Esercitazione N° 2: **Ibridazione interspecifica**

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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

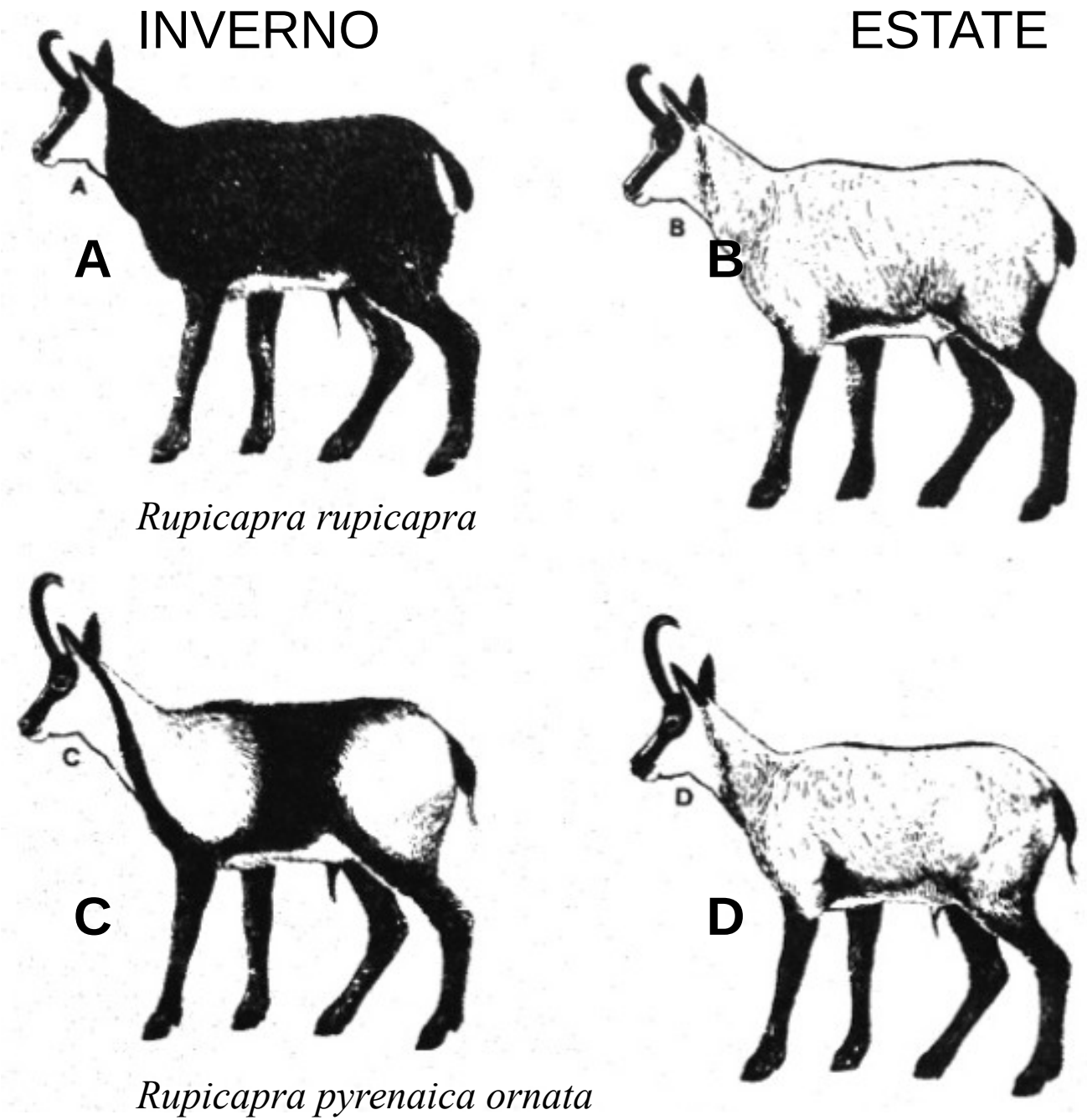
Most authors, on the base of significant differences among them, give the Alpine and the Abruzzo chamois the status of separate species, disregarding their interbreeding

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 omata* Neumann, 1899 (Artiodactyla: Bovidae) l." (1985).



Rupicapra rupicapra

Rupicapra pyrenaica ornata

Differenze biogeografiche

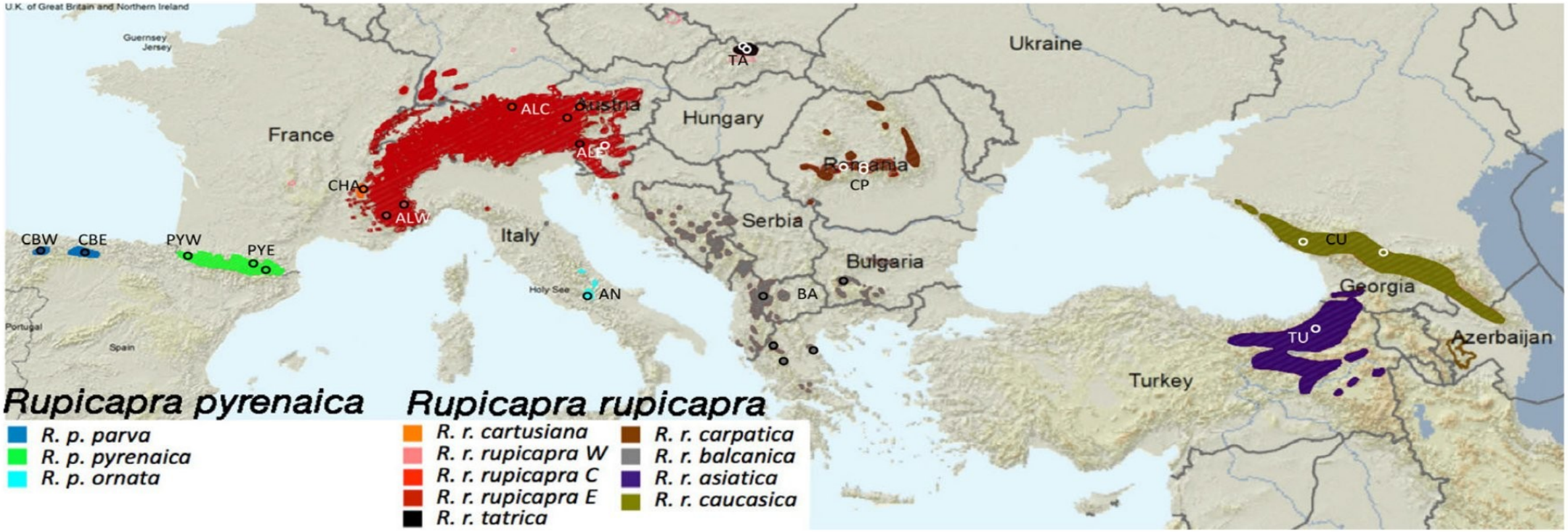


Figure 1 Geographic distribution of the subspecies of the genus Rupicapra. Sampling sites are indicated by circles and labelled with a letter code. The map was modified from the distribution map on the IUCN Red List [54].

Differenze etologiche

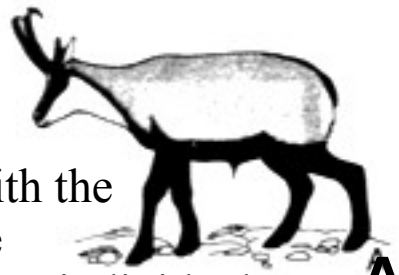
COMPORTAMENTO	*Rupicapra rupicapra*	*Rupicapra pyrenaica*
Approach	+	+
Body-head shake	+	+
Butt	+	+
Chase	+	+
Conflict posture	–	+
Flank stroke	–	+
Gambol	+	+
Head-down static	+	+
Head-down dynamic	–	+
Head up	+	+
Herding	+	–
Hook	+	+
Hop	+	+
Horning (veget.)	+	+

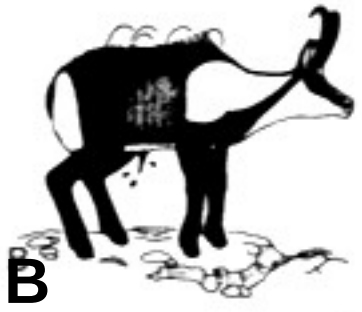
Comparison of the behaviour patterns recorded for the North-eastern chamois and the South-western chamois (original and from literature). +: present; (+): rare; ? Dubious; –: absent.

Differenze etologiche

COMPORTAMENTO	*Rupicapra rupicapra*	*Rupicapra pyrenaica*
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	+	+

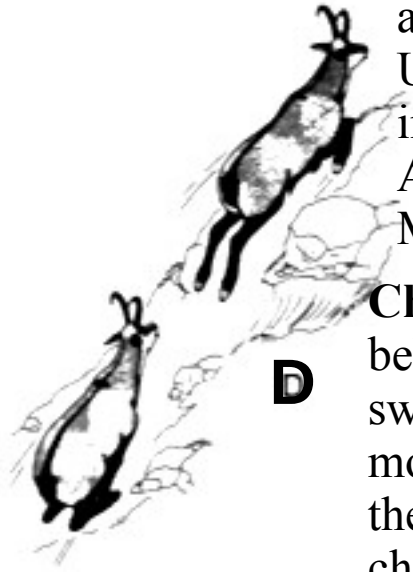
Approach: visual, mild threat. Direct form of aggressive behaviour. The sender walks straight towards the receiver with the tail pressed to the rump and the ears turned backwards. Dominant individuals to subordinants, displaced from food sources or resting sites. Both sexes.





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.

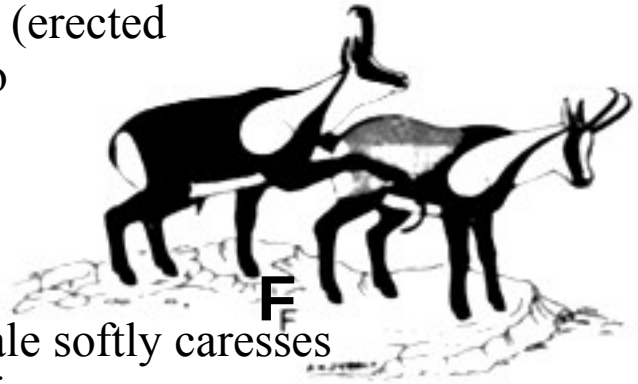
Butt: play in kids, visual threat in adults (direct aggressive behaviour). Adult chamois rarely clash; in most instances they only attempt to. Both sexes.



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 catchs up (raggiunge) with the chased chamois, it may attempt to hook the latter in its abdomen, groin (inguine) and hind limbs. Both sexes.

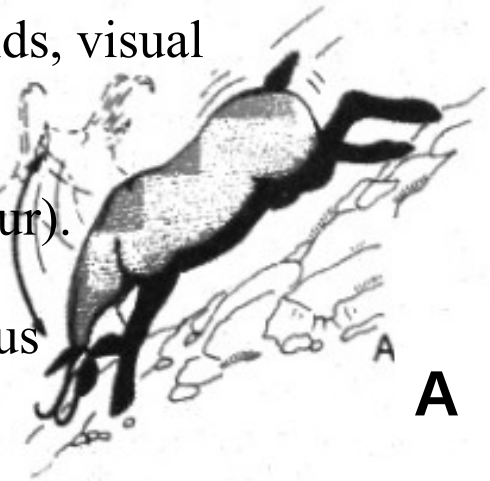
Conflict posture: visual display. It contains elements found in submissive behaviour (stretched head and neck, ears oriented Forwards) and in dominance display (erected mane along backbone, tail pressed to hindquarters, hunched back). Females only.

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



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

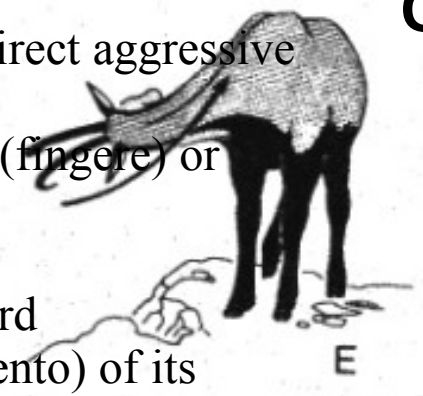
Head-down: **B**: **static**; **C**: **dynamic** visual threat (direct aggressive behaviour).

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

C D

Head-up: visual courtship pattern. Male approaches female with stiff and abrupt steps, up-lifting its muzzle; expecially common when females are in oestrus.

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.

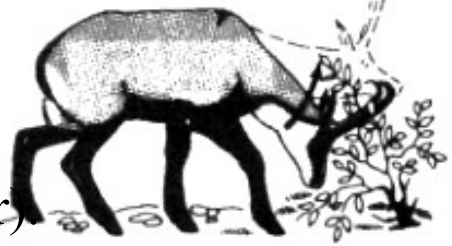


E F

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.

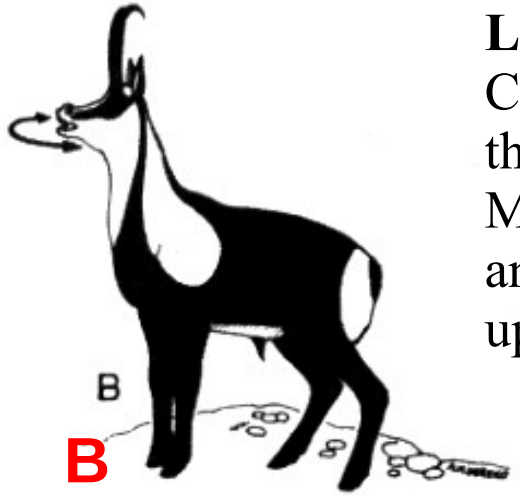
Horning:
visual and perhaps olfactory dominance display, if performed in social interactions (indirect aggressive behaviour).



A

The chamois 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.

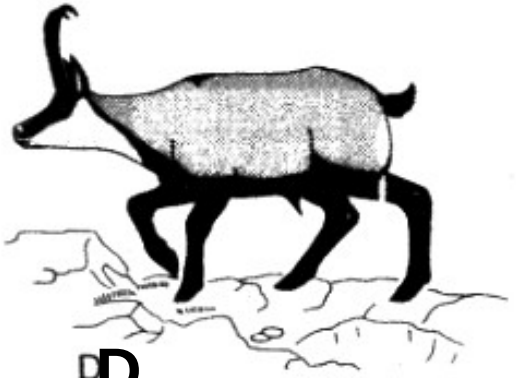
Lip-curl:
Commonly shown during the courtship sequence. Male sniffs female's urine and subsequently curls its upper lip.



B

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**.

