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Potamon fluviatile lanfrancoi, a new subspecies of a Mediterranean freshwater crab from the Maltese Islands (Crustacea, Decapoda, Potamidae)

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(With 2 figures)

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Abstract

A new subspecies of *Potamon fluviatile* HERBST, 1758 is described from the Maltese Islands as ssp. *lanfrancoi*. Morphological comparisons between Italian, Maltese and North African populations are discussed. Earlier literature is evaluated and sections on biogeography, distribution and biology of the new subspecies are also given.

Riassunto

I granchi d'acqua dolce delle Isole Maltesi vengono attribuiti ad una nuova sottospecie: *Potamon fluviatile lanfrancoi*. Le popolazioni maltesi vengono confrontate con quelle italiane e nordafricane. Viene discussa la letteratura e forniti elementi biogeografici e biologici.

Introduction

In the Maltese language the freshwater crab or river crab (*Potamon* sp.) has a common name and is referred to as Qabru (plural: Qwabar). Thanks to this common name it is possible to know the first probable reference, in the literature, to the freshwater crab in Malta. In 1647 the Maltese historian Fra Giovanni Francesco ABELA, while describing Malta, indicated the locality "Marsa piccola" with the words "Marsa picciola detta Sciat el Kuabar, cioè lido di granci" (ABELA 1647). Up to some decades ago in the early 19th century the locality of Marsa, situated at the head of Grand Harbour, was a large marshy area fed by the flood waters of Wied il-Kbir. This marshy area was drained between 1850 and 1860 as a precaution against malaria and is now occupied by the Marsa Sports Grounds (CASTAGNA 1888). Up to at least 1873 the freshwater crab still survived at Marsa, as recorded by Gavino GULIA, who also gave its first scientific determination, *Thelphusa fluviatilis* LATR., and added "Comune nei ruscelletti e nelle acque dolci alla Marsa, Gnejna, Lunzjata. Maltese: Kabru, Granc ta l'ilma helu, Granc ta l'art.

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Se ne fanno zuppe nei giorni di astinenza dalla gente povera, che spesso ne soffre diarree" (GULIA Gav. 1873).

The present situation of the Maltese freshwater crab has changed very much, essentially because of the slow reduction or total destruction of permanent freshwater streams in which it lives. Today the freshwater crab still survives at only one locality in Gozo and four localities in Malta. Moreover, in these localities the number of individuals is very much reduced, sometimes to the limit of extinction being affected by pressures from agriculture (i.e. pesticides), urbanization, free access, and indiscriminate collecting by man.

The question of the protection of the freshwater crab in Malta is not by any means new. An official petition for its protection was presented in June 1975 by the Natural History Society of Malta under its founder/president Mr. Guido G. LANFRANCO. In May of the same year, at Mr. LANFRANCO's suggestion, the government authorities minted the image of the crab on the 20 Maltese Liri gold coin (LANFRANCO G. G. 1975). The crab's image also appears on the current 10 Maltese Liri bank note and on the new 5 cents coin, minted in 1986.

Since June 1979 the Society for the Study and Conservation of Nature, formerly the Natural History Society of Malta, published a popular scientific journal entitled "POTAMON" with the silhouette of the crab as its logo. Various local naturalists also insisted on the protection of this crab in Malta (LANFRANCO 1963, 1975, 1976; SAVONA VENTURA 1979; SCHEMBRI 1983).

The present work confirms the scientific importance and high risk of extinction of the Maltese population of freshwater crabs and renews the appeal to the authorities to take immediate concrete measures, with the help of local nature conservation associations and the University of Malta, for the protection of this animal which is totally dependent on fresh water, and which by its extraordinary adaptive ability has managed to survive in localities where this is becoming scarce up to the limit of aridity. We therefore urge for the protection of these localities, where permanent freshwater streams still flow, and that they be declared nature reserves.

Taxonomy

Systematically the Maltese freshwater crab belongs to the family Potamidae, Genus *Potamon* (SAVIGNY, 1816), species *fluviatile* (HERBST, 1785).

The specific name *edule* (LATREILLE, 1818), common in past literature is a junior synonym as is the generic name *Thelphusa* (LATREILLE, 1819).

