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The herpetofauna of the "Area Marina Protetta di Tavolara-Punta Coda Cavallo" and, morphological and preliminary ecological observations on *Podarcis tiliguerta ranzii* of Molarotto Islet, NE Sardinia, Italy.

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Introduction

The "Area Marina Protetta di Tavolara Punta Coda Cavallo", which has been created in 1997 by the Italian Ministry of the Environment, includes 15.000 ha of sea and coastal habitats (Fig. 1). Geologically differentiated, this territory is mainly characterized by pink granite and quartz-feldspatic beaches, while Tavolara Island is characterized by calcareous-dolomitic relief. Along the coastal area, in the back dune system, ponds and lagoons are formed thanks to streams and channels which connect the sea with the inshore. Molara Island and many other islets as well, show the typical geology of granitic relief. The vegetation is typically Mediterranean. Many protected species of Amphibians, Reptiles and Birds are present in this area.

Beside the updated list of the herpetofauna of the whole Area Marina Protetta (islands and islets included), the present contribution focuses on the morphology and on some preliminary ecological data on the lacertid lizard population *Podarcis tiliguerta ranzii* inhabiting Molarotto Islet (Fig. 2). This islet of about 3 ha is the most distant from the main island. Both morphological and

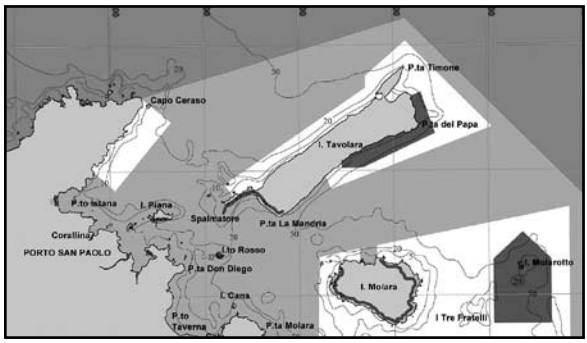

Figure 1. Map of the study area.

Figure 2. Molarotto Islet.

genetical studies carried out on *P. tiliguerta* populations of Sardinia and Corsica support the validity of the subspecific *status* of that of Molarotto Islet (Bruschi *et al.*, 2006; Vasconcelos *et al.*, 2006), confirming the uniqueness of this population.

Material and Methods

In order to update the check list of the herpetofauna (Poggesi *et al.*, 1995) of the protected area the territories of the main island, the islets and islands have been systematically searched during the years 2004-spring 2008. Morphological data regarding *Podarcis tiliguerta ranzii* derive from museum specimens stored in the Museo di Storia Naturale dell'Università di Firenze, Sezione di Zoologia "La Specola" (MZUF) (52 ♂♂ and 44 ♀♀) and from field individuals that have been captured by noose, measured and then immediately released (17 ♂♂ and 23 ♀♀). The following morphological characters have been studied: dorsal scales along a transversal line at the middle of the body (dors); ventral scales along the

midline on the left side of the body (vent); collar shields (coll); gular scales on the midline from the confluence of the inframaxillary scales to the collar shields (gul); femoral pores (fpor); scales under the 4th toe (4toe); supraciliar scales (scs); supraciliar granules (scg); supra-temporal scales (st); supra-labial scales preceding the eye (sl); scales on the shortest line connecting the masseteric shield and the supratemporal scales (sm); snout-vent length (svl); trunk length (trl); head length (ventrally, from the snout tip to the posterior edge of the collar; hl); pileus length (dorsally, from the snout tip to the posterior edge of the parietal-occipital scales; pl); posterior half of the pileus length (from the anterior edge of the 3rd supraocular to the posterior edge of the parietal-occipital scales; esd); head width (hw); head height (hh); mouth opening (mo); humerus length (hul); ulna length (ul); hand length (from the wrist to the tip of the 4ht finger; f4t); total length of the forelimb (ffl); femur length (fl); tibia length (tbl); foot length (from the ankle to the tip of the 4th toe; h4t); total length of the hind leg (hfl); tail length.

