



National University of Singapore
LSM1303 Animal Behaviour

Lecture 4 & 5: Living in Groups

With some questions for you:
<http://pollev.com/sivasothi54>



N. Sivasothi aka Ottermann

Living in Groups

1. Animal Social Groups – definitions
2. Group Living: Costs
3. Group Living: Benefits
4. Types of Animal Groups (10)

- | | |
|---------------|------------------|
| 1. Solitary | 6. Oligarchy |
| 2. Pair | 7. Arena/Lek |
| 3. Family | 8. Hierarchy |
| 4. Harem | 9. Aggregation |
| 5. Matriarchy | 10. Caste system |

LSM1303 Animal Behaviour Lectures 4 & 5

1. Animal Social Groups - definitions



What are animal social groups?

An aggregation of individuals,
of the same species,
numbering two to the thousands,
in permanent or temporary associations,
in ordered or unordered groups,
conferring some benefit to the individual



Locust @ Eliat, Israel, 2004 [Niv Singer, Flickr]

What are animal social groups?

Not merely a spatial juxtaposition of individuals
(i.e not defined purely by physical association)

It is a social construct (i.e. there is interaction)
between spatially aggregated individuals



Wildebeest @ Serengeti, 2012 [Ganesh Raghunathan, Flickr]

What are animal social groups?

Varies from a few, to millions

Insects - a plague of locusts

Fish - a shoal of bass, school of tuna

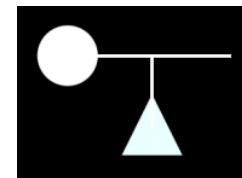
Amphibia - a knot of toads

Birds - gaggle of geese, a parliament of owls

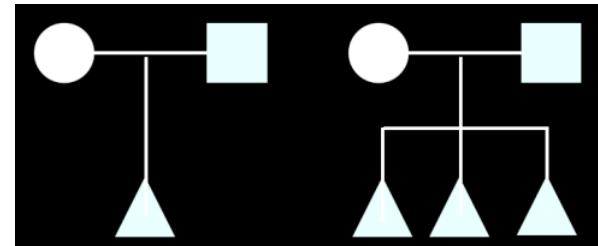
Mammals - a pride of lions, a litter of pups,
a richness of martens, a herd of deer,
a leap of leopards, a skulk of foxes

What are animal social groups?

- Simplest group = mother and offspring



- Mother, offspring + father



- Can you think of any more categories?

- Aggregation of unrelated individuals

Optimality and fitness

- Fitness is determined by the ability to raise offspring.
- Optimal behaviour - the selected behaviour in which benefits exceed costs
- This maximises fitness.

A central theme: costs and benefits

- When does natural selection favour group living?
- What are the *costs* and *benefits* of interactive aggregation?

Costs and benefits

- Cost and benefits of group living may vary from species to species and situation to situation.
- In order for an animal to live in groups, *benefits of such behaviour should exceed costs.*



Otters at Sungai Ulu Pandan

- A large family of otters (20 individuals) are residing in the Ulu Pandan catchment
- They were not here previously - perhaps there was not enough fish?

Costs and benefits: Otters at Sungei Ulu Pandan

- Construction work at their previous site (Jurong Lake Garden) is causing a disturbance
- Ulu Pandan has less food but no disturbance
- Perhaps,
 - No disturbance + less food is better than Heavy disturbance + more food?
 - Note that the family has six pups

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2. Group Living - what are the benefits?



2.1 Protection from predators

- There is a reduction in individual risk of capture at higher group sizes:
 1. ‘Predator confusion effect’
 2. ‘Many eyes hypothesis’
 3. Defense by mobbing
 4. Ganging up!
- *Each scenario has its own costs and benefits*

Protection from predators I

The ‘predator confusion effect’

Murmuration of common starlings
(*Sturnus vulgaris*) confuses their predator,
the Peregrine falcon (*Falco peregrinus*)



Prey



Predator

Wikipedia



Peregrine falcon hunting
a murmuration of common starlings over Rome
Earth Flight (BBC One, 2012; 3:00)

Protection from predators 2

The ‘many eyes hypothesis’ *or group vigilance hypothesis*

Benefit: protection from predators

ii) the ‘many eyes hypothesis’

- Early predator detection, e.g. a flock of pigeons flee a hawk [group size effect]
- Total group vigilance increases with group size. “Many eyes hypothesis”
- Larger flocks can detect a predatory bird of prey earlier



Christopher Walker, Poland, 2008



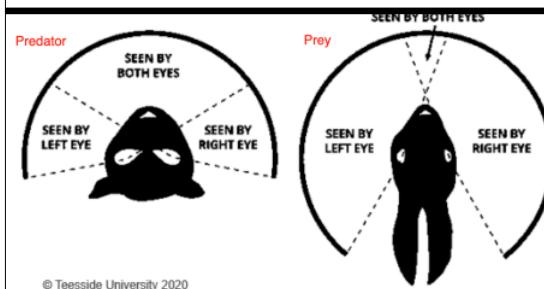
Predator



Predator

Sally King, 2010

Matthew Butcher, 2008



Prey



Chris Turner, 2011



Thomas Quine, 2010

Benefit: protection from predators

ii) the ‘many eyes hypothesis’

- ‘Group vigilance hypothesis’ or ‘many eyes hypothesis’
 - Is the signal to group members passive or active?
 - Do individuals take turns to be vigilant?



Christopher Walker, Poland, 2008

Benefit: protection from predators

ii) the ‘many eyes hypothesis’

reduced effort of individual vigilance

- What is the advantage to the individual?
- What does an animal have to do in the course of a day?
- How significant is a reduction in the effort of its daily burden?



Kyle Greenwell, 2010

Ostriches in an African savanna:
Overall vigilance increased with the increase in group size, and each individual spent less time on vigilance



Bertram, B. C. (1980). Vigilance and group size in ostriches.
Animal Behaviour, 28(1), 278-286.

Triple benefit:
*individuals spent less time on vigilance,
could do other things, and were safer*



Bertram, B. C. (1980). Vigilance and group size in ostriches.
Animal Behaviour, 28(1), 278-286.

Protection from predators 3

Defense by mobbing

Mobbing behaviour by birds = calls, aerial swoops and physical attacks which serves as protection against as they respond by moving away.

Mobbing might also give males a chance to advertise their physical qualities, to impress potential mating partners

da Cunha et al. 2017. The presence of conspecific females influences male-mobbing behaviour. *Behavioral Ecology and Sociobiology*, 71(3)

House crows (*Corvus splendens*) mobbing
an osprey (*Pandion haliaetus*)
at Sungei Buloh Wetland Reserve's Eagle Point
(Khoo Mei Lin, Bird Ecology Study Group, 20 Nov 2018)



Many African wild dogs vs a lone hyaena
(much like crows mobbing an eagle)
@ Beyond's Xaranna Camp, Botswana [Rob Fuller]



Protection from predators 4

Group defense

Ganging up helps!

