Ecosystem & Socioeconomic Profile Overview and Update

Kalei Shotwell, Groundfish Plan Team, September 2023

ESP Definition: A standardized framework that facilitates the integration of ecosystem and socioeconomic factors within the stock assessment process and acts as a proving ground for use in management advice.

Progression

Groundfish Plan Team (sablefish, pollock, Pacific cod)

Scientific and Statistical Committee

Crab Plan Team (king, snow)

Center Workshops

Council (+ecosystem)

National

- **Pacific Islands ESPs (2020, uku)**
- **Northeast center ESPs (2021, bluefish, seabass, cod, mackerel)**

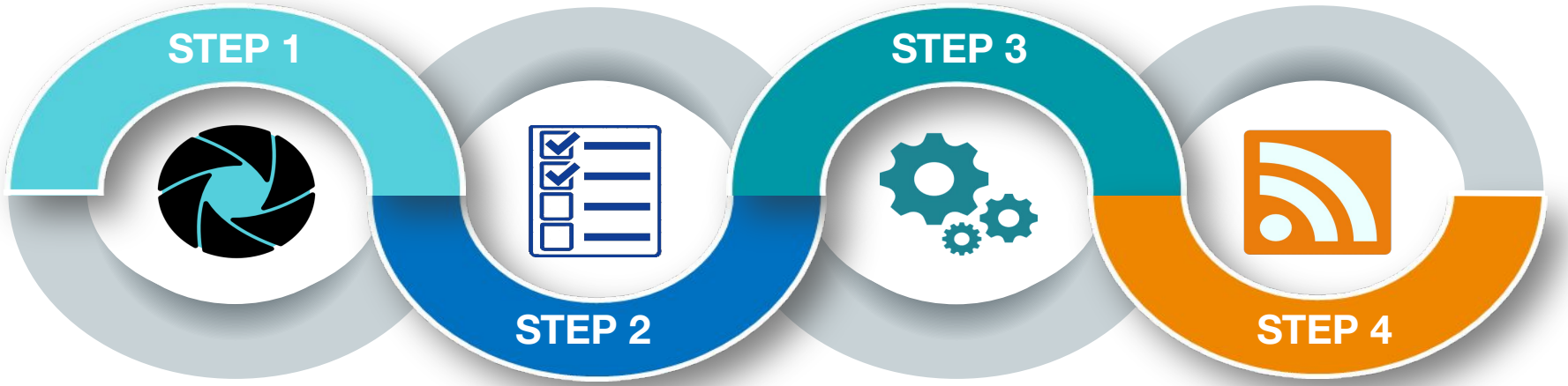
Process

Synthesize

- Conduct Literature Evaluation
- Create Ecological Synthesis
- Identify Mechanistic Linkages

Communicate

- Create Standard Templates
- Integrate with Management
- Report Status and Trends



Focus

- Objectively Review Stocks
- Use Regional Priorities
- Identify ESP Stocks

Analyze

- Create Indicator Suite
- Monitor Indicators Frequently
- Conduct Tests on Trends

Decisions

Inform uncertainty

Provide additional context

- Risk Tables
- Rebuilding Plans
- TAC Discussions
- Survey Planning
- Research Priorities
- Request for Proposals

Inform assessment model…

assumptions

- Mechanistic linkages
- Consistency with stock life history
- Biological realism

choices

- Inform data conditioning
- Time blocks
- Parameter values consistent with existing info

covariates

- Indicator time series directly included in a model

Report Summary

Stock	Year initiated	Full ESP	Partial update	Report card
Sablefish	2017	2017 - 2019	2020	2021, 2022
Gulf of Alaska Pollock	2019	2019	2020	2021, 2022
EBS Pacific Cod	2020	2021		2021, 2022
GOA Pacific Cod	2020	2021		2021, 2022
St Matthew Blue King Crab	2019	2019	2020	2022
Bristol Bay Red King Crab	2020	2020		2021, 2022, 2023
Bering Sea Snow Crab	2021	2022		2023

Note: Report cards are produced annually unless no SAFE

Update

This Year	Overview of ESPs for 2023, progress on importance methods, report streamlining
Next Year	Plans for 2024 ESPs, initiating Request For Information (RFI), data complexity advances, climate readiness alternatives
National	Developing National ESP Initiative including creating, sharing, synthesis workshops

Current (2023) ESPs

- ESP updates to Crab and Groundfish Plan Team (May, September)
- Report Card ESPs
  - Bristol Bay Red King and EBS Snow Crab in September
  - Sablefish, GOA pollock, GOA Pacific cod, and EBS Pacific cod in November
  - Only updated indicator data or minor changes (e.g., data updates to indicators, slight methods modifications, upgraded indicator)
- No full ESPs but testing climate readiness alternatives

