Abundance-based management for Pacific halibut PSC

June 2017 Council meeting
C-5

Inter-agency workgroup tasked to review:

1. Indices that may be available to assess the abundance of halibut
2. Types of control rules that could be used
   - E.g., “stair-step” PSC limits with or without “floors” or “ceilings”
   - Evaluate developing control rules that could be combined in a 2-or 3-dimensional framework for setting PSC
3. Types of policy decisions that the Council would need to consider as this effort progresses

Council objectives and overarching goals

- Halibut PSC limits should be indexed to halibut abundance
- Halibut spawning stock biomass should be protected especially at lower levels of abundance
- There should be flexibility provided to avoid unnecessarily constraining the groundfish fishery particularly when halibut abundance is high
- Provide for directed halibut fishing operations [in the Bering Sea]
- Provide for some stability in PSC limits on an inter-annual basis

Timeline / Council actions

April 2016

- purpose and need statement
- explore weightings on IPHC stock assessment and EBS trawl survey
- public review workshop of paper prior to Council meeting in October

October 2016

- workshop on discussion paper (September 2016)
- 5 Objectives confirmed for action
- consider broader range of indices and BCRs (SSC 2d and 3d)
- develop draft performance metrics w/ public input

February 2017

- Public workshop to solicit input on draft overarching goals, measurable objectives and associated performance metrics for analysis

April 2017

- Alternative development
  "Strawman" alternatives for illustration to aid selection of indices and control rules

June 2017

- Further exploration of indices
- Discussion of performance metrics/measurable objectives

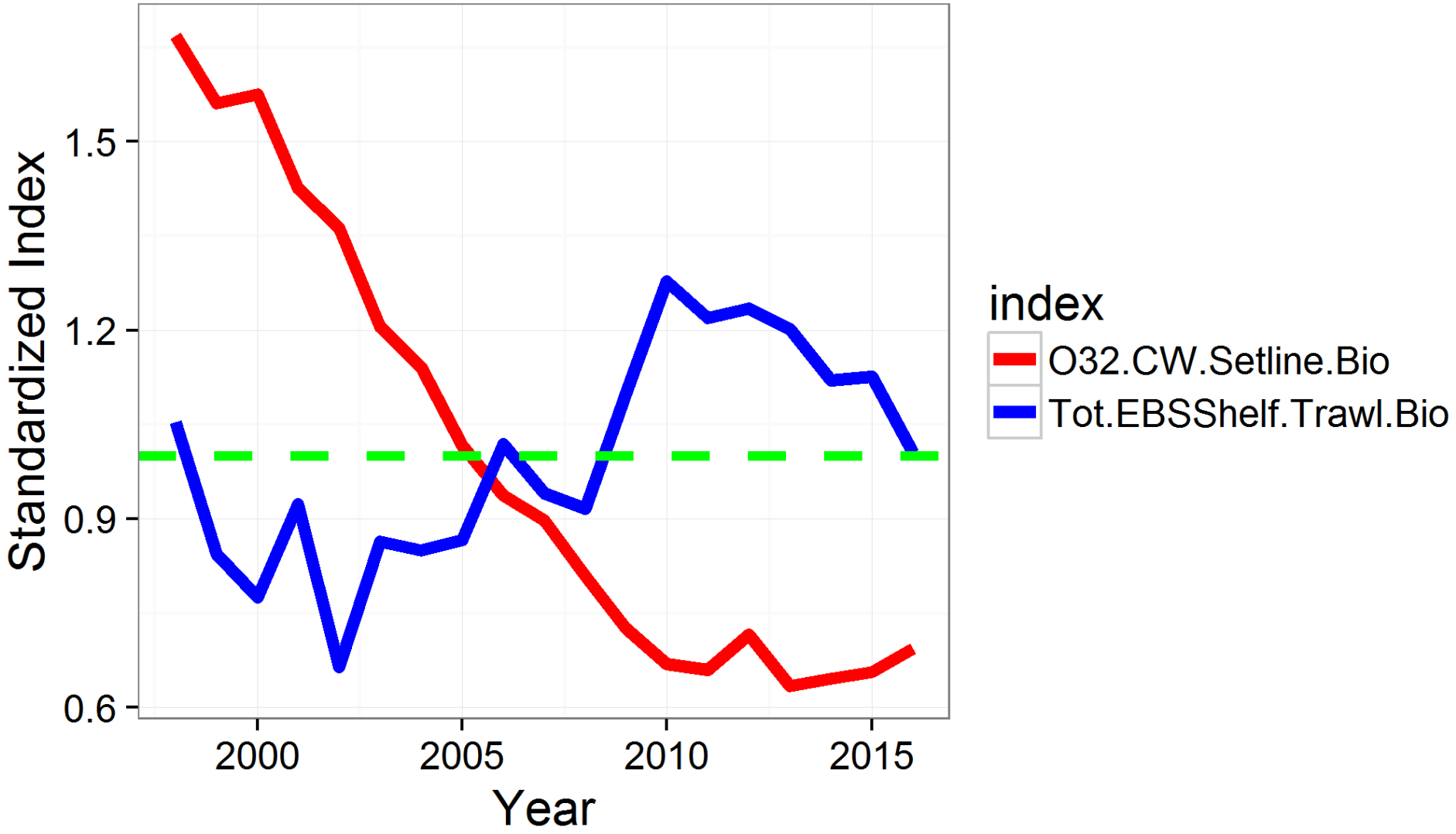
Council considerations in June 2017

Section name	Summary
Description of indices	A slightly more thorough description of the indices provided in April with some guidance on their use
Performance metrics review	Review the Council purpose and need and example of measurable objectives and related performance metrics
Draft outline of October 2017 discussion paper	Preliminary outline of what the workgroup thinks has been requested for October Council meeting

Considerations of indices for Pacific halibut for setting PSC limits {initial thoughts}

Candidate abundance index	Strengths	Weaknesses
IPHC coastwide stock assessment or set line survey	Comprehensive, annually available	Mainly older Pacific halibut than those in BSAI bycatch
AFSC EBS bottom trawl survey	Good younger Pacific halibut index, timely, available.	Inconsistent index of future Pacific halibut that recruit to the directed fisheries

