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Research article

Growth in a young male brown bear (*Ursus arctos* L., 1758) (Mammalia: Carnivora) captured and tagged with GPS-GSM collar

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Abstract: Body growth in mammals is an aspect of their biology that has always been interesting and carries important information about the individual's development. The relationship between growth patterns and factors that are affecting them, such as parasitism, is not entirely clear. In this short communication, we provide information obtained from a young brown bear (*Ursus arctos*), shot a year after being collared. Analysed growth patterns show a noticeable increase in the weight and circumference of the chest and head. The established low to moderate infestation with Baylisascaris transfuga in relation to absence of other parasites, has not affected the growth processes.

Keywords: body conditions, body mass, body size, brown bear cub

Introduction

Increase of body size in mammals is extremely important during the early stages of the life cycle, especially in predators (McNab, 1989). Brown bears are no exception. Individuals continue to grow for about 14 to 15 years (Blanchard, 1987), with the growth rates being more intense during the first couple of years. Rapid growth in the first months after birth is crucial for the survival of the cubs outside the den, especially considering Ursidae have lighter neonates (% of mother body mass) than all other Carnivora families (Gittleman, 1986). Therefore, their weight increases from 500 g (at birth) to 12 kg for females and 14 for males during the first five months (Tumanov, 1995). This rate stays a constant in the next three years.

Growth patterns vary depending on sex, diet, duration of mother care and other factors. Females usually wean the cubs before or during the breeding season which is April – June (Shimozuru et al., 2017). Some studies have found that the measured weight in the first three years has almost a double annual increase (Blanchard, 1987), even in orphaned individuals (when they have managed to survive) (Swenson et al., 1998). Male individuals have significantly larger body size (skull, body and hind paw length) after the first year and rapid growth is especially important for them, since they tend to roam at unsuitable habitats in the search of available territory and resources (Leland, 1977).

One of the factors affecting the growth rate is the presence of parasites in the body of the animals. Infestation by different organisms can affect not only the accumulation of mass but also the survival rate of the young individuals.

Baylisascaris transfuga (Nematoda: Ascarididae) is the dominant endoparasite in brown bears for the

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past few years in various countries like Slovakia, Romania, Poland and Italy (Borka-Vitalis et al., 2017; De Ambrogi et al., 2011; Gawor et al., 2017; Orosova et al., 2016; Štrkolcova et al., 2018). It is also the leading nematode species in European wild bears (Rigg & Adamec, 2007). Zoonotic potential (human larva migrans syndrome) of this nematode species increases its significance as parasitic pathogen from wildlife (Kazacos, 2016). *B. transfuga* is highly infectious parasite and studies have shown that 50–100% of bears harbour it, including cubs that can get heavily infected (Foster et al., 2011; Sprent, 1968). Heavy infestation can even lead to death (Testini et al., 2011).

Material and methods

Study area

Stara Planina Mountains is a home to one of the two large subpopulations of brown bears in Bulgaria. Approximately 100 bears inhabit that region, according to data from the annual national monitoring of the species (Executive Environmental Agency (Ministry of Environment and Water), 2016). Abundance of resources and suitable terrain are a prerequisite for the northern side of the mountain to have a higher bear density. The presence of forestry and hunting enterprises, which have higher level of security and provide additional food, is possibly another factor for the suitability of the territory. Parts of the study area falls within the borders of the largest national park in Bulgaria (Central Balkan), where some of the largest old-growth beech forests in Eastern Europe can be found (CB Administration, 2019).

First measurement

During the capture, two standard Aldrich snares (Aldrich Snare Co., Washington) were used, forming a trapline and placed near a tree with bait on it. MMS camera-traps (Ltl Acorn/ model LTL5210-MG) were used as capture alert system during the night, to minimise the bear stay in the trap. This made the process of capturing to be around 40 min. from the first picture alerting the animal is in the trap to first dart.

