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Herpetofaunal data from Cres Island, Croatia

Herpetofaunistische Daten über die Insel Cres, Kroatien

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KURZFASSUNG

Die vorliegende ausführliche Zusammenstellung über das Vorkommen der Amphibien und Reptilien auf der nordadriatischen Insel Cres basiert auf Literaturangaben, freundlicherweise zur Verfügung gestellten unpublizierten Beobachtungen und mehreren Besuchen der Autoren auf der Insel. Als Ergebnis liegen Punktkarten der Verbreitung der Arten vor. Zur Vervollständigung des Überblicks werden herpetofaunistische Funddaten von 25 Nachbarinseln in der Kvarner Bucht angeführt. Erstmals wird über ein Vorkommen von *Lacerta oxycephala* DUMÉRIL & BIBRON, 1839 auf Cres berichtet.

ABSTRACT

The present detailed account of the amphibian and reptile distribution in the North Adriatic Island of Cres (Croatia) is chiefly based on literature data supplemented by new observations kindly provided by a number of correspondents or made by the authors during various trips to the island. Dot maps of the species' distribution on Cres Island are presented. The overview is completed by information on the herpetofauna of 25 neighboring islands in the Kvarner Bay. *Lacerta oxycephala* DUMÉRIL & BIBRON, 1839 is reported for the first time from Cres Island.

KEY WORDS

Amphibia, Reptilia, Cres Island, north Kvarner, Croatia, herpetofauna, distribution maps, chorology, biogeography, *Lacerta oxycephala*, new island record

INTRODUCTION

The present detailed account of the amphibian and reptile distribution in the North Adriatic Island of Cres is chiefly based on literature data. The first comprehensive and most significant albeit controversial work dealing with the island is BRUNO's (1980) paper, summarizing his field experiences gained in the course of five years. More recently, SEHNAL & SCHUSTER (1999) provided an overview of the island's herpetofauna, which RATHBAUER (2002), MAYER & PODNAR (2002), and DIECKMANN (2004) later completed by their new observations. Supplementary to all these data the authors relied on personal communications with W. MAYER (Wien), M. DIECKMANN (Hamm) and several other sources (see acknowledgements) and made use of own experiences. As members of the teams from the Zoological and Botanical Garden of the City of Budapest (Hungary), which repeatedly surveyed the island from 2001 on, TT, BF, and JG made herpetological field trips in May 2001, 2003 and 2005, as well as June 2005.

In addition, the herpetofaunal records of 25 neighboring islands (tables 1, 3, figure 1) were included to complete the overview of the amphibian and reptile distribution in the Kvarner Islands. Among the larger islands, Pag and Rab in the Southeast were not considered in the analysis due to their greater distance from Cres (16 km and 15 km, respectively) while Krk and Lošinj (at 5 km and 0.01 km, respectively) were.

Figure 2 depicts the localities on the Island of Cres mentioned in the text. Museum acronyms used in the species accounts are as follows: BMNH = The Natural History Museum, London; MFSNU = Museo Friulano di Storia Naturale, Udine; NMW = Naturhistorisches Museum Wien; SMF = Senckenberg Museum, Frankfurt am Main; SMNS = Staatliches Museum für Naturkunde Stuttgart; SNHM = Slovenian Natural History Museum, Ljubljana.

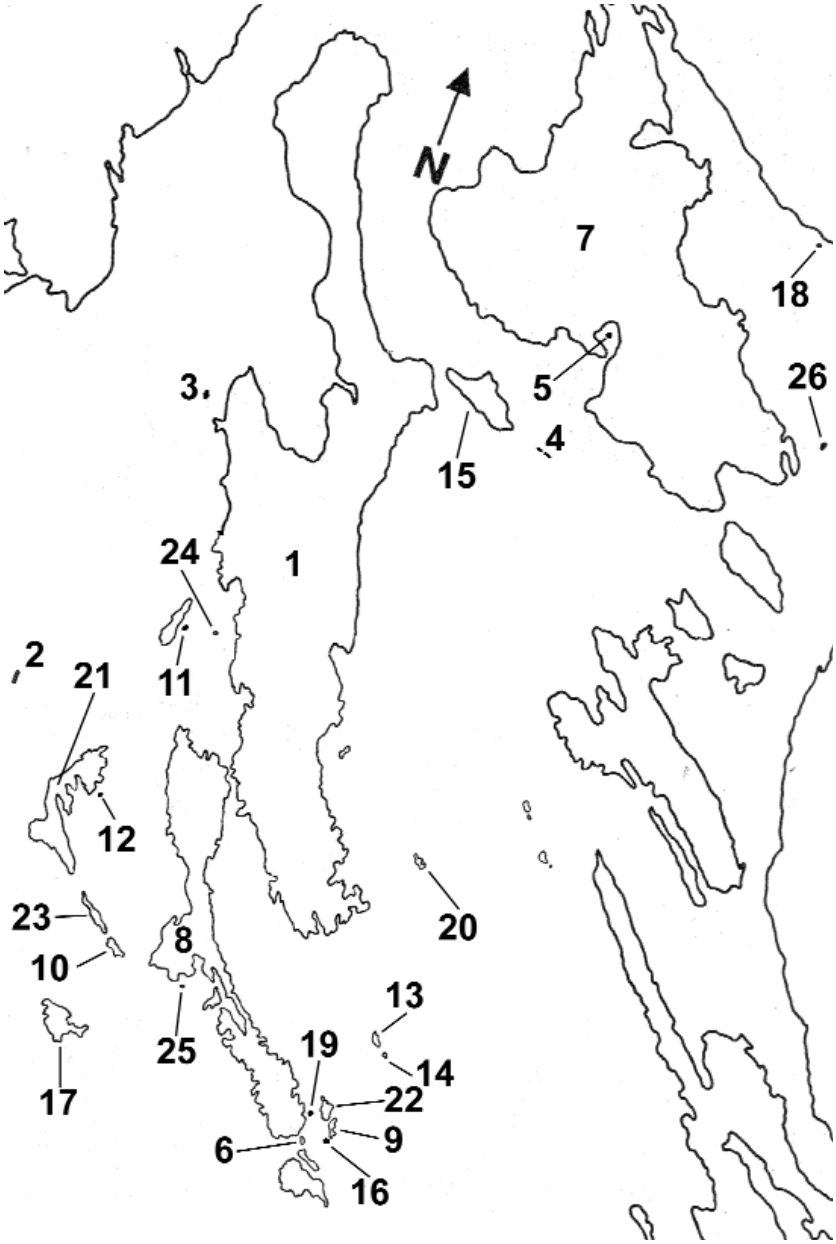


Fig. 1: Islands of the northwestern Kvarner Bay (Croatia) the herpetofaunal records of which are considered in the present paper. For the coordinates of the islands see table 1.

Abb. 1: Die Inseln der nordwestlichen Kvarner-Bucht (Kroatien), deren Amphibien- und Reptiliennachweise in der vorliegenden Arbeit berücksichtigt wurden. Die zugehörigen Inselkoordinaten sind in Tabelle 1 angeführt.

1 - Cres, 2 - Hrid Galiola, 3 - Hrid Zaglav, 4 - Kormat, 5 - Košljun, 6 - Kozjak, 7 - Krk, 8 - Lošinj, 9 - Male Orjule, 10 - Male Srakane, 11 - Mišar, 12 - Mišnjak, 13 - Oruda, 14 - Palacol, 15 - Plavnik, 16 - Školjić, 17 - Susak, 18 - Sveti Marin, 19 - Trasorka, 20 - Trstenik, 21 - Unije, 22 - Vele Orjule, 23 - Vele Srakane, 24 - Visoki, 25 - Zabodaski, 26 - Zec.

Table 1: Islands of the northwestern Kvarner Bay (Croatia) the herpetofaunal records of which were considered in the present paper. For the position of the islands see figure 1. The coordinates refer to the geometrical centre of each island, for larger islands the point of reference is indicated in parentheses.

Tab 1: Die Inseln der nordwestlichen Kvarner-Bucht (Kroatien), deren Amphibien- und Reptiliennachweise in der vorliegenden Arbeit berücksichtigt sind. Zur Lage der Inseln siehe Abb. 1. Die Koordinaten beziehen sich auf die geometrische Mitte der jeweiligen Insel, bei größeren Inseln ist ein Bezugspunkt in Klammern angeführt.

Island / Insel	Nr. in fig. 1	Coordinates
Cres (Cres township)	1	44°57.5' N, 14°24.6' E
Hrid Galiola	2	44°43.7' N, 14°10.5' E
Hrid Zaglav	3	44°55.3' N, 14°17.3' E
Kormat	4	44°56.7' N, 14°34.5' E
Košljun	5	45°01.6' N, 14°37.1' E
Kozjak	6	44°28.6' N, 14°32.6' E
Krk (Krk township)	7	45°01.6' N, 14°34.3' E
Lošinj (Mali Lošinj)	8	44°31.8' N, 14°28.2' E
Male Orjule	9	44°29.4' N, 14°33.9' E
Male Srakane	10	44°33.7' N, 14°20.0' E
Mišar	11	44°46.5' N, 14°19.1' E
Mišnjak	12	44°39.6' N, 14°17.1' E
Oruda	13	44°33.0' N, 14°34.9' E
Palacol	14	44°32.5' N, 14°35.7' E
Plavnik	15	44°58.2' N, 14°31.5' E
Školjić	16	44°28.9' N, 14°33.8' E
Susak	17	44°30.5' N, 14°18.0' E
Sveti Marin	18	45°07.2' N, 14°48.0' E
Trasorka	19	44°29.6' N, 14°32.5' E
Trstenik	20	44°40.1' N, 14°34.7' E
Unije (Unije township)	21	44°38.2' N, 14°14.8' E
Vele Orjule	22	44°29.8' N, 14°33.4' E
Vele Srakane	23	44°34.9' N, 14°18.6' E
Visoki	24	44°46.6' N, 14°20.9' E
Zabodaski	25	44°33.1' N, 14°24.1' E
Zec	26	44°59.7' N, 14°50.1' E

DESCRIPTION OF CRES ISLAND

Cres Island is situated in the Kvarner Bay of the North Adriatic Sea. From the geological point of view the Adriatic can be divided along the Gargano - Palagruža - Lastovo - Mljet - Dubrovnik line. The area north of this line was at one time an inland sea to which the Po and some other rivers discharged, and which came into connection with the southern Adriatic and the Mediterranean Sea by the end of the last Ice Age. The majority of Adriatic islands is comparatively young. Depending on the depth of the sea separating them from the mainland (the deepest point of the North Adriatic lies west of the island of Jabuka [Pomo] at 256 m, whereas the greatest depth [1.330 m] in the southern Adriatic can be measured along the Dubrovnik-Brindisi line) they are only about 10-30,000 years old (RADOVANOVIĆ 1956). Cres (separating depth of sea 51 m, minimum distance from the mainland of Istra approximately 4.5 km) was thus not isolated from the mainland during great parts of the Pleistocene (SUŠIĆ & PERINČIĆ 2004).

Cres (like the neighboring Krk) is among the largest islands in the Adriatic with a surface area of approximately 406 km^2 and a length of 65 km. Around halfway at 45° latitude, the island is divided into two portions. This region, at the same time, defines the northernmost limit of the Mediterranean Zone. Cres and its southern neighbour, Lošinj are, in fact, the extensions of the Istrian mountains of Čićarija and Učka and once formed a continuous mainland that was divided by a channel in Roman times at what is presently the town of Osor.

The subsoil of Cres consists mainly of dolomite and limestone, heavily eroded at the coastline, e.g., at the bays of the town-

Table 2: Climate data of Rovinj, representative of the North Adriatic (after PÉCZELY [1986]).
Tab. 2: Klimadaten von Rovinj als repräsentativer Station in der nördlichen Adria (nach PÉCZELY [1986]).

Month Monat	Rainfall (mm) Niederschlag	Relative cloud cover (%) Rel. Wolkenbedeckung	Number of sunny hours Anzahl der Sonnenscheinstunden	Mean temperature (ºC) Temperaturmittel
Jan.	58	60	103	5.6
Feb.	47	60	122	5.3
Mar.	70	56	166	8.3
Apr.	52	49	218	11.8
May	80	44	271	15.8
Jun.	52	38	288	20.2
Jul.	38	27	347	22.8
Aug.	51	31	305	22.8
Sep.	88	34	244	19.7
Oct.	100	40	202	15.1
Nov.	105	65	93	9.9
Dec.	60	62	95	7.6
Σ; $\bar{x}$	$\Sigma = 801$	$\bar{x} = 47$	$\Sigma = 2454$	$\bar{x} = 13.7$

ships of Cres and Martinšćica. The soil of karst fields is mainly terra rossa (fig. A). The northern part of the island is characterized by karst formations, such as dolines, collapses, caves, karst valleys, etc. The highest peak of the island is Mount Gorice at 648 m a.s.l., whereas its largest body of freshwater is Lake Vrana (fig. B) that supplies all the islands of Cres and Lošinj with freshwater. The lake is 74.5 m deep, and its surface at medium water level is 13 m a.s.l. The area is currently a military zone, hence it can only be visited by special permission. Due to the structure of its soil, the island is rather poor in freshwater, the main source being Lake Vrana. Hill streams rapidly emerge following rainfall, but quickly disappear after the rain stops. In addition, some 15 natural springs and ten wells are found on Cres (fig. C), which are supplemented by approximately 70 artificial wells (MAVROVIĆ 1997).

