FISHERIES
Leadership & Sustainability
FORUM

East Coast Forum 2015

Tools for Exploring and Communicating Uncertainty and Risk

Thursday, May 7th

Example 1: The use of decision tables by the Pacific Fishery Management Council

Michele Culver Regional Director, Washington Department of Wildlife; Pacific Fishery Management Council

Table ES-6. Decision table of 12-year projections for alternative states of nature defined based on the alternative time series of removals and natural mortality of spiny dogfish and the retrospective analysis.

Forecast	Year	Total removals (mt)	Retrospective run (data from the last three years removed) Spawning output (1,000s)	Depletion	Low M, low removals Spawning output (1,000s)	Depletion	**Base model** Spawning output (1,000s)	Depletion	High M, high removals Spawning output (1,000s)	Depletion
Forecast catch calculated from 45% SPR applied to base model	2011	3,041	14,133	34.32%	20,442	49.27%	44,660	63.15%	105,868	74.11%
	2012	3,010	13,622	33.08%	19,827	47.79%	44,130	62.40%	105,499	73.85%
	2013	2,980	13,122	31.86%	19,228	46.34%	43,615	61.67%	105,144	73.60%
	2014	2,950	12,631	30.67%	18,644	44.93%	43,113	60.96%	104,802	73.36%
	2015	2,921	12,150	29.50%	18,074	43.56%	42,624	60.27%	104,472	73.13%
	2016	2,893	11,678	28.36%	17,518	42.22%	42,147	59.59%	104,152	72.91%
	2017	2,866	11,214	27.23%	16,975	40.91%	41,682	58.94%	103,841	72.69%
	2018	2,839	10,757	26.12%	16,444	39.63%	41,228	58.29%	103,538	72.48%
	2019	2,813	10,307	25.03%	15,926	38.38%	40,783	57.67%	103,243	72.27%
	2020	2,787	9,865	23.95%	15,420	37.16%	40,349	57.05%	102,953	72.07%
	2021	2,763	9,430	22.90%	14,926	35.97%	39,924	56.45%	102,669	71.87%
	2022	2,738	9,002	21.86%	14,444	34.81%	39,508	55.86%	102,391	71.67%
2011-2012 OFL-derived catch	2011	1,584	14,133	34.32%	20,442	49.27%	44,660	63.15%	105,868	74.11%
	2012	1,584	13,977	33.94%	20,226	48.75%	44,530	62.96%	105,899	74.13%
	2013	1,584	13,822	33.56%	20,013	48.23%	44,402	62.78%	105,933	74.15%
	2014	1,584	13,666	33.18%	19,802	47.72%	44,277	62.61%	105,968	74.18%
	2015	1,584	13,509	32.80%	19,593	47.22%	44,153	62.43%	106,003	74.20%
	2016	1,584	13,350	32.42%	19,385	46.72%	44,030	62.26%	106,037	74.23%
	2017	1,584	13,189	32.03%	19,179	46.22%	43,907	62.08%	106,069	74.25%
	2018	1,584	13,025	31.63%	18,972	45.72%	43,783	61.91%	106,098	74.27%
	2019	1,584	12,858	31.22%	18,766	45.23%	43,659	61.73%	106,122	74.29%
	2020	1,584	12,688	30.81%	18,560	44.73%	43,533	61.55%	106,142	74.30%
	2021	1,584	12,513	30.38%	18,354	44.23%	43,405	61.37%	106,156	74.31%
	2022	1,584	12,334	29.95%	18,147	43.74%	43,275	61.19%	106,164	74.32%
Forecast catch calculated from 77% SPR applied to base model	2011	928	14,133	34.32%	20,442	49.27%	44,660	63.15%	105,868	74.11%
	2012	928	14,138	34.33%	20,406	49.18%	44,530	62.96%	105,899	74.13%
	2013	928	14,143	34.34%	20,373	49.10%	44,402	62.78%	105,933	74.15%
	2014	928	14,148	34.35%	20,341	49.02%	44,277	62.61%	105,968	74.18%
	2015	928	14,152	34.36%	20,309	48.95%	44,153	62.43%	106,003	74.20%
	2016	928	14,154	34.37%	20,278	48.87%	44,030	62.26%	106,037	74.23%
	2017	928	14,153	34.37%	20,247	48.79%	43,907	62.08%	106,069	74.25%
	2018	927	14,149	34.36%	20,214	48.72%	43,783	61.91%	106,098	74.27%
	2019	927	14,142	34.34%	20,182	48.64%	43,659	61.73%	106,122	74.29%
	2020	926	14,130	34.31%	20,147	48.56%	43,533	61.55%	106,142	74.30%
	2021	926	14,113	34.27%	20,111	48.47%	43,405	61.37%	106,156	74.31%
	2022	925	14,091	34.22%	20,073	48.38%	43,275	61.19%	106,164	74.32%

