Depredation in Stock Assessment

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COLTO depredation workshop

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Outline

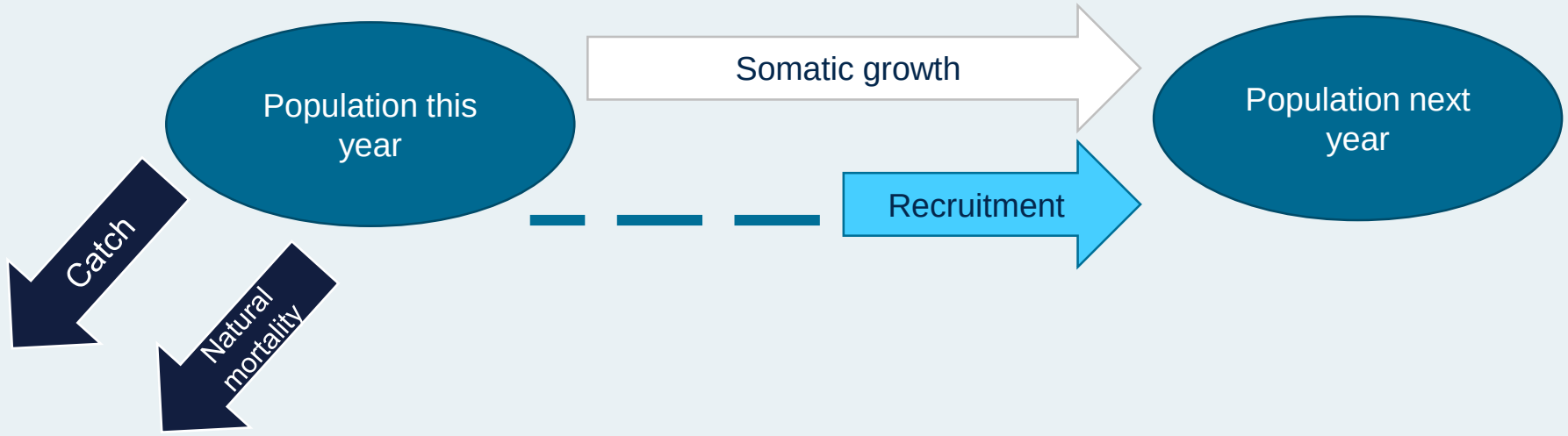
A. Background to stock assessment

B. What is the problem?

C. Estimating depredation

D. Summary

Biological production of population: Change in biomass



Population next year = Population this year + births + growth – deaths (Population growth)

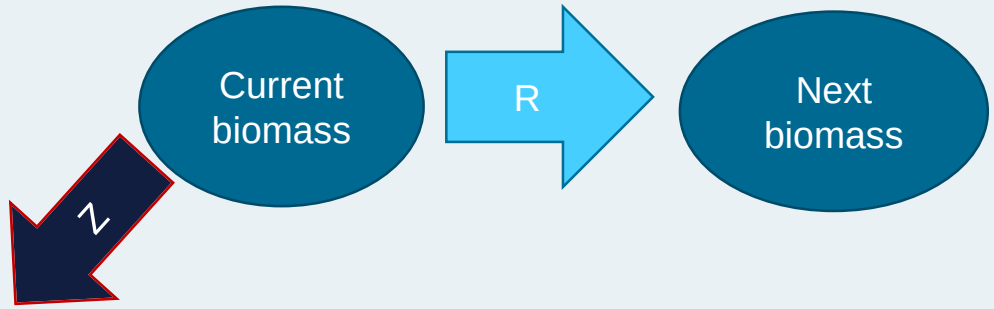
(Biological production)

Population next year = population this year + recruits + growth – (natural deaths + fishing deaths)

$$B_{t+1} = B_t + R + G \ (-M - F)$$

A. Background to stock assessment

Biological production of population: Change in biomass



Natural mortality

- Age
- Predation
- Sickness
- …

Fishing mortality

- Catch
- Depredation
- Damage
- …

B. What is the problem?

- Not including depredation == underestimating mortality
- Underestimating mortality == bias in stock assessment
- Bias in stock assessment == higher uncertainty
- Higher uncertainty == greater risk to stock

CCAMLR
CCAMLR decision rules

Non-CCAMLR: What are the safeguards?
Tier systems, safety margins, none?

Data collection:

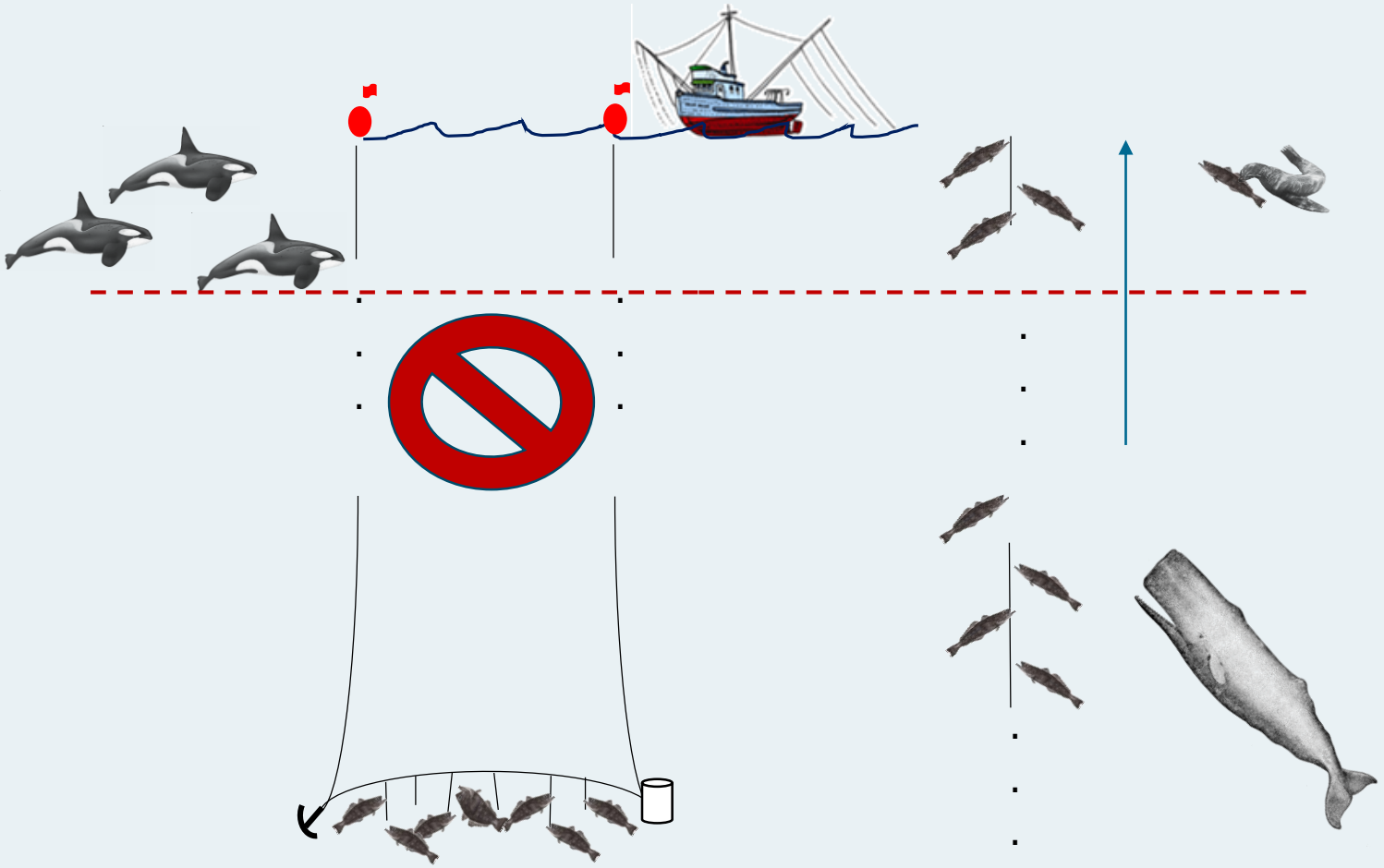
CCAMLR standard observer and vessel protocols
Collect: environmental, fishing, effort, operational, temporal and spatial data, standard across all CCAMLR areas

Observers collect biological data on target species and observations of mammals, birds: time, species, number, feeding: Standard across all CCAMLR areas

Some areas: extra data – Photography (population estimates, movements, culprit ID) standardised protocol available, behaviour, crew observations

Cryptic depredation: Guide to signs of depredation on toothfish at CCAMLR 2015 available for use

C. Estimating depredation



Theory:
Most (significant) depredators are depth-limited

Over given window (spatial/temporal):

- Calculate catch (CPUE) with and without presence/feeding of depredators

- Account for operational, spatial and temporal variables

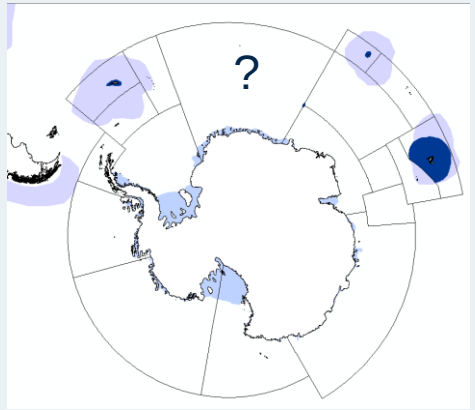
- Difference gives estimation of catch loss due to depredation

- Include loss into stock assessment

C. Estimating depredation

CCAMLR: All depredation-affected stock assessments estimate externally

- Statistical modelling
- Gasco method (see presentation N. Gasco)



48.3

Included since 2009 routinely

Estimation model review in 2013 (glm, gam, glmm, gamm)

Average estimation: ~ 5%

Kerguelen/Crozet

Included since 2014 for Crozet

Used model: safety margin
Model in prep (time series)

Average estimation: ~ 5% Kerguelen
~ 30% Crozet

Ob & Lena

Included since 2015

Used model: glm *and* Gasco bycatch (similar)

Average estimation: ~4% and ~25%

48.4, 48.6
HIMI
Ross Sea

No/minimal depredation

48.3

Average depredation for each year -> Depredation correction factor

Correct catches in CASAL input files

Standardised Catch per Unit Effort

Assessment output

D. Summary

- Depredation is an additional mortality to the stock
- Not including depredation == higher uncertainty

- Currently in CCAMLR: Depredation estimated externally to stock assessment calculation
- Catches corrected (?), CPUE standardised

- Different models used in different regions; need for comparability (CCAMLR review)

- ‘Lessons learned’ help other Subareas facing new depredation problem

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