

National University of Singapore

LSM1303 Animal Behaviour Lecture 2

1. The diversity of life and scientific names
2. Evolution by natural selection
3. What is Ethology?
4. Preventing bias
5. Observing animal behaviour.
6. An example of a student project

N. Sivasothi aka Otterman



LSM1303 Animal Behaviour Lecture 2

I. The diversity of life

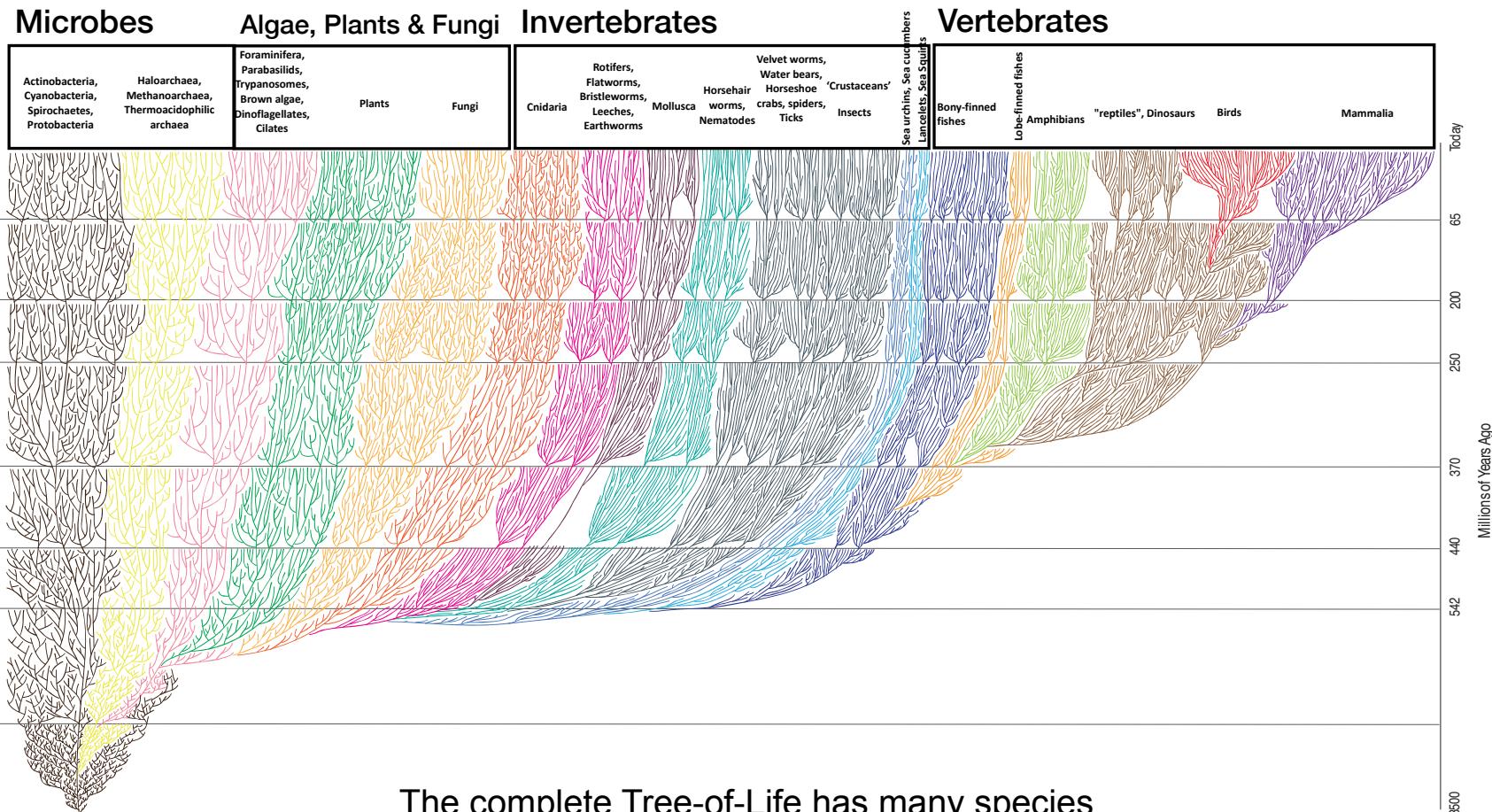
and the use of scientific names



Lee Kong Chian Natural History Museum, free entry for students



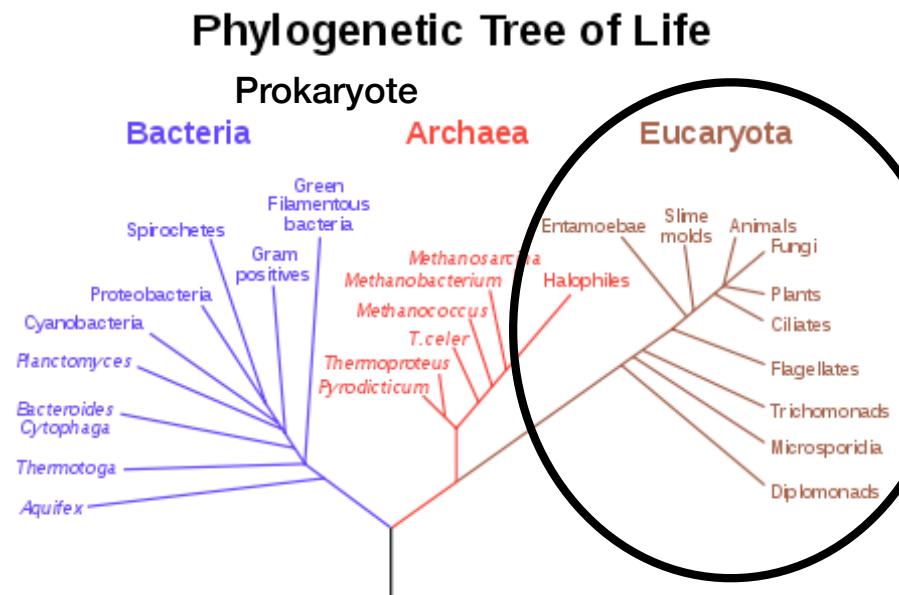
The Tree of Life



The complete Tree-of-Life has many species
Most species that lived on earth are extinct

Tree of Life adapted from Leonard Eisenberg (2008) by LKCNHM, NUS

Three domains



Classification of animal life

- Hierarchy of classification
- Helps identify sister species
- Look for clues to behaviour

