Reptiles

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info fauna
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Reptilia: Crocodiles


Reptilia: Tuataras

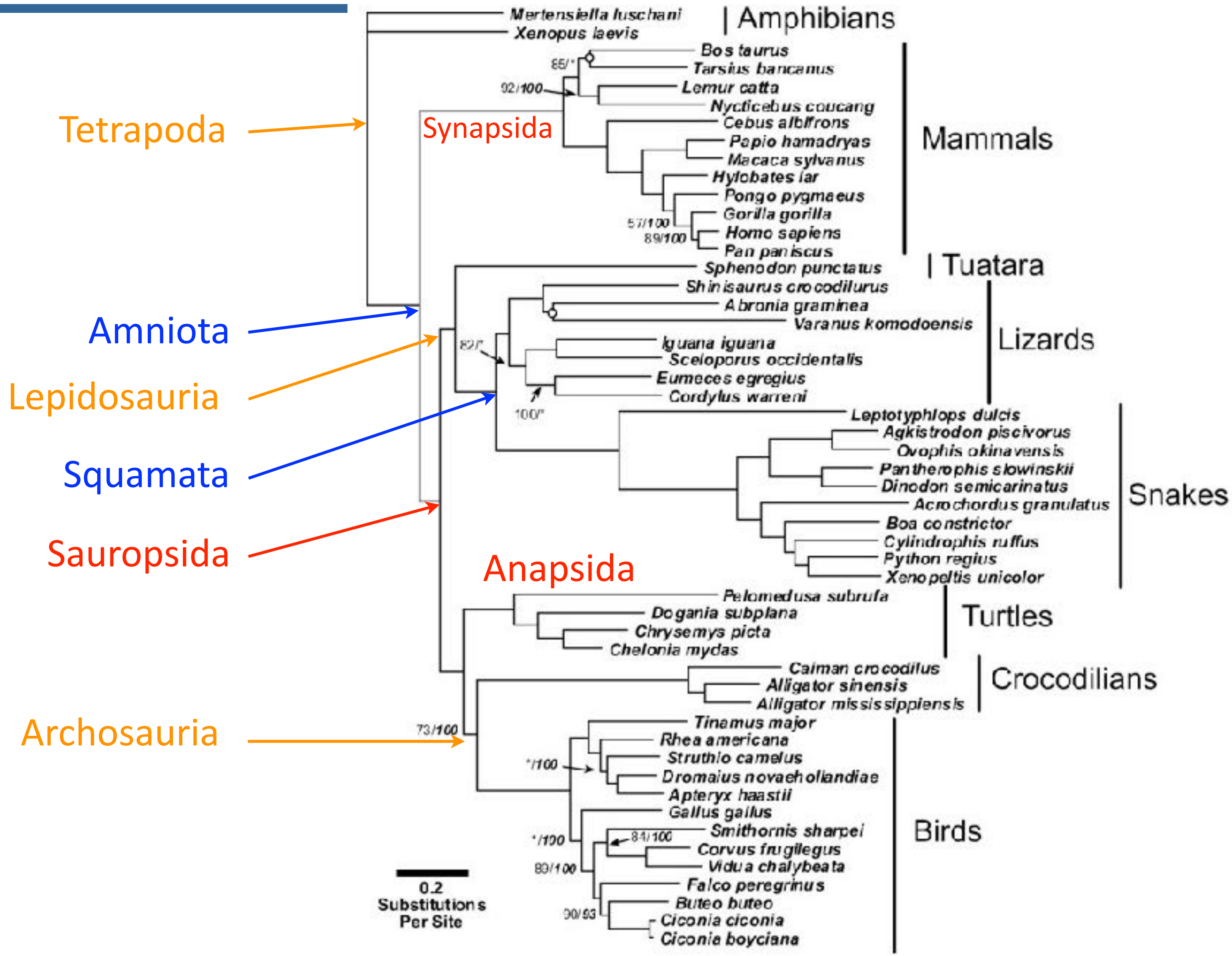

Reptilia: turtles


Reptilia: Squamata: snakes


Reptilia: Squamata: amphisbaenians


Reptilia: Squamata: lizards

Phylogeny



Tetrapoda
Amniota
Lepidosauria
Squamata
Sauropsida
Archosauria
Synapsida
Anapsida
Mertensiella luschani
Xenopus laevis
Amphibians
Bos taurus
Tarsius bancanus
Lemur catta
Nycticebus coucang
Cebus albifrons
Papio hamadryas
Macaca sylvanus
Hylobates lar
Pongo pygmaeus
Gorilla gorilla
Homo sapiens
Pan paniscus
Mammals
Sphenodon punctatus
Tuatara
Shinisaurus crocodilurus
Abronia graminea
Varanus komodoensis
Iguana iguana
Sceloporus occidentalis
Eumeces egregius
Cordylus warreni
Lizards
Leptotyphlops dulcis
Agkistrodon piscivorus
Ovophis okinavensis
Pantherophis slowinskii
Dinodon semicarinatus
Acrochordus granulatus
Boa constrictor
Cylindrophis ruffus
Python regius
Xenopeltis unicolor
Snakes
Pelomedusa subrufa
Dogania subplana
Chrysemys picta
Chelonia mydas
Turtles
Caiman crocodilus
Alligator sinensis
Alligator mississippiensis
Crocodilians
Tinamus major
Rhea americana
Struthio camelus
Dromaius novaehollandiae
Apteryx haastii
Gallus gallus
Smithornis sharpei
Corvus frugilegus
Vidua chalybeata
Falco peregrinus
Buteo buteo
Ciconia ciconia
Ciconia boyciana
Birds
92/100
57/100
89/100
100/*
73/100
*/100
*/100
84/100
89/100
90/93
0.2
Substitutions
Per Site

Phylogeny

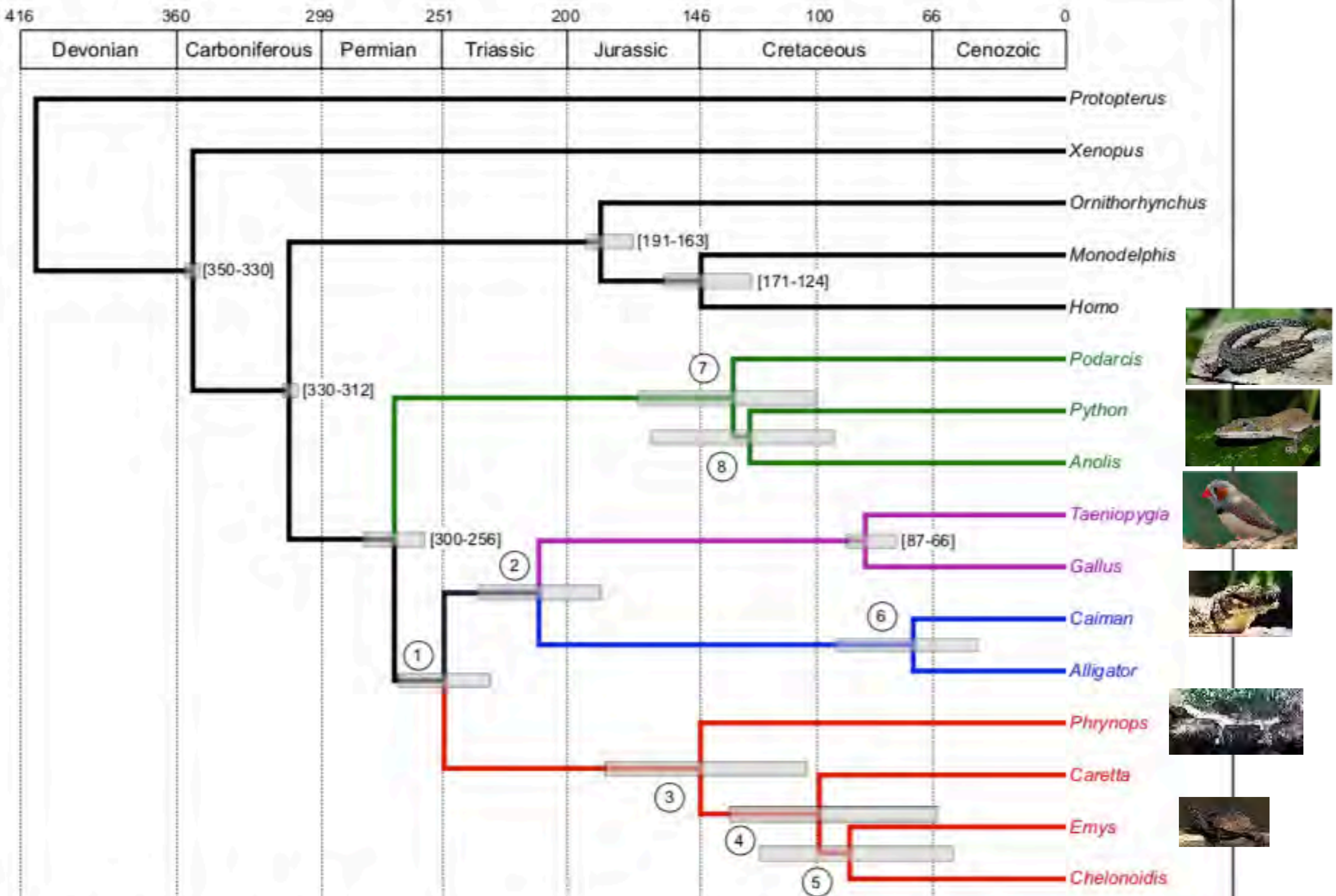


Figure 4 Bayesian relaxed molecular clock time scale. Chronogram obtained from the analysis of the nucleotide dataset using the CAT-GTR + G mixture model. Numbers in circles at nodes refer to lines of Table 3, and squared boxes represent 95% credibility intervals. Numbers between brackets represent the six calibration constraints implemented as soft bounds. Absolute ages of the geological periods follow Gradstein and Hogg [91].

Amphibians – reptiles - *differences*

	Amphibians	Reptiles
skin	numerous glands, generally wet, without scales	without or with limited number of glands, dry, with scales
reproduction	most of them in water, larval stage	no links with water, without a larval stage
eggs	most of them in water, packed in tranparent jelly	not in water, hard shell (leathery or with calk)
venom	passive transmission of venom, toxic skin as passive protection	some species with active venom injection
habitats	Generally in humide and shady areas, nearby or directly in aquatic habitats	Generally dry and warm habitats, away from aquatic habitats
migration	large seasonal movements inducing big traffic problems	no or limited seasonal movements, limited traffic problems

First reptiles

- first reptiles: about 320-310 millions years ago
- embryo is protected against dehydration
- ≈ 305 millions years ago:
  a dryer period ➜ new habitats for reptiles
- Mesozoic (252-66 mya): “Age of Reptiles”
- large disparition of species: ≈ 252 and 65 millions years ago

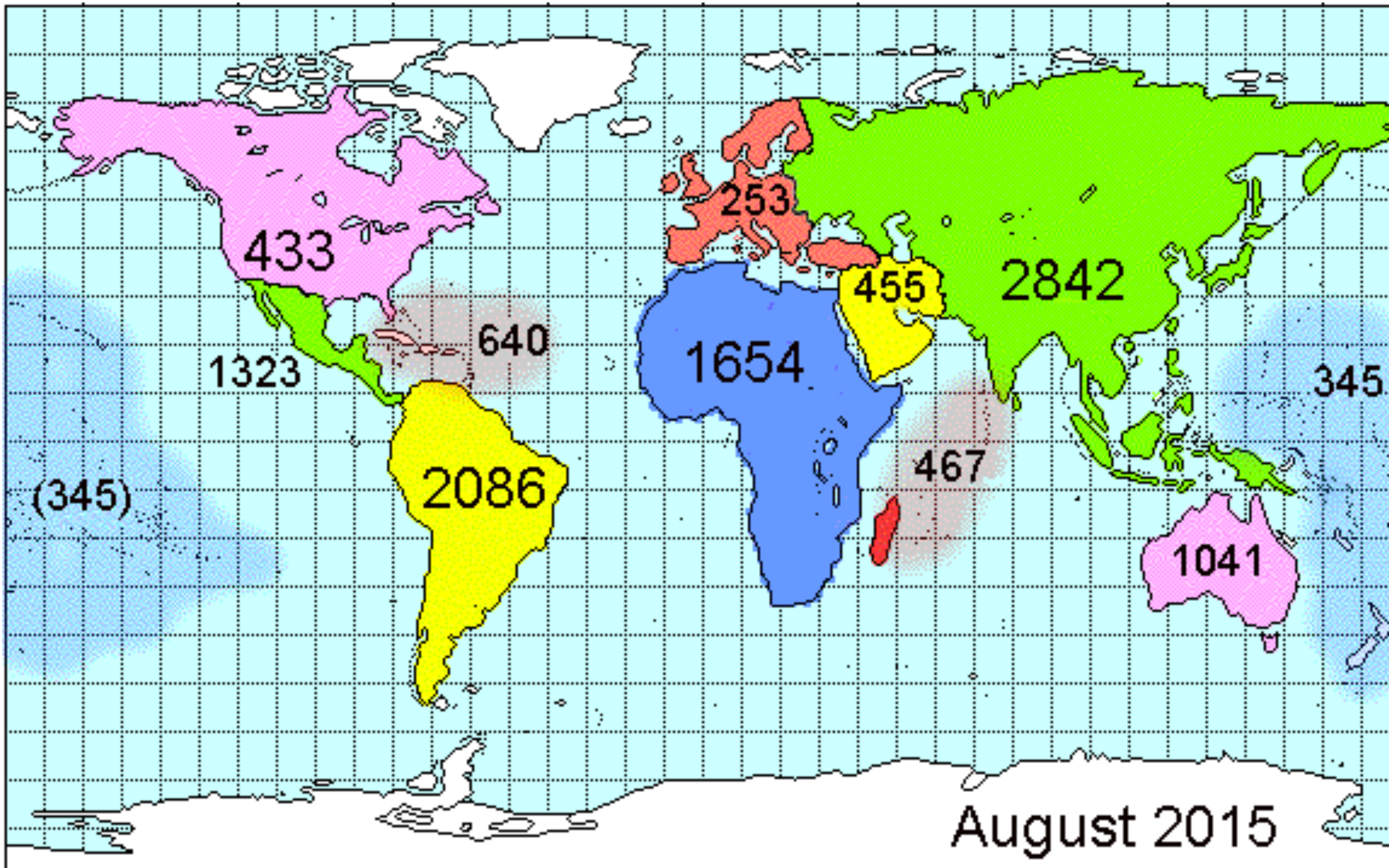

Mesozoic

Quick systematic overview

	total species (oct 2017)	CH species
Order Crocodylia (crocodiles) *Crocodiles, alligators, caimans and garvial*	24	0
Order Testudines (turtles) *terrestrial and aquatic turtles (tortoises and turtles)*	350	1
Order Rhynchocephalia *Tuataras*	1	0
Order Squamata (scales reptiles)		
clade Amphisbaenia (worm lizards)	139	0
clade Lacertilia or Sauria (lizards)	6399	6
clade Ophidia or Serpentes (snakes)	3672	9
Total	**10639**	**16**

source: http://www.reptile-database.org

Worldwide diversity of reptiles (2015)



Turtles and lizard of Switzerland

Order Testudines	
Family Emydidae (Pond Turtles)	
European pond turtle	*Emys orbicularis*
Order Squamata	
clade Lacertilia	
Family Anguidae (Slow worms)	
slow worm	*Anguis fragilis*
Italian slow worm	*Anguis veronensis*
Family Lacertidae (Lizard)	
viviparous or common lizard	*Zootoca vivipara*
sand lizard	*Lacerta agilis*
Western green lizard	*Lacerta bilineata*
wall lizard	*Podarcis muralis*

Snakes of Switzerland

Order Squamata

clade Ophidia

Family Colubridae (Colubrids)

Western grass snake	*Natrix natrix*
Barred grass snake	*Natrix helvetica*
Dice snake	*Natrix tessellata*
Viperine snake	*Natrix maura*
Smooth snake	*Coronella austriaca*
Green whip snake	*Hierophis viridiflavus*
Aesculapian snake	*Zamenis longissimus*

Family Viperidae (Vipers)

Adder	*Vipera berus*
Asp viper	*Vipera aspis*

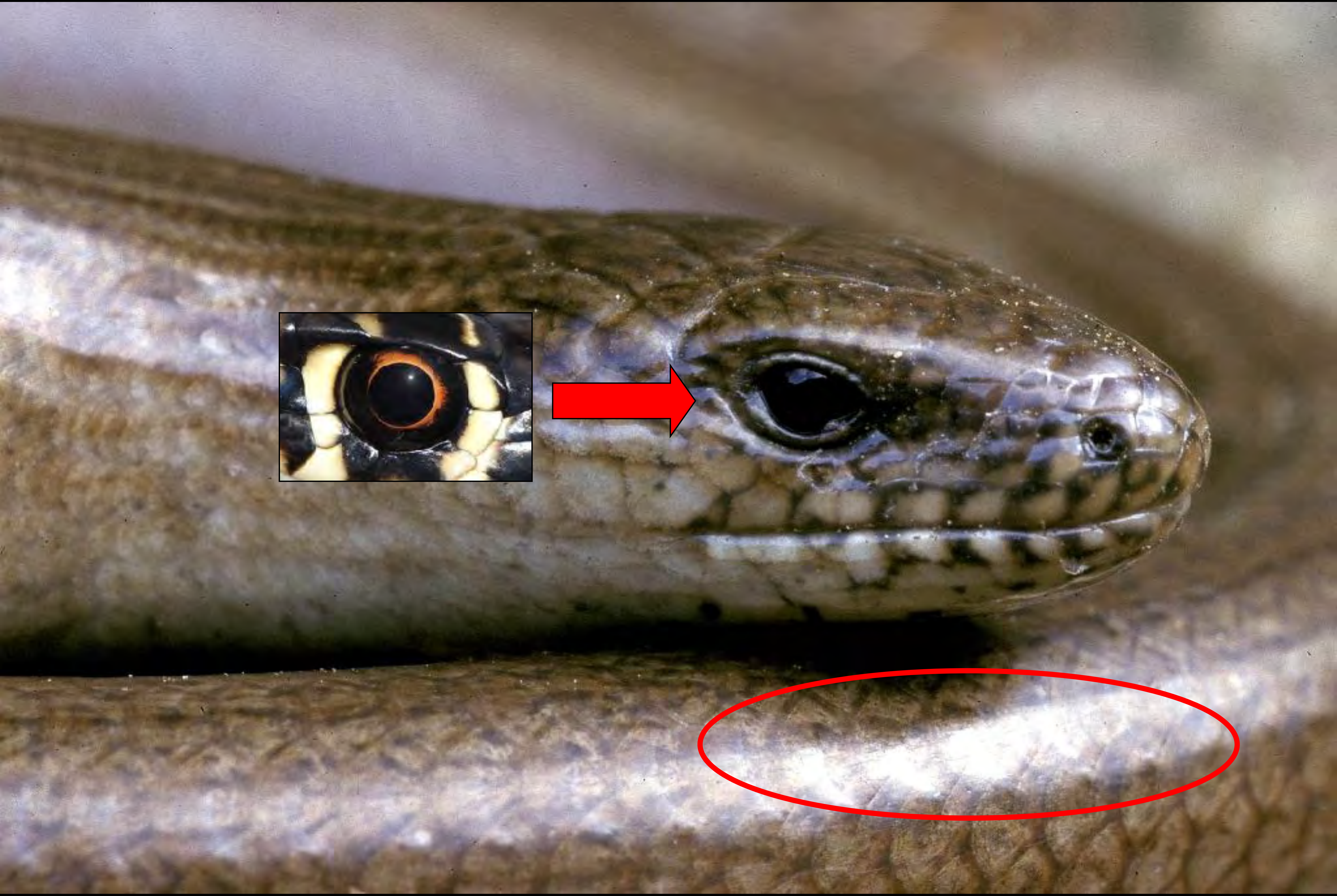
Slow worms (*Anguis fragilis*)

Slow worm - *characteristics*

- length: about. 40 cm (♂ max. 48 cm, ♀ max. 38 cm)
- long tail, snout-vent length only about 1/3 of the total length
- bright and smooth scales
- similar scales on the back and on the belly (on the opposite to snakes)
- coloration: grey to copper brown;
  ♂ : generally uniformly grey, sometimes with blue dots,
  ♀ and juveniles: dark on the flancs, generally with a small dark line on the back
- viviparous
- harmless

easy to find under plates, boards, etc…

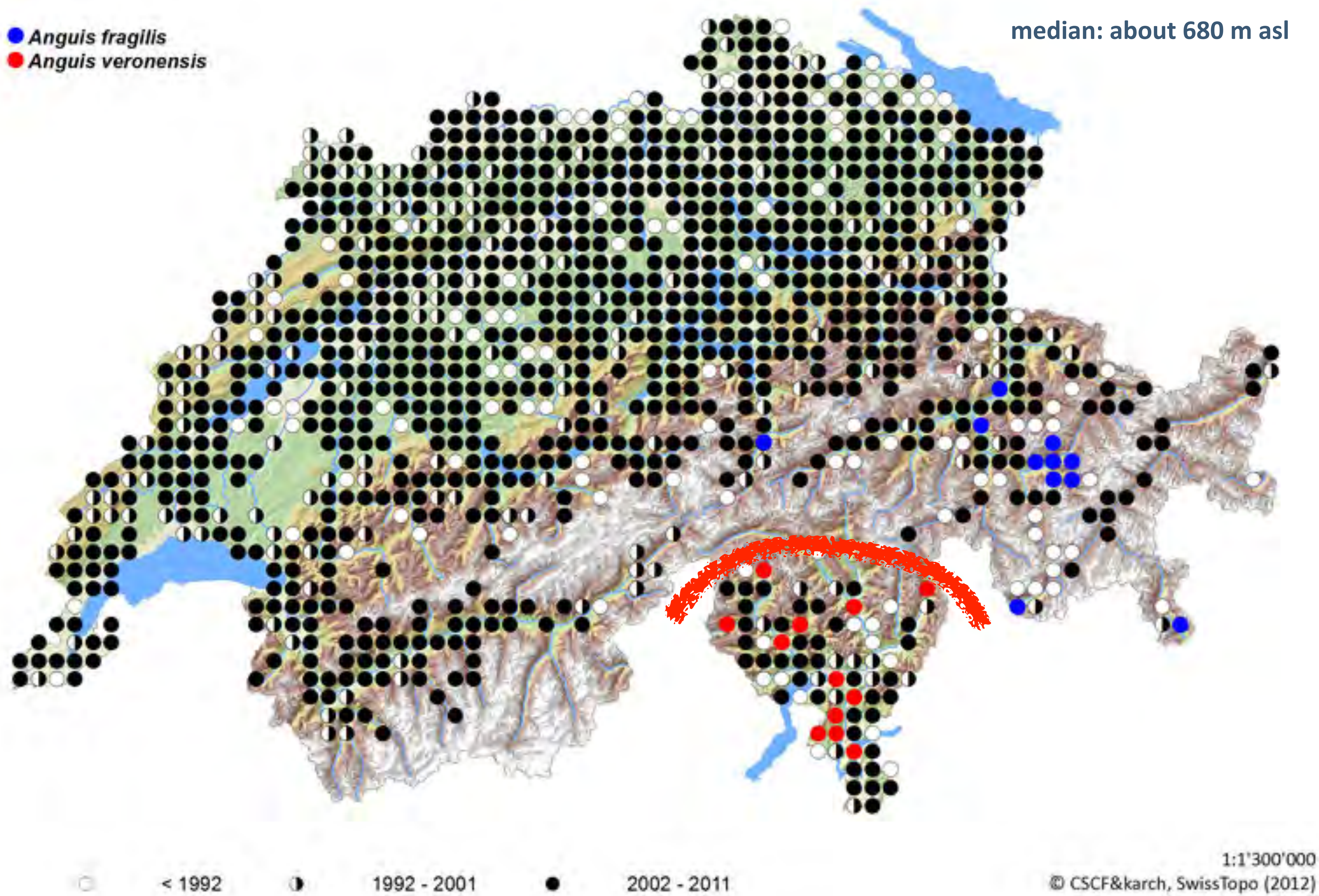
difference with snakes



Slow worms - *Swiss distribution*

altitudinal range: 230 – 2100 m asl

median: about 680 m asl



Italian slow worm, young male

Italian slow worm, female

Sand lizard (*Lacerta agilis*)

Sand lizard - *characteristics*

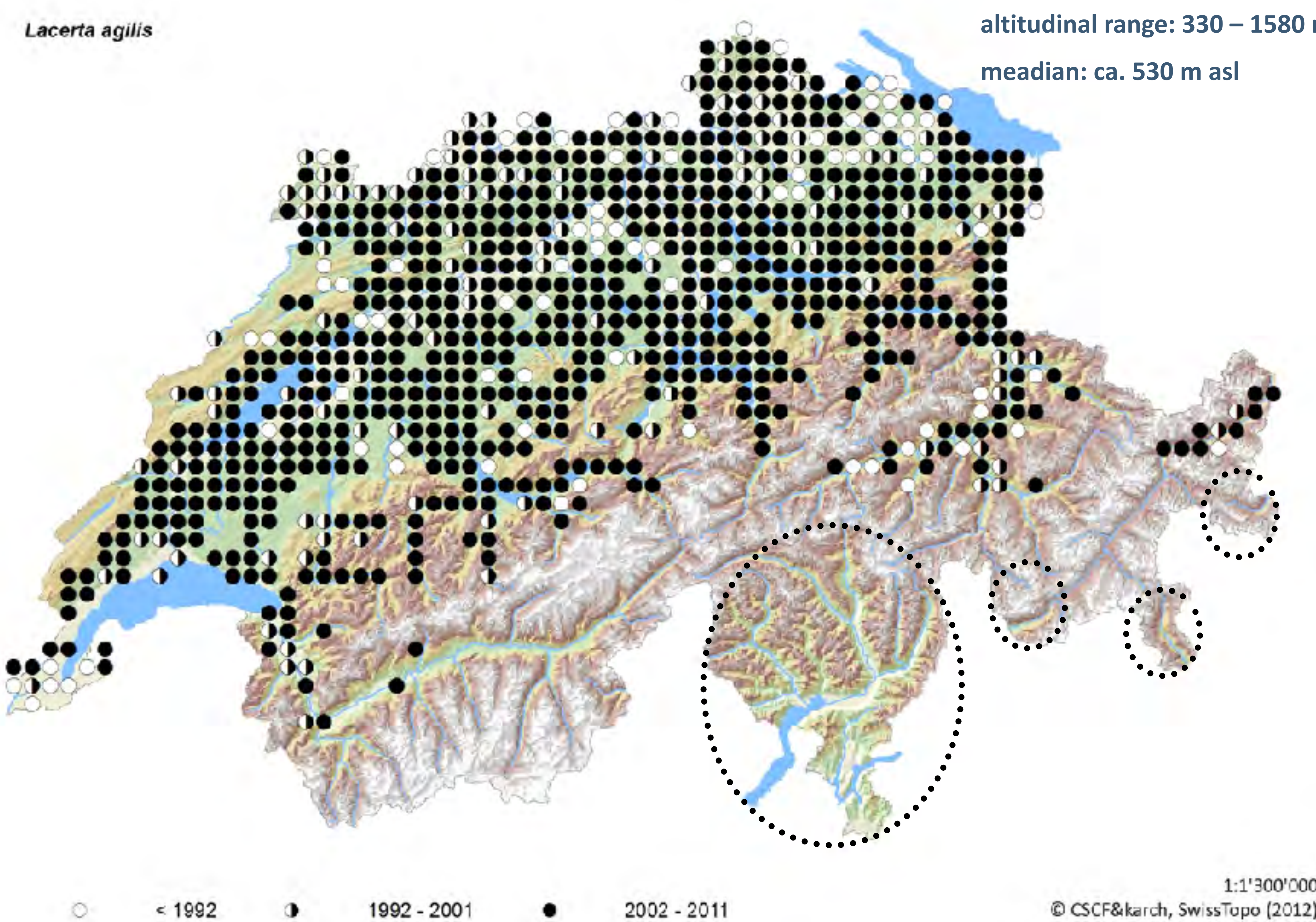
- solid body, large head
- round body section
- short tail, about 1/2 of the total length
- length: a bit more than 20 cm (♂ max. 22 cm, ♀ max. 21 cm)
- coloration: ♂ light green on the flancs, but braun on the back. ♀ and juveniles: braun with spots (light with edged with black) on the flancs
- oviparous
- relatively slow lizard, and really agile
- do not clim vertical structures

♂

Sand lizard - *Swiss distribution*

altitudinal range: 330 – 1580 m asl.

meadian: ca. 530 m asl



Viviparous lizard (*Zootoca vivipara*)

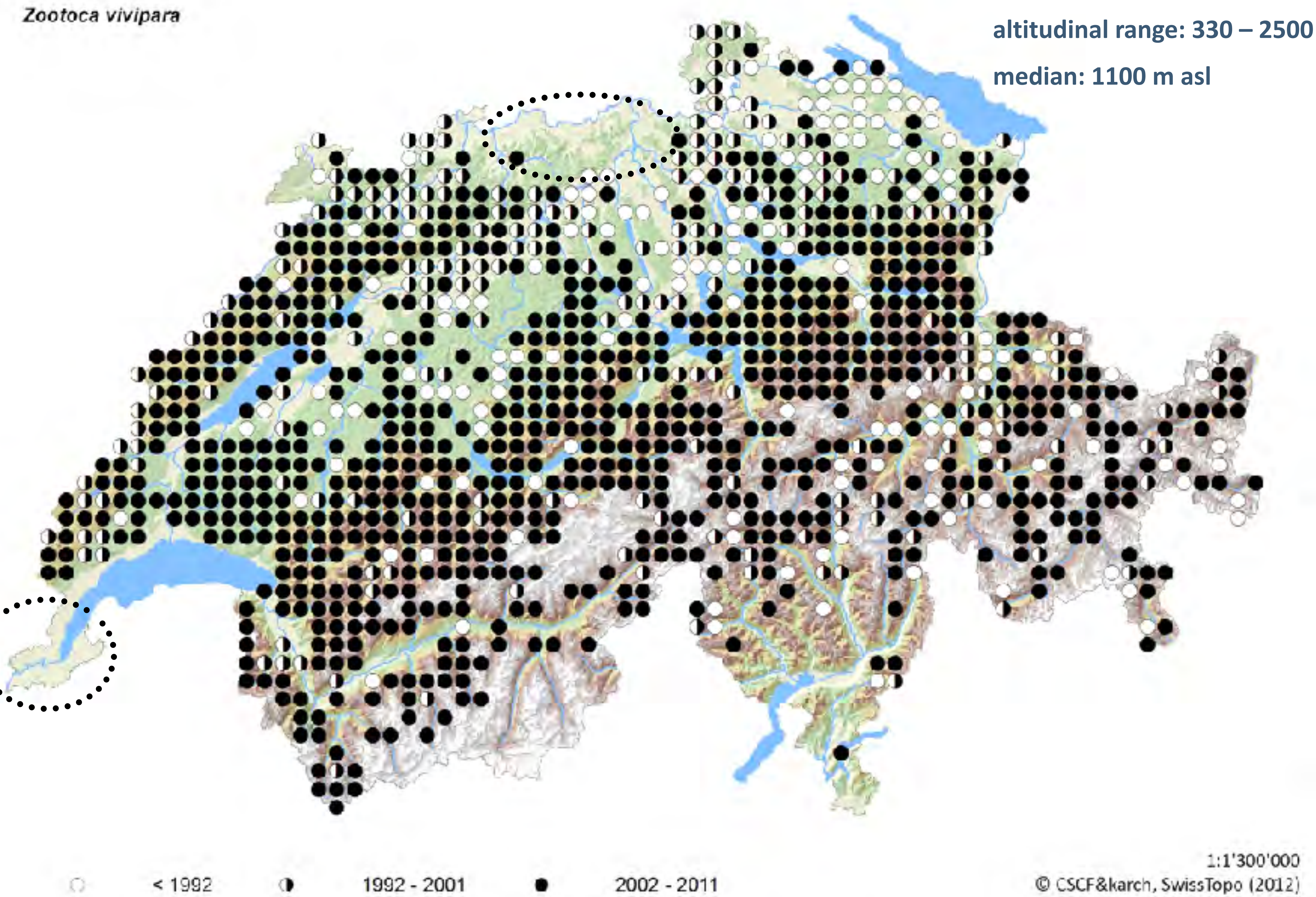
Viviparous lizard - *characteristics*

- small and slender body
- small and round head
- round body section
- tail relatively long, about 2/3 of the total length
- the smallest Swiss lizard about 15 cm (♂ max. 15 cm, ♀ max. 15 cm)
- coloration: always braun, with different shades of braun, some dorsal marks darker; belly is lighter, but can be orange; totally dark individuals frequent, especially juveniles
- viviparous
- move in the vegetation more or less like a snake
- does not climb vertical structures

Viviparous lizard - *Swiss distribution*

altitudinal range: 330 – 2500 m asl

median: 1100 m asl



Wall lizard (*Podarcis muralis*)

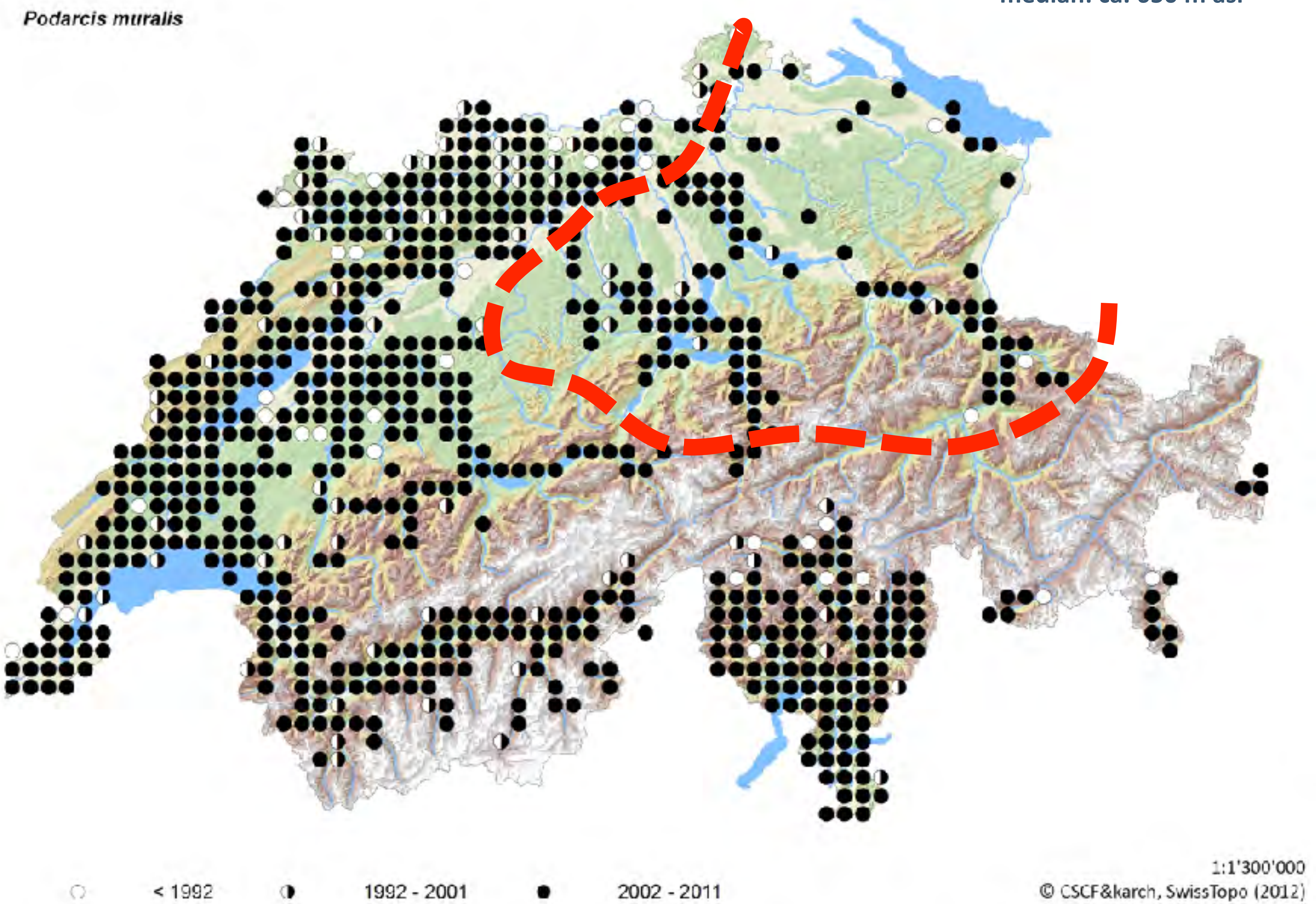
Wall lizard - *characteristics*

- slender thin body
- flat body section, with a sharp snout
- long tail, about 2/3 of the total length
- long and fine fingers
- length: 16 - 20 cm (♂ max. 21 cm, ♀ max. 16 cm)
- coloration: colour and pattern variable, generally braun with dark markings
  ♀ and juveniles: with dark flancs, less flecked than males
- oviparous
- very quick, very good climber on wall or other vertical structures
- frequent in human modified habitats