IPHC Setline versus EBS Shelf Trawl Biomass



Some WG initial considerations for appropriate indices

- Addressed older and younger population components
- Considered the coastwide geographic range
- Considered the coastwide stock status
- Addressed recruitment differences in the BSAI and GOA
- Information to derive the index was available in a timely manner for Council harvest specifications
- Information to derive the index easily accessible

October 2016

- Candidate indices characterized
  - E.g., guiding principles
- Integrated index developed
- Control rule development
  - Features of CRs (floors, ceilings, slope, starting point)

Considerations

Indices

Abundance index	Addresses older and younger population components	Consideration of CW geographic range	Consideration of CW stock status	Addresses recruitment differences in BS AI and GOA	Timeliness of information	Accessibility
Individual survey indices						
IPHC Coastwide setline survey	No	Yes	Yes	No	Yes	Yes
EBS shelf trawl survey	No	No	No	No	Yes	Yes
Integrated approaches across multiple indices						
IPHC assessment	No	Yes	Yes	No	Yes	Yes
Geostatistical model	No	Partial (AK)	No	Yes	Yes	No
EBS shelf trawl survey with IPHC assessment	Yes	Yes	Yes	No	Yes	Yes
ABM 3 survey combined index (EBS shelf trawl, GOA trawl, IPHC setline)	Yes	Yes	Yes	Yes	Yes	Yes

April 2017 Council meeting

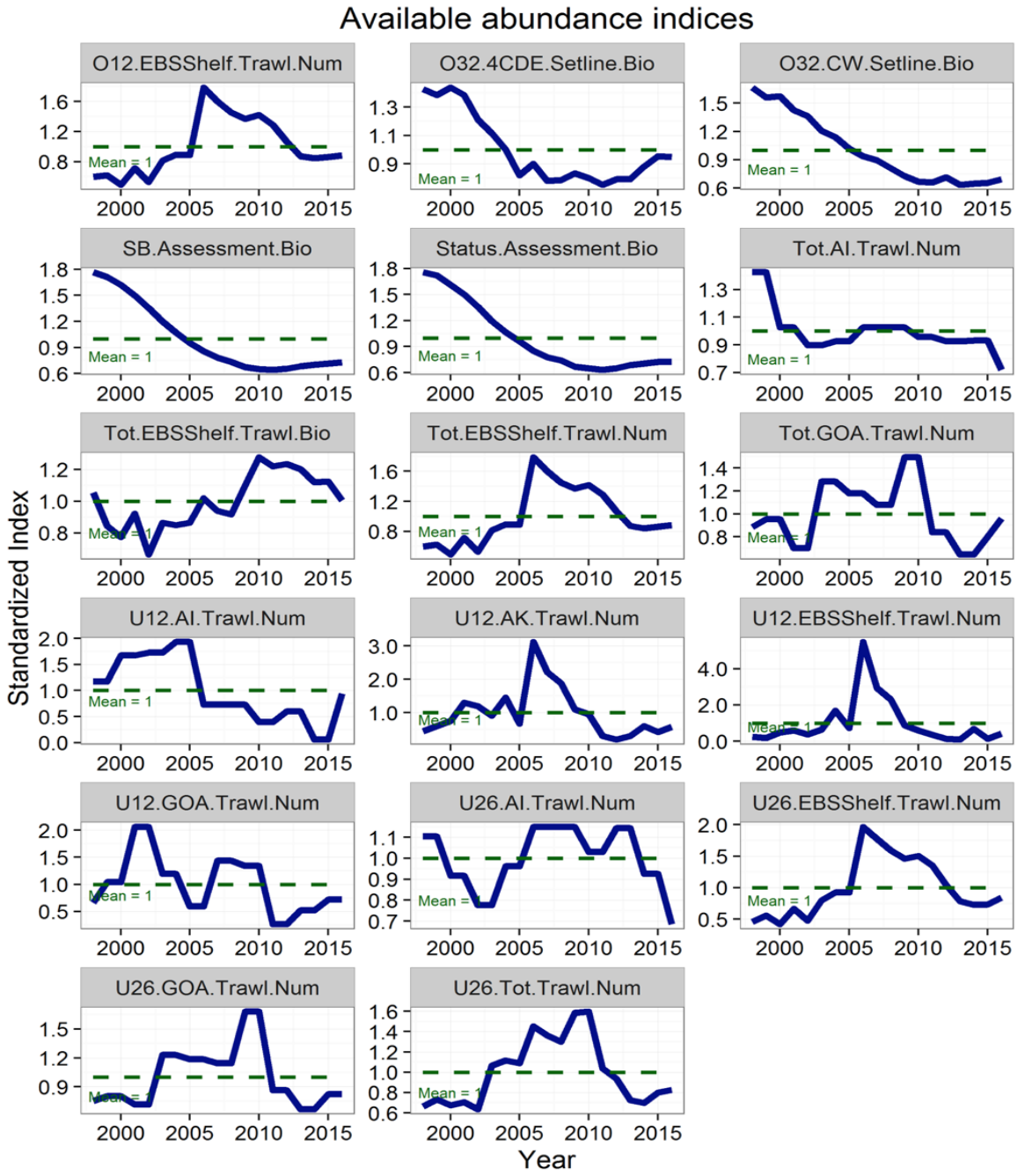
April 2017 Council Motion:

- *In the development of halibut abundance indices, the Council seeks to better understand the characteristics and applicability of each of the proposed component indices that comprise the strawmen ABMs.*

- The Council directed the workgroup to prepare an expanded discussion paper that:
  - Describes the extent to which the indices represent the segment of the population they are assumed to represent and what is actually encountered by the fisheries,
  - Describes the extent each index meets each working group principle,
  - Analyzes strawman ABMs using an 'all else equal' approach as specified by the SSC.

