

J. OBRADOVIC, A.Z. LOVRIC, M. RAC and B. SEKULIC

Center for Marine Research, R. Boskovic Institute, Zagreb (Yugoslavia)

RESUME : Synécologie des écrevisses et de l'herpétofaune des îles adriatiques. Les biotopes typiques dulçaquicoles dans l'Archipel Adriatique sont confinés aux îles plus élevées septentrionales présentant les biotopes d'*Austropotamobius italicus*, *Triturus vulgaris*, *Hyla arborea*, *Rana ridibunda*, *Matrix natrix* et *Emys orbicularis*. Ils sont absents des îles sèches méridionales de Dalmatie qui sont plus riches en lézards et serpents dont la synécologie y est également étudiée.

INTRODUCTION. The freshwater habitats of the crayfish and amphibians in the Adriatic Archipelago are rather rare, due to the lacking precipitations and especially to the predomination of the porous karst substrata being unsuitable for the forming of surface waters that there sink immediately into the subterranean cavities. Thus the stable and typical freshwater habitats there are restricted to the most rainy northernmost islands of Kvarner Gulf, especially in the islands Cres and Krk where occur the crayfish and some amphibians. More southwards on dry Dalmatian islands occur only some unstable seasonal tarns and the brackish lagoons where the crayfish is lacking, and the amphibians are rare including only *Bufo viridis* and *Bombina variegata*. These hot-dry southern islands in Dalmatia are but the richest ones in reptilians, and especially in different lizards. The main studied freshwater habitats are the next two ones; the well conserved Vrana lake, a deep rocky oligotrophic basin in Cres island, and in the Krk island the Ponikve flat lakelet, and the Velarika rivulet presenting the unique permanent running water of the entire archipelago. Both freshwater sites of Krk recently are partly degraded by the hydrotechnical regulations for water supply.

RESULTS. The insular crayfish in the fresh waters of Cres and Krk has been defined by SPANKOVIC (1961) to be *Austropotamobius italicus* Fsk., but it is rather deviating from its West Mediterranean type, especially concerning a minor size and the major spinescence, and this may be probably a separate insular subspecies. It occurs either in the muddy-shingly bottoms within the calciphilic karst hydrophytes of the alliance *Coleogeto-Nesjedion* Lov., and also on the rocky bottoms covered by the calcifying water mosses of Fontinalion antipreticace Hüb.

Among the amphibians, the most widespread ones across this archipelago are the swamp ubiquitous *Bufo viridis* Laxm., and *Bombina variegata* Gmel., being the most resistant amphibians to a periodical aridity. Thus during the summer, they find their refuge under the stones and in karst pores. Their habitats include the desiccating tarns of *Isotetalia* Br.-Bl., and also the subaline swamps of the *Bolboschoenion* S60 and *Ruppiaetalia* Br.-Bl. Other insular amphibians are related to the stable freshwater habitats and they occur almost only in the northern islands of Kvarner Gulf. The *Hyla arborea* L. of these islands is ecologically rather divergent from its mainland populations, for there it is lacking from its usual forest habitats and it is usually found by the springs and within the caves, mostly correlated with the skiophytic ferns of *Adiantum* Br.-Bl.

The Urodela are presented chiefly by *Triturus vulgaris tomassinii* (Walt.), an endemic subspecies of East Adriatic karst waters and there it lives, also as the crayfish, between the calciphilic hydrophytes of *Coleogeto-Nesjedion*. Other rare amphibians of N islands are *Rana ridibunda* Pall. and *Salamandra salamandra* (L.) whose synecology was not studied.

The freshwater reptilians found only in Cres and Krk are the turtle *Emys orbicularis* (L.) and serpent *Matrix natrix* (L.), both living mostly within the reeds of *Phragmitetalia* Tx. & Prs. The terrestrial turtles are presented only by *Testudo hermanni* Gmel., that is frequent in the major southern Dalmatian islands, but rare up to absent in northernmost ones. It occurs chiefly within the garrique scrub of *Cisto-Ericion* Hic. Concerning the terrestrial serpents of archipelago, *Vipera ammodytes* (L.) is frequent in some major islands but rare up to absent in many minor islets. It is there also ecologically divergent from its mainland populations, for it is there rare in its usual habitats of open rocks and grasslands and occurs mostly in the woods of *Orno-Quercetum ilicis* Hic and of *Garrinetum orientalis* Hic. *Vipera berus* L. occurs only in the northernmost Krk island, within the montane woods of *Seslerio-Ostryetum carpinifoliae* Horv. The largest and frequent insular serpent is *Coluber carbonarius* (Bonnsp.) living chiefly in the deciduous thornbush of *Paliuterum* Hic. *Telescopus fallax* (Fleisch.) occurs in many islands, almost in the grasslands of *Artemision lobelii*. Other rare insular serpents are also *Coluber najedum* (Eich.), *Elaphe situla* (L.), *E. quatuorlineata* (Lacép.) and *Malpoleon monspessulanus* Herzm., whose synecology is not studied.

