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Occurrence of Noble Crayfish (*Astacus astacus*) in Italy

von

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Synopsis: The noble crayfish (*Astacus astacus*) has been reported to live in Italian natural waters. However, this information was not verified up to now because verifiable papers were scarce. Since 1994 from Province of Belluno and since 1999 from South Tyrol *A. astacus* has been studied. Thus Italy has *A. astacus* in her natural waters. Although these populations would not be native to, they must be protected because they may have a long history of Austrian origin. It is very likely that there would be other established populations of *A. astacus* in Italy. Further information and research are therefore necessary for noble crayfish mapping in Italy.

1. Introduction

The noble crayfish (*Astacus astacus*) is widely distributed throughout central Europe (HOLDICH 1988). Since several decades, its occurrences have been reported in Italy too, however, always without precise location. This unclear information caused confusion within scientific communities: there are noble crayfish in Italy but nobody knows where. Even a division of biologists occurred into two groups: the one believing *A. astacus* in Italy and the other doing not. When the first precise location of *A. astacus* in Italy was reported (PAGOTTO & PAGOTTO 1994), for example, this location (Lago di Santa Anna, Province of Belluno) was not taken into account for crayfish distribution map of Italy (GHERARDI et al. 1999). And when *A. astacus* was found in South Tyrol (Province of Bolzano, Italy) in 1999, we thought this was the first in Italy. But later, as you see below, it was not. Here we talk about Italian *A. astacus* from two waters and why this species is enigmatic in Italy.

2. Sites and methods

Site 1 at Gais: In early summer 1999 we obtained crayfish information from a small creek without name, altitude 831 m above sea level, a left bank tributary of the Ahr River (=Aurino) in the valley Tauferer Tal (=valle di Tures) (Fig. 1). The geographical coordination, estimated roughly from "Le Grand Atlas de Géographie, Encyclopædia Universalis",

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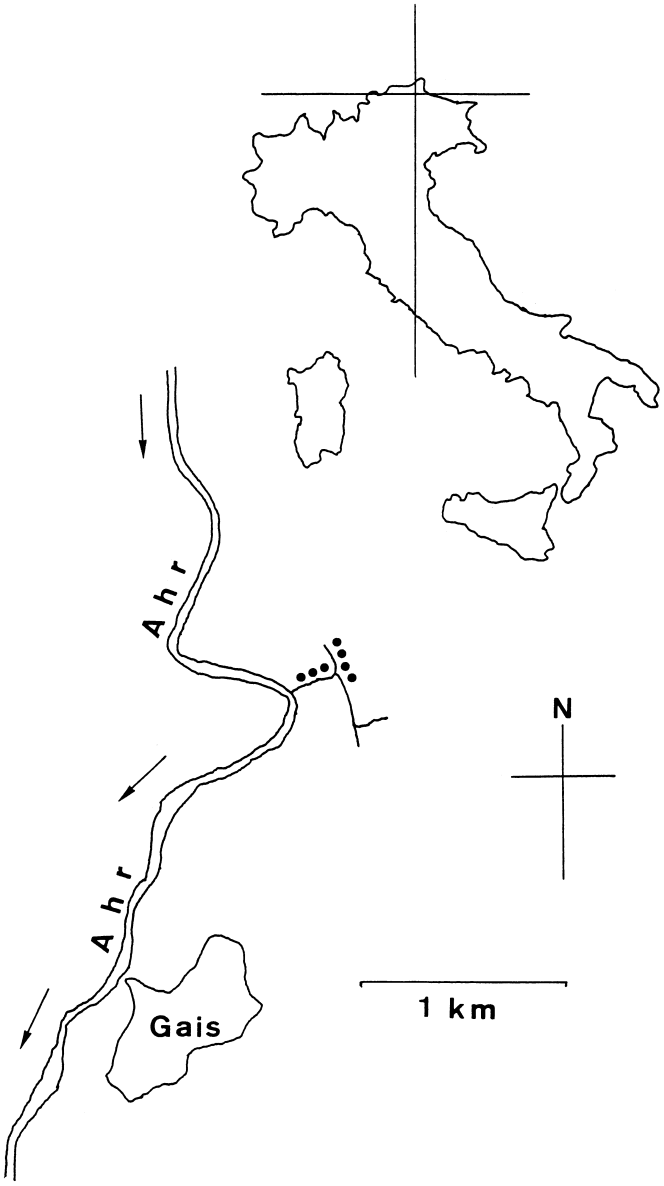