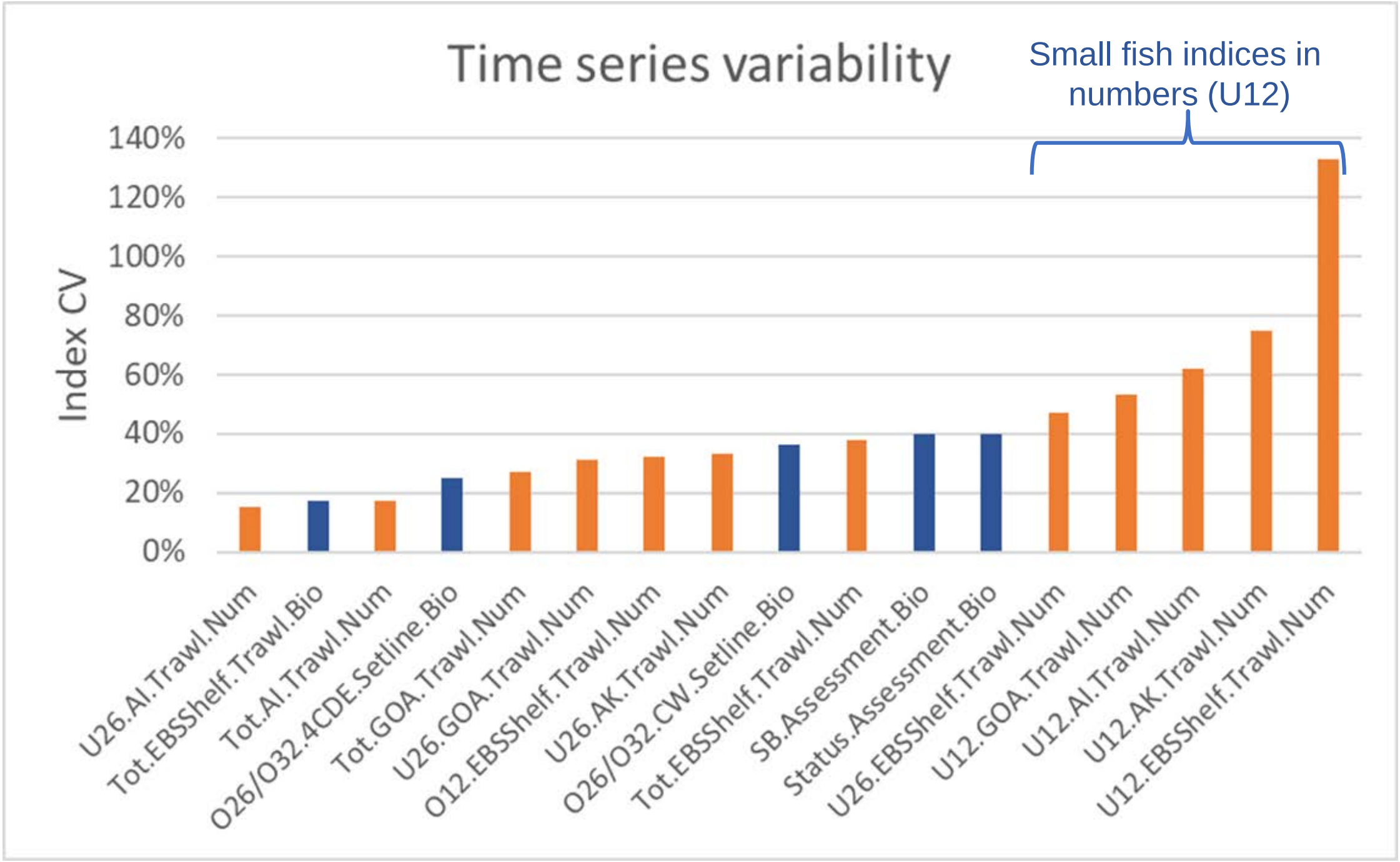
Description of indices

- April 2017 we presented 17 indices that related to various aspects of halibut abundance that were considered by the workgroup
- WG drafted some combinations of subset (8) indices to form ABM candidate alternatives to meet general principles



Uncertainty/variability

- We can compare all indices on their interannual variability or time-series coefficient of variation
  - This variability is a combination of both process and measurement error
- Indices in numbers will inherently vary more than those in biomass
  - High index variability is not a bad thing if it's measuring real changes in abundance, control rules can stabilize as desired
- Measurement/sampling error estimates missing for some indices
- Alternative measures of "index confidence" could include:
  - Spatial coverage (sampling fraction)
  - Total amount of halibut caught on average

