The information value of full-retention policies

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  - Model structure
  - Scenarios
- Results
- Conclusions, limitations, future steps

Discarding in world fisheries

- Some fisheries discard up to 62% of total catch
- Mortality rate estimates vary wildly but rates are probably mostly high
- Waste of resources, but also distortion of data
- EU landing obligation
    - Waste and data distortion cited as reasons
    - ‘Right’ mix of quota necessary

Research questions

- How will a discard ban affect a mixed fishery under different quota policies?
- To what extent can the effects be attributed to improved data quality in stock assessments?

Model structure

- Stocks
  - Gordon-Schaefer growth with lognormal disturbance
  - Spence harvest
- Fleet
  - Maximize short-term rents
  - Effort, discarding, landings
- Manager
  - Forms beliefs about escapement and biomass
  - Sets quota
  - Allows or bans discarding

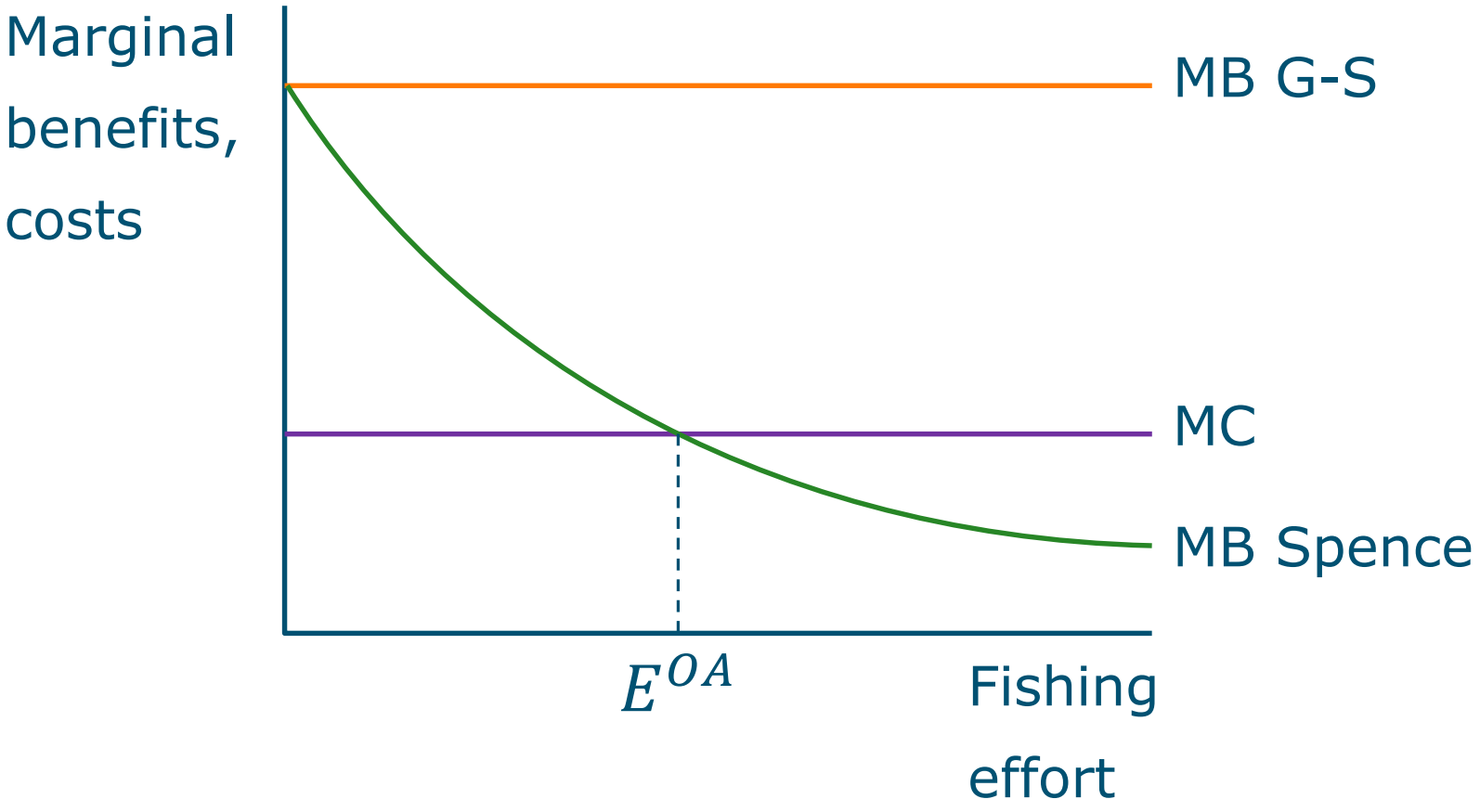
Spence harvest function

- Discrete-time version of continuous-time G-S harvest

$$H_{it} = B_{it}(1 - e^{-qE_t})$$