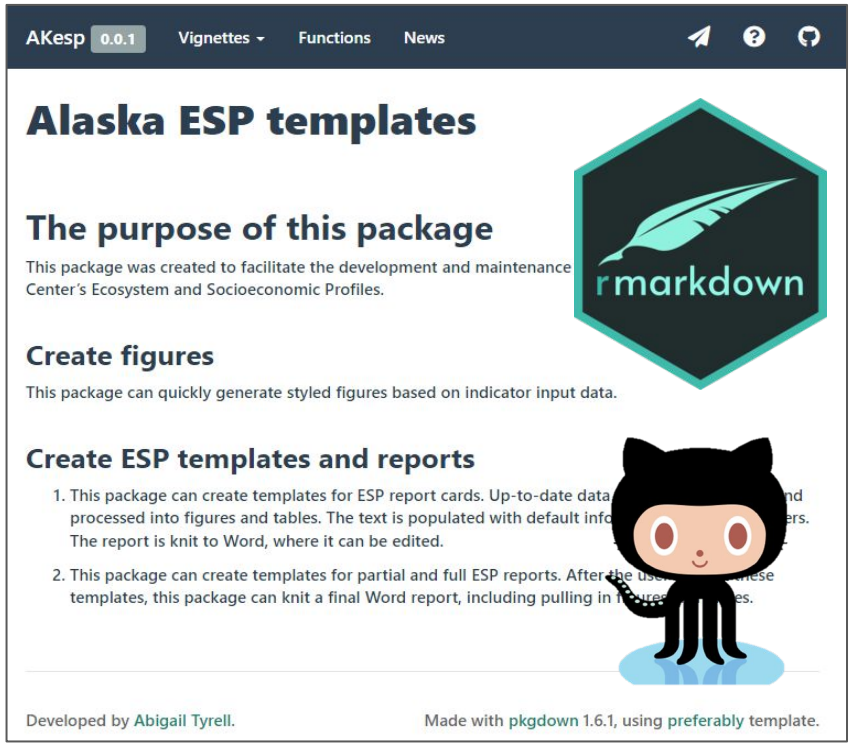
Importance Methods Project

- Evaluating five different statistical methods (sablefish case study)
  - Bayesian adaptive sampling (BAS)
  - Boosted regression trees (BRT)
  - General additive models (GAMs)
  - Dynamic factor analysis (DFA) + robust regression
  - Structural equation modeling (SEM, trial run)
- Preliminary results presented at ESP workshops

Team: Oke, Shotwell, Siddon, Cunningham, Goethel, Arimitsu, Lunsford

Reproducibility Project

- Developed AKESP R package
  - Provided through GitHub
  - Connects to AKFIN web service
  - ESP database has all ESP indicators
  - Standard set of graphics available (updating)
  - Report templates in R Markdown (updating)
- Expanding for National ESP (in progress)



Team: Shotwell, Fedewa, Karp, Chan, Oakes, Griffis, AKFIN

Reproducibility Project

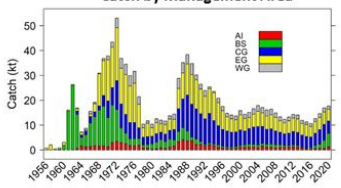
NOAA FISHERIES

Sablefish (*Anoplopoma fimbria*)

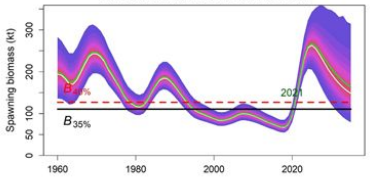
Stock Assessment & Status

- Bering Sea/Aleutian Islands and Gulf of Alaska stock with custom statistical catch-at-age model
- Benchmark assessment in 2016 included CIE recommendations to 1) account for whale depredation on the survey and fishery, and 2) propagate more structural uncertainty of management quantities.

Catch by Management Area



Biomass with Reference Points



Year	ABC	OFL	Total Biomass	B/ B_MSY	F/ F_MSY	Recruits (mill #s)	Total Catch	Ex-Value (mill $)
2015	13,657	16,128	188,000	0.66	0.78	26.63	10,970	100.6
2016	11,795	13,397	170,000	0.63	0.78	163.65	10,257	98
2017	13,083	15,485	206,000	0.60	0.88	123.44	12,270	123.5
2018	14,957	29,507	515,000	0.59	0.77	12.47	14,341	93.7
2019	15,068	32,798	414,000	0.66	0.58	17.5	16,624	73.6

This stock is not subjected to overfishing, currently overfished, nor approaching an overfished condition.

Research Priorities

1) Evaluate apportionment strategies for ABC, use spatially explicit research model
2) Explore integration of ecosystem data to understand highly variable recruitment
3) Refine fishery abundance index, identify covariates that affect catch rates

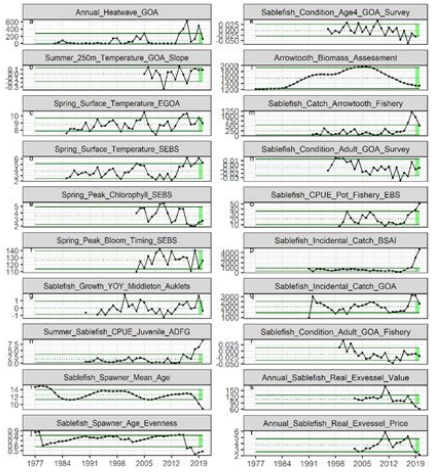
Assessment: https://www.afsc.noaa.gov/REFM/Docs/2019/GOAsablefish.pdf, Contact: Dana.Hanselman@noaa.gov

NOAA FISHERIES

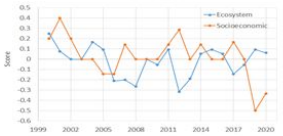
Sablefish (*Anoplopoma fimbria*)

- Data rich stock, high recruitment variability, rapid early life growth, shifting distribution, high value

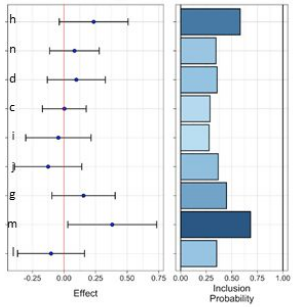
Indicators



Score



Importance



- Presence of 2016 and 2019 year class in ADF&G survey, age 4 fish generally in poor condition, higher spatial overlap with arrowtooth in fishery, physical + but < from 2019, lower stable, upper slight >
- Incidental catch < in GOA, > in BSAI indicates expanding habitat, ex-vessel value and price/pound on recent decline, community analysis in progress

Research Model Performance (hypothetical)

Model	ABC	OFL	Cross Validation	Retrospective	Recruitment Comparison	SSB Comparison
SAFE	26,250	30,000	28% +/- 6%	+0.19	0.5	0.5
Eco	23,625	27,000	46% +/- 12%	+0.07	0.65	0.3

ESP: https://www.afsc.noaa.gov/REFM/Docs/[YEAR]/GOAsablefish.pdf, Contact: Kalei.Shotwell@noaa.gov