C



D

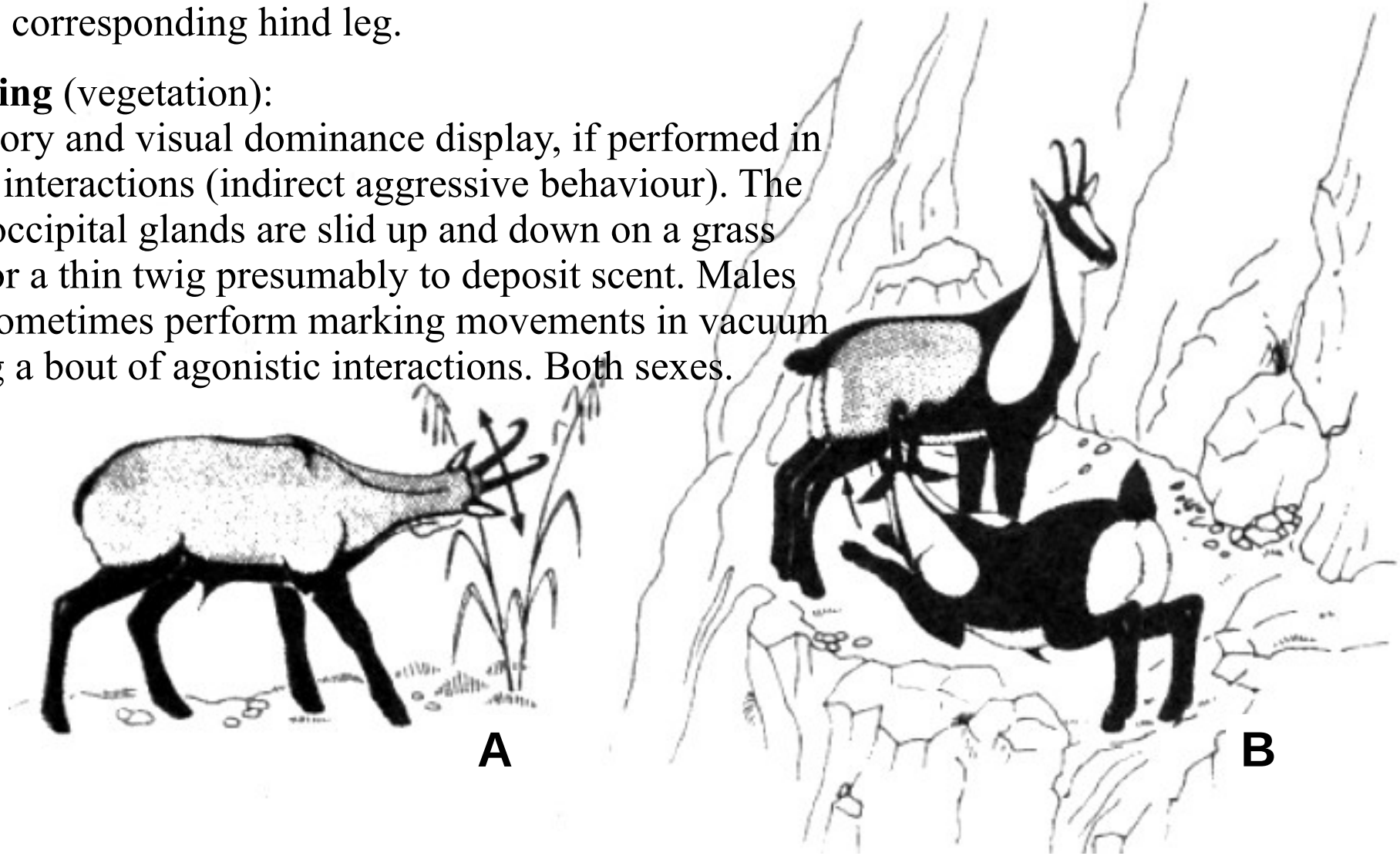
Low-stretch:
Visual submissive display performed by a subordinate to a dominant within each sex. The displaying animal faces the hindquarters of the dominant one, sometimes approaching the latter with quick steps on flexed carpal joints.

E

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.



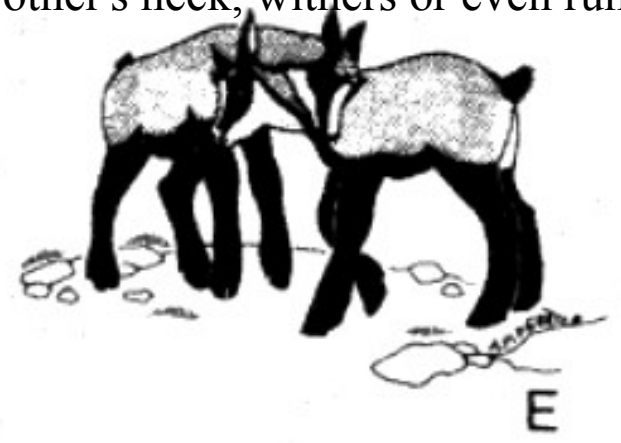
A: Marking (vegetation); **B**: Mock-suck.

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

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



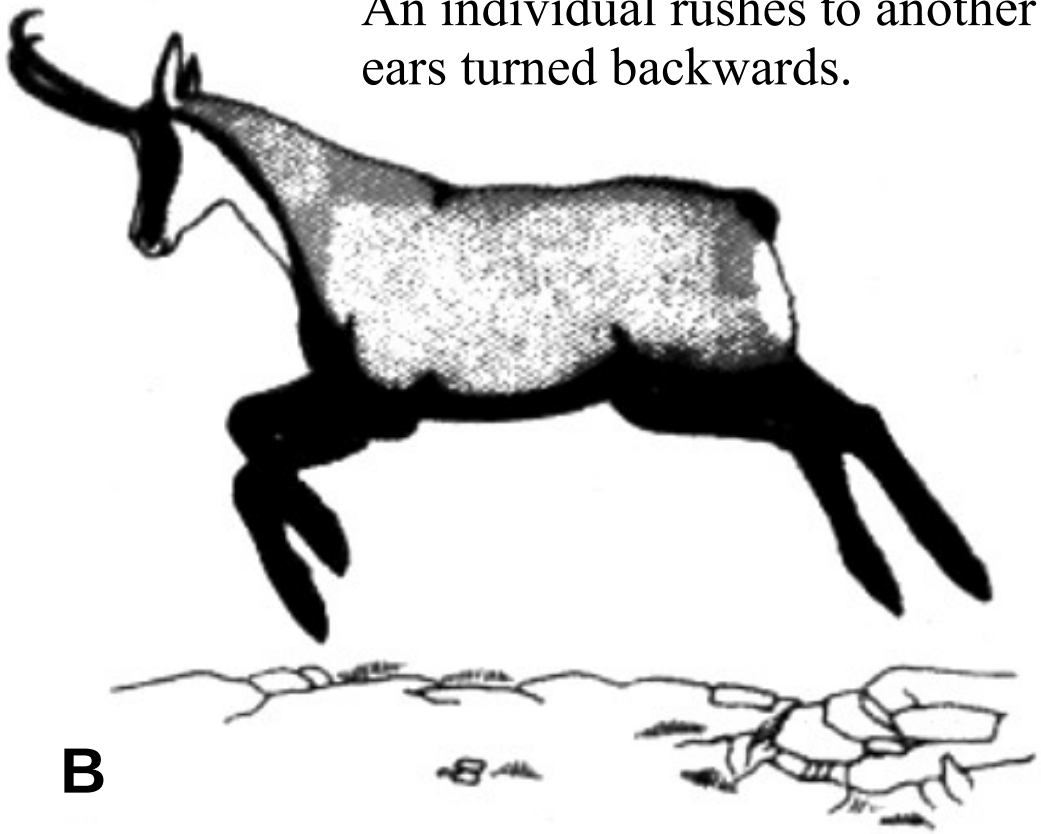
Neck-up:
Visual dominance display (indirect aggressive behaviour). An individual stands on fairly (abbastanza, piuttosto, alquanto) stiff legs, sometimes
moving slowly or else trotting towards the opponent along a tangential
line. The head is held high; mane or withers and rear part of the backbone
is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

9: Behaviour patterns. A: Marking (

A: Penile display; B: Rush.

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

A

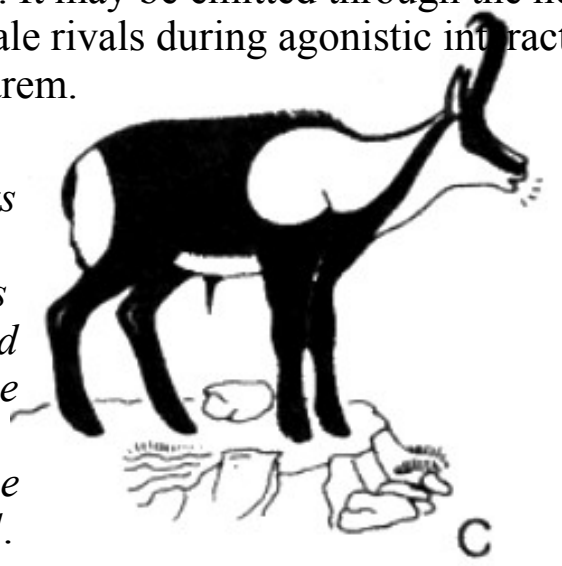


B

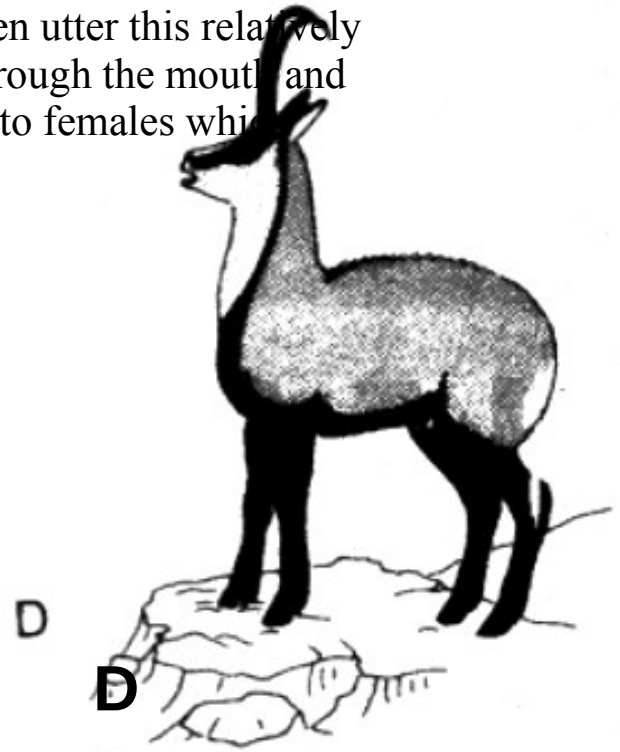
Penile display:
Visual (and olfactory) dominance display (indirect aggressive behaviour). The male squats slightly and unsheaths its penis. Ejaculation may also occur.
It is shown frontally by dominant individuals to male subordinates, whereas it is performed from behind to females during the rut. In 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.



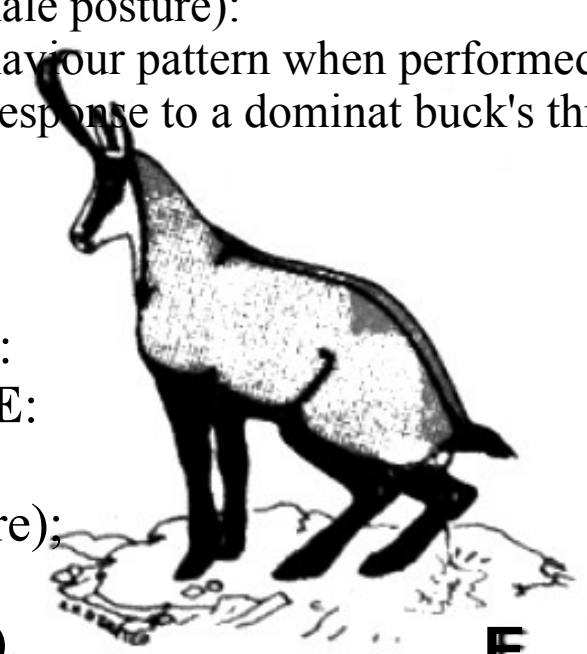
C



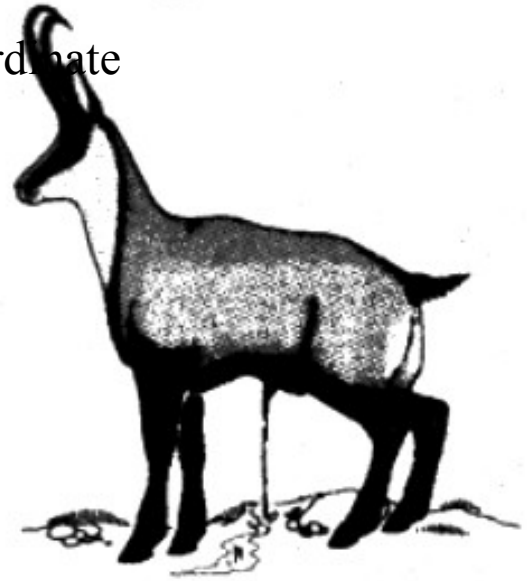
D

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 (female posture):
Submissive behaviour pattern when performed by subordinate adult males in response to a dominat buck's threat.



E



F

Urinating (male posture):
Visual dominance display when performed by dominant females to subordinate ones.

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

Differenze genetiche

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

Differenze genetiche

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

Research article | Open access | Published: 22 July 2010

Volume 10, article number 222, (2010) Cite this article

ELSEVIER

Quaternary Research

Volume 30, Issue 3, November 1988, Pages 339-349

Systematics, phylogenetic relationships, and dispersal of the chamois (*Rupicapra* spp.)

Federico Masini, Sandro Lovari

https://doi.org/10.1016/0033-5894(88)90009-9

Abstract

The Rupicaprini originated during the Miocene in Asia and dispersed during the late Miocene-early Pliocene, the Villafranchian, and the middle Pleistocene. *Rupicapra* and