Wall lizard - *Swiss distribution*

altitudinal range : 190 – 2200 m asl

median: ca. 650 m asl





Western green lizard (*Lacerta bilineata*)

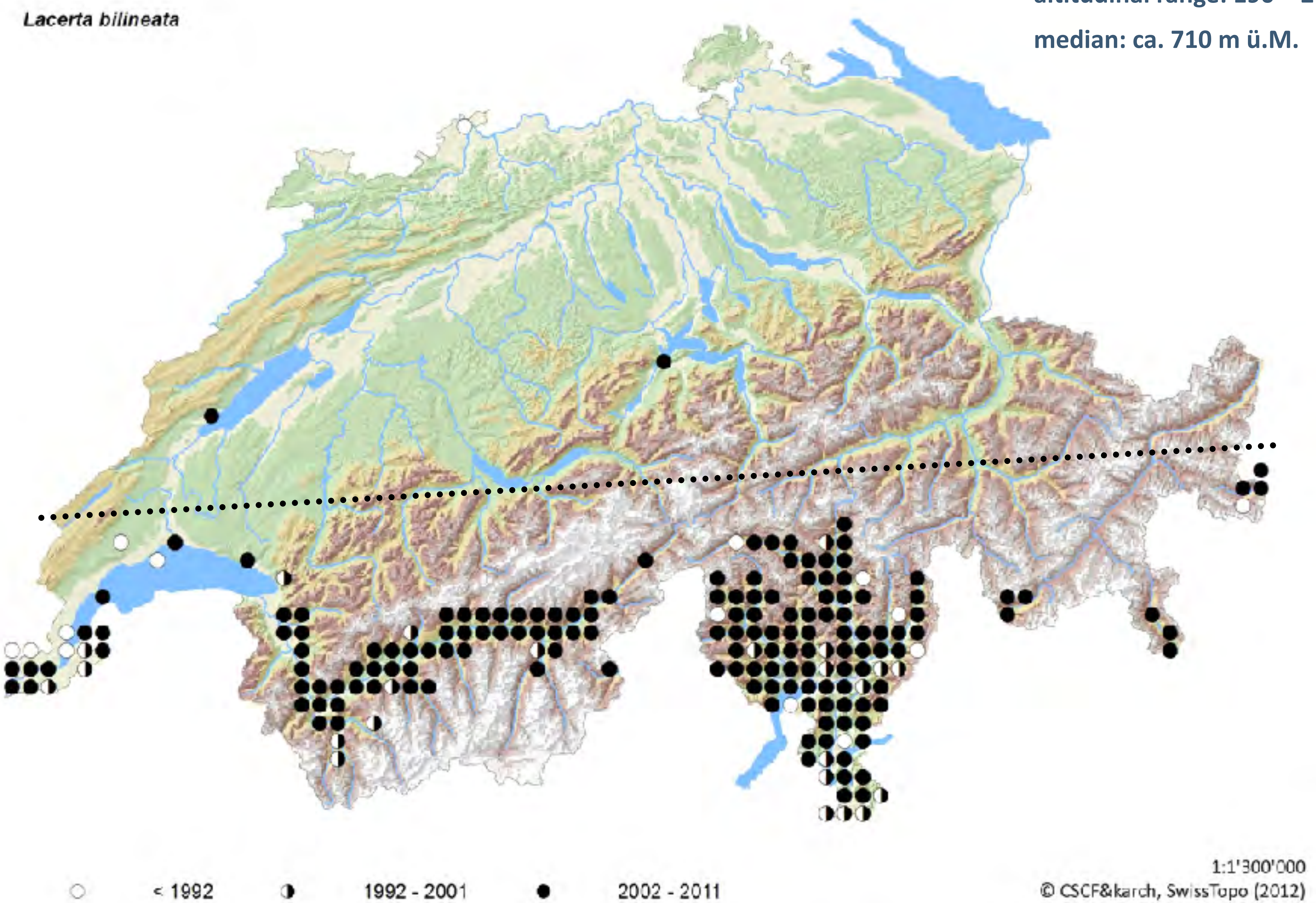
Western green lizard - *characteristics*

- large, massive body
- massive head, especially for ♂
- body section round
- long tail, about 2/3 of the total length
- the largest Swiss lizard: generally about 30 cm (♂ max. 36 cm, ♀ max. 33 cm)
- coloration: ♂ light green, both on the side and the flanks;
  ♀ and juveniles: more variable, but totally green, without dots. Frequently with 2 fines light lines on the back.
- oviparous
- quick, normal very shy
- generally do not clim on vertical structures

Western green lizard - *Swiss distribution*

altitudinal range: 190 – 2020 m ü

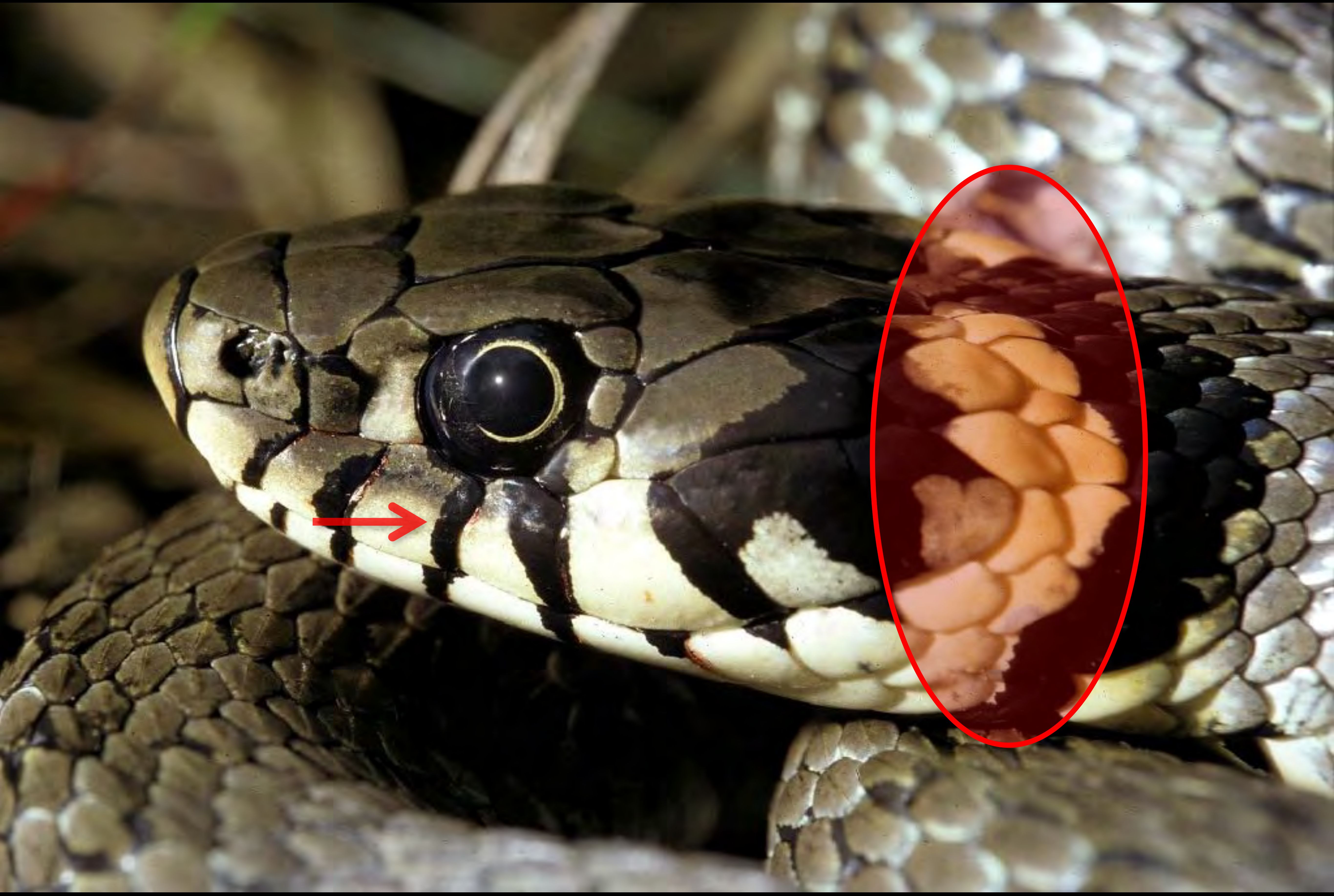
median: ca. 710 m ü.M.



Grass snakes (*Natrix natrix* and *N. helvetica*)

Grass snakes - *characteristics*

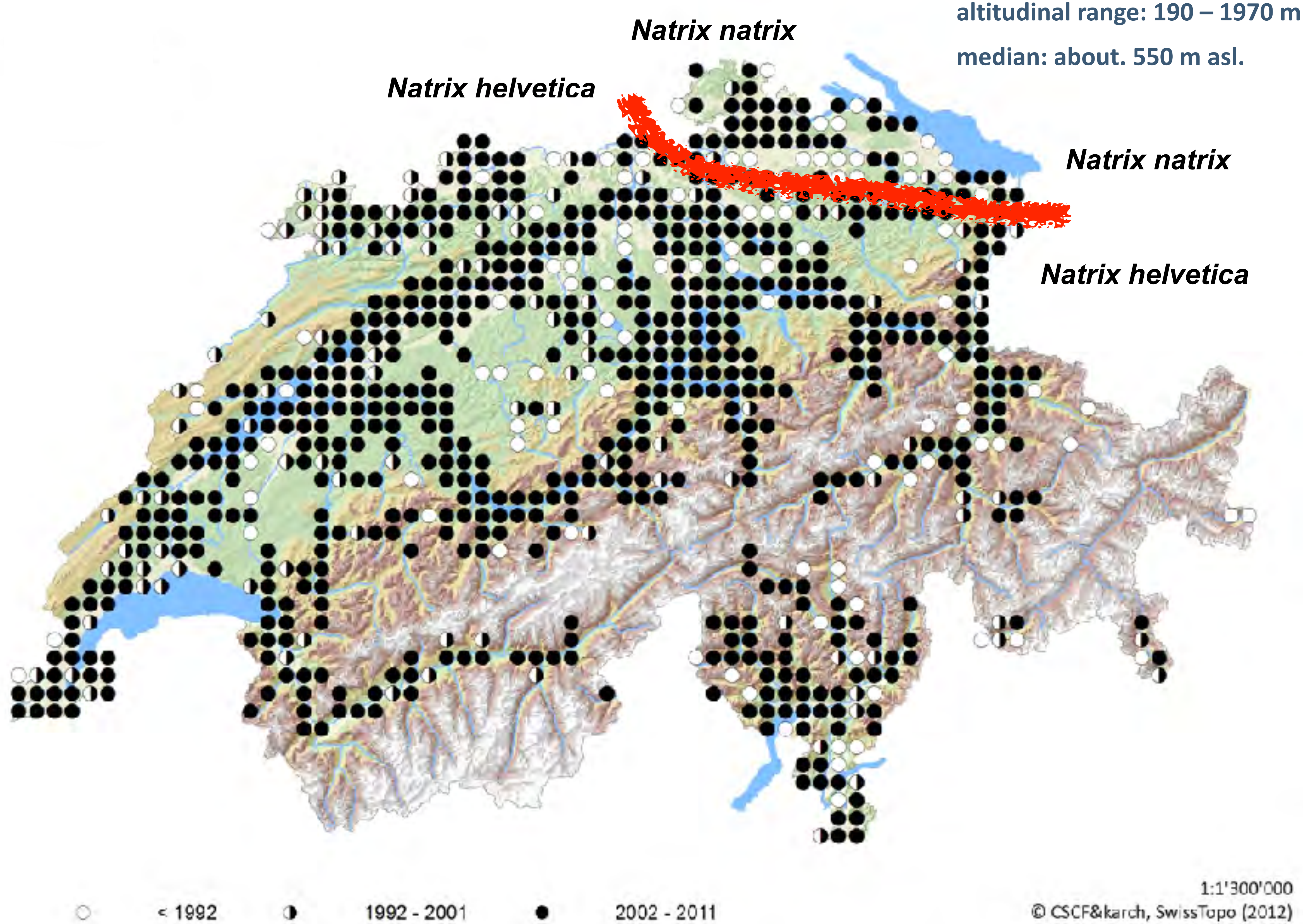
- quite massive snake (especially ♀♀)
- size: up to 130 cm (♂ max. 91 cm, ♀ max. 140 cm)
- round pupil
- keeled dorsal scales
- coloration: variable, generally grey or braun, more rarely olive or blue-grey, sometimes black. With lines on the flancs and on the back, larger for *N. helvetica* than for *N. natrix*.
- two crescent-shaped marks yellow followed by black on the neck; the crescent-shaped marks can be white or orange, or even lacking.
- oviparous
- relatively quick, shy
- very good swimmer and diver
- as defensive behavior: cloacal gland secretion, hissing, or can feign death
- not venomous, do not bite



Grass snakes - *Swiss distribution*

altitudinal range: 190 – 1970 m asl.

median: about. 550 m asl.



Dice snake (*Natrix tessellata*) and viperine snake (*N. maura*)

Natrix tessellata

Natrix maura

Dice snake and Viperine snake - *characteristics*

- morphologically and ecologically very similar
- size: *N. tessellata*: about 110 cm (♂ max. 76 cm, ♀ max. 117 cm)
  N. maura: about 70 cm (♂ max. 60 cm, ♀ max. 81 cm)
- small head, slender snout
- round pupil
- keeled dorsal scales
- coloration: braun/grey, sometime a bit more olive. *N. tessellata* with regular black marks on the back and on the flanks; *N. maura* more with a zigzag on the back
- viviparous
- aquatic species that eat mainly fish (some amphibians), so very good swimmer and diver
- run away in water when disturbed
- as defensive behavior: cloacal gland secretion, hissing, or can feign death
- non venomous, do not bite

Dice snake (Lumino, TI)

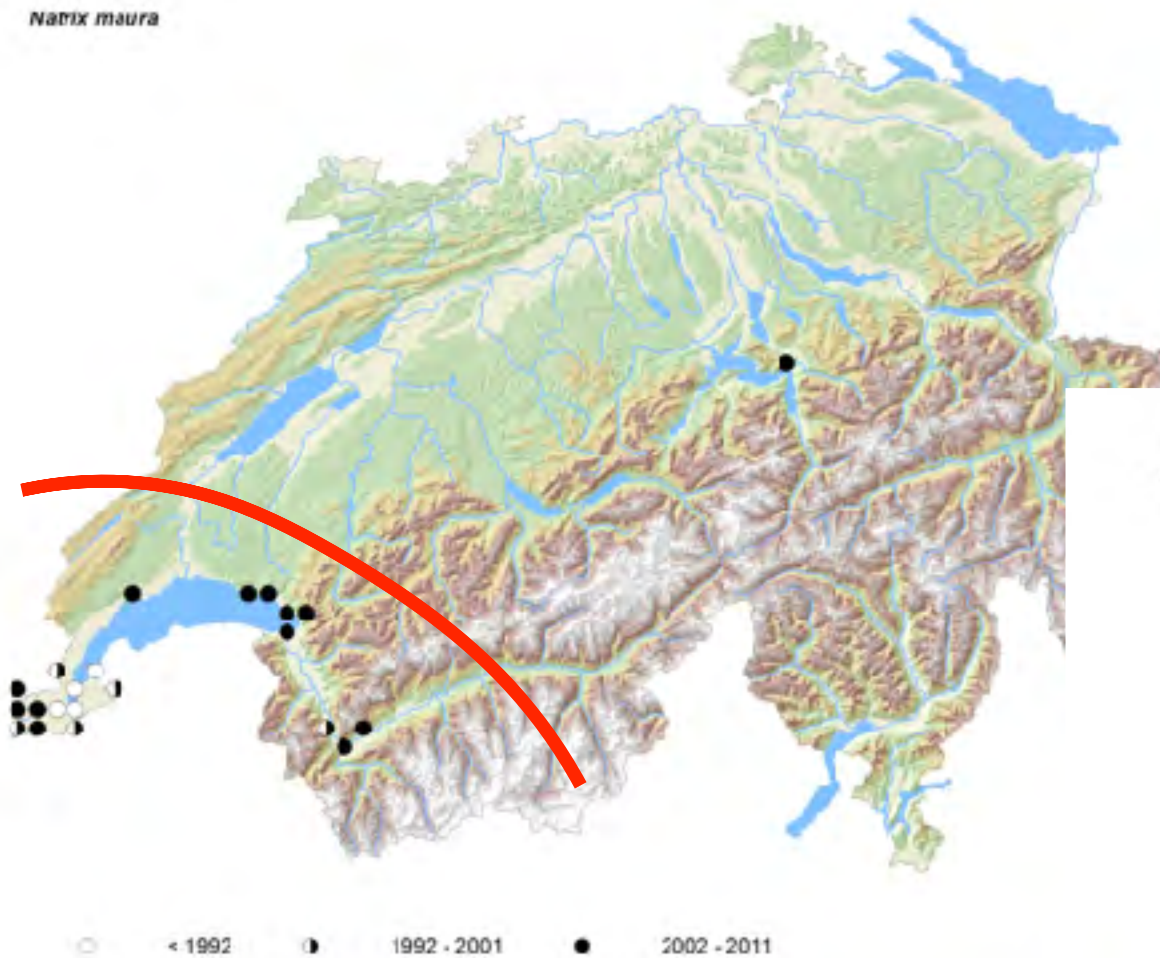

Viperine snake
(GE)

info fauna CSCF info fauna karch

Dice snake and Viperine snake - *Swiss distribution*

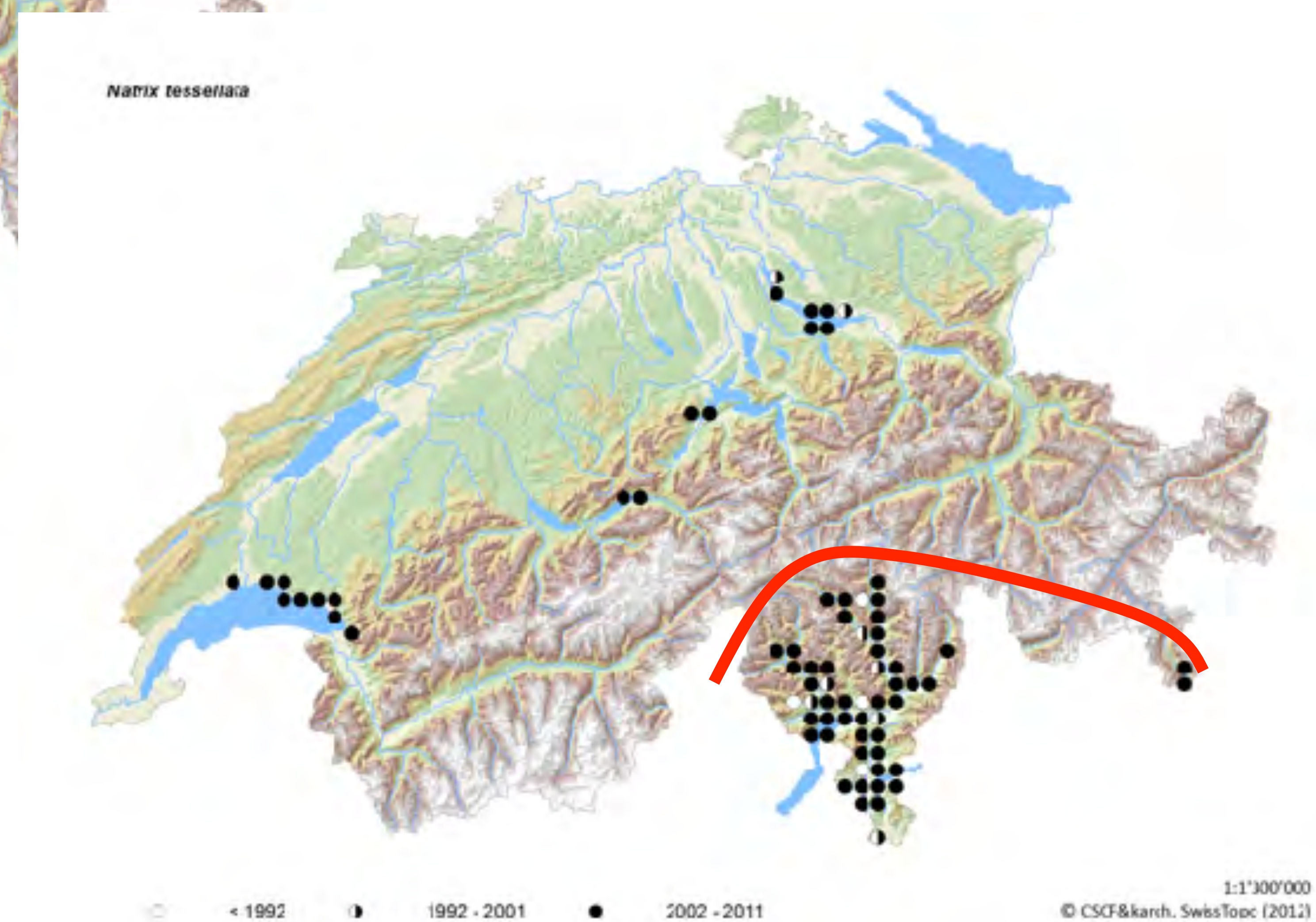
altitudinal range: 380 – 480 m asl

median: about 400 m asl



altitudinal range: 190 – 900 m asl

median: env. 400 m asl



Smooth snake (*Coronella austriaca*)

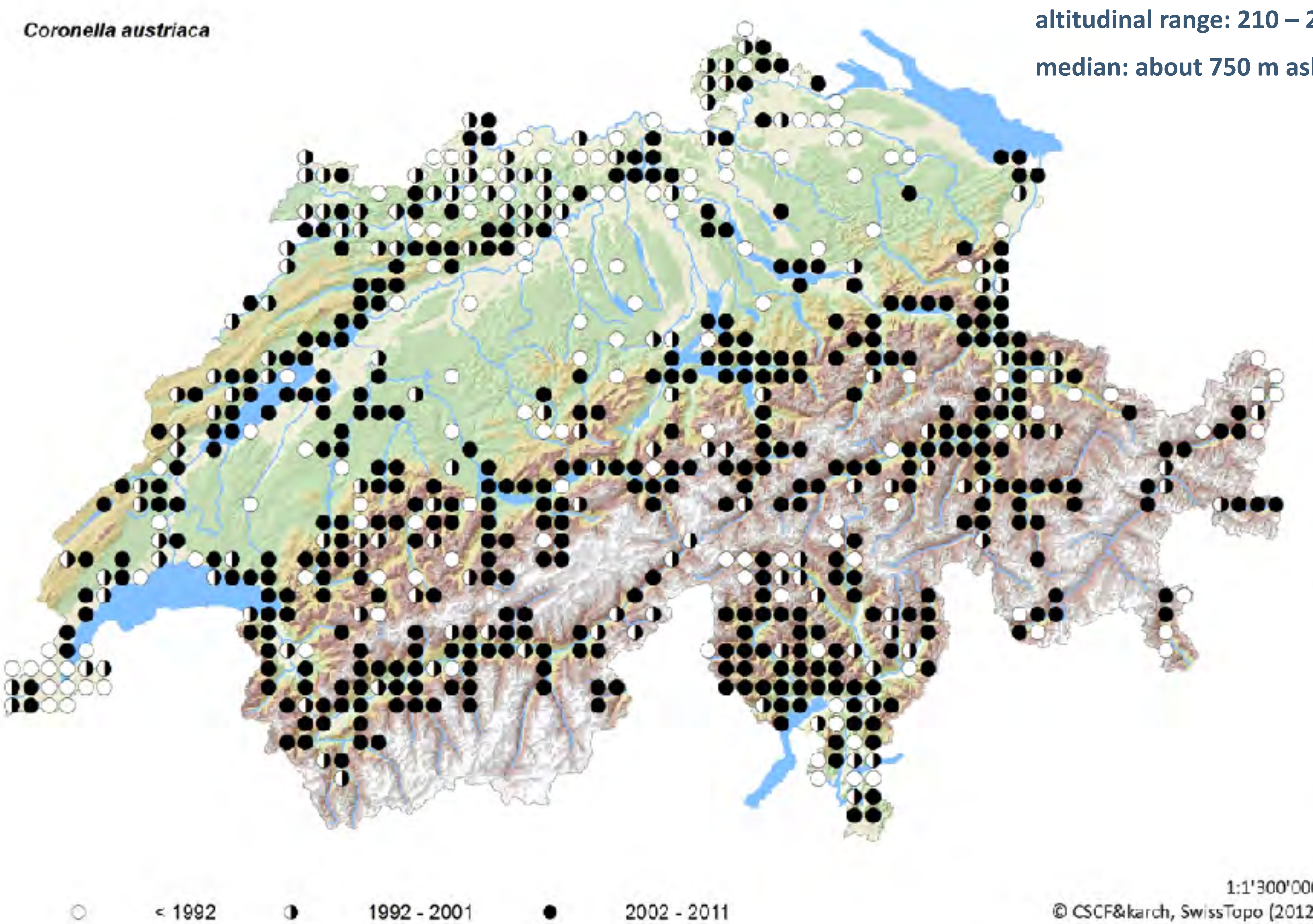
Smooth snake - *characteristics*

- thin, slender snake, the smallest species in Switzerland
- size: generally about 60 – 70 cm (♂ max. 75 cm, ♀ max. 95 cm)
- head not differentiated from the body
- round pupil
- dorsal scales not keeled (seems to be very smooth)
- coloration: grey, braun or beige; some dark braun marks on the backs with pattern changing between individuals, sometimes forming lines
- one typical line on the head going through the eye; marks on the head and on the neck that are individually specific.
- viviparous
- prey: mainly reptiles, also small mammals
- can bite if captured
- move slowly; normally do not escape or only really late before being capture
- very shy species, difficult to see exposed
- non venomous, but can bite (harmless)

Smooth snake - *Swiss distribution*

altitudinal range: 210 – 2240 m as

median: about 750 m asl




Green whip snake (*Hierophis viridiflavus*)

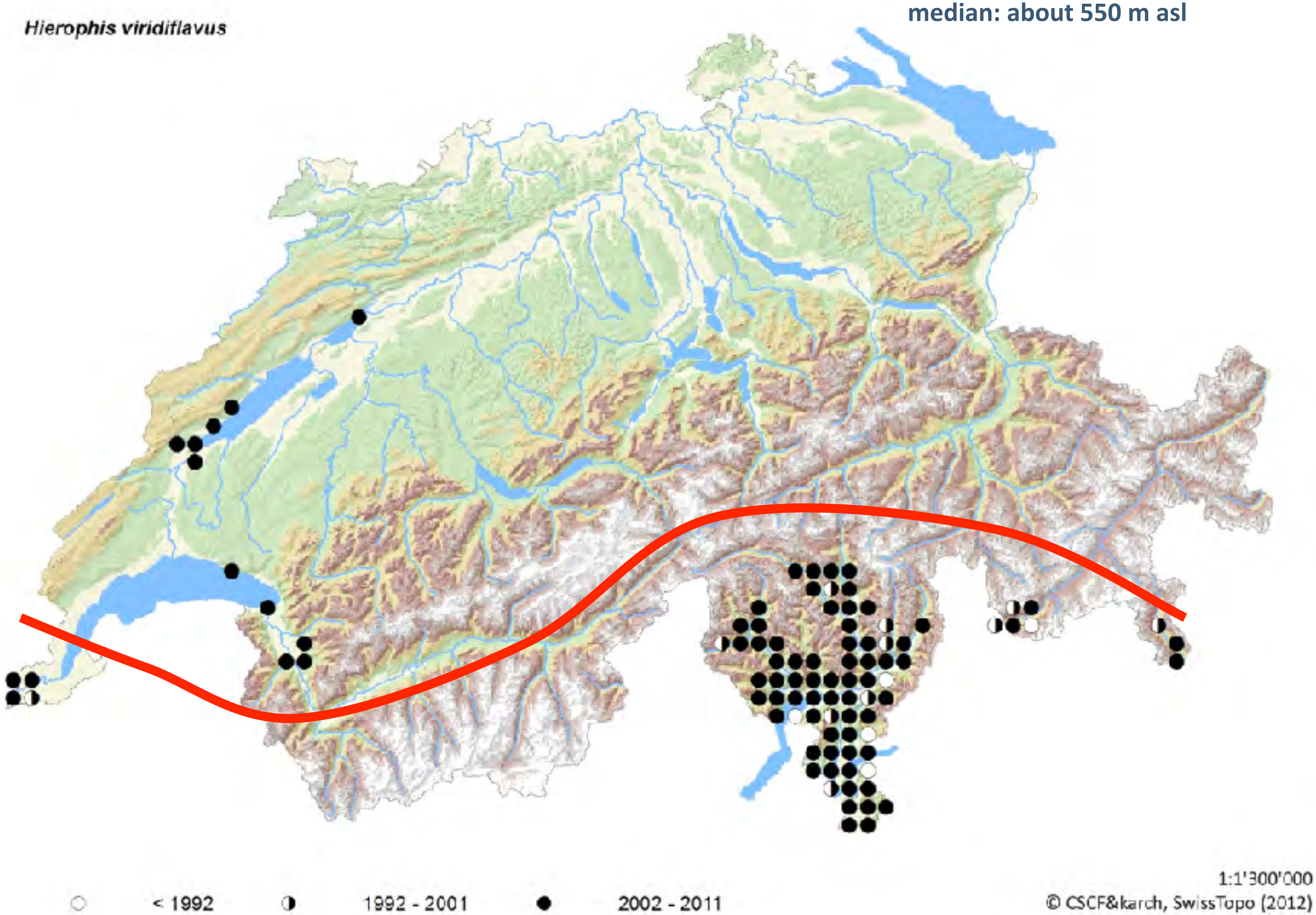
Green whip snake - *characteristics*

- slender but , strong body
- size: up to 150 cm (♂ max. 192 cm, ♀ max. 140 cm)
- head not separated from the body
- round pupil
- dorsal scales not keeled
- coloration: adult: quite dark with some yellow spots; juveniles more braun
- oviparous
- prey: not specific, eat more or less everything (reptiles, mammals, birds)
- move very quickly, noisily with a large escape distance
- when captured: bite immediately, very agressive.
- non venomous (harmless)
- frequent in Ticino

Green whip snake - *Swiss distribution*

altitudinal range: 195 – 1100 (1800) m asl

median: about 550 m asl



Aesculapian snake (*Zamenis longissimus*)

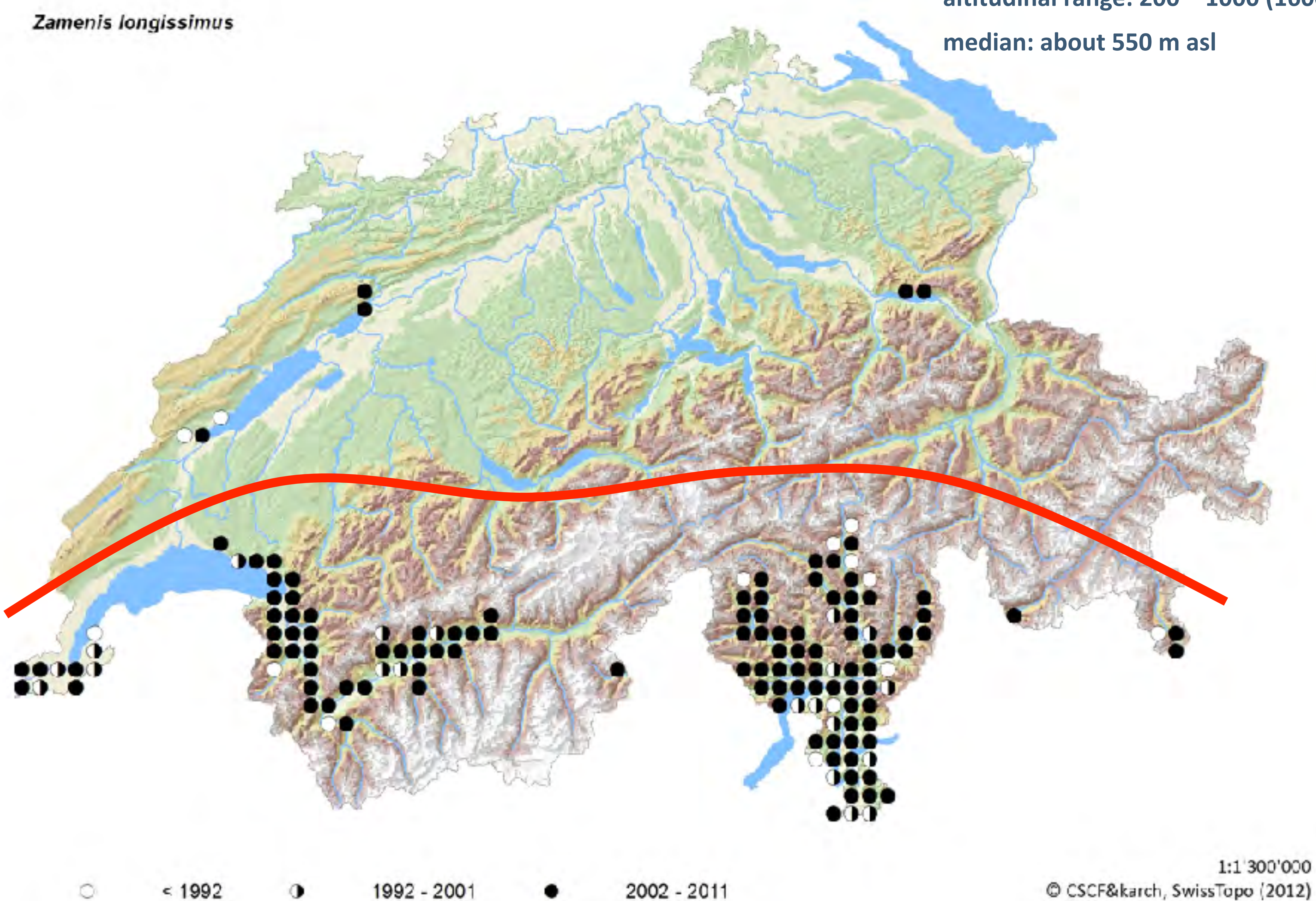
Aesculapian snake - *characteristics*

- slender, strong, elegant body
- size: generally up to 150 cm (♂ max. 148 cm, ♀ max. 122 cm)
- head not separated from the body
- round pupil
- dorsal scales not keeled
- Coloration: braun, sometime quite light, can also be a bit greenish or yellowish. Sometime lateral bande a bit darker. Juveniles with a small "collar" like the grass snakes, with more dark marks on the back.
- oviparous
- prey: small mammals, birds, eggs, rarely reptiles
- move slowly, short escape distance, stay generally without movement
- very discreet snake
- can bite when captured
- not venomous (harmless)


Aesculapian snake - *Swiss distribution*

altitudinal range: 200 – 1000 (1600) m asl

median: about 550 m asl

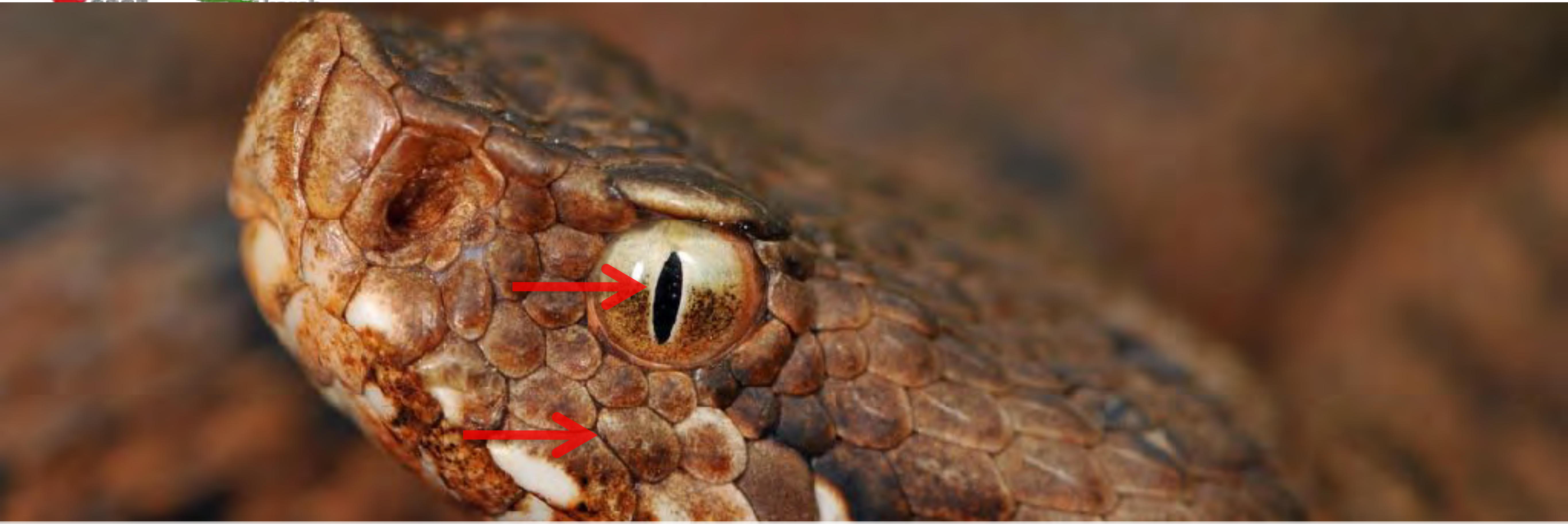


venomous snakes in Switzerland

What is a venomous snake?