Update

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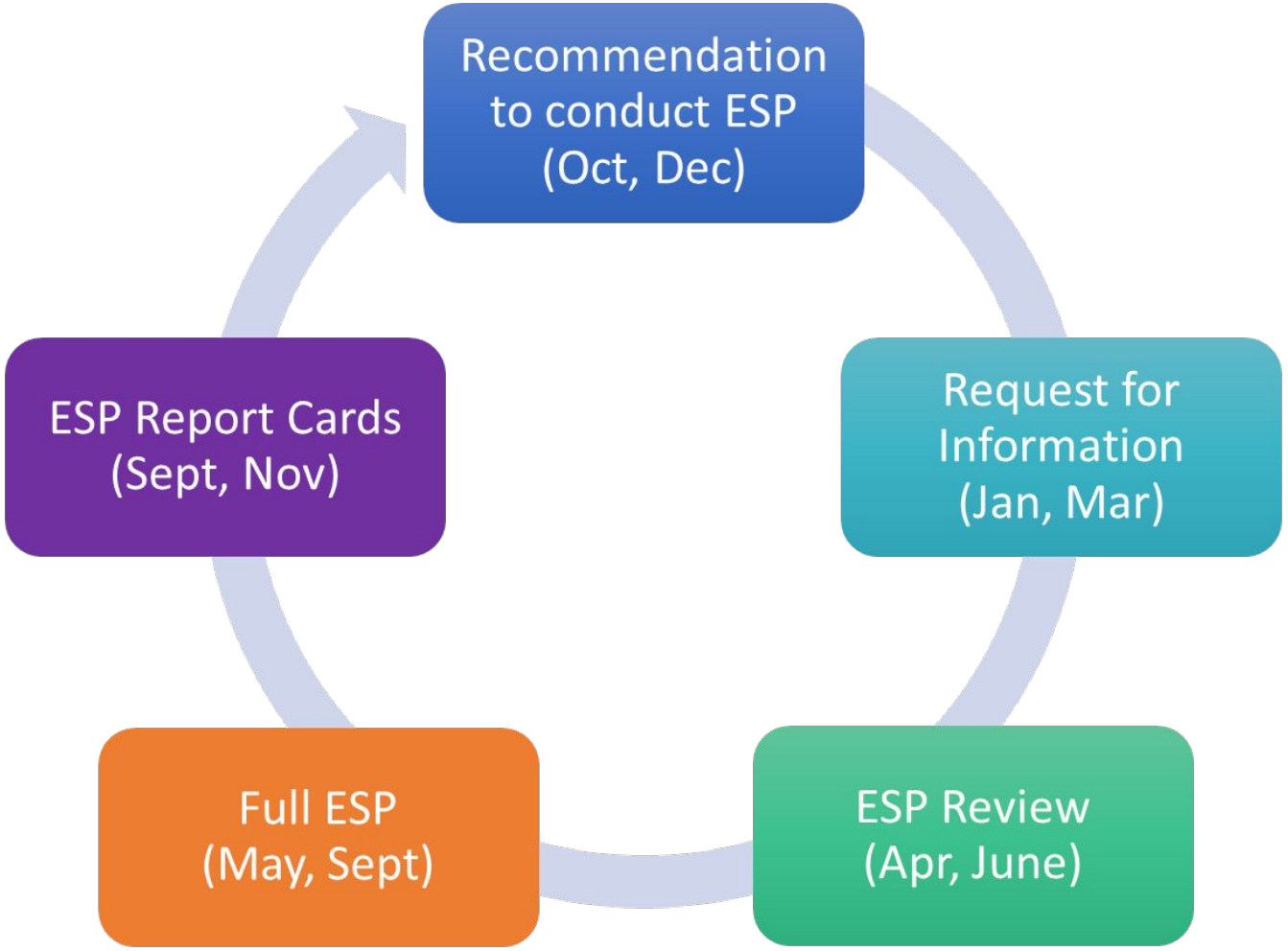
Future (2024) ESPs

- Full ESPs
  - Initiate EBS Tanner Crab ESP, present progress report in May (*support?*)
  - Initiate EBS Pollock ESP, present progress report in September (*support?*)
  - Potentially update full Sablefish ESP, present in September
- Report Card ESPs
  - St Matts blue king, Bristol Bay red king, and EBS snow crab in September
  - Sablefish, GOA pollock, GOA Pacific cod, and EBS Pacific cod in November

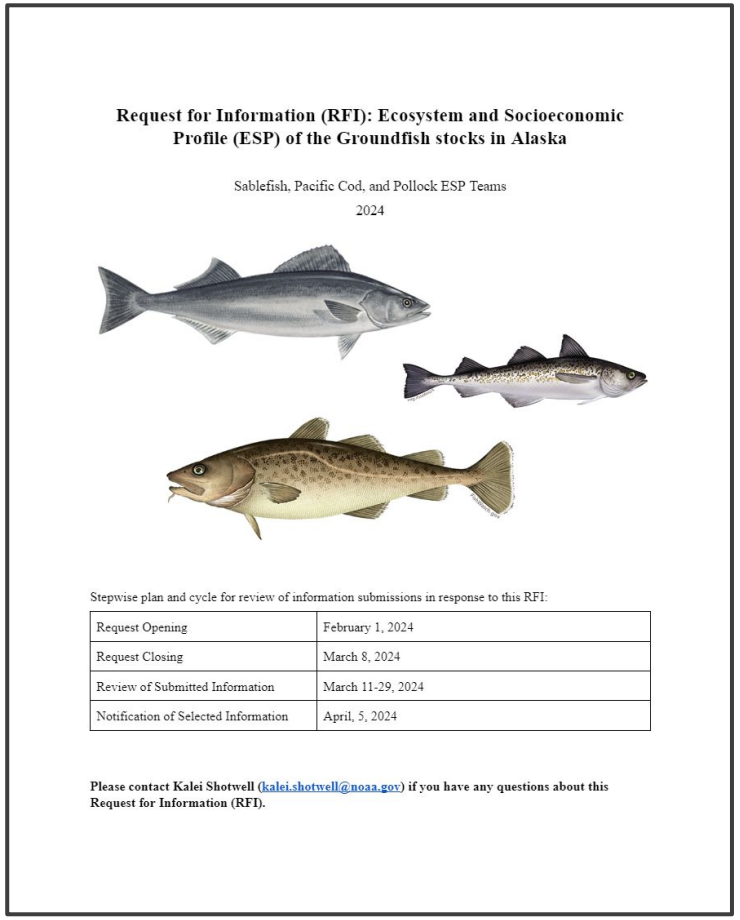
Timeline


Recommendation to conduct ESP (Oct, Dec)
Request for Information (Jan, Mar)
ESP Review (Apr, June)
Full ESP (May, Sept)
ESP Report Cards (Sept, Nov)

Request For Information (RFI)

Four main elements (example)

1. **Description**: process, cycle
2. **Request**: bulleted list of requested information representing data gaps and research priorities by stock
3. **Contributions**: data fields and submission instructions
4. **Review and Responsibilities**: teams and contributor roles, use and credit



Request for Information (RFI): Ecosystem and Socioeconomic Profile (ESP) of the Groundfish stocks in Alaska

Sablefish, Pacific Cod, and Pollock ESP Teams

2024

Stepwise plan and cycle for review of information submissions in response to this RFI:

Request Opening	February 1, 2024
Request Closing	March 8, 2024
Review of Submitted Information	March 11-29, 2024
Notification of Selected Information	April, 5, 2024

Please contact Kalei Shotwell (kalei.shotwell@noaa.gov) if you have any questions about this Request for Information (RFI).