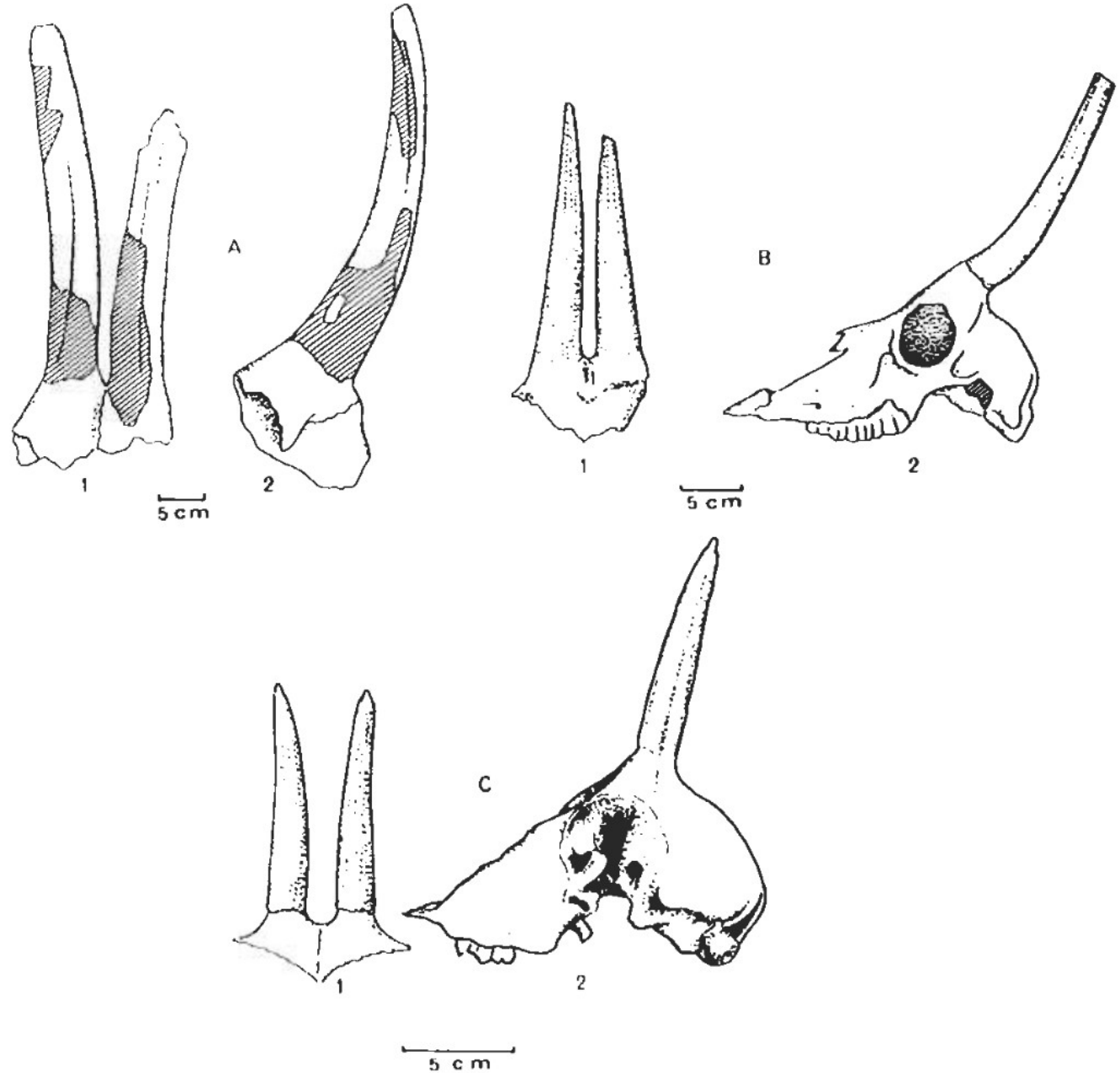


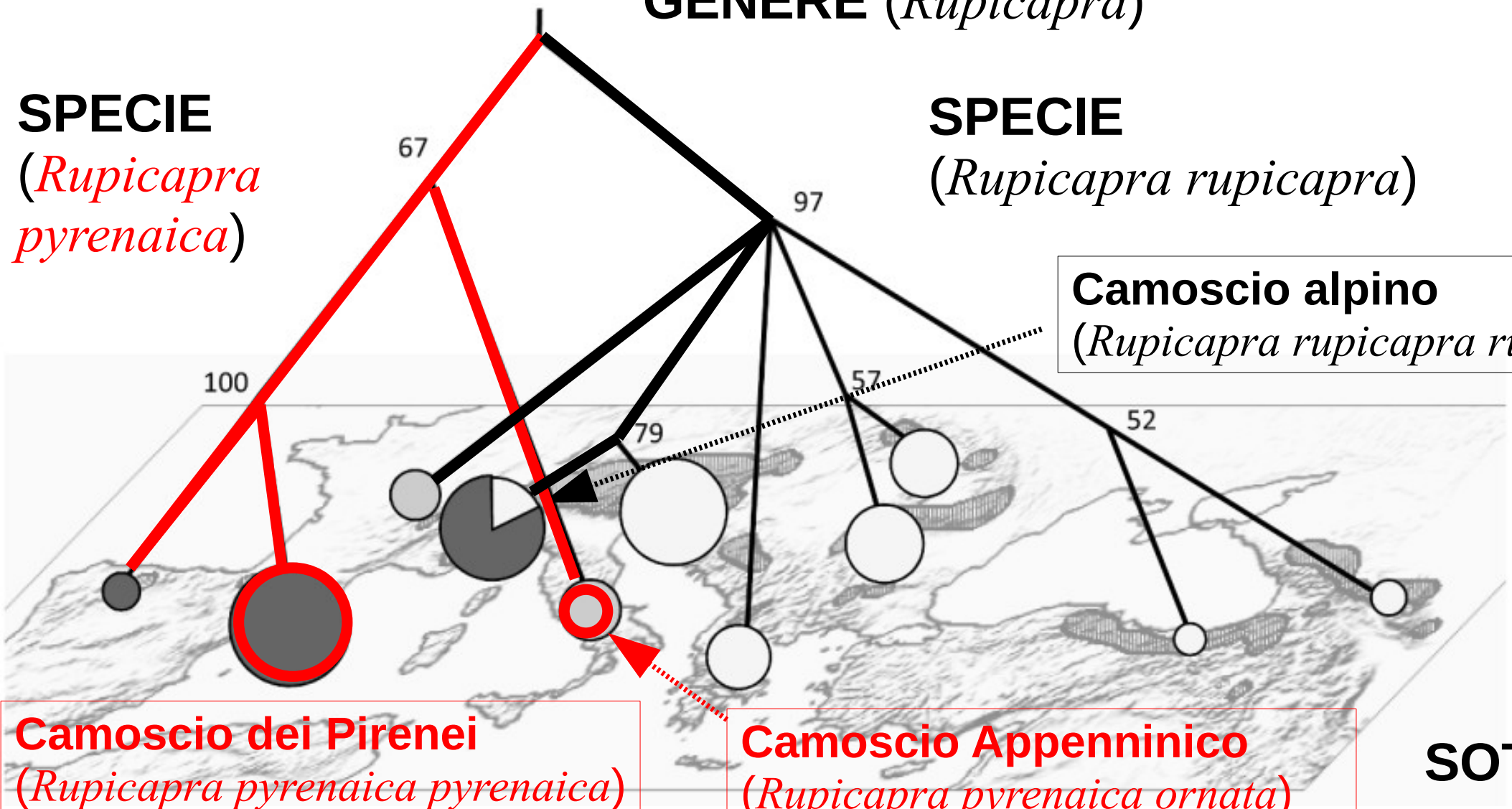
FIG. 3. (A) *Numidocapra crassicornis*, Ain Hanech, Algeria (from Arambourg, 1949). (B) *Procamptoceras brivatense*, Seneze, France (from Schaub, 1923). (C) *Rupicapra pyrenaica ornata*, Ripa Grande, Italy (present study). (1) Caudal view; (2) lateral view. Not to scale.

Differenze genetiche

GENERE (*Rupicapra*)

SPECIE
(*Rupicapra pyrenaica*)

SPECIE
(*Rupicapra rupicapra*)



Camoscio alpino
(*Rupicapra rupicapra rupicapra*)

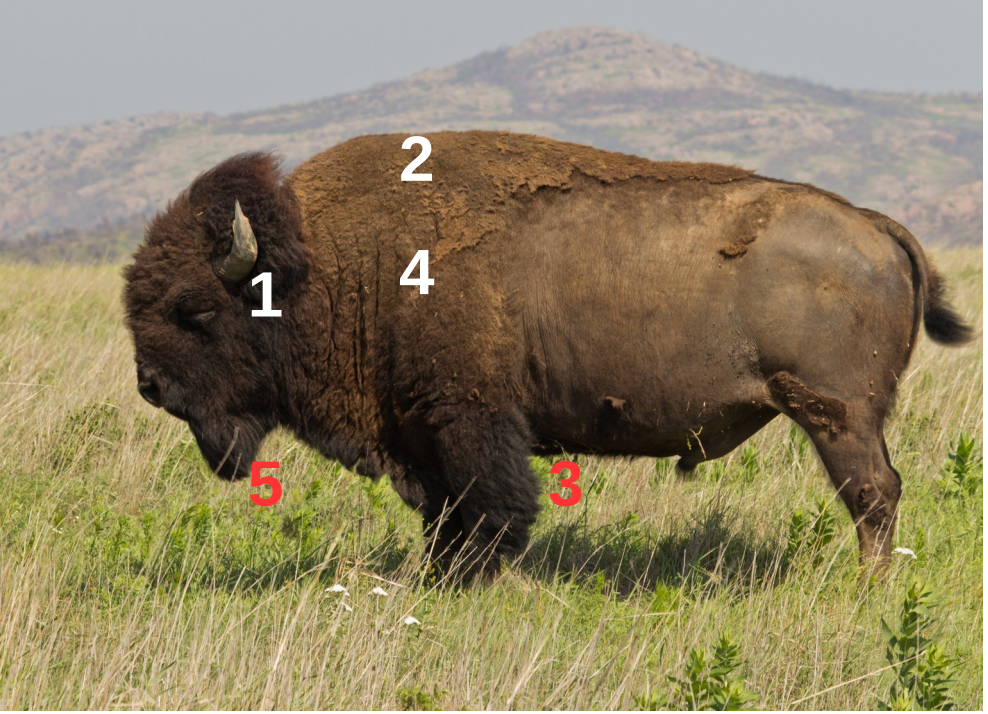
Camoscio dei Pirenei
(*Rupicapra pyrenaica pyrenaica*)

Camoscio Appenninico
(*Rupicapra pyrenaica ornata*)

SOTTOSPECIE

Sottospecie o razza

Gruppo di individui, $\in$ alla stessa specie, che si riproducono e in cui lo stato di determinati caratteri è $\approx$ e si differenzia da quello riscontrabile negli individui di altre popolazioni geografiche



BISONTE DI PIANURA
(*Bison bison bison*)

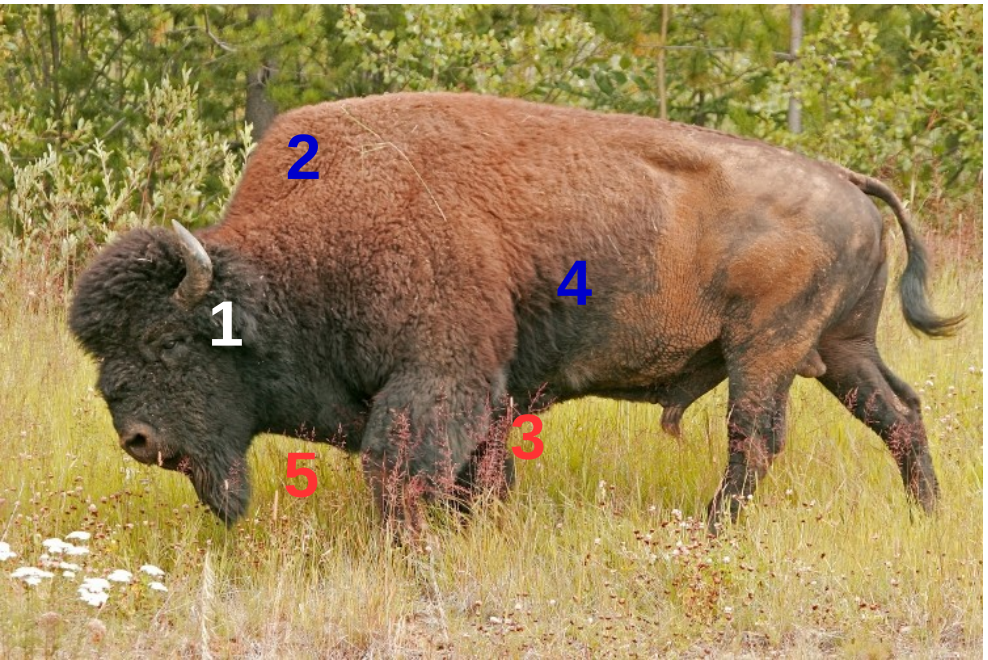
1. Corna circondate da un folto strato di pelo lanoso

2. Profilo di garrese e dorso leggermente convesso

3. Braccio rivestito posteriormente da folto pelo

4. Mantello anteriore nettamente distinto

5. Criniera molto sviluppata sul canale delle ganasce e sul collo.



BISONTE DEI BOSCHI
(*Bison bison athabascae*)

1. Lo strato che circonda le corna non è lanoso

2. Grande gobba (coppo), situata cranialmente all'asse dell'arto ant.

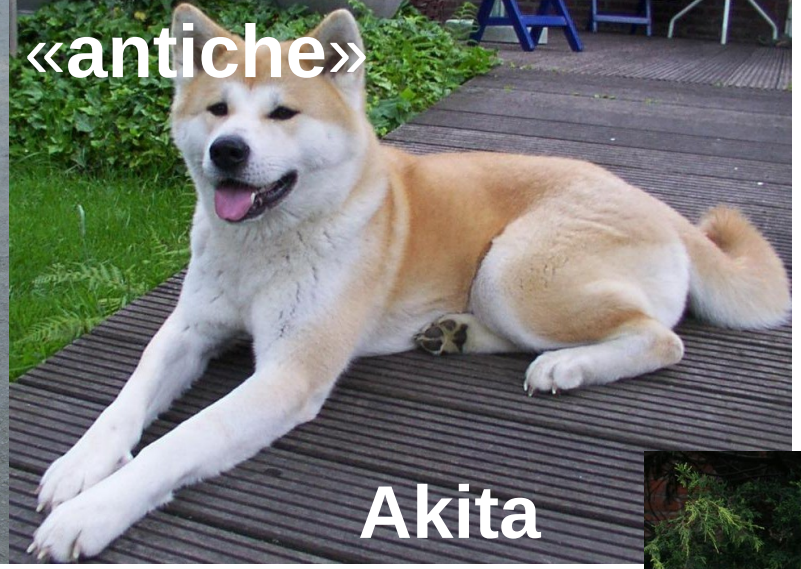
3. Braccio non rivestito da folto pelo

4. Mantello anteriore non distinto

5. Criniera meno sviluppata

Le razze canine «antiche»


Shar-Pei


Akita


Eurasier


Saluki


Basenji


Levriero afgano


Dingo


Finnish Spitz

Le razze canine «antiche»

Le razze canine antiche conservano una **> variabilità fenotipica** e, quindi, genetica probabilmente grazie al fatto che:

- discendono da un N° più elevato di fondatori
- nella loro storia evolutiva hanno avuto il tempo (migliaia di anni) per andare incontro a molte mutazioni genetiche

Lo standard di razza

Gli allevatori di qualsivoglia specie animale non apprezzano la variabilità fra individui ma perseguono l'omogeneità nei caratteri morfologici (e produttivi): gli stati dei vari caratteri devono uniformarsi ad un preciso «**standard di razza**», pena l'esclusione del soggetto dal registro che annovera tutti gli individui riconosciuti come appartenenti ad una determinata razza (Libro Genealogico, Registro Anagrafico, *Studbook*, *Zuchtbuch*) e, quindi, dalla riproduzione.
Gli stati dei vari caratteri devono, quindi, essere standardizzati, ossia **uniformarsi il più possibile ad un modello ideale di riferimento**; ogni scostamento da tale modello è considerato un'anomalia, un difetto.

Lo standard di razza

I criteri che gli allevatori applicano per scegliere i riproduttori sono spesso influenzati da **preferenze estetiche** per particolari varianti legate al colore ed alla pezzatura del mantello, alla pigmentazione delle mucose apparenti nonché alla forma ed alle dimensioni delle corna e, in alcune specie come il cane e il gatto, anche della testa. **Tali stati dei suddetti caratteri compaiono, raramente, in qualche esemplare in seguito a mutazioni geniche** cosicché, ogni tanto, nasce un soggetto diverso dagli altri che, suscitando curiosità ed interesse, viene scelto come riproduttore con la speranza che trasmetta le proprie caratteristiche alla prole.

Come nasce una nuova razza?

Come nasce una nuova razza?

Come nel caso del dromedario bianco, almeno nelle prime generazioni, un certo ricorso alla consanguineità è pressochè inevitabile se si vuole selezionare una popolazione di esemplari che presentino caratteristiche uniformi. Quindi, se il ♂ bianco viene usato per montare più ♀♀, assumendo che nascano due piccoli bianchi, un ♂ e una ♀, da madri ≠, questi due individui della F1 verranno allevati e fatti accoppiare per produrre la generazione successiva di dromedari bianchi: si tratta di un accoppiamento fra mezzi fratelli.

Tutti i cavalli di razza Purosangue Inglese, per esempio, discendono da 50 fattrici, le *Royal Mares*, e da appena quattro stalloni: Byerly Turk, Darley Arabian, Godolphin Barb e Curwen Bay Barb dai quali si stima provenga circa un terzo dei geni della popolazione attuale.

Che cos'è una «razza»?

Le differenti combinazioni di alleli a tre loci sono responsabili di sette fenotipi diversi del mantello nel cane. I segni più (+) e meno (−) indicano La presenza o l'assenza di una variante genotipica comparsa per mutazione. Ad ognuno dei sette tipi di mantello corrisponde una razza rappresentativa:
(A) pelo corto;
(B) pelo filamentoso;
(C) pelo filamentoso riccio;
(D) pelo lungo;
(E) pelo lungo e morbido con baffi e sopracciglia;
(F) pelo lungo e riccio;
(G) pelo lungo e riccio con baffi e sopracciglia.
Da Cadieu *et al.* (2009).

