Research Article

Burrow density of the endangered Maltese Freshwater Crab *Potamon fluviatile lanfrancoi* at Lunzjata and Xlendi valleys, Gozo

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Summary. *The density of burrows of the highly threatened and locally protected freshwater crab* Potamon fluviatile lanfrancoi *at its only known locality of occurrence on Gozo, the Wied tal-Lunzjata / Wied tax-Xlendi valley system, was surveyed during the 2006-2007 wet season. Of a length of 851m of the main channel of Wied tal-Lunzjata surveyed, 665m had burrows, while of 303m of Wied tax-Xlendi surveyed, only 60m had burrows, giving a mean burrow density of 1.29 and 0.10 burrows per metre, respectively. The highest concentrations of burrows occurred in three areas within Wied tal-Lunzjata: its upper reaches, in the Ta' Ghajn Tuta area, and in the Wied tas-Saqwi area. Only few burrows occurred in the lower reaches of Wied tax-Xlendi, the only accessible part of this valley that could be surveyed. There was no clear relationship between burrow density and either water depth or flow rate, although there were indications that high flow rates tended to favour high burrow densities. Burrows were invariably excavated in the soil or muddy sediment close to the water level and the availability of muddy sediment was a key factor determining the occurrence of burrows. Burrow occurrence and burrow density did not seem to be affected much by material dumped into the valley, or by moderately poor water quality, but there were clear indications that the crabs may be particularly susceptible to severe changes in water quality and in the hydrologic regime, particularly where this affects the availability of critical habitat.*

Keywords: *Crustacea, Decapoda, Potamidae, Malta, conservation.*

Received: 10 October 2007

Introduction

The only freshwater crabs currently occurring in Europe belong to the Eurasian genus *Potamon*. Three species are presently recognised as valid (Fauna Europaea, 2004): *Potamon ibericum* (Bieberstein, 1809), the most widespread, occurring in Romania, Bulgaria, Ukraine, Greece, some Aegean islands, and Turkey, and introduced into France; *Potamon fluviatile* (Herbst, 1785) occurring in Italy, Sardinia, Croatia, Albania, Greece and Malta (and in North Africa); and *Potamon potamios* (Olivier, 1804), which is found in Cyprus, Crete, some Aegean islands, and the southwestern and southern parts of Turkey (and in Syria, Israel and Palestine) (Pretzmann, 1980; 1983; Fauna Europaea, 2004; Crustikon, undated). However, other species of uncertain validity have been instituted [for example, *Potamon rhodium* (Parisi, 1913), supposedly endemic to a few Greek islands (Pretzmann, 1980; Brandis *et al*., 2000)], as well as a large number of subspecific and infrasubspecific taxa for the three accepted species (see for example Pretzmann, 1962; 1980; 1983), most of which are not considered valid.

Records of a freshwater crab in Malta date back to at least 1647, and this species has been recorded in the literature as *Thelphusa fluviatilis*, *Potamon edulis* and *Potamon fluviatile* (Capolongo & Cilia, 1990). *Thelphusa* Latreille, 1819 and *edulis* Latreille, 1818 are junior synonyms of *Potamon* Savigny, 1816 and *fluviatile* Herbst, 1785, respectively. In 1990, on the basis of small morphometric and morphological differences between Maltese populations and Italian (*Potamon fluviatile fluviatile*) and North African (*Potamon fluviatile algeriense*) populations of this species, Capolongo & Cilia (1990) described a new subspecies from Malta: *Potamon fluviatile lanfrancoi*.

In the semi-arid Maltese Islands, *Potamon fluviatile* is limited to localities with perennially available freshwater, and on the island of Malta it has been recorded from Marsa, San Martin and It-Tilliera (near Il-Wardija), Wied il-Gnejna and Bingemma (both near Mgarr), Wied il-Bahrija and L-Imtahleb (both on the outskirts of Rabat), and from Il-Wied ta' Gordajna (between L-Imtahleb and Wied il-Bahrija), while in Gozo it is only known from Il-Wied tal-Lunzjata (on the outskirts of Kercem) (Pace, 1974; Schembri, 1983; Schembri *et al.*, 1987; Capolongo & Cilia, 1990; Cachia, 1997; Camilleri & Cachia, 2000). All these localities are (or were) characterised by more or less perennial freshwater springs. The population at Marsa was extirpated when the marshes there were drained in the 1850s, while it seems that the population at Bingemma has also been lost (Capolongo & Cilia, 1990; Camilleri & Cachia, 2000). Although no quantitative estimates exist, there is general agreement among all authors that have studied the Maltese *Potamon fluviatile* populations, that these are suffering a general decline, which has been attributed to a variety of factors, including: loss of habitat due to agriculture and urbanization, excessive extraction of water, diversion of springs, pesticide use, over-collecting, human persecution, and unusually hot and dry summers (Schembri, 1983; Schembri *et al.*, 1987; Capolongo &