AKFIN Data Management Application

May include complex datasets such as error estimates, spatially explicit data

ESP Data Submission (csv, xls, ...)

AFSC Data Management Application

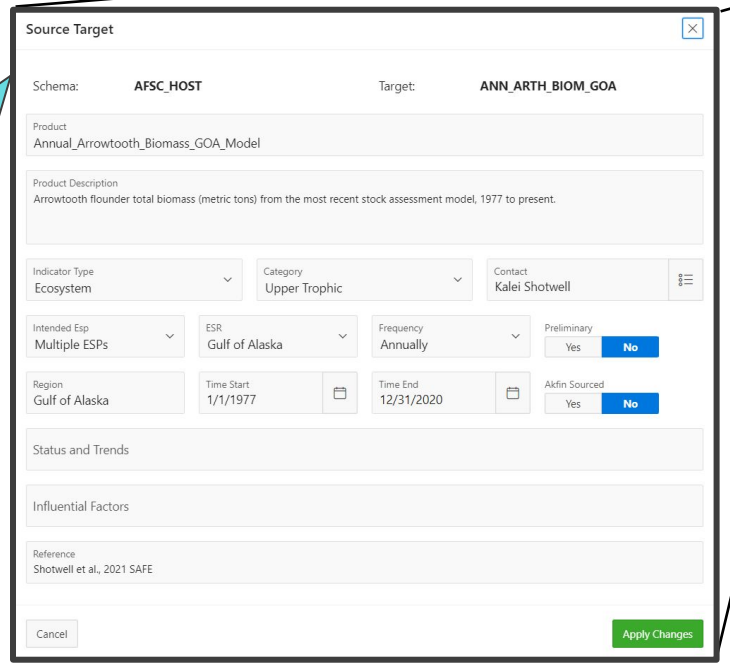
Upload Temporary File

Data Staging and Review

Data in Production

If data already on AKFIN, automatic updating is available

Advanced metadata features to include DOIs, prelim obs, images, and can add more as desired



Website landing page with links to ESPs, repos, instructions

AKFIN Answers Dashboard

AKFIN APEX Public Reports

AKFIN Web Services

AKFIN Data Access Points

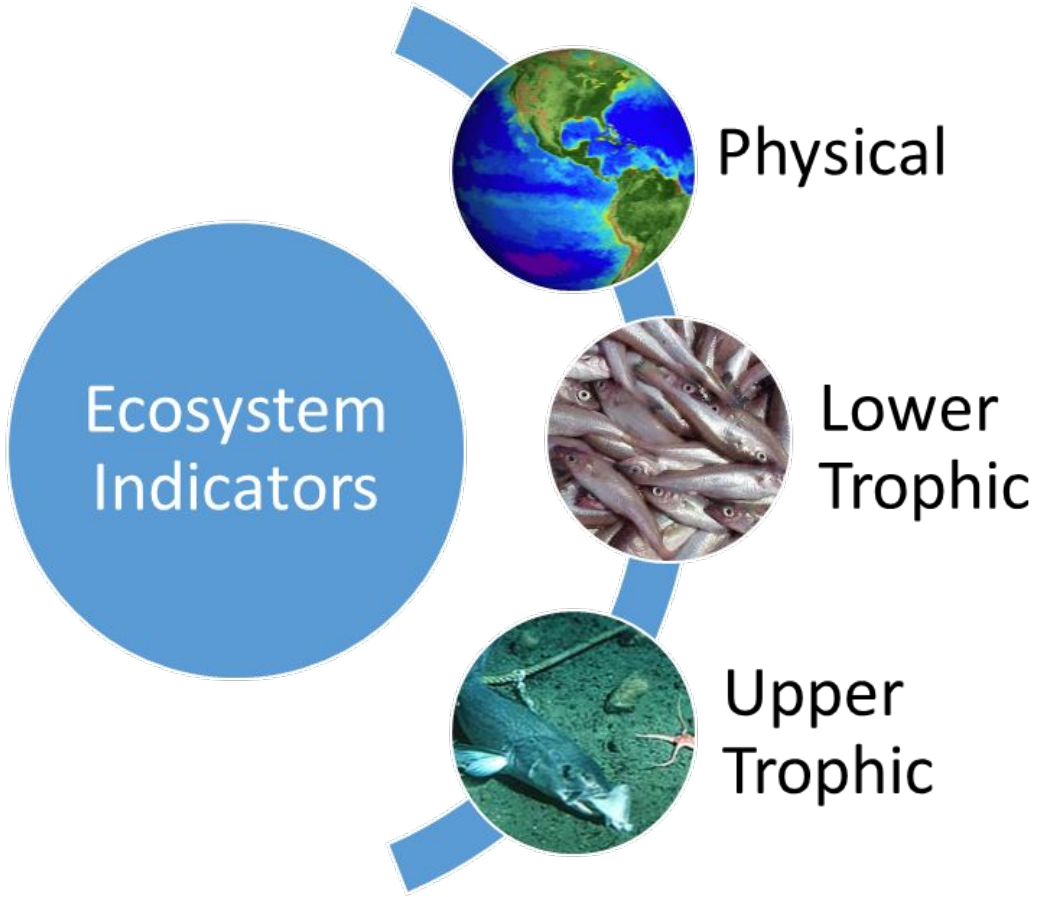
New ESP Contribution Template

```
#Ecosystem and Socioeconomic Profile (ESP) indicator contribution for stocks
managed under the North Pacific Fisheries Management Council
#This template is required for updating ESP indicator contribution information
#There are two required sections to check or update (see below): Indicator Review
and Indicator Data
#Please fill in the text (surrounded by " ") or data as values in the line after
each field marked with a # and capitalized name (e.g., #INDICATOR_NAME, the next
line should be the name of your indicator, for example
"Annual_Arrowtooth_Biomass_GOA_Model")
#Note that all fields are described in the Alaska ESP User Guide, please see [URL]
for more details
#INDICATOR_REVIEW ----------------------------------------------------------
-----------------------
#SUBMISSION_YEAR - Current year of contribution submission
2023
#INDICATOR_NAME - Composite key (meaning this must be unique to the indicator)
based on the ESP naming convention and used for joining ESP data tables. Please
see email with your indicator names, and copy/paste name to this location. Note:
this name must match the ESP records provided in the email, please do not change.
Questions, contact kalei.shotwell@noaa.gov
"Annual_Arrowtooth_Biomass_GOA_Model"
```