	PHENOTYPE	*FGF5*	*RSPO2*	*KRT71*
A	Short	-	-	-
B	Wire	-	+	-
C	Wire and Curly	-	+	+
D	Long	+	-	-
E	Long with Furnishings	+	+	-
F	Curly	+	-	+
G	Curly with Furnishings	+	+	+

Ibridazione interspecifica

incrocio fra individui $\in$ a specie $\neq$ -> soggetto ibrido sterile
(ma sono note molte eccezioni)
Es.
ASINO X CAVALLA = MULO (sterile)

Ibridazione interspecifica

WILDLIFE BIOLOGY
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Original Article | Open Access

Alpine ibex *Capra ibex ibex* x domestic goat *C. aegagrus domestica* hybrids in a restricted area of southern Switzerland

Marco Giacometti, Renato Roganti, Dario De Tann, Nasikat Stahlberger-Saitbekova, Gabriela Obexer-Ruff

First published: 01 June 2004 | https://doi.org/10.2981/wlb.2004.018 | Citations: 24

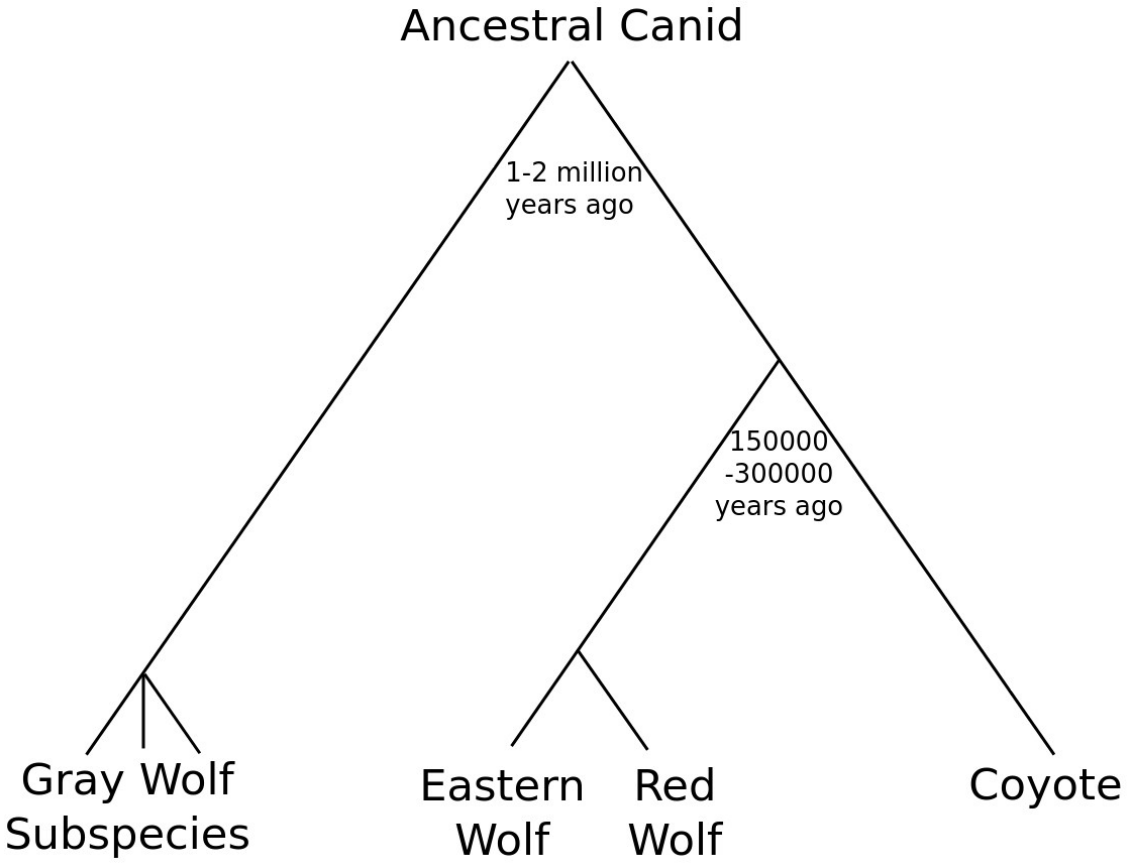
Associate Editor: Marco Festa-Bianchet

Ibridazione interspecifica

Stambecco X capra domestica

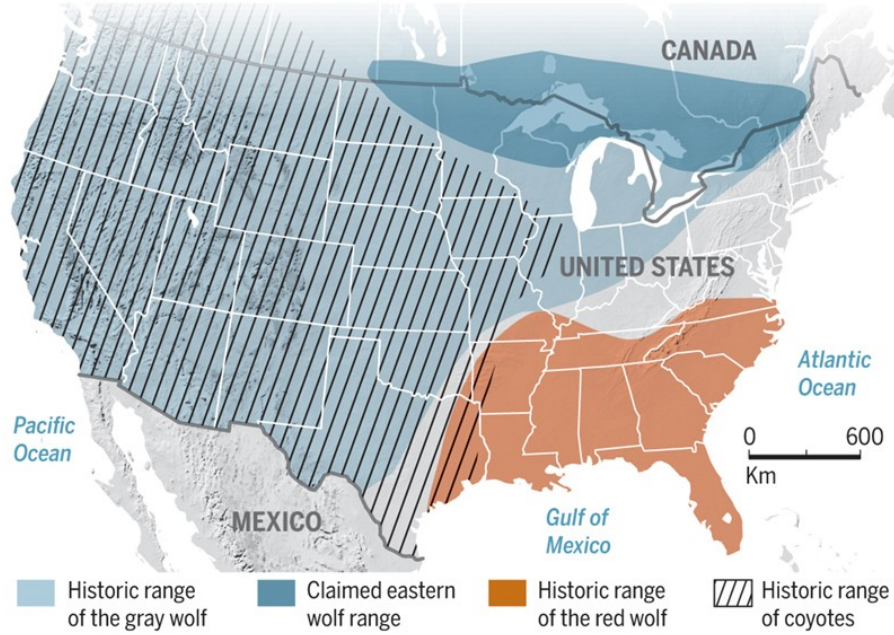
Stambecco puro F1 F2

Ibridazione interspecifica



A continent of canids

Opinions vary on wolf ranges and identities, but most researchers agree that the gray wolf once roamed across much of North America (including into Mexico, not shown) and that the coyote ranged across the west. A new genetic study finds that the red wolf and the eastern wolf (one from Quebec in Canada, bottom) arose later by mixing with coyotes as they expanded eastward.



Caso studio: lupi, coyote ed ungulati in Nordamerica

Lupo orientale X coyote = **coywolf**

Canis lycaon

Canis latrans

Caso studio: lupi, coyote ed ungulati in Nordamerica

ECOLOGICAL APPLICATIONS
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Article

Ungulate predation and ecological roles of wolves and coyotes in eastern North America

John F. Benson, Karen M. Loveless, Linda Y. Rutledge, Brent R. Patterson

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Corresponding Editor: John C. Stella.

Caso studio: lupi, coyote ed ungulati in Nordamerica

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eap1499-sup-0003-AppendixS3.pdf PDF document, 93.9 KB	
eap1499-sup-0004-AppendixS4.pdf PDF document, 101.9 KB	
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eap1499-sup-0006-AppendixS6.pdf PDF document, 103 KB	
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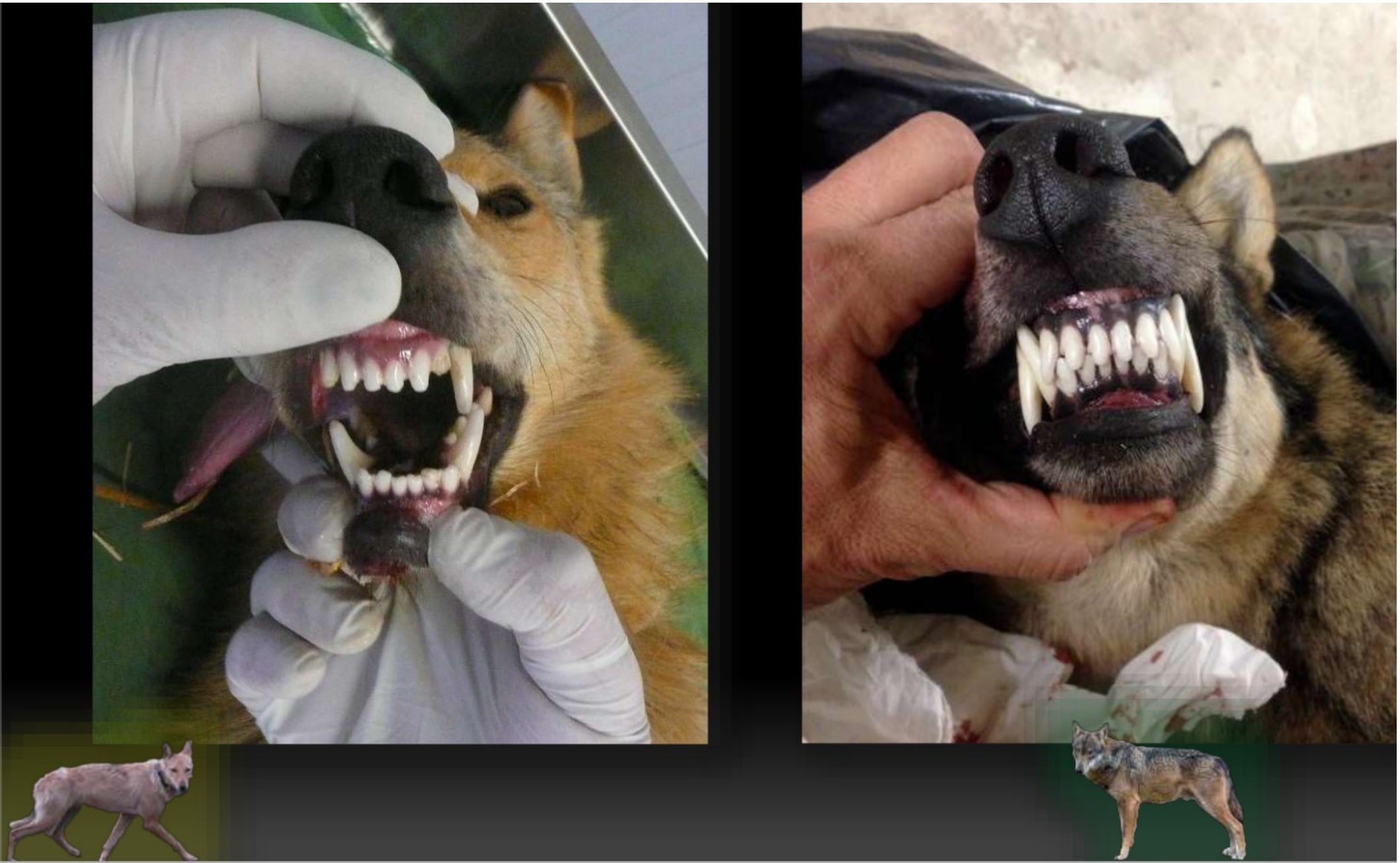
A protected area influences genotype-specific survival and the structure of a *Canis* hybrid zone

John F. Benson, Brent R. Patterson, Peter J. Mahoney

Ecology

Resource selection at homesites by wolves

Ibridazione lupo-cane



Caso studio: lupi, coyote ed ungulati in Nordamerica

Installazione di programmi dal terminale e di pacchetti in R

ctrl-alt-t

apriamo il terminale

```
$ sudo apt install libssl-dev libcurl4-openssl-dev
unixodbc-dev libxml2-dev libmariadb-dev libfontconfig1-
dev libharfbuzz-dev libfribidi-dev libfreetype6-dev
libpng-dev libtiff5-dev libjpeg-dev poppler-utils
```

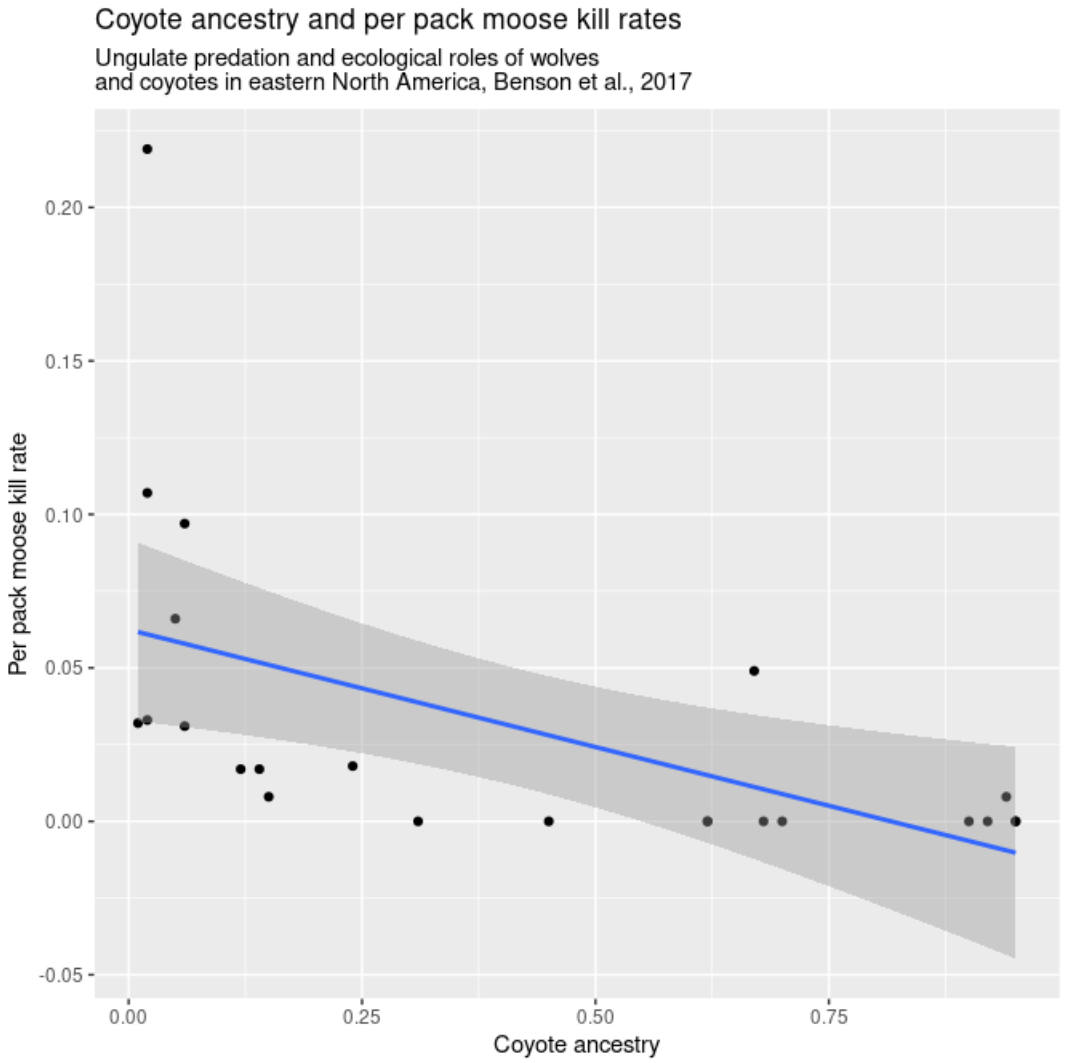
installiamo le dipendenze ed i programmi necessari

```
piero@piero-XPS-9320:~$ R
...
> install.packages('tidyverse')
> install.packages('ggplot2')
> install.packages('ggthemes')
> library(tidyverse)
> library(ggthemes)
```

Caso studio: lupi, coyote ed ungulati in Nordamerica

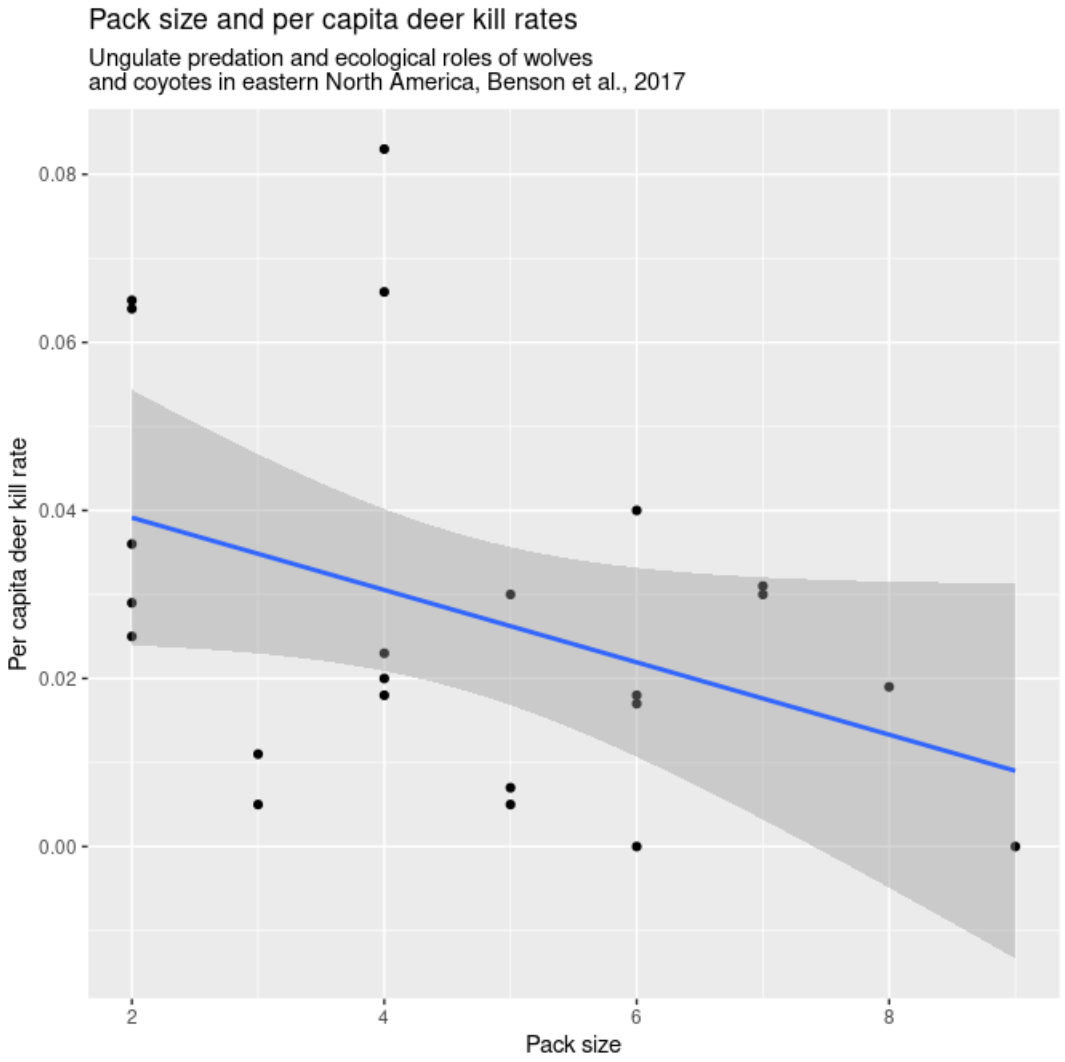
```
> ggplot(
data = wolves8,
mapping = aes(x = coyote_ancestry,
y = per_pack_moose_kill_rates)) +
geom_point() +
geom_smooth(method = 'lm') +
labs(title = "Coyote ancestry and per pack moose kill rates",
subtitle = "Ungulate predation and ecological roles of wolves
and coyotes in eastern North America, Benson et al., 2017",
x = "Coyote ancestry (%)", y = "Per pack moose kill rate")+
scale_color_colorblind()
```

