

ESTABLISHMENT OF THE NON-INDIGENOUS PRAWN *PENAEUS PULCHRICAUDATUS* STEBBING, 1914 IN THE MARINE AREA OF CYPRUS

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ABSTRACT

*The paper provides strong evidence on the establishment of the Lessepsian prawn *Penaeus pulchricaudatus* (Decapoda, Dendrobranchiata, Penaeidae) in Cypriot waters based on the occurrences reported in the present study and in previous records. On 3 September 2018, several *P. pulchricaudatus* individuals of different sizes were observed and one photographed in situ in Protaras, Trinity Beach. The individual, upon sight, was estimated to measure 15-17 cm in total length. The crustacean diversity of Cyprus is rather underestimated, even in common native species. This species should be considered as established in Cyprus, since several individuals of various sizes were observed during the sighting described herein and the species has so far been reported from three different locations along the coast of Cyprus (considering the previous records from Cape Greco and Cape Andreas).*

Key words: *Penaeus pulchricaudatus*, Decapoda, non-indigenous species, Cyprus, Levantine Sea, eastern Mediterranean Sea

STABILIMENTO DEL GAMBERO NON INDIGENO *PENAEUS PULCHRICAUDATUS* STEBBING, 1914 NELL'AREA MARINA DI CIPRO

SINTESI

*L'articolo fornisce una forte evidenza dello stabilimento del gambero lessepsiano *Penaeus pulchricaudatus* (Decapoda, Dendrobranchiata, Penaeidae) nelle acque cipriote, in base ai ritrovamenti riportati nel presente studio e a segnalazioni precedenti. Il 3 settembre 2018 sono stati osservati diversi esemplari di *P. pulchricaudatus* di dimensioni diverse, uno dei quali fotografato in situ a Protaras, Trinity Beach. La lunghezza totale di questo esemplare è stata stimata a vista (15-17 cm). La diversità dei crostacei di Cipro è piuttosto sottostimata, anche per le comuni specie autoctone. Questa specie lessepsiana dovrebbe venir considerata come stabilita a Cipro, poiché durante l'avvistamento qui riportato sono stati osservati diversi individui di varie dimensioni. La specie è stata finora segnalata in tre diverse località lungo la costa di Cipro (considerando anche i ritrovamenti precedenti di Capo Greco e Capo Andreas).*

Parole chiave: *Penaeus pulchricaudatus*, Decapoda, specie non indigena, Cipro, Mar di Levante, Mediterraneo orientale

INTRODUCTION

Citizen-scientists are contributing to monitoring alien and rare species in the Mediterranean Sea (e.g., Giovos *et al.*, 2018; Kampouris *et al.*, 2018a, b & c). There are several projects and initiatives successfully underway in the basin (e.g., Kondylatos *et al.*, 2017; Zenetos *et al.*, 2017; Bariche *et al.*, 2018; Giovos *et al.*, 2018). But although the social media are increasing the probability of data collection through direct involvement, some scientists remain sceptical (Katsanevakis & Moustakas, 2018).

It should not be a surprise that Cyprus, which is less than 400 nm distant from the Suez Canal, is heavily impacted by the introduction of non-indigenous species (Chartosia & Michailidis, 2016). The crustacean diversity of Cyprus is rather underestimated, even in common native species (Chartosia & Theodosiou, 2018). Perhaps the most comprehensive work is the study by Lewinsohn & Holthuis (1986), which inevitably lacks information, especially in relation to non-indigenous and rare species.

The name *Penaeus pulchricaudatus* (Stebbing, 1914) was believed to be a junior synonym of a species of global economic importance, *Penaeus japonicus*. The *Penaeus japonicus* species complex exhibits genetic differences throughout its geographical distribution (Tsoi *et al.*, 2014). *P. pulchricaudatus* occurs naturally in Australia, the western Indian Ocean, the South China Sea and the Red Sea. The population in the Mediterranean Sea, which originated from the Red Sea, is expanding northwards and the species is considered a Lessepsian migrant (Tsoi *et al.*, 2014). Regarded as an established species in the south Aegean Sea (Kampouris *et al.*, 2018b, and references within), it constitutes an important component of prawn fishery in Greece and Turkey (Can *et al.*, 2004; Corsini-Foka *et al.*, 2015). In

Cyprus, the first report of the species (as *P. japonicus*) dates to 1986 (Lewinsohn & Holthuis, 1986), but it is still undetermined if *P. pulchricaudatus* is established in Cyprus and what its population status is.

MATERIAL AND METHODS

On 3 September 2018, several *P. pulchricaudatus* individuals of different sizes were observed and one photographed *in situ* (Fig. 1) by one of the authors (C.C.) of the paper in Protaras, Trinity Beach, Cyprus (35°03'05.2"N 34°01'23.2"E, approximately), on a sandy bottom at a depth of 3-7 m, during a night dive with a Nikon D810 camera. For the purposes of the present paper only one photograph is presented.