P. *fluviatile* is present in almost all of Italy, the western Balkan Peninsula (Dalmatia, Albania, Greece), in Sicily, The Maltese Islands, and North West Africa (Tunisia, Algeria, Morocco). In this area the species is divided in three subspecies: *P. f. fluviatile* s. str. in Europe, *P. f. algeriense* (BOTT, 1967) in North Africa and *P. f. berghetripsorum* (PRETZMANN, 1976) in part of Morocco; in Europe, according to PRETZMANN it has been divided in various local forms, like *tarantinum* in the neighbourhood of Taranto, *thessalonis* in Greece, *laconis* in the

Peloponnese and *leucosis, kühnelti* and *androsium* on the greek islands of Levkas, Zante and Andros respectively (PRETZMANN 1962, 1976, 1982, 1983a, 1983b, 1984; BOTT 1967).

The Maltese population as seen from the following literature has in the past been attributed to the nominal subspecies:

1647 – Kuabar/Granci – ABELA G. F.
1873 – *Thelphusa fluviatilis* LATR./Kabru/Granc ta l'ilma helu/Granc ta l'art – GULIA Gavino.
1889–90 – *Thelphusa fluviatilis*/Kabru/Granc ta l'ilma helu/Granc ta l'art – GULIA Giov.
1913 – *Thelphusa fluviatilis* – GULIA Giov.
1963 – *Thelphusa fluviatilis*/Kabru – LANFRANCO G. G.
1971 – *Potamon edulis* – HARRIS R. R. & MICALLEF F. F.
1974a – *Potamon edulis* (LATR) – PACE F.
1974b – *Potamon edulis* – PACE F.
1975 – *Potamon edulis* – JACCARINI V. & HARRIS R. R.
1975 – *Potamon edulis* – Nat. Hist. Soc. Malta (LANFRANCO G. G.).
1976 – *Potamon edulis* – LANFRANCO G. G.
1976 – *Potamon edulis* (= *P. fluviatile)* (LATREILLE) – PACE F., HARRIS R. R. & JACCARINI V.
1979 – *Potamon edulis* (LATR) – SAVONA VENTURA C.
1983 – *Potamon fluviatile*/il-Qabru/Granc tal-Ilma Helu/Granc tal-Art – SCHEMBRI P. J.
1984 – *Potamon fluviatile*/Qabru – LANFRANCO E. & SCHEMBRI P. J.
1986 – *Potamon fluviatile* – LANFRANCO E. & SCHEMBRI P. J.

Table 1: Maltese material of *Potamon fluviatile* examined.
C/..: collection Joe L. CILIA; Z..: collection Mario ZAMMIT; AC./.: collection Patrick J. SCHEMBRI; UM/..: collection University of Malta; others: collection Domenico CAPOLONGO. (Measurements in centimetres)

N	locality	sex	L	B1	B2	H	mucro	cristae transversae	lobi tumidi
5	Wied il-Lunziata	♂	4.80	5.65	4.69	–	–	curved	–
6	Wied Bahrija	♀	3.98	4.74	–	–	lobed	curved	–
7	Wied Bahrija	♂	4.24	4.94	4.09	2.52	–	curved	swollen
31	Wied il-Lunziata	♂	3.80	4.48	3.79	2.33	–	slightly c.	swollen
51	Wied Bahrija	♂	5.20	6.17	5.11	3.15	–	curved	swollen
56	Wied il-Lunziata	♂	4.13	4.89	4.05	2.51	–	curved	swollen
C/02	Wied il-Lunziata	♂	3.90	4.60	3.90	2.40	–	curved	swollen
C/03	Wied il-Lunziata	♂	4.15	4.90	4.15	2.70	–	curved	swollen
C/01	Wied Bahrija	♂	4.60	5.45	4.55	2.45	–	curved	swollen
C/04	Wied Bahrija	♀	3.23	3.79	3.29	1.98	lobed	curved	–
C/05	Wied Bahrija	♀	3.20	3.77	3.19	1.93	lobed	curved	–
C/06	Gnejna	♂	3.80	4.42	3.77	2.25	–	slightly c.	swollen
C/07	San Martin	♀	4.23	4.94	4.20	2.62	lobed	curved	–
Z23	Wied Bahrija	♀	3.88	4.55	3.81	2.44	lobed	curved	–
AC4/2	San Martin	♀	3.40?	4.75	4.20	2.60	lobed	curved	–
AC4/1	Gnejna	♂	4.37	5.20	4.34	2.50	–	curved	slightly s.
UM/1	unknown	♂	4.40	5.25	4.50	2.71	–	slightly c.	swollen
UM/2	unknown	♂	4.75	5.55	4.70	2.90	–	slightly c.	swollen
UM/3	unknown	♀	4.10	4.75	4.00	2.60	lobed	curved	–