Caso studio: lupi, coyote ed ungulati in Nordamerica



Esercizio: ricreare il seguente grafico

Intervallo di confidenza al 95%



Indicazioni:

- Scaricare i *files* <eap1499-sup-0002-appendixs2.pdf> e <eap1499-sup-0004-appendixs4.pdf> da Supporting Information (https://esajournals.onlinelibrary.wiley.com/doi/abs/10.1002/eap.1499)
- `$ pdftotext eap1499-sup-0002-appendixs2.pdf`
  # trasforma il pdf in *file* di testo

- copiare i dati della colonna Pack Size per creare il vettore `pack_size` in **R**:
  `> pack_size = c(5, 3, 2…)`

- copiare la colonna Deer kill rates per capita dal file eap1499-sup-0004-appendixs4.pdf e creare il vettore `per_capita_deer_kill_rates` in **R**:
  `> per_capita_deer_kill_rates = c(0.005, 0.011, 0.029…)`

Indicazioni:

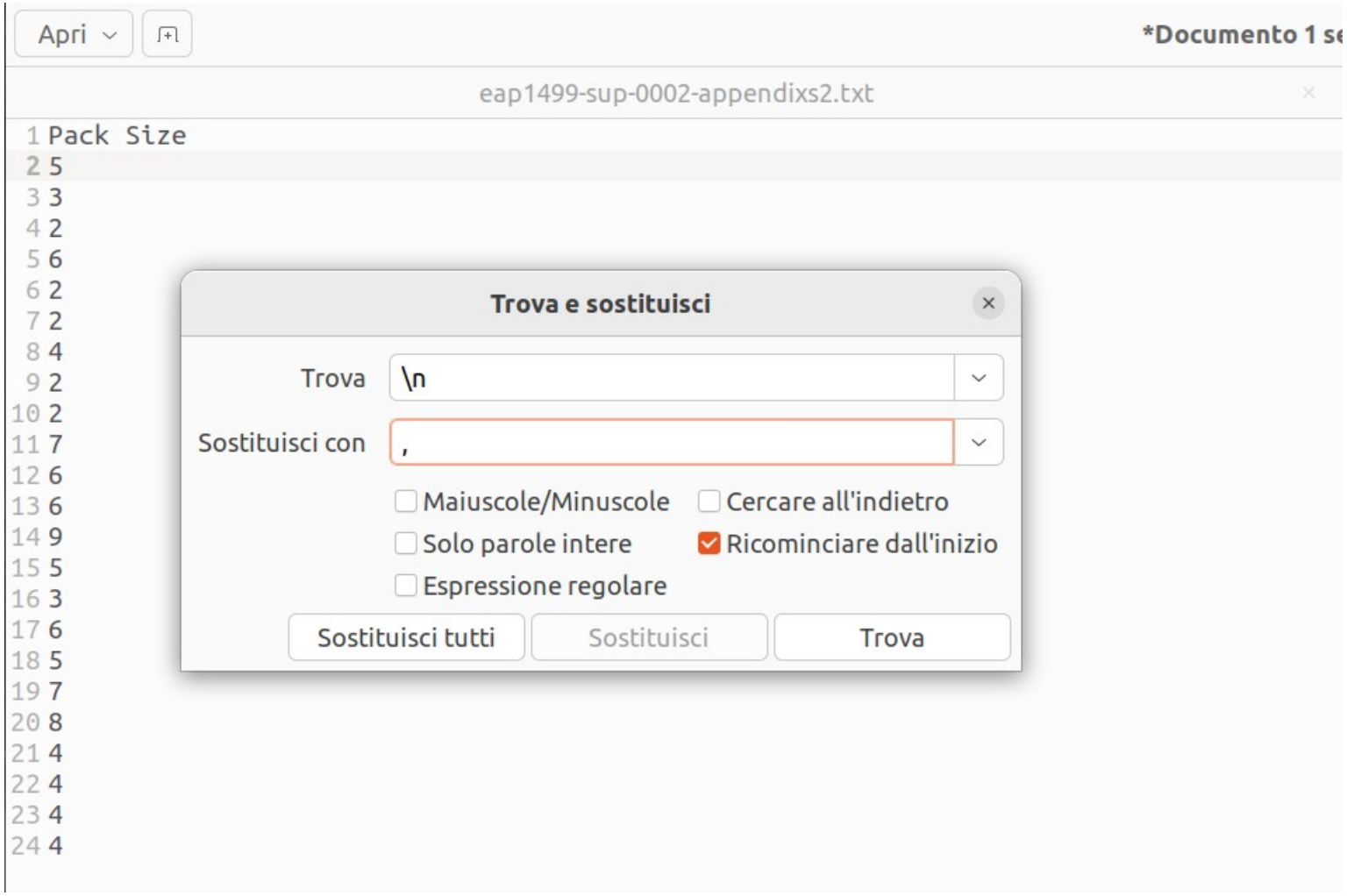
Apri

*Documento 1 se

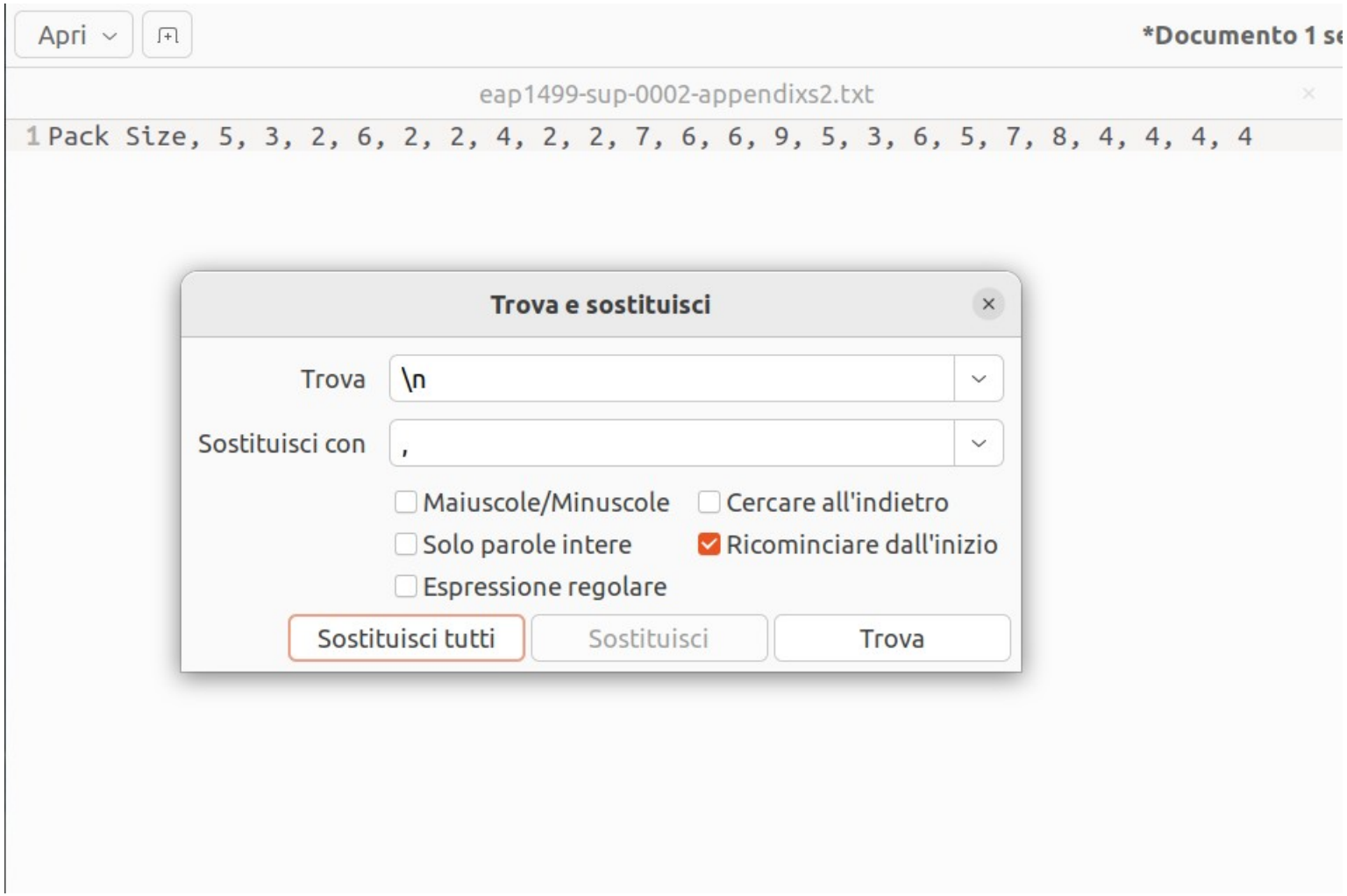
eap1499-sup-0002-appendixs2.txt

```
Pack Size
5
3
2
6
2
2
4
2
2
7
6
6
9
5
3
6
5
7
8
4
4
4
4
```

Indicazioni:



Indicazioni:



Indicazioni

- creare un **tibble** con i due vettori, uno dei quali contiene i valori della variabile indipendente (pack_size oppure coyote_ancestry) e l'altro quelli della variabile dipendente (i vari tassi di predazione)

- Il tibble <**wolves**> contiene, dunque, i dati necessari a costruire ciascuno degli 8 grafici

- Il contenuto di <**wolves**> sarà, ovviamente, diverso, contenendo una combinazione differente di variabili

- Se non vogliamo che <**wolves**> venga sovrascritto ogni volta, dobbiamo dargli nomi diversi (es. <**wolves1**>, <**wolves2**>, ..., <**wolves8**>

- ESEMPIO:

```
> wolves1 = tibble(pack_size, per_capita_deer_kill_rates)
> wolves2 = tibble(pack_size, per_pack_deer_kill_rates)
> wolves3 = ...
```

Suggerimento

- Creare la seguente TABELLA DATI

tibble	Variabile x	Variabile y
wolves1	pack_size	per_capita_deer_kill_rates
wolves2	pack_size	per_pack_deer_kill_rates
wolves3	pack_size	per_capita_moose_kill_rates
wolves4	pack_size	per_pack_moose_kill_rates
wolves5	coyote_ancestry	per_capita_deer_kill_rates
wolves6	coyote_ancestry	per_pack_deer_kill_rates
wolves7	coyote_ancestry	per_capita_moose_kill_rates
wolves8	coyote_ancestry	per_pack_moose_kill_rates

Indicazioni

```
>         >
coyot     pack
e_anc     _siz
estry     e
 [1]       [1]
0.67      5  3
0.92      2  6
0.68      2  2
0.95      4  2
0.90      2  7
0.94      6  6
0.95      9  5
0.62      3  6
0.70      5  7
0.06      8  4
0.05      4  4
0.14      4
0.06
0.02
0.02
0.12
0.02
0.15
0.01
0.31
0.62
0.45
0.24
```

Appendix S2. Focal canid packs in central Ontario 2005-2010. Shown are pack names, *Q*-scores for eastern coyote (% coyote), eastern wolf (% Eastern), and gray wolf (% Gray) ancestry, winter of study, number of days monitored, area (Algonquin Provincial Park, APP) or (Wildlife Management Unit 49, WMU49), number of individuals in pack (pack size), territory size and the dominant *Canis* ancestry: eastern coyote (Coyote), eastern and Great Lakes boreal (GLB) wolf (Wolf), or mixed coyote and wolf (Mixed).

Pack	% Coyote	% Eastern	% GLB	Winter	Days	Area	Pack Size	Terr Size (km^2)	Dominant Ancestry
Axe	0.67	0.31	0.02	2009-10	82	WMU49	5	142	Coyote
Golden City	0.92	0.05	0.04	2009-10	121	WMU49	3	7	Coyote
Horseshoe	0.68	0.29	0.02	2009-10	70	WMU49	2	83	Coyote
North Yearley	0.95	0.03	0.02	2009-10	28	WMU49	6	24	Coyote
Ripple	0.90	0.05	0.05	2009-10	70	WMU49	2	37	Coyote
Skeleton	0.94	0.03	0.03	2009-10	121	WMU49	2	46	Coyote
Turtle	0.95	0.04	0.02	2009-10	38	WMU49	4	53	Coyote
Wier	0.62	0.31	0.07	2009-10	70	WMU49	2	82	Coyote
Wolf	0.70	0.26	0.04	2009-10	69	WMU49	2	26	Coyote
Storm	0.06	0.62	0.32	2009-10	121	WMU49	7	146	Wolf
Achray	0.05	0.83	0.12	2005-06	64	APP	6	107	Wolf
Louis	0.14	0.85	0.02	2005-06	31	APP	6	180	Wolf
McKaskill	0.06	0.81	0.13	2005-06	64	APP	9	434	Wolf
Radiant	0.02	0.91	0.07	2005-06	121	APP	5	315	Wolf
Rain	0.02	0.95	0.03	2005-06	121	APP	3	190	Wolf
Sunday	0.12	0.85	0.03	2005-06	62	APP	6	190	Wolf
Big Crow	0.02	0.96	0.02	2006-07	121	APP	5	460	Wolf
Jocko	0.15	0.80	0.05	2006-07	121	APP	7	188	Wolf
Potter	0.01	0.97	0.02	2006-07	75	APP	8	493	Wolf
Lafleur	0.31	0.64	0.05	2005-06	45	APP	4	45	Mixed
Stevenson	0.62	0.20	0.18	2005-06	56	APP	4	80	Mixed
Buck Hill	0.45	0.54	0.02	2006-07	66	APP	4	84	Mixed
Pine	0.24	0.23	0.54	2006-07	121	APP	4	151	Mixed

Indicazioni

```
>
per_capita
_deer_kill
_rates
 [1] 0.005
0.011
0.029
0.000
0.036
0.025
0.020
0.064
0.065
0.031
0.018
0.040
0.000
0.007
0.005
0.017
0.030
0.030
0.019
0.023
0.083
0.066
[23] 0.018
```

Appendix S4. Ungulate kill rates and biomass in diet of canid packs in central Ontario, 2005-2010. Shown are packs, dominant ancestry type in pack, deer and moose kill rates per pack (prey/day) and per capita (prey/day/animals in pack), and proportion of deer and moose biomass from kills in diet of each pack.