The collared bear (CB9) was a second-year cub, led by his mother (present at the capture site). It was captured on 2 November 2016 on State Hunting Enterprises (SHE) Rusalkas' feeding station, also called "Gorna Marishnitsa". Upon capture, the bear was immobilised with Teledart CO2 injection gun from a car using a Tiletamine/Zolazepam (Zoletil Virbac 50; 5 mg/kg) (Arnemo & Fahlman, 2007). Due to a fast recovery from sedation (28 min.) only 9 measures were taken (Fig. 1): mass, body length, head length, neck circumference, hear circumference, chest circumference, width of left front food, width of left hind foot, length of hind pad without claws.

The bear cub was marked with GPS-GSM collar Followit (Tellus GPS Medium Plus, Followit, Lindesberg AB, Sweden). The collar worked properly until the 1 September 2017 (1130 fixes).

Second measurement

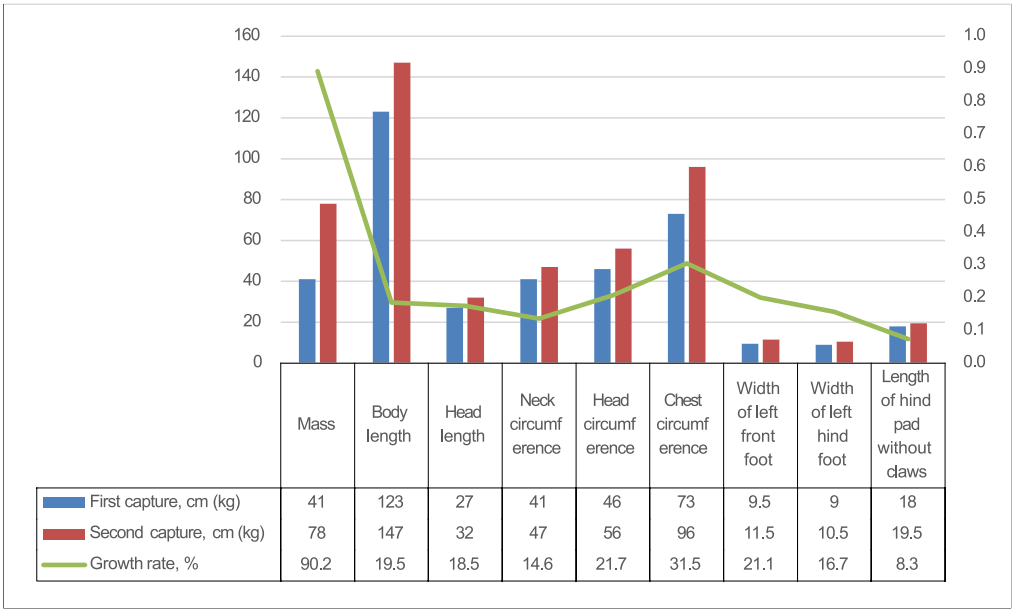
The second measurement was performed one year and 20 days after the tagging. On 23 November 2017, CB9 carcass was found in the area of Kartala located near the village of Enina, at 43 km (by air) southeast from the core area of its home range. The individual had been shot dead and the body was in extremely preserved state. There was a layer of snow covering the corpse, which indicates that the death occurred before the last snowfall on 18 November 2017. Thirty measurements were taken (Table 1).

Helminthological study

Partial helminthological necropsy was performed on the bear's carcass. All parts of gastrointestinal (GI) tract, internal visceral organs and diaphragm striated muscle sample were obtained for helminthological examination. Fecal sample taken from the rectum was tested for the presence of parasitic sexual products (eggs and oocysts) by salt and Sheather's flotation tests (Zayac & Conboy, 2012).

