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Rediscovery of *Hoplia walterrossii*: new localities, first ecological notes, description of the female and conservation issues (Coleoptera: Scarabaeidae)

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Abstract
Hoplia walterrossii is a species endemic to Molise, Southern Italy, with completely unknown ecology and virtually known only on the holotype, few additional specimens having been merely listed in a recent paper. Following the discovery of various new populations in the field and of old unpublished samples, we provide new information on ecology, phenology, distribution, and morphology, including the description of the female, so far unknown. *H. walterrossii* is associated to alluvial soils near the coast, and to lowland floodplains, with apparent tolerance for temporarily flooded areas. Adults are active for about one month, from early May to early June, and have been observed mostly on leaves of canes and on young poplars, never on flowers. An attempt of formal IUCN status assignment is provided, giving the species the "Endagered" status. Suitable habitats for *H. walterrossii* are small residual meadows and, in particular, wetlands which have been subjected to a recent strong reduction due to human activity. This process, that started centuries ago, is still in progress, in spite of the formal identification of these areas as sites of conservation concern.

Key words: Scarabaeidae, Italy, Molise, wetlands, ecology, conservation, IUCN categories of risk.

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Introduction

Hoplia walterrossii Sabatinelli in Baraud 1992 is a monkey beetle endemic to Molise region (Southern Italy). It was described on a single male specimen collected at the mouth of the Trigno river, with no further information available about the environment or the collecting circumstances. Since its description, the only addition to the knowledge of this species has been an uncommented listing of few specimens examined by Leo et al. (2010).

New findings, in fact, were made in a different area of Molise between 1998 and 2012 by AL, who also collected the first basic notes about habitat, phenology, and behavior at imaginal stage. Subsequent researches, carried out by DP e VG in the same area, allowed to gather further field observations, to increase the number of known localities, and led to the collection of some females, that were previously unknown. In the meanwhile, MU discovered additional specimens, preserved among the unsorted Scarabaeidae of the Museo di Storia Naturale di Milano, collected some decades ago in an additional new locality, which is far more inland than the previous ones.

This paper sums up the chorological and ecological information gathered by authors, and, based on these, provides a first evaluation on the conservation status of this little known species. In addition, adults of both sexes are described and illustrated, supplementing knowledge up to date based on a single specimen, and some clarifications are given on circumstances of the original description, for taxonomic and nomenclatorial purposes.

Materials and methods

Specimens examined. 222 males and 5 females were examined. Except when differently stated, specimens are preserved in the collector's private collection. New localities of observation were conventionally numbered from 1 to 7 as follows.

Locality 1. Italy: Molise (CB), Campomarino Lido, 41. 9411, 15.0752, 16.V.1998, leg. A. Liberto, on leaves of *Populus nigra*, 3♂; idem, 12.V.1999, 5♂ (1 in coll. MU; 2 in coll. P. Leo, Cagliari); idem, 7.V.2001, 3♂; idem, leg. D. Sechi, 1♂.

Locality 2. Italy: Molise (CB), Campomarino Lido, 41 56.86 N 15 03.61 E, 22.V.2012, leg. A. Liberto, 17♂.

Locality 3. Italy: Molise (CB), Campomarino Lido, 41 56.98 N 15 03.43 E, 22.V.2012, 18♂, A. Liberto leg.; idem, 31.V.2014, 78♂, 2♀, leg. D. Patacchiola (17♂ in coll. P. Boschin, Roma; 1♀ in coll. R. Lisa, Firenze); idem, 29.V.2016, 40♂ collected plus several other individuals observed in flight, leg. V. Gallerati (7 in coll. MU); idem, leg. D. Patacchiola, 35♂, 2♀ (1♂ in coll. MU).
Locality 4. Italy: Molise (CB) Campomarino, sand dunes, 41.9489, 15.0691, 30.V.2014, 2♂, leg. D. Patacchiola; idem, 29.V.2016, leg. V. Gallerati, 4♂.
Locality 5. Italy: Molise (CB) Campomarino, Pineta Sorantonio, 29.V.2016, 41.9508, 15.0657, leg. V. Gallerati, 1♀.
Locality 6. Italy: Molise (CB) Campomarino, Biferno river, 41.9621, 15.0264, 29.V.2016, leg. V. Gallerati, 4♂; idem: leg D. Patacchiola, 2♂.
Locality 7. Italy: Molise, "f. Biferno confl. Torr. Cigno" [= Biferno river at the confluence with Cigno stream], 3.VI.1956, leg. G. Mariani, 8♂ (7 in Coll. Museo di Storia Naturale di Milano, 1 in coll. MU).

