An update on the Management Strategy Evaluation (MSE)
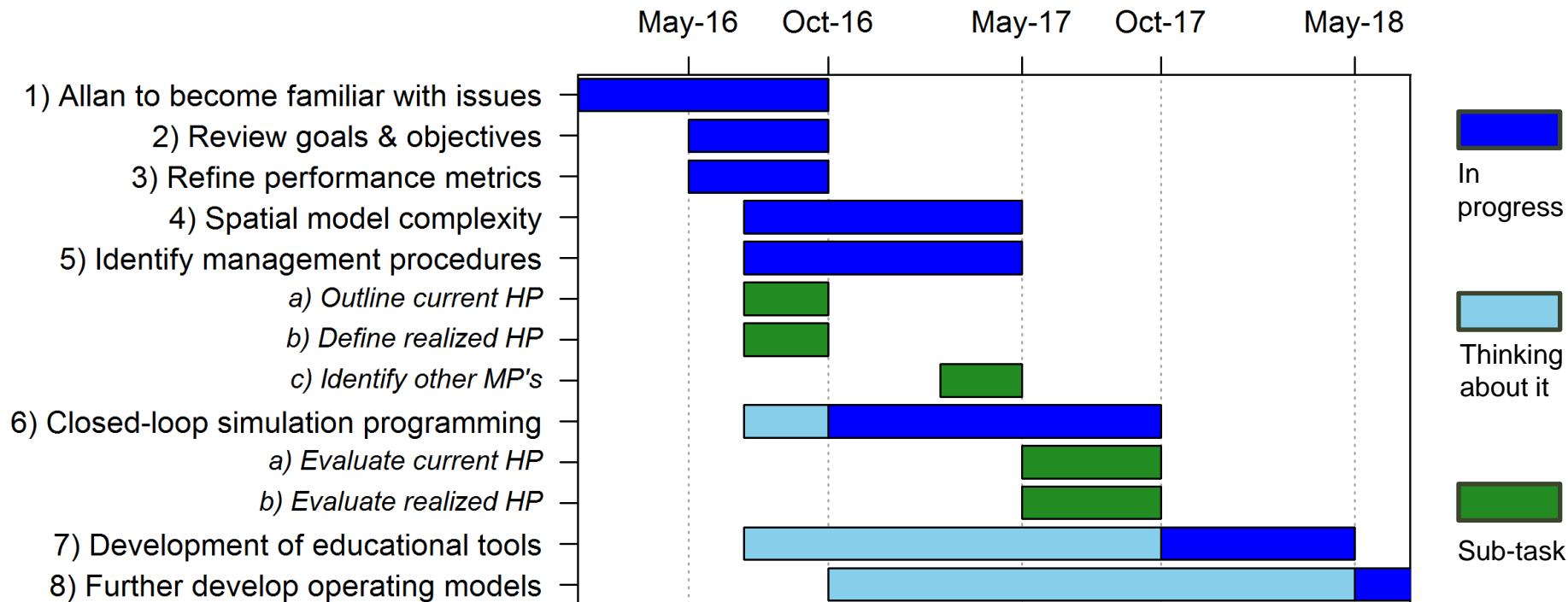
Allan Hicks

IPHC Annual Meeting
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IPHC-2017-AM093-09