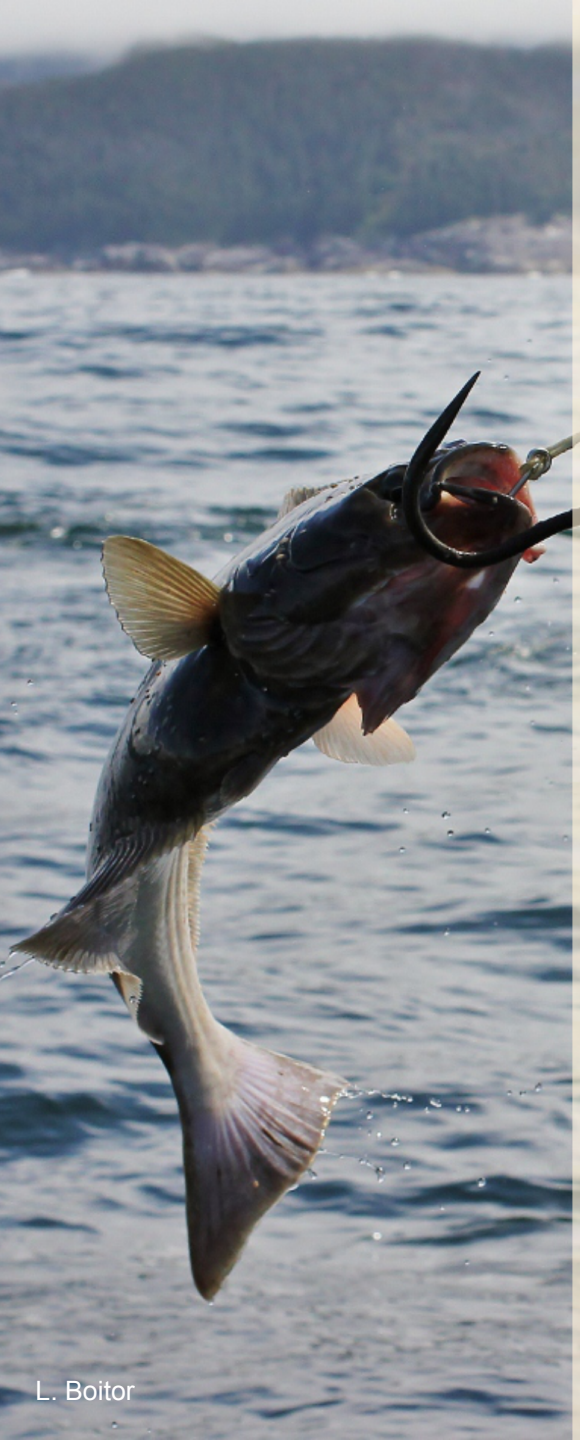
Source:

Table f. Decision table of 12-year projections for alternate states of nature (columns) and management options (rows) beginning in 2013. The percentiles of the asymptotic distribution are used to describe the relative probabilities among the states of nature. Values of relative SPR that exceed 100% indicate overfishing; order is reversed to maintain the "lower-to-higher" pattern consistent with other quantities, i.e., larger values implying greater relative fishing intensity are reported on the left side of the table. The results of this table are conditioned on the already-specified ACLs for 2011 and 2012 being achieved exactly.