RESULTS AND DISCUSSION

The identification of the species was based on high-resolution photos taken by one of the authors (C.C.) and on the visual identification criteria described in earlier studies (Tsoi *et al.*, 2014; Kampouris *et al.*, 2018b). WoRMS (2018) was used for taxonomy and systematics. The individual's total length was estimated as 15-17 cm. It was sighted as crawling slowly across the bottom (Fig. 2). The visual identification criteria are: 1. well-developed ridges and grooves on carapace, 2. body colour beige with brown transverse bands extending from top to midline, 3. pereopods yellow to cream-whitish, 4. flagella brown, 5. pleopods yellowish to reddish with white and brown spots/blotches at base (Tsoi *et al.*, 2014; Kampouris *et al.*, 2018b).

The present work provides further evidence that citizen science can contribute importantly to non-indigenous species monitoring by complementing scientific knowledge. The *P. pulchricaudatus* species should be considered as established in Cyprus, based on the obser-



Fig. 1: Map of Cyprus, indicating sampling location (black triangle).

Sl. 1.: Zemljevid Cipra z označeno lokaliteto vzorčenja (črn trikotnik).



Fig. 2: The *Penaeus pulchricaudatus* from Protaras, Trinity Beach, Cyprus, and its microhabitat.

Sl. 2: Kozica vrste *Penaeus pulchricaudatus* iz lokalitete Protaras, Trinity Beach, Ciper, in njen mikrohabitat.

vation of several individuals of various sizes in the wider area on this occasion and based on previous records, all following the methodologies used in earlier studies on non-indigenous species assessments (Thessalou-Legaki *et al.*, 2006; Dulčić *et al.*, 2011; Katsanevakis, 2011). Moreover, considering earlier records (Lewinsohn & Holthuis, 1986), the species has been observed in three different areas along the coast of Cyprus.

Underwater photography and videography are nowadays extensively used for non-indigenous and rare species detection and monitoring. They have proven very successful and useful in many cases, sometimes providing unique findings (e.g., Marcelli *et al.*, 2016, Kondylatos *et al.*, 2017; Bariche *et al.*, 2018; Deidun *et al.*, 2018; Kampouris *et al.*, 2018c).

The taxonomy of the Dendrobranchiata, the penaeid prawns, is a rather typical example of uncertainty and controversy in science (see De Grave & Fransen, 2011). Perhaps the most striking example is the *Penaeus*, where even the correct spelling of the genus is a matter of controversy (see Tsoi *et al.*, 2014 and references within for details). *P. pulchricaudatus* was introduced via the Suez Canal, contributing to an even wider phenomenon of the Lessepsian migration (Tsoi *et al.*, 2014).

CONCLUSIONS

The concurrently present kuruma prawn *P. japonicus* should not be excluded as a potential non-indigenous species in the Mediterranean Sea, since it is cultivated in many European and Mediterranean countries (Quigley *et al.*, 2013 and references therein). Further research, perhaps on a molecular basis, would be required to support this hypothesis.

The establishment of *P. pulchricaudatus* along the coast of Cyprus is not surprising, since there are many other Lessepsian species already regarded as established in the marine area of Cyprus, *Parupeneus forsskali*, Chartosia & Michailidis (2016), for example. Moreover, other penaeid species, such as *P. monodon* (e.g., Alfaro-Montoya *et al.*, 2015; Zink *et al.*, 2018), *P. japonicus* and *P. pulchricaudatus* (e.g., Quigley *et al.*, 2013; Kampouris *et al.*, 2018b) and *P. aztecus* (e.g., Kampouris *et al.*, 2018a, b; Zava *et al.*, 2018) are acknowledged as aliens in many other parts of the world, which corroborates their invasive nature.

To better understand the geographical extent of *P. pulchricaudatus*' establishment and the factors affecting it, systematic surveys are needed (Maceda-Veiga *et al.*, 2013; Nunes *et al.*, 2017). Other penaeid species that might already be established in Cyprus are *P. hathor* and *P. aztecus*, both extensively recorded in the Levantine and south Aegean Seas (see Kampouris *et al.*, 2018b and references therein for details).

TUJERODNA KOZICA *PENAEUS PULCHRICAUDATUS* STEBBING, 1914, USTALJENA
VRSTA V VODAH CIPRA

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POVZETEK

Avtorji poročajo o lesepski selivki, tujerodni kozici *Penaeus pulchricaudatus* (Decapoda, Dendrobranchiata, Penaeidae) v ciprskih vodah, ki jo lahko na podlagi novih podatkov iz pričujoče študije in predhodnih zapisov smatramo za ustaljeno vrsto. Tretjega septembra 2018 so bili številni različno veliki osebki kozice *P. pulchricaudatus* opaženi, eden od njih pa fotografiran v naravnem okolju na lokaliteti Protaras, Trinity Beach. Slednji naj bi meril med 15-17 cm totalne dolžine. Biodiverziteti rakov Cipra je razmeroma podcenjena, tudi na nivoju domorodnih rakov. Na podlagi opazovanj in drugih predhodnih zapisov s treh lokalitet (upoštevaje zapise iz lokalitet Cape Greco in Cape Andreas) vzdolž ciprske obale bi morali tujerodno kozico obravnavati kot ustaljeno vrsto.

Ključne besede: *Penaeus pulchricaudatus*, Decapoda, tujerodne vrste, Ciper, Levantsko morje, vzhodno Sredozemsko morje

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