As a result of the close proximity of the sea and the chains of the Dinaric Alps (Velebit Mountains included) that isolate the island from the cool northern winds, the climate is Mediterranean. Consequently, the area is characterized by temperate warm climate with hot and arid summers, and rainy autumns without a distinct dry period (see table 2).

With a flora consisting of approximately 1,300 plant species Cres is an island with one of the richest vegetation in the Adriatic. North of 45° latitude, in submediterranean areas deciduous forests consisting of downy oak (*Quercus pubescens*) and oriental hornbeam (*Carpinus orientalis*) predominate, whereas on higher ground also hop hornbeam (*Ostrya carpinifolia*) and Turkish oak (*Quercus cerris*) occur (MAVROVIĆ 1997; SUŠIĆ & PERINČIĆ 2004).

Besides, there is an open cave north of Merag famed for its bay laurel (*Laurus nobilis*) forest, and groups of sweet chestnuts (*Castanea sativa*) growing in the eastern and northeastern part of the island are also worth mentioning (MAVROVIĆ 1997). In the southern, mediterranean zone, however, dominant trees are holm oaks (*Quercus ilex*). Characteristic plant communities of the island include garrigue, macchia as well as stony, karstic meadows (fig. D) with *Stipo-Salvietum*. The island is home to a number of endemic plant species, such as Istrian bluebell (*Campanula istriaca*), Dalmatian toadflex (*Centaurea dalmatica*) and littoral corydalis (*Corydalis acaulis*) (MAVROVIĆ 1997; SUŠIĆ & PERINČIĆ 2004). Of the relictual species the European wild ginger (*Asarum europaeum*), fumewort (*Corydalis solida*), snowdrop (*Galanthus nivalis*), holly (*Ilex aquifolium*), sanicle (*Sanicula europaea*) and hedge violet (*Viola reichenbachiana*) are the most unique, particularly on Merag Peninsula (MAVROVIĆ 1997; SUŠIĆ & PERINČIĆ 2004).

SPECIES ACCOUNTS

Amphibia

Triturus vulgaris meridionalis
(BOULENGER, 1882)

BRUNO (1980) collected a male and two females in 1974 in Lake Vrana, which were for a long time the only vouchers from the island. Thus, nearly all authors (e.g., LANZA & VANNI 1987; SEHNAL & SCHUSTER 1999) actually referred to these specimens, while some (e.g., DŽUKIĆ et al. 1990; LANZA & VANNI 1990) simply listed this newt for the island without further comment. KOVÁCS (2003) observed a single specimen of this species at Garbovica in a deep pool of approximately 20 m diameter. The pool had a muddy bottom, but its water was clear (fig. 3).

Other Kvarner Islands records – Krk: observed by BRUNO (1980), SOCHUREK (1985), FRANZEN (1987) and MRŠIĆ et al. (1989); just reported by KARAMAN (1921), BURESCH & ZONKOV (1941), POZZI (1966), SCHMIDTLER & SCHMIDTLER (1983), FRANZEN (1987, various localities), LANZA & VANNI (1987, 1990), DŽUKIĆ et al. (1990), SCHMIDTLER & FRANZEN (2004). NMW vouchers from three different sites.

Bombina variegata variegata
(LINNAEUS, 1758)

BRUNO (1980) observed three specimens of the Yellow-bellied Toad in 1974 in a heavily vegetated part of Lake Vrana. In later studies authors either referred to BRUNO's (1980) observation (e.g., SEHNAL & SCHUSTER 1999) or simply listed the species' occurrence on Cres without comment (e.g., LANZA & VANNI 1990). A more recent confirmation is lacking (fig. 4).

Other Kvarner Islands records – Krk: observed by BRUNO (1980), SOCHUREK (1985); just reported by CUBICH (1875, as *Bombinator igneus*), DEPOLI (1898) and LANZA & VANNI (1987, 1990).

Bufo bufo spinosus
DAUDIN, 1803

BRUNO (1980) reported that he had found an adult male Common Toad at Sjevernjak šuma, a young specimen in the vicinity of Beli, and another adult male at Lake Vrana (fig. 5). More recently, W. MAYER (pers. comm.) observed Common Toad tadpoles west of Lake Vrana.

Other Kvarner Islands records – Krk: observed by BRUNO (1980), SOCHUREK (1985), and MRŠIĆ et al. (1989); just reported by CUBICH (1875, as *Bufo variabilis*), KARAMAN (1921), and LANZA & VANNI (1987, 1990). Several NMW vouchers.

Bufo viridis viridis
LAURENTI, 1768

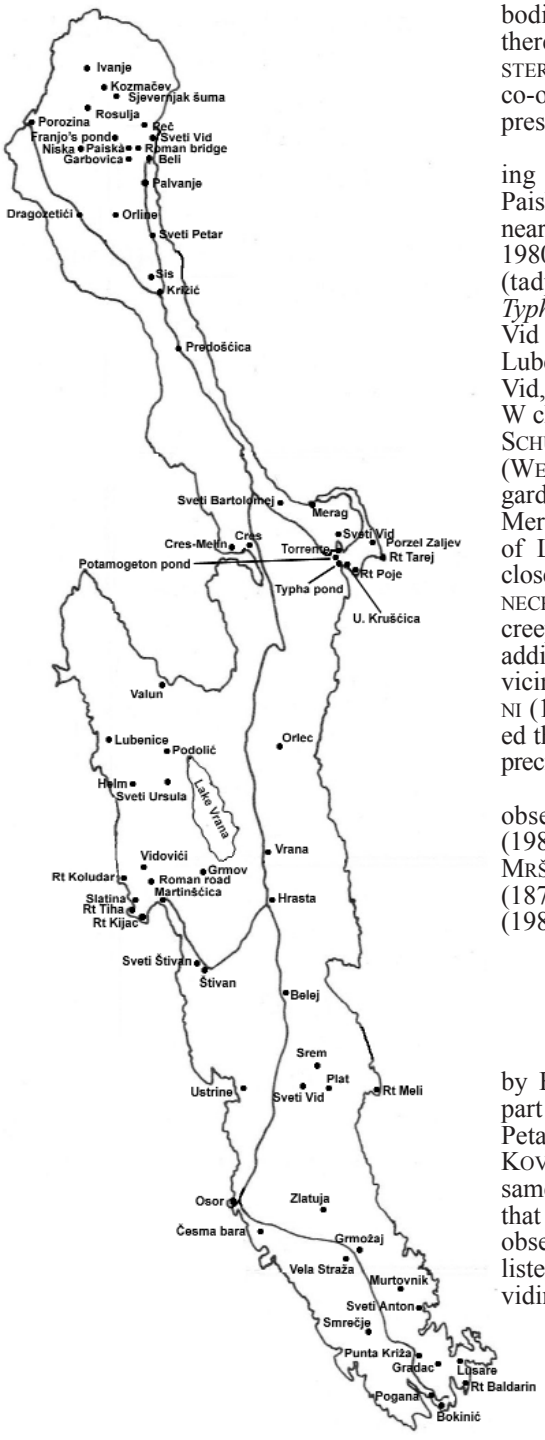
The Green Toad is a well-known amphibian on Cres Island, characterized by its high ecological tolerance – it occurs even in brackish water (BROGGI 1997) – and close association with human settlements. Thus it is found frequently on larger islands in the eastern and central basin of the Mediterranean Sea.

According to literature sources the Green Toad was reported from the following localities on Cres: Sjevernjak šuma, Porzel zaljev, Lake Vrana (BRUNO 1980), chapel at Srem, Vrana, Štivan, dumping ground near Cres (SEHNAL & SCHUSTER 1999), garden in Cres-Melin, forest patch E Osor (RATHBAUER 2002). We found two road-killed specimens in the harbor of Merag. Additionally, LANZA & VANNI (1987, 1990) and also DIECKMANN (2004) observed this species on Cres but provided no exact locality data (fig. 6).

Other Kvarner Islands records – Krk: observed by BRUNO (1980), SOCHUREK (1985), MRŠIĆ et al. (1989) and FARKAS (pers. obs.; roadkills only). Just reported by LANZA & VANNI (1987, 1990). Voucher specimens from the island at NMW.

Hyla arborea arborea
(LINNAEUS, 1758)

The occurrence of the European Tree Frog on Cres was already mentioned by WERNER (1891). It is of some interest that this species is found in great densities, considering the island's aridity and taking into account that the introduced mosquitofish, *Gambusia affinis* inhabiting larger water



bodies prey heavily on tree frog tadpoles there (Rathbauer 2002). Sehnal & Schuster (1999) observed that *H. arborea* do not co-occur with *Gambusia* which may represent a similar observation in other words.

This anuran is known from the following localities on the island: Garbovica, Paiskà (Kovács 2003), at Lake Vrana, pool near Beli, in the proximity of Osor (Bruno 1980), at an abyss NW Beli, doline NW Beli (tadpoles), Predošćica, flooded pool at *Typha* pond S Sveti Vid, *Typha* pond S Sveti Vid (also tadpoles), pond N Helm and SE Lubenice (tadpoles), W Belej, Srem W Sveti Vid, Grmov, gardens E Martinšćica harbor, W church of Martinšćica, Štivan (Sehnal & Schuster 1999), in the vicinity of Vrana (Werner 1891; Sehnal & Schuster 1999), garden pool at the edge of Cres township, Merag Peninsula (tadpoles), in the proximity of Lubenice, N Belej (Rathbauer 2002), close to hotel Kimen in Cres township (Warnecke 1998), Valun (among blackberry and creeper) (M. Dieckmann pers. comm.). In addition, also we observed this species in the vicinity of Beli and N Belej. Lanza & Vanni (1987, 1990). Dieckmann (2004) reported this species from the island without giving precise locality data (fig. 7).

Other Kvarner Islands records – Krk: observed by Bruno (1980), Entzeroth (1982), Sochurek (1985), Franzen (1987) Mršić et al. (1989). Just reported by Cubich (1875), Karaman (1921), Lanza & Vanni (1987, 1990), several NMW vouchers.

