BLACK COCKATOO CRISIS

MONITORING TO SAVE AN ENDANGERED SPECIES

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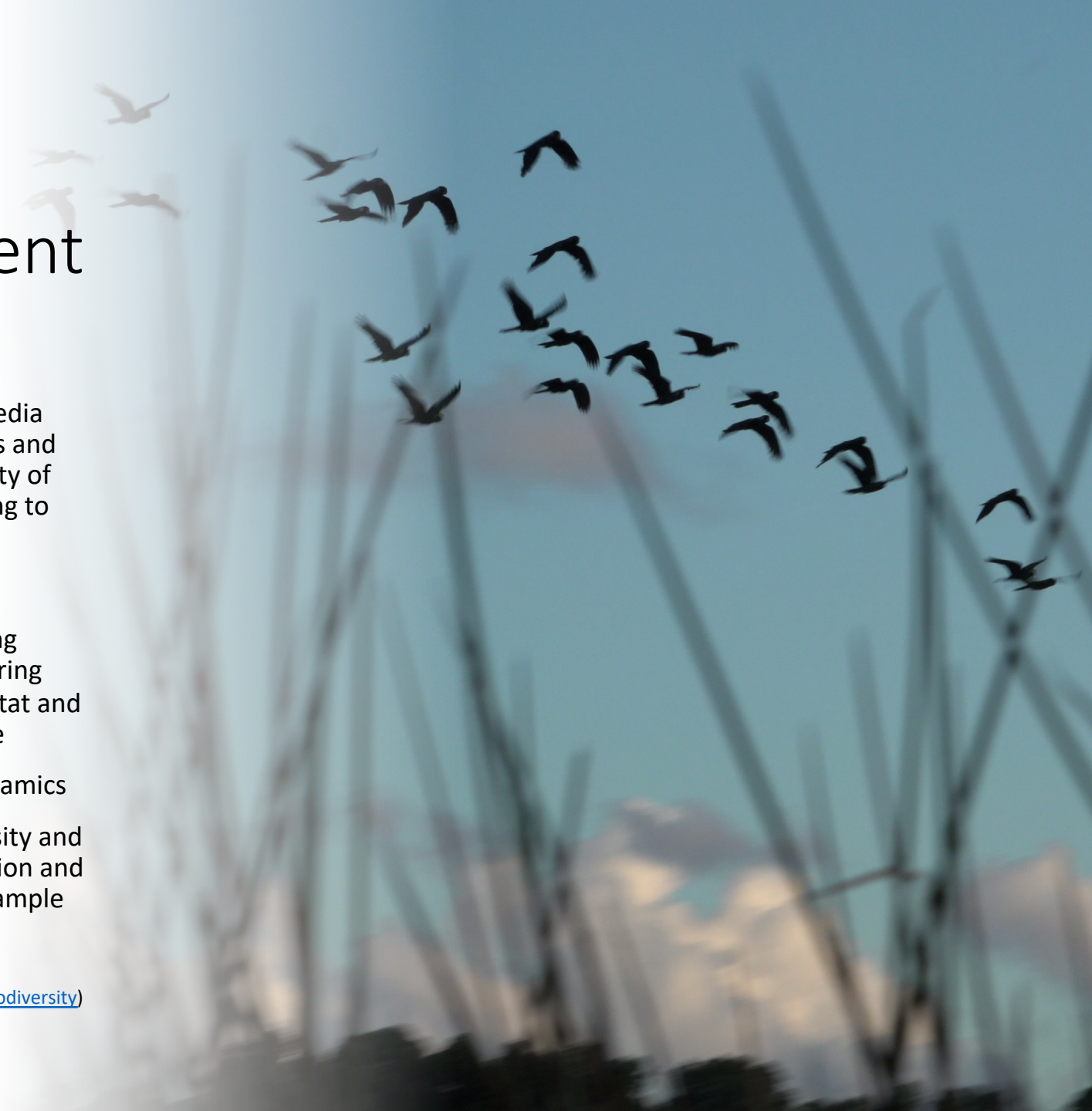
Year 11 ATAR Biology Learning Objectives

- understand that ecosystem diversity and dynamics can be described and compared with reference to biotic and abiotic components and their interactions
- use science inquiry skills to design, conduct, evaluate and communicate investigations into biodiversity and flows of matter and energy in a range of ecosystems
- evaluate, with reference to empirical evidence, claims about relationships between and within species, diversity of and within ecosystems, and energy and matter flows
- communicate biological understanding using qualitative and quantitative representations in appropriate modes and genres.

(Year 11 ATAR Biology, Unit 1, Ecosystem & Biodiversity)

Year 11 ATAR Biology Content



Science Inquiry Skills

- interpret a range of scientific and media texts, and evaluate processes, claims and conclusions by considering the quality of available evidence; and use reasoning to construct scientific arguments

Science as a Human Endeavour

- contemporary technologies, including satellite sensing and remote monitoring enable improved monitoring of habitat and species population change over time

Science Understanding: Ecosystem Dynamics

- human activities can affect biodiversity and can impact on the magnitude, duration and speed of ecosystem change. One example of this is habitat destruction, fragmentation or degradation.

(Year 11 ATAR Biology, Unit 1, Ecosystem & Biodiversity)

Monitoring to save an endangered species

Lesson Objective:

Students will examine the methods used to monitor the population of endangered Black Cockatoos in the Southwest of Western Australia. They analyse patterns and trends in ecological monitoring data (tagging and tracking) then examine the scientific methods, processes, claims, and conclusions presented in the Black Cockatoo Crisis film. They will consider the quality of evidence provided, and use knowledge of scientific concepts to draw conclusions that are consistent with evidence.

Tasks:

Students will create a presentation on the ecological monitoring methods used for Black Cockatoos, highlighting the significance of these methods for the conservation of this species.

Students will propose a monitoring plan to identify the effectiveness of conservation strategies for endangered species Black Cockatoos in Southwest Western Australia.

Key Points:

- Understanding ecological monitoring
- Recognising the challenges faced by endangered species like Black Cockatoos
- Exploring specific monitoring methods including Radio tracking and GPS tags and associated challenges.
- Analysing the impact of monitoring on conservation efforts
- Explain how scientific concepts are used to draw conclusions that are consistent with evidence

Previous class time or as ‘homework’:

Watch the *Black Cockatoo Crisis* Documentary film.

