CREEM MURAL

Find the number or letter
and learn about our research

Population size and density

One of the most fundamental questions we can ask about a population is *"How many are there?"*

We develop new survey design and analysis methods for estimating population size.

1 Spatial Capture Recapture
- used when animals can be individually identified and are detected at multiple locations

2 detector locations in a spatial capture recapture study - red locations detected the frog (g) using PAM (6)

3 Distance sampling
- counting animals from random transects and recording the distance to detected animals

4 Mark-recapture distance sampling
- distance sampling methods for studies with imperfect detection on the transect

5 Cue counting
- surveying for cues the animals produce, e.g., whale blows or bird songs

6 Passive acoustic monitoring (PAM)
- methods for estimating abundance of animals by monitoring the sounds they produce

Mark recapture (see a)
- estimating animal abundance and survival rates from multiple captures

Biodiversity

A key conservation goal is to maintain biodiversity -- but it is hard to quantify. We research biodiversity measures and how they change in space and time.

7 Turnover
- models describing changes in species composition within a community over time

Bayesian methods

Methods of statistical inference that allow the use of prior knowledge as well as data.

16 Bayes theorem
- is at the heart of many of the methods we use

Spatial distribution and movement models

Understanding animal habitat preferences and movement patterns is key to effective conservation. We develop new types of spatial models.

Spatial models 8
- statistical models that describe where objects (animals or plants) are in space

Spatial point process 9
- a model describing spatial patterns formed by objects using point locations

Density Surface Model 10
- spatial models applied to distance sampling data (see 3)

Splines 11
- smooth functions often used for spatial models

Hidden Markov models 12
- describe how an unknown quantity (such as behavioural states of animals) changes over space and time

Dive profiles 13
- show how the depth of a diving animal changes over time

Movement modelling 14
- describes how and why animals move in space and time

Environmental impact

We develop new methods for quantifying environmental impact of human activities.

Passive sonar equation 6
- model for how sounds propagate over space, used for modelling the spread of human-caused noise as well as the "acoustic space" of vocalizing animals

Effects of underwater noise 15
- study of how human-caused noise affects the behaviour, health and survival of animals

Sound exposure experiments 15
- scientific experiments to test the response of animals to human-caused sounds

Spatial models for understanding animal distribution 11
- includes power analyses to assess potential impacts of wind farm construction

a Humpback whale
- Humpbacks are studied using mark-recapture, as the markings on the underside of the fluke allow individual identification

b Spotted and spinner dolphins
- have been heavily impacted by fishing for tuna in the eastern tropical Pacific and are monitored using large scale distance sampling surveys

c Blainville's beaked whale
- these deep divers are studied using tags that record depth, orientation and sound

d Grey seal
- we use tags to learn about their movement patterns and preferred habitat

e Laysan albatross
- seabirds move faster than the ships they are often surveyed from, which can be accounted for by incorporating movement into distance sampling models

f Trees
- the way by which trees distribute themselves in the landscape or forests can be described with spatial point process methods

g Cape peninsula moss frog
- their individual sounds can be identified across multiple detectors

h Jaguar
- camera traps capture the distinct spot pattern of individuals for spatial recapture methods

i Giraffe
- large terrestial animals are monitored in Namibia using spatial models from data collected with drone-based high-resolution imagery

Cotton-top tamarin j
- are hard to see; we developed a call playback method for the first ever population survey

Robin, blue tit and great spotted woodpecker k
- distance sampling surveys are the basis for a long-term monitoring programme of abundances and biodiversity of British breeding birds

Loggerhead turtle l
- turtles are studied at sea using distance sampling methods (see 3)

Gopher tortoise m
- are studied using distance sampling methods that take into account that a proportion of them cannot be detected as they are hidden in their burrows

Bat-eared fox n
- was one subject of a trend analysis of Serengetti carnivores based on distance sampling methods

Little owl o
- the distribution of little owls in parts of Europe is studied via spatial models

Photographed by Thomas Rodger p
ThomasMaxwellRodger.com

Painted by Cornelia Oedekoven q
tiny.cc/CorneliaOedekoven

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For more information on the animals and research, see
creemmural.org

CREEM
Centre for Research into Ecological and Environmental Modelling