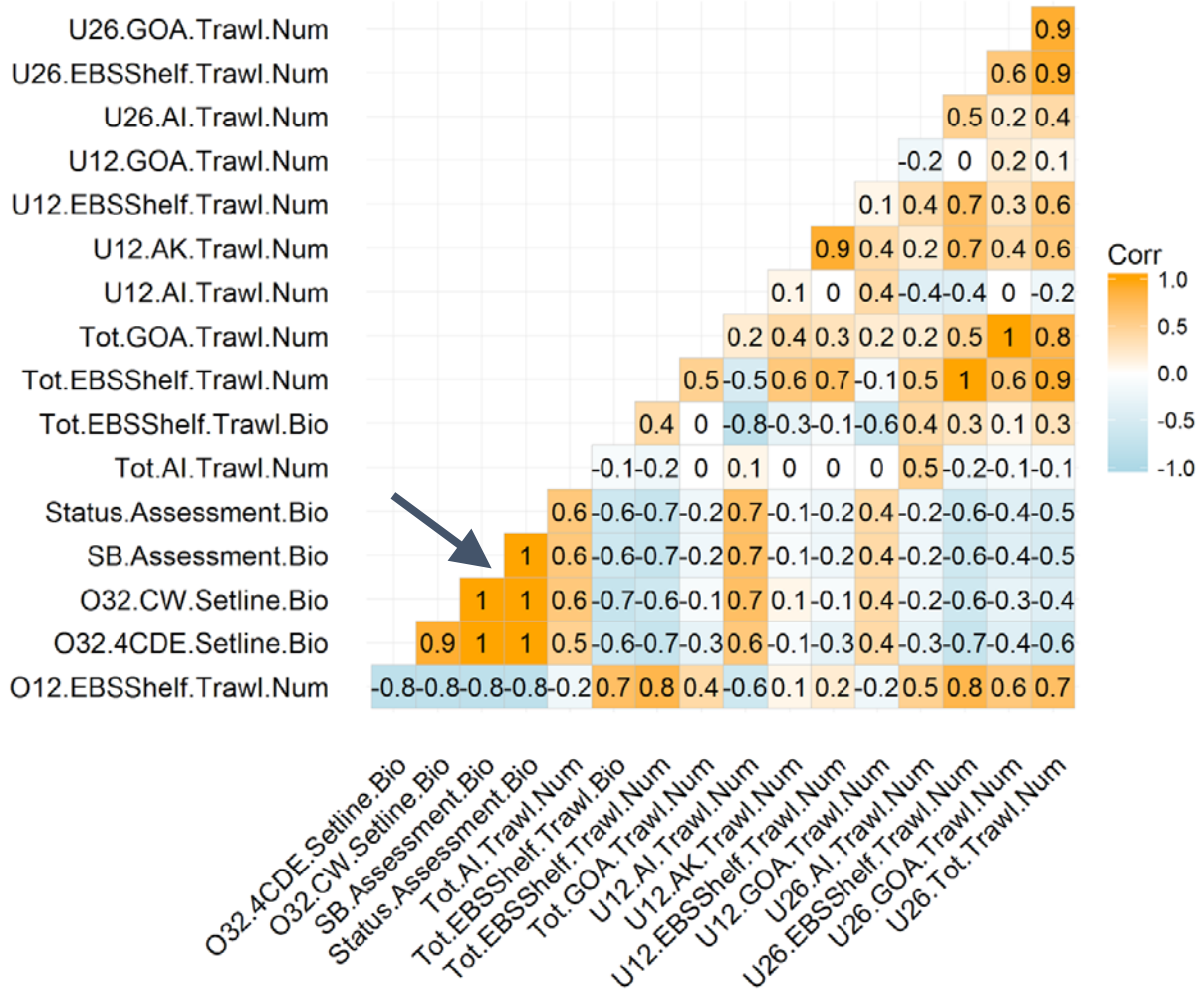

Time series variability
Small fish indices in numbers (U12)
Index CV
140%
120%
100%
80%
60%
40%
20%
0%
U26.AI.Trawl.Num
Tot.EBSShelf.Trawl.Bio
Tot.AI.Trawl.Num
O26/O32.4CDE.Setline.Bio
Tot.GOA.Trawl.Num
U26.GOA.Trawl.Num
O12.EBSShelf.Trawl.Num
U26.AK.Trawl.Num
O26/O32.CW.Setline.Bio
Tot.EBSShelf.Trawl.Num
SB.Assessment.Bio
Status.Assessment.Bio
U26.EBSShelf.Trawl.Num
U12.GOA.Trawl.Num
U12.AI.Trawl.Num
U12.AK.Trawl.Num
U12.EBSShelf.Trawl.Num

Review of the indices

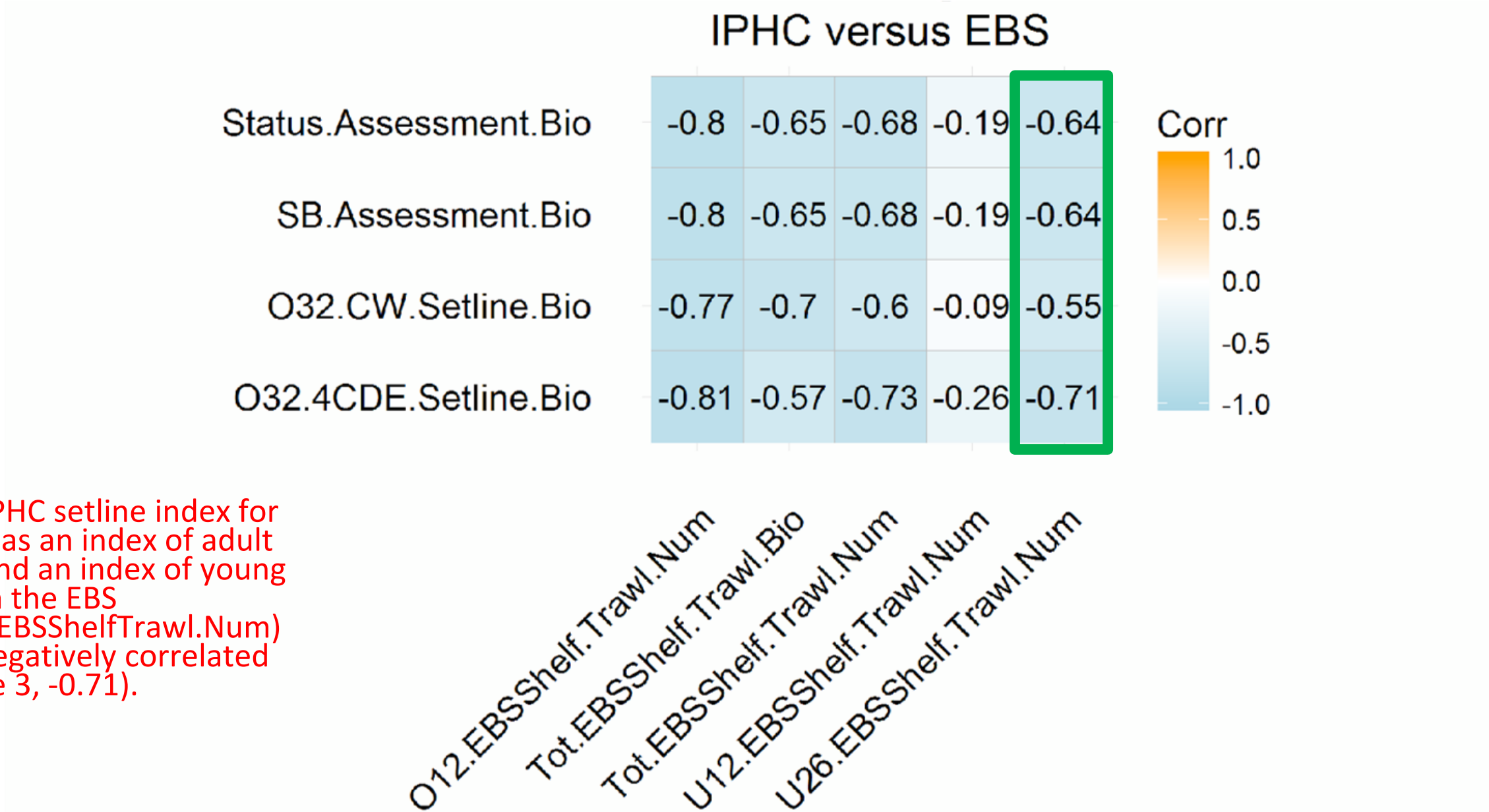
Biomass (adult indices and directed fishery)	Numbers (bycatch encounter and recruitment)
IPHC Setline Survey	NMFS EBS Shelf Trawl Survey
IPHC Stock Assessment Spawning Biomass	NMFS GOA Trawl Survey
IPHC Stock Status	NMFS AI Trawl Survey
NMFS EBS Shelf Trawl survey	Multiple combinations of the above with different size groups

