

# Le renne e il cambiamento climatico

I TEMPI DEL MONDO

LA STAMPA 19.12.2018

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## INVERNO NEI BALCANI PIOVE ALLE SVALBARD SI SALVA LA COP-24



**I**l tempo s'è fatto invernale negli ultimi giorni nei Balcani, con copiose nevicate (fino a 70 cm) in Bosnia, Serbia e Romania, e -16 °C lunedì mattina a Novi Sad (Serbia). Più anomalo, benché meno appariscente negli effetti, era tuttavia il tepore europeo della prima decade di dicembre, che con 4,5 °C sopra media è stata la terza più mite dopo i casi del 1953 e del 2000 in Francia, dove peraltro l'intero 2018 si avvia ad essere l'anno più caldo in oltre un secolo. Stessa prospettiva in Svizzera: qui ormai è pressoché certo che saranno battuti i primati del 2011 e 2015. Nel buio inverno artico, alle isole Svalbard le temperature della prima metà del mese sono state in eccesso rispetto al normale di 10 °C, e a Ny Alesund sabato scorso pioveva anziché nevicare: un fenomeno

sempre più frequente, che nelle regioni con suoli a permafrost favorisce la formazione di un tenace strato di ghiaccio alla base del manto nevoso, impedendo per mesi ad animali come le renne di cibarsi dei licheni. Ne parla lo studio *Spatiotemporal patterns of rain-on-snow and basal ice in high Arctic Svalbard*, su Environmental Research Letters. Tra sabato e domenica è stato stabilito un nuovo record australiano di pioggia per dicembre: 681 mm rovesciati in 24 ore a Halifax (Queensland) dall'ex-ciclone tropicale Owen. L'incremento delle precipitazioni estreme è già rilevabile in molte zone del mondo, e negli Stati Uniti i tre più intensi episodi come volume d'acqua caduta dal 1949 in poi si sono concentrati nell'ultimo triennio, secondo il North Carolina Institute for Climate Studies: la

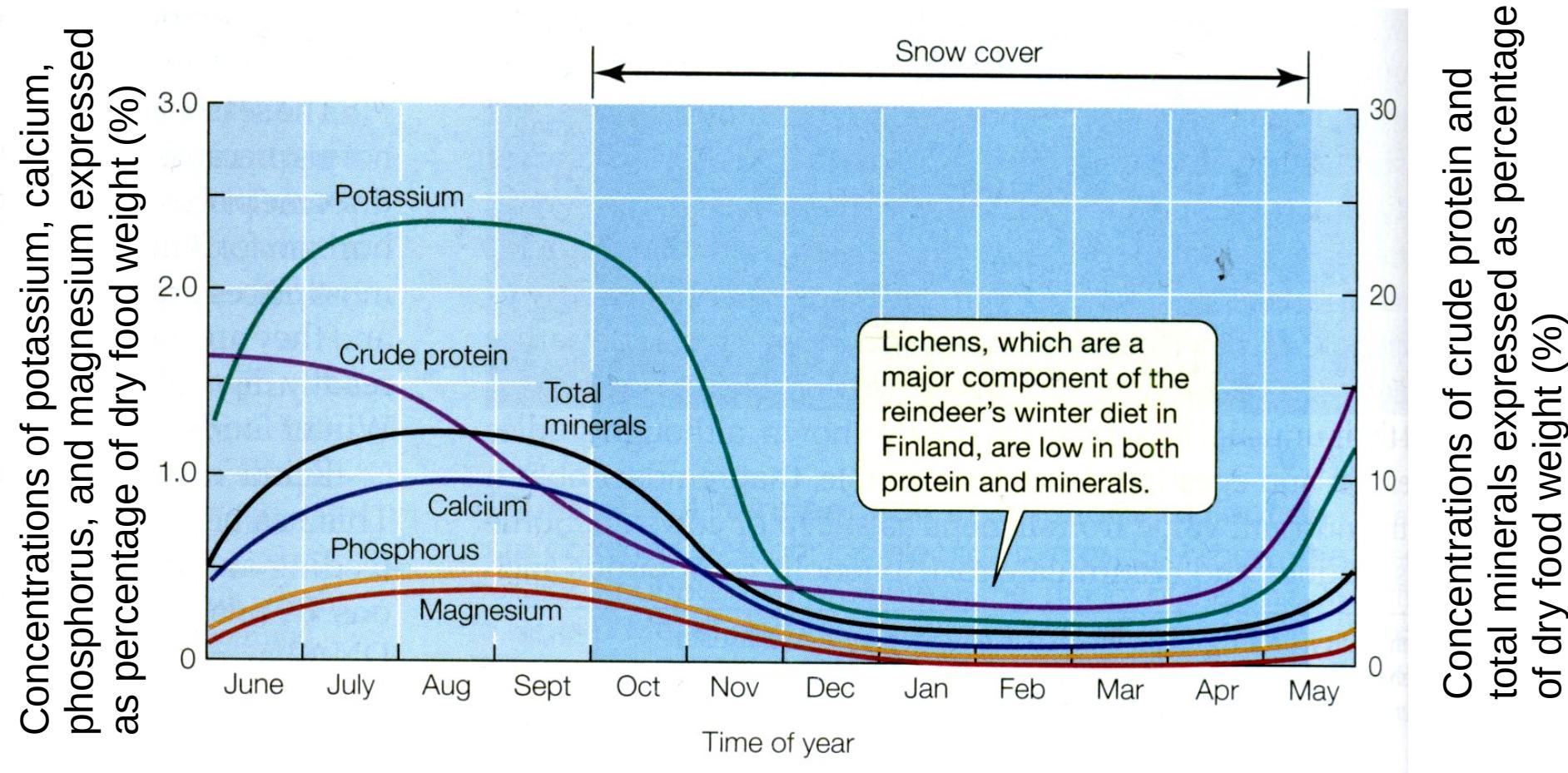
tempesta del marzo 2016 in Louisiana, e gli uragani Harvey (agosto 2017) e Florence (settembre 2018). Sabato 15 dicembre, dopo due settimane di negoziati come sempre complessi, i delegati riuniti alla Cop-24 di Katowice hanno partorito in extremis il regolamento attuativo dell'Accordo di Parigi, in particolare con l'adozione di un sistema comune e trasparente di monitoraggio e miglioramento delle promesse di riduzione di emissioni serra. Impegni che molti Paesi sono chiamati a rendere più ambiziosi entro il 2020. Per ora tuttavia si è raggiunto il minimo possibile – tra burocrazia, scarsi entusiasmi e l'ostruzionismo dei Paesi produttori di petrolio - mentre l'urgenza della situazione richiederebbe misure eccezionali. —

# Le renne e il cambiamento climatico

Le renne non riescono a nutrirsi a causa della formazione di uno strato di ghiaccio (dovuto al congelamento della neve intrisa d'acqua), che **impedisce loro di scavare in cerca di licheni**