D. Griffay

Workplan

- A 2-year workplan for MSE development was created

Topics for this presentation

- An investigation of the current harvest policy

- An improved harvest policy
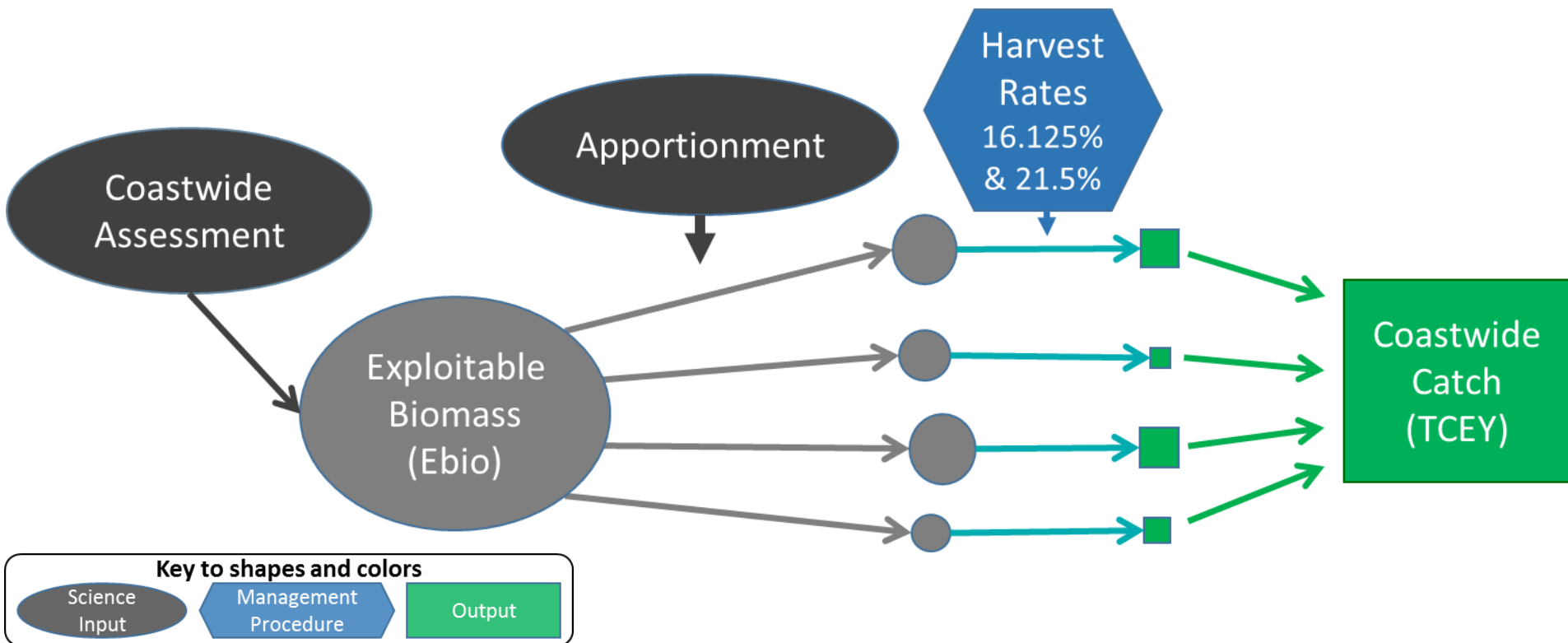
- MSE progress and future work

Current harvest policy

- Defines the catch described by the Blue Line

- Designed to meet five goals
    1. avoid very low stock sizes;
    2. mostly avoid low stock sizes;
    3. achieve most of MSY;
    4. reduce variability in catch; and
    5. distribute removals in proportion to the current stock biomass (i.e. preserve biocomplexity).
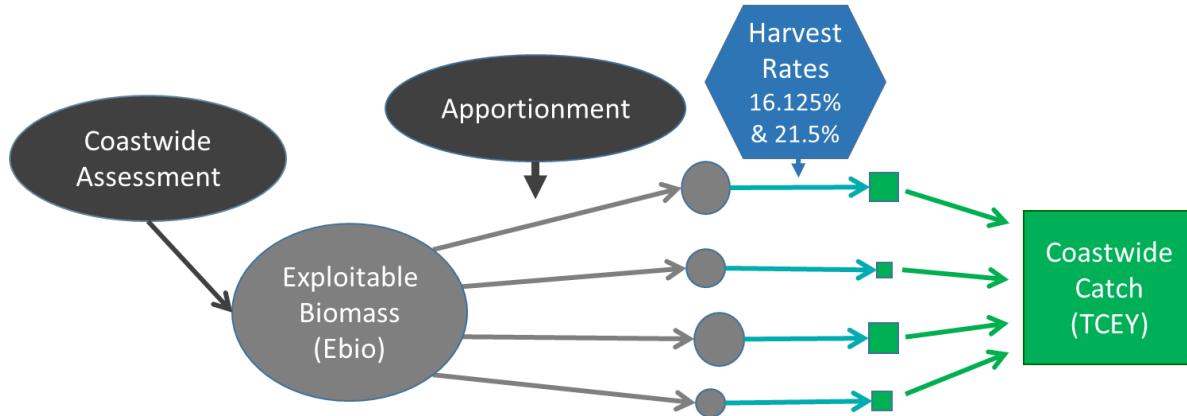
Current harvest policy

