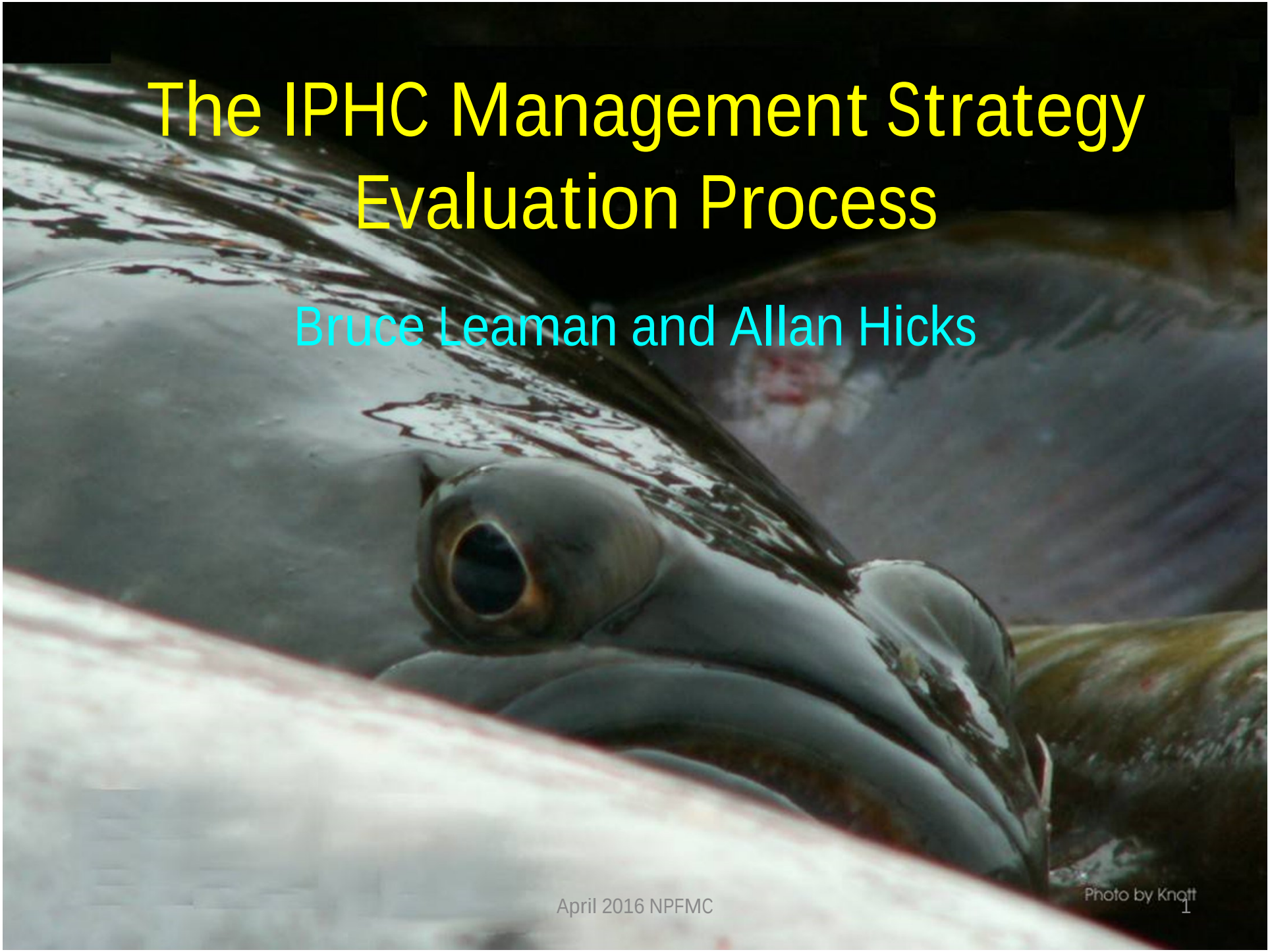
The IPHC Management Strategy Evaluation Process

Bruce Leaman and Allan Hicks



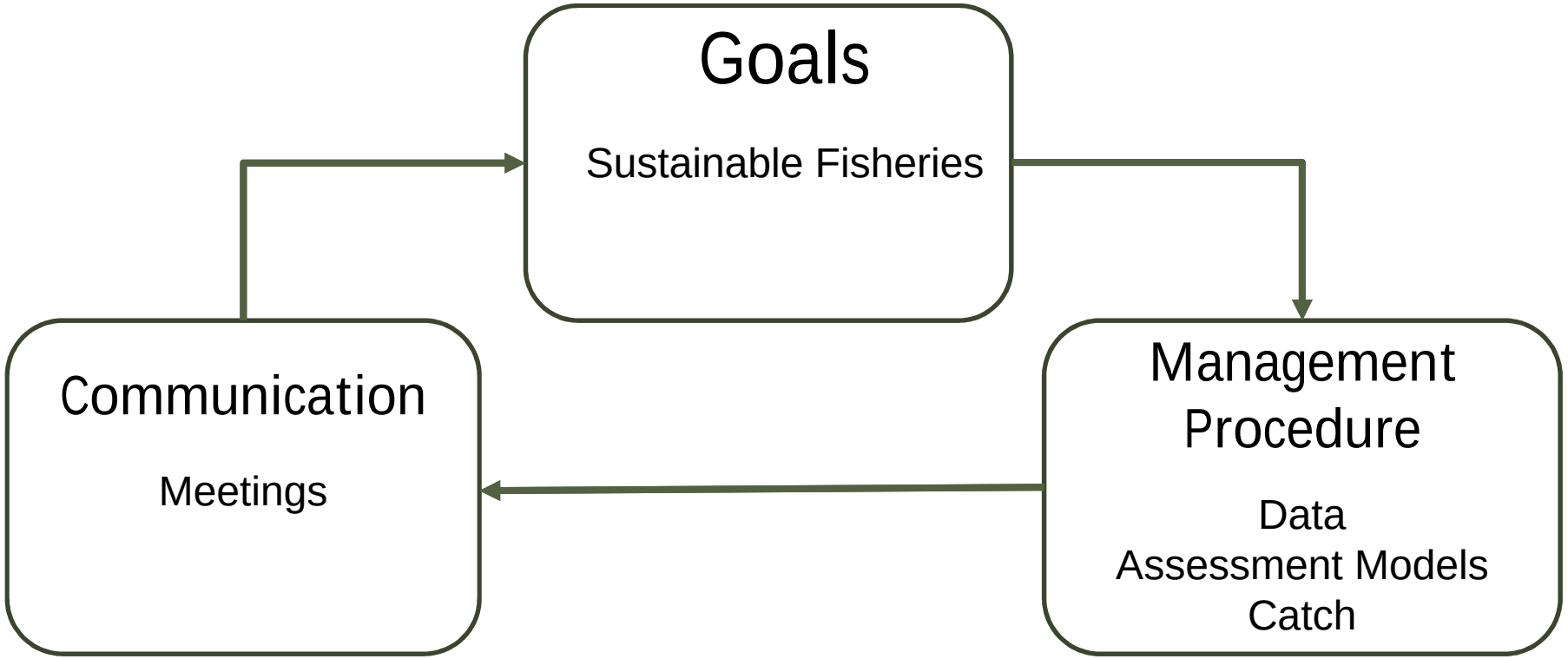
Outline

- What is the current IPHC process for management
- Why we need a different process
- What are the benefits of MSE
- How the IPHC is implementing MSE

Some industry views on where we have been

- Frequent model changes for assessments – why?
- Decision-making process unclear
- Issues indirectly related to stock status ignored
- Model doesn’t reflect “real world” experience
- Impediments to communication
- Perceived or real participation gaps
- Stakeholders losing confidence in existing approach
- Conflicts between users that science cannot and should not resolve
- Conflicts between scientists!