		Deer kill rates		Moose kill rates		Biomass from kills	
Pack	Ancestry	Per pack	Per capita	Per pack	Per capita	% deer	% moose
Axe	Coyote	0.024	0.005	0.049	0.010	0.12	0.88
Golden City*	Coyote	0.033	0.011	0.000	0.000	1.00	0.00
Horseshoe	Coyote	0.057	0.029	0.000	0.000	1.00	0.00
North Yearley*	Coyote	0.000	0.000	0.000	0.000	0.00	0.00
Ripple	Coyote	0.071	0.036	0.000	0.000	1.00	0.00
Skeleton	Coyote	0.050	0.025	0.008	0.004	0.60	0.40
Turtle	Coyote	0.079	0.020	0.000	0.000	1.00	0.00
Wier	Coyote	0.064	0.064	0.000	0.000	1.00	0.00
Wolf	Coyote	0.130	0.065	0.000	0.000	1.00	0.00
Achray	Wolf	0.188	0.031	0.031	0.005	0.70	0.30
Big Crow	Wolf	0.091	0.018	0.066	0.013	0.20	0.80
Jocko	Wolf	0.281	0.040	0.017	0.002	0.78	0.22
Louisa	Wolf	0.000	0.000	0.097	0.016	0.00	1.00
McKaskill	Wolf	0.063	0.007	0.219	0.024	0.05	0.95
Potter	Wolf	0.040	0.005	0.107	0.013	0.07	0.93
Radiant	Wolf	0.083	0.017	0.017	0.003	0.47	0.53
Rain	Wolf	0.091	0.030	0.033	0.011	0.40	0.60
Storm	Wolf	0.207	0.030	0.008	0.001	0.81	0.19
Sunday	Wolf	0.113	0.019	0.032	0.005	0.36	0.64
Buck Hill	Mixed	0.091	0.023	0.000	0.000	1.00	0.00
Lafleur	Mixed	0.333	0.083	0.000	0.000	1.00	0.00
Pine	Mixed	0.264	0.066	0.000	0.000	1.00	0.00
Stevenson	Mixed	0.071	0.018	0.018	0.004	0.46	0.54

* Substantial anthropogenic food consumed

Il mio data frame <wolves_df>

```
> wolves_df = data.frame(packs, pack_size, territory_size,
coyote_ancestry, per_capita_deer_kill_rates,
per_pack_deer_kill_rates, per_capita_moose_kill_rates,
per_pack_moose_kill_rates)
```

Il mio data frame <wolves_df>

```
> str(wolves_df)
'data.frame':  23 obs. of  8 variables:
 $ packs                      : chr  "Axe" "Golden City" "Horseshoe" "North
Yearley" ...
 $ pack_size                  : num  5 3 2 6 2 2 4 2 2 7 ...
 $ territory_size             : num  142 7 83 24 37 46 53 82 26 146 ...
 $ coyote_ancestry            : num  0.67 0.92 0.68 0.95 0.9 0.94 0.95 0.62
0.7 0.06 ...
 $ per_capita_deer_kill_rates : num  0.005 0.011 0.029 0 0.036 0.025 0.02
0.064 0.065 0.031 ...
 $ per_pack_deer_kill_rates   : num  0.024 0.033 0.057 0 0.071 0.05 0.079
0.064 0.13 0.188 ...
 $ per_capita_moose_kill_rates: num  0.01 0 0 0 0 0.004 0 0 0 0.005 ...
 $ per_pack_moose_kill_rates  : num  0.049 0 0 0 0 0.008 0 0 0 0.031 ...
>
```

Il mio data frame <wolves_df>

```
> View(wolves_df)
# per visualizzarne il contenuto
```

Data: wolves_df

	packs	pack_size	territory_size	coyote_ancestry	per_capita_deer_kill_rates	per_pack_deer_kill_rates
1	Axe	5	142	0.67	0.005	0.024
2	Golden City	3	7	0.92	0.011	0.033
3	Horseshoe	2	83	0.68	0.029	0.057
4	North Yearley	6	24	0.95	0.000	0.000
5	Ripple	2	37	0.90	0.036	0.071
6	Skeleton	2	46	0.94	0.025	0.050
7	Turtle	4	53	0.95	0.020	0.079
8	Wier	2	82	0.62	0.064	0.064
9	Wolf	2	26	0.70	0.065	0.130
10	Storm	7	146	0.06	0.031	0.188
11	Achray	6	107	0.05	0.018	0.091
12	Louis	6	180	0.14	0.040	0.281
13	McKaskill	9	434	0.06	0.000	0.000
14	Radiant	5	315	0.02	0.007	0.063
15	Rain	3	190	0.02	0.005	0.040
16	Sunday	6	190	0.12	0.017	0.083
17	Big Crow	5	460	0.02	0.030	0.091
18	Jocko	7	188	0.15	0.030	0.207
19	Potter	8	493	0.01	0.019	0.113
20	Lafleur	4	45	0.31	0.023	0.091
21	Stevenson	4	80	0.62	0.083	0.333
22	Buck Hill	4	84	0.45	0.066	0.264
23	Pine	4	151	0.24	0.018	0.071
24						
25						

piero@piero-XPS-9320: ~

```
                                                te salvato]

                                                ack_size, territory_size, coyote_ancestry,
                                                ack_deer_kill_rates, per_capita_moose_kill_


                                                iables:
                                                nr  "Axe" "Golden City" "Horseshoe" "North

                                                um  5 3 2 6 2 2 4 2 2 7 ...
 $ territory_size                  : num  142 7 83 24 37 46 53 82 26 146 ...
 $ coyote_ancestry                 : num  0.67 0.92 0.68 0.95 0.9 0.94 0.95 0.62
0.7 0.06 ...
 $ per_capita_deer_kill_rates : num  0.005 0.011 0.029 0 0.036 0.025 0.02 0.
064 0.065 0.031 ...
 $ per_pack_deer_kill_rates   : num  0.024 0.033 0.057 0 0.071 0.05 0.079 0.
064 0.13 0.188 ...
 $ per_capita_moose_kill_rates: num  0.01 0 0 0 0 0.004 0 0 0 0.005 ...
 $ per_pack_moose_kill_rates  : num  0.049 0 0 0 0 0.008 0 0 0 0.031 ...
> View(wolves_df)
>
```

Il mio data frame <wolves_df>

```
> write.csv(wolves_df, "wolves.csv")
```
esportiamo il data frame <`wolves_df`> come file csv (comma-separated values)

Il mio data frame <wolves_df>

File Edit Code View Plots Session Build Debug Profile Tools Help

Go to file/function | Addins

penguins | Progetto_Suolo.Rmd | wolves | wolves_df

Filter

	packs	pack_size	coyote_ancestry	per_capita_deer_kill_rates	per_pack_deer_kill_rates	per_capita_moose_kill_rates	per_pack_moose_kill_rates
1	Axe	5	0.67	0.005	0.024	0.010	0.
2	Golden City	3	0.92	0.011	0.033	0.000	0.
3	Horseshoe	2	0.68	0.029	0.057	0.000	0.
4	North Yearley	6	0.95	0.000	0.000	0.000	0.
5	Ripple	2	0.90	0.036	0.071	0.000	0.
6	Skeleton	2	0.94	0.025	0.050	0.004	0.
7	Turtle	4	0.95	0.020	0.079	0.000	0.
8	Wier	2	0.62	0.064	0.064	0.000	0.
9	Wolf	2	0.70	0.065	0.130	0.000	0.
10	Storm	7	0.06	0.031	0.188	0.005	0.
11	Achray	6	0.05	0.018	0.091	0.013	0.
12	Louis	6	0.14	0.040	0.281	0.002	0.
13	McKaskill	9	0.06	0.000	0.000	0.016	0.
14	Radiant	5	0.02	0.007	0.063	0.024	0.
15	Rain	3	0.02	0.005	0.040	0.013	0.
16	Sunday	6	0.12	0.017	0.083	0.003	0.
17	Big Crow	5	0.02	0.030	0.091	0.011	0.
18	Jocko	7	0.15	0.030	0.207	0.001	0.
19	Potter	8	0.01	0.019	0.113	0.005	0.
20	Lafleur	4	0.31	0.023	0.091	0.000	0.
21	Stevenson	4	0.62	0.083	0.333	0.000	0.

Showing 1 to 21 of 23 entries, 7 total columns

Esercizio:

Costruire il grafico delle seguenti variabili:

x = pack_size; y = territory_size

Come varia l'area dei territori dei branchi al variare della loro consistenza?

Il lupo: mortalità naturale per conflitto intraspecifico

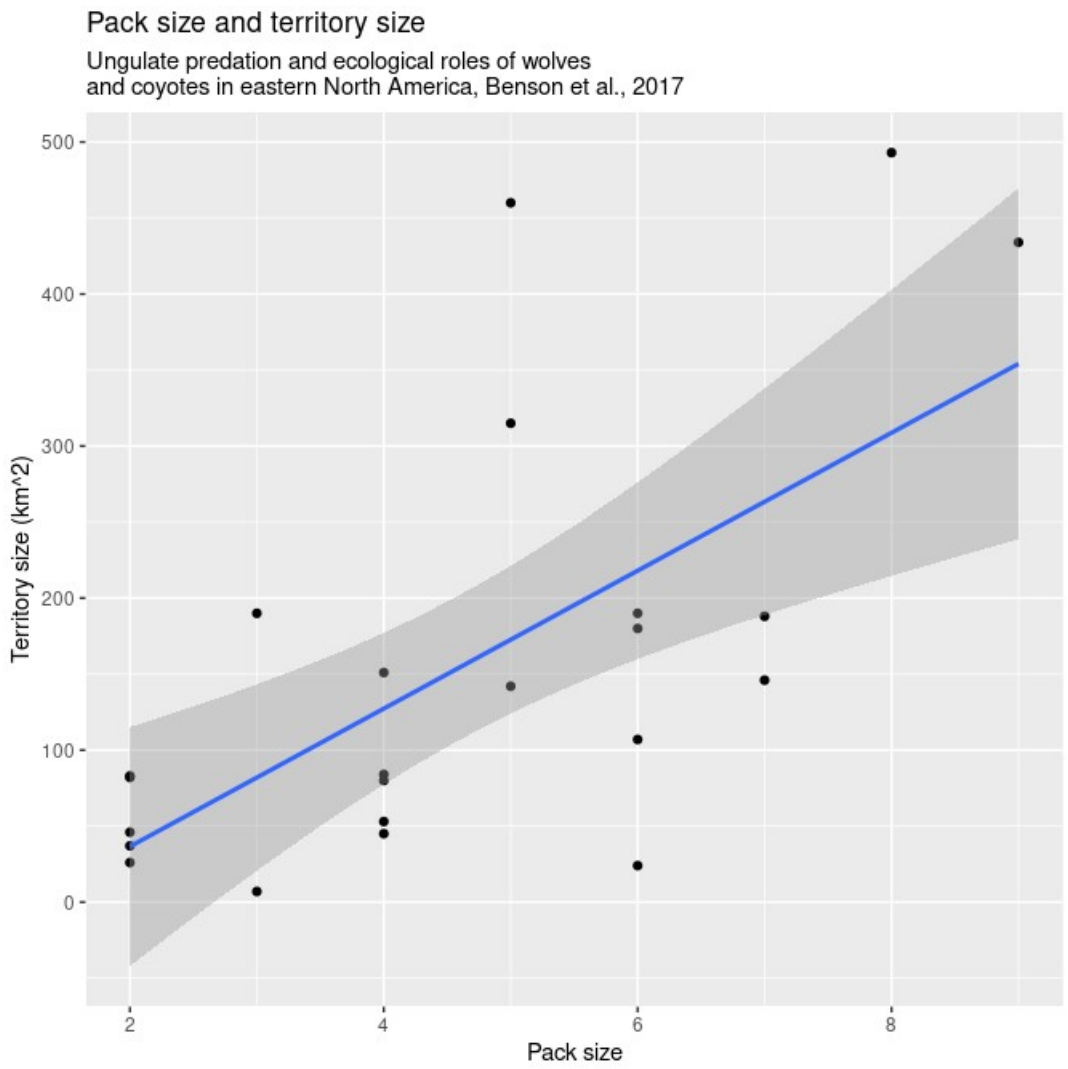
Giovane lupo ritrovato morto (e divorato) il 27 marzo 2010 in Alta Val Tanaro per aggressione da parte di conspecifici in seguito ad un conflitto territoriale tra branchi adiacenti. Infatti quest'area è stata contesa nell'inverno 2009-2010 tra i due branchi della Val Tanaro e della Val Pesio (come rilevato da tracce e deposizione di escrementi).
L'aggressione può essere quindi dipesa da elevata competizione territoriale.
In Nord America, nel Parco di Yellowstone, la > parte dei lupi muore per conflitti tra branchi.
In Italia quasi tutti i lupi muoiono per bracconaggio o investimento.

Esercizio:

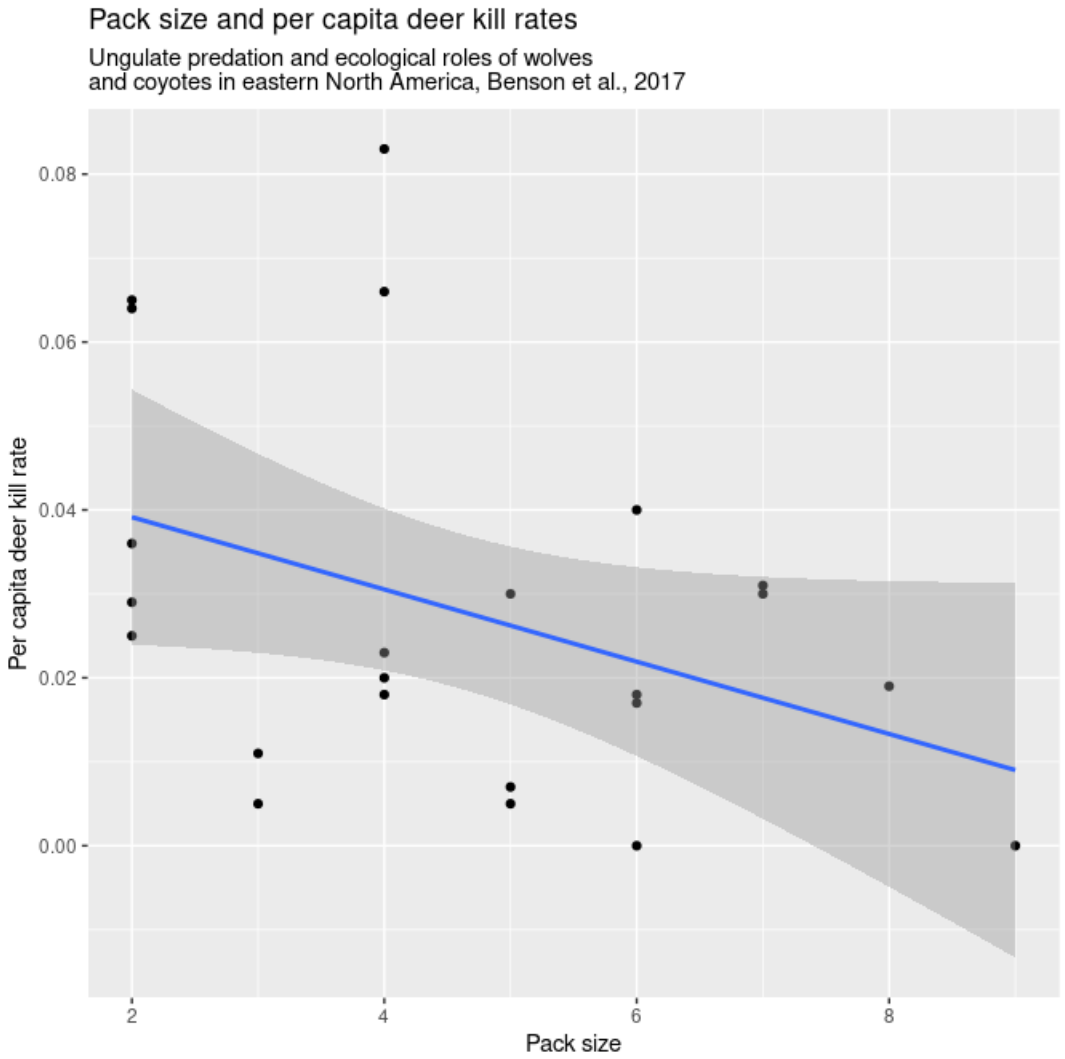
```
> data = tibble(pack_size, territory_size)

> ggplot(
data = data,
mapping = aes(x = pack_size,
y = territory_size)) +
geom_point() +
geom_smooth(method = 'lm') +
labs(title = "Pack size and territory size",
subtitle = "Ungulate predation and ecological roles of wolves
and coyotes in eastern North America, Benson et al., 2017",
x = "Pack size", y = "Territory size (km^2)")+
scale_color_colorblind()
```