BBC Earth: Emperor penguin chicks
(*Aptenodytes forsteri*) group defense against a
giant petrel (*Macronectes giganteus*) (1:17)



2.2 Cooperative Hunting

Group foraging enables predators to:

1. Strategically herd and ambush fast prey, who may be social animals
(African hunting dog and impala;
Harris hawk and jackrabbit)
2. Coordinate to overpower much larger prey species (African lions and elephants)
3. Aggregate and eat smaller prey efficiently
(smooth-coated otters and dolphins hunting fish)

Group hunting of Impala (*Aepyceros melampus*)
by African wild dogs (*Lycaon pictus*)
BBC Planet Earth (4:22)



Cooperative hunting by a social bird of prey species,
the Harris Hawk (*Parabuteo unicinctus*)
of southwestern United States and Latin America

- The most advanced form of cooperative hunting known in birds



Cooperative hunting by a social bird of prey species,
the Harris Hawk (*Parabuteo unicinctus*)
of southwestern United States and Latin America

- Groups of 2-7, but five most successful
- Strategies vary:
 - No cover – several pounce
 - Some cover – one flush prey, others capture
 - Long chase – share lead, intercept
- Guard prey (Mantling; food storage)
- Also nest cooperatively,
deter predators



Cooperative hunting by a social bird of prey species,
the Harris Hawk (*Parabuteo unicinctus*)
of southwestern United States and Latin America
Carolina Raptor Center (2:09)



[Young] “Elephant fends off attack by 14 lions”

Jesse Nash, Dan Christoffel, Steve Baker Nina Karnikowski &
Innocent in Zambia (2014), as featured in New York Post



[Young] “Elephant fends off attack by 14 lions”

Jesse Nash, Dan Christoffel, Steve Baker Nina Karnikowski &
Innocent in Zambia (2014), as featured in New York Post



Improved foraging by cooperative hunting: 'Elephant Killers of Botswana'



Improved foraging - Cooperative hunting by lions “elephant specialists”



Elephant-hunting lion specialists of Savuti in Chobe National Park,
northern Botswana: they hunt calves in the night

Herding behaviour of smooth-coated otters in shallow waters



Hherding behaviour of smooth-coated otters in shallow waters



Alvin Tan aka 'eleventh'



Dusky dolphins (*Lagenorhynchus obscurus*)
corralling anchovies (?*Engraulis* sp.)

Dusky dolphins corraling anchovies

Video: National Geographic (2:22)



Benefits of group living

1. Safety from predators
2. Improved foraging
3. Reduced vigilance effort
4. Mate access
5. Communal care
6. Social transmission of information
7. Others, e. g. thermoregulation

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3. Group Living - what are the costs?



Costs of group living

- What happens when you forage in a group instead of alone?
- What happens when you live in large numbers with others?
- What *ecological terms* did you learn from the Extinction Game which apply here?

I. Cost of group living to juvenile fish (various species)

Predation
versus
competition

- Often associate in large numbers (school)
- The growth rate of individual fish are slower in larger groups



I. Cost of group living to juvenile fish (various species)

Juvenile fish swim in large schools.

Individuals in large schools have a *higher rate of survival*, but a *slower growth rate*, compared with those in small schools.



Juvenile catfish at Changi (WildSingapore)

I.e. large groups have higher fitness early in season

I. Cost of group living to juvenile fish (various species)

As fish get older, they associate in smaller groups, which have a faster growth rate

i.e. *small groups have a higher fitness in older stages of growth*

Martinez, F.A. & E.A. Marschall, 1999. A dynamic model of group-size choice in the coral reef fish *Dascyllus albisella*. *Behavioral Ecology*, **10**(5): 572-577.

2. Cost of group living: ease of spread of disease (epidemic)



200 Hippos Die Of Anthrax in Uganda
posted on 7-9-2004 at 08:09 PM
200 Hippos Die Of Anthrax in Uganda
Update further down the thread...
Newsday: Some 60 Hippos Die Mysteriously in Uganda

Hippo deaths raise fears of anthrax epidemic
By Meera Selva
12 November 2004

Botswana finds anthrax outbreak after spate of hippo deaths

Reuters Staff

1 MIN READ



GABORONE (Reuters) - Anthrax has been detected in dead hippos floating in the Okavango River, officials in Botswana said on Wednesday, after more than 100 of the animals were suspected to have been killed by the disease in neighbouring Namibia.



Botswana, 2017

2. Cost of group living: ease of spread of disease



Induction cut



Head louse (*Pediculus humanus capitis*)

2. Cost of group living: ease of spread of disease

- Extinction game assumed overcrowded hexagons did not have a long-term survival value - hence populations were wiped out.

Predation
versus
competition
versus
cannibalism

3. Cost of group living: cannibalism!



Niko!

Black-headed gull

(Chroicocephalus ridibundus)





Erik Christensen

Predation
versus
competition

**Black-headed gulls
remove eggshells from
their nests - why?**

A black-headed gull's eggshell

Inside of egg shell - white



Outside = camouflage

Tinbergen et al.'s experiments

In an area patrolled by gulls and crows (predators),

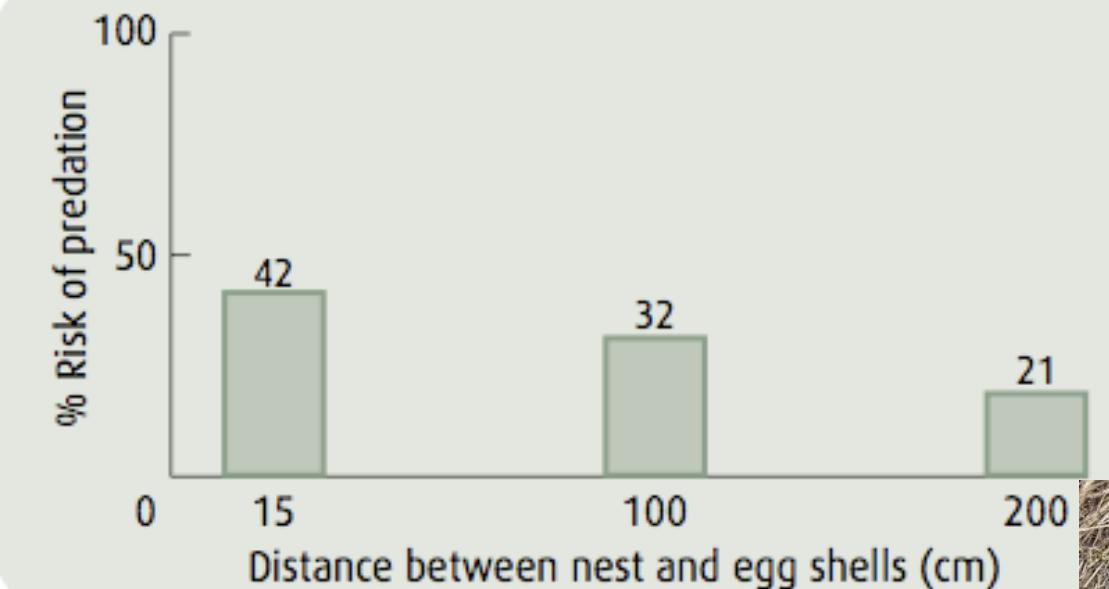
- *Experiment 1:* a mix of gull eggs were distributed:
 - unmodified (natural-coloured) and painted white
 - Predation rate:
 - Natural-coloured: 13 of 68 (~9%)
 - White-coloured: 43 of 69 (~30%)
 - => White eggs were discovered more frequently by predators

Tinbergen et al.'s experiments

In an area patrolled by gulls and crows (predators),

- *Experiment 2:* Two sets of unmodified gull eggs, on artificial gull nests, both camouflaged:
 - some alone
 - some near empty eggshells
 - => Eggs in nests near eggshells were *three times more likely* to be found

Eggs (in nests) near eggshells are more likely to be predated on





Conclusion:
Egg shells attracts predators.