# Seasonal changes in the protein and mineral content of the foods eaten by Finnish reindeer

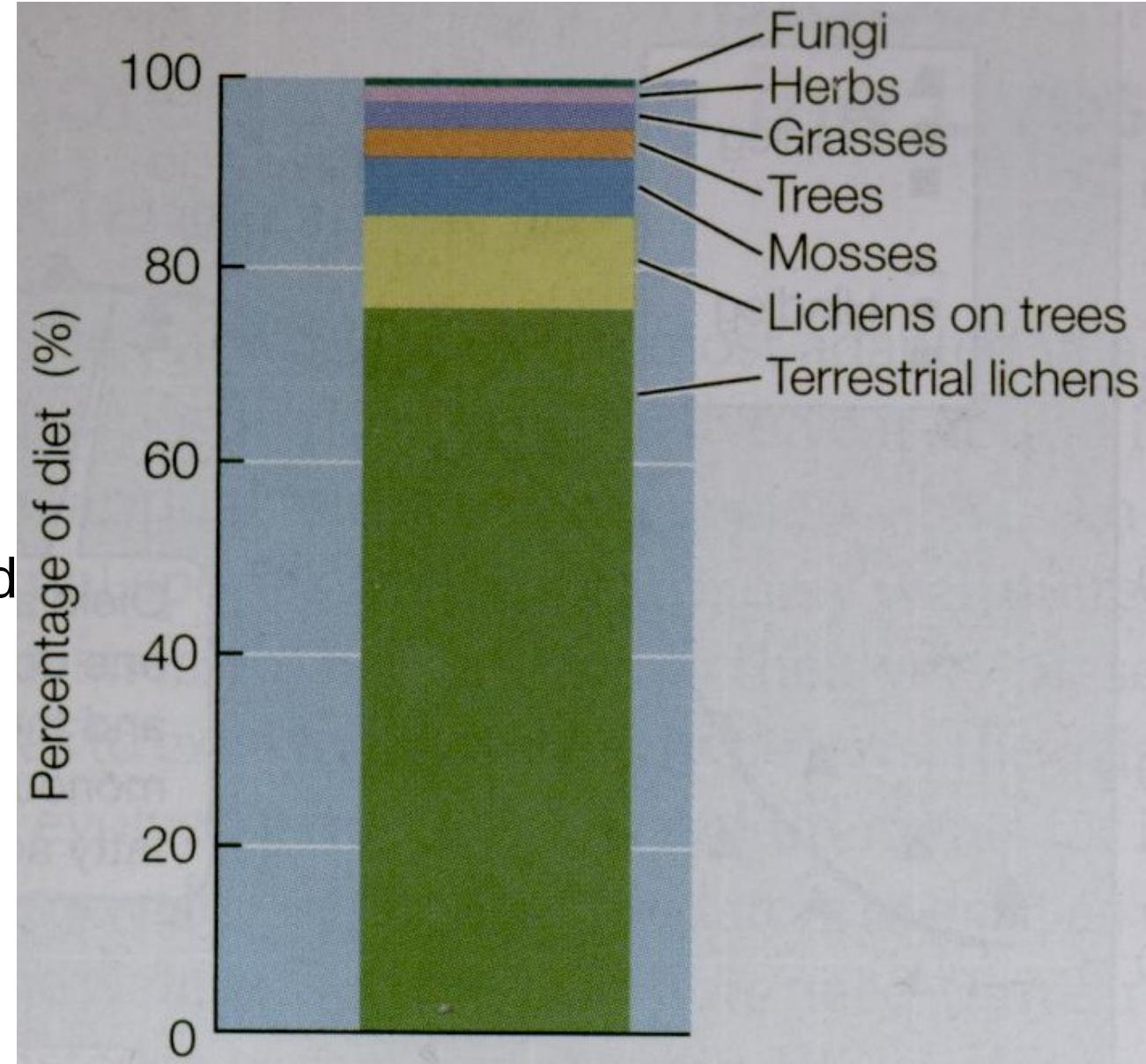


The foods available to – and eaten by – reindeer vary from place to place. The particular seasonal changes seen here are not, therefore, observed everywhere.

# L'alimentazione delle renne

Diet composition of winter reindeer as determined by DNA bar coding.

DNA was extracted from feces and analyzed to determine the foods eaten by 125 individuals.



# L'alimentazione delle renne

All'inizio della primavera, quando l'alternarsi di gelo e disgelo forma una crosta dura sulla superficie del manto nevoso, le renne selvatiche migrano verso Sud, in direzione della taiga dove, in foreste mature di pini e abeti, trovano abbondanza di licheni arborei dei generi *Alectoria* e *Bryoria*, che esse brucano sui rami più bassi degli alberi.

*Alectoria sarmentosa*





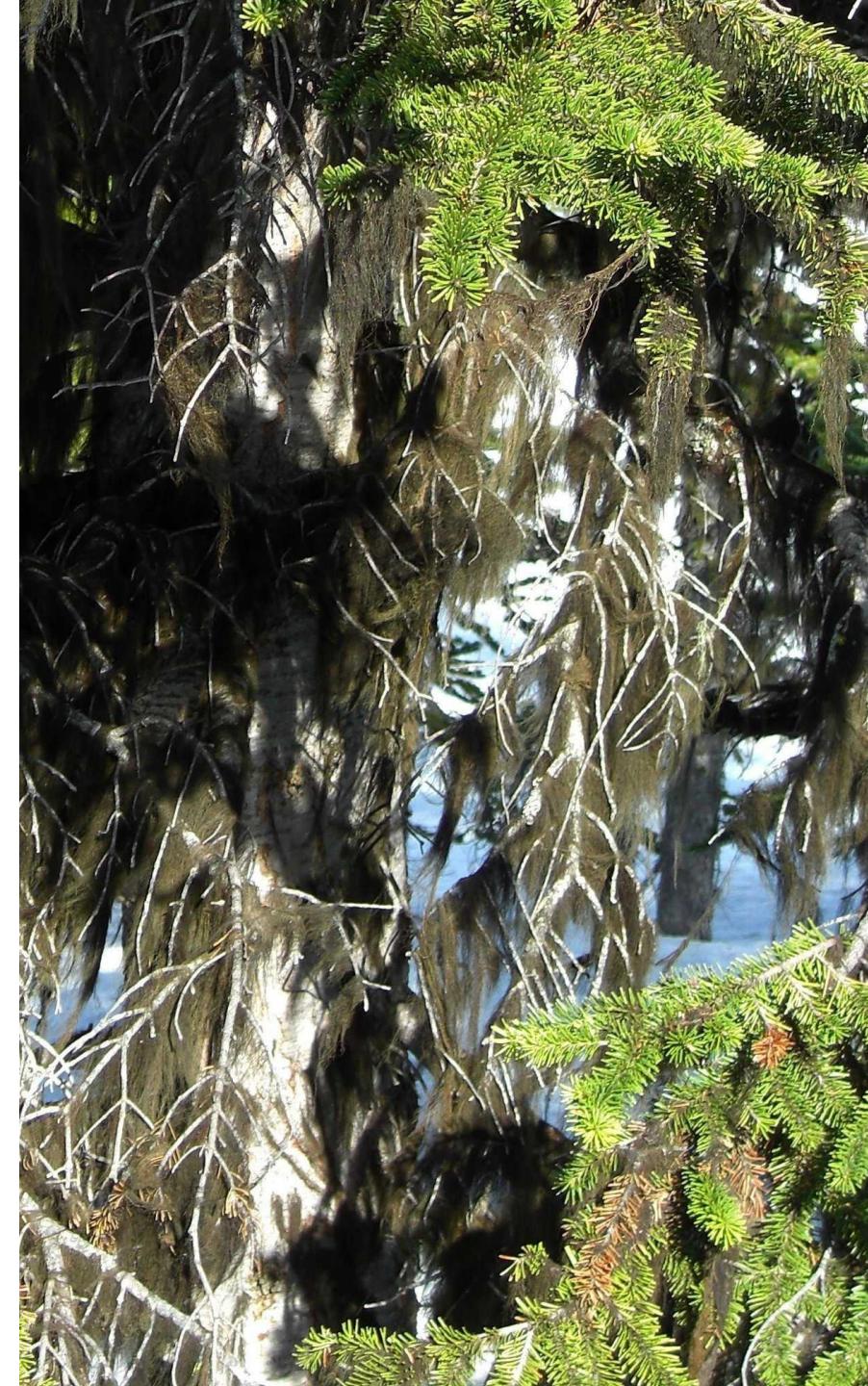
*Alectoria ochroleuca*

# L'alimentazione delle renne

Nascite a maggio, alla fine dell'inverno artico. All'inizio dell'estate le renne si nutrono di erbe che crescono in prossimità dei corsi d'acqua come le carici (*Carex*) e gli equiseti (*Equisetum*).

Anche alcune specie arboree come salici e betulle, di cui vengono consumate le gemme e le foglie quando sono ancora giovani e tenere, rientrano nella dieta estiva delle renne.