Preparation

Watch the *Black Cockatoo Crisis* film (at school or as homework).

Access Options:

Vimeo:
https://vimeo.com/ondemand/blackcockatoocrisis

SBS On Demand:
https://www.sbs.com.au/ondemand/movie/black-cockatoo-crisis/2295518787622

Clickview:
https://launch.clickview.net/open?AppLink=video:79607552

Think-Pair-Share

Decide on your own ideas, write them down then discuss with a partner:

“Why is important to monitor endangered species in their natural habitat?”

Black Cockatoos in Southwest WA

South-western Australia is home to three species of black-cockatoos: Baudin's Black-Cockatoo; Carnaby's Black-Cockatoo; and the Forest Red-tailed Black-Cockatoo.

All three species are listed as threatened or endangered under state and federal legislation.

In the last 50 years, the population of Carnaby's Black-Cockatoos in the Perth–Peel area has declined by about 50%

Their range has contracted by up to a third; similar contractions have been estimated for Baudin's and Forest Red-tailed Black-Cockatoos

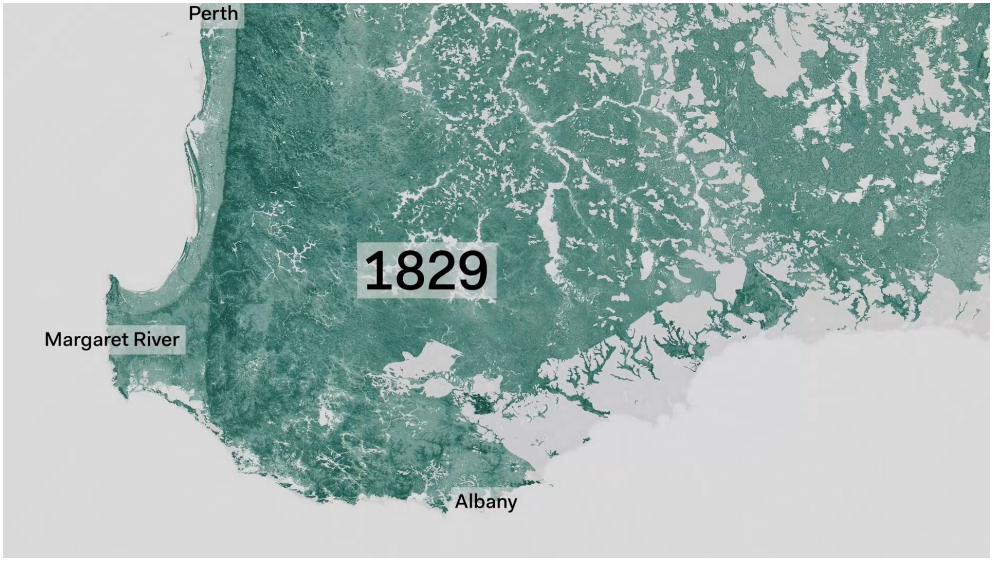
Though black-cockatoos are long-lived, few chicks survive to adulthood. The destruction of nesting sites makes it more difficult for them to breed, so the population is likely to be ageing.

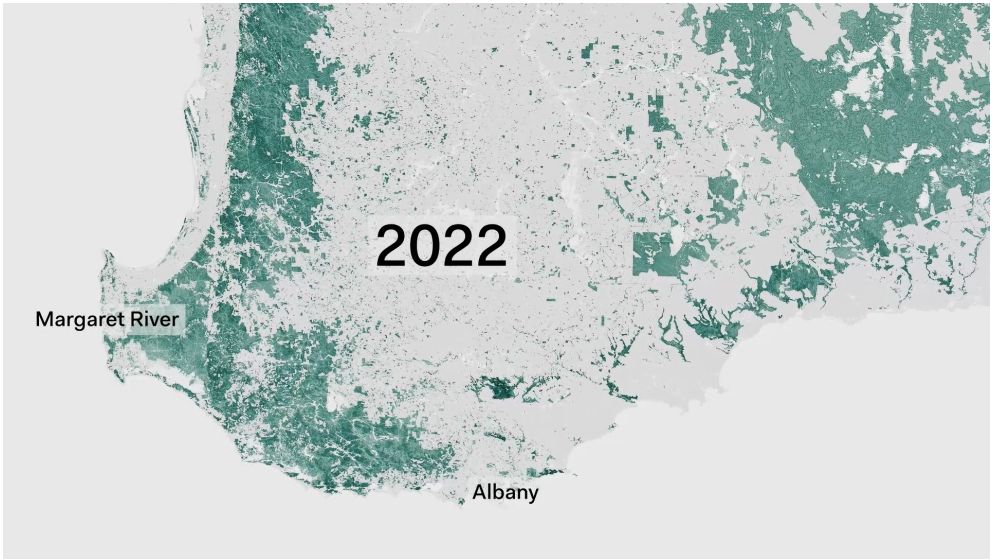
(Birdlife Australia, 2024)

Why are WA's Black Cockatoos disappearing?

The decline has been mainly caused by a loss of habitat and breeding sites.

Approximately 87% of Black Cockatoo habitat has been cleared of native vegetation since the 1950s.





Investigating the Distribution of Organisms

- The **distribution** of a species describes how it is spread throughout the ecosystem

- The **abundance** of a species is the number of individuals of that species

Estimating the size of a population

- Measuring all the different levels of biodiversity within an ecosystem could be very **time consuming**
- Finding out which species live in an ecosystem and the size of the populations requires the **identification and cataloguing** of all organisms present to build a **species list**
- This is possible for areas that are **very small** or where the species are **very large** like trees

Estimating the size of a population

- However, for larger and more complex ecosystems like rainforests, it is simply **impossible** to find, identify and count every organism that exists there