Black-headed gulls remove eggshells
from their nests to *reduce predation*

Predation
versus
competition
versus
cannibalism

But...why is egg shell
removal so slow?

Tinbergen et al.'s experiments

- Egg shell debris attracts predators, and in other species of solitary nesters, egg shell removal was conducted very quickly, e.g.:

- Oystercatchers
- Plovers



Black headed gulls, on the other hand, were *relatively slow* to remove shells - WHY?

Tinbergen et al.'s experiments

- Black-headed gulls were *waiting* before removing egg-shells.
- What was the reason?





Erik Christensen

Cannibalism!

- Neighbouring, unrelated adults in the colony, will predate on newly hatched chicks.
- So parent waits until emerging chicks are dry and fluffy
- Balance threats: cannibalism/predation

Predation
versus
competition
versus
cannibalism

Costs of group living

1. Increased competition.
2. Increased risk of disease and parasites.
3. More obvious to predators.
4. Risk to young; eg: cannibalism, misdirected parental care.
5. Interference with reproduction.
6. Risk of inbreeding.

Question:

The risk of inbreeding in animal groups

- <http://pollev.com/sivasothi54>
- How is this prevented in the wild?
- How is this prevented in captivity?



How is inbreeding prevented in the wild?

Start the presentation to see live content. For screen share software, share the entire screen. Get help at pollev.com/app



How is inbreeding prevented in captivity (zoos)?

Start the presentation to see live content. For screen share software, share the entire screen. Get help at pollev.com/app

A central theme: costs and benefits

- When does natural selection favour group living?
- What are the *costs* and *benefits* of interactive aggregation?

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4. Types of Animal Groups



Types of animal groups

1. Solitary
2. Pair
3. Family
4. Harem
5. Matriarchy
6. Oligarchy
7. Arena/Lek
8. Hierarchy
9. Aggregation
10. Caste system

Types of Groups:

I. Solitary



The adult male and female live alone and meet only during the breeding season.

After courtship and copulation, they go their separate ways

Many big cats, e.g. pumas, tigers



©2004 Andrea Furtach Art

**Community cats - are
they social
or anti-social?**

Sociability of an animal?

- Most mammals and birds exhibit a bond between mother and offspring
- Social animal - additionally, live together in permanent groups
- Eusocial animal - organisation with distinct roles and hierarchies, e.g. mole rats and ants, bees, wasps, termites. Includes sterile individuals (kin selection).

Discussion

The sociability of stray cats

Are they social or asocial?



Sociability of stray cats

- Wild cats are originally solitary.
- Yet stray cats are found in large colonies.
- How is this possible?
- Is this ‘natural’?



Sociability of stray cats

- What do the large colonies depend on? Resources?
- How would cats that hunt for their food differ from those fed by people?
- What would happen if ‘community cats’ were not fed?
 - Predation on what?
 - Foraging time?
 - Competition? Territoriality?
 - Life expectancy?
health, weight, dentition

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Types of Groups:

2. Pair

Whenever parental duties are too much for one parent, the male and female form a bond and live together as a pair at least during the breeding season.

Types of Groups: 2. Pair

Bird pair bond variations:

- Degree of association
 - Single nesting, breeding season (most birds),
 - Several seasons or for life (swans, cranes)
- Role of male
 - guard nest, bring food to female, hatch eggs



Swans



Cranes

Laysan albatross (*Phoebastria immutabilis*)



Adults are similar in size

Hornbills



CWKK © 2006

Hornbill nesting, BBC



The migratory Black-tailed Godwit



The migratory Black-tailed Godwit

- Synchronous arrival
- Winter apart in Europe
- Meet in Iceland in the spring
- “Divorce” – late arrivals can lose partners



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Types of Groups:

3. Family

In some animals, the young may stay with their parents and form extended family.

These young may help the parent to raise future offspring (cooperative breeding).

Cooperative Breeders

- About 3% (300 spp.) of birds are cooperative breeders.
- Two kinds:
 - Mature non-breeders are not parents
 - Some degree of shared parentage
 - shared maternity
 - shared paternity
 - both

3. I Scrub Jays in Florida



Scrub Jay

- Cooperative breeder
 - most offspring stay with parents initially
 - Family unit
 - = breeding pair
 - + offspring (non-breeding) helpers
- May even include adopted individuals which help
 - helpers defend breeding territory, nest and young
 - help feed young



Scrub Jay



- when hunting, take turns at sentinel duty
 - watch for predators (e.g. hawks, snakes) and sound the alarm
 - rest hunt; whilst listening out for the sentinel
 - mob predator

Scrub Jay

- But helpers not involved in:
 - nest building
 - incubation
 - egg brooding
 - tolerated but increase reproductive success
 - limited territory
- acceptable investment, 3 out of 25 years



Why cooperate

Ecological conditions (e.g. availability of food, predator pressure) determine the behaviour favoured by natural selection.

Why cooperate?

- Cooperative breeding is a common strategy in arid and semiarid portions of Africa and Australia
- Young adults put off the start of their own breeding, but survive tough conditions to maximize their lifetime reproductive output,
- and in the process occasionally promote genes identical with their own (*kin selection*)

Why cooperate?

- Environmental constraints, e.g. opportunities for younger birds to breed independently severely limited
 - shortage of territory openings,
 - shortage of sexual partners (generally this means lack of females),
 - unpredictable availability of resources

