Abundance-based BSAI Halibut PSC Limits

Steven Martell, Ian Stewart, and Catarina Wor
International Pacific Halibut Commission

Highlights

- Fixed biomass-based PSC limits incentivize **growth overfishing**.
- There is an **implicit allocation** of halibut to directed and non-directed users based on IPHC and NPFMC harvest policies.
- Policy changes (either by IPHC or NPFMC) affect all users (+ & -ve) and should be fully vetted before implementing change.
- Can use existing apportionment methods for creating an abundance index for setting PSC limits in BSAI (with some caveats).
- Options for allocations: allocate surplus (yield), or allocate the principle (spawning capital) that produces the surplus.
- Transferring allocations across sectors based on yield equivalence does not imply an equivalent impact on the resource.

Introduction

allocation | ˌaləˈkāSHən |

noun

the action or process of allocating or distributing something: *more efficient allocation of resources* | *ticket allocation*.

- an amount or portion of a resource assigned to a particular recipient.

Two General Approaches

Independent

Coordinated

Abundance-based PSC limits

- Annual PSC limit is **proportional** to the **biomass**.

Options for setting PSC limits

1. Status quo.
2. Periodic updates to fixed PSC limits.
3. Empirical estimates of halibut abundance.
4. Model-based estimates & apportionment.
5. Integrate industry catch-rate data in model-based estimates.

Outline

- Tradeoffs
- Harvest Control Rules
- Abundance Index for Area 4 (BSAI)
- Incentive Landscape
- Yield Equivalence
- Critical Assumptions
- Research Recommendations

Tradeoffs

1. Current IPHC harvest policy
2. Current trends in fishing intensity
3. Catch composition

Current IPHC harvest policy

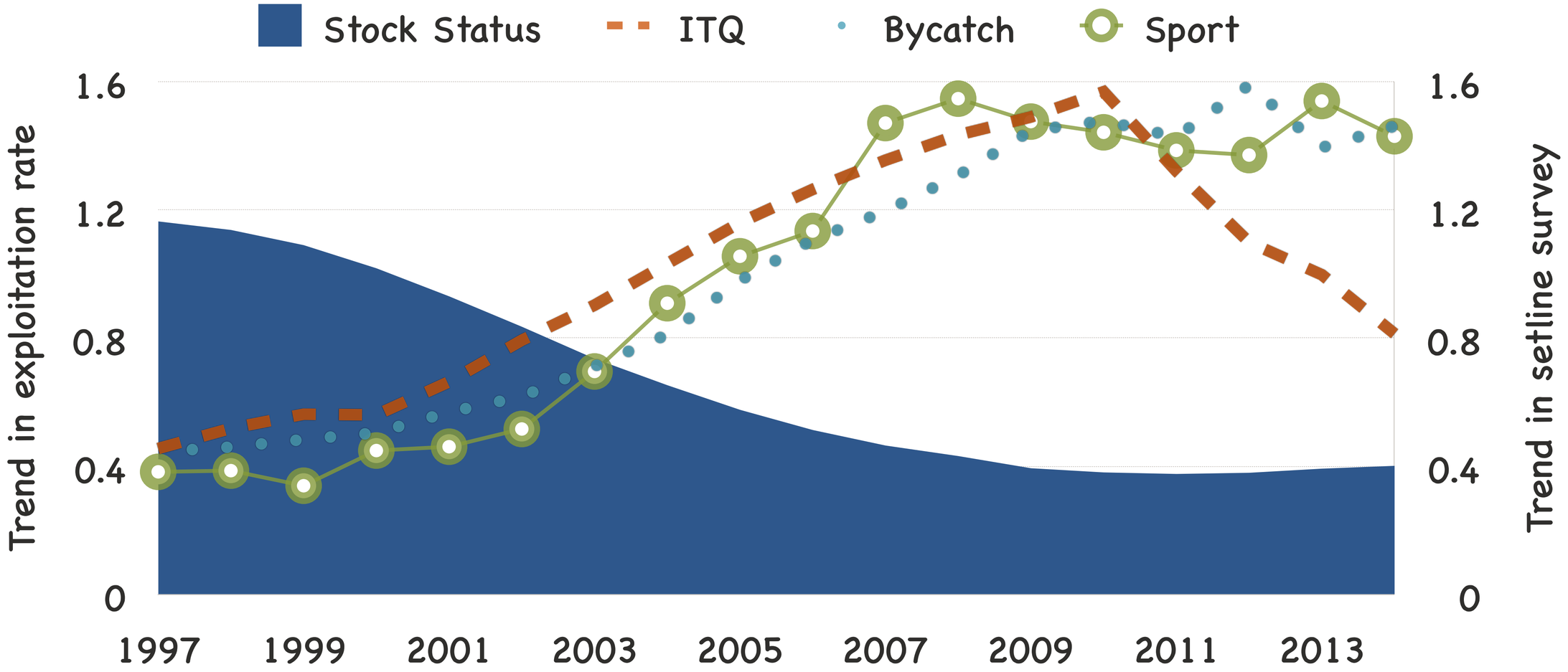
Objective: maintain spawning stock biomass above 30% of the unfished state 80% of the time.

TCEY = (harvest rate) * (biomass)

FCEY = TCEY - (O26 bycatch + non-CSP removals)

IPHC required to address bycatch and non-CSP removals in order to achieve its conservation mandate; remainder is allocated to the directed fishery.

Current trends in fishing intensity



Fishing intensity decreased in commercial fishery starting in 2011.