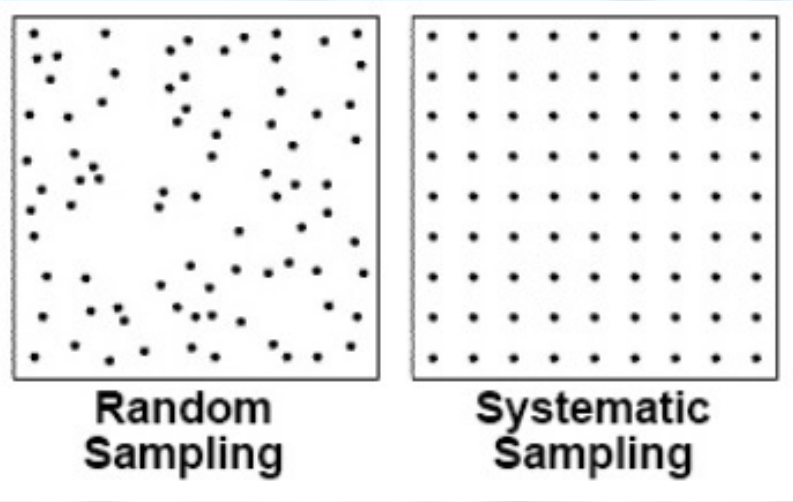
- When this is the case **samples** of the area can be taken and used to make an **estimate for the total** species numbers in the area
- Taking reliable measurements in the field requires measuring a sufficiently large, **representative sample** of the population.

Sampling

Sampling is a method of investigating the **abundance and distribution of species and populations**

There are two different types of sampling:

- **Random**
- **Systematic**

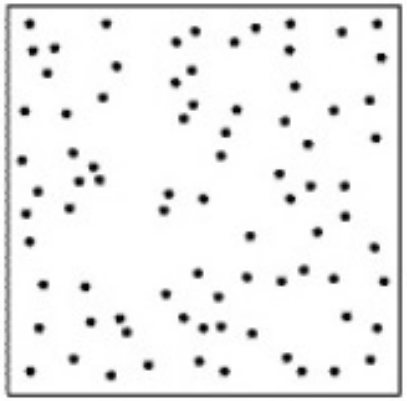


Random Sampling

In random sampling the positions of the **sampling points** are completely random or **due to chance**

This method is beneficial because it means **there will be no bias** by the person that is carrying out the sampling that may affect the results

- When a sampling area is **reasonably uniform** or has **no clear pattern** to the way the species are distributed then **random sampling** is the best choice

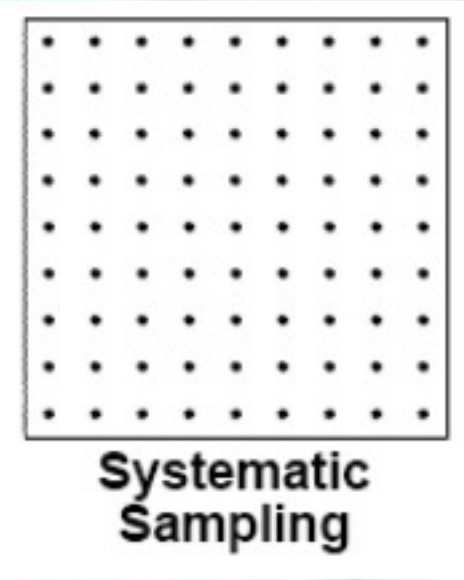


Random Sampling

Systematic Sampling

In systematic sampling the positions of the **sampling points are chosen** by the person carrying out the sampling.

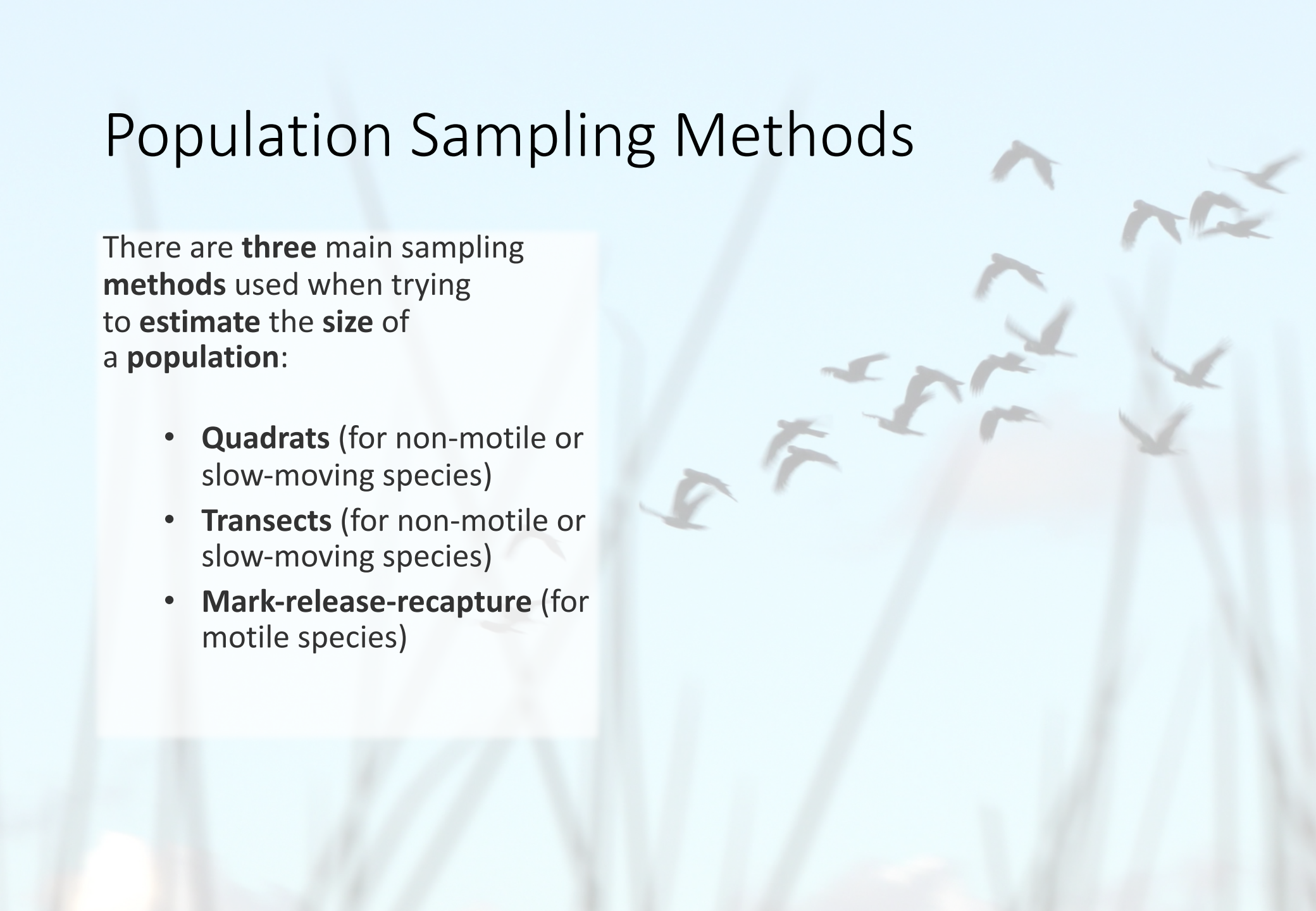
- There is a possibility that the person choosing could show bias towards or against certain areas
- Individuals may deliberately place the quadrats in areas with the least species as these will be easier and quicker to count which is unrepresentative of the whole area