Rana dalmatina Bonaparte, 1840

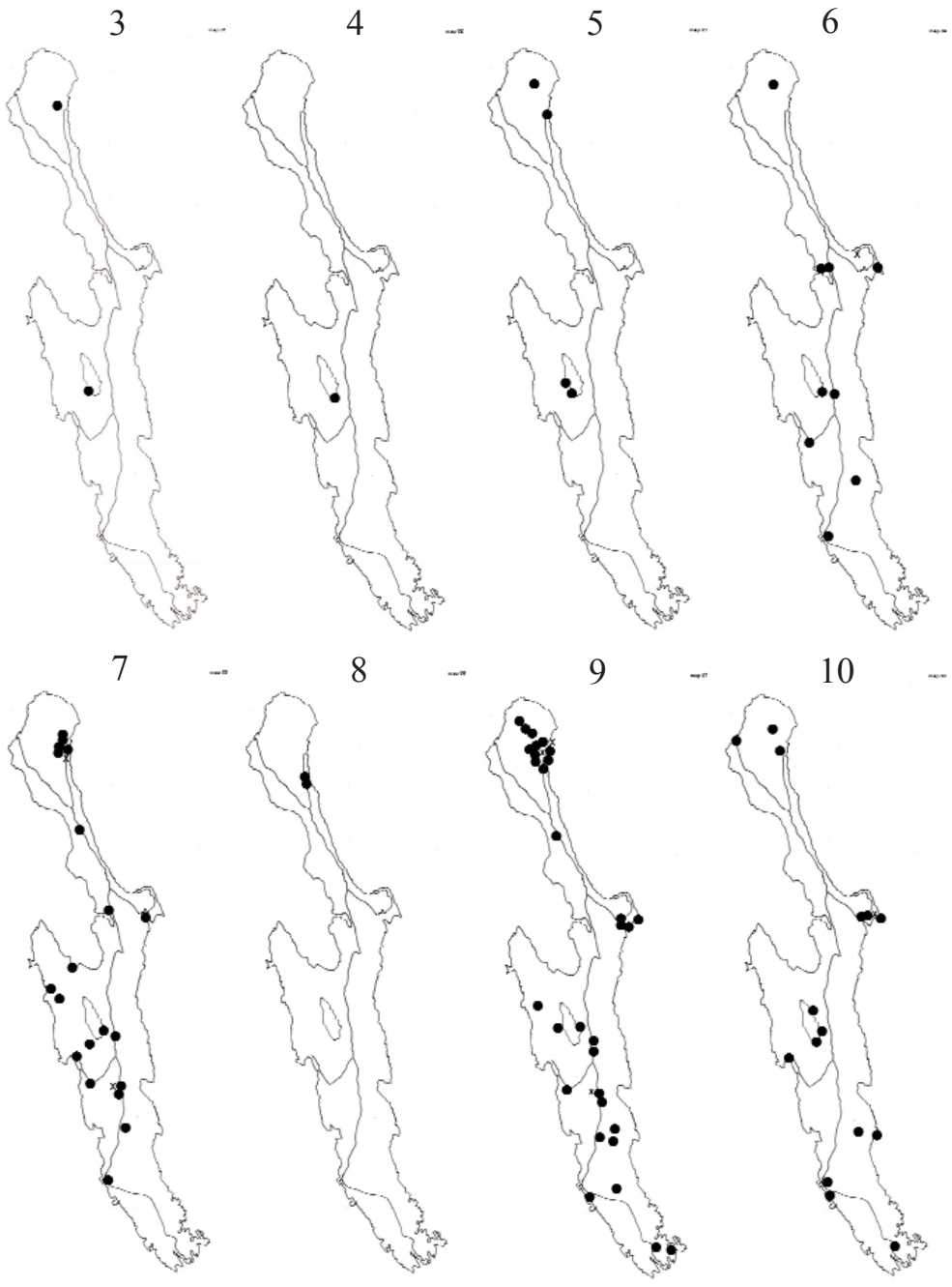
This species was observed exclusively by Bruno (1980) in 1979 in the northern part of the island, in the vicinity of Sveti Petar along the road leading to Beli. Also Kovács (2003) found a specimen along the same road in close proximity of Sveti Petar that further substantiates Bruno's (1980) observation. Lanza & Vanni (1987, 1990) listed this species for the island without providing locality data (fig. 8).

Fig. 2: The record localities on the Island of Cres (Croatia).

Abb. 2: Die Fundorte auf der Insel Cres (Kroatien).

Fig. A: Forest near Beli, Cres Island. Photograph: J. HILL.
Abb. A: Wald bei Beli, Insel Cres. Photo: J. HILL.

Fig. B: Lake Vrana, Cres Island. Photograph: J. HILL.
Abb. B: Vrana-See, Insel Cres. Photo: J. HILL.



Figs. 3-10: Herpetological records on Cres Island (Croatia). **x** – own observation; ● – data from other sources.
Abb. 3-10: Herpetologische Funde auf der Insel Cres. **x** – eigene Beobachtungen; ● – Daten aus anderer Quelle.
3 – *Triturus vulgaris*; 4 – *Bombina variegata*; 5 – *Bufo bufo*; 6 – *Bufo viridis*;
7 – *Hyla arborea*; 8 – *Rana dalmatina*; 9 – *Rana ridibunda*; 10 – *Testudo hermanni.*

Other Kvarner Islands records – Krk: observed by BRUNO (1980), SOCHUREK (1985). Just reported by KARAMAN (1921), BURESCH & ZONKOV (1942), LANZA & VANNI (1987, 1990).

Rana ridibunda PALLAS, 1771

This is the most widely distributed amphibian species on Cres. It it seemingly not limited in its range in the given area by *Gambusia* populations preying upon amphibian larvae as discussed by SEHNAL & SCHUSTER (1999), RATHBAUER (2002) and KOVÁCS (2003). KOVÁCS (2003) observed *Rana* kl. *esculenta*-like specimens in approximately 10-15% of the *R. ridibunda* populations occurring in the environs of Paiskà and Garbovica. The same author observed these frogs while feeding on bees.

Several localities are known from Cres: near Ivanje (drinking pool) (KOVÁCS 2003), Sjevernjak šuma, Belej, Lusare, Zlatuja (Osor), Česma bara (Osor), Rt Tarej, Rt Poje (BRUNO 1980), Paiskà (Beli) (BRUNO 1980; KOVÁCS 2003), Kozmačev, Peč, Palvanje, Garbovica, springs in the vicinity of Beli, Sveti Vid, "Franjo's pond" (KOVÁCS 2003), doline NW Beli, pond NW Beli, Predošćica, *Typha* pond S Sveti Vid (also tadpoles), *Potamogeton* pond S Sveti Vid (also tadpoles), Vrana, pond N Helm and SE Lubenice, Štivan, N Belej, Srem, pond at Srem SE Sveti Vid, pond at Srem, W Sveti Vid (SEHNAL & SCHUSTER 1999), Lake Vrana (WERNER 1891, BRUNO 1980), pool W Lake Vrana (W. MAYER pers. comm.), S Vrana township (WERNER 1891), Punta Križa (BRUNO 1980; M. DIECKMANN pers. comm.). We found this species N and NE of Beli at two drinking pools, and N of Belej. Its occurrence on Cres was reported but no locality data were provided by either WERNER (1897), TORTONESE & LANZA (1968), LANZA & VANNI (1987, 1990), WARNECKE (1998) or DIECKMANN (2004) (fig. 9).

Other Kvarner Islands records – Krk: observed by BRUNO (1980), ENTZEROTH (1982), SOCHUREK (1985), FRANZEN (1987), MRŠIĆ et al. (1989). Just reported by CUBICH (1875, as *Rana esculenta*), WERNER (1897), KARAMAN (1921), POZZI (1966), TORTONESE & LANZA (1968), LANZA & VANNI (1987, 1990). NMW vouchers.

Reptilia

Testudo hermanni boettgeri MOJSISOVICS, 1889

Prior to BOUR's (1987) rediscovery of the holotype of *Testudo hermanni* GMELIN, 1789, the eastern race of Hermann's Tortoise was believed to be the nominotypical subspecies. However, the nominate form actually turned out to represent the western race, and, as a consequence, a „new" name – *T. hermanni boettgeri* MOJSISOVICS, 1889 – was reintroduced for the eastern populations. Thus, BRUNO (1980) listed Cres tortoises as *T. h. hermanni*, as did SEHNAL & SCHUSTER (1999). RATHBAUER (2002) correctly assigned them to *T. h. boettgeri*. DIECKMANN (2004) reported them as *T. graeca ibera*, even though he did not personally encounter specimens on the island. The presence of the latter species on Cres can be fully excluded, as its closest documented occurrence is at Mitrovica, Kosovo, at approximately 500 km linear distance from our island (BUSKIRK et al. 2001). According to available data, tortoises became rare on the island due to collecting and hinderance by stone walls, and the largest population now undoubtedly inhabits Merag Peninsula.

Published localities from Cres include: Porozina, Rt Tarej, Rt Meli, Česma bara (Osor), Lake Vrana, Punta Križa, Sjevernjak šuma (BRUNO 1980), *Salvia* garrigue SE Sveti Vid (also dead specimen), Torrente (garrigue), E Torrente, Martinšćica (garden), Martinšćica (macchia) (SEHNAL & SCHUSTER 1999), E Srem in the proximity of Plat, WNW Beli, E Osor (RATHBAUER 2002). In total we found four tortoises on Merag Peninsula, E Sveti Vid, between the road and the seacoast. BRUNO & MAUGERI (1976) did not list this species from the island, but plotted its occurrence on their map (fig. 10).

Other Kvarner Islands records – Krk: observed by BRUNO (1980, 1988), SOCHUREK (1985), and MRŠIĆ et al. (1989); just reported by CUBICH (1875, as *Testudo graeca*), DEPOLI (1898), TORTONESE & LANZA (1968), BRUNO & MAUGERI (1976), and CHEYLAN (2001) – Plavnik: observed by BRUNO (1980, 1988); just reported by CHEYLAN (2001).

Fig. C: Pond near Beli, Cres Island. Photograph: J. Hill.
Abb. C: Tümpel bei Beli, Insel Cres. Photo: J. Hill.

Fig. D: Pasture near Srem, Cres Island. Photograph: J. Hill.
Abb. D: Weide bei Srem, Insel Cres. Photo: J. Hill.

Fig. E: *Hemidactylus turcicus turcicus* (LINNAEUS, 1758) from Mali Lošinj, Lošinj Island. Photograph: J. HILL.
Abb. E: *Hemidactylus turcicus turcicus* (LINNAEUS, 1758) von Mali Lošinj, Insel Lošinj. Photo: J. HILL.

Fig. F: *Lacerta bilineata bilineata* DAUDIN, 1802 from near Beli, Cres Island.
Note tick infestation. Photograph: D. LEŠIĆ (Zagreb).
Abb. F: *Lacerta bilineata bilineata* DAUDIN, 1802, Umgebung von Beli, Insel Cres.
Man beachte den Zeckenbefall. Photo: D. LEŠIĆ (Zagreb).

Emys orbicularis hellenica
(Valenciennes, 1832)

The European Pond Terrapin is known from the following localities on Cres: Merag Peninsula (pond) (Sehnal & Schuster 1999), Lake Vrana, Zlatuja blato (Osor) (Bruno 1980). In addition, Rathbauer (2002), referring to personal communication with N. Bressi (Trieste), stated that this species was found in larger waterbodies E of Osor. Also Fritz (1992) mentioned its occurrence on the island and cited a live specimen housed at SMNS (uncatalogued). Fritz & Obst (1995) published a photograph (by M. Grabert) of a male *Emys orbicularis* having a reddish brown iris that was reportedly from the island of Cres, but did not provide locality details. Also Bruno & Maugeri (1976), and Fritz (2001) listed this species from the island without specific locality data. Considering that the species was not seen on the island in recent years it would be necessary to reconfirm its occurrence (fig. 11).

Other Kvarner Islands records – Krk: observed by Bruno (1980, 1988), and Mršić et al. (1989); just reported by Karaman (1921), Bruno & Maugeri (1976), Strohmaier (1984), Sochurek (1985) and Fritz (2001) – Plavnik: observed by Mršić et al. (1989); SMF voucher (cf. Fritz 1992, 2001).

Sea turtles
(Cheloniidae, Dermochelyidae)

Caretta caretta (Linnaeus, 1758) is very likely to occur regularly in the North Kvarner waters, however published data about stranded individuals, turtles as trawling bycatch or nesting events were not found by the authors. The last out of five records of *Dermochelys coriacea* (Linnaeus, 1766) in Croatian waters from July 1990 (Valbiska port, Krk Island) was photodocumented by Nina De Luca (Lazar & Holcer without year).

Hemidactylus turcicus turcicus
(Linnaeus, 1758)

This gecko was exclusively reported by Bruno (1980) from Beli, Osor and Punta Križa, but was not mentioned from Cres in more recent times (Sehnal & Schuster 1999). However, its occurrence cannot be excluded, considering that it was reported from the neighboring Island of Lošinj. Bruno & Maugeri (1976) did not mention this gecko from Cres, but its occurrence was plotted on their map (figs. 12).

Other Kvarner Islands records – Krk: observed by Bruno (1980), and Sochurek (1985); mapped by Bruno & Maugeri (1976) – Lošinj: reported by Schreiber (1912), Strohmaier (1984), Dieckmann (2004), voucher present at NMW, J. Hill (Wolkersdorf) pers. comm., fig. E – Plavnik: observed by Bruno (1980).

The Turkish Gecko reaches its northernmost limit of distribution slightly north of Cres, at approximately the level of Venice and Rijeka (Salvador 1981).

Tarentola mauritanica mauritanica
(Linnaeus, 1758)

Bruno (1980) was the first to report on the presence of this species on Cres Island (vicinity of Beli, from the trunk of *Quercus pubescens*). In addition there is an unsubstantiated record from Martinšćica published by Waitzbauer et al. (1997). Bruno & Maugeri (1976) did not discuss its occurrence but indicated it on their map, so the species' presence on Cres is somewhat questionable (fig. 13).

Other Kvarner Islands records – Krk: observed by Bruno (1980); mapped by Bruno & Maugeri (1976).

This species reaches its northernmost limit of distribution at a latitude corresponding to the environs of Verona and Trieste (Rieppel 1981).