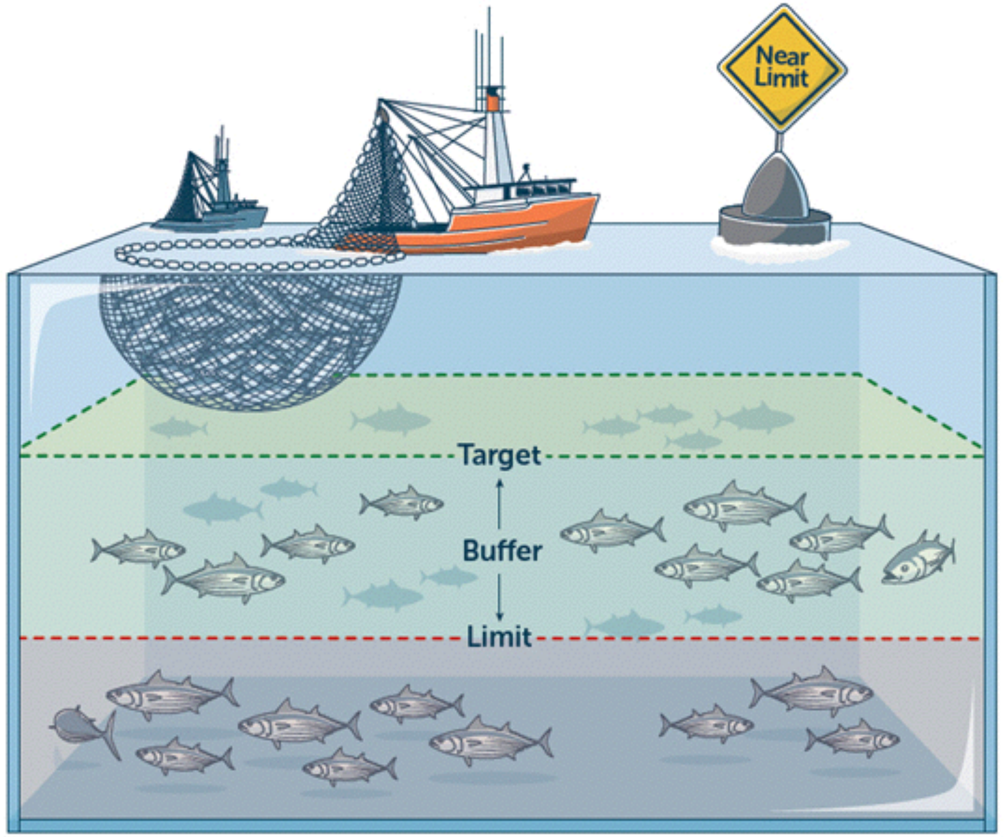
Catch Composition

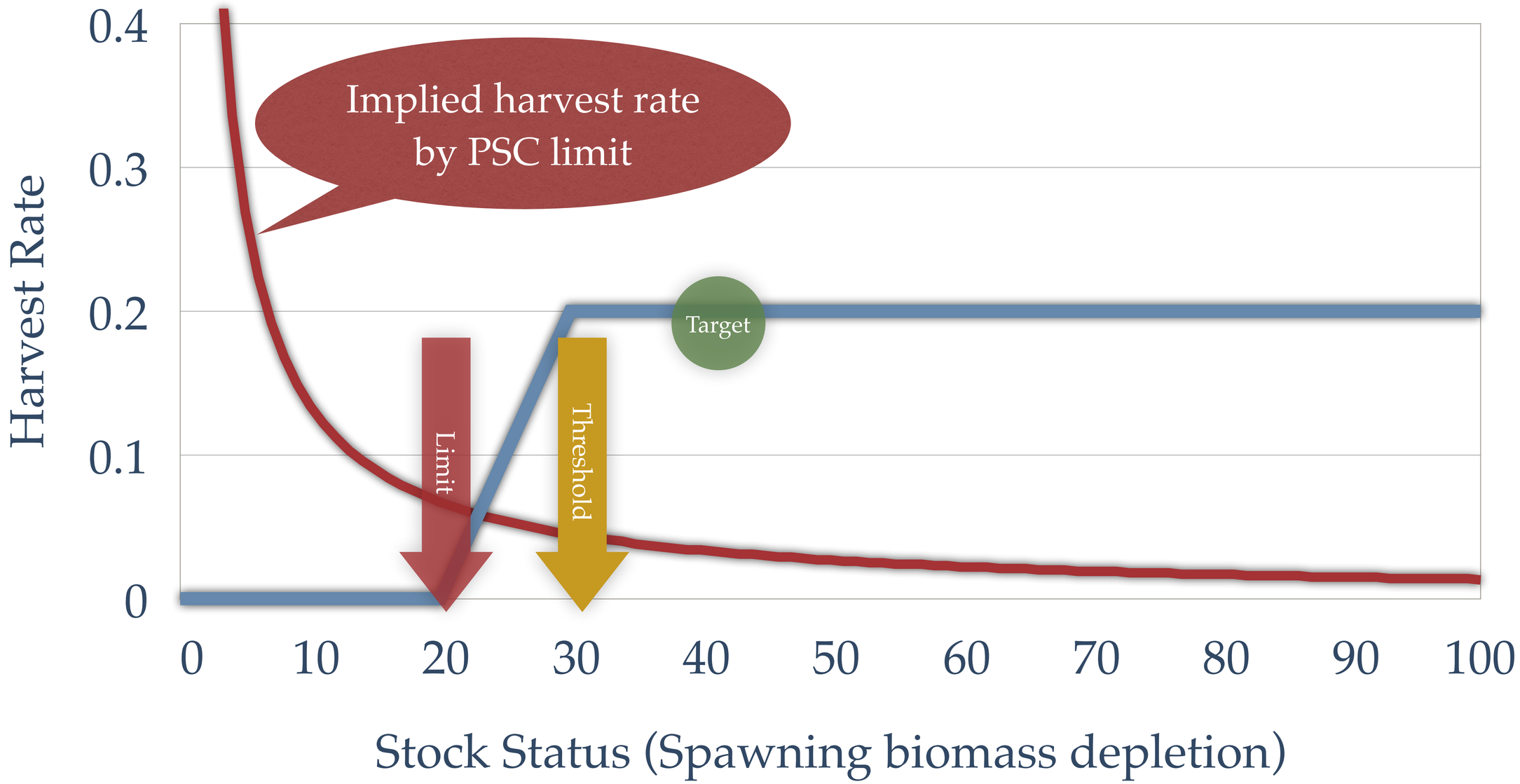
- Size Matters