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Cilia, 1990; Cachia, 1997). The 1989 *Red Data Book for the Maltese Islands* listed Maltese populations of this species as 'Endangered' (using the pre-1994 IUCN Red List criteria); a more recent re-assessment made using the 2001 IUCN Red List categories and criteria applied as per the most recent guidelines (IUCN, 2006) lists Maltese populations as CR (Critically Endangered) under B1ab (ADI & Ecoserv, 2005; MEPA, 2007).

Spearheaded by the efforts of a local environmentalist and a local environmental non-governmental organization, *Potamon fluviatile lanfrancoi* has become a conservation icon in Malta (Lanfranco, 1975; Schembri, 1983; Capolongo & Cilia, 1990) and has been legally protected since 1993. Under present legislation it is listed in Schedules III (Animal and plant species of national interest whose conservation requires the designation of special areas of conservation) and VI (Animal and plant species of national interest in need of strict protection) of the Flora, Fauna and Natural Habitats Protection Regulations, 2006 (Legal Notice 311 of 2006 published in the Supplement to the Malta Government Gazette of 7th December 2006).

Given its position in Malta as a highly threatened, protected species, it is very surprising that no overall assessment of the actual status of the populations of the crab on the Maltese Islands have been made. As far as we are aware, the only information available is the estimate of the population density in the San Martin area made by Cachia (1997). This author recorded population densities of between 125 crabs/ha and 350 crabs/ha along a 600m strip of watercourse, depending on season. No population density estimates for the only Gozitan population of *Potamon fluviatile lanfrancoi* exist, however, according to Capolongo & Cilia (1990), this population is concentrated along a length of watercourse of only 150m in the upper reaches of the Wied tal-Lunzjata valley.

Against this background of fragmentary information on the status of *Potamon fluviatile lanfrancoi* in Gozo, we have made surveys along as much of the Wied tal-Lunzjata/Wied tax-Xlendi valley system (Figure 1) as was accessible to us. Normally, much of the valley bed along this system is choked by dense reed beds that make it impenetrable; however, we took advantage of the fact that one of us (JD) was based in Gozo so that when farmers cropped reed beds along different sections of the valley, surveys could be made while the watercourse was accessible.

Methods used

Surveys were made during the 2006-2007 wet season, between December 2006 and April 2007. We surveyed Wied tal-Lunzjata from its headwaters at Ta' Wied Hmar at Kercem, south to Ta' Wistin Farun, limits of Munxar (Figure 2), a total distance of 973m; however, we did not survey a 120m section west of Fontana (section L20; see Table 1 and Figure 2) for health and safety reasons. We surveyed Wied tax-Xlendi from a point 140m west of where the small tributary known as Wied il-Gharab joins Wied tax-Xlendi up till that part of the mouth of Wied tax-Xlendi which has been developed into a car park at the head of Il-Bajja tax-Xlendi (Figure 3); this section measured 303m. We could not survey the middle section of the Wied tal-Lunzjata/Wied tax-Xlendi valley system between Ta' Wistin Farun and where the tributary known as Wied ta' l-Ghancija joins up with Wied tal-Lunzjata to become Wied tax-Xlendi, and between this point and the Wied il-Gharab area, because the valley system in this section is gorge-like and has very steep sides, making the watercourse inaccessible without the use of specialised rock climbing techniques, and even so, it is not possible to walk along the watercourse as it is choked by dense reed beds. The section that was not surveyed measured 788m. The tributary valleys of Wied ta' l-Ghancija and Wied il-Gharab were not surveyed for similar reasons. The tributaries feeding Wied tal-Lunzjata further upstream than the Ta' Wied Hmar area were also not surveyed. Although some burrows occurred in farmland in the Ta' Ghajn Tuta area, this land was also not surveyed as it is heavily cultivated, making access problematic. The tributary of Wied tas-Saqwi was surveyed but no traces of burrows were found. This tributary is mostly cultivated and does not appear to retain water for any great length of time following rainfall episodes.