Classification

KINGDOM

Animalia



PHYLUM

Chordata



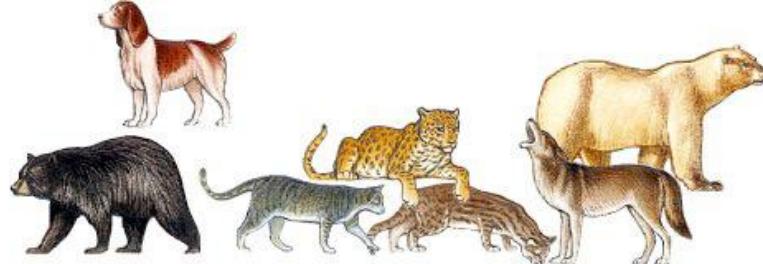
CLASS

Mammalia



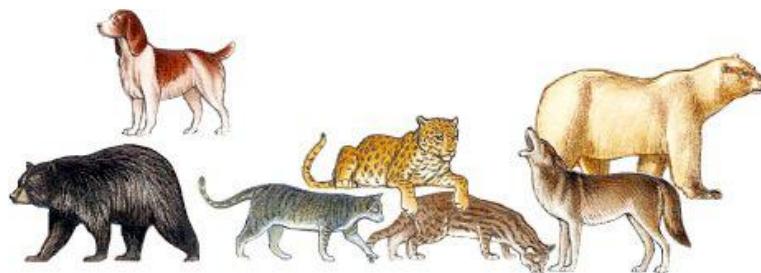
ORDER

Carnivora



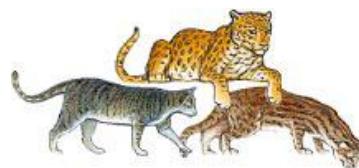
ORDER

Carnivora



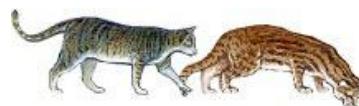
FAMILY

Felidae



GENUS

Felis



SPECIES

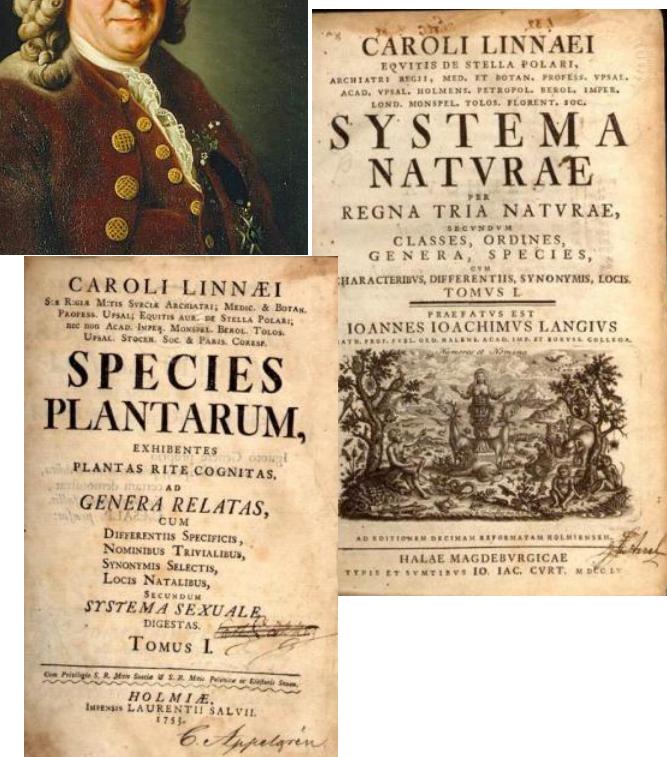
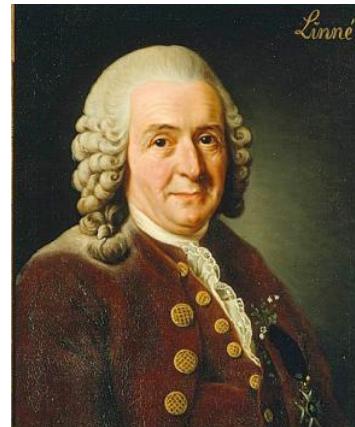
Felis catus



Classification

Linnaeus' system for scientific names: the binomial system

- **Carolus Linnaeus** (1753, 1758)
founder of modern taxonomy
- Binomial scientific names, i.e. each species has a **unique** paired combination of names.
- Based on the Latin language.
- Hierarchical system.
- Universality; practicality; first internationally recognised system.
- Catnip = *Nepeta cataria*



Scientific Names

- * Species name always *italicised* or underlined (differentiated).
 - * Genus name always with first letter in upper case.
 - * Specific epithet always entirely in lower case, never in caps.

Genus name	specific epithet	
<i>Homo</i>	sapiens	<input type="checkbox"/> incorrect
<i>Panthera</i>	Leo	<input type="checkbox"/> incorrect
<i>Panthera</i>	<i>tigris</i>	<input checked="" type="checkbox"/> correct
<i>felis</i>	<i>catus</i>	<input type="checkbox"/> incorrect



What is the use of scientific names?

- A standard point of reference.
- Data management.
- Start point for other biological disciplines
- Understand relationships

Will we use scientific names?

1. Scientific names will be indicated, but we will use common names.
2. You MUST know the scientific name of the species you are observing in your project, as well as its classification (e.g. family and order).
3. This will help you look up credible information about the species for comparisons.

Five Tips

Tap the scientific world
to provide credible,
evidence-based support
for your work!

Tip No. 1

Scientific names return more technical sources



All Images Videos News Maps More Search tools

About 908,000 results (0.44 seconds)

Monitor lizard - Wikipedia, the free encyclopedia

https://en.wikipedia.org/wiki/Monitor_lizard ▾

Monitor lizard is the common name of several large lizard species, comprising the genus *Varanus*. They are native to Africa, Asia and Oceania, but are now ...
Megalania - Savannah monitor - Spiny-tailed monitor - Bengal monitor

Monitor Lizards - National Parks Board

<https://www.nparks.gov.sg/gardens-parks-and.../dos.../monitor-lizards> ▾

Dec 30, 2014 - The most common monitor lizard among the three found in Singapore is the Malayan water monitor (*Varanus salvator*) that can grow up to 3m ...

Monitor Lizard-Monster in the house=trained Black Throat ...



<https://www.youtube.com/watch?v=PKQfAjwgU0g>

Nov 21, 2011 - Uploaded by Dave Durham
Showing Bigboy my Black Throat Monitor following voice commands,=Dont forget to Watch Bigboy,Buddy,And ...

malayan water monitor lizard (varanus salvator): info fact ...

www.naturia.per.sg/buloh/verts/monitor_lizard.htm ▾

Fact sheet on feeding, breeding, distribution, threats and the status in Singapore with photos and links.

Monitor Lizard (Varanus Indicus) - Animals - A-Z Animals ...

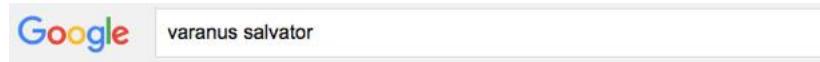
a-z-animals.com/animals/monitor-lizard/ ▾

Monitor Lizards are large reptiles found in Africa and all across Asia, including the surrounding seas. The monitor lizard is mainly found in jungle areas although ...

Pet Monitor Lizard Care, Information, Facts & Pictures

monitorlizards.org/ ▾

Monitor lizards are naturally found in Africa, Asia, Australia, and Indonesia. Their habitat can range from deserts to forests and savannas. Some monitors spend ...



All Images Videos News Maps More Search tools

About 156,000 results (0.23 seconds)

Asian water monitor - Wikipedia, the free encyclopedia

https://en.wikipedia.org/wiki/Asian_water_monitor ▾

The water monitor (*Varanus salvator*) is a large lizard native to South and Southeast Asia. Water monitors are one of the most common monitor lizards found ...
Mertens' water monitor - Marbled water monitor - Yellow-headed water monitor

malayan water monitor lizard (varanus salvator): info fact ...

www.naturia.per.sg/buloh/verts/monitor_lizard.htm ▾

Fact sheet on feeding, breeding, distribution, threats and the status in Singapore with photos and links.

Malayan Water Monitor - Varanus salvator - Ecology Asia

www.ecologyasia.com/verts/lizards/malayan_water_monitor.htm ▾

Family : VARANIDAE Species : *Varanus salvator*. Size (snout to vent) : up to one metre. Size (total length) : up to 3 metres. This common species occurs ...