Population Sampling Methods

There are **three** main sampling **methods** used when trying to **estimate** the **size** of a **population**:

- **Quadrats** (for non-motile or slow-moving species)
- **Transects** (for non-motile or slow-moving species)
- **Mark-release-recapture** (for motile species)



Population Sampling Methods

Different techniques are suitable for different types of studies. The method selected for sampling a population is an important component of the experimental design.

Technique	**Main Uses & advantages**	**Disadvantages**
Quadrats	Investigating abundance, density and diversity. If sufficient quadrats are used sampling should accurately represent the ecosystem.	Only useful for species that do not move (non-motile/immobile).
Transects	Investigating abundance and diversity along an axis. Can show changes across a changing area (spatial studies).	Only useful for species that do not move (non-motile). May not accurately represent the whole community (might miss species)
Electrofishing	Investigating abundance and diversity of fish species.	Limited application
Capture-recapture	Estimating population size of mobile animals.	Animal and human safety risks, ethics, specific timing required for accurate results.

Sampling Methods

The **distribution** and **abundance** of non-motile or slow-moving species in an area can be assessed using two different practical methods:

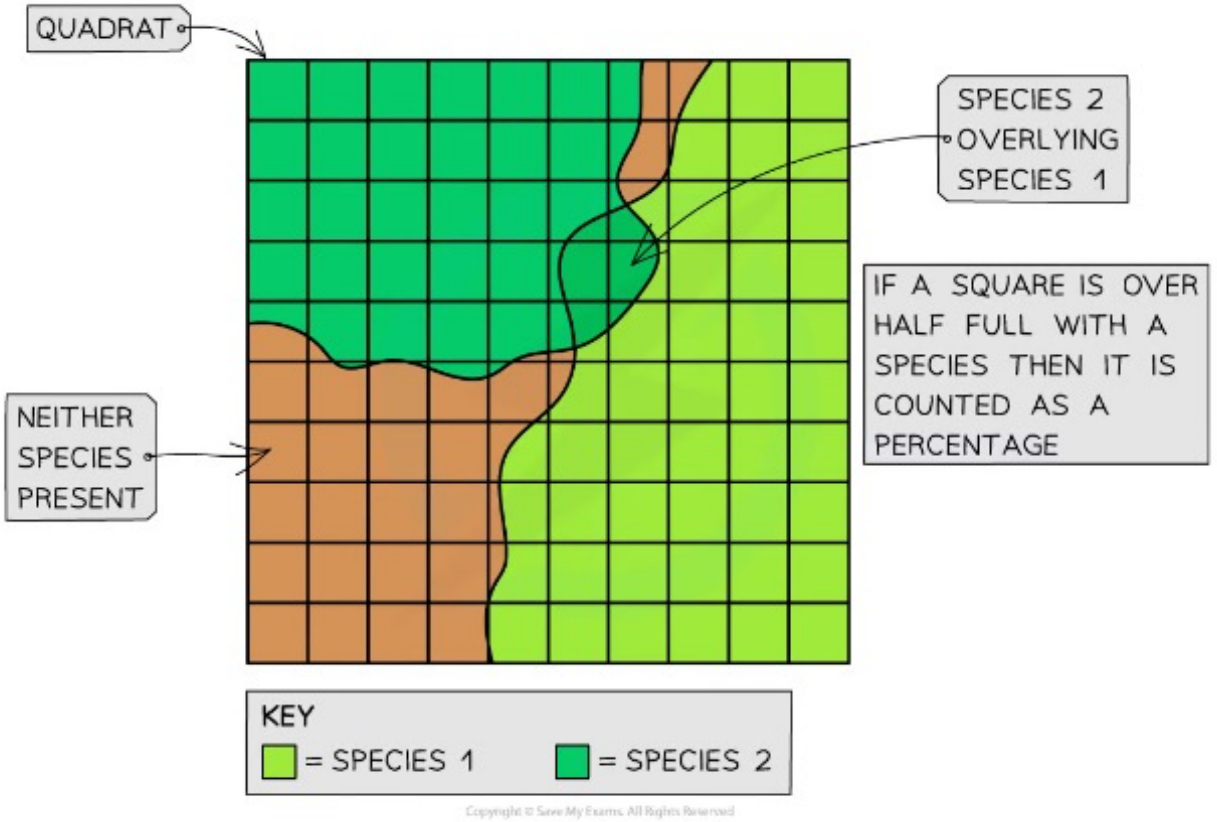
- Frame **Quadrats**
- Belt **Transects**

To asses the distribution and abundance of motile species different methods are required

- **Mark-release-recapture, including radio tracking and/or GPS tags.**

Sampling with Frame quadrats

- When sampling vegetation, square frames called **quadrats** can be used to mark off the area being sampled.
- Quadrats **size** depends on what is being measured and what is most suitable in the space being sampled.
- Once the quadrat is laid on the sample point the **abundance** of all the **different species** present is recorded.

