For 538 crabs, the carapace width (CW), including lateral spines, and carapace length (CL) were measured with a digital vernier caliper to the nearest 0.01 mm. From the above specimens, the total weight (BW) of all 246 intact specimens sampled in September and November 2011 and January 2012 was recorded on electronic scales to the nearest 0.001g; thus only non-ovigerous females were included (see Kevrekidis & Antoniadou, 2018). The growth of the measured variables is usually a close approximation to the allometric growth equation: $y = a\ x^b$. Transformed to logarithms the equation becomes: $\log y = \log a + b \log x$; the value of *b* defines the type of allometric growth and for log values a statistically significant departure from 1 or 3 (the isometric value) indicates either positive or negative allometry (Hartnoll, 1978) and was tested using a *t*-test ($p < 0.05$). Homogeneity of variables' variances was tested using the Levenes' test and analyses of covariance (ANCOVA) were performed to determine whether slopes and intercepts of the regression lines differed between the two sexes within each allometric relationship. All statistical analyses were performed using the SPSS software package.

## Results and Discussion

The ranges of each of the three variables analysed for males and females, the relative growth equations obtained and the results of a *t*-test for allometry for each sex and for combined sexes are shown in table 1. ANCOVA showed that slopes and intercepts of the regression lines in all allometric relationships, with the exception of the slopes of BW-CL relationship, differed significantly between females and males, thus indicating a differentiation in growth patterns. The relationship BW-CW in females and in combined sexes exhibits negative allometry, with CW increases faster than BW; however, in males, the relationship does not deviate from isometry. ANCOVA showed that in both slopes ($F = 21.456$) and intercepts ($F = 15.567$) there was significantly differentiation ($p < 0.001$) between the two sexes; males are significantly heavier than females for a higher width range. This is in accordance with all other studies with the *b* value being steadily higher than that of females, with the exception of Gökçe et al. (2006) and Sangun et al. (2009). In the present study, the *b* value estimated for both sexes lies within the range reported for the species, with that of males being the second highest, indicating however isometry and differentiating with most other studies reporting negative allometry; the *b* value ranged in males from 2.551 to 2.954 and for females from 2.108 to 2.872 (Newcombe et al., 1949a; Pullen & Trent, 1970; Olmi & Bishop, 1983; Abbe & Stagg, 1996; Atar & Seçer, 2003; Gökçe et al., 2006; Gelpi et al., 2009; Pereira et al., 2009; Sangun et al., 2009; Sumer et al., 2013; Abdel Razek et al., 2016). The relationship BW-CL in females tends to isometry, whereas, in males and in combined sexes a positive allometry is exhibited; BW in males increases more than CL, probably because of the abundant food supply in the bay. ANCOVA showed that the intercepts were significantly different between the two sexes ($F = 106.997$, $p < 0.001$) but not slopes ($F = 1.701$, $p = 0.193$); males have a greater weight than females for the same carapace length. Controversial results are rather given in the Levantine; *b*

**Table 1.** *Callinectes sapidus*. Carapace width/length-weight and carapace width-carapace length relationships for females and males and for combined sexes, *t*-value and type of allometric growth in Thermaikos Gulf. $SE_b$ = standard error of *b*, $R^2$ = coefficient of determination; N = number of specimens. BW range: ♀ = 28.97-223.13 g, ♂ = 14.42-378.7 g; CW range: ♀ = 74.62-168.13 mm, ♂ = 60.38-177.29 mm; CL range: ♀ = 36.61-70.80 mm, ♂ = 29.91- 84.98 mm.

| | Sex | Relationship ($y = a\ x^b$) | $SE_b$ | N | $R^2$ | $\|t\|$ | Allometry |
|---|---|---|---|---|---|---|---|
| **BW - CW** | ♀ | $BW = 0.0010\ CW^{2.411}$ | 0.069 | 80 | 0.940 | 8.536 | − |
| | ♂ | $BW = 0.0001\ CW^{2.927}$ | 0.069 | 166 | 0.915 | 1.058 | **Isometry** |
| | ♀ ♂ | $BW = 0.0002\ CW^{2.799}$ | 0.095 | 246 | 0.779 | 2.116 | − |
| **BW - CL** | ♀ | $BW = 0.0006\ CL^{2.991}$ | 0.048 | 80 | 0.980 | 0.187 | **Isometry** |
| | ♂ | $BW = 0.0004\ CL^{3.151}$ | 0.052 | 166 | 0.956 | 2.904 | + |
| | ♀ ♂ | $BW = 0.0003\ CL^{3.234}$ | 0.044 | 246 | 0.955 | 5.318 | + |
| **CW - CL** | ♀ | $CW = 0.7769\ CL^{1.262}$ | 0.020 | 177 | 0.956 | 13.100 | + |
| | ♂ | $CW = 1.6313\ CL^{1.059}$ | 0.012 | 361 | 0.956 | 4.917 | + |
| | ♀ ♂ | $CW = 1.7713\ CL^{1.042}$ | 0.015 | 538 | 0.894 | 2.800 | + |