3.2 Otters in Singapore: What is group size and composition?

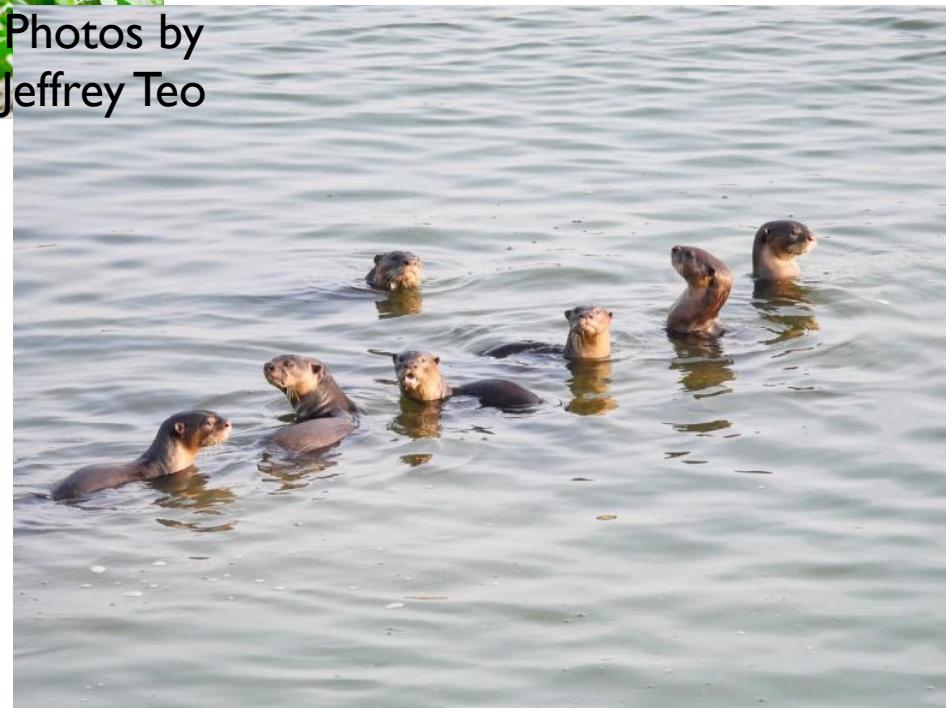


© Jeffery Teo 2014

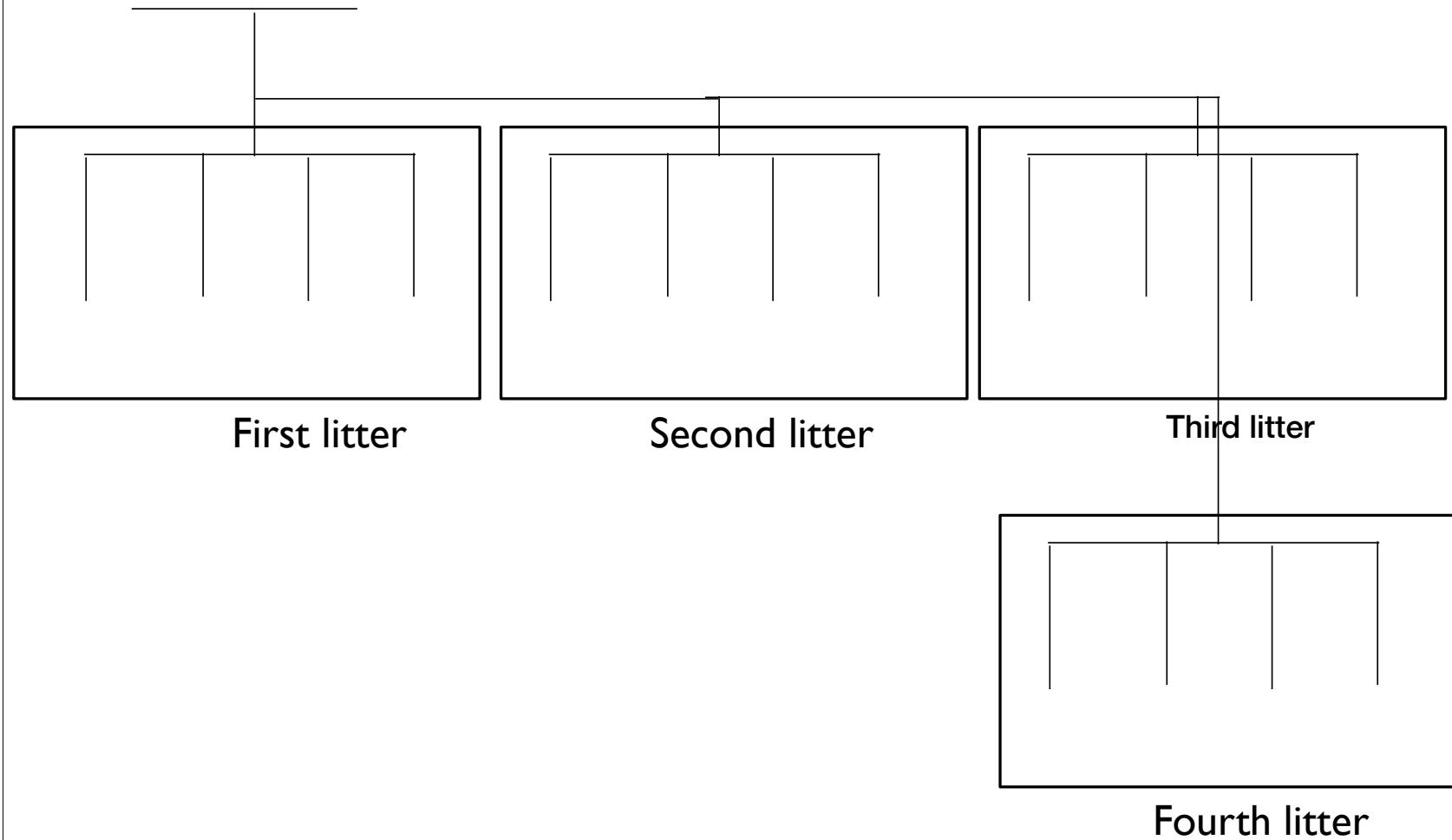


Photos by
Jeffrey Teo

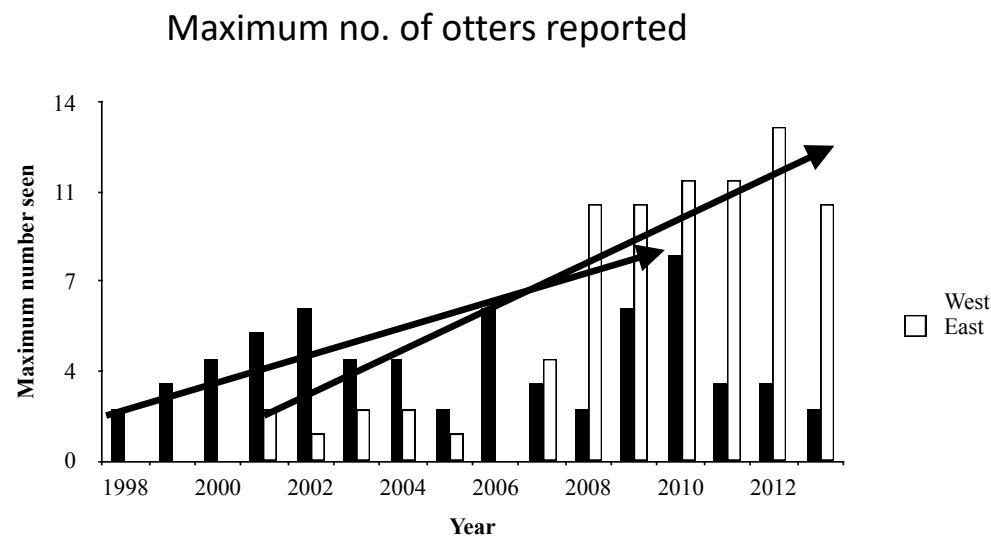
What is the group size?



Maximum smooth-coated otter family size in Singapore's urban waterways?