*Bryoria fuscescens*

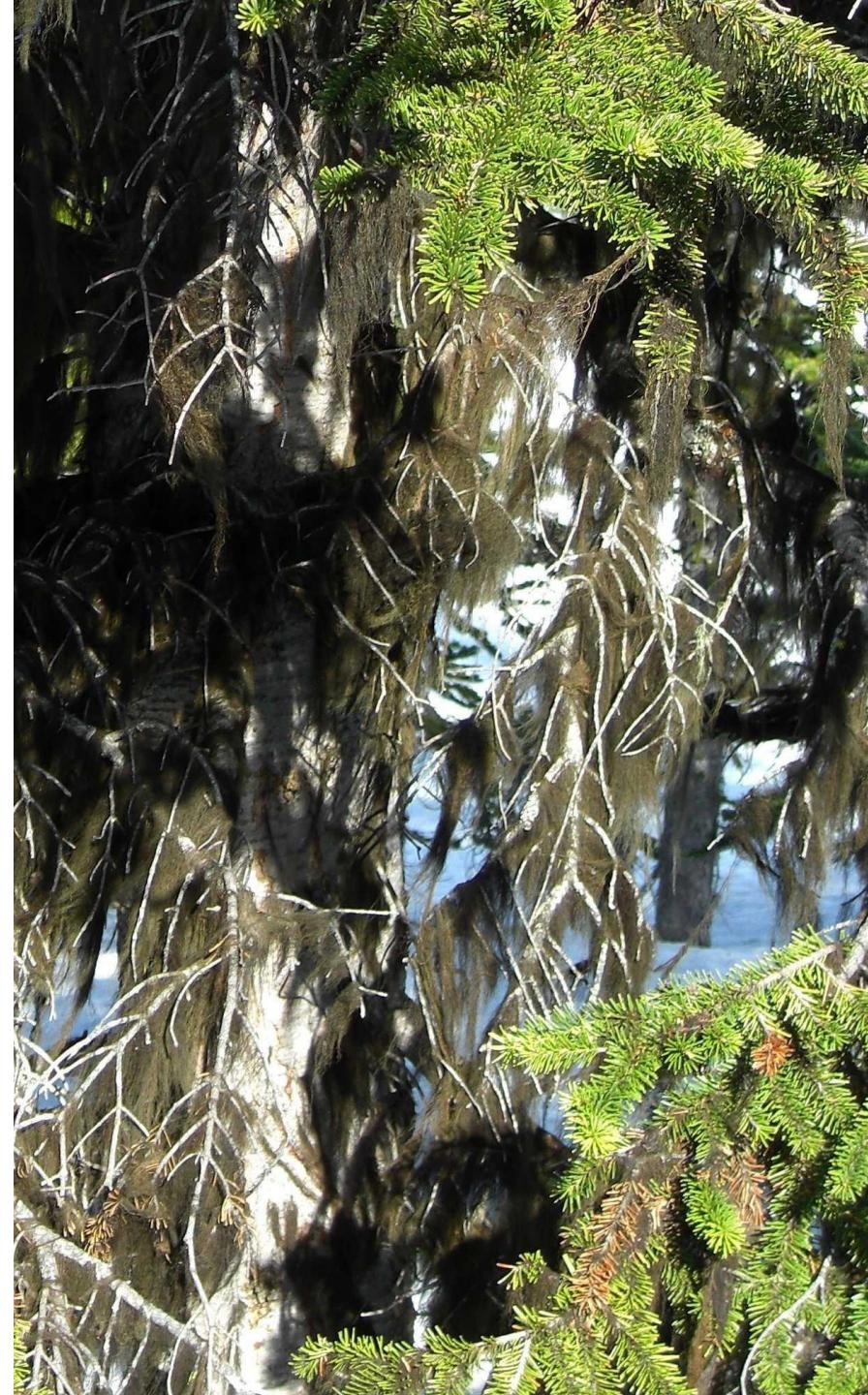


# L'alimentazione delle renne

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*Bryoria fuscescens*



# **Licheni arborei in Val Varaita**



*Carex pauciflora*



# L'alimentazione delle renne

In autunno questi brucatori specializzati si spostano nuovamente nella taiga, dove si nutrono di funghi e di alcune piante che rimangono verdi a lungo, come la *Deschampsia cespitosa*.



*Equisetum hyemale*

# La renna: un esperimento di domesticazione ancora in corso

- Controllo degli spostamenti ma, generalmente, non della riproduzione
- selezione naturale
- selezione sessuale  
(le ♀♀ scelgono il ♂ dominante)
- accoppiamenti con renne selvatiche



**La renna è un animale semi-domestico**



# Evoluzione e domesticazione

- **La domesticazione è riconducibile ad un fenomeno più generale,** l'evoluzione biologica, con la fondamentale differenza che il pastore o l'allevatore si sostituiscono alle femmine ed ai fattori naturali nel decidere quali individui, in particolare quali maschi, avranno il privilegio di riprodursi
- In tale scelta sessuale o *selezione artificiale*, l'uomo applica criteri che dipendono dallo scopo per il quale gli animali vengono allevati, scartando gli individui la cui attitudine produttiva è considerata insoddisfacente

# Evoluzione e domesticazione

Il miglioramento delle caratteristiche degli animali allevati fu realizzato in modo sistematico solo durante gli ultimi secoli, come dimostra il dipinto di questa vacca fiamminga, che risale al 1664 d.C. In essa sono riconoscibili alcuni caratteri tipici dell'attitudine lattifera, come la **spigolosità**.



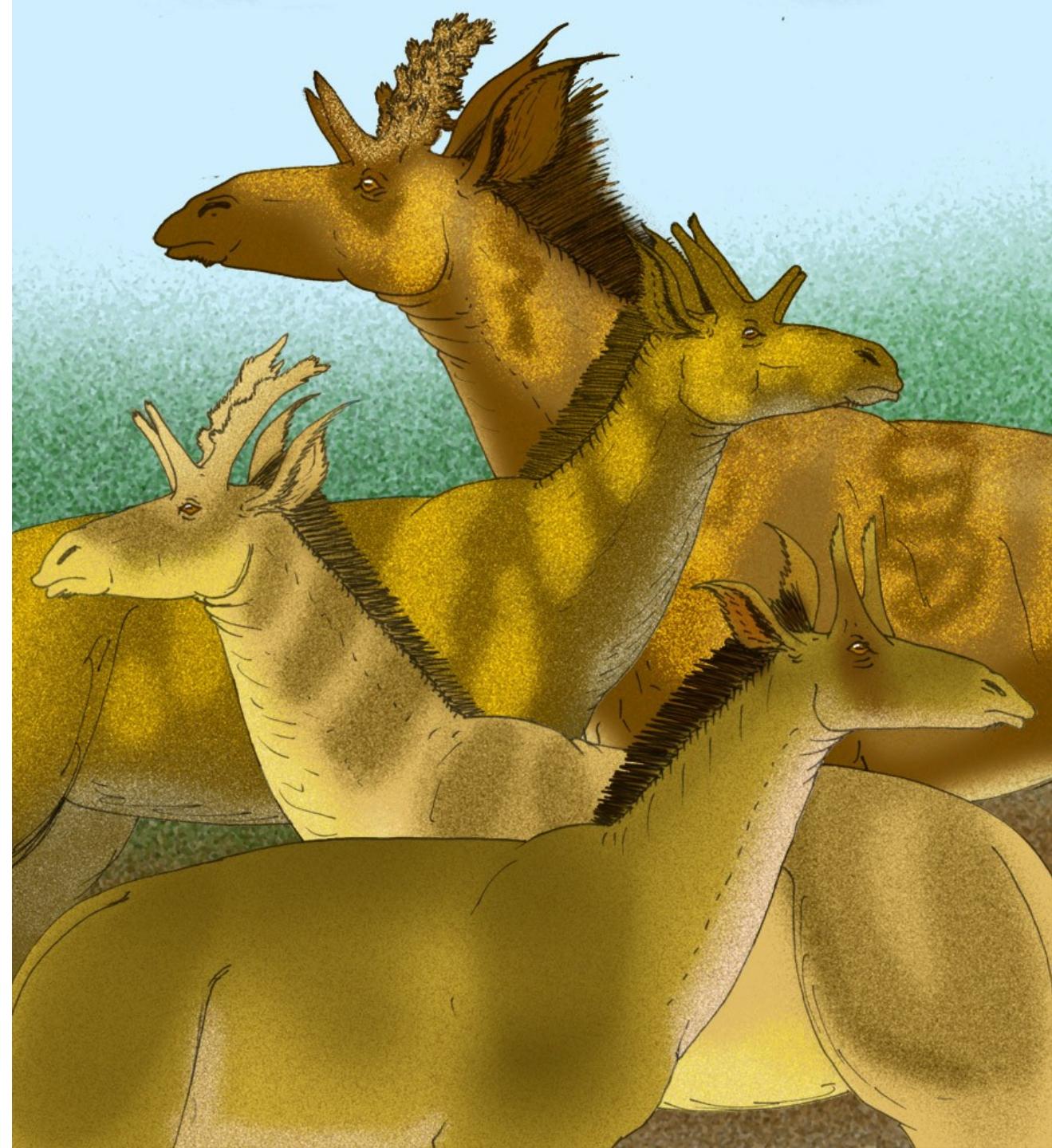
# Evoluzione e domesticazione



Aia in Normandia  
Claude Monet, 1863

# Evoluzione e domesticazione

Gli antenati della giraffa avevano il collo corto (come l'okapi)



L'okapi

(*Okapia johnstoni*)





**RETICULATED GIRAFFE**  
*Giraffa reticulata*

MALE	FEMALE
Weight 2,600 lbs	1,750 lbs
Height 17 ft	14 ft
Life span 25 years	

Ossicones, made of bone, are thicker in males, for sparring.