The number of *Potamon* burrow openings was counted along sections of the watercourse by first measuring a section using a surveyor's measuring tape, or where it was not possible to stretch the tape, by pacing, and then counting the number of active burrows on both banks of the watercourse. Where burrows were noted, 4-20m sections were measured, but where there were no burrows, longer sections were measured. Active burrows were taken as those that did not have the mouth clogged with soil, stones or debris. Water depth in each section was measured at the deepest point using a graduated rod. The speed of flow of the water was noted (as nil, low, medium or high) but was not quantified.

Results

A total length of 1154m of the main channel of the Wied tal-Lunzjata/Wied tax-Xlendi valley system was surveyed; this represents 56% of the main channel (that is, excluding tributary valleys) of the system. The density of burrows in different sections of the valley bed is given in Table 1, which also provides information on water depth, flow rate and general environmental conditions at the time of survey. Overall, out of a total length of 851m of Wied tal-Lunzjata surveyed, (excluding section L20, which was not surveyed), 665m (78.2%) had burrows. A total of 303m of Wied tax-Xlendi was surveyed, but only 60m (19.8%) had burrows. The mean burrow densities in the lengths of valley surveyed were 1.29 burrows per metre at Wied tal-Lunzjata, and 0.10 burrows per metre at Wied tax-Xlendi.