Pacific halibut Index Name	ABM Option	Description	Applies to what part of the halibut population
O26/O32.4CDE.Setline.Bio		Biomass of halibut over 32 inches from the IPHC setline survey in the BS/AI	Representative of mostly female mature fish, and fish targeted by the directed fishery in the EBS (Area 4CDE)
O26/O32.CW.Setline.Bio	**1, 2 3, 4**	Biomass of halibut over 32 inches from the IPHC setline survey in all areas	Representative of mostly female mature fish and as a proxy to coast wide stock status

Correlation between all indices

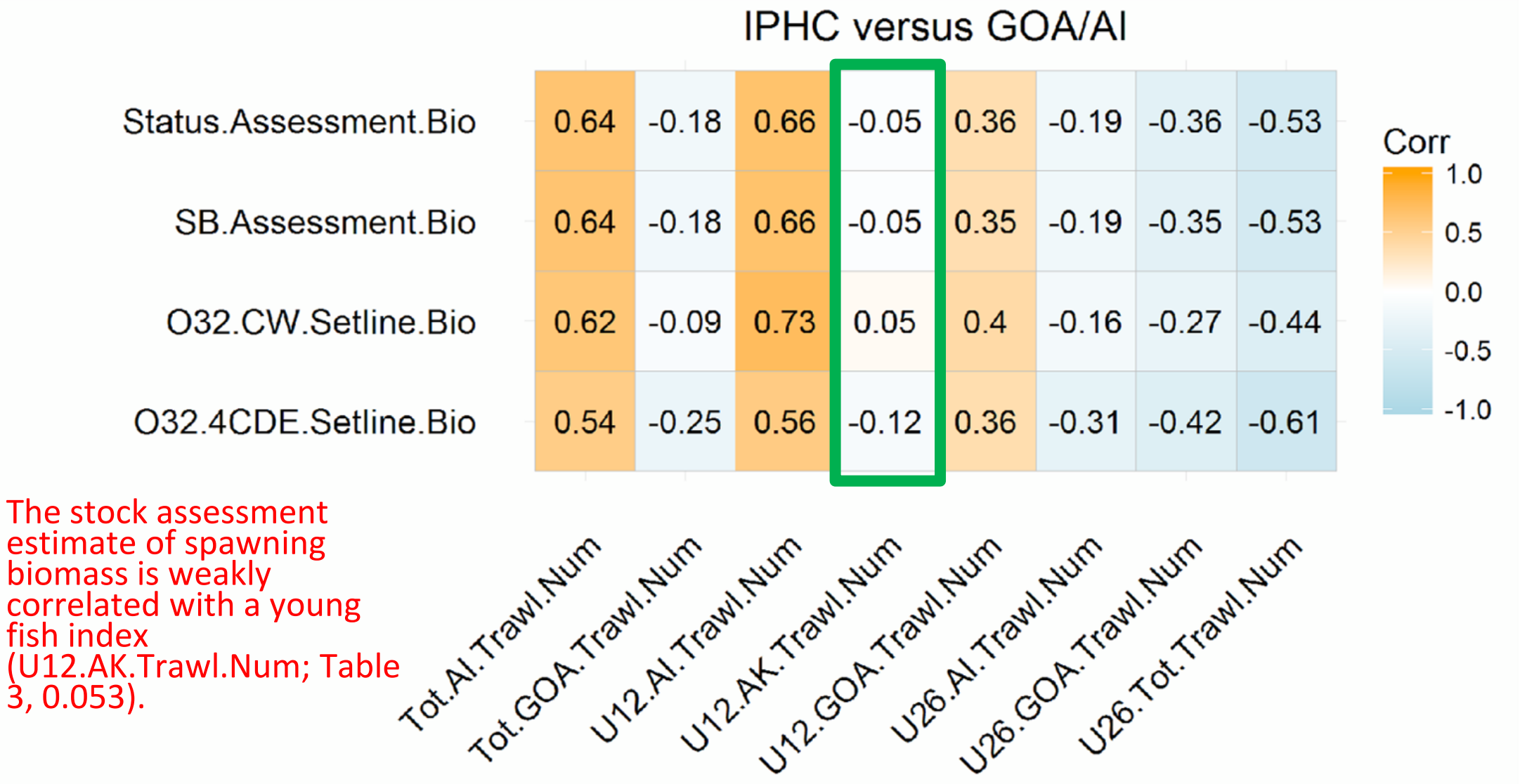


Correlation between indices



The IPHC setline index for 4CDE as an index of adult fish and an index of young fish in the EBS (U26.EBSShelfTrawl.Num) are negatively correlated (Table 3, -0.71).