values ranged in males from 2.626 to 3.133 and in females from 2.7707 to 3.09 (Atar & Seçer, 2003; Gökçe et al., 2006; Sangun et al., 2009; Abdel Razek et al., 2016). The relationship CW-CL in females and in males and in combined sexes exhibits positive allometry with CW to increase faster than CL. ANCOVA showed that both slopes ($F = 76.666$) and intercepts ($F = 61.236$) were significantly different ($p < 0.001$) between the two sexes; females have a significantly greater CW than males for a given CL. With the exception of Abdel Razek et al. (2016) reported negative allometry for both sexes, similar results are presented in other geographical areas; Newcombe et al. (1949b) reported $b = 0.910$ for males and $b = 0.888$ for females, but for the equation $L = a\ W^b$, as the variables are reversed. Similarly, in the Levantine, $b$ values ranged from 0.387 to 0.466 for both sexes with the lower values exhibited by females (Gökçe et al., 2006; Sangun et al., 2009). The strong precedence of CW than BW and CL in adult non-ovigerous females is probably associated to the reproductive strategy adopted by the species for the forthcoming spawning season; a linear increase in the number of eggs with increasing CW was demonstrated in ovigerous females (Gelpi et al., 2009). However, males always attain a larger final size, by investing metabolic energy in somatic growth as it is also shown in the present study by having a greater weight for the same CW and CL, while females egg production (Williams, 1974; Hartnoll, 1982). The resulting allometric equations could allow the calculation of growth rates between the basic somatic variables in the adult stages and over an entire ecdysial cycle of the species in the northern latitudes of the Mediterranean Sea. Furthermore, they will contribute to our knowledge of the growth of the blue crab that could allow the assessment and management of natural stocks of an invasive species of ecological and economic importance.

## References


**Abbe G.R. & Stagg C. 1996.** Trends in blue crab (*Callinectes sapidus* Rathbun) catches near Calvert Cliffs, Maryland, from 1968 to 1995 and their relationship to the Maryland commercial fishery. *Journal of Shellfish Research,* **15**: 751-758.

**Abdel Razek F.A., Ismaiel M. & Ammeran M.A.A. 2016.** Occurrence of the blue crab *Callinectes sapidus* Rathbun, 1896, and its fisheries biology in Bardawil lagoon, Sinai Peninsula, Egypt. *Egyptian Journal of Aquatic Research*, **42**: 223-229.

**Atar H.H. & Seçer S. 2003.** Width/length-weight relationships of the blue crab (*Callinectes sapidus* Rathbun 1896) population living in Beymelek lagoon Lake. *Turkish Journal Veterinary Animal Science,* **27**: 443-447.

**Gelpi C.G.Jr., Condrey R.E., Fleeger J.W. & Dubois S.F. 2009.** Discovery, evaluation, and implications of blue crab, *Callinectes sapidus*, spawning, hatching, and foraging grounds in federal (US) waters offshore of Louisiana. *Bulletin of Marine Science*, **85**: 203-222.

**Gökçe G., Ergüden D., Sangün L., Çekiç M. & Alagöz S. 2006.** Width/length-weight and relationships of the blue crab (*Callinectes sapidus* Rathbun, 1896) population living in Camlik lagoon Lake (Yumurtalik). *Pakistan Journal of Biological Sciences,* **9**: 1460-1464.

**Hartnoll R.G. 1978.** The determination of relative growth in Crustacea. *Crustaceana,* **34**: 281-293.

**Hartnoll R.G. 1982.** Growth. In: *The biology of Crustacea 2: Embryology, morphology and ecology* (L.G. Ebele ed), pp 111-196. Academic Press: New York.

**Kevrekidis K. & Antoniadou C. 2018.** Abundance and population structure of the blue crab *Callinectes sapidus* (Decapoda, Portunidae) in Thermaikos Gulf (Methoni Bay), northern Aegean Sea. *Crustaceana***, 91**: 641-657. Doi: 10.1163/15685403-00003795

**Newcombe C.L., Campbell F. & Eckstine A.M. 1949a.** A study of the form and growth of the blue crab, *Callinectes sapidus* Rathbun*.Growth,* **13**: 71-96.

**Newcombe C.L., Sandoz M.D. & Rogers-Talbert R. 1949b.** Differential growth and moulting characteristics of the blue crab, *Callinectes sapidus* Rathbun*. Journal of Experimental Zoology,* **110**: 113-152.

**Olmi E.J. III & Bishop J.M. 1983.** Variations in total width-weight relationships of blue crabs, *Callinectes sapidus*, in relation to sex, maturity, molt stage, and carapace form. *Journal of Crustacean Biology,* **3**: 575-581.

**Pereira M.J., Branco J.O., Christoffersen M.L., Freitas F.J., Fracasso H.A.A & Pinheiro T.C. 2009.** Population biology of *Callinectes danae* and *Callinectes sapidus* (Crustacea: Brachyura: Portunidae) in the south-western Atlantic. *Journal of the Marine Biological Association of the United Kingdom,* **89**: 1341-1351. Doi: 10.1017/S0025315409000605

**Pullen E.J. & Trent W.L. 1970.** Carapace width-total weight relation of blue crabs from Galveston Bay, Texas. *Transactions of the American Fisheries Society,* **99**: 795-798.

**Sangun L., Tureli C., Akamca E. & Duysak O. 2009.** Width/length-weight and width-length relationships for 8 crab species from the north-eastern Mediterranean coast of Turkey. *Journal of Animal and Veterinary Advances*, **8**: 75-79.

**Sumer C., Teksam I., Karatas H., Beyhan T. & Aydin C.M. 2013.** Growth and reproduction biology of the blue crab, *Callinectes sapidus* Rathbun, 1896, in the Beymelek lagoon (southwestern coast of Turkey). *Turkish Journal of Fisheries and Aquatic Sciences,* **13**: 675-684.

**Williams A.B. 1974.** The swimming crabs of the genus *Callinectes* (Decapoda: Portunidae). *Fisheries Bulletin,* **72**: 685-789.