A glimpse into the terrestrial invertebrate communities of Sazani island, Albania (arthropods, molluscs)

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Abstract

An exploration of the island of Sazani (Albania) was carried out from September, 3rd to 7th September 2012 within the framework of the programme "PIM Initiative for the Small Islands of the Mediterranean". Most arthropod groups and molluscs were sampled or observed: myriapods, arachnids (pseudoscorpions), crustaceans (Isopoda or woodlice), insects (Coleoptera, Heteroptera, Lepidoptera, Orthoptera and related groups, Odonata and Hymenoptera). Eleven species are new to Albania. A comparison with the Karaburun peninsula highlights the originality of the invertebrate communities on the island of Sazani. The most urgent management measures involve protecting the island beaches by limiting visitor numbers, eliminating plastic waste and conserving sea driftwood.

Përmbledhje

Një ekspeditë në ishullin e Sazanit (Shqipëri) u zhvillua nga data 3 deri më 7 shtator 2012 në kuadër të programit 'Iniciativa PIM për Ishujt e Vogël të Mesdheut'. Grupet artropodëve dhe molusqeve u grumbulluan ose u vëzhguan, ishin: myriapodët, araknidët (pseudoakrepat), krustacet (gafore), insekte (Coleoptera, Heteroptera, Lepidoptera, Orthoptera, Odonata dhe Hymenoptera). Njëmbëdhjetë lloje referohen të reja për Shqipërinë. Krahasimi me faunën e gadishullit të Karaburunit, jep të dhëna për individualitetin e faunës jovertebrore të ishullit të Sazanit. Për menaxhimin e ruatjes së kësaj faune duhen të meren masa të shpejta si p.sh: mbrojtja e plazheve të ishullit duke kufizuar numrin e vizitorëve, eliminuar hedhjet e mbetjeve plastike, dhe duke ruajtur depozitimet e detit.

Keywords: arthropods, mollusks, Sazani, Karaburun, insularity, conservation management.

Fjalë kyçe: artropodët, molusqet, Sazani, Karaburun, izolimi, menaxhimi i ruajtjes.

Introduction

Since 2006, the *Conservatoire du Littoral* coordinates an international programme to promote and assist the management of Mediterranean island micro-spaces. This programme, the "PIM Initiative for Small Islands of the Mediterranean", is co-financed by the *Fonds français pour l'environnement mondial* (FFEM) and the *Agence de l'eau Rhône Méditerranée-Corse* (PIM 2025). The PIM Initiative is developing a system for exchanging and sharing the knowledge needed to develop best management practices in these exceptional areas. During field missions and training courses, rangers, technicians, scientists, naturalists, managers, administrations and associations come together to promote the protection of small Mediterranean islands and implement concrete management actions that have a positive impact on ecosystems, biodiversity, natural resources and uses. The Sazani mission is part of a partnership between the University of Tirana, APAWA (Association for Protection of Aquatic Wildlife of Albania) and the *Conservatoire du littoral* as part of the PIM Initiative for Small Mediterranean Islands, with the support of the French Embassy in Tirana, the UNDP Programme in charge of Albanian Marine Protected Areas and the University of Vlorë. The main objective of this mission was to carry out a terrestrial and marine diagnosis of the island of Sazani, with the aim of improving our knowledge of the island natural environment and defining recommendations for integrated land-sea management.

Part of the Karaburun-Sazani Marine Protected Area (MPA), Sazani is Albania's largest island (570ha, 4.8km long and 2km wide), with a maximum altitude of 337 metres (Figures 1 and 2). Part of the municipality of Vlorë, the island is around 12km from the town's fishing port and 4.8km from the mainland at the nearest point. The Karaburun peninsula forms the western part of the bay of Vlorë. Together with the island of Sazani, the area has been identified as a priority zone by numerous national and international studies. However, the island of Sazani is not included within the perimeter of the Logara-Karaburun National Park. The creation of the Karaburun-Sazani MPA in 2010 (Albania's first MPA) is a first step towards the sustainable exploitation of marine resources in the area, while ensuring the preservation of its biodiversity and landscapes.

Due to its position between the Adriatic and Ionian Seas, the island has always been a strategic point for military defence. The history of the occupation of the island of Sazani is particularly complex, especially in the period between the Second World War and the present day. The construction of numerous military buildings and bunkers, and the presence of an extensive network of galleries, bear witness to a major military occupation. Possessed by Turkey in the 15th century, then by Italy in the 18th century, the island was ceded to Greece in 1864, who abandoned it in 1914. The installation of an Italian military base was ratified in 1915 in the Treaty of London. The Italian authorities then built a lighthouse and naval fortifications, before fishermen's families settled there. From 1943 to 1944, the island was under German occupation, before control was taken over by Albania. Today, access to the island is controlled and regulated by the Albanian Army. An Italo-Albanian military base was set up in 1997 to control illegal trafficking at sea. In the 1970s, the island was occupied by more than 300 families. In parallel with the development of the military bases, infrastructure and buildings were built to accommodate families on a long-term basis: housing, schools, a hospital, a library, a village hall, a cinema, a football pitch, etc. Extensive sheep farming and subsistence agriculture were also practised. In the mid-1980s, these families were removed from Sazani, leaving the island uninhabited to this day. The remains of many of the buildings are still visible. Until recently, the inaccessibility of the island has allowed vegetation to reclaim these areas, which are heavily marked by the imprint of past activities. Since 2014, the island has been open to visitors, and tourism has increased significantly. Now, the island has been open to tourists for several years. During summer, visitors reach the island via boats organized by travel agencies for beach trips. Several boats, each carrying around 30 people, arrive daily throughout the summer. It is now a key tourist destination for many agencies and tour operators in Albania, particularly in the Vlorë area. Several management plans, action plans, and strategies have since been developed and implemented for Sazani Island, the Karaburun-Sazani MPA, and the broader Vlorë region.