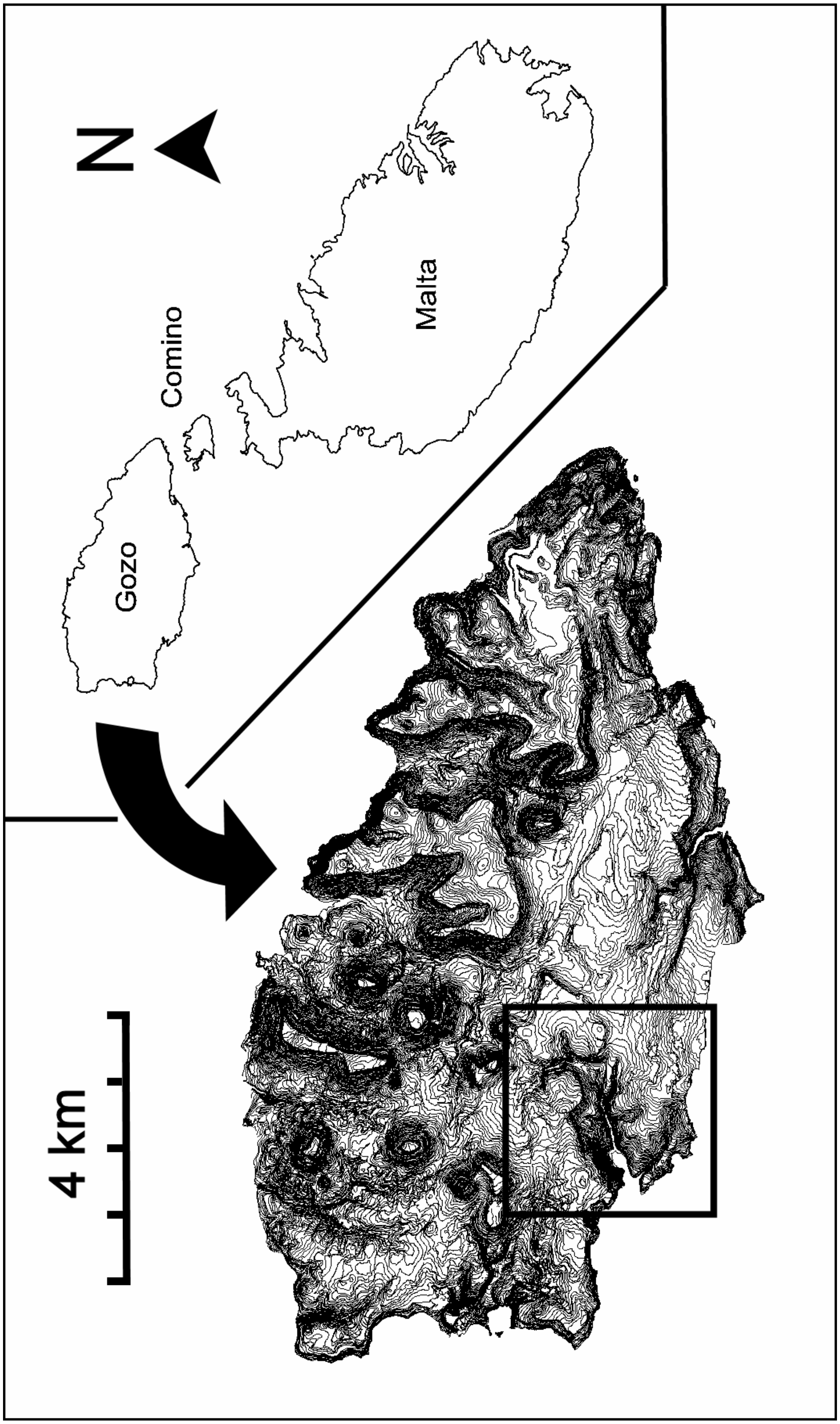

Fig. 1. Location of the Wied tal-Lunzjata / Wied tax-Xlendi system on Gozo (indicated by the rectangle on the contour map of Gozo).

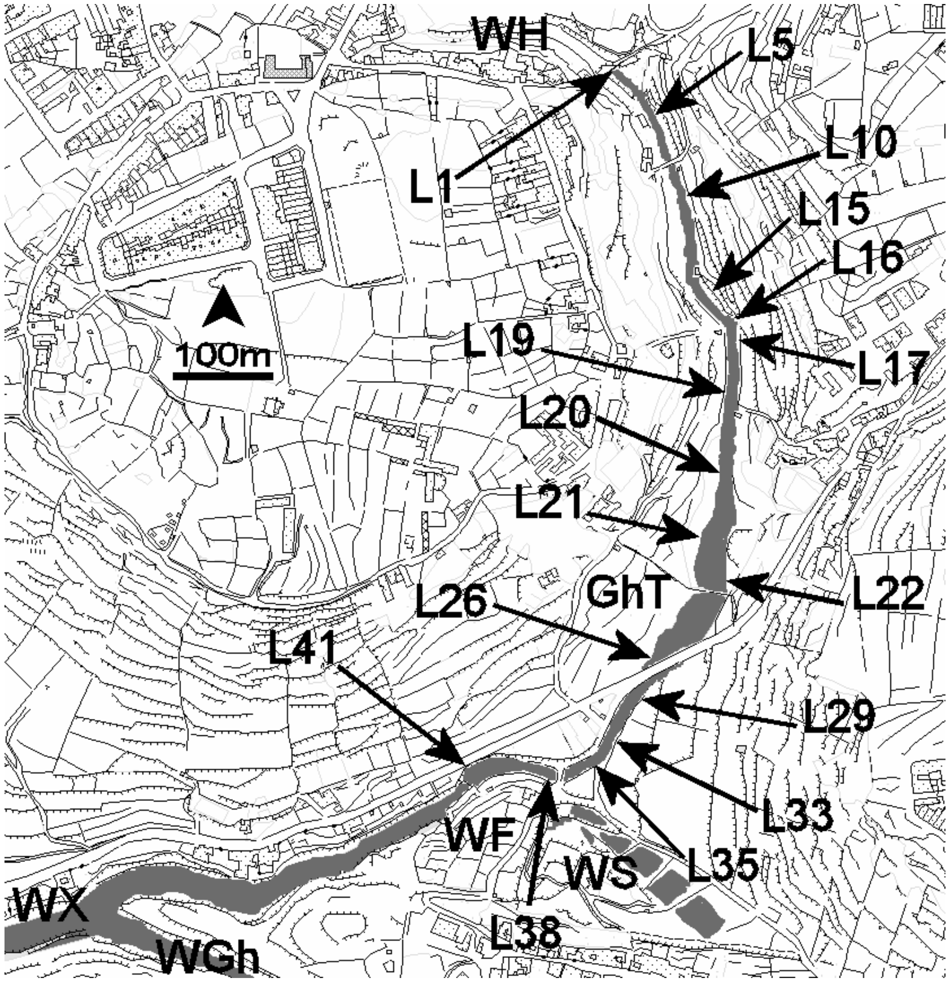

Fig. 2: The Wied tal-Lunzjata watercourse (shaded) showing the sections investigated in this study (L1 to L41). For clarity not all sections are labelled; arrows point to the midpoint of each labelled section. Locality codes: GhT – Ta' Ghajn Tuta; WF - Ta' Wistin Farun; WGh - Wied ta' l-Ghancija; WH - Ta' Wied Hmar; WS - Wied tas-Saqwi; WX - Wied tax-Xlendi.