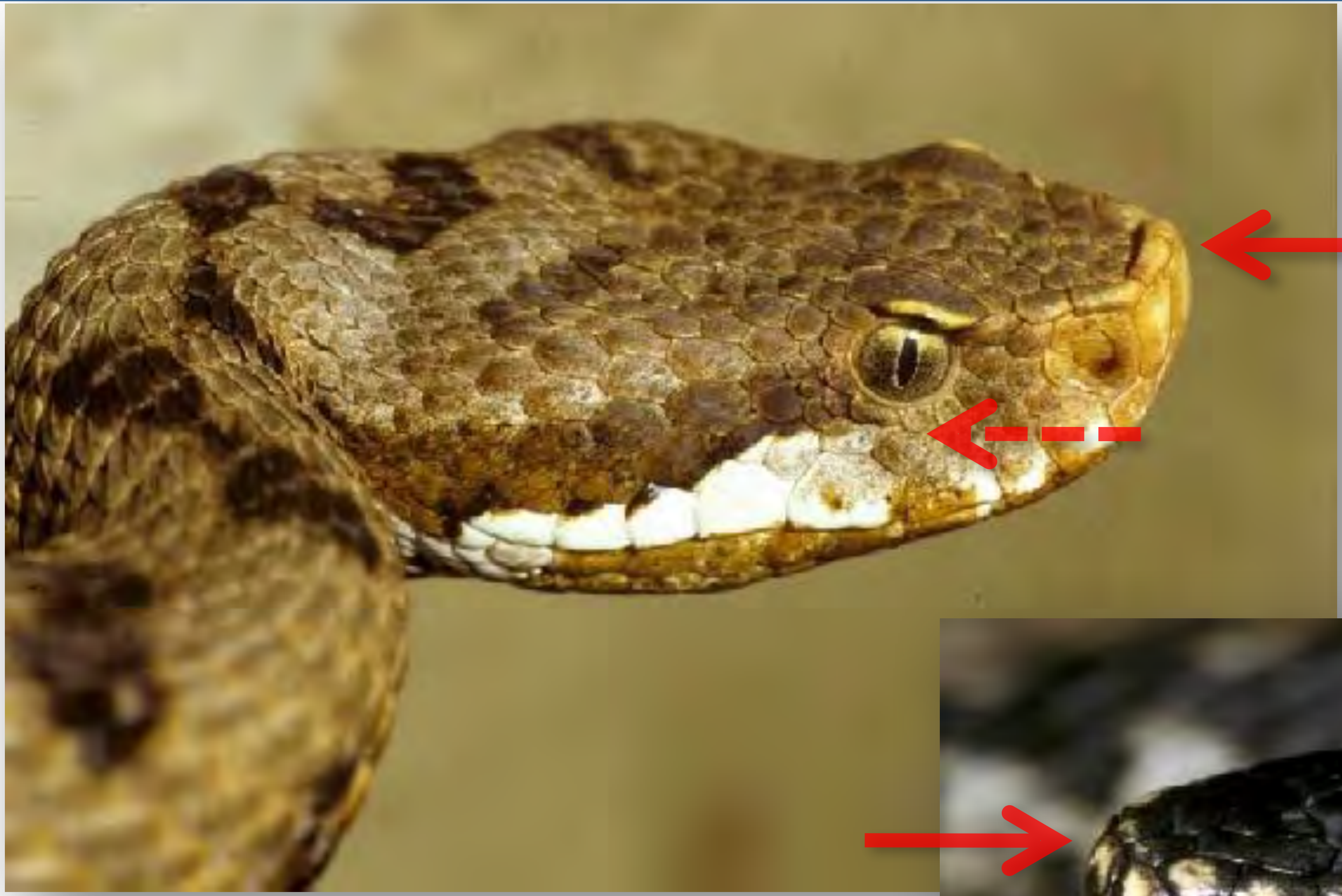
- there is no clear separation between venomous and non venomous snakes
- most of the species are not producing venom and are so considered as non venomous
- some species produce venom, but cannot actively inject it (no fang)
- some species produce venom, can inject it but the venom has practically no impact on human or, the amont is too low
- only a small proportion of snakes produce highly toxic venom for human and can inject it
- of the 3000 snake species, about 540 species have real impact on human
- so the medical impact of snakes in Europe is very limited: only 2 venomous species in Switzerland, about 9 species in Europe

Venomous or not?



size: > 90 cm = not venomous (be careful: the size of a snake is always overestimated!)

Asp viper and adder - *differences*



Asp viper (*Vipera aspis*)

adder (*Vipera berus*)

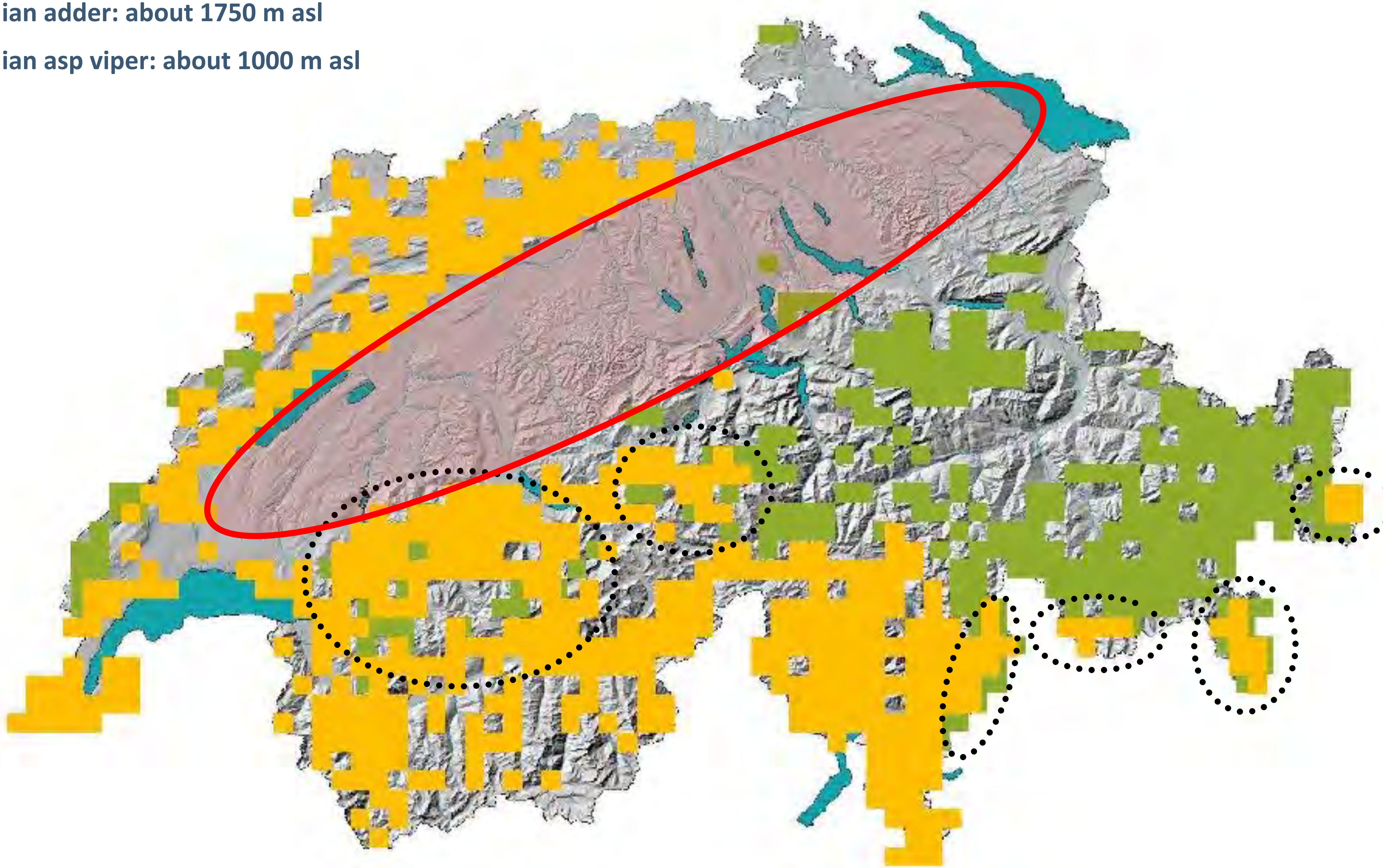
Asp viper and adder - *characteristics*

- small, massive body, especially the pregnant females
- size: asp viper: 60 – 70 cm, rarely up to 85 cm (♂ max. 74 cm, ♀ max. 84 cm)
  adder: about 50 – 60 cm, rarely up to 80 cm (♂ max. 58 cm, ♀ max. 65 cm)
- head clearly set off from the neck
- snout clearly upper
- vertical pupil (like cats)
- keeled dorsal scales
- coloration: extremely variable color, but mainly with some dark bands on the back and on the flancs (asp vipers), that could in the Alps look like a dark zigzag on the back;
  adder: coloration: variable color, but with mainly a dark zigzag on the back;
- frequent totally black individuals
- viviparous
- prey: small mammals and lizards
- defensive behavior: hissing and later bite (venomous)
- move relatively slowly, but quite shy
- can be locally at high density

Asp viper and adder - *Swiss distributions*

median adder: about 1750 m asl

median asp viper: about 1000 m asl



asp viper
(*Vipera aspis*)


adder: female


adder: male

Asp viper (*Vipera aspis*)

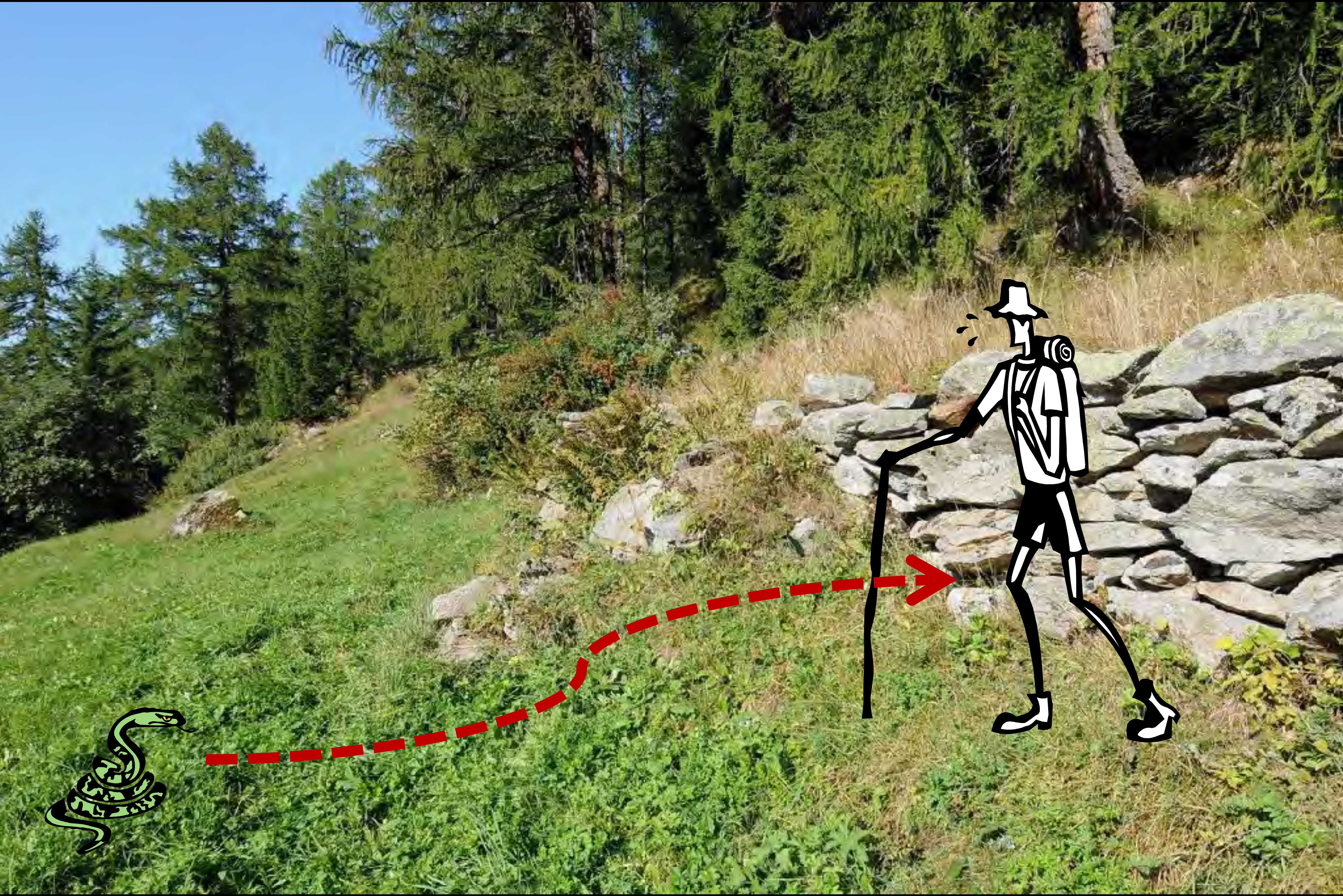

Asp viper (*Vipera aspis*)
or adder (*Vipera berus*)


adder (*Vipera berus*)

Behaviour

indigenous venomous snakes do not attack human!!

> frequent misinterpretation of the movement of the snakes.



Behaviour

indigenous venomous snakes do not attack human!!

> frequent misinterpretation of the movement of the snakes.

Escape reaction of the snakes are almost always induced by visual observation, not really by terrestrial vibration!

> hitting the ground is not really efficient!

snakes bites only when they feel in danger, so most bites are human-induced!

> large individual difference regarding the "aggressiveness" of the snakes

snakes love disorder! It provides lots of hiding places.

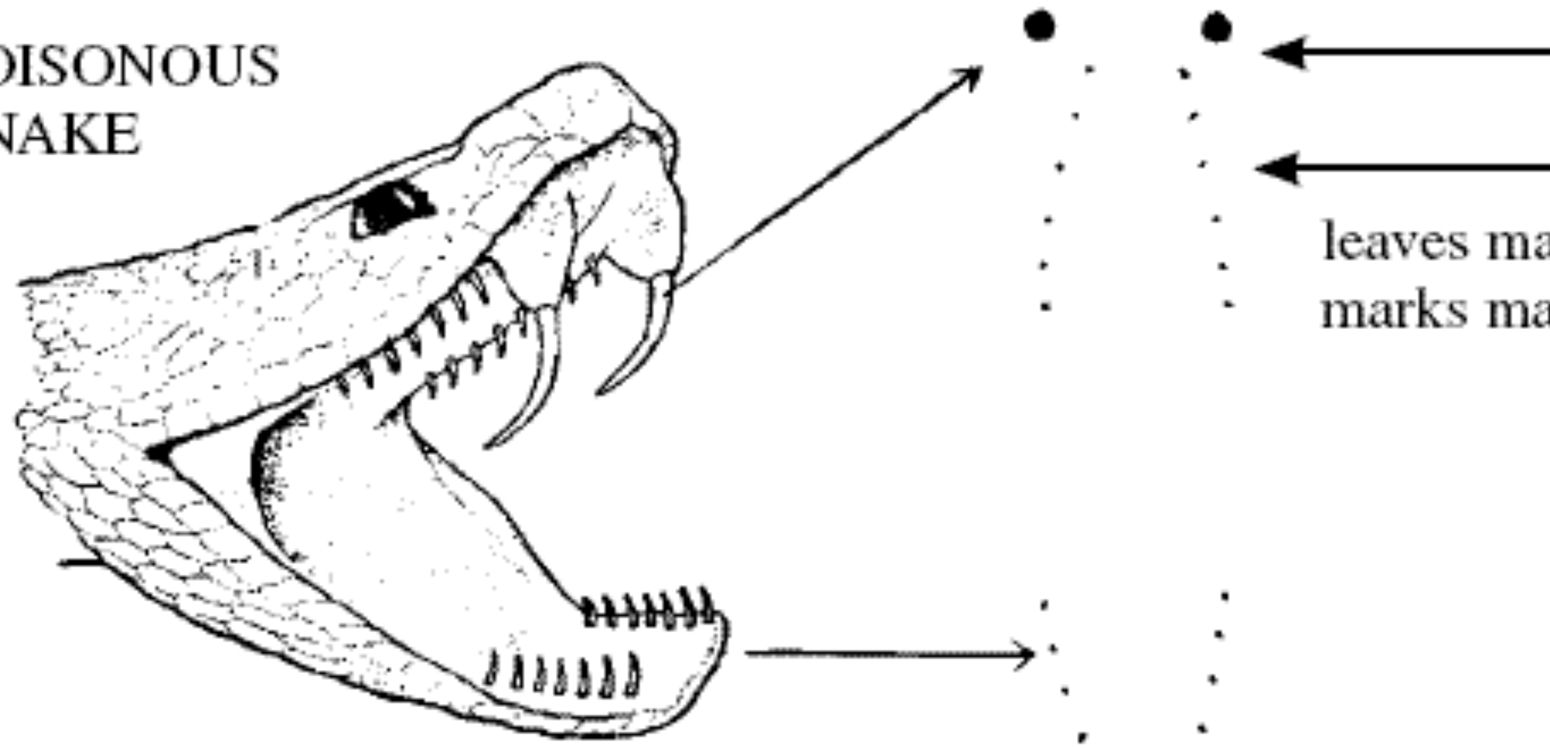
>no hiding places = no snake

do not walk barefoot in places where venomous snakes occur!

if necessary, just contact the local representative of the karch:

www.karch.ch

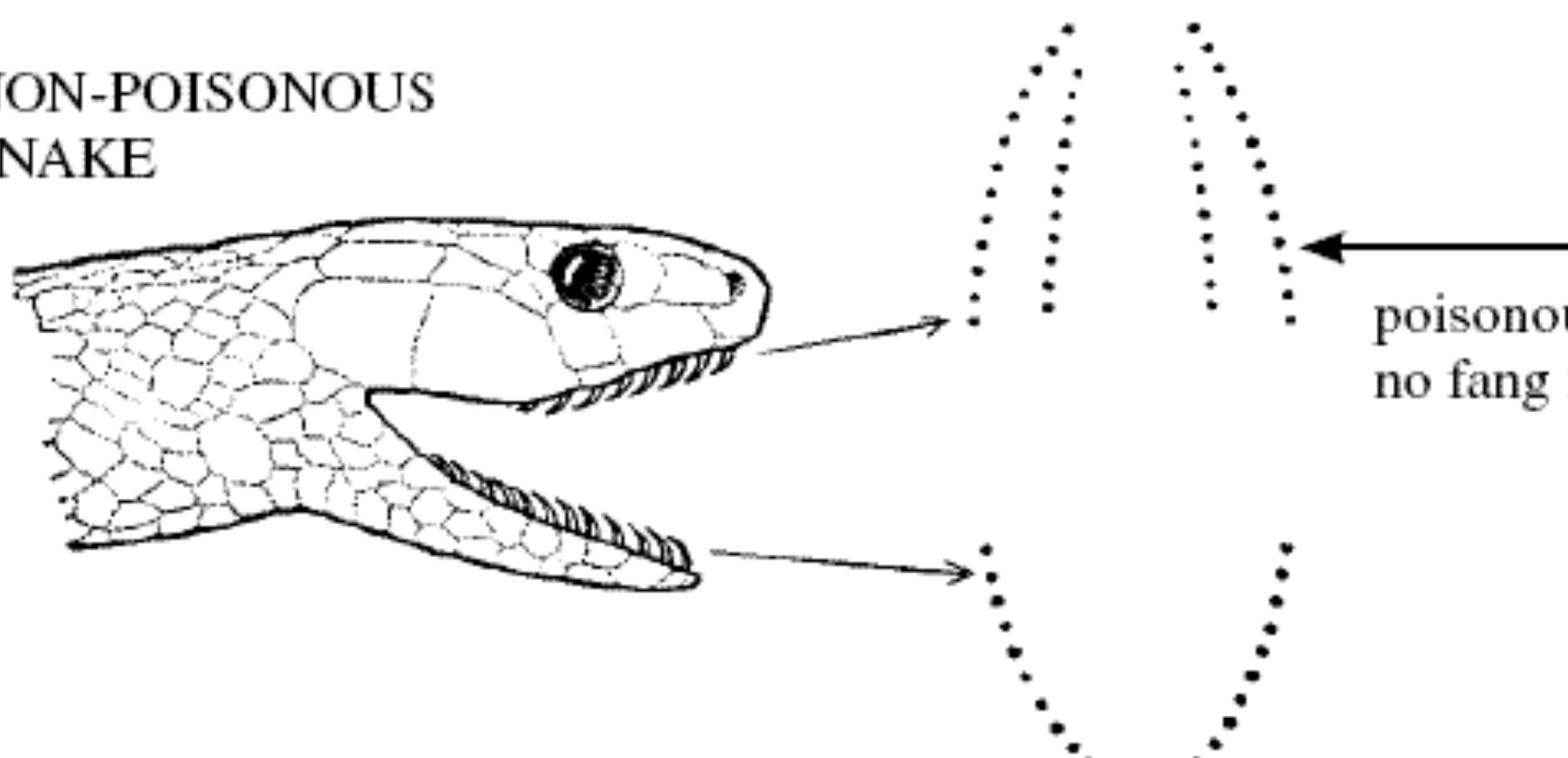
POISONOUS
SNAKE



fang marks

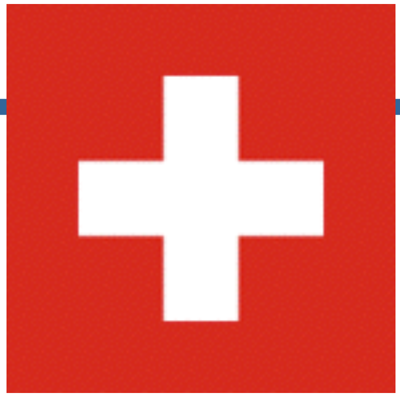
The bite of most poisonous snakes leaves marks of the 2 fangs (and sometimes, little marks made by the other teeth).

NON-POISONOUS
SNAKE



The bite of a snake that is not poisonous leaves only 2 rows of teeth marks, but no fang marks.

Venom



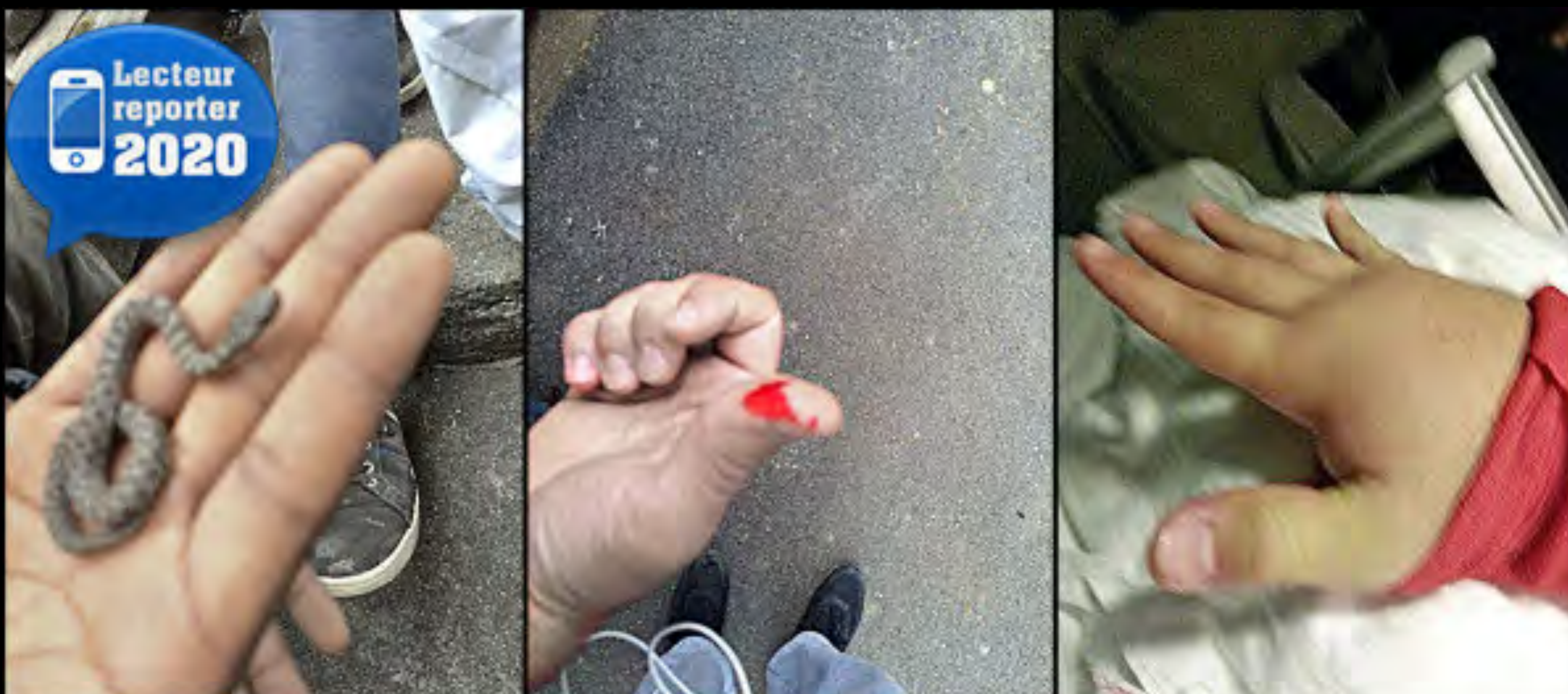
- 2 venomous species / 9 species
- about 20-40 cases every year
- last dead case: 1960’

- what to do if bitten?
- stay calm…
- avoid movement with the bitten arm or leg, in order to avoid spreading the toxins in the whole body.
- bring the bitten person to the nearest doctor;
  he/she must avoid any effort

- 50% of bites are without wenom
- serum injection: must be conducted in specific cases, only by medical doctor!

Il fait le mariole avec une vipère et termine à l’hosto

Un élève a été hospitalisé pendant une semaine après avoir joué avec un serpent venimeux.



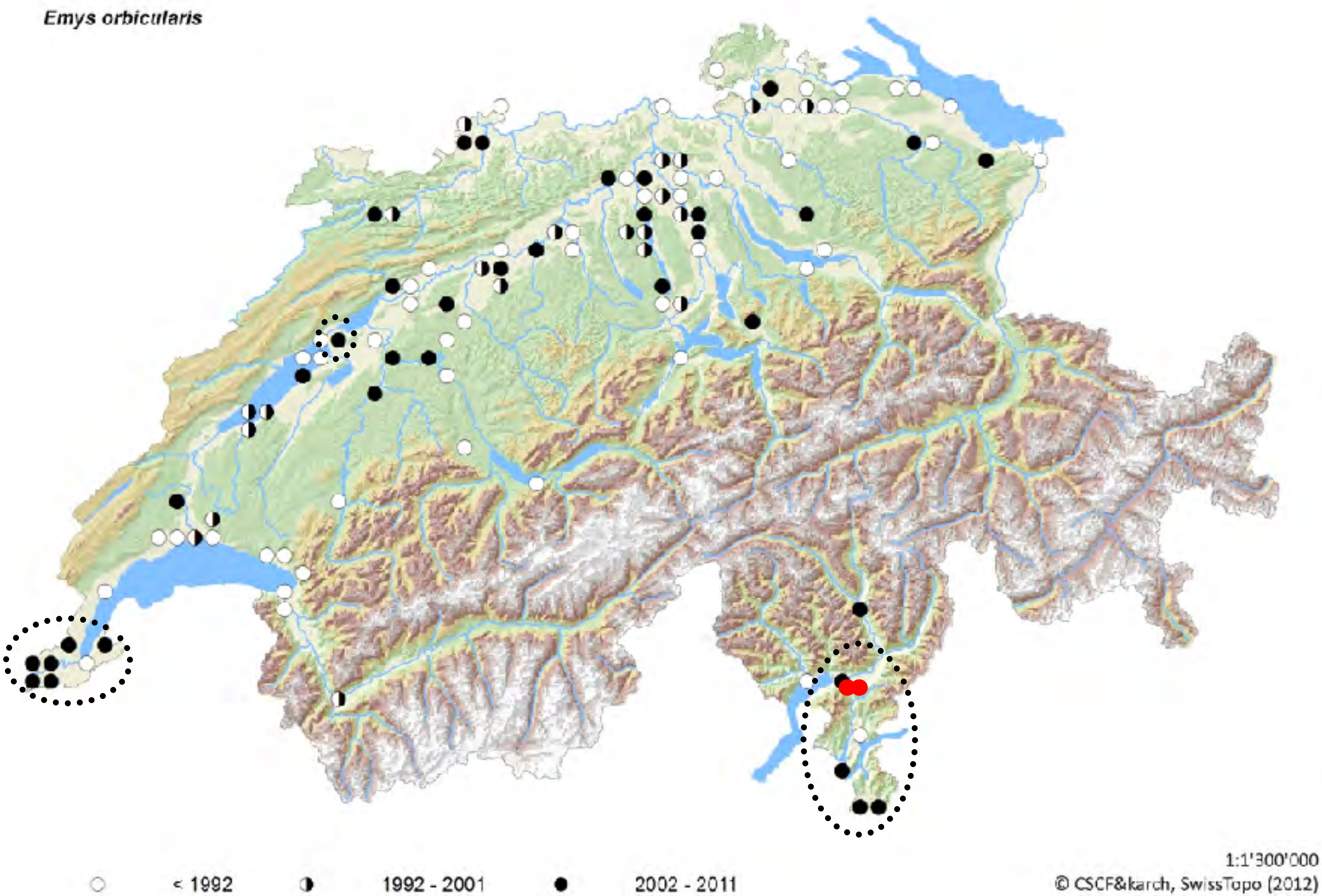
European pond turtle (*Emys orbicularis*)

European pond turtle - *characteristics*

- no confusion with other endemic species; but frequently confused with introduced American aquatic turtles
- braun to black shell, sometimes with yellow points or lines. Head, neck and legs: black with yellow points (no large marking or bands)
- small and slender, up to 20 cm as total length
- live in the water most of the time; hibernation, mating, feeding, etc… all in water
- just go out for laying the eggs; can go up to 1km away from aquatic habitats
- really shy species