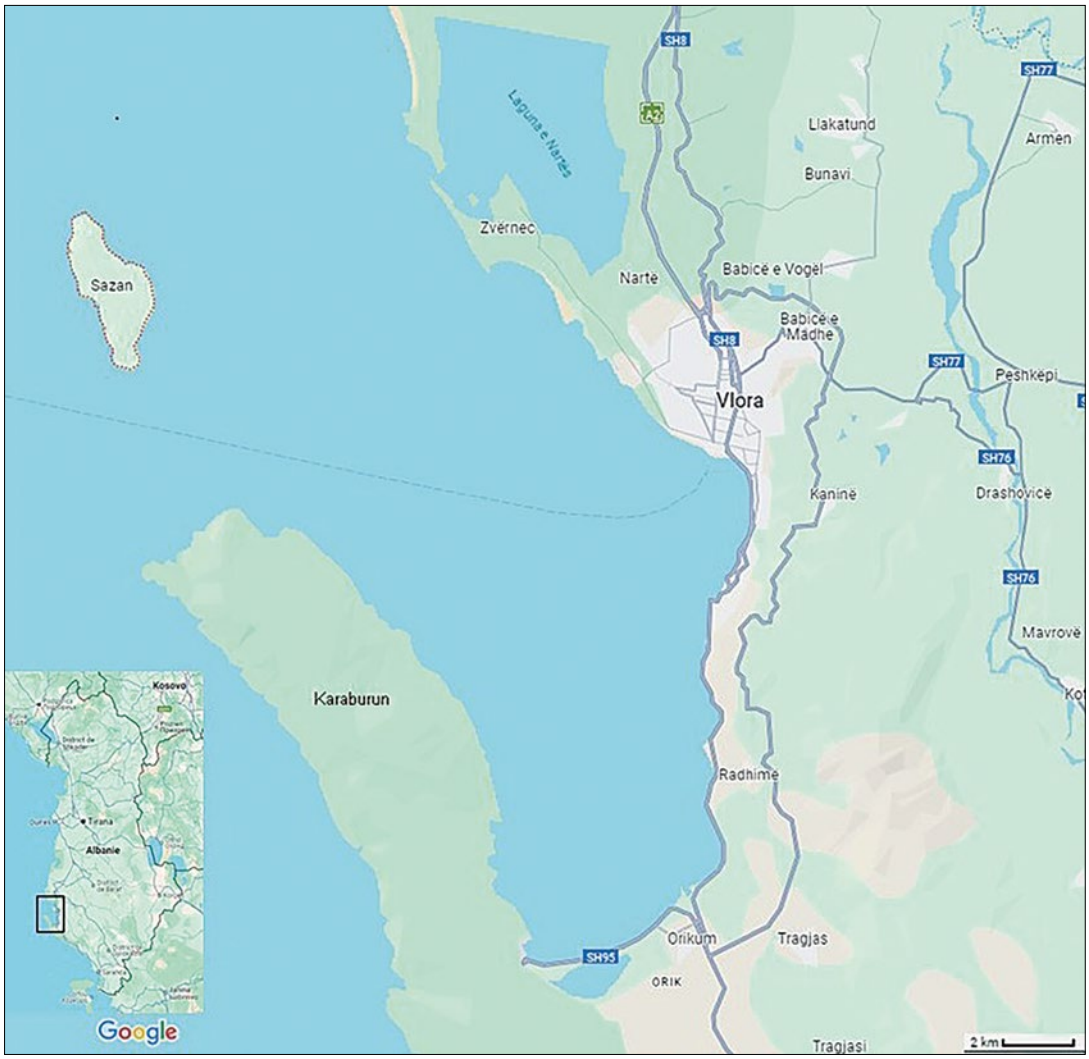

Figure 1 – Location of Sazani island.

Figure 2 – Sazani Island, September 2012.
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Materials and methods

Arthropods were collected using conventional methods of investigation: sight-hunting under stones, on flowers, under bark, prospecting with a beating tray for frondicolous fauna and with a sweep net for fauna associated with the herbaceous stratum. We also carried out a night-time survey using a headlamp around the old school. Given the limited time available (4 days, 1 night on the island + 1 day on the peninsula), we were only able to visit the entrances to the bunkers and galleries. The presence of intact ammunition did not encourage us to penetrate deeper into the network of galleries in search of troglobitic and troglophilic fauna. Most arthropod groups were sampled or observed: myriapods, arachnids, crustaceans (woodlice), insects (Coleoptera, Lepidoptera, Orthoptera and related groups, Odonata and Hymenoptera). The nomenclature used for arthropods is taken from the Fauna Europaea website (2011). Molluscs were not systematically surveyed during the mission, although a few shells were collected on sight.

Study sites

– 3-IX-2012 - Sazani, near the port and coastal path to the north, stands of *Euphorbia dendroides*.
– 4-IX-2012 - Sazani, southern track and tour of the southern tip of the island.
– 5-IX-2012 - Sazani, central mountain (elevation 331m), summit and south-facing slope.
– 6-IX-2012 - Sazani, south-east coast (*Lotus* zone, *Typha* zone), and survey of the *Pinus brutia* valley (N 40.49549° E 19.28230° alt. 72m) with numerous dead and dying trees.
– 7-IX-2012 - Karaburun Peninsula. The peninsula was briefly explored in order to compare the Sazani island arthropod populations with those of the nearby mainland. We were dropped off at two points on the peninsula and followed the coastal track along the north-east coast.

Results

Pseudoscorpiones

Only one species was collected under *Pinus* barks: *Rhacochelifer maculatus*, a common species around the Mediterranean, but not yet reported from Albania.