			State of nature								
						Maximum likelihood estimate					
Relative probability			Less likely (12.5th percentile)			More likely (expectation)			Less likely (87.5th percentile)		
Management alternative											
	Year	Dead catch (mt)	Depletion	Relative SPR	Spawning biomass (mt)	Depletion	Relative SPR	Spawning biomass (mt)	Depletion	Relative SPR	Spawning biomass (mt)
	2013	2,376	22%	66%	31,057	31%	48%	56,271	40%	30%	81,485
	2014	2,725	22%	68%	31,825	32%	49%	57,379	41%	30%	82,933
	2015	3,185	23%	71%	32,809	33%	51%	59,233	42%	31%	85,657
12.5th	2016	3,680	24%	74%	33,692	34%	53%	61,470	44%	31%	89,247
pctl.	2017	4,157	24%	77%	34,365	35%	54%	63,824	46%	31%	93,283
40:10	2018	4,581	24%	79%	34,846	36%	55%	66,142	49%	31%	97,437
catch	2019	4,938	24%	81%	35,187	38%	56%	68,352	51%	32%	101,516
	2020	5,211	24%	82%	35,444	39%	57%	70,438	53%	32%	105,432
	2021	5,415	24%	84%	35,661	40%	58%	72,410	55%	32%	109,159
	2022	5,595	25%	85%	35,869	41%	58%	74,286	57%	32%	112,703
	2013	5,451	22%	98%	31,057	31%	88%	56,271	40%	78%	81,485
	2014	5,909	22%	101%	31,830	31%	88%	56,358	40%	76%	80,885
	2015	6,512	23%	104%	32,775	31%	89%	57,066	40%	73%	81,356
	2016	7,121	23%	107%	33,539	32%	89%	58,015	41%	71%	82,491
40:10	2017	7,662	23%	110%	33,984	32%	90%	58,969	42%	69%	83,953
catch	2018	8,097	23%	112%	34,124	33%	90%	59,821	43%	68%	85,519
	2019	8,424	23%	114%	34,022	33%	90%	60,550	44%	67%	87,077
	2020	8,629	22%	115%	33,754	34%	90%	61,174	45%	66%	88,594
	2021	8,745	22%	117%	33,384	34%	91%	61,732	46%	65%	90,080
	2022	8,847	21%	118%	32,962	34%	91%	62,258	47%	64%	91,553
	2013	8,526	22%	144%	31,057	31%	117%	56,271	40%	90%	81,485
	2014	9,092	21%	147%	29,696	30%	118%	55,240	40%	89%	80,785
	2015	9,838	20%	150%	28,294	30%	118%	54,712	40%	87%	81,129
87.5th	2016	10,561	19%	153%	26,545	30%	119%	54,299	41%	84%	82,052
pctl.	2017	11,168	18%	156%	24,426	30%	119%	53,802	41%	83%	83,179
40:10	2018	11,614	16%	159%	22,048	29%	120%	53,167	42%	81%	84,286
catch	2019	11,911	15%	162%	19,534	29%	121%	52,413	43%	79%	85,292
	2020	12,047	13%	164%	16,963	28%	121%	51,572	43%	78%	86,180
	2021	12,075	12%	167%	14,429	28%	121%	50,726	44%	76%	87,024
	2022	12,100	10%	169%	11,951	27%	122%	49,900	45%	75%	87,849

Example 2: The use of decision tables by the International Pacific Halibut Commission

Dr. Ian Stewart, Quantitative Scientist, International Pacific Halibut Commission

