

## THE NON NATIVE RED SWAMP CRAYFISH *Procambarus clarkii* AS PREY FOR WATERBIRDS: A NOTE FROM TORRE FLAVIA WETLAND (CENTRAL ITALY)

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**Riassunto – Il Gambero rosso della Louisiana *Procambarus clarkii*, specie alloctona, come preda per gli uccelli acquatici: una nota dalla Palude di Torre Flavia (Italia centrale).** Si riportano dati di predazione su questo crostaceo alloctono da parte di nove specie di uccelli acquatici, tra cui due (Germano reale, *Anas platyrhynchos* e Folaga, *Fulica atra*) a dieta non strettamente carnivora. Per alcune specie (es., Beccaccino, *Gallinago gallinago*) si tratta, apparentemente, delle prime segnalazioni, almeno a scala nazionale. Sebbene sia noto il potenziale impatto di questa specie sugli ecosistemi umidi, si può ipotizzare un paradossale ruolo di questo crostaceo come surrogato trofico dopo che, negli ultimi anni, è andata progressivamente cessando la locale attività di piscicoltura, che ha favorito per anni la presenza di uccelli ittiofagi nella Palude di Torre Flavia.

One of the most important threats to ecosystems worldwide is represented by the invasion by allochthonous species (Wittenberg & Cock, 2005; Dueñas *et al.*, 2021)

Louisiana Crawfish (or Red Swamp Crayfish), *Procambarus clarkii*, occurs naturally from northeast Mexico, to south-central USA (Capinha *et al.*, 2011). The first introduction of the red swamp crayfish in Europe was in Spain in 1973 (Gutierrez-Yurrita *et al.*, 1999) and later in France, Portugal, Germany and England (Souty-Grosset *et al.*, 2016). Due to biological, economical, and social reasons, *P. clarkii* became progressively an invasive species in Europe (Gherardi, 2007). In Italy the species was observed for the first time, in 1989, in a small stream in the West Piedmont, near Turin, probably because of the accidentally escaping of some individuals from an astaci-culture farming (Delmastro, 1992). Due to the rapidly spread, the Louisiana crawfish can be seen more recently even in the Central and Southern part of Italy (e.g., Morpugo *et al.*, 2010). The distribution and the biological invasion of *P. clarkii* in Italy are studied exhaustively in the scientific work of Lo Parrino *et al.* (2020).

In Latium (central Italy) the species has been recently studied by many authors (Chiesa *et al.*, 2006; Scalici *et al.*, 2009; Di Russo *et al.*, 2017; Mazza *et al.*, 2018) and it is locally occurring in 'Torre Flavia' wetland at least from 2003-2004 (Chiesa, 2006).

*Procambarus clarkii* is an important food resource for mammals and birds and it seems to play a key role in the trophic interactions of the riparian and terrestrial communities of the marsh (e.g. Correia, 2001; Geiger *et al.*, 2005). While European and Italian distribution of *P. clarkii* are well studied, less informations are known about animals able to prey this crayfish in Europe and more specific, in Italy. In the scientific literature there are observations of many species feeding on the Louisiana crayfish, ex-

pecially birds and mammals (e.g. Correia, 2001, Amori & Battisti, 2008, Giménez-Anaya *et al.*, 2008), but not a single complete list.

In this note, we reported the observations on bird species preying on the invasive Louisiana crawfish in the ‘Torre Flavia’ Special Area of Conservation (SPA code IT6030020, according to the Directive 2009/147), a remnant coastal wetland located in Tyrrhenian central Italy (Municipalities of Cerveteri and Ladispoli; Latium, 41°58’N, 12°03’E).

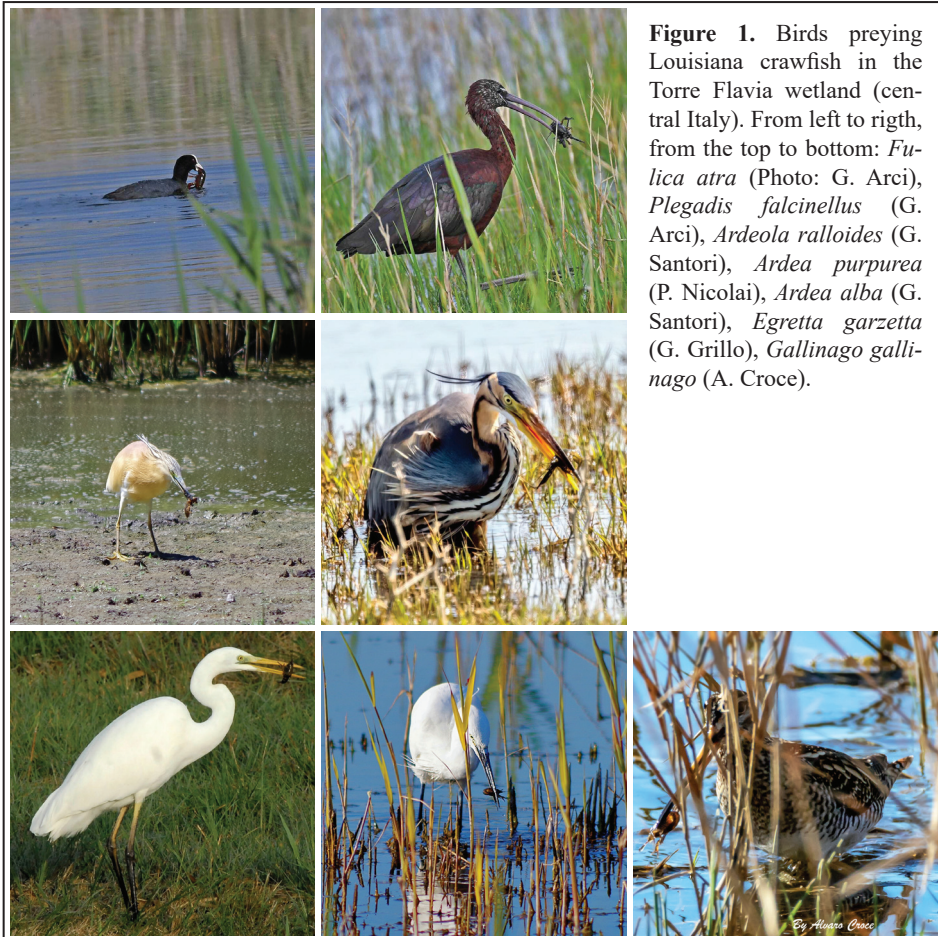
During exploratory rounds in the ‘Torre Flavia’ SPA, made in February, March and April 2023, and previous reports made in 2020 and 2021, nine bird species, of five different families (Anatidae, Rallidae, Threskiornithidae, Ardeidae, Alcenididae and Scolopacidae) were observed attacking and preying on adult and juveniles individuals of *P. clarkii*: *Anas platyrhynchos* (Mallard), *Fulica atra* (Eurasian Coot), *Plegadis falcinellus* (Glossy Ibis), *Ardeola ralloides* (Squacco Heron), *Ardea purpurea* (Purple Heron), *Ardea alba* (Great Egret), *Egretta garzetta* (Little Egret), *Alcedo atthis* (Common Kingfisher) and *Gallinago gallinago* (Common Snipe). Photos of the observations are available for seven of the nine different species (Fig. 1).