European pond turtle - *Swiss distribution*

altitudinal range: below 500 m asl

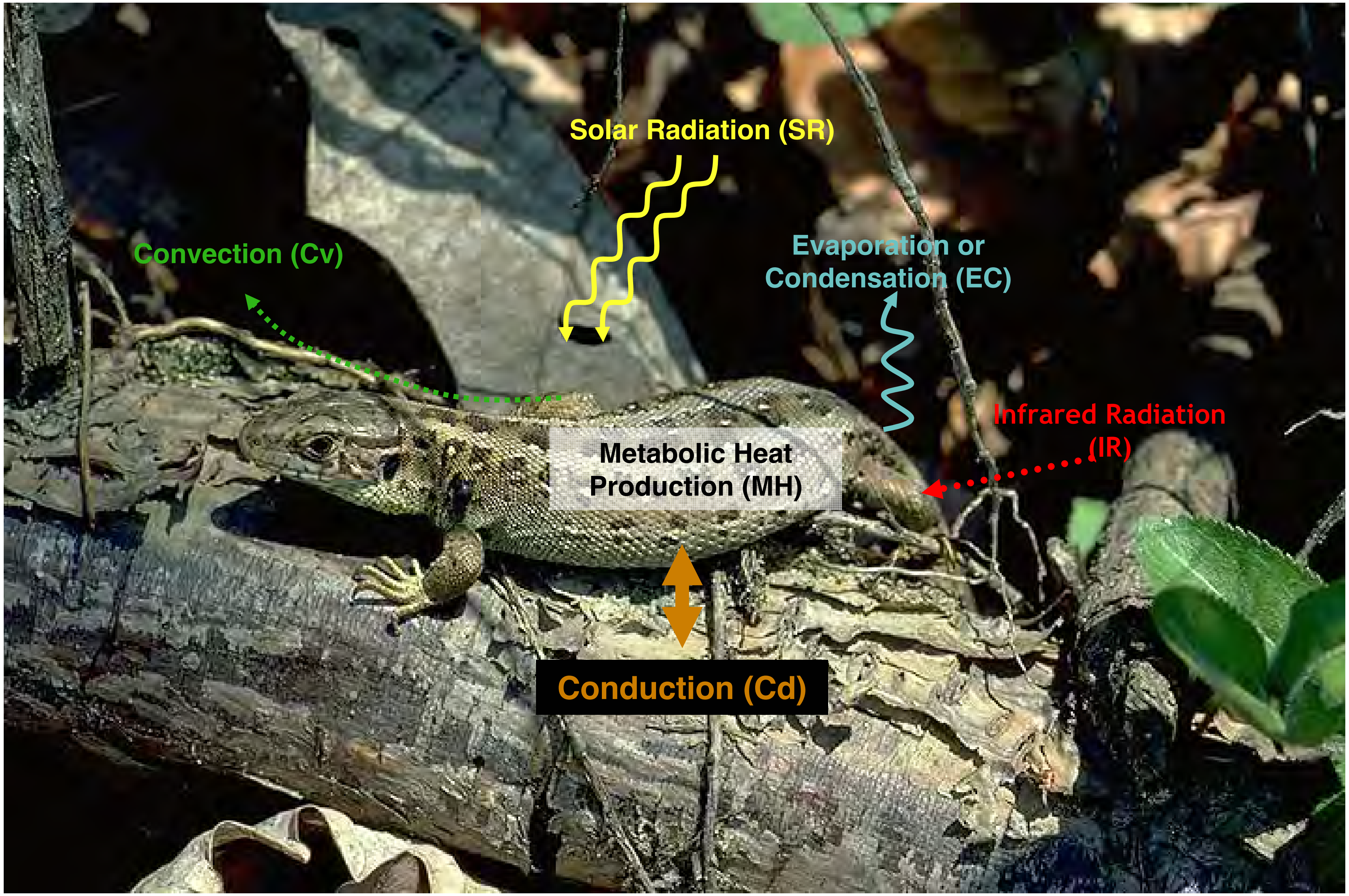


Spring - *out from hibernation and mating*

adder (*Vipera berus*)


adder (*Vipera berus*)

Thermoregulation



Heat energy gained = **SR** + **MH** ± IR ± Cv ± EC ± Cd

Thermoregulation

thermoregulation:
impact on the reptile
activities

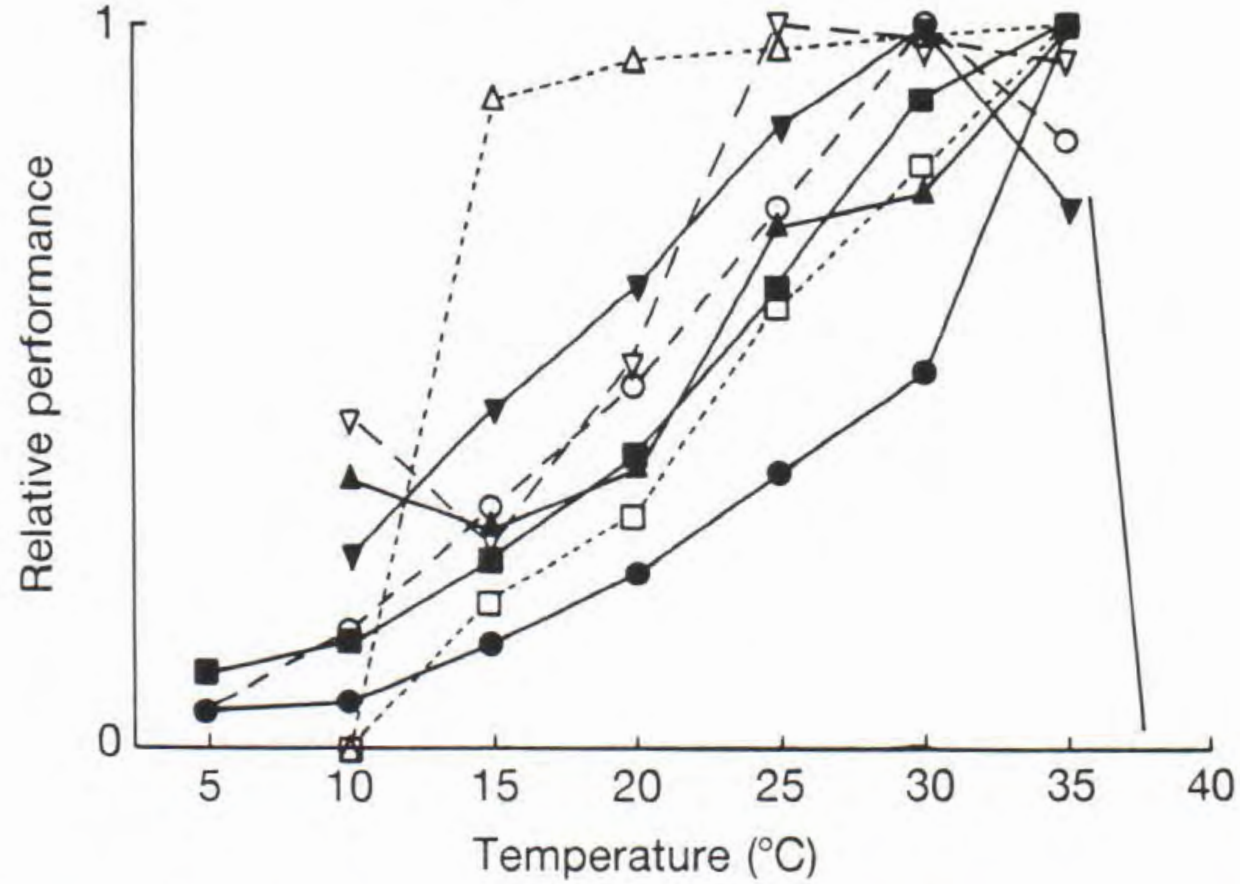


FIG. 3. The temperature-sensitivity of several physiological systems related to activity and digestion in *N. maura* (from Hailey, 1984). Rate (□) and efficiency (△) of digestion; increment of body lactate after 30s of activity (▽) and when exhausted (▲); burst speed (▼) and endurance (○); SMR (●) and aerobic scope (■). The fall to zero performance from 35–40 °C is drawn to indicate that the lethal maximum Tb is in this range.

Hailey A, Davies PMC (1988) Activity and thermoregulation of the snake *Natrix maura*. 2. A synoptic model of thermal biolgy and the physiological ecology of performance. Journal of Zoology, 214:325-342

Thermoregulation

thermoregulation in spring: impact of the substrat and the position

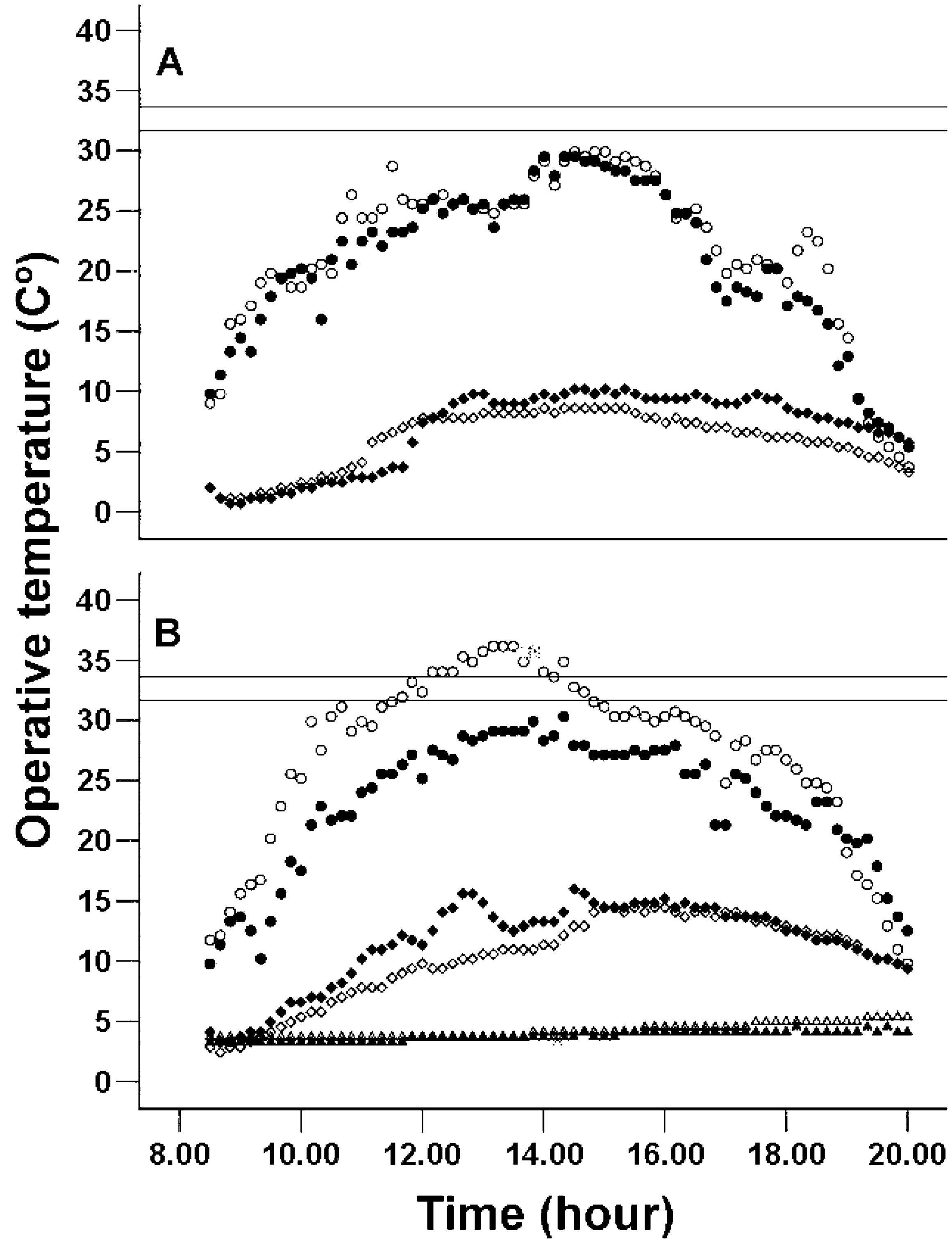


Figure 1. Operative temperature of the representative thermal microhabitats of our study area, measured (using *Vipera berus* carcasses) before (Period 1 = A) and after (Period 2 = B) the time that the females emerged from hibernation. During both periods, operative temperatures were measured in full sun, on herbal substrate (○); full sun, on rock substrate (■); full shade, herbal substrate (◇); and full shade, rock substrate (◆), and in addition (for Period 2 only), at 1-m depth inside two hibernacula entrances (△ and ▲). Horizontal lines represent the upper and lower boundaries of the preferred body temperature range of male *V. berus* (31.7–33.8 °C). Note that these operative temperature profiles represent the available maximum because they were measured on optimal days (clear sky conditions with minimal wind) in both periods.

Herczeg G, Saarikivi J, Gonda A, Perala J, Tuomola A, Merila J (2007) Suboptimal thermoregulation in male adders (*Vipera berus*) after hibernation imposed by spermiogenesis. Biological Journal of the Linnean Society, 92, 19-27.

adder (*Vipera berus*)

Thermoregulation

thermoregulation: impact of the reptile coloration

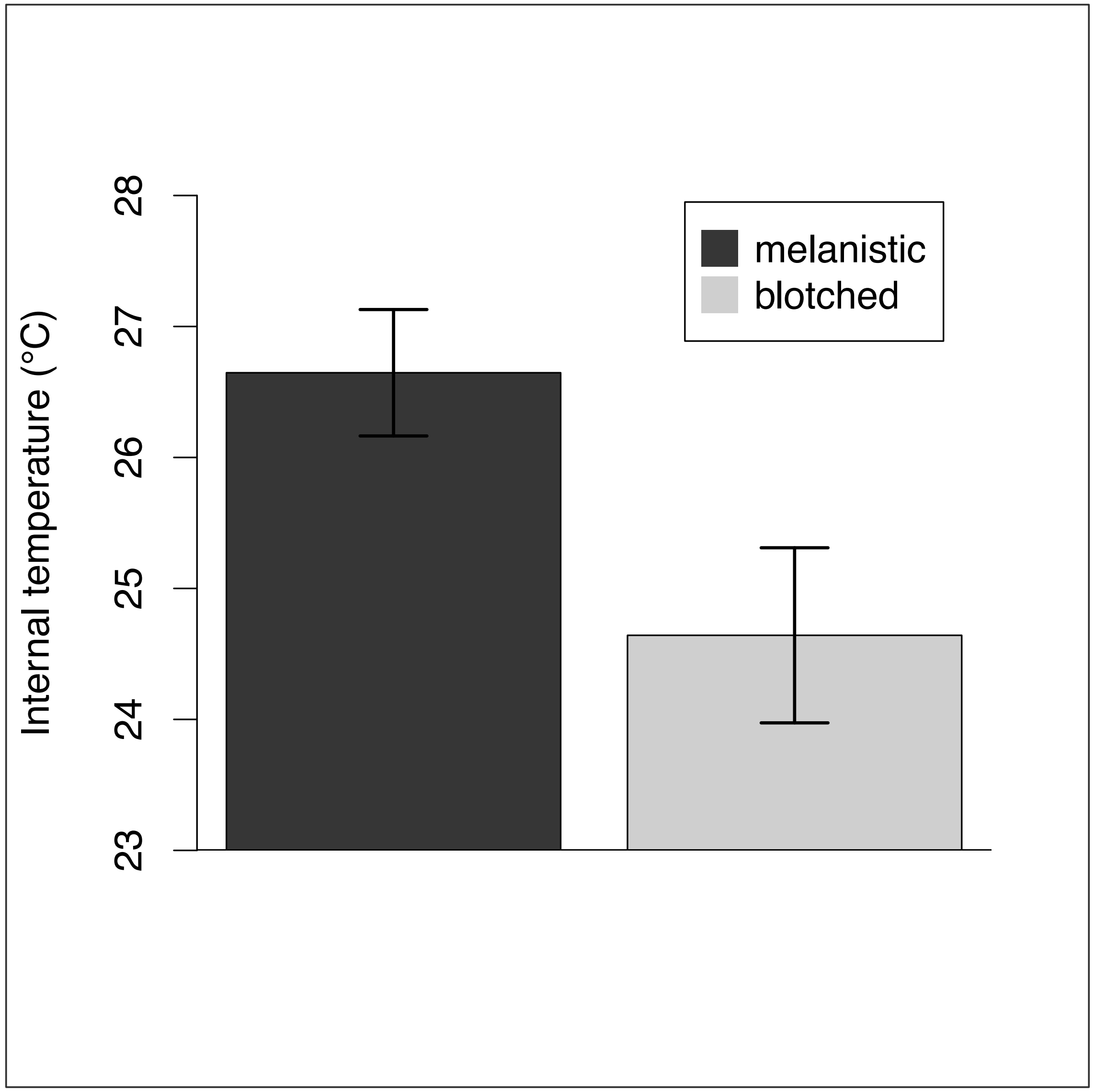


Figure 1 Average internal temperature for melanistic and blotched gravid females measured during 2014. Dark gray bar represents melanistic vipers while light gray one represents blotched vipers. Standard errors have been added on both bars. A significant difference in the average internal temperature can be observed between melanistic (26.65°C) and blotched (24.64°C) vipers.

Muri D, Schuerch J, Trim N, Golay J, Baillifard A, El Taher A, Dubey S (2015) Thermoregulation and microhabitat choice in the polymorphic asp viper (*Vipera aspis*). Journal of Thermal Biology, 53:107-112

Thermoregulation

Thamnophis sirtalis

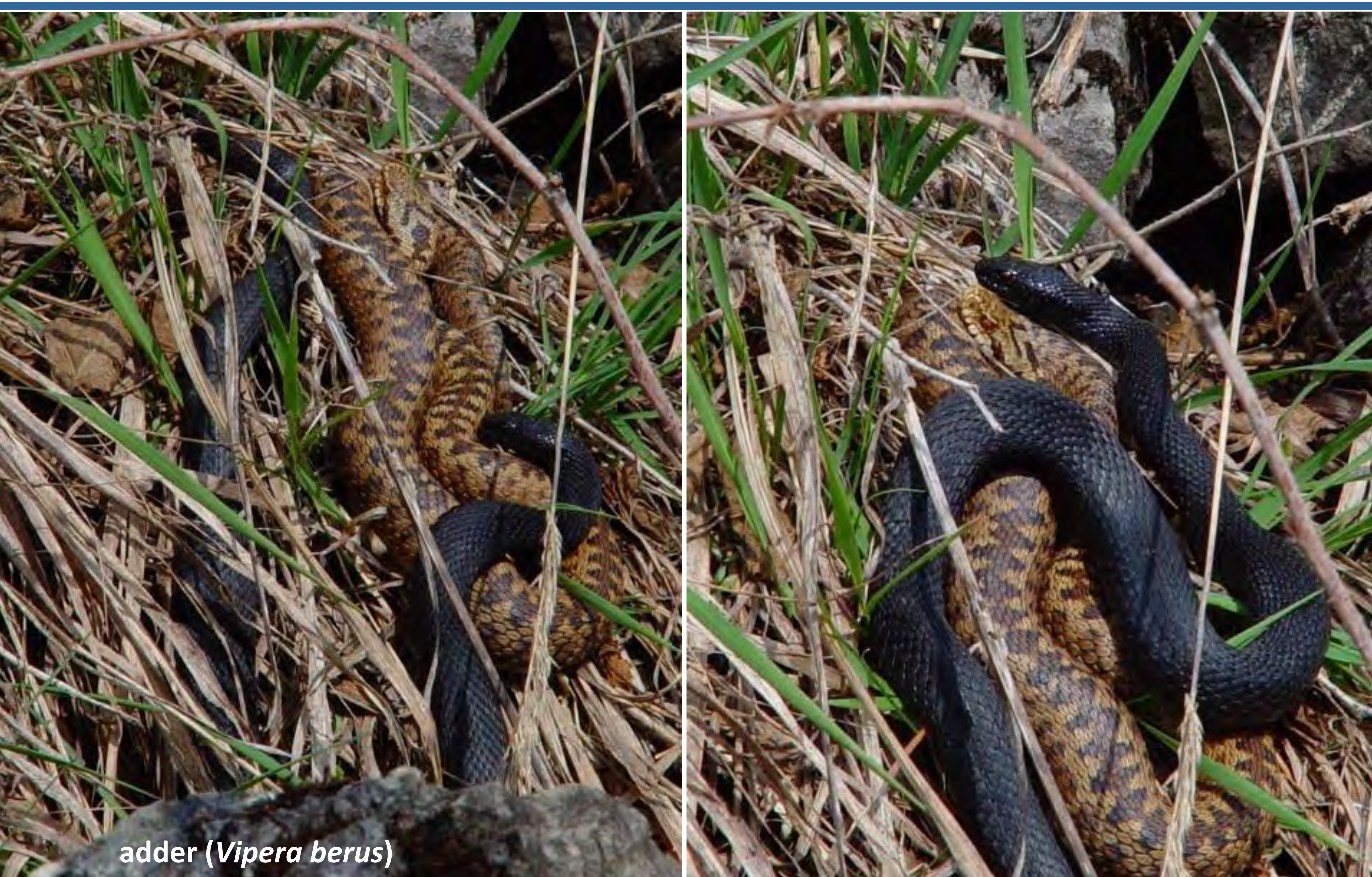
- large communal overwintering dens (Manitoba)
- males mating with females
- "she-males" attract males to increase their own temperature

Shine R, O'Connor D, Mason RT (2011) Female mimicry in garter snakes: Behavioural tactics of 'she-males' and the males that court. Canadian Journal of Zoology 78:1391-1396

Male-male fights

Male-male fights

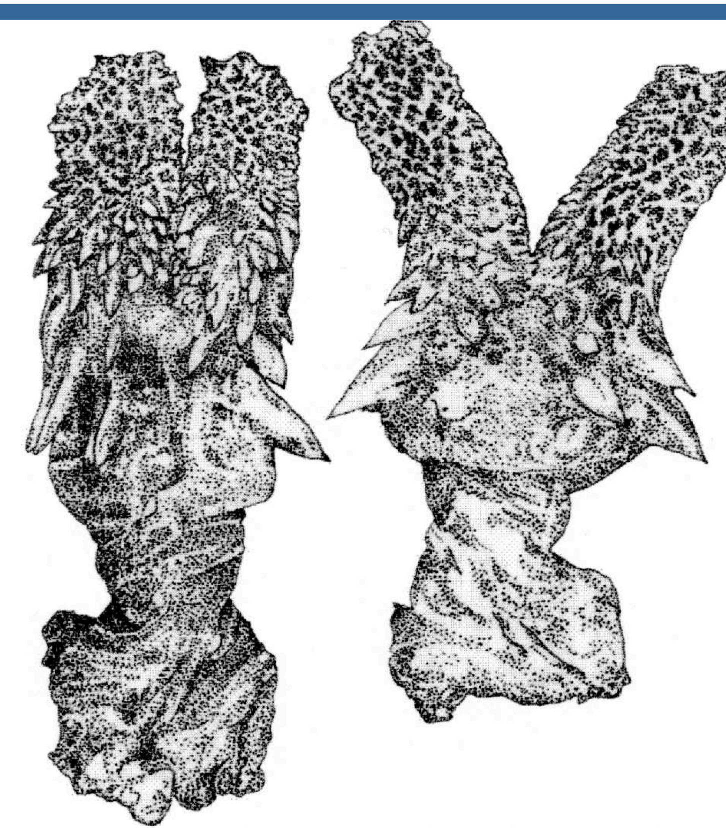
Mating



adder (*Vipera berus*)

Mating

Mating



Zuffi MAL (2002) A critique of the systematic position of the asp viper subspecies *Vipera aspis aspis* (Linnaeus, 1758), *Vipera aspis atra* Meisner, 1820, *Vipera aspis francisciredi* Laurenti, 1768, *Vipera aspis hugyi* Schinz, 1833 and *Vipera aspis zinnikeri* Kramer, 1958. Amphibia-Reptilia, 23:191-213.

Multiple paternity

Multiple mating, multiple paternity

Fitness related to the size of the fathers

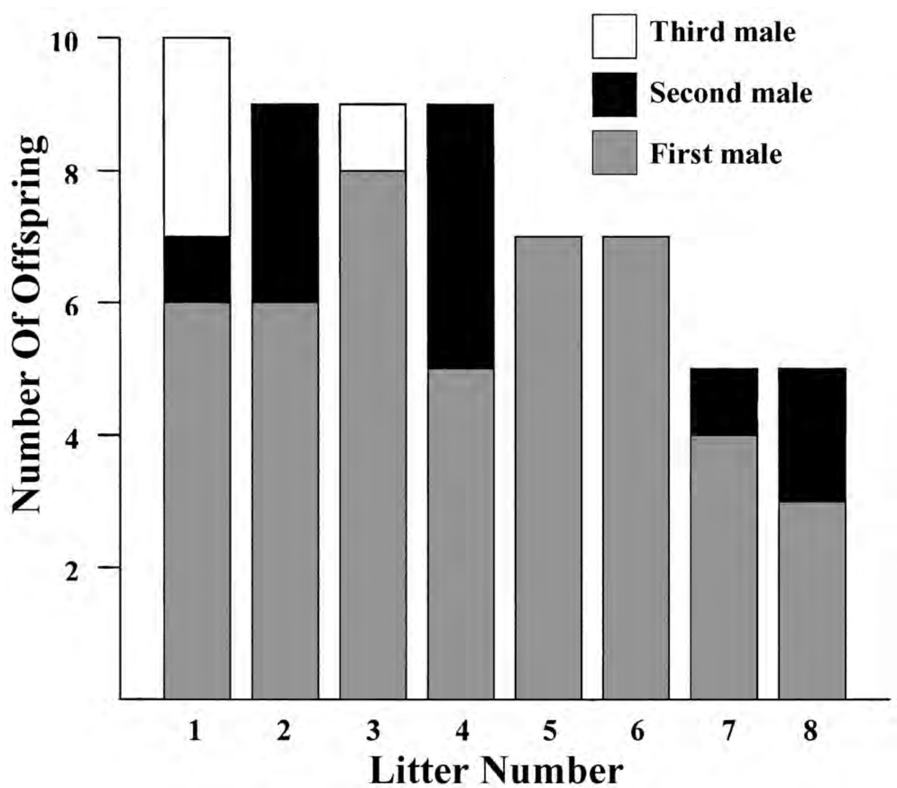


Fig. 1. Within litter proportions of offspring sired by the first, second, and third males when female *Vipera berus* were allowed to copulate with three different males each.

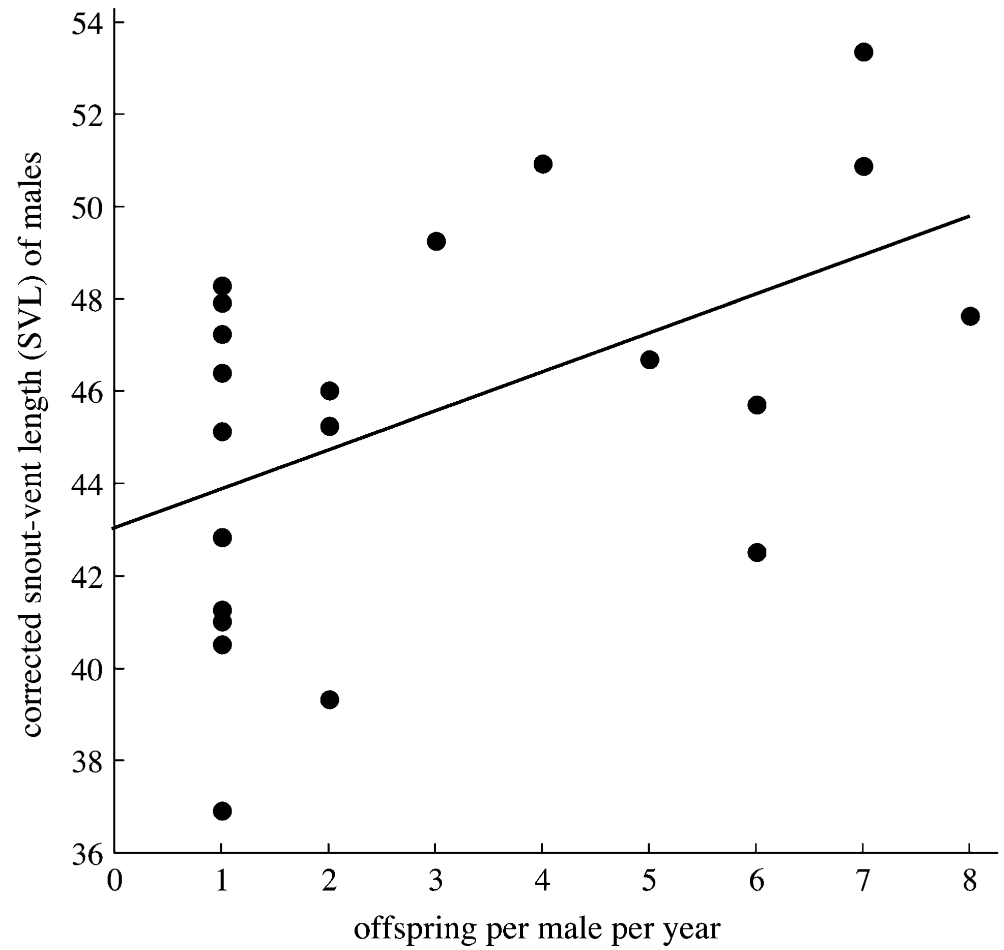


Figure 1. Correlation between the corrected SVL of the father and its number of offspring per year (Spearman rank correlation: $r_s = 0.252$, $N = 21$, $P = 0.02$).

Höggren M, Tegelström H (2002) Genetic evidence for first-male mating advantage in the adder (*Vipera berus*). *In*:Schuett GW, Höggren MH, Douglas ME, Greene HW (eds) Biology of the Vipers. Eagle Mountain Publishing, Sandy, UT.

Ursenbacher S, Erny C, Fumagalli L (2009) Male reproductive success and multiple paternity in wild, low density populations of the adder (*Vipera berus*). Journal of Heredity, 100, 365-370.

Mating

Wall lizard (*Podarcis muralis*)

Mating

Mating

Slow worm (*Anguis fragilis*)

Mating

mating injuries in females

Territoriality

Wall lizard (*Podarcis muralis*)

Territoriality

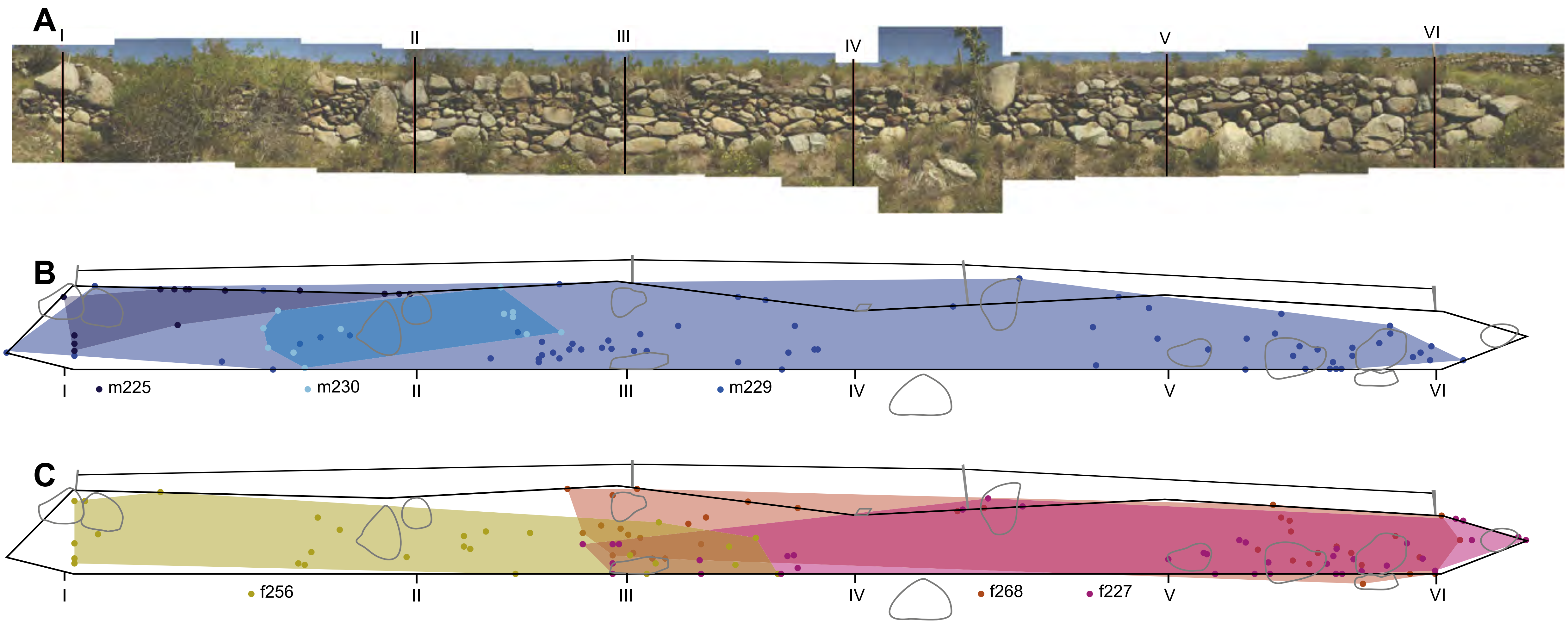


Fig. 1. Territoriality in *Podarcis muralis*. For the last five years we have been studying social and spatial behavior of a free-ranging population of *P. muralis* in the Pyrenees. The figure shows a photographic composition of a stone wall (A) in our field study site, and schematic representations of the home ranges of the male (B) and female (C) *P. muralis* observed in this wall during the 2009 breeding season. All the walls in our study site have been measured, mapped, and reference points painted in the field (using water-resistant paint) to allow us to locate lizards within an *x*–*y* coordinate system for each individual wall. *P. muralis* is a typical territorial species in which large adult males set out exclusive or nearly exclusive territories that encompass the home ranges of several females. Male m229, the dominant territorial male in this wall, was first spotted as a subadult in 2007 and remained the holding territorial male in this wall for two consecutive breeding seasons (2008 and 2009). Both m230 (a subadult male) and m225 (an adult but small – 2 year old – male) were chased and attacked by m229, and interactions between m229 and the three females within his home range (see Fig. 4) were frequently observed.

Font E, Barbosa D, Sampedro C, Carazo P (2002) Social behavior, chemical communication, and adult neurogenesis: Studies of scent mark function in Podarcis wall lizards. General and Comparative Endocrinology, 177:9-17.