Results and discussion

The results of the measurements confirm the previous observations of extremely fast body growth in brown bears during the first years of their lives. Weight gain is almost double between two measurements (92.2 %). High degree of skeletal growth is also present – head circumference (21.7 %), chest circumference 31.5 %),



	Mass	Body length	Head length	Neck circumference	Head circumference	Chest circumference	Width of left front foot	Width of left hind foot	Length of hind pad without claws
First capture, cm (kg)	41	123	27	41	46	73	9.5	9	18
Second capture, cm (kg)	78	147	32	47	56	96	11.5	10.5	19.5
Growth rate, %	90.2	19.5	18.5	14.6	21.7	31.5	21.1	16.7	8.3

Fig. 1. Comparison of measurements between the two captures.

Table 1. Second body measurements.

Measurement type	**Measurement (cm)**	**Measurement type**	**Measurement (cm)**
Tail length	9	Front foot. Left. Length with Central Claw	14
Shoulder height	82	Front foot. Left. Length with pad (no claw)	17
Distance from eye to nose	12.5	Front foot. Left. Length of Central Claw	4.5
Distance between ears	16	Front foot. Right. Width	12
Head width	21	Front foot. Right. Length	9
Length of ear LEFT	11	Front foot. Right. Length with Central Claw	13
Length of ear RIGHT	12	Front foot. Right. Length with pad (no claw)	18
Tooth wear Canines	4-4C	Front foot. Right. Length of Central Claw	5
Tooth wear Incisors	6-6I	Hind foot. Left. Length	20
Length canines. Upper left	33	Hind foot. Left. Length with Central Claw	21.5
Length canines. Upper right	34	Hind foot. Left. Length of Central Claw	2
Length canines. Lower left	31	Hind foot. Right. Width	11
Length canines. Lower right	30	Hind foot. Right. Length	20
Distance between canines UPPER	61	Hind foot. Right. Length with Central Claw	22
Distance between canines LOWER	58	Hind foot. Right. Length with pad (no claw)	19.5
Front foot. Left. Length	10.5	Hind foot. Right. Length of Central Claw	2.5

head and body length (18.5 % and 19.5 %). The least pronounced change is the width of front food and length of hind food and the circumference of the neck (14.6 %). The data from the second measurement are shown in Table 1. The comparison between first and second measurement results are presented in Fig. 1.

Our results provide a basis to agree with data from previous surveys, showing that the weight of brown bears is growing rapidly, from the end of the first year to the end of the third (Huber et al., 1993; Kingsley et al., 1988; Kojola & Laitala, 2001; Swenson et al., 2007). The measured autumn body mass is not relevant to the absolute mass of the individual, especially in brown bears, whose mass varies widely before and after hibernation. However, several parameters give a sufficiently clear idea of the growth rate in this particular male individual – the increase in weight, the expansion of the circumference of the thorax and the significant increase in the size of the head.

The infestation with nematode *B. transfuga* in an individual from Bulgaria once again confirms the species being the most common parasite for bears, especially brown bears (Schaul, 2006). However, only five specimens of a nematode in the small intestine would not affect the normal growth and health status of the animal, since it is considered low infestation, especially it is assumed that bears raised in a controlled environment are uninfected (Huber et al., 1993).

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Research article

Petalophyllum ralfsii (Wilson) Nees et Gottsche in Calabria: distribution, ecology and conservation

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Abstract: This paper reports data on distribution of *Petalophyllum ralfsii* in Calabria (S Italy). Investigations conducted from 2016 to 2019 permitted to outline an updated and accurate overview on the number and size of the populations of the species in the region. New findings were recorded, while some known locations were not confirmed. The size of each population was measured by direct counting of thalli or by sampling with plots, enabling to have a reliable estimate of the species density. Analysis of data gives also important information on the ecology and dynamism of the species.