Current harvest policy

- **Scale:**
  - Exploitable Biomass (EBio) & harvest rates

- **Distribution:**
  - Apportionment and relative harvest rates

Current harvest policy

- **Scale:**
  - Exploitable Biomass (EBio) & harvest rates
- **Distribution:**
  - Apportionment and relative harvest rates

What is the fishing intensity on the coastwide stock?

Scale and Distribution are not independent

Scale of exploitation
(current harvest policy)

Exploitable Biomass

- Uses externally derived selectivity

  - Not representative of the current stock assessment

Harvest rates (area-specific)

- 16.125%: Western areas (3B, 4A, 4B, 4CDE)

- 21.5%:   Eastern areas (3A, 2C, 2B, 2A)

- Reduced by a control rule at low stock sizes (< 30% of B0)

Distribution of exploitation (current harvest policy)

Apportionment

- Distribute EBio to Regulatory Areas

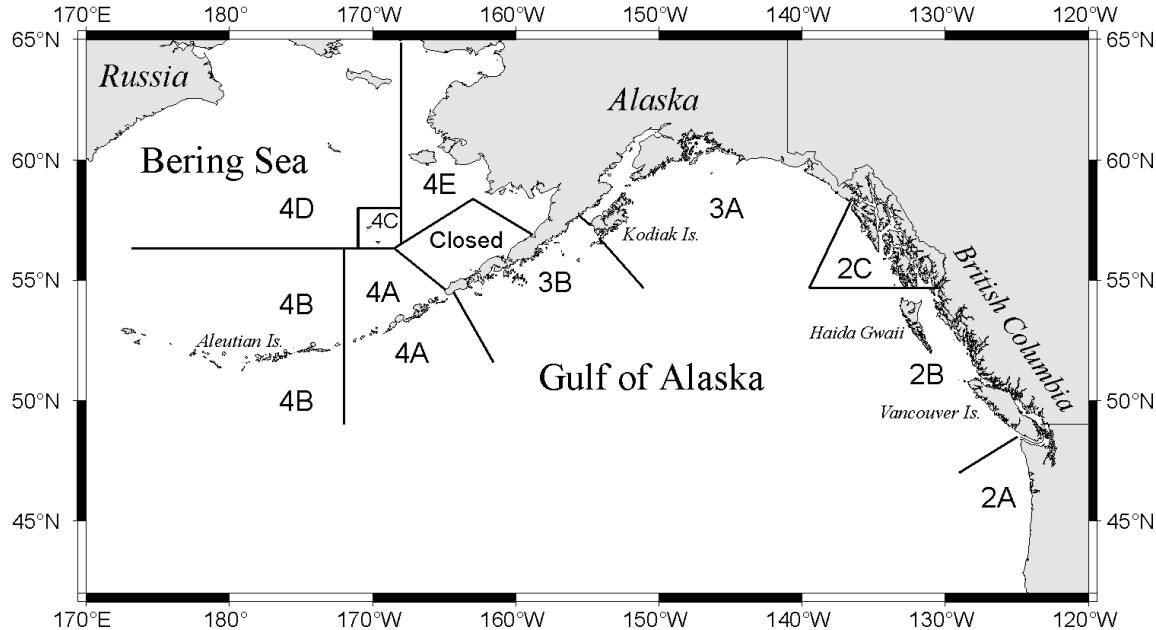- O32 WPUE from setline survey

Relative harvest rates

- Higher harvest rates in East

Problems with the current harvest policy

1. Past simulations based on core areas (2B, 2C, 3A)

Problems with the current harvest policy

2. Scale (fishing intensity) and distribution (catch across areas) confounded

– Coastwide assessment, split EBio into Areas, then sum it
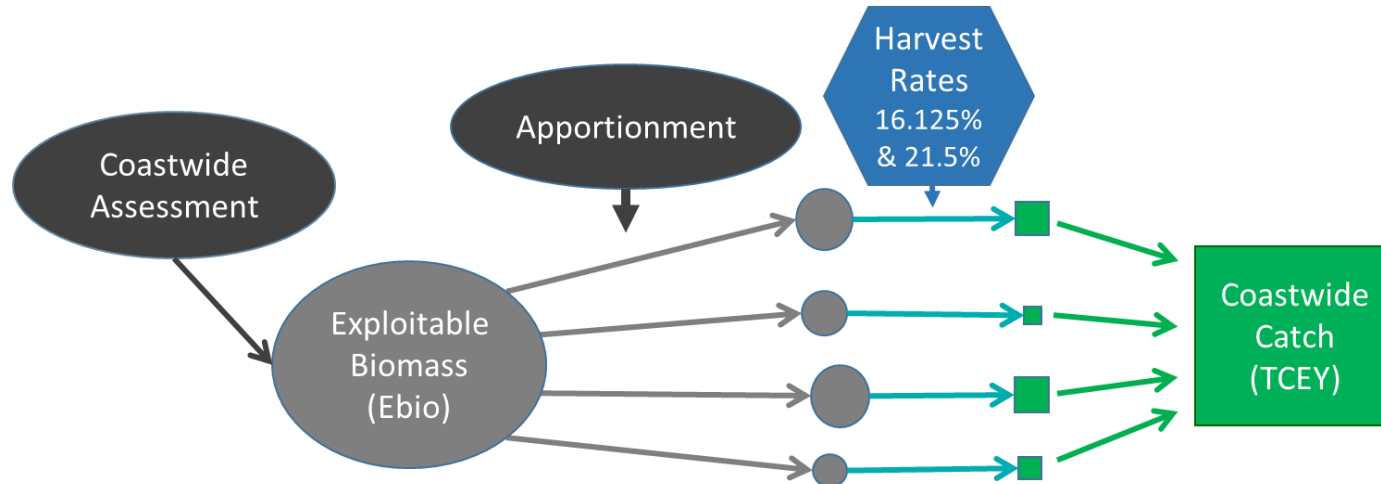
Problems with the current harvest policy

3. EBio is inconsistent with assessment results

   – Selectivity out of sync with current assessment

   – Does not include all sources of removals

   – Does not exactly represent fishing mortality

Problems with the current harvest policy

4. Mortality of U26 fish not explicitly accounted for

    – Apportionment (O32), Harvest rates (O26), EBio (???)