ADW: Varanus salvator: INFORMATION

animaldiversity.org/accounts/Varanus_salvator/ ▾

Varanus salvator is reported to grow to 3 meters in length, but most adults are 1.5 meters long at most. Individuals have a black temporal band edged with yellow ...

Varanus salvator (Common Water Monitor)

www.iucnredlist.org/details/178214/0 ▾

Taxonomic Notes: There is significant taxonomic uncertainty surrounding this species complex. The Philippine members of the *V. salvator* complex have been ...

Water Monitor & Black Dragon Care Sheet - Vital Exotics

www.vitalexotics.com/water-monitor-black-dragon-care-sheet/ ▾

This is a care sheet written with the specific needs of the Water Monitor complex (*Varanus salvator*) of animals addressed, but may also be used with slight ...

Malayan water monitor (Varanus salvator) - Wild Singapore

Tip No. 2
Use Google Scholar to tap into a powerful source of information - scientific, peer-reviewed, literature!

The screenshot shows a Google Scholar search results page. The search query 'varanus salvator behaviour' is entered in the search bar. The results are filtered by 'Scholar' and show approximately 974 results found in 0.30 seconds.

Scholar About 974 results (0.30 sec)

Articles [The food and feeding behaviour of water monitor, *Varanus salvator*, in Malaysia](#)
C Traeholt - 1994 - agris.upm.edu.my
Faecal pellets of *Varanus salvator* collected in Pulau Tulai in the South China Sea revealed that individuals there mainly feed on crabs and tourists' leftovers. The stomach contents of monitor lizards living in an oil palm estate in Peninsular Malaysia show that the main diet ...
Cited by 17 Related articles All 3 versions Cite Save More

Any time [Notes of the feeding behaviour of the water monitor, *Varanus salvator*](#)
C Traeholt - Malayan Nature Journal (Malaysia), 1993 - agris.fao.org
Abstract: The present study reviews some behavioural aspects of the feeding behaviour of five individuals of the Malaysian Water Monitor lizard, *Varanus salvator*. Search patterns and hunting techniques are revealed which document that *V. salvator* exhibits are...
Cited by 12 Related articles All 2 versions Cite Save More

Sort by relevance [Preferred body temperature, aerobic scope, and activity capacity in the monitor lizard, *Varanus salvator*](#)
TT Gleeson - Physiological Zoology, 1981 - JSTOR
... The family Varanidae includes arboreal and aquatic forms as well as large terrestrial predators ... basic information on the metabolic and activity capacities of the common water monitor, *Varanus salvator*. Although the behavior and social inter- actions of *V. salvator* have been the ...
Cited by 33 Related articles Cite Save

Sort by date [Commercial harvesting of giant lizards: the biology of water monitors *Varanus salvator* in southern Sumatra](#)
R Shine, PS Harlow, JS Keogh - Biological Conservation, 1996 - Elsevier
... des Bindenwarans, unter Berücksichtigung der paläogeographischen Verbreitung und der phylogenetischen Entwicklung der Varanidae. ... A preliminary study of the water monitor, *Varanus salvator*. ... R. Seigel, J. Collins (Eds.), Snakes: Ecology and Behavior, McGraw-Hill, New ...
Cited by 30 Related articles All 10 versions Cite Save

include patents include citations [Create alert](#)

[\[PDF\] Observations on *Varanus s. salvator* in North Sulawesi](#)
HF De Lisle - Biawak, 2007 - researchgate.net
... Krieger Publ., Malabar, FL. Deraniyagala, P. 1931. Family Varanidae. Spolia Zeylanica 16: 158-163. Erdelen, W. 1991. ... Wildl. Res. 28: 437-447. Traeholt, C. 1993. Notes on the feeding behaviour of the water monitor, *Varanus salvator*. Malay. Nat. J. 46: 229-241. ...
Cited by 12 Related articles All 3 versions Cite Save More

[Ritualized combat behavior of the pygmy mulga monitor lizard, *Varanus gilleni* \(Sauria: Varanidae\)](#)
JB Murphy, LA Mitchell - Herpetologica, 1974 - JSTOR
... COMBAT BEHAVIOR OF THE PYGMY MULGA MONITOR LIZARD, *VARANUS GILLENI* (SAURIA: VARANIDAE) ... Captive *Varanus* (varius, spenceri, mertensi, and salvadorii) use the tail for defense ... 1969) described a behavioral inventory for two male *V. salvator* which included ...
Cited by 22 Related articles Cite Save

[Thermal ecology of habitat and microhabitat use by sympatric *Varanus bengalensis* and *V. salvator* in Sri Lanka](#)
ED Wikramanayake, GL Dryden - Copeia, 1993 - JSTOR

Tip No. 3

Try specific search terms,
e.g. activity pattern,
foraging,
territoriality,
competition,
optimal habitat

Recognise these terms?

The screenshot shows a Google Scholar search results page. The search query is "varanus salvator activity budget". The results are filtered to show "Articles". The search took 0.09 seconds and found about 235 results.

Activity budgets and dietary investigations of *Varanus salvator* (Reptilia: Varanidae) in Karamjal ecotourism spot of Bangladesh Sundarbans mangrove forest
KMM Rahman, II Rakhimov... - Basic and Applied ..., 2017 - ojs.herpetologica.org
Tropical mangrove forest ecosystem of Sundarbans is considered as the most potential habitat for *Varanus salvator* in Bangladesh. The study was conducted to understand the general ecology and behavior of V. *salvator*, to assess its **activity** patterns and feeding ...
☆ 99 Cited by 9 Related articles All 9 versions

[PDF] Daily activity budget of long-tailed macaques (*Macaca fascicularis*) in Kuala Selangor Nature Park
K Hambali, A Ismail, BM Md-Zain - International Journal of Basic & ..., 2012 - researchgate.net
... insects, reptiles like lizards such as mangrove skink (*Emoia atrocostata*) and monitor lizard (*Varanus salvator*), river dolphins ... Chi-square test results showed that all eight **daily activities** have significant difference. The most observed daily **activity** from the study group was moving ...
☆ 99 Cited by 34 Related articles All 6 versions

Activity budgets and habitat preference of land monitor, Thalagoya *Varanus bengalensis* in a residential area
M Abayaratna, WAD Mahaulpatha - 2006 - dr.lib.sjp.ac.lk
... are least active during 0600-0900 hrs period because their body temperature has to reach the ambient temperature before commencing their **activities** ... Pandav & Choudhury 1996 observed that there was aseasonal difference in **activity** patterns for *Varanus salvator* ...
☆ 99 Cited by 3 Related articles All 4 versions