Protection of sites. Information about definition, degree of protection, and characteristics of the protected areas taken into account, including those hosting other species of *Hoplia* mentioned in the discussion, is based on official documents available at the website of Italian Ministry for Environment, Land and Sea Protection (http://www.minambiente.it/pagina/schede-e-cartografie) and on the updated sheets available at the website of the Molise region (http://www.regione.molise.it/web/grm/ ambiente.nsf/0/4A4D333C181C6E63C125757C003EFE54?OpenDocument) (both accessed on August 08, 2018).

Results

Hoplia walterrossii
original description and type locality

Although a formal description of *Hoplia walterrossii* was published by Sabatinelli 1993, and the species appeared with such authorship in subsequent works (including the recent catalogue of the Palaearctic fauna by Bezdek, 2016), the description of *Hoplia walterrossii* was anticipated in Baraud's monograph on the European fauna (1992), who attributed the authorship of the species to Sabatinelli in a paper dating 1991, citing it as in press in the Bollettino dell'Associazione Romana di Entomologia ("Boll. A.R.D.E. (sous presse)"). Such a work is not actually existing and the indication should be evidently referred to what was published two years later in the same journal (Sabatinelli, 1993).

As the treatment of the species by Baraud (1992) meets all requirements for nomenclatorial validity necessary at that time, it should be considered as a valid species description according to ICZN. However, as the attribution of the authorship to Sabatinelli is out of question, the correct citation of the species is *Hoplia walterrossii* Sabatinelli in Baraud 1992, according to ICZN articles 50.1.1. and 51E.

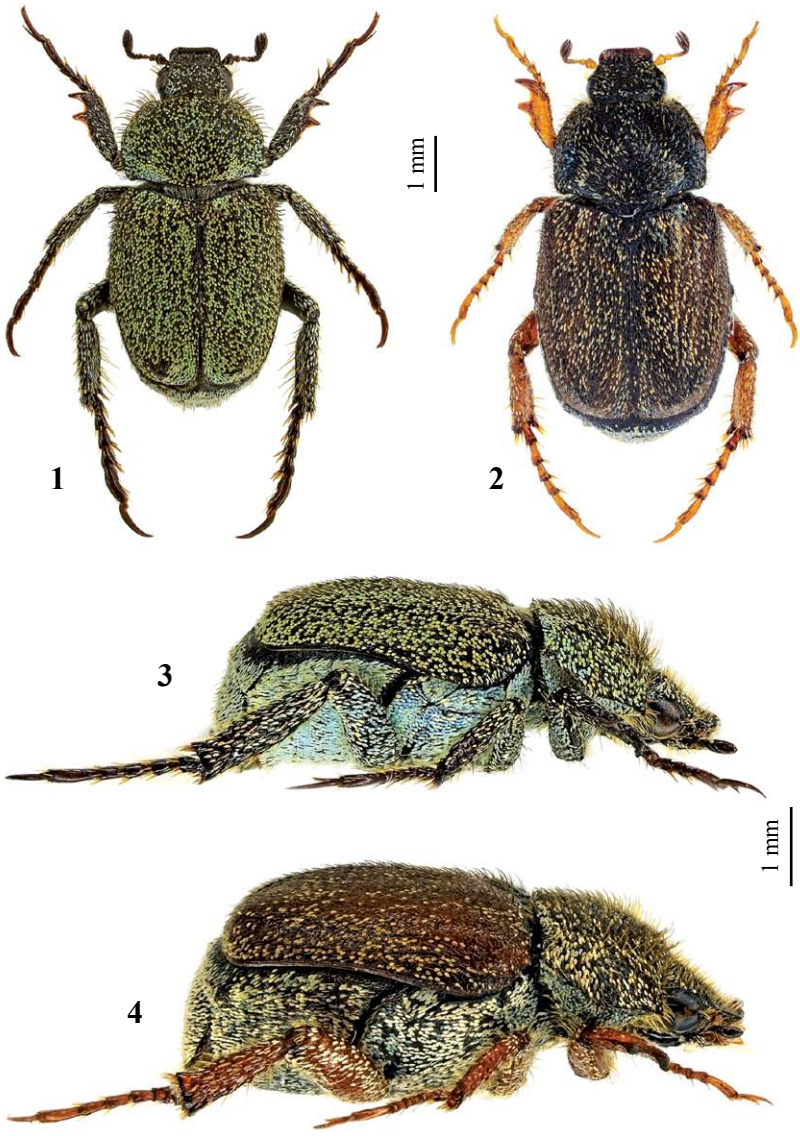
The collection locality of the new species was inaccurately reported by Baraud (1992) as "Campobasso", which is just the province in which the collecting site lies. Therefore, according to ICZN articles 76 and 76A.1.1., the correct type locality should be considered the one more precisely indicated by Sabatinelli, 1993 as "foci del fiume Trigno" [= mouth of the Trigno river].