    – TCEY/FCEY remains unchanged regardless of U26 mortality
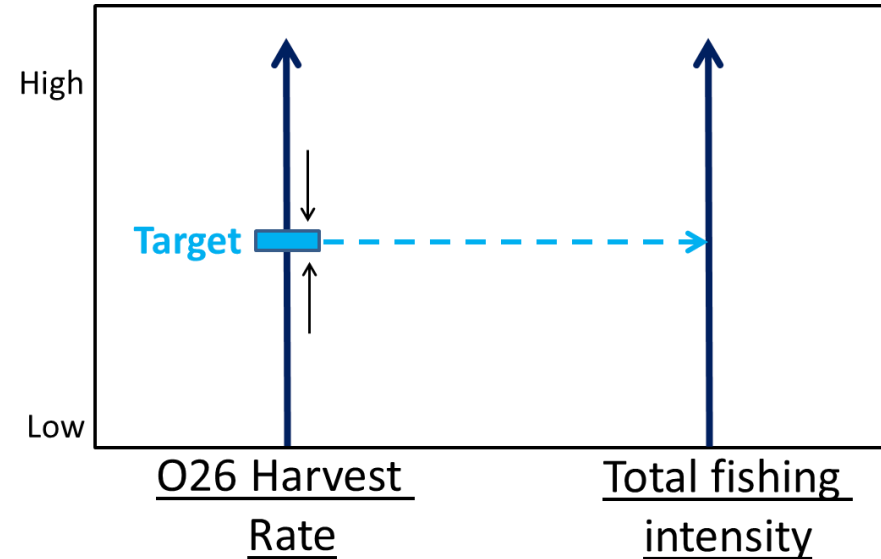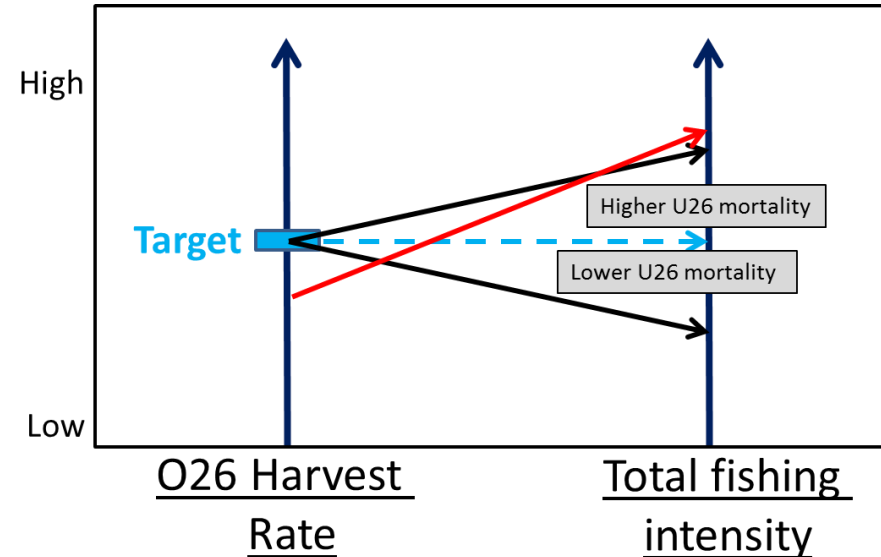
Problems with the current harvest policy

4. Mortality of U26 fish not explicitly accounted for

   – Apportionment (O32), Harvest rates (O26), EBio (???)

   – TCEY/FCEY remains unchanged regardless of U26 mortality

   – U26 mortality will be indirectly realized in later years

High

Target

Higher U26 mortality

Lower U26 mortality

Low

O26 Harvest Rate

Total fishing intensity

Why a harvest policy?

- Long-term strategic planning to meet objectives
    - Provides a reference point to base annual decisions on
    - Short-term, tactical decisions can override the harvest policy, understanding that consistent departure will have consequences

Why a harvest policy?

- Can be evaluated against external standards
  - For example, MSC certification
  - Provides credibility to the management of Pacific halibut
- Can include harvest agreements
  - For example, relative harvest rates across Areas

Developing an updated harvest policy

- Management Strategy Advisory Board (MSAB)
  - Develop a Management Strategy Evaluation (MSE) process for the Pacific halibut fishery
    - Design robust harvest policies, through stakeholder consultation and simulation modelling

Managing on total mortality

- Earlier assessments included only age 8 and older halibut

- Those were updated to include age 6 and older

- Then, management was based on O32 mortality

- In 2011, updated management for O26 mortality

- Now, why not manage on **OZero (over zero)** mortality?