All body measurements have been taken only on field animals (apart from snout-vent length, measured also on preserved specimens) using a calliper. Meristic characters have been studied only on preserved specimens using a stereo microscope. Characters have been analysed on the right side of the body (apart from ventral scales, counted on the left side for handling reasons); when the right side was damaged, the left has been measured.

For each single encountered individual tail *status* (regenerated/broken, entire) has been recorded. Faeces have been collected directly from each captured individual to determine lizards diet. Population density has been estimated using the line transect method and data have been analysed using "Distance" software (Thomas *et al.*, 2006), while for all other ecological analysis STATISTICA.6 and SPSS.13 statistical packages were used. When analysing data with Distance, we generated a simulated standard error of measurements by 10,000 random Monte Carlo simulations of the original data table, in order to allow for a better evaluation of the density characteristics of this species. The uniform function proved to be the most efficient (AICc scores lower than those of the other models) in order to calculate density of lizards with a good approximation, and thus density data provided in this article are based on such a function.

Results and Discussion

In the whole area the following species have been recorded: *Hyla sarda*, *Emys orbicularis, Testudo hermanni, Testudo marginata, Euleptes europaea, Hemidactylus turcicus, Algyroides fitzingeri, Podarcis tiliguerta, Podarcis sicula, Chalcides chalcides, Chalcides ocellatus, Natrix maura, Hierophis viridiflavus* (Tab. 1), *Bufo viridis* has not yet been found in the area.

Podarcis tiliguerta ranzii, inhabiting Molarotto islet, is a subspecies which

Table 1. Updated list of the herpetofauna of the Area Marina Protetta di Tavolara e Punta Coda Cavallo.

Main island	*Hyla sarda, Emys orbicularis, Testudo hermanni, Testudo marginata, Euleptes europaea, Hemidactylus turcicus, Algyroides fitzingeri, Podarcis tiliguerta, Podarcis sicula, Chalcides chalcides, Chalcides ocellatus, Natrix maura, Hierophis viridiflavus*
I.la Tavolara	*Emys orbicularis, Testudo hermanni, Testudo marginata, Hemidactylus turcicus, Euleptes europaea, Algyroides fitzingeri, Podarcis tiliguerta, Podarcis sicula, Chalcides chalcides, Chalcides ocellatus, Hierophis viridiflavus*
I.la dei Porri	*Podarcis tiliguerta*
I.to Spalmatore	*Podarcis tiliguerta*
I.la Piana di Tavolara	*Euleptes europaea, Podarcis tiliguerta, Chalcides ocellatus*
I.la dei Topi	*Euleptes europaea*
I.la Cavalli	*Podarcis tiliguerta*
I.la Reulino (=I.to Rosso)	*Euleptes europaea, Podarcis tiliguerta, Chalcides chalcides, Chalcides ocellatus*
I.la Cana	*Podarcis tiliguerta*
I.to del Fico	
I.la Molara	*Emys orbicularis, Testudo hermanni, Testudo marginata, Euleptes europaea, Algyroides fitzingeri, Podarcis tiliguerta, Podarcis sicula, Chalcides chalcides, Chalcides ocellatus, Hierophis viridiflavus*
I.to Molarotto	*Euleptes europaea, Podarcis tiliguerta*
Scogli i Cerri (=I tre Fratelli)	
I.la Proratora	*Euleptes europaea, Podarcis tiliguerta, Chalcides ocellatus, Hierophis viridiflavus*
I.la Rossa Brandinchi	*Euleptes europaea*

Table 2. - Descriptive statistics conducted on svl of all animals.