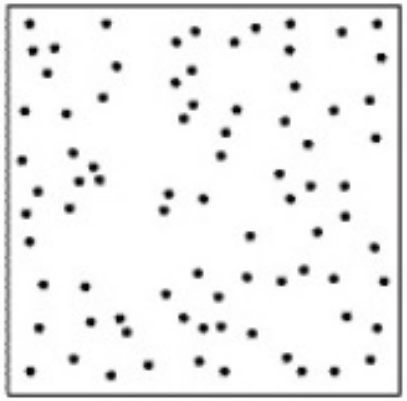


Using a quadrat to record percentage cover of two plant species. Some areas in the quadrat might not have any plants in them, while others might have multiple species. This means it is possible for the total percentage cover of a quadrat to be more than 100%.

Source: Lára@savemyexams

Random Sampling with Frame quadrats

- Quadrats must be laid **randomly** in the area to **avoid sampling bias**
    - This random sampling can be done by converting the total sampling area into a **grid format** and labelling each square on the grid with a number
    - Then a random number generator is used to pick the sample points



Random Sampling

Results from quadrats

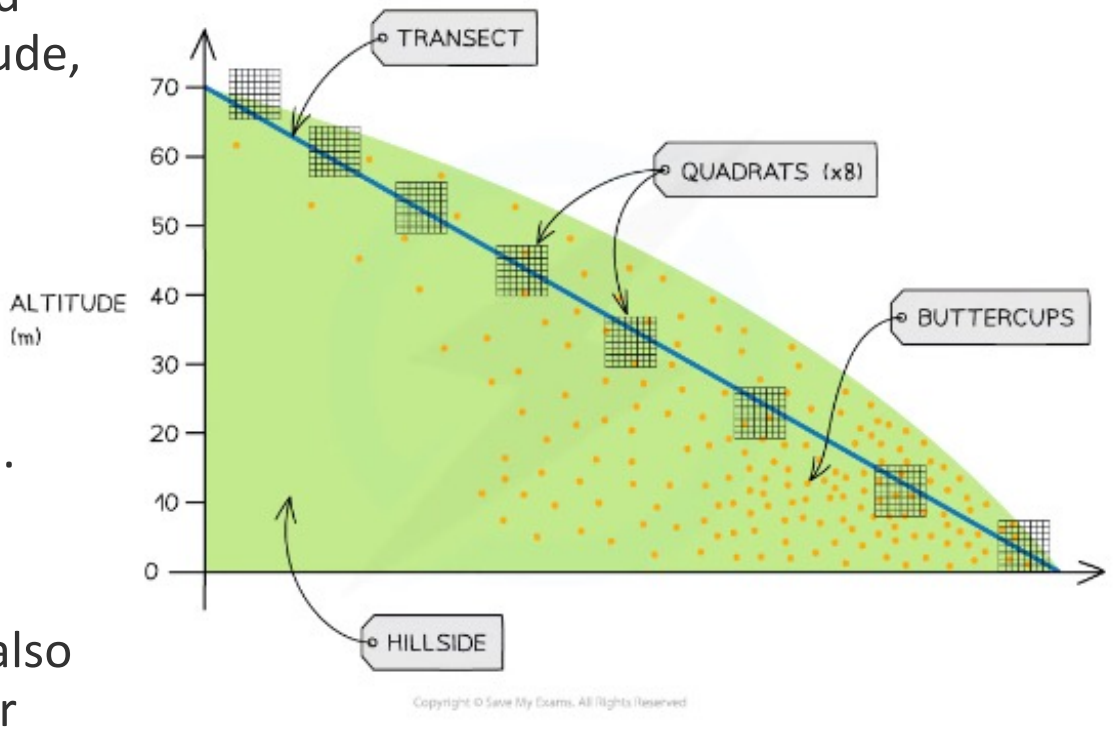
- Quadrat data can be used to calculate the predicted frequency and density of a species within an area.

- **Species frequency** is the probability that the species will be found within any quadrat in the sample area
  - The number of **quadrats** that the species was present in is divided by the total number of quadrats and then multiplied by 100
  - For example, if Banksia were found in 18 out of 50 quadrats the species frequency would be (18/50) x 100 = 36%

- It can be difficult to count individual plants or organisms. When this is the case **percentage cover** of the species within the quadrat can be estimated instead
  - The quadrat is divided into 100 smaller squares. The number of squares the species is found in is equivalent to its percentage cover in that quadrat
  - For example, if grass is found in 89 out of 100 squares in the quadrat then it has a percentage cover of 89%