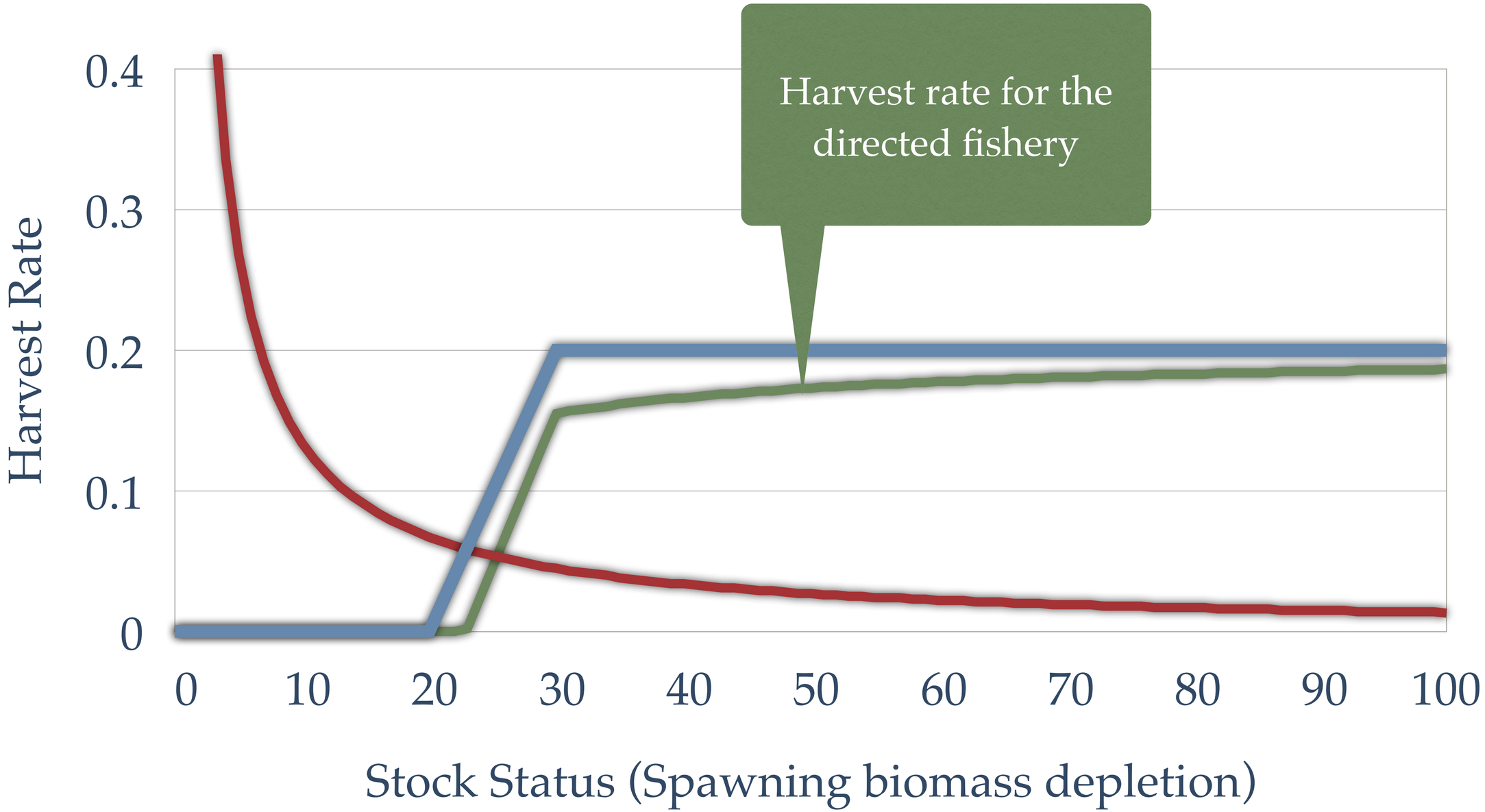
Sector	# halibut per ton
Commercial	128
Bycatch	465
Sport	158
Personal	205