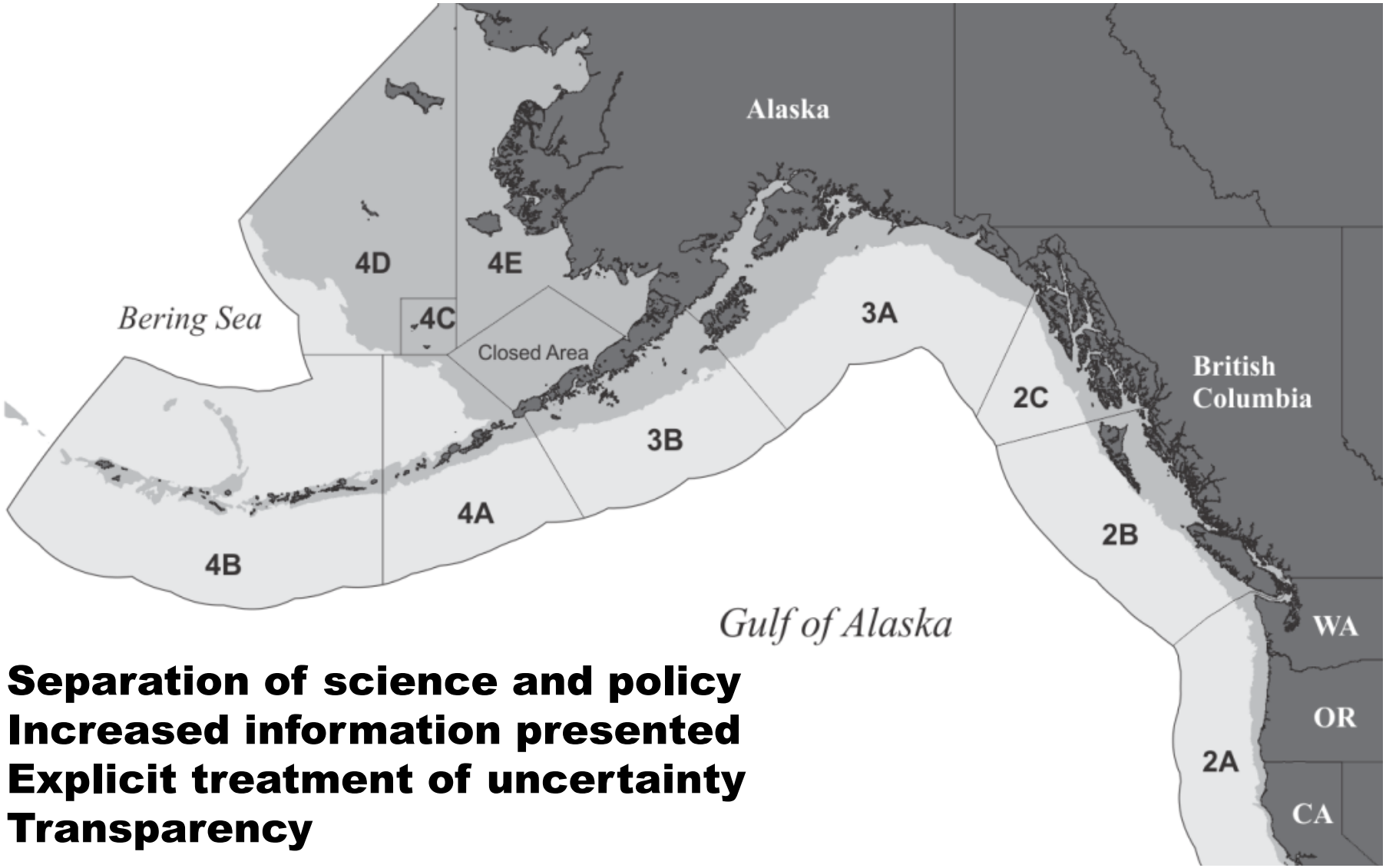


International Pacific Halibut Commission

Transition to risk assessment

L. Boitor

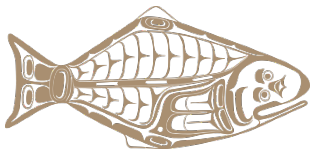
Catch advice to risk assessment



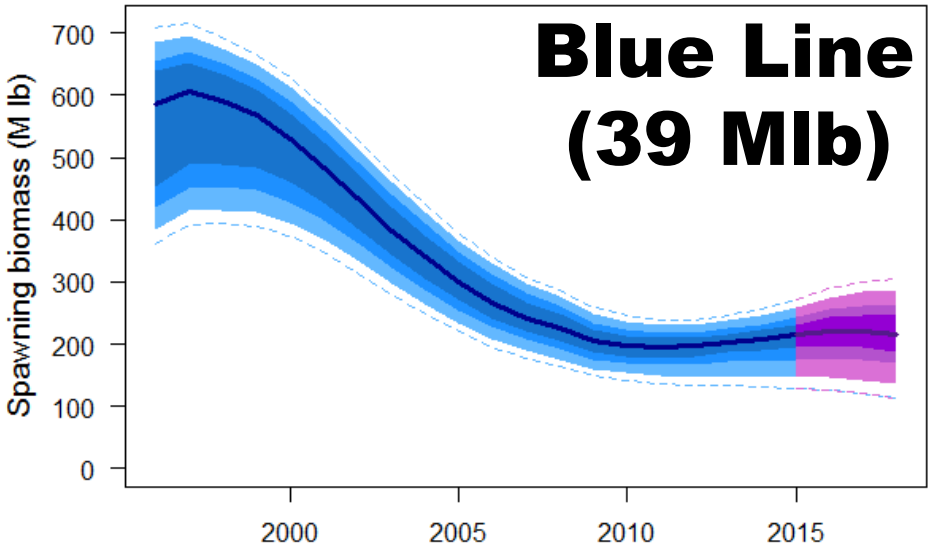
- **Separation of science and policy**
- **Increased information presented**
- **Explicit treatment of uncertainty**
- **Transparency**