Coleoptera

As a whole, 40 taxa of coleoptera were identified (Appendix 1). This figure is clearly an underestimation of the real beetle community, but the early September survey season was not appropriate for most Coleoptera, especially the phytophagous species, which live on herbaceous vegetation and disappear when the vegetation dries up in late summer.

The port area and the surroundings of dwellings with ruderal vegetation showed the greatest diversity in Coleoptera, but also in other arthropods (Heteroptera, Orthoptera *sensu lato*), perhaps because of the diversity of ruderal plants, the diversity of habitats and the slightly greater humidity, but, paradoxically, this sector is the most disturbed and the most artificial on the island. Numerous coprophages linked to faeces (probably dog faeces) were identified in this area, in particular *Onthophagus furcatus* and *Sisyphus schaefferi*. Many beetles were found on the ground, under stones, at the base of plants growing among the rubble: *Pseudoophonus rufipes, Drasterius bimaculatus, Hirticomus quadriguttatus, Paederus littoralis*. *Ecballium elaterium* is the host plant for the ladybird *Henosepilachna elaterii*, which was found wherever its host plant was found (Figure 3). The flea beetles *Longitarsus albineus* was found on its host plant *Heliotropium*, *Longitarsus tabidus* on *Verbascum* and *Ochrosis ventralis* on Borraginaceae. The presence of many *Parietaria* (Urticaceae) allowed the associated fauna to thrive, including in particular the small, widely distributed weevils *Kalcapion semivittatum* and *Taeniapion rufulum*.

Otiorhynchus aurifer (Figure 4) and *Otiorhynchus armatus* (Figure 5) are two weevil species originating from the Mediterranean basin and expanding progressively throughout Europe (Germann 2006; Heijerman & Drost 2000). Both were found under stones in the vicinity of the port area.

Figure 3 **– Henosepilachna elaterii *feeding and mating in a flower of* Ecballium elaterium.**
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Figure 4 **– Otiorhynchus aurifer.**
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Figure 5 **– Otiorhynchus armatus.**
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The tree associated beetle fauna included the tiny Scolytidae *Hypoborus ficus*, very abundant on fig-trees wearing dead branches and twigs. On elm-trees (*Ulmus*) it was possible to observe the xylophagous Cerambycidae *Exocentrus punctipennis*, along with the corticolous Salpingidae *Salpingus planirostris*. A few unidentified *Tamarix* formed a thicket at about 1km to the North-West of the harbour (N 40.50679° E 19.27581° alt. 1m). Beating these trees provided a female *Cryptocephalus* belonging to the sub-genus *Burlinius*, impossible to identify on isolated female specimen, and plenty of specimens of an Anthicidae species, *Cyclodinus constrictus*, with a wide distribution in the Mediterranean basin.

An abundant population of the Tenebrionidae *Allophylax picipes* (Figure 6) was also discovered in the port, a remarkable find as this beetle is new to Albania. This species was reported from Southern France, Corsica, the Tyrrhenian coast of Italy, Puglia (Is. Tremiti included), Sicilia (minor islands included), Dalmatia; old records from Tunisia and Algeria (Aliquò *et al*. 2006). The presence of this species in the port area where various materials have been deposited and stored for many years suggests that it may have been unintentionally introduced by humans along with materials or vehicles. It would be interesting to see whether this species is present elsewhere on the island. *Stenosis intermedia dalmatina* (Figure 7) is restricted to Albania, Croatia and Greece (Löbl *et al*. 2008). Another darkling beetle, *Pedinus helopioides*, was discovered in this area, this is a common species reported from the Balkan Peninsula, Bulgaria, Southern Italy (Aliquò *et al*. 2006).

A small population of the tiger beetle *Calomera littoralis* was isolated on the beach near the port. This population is limited to a few individuals whose chances of survival

***Figure 6* – Allophylax picipes.**
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***Figure 7* – Stenosis intermedia dalmatina.**
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in the event of sampling or environmental disturbance are questionable. The scarcity of beaches on the island is not favourable to the survival of this species.

Matorral with *Pistacia lentiscus*, *Olea europaea* and *Quercus coccifera* were surveyed since this plant formation covers most of the island (Figure 8). However the early September survey season was completely unsuitable to this type of warm and dry Mediterranean environment, a region where rainfalls are totally missing in summer. As a result, a very small number of coleoptera were recorded. Debris of *Parmena* were discovered under a stone; this is probably the species *Parmena bicincta*, which has a very limited distribution (Albania, Bosnia-Herzegovina, Croatia, Montenegro). Confirmation of this identification on fresh material of better quality would be highly desirable.

The ladybird *Chilocorus bipustulatus*, a very common frondicolous species, was present everywhere on the foliage of *Pinus brutia* (Figures 9 and 10) and *Cupressus sempervirens*. Beating the dry, scorched foliage of recently felled pine trees yielded one species of *Ernobius*, and *Opilo domesticus*. The only *Ernobius* specimen collected is a female, which does not allow a definite specific identification, however the external morphological characters correspond exactly to the French specimens of *Ernobius parens*. It is very likely that this is this species, that has never been recorded from Albania. In Provence, this *Ernobius* develops at the expense of pine branches, especially the Aleppo pine *Pinus halepensis*. The Anthribidae *Noxius curtirostris* was also found on the yellowed foliage of pine branches that had fallen to the ground, as well as on *Euphorbia dendroides*. On long-dead pine trees, the saproxylophagous weevil *Brachytemnus porcatus* is common under dehiscent barks. *Cis chinensis*, a chinese species now cosmopolite (Rose 2012), was common inside old bracket fungi growing on dead pines. Finally, remains of dead *Buprestis cupressi* were found on the ground, this is a xylophagous jewel beetle that thrives in the dead wood of *Cupressus* trees (Figure 11).

