

RESEARCH ARTICLE

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## Data on the distribution, population structure and establishment of the invasive blue crab *Callinectes sapidus* Rathbun, 1896 (Decapoda, Brachyura, Portunidae) in the Lagoon of Viluni (South-East Adriatic Sea, Albania)

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### Abstract

The invasive blue crab *Callinectes sapidus* has been largely distributed along the Adriatic coast of Albania during the recent years. The aim of the present study is to provide data on the distribution, assessment of the abundance, the structure and biometric characteristics of the blue crab population in Viluni Lagoon. The data presented in this paper has been collected during 2014 - 2015. Besides direct observation and samples, collection in the studied area, questionnaires have also been distributed to the local fishermen with the purpose of gathering information about the presence of the blue crab, assessment of its state and its possible impact on the other populations in the Viluni Lagoon, as this species seems to be already established in this lagoon.

**Keywords:** blue crab, invasive species, Viluni Lagoon, Adriatic Sea.

### Introduction

The blue crab *Callinectes sapidus* Rathbun, 1896 a species originating from the western Atlantic, also occurs and is considered as an invasive species in the Mediterranean. This species has been reported as a highly aggressive species and it has been selected among the 100 “worst invasive” species in the Mediterranean with impact on both biodiversity and socioeconomics. [19].

The first scientific report for the presence of this species in the Albanian coast dates in 2009 from Patok Lagoon [4]. However, referring to communications with local fishermen, the blue crab seems to have been seen in several lagoon and river mouth areas along the Albanian coast since late '70 – early '80 [1]. Based on personal communications with the local fishermen of the Viluni Lagoon, the blue crab appeared in the Viluni area in 2000. An earlier study on the Patok area and other lagoons in

Albania [1],[16] has mentioned the presence of the blue crab in Viluni lagoon, too, also showing a picture of this species in that lagoon. This paper represents the results of the first study related to the population structure and establishment of the blue crab in the Viluni Lagoon.

### Materials and methods

The Lagoon of Viluni is situated in the northern coast of Albania, in the south-eastern Adriatic Sea (41° 52' N; 19° 26' E.), between the mouths of the Buna river in the north and the Drini river in the south. The average depth of the lagoon varies from 0.8 to 1m, but in certain sectors it reaches 2-3 m. Viluni Lagoon has been frequently visited from September 2014 to June 2015, usually once a month. Blue crabs were captured with gillnets, as by-catch, by local fishermen. In the central part of the lagoon the collection of the individuals was made with vertical nets of a mesh size 24 mm and a linear length 300 m.

On the opposite parts of the lagoon, near the outlet channel, the blue crab individuals were captured by the eel-cages of a mesh size 8 mm and a linear length 10-15 m.



**Figure 1.** Map of Albania, showing the position of Viluni Lagoon

It has been evaluated the report between males and females (sex ratio) (F : M) and biometric measurements, referring to the classification system of Cadman and Weinstein [6], Harding [15] and Hines [14].

Based on the classification system of Harding [15], using the carapace width (CW), the blue crabs individuals were classified as juveniles (CW < 120 mm) and adults (CW > 120 mm).

Based on carapace width, the blue crabs have been classified in small individuals (CW < 80 mm),

medium (CW 80 – 120 mm) and large (CW > 120 mm), referring to the classification system of Cadman and Weinstein [6].

The blue crab individuals were also classified, based on the width of the carapace, in individuals up to 1 year (CW <100 mm), between 1 and 2 years (CW 100-170 mm) and in individuals over two years (CW > 170 mm), according to Hines [14].

Besides direct observation and samples, collection in the studied area, questionnaires have also been distributed to the local fishermen with the purpose of gathering information about the presence of the blue crab, assessment of its state and its possible impact on the other populations in the Viluni Lagoon.

## Results and Discussion

The blue crab has been recorded in relatively large quantities in the most periods of observations. The high abundance and frequency in the fishing nets, as well as the frequent records of juveniles and ovigerous females, are indicators of stability for the population of the blue crab *Callinectes sapidus* in Viluni Lagoon.