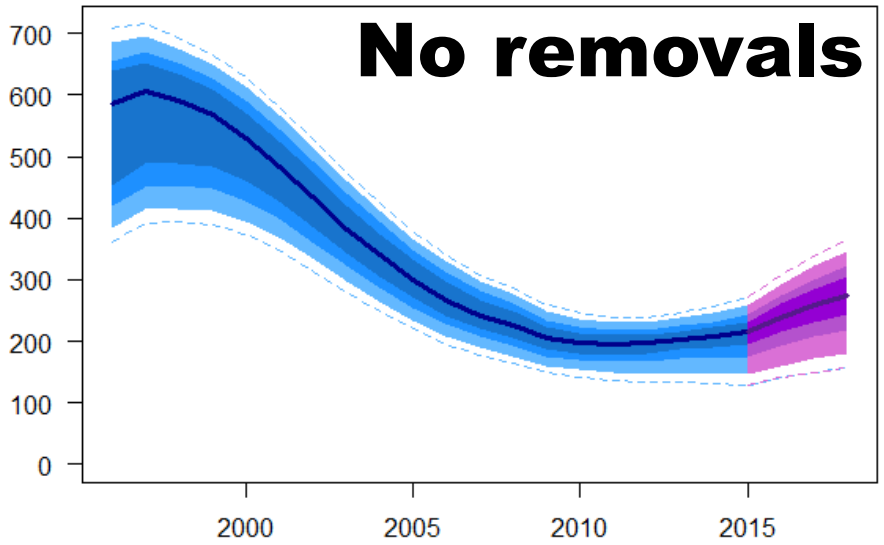
Decision table

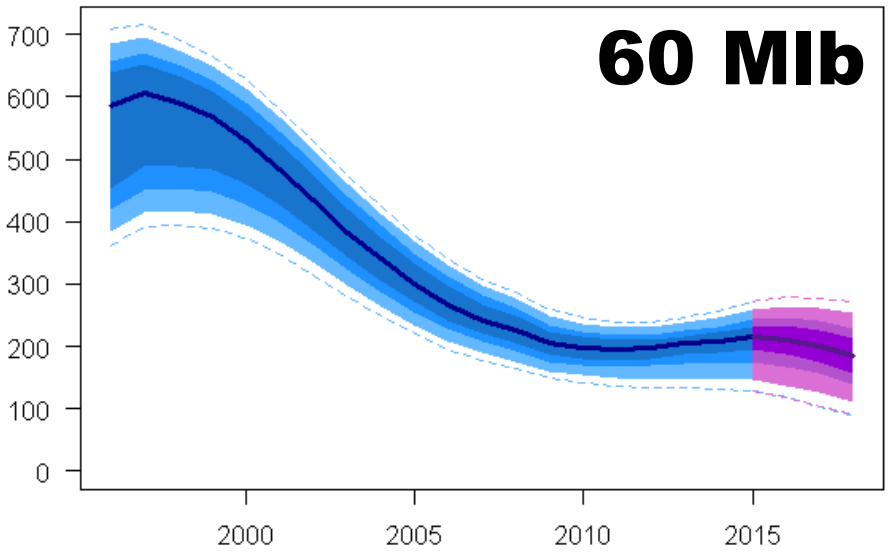
2015 Alternative	Total removals (M lb)	Fishery CEY (M lb)	Fishing intensity	Stock Trend: Spawning biomass in 2016: is less than 2015	Stock Trend: Spawning biomass in 2016: is 5% less than 2015	Stock Trend: Spawning biomass in 2018: is less than 2015	Stock Trend: Spawning biomass in 2018: is 5% less than 2015	Stock Status: Spawning biomass in 2016: is less than 30%	Stock Status: Spawning biomass in 2016: is less than 20%	Stock Status: Spawning biomass in 2018: is less than 30%	Stock Status: Spawning biomass in 2018: is less than 20%	Fishery Trend: Fishery CEY from the harvest policy in 2016: is less than 2015	Fishery Trend: Fishery CEY from the harvest policy in 2016: is 10% less than 2015	Fishery Trend: Fishery CEY from the harvest policy in 2018: is less than 2015	Fishery Trend: Fishery CEY from the harvest policy in 2018: is 10% less than 2015	Fishery Status: Harvest rate in 2015: is above target
Action	RISK															
				a	b	c	d	e	f	g	h	i	j	k	l	m