Anguis fragilis fragilis
Linnaeus, 1758

The Slow Worm is mainly known from the more densely vegetated northern areas on Cres Island. In accordance its known localities are as follows: Sjevernjak šuma (Bruno 1980), Beli (Bruno 1980; Sehnal & Schuster 1999), W Beli, Merag Peninsula (Rathbauer 2002), S Sveti Vid and Torrente, U. Krušćica (oil tree plantation), Srem (chapel) (Sehnal & Schuster 1999), proximity of

Cres township (W. MAYER pers. comm.). WARNECKE (1998) reported it without locality data (fig. 14).

Other Kvarner Islands records – Krk: observed by WERNER (1897, reported as very common), BRUNO (1980), SOCHUREK (1985) and MRŠIĆ et al. (1989); just reported by CUBICH (1875), BRUNO (1970), BRUNO & MAUGERI (1976), ENTZEROTH (1982), and STROHMAIER (1984), NMW vouchers – Košljun: observed by WERNER (1891), BRUNO (1970), and BRUNO & MAUGERI (1976).

Pseudopus apodus thracius
OBST, 1978)

Records of this large-bodied legless lizard are restricted to the central and southern part of the island. Several Cres localities are known in the literature: Sjevernjak šuma, Osor, Punta Križa, Rt Tarej (BRUNO 1980), Merag Peninsula, vicinity of Srem, W of road between Belej and Osor, N of road leading to Punta Križa, SE Osor, S shore of Lake Vrana (RATHBAUER 2002), N Torrente, SE steep coast SE Sveti Vid, E Torrente, S Torrente (skeleton), U. Krušćica (oil tree garden) (SEHNAL & SCHUSTER 1999), Orlec (roadkill) (M. DIECKMANN pers. comm.), Martinšćica, Martinšćica (edge of macchia), N Martinšćica, W Srem (stone wall), Plat (SEHNAL & SCHUSTER 1999; RATHBAUER 2002), between Osor and Grmožaj (RUCNER & RUCNER 1969), between Osor and Punta Križa, Punta Križa, cemetary (M. DIECKMANN pers. comm.). WARNECKE (1998) collected it in the SE part of the island, and also DIECKMANN (2004) mentioned to have met this species on Cres but provided no actual locality data. We found specimens on Merag Peninsula, S of Hrasta, at Osor, and halfway between Osor and Punta Križa. LAPINI (1984) listed a specimen from an unspecified source on Cres deposited at MFSNU (Inv. No. 400) (fig. 15).

Other Kvarner Islands records – Krk: observed by BRUNO (1980), ENTZEROTH (1982), SOCHUREK (1985) and MRŠIĆ et al. (1989); reported by BRUNO & MAUGERI (1976) – Plavnik: observed by BRUNO (1980).

On the mainland *Pseudopus apodus* reaches the western limit of its range area on the Istra Peninsula (OBST 1981).

Algyroides nigropunctatus nigropunctatus
(DUMÉRIL & BIBRON, 1839)

This lizard is found nearly throughout Cres, at forest edges, shadowy areas and overgrown walls. Its greatest density is on Merag Peninsula and the proximity of Beli.

Its known localities are as follows: Sjevernjak šuma, Punta Križa, Paiskà, Rt Baldarin, along the trail Punta Križa-Gradac-Lusare (BRUNO 1980), Beli (BRUNO 1980; SEHNAL & SCHUSTER 1999; RATHBAUER 2002), Beli (along the Eco-Trails), Predošćica, Merag Peninsula, old walls W Srem, stone walls at Osor, Cres-Melin, (crumbling rocks), road between Valun and Lubenice, Lubenice, Vrana, Hrasta (grazing ground, base of walls), SE Osor, road leading to Punta Križa (edge of grazing ground, in macchia vegetation) (RATHBAUER 2002), Beli (forest), Roman bridge W Beli (road), W Beli (sweet chestnut forest, stony meadow E of slope), W Sveti Petar (Turkish oak forest, NE slope, 320 m a.s.l.), SW slope of peak Sis (road), SE Sveti Vid (ruins), coast and oak forest SE Sveti Vid, laurel forest SE Sveti Vid, Torrente, stone wall below road S Sveti Vid, gorge of brook at U. Krušćica, bay exposed to WSW at U. Krušćica, Martinšćica (edge of macchia), Roman road N Martinšćica, Rt Koludar W Martinšćica, Sveti Štivan (macchia), Punta Križa (slope exposed to the NE at 105 m a.s.l.) (SEHNAL & SCHUSTER 1999), Valun and proximity (M. DIECKMANN pers. comm.), S Sveti Petar along road leading to Beli (W. MAYER pers. comm.), vicinity of the township of Cres (WERNER, 1891; W. MAYER pers. comm.), between Osor and Grmožaj (RUCNER & RUCNER 1969). We observed this colorful lizard NE of Beli on stone walls, as well as between roots along the Eco-Trails, at Belej and at Osor (fig. 16). The occurrence of this species on the island was mentioned by WERNER (1894, 1897), SCHREIBER (1912), KARAMAN (1921, 1939), MERTENS & MÜLLER (1940), RADOVANOVIĆ (1951), MERTENS & WERMUTH (1960), POZZI (1966), DIMOVSKI (1967), TORTONESE & LANZA (1968), BRUNO & MAUGERI (1976), BRUNO (1980, 1982), BISCHOFF (1981), GASC et al. (1997), WARNECKE (1998), MAYER & PODNAR (2002) and DIECKMANN (2004), without indicating precise localities. Voucher specimens from

northern Cres (NMW 35865) and an unknown location on the island (NMW 8210) have been deposited at the Naturhistorisches Museum Wien.

Other Kvarner Islands records – Krk: observed by Werner (1891, 1894, 1897), Schreiber (1912), Bruno (1980, 1982), Entzeroth (1982), Sochurek (1985), Mršić et al. (1989), Mayer & Podnar (2002), Farkas (pers. obs.); just reported by Karaman (1921, 1939), Mertens & Müller (1940), Radovanović (1941, 1951), Mertens & Wermuth (1960), Pozzi (1966), Dimovski (1967), Tortonese & Lanza (1968), Bruno & Maugeri (1976), Bischoff (1981), Strohmaier (1984), and Gasc et al. (1997), NMW vouchers – Lošinj: observed by Dieckmann (2004); just reported by Werner (1894), Bischoff (1981), Strohmaier (1984), and Gasc et al. (1997); mapped by Bruno & Maugeri (1976).

Algyroides nigropunctatus reaches the westernmost limit of its distribution not far from the Kvarner area, in the Gorizia region, northeastern Italy (Bischoff 1981).

Lacerta trilineata major Boulenger, 1887

The presence of this species on Cres is somewhat uncertain (Sehnal & Schuster 1999), but cannot be fully excluded given that there are substantiated records from nearby islands. One has to remember a remark made by Mayer & Podnar (2002) that reports published earlier are not to be taken seriously based on the fact that *L. trilineata*, *L. bilineata* and *L. viridis* were often confused by early workers.

In total, two reports are available for the island of Cres: vicinity of Murtovnik (Bruno 1980), and S of Sveti Vid on Merag Peninsula (*Salvia* garrigue) (Waitzbauer et al. 1997). Nettmann & Rykena (1984a) also reported the species' occurrence on the island based on accounts of Sinke (1973) and Bruno (1980). In addition, although Peters (1962) did not mention in text the occurrence of this species on Cres, he mapped its presence in his work (fig. 17).

Other Kvarner Islands records – Krk: observed by Fuhn & Mertens (1959), Bruno & Maugeri (1977), Bruno (1980) Entzeroth (1982), Sochurek (1985), Mršić et al. (1989), and Mayer & Podnar (2002); just reported by Tortonese & Lanza (1968), Strohmaier (1984) and Nettmann & Rykena (1984a), NMW, SMF vouchers – Lošinj: reported by Tortonese & Lanza (1968), Strohmaier (1984) and Nettmann & Rykena (1984a). Available evidence of the presence of *L. trilineata* on Lošinj Island was discussed by Nettmann & Rykena (1984a) on the basis of a photograph made by Koscielny in 1981. However, they were not able to reconfirm this lizard's occurrence on Lošinj. There are, on the other hand, two old voucher specimens undoubtedly identified as *Lacerta trilineata major* from Lošinj present at NMW (10874:3 - Lussin picola, don. Steindachner, 1900 and 10874:9 - Lussin, coll. Schreiber, No. 288., leg. Tomasini). In case these records are genuine, they represent the westernmost occurrence of *L. trilineata*, given that the green lizards collected on Brioni (W of Istria Peninsula) and deposited at the NMW are to be referred to *Lacerta viridis* or *bilineata* (Wettstein 1953; Fuhn & Mertens 1959; Mayer & Podnar 2002). In addition, the possibility of the species' occurrence on the island was mentioned by Dieckmann (2004).

Lacerta bilineata bilineata Daudin, 1802

This species of green lizard is one of the most widely distributed reptile species on the island, found in all habitat types (Mayer & Podnar 2002), even frequenting stone walls, shrubs, and trees (Dieckmann 2004). Werner (1891) only states that it occurred S of Lake Vrana, being not uncommon, especially at Belej.

Localities from where this species has thus far been reported from Cres are the following: environs of Porozina, Sjevernjak šuma, Rt Tarej, proximity of Štivan, environs of Osor, vicinity of Murtovnik, Sveti Anton, environs of Smrečje, Punta Križa (Bruno 1980), Srem, Beli (Sehnal & Schuster 1999; Rathbauer 2002), proximity of Beli (Bruno 1980; Rathbauer 2002), Martinšćica (Sehnal & Schuster 1999; W. Mayer pers. comm.), Vrana, Osor (Rathbauer 2002; W. Mayer pers. comm.), S Sveti Petar along the road lead-

Fig. G: *Lacerta oxycephala* Duméril & Bibron, 1839 photographed in Osor on a stone wall bordering the channel that separates the islands Lošinj and Cres. Photograph: T. Tóth.

Abb. G: *Lacerta oxycephala* Duméril & Bibron, 1839 in Osor auf einer Steinmauer am Rande des Kanals, der die Inseln Lošinj und Cres trennt. Photo: T. Tóth.

ing to Beli, environs of Cres township (W. Mayer pers. comm.), road leading to Beli (at bee hives), Merag Peninsula (decapitated specimen in a buzzard nest), Cres-Melin, road between Valun and Lubenice, SE Osor (grazing grounds, clearings, macchia) (Rathbauer 2002), Beli (forest), W Beli (forest path), W Sveti Petar (Turkish oak forest, above 320 m a.s.l.), Sis mountain (W slope), Predošćica, Merag Peninsula at the mountain top, Torrente, Sveti Vid, vicinity of *Typha* pond S Sveti Vid, *Salvia* garrigue S Sveti Vid, S *Typha* pond S Sveti Vid (old wineyards) Torrente, S Torrente, U. Krušćica (oil tree gardens) (Sehnal & Schuster 1999), Lubenice (Sehnal & Schuster 1999), Slatina SW Martinšćica, Rt Tiha W Martinšćica Štivan (dead specimen), Belej (dead specimen), W Srem, SW Srem, W Srem (grazing grounds, areas with hight grass and stone walls), Plat (Sehnal & Schuster 1999), Valun, Pogana (Dieckmann 2004). We found this species in the immediate proximity of Beli and along the Eco-Trails, in the neighbourhood and S of the ruins of Sveti Bartolomej monastery, E of Dragozetići, as well on the E side and harbor of Merag Peninsula, N of Rt Tarej, at Belej, S of Hrasta and SE from Plat. In addition, a dead specimen was encountered on the road N of Cres township (figs. 18, F). The occurrence of the species on the island was mentioned by Werner (1899), Bruno & Maugeri (1976), Strohmaier (1984), Nettmann & Rykena (1984b) and Warnecke (1998, as very common), without specifying localities. There is a specimen from Cres without further specification in MFSNU (Inv. No. 359; Lapini 1984), and three others at NMW (35860: 1-2; 36708: 1) .