Previous studies yet reported evidence for bird species preying on *P. clarkii* in Italy. For *A. platyrhynchos*, observations of active predation on *P. clarkii* are described in Delmastro (2017) and Laurenti (2020). Observations of *F. atra* were described summarily and briefly in Rizzato (2015), while it seems that there are only occasional observations of *P. falcinellus* preying on *P. clarkii* in Italy (e.g., E. Ferrari, Circeo national park, 2021, pers. comm.), while in other countries, like Portugal and Spain, there are large number of direct and indirect records (e.g. Macías *et al.*, 2009).

For the Ardeidae, observations of *Egretta garzetta* and *Ardea alba* preying on *P. clarkii* are described by Rizzato (2015), Fasola & Cardarelli (2015), Delmastro (2017) and Laurenti (2020).

For *Bubulcus ibis*, Fasola & Cardarelli (2015) yet obtained evidence of predation for Italy. Indeed, although for *Ardea purpurea* and *Ardeola ralloides*, there are evidence of predation outside Italy (e.g. Correia, 2001), *A. purpurea* was yet observed preying on *P. clarkii* in Italy (Fasola & Cardarelli, 2015), while our observation of *A. ralloides* seems to be one of the first ever reported in Italy. Moreover, although data of predation of crayfish by waders are available (e.g., Lourenço & Piersma, 2008, for Black-tailed Godwits *Limosa limosa*), data about the Common Snipe, *Gallinago gallinago* are lacking worldwide. Finally, predation by Common Kingfisher, *Alcedo atthis*, have been yet reported (for Italy: Delmastro, 2017; see also García *et al.*, 2022).

In the ‘Torre Flavia’ wetland a large number of non-native animal species occur (Amori and Battisti, 2008), such as *Myocastor coypus*, *Gambusia holbrooki*, *Trachemys scripta* and other terrapins (e.g. Ferri *et al.*, 2021; Grillo *et al.*, 2020; including the recent record of *Chelydra serpentina*, J. Giordano pers. obs.. Moreover, in the area there is evidence of alien food chains (Amori & Battisti, 2008), where *P. clarkii* can be both a predator of *Gambusia holbrooki* (e.g. Souty-Grosset *et al.*, 2016) and a prey (*Rattus norvegicus* and, probably, *Myocastor coypus*; S. De Michelis, pers. comm.).



The Louisiana crayfish is omnivorous and once introduced, it may disturb macrophytes and macroinvertebrate communities (Souty-Grosset *et al.*, 2016), amphibians (Renai and Gherardi, 2004) and fish populations (Ilhéu *et al.*, 2007), with apparent indirect impacts also on some birds. Moreover, it has been hypothesized that bird predation of crayfish may lead to a reduction of intraspecific competition between crayfish and to the production of more reproductively efficient adults (Correia, 2001; De Luise, 2010). Therefore, according to some authors, predation by birds and mammals can cause a renewal of the population of *P. clarkii* and not a decrease in numbers (e.g. Correia, 2001). However, the Louisiana crayfish may also represent a highly available resource for many animals species, especially mammals, birds, reptiles and fishes (e.g. Correia, 2001; Laurenti, 2020), providing food resources for many birds also of conservation concern (e.g., herons included in 147/2009/CEE).

In 'Torre Flavia' wetland this species occurs from 2004 (Chiesa, 2006). From this

year fish farming activity (providing a large amount of prey biomass for piscivorous birds) has been progressively abandoned. Therefore, in this regards, in this area non native crayfish may represent a paradoxical trophic surrogate for a large number of birds. Interestingly, also herbivorous species (*Fulica atra*, *Anas platyrhynchos*) appear feed on this non native crayfish.

Unfortunately, no complete list of the predator of *P. clarkii*, in Europe and especially in Italy, was available, although many other species, also not water-related, have been observed feed on crayfish (e.g., *Corvus cornix*; P. Plini, pers. comm.; Dalmastro, 2017; Laurenti, 2020).

Due to the rapid invasion of the species and the need of conservation project to protect native animal and plant species, future scientific studies could have the objective to create an european list of the species feeding on *P. clarkii* in both field and scientific literature.

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