Integrated projections

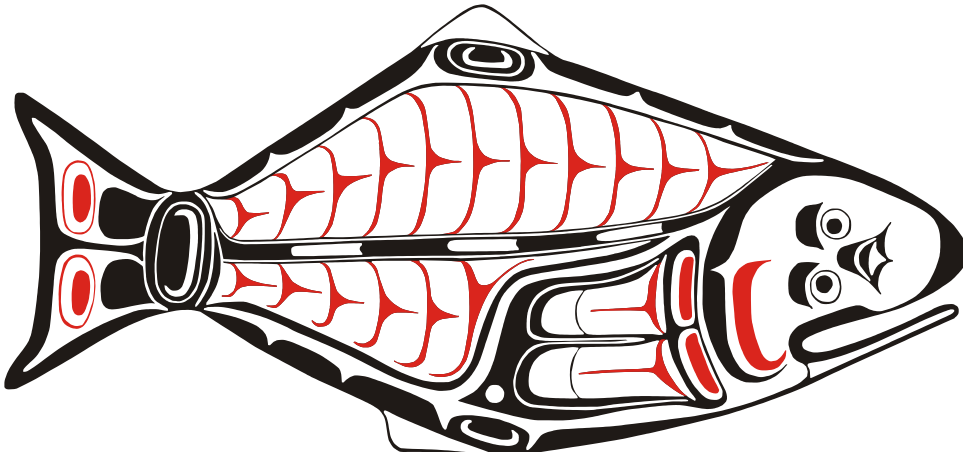


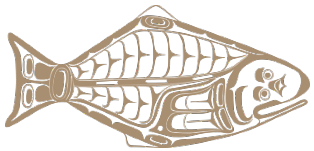




Decision table: Stock trend

2015 Alternative	Total removals (M lb)	Fishery CEY (M lb)	Fishing intensity	Stock Trend: Spawning biomass in 2016: is less than 2015	Stock Trend: Spawning biomass in 2016: is 5% less than 2015	Stock Trend: Spawning biomass in 2018: is less than 2015	Stock Trend: Spawning biomass in 2018: is 5% less than 2015
				a	b	c	d
No removals	0.0	0.0	$F_{100\%}$	<1/100	<1/100	<1/100	<1/100
FCEY = 0	13.1	0.0	$F_{73\%}$	<1/100	<1/100	<1/100	<1/100
	20.0	7.7	$F_{64\%}$	<1/100	<1/100	1/100	<1/100
	30.0	16.5	$F_{54\%}$	3/100	<1/100	17/100	4/100
Blue Line	38.7	25.0	$F_{46\%}$	19/100	<1/100	40/100	23/100
status quo	41.4	27.5	$F_{45\%}$	26/100	1/100	47/100	30/100
Final adopted	42.8	29.2	$F_{44\%}$	30/100	1/100	54/100	34/100
Maintain 2014 SPR	43.3	29.5	$F_{43\%}$	31/100	1/100	56/100	36/100
	50.0	36.0	$F_{39\%}$	44/100	5/100	75/100	51/100
	60.0	45.8	$F_{34\%}$	65/100	22/100	96/100	82/100





Example 3: Developing a risk matrix for New England FMPs

Lori Steele, Fishery Analyst, New England Fishery Management Council

FMP	XXX	**Complete this table with information about current conditions for the stock/fishery based on the most recent assessment and round of fishery specifications. This is an inventory of current conditions - not a "wish list."*
STOCK(S)	XXX	
LAST ASSESSMENT	Assessment/Meeting, Year	*Information provided in the cells should relate specifically to evaluating the risks to the resource and net benefits to the Nation, with consideration/acknowledgement of consequences to the fishery, ecosystem, and other consequences.*

Assessment Model, Terminal Year	Description of Assessment Model	Overfishing? Overfished?	In Rebuilding Program?	OFL	ABC/ABC CR	ACL	ACT
Name of most recent model used in assessment and terminal year of data	General description of assessment model	Most recent F/B status determinations	Yes/No; Year x of y (if yes)	OFL definition/formula and most recent specification (x lbs, year)	ABC and ABC CR/formula and most recent specification (x lbs, year)	Most recent (year) fishery ACL(s), sub-ACL(s)	Most recent (year) ACTs, if applicable

*Summarize major fisheries management issues/challenges here, in a few words.	MSY/OY	AMs	Discards	State Waters
	MSY/OY definitions/formulas and most recent specifications (values, year)	Briefly summarize accountability measures in FMP	Summarize how discards are treated for stock assessment and quota monitoring	Summarize state waters catch and how it is treated for stock assessment and quota monitoring