- What is the open-access effort and escapement?
- Resource rents dissipate
- Within-season rents?
  - If fishing is a sequential decision: maximize
  - If fishing is a simultaneous decision: dissipate

Open access and the Spence function (1)



Open access and the Spence function (2)

- Open access escapement and effort in a single-species fishery:

$$S^{OA} = \frac{c}{pq} \qquad E^{OA} = \frac{1}{q} \ln \frac{B}{S^{OA}}$$

- Hence
  - Escapement is independent of pre-harvest biomass
  - Effort depends on pre-harvest biomass

Open access and the Spence function (3)

- Open access escapement in a multi-species fishery is defined by:

$$\sum_i p_i q_i S_i^{OA} = c$$

$$\left(\frac{B_i}{S_i^{OA}}\right)^{\frac{1}{q_i}} = \left(\frac{B_j}{S_j^{OA}}\right)^{\frac{1}{q_j}}$$

- To solve this we assume $q_i = q_j = q$

Scenarios

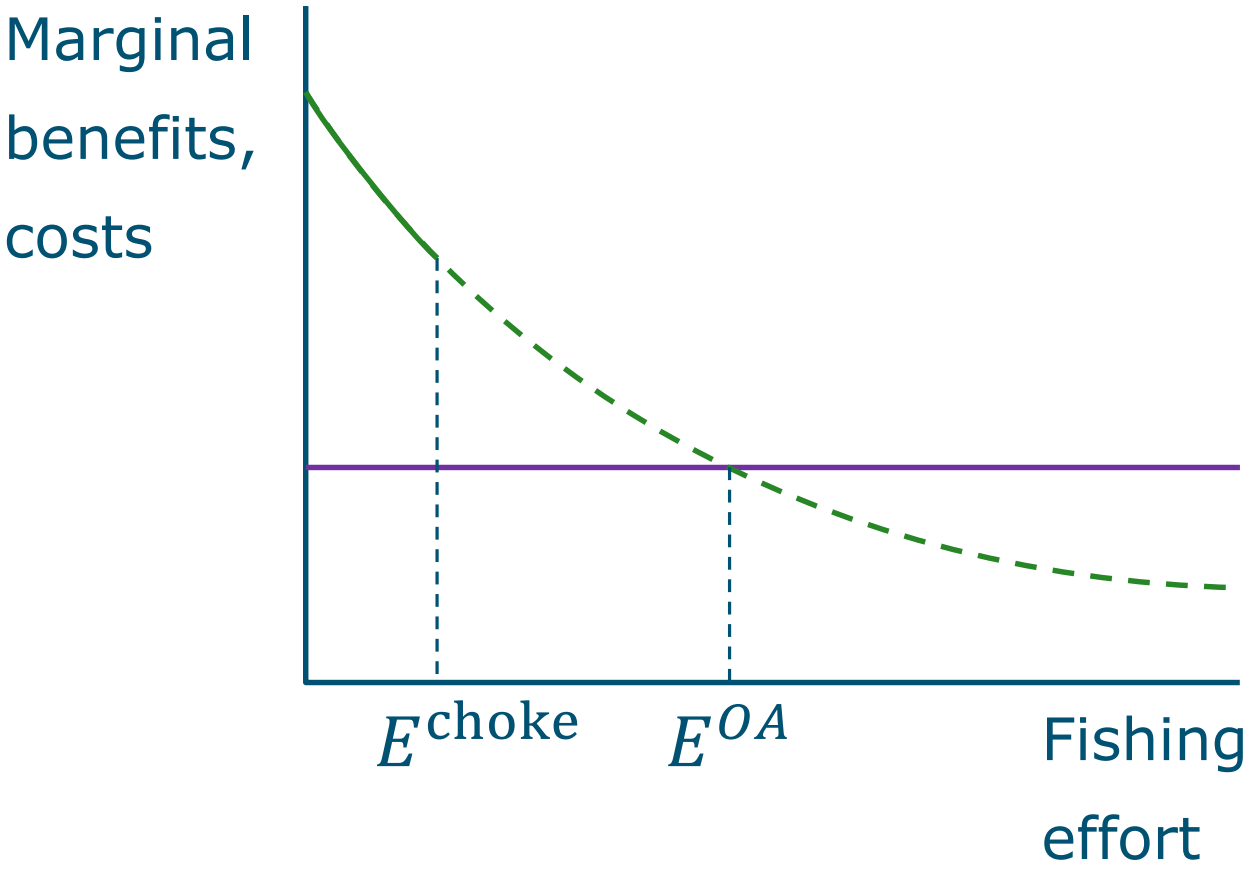
- Quota policy
  - Single-species: ignore catch composition
  - Multi-species: consider catch composition
- Discarding policy
  - Allow discards
  - Ban discards
- Quality of information
  - Manager can observe escapement perfectly
  - Manager induces escapement from landings and effort