Typical Annual Cycle



The Assessment-Based Approach

- Common practice to use:
  - Annual stock assessment
  - Target **reference points** to represent desired state
  - Threshold **reference points** to prevent over-fishing
  - Rules to trigger management actions
- For this to work the following must be true:
  - Assessment must be reliable and consistent
  - Reference points must be well determined

Catch = "*BEST*" estimated biomass **X** Target harvest rate

Assessment results depend on choices

NRC (1998) study on bias in stock assessment models

True Stock

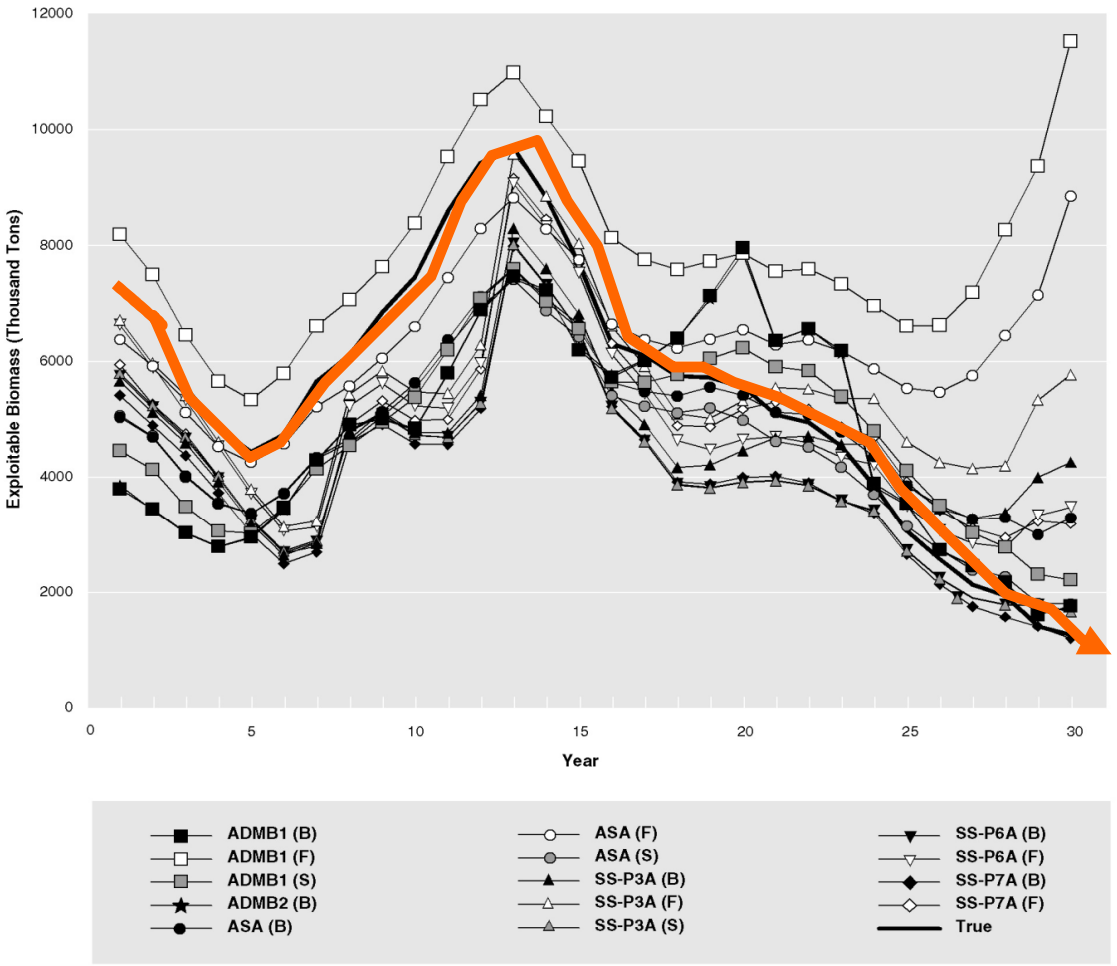


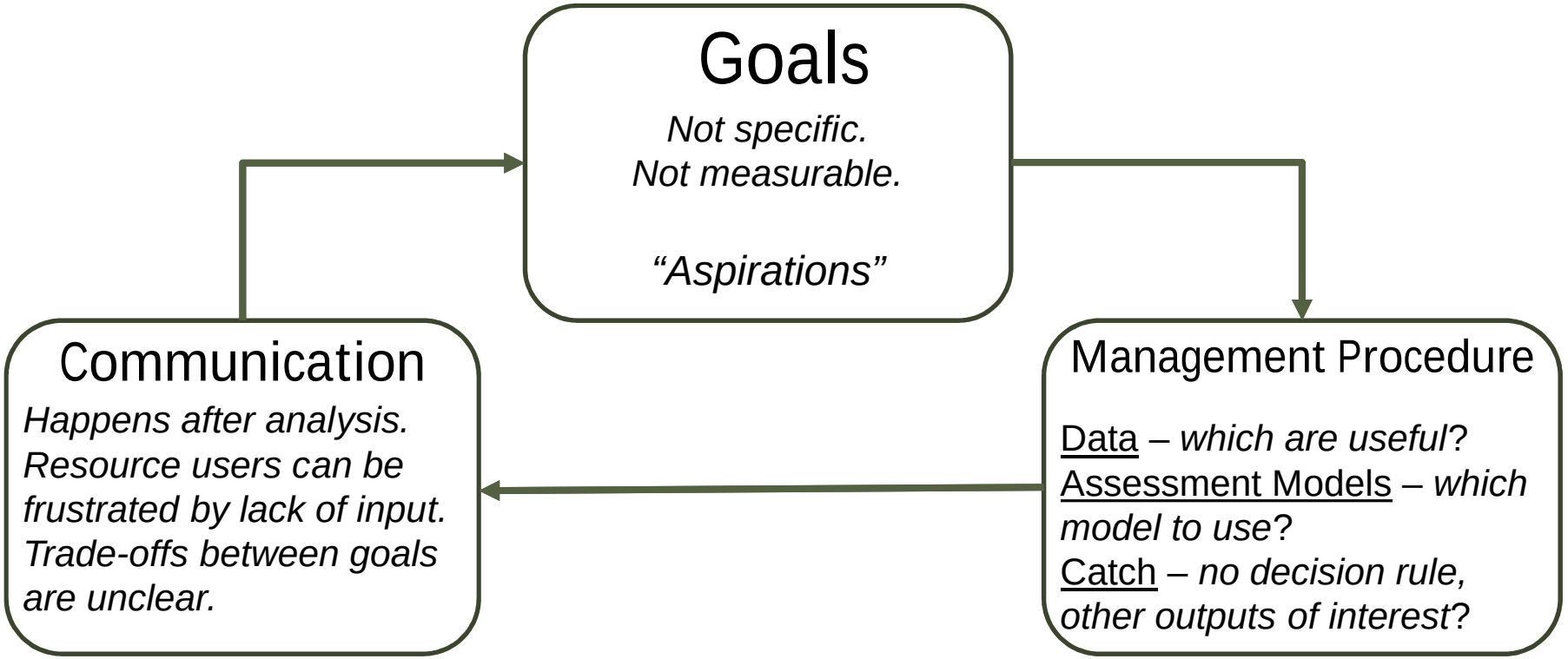
FIGURE I.8 Total biomass values using data set 3.