Figure 8 – Matorral with* Pistacia lentiscus *dominant.
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Figure 9* – Pinus brutia *forest on the eastern coast of Sazani.
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Figure 10* – *Mature stand of* Pinus brutia *with abundant dead trees.
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***Figure 11* – Buprestis cupressi.**
(https://www.galerie-insecte.org/galerie/ref-222606.htm, licence CC BY NC)

The stands of old *Euphorbia dendroides* with many dead stem and branches seemed favourable to the presence of a community of saproxylophagous Coleoptera. We were able to collect two specimens of the Anthribidae *Noxius curtirostris* and one unidentified species of *Laemophloeus*. *Noxius curtirostris* is not specifically associated with *Euphorbia*, but is a polyphagous saproxylophagous beetle able to develop on a wide variety of plants (broadleaved and coniferous). We did not come across *Dichromacalles rolletii* (Germar 1824), although it has been reported from Greece, not so far away. Further surveys in spring would be useful to potentially find this remarkable weevil on the island of Sazani.

Exploration of the island bare summits yielded a restricted but interesting beetle fauna. The island main "peaks" are just over 300m above sea level (Figure 12), so we did not expect to find mountain fauna there. However, the slightly more humid conditions than at lower altitudes meant that we were able to find a few beetles that had not been seen elsewhere, such as *Asida fasciculatis lineatocollis* and *Opatrum verrucosum*, which were seen right at the top of the central mountain (elevation 331m), and nowhere else on the island. However, it is possible that surveys to be carried out during the wetter season will reveal the presence of these two species in other parts of the island. The subspecies *lineatocollis* of *Asida fascicularis* (Figure 13) is restricted to Albania, Bosnia-Herzegovina, Croatia, Greece (Soldati 2008). *Opatrum verrucosum* (Figure 14) is an east Mediterranean species reported from Anatolia, Greece, Ionian islands, Adriatic coasts of the Balkan Peninsula, Southern Italy, Sicilia (Aliquò *et al*. 2006).

Figure 12 – Hills on Sazani, the Karaburun peninsula is visible in the background.
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Figure 13 **– Asida fascicularis *ssp.* lineatocollis.**
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Figure 14 **– Opatrum verrucosum.**
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Heteroptera

A total of 20 species of Heteroptera were identified to the species level. Few species were collected, however three common species are listed as new to Albania: *Lygus italicus*, *Nysius helveticus* and *Ortholomus punctipennis*. Numerous juvenile individuals of *Coranus*, *Dicranocephalus* and Lygaeidae were observed but not identified. A small Miridae belonging to the genus *Tuponia* had also developed in the *Tamarix* thicket near the port, but specific identification was impossible as it was teneral (i.e. state of the imago just after molting during which it is soft and immature in colouring).

Most of the species observed are polyphagous and widely distributed in the Western Palaearctic region, but mainly in warm, dry environments. However, several species are oligophagous, such as *Cydnus aterrimus* and *Dicranocephalus medius*, which depend on various *Euphorbia* species, *Eysarcoris ventralis*, which lives on *Juncus* and *Cyperus*, and *Hyalochilus dolosus*, which lives on *Parietaria* (*Parietaria officinalis* and *P. erecta*) (Péricart 1998b). *Orsillus maculatus* is associated with conifers, such as *Cupressus sempervirens*, *Pinus halepensis* and *Juniperus phoenicea* (Péricart 1998a). *Graphosoma semipunctatum* is associated with the Apiaceae. Some species are uncommon and their biology is poorly understood: *Proderus bellevoyei*, an East Mediterranean and Pontic species known from the Balkans, Crimea, Caucasus, Transcaucasia, Anatolia, Asia Minor and the Near East (Péricart 1998c), *Aoploscelis bivirgata*, a rare ponto-mediterranean species, which appears to be widespread from the Iberian Peninsula and Morocco in the west to the Near East and Transcaucasia in the east (Péricart 1998b), and *Hyalochilus dolosus*, a Pannonian species known from the Balkans, Cyprus, Anatolia, Transcaucasia and Turkmenia (Péricart 1998b).

Orthoptera

Fifteen species were identified during the survey (Appendix 1). Most of them are very common and widespread in the Mediterranean Basin. A small cricket was also observed under the seagrass on the beach near the harbour, but careful examination revealed that it was *Arachnocephalus vestitus*, a common species throughout Sazani, and not *Pseudomogoplistes squamiger*, a much rarer species that has been observed on a beach on the Karaburun peninsula.

Concerning other Orthoptera, two male *Calliptamus* were caught and identified by examination of the genitalia. It turns out that these specimens belong to the species *Calliptamus italicus* and not *Calliptamus barbarus*. In Provence, *C. italicus* tends to be associated with slightly damp, open environments with herbaceous vegetation and is able to live in mountains, whereas *C. barbarus* seeks out the most xeric biotopes at lower altitudes. The same situation is observed in Greece. For the moment, there is no verified data for *C. barbarus* in Albania. At Sazani, *Calliptamus* were only caught around the port in areas with cooler ruderal vegetation, but no specimens from the driest open areas with *Pistacia lentiscus, Euphorbia dendroides,* etc. were monitored. It cannot therefore be ruled out that the two species may coexist on the island, and further surveys would be necessary to clarify this point. One specimen of *Eupholidoptera* was observed but not collected and hence not identified, but *Eupholidoptera schmidti* is the only *Eupholidoptera* present in the Vlorë region.

Mantodea

The two species observed on Sazani, *Ameles decolor* and *Mantis religiosa*, are common and widespread in the Mediterranean Basin.