Fig. 1: Creek with noble crayfish (*Astacus astacus*) in Italy. The *A. astacus* population established in the dottes section (•••) of this creek (name unknown). It situates at 831 m altitude and 1,5 km north of Gais or 6 km north of Bruneck (=Brunico) in South Tyrol (=Province of Bolzano, Italy). This is a left-bank tributary of the Ahr River (=Aurine) belonging to the Po drainage. This crayfish population may originate from a very old introduction, possibly during the Austro-Hungarian Empire. Arrow (➔): direction of river flow.

map scale 1:1,000,000, is 46°51'12'' N, 11°57'34'' E. The creek is situated near Ebenkofler at Gais (1.5 km north from the centre of Gais) and 6 km north of Bruneck (=Brunico, South Tyrol). The Ahr River belongs to the Po River drainage. Crayfish were searched through daytime and nighttime observation, hand catching and crayfish traps (Pirate traps, Bock-Ås Ltd., PL 113, SF-21601 Parainen, Finland).

Site 2 Lago di Santa Anna (46°34'53" N, 12°28'54" E, altitude 1380 m a.s.l.): This site and *A. astacus* already were described in PAGOTTO & PAGOTTO (1994) and PAGOTTO (1995). Their growth was studied by PAGOTTO (1996). We wanted to have a quick look at the site in order to compare with other crayfish sites we know in Austria and Italy. Crayfish were searched through nighttime observation. No specimens were conserved.

3. Results

Site 1: Gais

This was visited five times: 12 July, 10, 17 August, 29 October 1999; 28 October 2000. Every time crayfish were found, except 12 July 1999 when appropriate methods were not used.

- -10 Aug. 1999: Daytime observation, exuviae of cephalothorax and chelae were found. Four traps in the night of 10 Aug: 65 specimens caught (OBERKOFLER 2000), the biggest (a male) measured TL=14.5 cm. One male (TL=12.5 cm) conserved in alcohol.
- -17 Aug. 1999: Daytime few crayfish caught by hand, one of them (a female) still had old winter carapace. Night observation, 85 crayfish seen. And with three traps in the night of 17 Aug, 16 crayfish caught (none conserved), among them one female still had young of the year on her abdomen.
- -29 Oct. 1999: night observation, 55 crayfish seen.
- -28 Oct. 2000: night observation, 23 crayfish seen (no mature females with eggs).

These observations revealed that crayfish of Gais was *Astacus astacus*. It had normal characteristics of noble crayfish, e.g., no talon on pleopod 2 in males, very visible spines on cresta median of rostrum, granulation on chelae rather big and chela surface rough. It probably belongs to the northern form of noble crayfish, which is rather monomorphic and lives in central or northern Europe, e.g., France, Germany, Austria (*A. a. astacus*, sensus KARAMAN 1962, 1963).

There was a possibility to find white-clawed crayfish (*Austropotamobius pallipes*) since one population was known in the Tauferer Tal (FÜREDER & MACHINO 1999a; OBERKOFLER 2000). But all crayfish observed in this creek in Gais belonged to *A. astacus*.

Local information said this crayfish was known in the creek at least since 1940, providing evidence that the animal was known since longtime ago in Gais.

Site 2: Lago di Santa Anna

This lake (surface area ca. 1 ha) is surrounded by coniferous trees, and offers a standard view of Alpine lake of median altitude. It was observed in the night of 13 October 2000. 27 specimens of *A. astacus* were observed. Most were males or young females. Only two were adult females. Form of post-orbital ridges indicates this animal belongs to northern form of *A. astacus*, which lives in central and northern Europe, e.g., Austria or Germany. The first pair of post-orbital ridges closer to eyes is very visible with spines while the second pair is slightly visible (even absent sometimes) and without spines.