Systemic sampling with Belt Transects

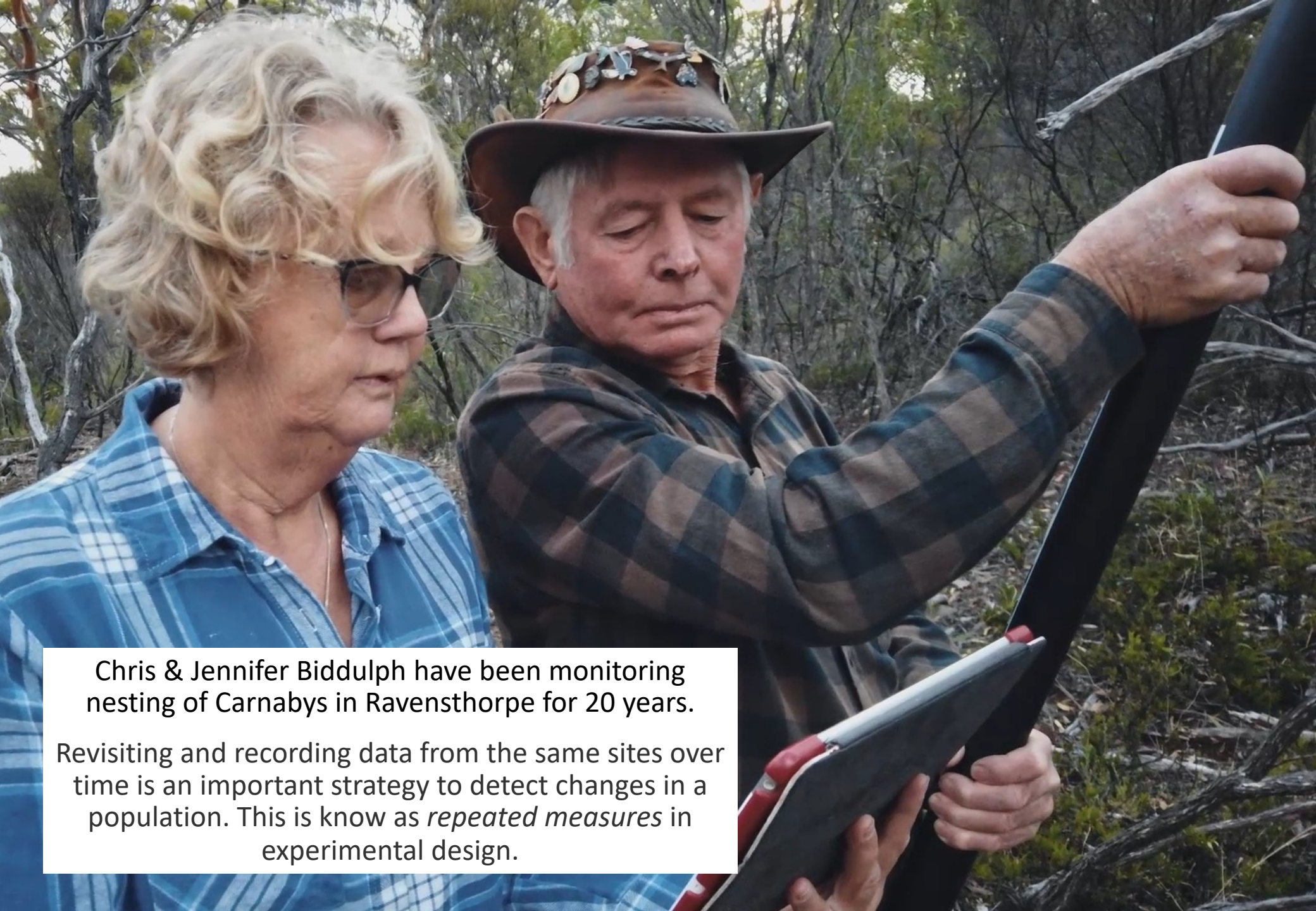
- In some areas changes in abiotic factors may effect abundance and distribution (e.g. changes in altitude, soil type, pH or light intensity).
- In these situations **systematic sampling** is more appropriate.
- A transect is a line is represented by a measuring tape, along which quadrat samples are taken.
- A belt transect method records the distribution or abundance of a species along a specific line also recording measurements of other target variables.



Using a transect on a hillside to measure abundance of buttercups with changing altitude. Quadrats are placed every 10m along the transect line and number of specie present is counted (e.g. buttercups).

Source: Lára@savemyexams

Dr Simon Cherriman checking nesting boxes in Black Cockatoo breeding habitat during breeding season to record any evidence of breeding success.



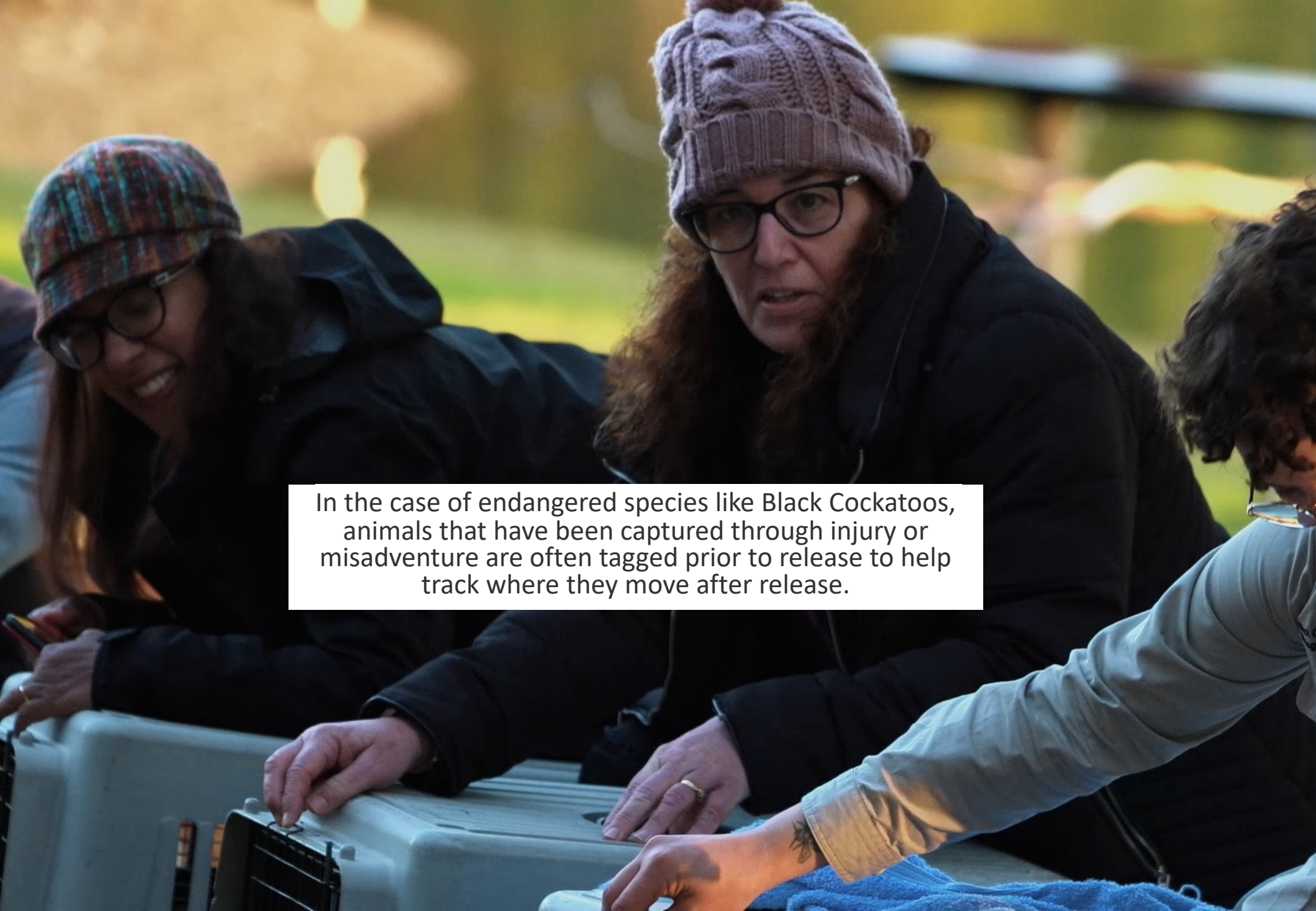
Chris & Jennifer Biddulph have been monitoring nesting of Carnabys in Ravensthorpe for 20 years.