Looking for partners

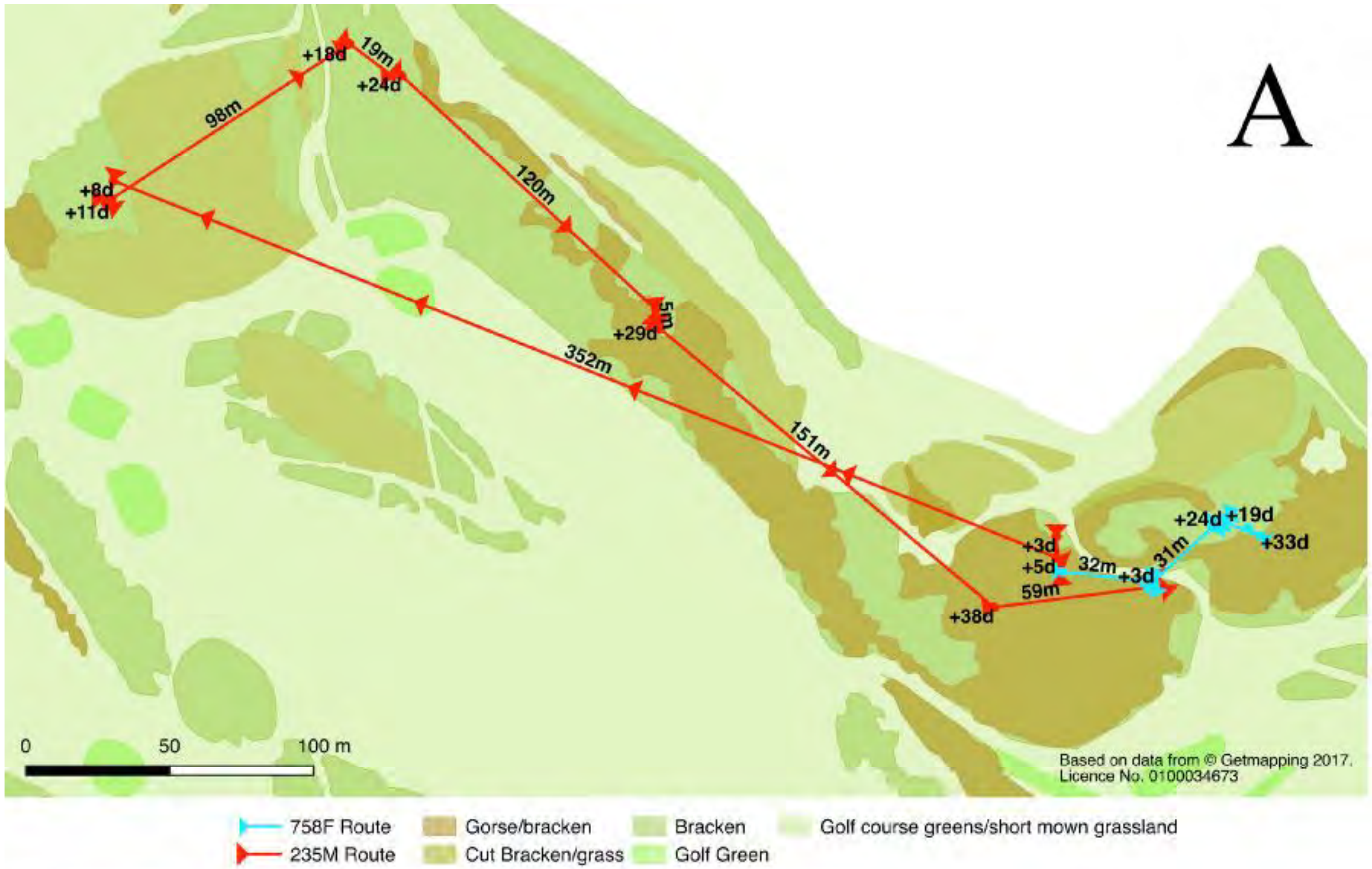


Fig. 4. Adder (*Vipera berus*) movements of two tracked snakes at a Herefordshire golf course and common, from April to early June 2017. A map (A) and photograph (B) of the study site. Snakes were tracked every two days with their position plotted using a GPS device. The routes of the male 235M (red line) and the female 758F (blue line) are shown. Male 235M tracked for 47 days, used a gorse (*Ulex* spp.) and bracken (*Pteridium* spp.) bank during the mate-searching period from April to early June, and was not recorded on short mown golf course fairways or greens. This snake found two females around day eight and day 11 (+8d, +11d) and on the return journey crossed a cut bracken/grassland area approximately 30 m wide, and is suspected to have attempted crossing this area twice. This snake moved 350 m over +5d to +8d, this outward move over three days to locate females was between tracking visits. This snake was not seen on the mown greens during tracking and likely travelled within cover. Notably the recorded return back to the initial overwintering area revealed a route through bankside cover. In contrast, female 758F movements were within a small area moving 109 m from tagging to tag sloughing, in a tracked time of 39 days, behaviour typical of females. 758F was thought to have been captured by a common buzzard (*Buteo buteo*) after the tag had been shed. These observations reveal the importance of suitable habitat to create safe dispersal corridors for snakes: overzealous management could result in isolating individual snakes and groups (Photo: N. Hand)

Looking for partners

End spring - summer

Feeding behaviour

Feeding behaviour

All Swiss snakes and lizards: predators

Lizards: arthropods

Slow worm: molluscs and eathworms

snakes: vertebrates

- *Natrix maura, N. tessellata*: manly fish (60-100%)
- *Natrix natrix, N. helvetica*: mainly amphibians (83-98%)
- *Coronella austriaca*: mainly reptiles (70-98%)
- *Zamenis longissimus*: also birds (good climber)
- *Herophis viridiflavus*: reptiles and mammals
- Vipers: mainly lizard when youngs, mainly mammals when adults

Emys orbicularis: omnivorous

Feeding behaviour

Grass snake: 31 g, frog: 22 g

Feeding behaviour

Feeding behaviour

asp viper (*Vipera aspis*)

asp viper (*Vipera aspis*)

asp viper (*Vipera aspis*)

asp viper (*Vipera aspis*)

asp viper (*Vipera aspis*)

asp viper (*Vipera aspis*)

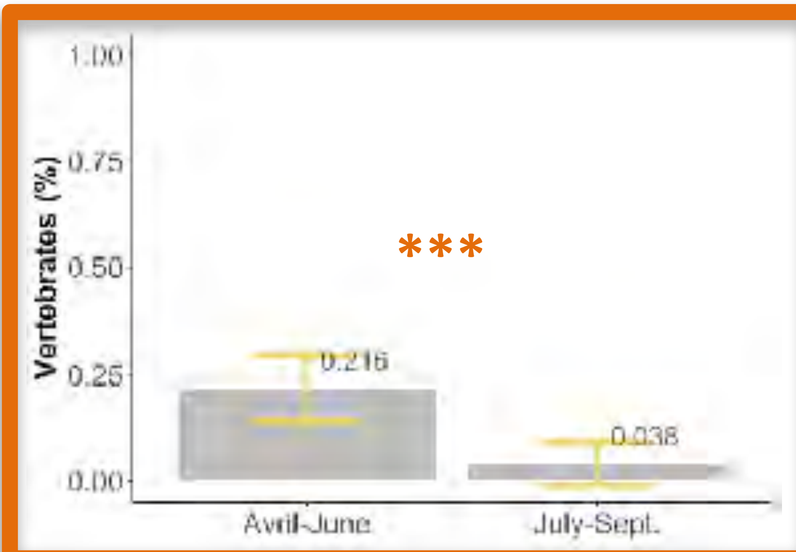
Feeding behaviour

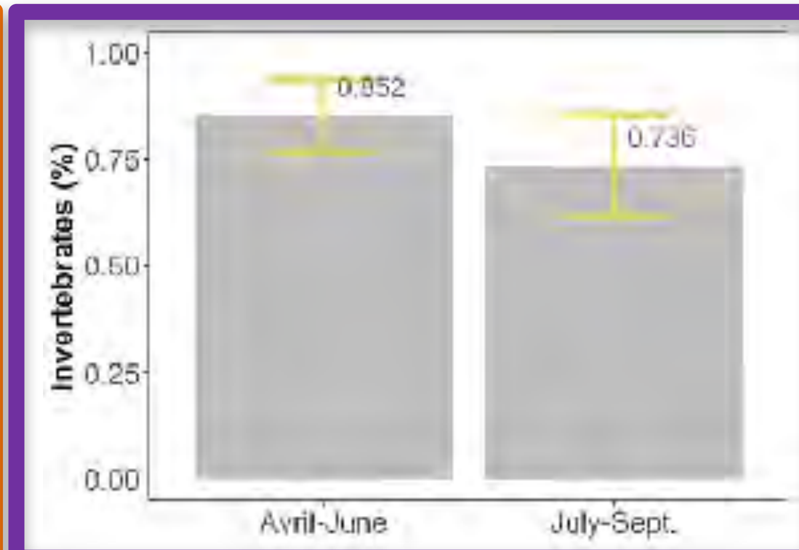
Feeding behaviour

Feeding behaviour

wall lizard (*Podarcis muralis*)

Feeding behaviour - Emys orbicularis

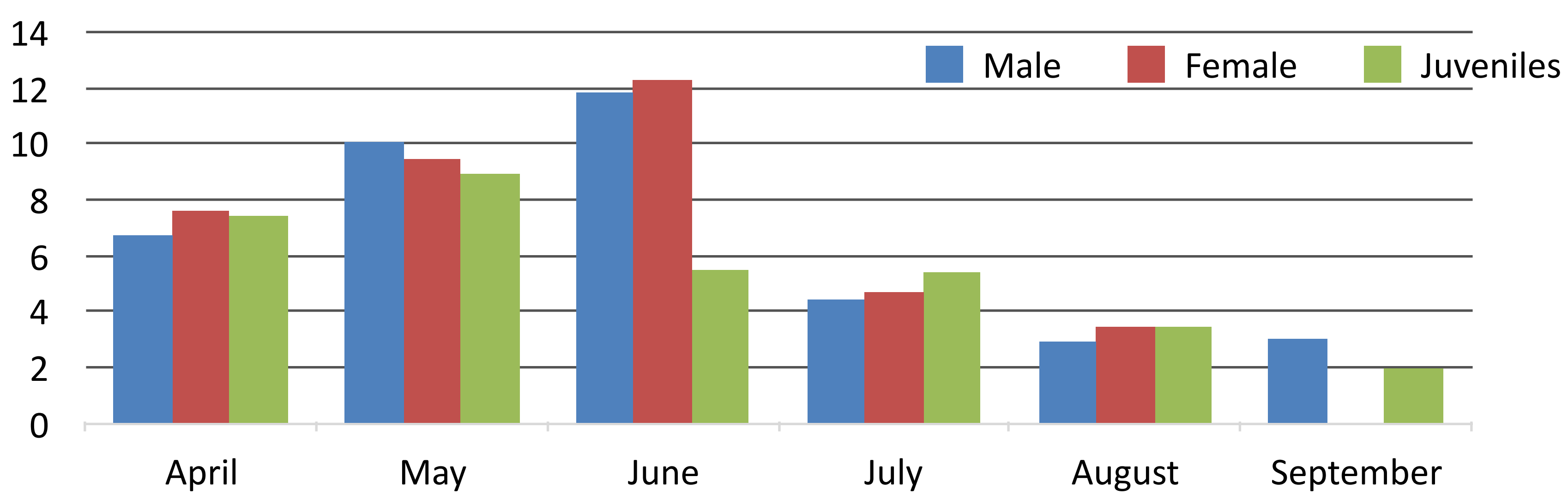




Plants : April-June 95.5% // others 100%

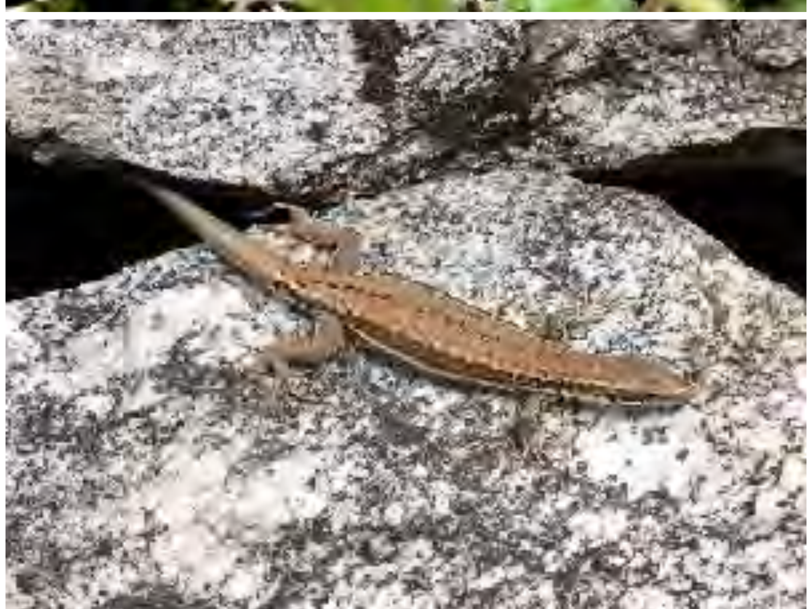
Vertebrates : April-June 21.6% // others 3.8 % -> p-value=0.008

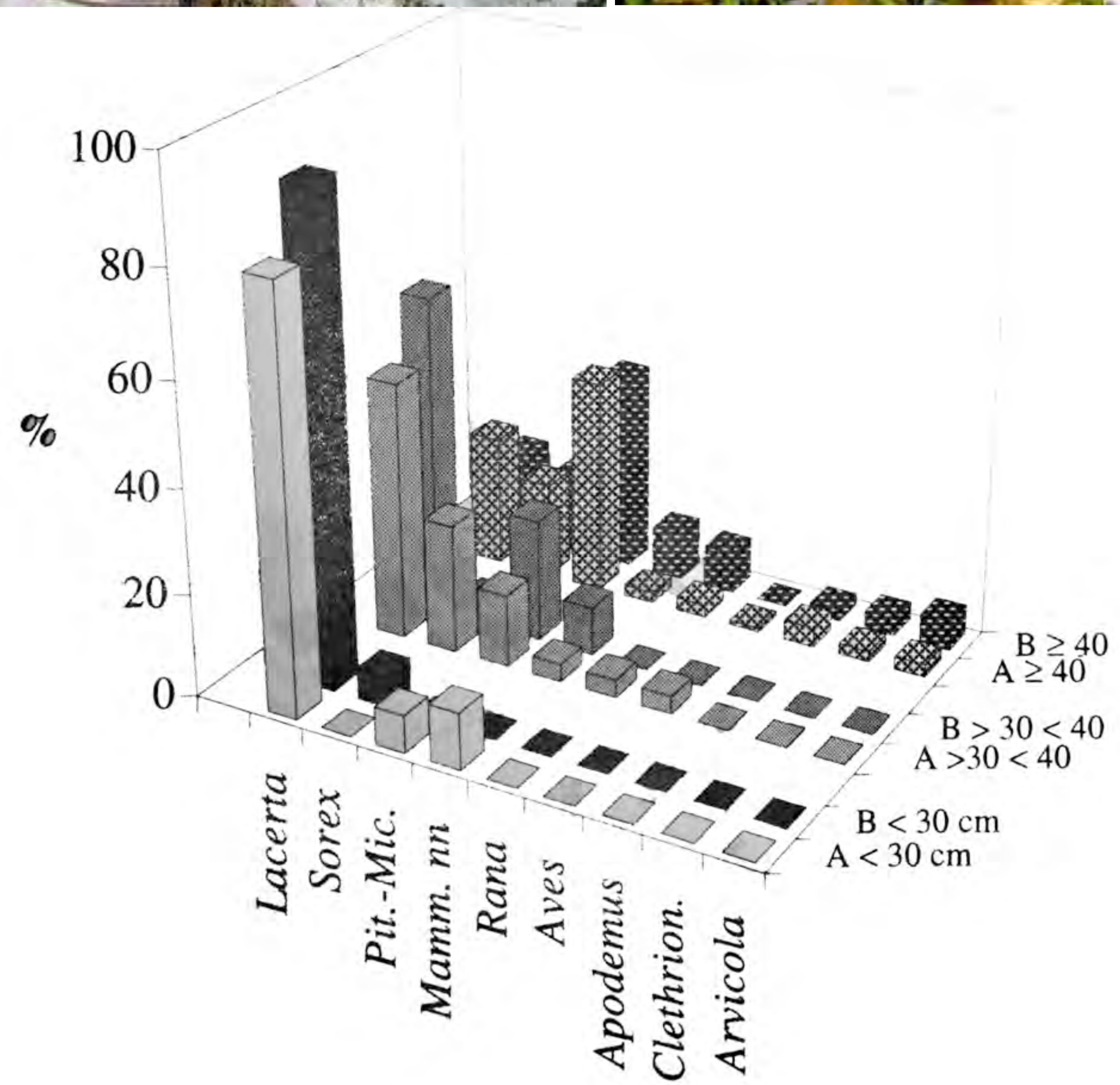
Invertebrates : April-June 86.4% // other 73.6%



Ducotterd C, Crovadore J, Lefort F, Guisan A, Ursenbacher S, Rubin J-F (submitted) The feeding behaviour of the European pond turtle (*Emys orbicularis*, L. 1758) is not a threat for other endangered species. Global Ecology and Conservation

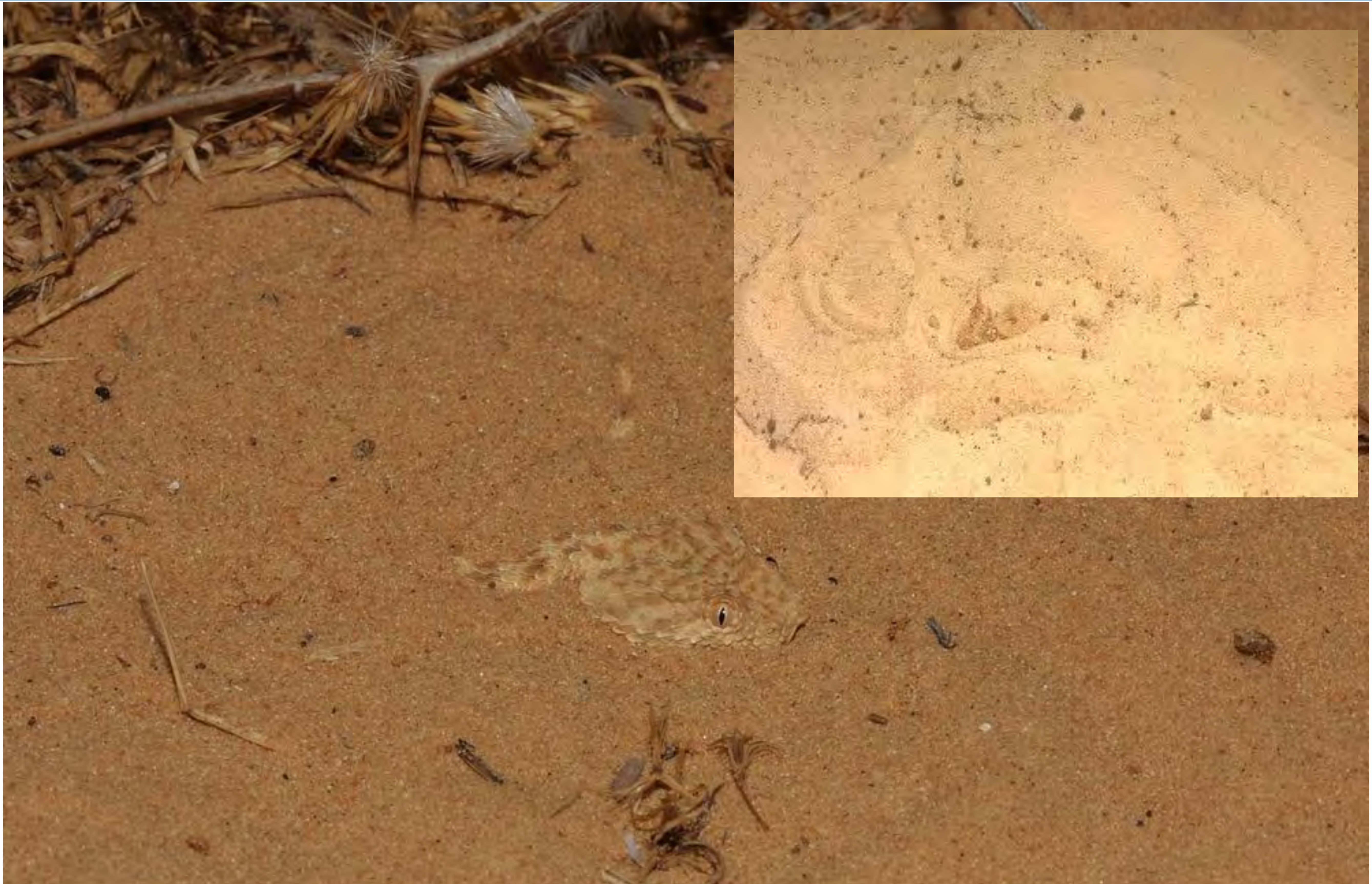
Feedingbehaviour - *vipers*





Monney J-C (1995) Comparaison du régime alimentaire de *Vipera aspis* et *Vipera berus* dans l'Oberland bernois. Bull Soc Frib Sc Nat, 84, 105-141.

Feeding behaviour - *special cases*



Feeding behaviour *- special cases*

caudal luring

https://www.youtube.com/watch?v=8SuuWLhJ8RY

Feeding behaviour - *special cases*

tongue luring

https://www.youtube.com/watch?v=x5iT_-twKD4

Predators

Predators

Predators

Predators

Anti-predator behaviour

Anti-predator behaviour

Anti-predator behaviour - *crypsis*

Anti-predator behaviour *- crypsis*

Anti-predator behaviour *- advertisement*

Anti-predator behaviour - *mimicry*

Coral snake
is poisonous

King snake is not

Digestion

Digestion

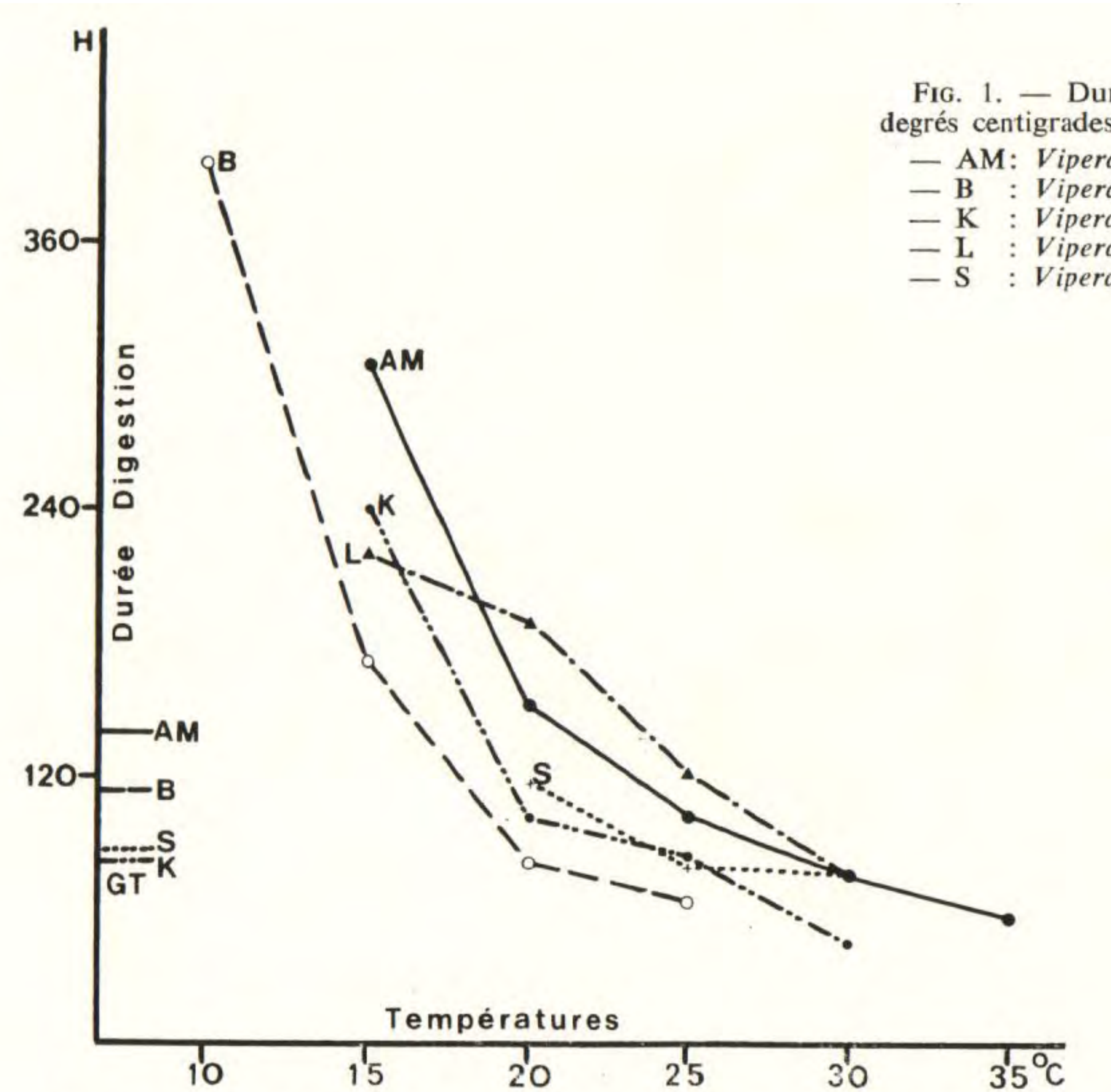


Fig. 1. — Durée de la digestion en heures en fonction de la température en degrés centigrades et en gradient thermique (G.T.).

— AM : *Vipera ammodytes*
— B : *Vipera berus*
— K : *Vipera kaznakovi*
— L : *Vipera latastei*
— S : *Vipera seoanei*

Naulleau G (1983) Action de la température sur la digestion chez cinq espèce de Vipères européennes du genre *Vipera*. Bulletin de la Société Zoologique de France, 108, 47-66.

Digestion

Durée de la saison d'alimentation et rations alimentaires annuelles chez les Vipères

	Durée de la saison d'alimentation (en jours)					Quantité de nourriture absorbée ([1])				
	mn	mx	m	$\sigma/\sqrt{n}$	n	mn	mx	m	$\sigma/\sqrt{n}$	n
— Grands mâles adultes										
Années normales. .	39	154	84,29 ±	4,34	31	81	141	112,75	5,54	19
1976	59	99	78,15 ±	3,99	13	113	191	142,06 ±	10,94	8
— Jeunes mâles matures										
Années normales. .	73	128	105,00 ±	7,75	7	169	222	189,35 ±	8,02	7
1976	97	102	99,50		2	177	180	178,50		2
— Femelles non reproductrices ni postparturientes										
Années normales. .	68	161	96,92 ±	7,01	12	105	133	117,37 ±	4,17	6
1976	59	96	81,50 ±	7,90	4	163	171	167,00		2
— Femelles reproductrices ([2])										
Années normales. .	20	115	66,80 ±	8,2	10	32	75	55,40 ±	8,10	5
— Femelles postparturientes ([3])										
Années normales. .	124	148	135,50 ±	5,32	6	244	300	276,00 ±	11,66	5
1976	101	120	111,30 ±	5,55	3	279	300	289,50 ±		2

Pour chaque résultat, nous donnons successivement le minimum, le maximum, la moyenne, l'erreur standard et le nombre de données.

([1]) En p. 100 du poids de la Vipère, pesée au début de la saison d'alimentation.
([2]) *Vipera berus* non comprise. Voir le texte pour cette espèce, ainsi que pour l'année 1976.
([3]) A l'exception des femelles ayant un cycle sexuel annuel ou biennal.

Saint Girons H (1979) Les cycles alimentaires des Vipères européennes dans des conditions semi-naturelles. Ann Biol Anim Bioch Biophys, 19: 125-134.

Metabolism

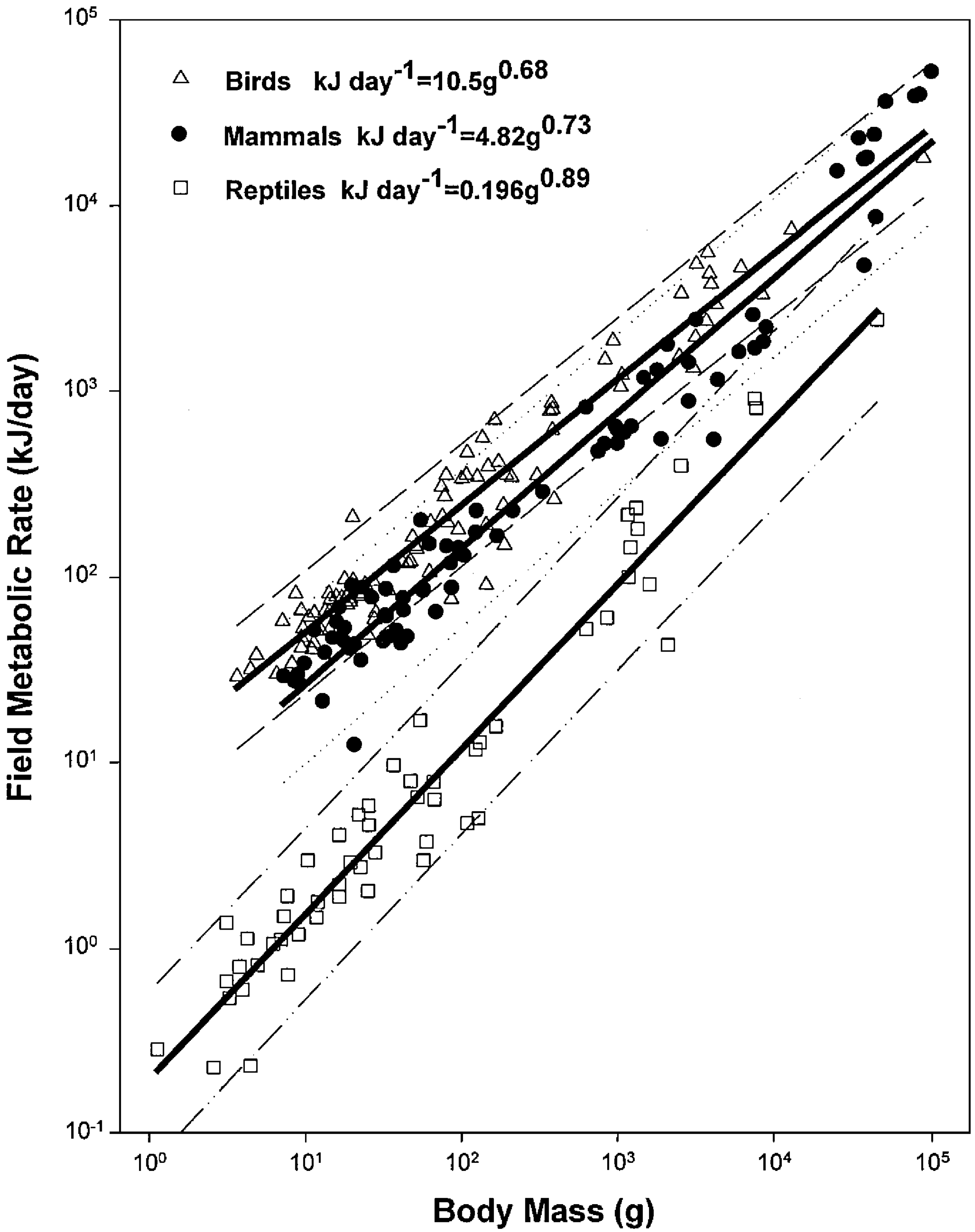


Figure 1 Allometry of field metabolic rate in terrestrial vertebrates. (*Solid lines*) least-squares linear regression lines for birds, mammals, and reptiles (see Equations 1, 17, and 32 in Table 2); (*dashed or dotted lines*) 95% confidence intervals of the prediction for each line.

shedding (skin changing)

shedding (skin changing)

shedding (skin changing)

shedding (skin changing)

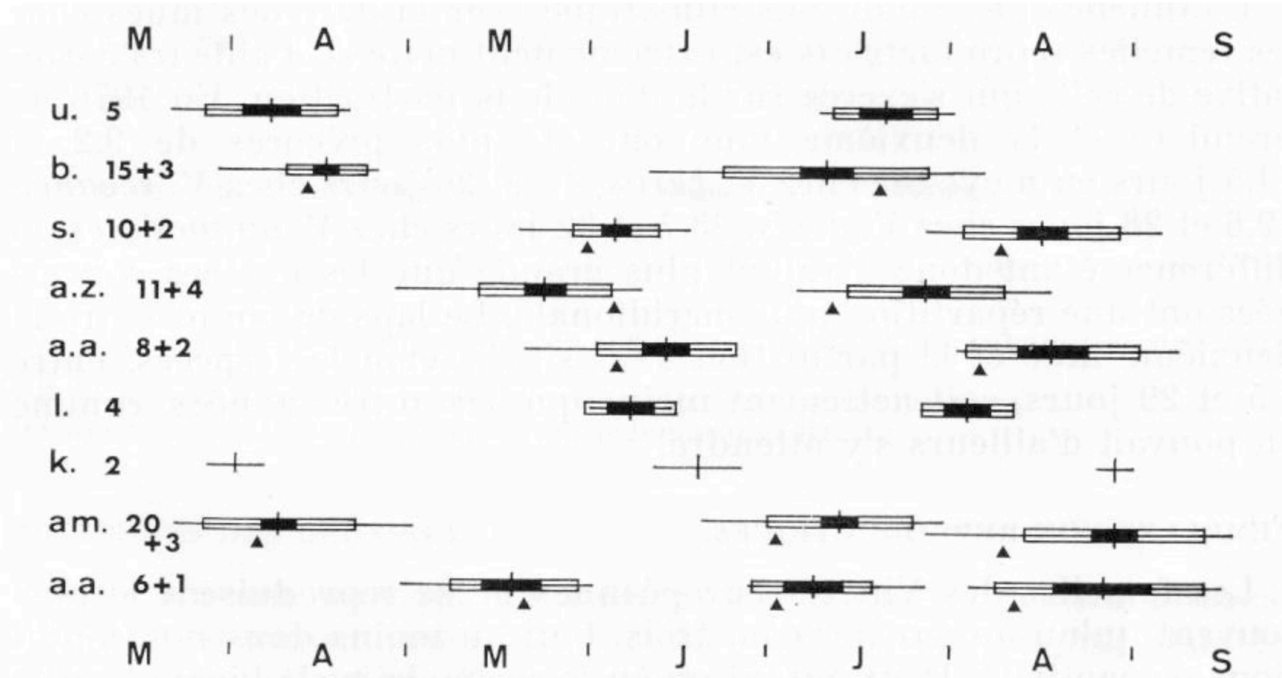


FIG. 1. — Cycle des mues chez les mâles adultes des différentes espèces de Vipères.

En abscisses : temps en mois. En ordonnées : les différentes espèces. u = *Vipera ursinii*. b = *V. berus*. s = *V. seoanei*. a.z. = *V. aspis zinnikeri*. a.a. = *V. aspis aspis*. l = *V. latastei*. k = *V. kaznakovi*. am = *V. ammodytes*. Le premier chiffre après la lettre indiquant l'espèce correspond au nombre d'années-individus lors des années « normales », le second au nombre des années-individus d'observations en 1976. Pour les années normales, nous donnons la moyenne, l'erreur standard, l'écart type et la dispersion totale, pour 1976 seulement la moyenne, indiquée par un triangle.