During the study, former or present crayfish information of a neighbour lake was given. It is Lago Cestella (46°34'10"N, 12°29'28"E, 1408 m a.s.l.). But observation could not be done and it remains unverified.

4. Discussion

Origin of *A. astacus* of Gais

On the biogeographical point of view, it is clear that this species is not native to Gais. Lower areas of Province of Bolzano are not colonized by *A. astacus* but only by *A. pallipes*. And the Po basin belongs to the distribution area of *A. pallipes* but not *A. astacus*. It is possible that this noble crayfish was stocked into Gais from Austria before the First World War, however, proofs by the documentation are missing. Prior to the war, Province of Bolzano was formerly a part of the Austro-Hungarian Empire. This empire was well known for its long tradition on fisheries and stockings of freshwater fishes and crayfish. The former Province of Tyrol, to which Province of Bolzano belonged then, had a long history of crayfish stockings (FÜREDER & MACHINO 1999b). Historically there were noble crayfish around Bozen town (=Bolzano), however, whether these were found either in natural waters or in fish market of Bozen is unknown (FÜREDER & MACHINO 1999b).

Origin of *A. astacus* of Lago di Santa Anna

PAGOTTO (1995) mentioned it was not known whether the origin was introduction by men or young transported by birds or even a glacial relict coming from the Palaeo Po River system. NINNI (1886) reported that in the Museo di Firenze there was one young specimen of *A. astacus* originating form Province of Belluno, however without precise location, either fish market or natural water. But from the other waters of Province of Belluno he reported only *Austropotamobius pallipes* (NINNI 1886). As mentioned above, the Po basin and neighbouring systems, including the Piave River and its related waters such as Lago di Santa Anna, do not belong to the distribution area of *A. astacus*. The most probable expla-

nation would be an introduction by men from territories once reigned by Austro-Hungarian Empire. On the point of view of direct distance, for example, the closest sites with *A. astacus* are Gais (South Tyrol, 50 km from Lago di Santa Anna), Tristacher See by Lienz (East Tyrol, crayfish extinct, 34 km), Greifenburg (Carinthia, 57 km) and Pressegger See by Hermagor (Carinthia, 73 km). These distances are short enough for transporting healthy crayfish for crayfish stocking former time as well as present time.

History of astacology and *A. astacus* in Italy

NINNI (1886) was probably the first author who gave general distribution pattern of crayfish in Italy. *A. pallipes* was the predominant species in Italy. *A. astacus* were present in fish markets of Venezia and Treviso. He also found one specimen of *A. astacus* from the Province of Belluno conserved in the Museo di Firenze (NINNI 1886). Later he affirmed *A. pallpes* to be the only crayfish species living in Italian waters as native species (NINNI 1889; see also VINCIGUERRA 1899; MAZZARELLI 1903). Since publication of NINNI's papers, crayfish of Italy of the pre-First World War were only *A. pallipes* (however, doubtful determinations still occurred, e.g. LORENZI 1897; STELLA 1951).

After the First World War Italy gained several territories of the former Austro-Hungarian Empire, e.g., Istria, Gorizia, Gradisca, etc. Some of these territories belonged to the distribution area of *A. astacus*, e.g. the Pivka River (SKET 1970). Since that time several papers reported *A. astacus* in these new territories of Italy. PARENZAN (1928, 1929) reported *A. astacus* from a lake in Istria, Cepicko jezero (=Lago d'Arsa) (according to LEINER & META 1993, this lake no longer exists). He also mentioned this species in an artificial pond of Sveti Peter (=San Pietro) at Klanec pri Kozini (=Madras), which belonged to the Rosandra drainage (PARENZAN 1928). STAMMER (1932) reported *A. astacus* from the Reka River (=Timavo). After the First World War, Italy became a country having noble crayfish. However, all these regions with *A. astacus* left Italy and became part of the Yugoslavian territories after the Second World War (see also DE LUISE 1988: p. 1, 1991: p. 23).