The high presence and stability of the blue crab in this lagoon seem to be supported by the rich benthos with macroinvertebrates and the large and dense cover of the underwater meadows with macro vegetation, predominated by *Zostera noltii* and *Ruppia cirrhosa* [2],[3]. These habitats provide shelter and food for the blue crab [8].

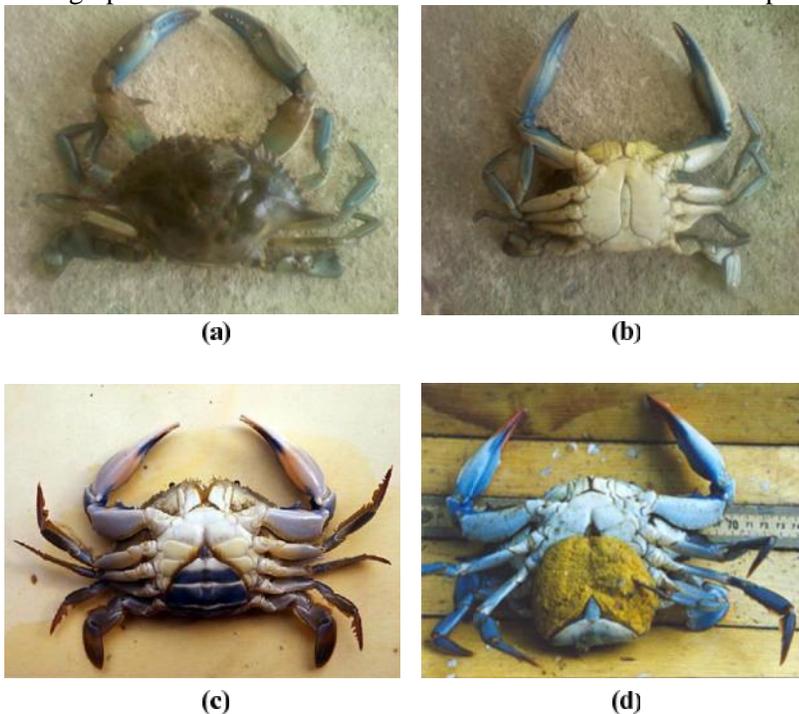
The largest quantity of individuals has been reported from the central part of the lagoon, where the collection was made by gillnets, as described in Materials and Methods here above. A small quantity of individuals has been reported from the opposite part of the lagoon, near the outlet channel, where the collection was made by eel-cages.

**Table 1.** Sampling periods and the number of individuals of the blue crab collected in the Viluni Lagoon.

Sampling periods	Nr of females	Nr of males	Total number
September 2014	3	4	7
October 2014	17	9	26
November 2014	14	17	31
December 2104	0	0	0
January 2015	0	0	0
February 2015	0	0	0
March 2015	0	0	0
April 2015	0	1	1
May 2015	11	14	25
June 2015	9	3	12
<b>Total number</b>	<b>54</b>	<b>48</b>	<b>102</b>

As it is shown in the Table 1, the highest quantity of individuals has been recorded from May to November. In most of bibliographic references, this is the period when the blue crab migrates from the sea into the lagoons and river mouths [7, 9, 11, 12, 17, 13, 21]. This species has been missing in the Viluni Lagoon from December to March that corresponds to the period when the blue crab migrates from the lagoon to the sea for hibernation, after the same bibliographic references mentioned here above.

The report between males and females (sex ratio) F : M, as it is shown in the table 1, was almost 1:1. Juveniles have been reported in May, June and November. Ovigerous females have been observed several times from September to early October and 8 of them have been measured and weighted. This situation is somewhat expected, referring to the literature, which notes that the blue crabs lay eggs usually from May to June and from August to September [14].



**Figure 2.** Blue crab *Callinectes sapidus* from Viluni Lagoon:

- (a) male, dorsal view; (b) male, ventral view;
- (c) female, ventral view; (d)

Most of the individuals found in Viluni Lagoon could be considered as matured, according to the classification system of Cadman and Weinstein [6], which reports that maturity is reached at carapace width of 120-170mm.