A comparative examination of material from Malta and Gozo with material from Italy, Sicily and North Africa (mainly from D. CAPOLONGO collection) was undertaken. The Maltese specimens presented morphological characteristics very similar to the subspecies *fluviatile;* however, the Maltese population seems to be in a fast process of differenciation from the nominal form, which permits the description of a new allopatric geographical race. In this respect, JACCARINI & HARRIS, when investigating haemocyanins of *Potamon fluviatile* from Malta and Italy stated that "the relatively short period (< 10,000 years) since the breaking of the Malta – Sicily land bridge . . . has resulted in only very limited divergence of the isolated Maltese population. This divergence is reflected in the slight physiological difference between the two populations" (JACCARINI & HARRIS 1975). This physiological difference was investigated earlier by HARRIS & MICALLEF (1971).

Potamon fluviatile lanfrancoi n. subsp.
(Fig. 1a, 1b)

Habitat: The Islands of Malta and Gozo (Republic of Malta), along courses with slow moving water in agricultural zones not far from the coast, sometimes also close to habitations.

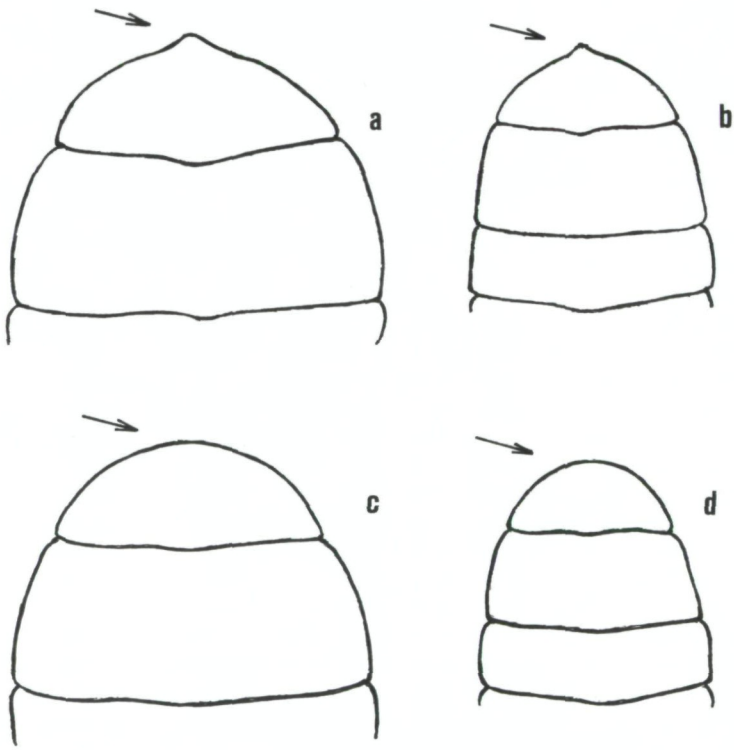

Fig. 1: End profile of last abdominal segment in females:
Malta: a = adult, b = immature
Italy: c = adult, d = immature

Holotype: No. C/04 from collection CILIA. Adult ♀ – 3.23 cm. L. – other data in table 1. J. L. CILIA leg. in Wied Bahrija (Malta) 10. 08. 1985. Now in the Naturhistorisches Museum, Vienna (NHMW Nr.: 6342).

Allotype: No. 51 from collection CAPOLONGO. Adult ♂ – 5.20 cm. L. – other data in table 1. D. CAPOLONGO leg. in Wied Bahrija (Malta) 28. 04. 1985. Now in the Naturhistorisches Museum, Vienna (NHMW Nr.: 6343).