Variazione dell’area del territorio in funzione della taglia del branco

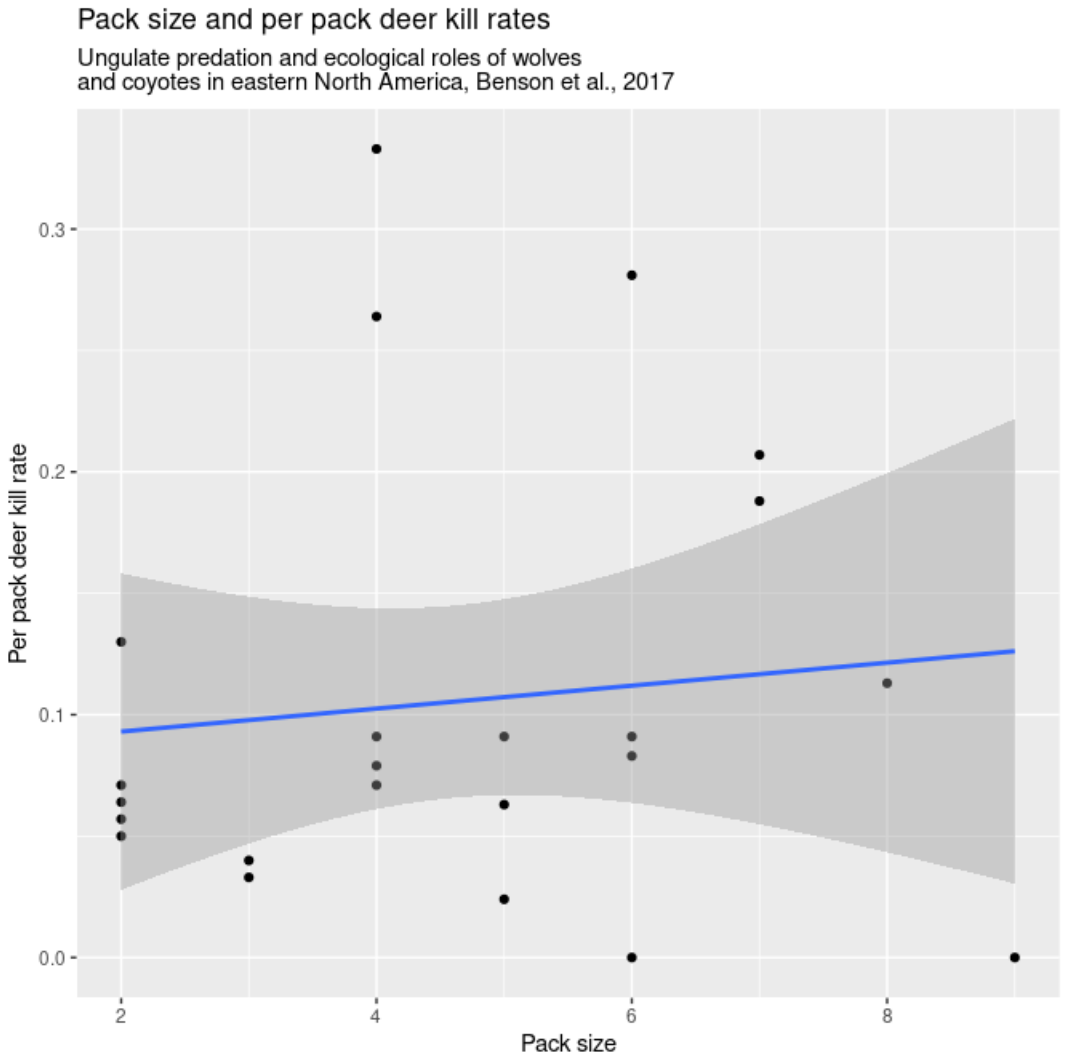


Variazione del tasso di predazione di cervi per canide in funzione della taglia del branco



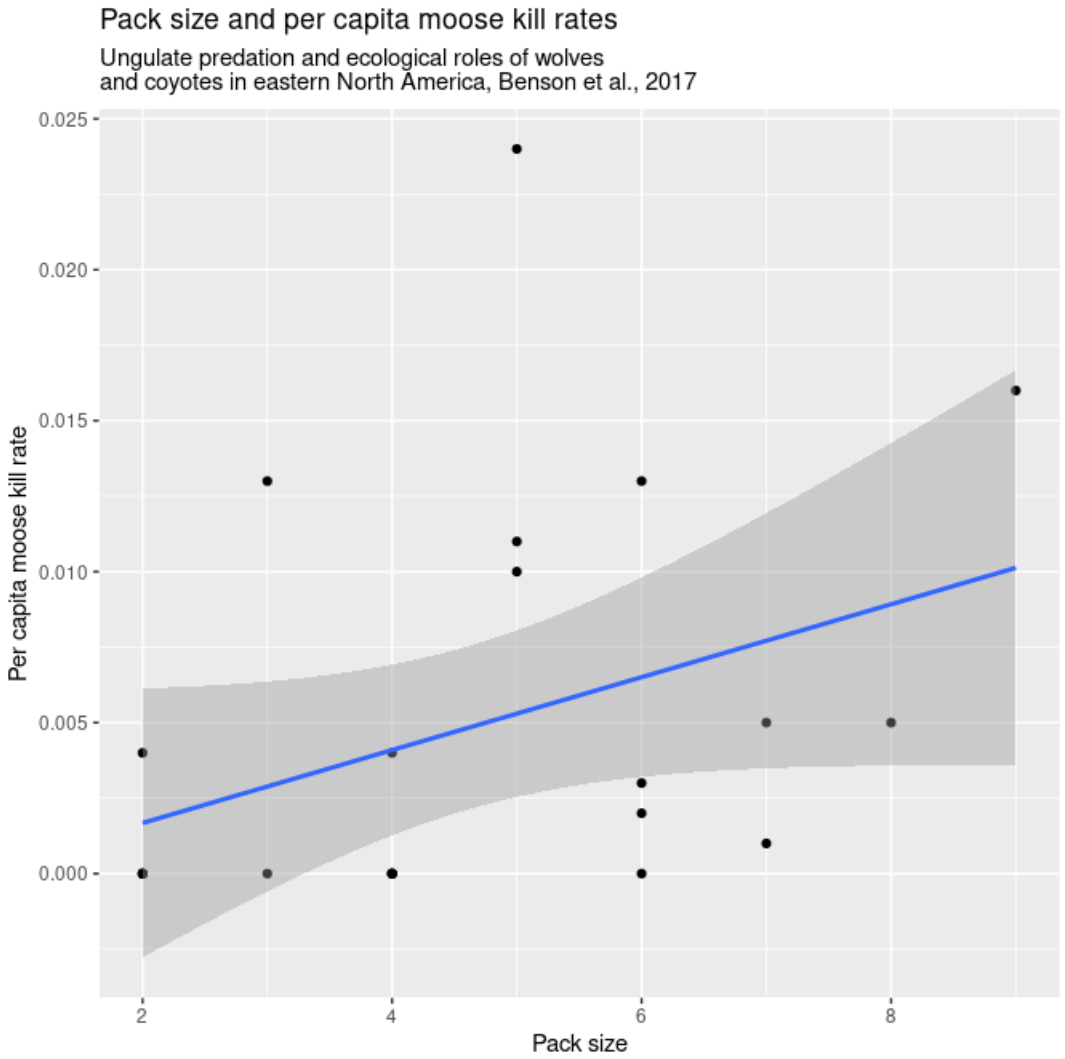
All'aumentare della pack size, la quantità di carne di cervo consumata / capo diminuisce... Qual è il vantaggio di far parte di branchi più numerosi?

Variazione del tasso di predazione di cervi per branco in funzione della taglia del branco



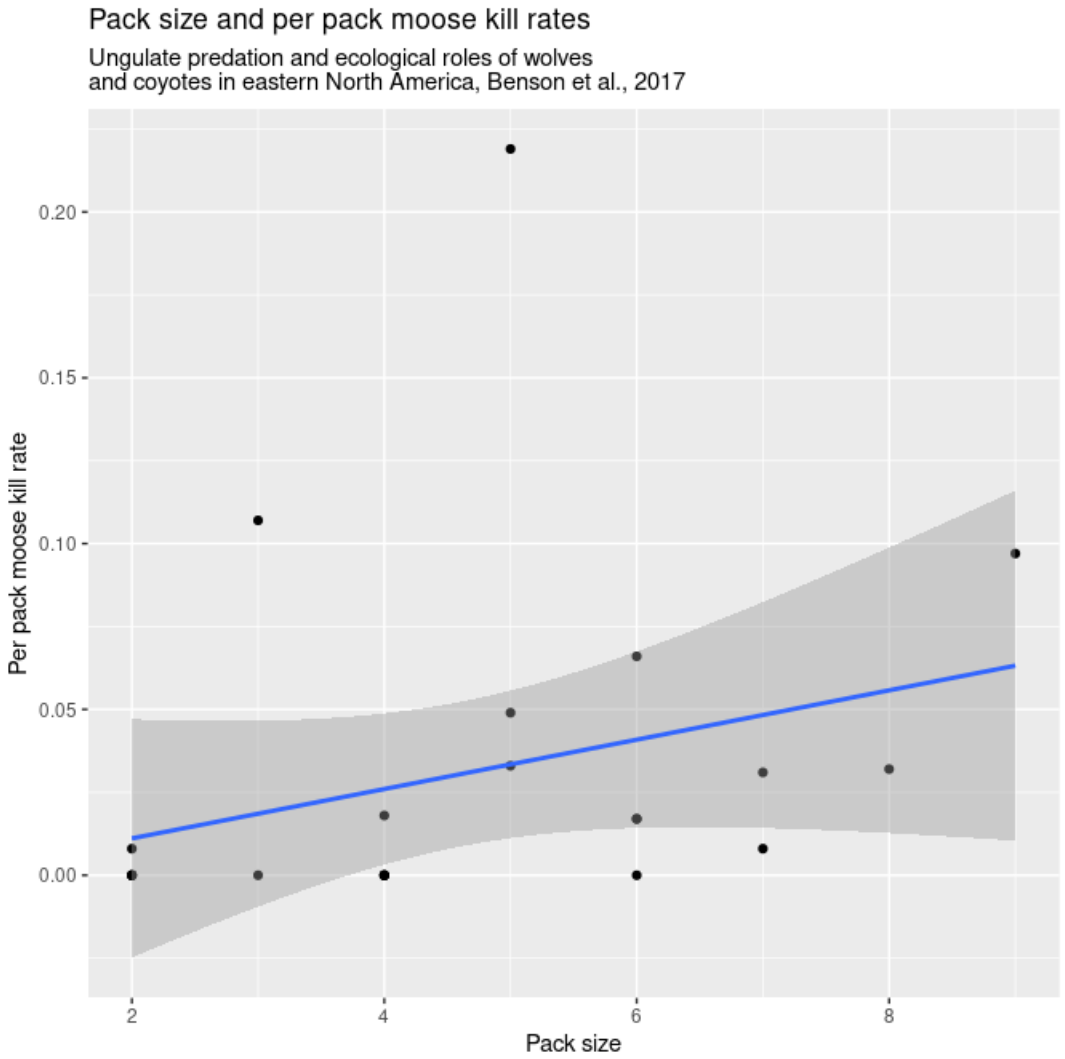
Branchi più numerosi uccidono qualche cervo in più, ma non abbastanza da far sì che i singoli *coywolves* non debbano spartirsi un pasto più piccolo

Variazione del tasso di predazione di alci per capo in funzione della taglia del branco



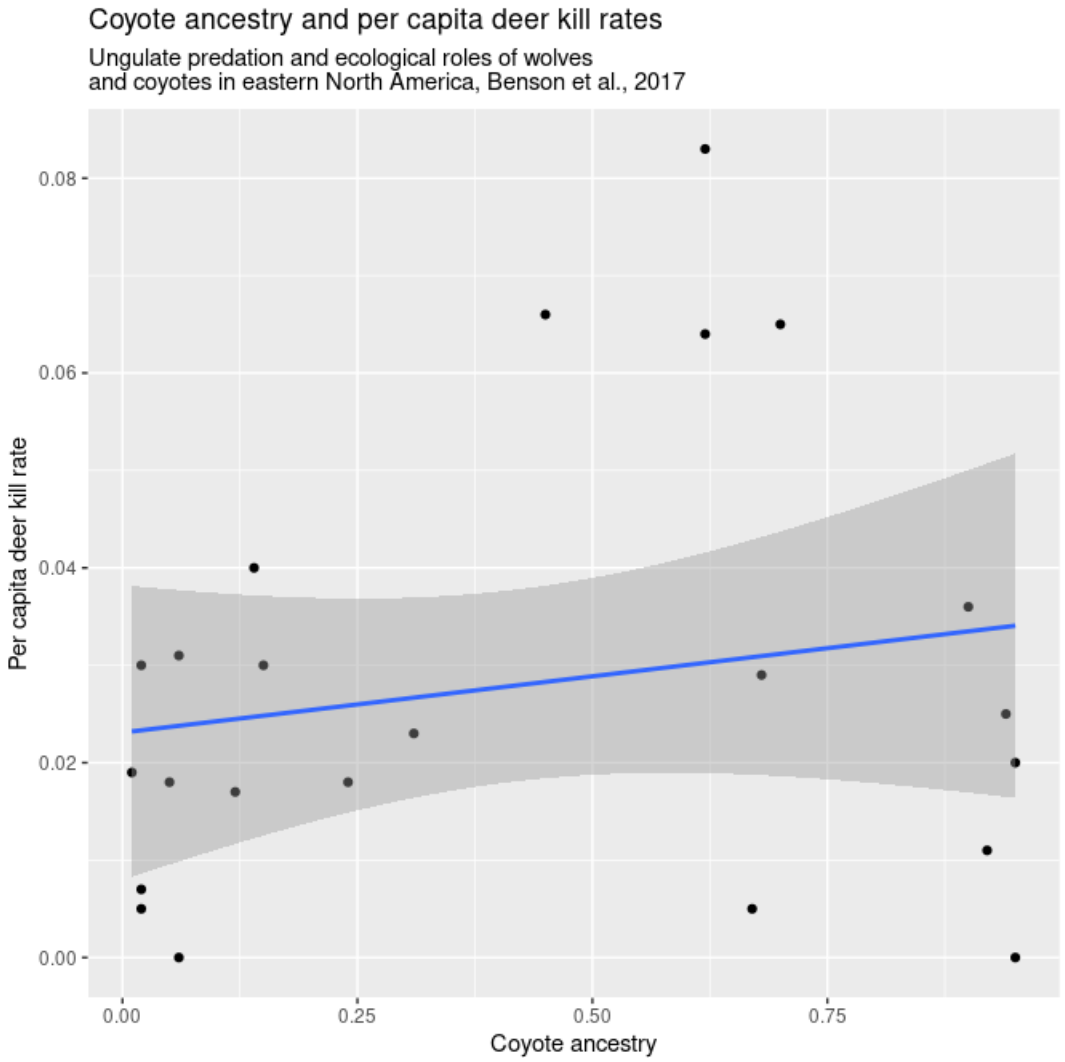
Branchi più numerosi predano gli alci con una maggiore efficienza: ogni membro del branco consuma una > quantità di carne -> vantaggio far parte branchi grandi

Variazione del tasso di predazione di alci per branco in funzione della taglia del branco



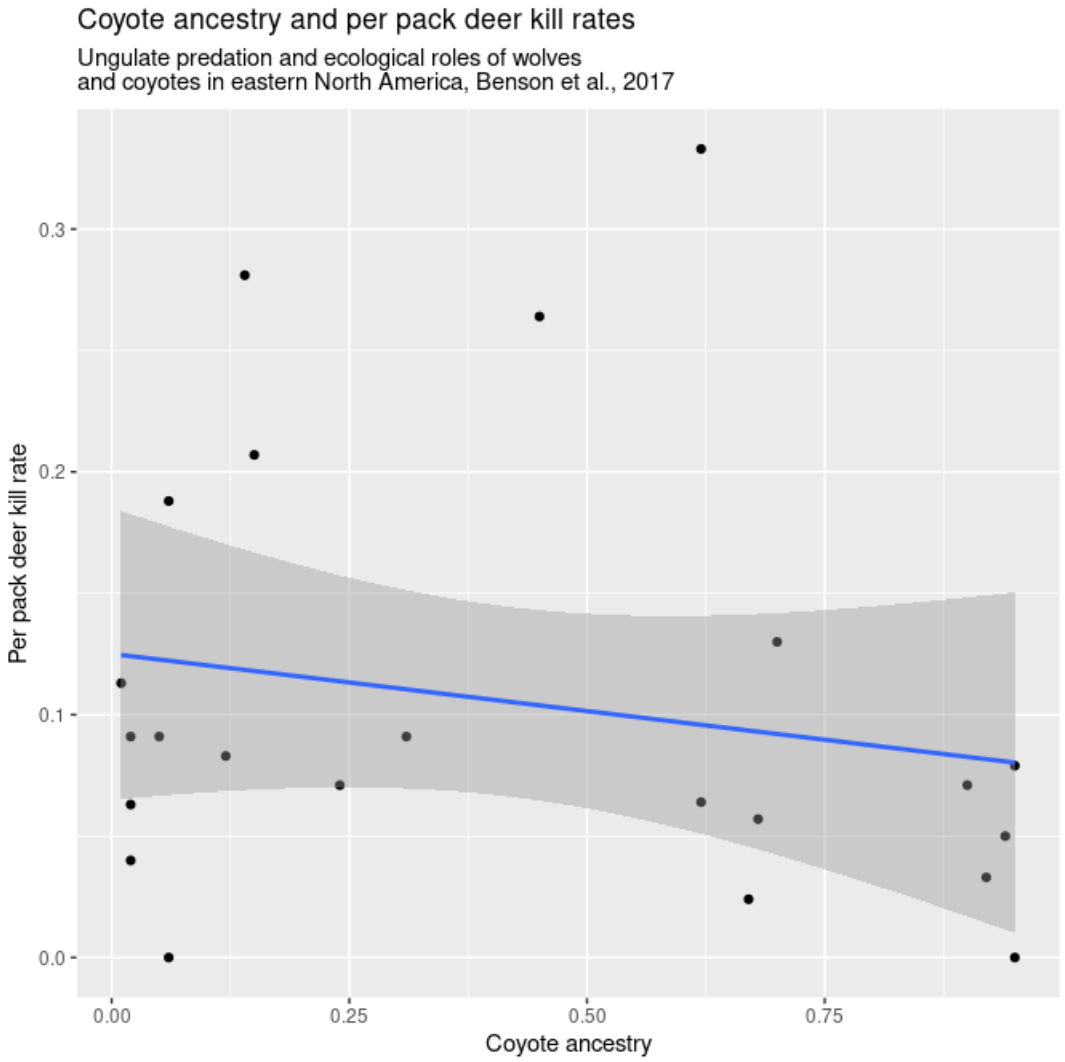
Il tasso di predazione di alci per branco aumenta abbastanza all'aumentare della *pack size* da far sì che ogni canide abbia più carne a disposizione