Availability of Biological and Assessment Data	*Used in Assessment:* ID biological data used in assessment (time period) *Other Biological Data:* ID other biological data that may be available but not used in assessment ID any significant biological/stock data elements that are missing
Recent Performance Against Harvest Control Rule	*For the most recent three years-* Summarize utilization of available yield (% of total ACL harvested) Summarize how control rule affected the stock? Has stock status and/or fishing mortality changed (improved/declined)?
Current Management Program	Briefly summarize major elements of current management program; include summary of Federal and State management, as appropriate
Catch, Revenues, and Variability	*For the most recent three years-* Provide average catch, revenues; Characterize trends and variability *over 10 to 15 years* , depending on data availability, using avg., min. and max. values.
Data - Vessels, Permits, Dealers, Processors, Employment	*For the most recent three years* - Number of vessels by permit and/or gear (and % of active/inactive), and percentage of catch taken by each category; Briefly summarize shoreside components- number of active dealers, processors/plants; ID and summarize any available employment information; Characterize trends and variability *over 10 to 15 years* , depending on data availability, using avg., min. and max. values.
% Food, % Recreational	*For the most recent three years* - Information about percentage landed/sold for food/recreational; Also include general summary of markets and ID any major factors that influence/change market conditions (ex., availability of other product)
Fishing Communities	*ID Top Fishing Communities for last 3-5 years based on:* (RQ) = Revenue of that species in a port/total revenue fishery-wide; and (LQ) = Revenue of that species in a port/total revenue in that port. Characterize trends. *Identify any vulnerable communities that may incur significant economic risk from resource decline*

Other Economic/Social Factors	Identify any other economies/industries that may be dependent on the resource (other than directed fishery); Describe the potential impacts of variability and size composition of resource/catch on market share and prices.
Major Sources of Scientific Uncertainty	Summarize the sources of uncertainty identified in the stock assessment; Identify/summarize other sources of scientific uncertainty
Major Sources of Management Uncertainty	Summarize the sources of management uncertainty that were explicitly accounted for during last round of fishery specifications; Identify and summarize any new/additional sources of management uncertainty
How is the probability of overfishing addressed?	What is the process and/or formula used to specify catch levels to prevent overfishing? How was the probability of overfishing addressed during the last round of fishery specifications?
What is the consequence of overfishing?	Given the current status of the stock (biomass), what are the short-term impacts of overfishing? What are the long-term impacts of overfishing the stock (if it were to continue)?
How are expected net benefits to the Nation currently measured/evaluated?	What tools/data are currently available to measure and evaluate net benefits to the Nation? How were net benefits to the Nation evaluated during the last round of fishery specifications?
Interactions with Other Fisheries/Stocks, Bycatch Issues	Describe most significant interactions with other fisheries/stocks, including stocks for which there may be catch/bycatch caps or sub-ACLs; Identify any overlapping fisheries with significant interactions
Ecosystem Considerations: Trophic Interactions	Describe any important trophic interactions related to the role of the stock in the ecosystem; Summarize important predator-prey interactions Discuss trends/variability over the last 10-15 years, and identify any new related data/analyses
Ecosystem Considerations: Habitat	ID habitat sensitivity/vulnerability issues for the stock; Describe any recent changes to important habitat for stock and/or changes to fisheries that impact stock habitat; Discuss trends/variability over the last 10-15 years, and identify any new related data/analyses
Ecosystem Considerations: Climate	Does the stock exhibit strong response to temperature? Has climate change affected the distribution of the stock? Discuss trends/variability over the last 10-15 years, and identify any new related data/analyses
Other Important Considerations/Notes	Discuss any other important considerations for evaluating risk to the resource and net benefits to the Nation.

FMP ATLANTIC HERRING FMP
STOCK(S) ATLANTIC HERRING
LAST ASSESSMENT SAW 54, JUNE 2012

Assessment Model, Terminal Year	Description of Assessment Model	Overfishing?/ Overfished?	In Rebuilding Program?	OFL	ABC/ABC CR	ACL	ACT
ASAP Model, 2011	Statistical Age-Structured Model	No/No Rebuilt (Above B target)	No	$F_{MAX} \times B_{CURRENT}$ ($F_{MAX} = F_{MSY}$ or F_{REB}, depending on stock status) 169,000 mt in 2013 136,000 mt in 2014 114,000 mt in 2015	**2013-2015: Constant Catch (114,000 mt)** 3 year average with 50% probability of overfishing in Year 3	**ABC - Management Uncertainty,** as determined by Council; Stockwide ACL = U.S. OY 107,800 mt 2013-2015	N/A; AMs close directed fishery at 92% of sub-ACLs and 95% of stockwide ACL

	MSY/OY	AMs	Discards	State Waters
***Fishery prosecuted primarily with midwater trawls (single/paired), purse seines, and small mesh bottom trawls; there is also a small fixed gear fishery in state waters. Most significant management challenges include minimizing interactions with non-target species like river herring, shad and some groundfish (haddock). The role of herring as a forage species and importance of herring to the ecosystem are also important managment considerations.**	MSY defined by assessment (53,000 mt in SAW 54); OY = Stockwide ACL	Closure of management areas at 92% sub-ACL; closure of directed fishery at 95% total ACL; overage deductions and carryover provisions; AM to close large area when haddock sub-ACL is reached	Less than 1% of total catch; added to landings for assessment; counted against management area sub-ACLs	Deducted from ABC as part of management uncertainty, if necessary (currently no deduction)