The sauriens include *Ophisaurus apodus* (Pall.), frequent in many isles within the flysch grasslands of *Scorzonerion villosae*. The geckos include *Tarentola mauritanica* (L.) frequent on the islands in old houses and ruins within *Kentrantho-Parietarion* R. Mart.; and more rare *Hemidactylus turcicus* (L.) of southern Dalmatian islands (synecology not studied). The true lizards include 6 main insular species with numerous endemic subspecies. So the *Agropyridae nigropunctatus* (Dum. & Bib.) is restricted to montane screes of *Peltarion alliaceae* Hic. in the northernmost islands Krk and Prvic. *Lacerta trilineata* Bedr. is frequent in insular scrub of *Cisto-Ericion*. The endemic *Podarcis oxycephala* (Dum. & Bib.) occurs in the mediterranean grasslands of *Cymbopogono-Brachypodion* Hic. in the southern Dalmatian islands only. *P. taurica* is there presented chiefly by ssp. *flumana* (Wern.) being widespread in the grasslands *Scorzonero-Chrysopogonetalia* Hic. & Horv. across the archipelago. *P. sicula* (Reif.) presents some insular endemics within the summer-deciduous scrub *Euphorbietum dendroideis* Guin. & Drou. of S external isles: ssp. *pelagosa* (Bedr.) in Palagruška, and ssp. *cazaze* (Braun) in Sušac. The reputed black lizard *Podarcis melisellensis* (Braun) is the most diversified in insular endemics. So its ssp. *melisellensis* s.str. in Brusnik islet and ssp. *pomoensis* (Wett.) in Jabuka and also ssp. *kammereri* (Wett.) in Barjak, all occur in the wintergreen scrub *Levataro-Capparetum sicules* Lov., while other endemics e.g. ssp. *lissae* (Wern.) in Vis and ssp. *galvagnii* (Wern.) in Svetac both live in xeric grasslands of *Stipilion capensis* Br.-Bl. (cf. RADOVANOVIC 1951).

## References

Radovanovic M. 1951: Amphibien und Reptilien Jugoslawiens. Beograd.  
Karsman M.S. 1961: Süßwasserkrebse Jugoslawiens. Skopje, 33p.

Rapp. Comm. int. Mer Médit., 31, 2 (1988).

A.Z. LOVRIC and J. OBRADOVIC

Rudjer Boskovic Institute, 41000 Zagreb (Yugoslavia)

RESUME : Aires de nidification et synécologie des oiseaux marins de quelques îlots adriatiques. Dans l'Archipel adriatique, on a trouvé 27 espèces d'oiseaux marins - pour la plupart en migration - et seulement chez dix espèces on a pu confirmer la nidification : *Larus cachinnans*, *Sterna hirundo*, *S. albifrons*, *Puffinus puffinus*, *Calonectris diomedea*, *Phalacrocorax aristotelis* et récemment, on a confirmé aussi *Gelochelidon nilotica*, *Hydrobates pelagicus*, *Oceanodroma leucorhoa* et *Fratercula arctica* nidifiant sur quelques îlots peu accessibles.

INTRODUCTION. The coastal avifauna in Adriatic Archipelago is rather poor if compared with other Mediterranean islands, and especially in relation to the Atlantic islands in NW Europe. In this archipelago one indicated 27 seabird species, but the classical studies prior to 1980ies (cf. LOVRIC 1981) there documented the nesting only for 6 ones: *Larus cachinnans*, *Sterna hirundo*, *S. albifrons*, *Phalacrocorax aristotelis*, *Puffinus puffinus* and *Calonectris diomedea*. The recent detailed studies across this archipelago added 4 other coastal nesters: *Gelochelidon nilotica*, *Oceanodroma leucorhoa*, *Hydrobates pelagicus* and *Fratercula arctica*. Thus the rest of 17 seabirds noted in this archipelago are never registered in nesting but only during their seasonal migrations e.g. *Sula bassana* L., *Stercorarius skua*, *St longicauda*, *Hydroprogne caspia*, *Halietor pygmaeus*, *Phalacrocorax carbo* (L.), *Rissa tridactyla* (L.), *Larus marinus* L., *L. ridibundus* L., *L. melanocephalus*, *L. minutus*, *Chlidonias niger*, *Ch. leucopeterus*, *Ch. hybridus*, *Sterna sandvicensis*, *Mergus serrator* and *Podiceps cristatus*. The nomenclature of bird species is after MATVEJEV and VASIC (1973).