Paratypes: All other specimens listed in table 1. The specimens are deposited at the Museo Zoologico dell'Università di Firenze: Nos. 31, C/07, at the Museo di Storia Naturale di Verona: Nos. 56, C/05, at the University of Malta, Biology Dept.: Nos. UM/1, UM/2, UM/3, at Dr. D. CAPOLONGO: Nos. 5, 6, 7, at Mr. J. L. CILIA: Nos. C/01, C/02, C/03, C/06, at Dr. P. J. SCHEMBRI: Nos. AC4/1, AC4/2 and at Mr. M. ZAMMIT: Nos. Z23.

Main differenciating characters: Examination of the specimens was based on four indices and three morphological characters:

1. $\frac{L}{B1} = \frac{\text{maximum length of carapace}}{\text{maximum width of carapace}}$

2. $\frac{L}{B2} = \frac{\text{maximum length of carapace}}{\text{metabranchial width of carapace}}$

3. $\frac{B1}{B2} = \frac{\text{maximum width of carapace}}{\text{metabranchial width of carapace}}$

4. $\frac{H}{L} = \frac{\text{maximum height of carapace}}{\text{maximum length of carapace}}$

5. Lobi tumidi = Profile of terminal part of the first pair of gonopods (in males), with or without swelling.
6. Mucro = End profile of last abdominal segment in females, with or without central "lobe".
7. Cristae transversae = Post orbital crests, straight or curved laterally backwards.

The values for index L/B1, independent from the size of the animal, are generally lower in *P. f. algeriense,* but do not present significant difference in the Italian and Maltese populations.

Table 2: Mean values and range for index L/B1 in different populations of *Potamon fluviatile.*

	♂♂			♀♀			♂♂ + ♀♀		
	n	mean	range	n	mean	range	n	mean	range
Tuscany	6	0.841	0.825–0.855	–	–	–	6	0.841	0.825–0.855
South Italy	22	0.862	0.842–0.882	14	0.852	0.843–0.871	36	0.858	0.842–0.882
Sicily	3	0.851	0.836–0.876	3	0.845	0.834–0.857	6	0.848	0.834–0.876
Malta	12	0.847	0.838–0.876	6	0.852	0.840–0.860	18	0.849	0.838–0.860
Tunisia-Algeria	6	0.831	0.815–0.845	1	–	0.814	7	0.829	0.814–0.845

As was expected this index presents a more restricted variability in the Maltese populations with respect to those of Italy.

The index L/B2 increases with the size of the animals, giving higher values in *P. f. algeriense.*

The index B1/B2 also increases with the size of the animal, with still higher values in *P. f. algeriense.*

The index H/L is independent on the size of the male animal but presents increasing values with increase in size in females. For this index the values for *P. f. algeriense* are lower than those of European specimens, including Malta.

In these three indices too there is no difference between Maltese and Italian populations.

The following table sums up the relative date of the three morphological characters examined:

Table 3: Relative data of three morphological characters in different populations of *Potamon fluviatile.*

	lobi tumidi	mucro	cristae transversae
Italy-Sicily	swollen	not lobed	curved
Malta-Gozo	swollen	lobed	curved
Tunisia-Algeria	not swollen	not lobed	not or slightly curved

We therefore conclude, from the examined morphological elements, that the freshwater crab of Malta and Gozo is closer to *P. fluviatile fluviatile* of Italy and Sicily than to *P. fluviatile algeriense* of Tunisia and Algeria, differing from the former however by the evident central prominence on the profile of the last abdominal segment of the female.

Derivatio nominis: We dedicate this new subspecies to the Maltese naturalist Guido G. LANFRANCO, founder of the Natural History Society of Malta, conservationist of the Maltese flora and fauna in general and of *Potamon* in particular.

Biogeography: The strong similarity between the Maltese *Potamon* and that of Italy and Sicily, is a confirmation of the various recent Pleistocene connections between the Maltese Islands and Sicily. Much has been discussed on the higher number of Sicilian animals present on the Maltese Islands against much lower numbers of North African origin. (VAUFREY 1929; DE LUCCA 1965; BARONI URBANI 1968; THAKE 1985). The latter, unless introduced by man or as a consequence of migration must be attributed to an earlier connection between North Africa and Europe at the end of the Miocene (Messinian Crisis) or early Pliocene.