Harvest Control Rules

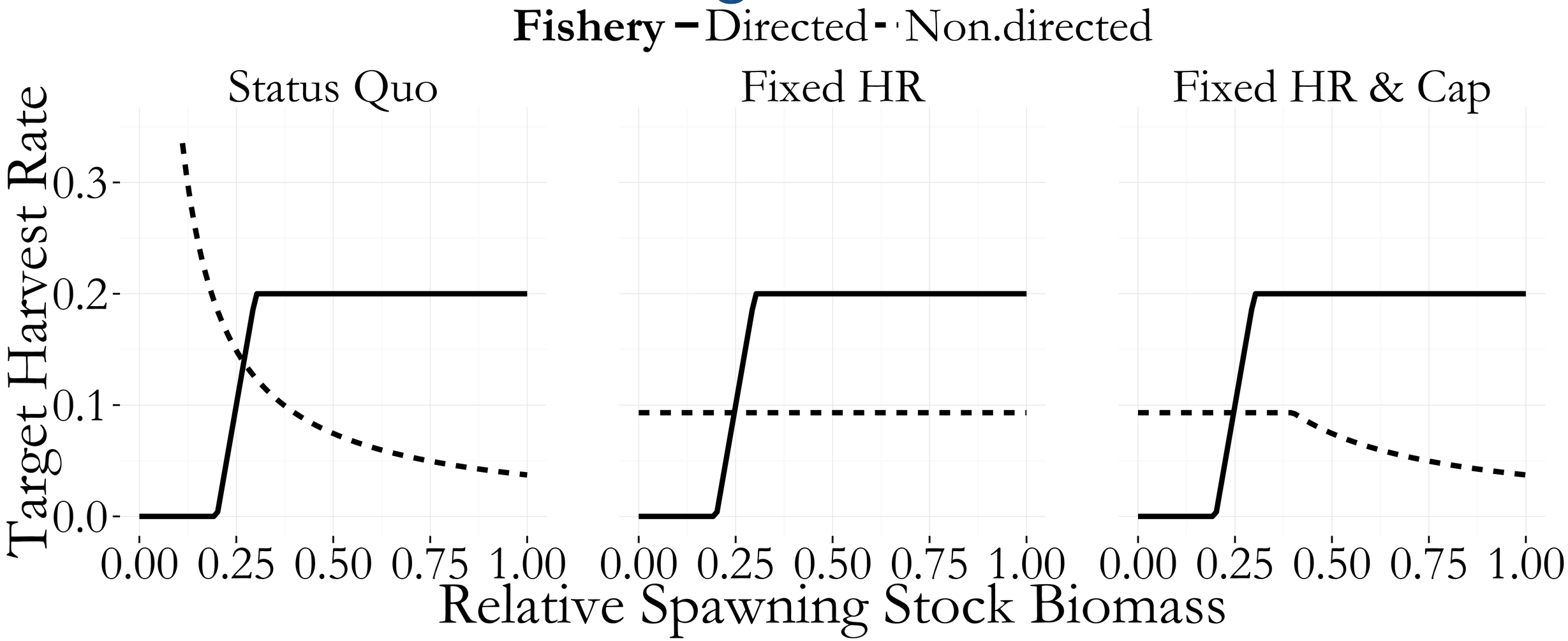
1. Sloping harvest control rules
2. HCRs for setting PSC limits
3. Tradeoffs in SPR



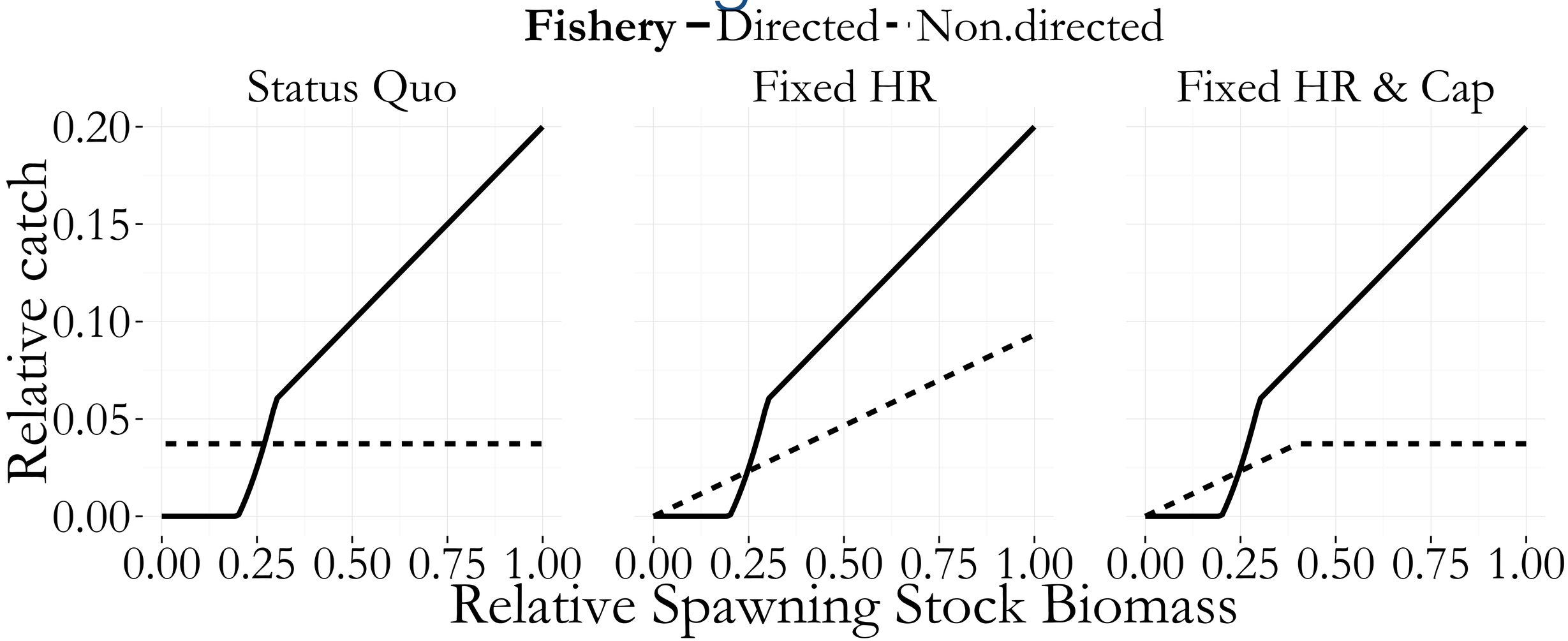

Implied harvest rate
by PSC limit
Target
Limit
Threshold
Harvest Rate
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
Stock Status (Spawning biomass depletion)


Harvest rate for the directed fishery
Harvest Rate
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
Stock Status (Spawning biomass depletion)

HCRs for setting annual PSC limits



HCRs for setting annual PSC limits



Harvest control rules for setting PSC limits

- What is the maximum harvest rate?
- Stock status: targets, thresholds, & limits reference points?
- MSY-based vs. SPR-based reference points?

Tradeoffs in SPR

FISHERY A

1000 mt,
50:50 sex ratio
50% of the catch is sexually mature

FISHERY B

1000 mt,
50:50 sex ratio
95% of the catch is sexually mature

Which fishery (A or B) has a larger impact on the Spawning Capital (SPR)?