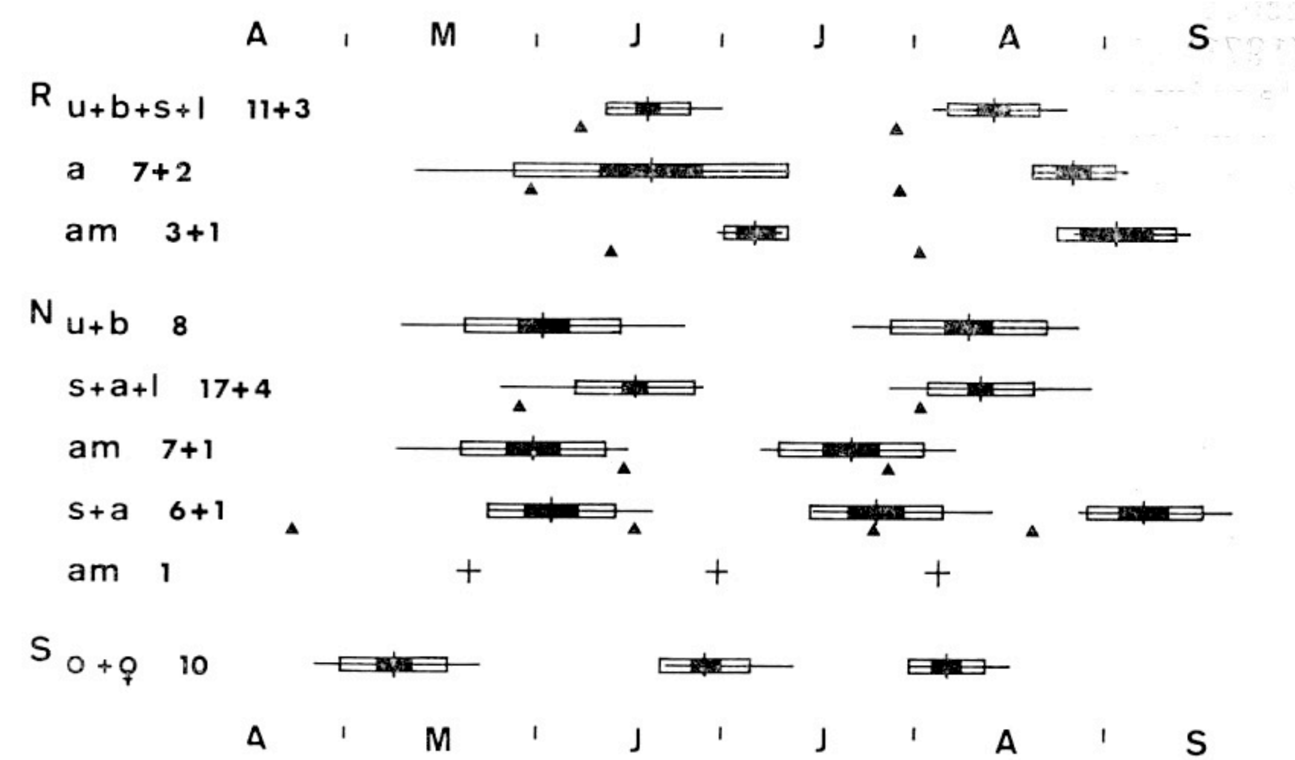


FIG. 2. — Cycle des mues chez les femelles adultes et les subadultes des deux sexes.

R = femelles reproductrices. N = femelles non reproductrices. S = subadultes des deux sexes. Pour le reste, même légende que fig. 1.

Saint Girons H (1980) Le cycle des mues chez les vipères européennes. Bulletin de la Société Zoologique de France, 105:551-559.

Reproduction

Oviparous

- lay eggs
- no or limited parental care

Ovoviviparous

- keep eggs inside

Viviparous

- keep eggs inside
- exchanges between mother and juveniles

Eggs

Oviparous

Sand lizard, green lizard, wall lizard

eggs development (before egg laying): 4-6 weeks ➜ ≈10-12 eggs
incubation: 4-7 weeks
size: ø 7-10mm, 12-18mm (wall lizard: ø 6-7mm, 10-12mm)

Grass snakes, dice snake, viperine snake

eggs development (before egg laying): 4-6 weeks ➜ ≈25 (40) eggs
incubation: 4-10 weeks,
size: ø 10-18mm, 20-30mm

Whip snake, Asculapian snake

eggs development (before egg laying): 5-7 weeks ➜ ≈15 eggs
incubation: 6-10 weeks
size: ø 15-22mm, 28-40mm (whip snake) / 40-55mm (Asculapian snake)

info fauna CSCF
info fauna karch

Eggs

sand lizard (*Lacerta agilis*)

Asculapian snake (*Zamenis longissimus*)

Asculapian snake (*Zamenis longissimus*)

Grass snake (*Natrix helvetica*)

Sand lizard (*Lacerta agilis*)

Sand lizard (*Lacerta agilis*)

Grass snake (*Natrix helvetica*)

Grass snake (*Natrix helvetica*)

home range: 15.7 – 57.8 ha

5 of 7 ♀ gravid females have selected the same place to lay the eggs

Wisler C, Hofer U, Arlettaz R (2008) Snakes and monocultures: Habitat selection and movements of female Grass Snakes (*Natrix natrix* L.) in an agricultural landscape. J Herpetol, 42: 337-346.

Oviparous

oviparous cycles (lizards and snakes)

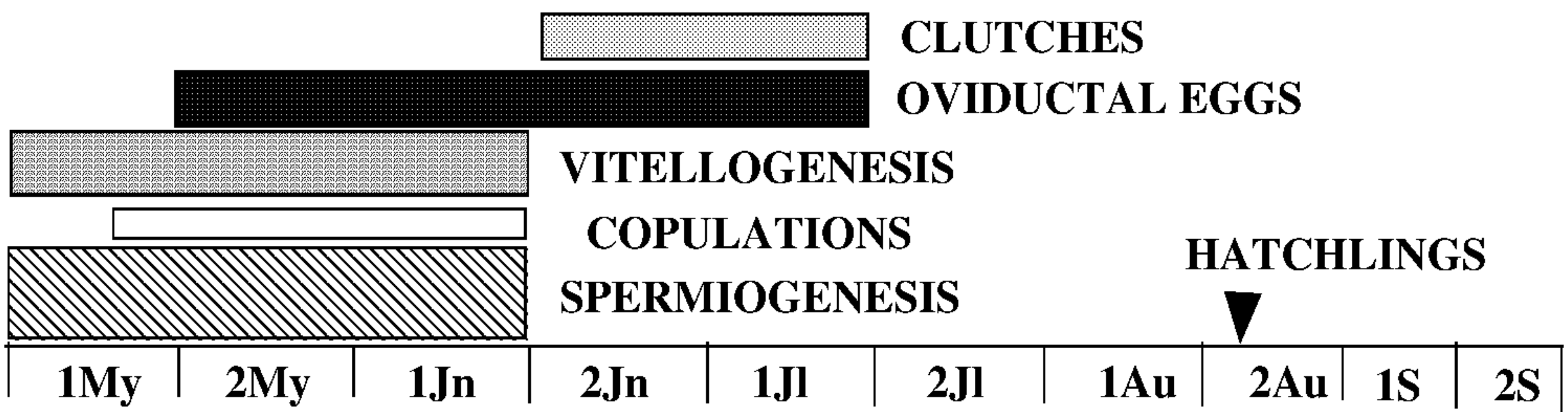


Figure 2. Phenology of the main reproductive events of the Pyrenean population of *Lacerta agilis.*

Amat F, Llorente GA, Carretero MA (2000) Reproductive cycle of the sand lizard (*Lacerta agilis*) in its southwestern range. Amphibia-Reptilia 21:463-476

Ovoviviparous - viviparous

common lizard

8-10 weeks before parturition ➜ 6-8 young

slow worm, smooth snake, asp viper, adder

9-15 weeks before parturition ➜ 6-12 (15) young


asp viper (*Vipera aspis*)

smooth snake (*Coronella austriaca*)


asp viper (*Vipera aspis*)

common lizard (*Zootoca vivipara*)

common lizard (*Zootoca vivipara*)

slow worm (*Anguis fragilis*)

asp viper (*Vipera aspis*)

asp viper (*Vipera aspis*)

asp viper (*Vipera aspis*)

asp viper (*Vipera aspis*)

asp viper (*Vipera aspis*)

asp viper (*Vipera aspis*)

asp viper (*Vipera aspis*)

asp viper (*Vipera aspis*)

asp viper (*Vipera aspis*)

asp viper (*Vipera aspis*)

Ovoviviparous - viviparous

common lizard: *Zootoca vivipara*

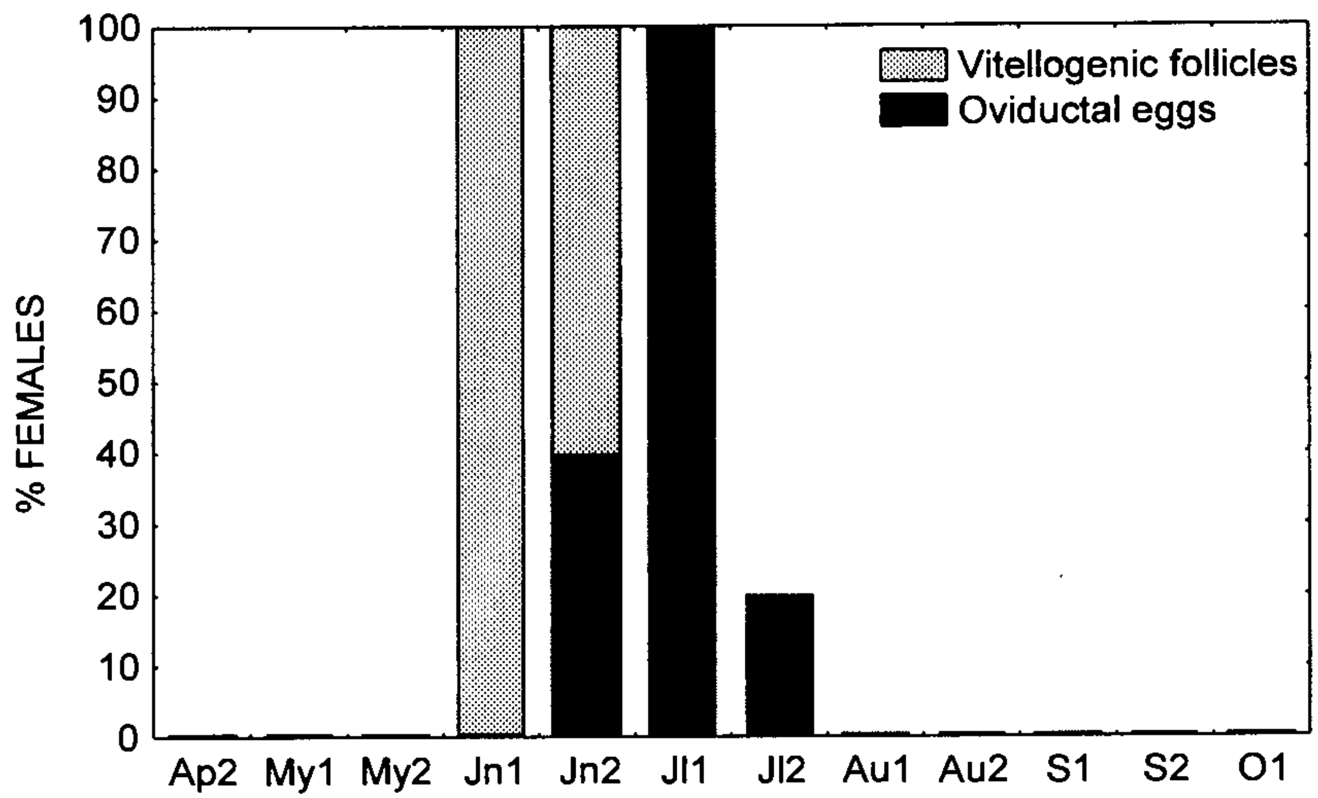


Fig. 5. Percentage of females with vitellogenic follicles and oviductal eggs throughout the active period.

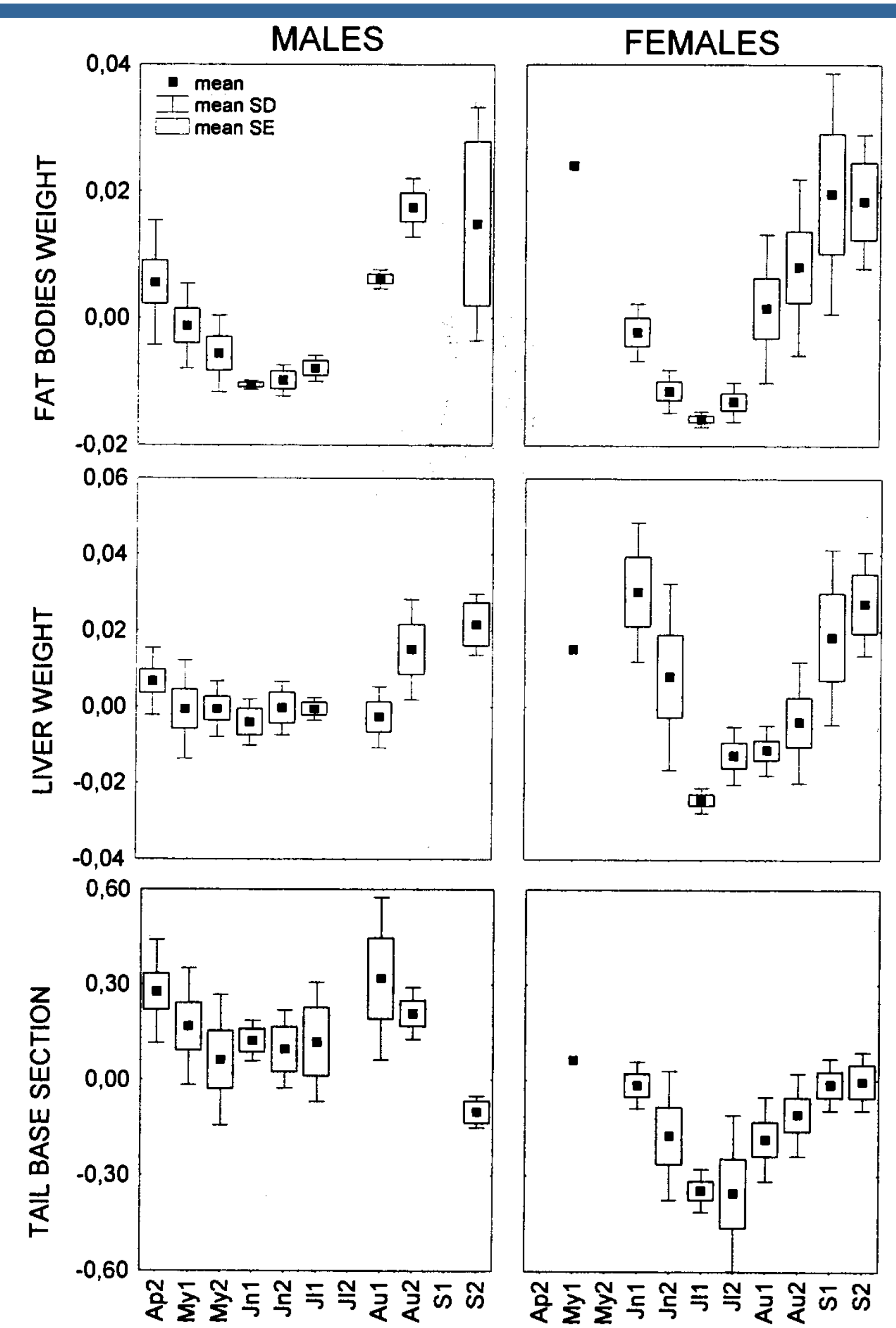


Fig. 6. Annual variation of the fat body and liver weight, and the area of the tail base section in males and females. Abscises show the regression residuals between each variable and the snout-vent length, SVL (both log-transformed).

Roig JM, Carretero MA, Llorente GA (2000) Reproductive Cycle in a Pyrenean Oviparous Population of the Common Lizard (*Zootoca vivipara*). Netherlands Journal of Zoology 50:15-27

Ovoviviparous - viviparous

ovulation in the Asp viper: *Vipera aspis*

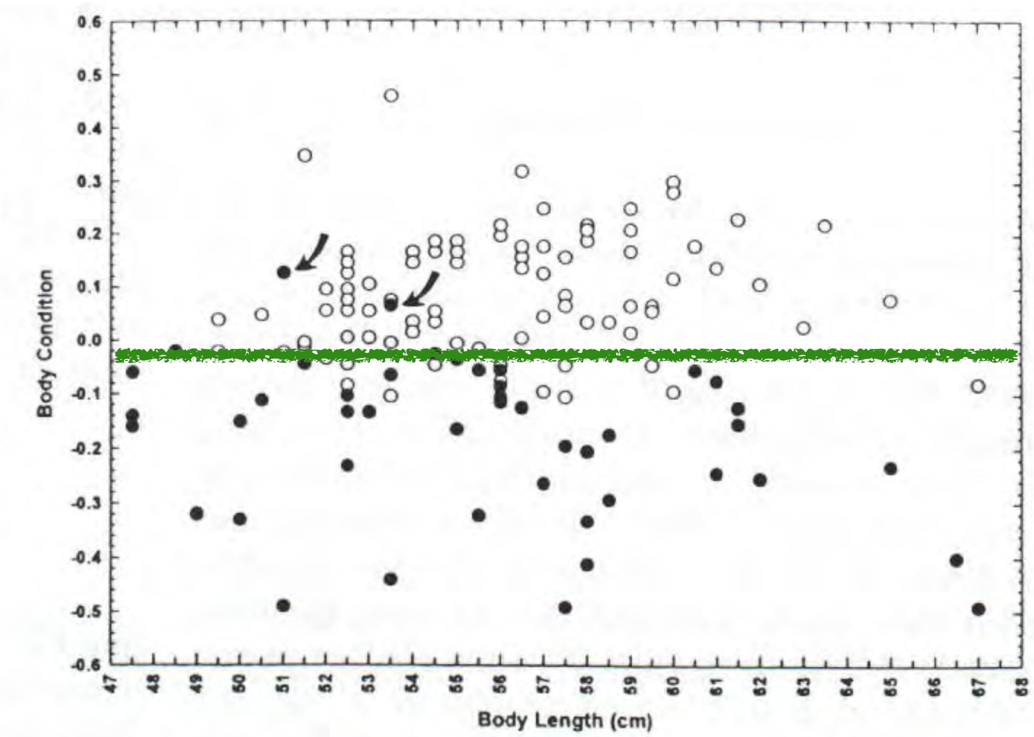


Fig. 1 Early body condition plotted against body length (March-April) of 129 free-ranging female asp vipers. The 129 snakes were recaptured 2–6 months later in order to determine individual reproductive status, hence a posteriori reproductive decision. Females which became vitellogenic are indicated by *open circles*, females that did not by *filled circles*. *Arrows* show two small females with high body condition that did not become vitellogenic

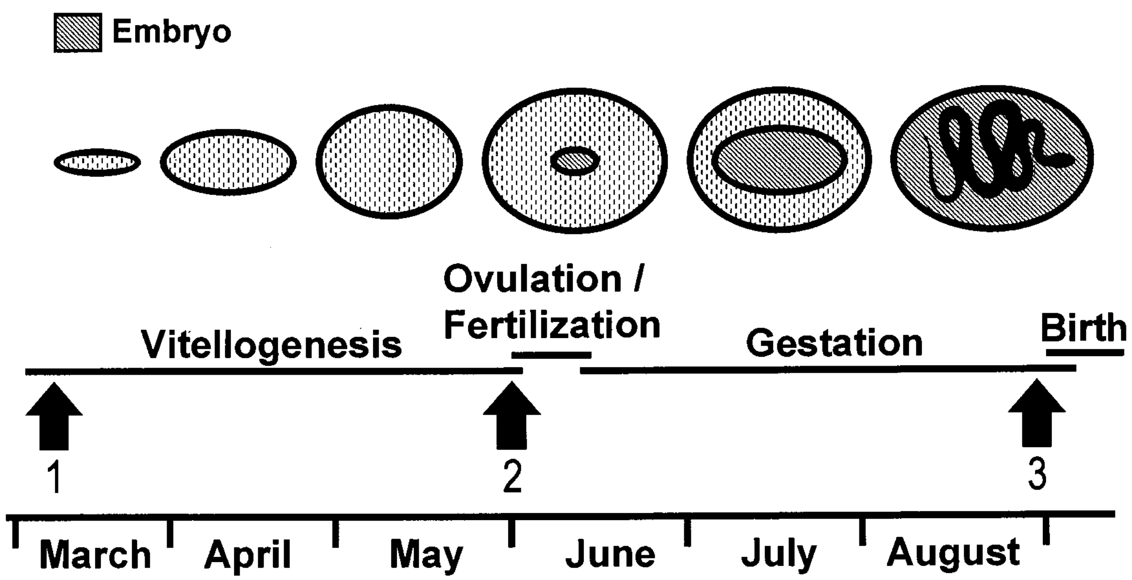


Fig. 1. In the aspic viper (*Vipera aspis*), vitellogenesis begins in early March, with ovulation occurring three months later in early June. Follicular growth (yolk deposition) accelerates in late April and is complete in early June. Embryonic development and egg hydration (dashed zones) occur later, from June to August during gestation until parturition three months later. In the present study, 44 reproductive females were captured at three different physiological states: (1) at the onset of vitellogenesis (arrow 1), (2) at the end of vitellogenesis (arrow 2), and (3) before parturition (arrow 3). Maternal body condition index (an estimate of previtellogenic body reserves) was calculated at the onset of vitellogenesis.

Naulleau G, Bonnet X (1996) Body condition threshold for breeding in a viviparous snake. Oecologia, 107:301-306.
Bonnet X, Naulleau G, Shine R, Lourdais O (2001) Short-term versus long-term effects of food intake on reproductive output in a viviparous snake, *Vipera aspis*. Oikos, 92:297-308

Ovoviviparous - viviparous

fecundity in the Asp viper: *Vipera aspis*: impact of high density of food

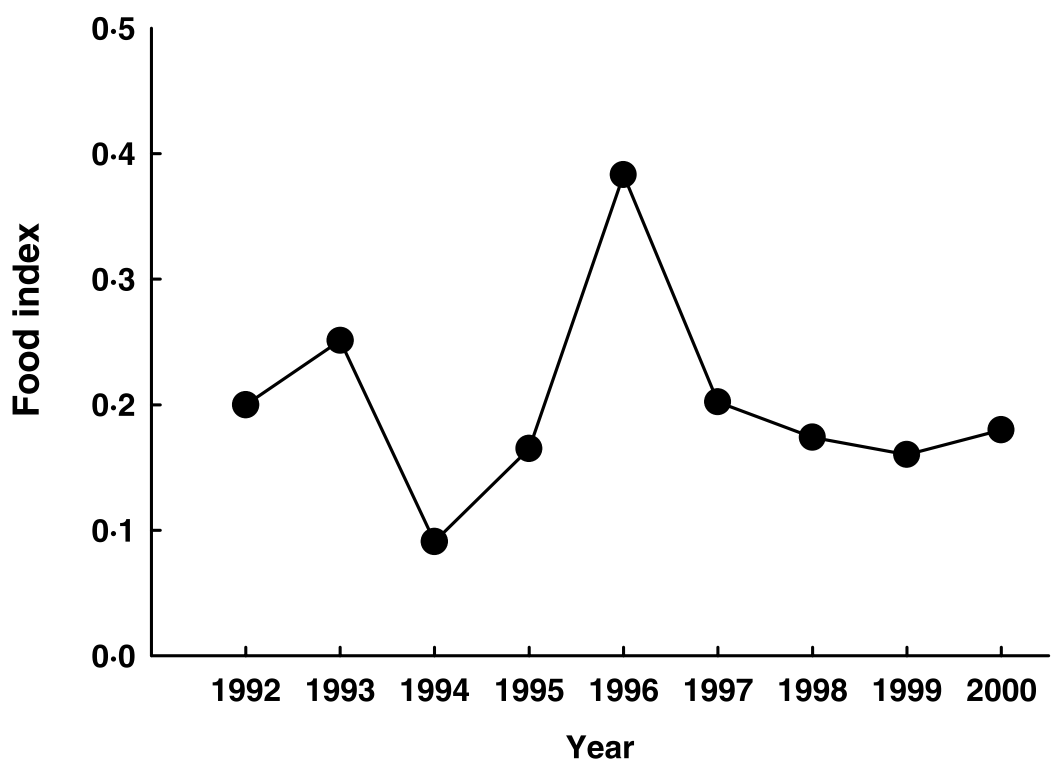


Fig. 1. Annual variation in the proportion of aspic vipers containing prey items in the stomach at the time of capture. Analyses in this paper use this proportion as an index of availability of prey for the snakes. Most of these prey were voles (*Microtus arvalis*). See text for details on the method.

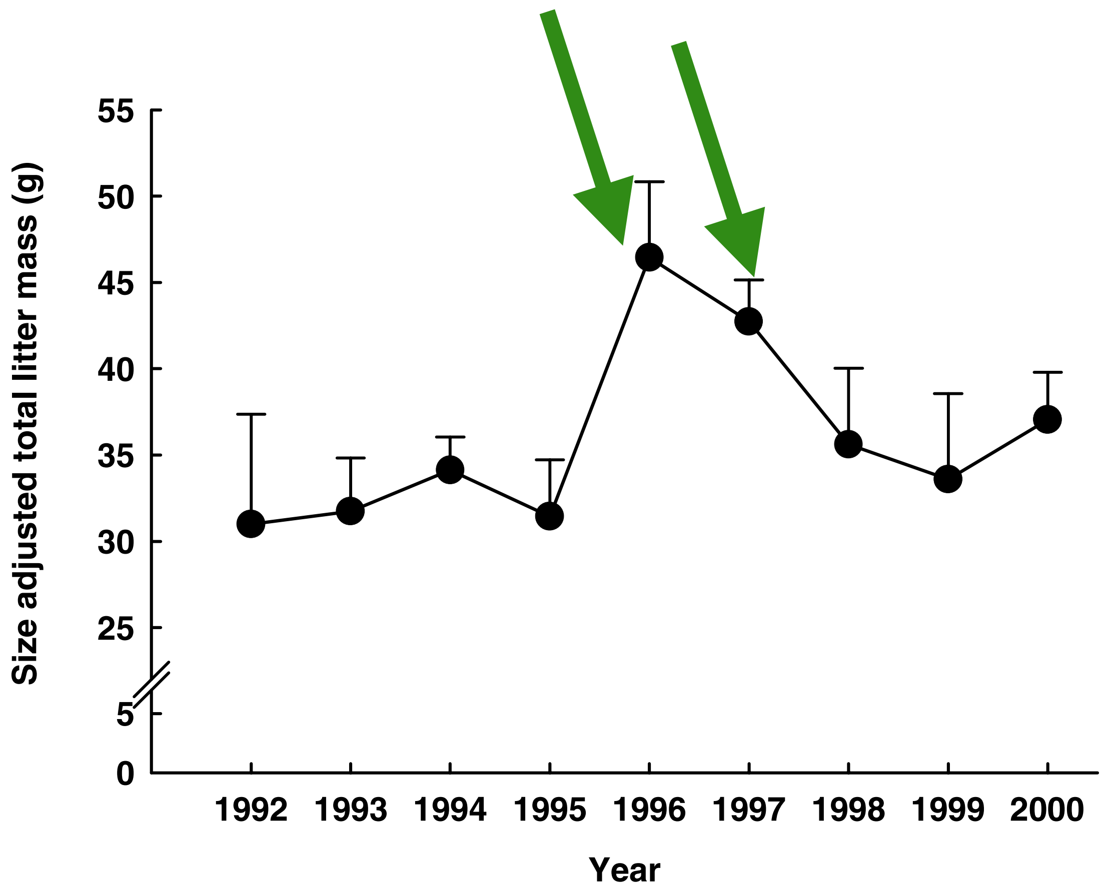


Fig. 3. Annual fluctuations in mean total litter mass (± SE) of female aspic vipers. Values have been scaled with female body length. Fifteen litters that were entirely nonviable were excluded from this analysis (see text for statistics).

Lourdais O, Bonnet X, Shine R, Denardo D, Naulleau G, Guillon M (2002) Capital-breeding and reproductive effort in a variable environment: a longitudinal study of a viviparous snake. Journal of Animal Ecology, 71:70-479.

Ovoviviparous - viviparous

fecundity in the Asp viper: *Vipera aspis*: impact of high density of food

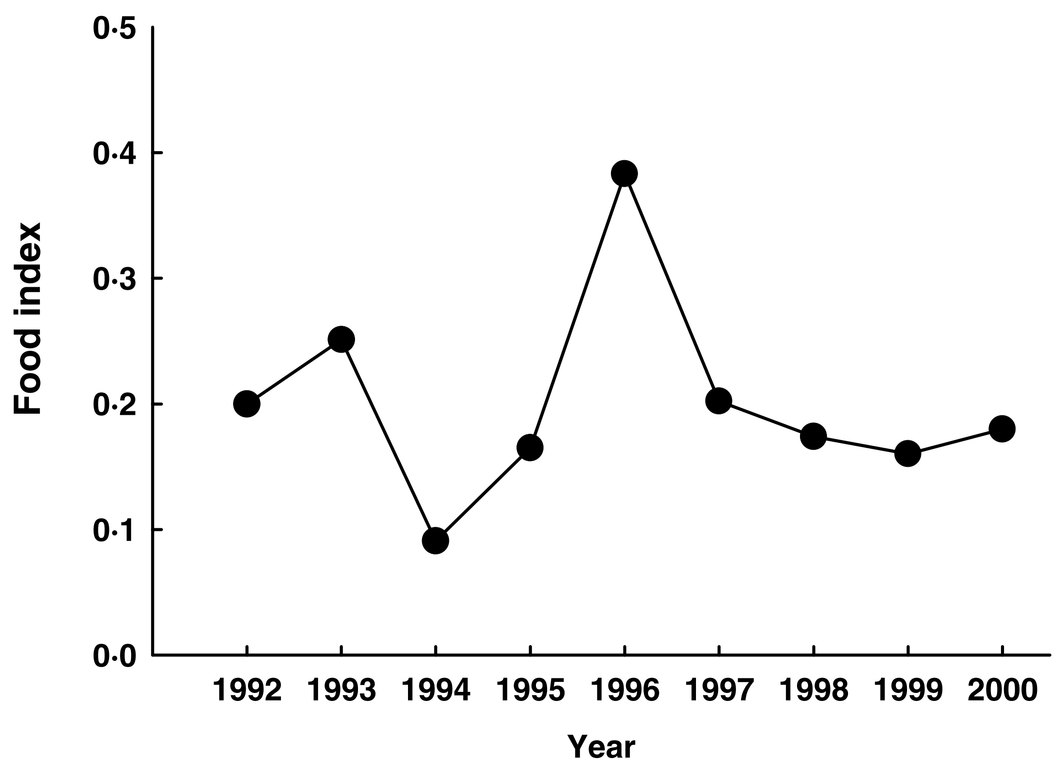


Fig. 1. Annual variation in the proportion of aspic vipers containing prey items in the stomach at the time of capture. Analyses in this paper use this proportion as an index of availability of prey for the snakes. Most of these prey were voles (*Microtus arvalis*). See text for details on the method.

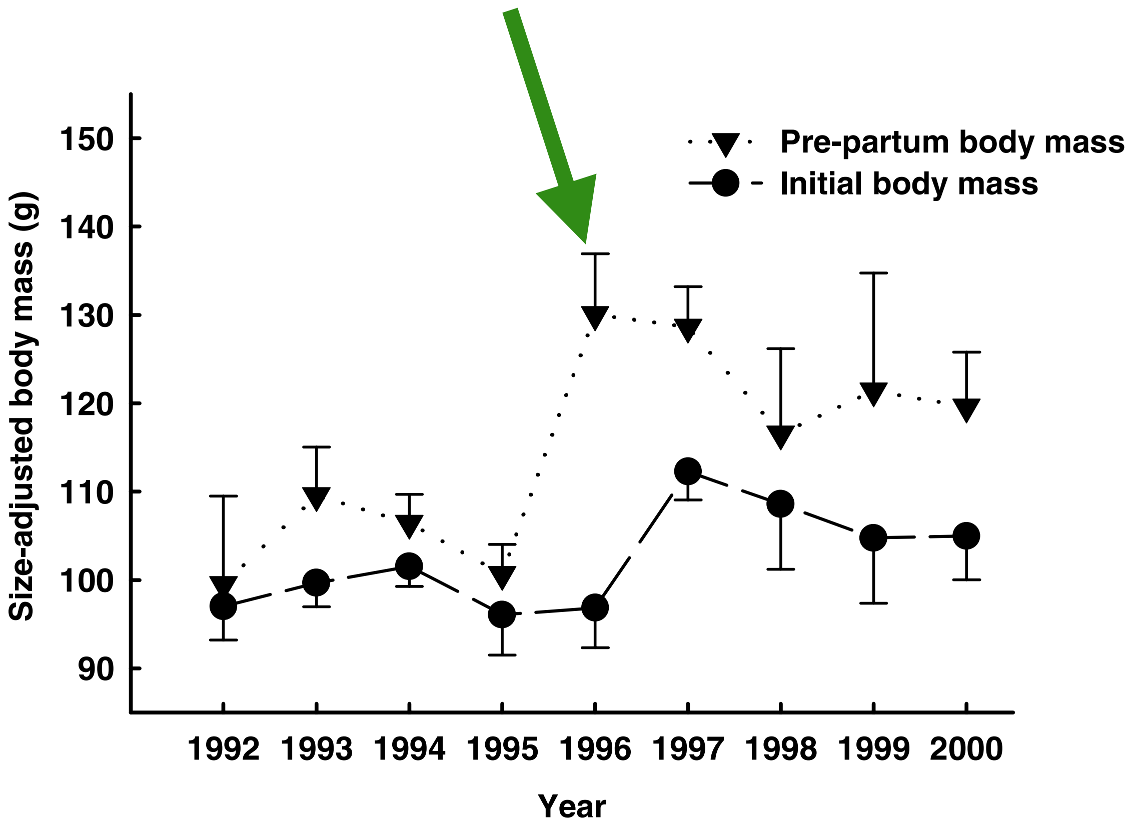
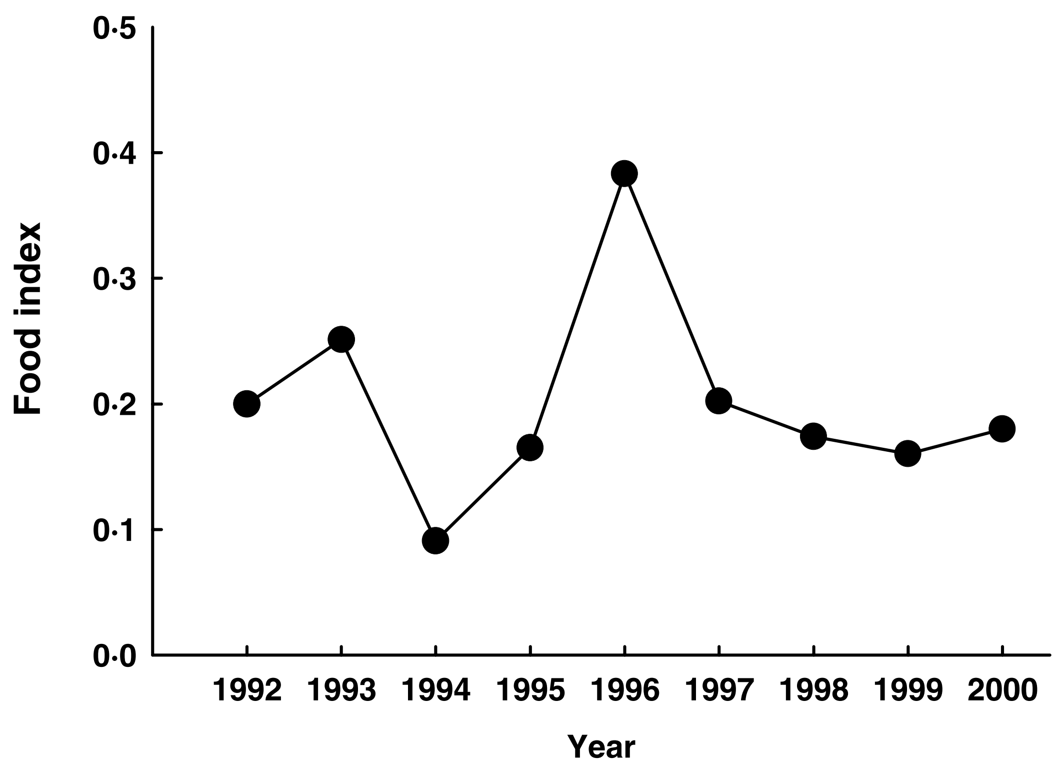


Fig. 4. Annual fluctuations in size-adjusted body mass of reproducing female aspic vipers. The black circles and dashed line represent values for body condition of adult female vipers in spring (initial condition), while the black triangles and dotted line represent values for prepartum female body condition. Error bars represent standard errors.

