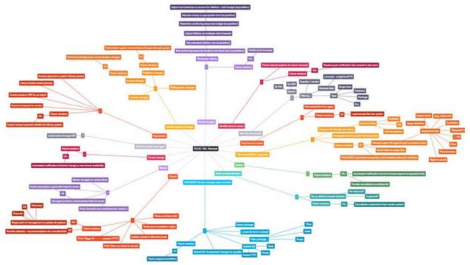
Causal modelling of climate-fish-fisheries. Confronting conceptual models with data.

Benjamin Planque, Etienne Hamard, Lucie Buttay

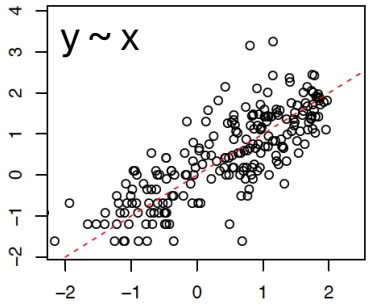
SES models come in various forms

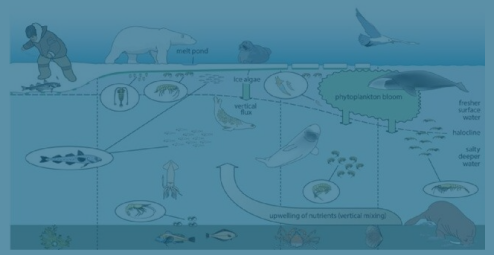
Conceptual



Interaction design foundation

Statistical

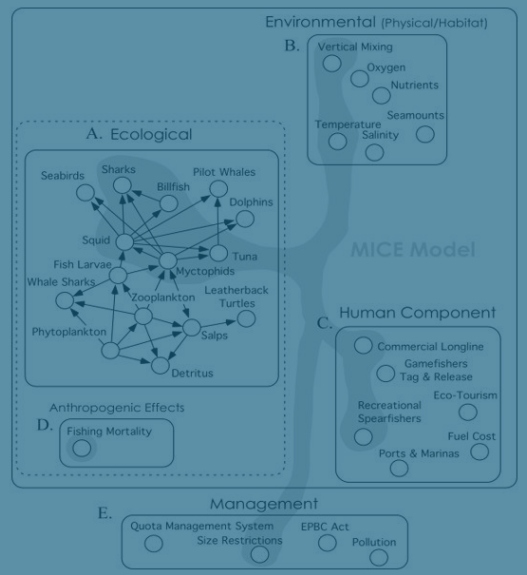




AMAP 2012

MICE

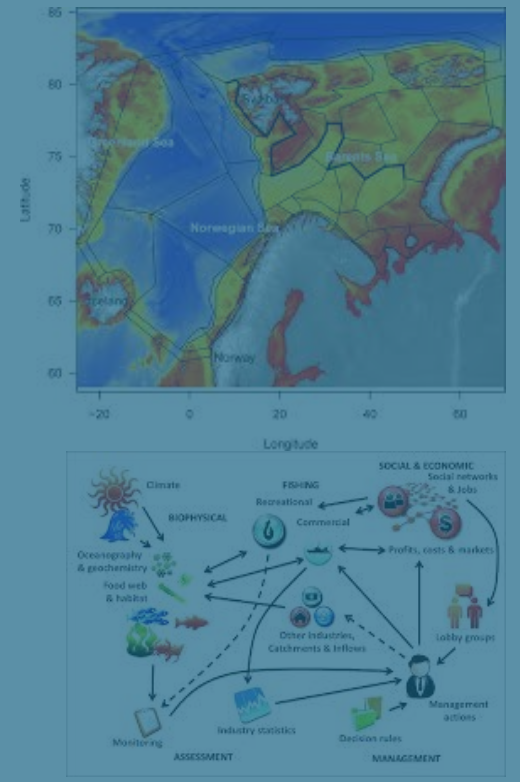
Models of Intermediate Complexity



Plagányi et al 2014

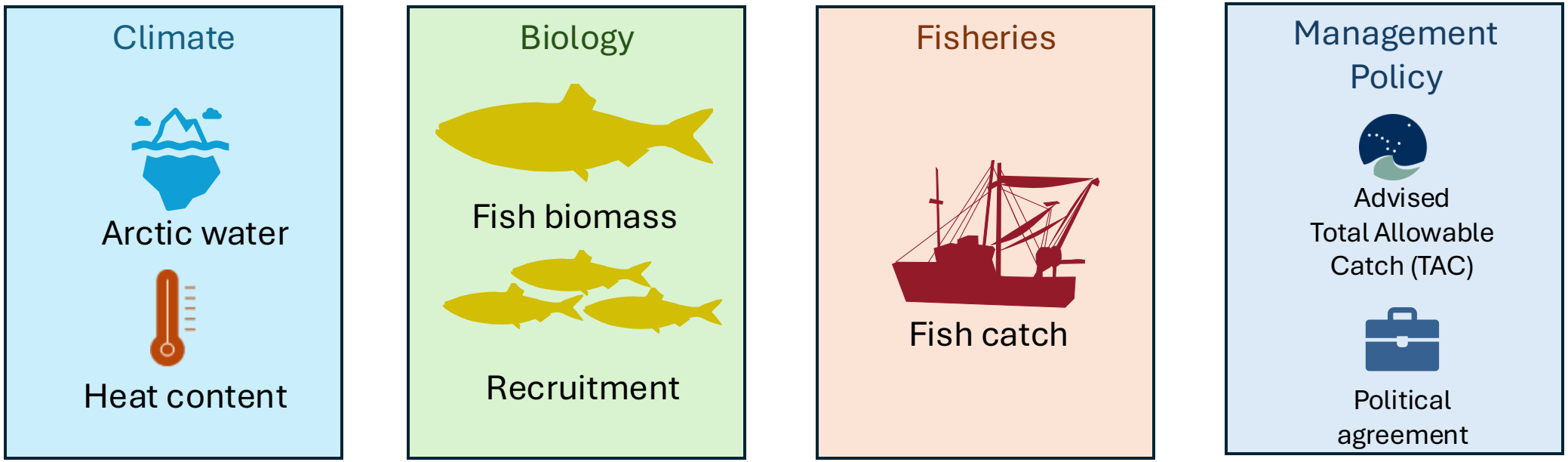