Dermaptera

Along with the tiger beetle *Calomera littoralis*, an isolated population of the maritime earwig *Anisolabis maritima* represented by very few individuals was observed very close to the port, on a pebble beach with scattered sea driftwood and other marine plant debris. Again, the scarcity of beaches on the island is not favourable to the survival of this species. Beating *Euphorbia dendroides* provided the widely distributed Mediterranean forficula *Forficula decipiens*. This is the only insect found in abundance on this bush species.

Phasmida

A population of *Bacillus rossius* (Phasmida) (Figure 15) was found on the island. The island of Sazani falls within the geographical range occupied by *Bacillus rossius redtenbacheri* Nascetti & Bullini 1983 (southern Italy, Sardinia, Dalmatia, Albania, Greece). However, the taxonomy of this group is

Figure 15 **– Bacillus rossius *cf.* redtenbacheri.**
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delicate and the identification must be considered provisional (Lelong 1993; Berni 1997). Further research would be desirable to study this island population.

Hymenoptera

Two families only were collected, Formicidae and Vespidae (Appendix 1). Among the ants, two species are new for Albania, *Messor wasmanni* and *Tetramorium semilaeve*. The identified species of Vespidae are the very common *Vespa orientalis* and *Vespula germanica*. As for Heteroptera, the limited number of species observed at Sazani is certainly a consequence of this short survey.

Lepidoptera

The Lepidoptera community is represented by 16 species, 13 butterflies and 3 moths (Appendix 1). Unfortunately it was not possible to install a light trap, which explains the rarity of moths. As a whole, the Lepidoptera are represented by common and widespread species, most are polyphagous but *Aglais io*, *Polygonia egea* (Figure 16) and *Vanessa atalanta* feed on diverse *Urtica* and *Parietaria* species during the larval stages. Other host plants includes *Rumex* (*Lycaena phlaeas*), *Lonicera* (*Limenitis reducta*), *Prunus* (*Iphiclides podalirius*), *Iberis* (*Pieris mannii*), various Fabaceae (*Polyommatus icarus*) and various Poaceae (*Maniola jurtina*). An interesting butterfly flew in *Hyparrhenia hirta* grasslands (Figure 17), probably *Gegenes nostrodamus* but unfortunately the identification cannot be confirmed since no specimens were caught and a confusion with *Gegenes pumilio* is possible. The caterpillars of both *Gegenes nostrodamus* and *G. pumilio* eat this Poaceae species.

Odonata

Streams and marshes are scarce or absent on Sazani, hence dragonflies and damselflies are represented by very few species (Appendix 1). *Sympecma fusca, Sympetrum fonscolombii, Sympetrum meridionale,*

***Figure 16* – Polygonia egea.**
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***Figure 17* – Biotope of Gegenes *sp. with population of* Hyparrhenia hirta.**
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Figure 18 – Brackish water pond near the port, possible habitat for several species of Odonata.
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Sympetrum striolatum are all able to develop in brackish water, so their occurrence at Sazani may be explained by the presence of small water bodies close to the sea (Figure 18). One specimen of *Aeshna* was observed in flight but not caught and not identified, it is possible that this good flyer was a vagrant specimen originating from the Narta lagoon close to Vlorë, and located to the East 9km away from Sazani.

Isopoda

The Oniscoids *Trachelipus* cf. *camerani*, *Porcellio obsoletus* and *Armadillidium pallasii* thrive under dead tree barks in *Pinus brutia* woods and artificial stands of *Cupressus sempervirens*.

Gastropoda

The shells of six species of Gastropoda only were collected on Sazani, but the mollusc community is certainly much more diversified since Sazani is a limestone island, favourable to this group of animals. *Cochlostoma tesselatum* is in the broadest sense an endemic Balkan species found only in western Greece (including the Ionian Islands) and the southern half of Albania. Within this species, numerous 'forms', often treated as subspecies, are sometimes recognised and it could therefore be *C. tesselatum excisum* (Mousson 1859). According to Fehér *et al*. (2001), this taxon is not of significant taxonomic value. *Pomatias elegans* is a Western European species that is abundant almost everywhere. It is much rarer and localised in North Africa. Following the advice of F. Welter-Schultes and H. Nordsieck, *Siciliaria* cf. *stigmatica* is the name given to the clausilids collected on the island of Sazani. However, they stand out because of their small size and deserve further study. Some of the other shells collected seem to correspond to *Cernuella virgata*, a widely distributed species, which undoubtedly originated in the Mediterranean but is now widely distributed throughout Europe following introductions, some of which are very old. Further collections will enable us to make a definitive decision on the exact identity of the taxon observed on the island. *Cochlicella acuta* is a Mediterranean-Atlantic species, common mainly on the coasts within its wide range covering Western Europe and the Mediterranean Basin. For certain identification of *Monacha*

species, and in particular to distinguish it from *Monacha cartusiana* (Müller 1774), it is normally necessary to study internal anatomy. However, *M. cartusiana* appears to be found only in northern Albania (see distribution map in Welter-Schultes 2012). We therefore attribute these empty shells collected from Sazani to *M. claustralis*, a species distributed from southern Albania to western Turkey.

Comparison with Karaburun peninsula

It was possible to spend a few hours exploring the tip of the Karaburun peninsula, in the part closest to the island of Sazani (Figure 19). A comparison with the list of species recorded on the peninsula is interesting because it shows significant differences with the fauna of Sazani. Despite the very limited number of insects seen in Karaburun, 11 species were not recorded on the island, although the survey effort was much greater on the latter. The populations of the two regions (continent and island) therefore appear to be very different, even at the same altitude. The effect of insularity on biodiversity seems therefore obvious, however an over-exploitation of the island in the past, leading to the local extinction of certain species, cannot be ruled out. The advantages of combining a continental and an insular part in the same protected area are highlighted by this comparative study (which deserves to be developed further). The same observations seem to apply also to the flora since, for example, the Mount Thabor oak (*Quercus ithaburensis* subsp. *macrolepis*) is absent from Sazani but well represented on the north-east coast of Karaburun peninsula, only a few kilometers away (Tomàs-Vives 2014).