	Snout-vent lenght				
	N	**Mean**	**ES**	**Minimum**	**Maximum**
Males	69	66.64	0.53	48.00	73.00
Females	68	60.63	0.63	40.00	70.00

differs from the other inland and mainland populations for size and coloration: it is a strong melanic and gigantic subspecies. Statistical analysis have shown that for this subspecies, just as for *Podarcis tiliguerta* in general (Bruschi *et al.*, 2006), there is a strong sexual dimorfism in snout-vent length (ANOVA: $F_{1,135} = 53.50$, $P < 0.005$; Tab. 2). The other characters have been analysed with both ANOVA and ANCOVA (using svl as a covariate): no significant difference in the results has anyway been detected, apart from trunk length and femural length. On the whole, males have bigger dimensions, apart from pileus length and femural length, for which no significant difference between sexes has been detected. Females, anyway, show a longer trunk: in males the trunk is, on average, 51.03%

Table 3. Descriptive statistics conducted con body measurements of field animals.

	MALES					FEMALES				
	N	**Mean**	**ES**	**Min.**	**Max.**	**N**	**Mean**	**ES**	**Min.**	**Max.**
trl	17	35.35	0.61	29.30	40.00	23	33.97	0.79	27.50	40.50
hl	17	24.49	0.37	19.50	26.60	23	20.64	0.22	18.80	22.40
pl	17	17.71	0.23	14.50	19.00	23	18.73	3.75	13.00	19.00
esd	17	8.87	0.16	6.60	9.80	23	7.06	0.09	6.00	7.90
hw	17	9.53	0.23	7.70	11.50	23	7.77	0.15	6.40	9.00
hh	17	7.11	0.11	6.40	8.20	23	5.70	0.08	4.80	6.40
mo	17	15.84	0.28	13.00	17.20	23	12.93	0.17	11.00	14.40
hul	17	8.18	0.23	5.60	9.70	23	6.66	0.16	5.00	8.00
ul	17	8.82	0.22	7.50	10.40	23	7.57	0.19	6.00	9.50
f4t	16	10.28	0.16	9.00	11.50	23	9.32	0.22	7.70	11.00
ffl	15	25.07	0.70	18.70	29.70	23	20.88	0.57	10.30	24.00
fl	17	11.62	0.30	8.00	14.00	23	9.86	0.23	6.40	12.00
tbl	17	11.42	0.23	8.80	13.00	23	9.60	0.19	7.50	11.00
h4t	17	18.11	0.54	12.00	20.80	23	16.41	0.42	11.30	19.00
hfl	17	38.35	0.61	31.00	42.00	23	34.28	0.52	29.00	38.40

Table 4. ANOVA and ANCOVA (with svl used as covariate) conducted on body measurements.

	ANOVA			ANCOVA		
	df	**F**	**p**	**df**	**F**	**P**
trl	1, 38	1.67	0.20	1, 37	11.56	0.002
hl	1, 38	87.83	<0.0001	1, 37	25.92	<0.0001
pl	1, 38	0.05	0.82	1, 37	0.47	0.50
esd	1, 38	104.07	<0.0001	1, 37	30.34	<0.0001
hw	1, 38	44.40	<0.0001	1, 37	11.84	0.001
hh	1, 38	110.41	<0.0001	1, 37	37.41	<0.0001
mo	1, 38	89.97	<0.0001	1, 37	23.79	<0.0001
hul	1, 38	30.25	<0.0001	1, 37	11.18	0.02
ul	1, 38	18.04	0.0001	1, 37	15.54	0.0003
f4t	1, 38	10.52	0.003	1, 36	6.87	0.01
ffl	1, 36	21.60	<0.0001	1, 35	11.66	0.002
fl	1, 38	22.71	<0.0001	1, 37	2.95	0.09
tbl	1, 38	37.66	<0.0001	1, 37	14.71	0.0005
h4t	1, 38	6.31	0.02	1, 37	6.02	0.02
hfl	1, 38	26.97	<0.0001	1, 37	11.45	0.002

Table 5. Descriptive statistics conducted on pholidotic characters of preserved specimens.