End-to-end

Whole of ecosystem models



A case study: Norwegian Sea fisheries

- Combined drivers of herring biomass in the Norwegian Sea
- Causal Structural modelling (~Bayesian Belief Networks)
- Informed by data = time-series



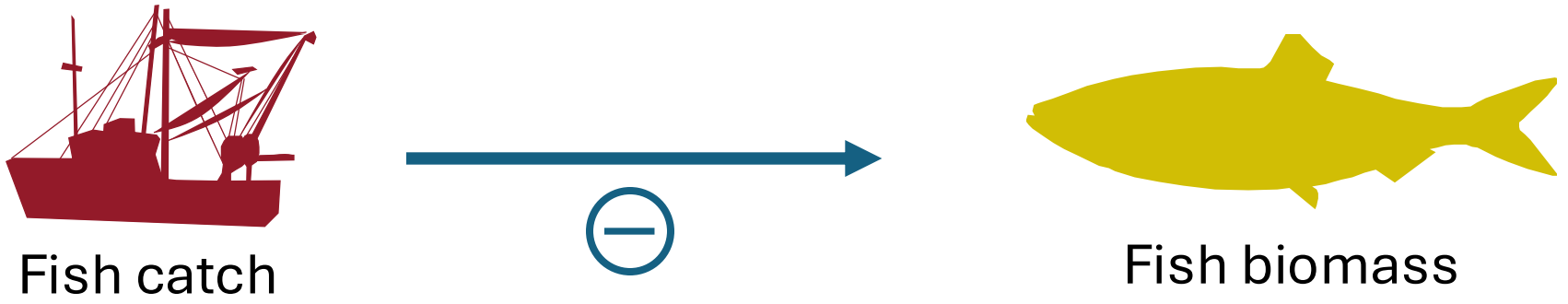
Take home message

- Incorporating data in a conceptual model
  - Is not trivial
  - Is often misleading
  - Must be performed iteratively
  - Can be insightful

- When successful
  - It provides quantitative estimates of cause-effect relationships