Keywords: Calabrian bryoflora, Habitat Directive species monitoring, *Petalophyllum ralfsii*

Introduction

After the discovery of a new population of *Petalophyllum ralfsii* (Wilson) Nees & Gottsche in Calabria, an investigation was launched in 2016 to verify known populations and apply methods for quantifying density. In the area of the middle Valle of Crati River, small populations were already known, with dozens of individuals. The new site, which by number of individuals could represent the largest population in Italy, has been the subject of various inspections in which an attempt has been made to develop an effective and expeditious monitoring methodology. Monitoring activities have been extended to all the populations known in Calabria, located largely along the Crati Valley. The presence of the species elsewhere is more sporadic, in particular on the Tyrrhenian coast (Capo Suvero), the Ionian coast (Foce del Crati) and in the surroundings of Crotone, where however the presence has not been confirmed recently.

Petalophyllum ralfsii is a thallose liverwort, included in Appendix I of Bern Convention of 1991 and listed on Annex II of the EU Habitats Directive. It has a light green thallus 5–10 mm long, with thin lateral wings and carinated rib, swelled at the end, in old thalli covered by rhizoids. Sporophytes ripe in March–April. It develops in springs and disappears in summer when it survives the aridity producing spores, remaining dominant till next spring. Also, it has a rhizome-like subterranean axis which becomes tuberous at the apex of mature plants, and which enables it to withstand long periods of desiccation (Paton, 1999).

The species occurs on wet and sandy places, on the shore of coastal ponds, in the rainiest periods, from the level of the sea up to 300 m of altitude. It is an Oceanic-Mediterranean species, distributed in the Mediterranean Region extending northwards along the Atlantic coast (Campbell et al., 2015). Populations of southern USA were recently referred to a distinct species, *P. americanum* C. H. Ford & Crand.-Stot. (Crandall-Stotler et al., 2002).

In Europe *P. ralfsii* is not very widely distributed. It has discontinuous populations in North Africa, Spain (in the Balearic Islands), Portugal, Greece (including

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Crete), Italy (including Sicily and Sardinia), and Turkey, extending northwards along the Atlantic coast to Britain and Ireland (Söderström et al., 2002; Ros et al., 2007).

A review of its distribution in Italy is presented in Aleffi (2008) who reports it in few localities of Tuscany, Calabria, Sicily and Sardinia (11 localities total). In Calabria only two sites are indicated: Capo Suvero and Campagnano (Aleffi & Puntillo, 1998).

Last investigations in Calabria allow to have a more updated and exhaustive scheme of distribution in the Region, showing a very changeable situation, with new populations recording in dynamic environments and frequent disappearance of others. A short term monitoring system is necessary for a correct interpretation of population dynamism and trends of this so interesting species.

Material and methods

Distribution data in Calabria come mostly from investigations and collections started in 80s by D. Puntillo. Specimens kept in the Herbarium of Museum of Natural History of Calabria and Botanic Garden (CLU) have been used to outline the preliminary distribution map of the species in the region.

New field surveys were carried out from 2016 to 2019 in order to verify known populations, extending investigations to potential sites looking for new findings.

Phytosociological relevés were carried out in order to determine syntaxa and Natura 2000 habitat in which the species occurs.

Monitoring methods applied for the species in other countries (Campbell et all., 2015) have been evaluated as well as methodology proposed in Italy (Ercole et al., 2016), in order to comply with commitments arising from article 17 of Habitat Directive, but above all to obtain useful information about trend and dynamism of populations in South Italy, the effective impact of human activities and the real conservation status of the species.

For every population, the covered area was calculated in m^2. When possible, for small populations, number of individuals were estimated by coverage percentage and direct counting of single thalli. For larger populations counting was carried out in small plots of 0,5 m x 0,5 m, with a grid of 0,1 m x 0,1 m. The area covered by the population (m^2) was multiplied by the mean number of thalli/m^2.

Results and discussion

In Calabria, *Petalophyllum ralfsii* is recorded in three main areas: Neto River, close to Cotronei in the province of Crotone; on the Thyrrenian coast, north of Cape Suvero (Falerna, CS) and in the Crati Valley, from Cosenza to the Crati River mouth. Investigations in these three areas permit to update distribution data as shown in Table 1.