Errors in scale and trend!

Current IPHC approach

- An ensemble of assessment models
  - Not a single assessment model
    - an ensemble of 4 assessment models
  - Provides probability distributions for short-term metrics
    - A better understanding of uncertainty and risk
- Reference points must still be well determined and useful

Typical Annual Result



Change Needed

- Existing ensemble approach provides only short-term risk evaluation
- Need to acknowledge that negative outcomes will happen and take action when they do
- Should cope *by design* with a range of uncertain outcomes using robust *management procedures*
- Need to *demonstrate by testing* that management procedures can provide satisfactory outcomes
  - Testing helps us refine procedures before we implement them in the fishery - we don't play with live ammunition

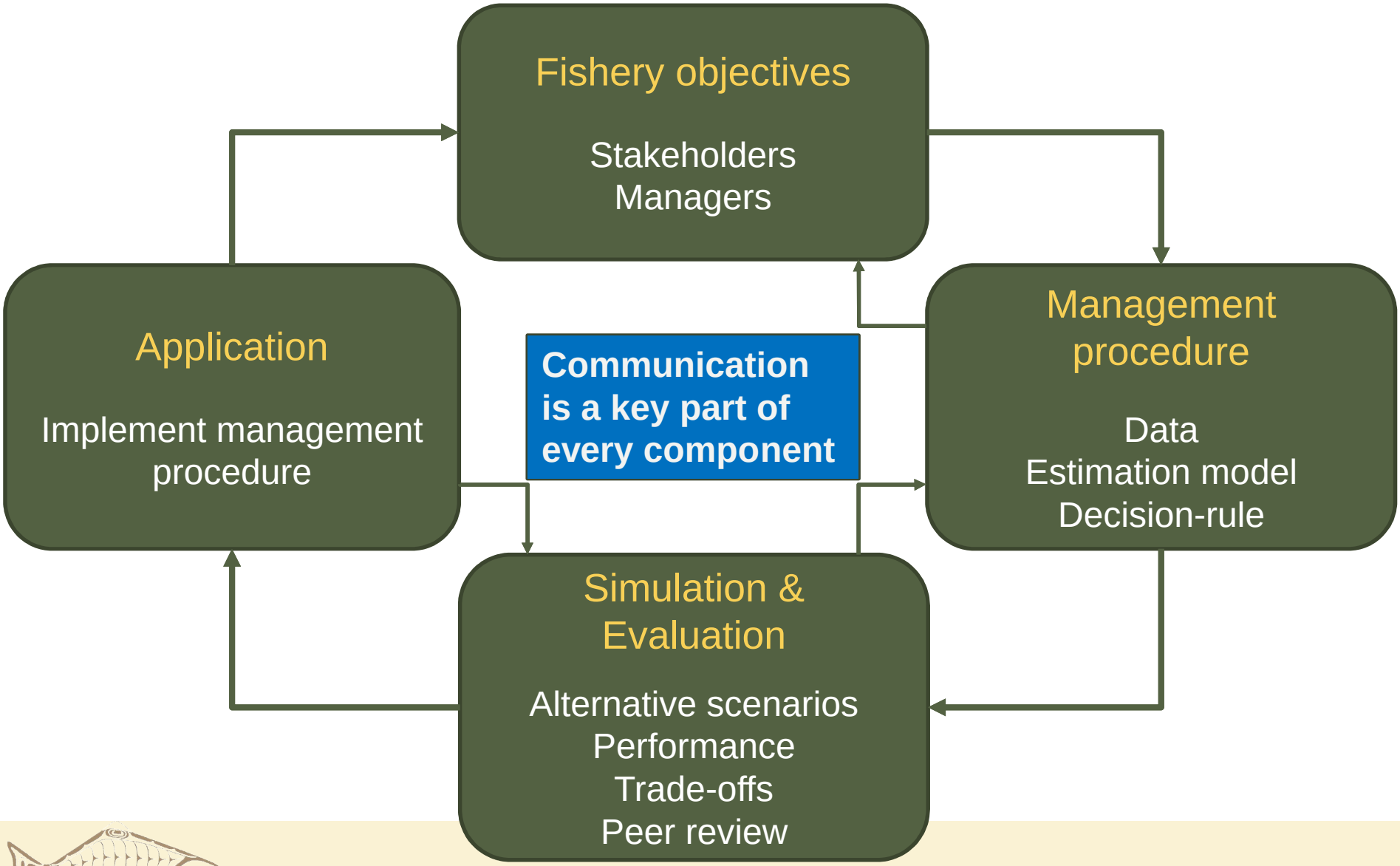
Improvements?

- Can we modify existing annual cycle to:
  - Increase engagement of resource users
  - Demonstrate policy goals are being met
  - Direct energy to decision-making rather than confrontation

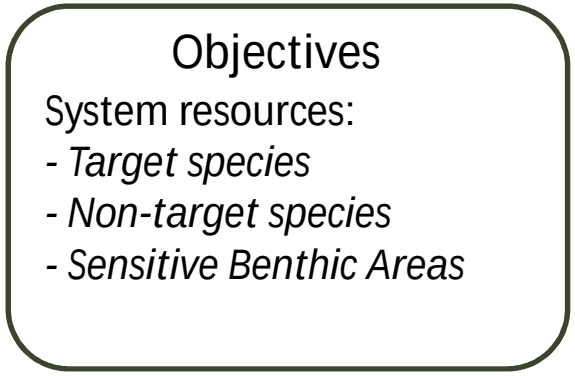
Components of Re-Organized Cycle

- **Natural Resources**: Target Species, Non-target Species and Benthic Areas
- **Human Resources:** Fisheries Management, Catch Monitoring, Enforcement, Science, and Resource Users
- **Management System:** A combination of Objectives, Data, Assessment, Decision Rules, and Application - organized by Human Resources
- Fish don’t need organization; they know what to do.

