29/07/13

Lecture 1: Intro to unit.

Outcomes:

- Gain an understanding of current issues in wild life and conservation management in Australia and elsewhere
- Be able to critically discuss the causes and effects of population decline and expansion.
- Be able to identify methods of managing the threatened or pest species and understand the limitations of the methods.
- Understand the basic ideas or models and be able to demonstrate that understanding through application in assignments or by answering exam questions
- Be able to communicate information clearly and logically in spoken and written formats.
- Gain experience in a field based research project and be able to explain the rationale for the work, the methodology, results and management implications.

30/07/13

Lecture 2: A short history of wildlife research in WA

The development of our knowledge of the marsupials of WA - 1948

Ludwig Glauert
- 1879 – 1963
- paleontologist, herpetologist and museum curator
- Pleistocene mammals in Margaret river caves discovered by him

Phases:
- 1629 – Indigenous knowledge
  - aboriginal people had extensive knowledge of species including:
    - physical characteristics
    - anatomy
    - habitat uses
    - diet - based on observations of feeding anf stomach contents
    - behavior
    - reproduction
    - predators
    - response to fire
  - Telfer and Garde 2006 compared indigenous knowledge of four macropods with taxonomic research to see the correlation
    - They concluded that the knowledge is intimate and extensive and matches and extends the reported scientific literature. The knowledge is passed on through generations.
- 1629–1802 – Collection and naming: Dutch and French explorers
  - 1629 – Pelsart of the abrolhos islands
    - first Europeans to study marsupials (Quokkas)
    - fallacy that young grow from nipple
  - 1658 – Volkersen referred to quokkas on Rottnest island (island named by de Vlamingh)
  - 1969 – de Vlamingh surveyed WA coast in summer and gave poor reports
  - 1699 – Dampier (English explorer)
  - 1792 – Riche saw kangaroos in Esperance region
  - 1801 – Baudin expedition

        - ships geography and naturaliste
        - mapped west and south coasts of Australia
        - 200000 specimens collected and described 2500 new species
        - Several zoologists and botanists – Peron, Lesueur etc
- 1802–1880 – Collection and naming: early British explorers
    - 1802 - Mathew flinders on the south coast and collected specimens.
    - 1819 - King on northern coastline
    - 1829 - Foundation of colony and arrival of settlers
        - 1831 - numbats knighted near Beverly
        - 1839 - Bilby near york
    - 1837 - Beagle survey with Charles Darwin
    - professional collectors like Ludwig Preiss, john gilbert, George grey.
    - 1846 - 'the natural history of the mamalia vol 1' by Waterhouse.
    - Some research on taxonomy, but more on how to minimize damage to crops by native mammals.
    - John gilbert 1812-1845
        - Principal collector in Australia
        - Birds mammals reptiles, insects
        - 2 trips to Australia – over 6 years
        - Gould used his notes extensively
        - collected type specimens for mammal fauna.
- 1880–1930 – Research: nomenclature and distribution
    - museum and government surveys
        - systematic and widespread
    - revision of previous information collected
- 1930 – 1990 – Research: taxonomy and physiology
    - UWA department of zoology established in the 1930's
    - physiological studies
        - reproduction
        - nutrition
        - water turnover
        - thermoregulation
        - Early genetics and ecology
        - Women entered the field of zoology.
            - Patricia Woolley.
            - Jennifer Arnold.
            - Barbara York Main – spider studies in the south west.
- >1990 – Ecology and Genetics

- WL conservation act 1950 replaced by the environment protection and biodiversity conservation act 1999
  - Shift from species to ecological communities
- Improvements in molecular markers
- Evolutionary biology

What has changed since 1948?

- Then threats recognized as:
  - Foxes, cats, rabbits, rats and mice
  - Grazing by sheep and cattle.
  - Widespread fire
  - Clearing for agriculture
  - Fur trade
  - Epizootic disease
  - Large scale use of poison bait (strychnine)
- All still relevant (fur and poison bait not so much)
  - Plus salinity and climate change, cane toads and other pests (feral pigs)

WA research highlights

- Rediscovery of
  - Noisy scrub bird 1961
  - Western swamp tortoise 1953
  - Dibbler 1967
  - Gilberts potoroo 1994
- Kinnear 1988 demonstrated effect of fox control on the stop of rock wallaby extinction.
  - Translocation and reintroduction research to preserve threatened species.

Future?