Population of Neto river (PET_CAL9), recorded in 1997, was not confirmed, and its disappearance is probable because of drastic changes in the location. The station of Falerna (PET-CAL4) is confirmed, but with a very small population (ca. 40 thalli). The Crati Valley (Table 2) is the most important area for this species, with numerous surviving populations (many of them are new findings) and three not confirmed in 2017–2018 investigations. Most of locations are situated along the Crati Valley very close to tributaries of Crati River (Annea, Mavigliano, Settimo, Campagnano), within an area of 15 km long, at an altitude range between 120 and 200 m a.s.l. In Annea (PET_CAL3) and Mavigliano creeks (PET_CAL2) the areas covered by the populations are very small (45 and 140 m^2). The latest findings during Natura 2000 monitoring activities in 2018 allow to extend distribution area up to the Crati River mouth (PET_CAL12).

Substratum is characterised by alluvial soils, rich in sand and very wet in winter and spring. Only the populations in Cape Suvero (PET_CAL4) and Crati River mouth (PET_CAL12) are located on the dunal system, on depressions with compact sand, from 40 to 90 m far from shoreline.

All locations are in a strong dynamic ecological contest, due not only to the characteristics of ecosystems (coastal dunes and river banks), but also to human activities.

The population found in 2016 along Settimo creek (PET_CAL1) is probably the largest one in Italy, with a covered area of 2590 m^2 and a density that reaches 700 thalli per m^2. Total number of thalli in the location is estimated of 414000 individuals!

Petalophyllum ralfsii occurs in communities that does not have a clear phytosociological characterisation. Generally it is considered belonging to *Isoëto-Nanojuncetea* Br.-Bl. & Tüxen ex Westhoff, Dijk & Paschier 1946, but also to bryophytic alliance *Phascion* Waldheim 1944 (syn: *Tortulion acaulonis* Waldheim 1944) of *Psoretea decipientis* Mattick ex Follmann 1974 (syn: *Barbuletea unguiculatae* Mohan 1978) that

Table 1. Localities known in Calabria.

Location code	Locality	x	y	Check 2017–2018	Notes
PET_CAL1	hydrographic left of Settimo stream, Settimo di Montalto, Montalto Uffugo (CS)	606942	4360388	confirmed	—
PET_CAL2	hydrographic right Mavigliano stream, Montalto Uffugo, (CS)	605760	4361632	confirmed	—
PET_CAL3	hydrographic right Annea stream, Taverna, Montalto Uffugo (CS)	606563	4366387	confirmed	—
PET_CAL4	North of Capo Suvero, Falerna (CZ)	599839	4313256	confirmed	—
PET_CAL5	hydrographic right Mavigliano Stream, Montalto Uffugo (CS)	607100	4361929	unreachable	—
PET_CAL6	Bosco di Mavigliano, Montalto Uffugo (CS)	604526	4359803	confirmed	—
PET_CAL7	Campagnano, Rende (CS)	607786	4353695	not found	Habitat transformation
PET_CAL8	hydrographic left Crati River, Rende (CS)	607849	4359892	confirmed	—
PET_CAL9	hydrographic right Neto River, Cotronei (KR)	656586	4337142	not found	Habitat transformation
PET_CAL10	hydrographic right Annea Stream, Taverna, Montalto Uffugo (CS)	606730	4366475	not found	Habitat transformation
PET_CAL11	Loc. C. Trifoglio, near Grondo stream, Altomonte (CS)	601024	4392961	new	—
PET_CAL12	Crati River mouth, Corigliano Calabro (CS)	631030	4398059	new	—
PET_CAL13	Loc. Marinetto, Tarsia (CS)	610512	4385605	new	—

Table 2. Population sizes of *Petalophyllum ralfsii* in Calabria.