MSE Process


Fishery objectives
Stakeholders
Managers
Management procedure
Data
Estimation model
Decision-rule
Simulation & Evaluation
Alternative scenarios
Performance
Trade-offs
Peer review
Application
Implement management procedure
Communication is a key part of every component

Changing Goals to Objectives



- Iterative user participation can help change goals to objectives
- Objectives for natural resources must have:
  1. An outcome (what you want)
  2. A time frame (when you want the outcome)
  3. A probability (tolerance for failure)
- These 3 elements change Goals to **Measurable** Objectives
  - Design a fishery management system to meet these objectives
  - However, objectives are usually in conflict

Changing Goals to Objectives Example

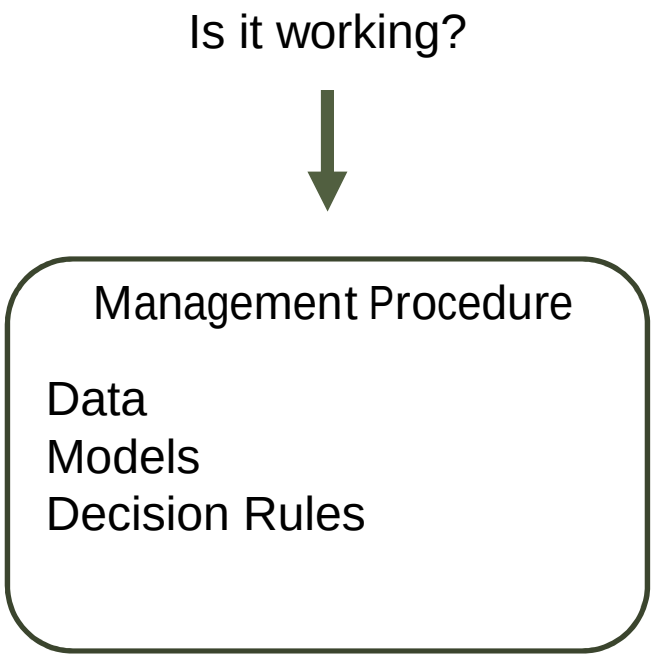
Goal: Promote Healthy Halibut Stock

Measurable Objective:

1. *Outcome*: Spawning stock greater than $0.20B_0$
2. *Time Horizon*: Evaluate over *x* years
3. *Probability*: Spawning stock greater than $0.20B_0$ at least 95% of the time in a specific year

Define Management Procedures as Choices

- A management procedure consists of things we control
- No “right choice”
- Some choices meet objectives more closely
- Components interact
- Cannot evaluate the efficacy of any one choice of component (data, model or rule) in isolation



Simulation and Evaluation

- Testing a choice of management procedures against alternative scenarios – what does this achieve?
  - Defines risk assessment by admitting uncertainty in natural systems (alternative hypotheses)
    - Simulated with operating models
  - Calculation of performance measures to measure whether objectives are likely to be met
  - Compliance with Precautionary Approach, world-wide “best practices”
  - Exposes trade-offs between objectives – users get to see this

Evaluation
Performance measures re: Objectives
Technical analysis
Robustness tests = risk assessment
Outputs for decision-making

Operating model vs. mgmt procedure

Scenarios

Operating model
Stock-recruitment relationship
Natural mortality
Selectivity (time-varying?)
Movement and life history
Growth (time-varying?)
Predator-prey drivers
Environmental drivers
Discard mortality (by gear types?)
Recruitment forecasting

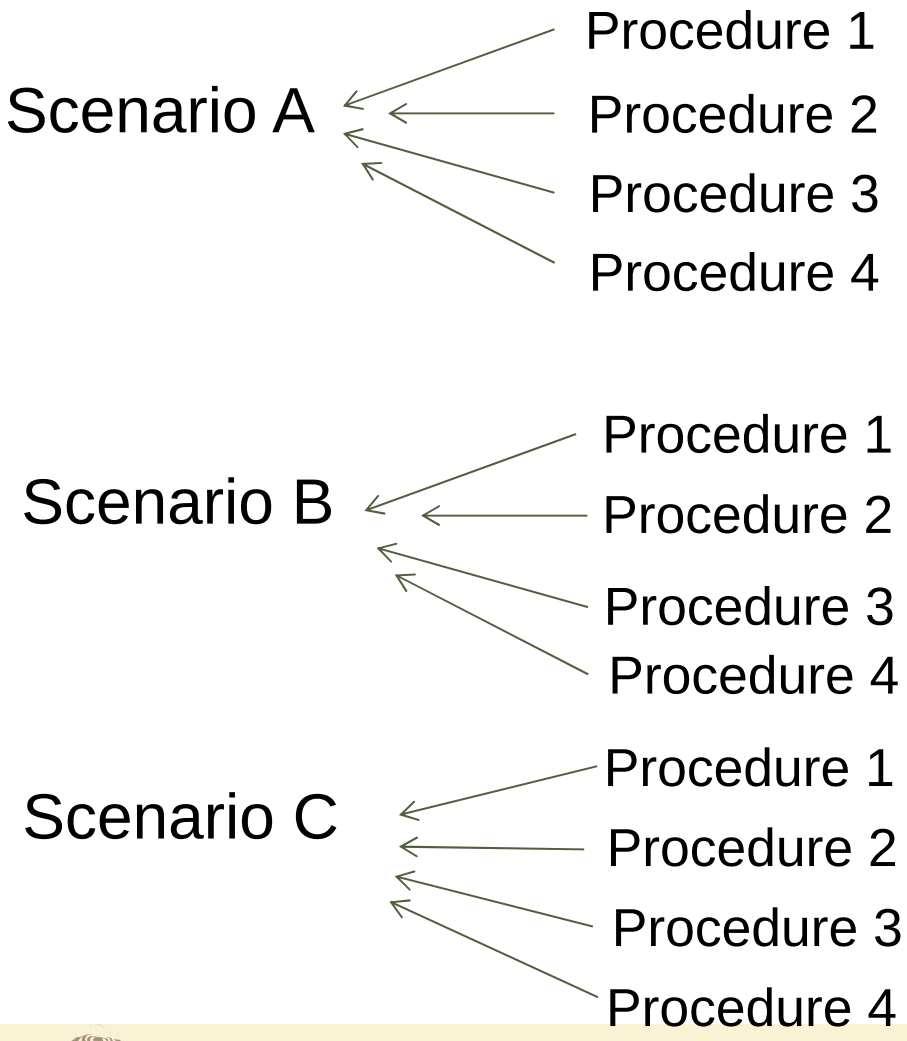
We don't control these things
We make assumptions
We might have data to help

Choices

Management Procedure
Survey index (frequency, sample size?)
Biological data (frequency, which samples?)
Estimation models (simple or complex)
Assessment frequency
Harvest control rule
- Form of rule shape
- Choice of control points
Biomass control points
Fishing rate control points