Based on the classification system of Harding [15], the blue crabs individuals were classified as juveniles (CW < 120 mm) and adults (CW > 120 mm) (see Table 2).

**Table 2.** The classification of blue crab individuals in juveniles and adults

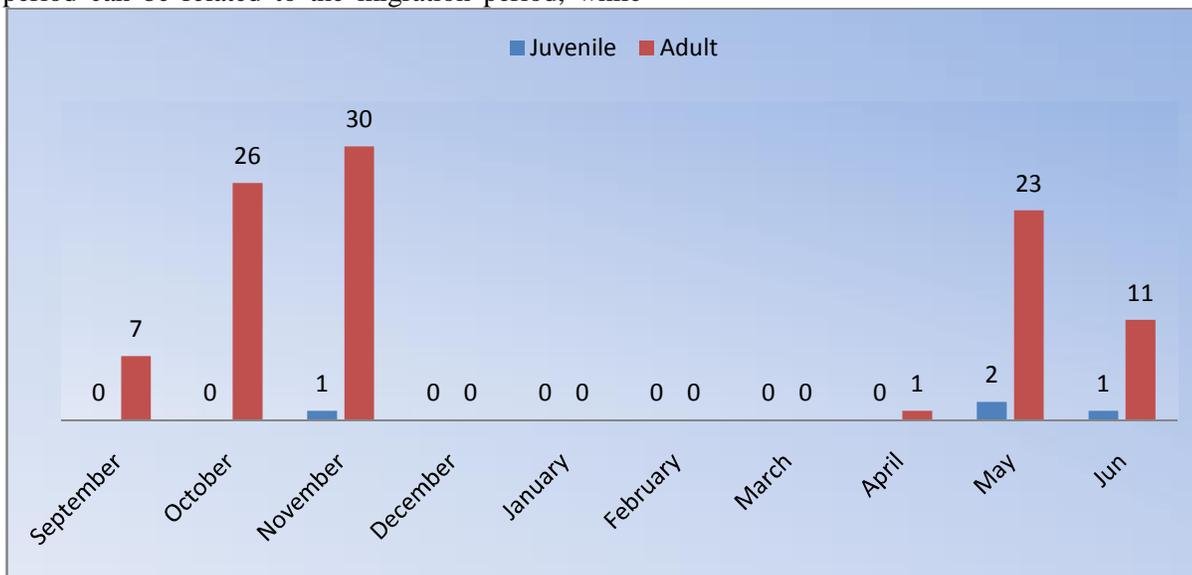
	Juveniles (CW < 120 mm)	Adults (CW > 120 mm)	Total
<b>Female</b>	0	54	54
<b>Male</b>	4	44	48
<b>Total</b>	4	98	102

As it is shown in the Table 2 here above, 4 individuals were juvenile (4%) and 98 individuals were adults (96%). The four juveniles were males and from the 98 adults, 48 were females and 50 were males. The adults have been reported during most of the year, while the juveniles have been reported in May, June and November. Taking into account that the blue crab start migrating from the sea into the lagoon during March – April and from the lagoon to the sea in November, as mentioned earlier here above, perhaps the largest quantity of the juveniles in this period can be related to the migration period, while

the adults can be considered as stabilized in the Lagoon of Viluni.

Based on carapace width, the blue crabs have been classified in small individuals (CW < 80 mm), medium (CW 80 – 120 mm) and large (CW > 120 mm), referring to the classification system of Cadman and Weinstein [6].