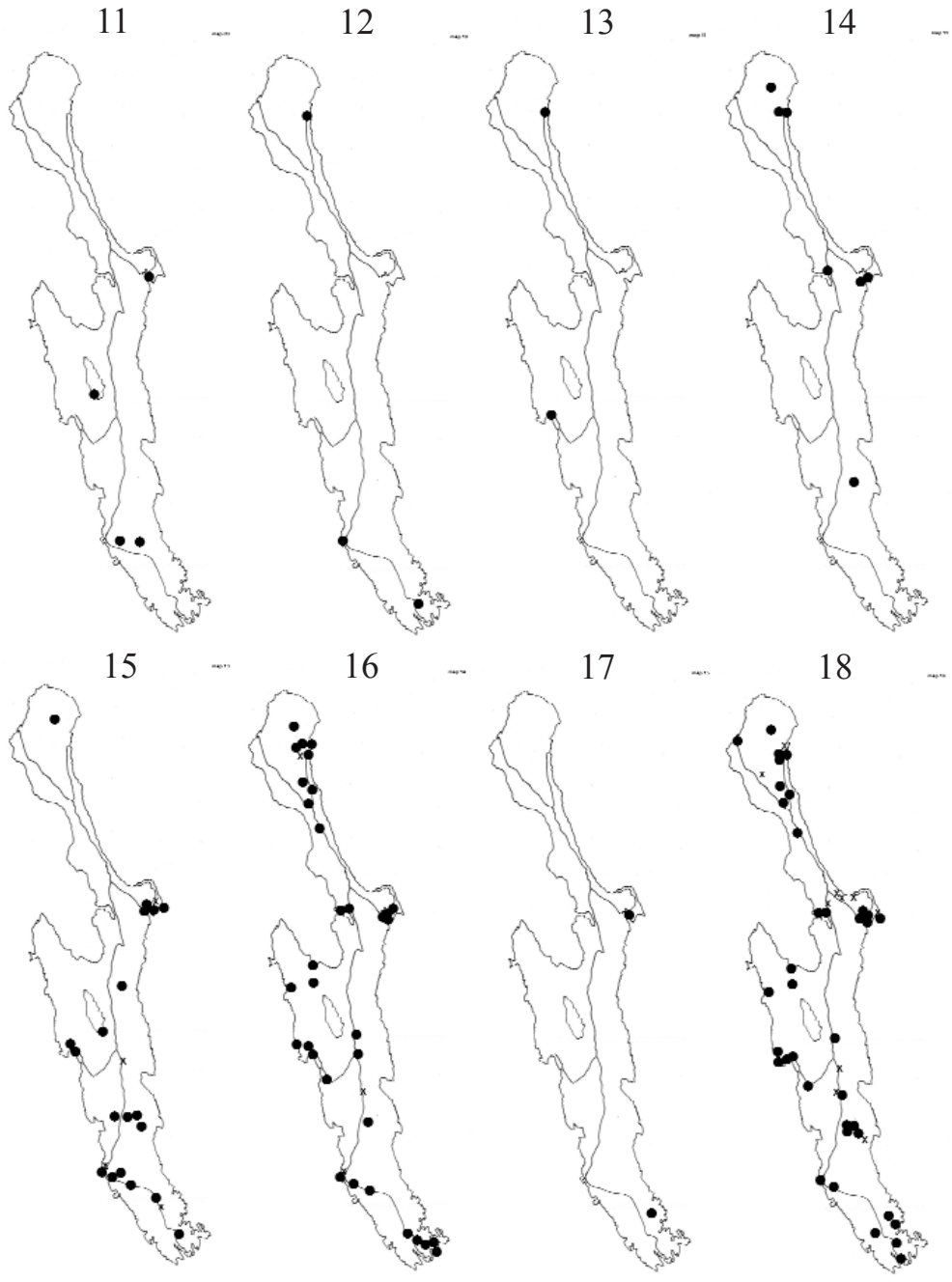
Other Kvarner Islands records – Krk: reported by Cubich (1875) and Strohmaier (1984) – Lošinj: observed by Werner (1891), and Dieckmann (2004); several NMW vouchers – Trstenik: observed by Bruno (1980); just mentioned by Werner (1899), Brelih (1963), Brelih & Džukić (1974), Bruno & Maugeri (1976), Strohmaier (1984), and Nettmann & Rykena (1984b).

Lacerta oxycephala Duméril & Bibron, 1839

We photographed three specimens on a stone wall bordering the channel that separates Lošinj and Cres (at Osor). Ours is the species' first report from Cres Island. Its nearest occurrence is at Zadar (Boulenger 1916, 1920), which Bischoff (1984) considered unconfirmed. Reliable records are available from the Krka River (Bedriaga 1886; Schreiber 1912) and the environs of Šibenik (Méhely 1909), that are at 100 and 160 km airline distance, respectively. It is very likely that the specimens we encountered had been introduced (figs. 19, G).

Podarcis melisellensis fiumana (Werner, 1891)

Data published in the literature are to be treated with some caution, considering that the extremely variable *P. melisellensis* is frequently confused with *P. sicula* (see Mayer & Podnar 2002). This lizard is the most common species of reptile occurring on Cres, and frequents all available habitat types in large numbers, including house and stone walls, trees, sheep grazing grounds, etc. As to the frequency of occurrence of this species, SW of Srem 40 specimens were encountered in an area of 1000 m^2 (Sehnal 1999a), whereas from SE of Sveti Vid 60



Figs. 11-18: Herpetological records on Cres Island (Croatia). **x** – own observation; ● – data from other sources.
Abb. 11-18: Herpetologische Funde auf der Insel Cres. **x** – eigene Beobachtungen; ● – Daten aus anderer Quelle.
11 – *Emys orbicularis*; 12 – *Hemidactylus turcicus*; 13 – *Tarentola mauritanica*; 14 – *Anguis fragilis*;
15 – *Pseudopus apodus*; 16 – *Algyroides nigropunctatus*; 17 – *Lacerta trilineata*; 18 – *Lacerta bilineata*.

specimens per 1000 m2 were reported (SEHNAL 1999b).

The following Cres localities are known from the literature: vicinity of Porozina, Sjevernjak šuma, Rt Tarej, vicinity of Lake Vrana, Česma bara (Osor), Sveti Anton, environs of Murtovnik (BRUNO 1980), Punta Križa, environs of Beli (BRUNO 1980; RATHBAUER 2002), between Osor and Grmožaj (RUCNER & RUCNER 1969), proximity of *Typha* pond SE Sveti Vid (meadow, crumbling rocks, pond, stone walls, individual bushes) (SEHNAL 1999a, 1999b; SEHNAL & SCHUSTER 1999), SW Srem and SE Belej (SEHNAL 1999a), Beli (SEHNAL & SCHUSTER 1999), Beli, slightly outside the town (stone walls), W Beli (forest road), NW Beli (stony grazing ground), Beli (forest, forest bottom, stone walls), Beli (grazing ground), W Sveti Petar (Turkish oak forest) (SEHNAL & SCHUSTER 1999), Sis mountain (stony E slope), *Salvia* garrigue SE Sveti Vid, environs of *Typha* pond S Sveti Vid, S *Typha* pond S Sveti Vid (old wineyards), S Sveti Vid (old wineyards, *Juniperus* population), seacoast on Merag Peninsula, S Sveti Vid (grazing grounds) Torrente, S Torrente, U. Krušćica (stream valley), U. Krušćica (oil tree gardens), U. Krušćica (seacoast), Lubenice, N Helm, SE Lubenice (around lake and grazing grounds), E Sveti Ursula (W Lake Vrana at 200 m a.s.l.), N Vidovići, Martinšćica (edge of macchia), Martinšćica (seacoast), Martinšćica (harbor), N Martinšćica (Roman road), Slatina, Rt Kijac, Rt Tiha SW Martinšćica, Srem (stone walls), W Srem and Sveti Vid (grazing grounds), Osor (SEHNAL & SCHUSTER 1999), S Sveti Petar, along the road leading to Beli (W. MAYER pers. comm.). We observed this lizard in and around Beli, along the Eco-Trails, North of Beli as far as NW of Niska, around the ruins of Sveti Bartolomej monastery, E of Dragozetići, on Merag Peninsula between Sveti Vid and Rt Tarej, at the edge of the township of Cres, in the environs of Lubenice, at Belej, S of Ustrine, S of Plat, and at Osor (fig. 20).

Without specifying localities, the species' occurrence on Cres was mentioned by WERNER (1891, 1897, 1902, 1908), LEHRS (1902), BOULENGER (1913, 1920, 1921), KARAMAN (1921), KAMMERER (1926), WETTSTEIN (1926, 1949), RADOVANOVIĆ (1959), MERTENS & WERMUTH (1960), TORTONESE & LANZA (1968), BRUNO (1982) and WARNECKE (1998), and was mapped by BRUNO & MAUGERI (1976). Specimens from Cres island with more or less precise locality data are available at NMW (26371:1; 26445:1; 35857:1) and MFSNU (LAPINI 1984).

Other Kvarner Islands records – Krk: observed by BRUNO (1980), ENTZEROTH (1982), SOCHUREK (1985), MRŠIĆ et al. (1989), and MAYER & PODNAR (2002); just reported by WERNER (1891, 1897, as occurring together with *Lacerta serpa* syn. *P. sicula*, 1902, 1904, 1908), LEHRS (1902), KARAMAN (1921), KAMMERER (1926), RADOVANOVIĆ (1941, 1953), WETTSTEIN (1949), MERTENS & WERMUTH (1960), PAVLETIĆ (1962), TORTONESE & LANZA (1968), BRUNO (1982), TIEDEMANN & HENLE (1986) and WARNECKE (1998); BRUNO & MAUGERI (1976) presented a drawing of a specimen originating from Krk, several NMW vouchers – Lošinj: observed by GUGLER (1903), RADOVANOVIĆ (1956), and DIECKMANN (2004); just reported by WERNER (1897, 1902, 1908), LEHRS (1902), BOULENGER (1913), KARAMAN (1921, 1939), KAMMERER (1926), WETTSTEIN (1926, 1949), TADDEI (1950), MERTENS & WERMUTH (1960), TORTONESE & LANZA (1968), RUCNER & RUCNER (1969), BRUNO (1982), STROHMAIER (1984), and TIEDEMANN & HENLE (1986); mapped by BRUNO & MAUGERI (1976), MFSNU (LAPINI 1984) and NMW vouchers – Susak: NMW vouchers – Plavnik: reported by BRUNO (1980), MRŠIĆ et al. (1989), and TIEDEMANN & HENLE (1986) – Male Srakane: reported by PAVLETIĆ (1962), BRELIH (1963), and TIEDEMANN & HENLE (1986) – Vele Srakane: reported by TIEDEMANN & HENLE (1986, cit: SNHM) – Sveti Marin: reported by WETTSTEIN (1926), and TIEDEMANN & HENLE (1986) – Trstenik: reported by BRELIH (1963), BRUNO (1980), and TIEDEMANN & HENLE (1986) – Unije: reported by PAVLETIĆ (1962), BRELIH (1963), and TIEDEMANN & HENLE (1986) – Zec: reported by BOULENGER (1920), WETTSTEIN (1926), BRELIH (1963), and TIEDEMANN & HENLE 1986) – Hrid Galiola: reported by WETTSTEIN (1949).

The northwesternmost occurrence of this species is not far from the study area, at the city of Monfalcone, norheastern Italy (TIEDEMANN & HENLE 1986).

Podarcis muralis muralis
(Laurenti, 1768)
&
Podarcis muralis maculiventris
(Werner, 1891)

Most remarkably, two subspecies of the Wall Lizard are known from Cres. The nominate form inhabits the northern part of the island, whereas *P. m. maculiventris* normally occurs in coastal regions, in close proximity of human settlements (Mayer & Podnar 2002; Rathbauer 2002; Dieckmann 2004). According to Rathbauer (2002) and Mayer & Podnar (2002), the presence of the latter subspecies in harbor towns argues for an introduction. Sehnal & Schuster (1999) observed this species above 350 m a.s.l. NW of Beli, where it was replaced by *Algyroides nigropunctatus* below this altitude. The preferred habitat of the nominate race includes, besides stone walls, oak trees (Rathbauer 2002), which we can also confirm on the basis of our own observations. The presence of *P. m. maculiventris* on Cres was first reported by Bruno (1982), and later by De Luca & Grbac (1995). The latter authors remarked that the two subspecies were ecologically separated. It has to be mentioned that not only the two subspecies differ markedly from each other but also ssp. *maculiventris* is highly variable in coloration and pattern in different areas of the island (Dieckmann 2004). It is unknown as yet how exactly the ranges of the two subspecies are delimited. Of *P. m. maculiventris* only two record localities are known (Cres township and Valun; see below for details), all other records refer to the nominate form.

Documented localities from Cres are the following: Sjevernjak šuma near Rosuja, Kal Mountains above Niska (SW slope), NW edge of Mount Orline, environs of Beli (Bruno 1980), Beli, Beli (forest floor), W Beli (forest road and quarry), NW Beli (forest road, E of stony grazing ground), W Sveti Petar (Turkish oak forest, NE slope) (Sehnal & Schuster 1999), Beli (forest) (Sehnal & Schuster 1999; Rathbauer 2002), S Sveti Petar along the road leading to Beli (W. Mayer pers. comm.), Merag Peninsula along the road leading from the harbor station (Mayer & Podnar 2002), Cres township (Brelih 1963; Tortonese & Lanza 1968; De Luca & Grbac 1995; Warnecke 1998; Mayer & Podnar 2002; Dieckmann 2004; W. Mayer pers. obs.), Cres township (wall in the harbor) (this is *maculiventris* NMW 26373), Cres-Melin (Rathbauer 2002), Valun (Warnecke 1998; Rathbauer 2002; Dieckmann 2004; W. Mayer pers. comm.). There are three NMW specimens (35856:1-3 captured between the town of Cres and the North of the Island) assigned to the nominate race. We encountered this species on walls in the settlement of Beli, as well as in oak forests North of Beli (figs. 21, H).

