Ecological data & distributions

Analysis of Ecological and Environmental Data

QERM 514

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3 April 2020

Goals for today

- Identify features of data that drive analyses
- Think critically about what the data *could* tell you

General approach

Question → Data → Model → Inference → Prediction

General approach

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Common questions in ecology

At the individual level

Sex?

Fecundity?

Growth?

Survival?

Movement?

Common questions in ecology

At the population level

Abundance?

Survival?

Spatial distribution?

Movement/migration?

General approach

Question → Data → Model → Inference → Prediction

Ecological data

At the individual level

1 Detection → presence/absence

2+ Detections → survival, movement

Ecological data

At the individual level

1 Detection → presence/absence

2+ Detections → survival, movement

1 Measurement → fecundity, age, size

2+ Measurements → growth

Ecological data

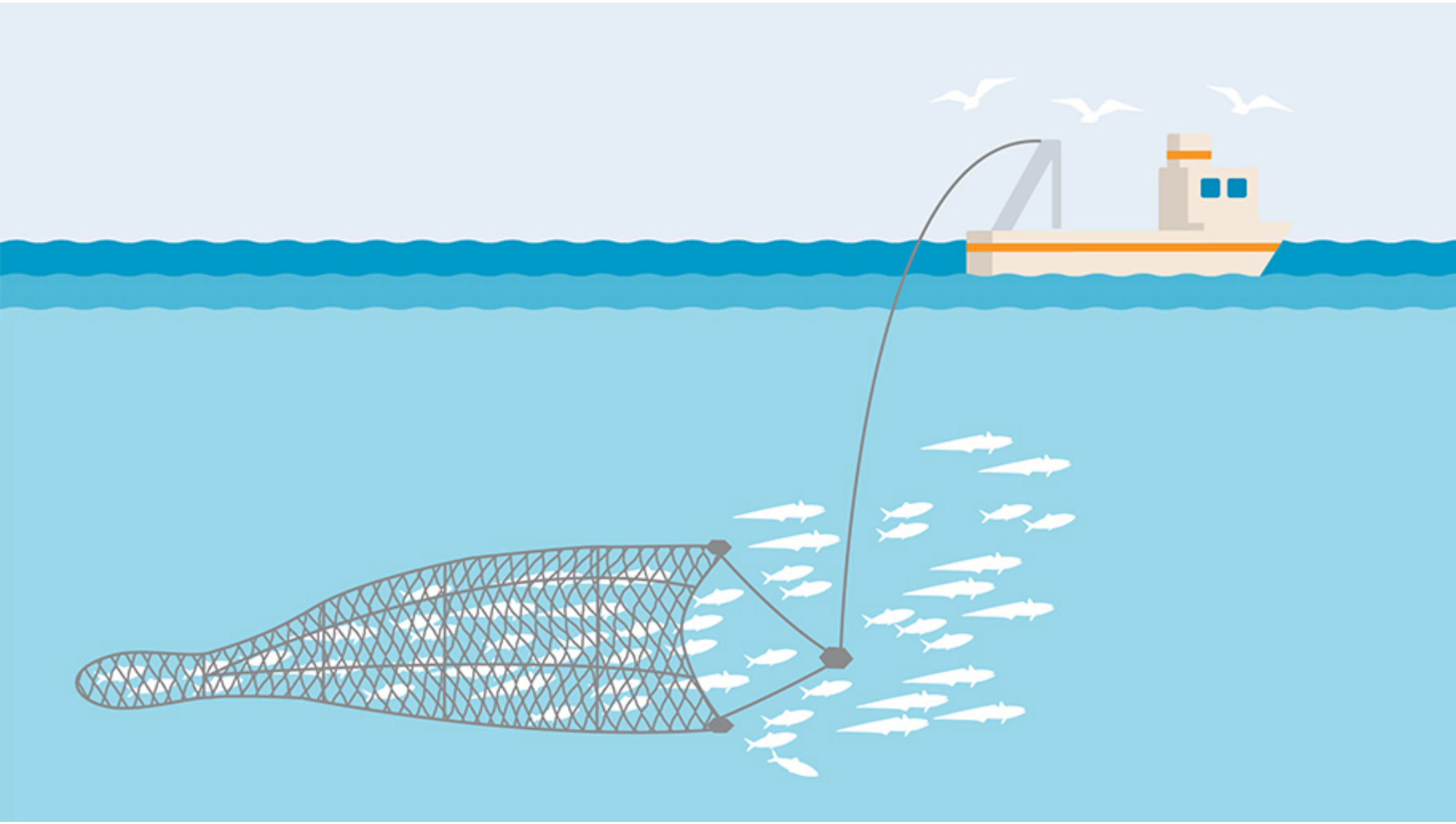
At the population level

Detections → presence/absence

Counts → density or survival/movement

Data collection methods

Nonexhaustive counts



Data collection methods

Exhaustive counts

Data collection methods

(Non)exhaustive surveys

Depletions

Data collection methods

(Non)exhaustive surveys

Depletions

Capture/Tag/Recapture


© CLEvans

Data types

Discrete values

Sex

Age

Fecundity

Counts/Census

Survival (individual)

Data types

Continuous

Size (length, mass)

Density

Survival (population)

A note on continuous variables

Approximating rational numbers with real numbers

Survival (7 of 9 survived ≈ 0.78)

Composition (4 age-3, 18 age-4, 11 age-5 $\rightarrow$ ~55% age-4)

Density (3 animals in 21 ha plot ≈ 0.14 per ha)

A note on continuous variables

Approximating rational numbers with real numbers

Which of these give you more confidence?

A) $3 / 9 \approx 0.33$

B) $300 / 900 \approx 0.33$

The importance of raw data cannot be overstated

Distributions of data

Discrete distributions

Binary (0,1) → Bernoulli

Discrete distributions

Binary (0,1) $\rightarrow$ Bernoulli

Count $\left(\mathbb{Z}^{\geq}\right) \rightarrow$ Poisson or Negative-Binomial

Discrete distributions

Binary (0,1) $\rightarrow$ Bernoulli

Count $\left(\mathbb{Z}^{\geq}\right)$ $\rightarrow$ Poisson or Negative-Binomial

Composition $\left(S^{D}\right)$ $\rightarrow$ Binomial ($D = 2$) or Multinomial ($D > 2$)

Continuous distributions

Density $\left(\mathbb{R}^{\geq}\right) \rightarrow$ log-Normal or Gamma

Continuous distributions

Density $\left(\mathbb{R}^{\geq}\right) \rightarrow$ log-Normal or Gamma

Proportion $\left(\mathcal{C}^{D}\right) \rightarrow$ Beta ($D = 2$) or Dirichlet ($D > 2$)

Continuous distributions

Density $\left(\mathbb{R}^{\geq}\right)$ → log-Normal or Gamma

Proportion $\left(\mathcal{C}^{D}\right)$ → Beta ($D = 2$) or Dirichlet ($D > 2$)

Transformations $(\mathbb{R})$ → Normal