Tradeoffs in SPR

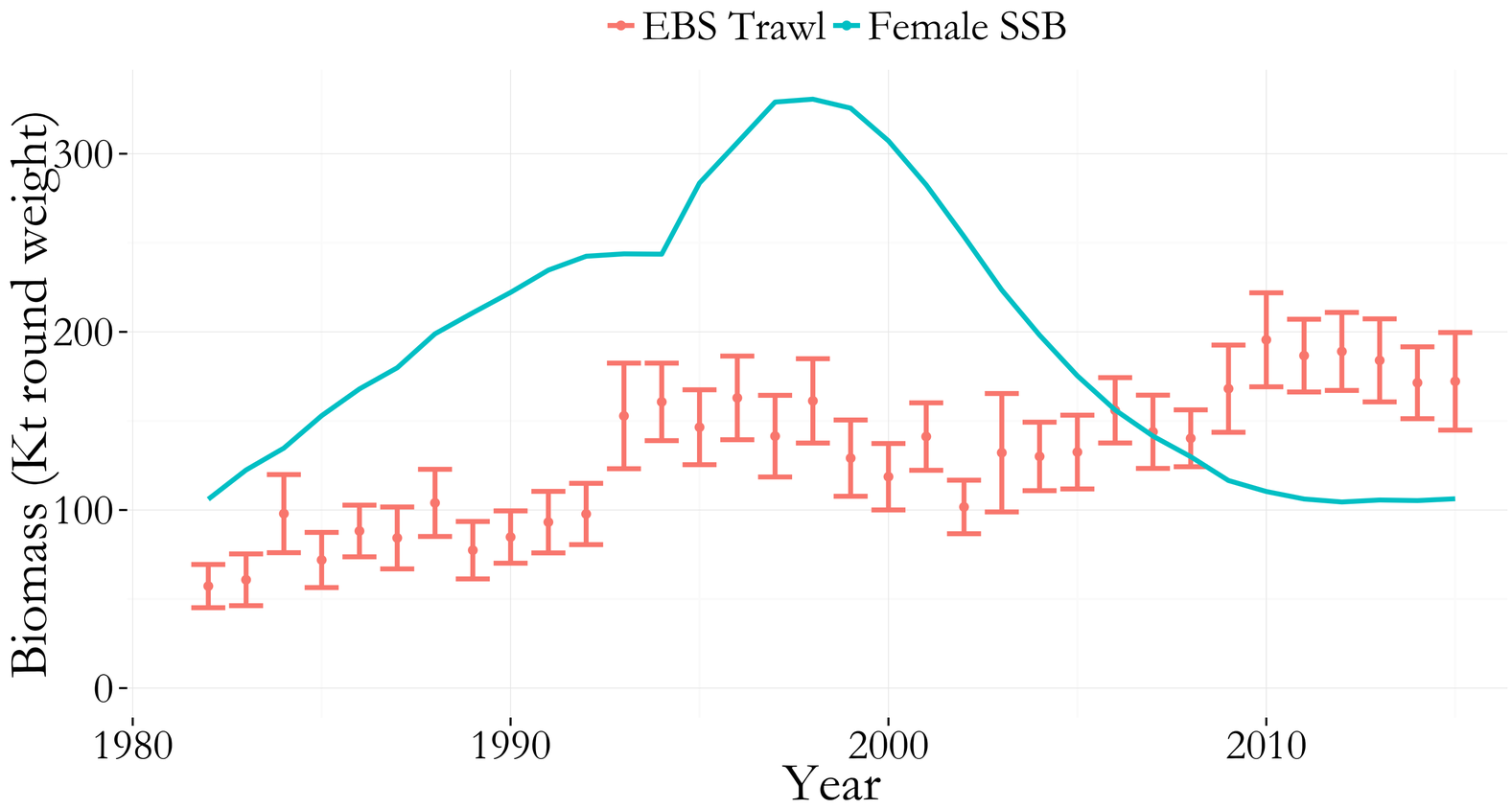
- Answer is A.
- The SPR integrates all sources of mortality over a lifetime.

Halibut abundance index for BSAI

1. EBS bottom trawl survey
2. Model based estimates
3. Integrating industry & observer data

EBS-trawl Area Swept Estimates

- IPHC setline survey does not index the EBS shelf region.