The occurrence of this species on Cres Island was mentioned by Brelih & Dzukić (1974), and Bruno & Maugeri (1976) but no locality details were given. Gasc et al. (1997) questioned the presence of this species on the island.

Fig. H: *Podarcis muralis maculiventris* (Werner, 1891) from the township of Cres, Cres Island. Photograph: F. Tiedemann.

Abb. H: *Podarcis muralis maculiventris* (Werner, 1891) von nahe der Stadt Cres, Insel Cres. Photo: F. Tiedemann.

Fig. I: *Hierophis gemonensis* (Laurenti, 1768), near Beli, Cres Island. Photograph: J. Hill.
Abb. I: *Hierophis gemonensis* (Laurenti, 1768), nahe Beli, Insel Cres. Photo: J. Hill.

Fig. J: Adult *Elaphe quatuorlineata quatuorlineata* (Lacepède, 1789), Cres Island. Photograph: J. Hill.
Abb. J: Adulte *Elaphe quatuorlineata quatuorlineata* (Lacepède, 1789), Insel Cres. Photo: J. Hill.

Other Kvarner Islands records: On the basis of available literature, the Wall Lizard does not seem to occur on neighboring islands, whereas it is present on the Istra Peninsula (Mayer & Podnar 2002). However, Bruno & Maugeri (1976) did map it for Krk Island.

Podarcis sicula campestris
De Betta, 1857

Despite earlier reports (e.g., Bruno 1980) this species is most likely absent from the island (Mayer & Podnar 2002). It is possible that *P. muralis* or *P. melisellensis fiumana* specimens were mistaken for *P. s. campestris* by early workers. However, the latter taxon might eventually be found again on the island, considering that Dieckmann (2004) recently reported it from neighboring Lošinj.

The following localities were provided by Bruno (1980) for Cres Island: Lake Vrana, Osor, environs of Bokinić (SE Punta Križa). Without locality it was reported for Cres by Werner (1891, 1902), Brelih & Džukić (1974), Bruno & Maugeri (1976), Gasc et al. (1997) (fig. 22).

Other Kvarner Islands records: – Krk: observed by Radovanović (1959), Entzeroth (1982), Sochurek (1956, 1985), Bruno (1980), Mršić et al. (1989), Mayer & Podnar, (2002) and Farkas (pers. obs.); just reported by Werner (1891, 1897, as syntopic with *Lacerta littoralis* syn. *P. melisellensis*, 1902, 1904, 1908), Lehrs (1902), Karaman (1921, 1939), Kammerer (1926), Radovanović (1941, 1953, 1956), Wettstein (1926, 1949), Mertens & Wermuth (1960), Pavletić (1962), Brelih (1963), Tortonese & Lanza (1968), Rucner & Rucner (1969), Bruno & Maugeri (1976), Strohmaier (1984), Henle & Klaver (1986), and Gasc et al. (1997) – Lošinj: reported by Werner (1891), Boulenger (1920), Wettstein (1926), Bruno & Maugeri (1976 – only mapped), and Dieckmann (2004) – Plavnik: observed by Farkas (pers. obs.); reported by Henle & Klaver (1986, referring to pers. comm. with Nemetschkah [sic!]), and Mršić et al. (1989) – Hrid Galiola: reported by Wettstein (1926), Mertens (1926), Kammerer (1926), Brelih (1963), Brelih & Džukić (1974), and Henle & Klaver (1986) – Hrid Zaglav: reported by Brelih (1963), and Henle & Klaver (1986) – Kormat: reported by Radovanović (1941, 1956), Henle & Klaver (1986), and Mršić et al. (1989) – Košljun: observed by Farkas (pers. obs.); reported by Werner (1891), and Henle & Klaver (1986) – Kozjak: reported by Kammerer (1926), Wettstein (1926), and Henle & Klaver (1986) – Male Orjule: reported by Kammerer (1926), Wettstein (1926), Brelih (1963), and Henle & Klaver (1986, cit.: SNHM) – Male Srakane: reported by Pavletić (1962), Brelih (1963), and Henle & Klaver (1986) – Mišar: reported by Brelih (1963), Brelih & Džukić (1974), and Henle & Klaver (1986) – Mišnjak: reported by Brelih (1963), and Henle & Klaver (1986) – Oruda: reported by Brelih (1963), and Henle & Klaver (1986) – Palacol: reported by Werner (1908), Brelih (1963), and Henle & Klaver (1986) – Školjić: reported by Kammerer (1926), Brelih (1963), and Henle & Klaver 1986) – Susak: reported by Werner (1908), Karaman (1921, 1939), Wettstein (1926, 1949), Radovanović (1953, 1955, 1956), and Henle & Klaver (1986) – Trasorka: reported by Kammerer (1926), Brelih (1963), and Henle & Klaver (1986) – Unije: reported by Pavletić (1962), Brelih (1963), and Henle & Klaver (1986) – Vele Orjule: reported by Kammerer (1926), Wettstein (1926), Brelih (1963), and Henle & Klaver (1986, cit.: SNHM) – Vele Srakane: reported by Brelih (1963), and Henle & Klaver (1986) – Visoki: reported by Brelih (1963), Brelih & Džukić (1974), and Henle & Klaver (1986) – Zabodaski: reported by Brelih (1963), and Henle & Klaver (1986).

According to Boulenger (1913: 177), *P. s. campestris* inhabits „most islands between Istria and Croatia".

Hierophis gemonensis
(Laurenti, 1768)

Abundant food and stony ground provide an ideal habitat for this snake, which is the most widespread colubrid on the island, occurring in substantial numbers even within settlements.

Localities known from the literature are as follows: Sjevernjak šuma, Lake Vrana, environs of Beli (BRUNO 1980), Beli (forest clearing), W Beli (light downy oak forest), SE Sveti Vid (wineyards), S Sveti Vid (roadkill), brook valley, at U. Krušćica, N Martinšćica, road, W Srem (moribund specimen), W Srem, SE Sveti Vid (pond, stone wall) (SEHNAL & SCHUSTER 1999), crossing of roads Cres-Merag-Porozina, road leading to Beli, environs of Beli (grazing grounds, at bee hives), Beli (clearing in downy oak forest), Eco-Trails at Beli, Predošćica (gardens), Cres township, southern shore of Lake Vrana (motorway, dead specimen along road between Lake Vrana and the seacoast), Belej-Osor road (roadkills), E Osor (stone walls along footpaths), N of road to Punta Križa (deserted grazing grounds in the macchia), Hrasta (grazing grounds) (RATHBAUER 2002), Merag Peninsula (SEHNAL & SCHUSTER 1999; RATHBAUER 2002), Valun and environs, road between Osor and Vela Straža, Martinšćica (hotel and seacoast), Hrasta, Belej, Punta Križa (cemetary) (M. DIECKMANN pers. comm.). We found this snake twice in Beli on and near the fence of Tramontana guest house, several times along the Eco-Trails near Beli, as well as among the ruins of Sveti Bartolomej monastery, at the crossing of the roads leading to Cres, Merag and Porozina (roadkill), SE of Lubenice in the environs of Podolić (roadkill), and between Osor and Punta Križa (roadkill) (figs. 23, I). Without listing actual localities, the occurrence of this species on Cres was mentioned by BRUNO & MAUGERI (1977, 1992), BRUNO (1984), GASC et al. (1997), WARNECKE (1998), and DIECKMANN (2004). Specimens from Cres without precise locality information have been deposited at NMW (36704 - perhaps one of the individuals mentioned above) and MFSNU (LAPINI 1984).

Other Kvarner Islands records: – Krk: observed by BRUNO (1980), ENTZEROTH (1982), SOCHUREK (1985); just reported by BRUNO (1970, 1984), BRUNO & MAUGERI (1977, 1992), SCHÄTTI (1988), MRŠIĆ et al. (1989), HENLE (1993), and GASC et al. (1997). Vouchers at NMW and MFSNU (LAPINI 1984) – Lošinj: observed by WERNER (1891, 1897, 1908) and TORTONESE & LANZA (1968); just reported by BRUNO & MAUGERI (1977, 1992), BRUNO (1984), SCHÄTTI (1988) and HENLE (1993). Vouchers at NMW and MFSNU (LAPINI 1984). In the appendix of SCHÄTTI's (1988) work collection data of specimens originating from these islands were summarized. However, it is not possible to identify exactly which specimen came from which island – Plavnik: observed by BRUNO (1980); just reported by HENLE (1993).

The range area of this characteristic colubrid of the southwestern Balkans extends along the west coast of the Istra Peninsula northward towards Trieste (HENLE 1993), i.e. not much beyond the Kvarner region.

Elaphe (*Zamenis*) *longissima longissima* (LAURENTI, 1768)

The distribution of this species on the island is possibly restricted to the northern part, considering that all data originate from this area. BRUNO (1980) found an adult specimen at Sjevernjak šuma, while W. MAYER (pers. comm.) encountered two individuals S of Sveti Petar, along the road leading to Beli. RATHBAUER (2002) also reported to have come across two specimens on the same road at the bee hives, and a day later another one on the road. A single specimen was found dead on road (NMW 36709) (fig. 24). Without giving localities the species was mentioned from Cres by BRUNO & MAUGERI (1992), and BÖHME (1993).

Other Kvarner Islands records: – Krk: observed by BRUNO (1980), SOCHUREK (1985) and MRŠIĆ et al. (1989); just reported by CUBICH (1875, as *Coluber Aesculapii*), BRUNO & MAUGERI (1977, 1992), BRUNO (1970, 1984), BÖHME (1993), and SCHULZ (1996). NMW vouchers.

Elaphe quatuorlineata quatuorlineata (LACEPÈDE, 1789)

The Four-lined Rat Snake is among the most common snake species on the island, mainly occurring in forested patches and macchia bushes. SEHNAL & SCHUSTER (1999), referring to personal communication with J. ORTEL (Wien) found the length of the longest specimen recovered from the island to be 230 cm.

Fig. K: Juvenile *Elaphe quatuorlineata quatuorlineata* (Lacepède, 1789), between Belej and Osor, Cres Island. Photograph: J. Hill.

Abb. K: Juvenile *Elaphe quatuorlineata quatuorlineata* (Lacepède, 1789), zwischen Belej und Osor, Insel Cres. Photo: J. Hill.

Localities known thus far from Cres are as follows: Sjevernjak šuma (Bruno 1980), Beli, W Sveti Petar (Turkish oak forest), S and SE Sveti Vid (*Typha* pond), SE Sveti Vid (*Salvia* garrigue), Vrana SW slope elevation, SW Srem (stone wall) (Sehnal & Schuster 1999), Beli (touring path), approximately 3 km N Beli (clearing), Valun-Lubenice road (near crossing, in the direction of Valun), environs of Srem, W Srem, W Belej-Osor road, E Osor (among stone walls) (Rathbauer 2002), S Sveti Petar (along the road leading to Beli) (W. Mayer pers. comm.), Belej, between Osor and Vela Straža (M. Dieckmann pers. comm.).

We found a young specimen run over by a car close to the crossing of the roads connecting Porozina, Cres and Merag, and a number of approximately 160 cm long specimens under a stone heap near Beli along the Eco-Trails, and N of Cres township (figs. 25, J, K). Without locality details, the occurrence of this species on Cres was mentioned by Werner (1891, 1897, with question mark), Bruno & Maugeri (1992), Böhme & Ščerbak (1993), and Dieckmann (2004) – the latter author found young and subadult specimens on the island. There is a voucher without associated precise locality information available at the Naturhistorisches Museum Wien (NMW 36707).