Redescription of *Hoplia walterrossii*

As an integration and amendment to the information available based only on the holotype, the following conditions are observed.

Males (Figs 1, 3, 5)

Length, from clypeus to pygidium: 5.5-6.8 mm.
Colour of integument. Integument black, polished, except tarsi, teeth of protibia, and proximal part of the antennal funicle, which are brown.
Setae, structure. Setae of pronotum very variable in length, shorter in the basal area, especially near the sides (minimum length: about 2 times the length of a scale), longer in the antero-lateral areas (maximum length: about 7 times the length of a scale). Setae of scutellum similar to those of elytra as for thickness, but shorter, 1-2 times the length of a scale. Setae of elytra dense, 1.5-3.5 times the length of a scale, vaguely arranged in loose longitudinal rows. Setae of pygidium 1.5-2 times the length of a scale.
Setae, colour. Setae testaceous-yellow on head, margins and antero-lateral areas of pronotum (bands having variabile extension and corrisponding to longer setae), pygidium, ventral surface and appendages. Setae black on the basal and discal areas of pronotum and on elytra.
Scales, structure. Scales of the dorsal side quite irregularly sparse, leaving exposed the integument. Shape broadly oval, distance between adjacent scales from null (scales touching each other) to about 2 times the width of a scale. Scales may be slightly imbricate on areas of higher density (base of pronotum, base and apex of elytra).
Scales, colour. Scales of the dorsal side from pale yellow-green, to intense green, to cyan-green. Sides of pronotum bearing a poorly defined stripe of lighter scales, tending to light cyan or to white with nacreous shining; this stripe can extend up to about 1/4 of the pronotal width, but is often narrower and more evident in form of a basal patch. Apical area of elytra, in dorsal view, seeming covered with lighter scales, which however appear of the same colour of the other when observed from behind, along the longitudinal body axis. Ventral side and pygidum with lighter scales, the dominant hue being variable between light shades of pink, green, and cyan, with nacreous aspect.



Figs 1-4 – *Hoplia walterrossii*, habitus in dorsal and lateral view. **1**, **3**, male; **2**, **4**, female.