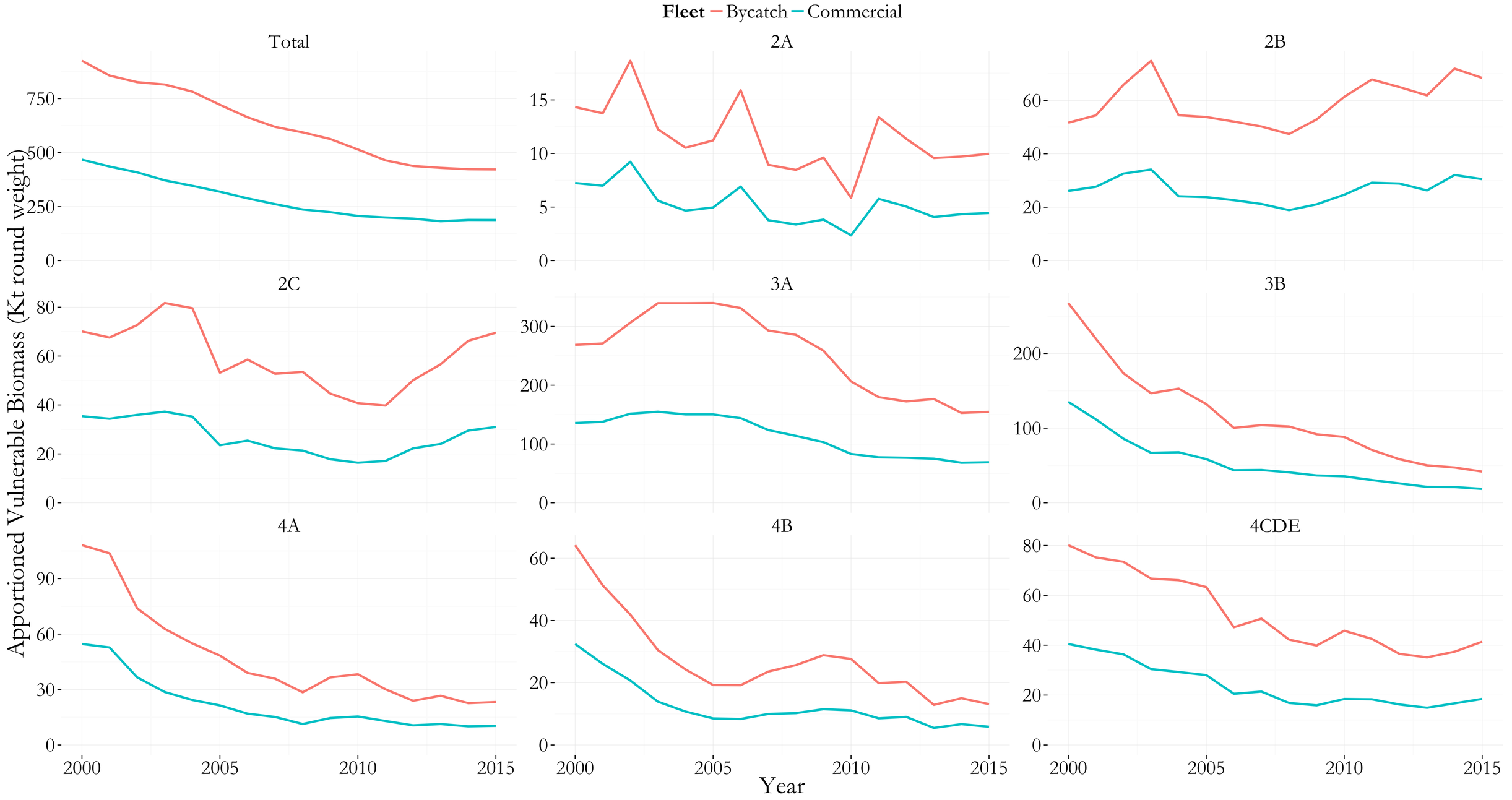

Age-0 recruits
Numbers (1000s)
300
200
100
0
1980
1990
2000
2010
Year

Model based estimate of BSAI halibut abundance

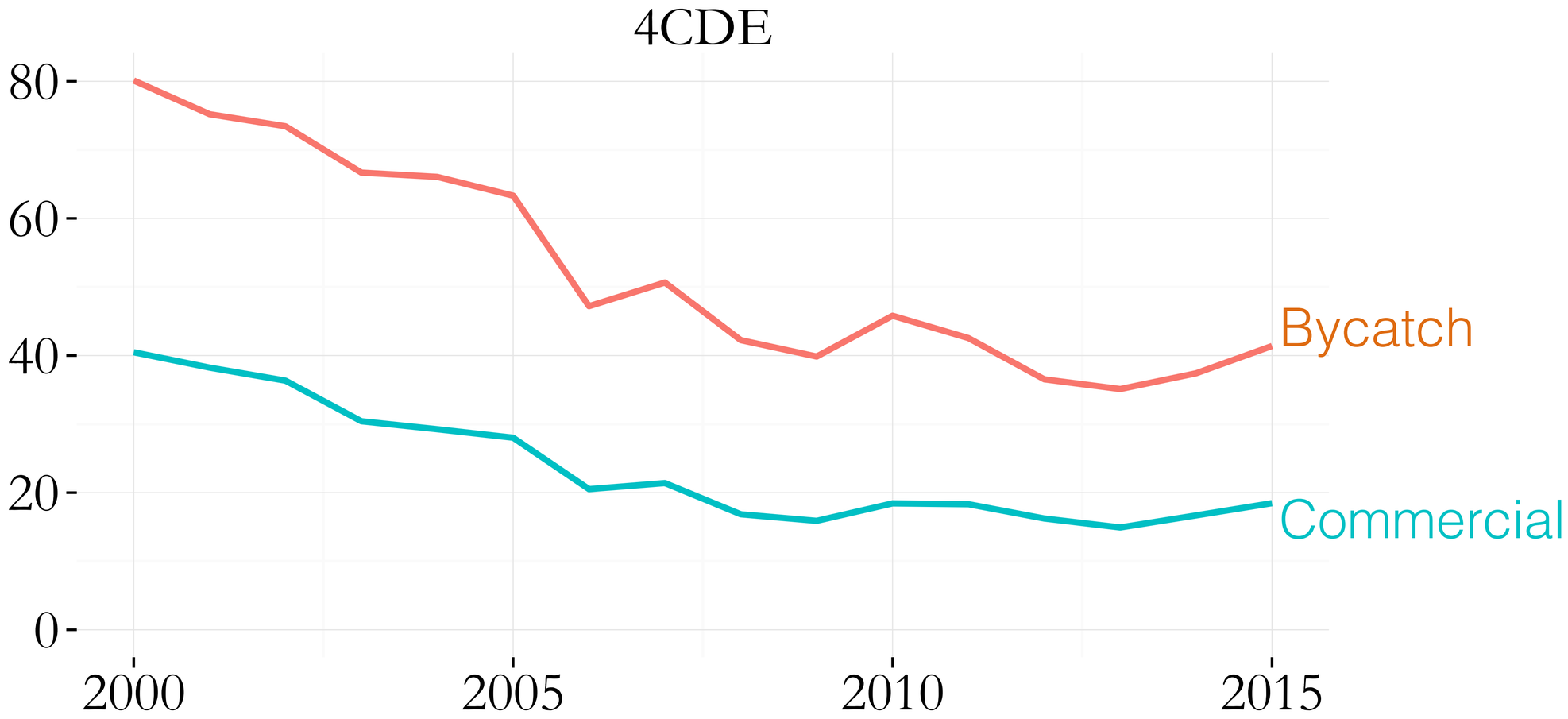
- Estimates of vulnerable biomass obtained from stock assessment.
- Two issues with using model estimates:

  1. how to apportion biomass to each regulatory area,

  2. lags associated with estimating relative cohort strength prior to recruiting to the setline survey.