Quota policy

- We assume a constant-escapement rule
- Single species:
  - $Q_{it} = \max\{0, B_{it} - \bar{S}_i\}$
- Multi-species:
  - Set initial quota
  - Identify most likely choke species
  - Set all quota according to choke species

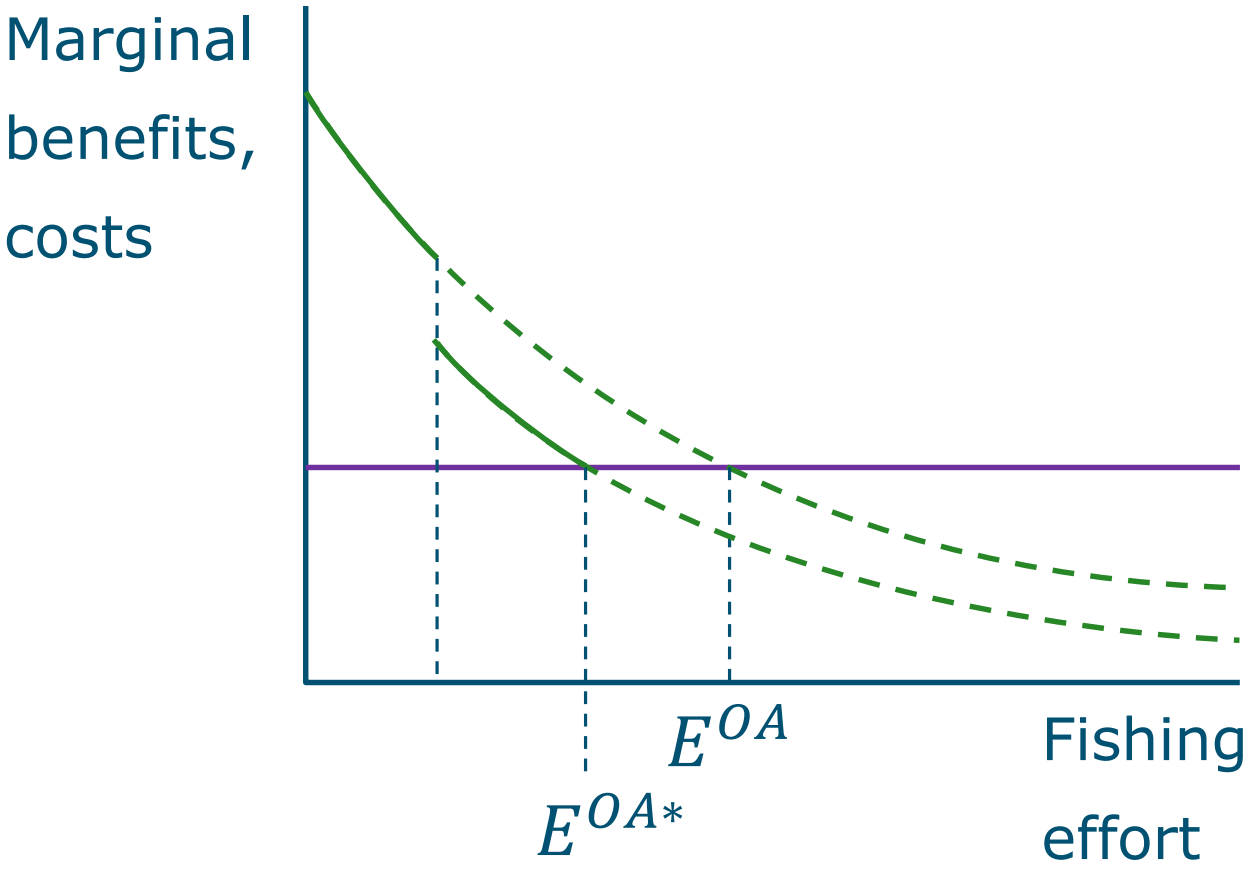
Discarding policy (1)