We make these choices

Testing Candidate Procedures

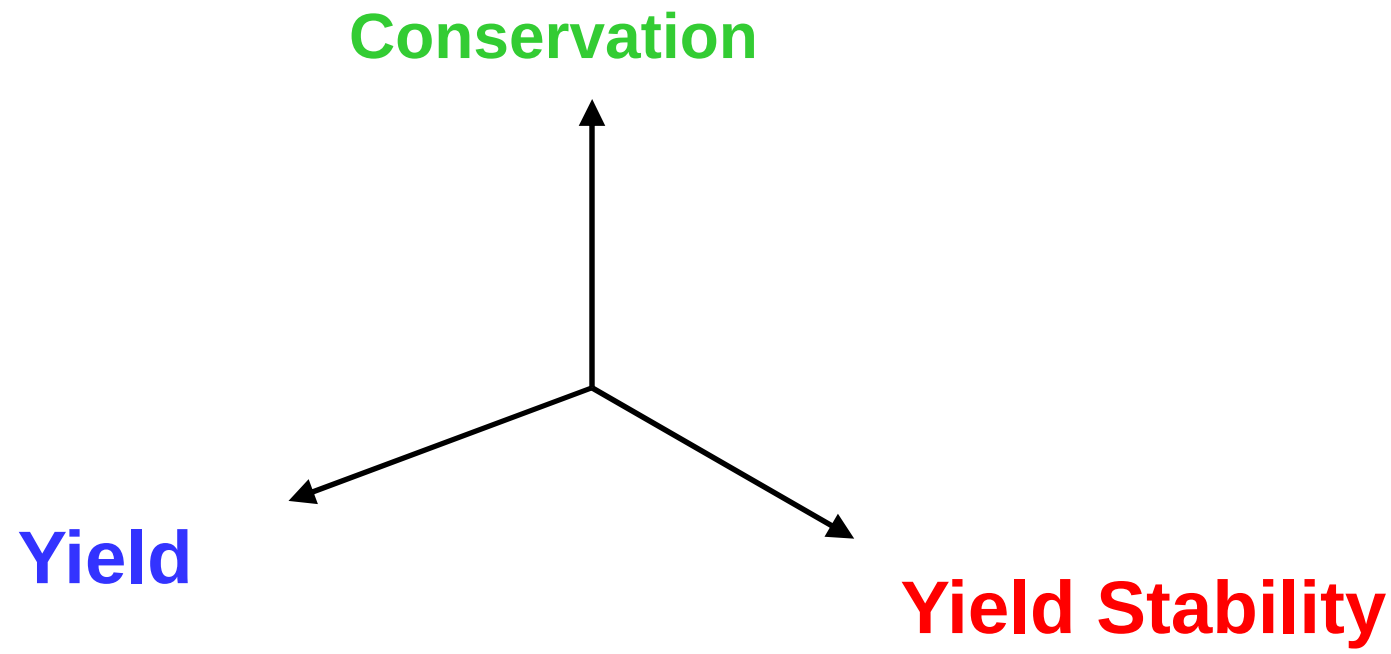


Apply each candidate procedure against each Scenario generated by the Operating Model.

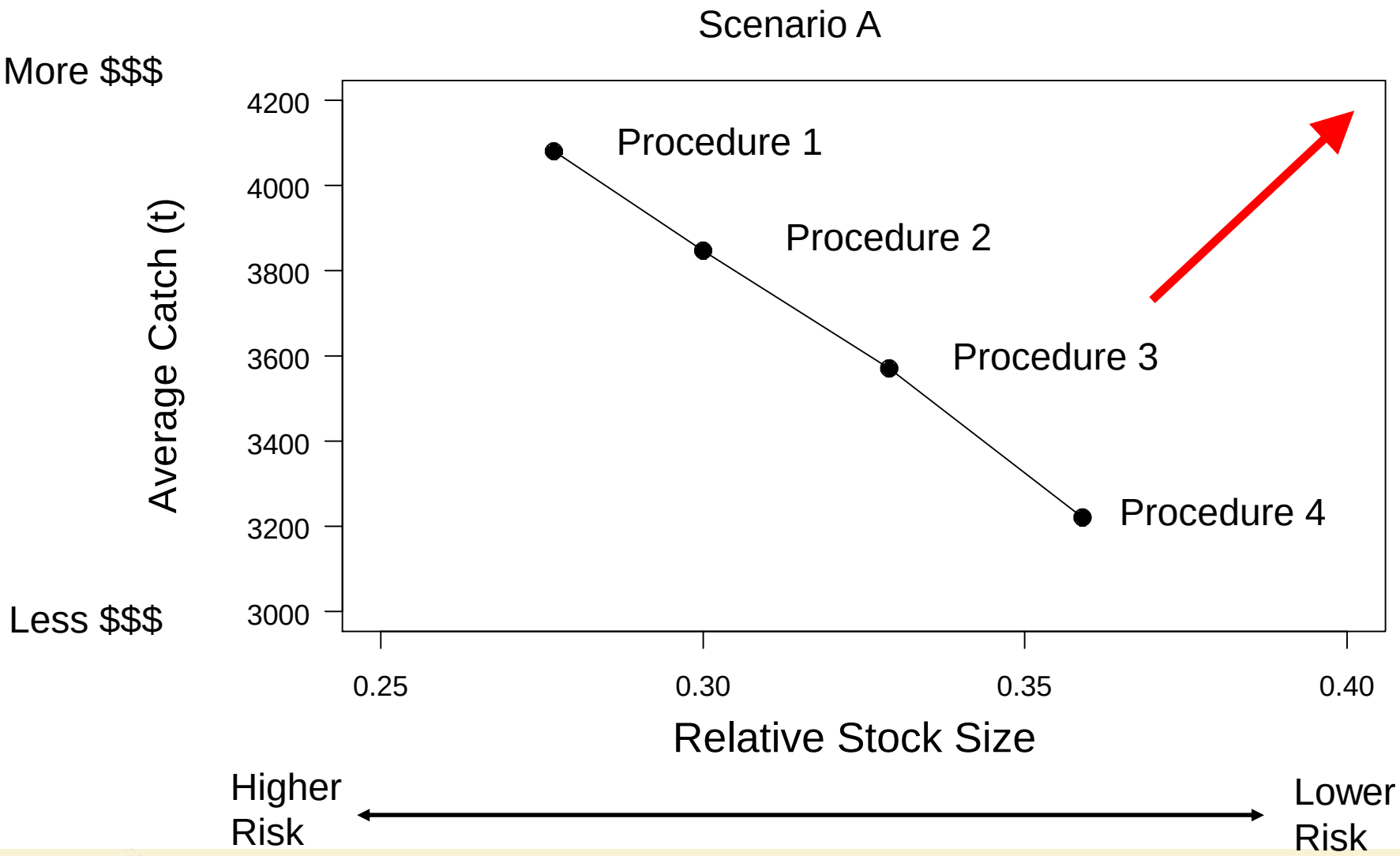
Do this many times with random noise on each repeated trial (or replicate) to capture uncertainty.

Decision Making

- Can’t maximize conservation, yield, and stability objectives at the same time – these objectives trade-off
- Pick management procedure (data, assessment, rule) not the TAC