Fleet Bycatch Commercial
Total
2A
2B
2C
3A
3B
4A
4B
4CDE
Apportioned Vulnerable Biomass (Kt round weight)
Year
0
250
500
750
5
10
15
20
40
60
80
100
200
300
30
90
2000
2005
2010
2015

Vulnerable Biomass in Area 4CDE

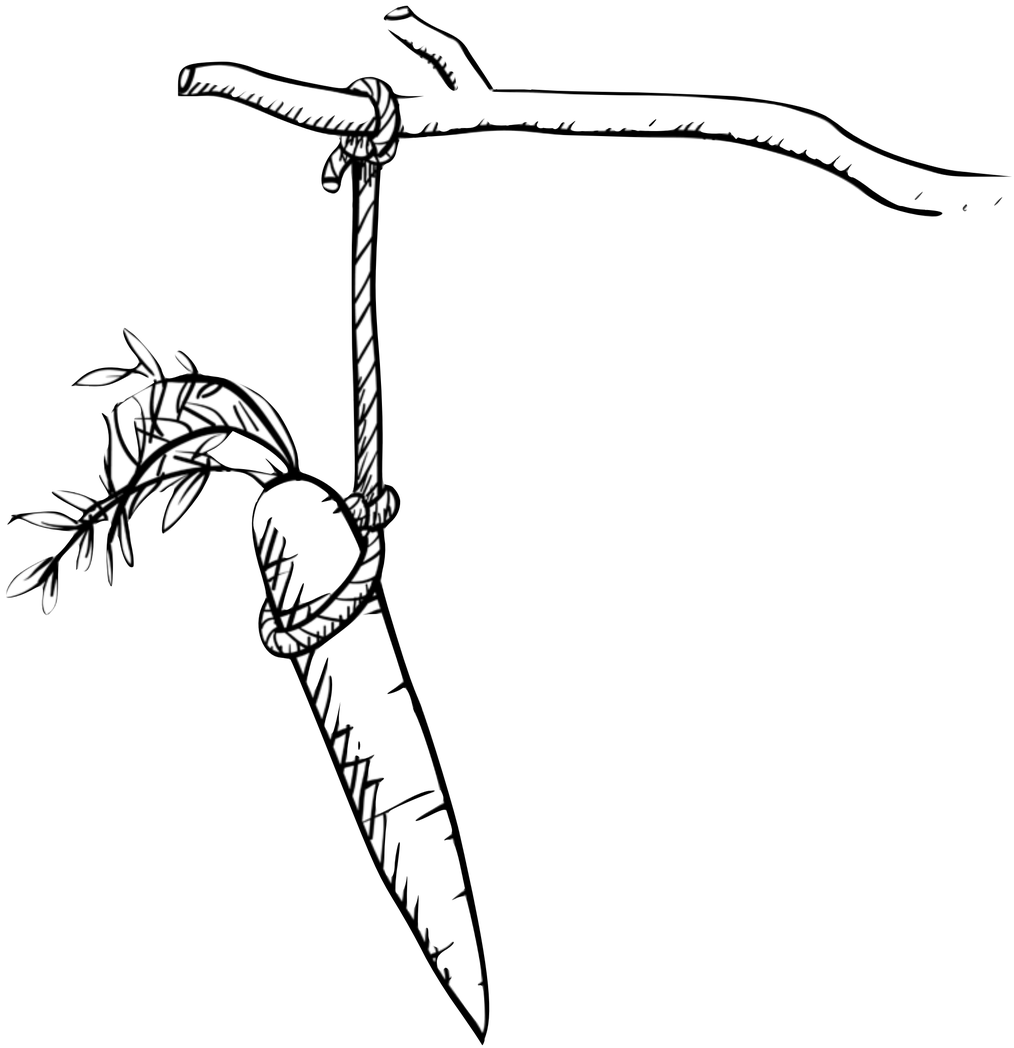


Integrating industry & observer data

- Setline survey is not a good index for halibut less than 26-inches.
- Lots of data on U26 halibut in bycatch fisheries, but:
  - likely biased due to non-random sampling,
  - bias introduced by changes in management.
- Useful for composition information.
- Scale: should not be limited to data in the BSAI region only.

Incentives

1. Growth overfishing?
2. Allocations: yield vs. spawning capital



Terms

- Growth Overfishing: When fish are harvested at an average size that is smaller than the size that would produce the maximum yield per recruit.

- Recruitment Overfishing: Recruitment overfishing occurs when the mature adult (spawning biomass) population is depleted to a level where it no longer has the reproductive capacity to replenish itself.

Are current policies incentivizing growth overfishing?

- There is a strong incentive to reduce the encounter rate of halibut and the units are based on weight (e.g., kg/t).
- Reducing encounter rate can lead to increased effort in a cap-constrained fishery.

Allocations based on yield vs spawning capital

- Yield-based allocations: share a fixed proportion of the total catch.
- Spawning-capital-based allocations: share a fixed proportion of the Spawning Potential Ratio.