Females (Figs 2, 4, 6)

Only considerable differences from males are listed. Slightly larger (mm 7.0-7.3), stouter, and more convex. Appendages completely testaceous (dark brown to black in males), except antennomeres 5-9, that are brown. Elytra brown (instead of black), irregular darkened areas may be observed, which are the result of adherence of the underlying wings to the semi-transparent elytra. Legs on the whole less developed, particularly shortened are protibia, mesotibia, tarsi, which are also thinner, and claws. The protibia, in addition, are remarkably dimorphic compared to those of the males also for the different complexion of the lateral teeth: the apical tooth is much more elongated and thickened, all teeth are broader, with apex rounded instead of sharp, and is present a third tooth, which is absent in males.

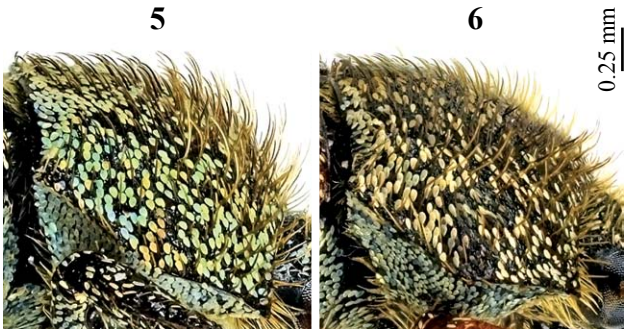
Ecological notes

Sites and environments of observation

The new sites are all located in the basin of the Biferno river, at a considerable distance (about 20-25 km) from the mouth of the Trigno river, the only site of occurrence known so far (figs 7-8).

Most of them (localities 1-5) are gathered within 1 Km from Campomarino Lido and its south-eastern outskirts. Here, the species was encountered in a variety of semi natural coastal and sub coastal biotopes, below listed from the coast inwards.

In the vicinity of the sandy beach (locality 4), the species was observed in activity both in the retrodunal area, covered by open, mostly grassy vegetation (although all individuals have been observed on *Arundo* canes), and in the near pine wood (locality 5), where a single female has



Figs 5-6 – *Hoplia walterrossii*, detail of pronotum in right lateral view. **5**, male; **6**, female.

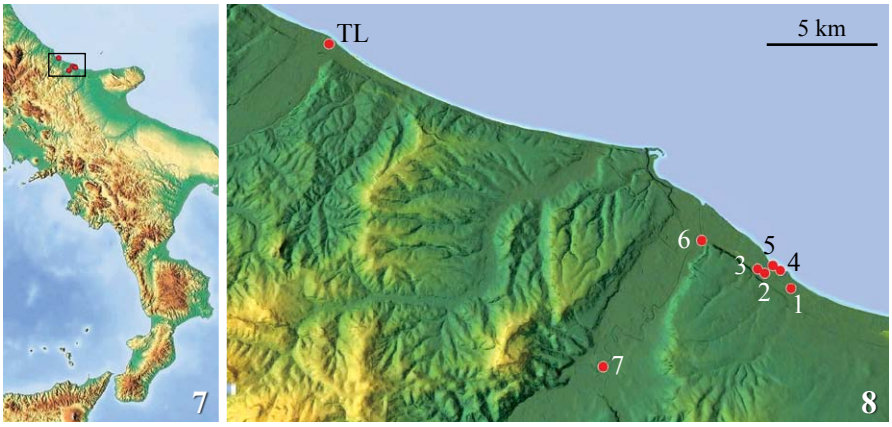
been collected in flight. Since no other specimens have been observed in this environment, it seems likely that the mentioned female was a dispersing individual, observed outside its natural context. Immediately behind the pine wood lies locality 1, placed along the road that goes SE from the town, parallel to the coastline and about 400 m distant from the sea, separating the fixed dunes (where relevant vegetal species include *Pinus halepensis*, *Eucalyptus* sp., *Halimium halimifolium, Rosmarinum officinale, Silene* sp.) from grasslands growing on hardened sandy soil, mostly populated by terophytes, but with the relevant presence of the hemicryptophyte *Verbascum niveum garganicum*. Along this road, there was a sparse row of black poplars (*Populus nigra*), of different age and most likely planted, on whose leaves *Hoplia* adults have been observed.