Revisiting and recording data from the same sites over time is an important strategy to detect changes in a population. This is know as *repeated measures* in experimental design.

Sampling with Capture-Mark-Recapture

- Capture-recapture methods are used for estimating population size of animals that move around.
- For a single species:
  - A For a single species in the area:
  - The first large sample is taken. As many individuals as possible are caught, counted and marked in a way that won't affect their survival e.g. bird leg bands, ear tags, paint markings).
  - The marked individuals are returned to their habitat and allowed to randomly mix with the rest of the population
  - After a sufficient amount of time has passed another large sample is captured and the number of marked and unmarked individuals within the sample are counted
  - The proportion of marked to unmarked individuals is used to calculate an estimate of the population size
  - The formula for the calculation is:

$$\textbf{Population Estimate} = \frac{(\text{number of } \textit{marked individuals released} \times \text{total individuals caught in the second sample})}{\text{number of marked individuals in the second sample}}$$



In the case of endangered species like Black Cockatoos, animals that have been captured through injury or misadventure are often tagged prior to release to help track where they move after release.

Attaching a GPS and radio tag under anaesthetic to a Carnaby's Cockatoo due to be released.

Attaching tags under anaesthetic to a Carnaby's Cockatoo due to be released.

Figure 2. Double-mount of satellite and GPS tags dorsally on a black-cockatoo: Microwave Telemetry PTT-100 (at right) attached to dorsal aspect of central rectrices, and UvA-BiTS (5CDLe) (at left) attached to the feathers on the back of a Carnaby's Black-Cockatoo. Photo: Lian Yeap & Jill M. Shephard

Yeap, L., Shephard, J. M., Bouten, W., Jackson, B., Vaughan-Higgins, R. J., & Warren, K. (2017). Development of a tag-attachment method to enable capture of fine- and landscape-scale movement in black-cockatoos. Australian Field Ornithology, 34, 49–55.https://researchportal.murdoch.edu.au/esploro/outputs/journalArticle/Development-of-a-tag-attachment-method-to/991005543003707891

Releasing the tagged Black Cockatoos.


Tag visible on released
Red-tail Black Cockatoo
in flight.

Electronic tracking tools

- Advancements in technology help scientists monitor birds, especially across long distances and in remote areas.
- One way scientists reach beyond park boundaries is through attaching electronic tracking devices, or tags, to birds.
- Tags are particularly important when monitoring migratory birds or birds that cover large areas in their normal movement.
- Once flocks of birds are located, measures of relative abundance can be obtained by using the simple line transect, simple point count, fixed-width line transect, and fixed-radius point count methods.
- Population trends during the same season each year can be detected by using the same trends as those used for relative abundance.

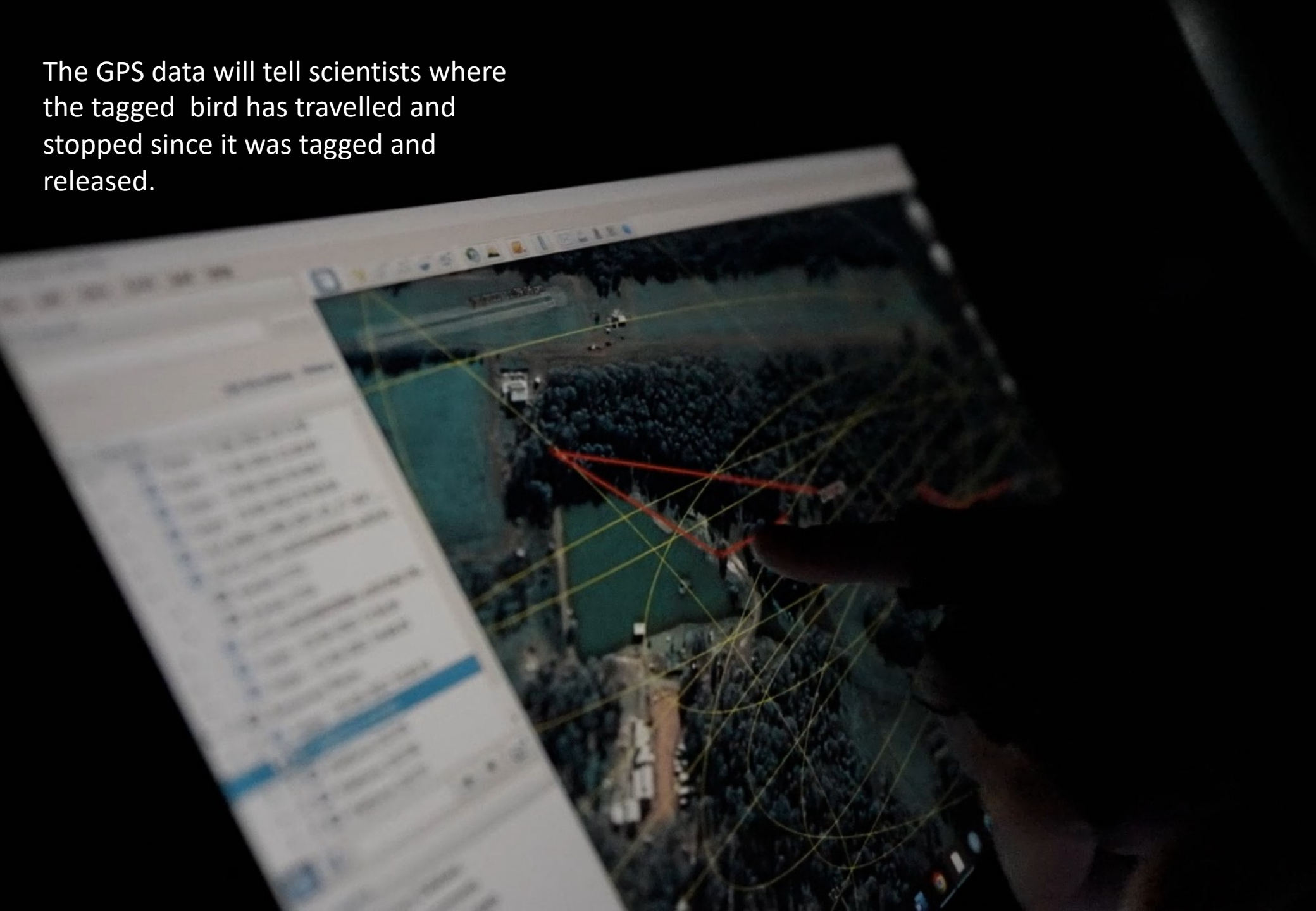
Radio tracking to try and find a flock of Black Cockatoos

Once you get a radio tracking signal you follow it to get as close to the flock as possible, then wait patiently until they roost at night.