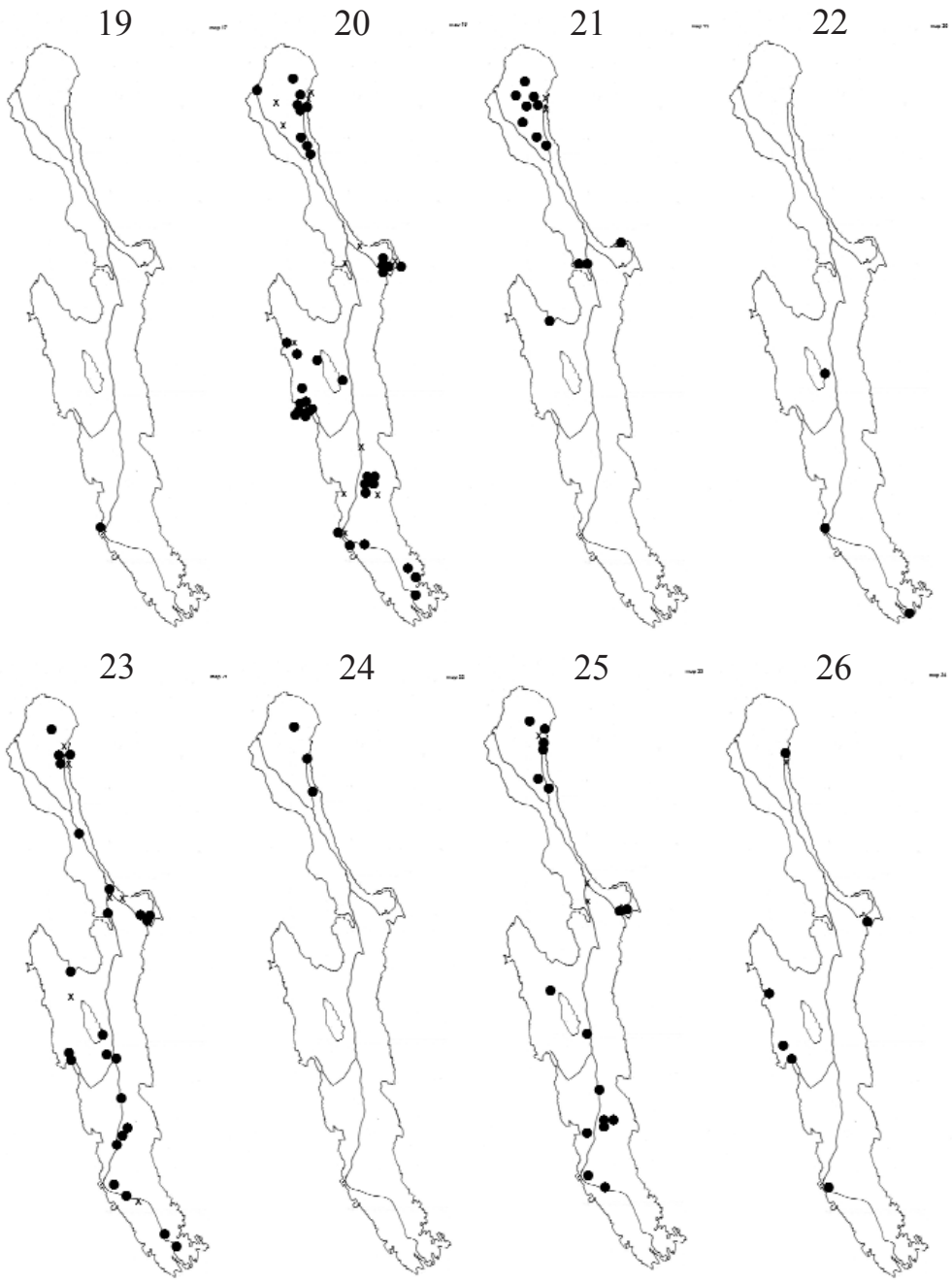
Other Kvarner Islands records: – Krk: observed by Bruno (1980), Sochurek (1985), Mršić et al. (1989) and Farkas (pers. obs.), while Kratzer (1973) discussed a specimen collected by E. Sochurek (Wien) and deposited at NMW (where another voucher from Krk is catalogued as well); just mentioned by Werner (1897, with a question mark), Karaman (1939), Pozzi (1966), Tortonese & Lanza (1968), Bruno & Maugeri (1977, 1992), Strohmaier (1984), Bruno (1984), Böhme & Ščerbak (1993), and Schulz (1996) – Lošinj: observed by Werner (1891); just mentioned by Werner (1897), Gugler (1903), Schreiber (1912), Karaman (1921, 1939), Pozzi (1966), Tortonese & Lanza (1968), Bruno & Maugeri (1977), Bruno (1980, 1984), Strohmaier (1984), and Böhme & Ščerbak (1993).

Elaphe (*Zamenis*) *situla* (Linnaeus, 1758)

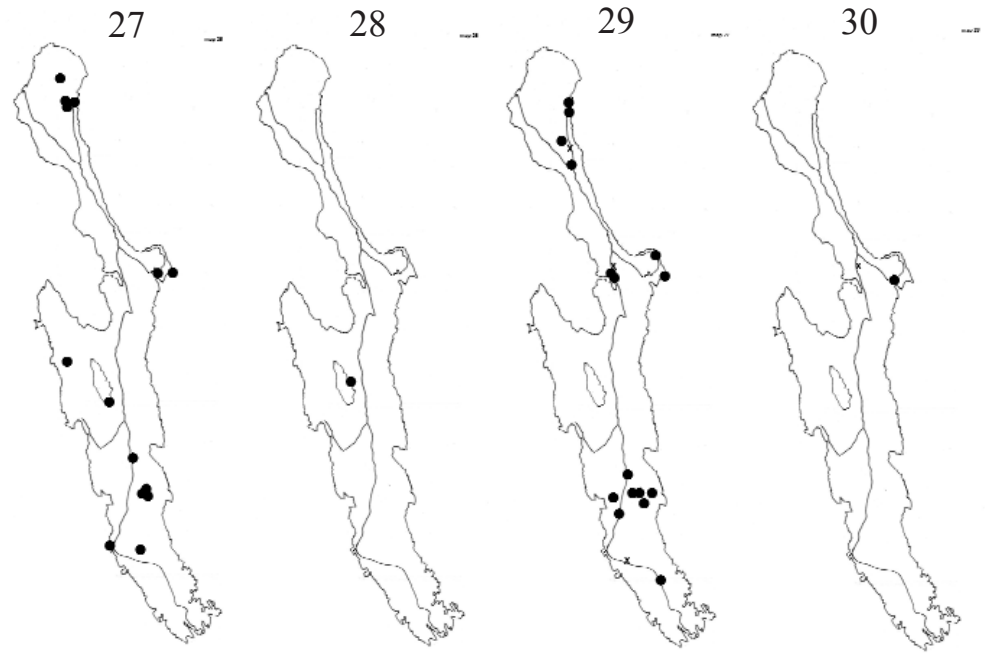
Preferred habitats of the rarely encountered Leopard Snake are stony areas and stone walls. Few localities are available from Cres: Beli (sea coast), near Osor (Bruno 1980), S Sveti Vid (*Typha* pond, crumbling rocks), Martinšćica (Sehnal & Schuster 1999), environs of Vidovići, stone wall (Dieckmann 2004), environs of Lubenice (W. Mayer pers. comm.). We found a young individual at the edge of Beli, freshly run over by a car (fig. 26).

Without providing detailed locality data the occurrence of *E.* (*Z.*) *situla* on Cres is mentioned by Bruno (1984), Bruno & Maugeri (1992) and Obst et al. (1993).

Other Kvarner Islands records: – Krk: observed by Bruno (1980) and Sochurek (1985); just mentioned by Werner (1894, 1897), Schreiber (1912), Karaman (1921, 1939), Buresch & Zonkov (1934), Pavletič (1962), Pozzi (1966), Tortonese & Lanza (1968), Bruno & Maugeri (1977, 1992), Bruno (1984), Strohmaier (1984), Obst et al. (1993), and Schulz (1996) – Lošinj: reported as new to the island by Gugler (1903); mentioned by Schreiber (1912), Karaman (1939), Pavletič (1962), Pozzi (1966), Tortonese & Lanza (1968),



Figs. 19-26: Herpetological records on Cres Island (Croatia). **x** – own observation; ● – data from other sources.
Abb. 19-26: Herpetologische Funde auf der Insel Cres. **x** – eigene Beobachtungen; ● – Daten aus anderer Quelle.
19 – *Lacerta oxycephala*; 20 – *Podarcis melisellensis*; 21 – *Podarcis muralis*; 22 – *Podarcis sicula*;
23 – *Hierophis gemonensis*; 24 – *Elaphe longissima*; 25 – *Elaphe quatuorlineata*; 26 – *Elaphe situla*.



Figs. 27-30: Herpetological records on Cres Island (Croatia). **x** – own observation; ● – data from other sources.
Abb. 27-30: Herpetologische Funde auf der Insel Cres. **x** – eigene Beobachtungen; ● – Daten aus anderer Quelle.
27 – *Natrix natrix*; 28 – *Natrix tessellata*; 29 – *Malpolon monspessulanus*; 30 – *Telescopus fallax*.

Bruno & Maugeri (1977, 1992), Bruno (1980, 1984), Strohmaier (1984), Obst et al. (1993) and Schulz (1996). Voucher at MFSNU (Lapini 1984).

The northernmost documented occurrence of the Leopard Snake in Europe is on the mainland at nearby Crkvenica (Obst et al. 1993).

Natrix natrix helvetica
(Lacepède, 1789)

The Grass Snake is found in and near almost all larger water bodies on the island, and numerous localities are known. Rathbauer (2002) described Grass Snakes hunting tree frog tadpoles in shallow pools around Merag.

Localities documented in the literature are the following: Sjevernjak šuma, Paiskà near Beli, Lake Vrana, near Belej, Rt Tarej, Osor, Zlatuja (marsh near Osor) (Bruno 1980), S and SE Sveti Vid (*Typha* pond), N Helm and SE Lubenice (pond), Srem (grazing grounds), W Srem and E Sveti Vid (pond) (Sehnal & Schuster 1999), near Beli (at the start of the Eco-Trails), Merag Peninsula (wet areas), S Srem (grazing ground) (Rathbauer 2002), Garbovica near Beli (Kovács 2003) (fig.27). The occurrence of the species on the island was mentioned by Bruno & Maugeri (1992) and Kabisch (1999).

Other Kvarner Islands records: – Krk: observed by Bruno (1980), Entzeroth (1982), Sochurek (1985), Franzen (1987) and Mršić et al. (1989); just mentioned by Cubich (1875, as *Coluber natrix*), Schreiber (1912), Bruno & Maugeri (1977, 1992), Strohmaier (1984), and Kabisch (1999). Several NMW vouchers.

Interestingly, some other material from Krk deposited at NMW is identified as *N. n. persa* (Pallas, 1814). Strohmaier (1984) lists three forms of the Grass Snake from Krk – *N. n. natrix* (Linnaeus, 1758), *N. n. helvetica* and *N. n. persa*. Kabisch (1999) records *N. n. helvetica* from Istra,

whereas also RATHBAUER (2002) determined Cres specimens of the Grass Snake as *N. natrix helvetica*. On the basis of pattern characteristics SEHNAL & SCHUSTER (1999) identify Cres specimens as "probably *N. n. helvetica*".

Natrix tessellata (LAURENTI, 1768)

The only mention of the Dice Snake from Cres is by BRUNO (1980), who stated to have seen a specimen at Lake Vrana. Although its occurrence is not yet documented by a voucher specimen, its possible settling on the island is theoretically possible as this species is known from the mainland (GRUSCHWITZ et al. 1999) and has been observed to hunt for fish in the sea e.g., in southeastern Bulgaria. Additionally, MÜLLER (1928) described a population of *N. tessellata* (as *N. t. heinrothi*) inhabiting Ostrov Zmeinyj (Snake Island) in the Black Sea at approximately 45 km off the Danube Delta living exclusively of sea fish, due to the fact that vertebrates other than birds (*Larus argentatus*, *Ruticilla* sp.) were absent from the island (fig. 28). The presence of the Dice Snake on Cres was also mentioned by BRUNO & MAUGERI (1992), GASC et al. (1997) and GRUSCHWITZ et al. (1999).

Other Kvarner Islands records: – Krk: observed by BRUNO (1980), SOCHUREK (1985), FRANZEN (1987), and MRŠIĆ et al. (1989); just mentioned by BRUNO & MAUGERI (1977, 1992), BRUNO (1984), STROHMAIER (1984, with a question mark), GASC et al. (1997) and GRUSCHWITZ et al. (1999).

Malpolon monspessulanus insignitus (GEOFFROY, 1827)

A melanistic specimen of this opisthoglyphous snake was found W of the road between Belej and Osor (RATHBAUER 2002).

Localities known from Cres are the following: Beli (sea coast), Rt Tarej on Merag Peninsula, Cres-Osor road (in the proximity of Cres township), Osor-Punta Križa road (BRUNO 1980), Beli (cultured land), W Sveti Petar (Turkish oak forest), Križić-Sis road crossing to Beli, between Belej and Srem (roadkill), W Srem, Plat (SEHNAL & SCHUSTER 1999), road leading to

Fig. L: Melanistic *Malpolon monspessulanus insignitus* (GEOFFROY, 1827), between Belej and Osor, Cres Island. Photograph: J. HILL.