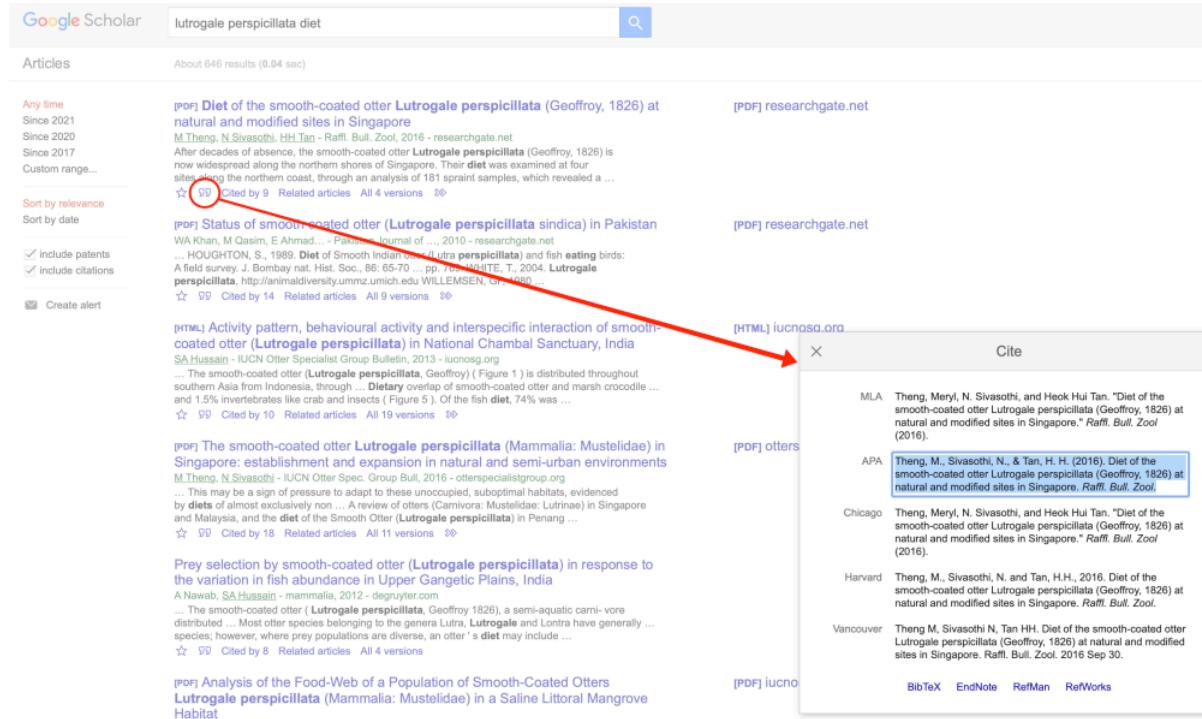
Ecological and behavioural traits of the Sri Lankan water monitor (*Varanus salvator*) in an urban landscape of Western Province, Sri Lanka
S Karunarathna, T Surasinghe, M Madawala... - Marine and Freshwater ..., 2017 - CSIRO
... have shown that basking does not constitute a substantial proportion of the daily **activity budget** of V ... A field study of the water monitor lizard (*Varanus salvator*) in West Kalimantan, Indonesia - new methods ... Checklist of the living monitor lizards of the world (family *Varanidae*) ...
☆ 99 Cited by 4 Related articles All 6 versions

[PDF] Encounter rates, agonistic interactions, and social hierarchy among garbage-feeding water monitor lizards (*Varanus salvator bivittatus*) on Tinjil Island ...
LT Uyeda, E Iskandar, RC Kyes... - Herpetological ..., 2015 - researchgate.net
... anthropogenic food subsidies; behavioral ecology; dominance hierarchy; Java; sociometric matrix; *Varanidae* ... All *Varanus salvator* captures and handling were carried out in accordance with the ... Differences in **activity budgets** and diet between semiprovisioned and wild-feeding ...
☆ 99 Cited by 12 Related articles All 5 versions

The Water Monitor Lizard *Varanus salvator*: Behavior, Ecology, and Human Dimensions in Banten, Indonesia
LT Uyeda - 2015 - digital.lib.washington.edu
... 1999. A Radio-Telemetric Study of the Water Monitor Lizard (*Varanus salvator*) in North Sumatra, Indonesia ... 2012. Population status of two *Varanus* species (Reptilia: Sauria:*Varanidae*) in Sri Lanka's Puttalam lagoon system, with notes on their diet and conservation status ...

Tip No. 4

Cite your sources! (use APA) even in slides



The screenshot shows a Google Scholar search results page for the query "lutrogale perspicillata diet". The results are filtered to "Articles" and show approximately 646 results. The first result is a PDF titled "Diet of the smooth-coated otter *Lutrogale perspicillata* (Geoffroy, 1826) at natural and modified sites in Singapore" by M. Theng, N. Sivasothi, and H.H. Tan, published in Raffl. Bull. Zool. 2016. A red arrow points from this result to a detailed citation box on the right.

[PDF] Diet of the smooth-coated otter *Lutrogale perspicillata* (Geoffroy, 1826) at natural and modified sites in Singapore
M. Theng, N. Sivasothi, HH Tan - Raffl. Bull. Zool., 2016 - researchgate.net
 After decades of absence, the smooth-coated otter *Lutrogale perspicillata* (Geoffroy, 1826) is now widespread along the northern shores of Singapore. Their diet was examined at four sites along the northern coast, through an analysis of 181 sprint samples, which revealed a ...
☆ 99 Cited by 9 Related articles All 4 versions

[PDF] researchgate.net

[PDF] Status of smooth-coated otter (*Lutrogale perspicillata sindica*) in Pakistan
WA Khan, M. Ossain, E. Ahmed - Pakistan J. Zool., 2010 - researchgate.net
 ... HOUGHTON, S., 1989. Diet of Smooth Indian Otter (*Lutra perspicillata*) and fish eating birds: A field survey. J. Bombay nat. Hist. Soc., 86: 65-70. ... WHITE, T., 2004. *Lutrogale perspicillata*, <http://animaldiversity.ummz.umich.edu>. WILLEMSSEN, C., 1990. ...
☆ 99 Cited by 14 Related articles All 9 versions

[PDF] researchgate.net

[HTML] iucnosa.org

[PDF] Activity pattern, behavioural activity and interspecific interaction of smooth-coated otter (*Lutrogale perspicillata*) in National Chambal Sanctuary, India
SA Hussain - IUCN Otter Specialist Group Bulletin, 2013 - iucnosa.org
 ... The smooth-coated otter (*Lutrogale perspicillata*, Geoffroy) (Figure 1) is distributed throughout southern Asia from Indonesia, through ... Dietary overlap of smooth-coated otter and marsh crocodile ... and 1.5% invertebrates like crab and insects (Figure 5). Of the fish diet, 74% was ...
☆ 99 Cited by 10 Related articles All 19 versions

[PDF] iucnosa.org

[PDF] The smooth-coated otter *Lutrogale perspicillata* (Mammalia: Mustelidae) in Singapore: establishment and expansion in natural and semi-urban environments
M. Theng, N. Sivasothi - IUCN Otter Spec. Group Bull., 2016 - otterspecialistgroup.org
 ... This may be a sign of pressure to adapt to these unoccupied, suboptimal habitats, evidenced by diets of almost exclusively non ... A review of otters (Carnivora: Mustelidae: Lutrinae) in Singapore and Malaysia, and the diet of the Smooth Otter (*Lutrogale perspicillata*) in Penang ...
☆ 99 Cited by 18 Related articles All 11 versions

[PDF] iucnosa.org

[PDF] Prey selection by smooth-coated otter (*Lutrogale perspicillata*) in response to the variation in fish abundance in Upper Gangetic Plains, India
A Nawab, SA Hussain - mammalia, 2012 - degruyter.com
 ... The smooth-coated otter (*Lutrogale perspicillata*, Geoffroy 1826), a semi-aquatic carnivore distributed ... Most other species belonging to the genera *Lutra*, *Lutrogale* and *Lontra* have generally ... species; however, where prey populations are diverse, an otter's diet may include ...
☆ 99 Cited by 8 Related articles All 4 versions

[PDF] iucnosa.org

[PDF] Analysis of the Food-Web of a Population of Smooth-Coated Otters *Lutrogale perspicillata* (Mammalia: Mustelidae) in a Saline Littoral Mangrove Habitat

Cite

MLA Theng, Meryl, N. Sivasothi, and Heok Hui Tan. "Diet of the smooth-coated otter *Lutrogale perspicillata* (Geoffroy, 1826) at natural and modified sites in Singapore." *Raffl. Bull. Zool.* (2016).