BREEDING AND DISPERSAL



Serangoon Reservoir; 20 Jun 2012 (Samson Tan)

Meryl Theng (2012)

After 2008, ≥ 8 individuals were sighted

Largest group sizes recorded:

8 (NW) – mangrove

13 (NE) – coastal habitats, canals & reservoirs

Why cooperate?

- Environmental constraints, e.g. opportunities for younger animals to breed independently are severely limited
 - shortage of territory openings,
 - shortage of sexual partners (generally this means lack of females),
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Types of Groups:

4. Harem

A harem may consist of one dominant male and a harem of females.

Some harems are permanent, others dissolve at the end of the breeding season.

4. I What to expect of males in harems?



Question:
**What could you expect
of males in a harem?**
<http://pollev.com/sivasothi54>

Consider these factors:

- Behaviour | Temperament | Size
- Winners | Losers



What could you expect of males in a harem?

Start the presentation to see live content. For screen share software, share the entire screen. Get help at pollev.com/app

Some characteristics of harems

- Intense competition with rivals
- Larger males obtain a higher rank
- Leads to significant difference between size and pelage and other structures of males and females.

Classic dimorphism

Elephant seals



Nyala (*Tragelaphus angasii*)

a spiral-horned southern African antelope



Maylandia lombardoi,
a freshwater cichlid from Lake Malawi





ZOOBERLIN
ZOOBERLIN

Flanged male



© Thomas Marent / www.ardea.com

orangutans – solitary
but also social, not
harem owners

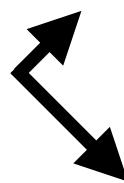


© Jurgen Freund / naturepl.com

4.2 Permanent harems in Hamydras Baboon (*Papio hamadryas*)

Dominant male - Central females ~1:10 OMU

Follower male



Peripheral females



© Ingo Arndt / naturepl.com



© Elio Della Ferrera / naturepl.com



Hamydras Baboon (*Papio hamadryas*)

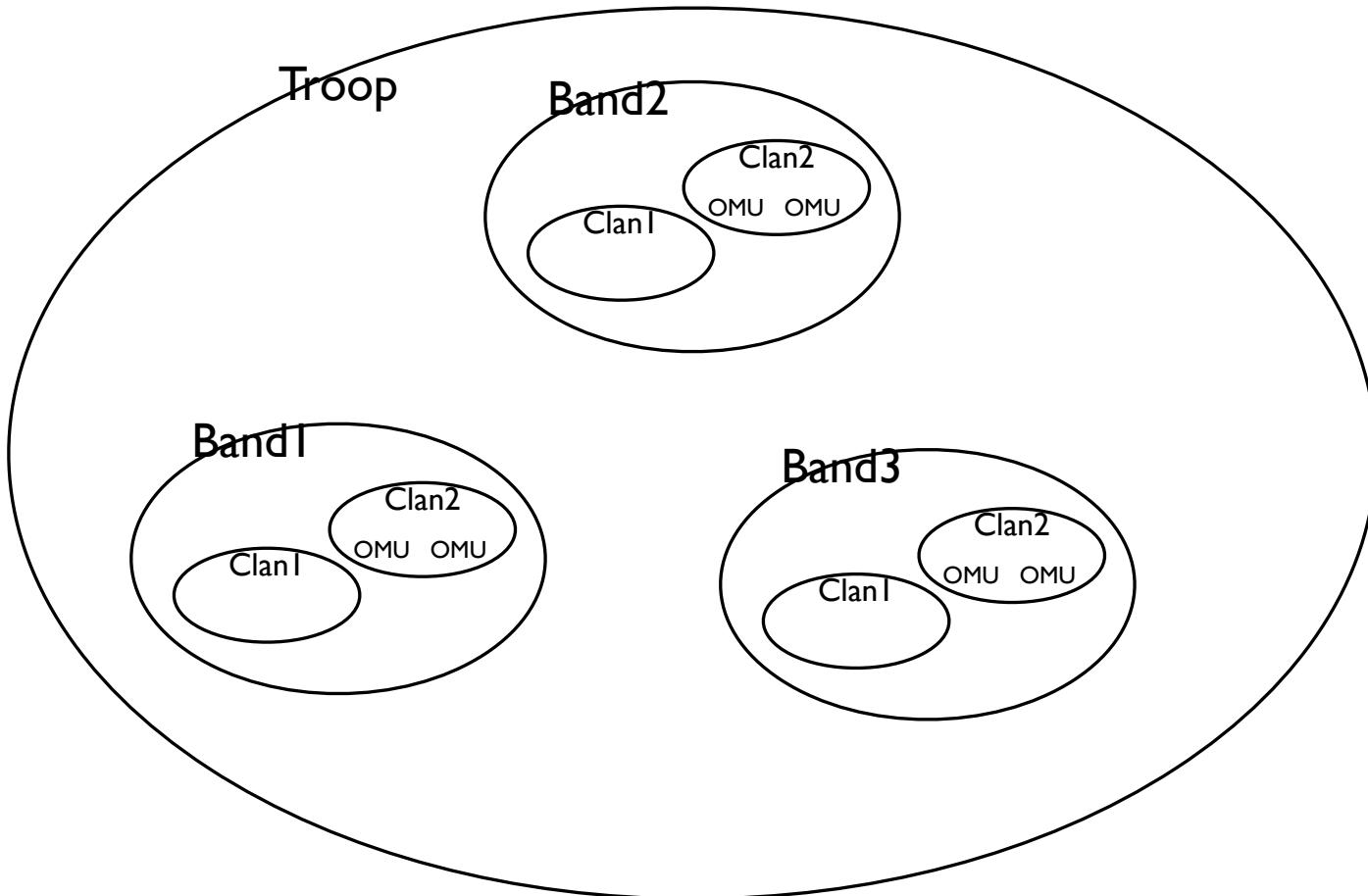
Four-level social system

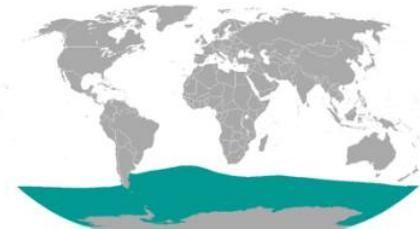
males
related

- OMU = one-male units / harems: one male + up to ten females, + a younger "follower" male
- Clan = 2-3 OMUs
- Bands = 2 - 4 clans of up to 200 individuals + non-leaders/follower solitary males
 - Troop = several bands

dominant
males related;
age-related
hierarchy
[Abegglen, 1984]

non-relatives; will
fight over food





4.3 Seasonal harems in the Southern elephant seal (*Mirounga leonina*)

- Seasonal terrestrial harem
- Specific oestrus



Beachmaster

4.4 Some costs of harems: infanticide

1. Large number of males are unlucky
2. Related males may co-exist,
low reproductive
3. Cost to harem master high



Presbytis entellus

4. New harem master may kill existing young - Infanticide:
a reproductive strategy by unrelated males



Panthera leo

Infanticide in hanuman langurs (India)

BBC Earth: Monkey Warriors



The new dominant male has a reproductive monopoly – why then the urgency to kill off rival infants?