After the Second World War, however, papers still continued to mention the presence of *A. astacus* in Italian territories but without mentioning precise locations. HOLDICH et al. (1999) mentioned *A. astacus* in Italy. FROGLIA (1978, 1995), Mancini (1990) and GHERARDI et al. (1999) reported *A. astacus* in eastern part of Venezia-Giulia near the Yugoslavian borders. MANCINI (1986) also mentioned it but added "probably". But for this area, DE LUISE (1991) and STOCH et al. (1992) mentioned clearly that noble crayfish were absent near the Yugoslavian borders in Friuli-Venezia Giulia Region. Among the papers mentioning Italian *A. astacus*, only PAGOTTO & PAGOTTO (1994) and PAGOTTO (1995) were verifiable ones (and this was what we've done). But these precious papers were ignored or not seen by other astacologists and Italian *A. astacus* remained enigmatic. Up to now only DELMASTRO (2000) seems to accept *A. astacus* information from Lago di Santa Anna.

Besides information from Lago di Santa Anna, as far as we know, there is only one exception mentioning *A. astacus* with precise location: noble crayfish found in the Auenbach Creek in South Tyrol in 1992 (BALDASSI 1993). However this case turned to be wrong with a wrong determination of species and in fact signal crayfish (*Pacifastacus leniusculus*) lived in the Auenbach since 1981 (MACHINO 1997; FÜREDER & MACHINO 1999a,b; OBERKOFLER 2000).

Although several papers reported *A. astacus* in Italy after the Second World War, almost none specified the location. As information says "yes" but the location not known, the presence of *A. astacus* in Italy has become an enigma. Some biologists believed its presence in the lack of counter-arguments but others did not because not knowing any proofs.

Besides the publications of PAGOTTO & PAGOTTO (1994), PAGOTTO (1995) and OBERKOFLER (2000), in Italy of today, occurrence of *A. astacus* in natural waters seems not be proofed by documentation. In Italian territories, however, it had *A. astacus* at least at fish market (NINNI 1886). And the Bayerische Staatssammlung München has two specimens of *A. astacus* collected from Bozen town (catalog 38/10), but without precision (a creek, pond or fish market?) (FÜREDER & MACHINO, 1999b). Furthermore, there was a population of crayfish bigger and apparently different from standard native crayfish (*A. pallipes*) that was reported from Naturs (=Naturno) in South Tyrol till 1974 (SCHENK et al. 1978). These facts suggested that noble crayfish might be still present somewhere in South Tyrol (FÜREDER & MACHINO, 1999b) or elsewhere in Italy. In fact one of us saw one exuvia of noble crayfish belonging to a population established in a creek in the Province of Pesaro e Urbino (MACHINO 1996, pers. observ.: morphologically this probably belonged to species with Yugoslavian origin), but no further information about where the creek was could not be obtained. Also the presence of *A. astacus* in Italian crayfish farms since the 1980s (DE LUISE 1991; GHERARDI et al. 1999) suggests a possible establishment of noble crayfish populations in Italian natural waters.

5. Conclusion

The present paper treats the occurrence of *A. astacus* in Italy. But even such simple information has not been verified up to now and the enigma (presence but place unknown) has been fed by repeated publishing of the enigma.

In Italy, noble crayfish live in Lago di Santa Anna (Province of Belluno) and a small creek at Gais (South Tyrol). Although these crayfish would not be native to, they must be protected because they have historical value: the stock may be of an old origin from Austria and local people may know these animals since long time ago. Protection here should not mean a series of interdictions. Lago di Santa Anna seems to have been managed correctly by a fishing association of Padola. In Gais, crayfish live in a creek of farmland and people

live near by. One of the best ways to protect noble crayfish of Gais is to look for how to live with them together. The crayfish should not become the "enemy" of local people through severe protection measures with many interdictions. One good example of protection exists in the Moosbachl Creek at Sankt Georgen near Bruneck, where farmers are trying to live with native white-clawed crayfish (FÜREDER & MACHINO 1999b).

It is possible that several noble crayfish populations already have been established in Italy and some even may be locally known. Further crayfish research in Italy should continue, thus Italian noble crayfish will fill its distribution map and cease to be enigmatic.

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