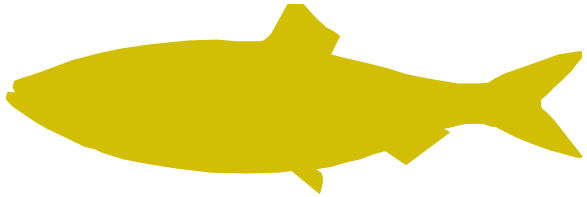
A simple conceptual model

A simple conceptual model



A simple conceptual model

Fish catch



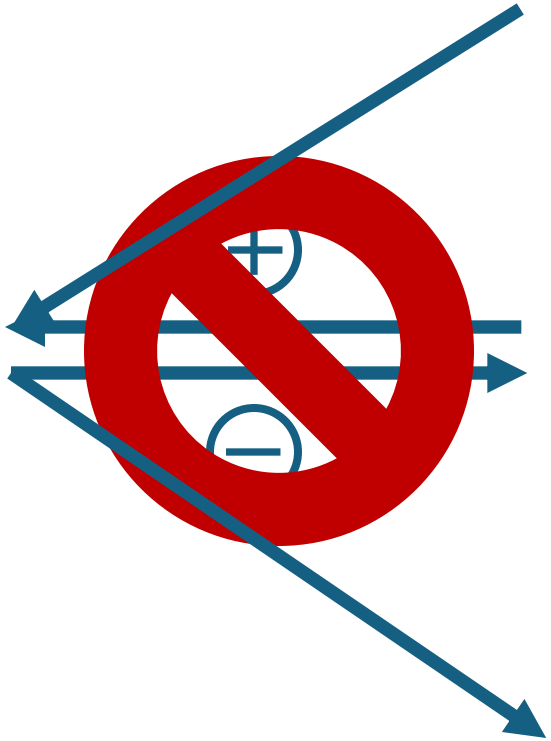