- If discarding is banned:



Discarding policy (2)

- If discarding is allowed:



Quality of information

- Perfect information:
  - Managers knows escapement
  - E.g., fishers do discard but they inform manager
- Imperfect information:
  - Belief about escapement derived from effort and landings data

$$\hat{S}_i = \begin{cases} \dfrac{L_i}{1 - e^{-qE}} & \text{if } E > 0 \\ \hat{B}_i & \text{if } E = 0 \end{cases}$$

Data and model runs

- So far some test runs with a numerical example
  - Two identical species
  - K=100, r=0.1, p=0.5, c=0.1, q=0.1, m=0.8
  - Target escapement 50 (MSY)
  - 40 years, 100,000 trials
- Focus on values in 40th year
  - Minimize effect of starting point
  - Discount rate not considered
- Eight scenarios
  - Three policies, two alternatives each

Preliminary results

- Average annual short-term rents:

		Quality of information	
Quota policy	Discarding	Perfect	Imperfect
Single-species	Allowed	2.22	1.63
	Banned	3.24	3.23
Multi-species	Allowed	3.18	3.05
	Banned	3.24	3.24

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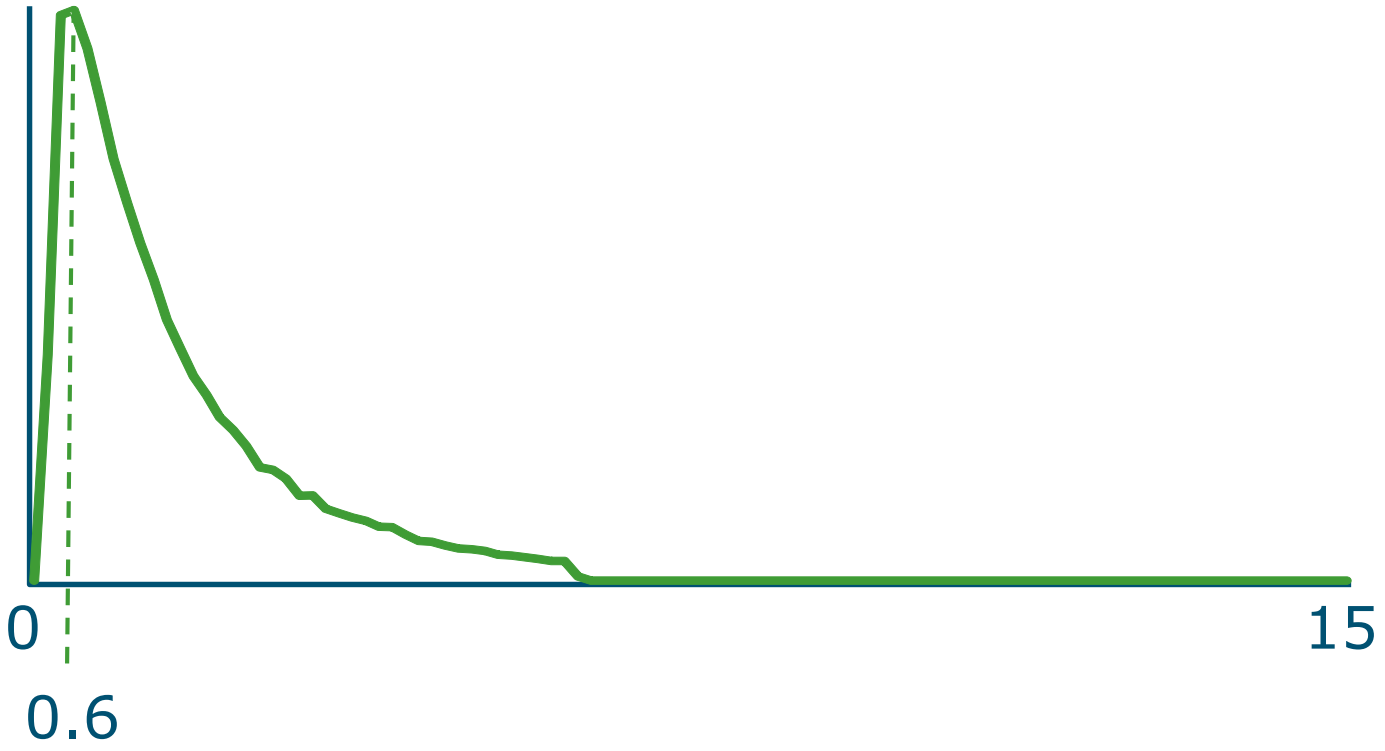
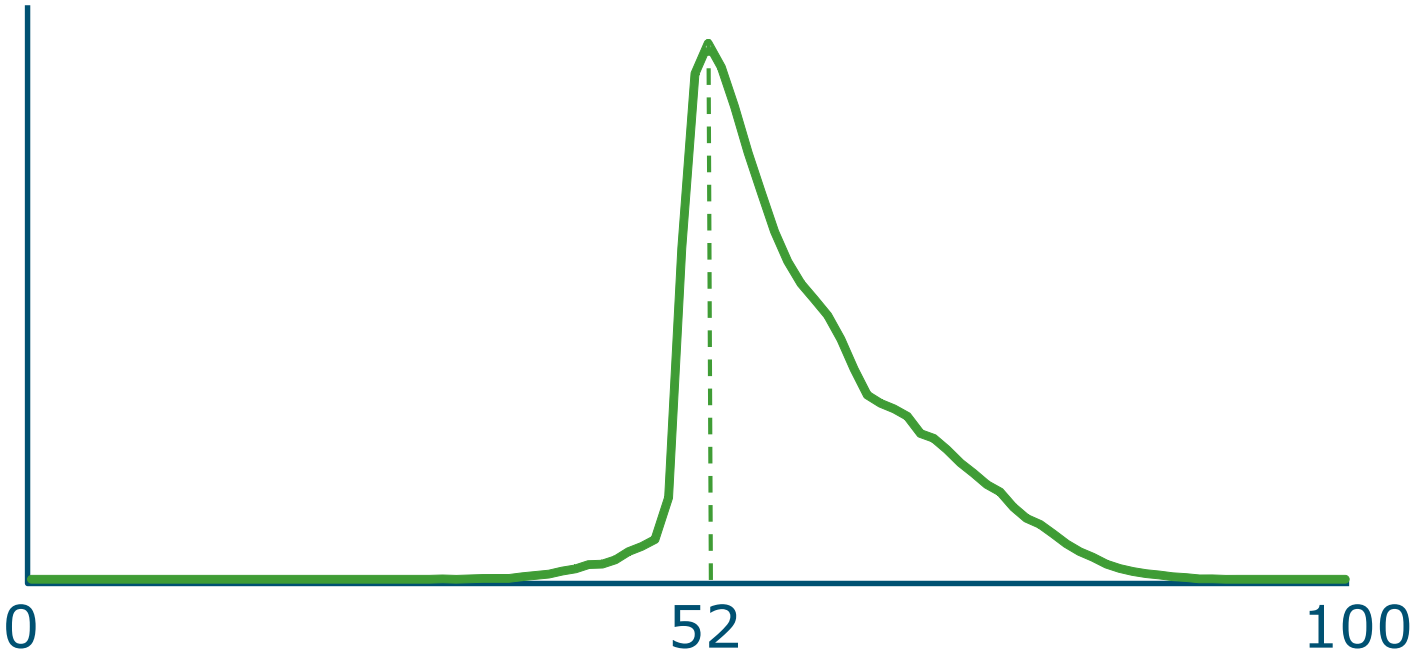
Single-species quota, discards allowed