Abb. L: Melanistischer *Malpolon monspessulanus insignitus* (GEOFFROY, 1827), beobachtet zwischen Belej und Osor, Insel Cres. Photo: J. HILL.

Fig. M: *Telescopus fallax fallax* (FLEISCHMANN, 1831) from south of the crossing to Porozina, Cres and Merag, Cres Island. Photograph: T. TÓTH.

Abb. M: *Telescopus fallax fallax* (FLEISCHMANN, 1831) von südlich der Straßenkreuzung nach Porozina, Cres und Merag, Insel Cres. Photo: T. TÓTH.

Merag (dead specimens), at the edge of Cres township (dead specimen), environs of Srem, shortly after the crossing of the main road leading to Srem (ruined countryside), Belej-Osor road (dead specimens), W Belej-Osor road (the abovementioned melanistic specimen) (Rathbauer 2002) (figs. 29, L). We found a subadult in the environs of Sveti Petar, an adult N of Cres township, and another subadult S of Osor (all roadkills).

The occurrence of the species on Cres Island is mentioned by Schreiber (1912), Buresch & Zonkov (1934), Karaman (1939), Pozzi (1966), Bruno & Maugeri (1977, 1992), Bruno (1984), Warnecke (1998), and De Haan (1999) without locality details. A specimen without precise locality data is available at the Naturhistorsches Museum Wien (NMW 36703), and another one is preserved at MFSNU (Lapini 1984; Inv. No. 357, as *M. monspessulanum monspessulanum*).

Other Kvarner Islands records: – Krk: observed by Bruno (1980), and Sochurek (1985); just mentioned by Bruno & Maugeri (1977, 1992), Bruno (1984), and De Haan (1999) – Lošinj: Voucher at MFSNU (Lapini 1984).

Telescopus fallax fallax
(Fleischmann, 1831)

The European Cat Snake belongs to the most rarely encountered species on the island. In the literature there is a single record available from Merag Peninsula, E of Torrente, from between crumbling rocks and a *Salvia* garrigue (Sehnal & Schuster 1999) (figs. 30, M).

However, Rössler (1903), Bruno (1984), Bruno & Maugeri (1977, 1992) and Grillitsch & Grillitsch (1999) list the species for the island without further site specification. We found a roadkill specimen S of the crossing of the roads leading to Porozina, Cres and Merag.

Other Kvarner Islands records: – Krk: observed by Schreiber (1912), Bruno (1980), Sochurek (1985) and Farkas (pers. obs.; roadkill); just mentioned by Werner (1894, 1897), Karaman (1939), Pavletić (1962), Pozzi (1966), Tortonese & Lanza (1968), Bruno & Maugeri (1977, 1992), and Bruno (1984); mapped by Mršić et al. (1989). BMNH (Grillitsch & Grillitsch 1999) and NMW vouchers – Lošinj: mentioned by Pavletić (1962), Lapini (1984), and Grillitsch & Grillitsch (1999). NMW voucher, MFSNU voucher (Lapini 1984) – Plavnik: Farkas (unpubl.).

The range of this species does not surpass the Kvarner area by much in northern direction, as its northernmost occurrence is between Duino and Sistiana, Italy (Grillitsch & Grillitsch 1999).

Vipera ammodytes ammodytes [1)]
(Linnaeus, 1758)

This viper most probably does not occur on the island. However, Depoli (1898) mentioned that due to a miracle attributed to Sveti Gaudenzio, vipers were harmless to man on Cres and Lošinj. Like with many other species that do not occur on Cres but are present on some neighboring island, the possibility of introduction always exists.

Other Kvarner Islands records: – Krk: observed by Bruno (1980) and Sochurek (1985); just mentioned by Cubich (1875), Werner (1897), Depoli (1898), Buresch & Zonkov (1934), Bruno & Maugeri (1977, 1992) and Bruno (1984, 1985). NMW vouchers (25255:2, 36279).

[1)] Note added in proof: In an e-mail message to J. Hill (Wolkersdorf) on January 27, 2003, the zoologist and experienced snake keeper Dr. Rainer Fesser (Großklein) reports on snake observations he and his friends had made on the Islands of Cres, Lošinj and Unije. *Vipera ammodytes ammodytes* (Linnaeus, 1758): Cres – between Cres and Beli, 1975 but also in the karst area in the southern part of Cres Island [obs. Fesser]. "All looked like individuals from Pag and Krk, rather small, lightweighted, in various shades of grey, not very contrasting in pattern. They were hard to find and even harder to catch in the karst. People there knew this snake. Not only did they tell me about the occurrence of 'Poskok' (= *V. ammodytes*) as is usual on the islands, but also reported on the occurrence of harmful snakes characterized by a horn on the tip of the snout and a red tail". *Hierophis viridiflavus carbonarius* (Bonaparte, 1833): Lošinj – W of the road from Mali Lošinj to Veli Lošinj, July 1978, adult male [obs. Fesser]. Cres – between Cres and Beli, 1975, adult female, highly gravid, violated (car accident?) [obs. Fesser]. Unije – 2001, gravid female [Photographs made by a friend, shown to Fesser].

Table 3: Herpetofaunal records reported from the islands of the northwestern Kvarner Bay (Croatia). For the position of the islands see figure 1. The occurrence of some species recorded earlier has not been confirmed by more recent studies.

Tab. 3: Herpetofaunistische Nachweise von den Inseln der nordwestlichen Kvarner-Bucht (Kroatien). Zur lage der Inseln siehe Abbildung 1. Für einige Arten konnte das in früheren Arbeiten angegebene Vorkommen durch jüngere Beobachtungen nicht mehr bestätigt werden.

1 – *Triturus vulgaris*, 2 – *Bombina variegata*, 3 – *Bufo bufo*, 4 – *Bufo viridis*, 5 – *Hyla arborea*, 6 – *Rana dalmatina*, 7 – *Rana ridibunda*, 8 – *Testudo hermanni*, 9 – *Emys orbicularis*, 10 – *Tarentola mauritanica*, 11 – *Hemidactylus turcicus*, 12 – *Anguis fragilis*, 13 – *Pseudopus apodus*, 14 – *Algyroides nigropunctatus*, 15 – *Lacerta trilineata*, 16 – *Lacerta bilineata*, 17 – *Lacerta oxycephala*, 18 – *Podarcis melisellensis*, 19 – *Podarcis muralis*, 20 – *Podarcis sicula*, 21 – *Hierophis gemonensis*, 22 – *Platyceps najadum*, 23 – *Hierophis viridiflavus*, 24 – *Elaphe* (*Zamenis*) *longissima*, 25 – *Elaphe quatuorlineata*, 26 – *Elaphe* (*Zamenis*) *situla*, 27 – *Coronella austriaca*, 28 – *Natrix natrix*, 29 – *Natrix tessellata*, 30 – *Malpolon monspessulanus*, 31 – *Telescopus fallax*, 32 – *Vipera ammodytes*, 33 – *Vipera ursinii.*

Island/Insel	Cres	Hrid Galiola	Hrid Zaglav	Kormat	Košljun	Kozjak	Krk	Lošinj	Male Orjule	Male Srakane	Mišar	Mišnjak	Oruda	Palacol	Plavnik	Školjić	Susak	Sveti Marin	Trasorka	Trstenik	Unije	Vele Orjule	Vele Srakane	Visoki	Zabodaski	Zec
Island Nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Taxon																										
1	*						*																			
2	*						*																			
3	*						*																			
4	*						*																			
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DISCUSSION

A great number of herpetofaunal questions remains unanswered still. Due to the apparent absence of suited water bodies on the smaller North Kvarner Islands, amphibians are known only from the large Islands of Cres an Krk. On one or both islands some apparently rare species are, at least today, only known from a few observations whereas records substantiated by vouchers are not available. This applies to *Triturus vulgaris*, *Bombina variegata*, *Rana dalmatina* and *Bufo bufo* for Cres and to *Bombina variegata* and *Rana dalmatina* for Krk (all mentioned by BRUNO 1980). All amphibian species reported from Cres are also mentioned to occur on Krk.

Among the geckos, substantiated records of *Hemidactylus t. turcicus* and *Tarentola m. mauritanica* (both found by BRUNO 1980 only) are lacking since.

For *Lacerta trilineata major* (observed by BRUNO 1980) there is no doubtless proof of its occurrence on Cres yet. It is, however well-known from Krk and there are two voucher specimens from nearby Lošinj present at NMW.

The fate of the small *Lacerta oxycephala* population detected by the authors has to be studied in more detail. The same applies to the unusual occurrence and distribution of two *Podarcis muralis* subspecies (*muralis* and *maculiventris*) on Cres, which is not yet fully understood.

There is no sound evidence that *Podarcis sicula campestris* – alhough present on many neighboring islands – really occurs on the island of Cres (observed but maybe misidentified by BRUNO 1980). The mosaic pattern of co-occurrence or mutually exclusive presence of *P. sicula campestris* and *P. melisellensis* on the various Adriatic islands is still to be explained.

The systematic allocation of *Natrix natrix* in the North Kvarner Islands deserves further investigation. The variation in colorpattern (morphometrics were not studied in detail) made naturalists assign the specimens from the northern Kvarner region to what was called *natrix*, *helvetica* or *persa* in the traditional subspecies concept. *Natrix tessellata* (found by BRUNO 1980 only) was never again observed on Cres, however its presence on Krk and the mainland seems to be beyond doubt. No museum specimen or published observation of *Vipera ammodytes* from Cres is known apart from its mention by DEPOLI (1898).

On the basis of the available data, even though some observations remain to be confirmed by voucher specimens, the five largest islands (size in parentheses) in the area have the following numbers of amphibian plus reptile species, respectively: Cres (406 km^2) 7+20, Krk (406 km^2) 7+25, Lošinj (74 km^2) 0+11, Unije (16.8 km^2) 0+2, Plavnik (9.2 km^2) 0+8.

Due to the considerable degree of inter- and intra insular uniformity of the habitats the small islands harbor only a comparatively poor reptile fauna in terms of species diversity (see table 3). The positive correlation between island size and species richness in the North Kvarner Islands is obvious.

The natural presence or absence on Cres of many of the abovementioned amphibian and reptile taxa cannot be ruled out easily on biogeographic grounds. All of the species occur on one of the islands and/or on the mainland in the North Kvarner region. Moreover, most reptile taxa on Cres have their northern or northwestern distribution limit in the North Kvarner and Istra region (*Hemidactylus t. turcicus*, *Tarentola m. mauritanica*, *Testudo hermanni boettgeri*, *Pseudopus apodus*, *Algyroides nigropunctatus*, *Lacerta trilineata major*, *Podarcis muralis maculiventris*, *Podarcis sicula campestris*, *Podarcis melisellensis*, *Hierophis gemonensis*, *Elaphe quatuorlineata*, *Elaphe* (*Zamenis*) *situla*, *Malpolon monspessulanus*, *Telescopus fallax*). Some of these taxa may therefore be at the brink of their ecological tolerance on Cres and thus, rare or close to extinction.

According to our and others' (SEHNAL & SCHUSTER 1999) experiences the major threat to the herpetofauna of Cres are motor vehicles that substantially decimate amphibian and reptile populations, especially during spring and summer. For establishing the damage caused by traffic one would need to make a survey in order to determine which species are the most endangered on the

island. In addition, it would be important to document roadkills over space and time. Among endangering factors sheep watering, silting up, lack of oxygen and eutrophication deserve to be mentioned, which result in killing off amphibians (KOVÁCS 2003). On a smaller scale collecting for the pet trade remains a threatening factor. Especially Hermann's Tortoises (*T. hermanni boettgeri*) may easily suffer from overcollecting, the populations of which are also otherwise very small and seriously endangered on Cres.

As mentioned above, many species of Cres do not live far from the edge of their distribution area meaning that populations inhabiting this region are often of low density and particularly susceptible to any kind of environmental stress. As a result, protection measures should be enforced on the above islands to preserve the unique biocoenosis in spite of a growing civilization pressure. We propose that certain species of amphibians and reptiles, as well as areas inhabited by other rare animal and plant species in substantial numbers are to be granted strict protection. Lake Vrana is a good example for the positive effects of such conservation measures, as it has served as a military area with restricted access for years. As a consequence of such a restriction, the richest herpetofauna on the island can be observed just here. Further areas that would benefit from similar action include the Merag Peninsula and the wider environs of Beli, where many rare and threatened taxa (such as *T. h. boettgeri*, *E. o. hellenica*, *P. a. apodus*, *A. n. nigropunctatus*, *E. q. quatuorlineata*, *E. situla*, *T. f. fallax*) are still present in comparatively large numbers.

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