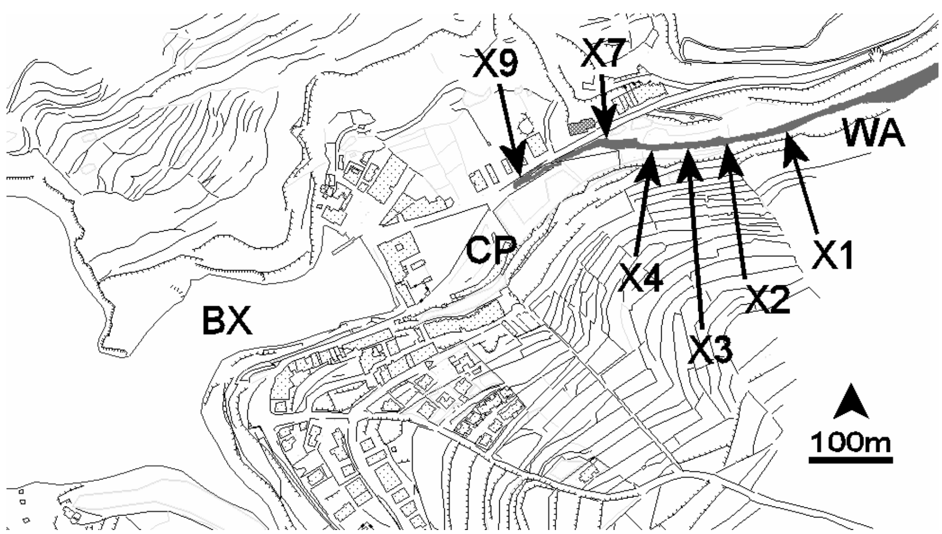

Fig. 3: The lower reaches of the Wied tax-Xlendi watercourse (shaded) showing the sections investigated in this study (X1 to X9). For clarity not all sections are labelled; arrows point to the midpoint of each labelled section. Locality codes: BX – Bajja tax-Xlendi; CP – carpark; WA - Wied il-Gharab.

Section	Length of section (m)	No. of burrows per metre of valley bed	Water depth (m)	Water flow	Notes
L1	30	0	0	dry	Rocky bed with shingle; abundant dumped rubbish
L2	15	0	0.20	nil	Turbid water; rocks on bed
L3	18	0.06	0.25	nil	Turbid water; rocks on bed
L4	10	2.70	0.58	nil	Greenish-grey water
L5	14.4	2.30	0.11	nil	Greenish-grey water
L6	11.2	1.80	0.90	low	Moderately clear water; some dumped rubbish
L7	12	0.70	0.80	low	decomposing dumped vegetable waste and dumped rubbish
L8	14	0.40	0.20	medium	Turbid water; rocks on bed; dumped rubbish; vegetated banks
L9	15	0.70	0.30	low	Turbid water; reed debris
L10	11	0.50	0.15	nil	Foul-smelling, turbid water
L11	8	0	0.15	nil	Foul-smelling, turbid water
L12	19	0.20	0.10	low	Rocky bed; banks almost dry
L13	20	1.10	0.10	low	Turbid water; rocky bed
L14	29	0.70	0.32	nil	Turbid water; dumped rubbish
L15	44	0	0.10	low	Paved bed; dumped rubbish and reed debris; banks consist of ashlar walls
L16	15	0	0.18	low	Turbid water; dumped rubbish; banks consist of ashlar walls
L17	53	0.10	0.20	low	Clear water; dumped rubbish
L18	26	0.10	0.28	low	Clear water; dumped rubbish
L19	35	0.10	0.20	nil	Sewage pumping station on east bank; turbid water; dumped rubbish
L20	122	?	?	low	Foul smelling, turbid water; not surveyed for health and safety reasons
L21	35	0.70	0.35	low	Foul-smelling, turbid water (but clear water discharge from fields); anoxic sediment on valley bed;
L22	24	0.20	0.35	nil	Foul-smelling, turbid water; anoxic sediment on valley bed
L23	23	1.70	0.16	medium	Clear water; dumped rubbish
L24	23	0.04	0.16	medium	Clear water; dumped rubbish
L25	40	0.60	0.23	medium	Clear water; one bank covered by cut reeds
L26	30	0.30	0.25	low	Clear water
L27	30	0	0.14	medium	Clear water; bed choked with debris