	MALES					FEMALES				
	N	**Mean**	**ES**	**Min.**	**Max.**	**N**	**Mean**	**ES**	**Min.**	**Max.**
dors	52	71.08	0.54	60.00	79.00	**43**	67.23	0.43	61.00	73.00
vent	51	25.92	0.15	23.00	28.00	**44**	27.86	0.16	25.00	30.00
coll	49	10.63	0.14	9.00	13.00	**43**	10.44	0.15	9.00	13.00
gul	50	29.56	0.30	23.00	34.00	**44**	28.81	0.27	25.00	33.00
fpor	51	19.82	0.20	16.00	22.00	**44**	19.66	0.23	17.00	24.00
4toe	48	29.40	0.16	27.00	31.00	**42**	28.57	0.20	26.00	32.00
scs	52	5.33	0.09	4.00	7.00	**44**	5.23	0.10	4.00	6.00
scg	52	12.52	0.37	7.00	22.00	**44**	11.93	0.34	4.00	15.00
st	49	5.47	0.15	3.00	9.00	**44**	5.32	0.14	4.00	7.00
sl	51	3.96	0.03	3.00	4.00	**44**	4.00	0.00	4.00	4.00
sm	50	1.12	0.08	0.00	3.00	**44**	1.20	0.10	0.00	4.00

Table 6. ANOVA and ANCOVA (with svl used as covariate) conducted on pholidotic characters.

	ANOVA			ANCOVA		
	df	**F**	**p**	**df**	**F**	**P**
dors	1, 93	29.27	<0.0001	1, 92	30.26	<0.0001
vent	1, 93	82.14	<0.0001	1, 92	73.24	<0.0001
coll	1, 90	0.87	0.35	1, 89	1.04	0.31
gul	1, 92	3.32	0.07	1, 91	2.35	0.13
fpor	1, 93	0.30	0.58	1, 91	0.32	0.57
4toe	1, 88	10.32	0.002	1, 87	5.70	0.02
scs	1, 94	0.16	0.48	1, 93	0.08	0.77
scg	1, 94	1.32	0.25	1, 93	2.79	0.10
st	1, 91	0.53	0.47	1, 90	0.10	0.76
sl	1, 93	1.76	0.19	1, 92	1.03	0.31
sm	1, 92	0.45	0.51	1, 91	0.30	0.58

of the length of the body, while in females it is 54.53% (Tabs 3 and 4). Regarding pholidotic characters, males have more dorsal scales and more scales under the fourth toe, while females have more ventral scales; this can be related to the fact that females have a longer trunk in respect to snout-vent length. The other characters do not show significant differences between the sexes (Tabs 5 and 6).

Table 7. Correlation between tail status, sex and SVL.

Correlations

	df	sex	SVL	tail
sex	Pearson Correlation	1	-,705**	,053
	Sig. (2-tailed)		,000	,746
	N	41	41	40
	Pearson Correlation	-,705**	1	-,119
SVL	Sig. (2-tailed)	,000		,465
	N	41	41	40
	Pearson Correlation	,053	-,119	1
	Sig. (2-tailed)	,746	,465	
tail	N	40	40	40

** Correlation is significant at the 0.01 level (2-tailed)

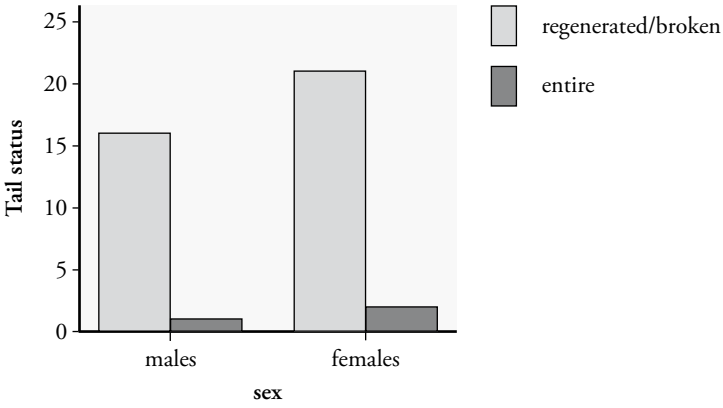

Figure 3. Tail *status*.