Fish biomass

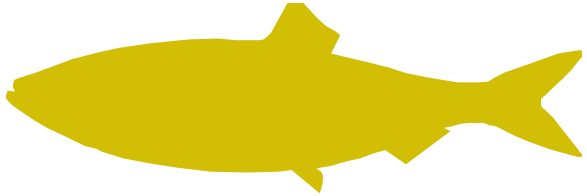
A simple conceptual model

past

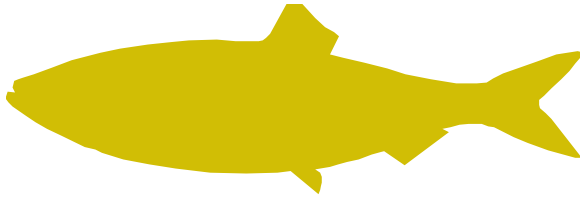
present

Fish catch





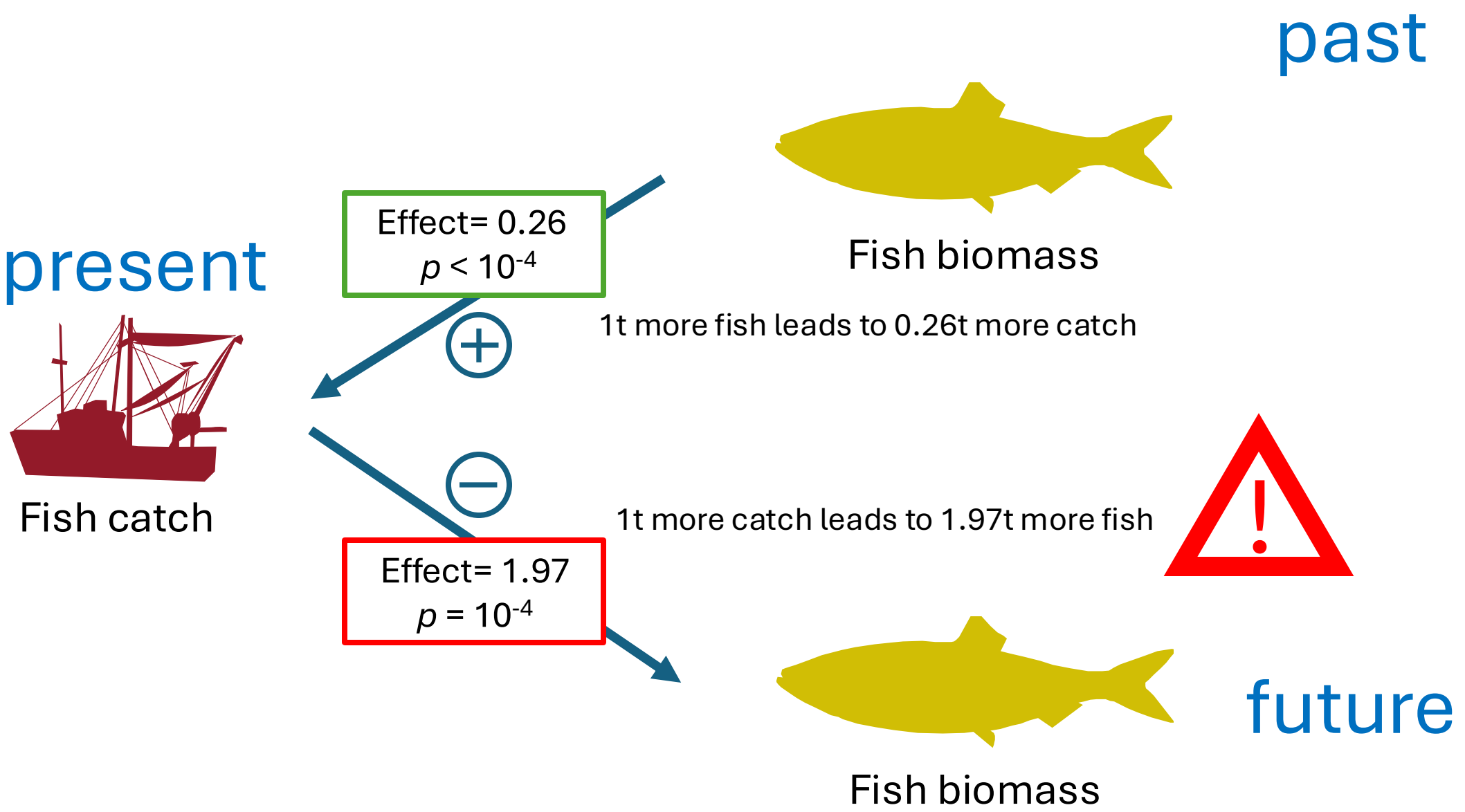