- Allows females to become fertile faster (do NOT ovulate during lactation; unlike cheetah, domestic cats, induced ovulation)
- Reduces intra-specific competition with offspring of other males
- Subordinate males will always try to take over
- An infanticidal male is more likely raise and protect offspring and is more fit

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Types of Groups:

3.5 Matriarchy

- One female mates with a number of males (polyandrous)
 - Males compete to mate (more in the Courtship lecture)
 - Defend territories encompassing males
 - Reversed sexual-sized dimorphism: females larger than males

Eyes on Africa: Hyaena clans



Asian Elephant

- The herds are matriarchal, usually consisting of sisters and their offspring.
- The oldest, most experienced female is in charge with an extensive knowledge of the resources within the home range.
- Cooperative and protective of the group and will protect and care for the young.
- Males sometimes come together in bachelor herds, but are a more loose association.



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Types of Groups:

3.6 Oligarchy

- Several powerful males in a group. They share females and offspring.
- An efficient means of predator defence, establishing and maintaining territory

A three male lion coalition, Kruger National Park



Aug 2008 - three male lions at Shimangwaneni Dam,
just south of the Muzandzeni picnic site, Kruger National Park.

Photo by Jo,

<http://www.parks-sa.co.za/forums/viewtopic.php?f=21&t=27113&start=30>

A three male lion coalition, Kruger National Park, South Africa



Aug 2008 - three male lions at Shimangwaneni Dam,
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Photo by Jo,

<http://www.parks-sa.co.za/forums/viewtopic.php?f=21&t=27113&start=30>

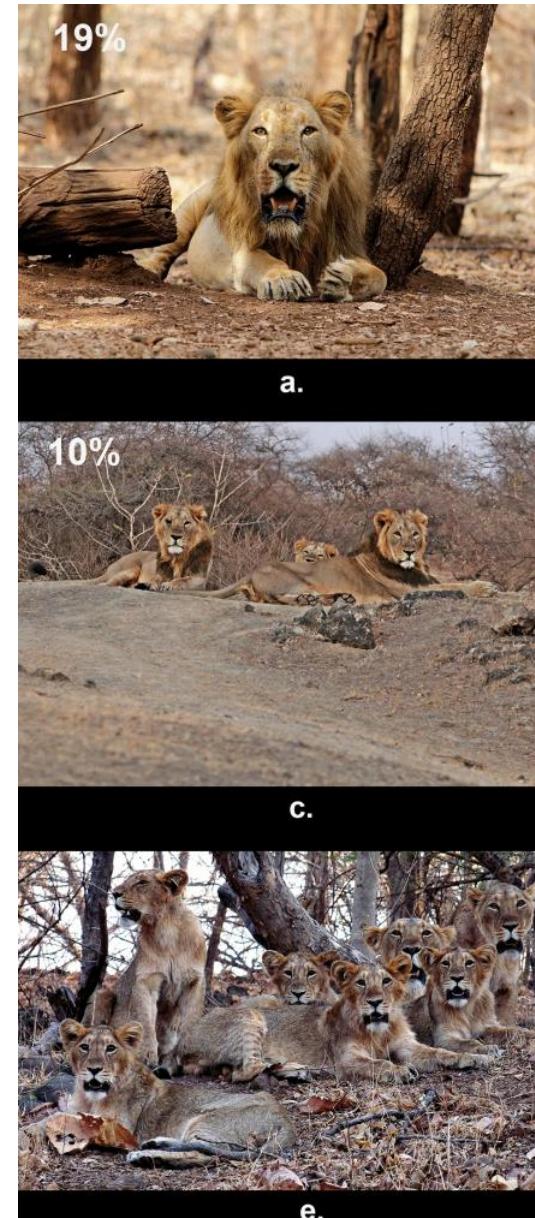
The Mapogo [Male] Lion Coalition

- Raised by a coalition of five males [Sparta pride] up to 2005
- By 2009, a six male coalition in control of about 3 prides.
- Killed many large prey, many lions from other prides.
- Supposedly even cannibalistic.

Asiatic (Gir) Lions

- Fitness
 - Pairs (even when unrelated)
>> Single male
 - Trios or Quartets - are all related
 - non-dominants have reduced breeding opportunities
 - Not common for all siblings to reach maturity – so only make up 12-13% of groups

Chakrabarti, S., Kolipakam, V., Bump, J. K., & Jhala, Y.V. (2020). The role of kinship and demography in shaping cooperation amongst male lions. *Scientific reports*, 10(1), 1-13.



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Types of Groups:

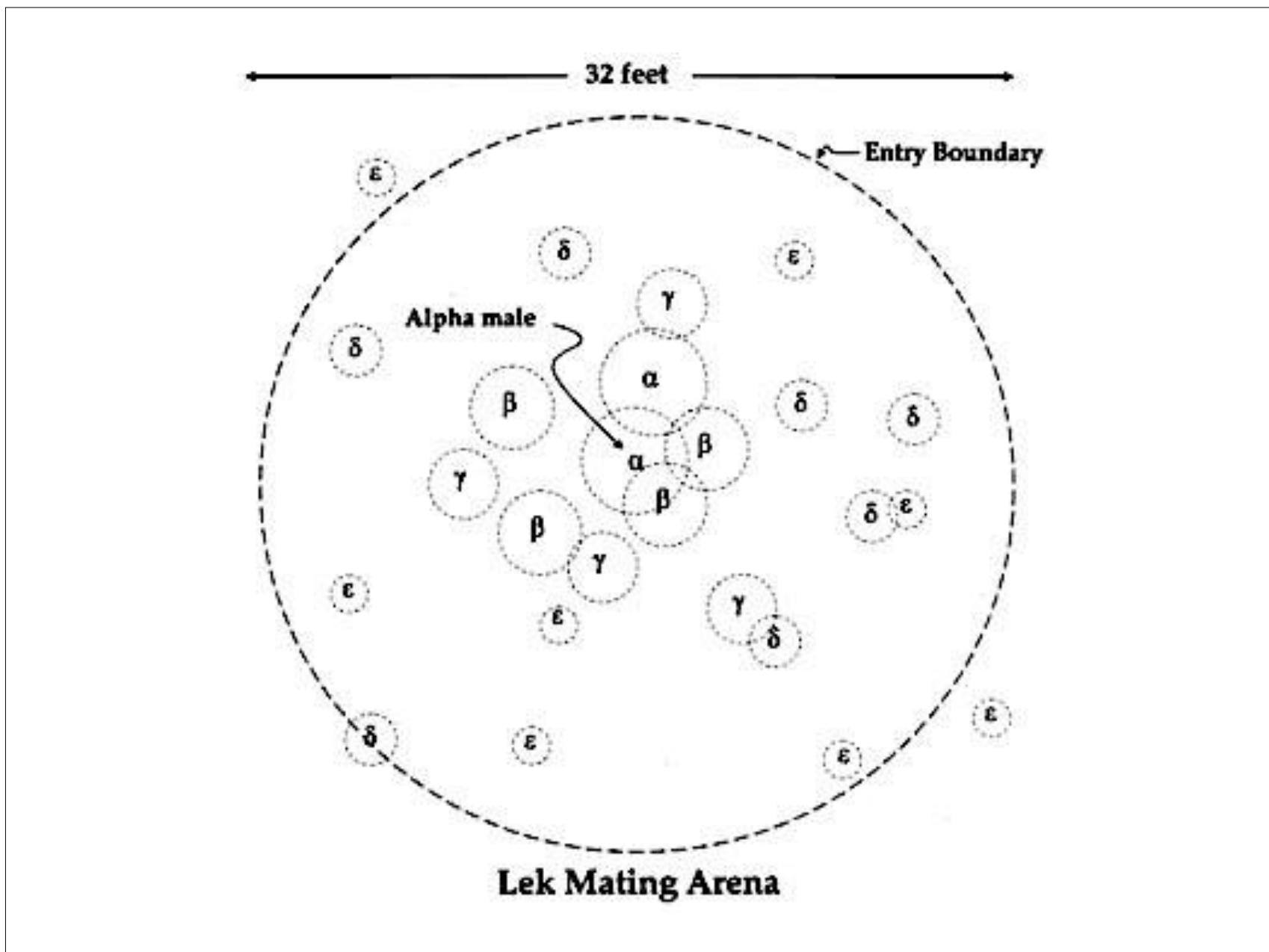
3.7 Mating Arena/Lek

Males aggregate at a site and display competitively.

Females visit the site and mate with their chosen male and leave.

Greater sage-grouse (*Centrocercus urophasianus*),
or sagehen, in North America.





In a lek – the Greater prairie chicken
(*Tympanuchus cupido*), aka ‘boomer’



Displaying male in a lek at Illinois, USA
(Greg Schechter, 2010)

Greater Prairie Chicken in a lek

- Some things to look out for in the upcoming video:
 - Males, note the fixed action patterns and display plumage
 - Females, note position, behaviour
 - Are there any signs of aggressive interactions?

Greater Prairie Chicken in a lek



Greater Prairie Chicken in a lek – male competition (Colorado Outdoors, 2013)



Lekking

- Main benefit (both sexes) = mating success
- Multiple reasons suggested for fitness
 - 1. Hotshot hypothesis - male attracts females
 - 2. Hotspot model - male goes to female clusters
 - 3. Kin selection – males are related
 - 4. Predation protection

Types of animal groups

1. Solitary
2. Pair
3. Family
4. Harem
5. Matriarchy
6. Oligarchy
7. Arena/Lek
8. Hierarchy
9. Aggregation
10. Caste system

BBC: Domestic chicken pecking order and Margo the dominant hen



Types of Groups:

3.8 Hierarchy

Grouping that consists of individuals that are ranked according to their status.

This type of grouping is also called as peck order.

3.8 Hierarchy

Chickens, dogs, cats, monkeys, etc.

Animals in social groups which establish a dominance hierarchy

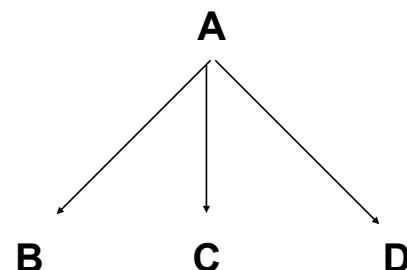
“Pecking order”, “top dog”, ‘alpha male’

The result of encounters

- Relative tendency to win or lose
- Rank orders
- Social or dominance hierarchies

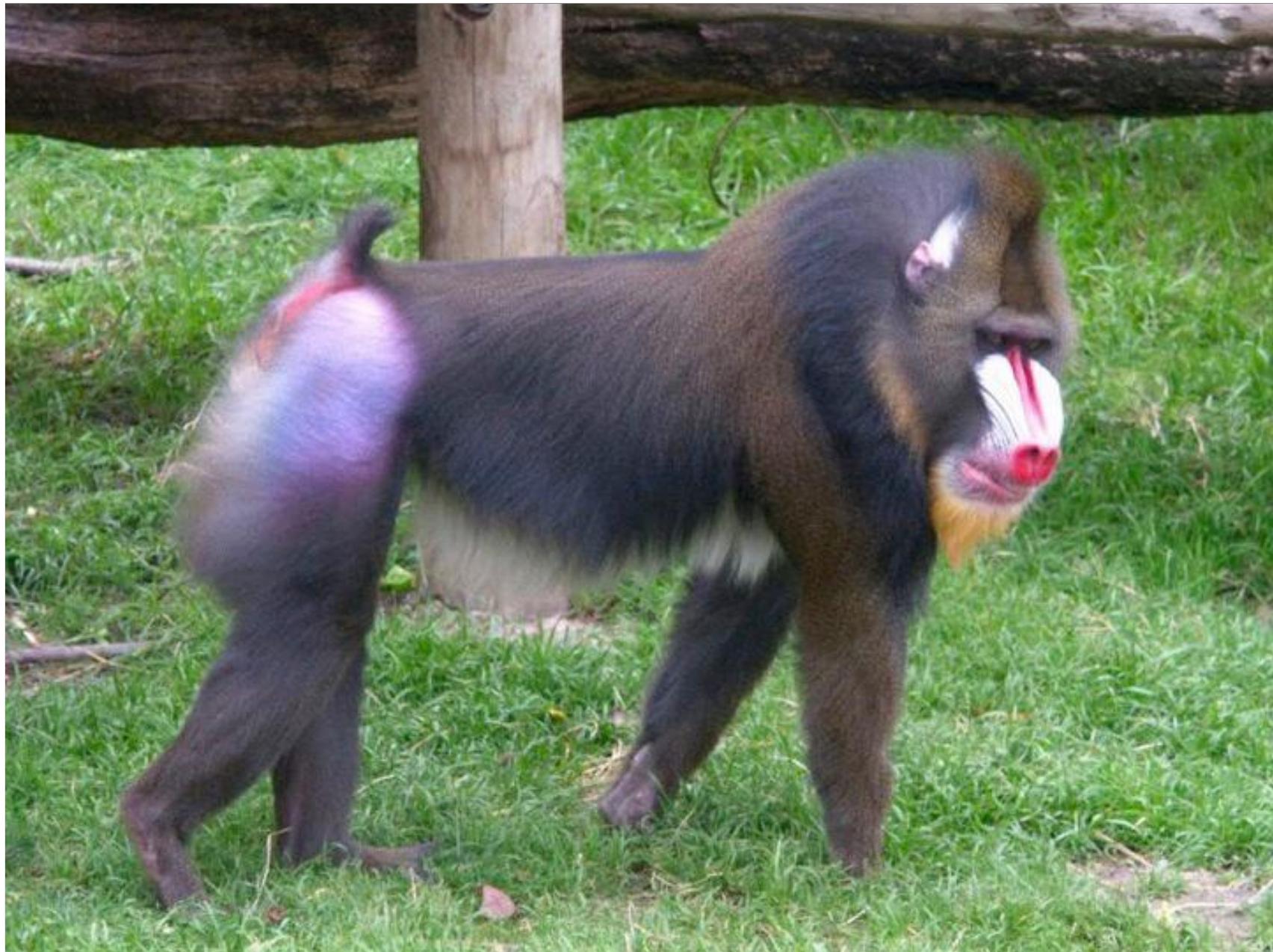
Dominance Hierarchy

A ————— B ————— C ————— D



Relationship?