Location code	Area pop (m^2)	Area habitat (m^2)	Numbers of thalli	Method
PET_CAL1	2590	5450	414000	estimate based on 5 plots
PET_CAL2	177	9000	1800	estimate based on 3 plots
PET_CAL3	133	1500	124	direct count
PET_CAL4	1	800	39	direct count
PET_CAL6	10	6000	350	direct count
PET_CAL8	2	500	5	direct count
PET_CAL11	3	700	1200	direct count
PET_CAL12	5	500	300	direct count
PET_CAL13	3	100	70	direct count
Total	2924	24550	417888	—

includes typical euhemerophilous pioneer bryophyte vegetation on temporary dry and dry loamy soils in the nemoral and boreal zones (Ercole et al., 2016; Mucina et al. 2016).

Nordic community of Ireland and Great Britain are referred to "2190 Humid Dune Slack", listed on Annex I of the EU Habitats Directive. This habitat type has recently been ruled out from Italy, so coastal dune depressions are referred to other habitat types. In Ercole et al. 2016 *Petalophyllum ralfsii* is not referred to specific habitat in Council Directive 92/43/EEC.

In the relevé in Crati Valley characteristic species of *Isoëto-Nanojuncetea* are very scarce or absent, but there is a significant group of bryophytes of *Psoretea*

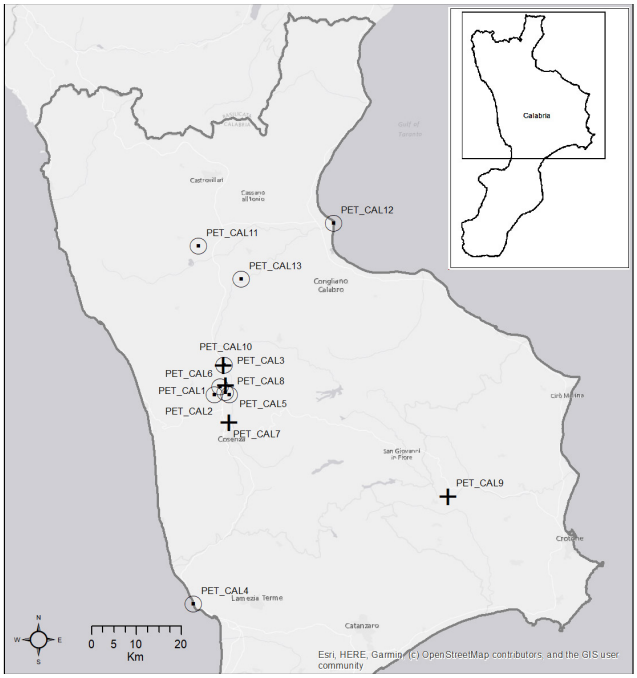

Fig. 1. Distribution of *Petalophyllum ralfsii* in Calabria (•) present; (+) not found.

decipientis. Among vascular plant the most frequent belongs to *Poetea bulbosae* Rivas Goday et Rivas-Mart. in Rivas-Mart. 1978 in which are included perennial, mainly hemicryptophytic Mediterranean pastures, and *Stellarietea mediae* Tüxen et al. ex von Rochow 1951 (annual, ephemeral, weed ruderal nitrophilous and sub-nitrophilous vegetation) (Table 3).

Distribution data of *P. ralfsii* in Italy have recently increased (Cogoni et al., 2006; Provenzano et al., 2011) because of more attention paid to this species since its inclusion in Annex II of Habitat Directive. Therefore, it's not easy to understand its real demographic trends at long term and there is no evidence of a clear decline also because of the scarcity of previous data. Moreover, the dynamism of habitats and the ecology of the species are at the base of strong fluctuations in population density.

In any case it is evident that *P. ralfsii* in Mediterranean area is not exclusive of coastal habitats (Puntillo, 2004; Sim-Sim et al., 2000; Cogoni et al., 2006; Provenzano et al., 2011), and in the inner areas it finds environmental conditions that are dynamically similar to a dunal system, preferring river banks and alluvial soils. By a diachronic comparison of orthophotos it is evident that the richest populations of Crati valley colonised former sand pits, where the species is advantaged by the scarcity of vascular flora (Fig. 3). A similar situation has been verified for other populations too.