**KEEPING A COOL HEAD**  
A large nasal cavity likely helps cool both blood and the brain.

**SUPER FLEXIBLE**  
Like okapis and humans, giraffes have seven neck vertebrae, but ball-and-socket connections, similar to human shoulders, allow them to rub their noses on their lower backs.

**ARTERIES AND GRAVITY**  
Arteries above the heart are muscular and elastic to pump blood against gravity to the brain. Lower arteries are narrower with thick walls to bear higher pressures and to prevent blood from pooling.

**MULTITASKING HEART**  
The left ventricle has thick muscular walls to pump blood up to the head and then around the body. The thinner right ventricle pumps blood a short distance to the lungs.

**ADJUSTING FOR PRESSURE**  
A network of elastic vessels expands when the head is lowered, to prevent blood from flooding the brain, and constricts when the head is raised, to prevent quick depletion.

Tongue can be 20 inches long.  
An agile, thick tongue grasps leaves while tough skin in the mouth protects against thorns. The tip of the tongue is black, possibly for sun protection.

**ANGLING FOR ADVANTAGE**  
A joint at the base of the skull allows the head to lift into a line nearly vertical with the neck.

A powerful elastic ligament structure in the neck reduces the muscle effort required to support the head and neck.

**COOLING PATCHWORK**  
Scientists theorize that these unique color patterns provide more than just camouflage. Clusters of blood vessels and sweat glands under each brown patch act as thermal windows that release heat from the body.

**OKAPI**  
*Okapia johnstoni*

MALE	FEMALE
Weight 395 to 575 lbs	530 to 785 lbs
Height 4.5 - 5.1 ft	4.7 - 5.2 ft (shoulder)
Life span 20-30 years	

The okapi is the giraffe's closest living relative.

Heat regulation    Bones    Vascular system

## ANATOMY OF A GIANT

At 14 to 19 feet tall, giraffes tower over the entire animal kingdom. But their iconic height, which evolved over seven million years, requires unique features to regulate blood flow, mitigate the effects of gravity on muscles and bones, and heat and cool their massive bodies.

**WHY THE LONG NECK?**

Feeding    Surveying    Fighting

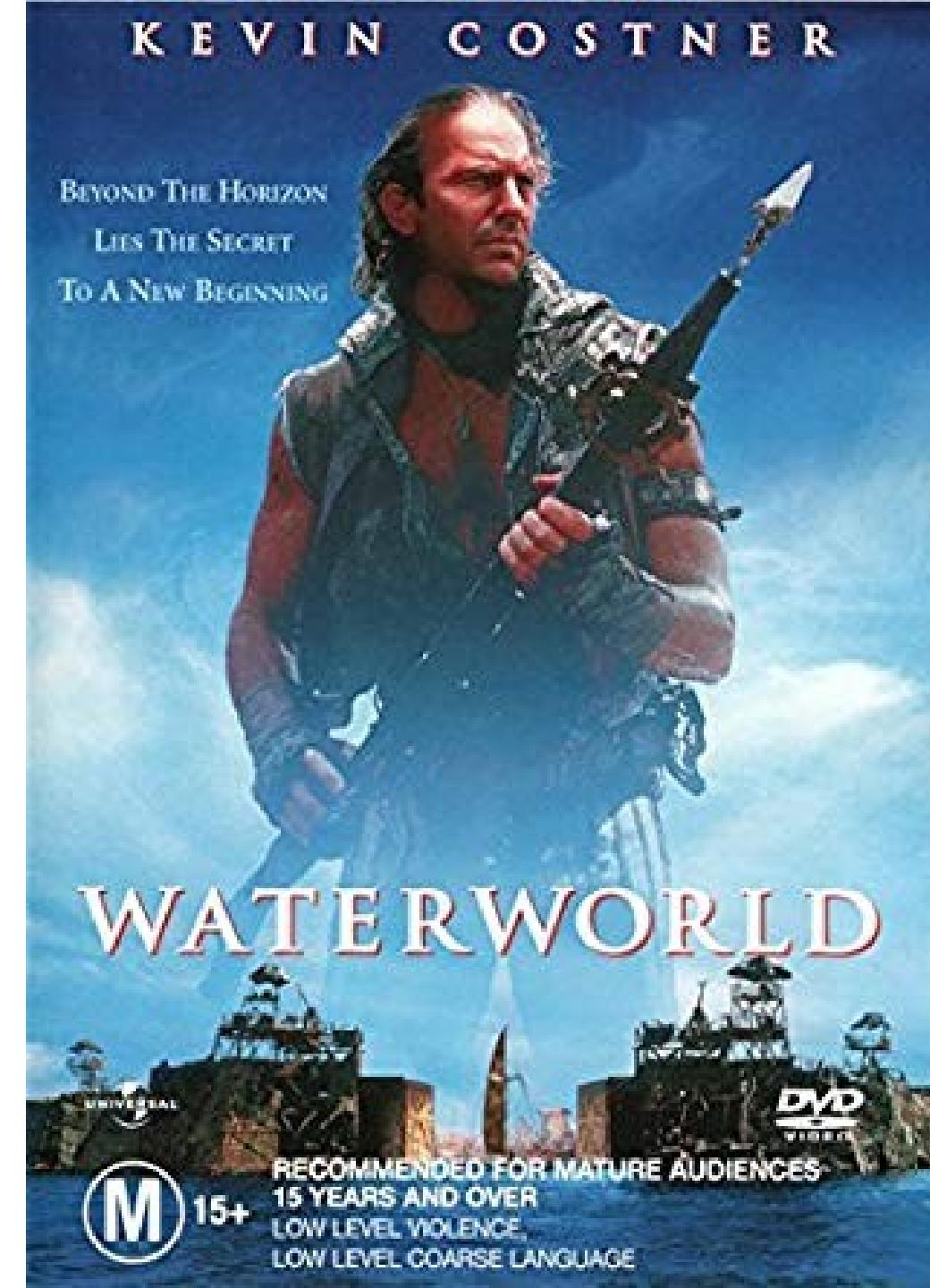
The reason for the giraffe's six-foot neck remains a mystery. It may have evolved to reach high branches, above competitors. Other theories suggest it improved vigilance or that longer necks provided an advantage to males fighting to win a mate.

1 inch = 2,54 cm  
1 foot = 30,48 cm  
1 pound (lb) =  
= 0.45359237 kg

# Come funziona l'evoluzione?

In un futuro apocalittico, in seguito allo scioglimento dei ghiacciai, il pianeta è quasi del tutto sommerso dalle acque

Il mutante *Mariner*, navigatore solitario, vaga alla ricerca di *Dryland*, l'ultima regione di terra sopravvissuta al disastro



# Come funziona l'evoluzione?

*Marcella*



0.3671

*Marco*



0.0000

*Nancy*



0.1528

# Come funziona l'evoluzione?

La sindattilia è una «malformazione» ma sono possibili diversi casi:

- Marcella è una campionessa di nuoto
- M. è una cacciatrice di una tribù africana, che, per sopravvivere, deve inseguire gnu, antilopi, bufali ecc. correndo a piedi scalzi
- M. non è né una nuotatrice né una cacciatrice africana

# Come funziona l'evoluzione?

*Giulio*



# **Che cos'è una specie?**

# Specie

Insieme di popolazioni di individui interfecondi, separato da altri insiemi ≈ ad opera di una **barriera riproduttiva**  
es. *Rupicapra rupicapra* (camoscio alpino)



# Specie

Ma sull'Appennino ci sono camosci che presentano un aspetto fenotipico differente...