Arthropods marked with an asterisk were seen on the peninsula but not on the island of Sazani:

– *Ameles decolor* (Charpentier 1825)
– **Empusa fasciata* Brulle 1832
– *Calliptamus italicus* (Linnaeus 1758)
– **Acrida ungarica* (Herbst 1786)
– **Chorthippus* cf. *mollis* (Charpentier 1825)
– **Pseudomogoplistes squamiger* (Fischer 1853), several specimens on a pebble beach (Figure 20)

Figure 19 – View of Sazani island from the northern tip of Karaburun peninsula.
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***Figure 20 – Beaches at the northern tip of Karaburun peninsula, habitat of* Pseudomogoplistes squamiger.**
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– **Capnodis cariosa* (Pallas 1776), many specimens flying around *Pistacia lentiscus*
– **Cetonia aurata* (Linnaeus 1761)
– **Chrysolina vernalis* (Brulle 1832)
– **Otiorhynchus lugens* (Germar 1817)
– *Pedinus helopioides* Ahrens 1814
– *Stenosis intermedia dalmatina* Reitter 1916
– **Ophonus subquadratus* (Dejean 1829)
– *Vespa orientalis* Linnaeus 1771
– **Graphosoma semipunctatum* (Fabricius 1775)
– **Cataglyphis nodus* (Brulle 1832)
– *Limenitis reducta* Staudinger 1901
– **Papilio machaon* Linnaeus 1758
– **Argynnis paphia* (Linnaeus 1758)

Species new for Albania

Despite the unfavourable survey season, a significant number of arthropod species new to Albania were found.

On Sazani island:
– *Rhacochelifer maculatus* (L. Koch, 1873)
– *Ernobius parens* (Mulsant & Rey 1863)
– *Carphoborus pini* Eichhoff 1881
– *Allophylax picipes* (Olivier 1811)
– *Lygus italicus* Wagner 1950
– *Nysius helveticus* (Herrich-Schäffer 1850)
– *Ortholomus punctipennis* (Herrich-Schäffer 1838)
– *Messor wasmanni* Krausse 1910
– *Tetramorium semilaeve* André 1883

On Karaburun peninsula:
– *Otiorhynchus lugens* (Germar 1817)
– *Pseudomogoplistes squamiger* (Fischer 1853)

Conclusions, prospects for future investigations

Despite the unfavourable summer weather and the relatively limited survey time, the results of this first survey of arthropods and molluscs on the island of Sazani show that, despite the long history of human activity on the island (several millennia) and the major development work carried out in the more

recent past, the fauna appears to be relatively rich.

In the event that more field-trips are planned to complete the survey, the ideal period would be April-May for most arthropod groups.

The abandoned galleries and other subterraneous habitats were not visited in detail, despite their potential interest, due to the inadequacy of the lighting available and the presence of old munitions here and there. However, spiders were observed at the entrances to some of the galleries. An important project would be to study the subterranean fauna in this particular habitat. As the island is limestone, the possibility that the network of diaclases is home to cave dwellers (beetles, arachnids, myriapods, etc.) should be considered.

If new surveys were scheduled during the hottest periods of summer (late June to late August), it would be very interesting to carry out surveys using UV light, as many species of saproxylophagous Coleoptera are crepuscular and are attracted by this type of light. This is the most effective inventory method for this group, as these insects are very difficult to detect using the usual sight-hunting methods, particularly species that live in inaccessible parts of dying trees (pines, for example).

Assuming that staff would be present on the island between April and September, it would also be interesting to install aerial insect traps, either with "polytrap" traps (see for example Brustel 2012), or with less expensive simplified traps (see for example Allemand & Aberlenc 1991). These traps should be checked at least every 15 days. This type of traps, also known as a glass trap or interceptor trap, can operate without bait, but can also be fitted with a bait consisting of beer contained in the receptacle jar. This technique increases the attractiveness of the trap. Its effectiveness is based on the attractiveness of fermented liquids to many species of Coleoptera. As the beetles fly around the trap, they hit the Plexiglas plates and are collected in the receiver jar, which contains the bait with added salt and sugar. To increase trap yields, a tube with a pierced stopper containing sawdust soaked in a 50% mixture of rubbing alcohol and turpentine oil could be added to each trap. The purpose of this additional bait is to attract beetles associated with coniferous species.

Surveys carried out from autumn to spring would make it possible to sample the "leaf litter" fauna. The "leaf litter" is the mixture of dead leaves, twigs and various plant debris that accumulates at the foot of trees and shrubs. Many micro-organisms and invertebrates are found in this habitat and are involved in the fragmentation, degradation and natural transformation of this plant debris into humus. To sample these decomposer invertebrates (including many Coleoptera) living in this very particular environment, it is necessary to use a special entomological sieve, the Winkler sieve. This tool is used to treat accumulations of plant debris by separating the coarse fragments from the fine particles. The latter fall into the receiving bag along with the small insects. Back in the laboratory, this mass of debris is placed on a Berlese apparatus, which automatically extracts the microfauna by desiccation. The small animals pass through the grid and fall into the receiving bottle placed under the funnel.

Finally, it would be highly desirable to develop research on the Karaburun peninsula, where the entomological population quickly surveyed in 2012 appears to be quite different from that of Sazani. A comparison of these two close environments, one insular and the other continental, would certainly be instructive.