The progressive stabilisation of substratum and the evolution of vegetation, with increasing of perennial herbs and shrubs, can determine a negative trend leading to the total disappearance of the population. In PET-_CAL6, for example, the population is very scattered probably because of gradual evolution of vegetation.

The species occurs on sandy and silty soils colonising open areas without arboreal and shrub vegetation. However, in many sites it was observed that thallus growing under grass heads and small shrubs are more luxuriant. Also, in the largest population (PET-CAL1) the species seems to tolerate the coverage of the falling down poplar leaves, where thallus is favoured by the persistence of humidity conditions. At the Crati River mouth, all micro-populations stand under *Ephedra distachya* shrubs. It is likely that on the Atlantic coasts *Petalophyllum* can live in drier environments, directly on the dunes, but with a more humid general climate. Whereas, in Mediterranean areas it needs small depressions with greater water stagnation where it finds favourite ecological conditions and, moreover, doesn't find competition with other bryophytes (Walter & Straka 1970).

It is a fact that all stands of *P. ralfsii* in Calabria are localised in areas subject to rapid and drastic transformations, often very close to urban agglomerations. For this, in spite of its pioneer character and new findings, it should continue to be considered a threatened species.

Definition of the range of the species is very difficult because of its ecology that in Mediterranean area is not confined to dunal habitats like in Northern Europe but colonises alluvial soils along river valleys.

In order to compensate costs and benefits, an optimised monitoring programme could be based on a rapid assessment of known populations, their size and main pressure factors. Simultaneously, small representative permanent areas, can be chosen for a detailed demographic analysis in order to interpret fluctuations and relations with ecological conditions and vegetation evolution.

Declaration

Present investigation started as study case in the LIFE project Natura 2000 Action Programme (2014-2017), with Calabria Region as beneficiary. Field surveys and

Table 3. Phytosociological relevés of communities with *Petalophyllum rallfsii*.