APA Theng, M., Sivasothi, N., & Tan, H. H. (2016). Diet of the smooth-coated otter *Lutrogale perspicillata* (Geoffroy, 1826) at natural and modified sites in Singapore. *Raffl. Bull. Zool.*

Chicago Theng, Meryl, N. Sivasothi, and Heok Hui Tan. "Diet of the smooth-coated otter *Lutrogale perspicillata* (Geoffroy, 1826) at natural and modified sites in Singapore." *Raffl. Bull. Zool.* (2016).

Harvard Theng, M., Sivasothi, N. and Tan, H.H., 2016. Diet of the smooth-coated otter *Lutrogale perspicillata* (Geoffroy, 1826) at natural and modified sites in Singapore. *Raffl. Bull. Zool.*

Vancouver Theng M, Sivasothi N, Tan HH. Diet of the smooth-coated otter *Lutrogale perspicillata* (Geoffroy, 1826) at natural and modified sites in Singapore. *Raffl. Bull. Zool.* 2016 Sep 30.

BibTeX **EndNote** **RefMan** **RefWorks**

Tip No. 5

Journal articles are free with NUS Libraries proxy bookmarklet!

The screenshot shows a journal article page from NUS Libraries. At the top, there's a banner with "Access through your institution" and "to view subscribed content from home". Below that is a "Get Access" button. The main content area asks "Choose an option to locate/access this article:" with three options: "Access via your institutional login" (selected), "Access via your institutional email", and "Purchase PDF \$35.95" (highlighted with a red box and arrow). The article title is "indicator of recovery in defaunated river communities" by Marta Narváez, Sonia Cabezas, Francisco Blanco-Garrido, Raquel Baos, Miguel Clavero, Miguel Delibes, et al. The NUS Libraries logo is at the bottom left.

This screenshot shows the "Find Full Texts: Proxy Bookmarklet" guide page. It includes the NUS Libraries header, a navigation bar with "Find It! @NUS Libraries", "Proxy Bookmarklet" (selected), and "LibKey Nomad", and a section titled "Using Proxy Bookmarklet" with the same text as the screenshot above.

<https://libguides.nus.edu.sg/findfulltext/proxybookmark>

Appreciate the context in each paper that you read

- What were the environmental conditions in that study?
 - E.g. season (temperature),
 - forest type and size – space available to the animal
 - Food availability, disturbance
- Compare against Singapore, which is in the tropics with monsoon seasonality, and is composed of fragmented and semi-urbanised habitats

When do you most refer to works of others?

- Introduction – when introducing your animal and what is known about a specific behaviour you will examine
 - Your specific study can compare the results; does it hold true? If not of the same species then a similar species will provide some idea
- Discussion – this is when you will make comparisons between your results and what is known (similarities and differences)

LSM1303 Animal Behaviour Lecture 2

2. A word about evolution by natural selection



What is Evolution?

- Evolution or change over time,
- is the process
- by which modern organisms have descended
- from ancient ancestors

What are mechanisms of evolution?

- natural selection,
- mutation,
- gene flow, and
- genetic drift



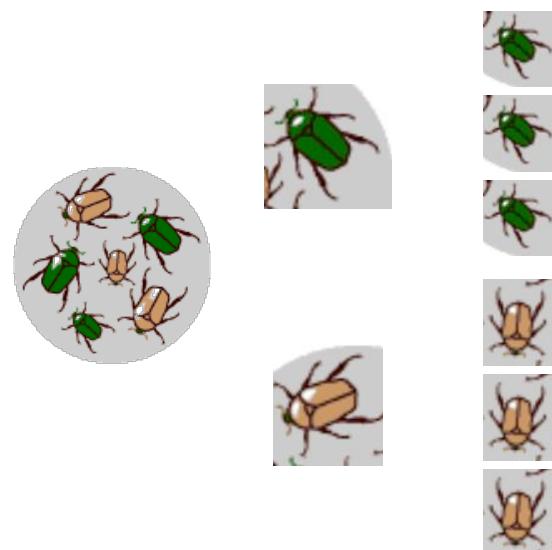
<https://evolution.berkeley.edu/>

What are mechanisms of evolution?

- Natural selection is the differential success (survival and reproduction) of individuals within the population
- Variability ● Characteristics of individuals in a population vary
- Inheritance ● Each individual inherits characteristics
- Survival ● As environmental pressures vary, individuals with useful traits survive in higher numbers and spread in a population – over time
- Time

What are mechanisms of evolution?

- Variation
- Inheritance

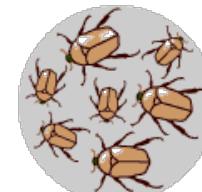
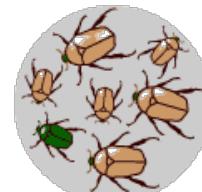
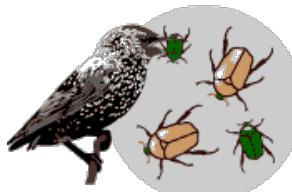
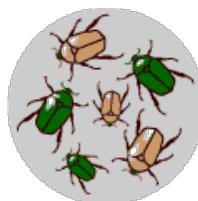


 **Understanding Evolution**
your one-stop source for information on evolution

<https://evolution.berkeley.edu/>

What are mechanisms of evolution?

- Variation
- Inheritance
- Selection
- Time



What is fitness?

- The fitness of an individual is measured as its contribution to future generations

What about ecology?

- the branch of biology that deals with
- the relations of organisms to one another
- and to their physical surroundings

Ecological concepts in the Extinction Game

- Optimal Habitat
- Fecundity
- Competition, Territoriality
- Predation, Prey defense
- Environmental change

LSM1303 Animal Behaviour Lecture 2

3. What is Ethology?



Ethology

- Ethology is the scientific study of animal behaviour
- with a focus on behaviour observed under natural conditions
- with a view of behaviour as an evolutionary adaptive trait
- Scientists who study ethology are *ethologists*

What? Why? How?

Who, Where, When (5W+IH)

- What is that animal doing?
- Why do birds sing?
- How do honeybees know when to look for food?
- How do sea turtles return to their birth beaches to lay eggs?

Movement

- Animal behaviour is centered around movement
- Animals seek food, water, shelter, mates
- Animals play, fight, interact

Reaction to stimulus

- Behaviour results as a reaction to a stimulus.
- Stimulus = detectable change in the animal's internal or external environment.
 - Sound, Movement, Visual cues
 - Hunger, Pain, Smell, Chemical cues
 - Hormonal changes

How is an ethogram used?

- E.g. Is an animal in captivity comfortable?
 - I.e. are they presenting a diverse set of behaviours?
- Create an ethogram which list behaviours
- Have observers visually sample animals for 5mins every 20 mins over three hours
- Score the traits they observe: analyse!