  - Account for all removals across all fleets

  - Need a measure that accounts for all sizes and sources

    - Selectivity varies by fleet, thus harvest rates are not comparable

Rearranging the current harvest policy

Rearranging the current harvest policy

Key to shapes and colors

Science Input — Management Procedure — Output

Coastwide Assessment

Coastwide Fishing Intensity (e.g., F_{SPR})

Total Mortality

DISTRIBUTION

SCALE

Rearranging the current harvest policy
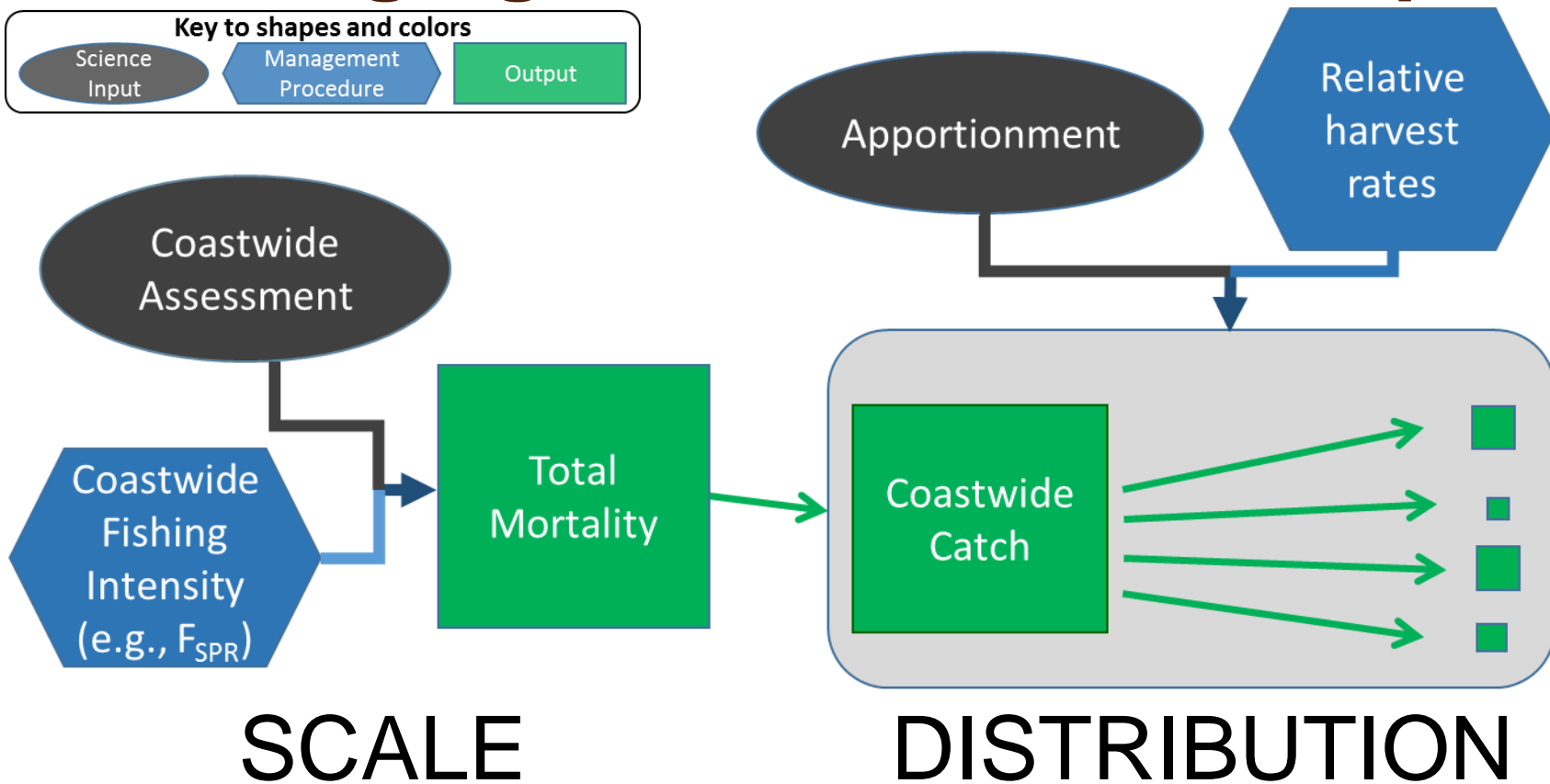
Spawning Potential Ratio (SPR)

$$\frac{\textbf{Spawning Output Per Recruit with fishing}}{\textbf{Spawning Output Per Recruit with no fishing}}$$

divided by

- A measure of the reduction in spawning potential due to fishing at a constant rate (F_{SPR})