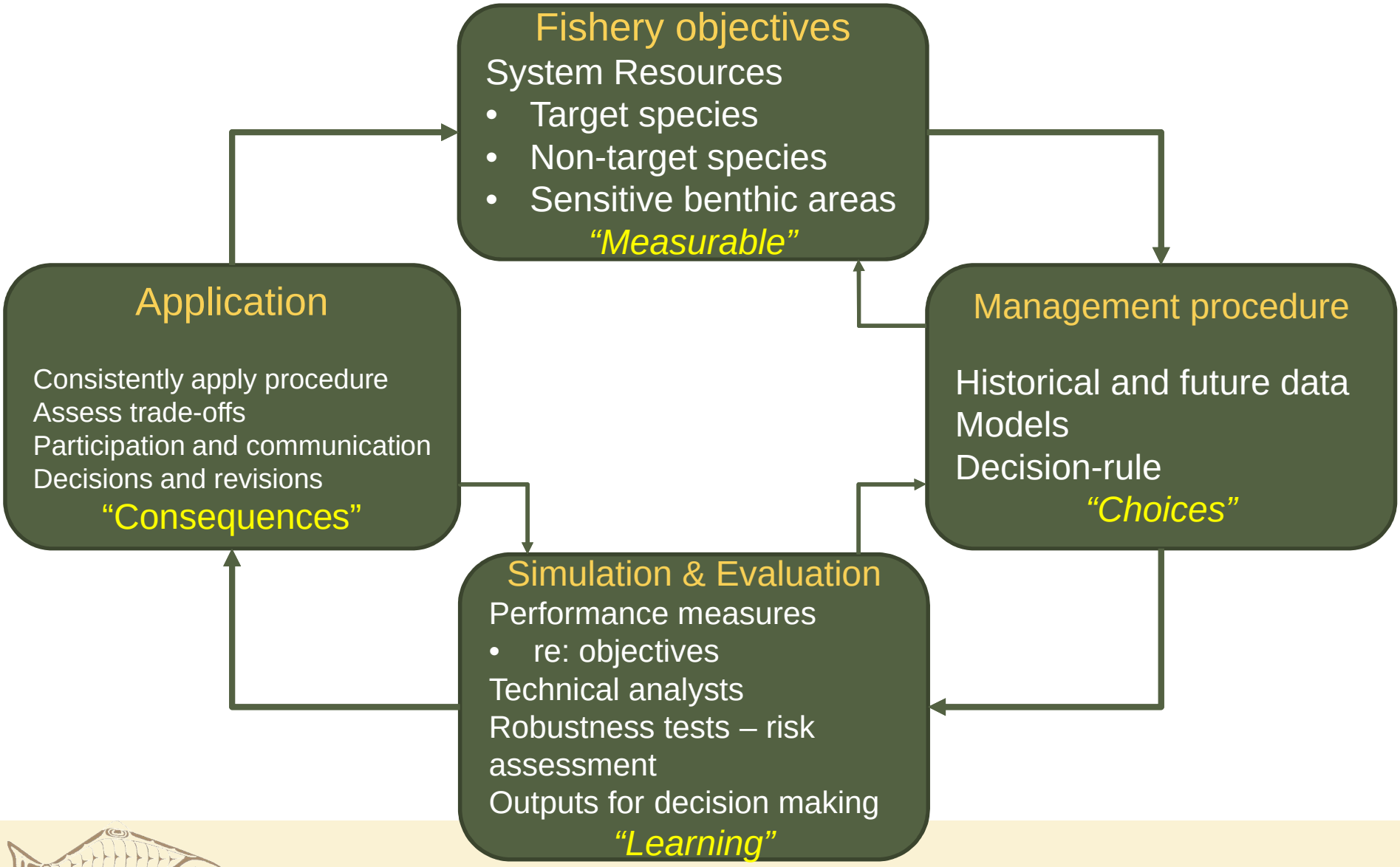
Performance Trade-offs



Consistent Application

- Learning requires feedback
- Feedback comes from stock and fishery monitoring data
- If a management procedure is not consistently applied there is no evaluation feedback
  - Users see consequences of choices
  - Users participate in evaluating trade-offs between objectives
  - Users can suggest new **Procedures** to be tested in **Evaluation** step

A process not a product



The MSE Process

- Is not an annual process
- It will likely take longer than a year to get to Application
- However, once a management procedure is applied, it can be left in place for many years
  - Consistent application
  - Evaluated and chosen to be robust
- The annual process is to apply the management procedure

How the IPHC is implementing MSE

Management Strategy Advisory Board

MEMBER	COUNTRY	SECTOR
1. Bruce Gabrys	U.S.	Commercial
2. John Woodruff	U.S.	Processing
3. Peggy Parker	U.S./CDN	Processing
4. Shane Halverson	U.S.	Processing
5. Brad Mirau	CDN	Processing
6. Jeff Kauffman	U.S.	Commercial
7. Per Odegaard	U.S.	Commercial
8. Ryan Littleton	U.S.	Commercial
9. Scott Mazzone	U.S.	Tribal
10. Michele Culver	U.S.	Fish Mgmt Cncl
11. Dan Hull	U.S.	Fish Mgmt Cncl
12. Gary Robinson	CDN	Commercial
13. Jim Lane	CDN	First Nations
14. Chris Sporer	CDN	Commercial
15. Gregg Elwood	U.S.	Commercial
16. Tom Marking	U.S.	Sport
Ex-officio		
Rachel Baker	U.S.	Manager
Adam Keizer	CDN	Manager
Scott Meyer	U.S.	Sport Manager
Rob Kronlund	CDN	MSE Expert
Robyn Forrest	CDN	Sci. Advisor
Loh-Lee Low	U.S.	Sci. Advisor
Commissioner Ryall	CDN	
Commissioner Balsiger	U.S.	

Commercial harvesters
Recreational harvesters
Tribal/First Nations
Processors
Managers
Scientists

Objectives, Procedures, Operating Model, Timeline

- Objectives initially proposed in 2013, refined in May 2014
- Scenarios for coastwide modelling defined in 2014, modified in 2015
- Candidate management procedures proposed in 2013 and refined in May/October 2014 with staff comments
- MSE progress and objectives reviewed with the SRB in June 2015
- Major governance changes made in May 2015
- Revised process began in October 2015

Review of Objectives

Five Overarching Objectives

- Biological sustainability – identify stock conservation objectives
- Fishery (all directed fisheries) sustainability and stability – identify harvest minimum and acceptable variability
- Assurance of access – minimize probability of fishery closures
- Minimize bycatch mortality
- Serve consumer needs

Management Procedures Initially Proposed for Examination

- Total mortality: Direct accounting by area for all sources of mortality in that area, including sublegals.
- Size limits: No size limit, current minimum size limit, 26 inches instead of 32, slot limits.
- Harvest strategies: 30:20 control rule, reference removal rate 21.5%/16.125%, coastwide and by area.
- National shares: catch limits by areas would be allocated rather than based on apportionment.
- Bycatch mitigation: Impacts among areas for bycatch in a particular area.

Candidate goals and objectives for MSE process – May 2014

Goals	Objective	Outcome	Probability	Time frame
Biological sustainability	Keep abundance above a certain level (**Limit**)	Maintain a minimum of number of mature female halibut coast-wide (e.g., one million)	0.99	Each year
		Maintain a minimum spawning stock biomass of 20% of the unfished biomass	0.95	Each year
	Reduce harvest rate when abundance is below a certain level (**Threshold**)	Maintain a minimum spawning stock biomass of 30% of the unfished biomass	0.75	Each year
	Risk tolerance and assessment uncertainty	When the estimated biomass is between the limit and threshold, reduce the probability of further declines	0.05-0.5	10 years