Climate Readiness

1. Focus: use climate vulnerability assessments to determine which stocks are priorities for conducting an ESP
2. Synthesize: identify thresholds and bottlenecks that may influence survival in a changing climate
3. Analyze: create projections using ocean models to make selected indicators climate informed
4. Communicate: include new graphics and measures in standard reporting template to convey climate readiness

Ecosystem Indicators

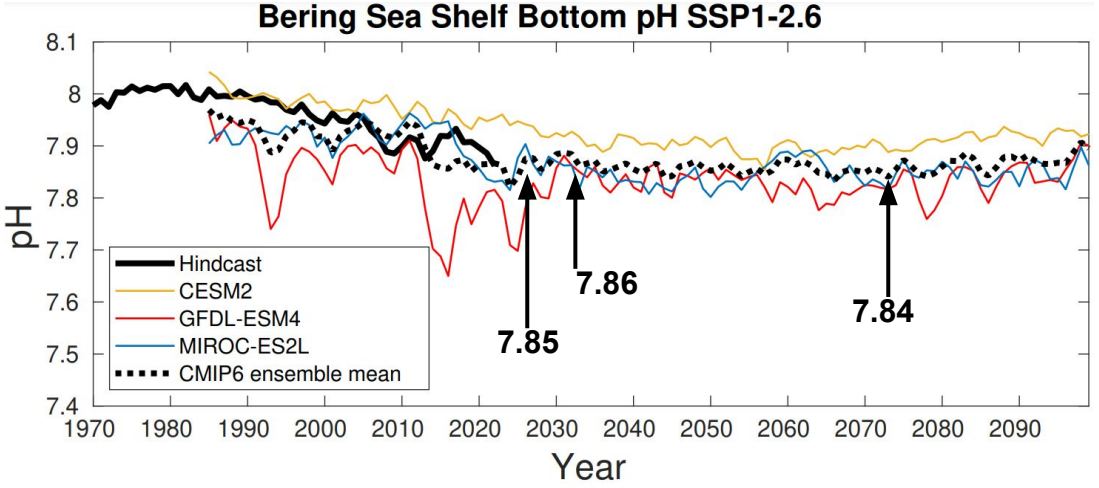


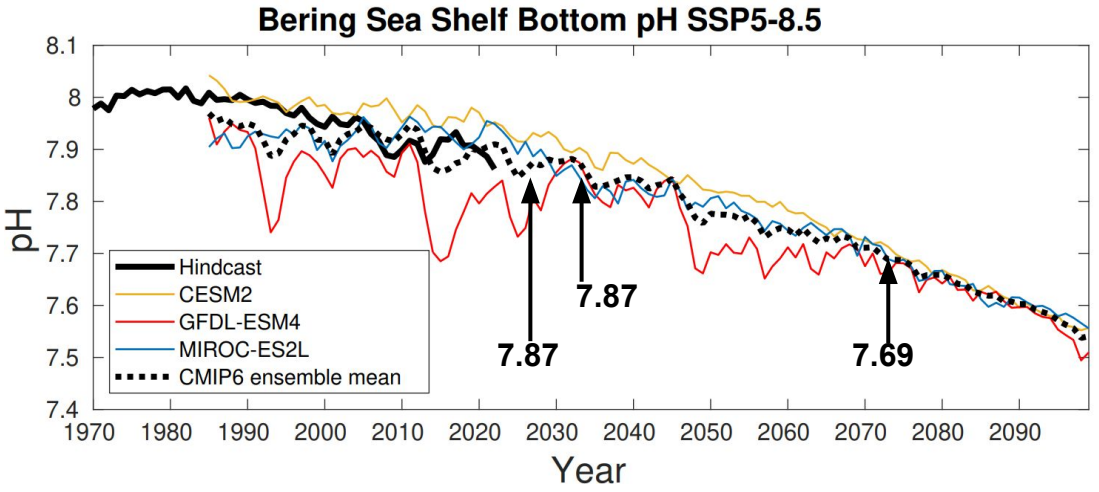
1. Marine heatwave index (model)
2. Bottom temperature (survey, **ROMS**)
3. SST, wind stress, sea-ice (satellite)
4. Corrosivity or pH index (**ROMS-NPZ**)
5. Production (chlorophyll *a*, satellite)
6. Small/Large copepods (survey)
7. Euphausiids (survey)
8. Seabird reproductive success (survey)
9. Larval fish abundance, condition (survey)
10. YOY biomass, growth seabird diets (survey)
11. Juvenile CPUE, condition (survey)
12. Juvenile predation mortality (model)
13. Proportion euphausiid in fish diet (survey)
14. Adult condition (survey, fishery)
15. Center of gravity, area occupied (model)
16. Predator biomass (**stock assessment**)
17. Steller sea lion non-pup estimates (survey)