Fish biomass



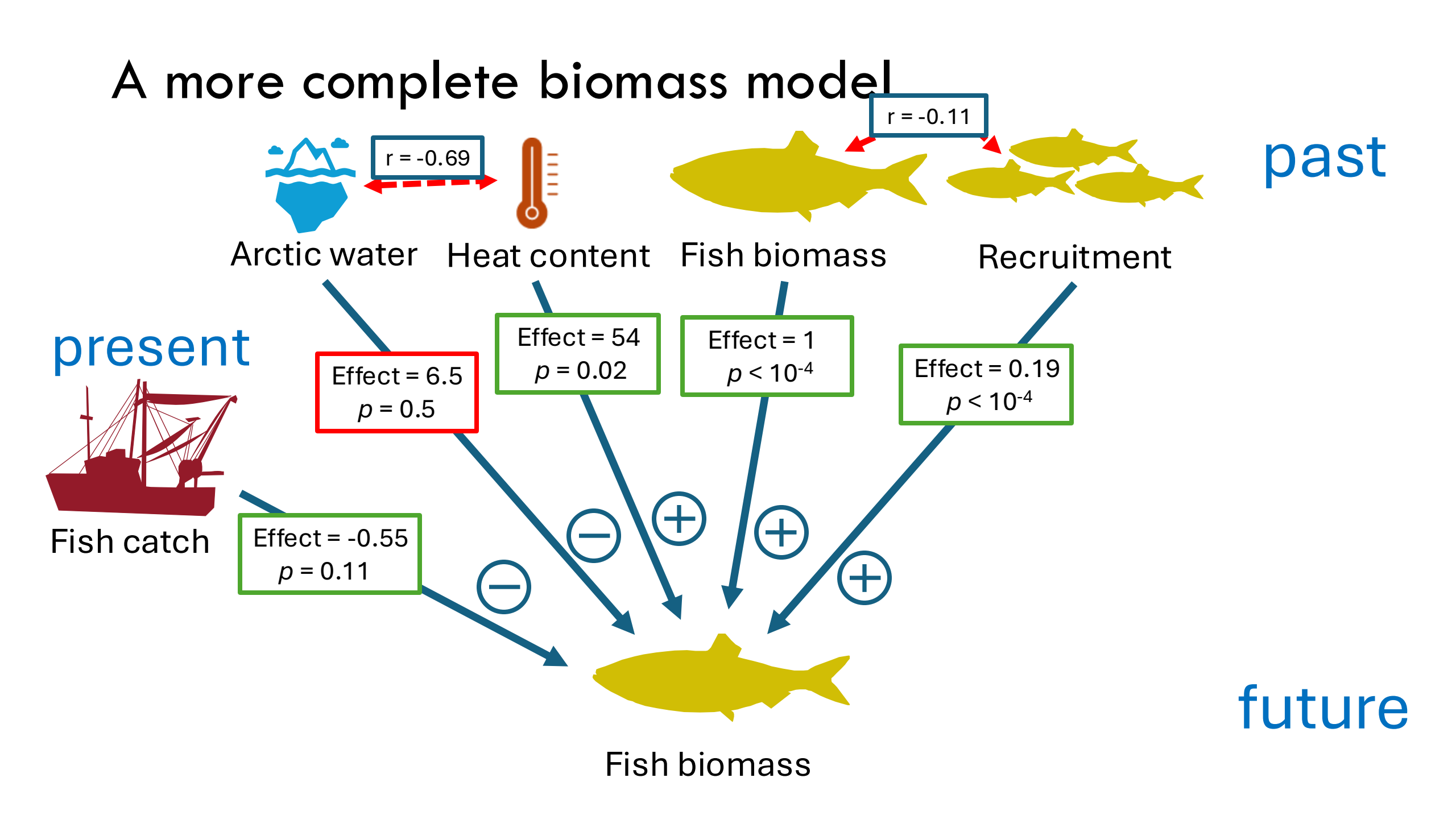
Fish biomass

future

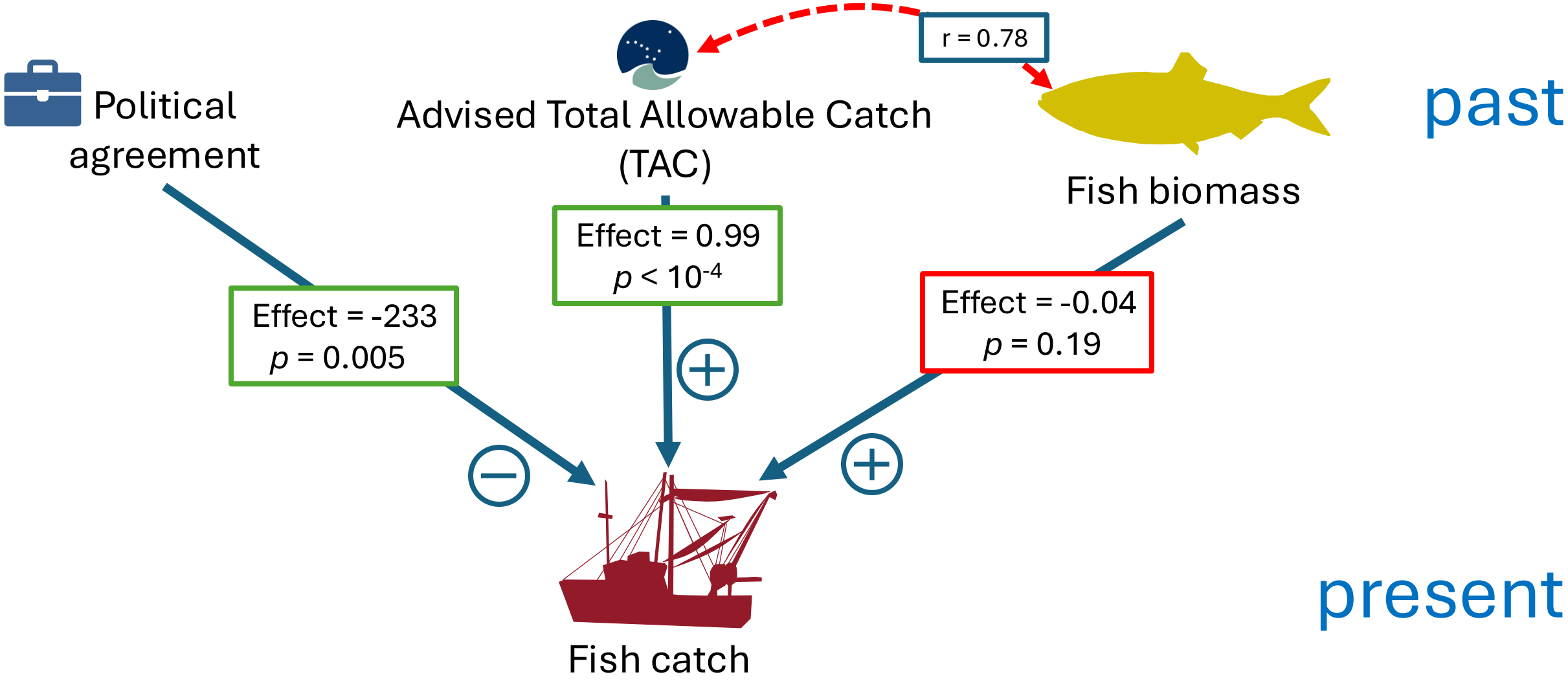
Estimating effects from observation data