Average population size was about 2500 individuals, with a mean density of nearly 850 individuals per ha. In both males and females 90% of the observed individuals had regenerated tails (Fig. 3) which could suggest high predation pressure as well as intraspecific competition (Pérez-Mellado *et al.*, 1997) but no correlation has been observed between sex and tail *status*, nor between the latter and SVL (Tab. 7). On the islet, *Falco peregrinus* is known to nest. This bird of prey is known catching preys flying, while *Falco tinnunculus*, a lizard-eating bird of prey, has been never observed on the islet as well as rats. Further observations are needed to clarify this aspect.

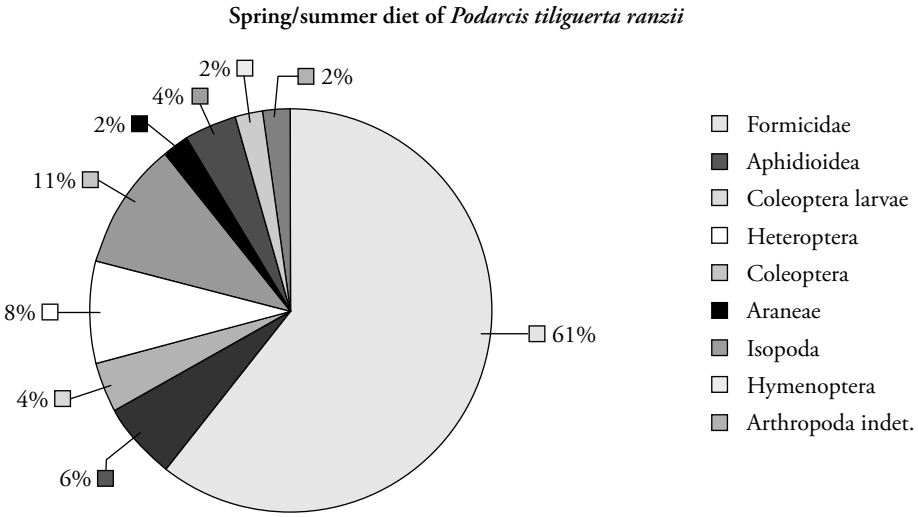

Figure 4. Preliminary observations on the spring/early summer diet of *Podarcis tiliguerta* (n = 12).

Very preliminary data regarding faecal analysis seem to indicate an high consumption of Formicidae (Fig. 4) which is relatively typical for islet characterized by low food availability (Pérez-Mellado & Corti, 1993).

References

Bruschi S., Corti C., Carretero M.A., Harris D.J., Lanza B. & Leviton A., 2006. Comments on the Status of the Sardinian-Corsican Lacertid Lizard *Podarcis tiliguerta.* Proceedings of the California Academy of Sciences, 57(6): 225-245.

Pérez-Mellado V. & Corti C., 1993. Dietary adaptations and herbivory in lacertid lizards of the genus *Podarcis* from western mediterranean islands (Reptilia: Sauria). Bonn. Zool. Beitr., 44 (3-4): 193-220.

Perez-Mellado V., Corti C. & Lo Cascio P., 1997. Tail autotomy and extiction in Mediterranean lizards. A preliminary study of continental and insular populations. Journal of Zoology, 243: 533-541.

Poggesi M., Agnelli P., Borri M., Corti. C., Finotello P.L., Lanza B. & Tosini G., 1995. Erpetologia delle isole circumsarde. Biogeographica, (N.S.) 18[1994]: 583-618.

Thomas L., Laake J.L., Strindberg S., Marques F.F.C., Buckland S.T., Borchers D.L., Anderson D.R., Burnham K.P., Hedley S.L., Pollard J.H., Bishop J.R.B. & Marques T.A., 2006. Distance 5.0. Release "x"1. Research Unit for Wildlife Population Assessment, University of St. Andrews, UK. http://www.ruwpa.st-and.ac.uk/distance

Vasconcelos, R., Harris D.J, Corti C., Carretero M.A., Capula M., Pinho C., Delauguerre M. & Spano G., 2006. *Podarcis tiliguerta*, a species complex. In: Corti C., Lo Cascio P. & Biaggini M. (eds). Mainland and Insular Lizards: a Mediterranean Perspective. Firenze University Press, Florence, Italy.