## Specie

Most authors, on the base of significant differences among them, give the Alpine and the Abruzzo chamois the status of separate species, disregarding their interbreeding

In effetti, ciò che conta non è il fatto che due taxa siano potenzialmente interfecondi, ma che non ibridino in simpatria

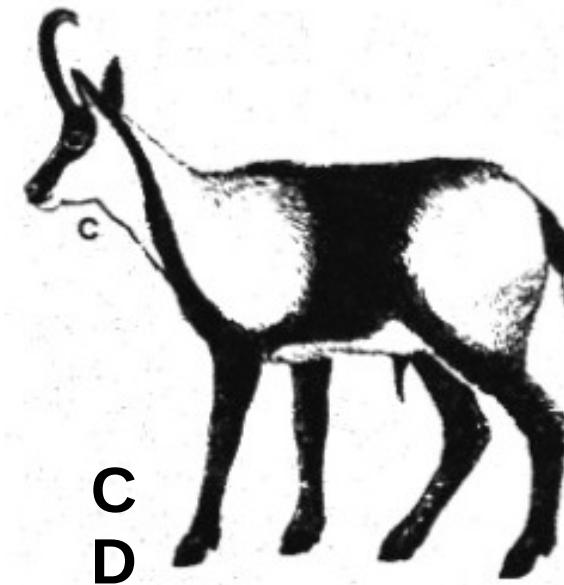
Che cosa vuol dire significativamente diversi?

# Differenze fenotipiche

Coat patterns of the Alpine (above: *R. r. rupicapra*) and (below: *R. p. ornata*) chamois. All North-eastern populations show a close resemblance to the Alpine chamois (A: winter; B: summer). On the other hand, horn and body sizes increase from west to east in the South-western species, but no variation occurs in the distinctive coat pattern (C: winter; D: summer).  
Da Lovari, Sandro. "Behavioural Repertoire of the Abruzzo Chamois, *Rupicapra pyrenaica ornata* Neumann, 1899 (Artiodactyla: Bovidae) I." (1985).



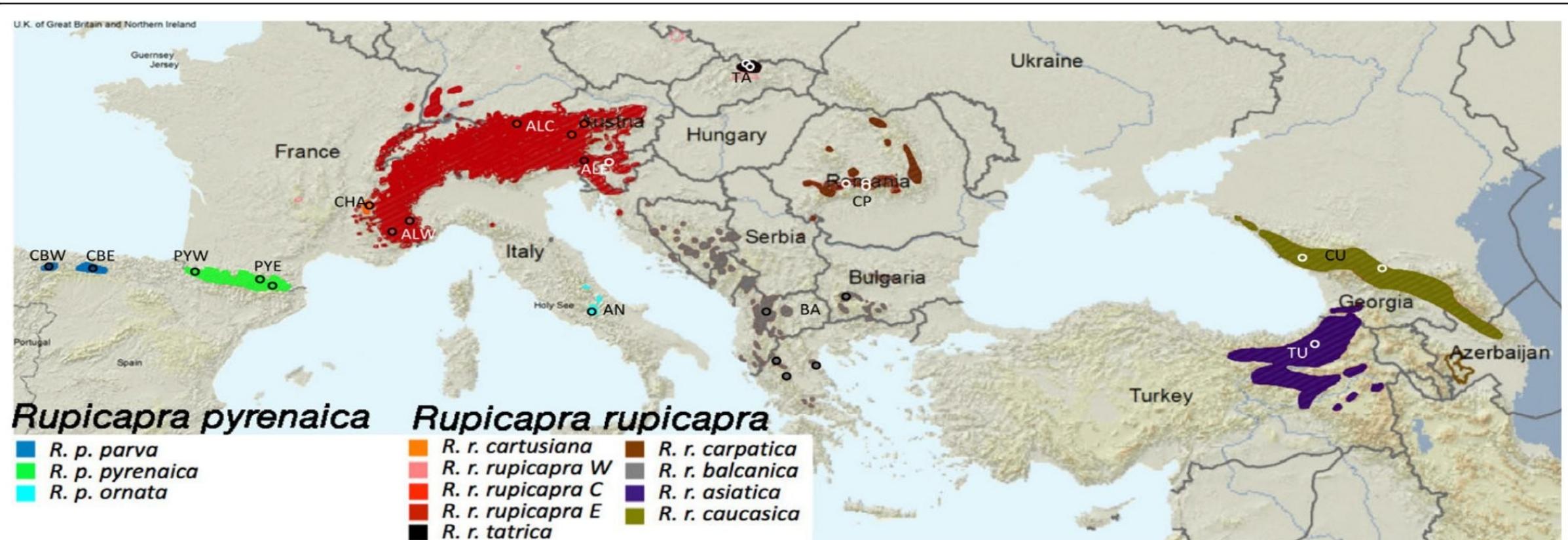
*Rupicapra rupicapra*



*Rupicapra pyrenaica ornata*



# Differenze biogeografiche



**Figure 1 Geographic distribution of the subspecies of the genus *Rupicapra*.** Sampling sites are indicated by circles and labelled with a letter code. The map was modified from the distribution map on the IUCN Red List [54].

# Differenze etologiche

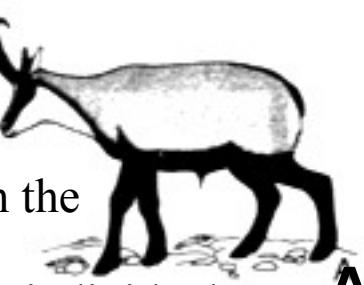
COMPORTAMENTO	<i>Rupicapra rupicapra</i>	<i>Rupicapra pyrenaica</i>	
Approach	+	+	
Body-head shake	+	+	
Butt	+	+	
Chase	+	+	
Conflict posture	-	+	
Flank stroke	-	+	
Gambol	+	+	
Head-down static	+	+	
Head-down dynamic	-	+	
Head up	+	+	
Herding	+	-	
Hook	+	+	
Hop	+	+	
Horning (veget.)	+	+	

Comparison of the behaviour patterns recorded for the North-eastern chamois and the South-western chamois (original and from literature).  
+: present; (+): rare; ?: Dubious; -: absent.

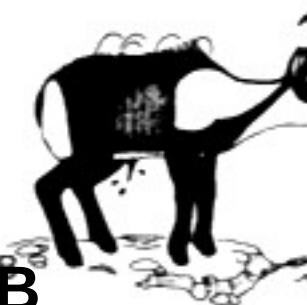
# Differenze etologiche

COMPORTAMENTO	<i>Rupicapra rupicapra</i>	<i>Rupicapra pyrenaica</i>
Kick	(+)	-
Lip-curl	+	+
Low-stretch	+	+
Marking (veget.)	+	+
Mock-suck	-	+
Naso-genital contact	(+)	(+)
Naso-nasal contact	(+)	+
Neck fight	+	(+)
Neck-up	+	+
Penile display	+	+
Rush	+	+
Side display	+	+
Stare	?	+
Urinating in female posture by males	+	+

**Approach:** visual, mild threat. Direct form of aggressive behaviour. The sender walks straight towards the receiver with the tail pressed to the rump and the ears turned backwards. Dominant individuals to subordinates, displaced from food sources or resting sites. Both sexes.



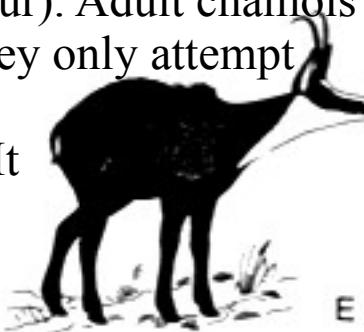
**A**



**B**



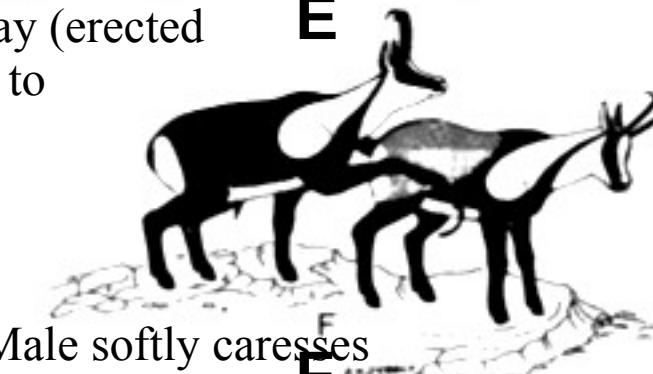
**C**



**D**



**E**



**F**

**Butt:** play in kids, visual threat in adults (direct aggressive behaviour). Adult chamois rarely clash; in most instances they only attempt to. Both sexes.

**Conflict posture:** visual display. It contains elements found in submissive behaviour (stretched head and neck, ears oriented forwards) and in dominance display (erected mane along backbone, tail pressed to hindquarters, hunched back).