(cont.)…

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L28	26	0.30	0.17	medium	Slightly turbid water; parts of watercourse obstructed by cut reeds; dumped rubbish
L29	11	4.20	0.35	low	Clear water
L30	15	2.00	0.20	high	Very clear water; dumped rubbish; narrow watercourse (1m)
L31	9	2.40	0.10	high	Very clear water; very narrow watercourse (0.9m)
L32	4	10.00	0.15	high	Clear water; very narrow watercourse (0.5m)
L33	4.5	4.70	0.15	high	Clear water; very narrow watercourse (0.5m)
L34	9	0	>0.2	low	Deepest part not accessible to measure water depth; turbid water; heavily littered
L35	23	0.40	0.25	low	Turbid water; dumped rubbish; rubble walls on west bank
L36	11	1.50	0.15	low	Clear water; parts of watercourse obstructed by cut reeds
L37	17	0.30	0.40	low	Grey to black sediment on bed
L38	12	0.40	0.20	nil	Foul-smelling, turbid water; dumped rubbish
L39	47	0.04	0.65	low	Clear water; pebbly substratum
L40	23	0.04	0.70	nil	Turbid water; parts of watercourse obstructed by cut reeds
L41	35	0.0	0.5	low	Very turbid water; drop-off to gorge-like section of valley beyond this point
	788	?	?	?	Inaccessible deep gorge-like section of valley; dense reed beds
X1	56	0	0.10	low	Dry muddy banks; rocky bed
X2	21	0	0.05	low	Very shallow pebbly watercourse
X3	30	0.10	0.12	low	Clear water with dense algal growth; thick vegetation on banks
X4	30	0.10	0.12	low	Wet muddy banks with vegetation
X5	30	0	0.12	low	Dumped rubbish
X6	30	0	0.20	low	Yellowish-green water
X7	38	0	0.20	low	Yellowish-green water
X8	30	0	0.50	nil	Concrete bank on east side of watercourse; cut reeds floating in greyish-green water
X9	38	0	0.30	nil	Concrete bank on east side of watercourse; cut reeds floating in greyish-green water

Table 1: Counts of the density of *Potamon* burrows along the Wied tal-Lunzjata/Wied tax-Xlendi valley system made between December 2006 and April 2007. The 'Length of section' column represents the measured lengths of different sections of Wied tal-Lunzjata (sections coded 'L'; Fig. 2) and Wied tax-Xlendi (sections coded 'X'; Fig. 3), while the 'No. of burrows' column represents the number of burrows in that section standardized to 'per metre of valley bed'; note that burrows on both banks of the watercourse were counted and used for the burrow density estimations.

These data were explored by inspection and graphically. In general, there was no obvious relationship between water depth, flow rate, and burrow density with increasing distance from the 'source' (that is, the start of section L1). Neither was there any clear relationship between burrow density and either water depth or flow rate, although there was a tendency for the highest burrow densities to occur where the flow rate was high (for example, in sections L30-L33). Although it would be reasonable to assume that water is more abundant towards the head of the valley system, where springs run into the channel, and least abundant towards the mouth, in effect, the water supply depends also on the contribution from tributary valleys that join the main channel at various points along its course, on drainage from fields situated adjacent to the valley banks (as for example, in section L21), and on localised sources of water input, including leakage and overflow from farmers' irrigation canals and from the sewage pumping station in section L19. The depth of water depended mostly on the availability of water at particular points along the valley and on the microtopography of the watercourse. Thus, water tended to accumulate in localised depressions in the valley bed, irrespective of where these occurred along the valley. Similarly, the rate of water flow was determined primarily by the rainfall and the local gradient and microtopography of the different sections of the valley system, as well as by any obstruction of the watercourse.

Potamon burrows were invariably excavated in the soil or muddy sediment on the banks of the valley, usually close to the water level (normally ± 10cm from the water surface), but occasionally below it and sometimes up to 80cm above it. It was obvious that the availability of muddy sediment was a key factor determining the occurrence of burrows; thus, burrow density was least where there was little muddy sediment available (for example, sections L1 and L2), and there were no burrows where there was no sediment, for example, where the banks were constructed of either ashlar limestone blocks (sections L15 and L16) or of concrete (sections X8 and X9), irrespective of the availability of water. In some places, burrows were observed to have been excavated in the soil-filled spaces in dry stone (rubble) walls when these were present close to the water (for example, in section L35). A second key factor was the wetness of the mud. Burrows were excavated where the mud was wet and burrows in dry mud seemed to be abandoned. Provided that the sediment was wet, water depth did not seem to affect the occurrence of burrows, however, more burrows tended to occur where the flow rate was high. In this regard, it is also worth noting that burrows occurred close to irrigation canals carrying clear, fast-flowing water in agricultural land in the Ta' Ghajn Tuta area.