Locality 2 (41 56.86 N 15 03.61E, fig. 9) corresponds to a prairie on hardened sandy soil, with abundant presence of *Verbascum niveum garganicum* and *Artemisia* cfr. *campestris*, where young black poplars were sparsely growing (maximum height about 3 m), anyway distant from any actual woody patch. Locality 3 (41 56.98 N 15 03.43E, fig. 10), is the one where the highest density of *H. walterrossii* has been observed, and consists of a more humid biotope than the previous ones, characterized by a depression at the very least occasionally flooded during the cold season, and covered mostly by hygrophilous species of Juncaceae, Cyperaceae, Poaceae, Cariophyllaceae, and Lamiaceae; the higher and drier portions of its edges being instead occupied by black poplars, *Arundo pliniana* and *Dittrichia viscosa*.

Localities 1-5 are all referable to the ecotonal mosaics on areas subjected to human interventions for a long time, and hence deeply modified from their original condition: see Taffetani (2011: 6-13) for a detailed report of interventions suffered since XVII century by the land going from the mouth of Biferno to that of Saccione, including draining of coastal lakes and the "Bonifica Ramitelli", a land reclamation that was concluded in the 1950s.

More inland, the species has been found in the floodplain of the Biferno river (locality 6), in a wetland mostly covered by canes (*Arundo* sp.), about 1.8 km away from the river mouth. Most likely, a similar environment was the one that hosted the specimens collected in 1956 at the confluence between the Biferno river and the Cigno stream (locality 7, approximately at 41.9092, 14.9671), an area where also the presence of *Salix alba* and *Populus alba* galleries is reported (habitat of community interest 92A0). This locality is placed about 9 Km inland from the coastline, and is therefore noteworthy as it releases *H. walterrossi* from a putative association to coastal and sub coastal environments.

With reference to the different environmental conditions where the species was observed, we consider to be most representative of its ecological requirements those of locality 3, where the most abundant population was encountered. This area is apparently corresponding to the relic of an ancient "fantina", a kind of humid biotope whose last well-preserved remains are enclosed in the protected area Bosco delle Fantine, about 2 Km SSE from the so



Figs 7-8 – Distribution of *H. walterrossii* mapped on the Italian peninsula (**7**) and on a local relief map (**8**). Modified from map available at https://maps-for-free.com/ and World Hillshade layer from Esri at https://www.arcgis.com/home/item.html?id=1b243539f4514b6ba35e7d995890db1d. (accessed August 8, 2018).

Figs 9-11 – Collecting localities of *H. walterrossii* near Campomarino. **9**, locality 2, 22.V.2012, photo AL. **10**, locality 3, 22.V.2012, photo AL. **11**, males of *H. walterrossii* crawling on leaves of *Arundo* sp., 29.V.2016, photo VG.