Variazione del tasso di predazione di cervi per capo in funzione del tasso di ascendenza di coyote



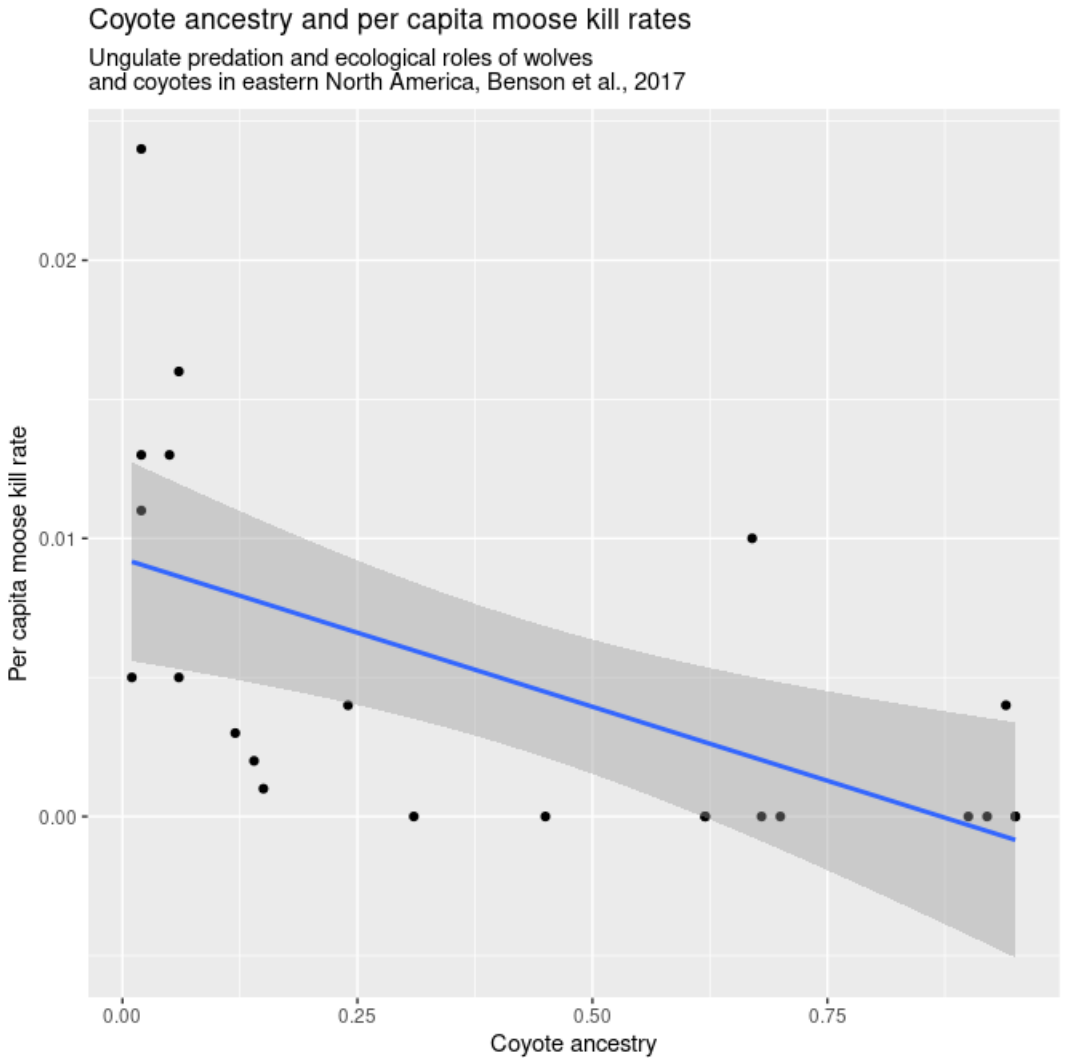
Più antenati coyote ci sono in un branco, più aumenta la quantità di carne di cervo consumata: forse i *coywolves* ~ coyote si concentrano su questa specie preda

Variazione del tasso di predazione di cervi per branco in funzione del tasso di ascendenza di coyote



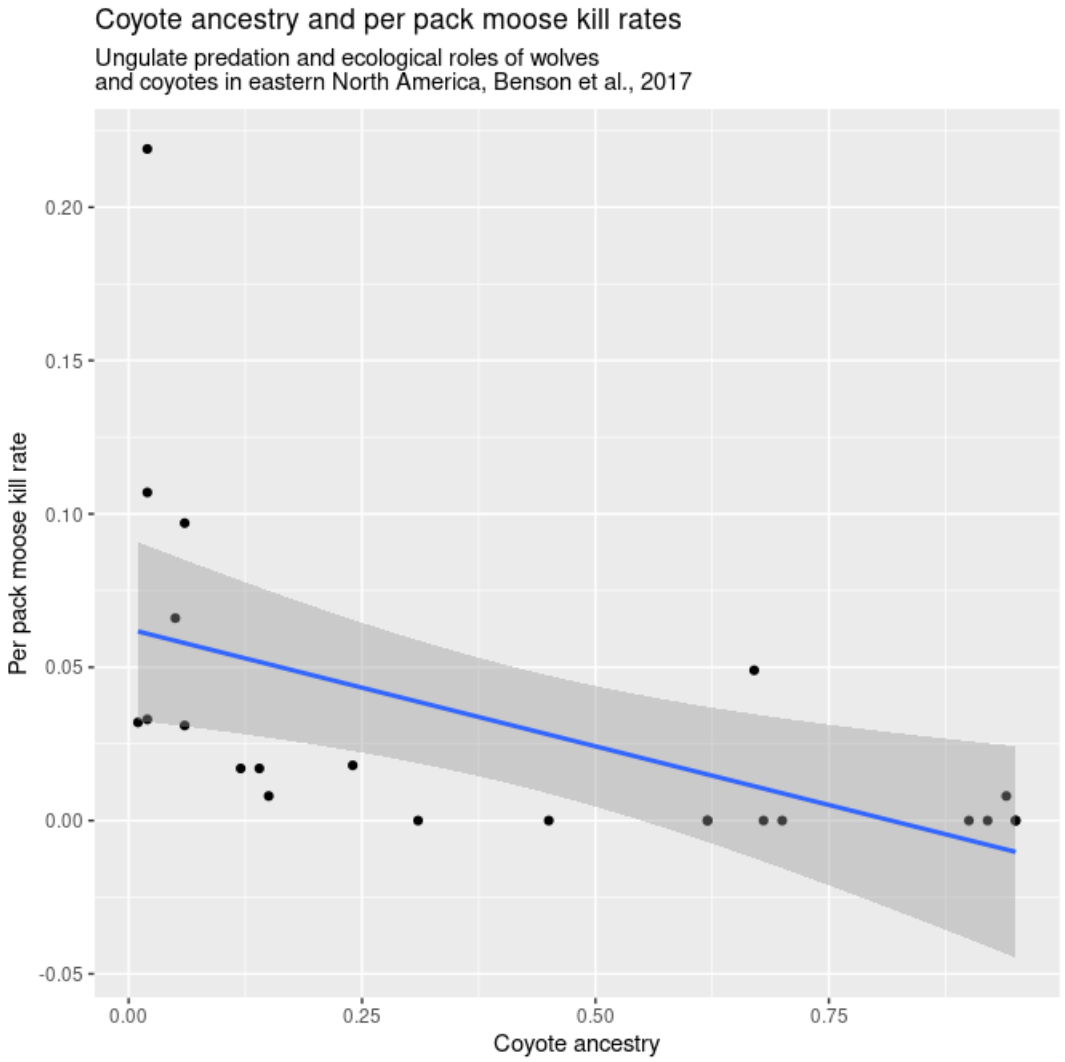
Branchi più ~ al coyote uccidono un n° < di cervi? Qualcosa non torna...

Variazione del tasso di predazione di alci per capo in funzione del tasso di ascendenza di coyote



I singoli *coywolves* consumano quantità decrescenti di carne di alce all'aumentare del tasso di ascendenza di coyote del branco a cui appartengono

Variazione del tasso di predazione di alci per branco in funzione del tasso di ascendenza di coyote



All'aumentare del tasso di ascendenza di coyote del branco viene ucciso un n° decrescente di alci

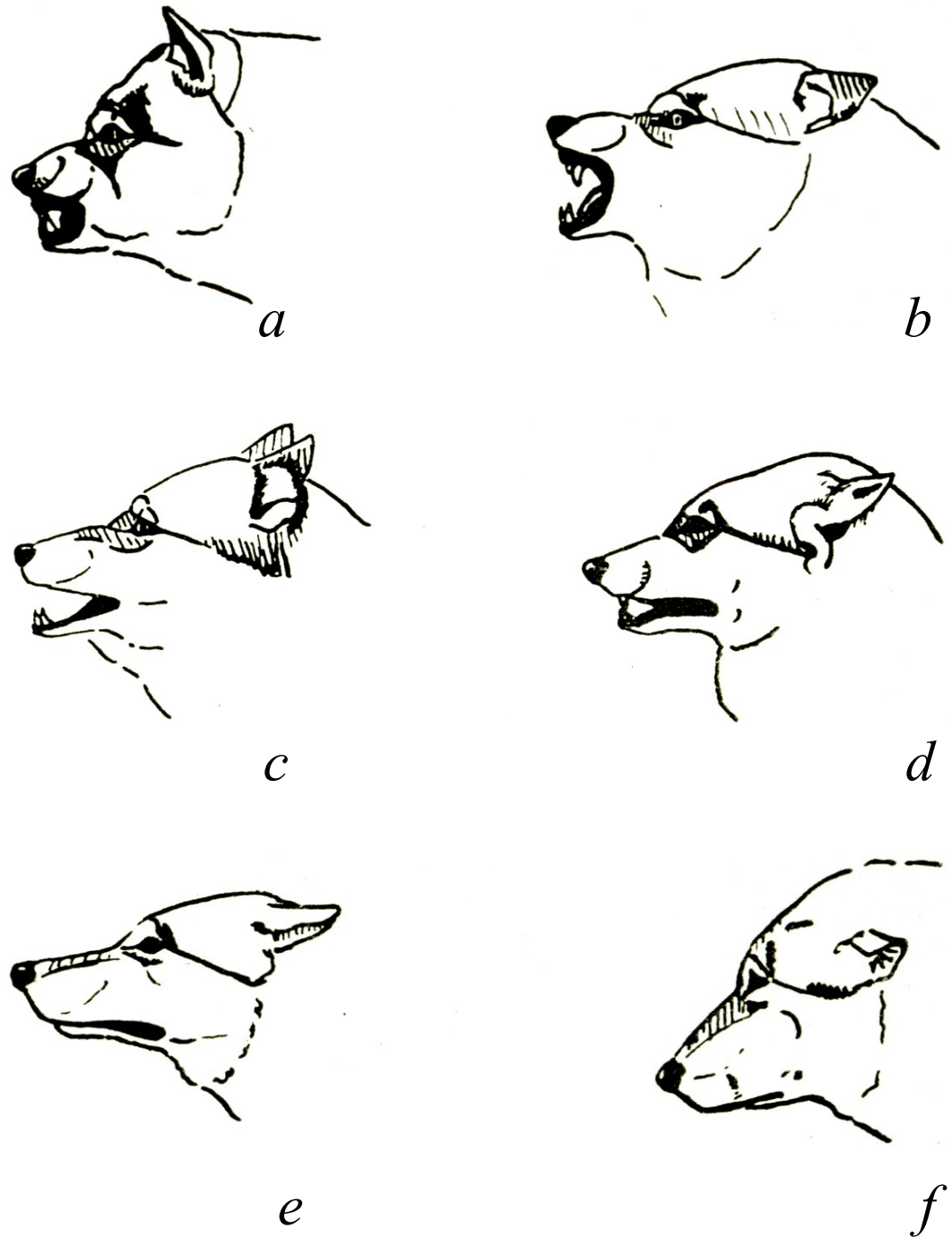
Come sono stati stimati i tassi di predazione per branco e per capo?

```
> per_capita_deer_kill_rates
 [1] 0.005 0.011 0.029 0.000 0.036 0.025 0.020 0.064 0.065 0.031 0.018 0.040
[13] 0.000 0.007 0.005 0.017 0.030 0.030 0.019 0.023 0.083 0.066 0.018
> per_pack_deer_kill_rates / pack_size
 [1] 0.00480000 0.01100000 0.02850000 0.00000000 0.03550000 0.02500000
 [7] 0.01975000 0.03200000 0.06500000 0.02685714 0.01516667 0.04683333
[13] 0.00000000 0.01260000 0.01333333 0.01383333 0.01820000 0.02957143
[19] 0.01412500 0.02275000 0.08325000 0.06600000 0.01775000
>
```

Come sono stati stimati i tassi di predazione per branco e per capo?

Estimation of kill rates

We estimated kill rates in multiple ways to address different questions while accounting for differences in sizes of social groups, prey, and areas used by canids. First, we summed the number of deer and moose that were killed by each pack during each winter and divided these totals by the number of days the pack was monitored to estimate the kill rates by pack (kills/d). Second, we divided per pack kill rates by the number of canids in the pack to estimate per capita kill rates (kills·d^{-1}·$canid^{-1}$). Third, we estimated the proportion of biomass (kg) available to each pack from deer and moose carcasses killed by canids based on published masses of moose and deer from central Ontario (Kolenosky 1972, Quinn and Aho 1989; see additional details in Appendix S1). We divided estimates of biomass available from kills by the number of days the pack was monitored and the number of animals in each pack to estimate mass consumed daily per animal at kills and scavenged carcasses (kg biomass·d^{-1}·$canid^{-1}$). Finally, we divided the per pack kill rates by the home range size for each pack to estimate kill rates per pack per unit area (kills·d^{-1}·km^{-2}).



MINACCIA *a*. L'animale digrigna i denti, arriccia il naso ed aggrotta le sopracciglia comunicando sicurezza di sé; angolo boccale (commessura labiale) non arretrato, eccitazione costante, mascelle chiuse.

b. Digrignamento dei denti, eccitazione crescente, bocca spalancata; LEGGERA INSICUREZZA: angolo boccale un po' arretrato, fronte lievemente corrugata e orecchie rivolte verso l'indietro.

c. MINACCIA DEBOLE: digrigamento dei denti appena accennato, insicurezza, aumento dell'eccitazione, bocca in parte aperta.

d. MINACCIA MOLTO DEBOLE: forte insicurezza.

e. PAURA.

f. AVVERSARIO A STRETTO CONTATTO: orecchie rivolte lateralmente; componente di difesa: sopracciglia aggrottate; insicurezza, diffidenza; orecchie leggermente piegate e rivolte verso l'indietro, angolo boccale leggermente arretrato (da Schenkel, 1947).