Females only.

**Flank stroke:**

Visual (tactile) courtship pattern. Male softly caresses the female's hindquarters once or twice.

**Body-head shake:**

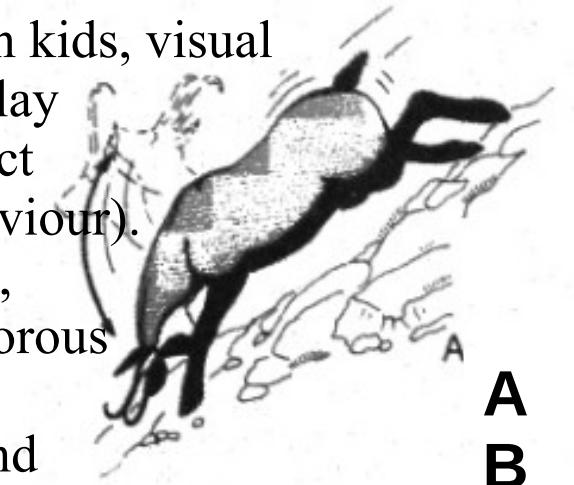
Visual/olfactory dominance display. Indirect form of aggressive behaviour.

The sender starts by shaking the body slowly, but the movement accelerates during performance. Urine may be eliminated, thus impregnating the flank pelage. A head-shake often follows. Males.

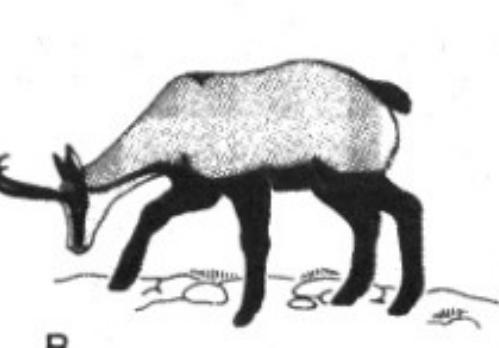
**Chase:** visual dominance display (aggressive behaviour). The pursuer and the chased individual may switch roles once or twice during their performance. In most cases it ends with after a run down- or up-hill. If the pursuer catches up (raggiunge) with the chased chamois, it may attempt to hook the latter in its abdomen, groin (inguine) and hind limbs. Both sexes.

**A:** approach; **B** Body-head shake (shaded area indicates the part of the body which becomes drenched with urine); **C:** butt; **D:** chase; **E:** conflict posture; **F:** flank stroke.

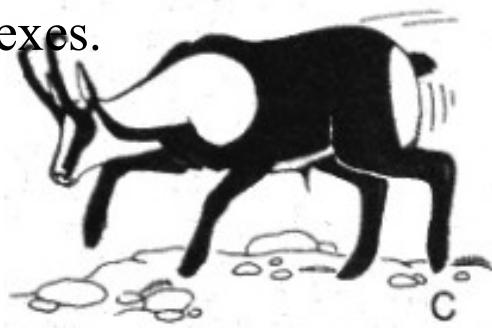
**Gambol:** play in kids, visual dominance display in adults (indirect aggressive behaviour). A run down-hill, inclusive of vigorous head nodding (oscillazione) and throwing up the hind quarters. Both sexes.



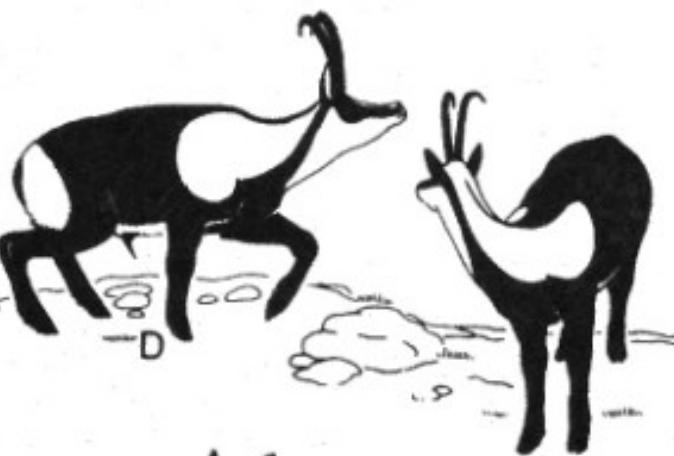
**A**  
**B**



**B**



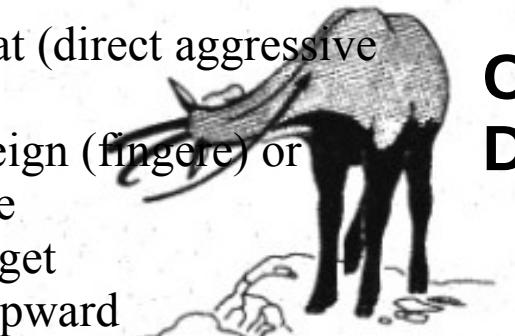
**C**  
**D**



**Head-down:** **B:** static; **C:** **dynamic** visual threat (direct aggressive behaviour).

Head held lower than main body axes, ears turned backwards, tail pressed to the rump or half way (B). Both sexes.

**Hook:** visual threat (direct aggressive behaviour). The sender may feign (fingere) or actually try to gore (incornare) the target individual by an upward sweep (rapido movimento) of its horns. Both sexes.



**E**



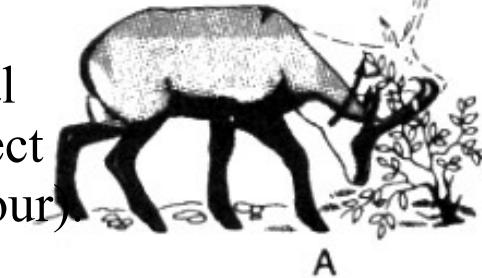
**F**

**Hop:** play behaviour of kids and, to a lesser extent, yearlings. The animal springs in the air, waving its legs and contorting energetically. Usually other kids and/or yearlings join in the play bout.

**A:** Gambol; **B:** Head-down static; **C:** Head-down dynamic; **D:** Head-up (male displaying on female on the right); **E:** Hook; **F:** Hop.

## **Horning:**

visual and perhaps olfactory dominance display, if performed in social interactions (indirect aggressive behaviour)



**A**

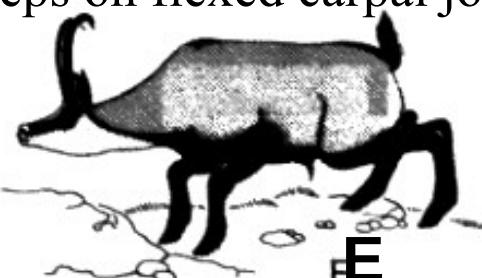
The chamois **A** vigorously horns a bush or a low branch, every now and again sniffing at the horned vegetation, making conspicuous damages to the substratum. Both sexes.



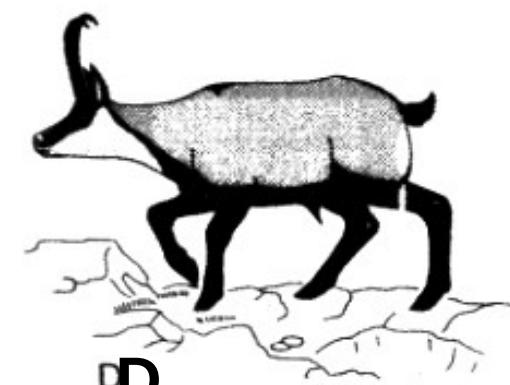
**B**

## **Low-stretch:**

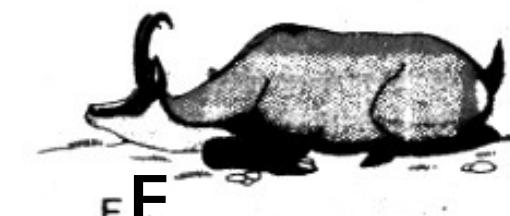
Visual submissive display performed by a subordinate to a dominant within each sex. The displaying animal faces the hindquarters of the dominant one, sometimes approaching the latter with quick steps on flexed carpal joints.