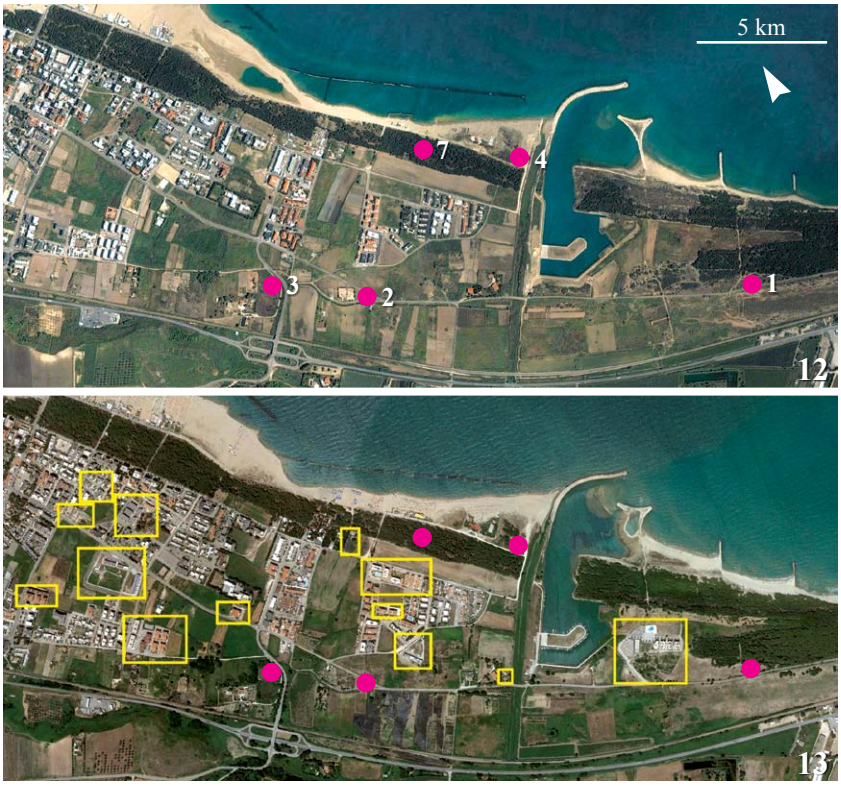
far verified range of the species. As typical of "fantinas", locality 3 is occasionally or regularly flooded during the winter, and, based on this, we hypothesize that preimaginal stages of *H. walterrossii* may tolerate or prefer periodically flooded soils.

As our field activity covered only a part of the potential range of the species, we deem possible the presence of other populations along the basins of the Trigno and the Biferno rivers. In addition, its possible presence along the rivers Sinello and Sangro northwards and Fortore southwards seems worth checking. The paucity of apparently suitable areas, and the lack of observation of the species in some of them, however, suggests at most the presence of scarce and fragmented populations. Surveys with negative results have been carried out by AL at the Bosco delle Fantine (21.V.2012) and at Bosco della Bufalara in the Marina di Chieuti municipality (11-13.VI.1996), and by VG and DP at the mouth of Biferno (left bank, 29.V.2016) and in some spots placed about 300 m southwards from locality 3.

Adult activity

Active males have been observed only on leaves, in different situations: on black poplars (locality 1 and 2), on canes (*Arundo plinii* and *A. donax*) (locality 3, 4 and 6, fig. 11), and on a mixed grassland (località 3), by sweeping net.

Adults observed on poplars (locality 1) were clinging or walking along leaves and petioles at about 1-2 m



Figs 12-13 – Comparison of satellite photos taken on 21.4.2001 (above) and on 29.6.2016 (below) of the coast SW of Campomarino, included in SCI IT7222216 "Foce Biferno - litorale di Campomarino", with localities 1-5 mapped. Yellow markings evidence quick loss of land due to building activity. Source: Google Earth; images 2018 DigitalGlobe and 2018 Terrametrics on data SIO, NOAA, U.S. Navy, NGA, GEBCO (accessed August 8, 2018).

of height. Here, a thorough inspection of higher and lower leaves of poplars, and of the surrounding herbaceous vegetation, carried out both by sight and then by sweeping, did not yield any result.

No specimen has ever been observed to feed, and all observations agree in excluding adults to be anthophilous. In particular, in spite of the abundant population sampled in locality 3 by sweeping grasses, an accurate examination of flowers did not provide any specimen.

In locality 3, several males have also been collected or observed in flight (VG e DP, 29.V.2016), up to about 4 meters high. They were mostly taking short flights from one cane to the other, apparently avoiding dispersal in the surrounding area.

The peak of adult activity was centered around midday, indicatively between 10 a.m. and 2 p.m., although they have been observed moving until about 4 p.m. We could not understand whether they remain on leaves also when inactive, or during the night, as verified for other species of non-anthophilous *Hoplia* (cf. Uliana et al., 2017: 216). A survey carried out during late afternoon (AL, 21.V.2012) on the same poplar bushes where the species would have been collected the next day, did not produce any result. In that occasion, however the meteorological conditions had not been the most favourable for the adults activity.