It is not clear what effect water quality has on occurrence or density of burrows. Burrows were found where the water was clear as well as where it was turbid and where there were clear signs of mild eutrophication (for example, in sections L4 and L5). It was only where the water was highly eutrophicated that burrows were absent or present in low densities (for example, in sections L19, L21, L22, L37 and L38). However, these results need to be interpreted with caution since the crabs may be responding to localised micro-environmental conditions rather than to the overall state of the valley section. Thus, for example, although the water in section L21 was overall foul smelling and turbid, the majority of burrows were actually clustered around an outlet delivering clear water discharge from fields bordering the valley banks.

Burrow occurrence and burrow density did not seem to be affected much by material dumped into the valley. This material ranged from vegetable waste, to rags, metal cans, plastic containers, plastic pipes, building waste, household white-goods and discarded farm tools. Most sections of the valleys had dumped material of this type and parts were heavily dumped.

In general, the highest burrow densities (2-10 burrows per metre) were recorded in sections L29-L33, which are located in that part of Wied tal-Lunzjata where the tributary known as Wied tas-Saqwi joins the main channel. Moderate burrow densities were recorded in sections L4-L10 (0.4-2.7 burrows per metre) and in L13-L14 (0.7-1.1 burrows per metre), all of which are in the upper reaches of Wied tal-Lunzjata. Another stretch with a medium to low burrow density occurred in sections L21-L28 (0.2-1.7 burrows per metre, except L24 and L27) in the Ta' Ghajn Tuta area, and in L35-L38 (0.3-1.5 burrows per metre) in the Wied tas-Saqwi area. It thus appears that there are three regions of the main channel of Wied tal-Lunzjata where substantial concentrations of *Potamon* burrows occur: the upper reaches, the Ta' Ghajn Tuta area, and the Wied tas-Saqwi area. Wied tax-Xlendi had very low to zero burrow densities and this part of the Wied tal-Lunzjata/Wied tax-Xlendi system cannot be considered a good habitat for *Potamon fluviatile.*

Discussion

With a native range limited to North Africa, Italy, Malta, and the southwestern Balkan area (although there is some recent molecular evidence to suggest that *Potamon fluviatile* was actually introduced to Italy at least twice by historic human transport; Jesse, 2007), the Mediterranean freshwater crab *Potamon fluviatile* does not have a wide global distribution. If the various subspecies that have been described are accepted as valid, then the range of some of these is very limited indeed, with that of *Potamon fluviatile lanfrancoi* being arguably the most limited, since this subspecies occurs only in the Maltese Islands, and therein, in a very restricted number of localities and in a habitat (valleys fed by perennial springs) that is not only rare but also threatened. The designation of these populations as 'Critically Endangered' is almost self-evidently justified, even if no overall quantitative assessment of the Maltese population has been made.

Even if *Potamon fluviatile lanfrancoi* is not considered to be a valid taxon, the Maltese populations may nonetheless qualify as an 'evolutionarily significant unit' (ESU) *sensu* Waples (1991) (populations that are reproductively separate from other populations and have unique or different adaptations), certainly as far as reproductive isolation is concerned, although whether *Potamon fluviatile lanfrancoi* has unique genes or gene combinations has yet to be determined; the Maltese populations also qualify as a 'management unit' *sensu* Moritz (1994) (sets of populations that are currently demographically independent) for conservation management purposes. In this respect, the Gozo population of *Potamon fluviatile lanfrancoi* is a completely demographically enclosed one and as such is of intrinsic conservation value, quite apart from its cultural importance.