Yield Equivalence

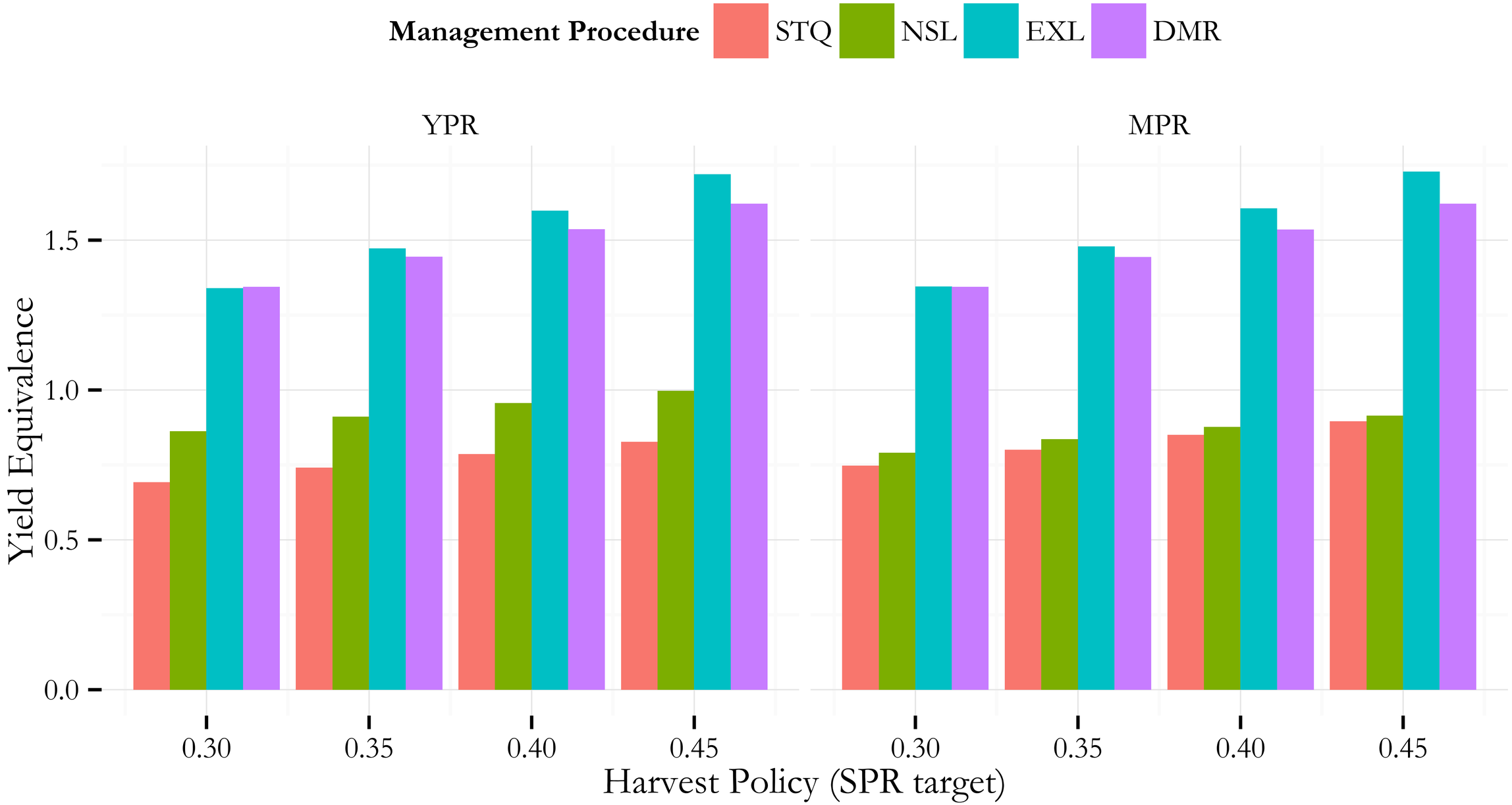
1. Fisheries interactions

Yield equivalence

- For each pound of bycatch, what is the equivalent lost yield in other sectors?
  - E.g., 1 pound of U26 is equivalent to 1 pound of O32 (Hare 2010).

Factors that affect yield equivalence

- Selectivity
- Discard mortality rates
- Target SPR
- Harvest control rules
- Sector allocation
- Natural mortality
- Size-at-age
- Migration rates
- Availability
- Density-dependent growth
- Sex ratio in the catch
- Apportionment
- …


Management Procedure
STQ
NSL
EXL
DMR
YPR
MPR
Yield Equivalence
1.5
1.0
0.5
0.0
0.30
0.35
0.40
0.45
Harvest Policy (SPR target)

Critical Assumptions

1. Natural mortality & growth rates
2. Harvest policy calculations

Size-dependent natural mortality

- Assessment model assumes natural mortality is age-independent.
- Natural mortality is very likely to be size- or age-dependent.
- Bycatch of small halibut may translate into no net loss to the directed fishery because small fish would die anyways.
- PROBLEM: it's very difficult to measure natural mortality, let alone size-dependent natural mortality.
- Policy implications are HUGE.

Density-dependent growth

- At low densities, less competition translates into increased growth rates.
- It would be wonderful if reducing the densities of small fish could be used to enhance growth, and therefore, enhance yield in directed fisheries.

Harvest policy calculations

- Developing harvest control rules should be based on full utilization of the catch limits.

Research Recommendations

1. Harvest policy
2. Economic & social impacts
3. Spatial scale
4. Parametric uncertainty

Harvest policy

- Management Strategy Evaluation.
  - Objectives for **directed** and **non-directed** halibut fisheries.
  - Measurable performance metrics that expose the tradeoffs.
  - Cons: expensive, duration, difficult to accommodate, short-term costs of the transition.

Economic & Social impacts

- What are the social and economic impacts of alternative policies?

Spatial Scale

- Each Regulatory Area has a very different set of rules.
- We don’t understand what the policy implications are with respect to migration and movement across Regulatory Areas.
- Objectives: maximize total yield ≠ maximize total yield in each area.

Uncertainty in demography

RISK = Probability * Consequence

Acknowledgements

- Mark Fina
- Wes Erikson
- John Gauvin
- Karl Haflinger
- Austin Estabrooks
- Arnie Fuglvog
- Chad See
- Peggy Parker
- Bob Alverson
- Catarina Wor
- Ian Stewart
- Bruce Leaman
- Jim Balsiger
- Heather McCarty
- Jeff Kaufman
- Linda Bhenkin
- Jeff Farvour
- Dan Falvey
- Shannon Carroll
- Jim Ianelli
- Sean Cox
- Marc Mangel
- Joan Forsburg
- Liz Martell
- Elizabeth Figus
- Terry Quinn
- Carl Walters