Correlation between indices



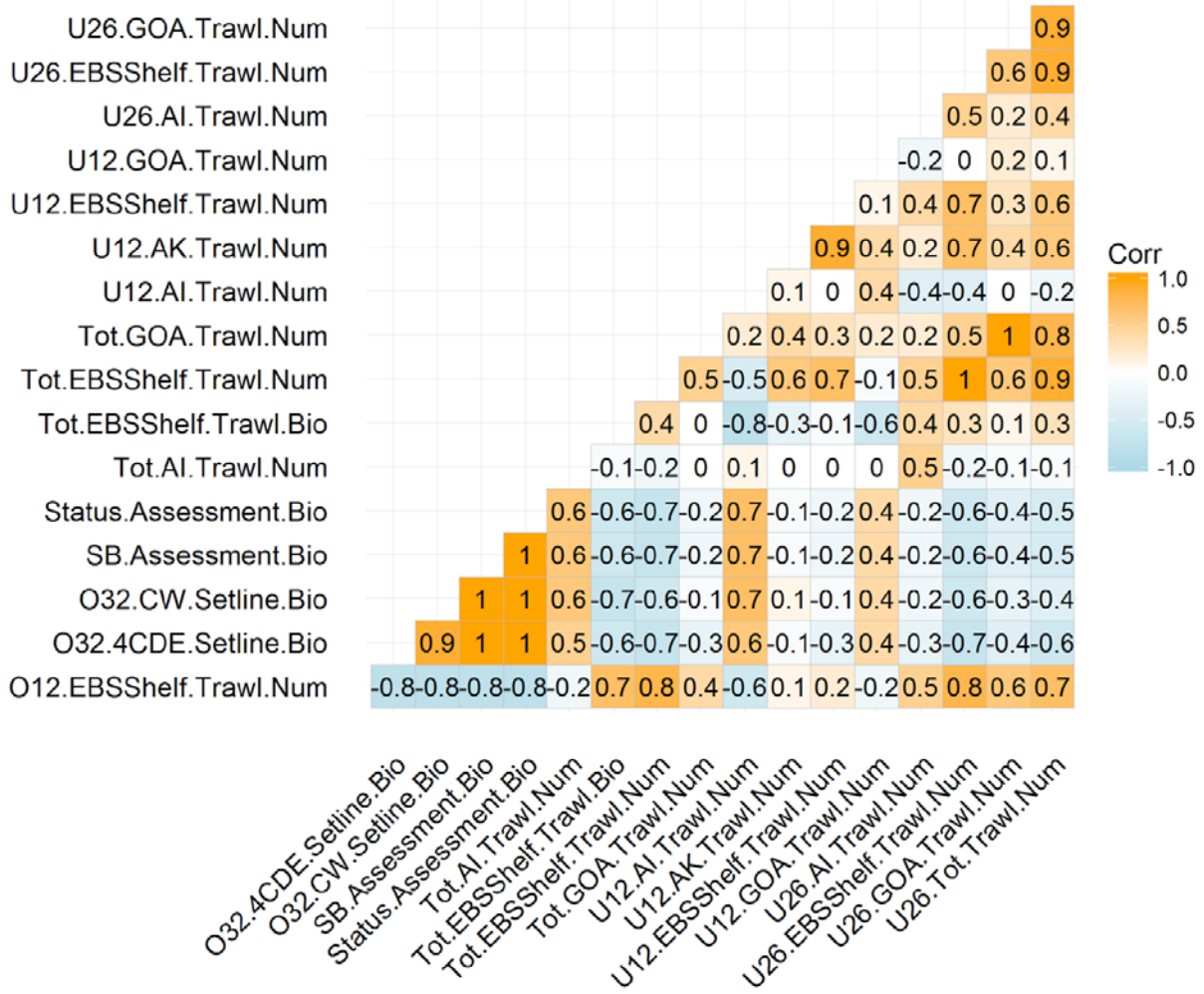
The stock assessment estimate of spawning biomass is weakly correlated with a young fish index (U12.AK.Trawl.Num; Table 3, 0.053).

Correlation between indices

- Coastwide stock status is best tracked with IPHC indices. Indices from their stock assessment model and their setline survey are virtually interchangeable due to their high **positive correlations**.
- This contrasts with EBS trawl-survey indices which are negatively correlated with IPHC indices.
- **Hence, EBS trawl survey indices appear to be unsuitable for tracking coastwide Pacific halibut stock status.**
- **For indices that track Pacific halibut recruitment, or general presence of young fish, it is probably best to choose an index in numbers.** Such an index may be **uncorrelated** with stock status or an index of large fish.

Index Combination Summary

- Combining indices that are either uncorrelated or negatively correlated would have properties that would help in explaining different dynamics of the population
- Choosing indices that are highly positively correlated would have the effect of adding emphasis to that population component and for simplicity, it would likely be better to use just one of them.
- There are multiple indices available for each stock attribute being addressed and several are interchangeable.



Some WG initial considerations for appropriate indices

- Addressed older and younger population components
- Considered the coastwide geographic range
- Considered the coastwide stock status
- Addressed recruitment differences in the BSAI and GOA
- Information to derive the index was available in a timely manner for Council harvest specifications
- Information to derive the index easily accessible