- Probability distribution of rents:



Single-species quota, discards allowed

- Probability distribution of biomass:



Preliminary results: discard ban

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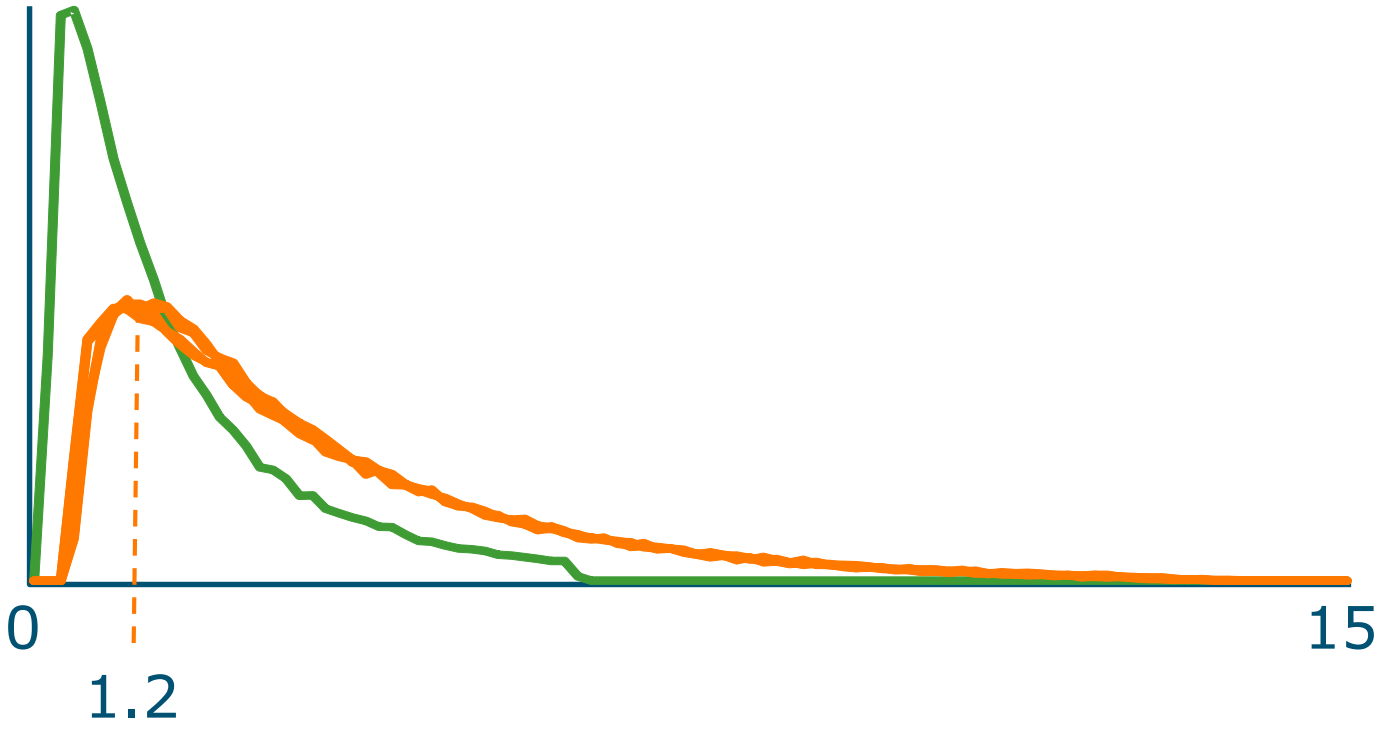
- Under a discard ban:
  - Landings and effort perfect indicator of escapement
  - Single-species quota rule effectively equivalent to multi-species quota rule