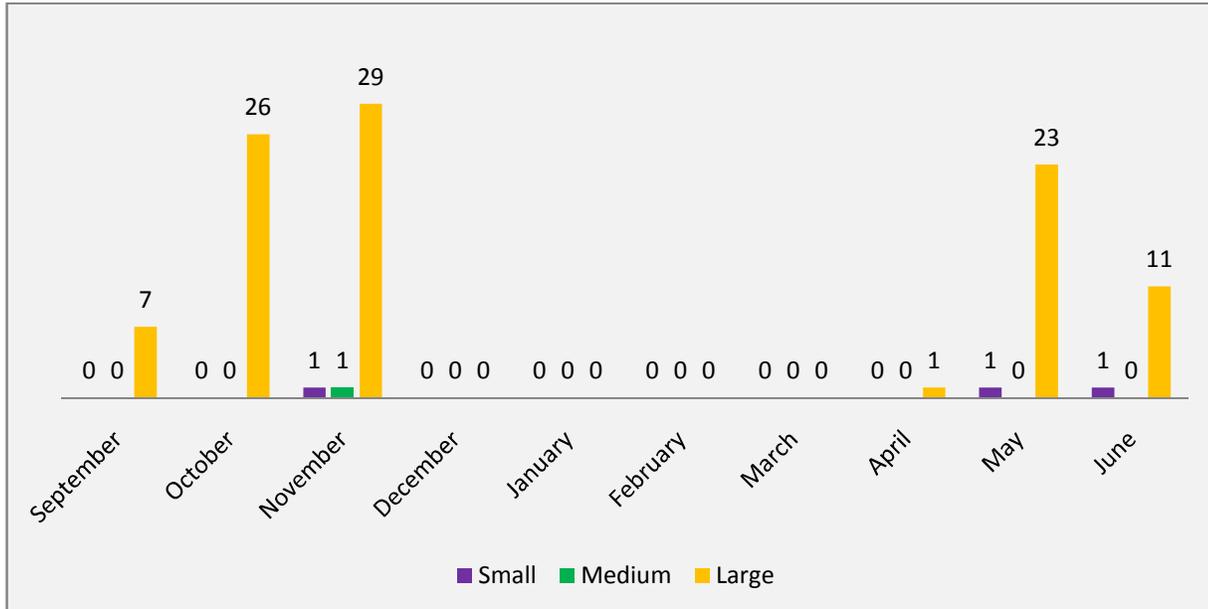
As it is shown in the table 3, referring to the size classification system of Cadman and Weinstein [6] there was a high predominance of the large individuals.



**Figure 3.** The report between juveniles and adults of the blue crab for each sampling month in the Viluni Lagoon.

**Table 3.** The classification of the blue crab individuals according to the size in the Viluni Lagoon

Sex	Small (CW<80mm)	Medium (CW 80-120mm)	Large (CW>120mm)	Total
Female	0	0	54	54
Male	3	1	44	48
<b>Total</b>	3	1	98	102



**Figure 4.** The classification of individuals according to the size for each sampling month in Viluni Lagoon.

The small and the medium individuals have been recorded in May, June and November, while the large individuals have been recorded in every month when the blue crabs were present in the lagoon. The largest quantity has been reported in November with 29 individuals.

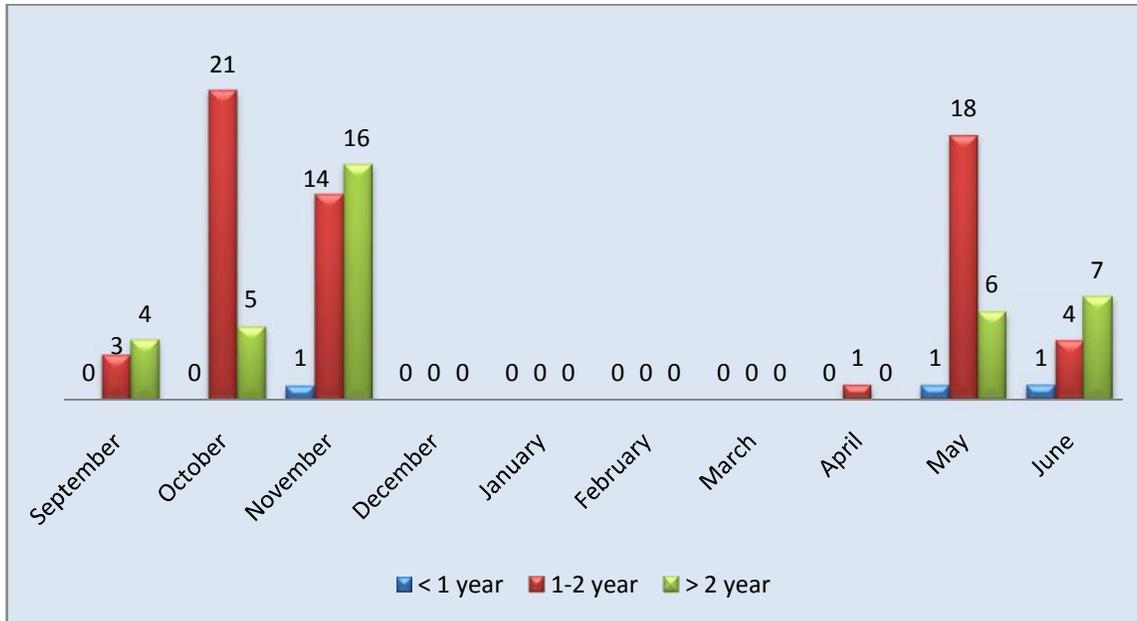
The blue crab individuals were classified, based on the width of the carapace, in individuals up