Females of *H. walterrossii* turned out to be much more difficult to observe than males, as verified for other species of *Hoplia*, both antophilous and not (Uliana et al. 2017, Pernice V., 2002). Out of three female specimens observed, one was collected while flying along a pathway in a pinewood, about 1.50 m high (locality 5), the two others were observed on *Arundo plinii* canes, one of them mating. The ascertained period of activity spans for about one month, from May 7 to June 3; occasional earlier surveys carried out by AL, between April 25 and May 1st, did not produce any result. The holotype, according to its label, was collected well later, on June 21 or 28 (the handwriting being badly readable, cfr. Sabatinelli 1993 and pictures in Ballerio et al., 2010, 2014). However, its status of preservation suggests that it may have been found dead, hence making uncertain the interpretation of its collecting date.

Conservation issues

Hoplia walterrossii is an endemic species of Molise region (Southern Italy), whose ecology was unknown up to date. Based on our observations, it is associated to subcoastal lowland quaternary alluvial soils, between the mouth of Trigno and Biferno rivers, moderately expanding towards the inland along river floodplains (fig. 8). Its range extends

therefore on a quite limited area, having peculiar hydrological characteristics, and significantly degraded by human intervention (Taffetani, 2011); here populations appears to be fragmented across different small-sized biotopes.

All known sites are included in the European network Natura 2000: the mouth of the river Trigno is included within the SCI IT7228221 "Foce Trigno - Marina di Petacciato", localities 1 to 6 within the SCI IT7222216 "Foce Biferno - litorale di Campomarino", and locality 7 within the SCI IT7222237 "F. Biferno (Confluenza T. Cigno - foce esclusa)"; in addition, localities 1 to 7 are also included in the SPS IT7228230 "Lago di Guardialfiera - Foce fiume Biferno".

However, such designations do not lead to an effective land conservation. This is particularly evident with reference to SCI IT7222216, that includes also the most abundant population (locality 3): in spite of being mentioned as one of the most valuable SCI across the whole Molise region, a comparison between two satellite photos taken in 2001 and in 2016 highlights a diffuse and important loss of natural land due to the construction of new buildings (Figs 12-13).

By applying criteria adopted by Carpaneto et al. 2015 to assess the IUCN index of Italian saproxylic beetles, *Hoplia walterrossii* is at least included in the category "Endangered", following criterion B ("*Geographic range in the form of either extent of occurrence and/or area of occupancy"*) and following subcriteria: the range of the species, in fact, is smaller than 5.000 km^2, and the surface actually occupied by known populations is much smaller, consisting in less than 10 observation spots. In addition, the area is still undergoing negative and mostly irreversible processes that deplete the environmental quality, such as intense agricultural and infrastructural exploitation of land, deep modifications to the hydrological system, recurring fires, and establishment of alien invasive plant species. As the species is endemic, IUCN criteria for global assessment also apply locally (see Carpaneto et al. 2015: 64).

Hoplia walterrossii is included among species of *Hoplia* endemic to Italy that are threatened due to their range being extremely small and limited to coastal areas subjected to actual or potential anthropogenic incidence. Listed in order of increasing range size, they are *Hoplia attilioi* Massa, 1979, *H. dubia* (Rossi, 1792), *H. maremmana* Leo, Liberto, Rattu, & Sechi, 2010, *H. messapia* Uliana, Liberto & Leo 2017. Among these, only *H. dubia* is explicitely protected by law (regional law 56/2000 of Toscana), while all of them, except *H. walterrossii*, enjoy indirect protection from their range being at least partly included in protected areas (State Natural Reserves, Regional Natural Reserves and Ramsar Sites).

Hopefully, the presence of this threatened endemite may contribute to a more effective conservation program of his homerange.

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