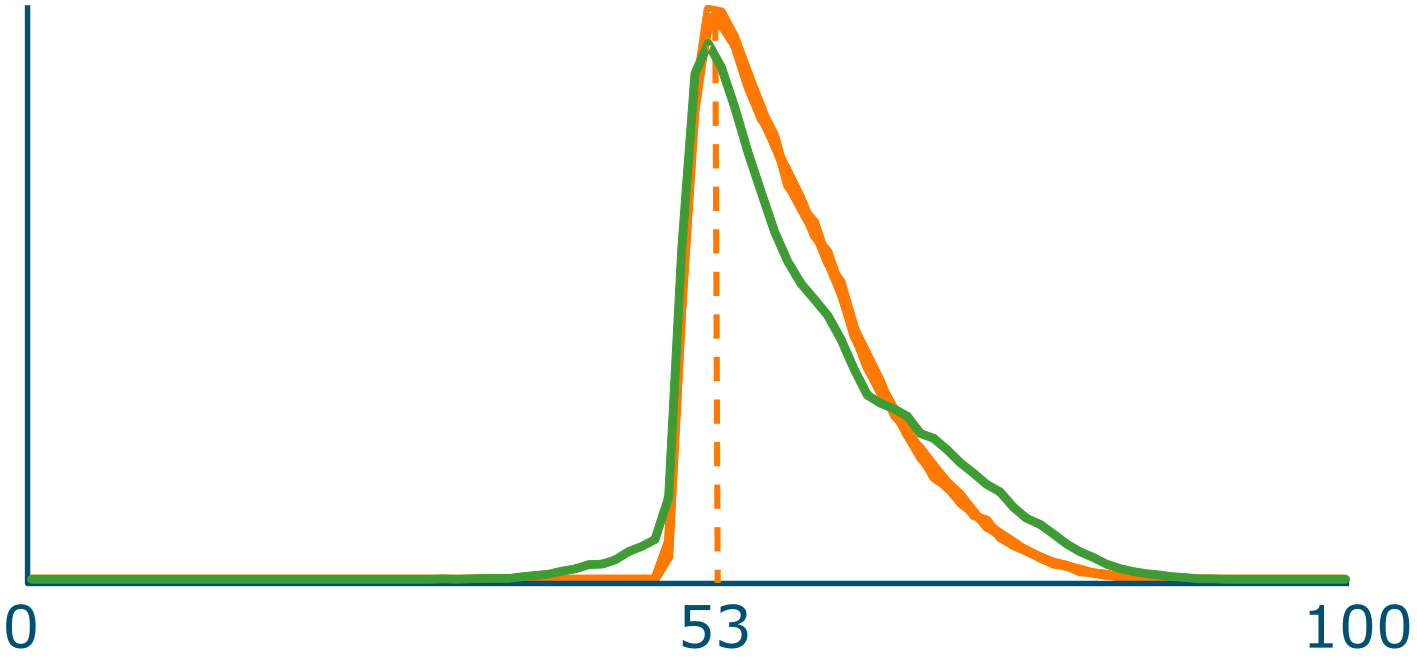
With discard ban

- Probability distribution of annual rents:

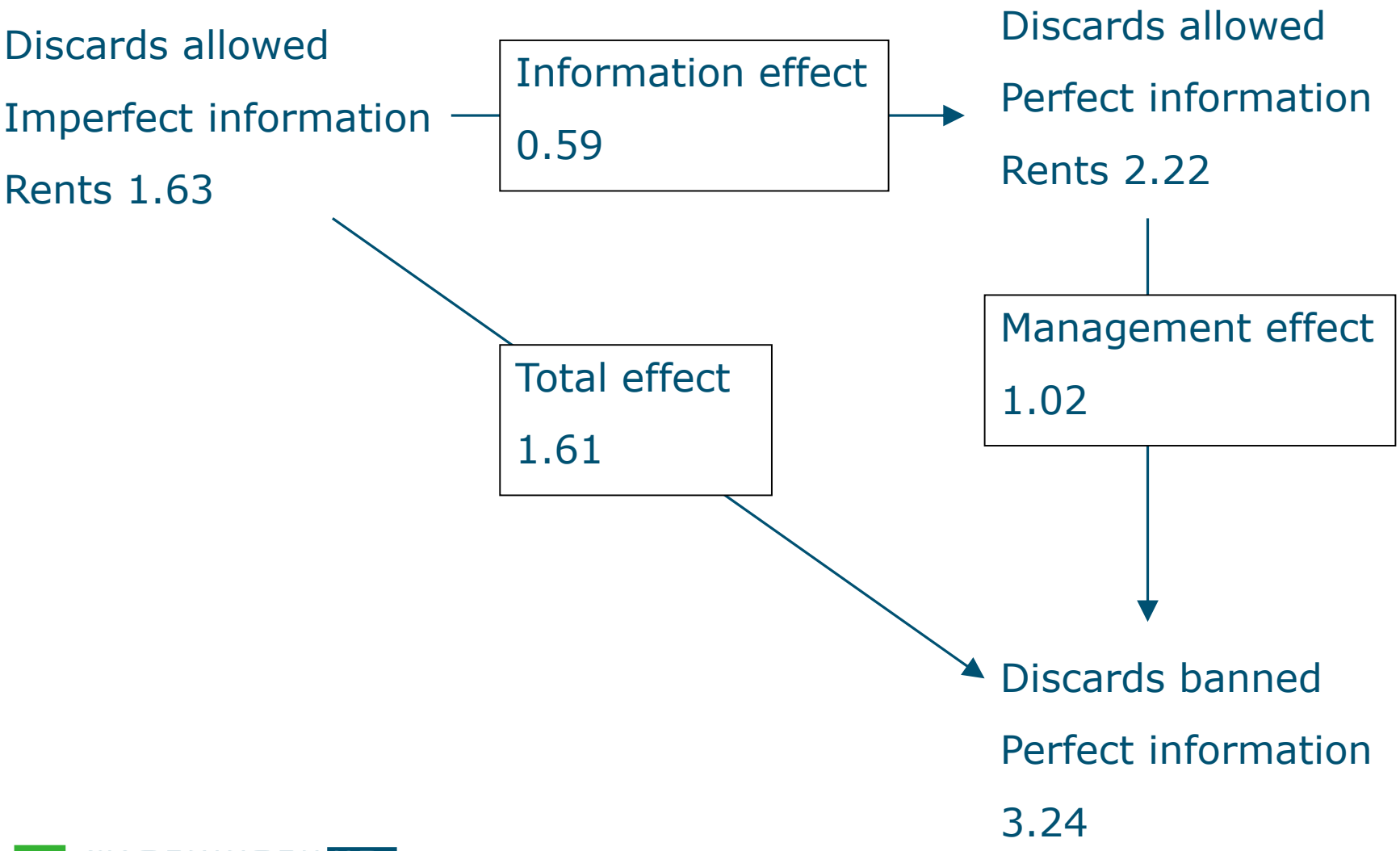


With discard ban

- Probability distribution of biomass:



Effects of the discard ban



Preliminary results

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- A sensible quota policy could come a long way towards the rents associated with eliminating discards

Conclusions

- At least in this numerical example, a discard ban seems to give the best outcome
- About a third of benefits due to improved information
- A more comprehensive quota policy might also come a long way towards improving annual rents

Limitations

- Numerical example
- Two species only
  - More species may lead to earlier ‘choke moments’
- Simplistic quota-setting rules
  - *Optimal* escapement one species depends on biomass, prices of all species, and costs
- Simplistic belief function
  - What about stock surveys?

Future steps

- Parameterization for the Dutch cutter fishery
  - Two dominant species (plaice and sole)
  - But also many others (potential choke species)
- Other policies
  - Near-optimal quota policies
  - Landing over-quota harvest at lower prices

Thank you

Questions?

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