Indicator Projections

Courtesy: Darren Pilcher

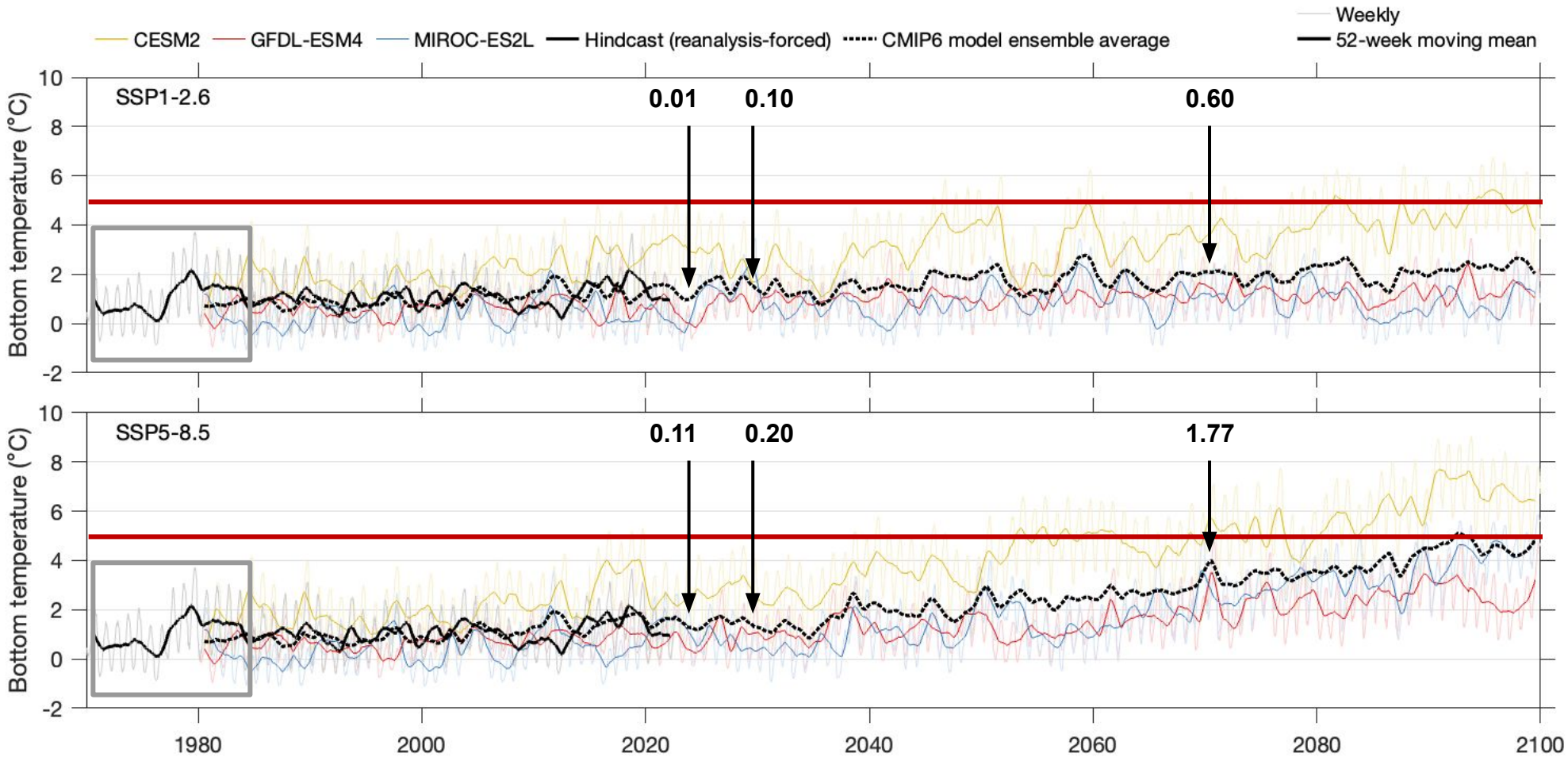
- Indicator Expansions
  - Include different IPCC models and ensemble mean
  - Evaluate over a range of emissions scenarios
- Indicator Metrics
  - Calculate moving mean to account for interannual variability
  - Report at various future intervals (e.g., 5, 10, 50)





Additional Features

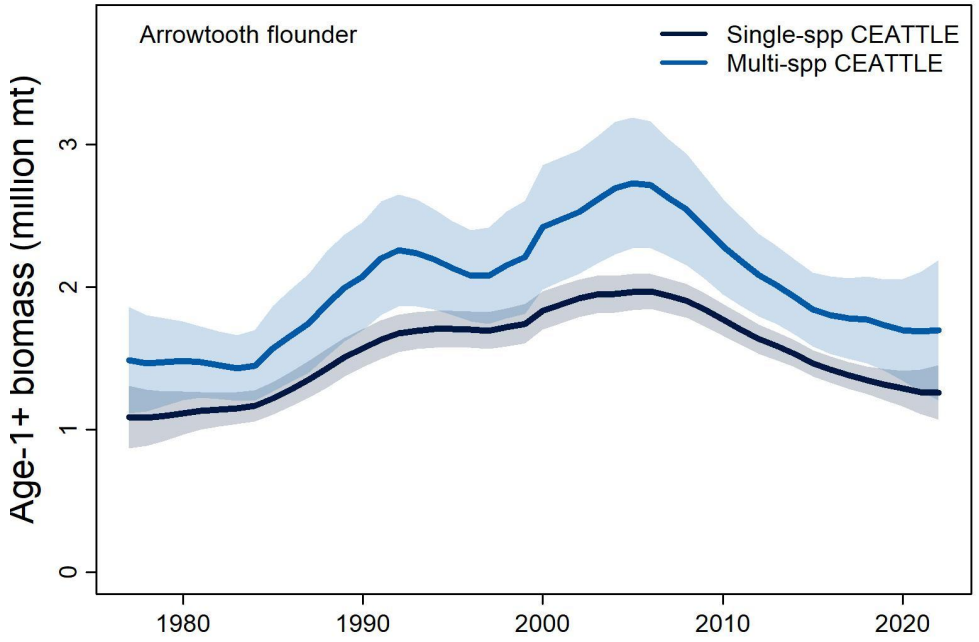
Courtesy: Kelly Kearney



Indicator Enhancements

Courtesy: Grant Adams

- Indicator Alternatives
  - Include different indicator version based on ecosystem model
  - Provide error estimates to allow for comparison of overlap
- Indicator Linkages
  - Estimates of time varying stock assessment parameters
  - Identify shifts in the indicator and other indicators to monitor