to 1 year (CW <100 mm), between 1 and 2 years (CW 100-170 mm) and in individuals over two years (CW > 170 mm), according to Hines [14].

Referring to the age classification system of Hines [14] individuals of the age 1 – 2 years were predominant, with about 60% of the total, while individuals over 2 years were about 37% of the total (table 4).

**Table 4.** The classification of the individuals according to the age

	Up to 1 year (CW < 100 mm)	Between 1 and 2 year (CW 100 - 170 mm)	Over 2 year (CW > 170 mm)	Total
Female	0	38	16	54
Male	3	23	22	48
<b>Total</b>	3	61	38	102



**Figure 5.** The classification of the individuals according of the age for each sampling month in the Viluni Lagoon.

As seen in the figure 5, individuals of the age 1-2 years were predominant in October and May, while those of over 2 years were slightly predominant in September, November and June.

The answers from the questionnaires distributed to the local fishermen reported that the blue crab is very common in the Lagoon of Viluni. The first seeing of the blue crab in the lagoon of Viluni dates since 2000. Although the scientific report of this species in Viluni dates in 2011 [1] the earlier records by fishermen were expected, taking into account that the blue crab has been reported for the first time in the Mediterranean in 1949 [20] and in the Central Adriatic in 1972 [10]. The fishermen confirmed that the outlet channel is always open and that the blue crab is present in the most part of the year. Thus, their migration to and from the sea is not modified, which is a different case compared to many lagoons of Albania, where the outlet channels are closed for some part of the year by the local fishermen. The blue crab is considered aggressive by the fishermen and as a potential risk, while they collect the blue crab for commercial purpose. In a

general consideration, the fishermen do not confirm any evident change in the autochthonous lagoon biota after the introduction of blue crab. The fishermen confirmed the presence of the ovigerous females from June to early October. The largest individual collected in the Viluni lagoon weighted 1.5 kg. According to the questionnaires, the blue crab has been a common species in this lagoon since 2010.

### Conclusion

The invasive blue crab *Callinectes sapidus* is considered a common species in the Viluni Lagoon with relatively high abundance during most of the year and it seems to be established in this lagoon. Some of the reasons for the stability and high presence of the blue crab in this lagoon can be related to the richness of benthic invertebrates, which is the main food for this crab, as well as the large and dense cover of underwater meadows with macro vegetation, mainly *Zostera noltii* and *Ruppia cirrhosa* that serves as a suitable habitat for sheltering.

The report between females and males (sex ratio) is almost 1:1. Large, matured, aged from 1 to 2

years individuals are predominating in the blue crab population in this lagoon.

The highest presence of the blue crab in the Viluni Lagoon is from May to November, with the highest presence of juveniles in May, June and November and with ovigerous females from September to early October.

The migration of the blue crab population in the Viluni Lagoon is not influenced by humans, because the channel of communication with the sea is always open. Thus, the blue crab is supposed to migrate to the sea for spawning and hibernating, and entering into the lagoon by early spring.

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