Relevé (n°)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Data	19/2/17	19/2/17	19/2/17	19/2/17	19/2/17	8/4/17	8/4/17	15/3/18	15/3/18	8/2/19	8/2/19	8/2/19	18/2/19
Area (m^2)	0,25	0,25	0,25	0,25	0,25	0,25	0,25	1	1	0,25	0,25	0,25	1
Altitude (m a.s.l.)	150	150	150	150	150	165	165	160	123	200	200	202	136
Total coverage (%)	90	100	100	100	95	95	100	90	80	90	95	100	90
Char. *Psoretea decipientis* Mattick ex Follmann 1974													
Petalophyllum ralfsii (Wilson) Nees & Gottsche	2	3	2	1	5	+	+	2	2	+	+	1	2
Fossombronia caespitiformis De Not. ex Rabenh.	1	+	.	1	.	.	.	1	.	+	1	+	.
Pleuridium acuminatum Lindb.	3	3	2	3	2	.	.	.	.	.	.	.	.
Pseudocrossidium hornschuchianum (Schultz) R. H. Zande	.	.	.	.	.	.	.	.	.	+	.	+	2
Corsinia coriandrina (Spreng.) Lindb.	+	.	.	.	.	.	.	.	.	.	.	+	.
Riccia sorocarpa Bisch	.	.	.	.	.	.	.	+	.	.	.	.	.
Char. *Poetea bulbosae* Rivas Goday et Rivas-Mart. in Rivas-Mart. 1978													
Plantago serraria L.	.	.	.	2	.	.	.	.	.	3	1	.	.
Trifolium nigrescens Viv. subsp. *nigrescens*	1	+	+	.	.	2	2	1	2.2	+	.	.	+
Parentucellia latifolia (L.) Caruel	+	+	+	+	.	+	.	+	.	+	1	.	+
Bellis annua L.	.	.	.	.	.	1	2	2	.	.	.	1	.
Romulea bulbocodium (L.) Sebast. & Mauri	.	.	.	.	.	+	.	.	.	2	2	.	.
Romulea columnae Sebast. & Mauri	.	.	.	.	.	.	.	1	.	.	.	.	.
Trifolium subterraneum L.	.	.	.	.	.	+	.	.	.	.	.	.	.
Char. *Stellarietea mediae* Tüxen et al. ex von Rochow 1951													
Cynodon dactylon (L.) Pers.	2	2	2	2	+	1	.	.	4	.	.	.	+
Erodium cicutarium (L.) L'Hér.	.	.	.	1	.	2	1	4	+	.	.	2	1
Euphorbia helioscopia L. subsp. *helioscopia*	.	.	+	.	.	+	+	.	+	.	+	.	+
Poa annua L.	4	3	2	.	.	.	.	.	.	.	.	+	.
Sherardia arvensis L.	.	.	.	.	+	+	+	.	+	.	.	.	.
Galactites tomentosus Moench	.	.	1	.	.	.	.	.	.	.	.	1	.
Anagallis arvensis L.	.	.	.	.	.	.	.	.	.	.	.	.	.
Other species													
Hypochaeris achyrophorus L.	+	+	.	.	+	+	+	1	.	.	.	+	2
Geranium molle L.	1	+	1	.	+	.	+	.	.	.	.	+	.
Cerastium sp.	+	+	.	.	+	+	.	.	+	+	.	1	.
Didymodon vinealis (Bridel) R. H. Zander	.	.	.	.	.	2	.	2.2	+	+	1	1	1
Crepis vesicaria L. subsp. *vesicaria*	2	1	1	.	.	1	2	.	.	.	.	.	.
Senecio vulgaris L. subsp. *vulgaris*	.	.	.	.	.	.	.	+	+	+	.	+	1
Sagina micropetala Rauschert	.	.	.	2	.	.	.	+	+	1	.	.	.
Hypochaeris radicata L.	+	.	.	.	.	.	+		+	.	.	.	.
Serapias lingua L.	.	.	+	.	+	.	.	.	.	1	.	.	.
Plantago bellardii All. subsp. *bellardii*	.	.	.	.	.	3	3	.	.	.	.	.	+

Table 3 continued…

Relevé (n°)	1	2	3	4	5	6	7	8	9	10	11	12	13
Carex sp.	.	.	.	.	.	.	.	.	.	+	2	2	.
Veronica sp.	+	.	.	.	.	.	.	.	.	+	.	.	.
Vicia sp.	.	.	1	.	+	.	.	.	.	.	.	.	.
Catepyrenium squamulosum	.	.	.	.	.	.	.	.	.	+	2	.	.
Bellis perennis L.	.	.	.	.	.	.	.	.	.	1	.	1	.
Filago germanica (L.) Huds.	+	+	.	.	.	.	.	.	.	.	.	.	.
Aphanes arvensis L.	.	+	.	.	.	.	.	.	.	.	.	1	.
Bryum capillare Hedw.	.	+	.	.	.	.	.	.	.	.	.	+	.
Cichorium intybus L.	.	.	.	.	.	.	.	.	.	+	1	.	.
Eurhynchium praelongum (Hedw.) Schimp.	.	.	.	.	.	.	1	.	.	.	.	1	.
Medicago sp.	.	.	.	1	.	.	.	.	.	2	+	1	.
Phaeoceros bulbiculosus (Brot.) Prosk	.	.	+	.	.	.	.	.	.	.	.	1	.
Vulpia sp.	.	.	.	.	.	+	+	.	.	.	.	.	.

Fig. 2. Comparison between 2017 (above) and 2002 (below) orthophotos of PET_CAL1 location. In red the position of the population.

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