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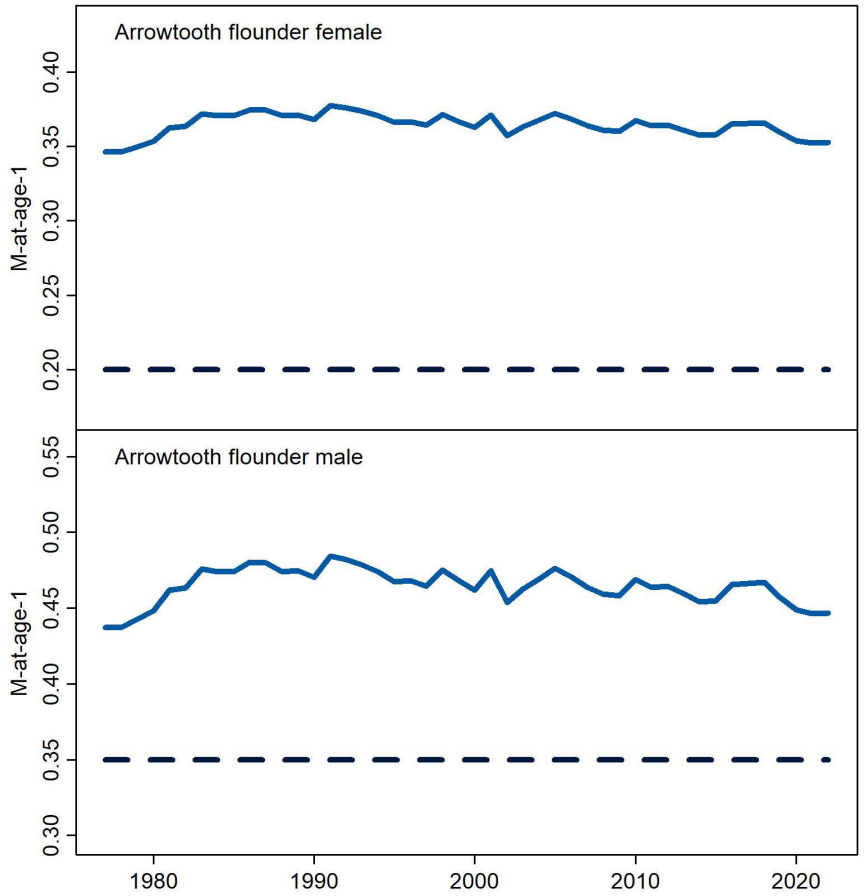

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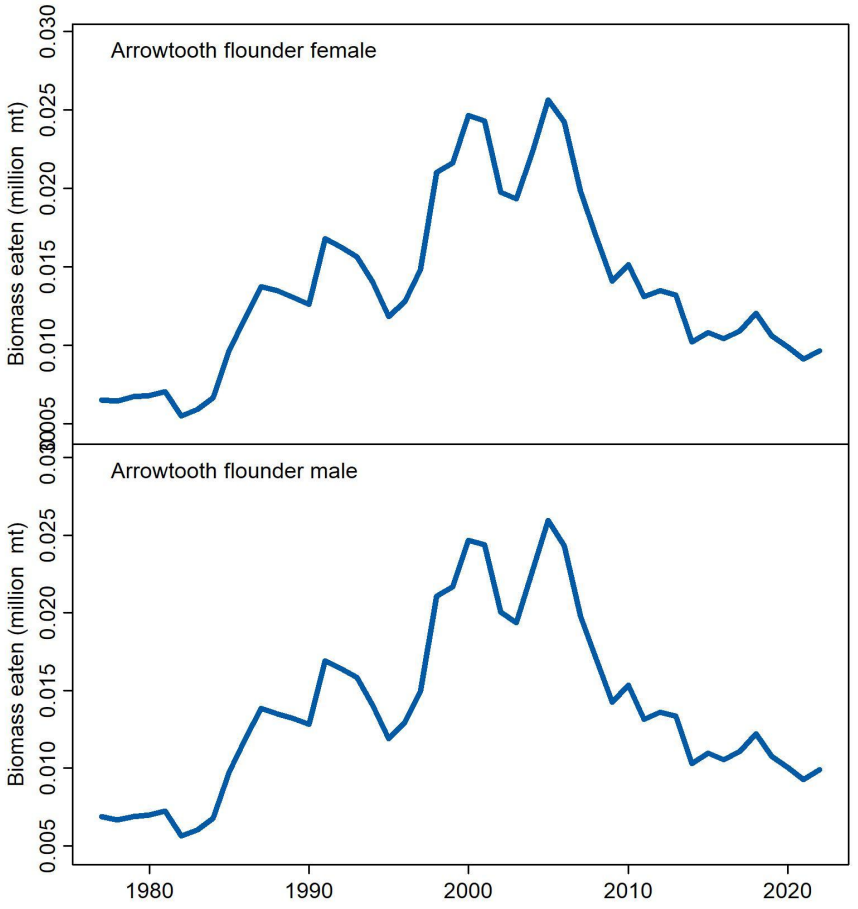

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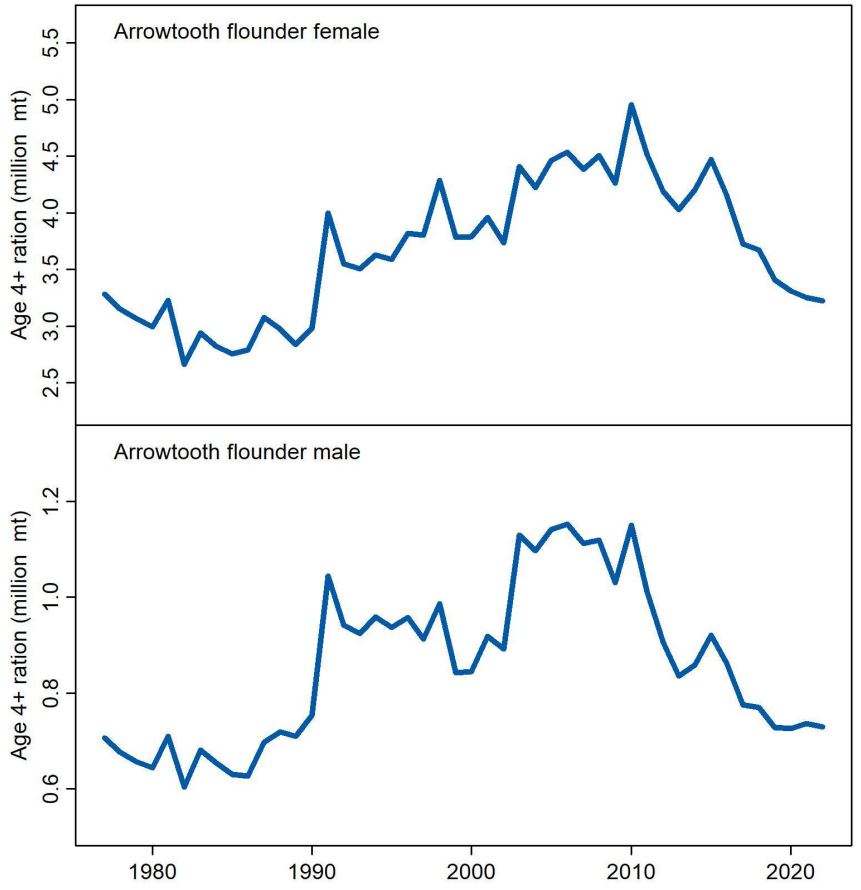