Management recommendations

There are currently few conservation problems on the island, at least as far as invertebrates are concerned. The most sensitive point concerns the small beaches of the port. There are at least two remarkable species in this area, the marine earwig *Anisolabis maritima*, and a beetle associated with coastal sands, the tiger beetle *Calomera littoralis*, both represented by reduced populations. Increased visitor numbers would be detrimental to the survival of these species, as would be the cleaning of the seagrass beds, which absolutely must not be eliminated (with the obvious exception of imputrescible waste of human origin: plastics, bottles, polystyrene, etc.) (Boudouresque *et al*. 2017). Not all the beaches were visited, but these comments apply to the entire coastline of the island of Sazani and the Karaburun peninsula. It should also be pointed out that a significant proportion of the arthropod diversity is supported by the ruderal vegetation that has developed around the inhabited areas of the port. This is the case, for example, with

nettles, which feed many Coleoptera, butterfly caterpillars and Heteroptera. Even if many of these species are insects with a fairly wide distribution, we should certainly take them into account and avoid destroying these plant formations. It should also be noted that a fairly rich fauna has been identified under the bark of dead and dying pine trees. A common sense measure would obviously be to leave the felled or standing trees in place (which do not necessarily harbour the same species) (Zuo *et al*. 2021). Finally, as mentioned above, the arthropod fauna associated with cavities and artificial galleries really deserves to be studied (Gueorguiev 1977). In this case, it would be necessary to clean these structures, which still contain a variety of munitions that present a danger of explosion.

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Appendix

Appendix 1 – Check-list of animals observed on Sazani island. See Appendix 2 for identification and reference documents.

CHILOPODA	**Scutigeromorpha**	Scutigeridae	*Scutigera coleoptrata* (Linnaeus 1758)
ARACHNIDA	**Pseudoscorpiones**	Cheliferidae	**Rhacochelifer maculatus* (L. Koch, 1873)
INSECTA	**Coleoptera**	Aderidae	*Aderus populneus* (Creutzer in Panzer 1796)
		Anobiidae	**Ernobius parens* (Mulsant & Rey 1863)
		Anthicidae	*Cyclodinus constrictus* (Curtis 1838)
		Anthicidae	*Hirticomus quadriguttatus* (Rossi 1792)
		Anthribidae	*Noxius curtirostris* (Mulsant & Rey 186)
		Anobiidae	*Ernobius parens* (Mulsant & Rey 1863)
		Buprestidae	*Buprestis cupressi* Germar 1817
		Carabidae	*Calomera littoralis* (Fabricius 1787)
		Carabidae	*Microlestes fissuralis* (Reitter 1901)
		Carabidae	*Pseudoophonus rufipes* (De Geer 1774)
		Carabidae	*Syntomus impressus* (Dejean 1825)
		Cerambycidae	*Exocentrus punctipennis* Mulsant & Guillebeau 1856
		Cerambycidae	*Parmena bicincta* Kuster 1849
		Chrysomelidae	*Cryptocephalus* (*Burlinius*) sp. (♀)
		Chrysomelidae	*Longitarsus albineus* (Foudras 1860)
		Chrysomelidae	*Longitarsus tabidus* (Fabricius 1775)
		Chrysomelidae	*Ochrosis ventralis* (Illiger 1807)
		Ciidae	*Cis chinensis* Lawrence 1991
		Cleridae	*Opilo domesticus* (Sturm 1837)
		Coccinellidae	*Chilocorus bipustulatus* (Linnaeus 1758)
		Coccinellidae	*Coccinella septempunctata* Linnaeus 1758
		Coccinellidae	*Henosepilachna elaterii* (Rossi 1794)
		Curculionidae	*Otiorhynchus armatus* Boheman 1843
		Curculionidae	*Otiorhynchus aurifer* Boheman 1843
		Curculionidae	*Brachytemnus porcatus* (Germar 1824)
		Curculionidae	*Kalcapion semivittatum* (Gyllenhal 1833)
		Curculionidae	*Taeniapion rufulum* (Wencker 1864)
		Dermestidae	*Dermestes undulatus* Brahm 1790
		Elateridae	*Drasterius bimaculatus* (Rossi 1790)
		Salpingidae	*Salpingus planirostris* (Fabricius 1787)
		Scarabaeidae	*Onthophagus furcatus* (Fabricius 1781)
		Scarabaeidae	*Sisyphus schaefferi* (Linnaeus 1758)
		Scolytidae	**Carphoborus pini* Eichhoff 1881
		Scolytidae	*Hypoborus ficus* Erichson 1836
		Staphylinidae	*Paederus littoralis* Gravenhorst 1802
		Tenebrionidae	**Allophylax picipes* (Olivier 1811)
		Tenebrionidae	*Asida fascicularis lineatocollis* Küster 1849
		Tenebrionidae	*Opatrum verrucosum* Germar 1817
		Tenebrionidae	*Pedinus helopioides* Ahrens 1814
		Tenebrionidae	*Stenosis intermedia dalmatina* Reitter 1916
	Heteroptera	Pentatomidae	*Graphosoma semipunctatum* (Fabricius 1775)
		Pentatomidae	*Dolycoris baccarum* (Linnaeus 1758)
		Pentatomidae	*Eysarcoris ventralis* (Westwood 1837)
		Pentatomidae	*Holcostethus sphacelatus* (Fabricius 1794)
		Pentatomidae	*Carpocoris purpureipennis* (De Geer 1773)
		Cydnidae	*Cydnus aterrimus* (Forster 1771)
		Cydnidae	*Geotomus sp.* (♀)
		Miridae	**Lygus italicus* Wagner 1950