Small-clawed otters in captivity



Mandai Zoo

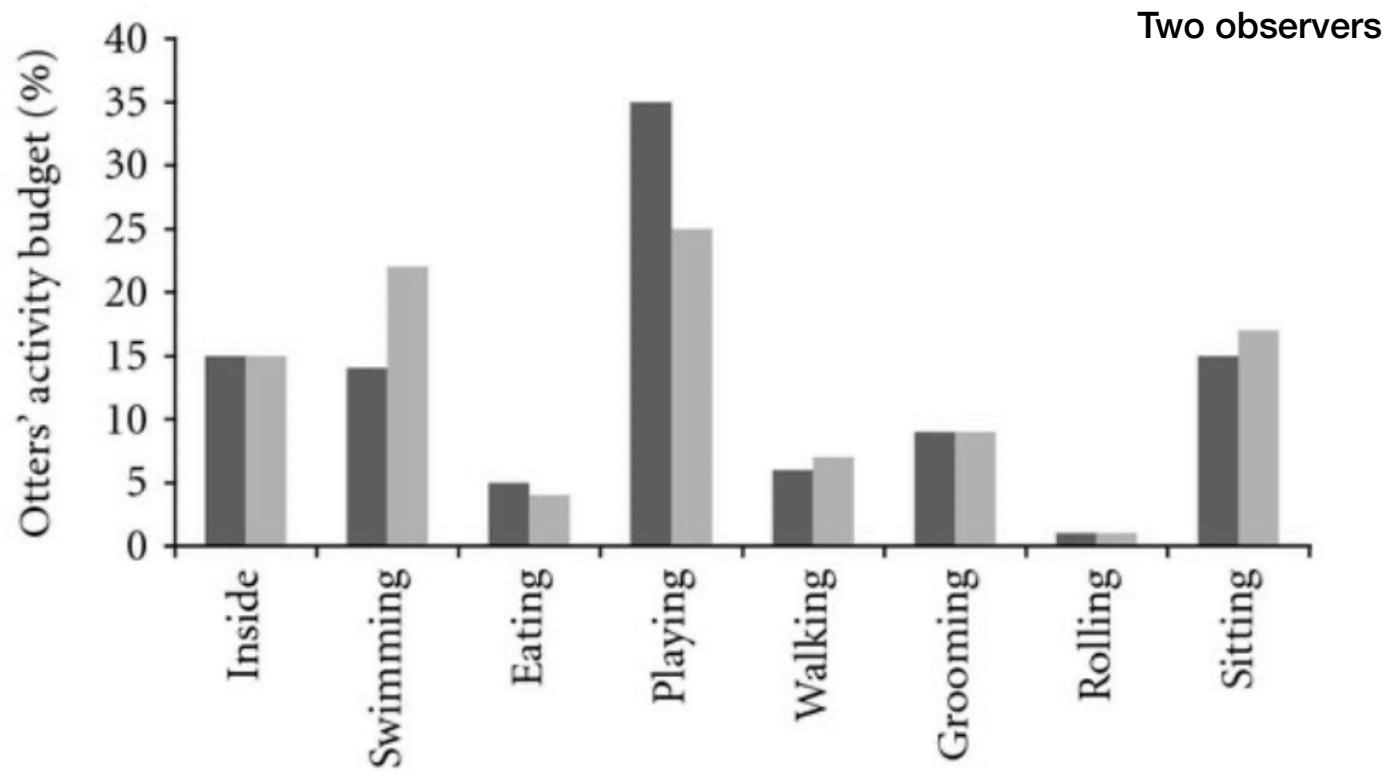
Table 1

Ethogram used by a trained biologist to record simple otter behaviours.

Behaviour	Comments and additional information
Inside	"Inside" is not a behaviour, but it was necessary to record this so that the period of time that the otters spent inside was included in the activity budget (it was speculated that visitors may underrecord otters when they were inside—Section 4).
Swimming	In water, not interacting with other otters and/or showing signs of play.*
Eating	This occurred mainly during twice-daily public demonstrations.
Playing	Any playful interaction with another otter (such as chasing, play fighting) or playing alone (diving/rolling in the water, playing with an object).*
Walking or running	As stated.
Grooming	Self-grooming or mutual grooming (if mutual grooming occurred, all otters involved were recorded as grooming).
Rolling	Rolling on land.
Sitting or lying down	Inactive animal (included pausing for a few seconds but also sleeping outside).
Fighting	This was never recorded with the ethogram, though the otters did display aggressive behaviour over food on one occasion (outside a recording period), so it is possible that visitors could have recorded this.
Other	Any behaviour not mentioned above, for example, spraiting, climbing a tree, and drinking.
Out of view	If an otter was not observable at any point during a sampling interval such that its behaviour could not be recorded (i.e., under the pedestrian walkway or hidden in vegetation).

Williams, R. L., Porter, S. K., Hart, A. G., & Goodenough, A. E. (2012). The accuracy of behavioural data collected by visitors in a zoo environment: Can visitors collect meaningful data? *International Journal of Zoology*, 2012, 1–13.

Activity budget of captive otters



Williams, R. L., Porter, S. K., Hart, A. G., & Goodenough, A. E. (2012). The accuracy of behavioural data collected by visitors in a zoo environment: Can visitors collect meaningful data? *International Journal of Zoology*, 2012, 1–13.

An amazing tool –
the ethogram
(Practical 2)

Helps us prevent bias

LSM1303 Animal Behaviour Lecture 2

4. Preventing bias



What before Why!

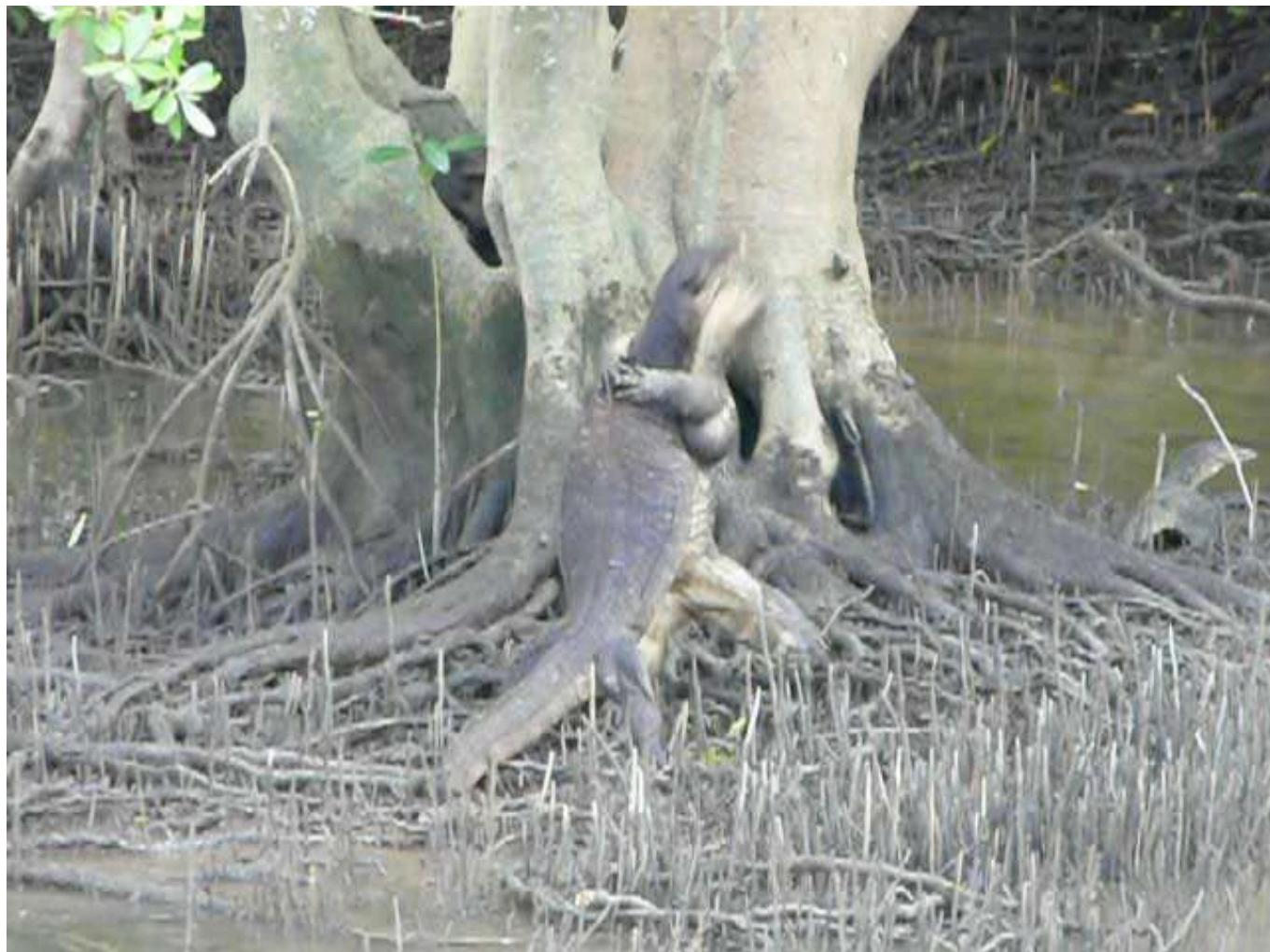
- First observe WHAT an animal is doing
(your focus is required!)
 - This prevents confusing observations with impressions which may be biased - so record data objectively without imagining reasons!
- Later, decide WHY
 - After data is analysed, reasons can be suggested, and further experiments conducted as needed