- Improvements in technology.
  - Remote and miniaturized tracking devices
  - Camera surveillance.
  - Forensics
  - Molecular genetics
- Role of private industry
  - Australian wildlife conservancy

– Kanyana

"I think something may be done to improve the position. True, some species have already disappeared whilst others are on the decline through natural causes. But if we act at once, if we undertake active propaganda and make the public fauna-conscious ; if we make the reserves already in existence real sanctuaries for wild life by fencing out the rabbit and the fox and by forbidding access to domestic flocks and herds and, if the Fisheries and Game Department is enlarged so that the inspectors and game wardens can adequately pefrorm their functions, then I feel sure that our very efficient and enthusiastic Chief Guardian of Game can be relied upon to do his utmost to preserve and foster our unique and remarkable fauna—a national heritage that we hold in trust for generations to come. It is not ours to deal with as we wish."

5/8/13

Lecture 3 – Defining and measuring biodiversity

Biodiversity:
- All living things in a unit of area.
- Diversity of plant and animal life as represented by the umber of extant species
- The variety and variability among living organisms and the ecological complexes in which they occur.

Hierarchy
- Ecosystem → ecological communities → species → population → genes.
- Species is used more to measure biodiversity
  - Preservation of genes reduces the evolutionary potential of a species.
  - Preservation of species is more likely because its easier to measure the amounts of species rather than genes also.

Defining a species isn't always simple
- Eastern forest bat
  - Though to be single species found across Australia
  - After taxonomic review, species divided into two
  - There are now several genera now after more genetic reviews.
  - The actual eastern forest bat is restricted only to the Mideast coast of Australia.

How do we measure biodiversity?
- Species richness
  - Definition: Species richness is the number of different species in a given area.
  - limitations of species richness
    - practical at small scales but not large
    - scale of measurements can effect conclusions
    - sampling efforts affects results
    - all taxa assigned equal status.
- Shannon-weiner diversity index

- $H = -\sum_{s=1}^{s} p_i \ln p_i$

  S = total number of species (richness)
  p_i = proportion of S made up of the *i*th species

    - higher index value means more biodiversity and species evenness.
    - It assumes even distribution is better than a site with uneven distribution. May not be the case as species maybe naturally dominate.
  - Shannon's equitability (eh)
    - Makes it easier to compare along different systems
    - Values between 0 and 1
    - 1 is complete evenness
    - max diversity occurs when all species are equally abundant
    - impossible to assign a probability value
    - no ecological interpretation
    - biodiversity naturally increases with habitat complexity. This needs to be kept in mind when comparing more vs. less complex ecosystems – though they may be different, it may be fine.
- Mean species abundance
  - Indicator of naturalness of biodiversity intactness
  - Defines as the mean abundance of original species relative to their abundance in undisturbed
  - MSA of 100% means a biodiversity that is similar to the natural situation
  - MSA of 0% means a completely destructed ecosystem, with no original species remaining
- Alpha, beta, gamma indices
  - Alpha: species richness of local area
  - Gamma: species richness over larger regional area
  - Beta: spatial variation in species richness among sites within a region (gamma/alpha)
- Higher taxon approach
  - Use of genera or family instead of species
  - Usually vertebrates (mammals, birds)

  - Assumes diversity of higher taxon is representative of lower taxon
  - Eg. Wildlife picture index – a biodiversity indicator for top trophic levels in tropics.
- Living planet index
  - From 1970 datasets of biodiversity, you see if there are overall gains or losses.
- Other surrogates
  - Often vegetation types
  - Abiotic data
  - Use of remote sensing
    - Allow assessment of large areas
    - Effectiveness is questionable.
    - Choice of surrogate affects results
    - Cross taxon surrogates affects results
    - Best within the same realm (terrestrial marine)
  - Occupancy modeling.
    - Less abound abundance of species and more about distribution.

General problems with measuring biodiversity.
- Which measure should be used for specific datasets?
- Taxonomy is unresolved in some cases – identification is hard and effects results
- Bias according to taxonomic level.
- Data not available – not enough taxonomists.
- Genetics and ecosystem function are difficult to measure.
- Not all species are the same – value them differently

Which are important species
- Keystone species – functioning of the ecosystems is dependent on a single species.
- Umbrella species – something that other species rely on to provide resources (trees have nesting sites, and food).
- Flagship species – usually mammal iconic species that can be used to foster interest for conservation.
- Indicator species – indicates health of wider ecosystems.

Summary:

- Biodiversity not completely know everywhere. Conservation planning based on estimates
- Best estimates use genetic richness.
- Popular estimates use species richness currently.
- Practical estimates ise higher taxa or environmental variables as surrogates