Evolution of indices

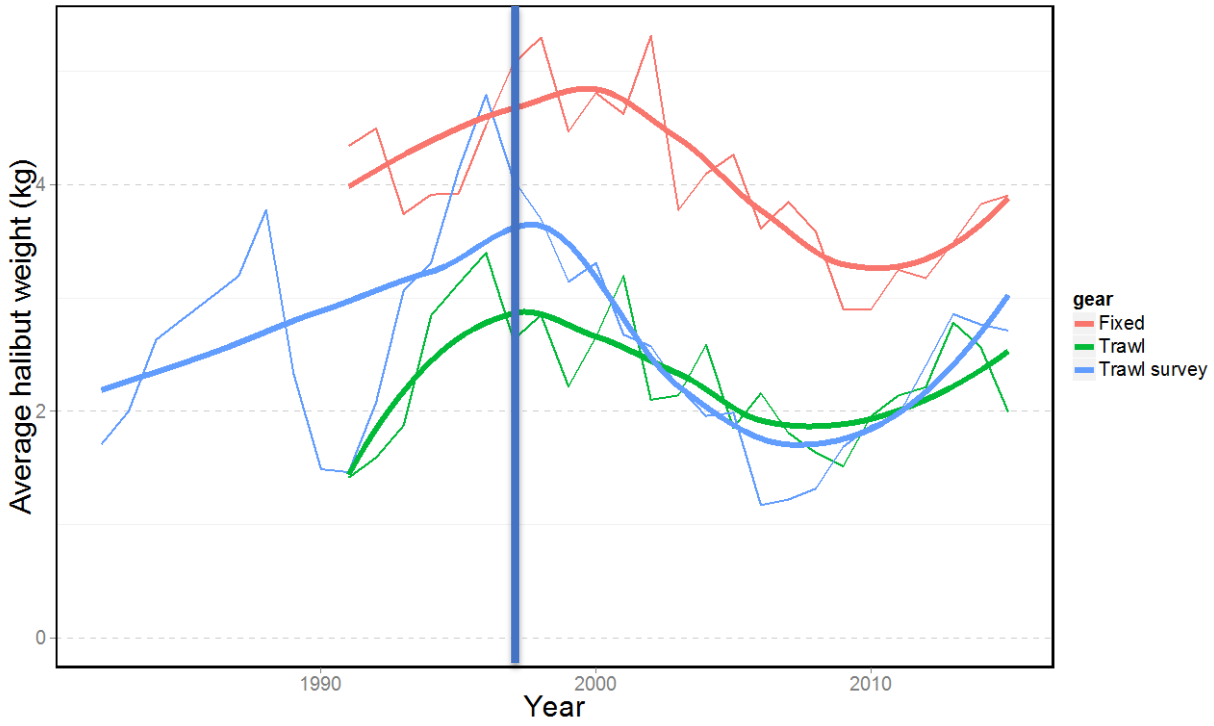
- Gather all available data sources related to halibut
- Explore portion of halibut stock covered
- Discuss limitations of each data set
- Got feedback on what indices should cover
  - Stock status
  - Fishery encounters
  - Directed fishery
  - Recruitment
- Initial winnowing excluded EBS Slope, NMFS longline, geostatistical indices
- 2nd pass created more length based indices
- Final pass will further winnow to just a few of the “best”

Fishery data analysis

- April 2016
  - Examination of available halibut bycatch data from 1991-2015
    - Comparison of fixed gear, trawl gear, and EBS shelf trawl survey
      - By week
      - By target
      - Catch of halibut/catch of target (not by sector)
      - Size comparisons by gear
- April 2017
  - Comparison of size compositions between targets and gear types

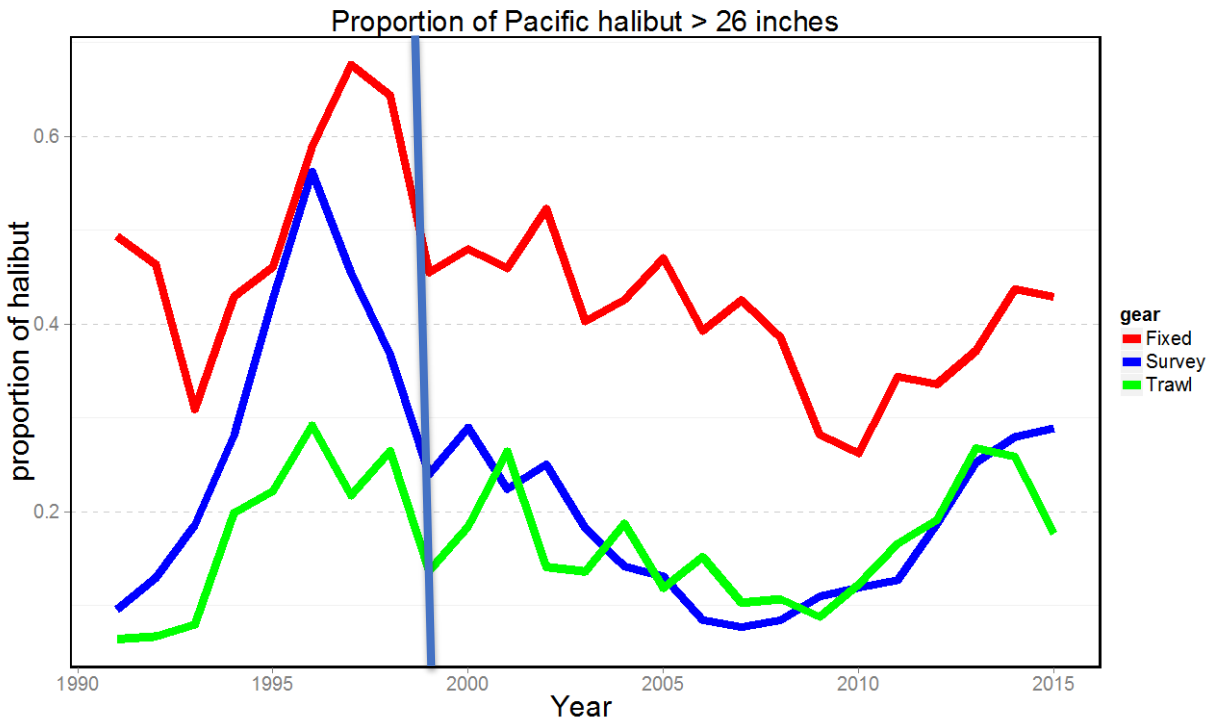
Fishery data analysis

- Trawl survey and trawl fishery average weight is very similar since 1998
- Proportion of O26/O32 in trawl survey and fishery similar since 1998