RESULTS. Seabirds include two species nesting chiefly on coastal dunes, beaches and sandy islets (eyots) within the psammophytic vegetation of *Ammophiletalia* Br.-Bl. Among the Adriatic islands, such habitats with the related nesting birds are well developed only in the loess and flysch islets within the Losinj Archipelago in N Adriatic.

1. *Sterna albifrons* Pall. occurs in the sandy eyots by Losinj within the psammophytes of *Ammophiletalia*.

2. *Gelochelidon nilotica* (Gmel.) is a very rare nester of the loess sandy islets Srakane and Palacol within the Losinj group, nesting associated with *Sterna albifrons* in the psammophytic vegetation of *Eriantho-Agroppretum maritima* (Hic.) Lov.

The skerry birds include two species nesting mostly in the subhorizontal stony shores, and in the minor rocky islets and reefs within the xerohalophytic vegetation of the *Crithmo-Limonietalia* Br.-Bl.:

3. *Larus cachinnans* (L., *C. michahellis*) is the most frequent seabird within the Adriatic Archipelago, and the nesting colonies there occur in numerous rocky islets and reefs, sometimes also in the rocky capes of major islands. The nesting sites are variable, so among the xerohalophytic vegetation of *Microrrhinion litoralis* (Hic.) Lov., and also in the aerosaline shrublands of *Thymelaion hirsutae* Tadr.

4. *Sterna hirundo* L. nests in some minor Adriatic islets, especially in Galun and Kormat within the Kvarner Archipelago and in the minor islets of Kormati Archipelago, often in the mixed colonies associated with *Larus cachinnans*.

The seacliff birds include other 6 ones nesting in the stormy coastal escarpments of craggy islets and in lofty major islands, within the cliff vegetation of *Euphorbietalia dendroideis* Zoh.

5. *Phalacrocorax aristotelis desmarestii* is the second frequent coastal nester of this archipelago, since the gulls. The nesting sites lie within the aerosaline cliff vegetation of the alliance *Aurinio-Capparion* Lov. The richest colonies persist in the Kornati and Lastovci, and Vis and Senj Archipelago.

6. *Puffinus puffinus velkouan* there is a rare nester, so far registered in the remote islets of Vis Archipelago in central Adriatic, and also in the stormy islets Prvic and Grgur in NE Adriatic. Both sites are in seacliffs (*Aurinio-Capparion*).

7. *Calonectris diomedea* is also in Yugoslavia a rare nester, so far registered in the seacliffs of Mid Dalmatian islands, often associated in the colonies of *Phalacrocorax aristotelis* within the phytocoenosis *Aurinio-Brassicetum frutescentis*.

8. *Hydrobates pelagicus* is a very rare nester registered so far only in the remote volcanic islets (guyots) of the Vis Archipelago in central Adriatic, and especially in the igneous seacliffs of Jabuka and Brusnik overexposed to the Sirocco storms from open sea. The nests are in the cliff pores within the endemic xerohalophytic phytocoenosis of *Puccinellio teybericentaureetum crithmifoliae* (Lov.) Lov.

9. *Oceanodroma leucorhoa castro* is the most rare seabird of Adriatic, and there is registered sporadically as nesting only on the craggy islet Prvic (NE Adriatic). They are associated with *Fratercula*, in the lofty seacliffs overexposed to the strongest Bora hurricanes, within the endemic aeolian phytocoenosis *Aurinio mediae-Astragaletum dalmaticum* Lov.

10. *Fratercula arctica* is also very rare in NE Adriatic. The ancient indications in Krk and Pag recently are not confirmed, and actually is registered in a sporadic nesting only in the stormy seacliffs of Prvic islet overexposed to the strongest Bora, within the *Aurinio-Astragaletum* vegetation.

Thus these richest nesting sites of seabirds in Prvic and also in the remote Mid-Adriatic islets need an urgent protection.

## References

Lovric A.Z. 1981: Ornithogenic biocoenoses of Kvarner. *Larus* 23: 39-67.  
Matvejev S.D. and Vasic V.F. 1973: Aves. *Catalogue Faune Yugoslavica*, IV/3: 1-118, Acad. Sci. Ljubljana.

Rapp. Comm. int. Mer Médit., 31, 2 (1988).