Lourdais O, Bonnet X, Shine R, Denardo D, Naulleau G, Guillon M (2002) Capital-breeding and reproductive effort in a variable environment: a longitudinal study of a viviparous snake. Journal of Animal Ecology, 71:70-479.

Ovoviviparous - viviparous

fecundity in the Asp viper: *Vipera aspis*: impact of high density of food



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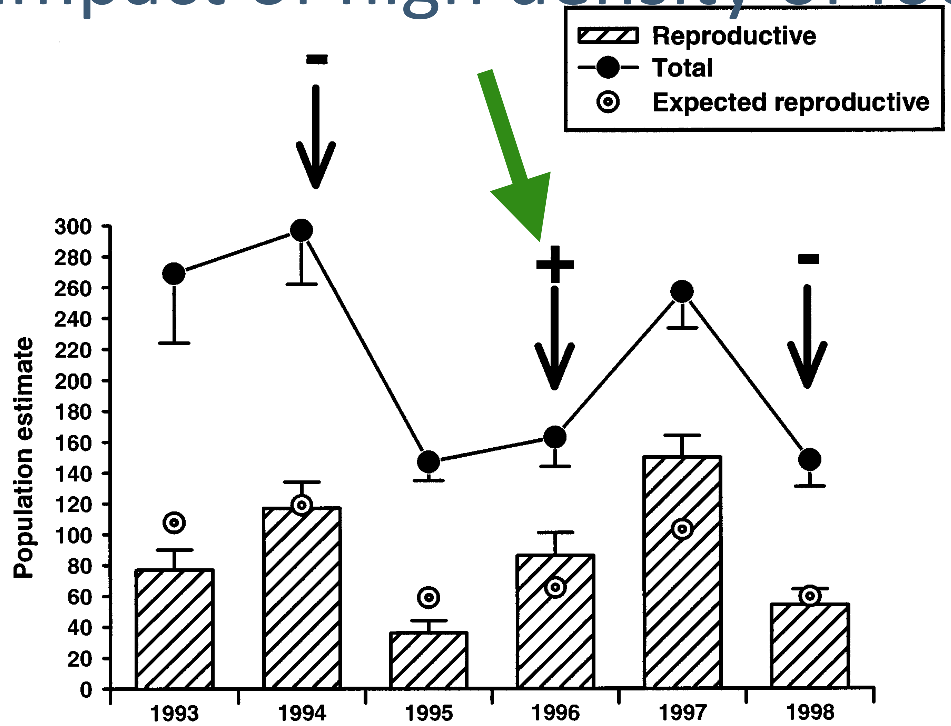


Fig. 6. Annual variation in the total number of adult females in a closed population of asp vipers (black dots − S.D., black line). The observed number of reproductive females (a subset of the total number of adult females) is represented with hatched bars (+ S.D). The expected number of reproductive females (dotted circles), simply calculated as a constant proportion (33%; see Bonnet and Naulleau 1996) of the total number of adult females, is indicated to better visualise the annual fluctuations in the relative number of reproductive females in comparison to the total number of adult females. The arrows with the sign " − " indicates a low food availability year, the arrow with the sign " + " indicates an exceptionally high food availability year. Population estimates (± S.D.) were calculated using the program CAPTURE (see text for statistics).

Naulleau G, Bonnet X (1996) Body condition threshold for breeding in a viviparous snake. Oecologia, 107:301-306.

Lourdais O, Bonnet X, Shine R, Denardo D, Naulleau G, Guillon M (2002) Capital-breeding and reproductive effort in a variable environment: a longitudinal study of a viviparous snake. Journal of Animal Ecology, 71:70-479.

Ovoviviparous - viviparous

fecundity in the Asp viper: *Vipera aspis*: impact of the temperature

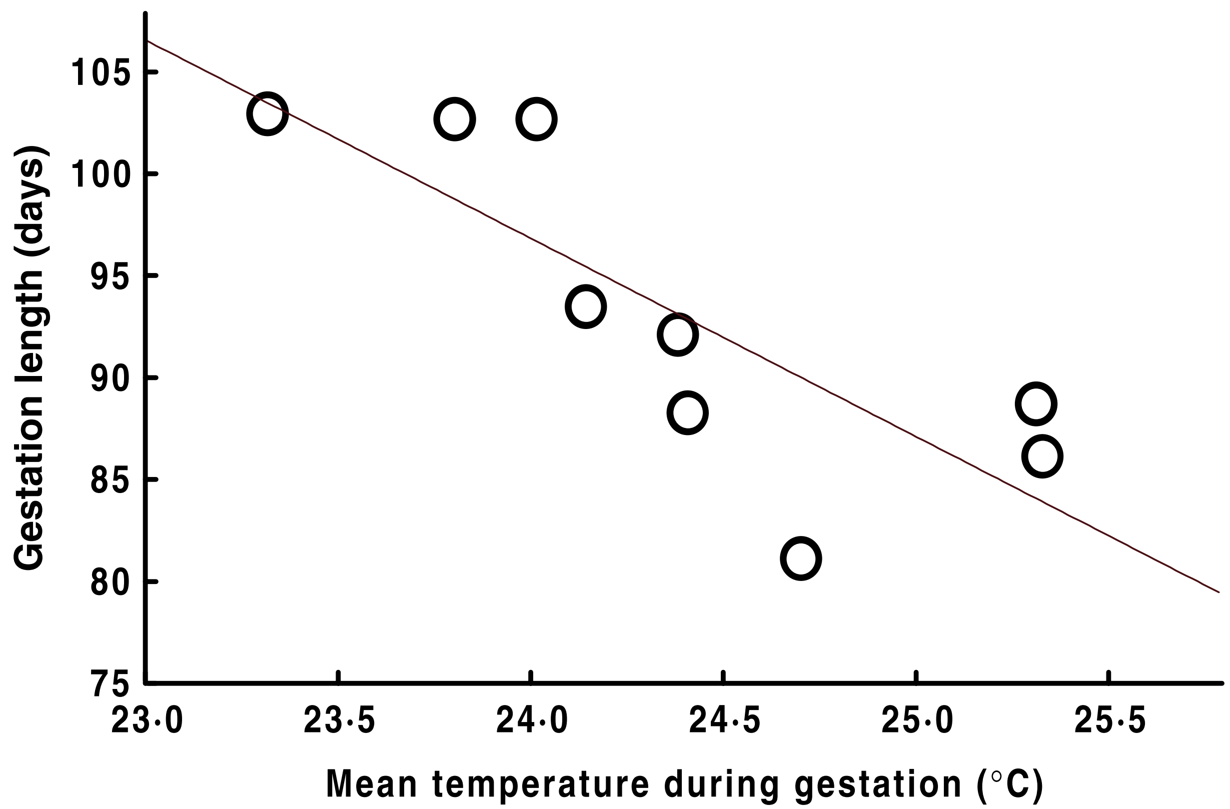


Fig. 7. Influence of mean environmental temperature during the gestation period (summer) on the duration of gestation in free-ranging aspic vipers. For simplicity, the graph shows mean annual gestation length. See text for detailed statistical analyses of these data.

Lourdais O, Bonnet X, Shine R, Denardo D, Naulleau G, Guillon M (2002) Capital-breeding and reproductive effort in a variable environment: a longitudinal study of a viviparous snake. Journal of Animal Ecology, 71:70-479.

Ovoviviparous - viviparous

fecundity in the Eurasian vipers: impact of the size

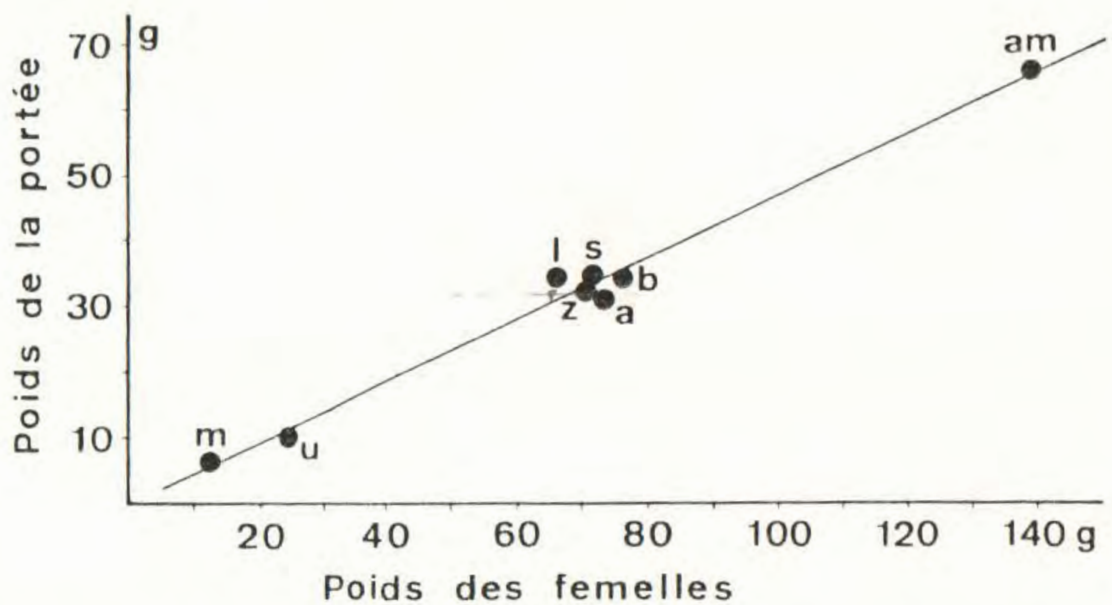


Figure 1. — Relations entre le poids moyen des femelles post-parturientes (en abscisses) et le poids moyen des portées (en ordonnées), chez les Vipères européennes. r = 0,994, y = 0,476x — 0,716. a = *V. aspis aspis*. am = *V. ammodytes*. b = *V. berus*. l = *V. latastei latastei*. m = *V. latastei monticola*. s = *V. seoanei*. u = *V. ursinii*. z = *V. aspis zinnikeri*.

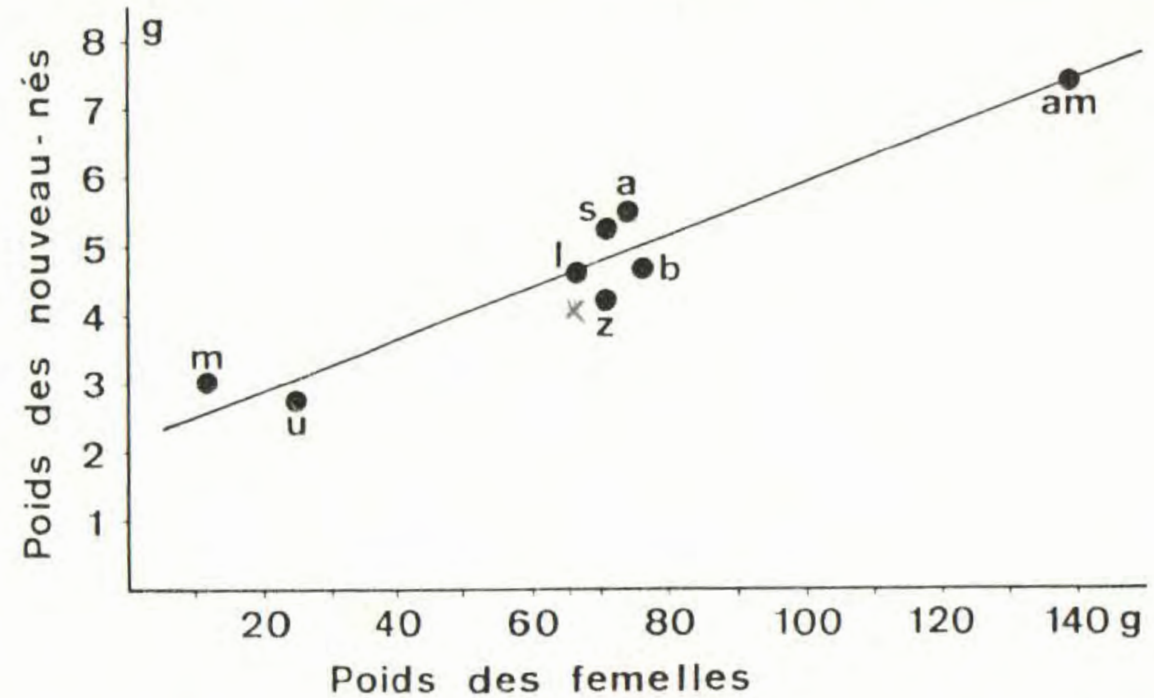


Figure 2. — Relations entre le poids moyen des femelles post-parturientes (en abscisses) et le poids individuel moyen des nouveau-nés (en ordonnées), chez les Vipères européennes. r = 0,962, y = 0,037x + 2,195. Même légende que fig. 1.

Saint Girons H, Naulleau G (1981) Poids des nouveau-nés et stratégies reproductrices des vipères européennes. Rev Ecol (Terre & Vie), 35:597-616.

Reproduction - *oviparous/viviparous*

Limits of oviparity

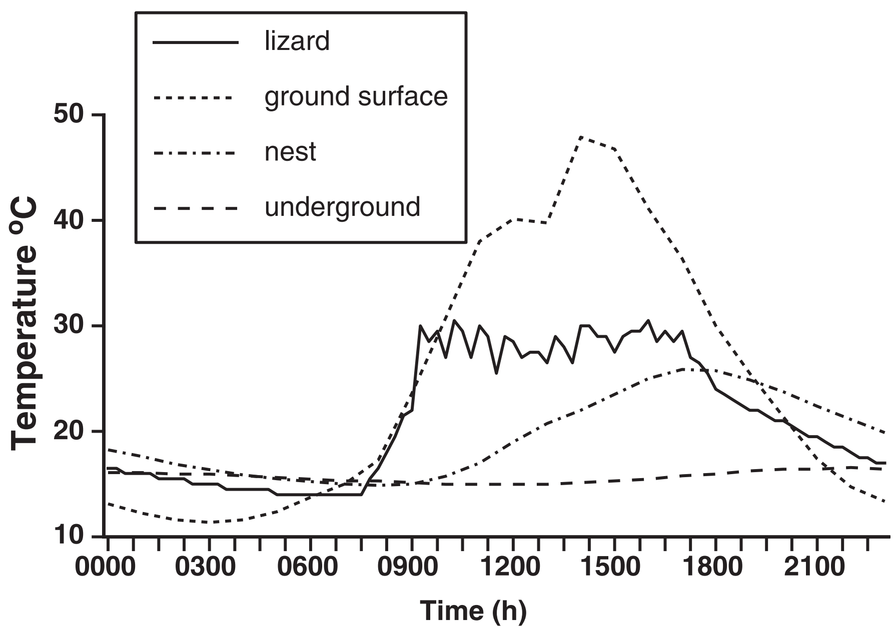


Figure 1. Diel variation in temperatures on a fine warm day (15 January 2001) at 1660 m asl (middle slopes of Mount Ginini) in the Brindabella Range. The graph shows output from miniature data-loggers that were (a) attached to the dorsal surface of a gravid female of a viviparous lizard species (*Eulamprus heatwolei*) in an outdoor arena, and thus free to thermoregulate ('lizard'); (b) glued to the upper surface of a grey concrete paver ('ground surface'); (c) placed under the paver, where eggs would typically be laid ('nest'); or (d) buried 30 cm deep under the paver ('underground').

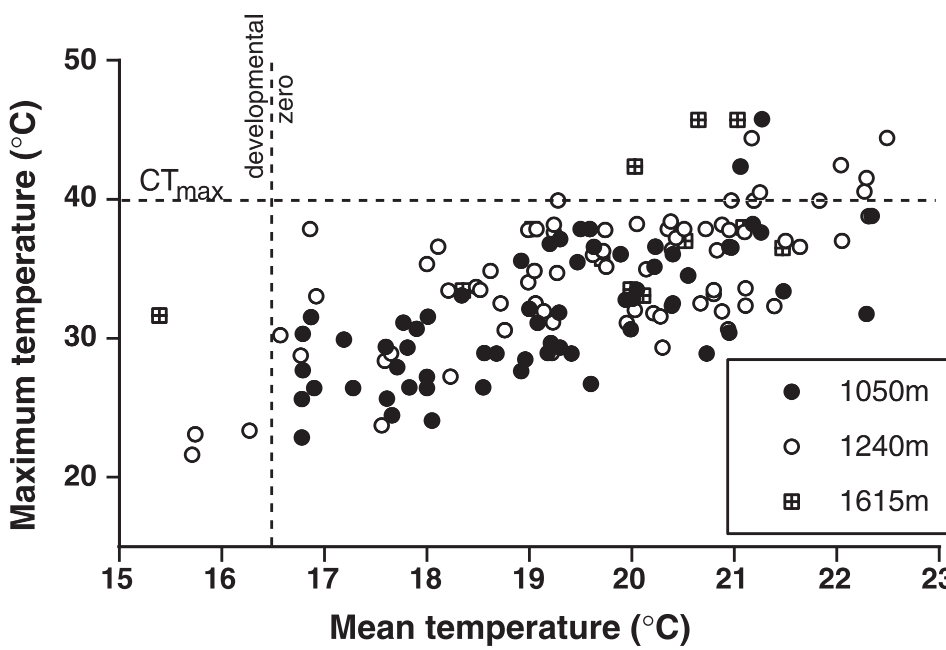


Figure 3. The relationship between mean temperature and maximum temperature for natural nests in the Brindabella Range (numbers show elevations in m asl). The horizontal line at a maximum temperature of 40°C represents the critical thermal maximum (CTmax), the level likely to be lethal to eggs. The vertical line at 16.5°C ('developmental zero') shows the minimum temperature below which embryogenesis ceases in this species. Thus, development can occur successfully only in the thermal region to the lower right of this Figure, bounded by these two lines (see text for further explanation). The graph shows data for natural nests (separately for three sites, at 1050, 1240 and 1615 m) monitored over a seven-year period. Higher mean values were associated with higher maximum values, and the relationship between mean and maximum nest temperatures varied with elevation (see text).

Shine R, Elphick MJ, Barrott EG (2003) Sunny side up: lethally high, not low, nest temperatures may prevent oviparous reptiles from reproducing at high elevations. Biological Journal of the Linnean Society, 78:325–334.

Reproduction - *oviparous/viviparous*

Limits of viviparity

Lourdais et al (2004): impact of °C

- June = number of ventral scales
- July = duration of gestation
- August = % stilborn

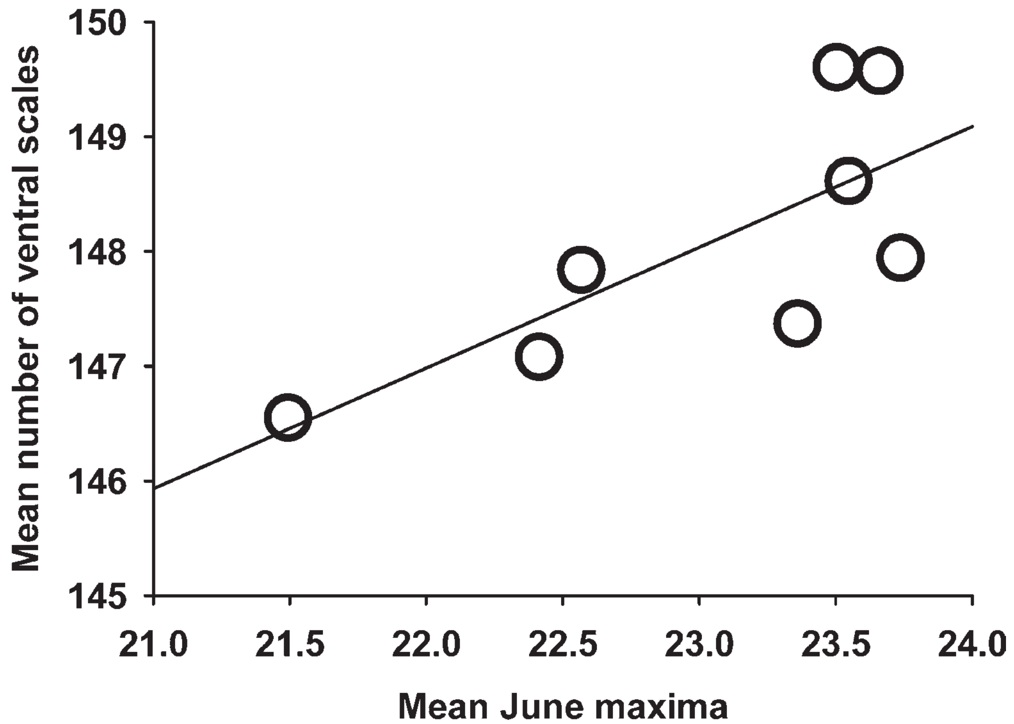


Fig. 3. Relationship between mean June ambient thermal maxima and mean number of ventral scales in neonatal vipers over the course of the study.

Table 2. Influence of mean temperatures during the three months of pregnancy on the duration of gestation in female aspic vipers.

Multiple Regression $r = 0.71$; $r^2 = 0.51$; $n = 80$; $F(3, 76) = 26.86$; $p < 0.0001$

	Beta	Partial correlation	p-value
June	0.23	0.18	0.11
July	− 0.77	0.62	< 0.0001
August	− 0.09	0.09	0.44

Lourdais O, Shine R, Bonnet X, Guillon M, Naulleau G (2004) Climate affects embryonic development in a viviparous snake, *Vipera aspis*. Oikos, 104, 551-560.

Autumn

Autumn - *some late parturition*

Autumn *- some late parturition*

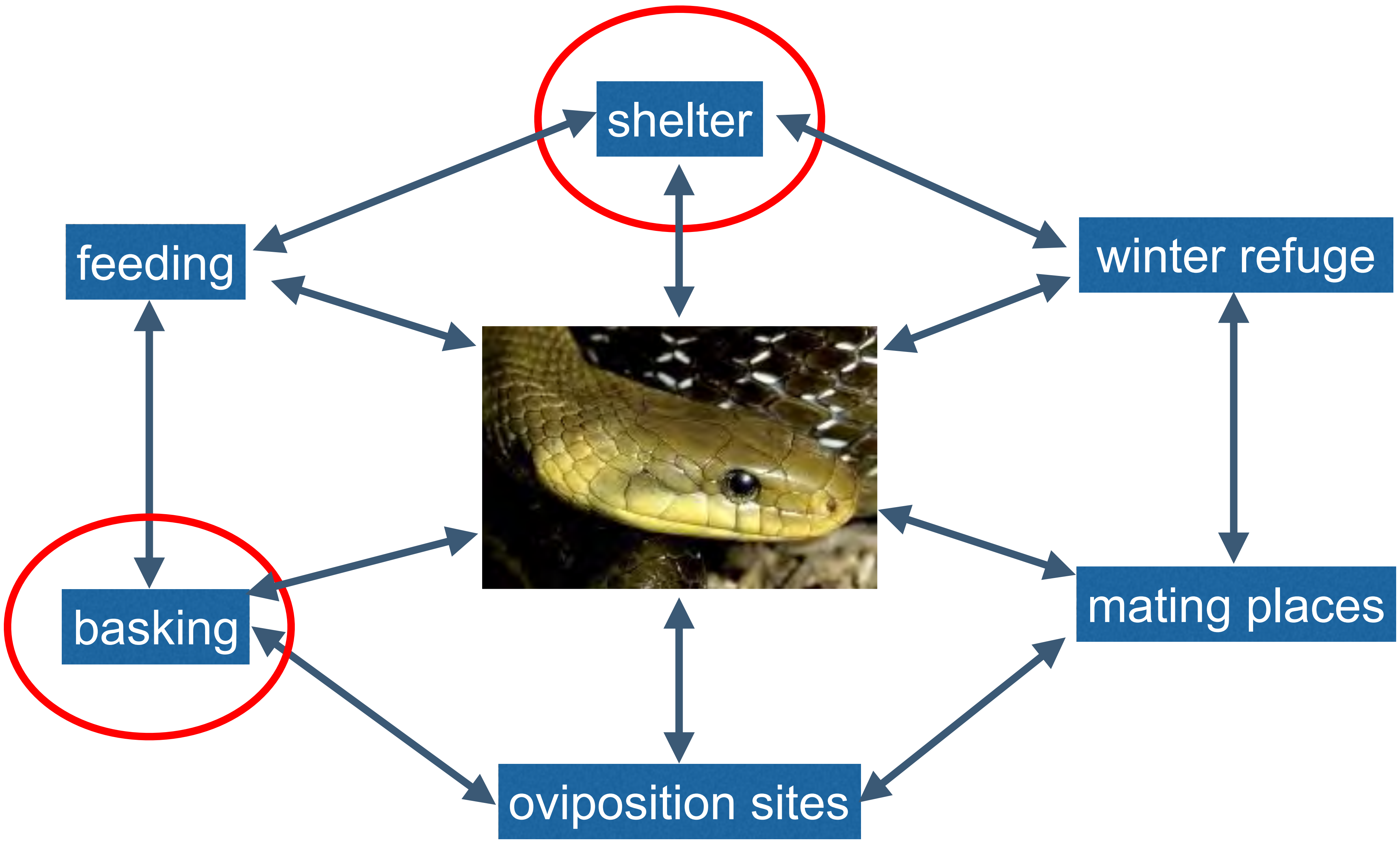
Autumn - *autumn mating in some species*

Autumn + winter

Annual activities - *summary*

- main activity period: March-April (May) - September-October
- reproductive cycles:
  - oviparous lizards: 1-2 clutch(es) / year
  - oviparous snake: 1 clutch/year
  - viviparous lizards : 1 clutch/year (probably biannual for the Slow worm)
  - viviparous snakes: biannual or triannual (or more)
- mating: spring, some species also in autumn
- gestation time (viviparous species): 3-4 months
- eggs incubation: 1-2 month(s)
- shedding: 2-3 / year for adults, a bit more for young.

Reptiles - *high requirements on their habitats*



Reptiles - *large decline*

biology letters
Conservation biology

Biol. Lett. (2010) **6**, 777–780
doi:10.1098/rsbl.2010.0373
Published online 9 June 2010

Are snake populations in widespread decline?

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[2]*Institute of Environmental Studies, DEMETRA, Via Olona 7, I-00198 Rome, Italy*
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[5]*CNR, Institute of Ecosystem Studies, via Borelli 50, I-00161 Rome, Italy*
[6]*Piazza Capri 20, I-00141 Rome, Italy*
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**Author for correspondence (cjr@ceh.ac.uk).*

Long-term studies have revealed population declines in fishes, amphibians, reptiles, birds and mammals. In birds, and particularly amphibians, these declines are a global phenomenon whose causes are often unclear. Among reptiles, snakes are top predators and therefore a decline in their numbers may have serious consequences for the functioning of many ecosystems. Our results show that, of 17 snake populations (eight species) from the UK, France, Italy, Nigeria and Australia, 11 have declined sharply over the same relatively short period of time with five remaining stable and one showing signs of a marginal increase. Although the causes of these declines are currently unknown, we suspect that they are multi-faceted (such as habitat quality deterioration, prey availability), and with a common cause, e.g. global climate change, at their root.

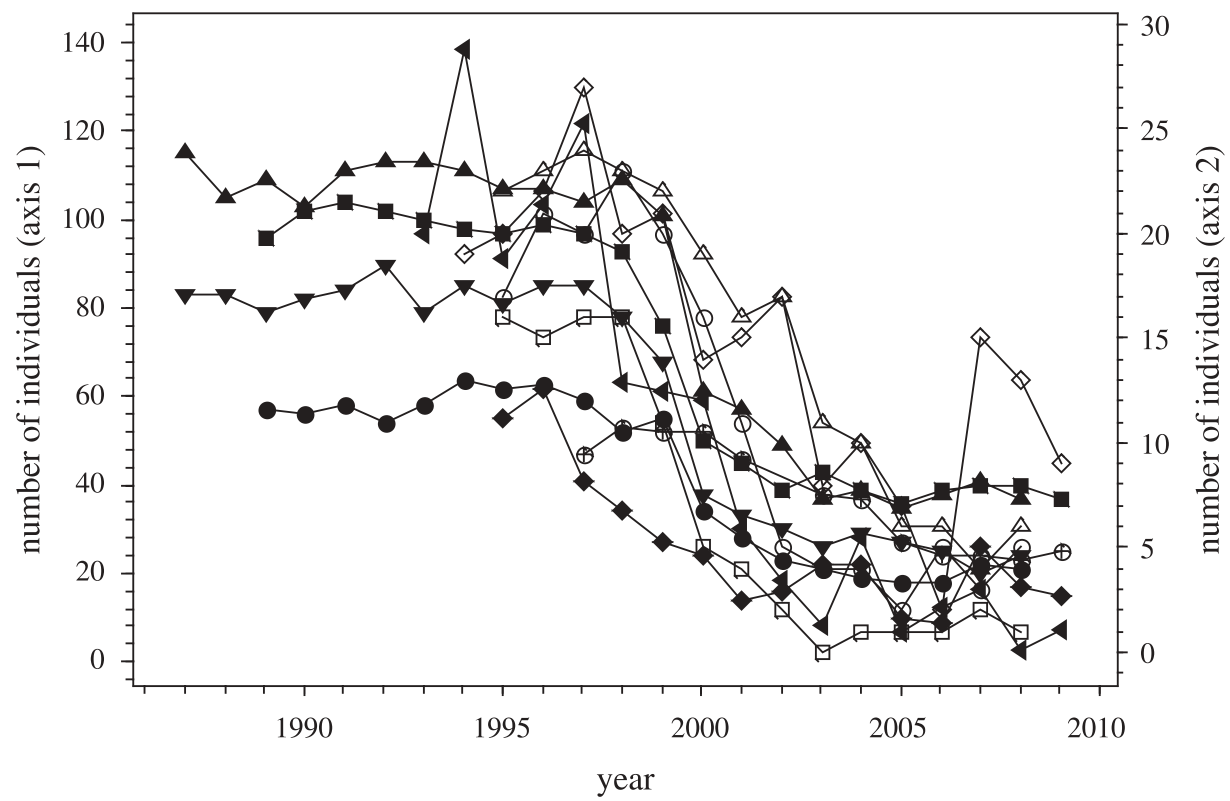


Figure 1. Annual total number of individuals found for each declining snake species population. Axis 1: filled left-pointed triangles, *Va*[1]; filled circles, *Va*[2]; filled squares, *Va*[3]; filled triangles, *Vu*[1]; filled inverted triangles, *Vu*[2]; cirlces with crosses, *Ca*; filled diamonds, *Hv*[1]. Axis 2: open circles, *Bg*; open squares, *Bn*; open triangles, *Pr*; open diamonds, *Zl*[1]. Values shown for *Va*[1] are one-third of true values. See table 1 for key to snake species abbreviations and country of origin.

Reptiles - *large decline*

Future Swiss Red lists

- same 303 random 1km²
- data collected between 2003-2004 and 2017-2018

species	locations occupied 2003-2004	locations occupied 2017-2018	difference (14 years)	% reduction
ANFR	60	65	5	
ANVE	7	3	-4	-57%
COAU	41	24	-17	-41%
EMOR				
HIVI	22	21	-1	-5%
LAAG	86	82	-4	-5%
LABI	40	42	2	
NAHE	56	35	-21	-38%
NANA	3	2	-1	-33%
NAMA	4	1	-3	-75%
NATE	6	3	-3	-50%
POMU	123	144	21	
VIAS	76	50	-26	-34%
VIBE	37	30	-7	-19%
ZALO	20	16	-4	-20%
ZOVI	49	50	1	

Swiss Red List - *Monney & Meyer, 2005*

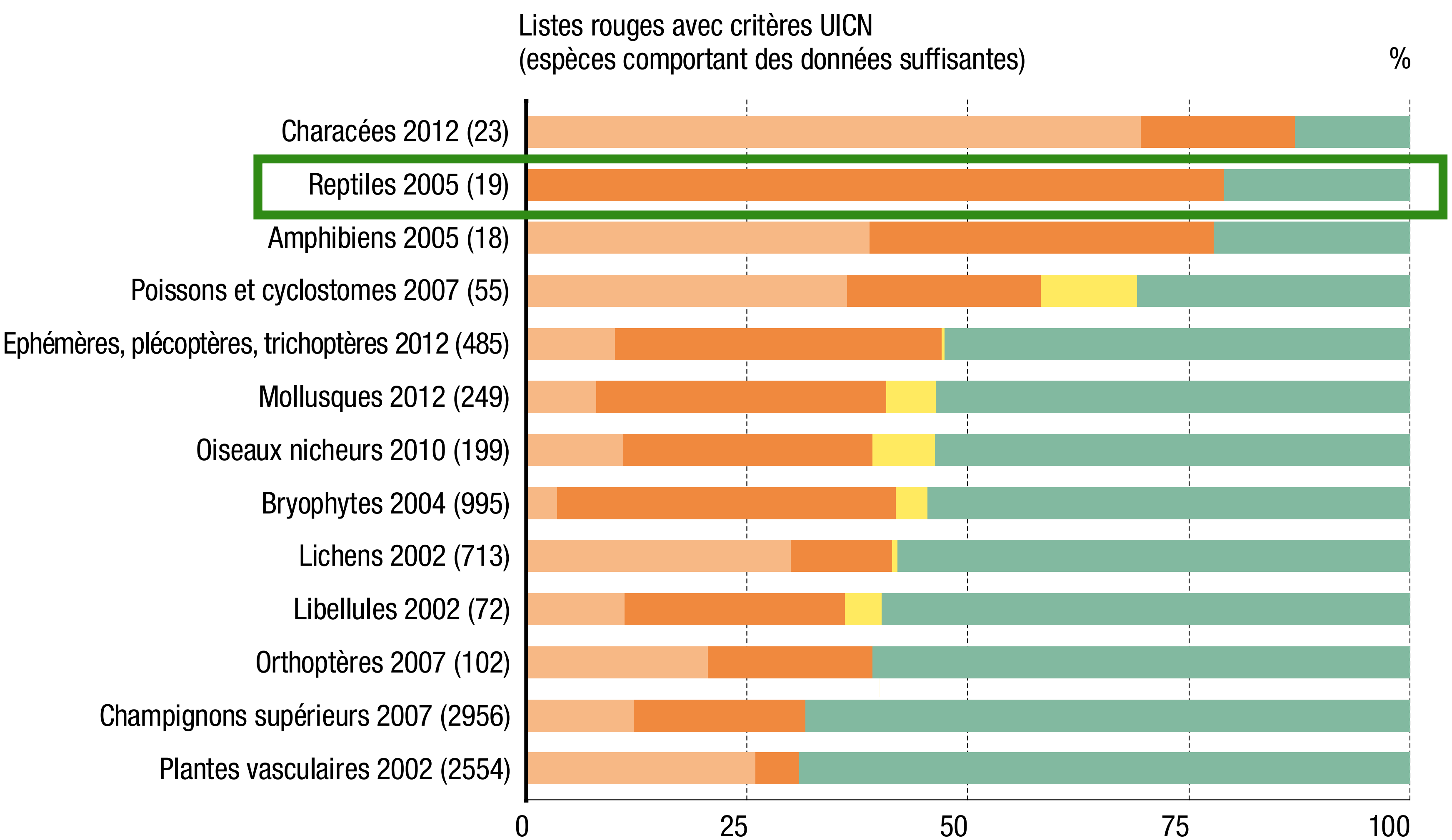
	19 taxa
CR (3)	European pond turtle
	Asp viper (*V. a. aspis*)
	Viperine snake
EN (7)	Adder (2 genetic clades)
	Asp Viper (*V. a. francisciredi*)
	Grass snake (*N. natrix*)
	Dice snake
	Whip snake
	Asculapian snake
VU (5)	Grass snake (*N. helvetica*)
	Smooth snake
	Asp viper (*V. a. atra*)
	Green lizard
	Sand lizard
LC (4)	Wall lizard (2 ssp)
	Common lizard
	Slow worm

79% (CR, EN, VU)

Swiss Red Lists - *comparison*

Fig. 36 > Proportions d'espèces rares par groupe d'organismes

Rare = petits effectifs et/ou aire de répartition restreinte et fragmentée (critères D, B2a; voir annexe C). Menacé = CR, EN, VU. Seulement groupes d'organismes avec critères UICN, donc listes rouges à partir de 2001. Les espèces «rares» représentent 19 % des espèces évaluées (1631 espèces sur 8418 évaluées selon critères UICN). Ce taux varie considérablement d'un groupe d'organismes à l'autre. Reptiles et amphibiens comptent les plus fortes proportions d'espèces à la fois rares et menacées.