- Linear
- Triangular
- Despotic
- Alliance (e.g. oligarchy)
- **Dominance matrix**



	Monkey 1	Monkey 2	Monkey 3	Monkey 4
Monkey 1		12 Monkey 1 >> Monkey 2	3	0
Monkey 2	5		15	2
Monkey 3	16	7		0
Monkey 4	23	15	14	

Minimised Dominance Reversals

	Monkey 4	Monkey 2	Monkey 3	Monkey 1
Monkey 4		14	15	23
Monkey 2	2		15	5
Monkey 3	0	7		16
Monkey 1	0	3	12	

Dominance reversals

Hierarchy real or imagined?

- Captive?
- Influence of observer?



Mr Bats





Types of animal groups

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Types of Groups: 3.9 Aggregation

Sometimes animals form large groups that have no apparent social structure

Zebras and impala graze on the African savannah; mutual protection

[Kandukuru Nagarjun on Flickr]



“...and the thousands of fishes moved as a huge beast, piercing the water. They appeared united, inexorably bound to a common fate. Whence cometh this unity?”

Anonymous, 17th century

Monarch butterfly, migratory birds



Flocking phenomena

- Rapid directed movement of the whole flock
- Reactivity to predators (flash expansion, fountain effect)
- Reactivity to obstacles
- No collisions between flock members
- Coalescing and splitting of flocks
- Tolerant of movement within the flock, loss or gain of flock members
- **No dedicated leader**
- ~~Different species can have different flocking characteristics – easy to recognise but not always easy to describe~~

Types of animal groups

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Types of Groups:

3.10 Caste System

Among social insects there exist extremely complex social organization in which there are different classes of individuals.

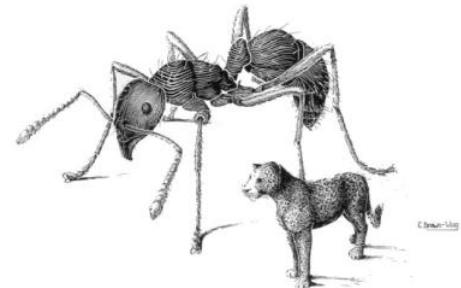
Division of labour generally exists between the classes

Social Insects

- Ecological dominance!
- 1,000 social species of wasps
- 1,600 social species of bees
- 2,500 species of termites
- 11,839 (antbase.org) species of ants

Social Insects

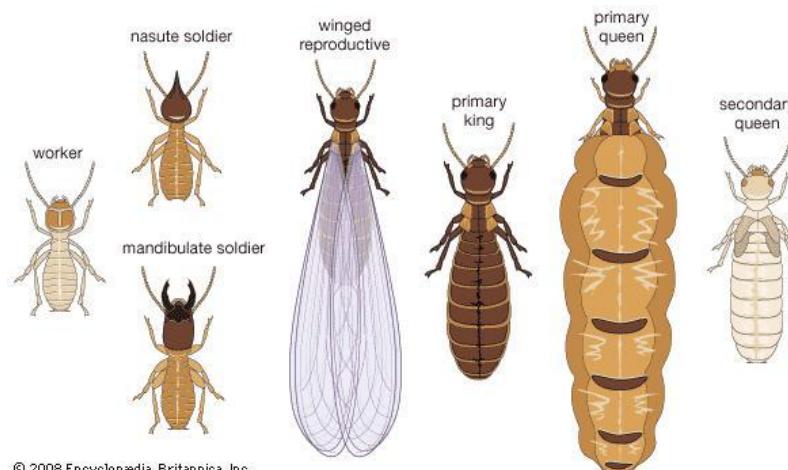
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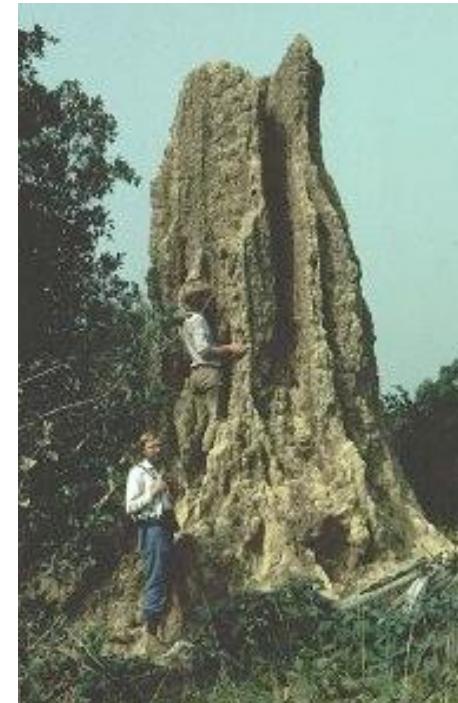
Ants account for
15 -25% of terrestrial
animal biomass

Termites

- Primary reproductives (male, female)
- supplementary reproductives
- sterile workers and soliders
- Higher termites – most sophisticated family structure in the world



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LSM1303 Animal Behaviour Lectures 4 & 5

What about friendship?

Friends: Owen and Mzee

- NAIROBI, Jan 6, 2005: A baby-hippopotamus that survived the tsumani waves on the Kenyan coast has formed a strong bond with a giant male century-old tortoise, in an animal facility in the port city of Mombasa.
- The hippopotamus, nicknamed Owen and weighing about 300 kilograms, was swept down Sabaki River into the Indian Ocean, then forced back to shore when tsumani waves struck the Kenyan coast on Dec 26, before wildlife rangers rescued him.

Friends

- "It is incredible.
- A-less-than-a-year-old hippo has adopted a male tortoise, about a century old,
- and the tortoise seems to be very happy with being a 'mother',"
- ecologist Paula Kahumbu said.



MOVIES

'Tortoise and Hippo' finds director

Wednesday, March 1 2006, 11:23 GMT - by Daniel Saney

John Dykstra will make his directorial debut on *Tortoise and Hippo*, a live-action and animation mix for Walden Media and Relevant Entertainment, according to *The Hollywood Reporter*.

Written by Roger S.H. Schulman (*Shrek*), the project was inspired by the friendship struck up by a baby hippo and a 100-year-old tortoise in a wildlife sanctuary in 2004 in the aftermath of the Asian tsunami.

Dykstra has won two Oscars in the capacity of visual effects supervisor, winning the award for best visual effects for *Spider-Man 2* last year.

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Showbiz

➤ Paula Abdul in trouble over airport antics



IMDb > Tortoise and Hippo (2011)

Tortoise and Hippo (2011)

Overview

MOVIEmeter: Up 15% in popularity this week. See

Director: [John Dykstra](#)

Writer: [Roger S.H. Schulman \(writer\)](#)

Contact: [View company contact information for](#)

Friends: Owen and Mzee (2:30)



A central theme: costs and benefits

- When does natural selection favour group living?
- What are the *costs* and *benefits* of interactive aggregation?

Conclusion

- Animals live alone or in groups or may exhibit both behaviours.
- Groups have varied structures, and not all may be permanent.
- In each life strategy, the benefits must outweigh the costs