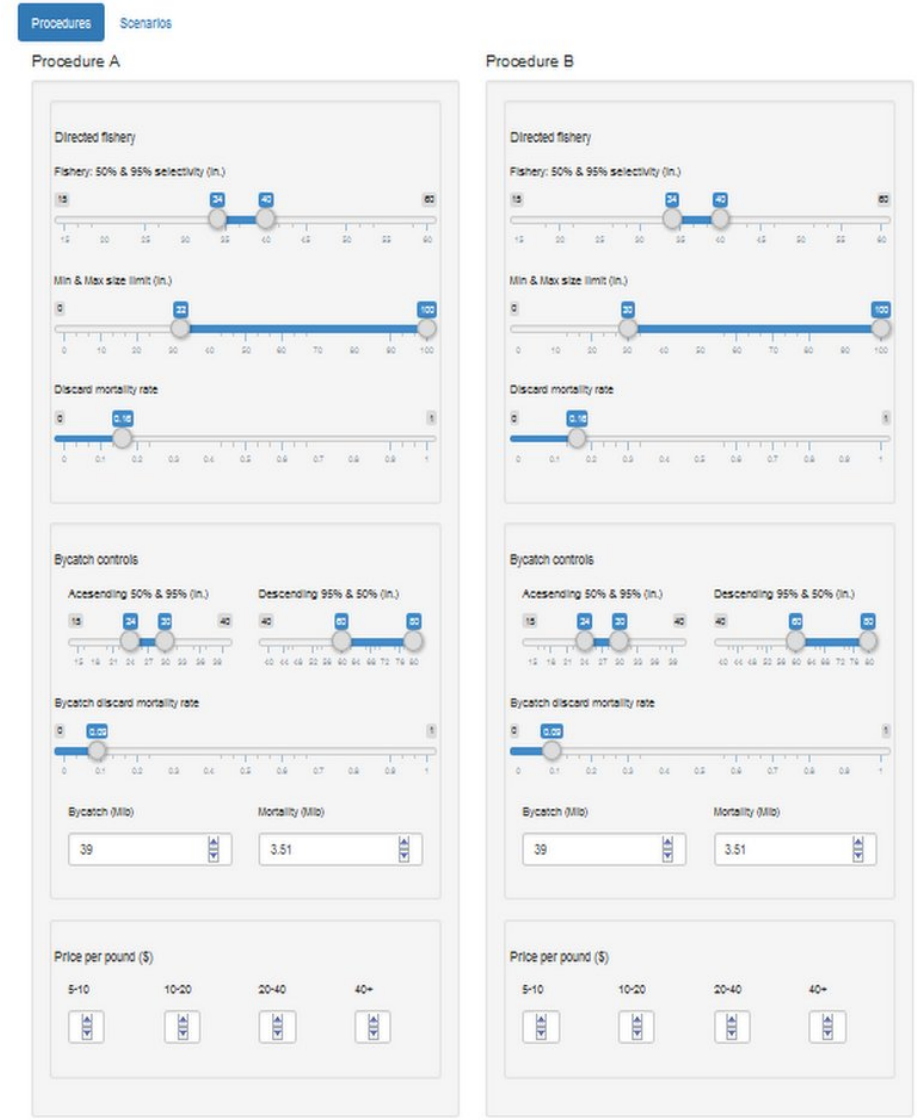
Candidate goals and objectives for MSE process – May 2014

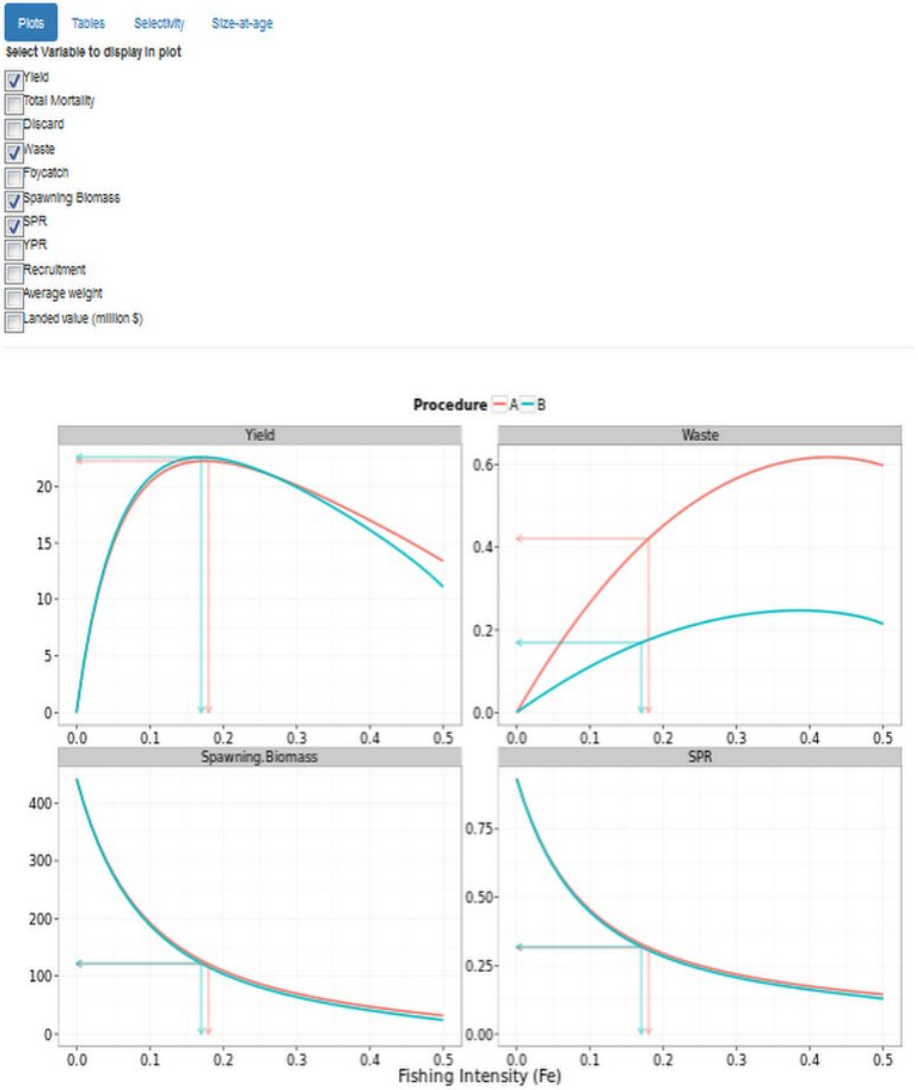
Goals	Objective	Outcome	Probability	Time frame
Fishery sustainability and stability **Assurance of access** **Serve consumer needs**	Maintain directed fishing opportunity (fish at the target harvest rate) Maintain a median catch within ±10% of 1993-2012 average Maintain average	Maintain directed fishery (*needs a quantifiable unit*)	0.95	Each year
	Catch at >70% of historical 1993-2012 average	Maximize yield in each regulatory area (*needs a quantifiable unit*)	0.5	Each year
			??	Within 5 years
	Harvest efficiency	Wastage in the longline fishery <10% of annual catch limit	0.75	5 year period
	Limit catch variability	Annual changes in TAC (coastwide or by Regulatory Area) are less than 15%	1	Each year

Many of the performance metrics are likely to interact with both conservation targets and harvest rate objectives, and their probabilities will be dependent on recruitment variation and desirable/acceptable economic standards of participants. Finding the balance of the competing objectives is the primary purpose of the MSE process.

Harvest variables implemented in coastwide equilibrium model

- Fisheries selectivity,
- Minimum and maximum size limits,
- Discard mortality rate (DMR) for the directed fishery,
- Average selectivity in bycatch fisheries,
- Bycatch mortality from all other fleets, and
- Price per pound for four different size grades.