According to PRETZMANN (1982) in the Aegean, *Potamon fluviatile* is differenciated as a geographical race of *Potamon potamios* OLIVIER, arriving in North Africa through Italy. The Maltese population however can be a relict both of the older land bridge connection between Europe and North Africa and of the more recent Pleistocene connection, up to the last glacial period, between Sicily and Malta. The strong similarities between *P. f. fluviatile* and *P. f. lanfrancoi* suggests

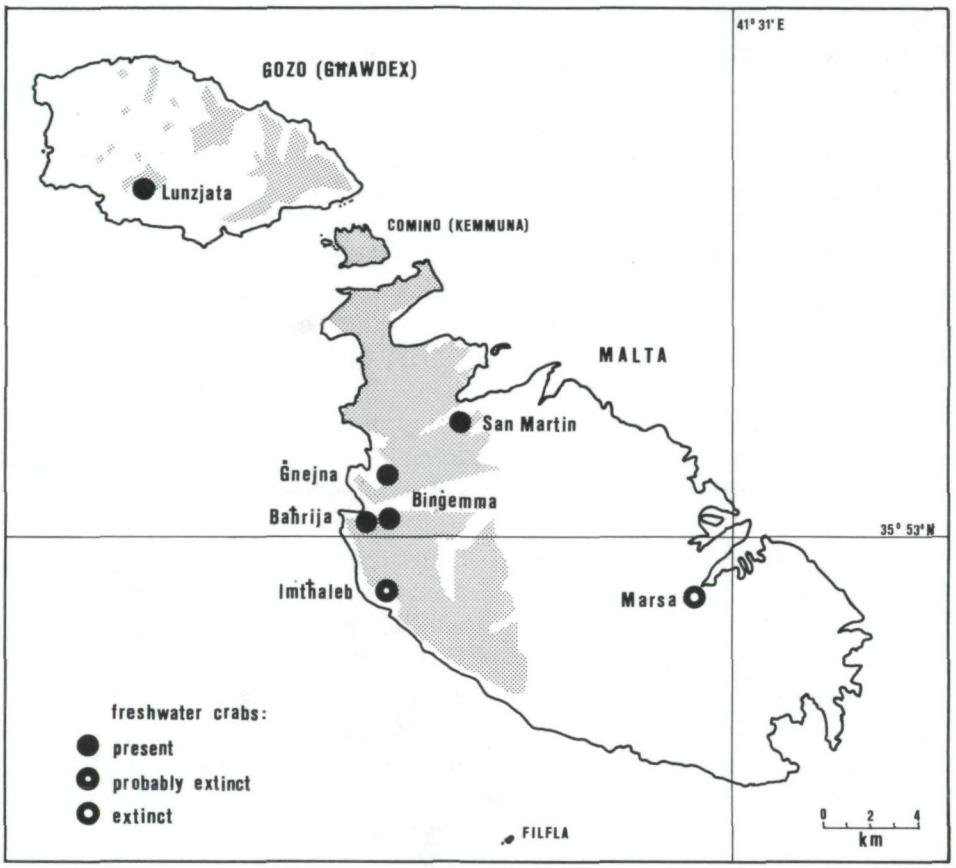

Fig. 2: Localities with freshwater crabs in the Maltese Islands.

that although the arrival of *Potamon* might have been at the end of the Miocene, during the Messinian Crisis, the original early population must have had further genetic exchange with Sicilian populations during subsequent quaternary connections, thus keeping differenciation "under control". This however did not happen to the North African populations because of the Sicilian Channel Graben occuring during the Pliocene, which totally isolated North Africa from Sicily. *Potamon fluviatile algeriense* therefore was totally isolated from *P. f. fluviatile* some 2 million years earlier than *P. f. lanfrancoi* whose total isolation seems to have been to nearly 10,000 years, in agreement with JACCARINI & HARRIS (1975). The survival of *Potamon* in Malta and Gozo up to our time confirms at least, that the climate of the Maltese Archipelago assured environmental conditions ideal for its existence on the islands, perhaps with a wetter climate and more freshwater springs than are known today (THAKE 1985).