Preventing bias

- Two monitor lizards are grappling with each other:
 - Determine WHAT is going on; describe the interaction in detail
 - Only after attempt to understand WHY

What is going on?

- This involves an accurate description of actions, including the placement of their
 - legs
 - tail
 - neck
- I.e. an ethogram is required!
- What were the surroundings like?
- Were other animals present nearby?



Some time later....



Preventing bias

1. You observe two monitor lizards grappling with each other.
2. WHAT is going on: description
3. Next attempt to understand WHY -
 - reasons:
 - territorial battle
 - mating ritual
 - fight over mates
 - play-fighting
 - fighting over food
 - This may require more observations and experiments.
 - Examine the literature for possibilities.

LSM1303 Animal Behaviour Lecture 2

5. Observing animal behaviour



Why recce now?

- Your schedule is less hectic now – easier for group mates to arrange
- Visiting parks – at least in pairs, and in the day time
- Keep an open mind and your eyes open!

Common animals in Singapore suitable for student observation projects : Sheet1

No.	Birds	Kent Ridge?	Mammals	Kent Ridge?	Herptiles	Kent Ridge?	Fish	Kent Ridge?	Invertebrates	Kent Ridge?
1	Asian Glossy Starling	Yes	Plantain squirrel (<i>Callosciurus notatus</i>)	Yes	Common House Gecko (<i>Hemidactylus frenatus</i>)	Yes	Giant Mudskipper (<i>Periophthalmus schlosseri</i>) Blue-spotted Mudskipper (<i>Boleophthalmus boddaerti</i>)	No	Dragonflies (various species)	Yes
2	Javan Myna	Yes	Long-tailed macaque (<i>Macaca fascicularis</i>)	No	Changeable Lizard (<i>Calotes versicolor</i>)	Yes		No	Butterflies (various species)	Yes
3	Rock Pigeon	Yes	Feral cats (<i>Felis catus</i>)	No	Asian Toad (<i>Duttaphrynus melanostictus</i>)		Yellow-spotted mudskipper (<i>Periophthalmus walailakae</i>) Silver-lined mudskippers (<i>Periophthalmus argentilineatus</i>)	No	Ants (e.g. weavers ants)	Yes
4	Asian Koel	Yes	Asian house shrew (<i>Suncus murinus</i>)		Asian water monitor (<i>Varanus salvator</i>)	Yes		No	Carpenter bees. (<i>Xylocopa spp.</i>)	Yes
5	House Crow	Rare	Feral dogs (<i>Canis familiaris</i>)		brown anole (<i>Anolis sagrei</i> ; not native) at GBB		Archer fish	No	Oriental Honey Bee (<i>Apis cerana</i>)	Yes
6	Pink-necked Green Pigeon	Yes	Lesser Dog-faced Fruit Bat (<i>Cynopterus brachyotis</i>)	Yes	American bullfrog (<i>Lithobates catesbeianus</i> ; not native)	No	Green chromide (<i>Eretmopus suratensis</i>)	No	Golden web spider (<i>Nephila spp.</i>)	Yes
7	Yellow-vented bulbul	Yes	Wild pig (<i>sus scrofa</i>)	Yes	Saltwater crocodile (<i>Crocodylus porosus</i>)	No	Tilapia or other non-native cichlids	No (maybe in ponds at Kent Ridge Park)	Jumping spiders	Yes
8	Black-naped Oriole	Yes			Paradise Flying Snake (<i>Chrysopelea paradisi</i>)	Yes	Common snakehead (<i>Aruan; Channa striata</i>)	No (maybe in ponds at Kent Ridge Park)	Caterpillars (various species)	Yes
9	White-crested laughing thrush	Yes			Banded bull frog (<i>Kaloula pulchra</i>)	Yes			Land snails	Yes
10	Red Junglefowl	Yes			Four-lined Tree Frog (<i>Polypedates leucomystax</i>)	Yes			Fiddler crab	No
11	Parakeets & cockatoos	Yes			Common Gliding Lizard (<i>Draco sumatranus</i>)	Yes			Tree-climbing crabs (<i>Episesarma spp.</i>)	No
12	Oriental Magpie Robin	Yes							Marine snails	
13	Racket-tailed drongo	Yes							Barnacles	
14	Brahminy Kite, White-bellied Sea Eagle	Yes								
15	White-collared Kingfisher or White-throated Kingfisher	Yes								
16	White-breasted Waterhen	Yes								
17	Black-crowned Night Heron	No								
18	Grey Herons	No								
19	Cattle Egret	Yes								
20	Striated Heron	No								

Wildlife species in Singapore – potential species to study

<http://tinyurl.com/lsm1303-species>

Singapore Map Exercise
LSM1303, LSM2251

Singapore Map exercise

I – Locate these coastal locations on the map:

- 1. Sungai Buloh
- 2. Punggol-Serangoon
- 3. Pasir Ris
- 4. Changi
- 5. Tanah Merah
- 6. East Coast
- 7. Marina Bay
- 8. Singapore River
- 9. Kallang River
- 10. Labrador Nature Reserve
- 11. Sungai Ulu Pandan
- 12. Sister's Island Marine Park

II – What are these areas and what do they represent?

- 1. Central Catchment
- 2. Western Catchment
- 3. Pulau Ubin
- 4. Pulau Tekong

III - Where can you find major representations of these ecosystems?

- 1. Mangroves (muddy shores)
- 2. Beaches (sandy shores)
- 3. Rocky shores
- 4. Coral reefs
- 5. Sea grass beds

IV – Where is the sea?

- 1. What are the names of the major water bodies north and south of Singapore?
- 2. What are the names of the land masses north and south (not indicated in the map) of Singapore?
- 3. Where and what are the seas nearest to Singapore?