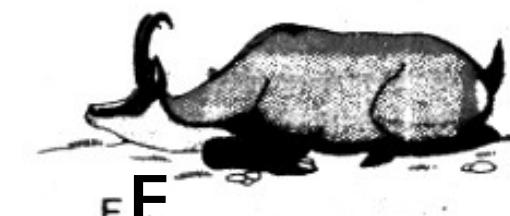
**C**



**D**



**E**



**F**

## **Lip-curl:**

Commonly shown during the courtship sequence. Male sniffs female's urine and subsequently curls its upper lip.

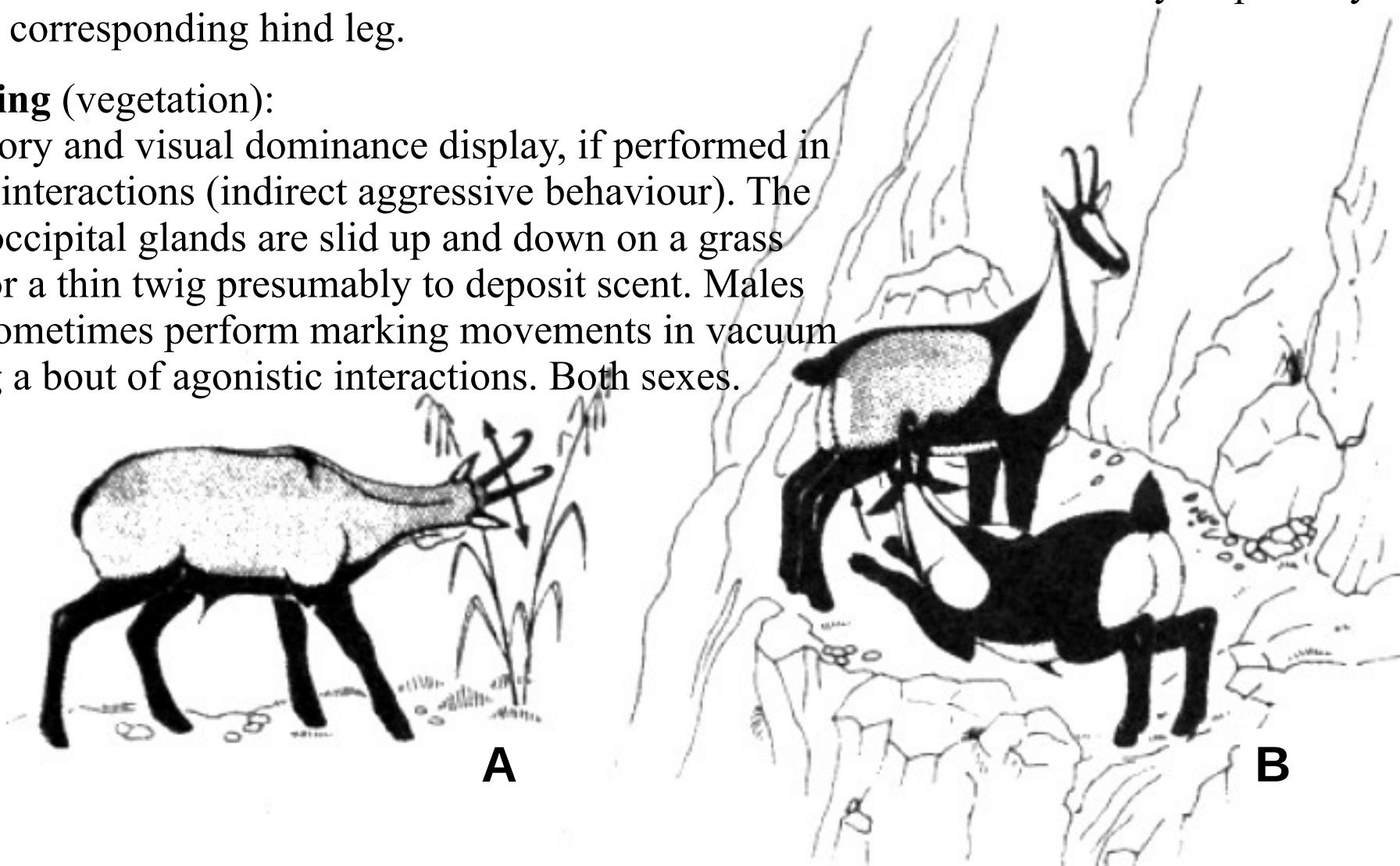
**A:** Horning (vegetation); **B:** Lip-curl; **C:** Low-stretch (mild); **D:** Low-stretch (medium); **E:** Low-stretch (intense); **F:** Low-stretch (extreme). Forelimbs may be outstretched in **E** and **F**.

## Mock-suck:

Visual (tactile) behaviour pattern, shown by males during courtship on the pick of the rut. The male, in low-stretch, approaches a female, squats with its forelimbs, inserts its muzzle under the female's udder area and delivers 2-3 blows like kids do to stimulate lactation. The female may respond by slightly lifting its corresponding hind leg.

## Marking (vegetation):

Olfactory and visual dominance display, if performed in social interactions (indirect aggressive behaviour). The supraoccipital glands are slid up and down on a grass stem or a thin twig presumably to deposit scent. Males may sometimes perform marking movements in vacuum during a bout of agonistic interactions. Both sexes.



A: Marking (vegetation); B: Mock-suck.



**Mount (copulative):**  
Copulative behaviour shown by adult male and females during the rut.



**Mount (non-copulative):**  
Non-copulative mounting is shown commonly by kids during play bouts, sometimes by yearlings as well.

**C**

**D**



**E**



**F**

### **Neck-fight:**

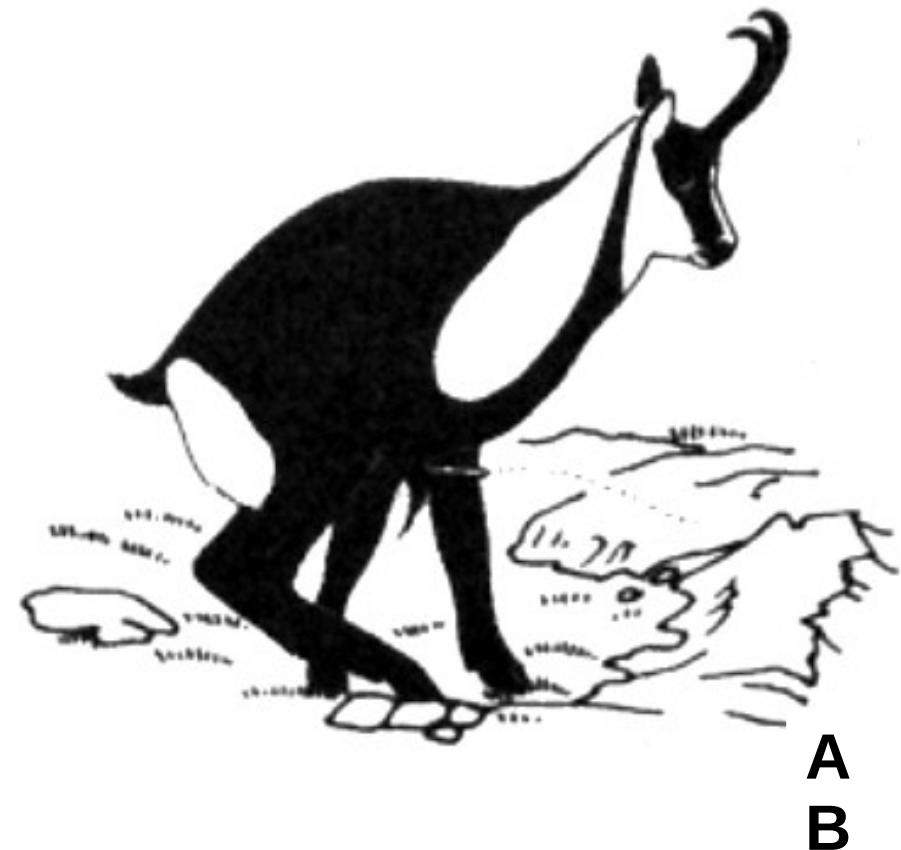
Play behaviour (kids, rarely yearlings). No real push seems to be exerted, an animal simply resting its neck on the other's neck, withers or even rump.