- A long-term, average concept

- SPR=100% means no fishing

- SPR=40% means a 60% reduction in spawning potential

Coastwide Fishing Intensity

The benefits of SPR

- Provides a single measure of fishing intensity on all sizes and over all fisheries

- Relates to spawning potential

- Is commonly used around the world

- Has been researched extensively

Benefits of this SPR-based harvest policy

- Accounts for all mortality from all sources

- Separates scale and distribution

- Allows for a more straightforward and clear evaluation in an MSE

- First step to investigating Fisheries Footprints

Mapping to an SPR-based approach

1. Introduction of F_{SPR} to set the scale

   – Use past adopted catch levels to define *status quo*

2017 Alternative	Total removals (M lb)	Fishery CEY (M lb)	Fishing intensity	Stock Trend				Stock Status			
				Spawning biomass				Spawning biomass			
				in 2018		in 2020		in 2018		in 2020	
				is less than 2017	is 5% less than 2017	is less than 2017	is 5% less than 2017	is less than 30%	is less than 20%	is less than 30%	is less than 20%
No removals	0.0	0.0	$F_{100\%}$	<1	<1	<1	<1	3	<1	1	<1
Blue Line	37.9	26.1	$F_{48\%}$ 33%-62%	56	3	77	53	6	<1	12	<1
status quo SPR	41.6	29.7	$F_{46\%}$ 32%-60%	68	6	87	64	6	<1	15	<1

Looking into the future

- The *status quo SPR*

  – A stepping stone to map to a new harvest policy

  – Consistent with what we've been doing

    - The spawning biomass has recently been stable or slowly increasing at this F_{SPR} fishing intensity

  – Short-term, tactical decision making

- Various values of F_{SPR} can be evaluated with MSE

  – Long-term, strategic thinking

Management Strategy Evaluation

- Simulations to evaluate alternative management strategies (i.e., SPR) against defined objectives

		Management Procedures					
		High Effort				Low Effort	
		SPR=10%	SPR=20%	SPR=30%	SPR=40%	SPR=50%	SPR=60%
Objectives / **Performance metrics**	*Conservation*						
	Average biomass	XX	XX	XX	XX	XX	XX
	Biomass above value	Probability	Probability	Probability	Probability	Probability	Probability
	Yield						
	Average yield	XX	XX	XX	XX	XX	XX
	Variability in yield	XX	XX	XX	XX	XX	XX
	Catch above a value	Probability	Probability	Probability	Probability	Probability	Probability

Management procedures and scenarios

- A management procedure
  - Something that we control

- A scenario
  - Something that we cannot (or choose not to) control

Choose management procedures
that are robust to scenarios

Management procedures and scenarios

What about bycatch?

Abundance-based Management of PSC limit

- Prohibited Species Catch limit (PSC) of Pacific halibut
  - Currently a fixed amount determined by the NPFMC
- As halibut abundance declines
  - PSC limit is a larger proportion of the total removals
- As halibut abundance increases
  - PSC limit constrains other fisheries
- ABM of a PSC limit in Bering Sea/Aleutian Islands is a priority for NPFMC
  - Working group formed to provide alternatives for consideration

Bycatch in the MSE

- Potentially, future IPHC MSE models can help evaluate ABM of PSC limits in the BSAI

- The MSAB is focused on the directed fishery

- Current plan is to treat "bycatch" as a scenario
  - Integrate over a range of possible bycatch limits to develop a harvest policy robust to various PSC scenarios

Summary

- The current harvest policy needs updating

- An SPR-based harvest policy is presented
  - *Status quo* SPR a row in the decision table is an interim, short-term mapping over

- MSE will be used to evaluate alternative SPR values that will meet long-term objectives
  - Robust to possible bycatch scenarios