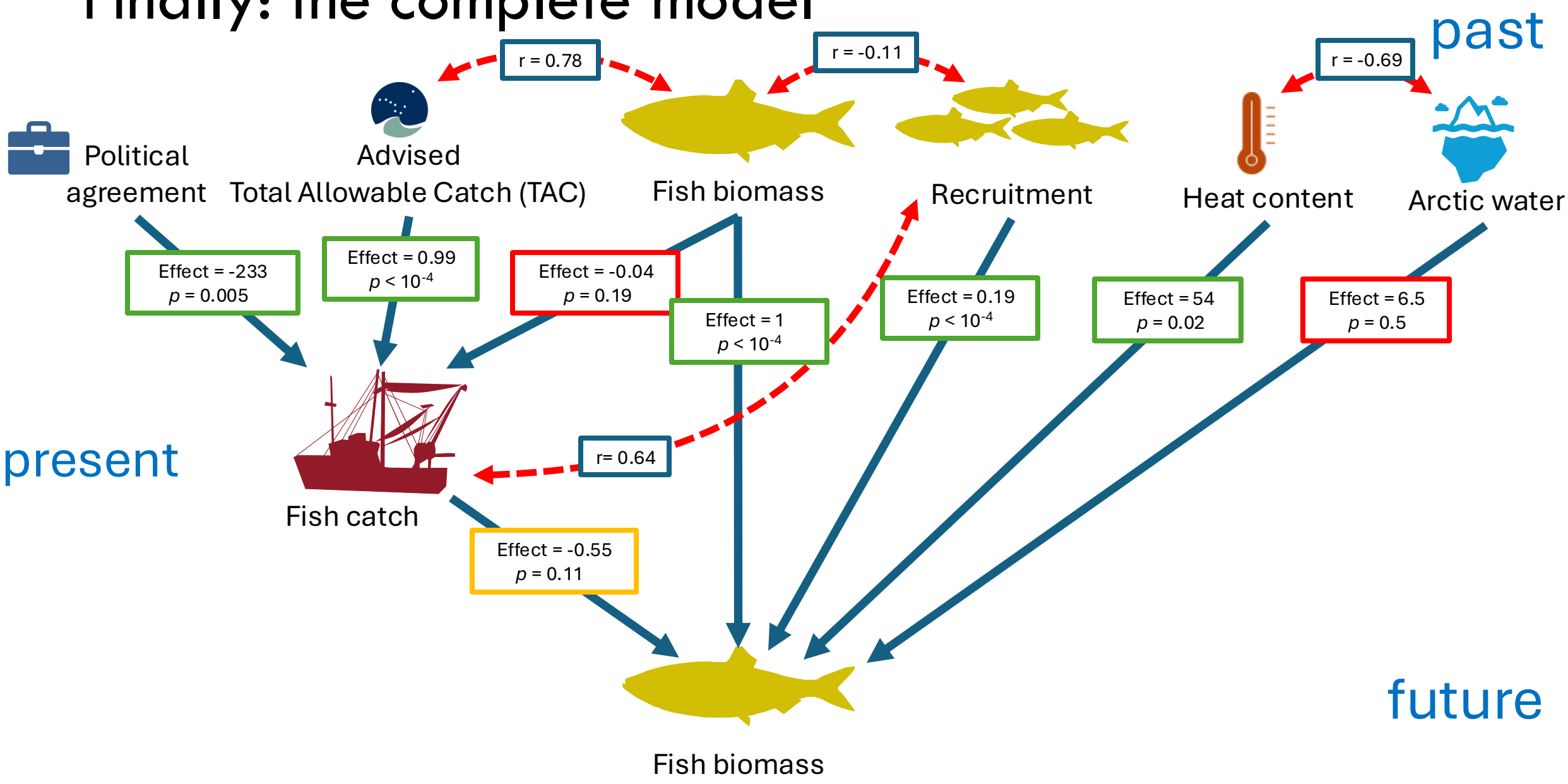
A more complete biomass model



A more complete catch model



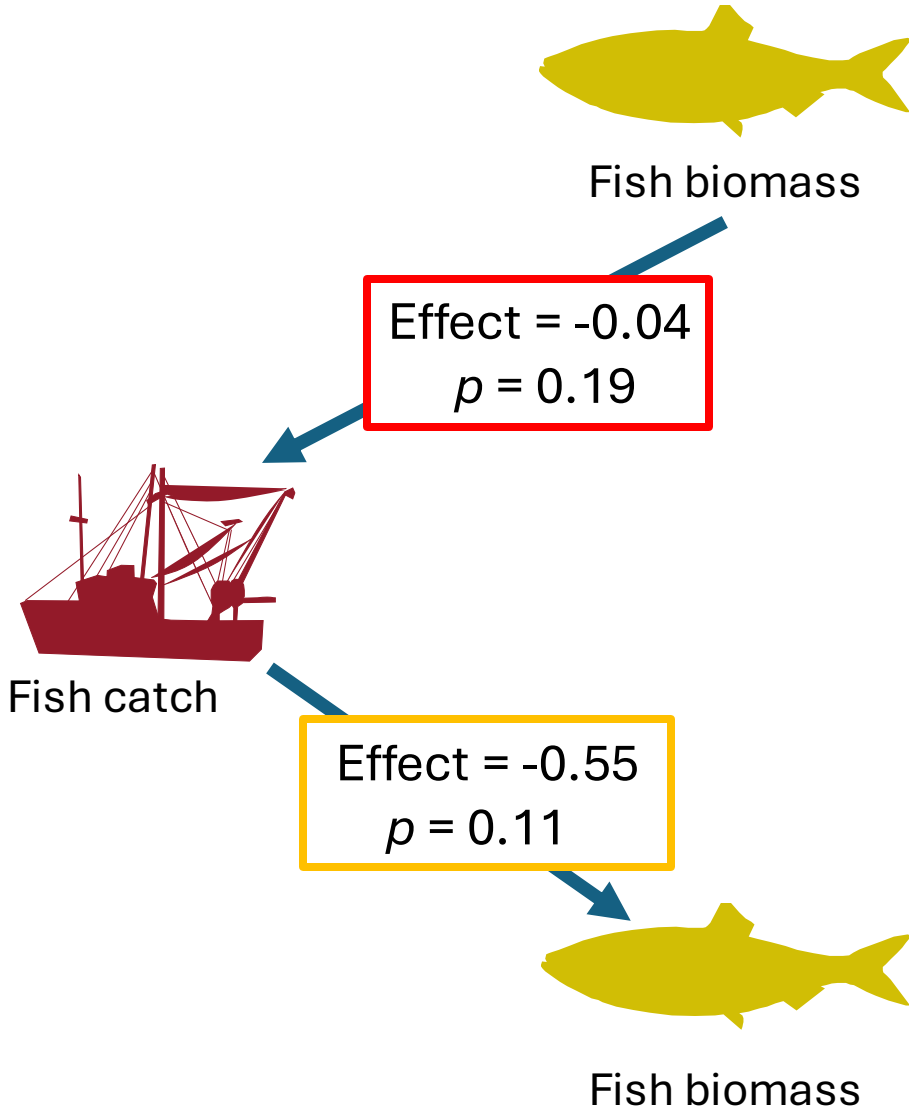
Finally: the complete model



Causal dependencies in complete vs simple models

past

present



Original model

Effect= 0.26
$p < 10^{-4}$

Effect= 1.97
$p = 10^{-4}$

future

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