**C: Mount (copulative); D: Mount (non-copulative); E: Neck fight; F: Neck-up.**

### **Neck-up:**

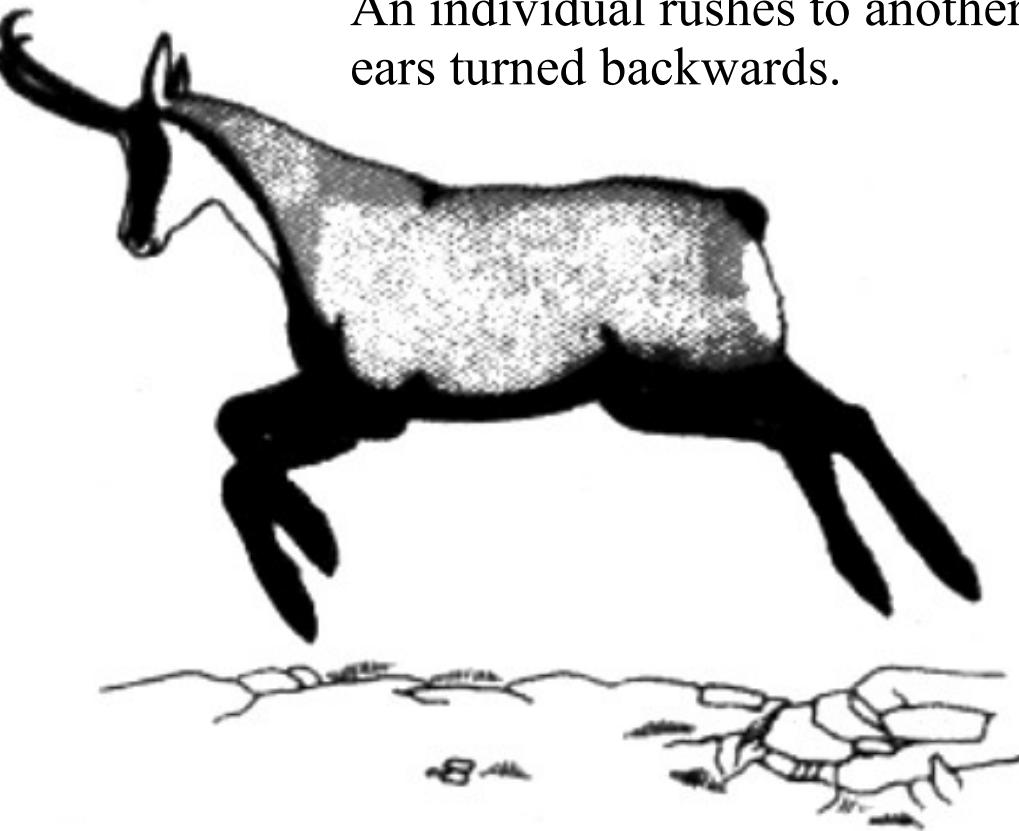
Visual dominance display (indirect aggressive behaviour). An individual stands on fairly (abbastanza, piuttosto, alquanto) stiff legs, sometimes moving slowly or else trotting towards the opponent along a tangential line. The head is held high; mane or withers and rear part of the backbone is fully erected; tail is pressed to the rump; mouth is often open. Males.

A: Penile display; B: Rush.



**Rush:**

Visual threat (direct aggressive behaviour). An individual rushes to another with its ears turned backwards.



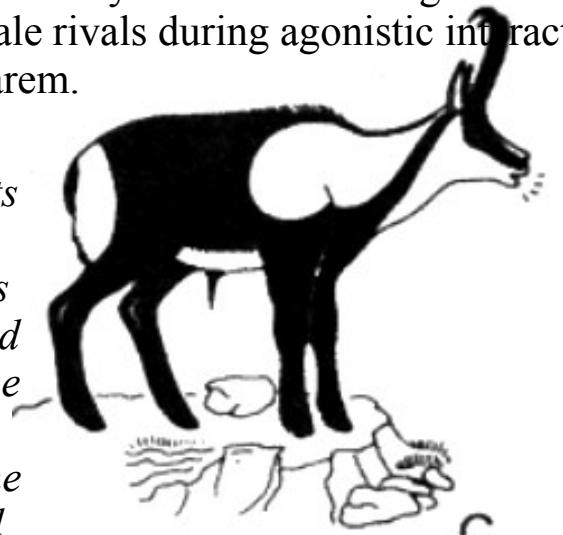
**Penile display:**

Visual (and olfactory) dominance display (indirect aggressive behaviour). The male squats slightly and unsheathes its penis. Ejaculation may also occur.

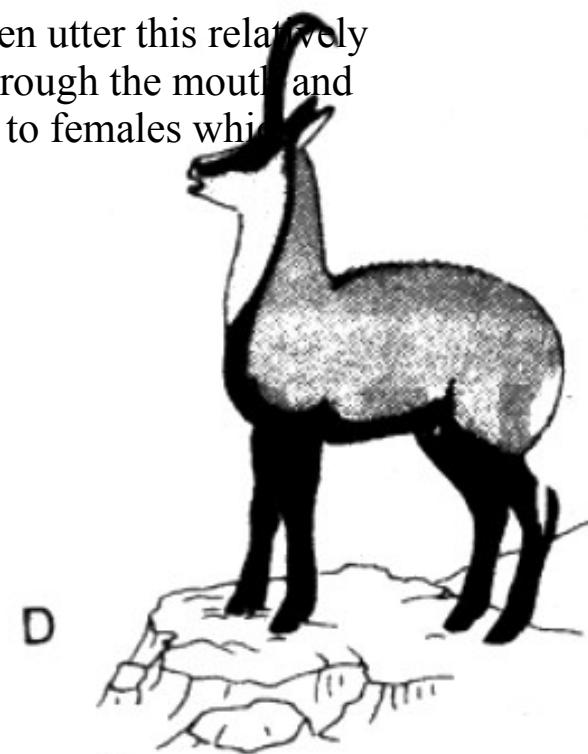
It is shown frontally by dominant individuals to male subordinates, whereas it is performed from behind to females during the rut. In the latter case, copulatory movements in vacuum may follow.

**Rut call:** Vocal dominance display. Rutting males quite often utter this relatively low pitched grunt. It may be emitted through the nose or through the mouth and is addressed to male rivals during agonistic interactions, or to females which try to leave the harem.

*It is uncertain whether the grunts sometimes uttered by females in side display and by males out of the rut, especially in late spring, are the same vocal signal.*



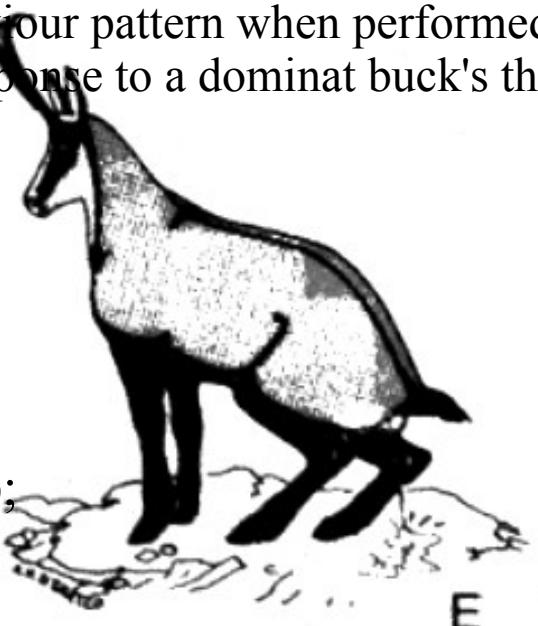
C



D

### Urinating (female posture):

Submissive behaviour pattern when performed by subordinate adult males in response to a dominant buck's threat.



E

C: Rut call; D:  
Side display; E:  
Urinating  
(female posture);  
F: Urinating  
(male posture).



F

### Side display:

Visual dominance display (indirect aggressive behaviour). An individual stands on stiffly stretched legs, broadside on; back is hunched; hair along backbone may be slightly erected; head is held high; mouth is usually open and closed intermittently; ears are drooping (pendenti) and turned backwards; tail is flat on the hindquarters. Sometimes a low pitch grunt may be uttered. It is usually performed by yearlings and up to class 4 females and by class 1 bucks.

### Urinating (male posture):

Visual dominance display when performed by dominant females to subordinate ones.

# Differenze genetiche

Il camoscio appenninico è più ≈ geneticamente a quello dei Pirenei (*Rupicapra pyrenaica*), di cui è considerato una sottospecie



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## Integrating phylogeographic patterns of microsatellite and mtDNA divergence to infer the evolutionary history of chamois (genus *Rupicapra*)

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Volume 10, article number 222, (2010) [Cite this article](#)

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# Differenze genetiche