Cordillot F, Klaus G (2011) Espèces menacées en Suisse. Synthèse des listes rouges, état 2010. Office fédéral de l'environnement, Berne. Etat de l'environnement n° 1120: 111 p.

Reptiles - *threats*

Landscape changes

- new construction, roads, etc..
- agriculture: intensification / extensification
- growth of forests (lack of sun on the ground)
- lack of dynamic in the landscape (rivers, avalanches, …)

direct human impact

- direct destruction
- predators (cat)
- competitor (introduced species)

Threats - *habitat destruction*

Threats - *habitat destruction*

Threats - *agricultural intensification*

Threats - *agricultural intensification*

Threats - *forest growth*

info fauna CSCF

info fauna karch

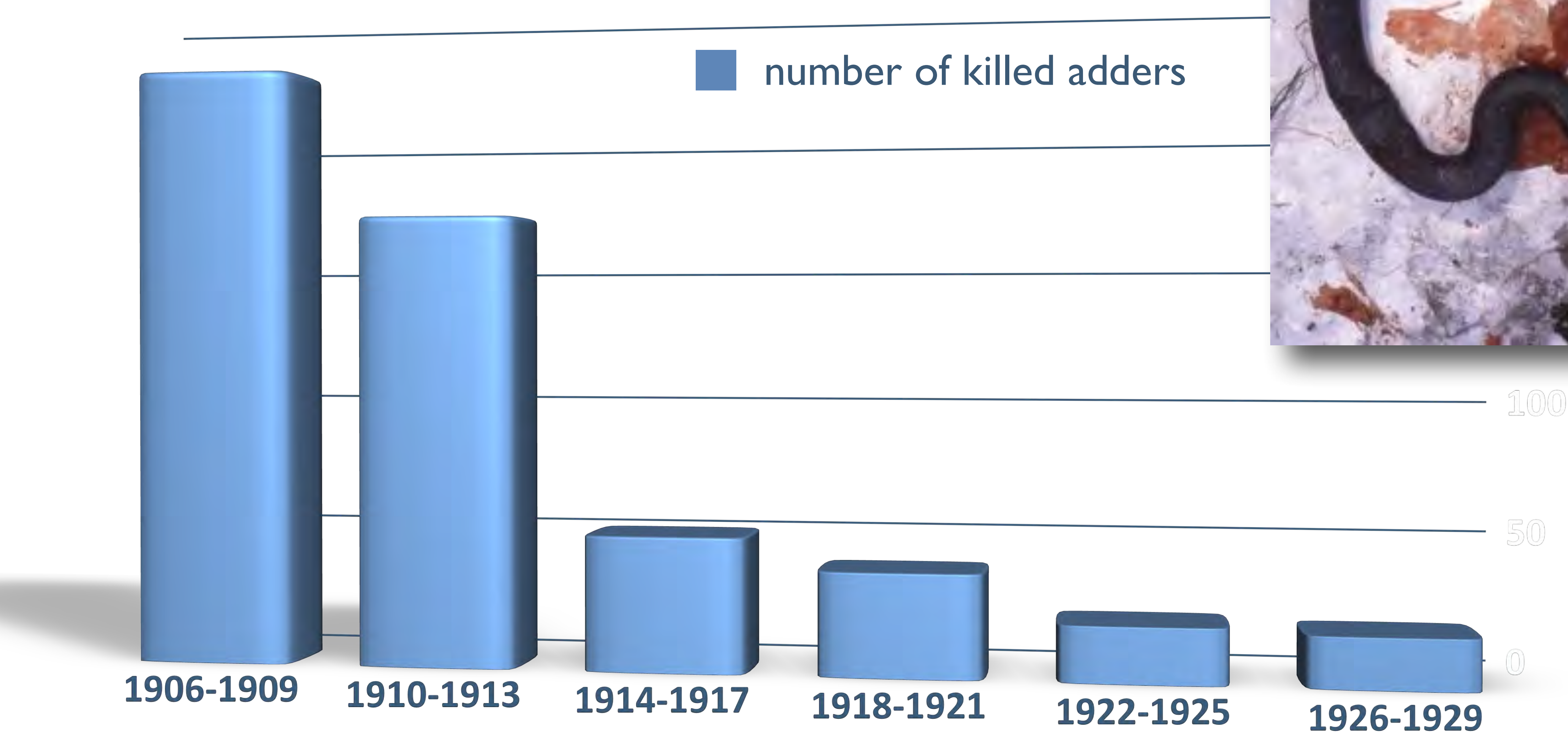
Threats - *lack of dynamics*

Threats - *lack of dynamics*

Threats - *destruction of small structures*

Threats - *direct destruction*

Number of adders killed and paid at the municipality of Les Ponts (NE) between 1906 et 1928 (N=530) following Ischer (1930)



Ischer A (1930) La Vipère péliade des Ponts de Martel. Le Rameau de Sapin du club jurassien, 1:2-5.

Threats - *direct destruction*

Threats - *introduced species*

Threats - *introduced species*

nature COMMUNICATIONS

ARTICLE

Received 6 Sep 2012 | Accepted 12 Dec 2012 | Published 29 Jan 2013

DOI: 10.1038/ncomms2380

The impact of free-ranging domestic cats on wildlife of the United States

Scott R. Loss[1], Tom Will[2] & Peter P. Marra[1]

and will allow increased comparability of mortality sources[23]. Nonetheless, no estimates of any other anthropogenic mortality source approach the value we calculated for cat predation, and our estimate is the first for cats to be based on rigorous data-driven methods. Notably, we excluded high local predation rates and used assumptions that led to minimum predation rate estimates for un-owned cats; therefore, actual numbers of birds killed may be even greater than our estimates.

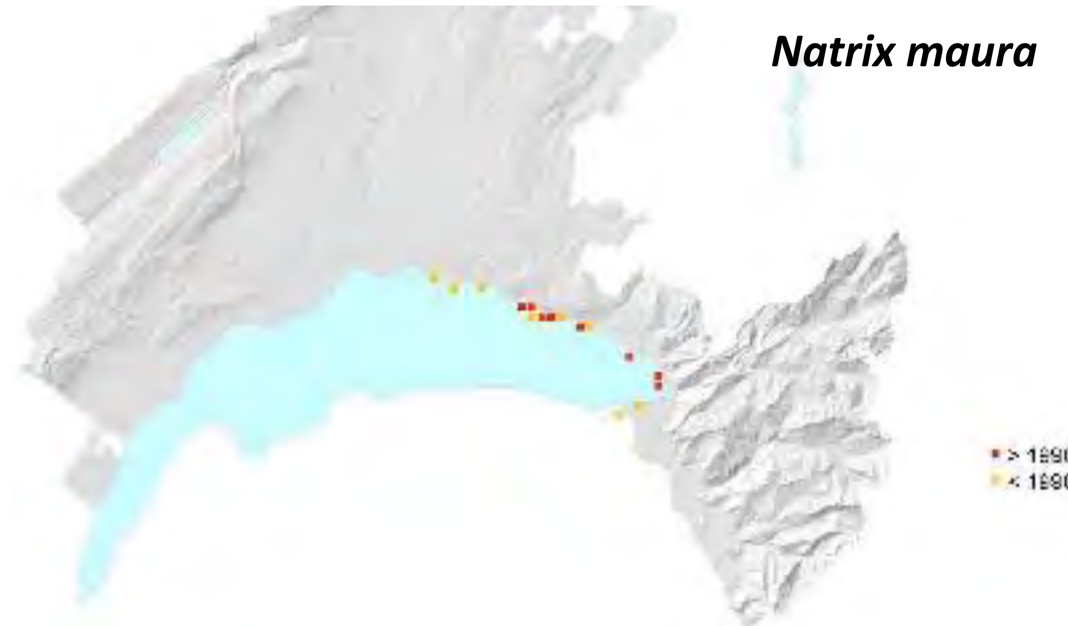
Free-roaming cats in the United States may also have a substantial impact on reptiles and amphibians. However, US studies of cat predation on these taxa are scarce. To generate a first approximation of US predation rates on reptiles and amphibians, we used the same model of cat predation along with estimates of cat predation rates on these taxa from studies in Europe, Australia and New Zealand. We estimate that between 258 and 822 million reptiles (median = 478 million) and between 95 and 299 million amphibians (median = 173 million) could be killed by cats in the contiguous United States each year. Reptile and amphibian populations, and, therefore, cat predation rates, may differ between the regions where we gathered predation data for these taxa and the United States. Furthermore, reptiles and amphibians are unavailable as prey during winter across much of the United States. Additional research is needed to clarify impacts of cats on US herpetofauna, especially given numerous anthropogenic stressors that threaten their populations (for example, climate change, habitat loss and infectious diseases) and documented extinctions of reptiles and amphibians due to cat predation in other regions[4,24].

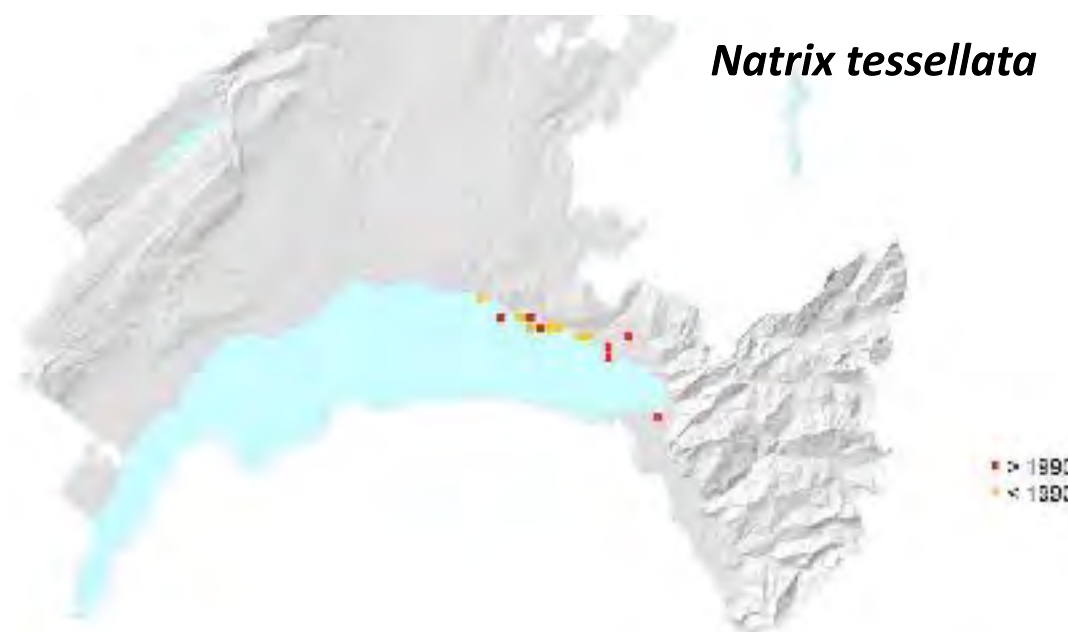
The exceptionally high estimate of mammal mortality from cat predation is supported by individual US studies that illustrate high annual predation rates by individual un-owned cats in excess

Threats - *introduced species*

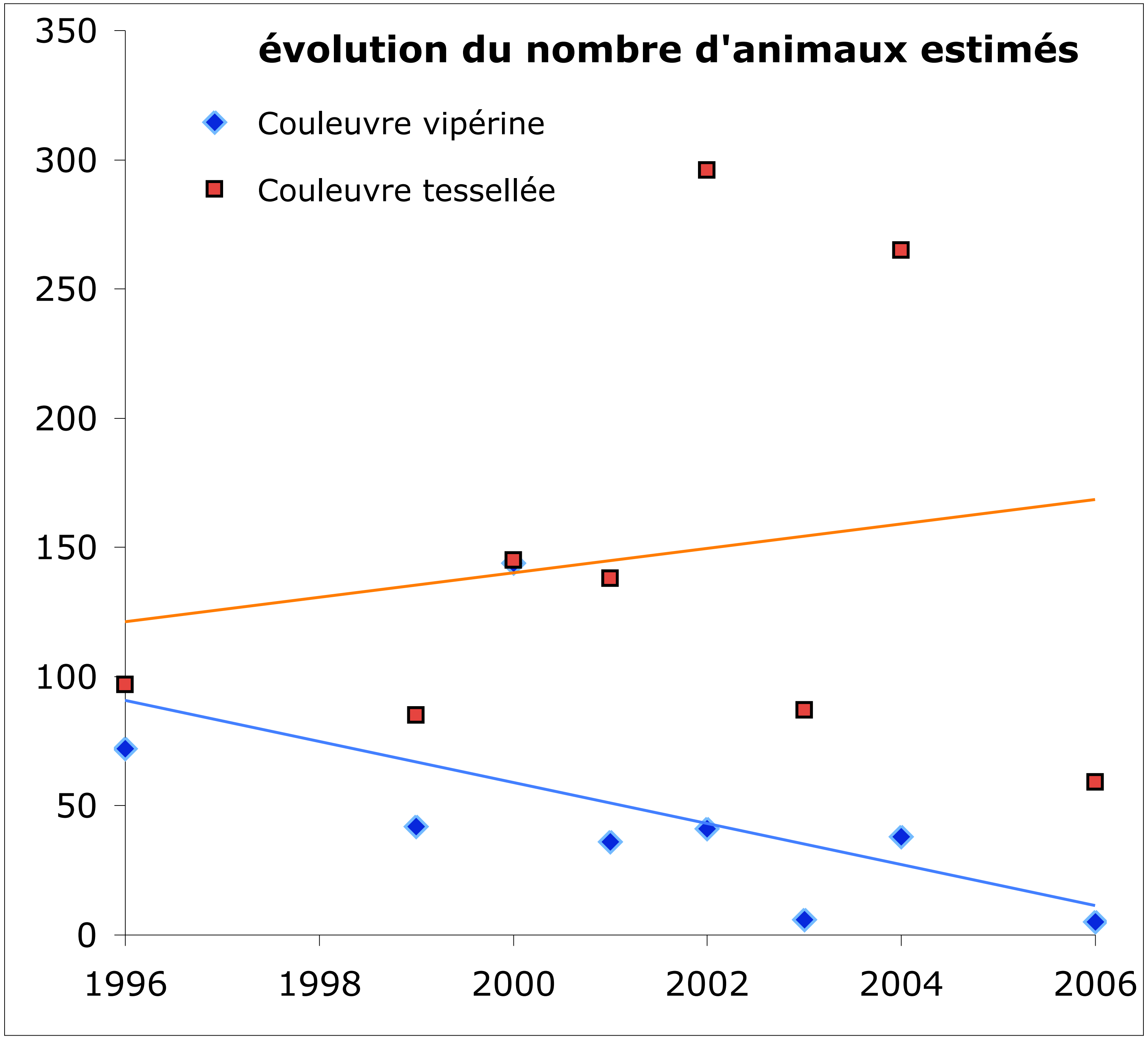
Threats - *introduced species*

Koller & Ursenbacher (1996):
300 adults of *Natrix maura*





Threats - *introduced species*



Threats - *what to do to improve it*

habitat improvement

- new habitats
- forestery
- improve connectivity
- …

Habitat improvement - *new habitats*

Habitat improvement *- new habitats*

Habitat improvement *- new habitats*

Habitat improvement - *new habitats*

info fauna CSCF

info fauna karch

Habitat improvement - *forestry*

Habitat improvement - *connectivity*

Current research *- possible MSc projects…*

Species distribution

- what is a species / delimitation of genetic groups

Invasive species

- Snake fungal disease (SFD)
- introduced Whip snake populations
- …

Translocated individual in destroyed habitats

…

Current research - *Natrix helvetica*

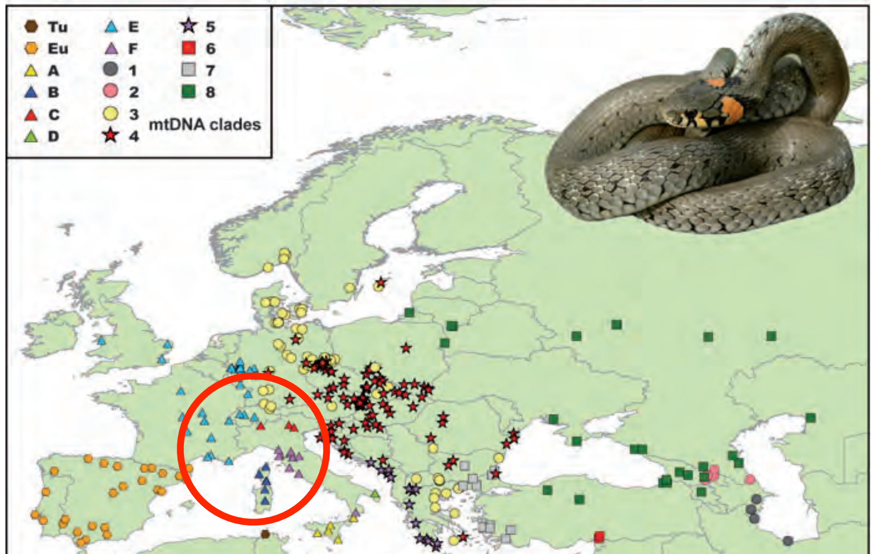
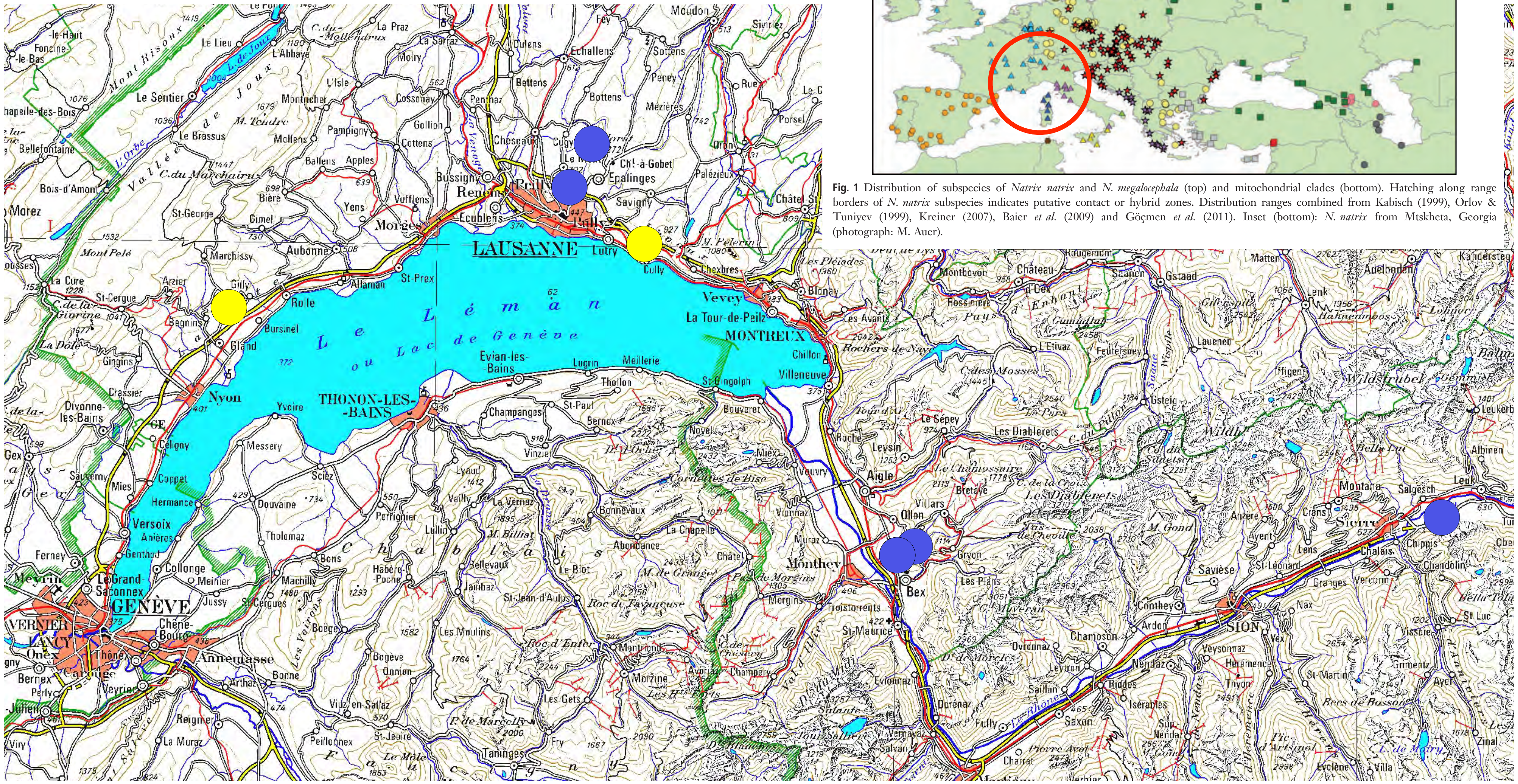
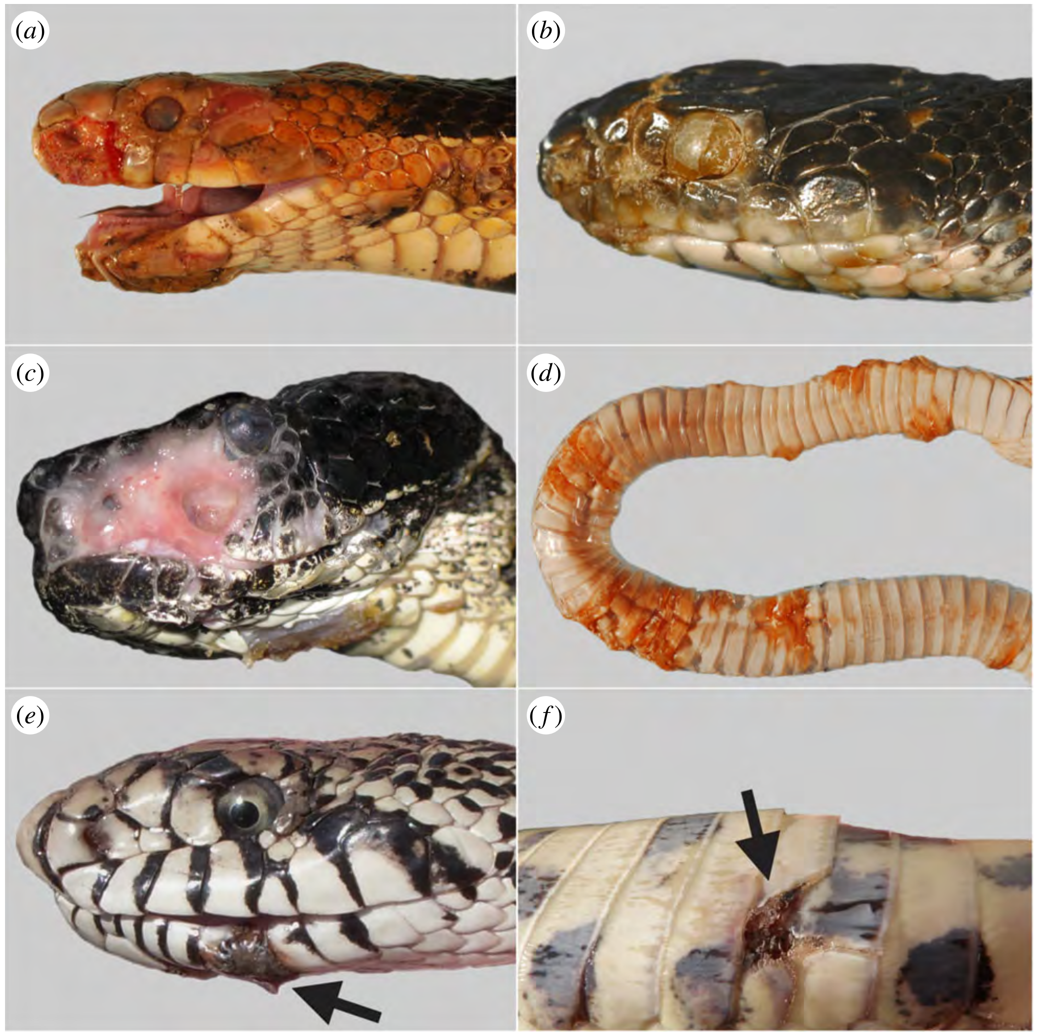


Fig. 1 Distribution of subspecies of *Natrix natrix* and *N. megalocephala* (top) and mitochondrial clades (bottom). Hatching along range borders of *N. natrix* subspecies indicates putative contact or hybrid zones. Distribution ranges combined from Kabisch (1999), Orlov & Tuniyev (1999), Kreiner (2007), Baier *et al.* (2009) and Göçmen *et al.* (2011). Inset (bottom): *N. natrix* from Mtskheta, Georgia (photograph: M. Auer).



Herpetology Notes, volume 11: 885-891 (2018) (published online on 17 October 2018)

First case of Snake Fungal Disease affecting a free-ranging *Natrix natrix* (Linnaeus, 1758) in Ticino Canton, Switzerland

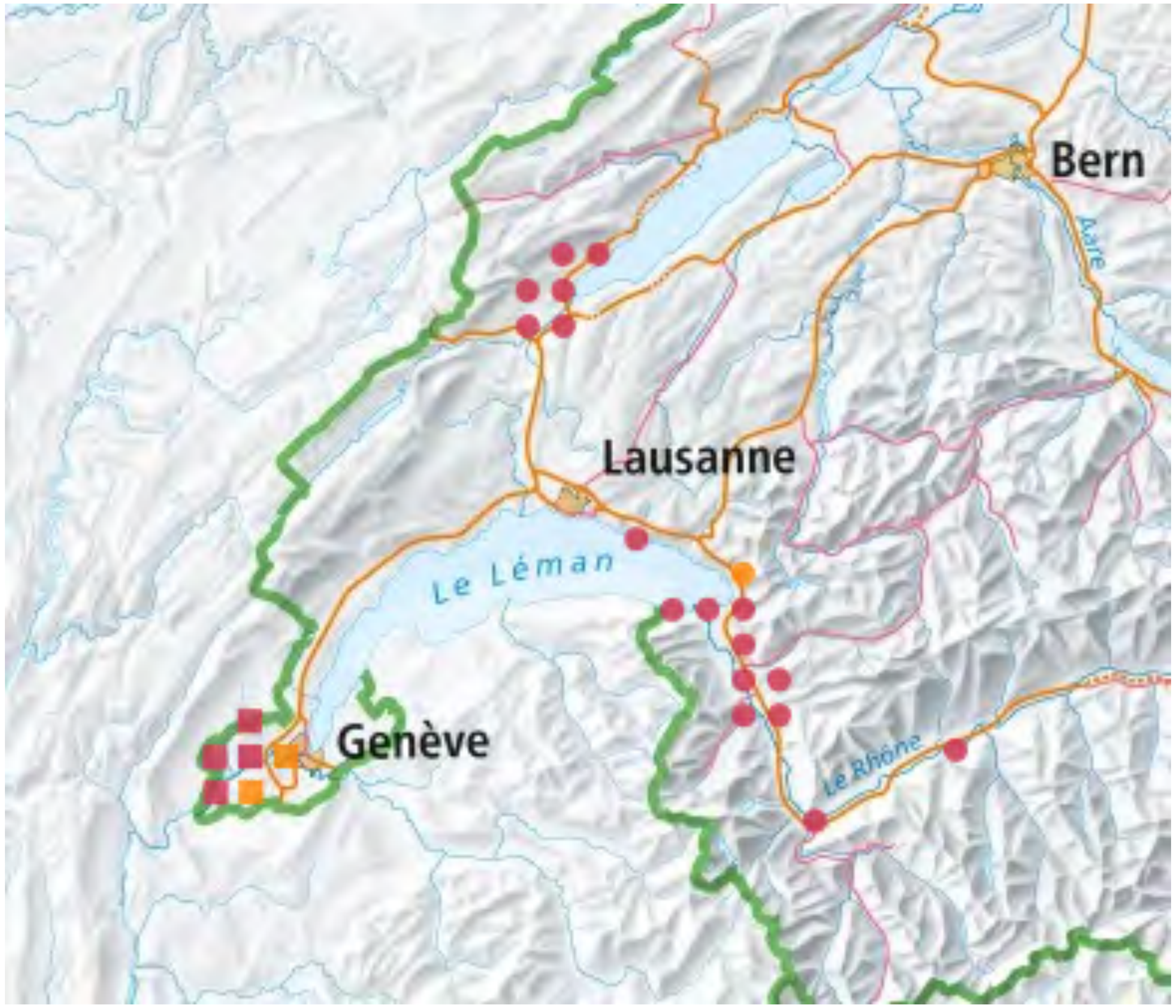


Grégoire Meier[1], Tommaso Notomista[2], Daniele Marini[3,*], and Vincenzo Ferri[4]

Abstract. We here report a new European case of Snake Fungal Disease in a free-ranging *Natrix natrix* (Linnaeus, 1758) from Ticino Canton (Switzerland). This is the first Swiss case and only the second occurrence in a wild snake from continental Europe. We provide a description of clinical and methodological aspects beginning with the capture and the stabling period of the affected individual. Moreover, we report observations of *Natrix* spp. displaying clinical signs consistent with SFD in northern Italy.

Keywords. *Ophidiomyces ophiodiicola*, keratinophile, mycosis, dermatitis, emerging disease, *Natrix natrix*, case report, Switzerland

Current research *- introduced Whip snake pop.*



for more information…

Ecology of Swiss reptile species:

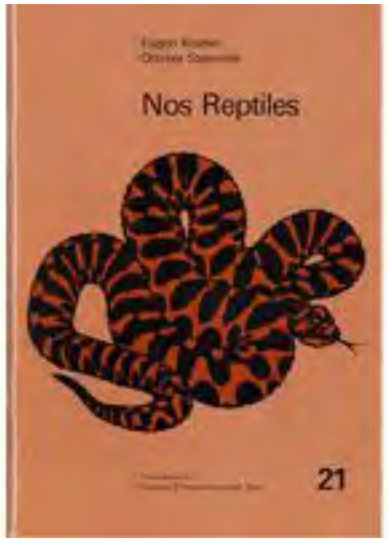
- Les amphibiens et reptiles de Suisse

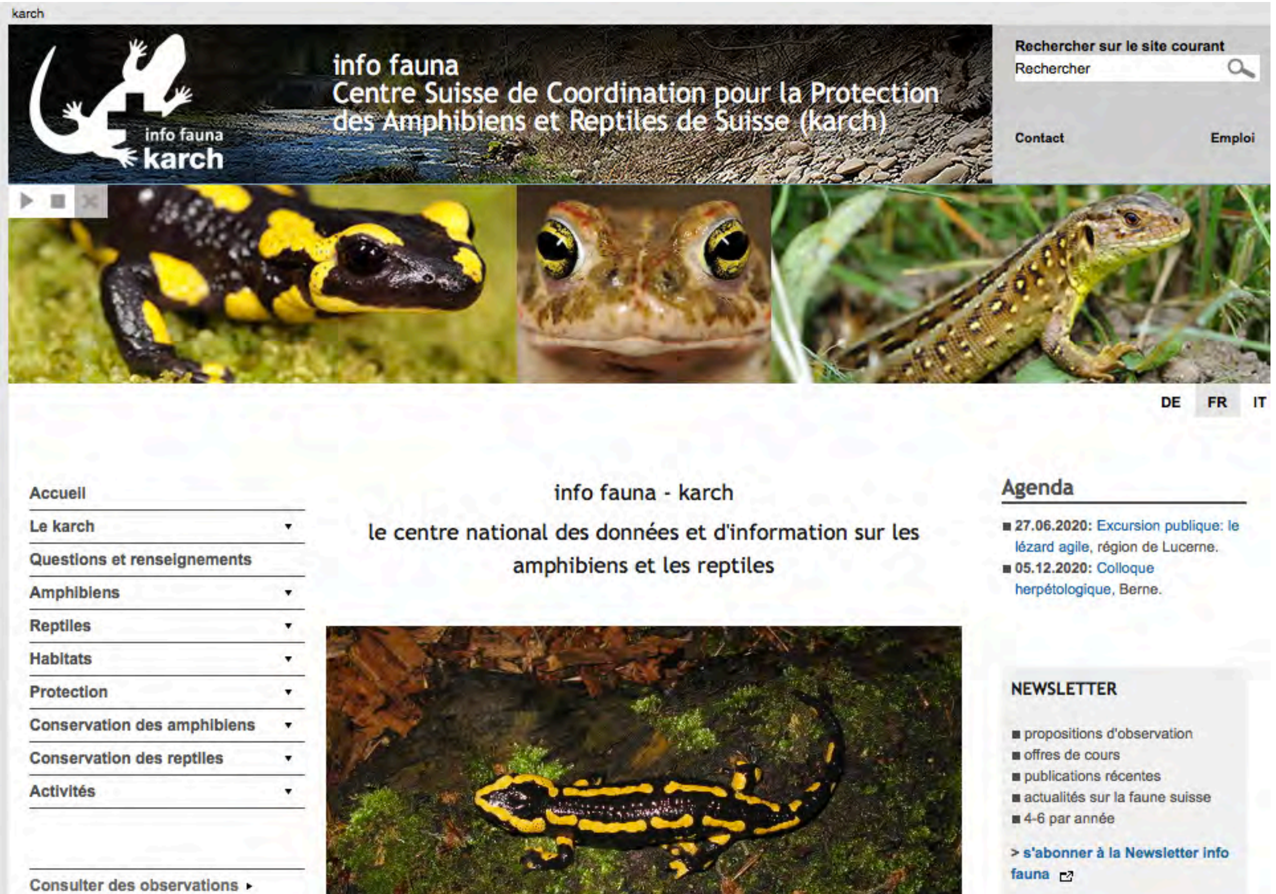
  https://cscf.abacuscity.ch/fr/chf/A~22ARE05F/1~2~Typ/Amphibiens-Reptiles/Les-amphibiens-et-les-reptiles-de-Suisse

- Nos reptiles

  https://cscf.abacuscity.ch/fr/chf/A~99APU02F/2~20~Typ/Amphibiens-Reptiles/Reptiles/Nos-Reptiles

- www.karch.ch





what is "important"