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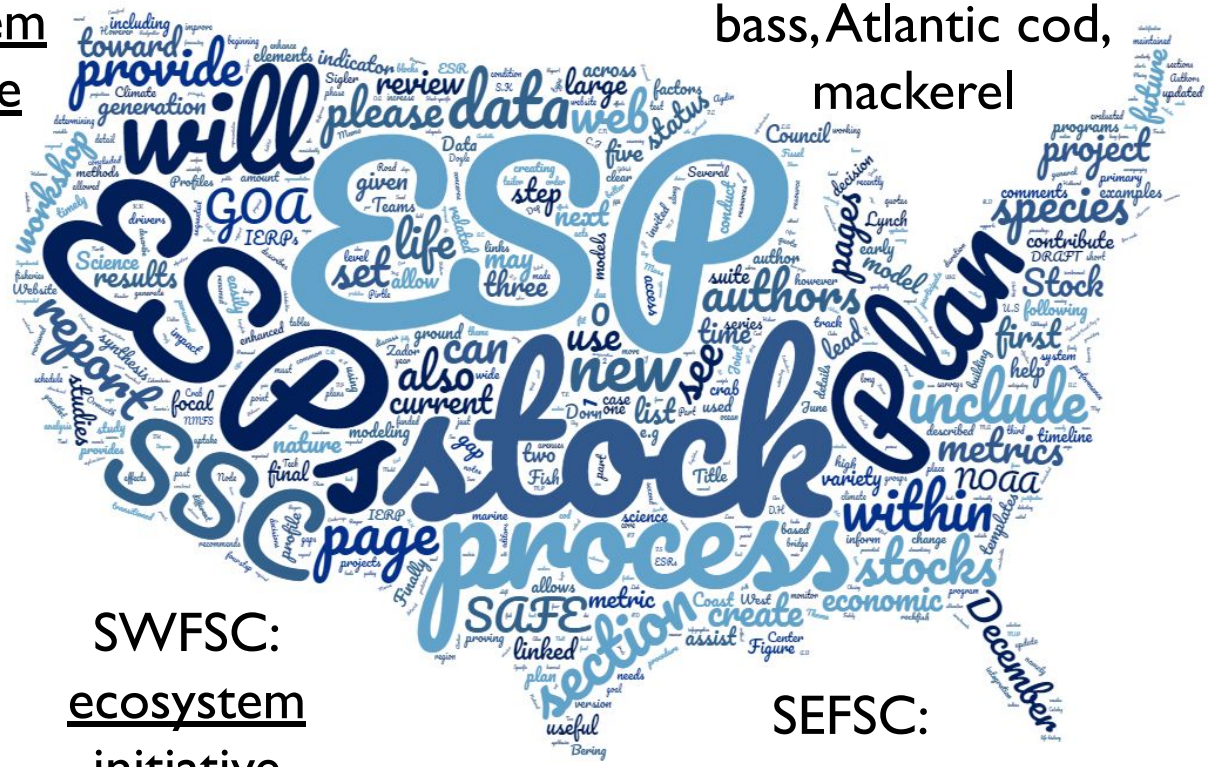
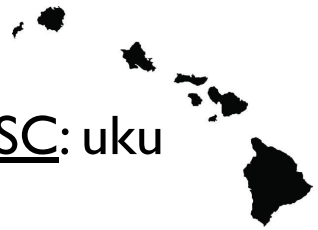
National ESP Progress

AFSC:
sablefish, pollock, Pacific cod, king crab, snow crab

NWFSC:
ecosystem initiative



NEFSC:
bluefish, black sea bass, Atlantic cod, mackerel



PIFSC: uku

SWFSC:
ecosystem initiative

SEFSC:
~gray snapper

National ESP Initiative

- National ESP Proposal (CA/MSA 2023 RFP)
  - Series of focused workshops to develop ESP programs at different centers
  - Special sessions at existing conferences to communicate ESP progress
  - Working group to create and refine National ESP Initiative elements
- Workshops 2023 (Share agenda, Co-creating agenda)
  - Share (virtual): 80+, July workshop included reps from all centers, RO, HQ
  - Co-creating (hybrid): 30+ August workshop at PIFSC, coordinated with NEMoW
  - Synthesizing (hybrid?): 15+ working group, summarize previous workshops, ID common barriers, discuss support and future workshops

ESP Support

1. Forum: form a national working group to help connect programs and coordinate ESP development across centers
2. Metrics: develop a common set of measures to track ESP development and how indicators get used in management advice
3. Tools: data management options, R tools to speed up indicator analysis, modular code that can be adapted by regional needs, web services
4. Funding: coordinate across centers to leverage limited resources, advocate for within center ESP coordinators, connect with ESRs

Discussion

1) Are there any changes to the ESP 2023 or 2024 schedule that the GPT would like to make?
2) Are there any questions or changes regarding the future plans for ESPs (e.g., RFI, data/AKFIN, climate readiness)?
3) Are there any ideas or thoughts regarding support for ESPs at the AFSC?

Thank You!

Contact:

Kalei Shotwell, AFSC
Kalei.Shotwell@noaa.gov

Resources