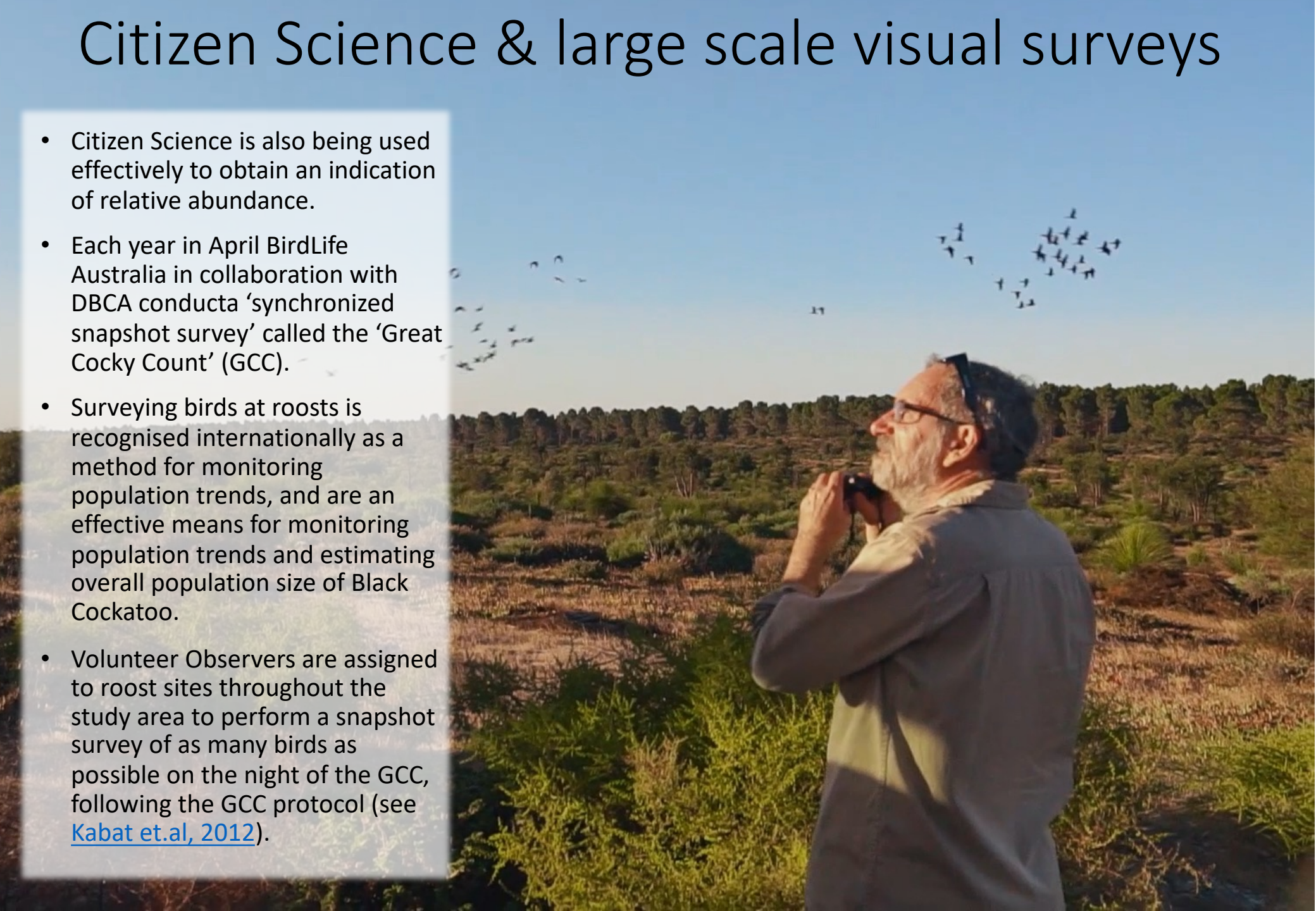
At night when the Cockatoos are all roosting the researcher must sneak close enough to receive a signal from the GPS tracking device

Then they must quickly and quietly download the data from the GPS data chip. If light or noise disturbs the birds and they fly away they will have to start all over again the next day.

The GPS data will tell scientists where the tagged bird has travelled and stopped since it was tagged and released.



Citizen Science & large scale visual surveys



- Citizen Science is also being used effectively to obtain an indication of relative abundance.
- Each year in April BirdLife Australia in collaboration with DBCA conducta ‘synchronized snapshot survey’ called the ‘Great Cocky Count’ (GCC).
- Surveying birds at roosts is recognised internationally as a method for monitoring population trends, and are an effective means for monitoring population trends and estimating overall population size of Black Cockatoo.
- Volunteer Observers are assigned to roost sites throughout the study area to perform a snapshot survey of as many birds as possible on the night of the GCC, following the GCC protocol (see Kabat et.al, 2012).

Learning Activities:

1. Use the film and documents available from the reference list to research and create a monitoring plan for Black Cockatoos.

   Include details on the methods you would use and why these methods are suitable for this species.

Learning Activities:

2. Create a poster to explain how radio tracking and GPS tags work to collect data on the habitat use and movement of Black Cockatoos.

3. Research and write a short reflection on the role of ecological monitoring in protecting endangered species like Black Cockatoos.

4. Write a short paragraph explaining what you think it would be like conducting the fieldwork that Molly, Zoe and Jill were shown doing in the film.

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