The present study has provided the first data on the distribution and abundance of burrows of the only known population of *Potamon fluviatile lanfrancoi* in Gozo. Contrary to the statement made by Capolongo & Cilia (1990), the Gozitan *Potamon* population is not restricted to a stretch of some 150m in the upper reaches of Wied tal-Lunzjata but occurs throughout the length of this valley from south of Ta' Wied Hmar to the Ta' Wistin Farun area, with three concentrations – in the upper reaches of Wied tal-Lunzjata, in the Ta' Ghajn Tuta area, and in the Wied tas-Saqwi area – at least on the basis of the occurrence of burrows; the highest concentration was in the Wied tas-Saqwi area. A few burrows also occur in the lower reaches of Wied tax-Xlendi, whereas the situation in the upper reaches of this segment (that is, between the Ta' Wistin Farun and the Wied il-Gharab areas) is not known as this part of the valley was not surveyed due to its inaccessibility.

It is important to note that our assessment was based on the density of burrows and not on actual counts of the live crabs, although crabs were seen in some stations during the survey (in particular in sections L4, L5, L26, L32, L35 and L39); *Potamon fluviatile* is mostly active at night (Gherardi *et al*., 1988) and therefore very difficult to survey directly, especially given the mostly inaccessible localities where it occurs in Gozo.

Although it is reasonable to assume that the density of burrows is proportional to the density of live crabs, there are a number of problems with this assumption, the chief of which is that where many burrow openings occurred next to each other, it was not possible to determine if these represent different burrows or single burrows with multiple openings. Burrows with more than one opening were reported by Pace *et al*. (1976), while by casting burrows, Cachia (1997) demonstrated that these tend to be U-shaped with one arm of the U sometimes forming a second opening to the same burrow. If this was common in the valley system we investigated, than the actual population density of crabs may be considerably lower than the burrow density. On the other hand, there is also the possibility of different burrows sharing a common opening, although this has never been shown to occur.

Additional sources of error are related to the dense reed beds along the valley floor making it hard to spot burrows along the banks, even when the reeds were cut (since the stem bases still remain and cut reeds are left on the banks). Thick vegetation growing on the banks also made counting burrows difficult. Burrows constructed in rubble walls were sometimes hard to distinguish as burrows. Submerged burrows were also not easy to spot and count, particularly where the water was relatively deep and turbid. All these cases result in underestimates of burrow density and hence of crab density. Yet another source of error was that in recently dry areas, it was difficult to say if burrows were active or abandoned. Given these problems, our results need to be interpreted with caution and should probably be considered only as indicative of the actual population density of live crabs.

Observations made in this study agree very well with those made by Cachia (1997) in his study of *Potamon fluviatile lanfrancoi* from San Martin (on Malta). As at San Martin, the critical habitat for the freshwater crab in the Wied tal-Lunzjata/Wied tax-Xlendi system is wet and muddy valley banks; this includes spaces filled with wet soil at the base of dry stone walls close to the watercourse. Again as at San Martin, most burrows are constructed just above the water level and are abandoned if the sediment dries out. Also as at San Martin, burrows were found in agricultural land away from the watercourse, although always in close association with irrigation canals carrying flowing water. At both San Martin and in the Wied tal-Lunzjata/Wied tax-Xlendi system, the crabs appear to be very tolerant of human presence. In the Wied tal-Lunzjata/Wied tax-Xlendi system the crabs constructed burrows in heavily littered sections of the watercourse as well as those that were not littered; burrows were constructed at the base of rubble walls, within spaces between their stones, and close to irrigation canals, as already stated. The crabs were also tolerant of suboptimal water quality and burrows were present in sections where the water was turbid, where it was moderately eutrophic, and where there appeared to be mild contamination from sewage and from dumped decomposing organic material, although in such areas burrows may have been constructed where very localised pockets of better water quality occurred.

The resilience of the crab and its opportunistic habits probably account for its survival in spite of the heavy human use of the sites where it occurs and the frequent and often intense natural and anthropogenic disturbances. However, continued survival of the crab in the Maltese Islands depends on careful management since in spite of its resistance to disturbance and its tolerance to moderately poor water quality, nonetheless the crabs seem to be susceptible to severe changes in water quality and in the hydrologic regime. Factors that cause such changes need to be addressed with top priority in any conservation management plan for the species and there is obviously the need for more research on the ecology of *Potamon fluviatile* in the Maltese Islands as well as for monitoring the existing populations.

Acknowledgments

We are grateful to a number of farmers who cultivate land at Wied tal-Lunzjata for kindly informing us about the occurrence of freshwater crabs in their fields, and to Ms Marija Sciberras (Department of Biology, University of Malta) for her help in the preparation of this paper. We thank the Nature Protection Unit, Malta Environment and Planning Authority (MEPA) for making available their unpublished datasheet on the freshwater crab and for other information.

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