	Miridae	*Tuponia (Chlorotuponia)* sp.
	Lygaeidae	*Proderus bellevoyei* Puton 1874
	Lygaeidae	*Spilostethus pandurus* (Scopoli 1763)
	Lygaeidae	**Nysius helveticus* (Herrich-Schäffer 1850)
	Lygaeidae	*Nysius graminicola* (Kolenati 1845)
	Lygaeidae	**Ortholomus punctipennis* (Herrich-Schäffer 1838)
	Lygaeidae	*Aoploscelis bivirgata* (A. Costa 1853)
	Lygaeidae	*Xanthochilus minusculus* (Reuter 1885)
	Lygaeidae	*Hyalochilus dolosus* Horvath 1897
	Lygaeidae	*Orsillus maculatus* (Fieber 1861)
	Nabidae	*Himacerus mirmicoides* (O. Costa 1834)
	Anthocoridae	*Anthocoris nemoralis* (Fabricius 1794)
	Stenocephalidae	*Dicranocephalus medius* (Mulsant & Rey 1870)
	Pyrrhocoridae	*Pyrrhocoris apterus* (Linnaeus 1758)
Orthoptera	Acrididae	*Acrida ungarica* (Herbst 1786)
	Acrididae	*Acrotylus patruelis* (Herrich-Schäffer 1838)
	Acrididae	*Aiolopus strepens* (Latreille 1804)
	Acrididae	*Anacridium aegyptium* (Linnaeus 1764)
	Acrididae	*Calliptamus italicus* (Linnaeus 1758)
	Acrididae	*Locusta migratoria* (Linnaeus 1758)
	Acrididae	*Oedipoda caerulescens* (Linnaeus 1758)
	Acrididae	*Pezotettix giornae* (Rossi 1794)
	Gryllidae	*Oecanthus pellucens* (Scopoli 1763)
	Mogoplistidae	*Arachnocephalus vestitus* Costa 1855
	Tettigoniidae	*Phaneroptera nana* Fieber 1853
	Tettigoniidae	*Tylopsis lilifolia* (Fabricius 1793)
	Tettigoniidae	*Yersinella raymondii* (Yersin 1860)
	Tettigoniidae	*Decticus albifrons* (Fabricius 1775)
	Tettigoniidae	*Eupholidoptera* sp.
Mantodea	Amelidae	*Ameles decolor* (Charpentier 1825)
	Mantidae	*Mantis religiosa* (Linnaeus 1758)
Dermaptera	Anisolabididae	*Anisolabis maritima* (Bonelli 1832)
	Forficulidae	*Forficula decipiens* Gené 1832
Phasmida	Bacillidae	*Bacillus rossius* (Rossius 1790)
Hymenoptera	Formicidae	*Camponotus aethiops* (Latreille 1798)
	Formicidae	*Camponotus lateralis* (Olivier 1791)
	Formicidae	*Crematogaster schmidti* (Mayr 1853)
	Formicidae	**Messor wasmanni* Krausse 1910
	Formicidae	*Pheidole pallidula* (Nylander 1849)
	Formicidae	**Tetramorium semilaeve* André 1883
	Formicidae	*Tetramorium* sp.
	Vespidae	*Polistes* sp.
	Vespidae	*Vespa orientalis* Linnaeus 1771
	Vespidae	*Vespula germanica* (Fabricius 1793)
Lepidoptera	Geometridae	*Orthostixis cribraria* (Hübner 1799)
	Hesperiidae	*Gegenes ?nostrodamus* (Fabricius 1793)
	Lycaenidae	*Celastrina argiolus* (Linnaeus 1758)
	Lycaenidae	*Leptotes pirithous* (Linnaeus 1767)
	Lycaenidae	*Lycaena phlaeas* (Linnaeus 1761)
	Lycaenidae	*Polyommatus icarus* (Rottemburg 1775)
	Noctuidae	*Heliothis peltigera* (Denis & Schiffermüller 1775)
	Nymphalidae	*Aglais io* (Linnaeus 1758)
	Nymphalidae	*Limenitis reducta* Staudinger 1901

		Nymphalidae	*Maniola jurtina* (Linnaeus 1758)
		Nymphalidae	*Polygonia egea* (Cramer, 1775)
		Nymphalidae	*Vanessa atalanta* (Linnaeus 1758)
		Nymphalidae	*Vanessa cardui* (Linnaeus 1758)
		Papilionidae	*Iphiclides podalirius* (Linnaeus 1758)
		Pieridae	*Pieris mannii* (Mayer 1851)
		Sphingidae	*Macroglossum stellatarum* (Linnaeus 1758)
	Odonata	Aeshnidae	*Aeshna* sp.
		Lestidae	*Sympecma fusca* (Van der Linden 1820)
		Libellulidae	*Sympetrum fonscolombii* (Selys 1840)
		Libellulidae	*Sympetrum meridionale* (Selys 1841)
		Libellulidae	*Sympetrum striolatum* (Charpentier 1840)
Malacostraca	**Isopoda**	Armadillidiidae	*Armadillidium pallasii* Brandt 1833
		Porcellionidae	*Porcellio obsoletus* Budde-Lund 1885
		Trachelipodidae	*Trachelipus* cf. *camerani* (Tua 1900)
Gastropoda	**Littorinimorpha**	Clausilidae	*Siciliaria* cf. *stigmatica* (Rossmässler, 1836)
		Diplommatinidae	*Cochlostoma tesselatum* (Rossmässler 1837)
		Hygromiidae	?*Cernuella virgata* (Da Costa, 1778)
		Hygromiidae	*Cochlicella acuta* (Müller, 1774)
		Hygromiidae	*Monacha claustralis* (Rossmässler, 1834)
		Pomatiidae	*Pomatias elegans* (Müller, 1774)

* Species new for Albania.

Appendix 2 – Identification and reference documents

There are few taxonomic works devoted specifically to the fauna of Albania, so it was necessary to consult more general works in order to identify the animals observed.

Arachnids

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