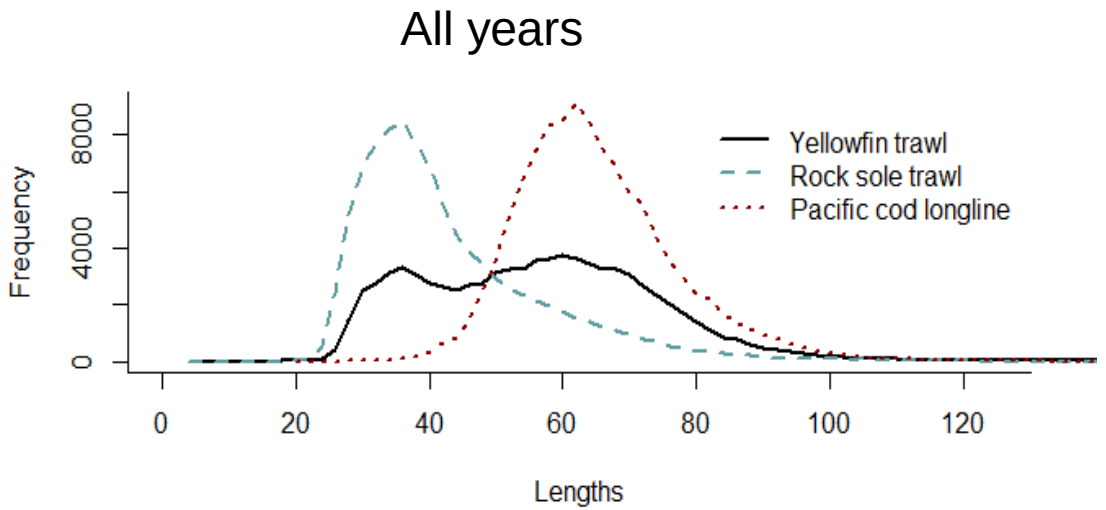
Fishery data analysis

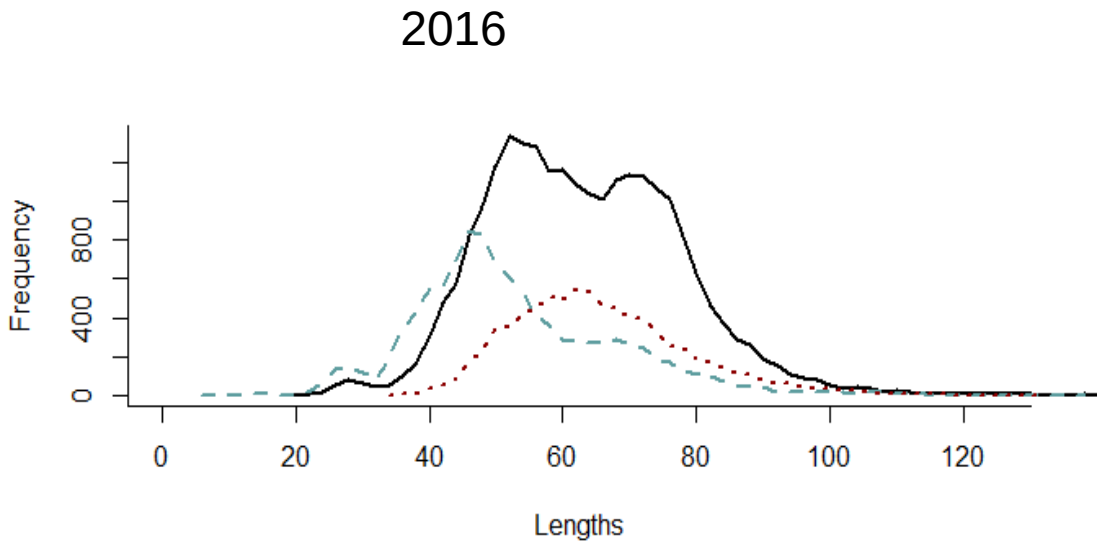
- Trawl survey and trawl fishery average weight is very similar since 1998
- Proportion of O26/O32 in trawl survey and fishery similar since 1998



Fishery data analysis

- Bycatch length frequencies compared among targets and gear types
- All year average is typical with rock sole catching small fish, P. Cod longline larger, and YFS in between
- 2016 looked similar but more variable





Measurable objectives and performance metrics for analysis

- In order to assist in formulating alternatives, the workgroup requested the Council and stakeholders to define detailed management objectives with measurable outcomes
- Each measurable objective has an outcome (“a certain abundance”), a time-frame (“a specified number of years”) and a probability or acceptable risk level
- A performance metric can then be defined to evaluate whether or not a measurable objective has been achieved in the analysis of alternatives (e.g., the probability that the spawning stock abundance is above a certain level over a specific number of years)

Example performance metrics (Table 3)

Adult stock status:

Objective: Maintain a healthy coast wide halibut stock

Metric: Halibut spawning biomass must be above 30% of unfished 80% of the time

Stability:

Objective: Do not allow PSC limits to have extreme annual changes

Metric: PSC limit cannot change more than 5% per year

Moving forward: Outline of October Discussion Paper (Section 4 of paper)

1. Background information (additional fishery data?)
2. Components of abundance-based halibut PSC management
    a. Characteristics and correlation analysis of indices considered and recommended ones for consideration
    b. Analysis of impact of systematically combining some individual indices
3. Development of ABM alternatives
    a. Using a sub-set of the individual and combined indices considered in Section 2 {SSC guidance June 2017}
    b. Construction of additional Elements and Options for range of ABM alternatives
4. Overview of intent for analysis of ABM alternatives

Some additional considerations

1. Potential **starting points** for PSC (June 2017 SSC minutes)
    - Absent additional guidance from the Council, staff will use the default values listed in Element 4 for preliminary analysis.

Element 4 – Starting point for PSC limit

- Option 1. 2016 PSC limit (3,515 t)
- Option 2. Average of 2008 - 2016 PSC limit (4,369 t)
- Option 3. Average of 2008 - 2016 PSC use (3,265 t)

Fishery data analysis

- Trawl survey and trawl fishery average weight is very similar since 1998
- Proportion of O26/O32 in trawl survey and fishery similar since 1998
- Trawl CPUE and survey CPUE similar since 1998