Distribution and biology: In the Maltese Islands *P. fluviatile* has been recorded in the literature from the following localities:

Malta:
Marsa – ABELA 1647; GULIA Gav. 1873; GULIA Giov. 1889–90.
Gnejna – GULIA Gav. 1873; GULIA Giov. 1889–90; SAVONA VENTURA 1979; SCHEMBRI 1983; LANFRANCO, G. 1963.
Bahrija – PACE 1974a; PACE, HARRIS & JACCARINI 1976; LANFRANCO G. 1963; SCHEMBRI 1983; SCHEMBRI & LANFRANCO E. 1984.
Imtahleb – PACE 1974a.
San Martin – PACE 1974a; SCHEMBRI 1983.
Bingemma – PACE 1974a; PACE, HARRIS & JACCARINI 1976; SCHEMBRI 1983.
Gozo:
Lunzjata – GULIA Gav. 1873; GULIA Giov. 1889–90; GULIA Giov. 1913; SCHEMBRI 1983.

Today the Marsa population is extinct and probably also that of Bingemma, unless a mistake has been made in reporting *Potamon* from this locality. This investigation confirms only the populations of Bahrija, San Martin, Gnejna, Imtahleb and Lunzjata. These five localities consist of valleys cut in Upper Coralline Limestone, Blue Clay and *Globigerina* Limestone, and have a North West to Northerly direction with the exception of Wied Lunzjata which is directed South to South West. All these localities have permanent freshwater springs. The quantity of water throughout the year varies from a steady flow of water which fills shallow pools to their extent in the winter months, to a mere trickle during very dry hot summers. It is possible that the freshwater crab can survive very dry summers when streams stop flowing, as observed by one of the authors in Sicily for *P. f. fluviatile.* The Bahrija population is the most abundant on Malta occupying a water course of about 350 metres at its fullest extent. The only Gozo population, at Wied Lunzjata, is more abundant as is the amount of water flowing from the source. Although the water course is over 500 metres, the crab population is concentrated to a length of just over 150 metres at the upper levels near the source.

In the Maltese Islands freshwater habitats are generally characterized by a typical flora consisting of plants like *Nasturtium officinale* R. BR., *Apium nodiflorum* (L) LAG, *Polygonium salicifolium* BROUSS. ex WILLD., *Teucrium scordium* L., *Arundo donax* L., and *Scrophularia auriculata* L. amongst others. The fauna is generally dominated by *Discoglossus pictus* OTT., the only local amphibian, and other freshwater insects like *Notonecta, Velia, Dytiscus, Meladema* and larvae of dragonflies (Odonata). The freshwater mollusca are few, and include restricted endemic species such as *Pseudaminicola melitensis* as well as others such as *Ancylus fluviatilis* (LANFRANCO & SCHEMBRI 1984/1986).

Potamon fluviatile lanfrancoi generally occupies the banks of the stream and digs burrows, sometimes nearing one metre in depth. Such burrows may have more than one opening (PACE, HARRIS & JACCARINI 1976). Individuals, possibly males, may dig more than one burrow on opposite banks and patrol these as hunting or scavenging territories, as observed at Wied Lunzjata. Small individuals generally keep under stones and in crevices under dense vegetation. Adults feed by scavenging and hunting, catching frogs and large insects as well as smaller crabs. Snails are

also caught and their shells are cracked open. Scavenging seems to be the general rule and hunting is mostly limited to night-time.

Mating behaviour has been described by PACE, HARRIS & JACCARINI (1976). Fertilization is internal and the female lays about 200 eggs, orange in colour, of about 2.5 mm diameter and carries them under the abdomen attached to the modified pleopods. The eggs hatch about 46 days from laying as a juvenile miniature adult of about 3.5 mm carapace width. The newly hatched crabs live independently within 24 hours. The ontogenesis was also described by PACE (1974a, 1974b) and PACE, HARRIS & JACCARINI (1976). Hatching occurs mostly between early June and early September.

During this investigation many behaviour patterns have been observed and correlated to the work of VANNINI & SARDINI (1971), VANNINI, GHERARDI & PIRILLO (1983) and VANNINI & GHERARDI (1981) for *P. f. fluviatile*.

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