Procedures
Scenarios
Procedure A
Procedure B
Directed fishery
Fishery: 50% & 95% selectivity (in.)
Min & Max size limit (in.)
Discard mortality rate
Bycatch controls
Acesending 50% & 95% (in.)
Descending 95% & 50% (in.)
Bycatch discard mortality rate
Bycatch (Mlb)
Mortality (Mlb)
39
3.51
Price per pound ($)
5-10
10-20
20-40
40+


Plots
Tables
Selectivity
Size-at-age
Select Variable to display in plot
Yield
Total Mortality
Discard
Waste
Foycatch
Spawning Biomass
SPR
YPR
Recruitment
Average weight
Landed value (million $)
Procedure A B
Yield
Waste
Spawning.Biomass
SPR
Fishing Intensity (Fe)

Procedures | Scenarios

Plots | Tables | Selectivity | Size-at-age

Procedure A

Directed fishery

Fishery: 50% & 95% selectivity (in.) — 15, 34, 40, 60

Min & Max size limit (in.) — 0, 32, 100

Discard mortality rate — 0, 0.16, 1

Bycatch controls

Acesending 50% & 95% (in.) — 15, 24, 30, 40

Descending 95% & 50% (in.) — 40, 60, 80

Bycatch discard mortality rate — 0, 0.09, 1

Bycatch (Mlb): 39

Mortality (Mlb): 3.51

Procedure B

Directed fishery

Fishery: 50% & 95% selectivity (in.) — 15, 30, 40, 60

Min & Max size limit (in.) — 0, 30, 100

Discard mortality rate — 0, 0.16, 1

Bycatch controls

Acesending 50% & 95% (in.) — 15, 24, 30, 40

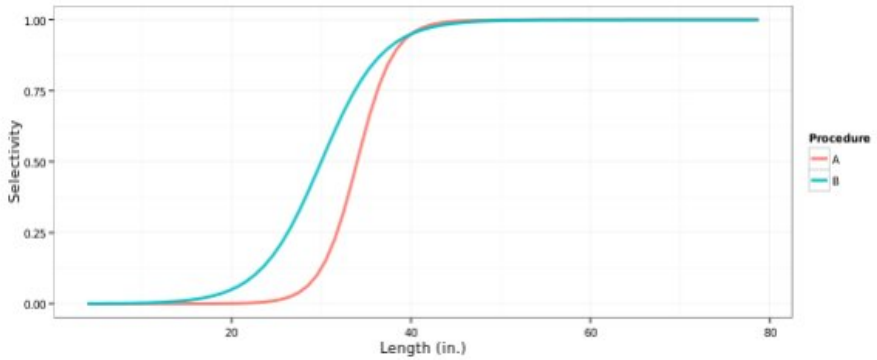
Descending 95% & 50% (in.) — 40, 50, 64, 80

Bycatch discard mortality rate — 0, 0.09, 1

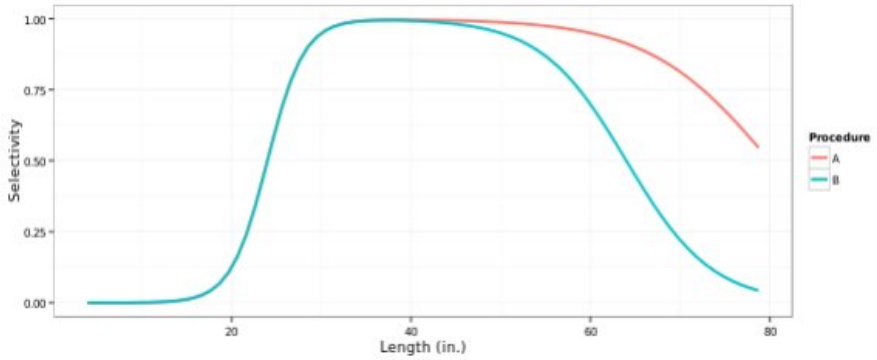
Bycatch (Mlb): 39

Mortality (Mlb): 3.51

Fishery selectiity



Bycatch selectivity



MSAB October 2015 Meeting

- Key Results
- Summary of Actions

Summary of Key Outcomes 1

- The group brainstormed the roles of MSAB members, IPHC staff, and stakeholder constituents (to be refined as needed), and the group discussed the relationship of the MSAB to the Commission and other Commission advisory bodies
- Representatives of the bycatch fisheries need to be engaged in the future given the huge influence that bycatch mortality has on the directed fishery overseen by the IPHC
- The MSAB will continue to use the coastwide operating model though IPHC staff will continue to develop the spatially explicit model given that many ecological, political, and management issues are specific to halibut management areas
- Four management procedures were evaluated in a group exercise; board members gained greater working capability with the IPHC MSE Tool, and a variety of lessons were learned in terms of the effectiveness of some management procedures with respect to objectives for the fishery

Summary of Key Outcomes 2

- The group had a first look at the notion of “fishery footprint” which is a measure of fishery impact on the spawning capital and which can be used as a way to understand the relative impacts of the directed and bycatch fisheries on the halibut stock
- A draft outreach strategy including objectives of outreach, who the MSAB engages with, what content is shared out and what input is sought, what tools are used for outreach, and when outreach occurs was reviewed
- Several next steps were identified for co-chairs, the agenda committee, and IPHC staff with respect to documenting the MSE and MSAB’s terms of reference, a presentation at the IPHC annual meeting, preparation for the next MSAB meeting in May 2016, and securing additional resources to support the MSAB in the MSE process
- Future facilitation needs were discussed in a closed door session, and the MSAB agreed that the use of a facilitator but also co-chairs and the agenda committee helped make for a very successful meeting, and that upon further consideration the MSAB continue with facilitation

Summary of Actions

Number	Description
1.	IPHC staff to make revisions to May 2015 meeting minutes by end of day October 1st regarding explicit reference to tribal fishers' share and lack of involvement on the MSAB of bycatch fishers. This action was completed October 1st and updated minutes were posted on the MSAB website.
2.	Staff should conduct a structured comparison of the two modeling options (coastwide vs. spatially explicit) and present this back to the board by the next MSAB meeting.
3.	IPHC to add explanatory notes to the presentation materials on 'fishery footprints' including with regard to the hypothetical numbers used in the example in the presentation and then to distribute the materials. This action to be completed prior to the presentation materials being posted to the internet.
4.	Steering Committee to develop a document covering items that are commonly present in what is often known as a 'terms of reference' and submit this document to the rest of the board for feedback prior to, or at, the next MSAB meeting.
5.	Keizer and Culver to present on MSAB progress at the upcoming IPHC annual meeting.
6.	The Steering Committee will sketch out a plan and a rough agenda for the next few meetings prior to the next MSAB meeting.
7.	IPHC staff to work on securing additional resources for technical staff to support the MSE/MSAB process (no firm deadline was identified; this action will take place through the IPHC budgetary process and may be fulfilled over several annual budget cycles).

Next steps

- May 2016 meeting
  - Terms of Reference developed and approved for recommendation to the Commission
  - Two-year work plan developed with Dr. Hicks and other IPHC staff
  - Introduce concepts of Closed-loop MSE and data-based vs. model-based control rules
  - Finalize Outreach Plan developed by consultants in 2015
  - Plan elements of October 2016 meeting