LSM1303 Animal Behaviour Symposium projects – *examples of senior's abstracts*

- Examples from Symposia:
[https://blog.nus.edu.sg/lsm1303/
symposiums/](https://blog.nus.edu.sg/lsm1303/symposiums/)
 - Diversity of animals,
locations
 - Sample size, group
efficiency
 - Recent abstracts will be
placed in LumiNUS > Files
- [2016 Abstracts \(PDF\)](#)
 - [2017 Abstracts \(PDF\)](#)
 - [2015](#)
 - [2014](#)
 - [2013](#)
 - [2012](#)
 - [2011](#)
 - [2010](#)
 - [2009](#)

Your project: a wild animals observed *without* interference

- Study an animal in the *wild* - no zoo animals, no pets!
- Ethics
 - No interference – animal does not have to change its position, or turn to observe you)
 - or manipulation (e.g. feeding, disturbance)
- No study of interference (unless there is a compelling case)
- Any indication of manipulation = 0 marks
- Consult us – we can help you avoid pitfalls (*important!*)
- And we will evaluate your proposal in Practical 3

LSM1303 Animal Behaviour Lecture 2

6. An example of a student project from 2012

Before we instructed them on ethograms



Why examine this example?

- This was carried out in 2012 – students received much less preparation for their project then
 - You will be introduced to sampling methods and a very useful tool – the ethogram (Practical 2 Ethological Methods)
 - Your project design will be reviewed (Practical 3 The Elevator Pitch) and you will receive feedback for your presentation (oral and slides) (Practical 4 The Dry Run video)

Why examine this example?

- Many things to appreciate here:
 - the clarity of the introduction,
 - the choice of animal (opportunistic),
 - the simplicity of their design and comparison,
 - the quantitative approach,
 - and the acknowledgement of confounding factors.

Does human traffic affect the prey capture efficiency of the Cattle Egret? (2012)

Goh Cher Li Jamie, Sng Weiping, Janice, Loke Rong Hao
Joel, Trini Zerlina Tan Zhao Ling, Toh Xiao Min

- “Our project focuses on investigating the factors that affect the hunting efficiency of cattle egrets.
- Hence we compared foraging acuity in two fields, both located at Buangkok.
- One field is located near urban buildings (more human traffic) and another at the forest edge.



LSM1303 (2012)

Cattle Egrets of Buangkok

Jamie | Janice | Trini | Joey | Xiaomin

Overview

INTRODUCTION TO CATTLE EGRETS

OUR BIRD WATCH PROJECT IN BUANGKOK

ANALYSIS OF DATA COLLECTED

OTHER INTERESTING OBSERVATIONS SIGHTED

CONCLUSION TO PROJECT

Cattle Egret (*Bubulcus ibis*)

- * Member of the Ardeidae family
- * Mainly found in tropics
- * Feeds on mainly insects, but diet varies accordingly
- * Usually feed along grassy habitats efficiently with accompanying cattle or mammal, but still able to forage individually



Spotting a Cattle Egret

- * White plumage
- * Short thick yellow bill
- * Dark greyish legs



Other species of Egrets



Snowy Egret



Great Egret



Little Egret

Why this project?

- * Reference to “Foraging success of Cattle Egrets” written by James J Dinsmore, University of Notre Dame [Dinsmore, J. J., 1973. Foraging Success of Cattle Egrets, *Bubulcus ibis*. *American Midland Naturalist*, 89 (1): 242–246.]
- * Comparison of foraging success of egrets with cows and alone
- * Found out that egrets that forage with cows are more successful in prey capture and take lesser steps to do so
- * Decided to adopt a similar study of such, using Dinsmore’s methods in his project

Does **human traffic** affect the prey
capture efficiency of Cattle Egret?



Site of Study



Field A

- * Field that extends to the lush greenery on the other end



175,000 km²

Field B

- * Field that is situated in the middle of traffic and pathways



100,000 km²

How we collected data

- * Data collection done between 7.30am – 9am
- * Went FOUR days to collect data
- * Watched Egret for 2-min intervals from afar using binoculars.
Following Dinsmore, (1973).

How we collected data

Took note of

- * The number of steps it took
- * The number of times it succeeded in capturing prey

- A. Steps/Successful prey captured = Ave no of steps to capture prey
- B. Successful prey captured/min = How many preys they capture in one min
- C. Efficiency Ratio (a/b)

**Video: Successful in capturing prey
determined by swallowing motion**



Our Results

Sample of Raw Data

Day 1			
Field B		Field A	
No of Steps in 2 minutes	No of successful forages	No of Steps in 2 minutes	No of successful forages
30	1	22	9
9	3	12	2
39	2	23	1
20	2	44	3
36	4	21	3
16	3	8	2
52	5	32	5
6	2	29	4
22	3	59	4
4	1	90	7
21	4	12	4
4	2	61	5
20	3	54	8
12	2	47	4
6	2	58	5
14	1	49	3
13	2	22	2
10	2	86	13
20	2	43	4

Day 2			
Field B		Field A	
No of Steps in 2 minutes	No of successful forages	No of Steps in 2 minutes	No of successful forages
14	1	54	10
35	2	92	9
14	1	17	8
25	2	57	27
31	3	67	33
42	4	44	13
0	1	00	00
27	2	65	16
23	2	50	25
11	2	50	17
5	1	36	18
31	4	92	41
18	2	66	8
23	2	40	22
27	3	90	12
16	3	64	13
14	2	72	19
9	1	104	5

Sample size: 25

Summary of raw data

	Field A	Field B
(a) Steps/Successful prey capture	7.35	9.65
(b) Successful prey capture/min	3.66	1.27
Efficiency ratio (a)/(b) The smaller the ratio the higher the efficiency	2.01	7.61

Contributing factors

- 1) Egrets are very sensitive to their surroundings
 - * When a human came close, which was approximately 10m away, the egret immediately flew away.
- 2) Humans are viewed as the only predators nearby



Contributing factors

- 2) Humans are viewed as the only predators nearby
- 3) Prey Abundance
- 4) Human traffic for both fields
- 5) Larger number of birds in Field A compared to Field B

Explanation 1

- * Humans were viewed as the main predator of the area
- * Difference in the amount of human traffic between the fields
- * The egrets were able to discern that the Field A is safer for hunting due to lesser human(predator) traffic.
- * Hence the Egrets could concentrate more on hunting, increasing the success rate.

	Field A	Field B
(a) Steps/Successful prey capture	7.35	9.65
(b) Successful prey capture/min	3.66	1.27
Efficiency ratio (a)/(b)	2.01	7.61

Explanation 2

- * Larger number = Stir more insects = more visible to egrets = prey capture success increases
- * Prey Abundance

	Field A	Field B
(a) Steps/Successful prey capture	7.35	9.65
(b) Successful prey capture/min	3.66	1.27
Efficiency ratio (a)/(b)	2.01	7.61

Limitations

- * Observation time period too short.
- * Unable to tell if we were observing the same egret at times
- * Weather
- * Differing field size
- * Competition from other animals
- * Unable to differentiate whether they are adult or juveniles

Interesting observations sighted

- * Cattle egrets are aware of their surroundings
 - * While an egret was hunting, a crow ventured into its territory which got the egret ruffle its feathers to scare the crow off.



Interesting observations sighted

- * Breeding Plumage
 - * They develop orange-buff plumes on the back, breasts and crown.



Interesting observations sighted

- * Prey capture techniques we observed
 - * “Walk Slowly” Behavior (Meyerriecks, 1960)
 - * The most common and efficient method



Interesting observations sighted

- * Prey capture techniques we observed
 - * “Stand and Wait”



Conclusion

Does **human traffic** affect the prey capture efficiency of Cattle Egret?

Cattle Egrets tend to have a higher prey capture success where there is lesser human traffic.

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Enjoy your field trips!