Availability of Biological and Assessment Data	Used in Assessment: spring/summer/fall NEFSC trawl surveys (highly variable for herring); catch data from VTRs; observer data; age data for catches (port samples) and trawl surveys (not summer); diet/consumption data (imprecise); catch-at-age data from port samples and survey - ageing fish is an ongoing source of uncertainty; Other Data: Hydroacoustic surveys currently not used in assessment; larval surveys, state surveys, other sources of data are identified in assessment literature but not used in assessment model
Recent Performance Against Harvest Control Rule	Stock has remained in a rebuilt condition with no overfishing occuring for many years. Catch and fishing mortality have been relatively consistent for years; the fishery is near full utilization because ACLs have decreased over time. 100% of the stockwide ACL was utilized in 2012. 2013 catch was 92% of the stockwide ACL. Prelim. 2014 catch was 91% of stockwide ACL.
Current Management Program	Limited access fishery (4 limited access categories, 2 open access categories); Catch quotas (TACs/ACLs), divided by management area since 2000; 3-year specifications; AMs to prevent ACLs/sub-ACLs from being exceeded and to address overages; carryovers (up to 10%) for sub-ACL underage; catch caps to manage interactions haddock and river herring/shad; seasonal gear restrictions (mwt) in the inshore GOM; seasonal availablility of management area sub-ACLs (1A and 1B); observer coverage and other monitoring/reporting requirements; measures to address net slippage
Catch, Revenues, and Variability	Total catch averaged 91,500 mt from 2003-2013, with a high of 103,943 mt in 2009 and low of 72,852 mt in 2010. Prices for herring increased over this time period, averaging $239 per mt from 2003-2013 ($160/mt in 2003 and $316/mt in 2013).
Data - Vessels, Permits, Dealers, Processors, Employment	~28 of 40 Cat. A/B (LA directed fishery) vessels were active in recent years - these vessels landed >98% of the total catch; ~10 of 44 Cat. C vessels (LA incidental catch) are active; over 1,700 open access (Cat. D) permits that land <1% of total ~100 active dealers, mostly bait; major processing companies in Gloucester, New Bedford, and Cape May.
% Food, % Recreational	100% commercial fishery, no recreational fishery 70% commercial fishery utilized for lobster bait (and recreational fishery bait); 30% for food - frozen whole export and sardines; Primary market is for lobster bait (June - November), food export is primarily for overseas markets, small market for sardine cannery in Black's Harbor, Canada;
Fishing Communities	Fishing communities in ME most directly dependent on herring fishery (Rockland, Vinalhaven); also large processors in Gloucester, New Bedford, and Cape May NJ;
Other Economic/Social Factors	Direct linkage between lobster fishery and herring (utilization of herring for bait); linkage between herring and recreational fishing industry; linkage between herring and eco-tourism industry
Major Sources of Scientific Uncertainty	**From the Stock Assessment** - (1) Size of the 2008 year class; (2) Estimate of Natural Mortality; (3) Biological Reference Points (BRPs) -Retrospective pattern apparent in previous assessments was addressed by changing assumptions about natural mortality and changes to maturity-at-age. **Other Sources of Uncertainty** - Stock Structure/Stock Component Mixing (inshore/offshore)
Major Sources of Management Uncertainty	Canadian catch (NB weir fishery) currently the only source of management uncertainty accounted for in buffer between ABC and stockwide ACL (uncertainty re. discards and state waters catch also considered, but not accounted for in 2013-2015 specifications)
How is the probability of overfishing addressed?	Currently, the FMP focuses on reducing the risk of overfishing - metrics available include OFL distribution, probability of exceeding OFL (assessment); Risk of overfishing the stock complex (high F) and reducing biomass to overfished (low B) addressed ad-hoc during three-year specifications

Catch, Revenues, and Variability	Total catch averaged 91,500 mt from 2003-2013, with a high of 103,943 mt in 2009 and low of 72,852 mt in 2010. Prices for herring increased over this time period, averaging $239 per mt from 2003-2013 ($160/mt in 2003 and $316/mt in 2013).
Data - Vessels, Permits, Dealers, Processors, Employment	~28 of 40 Cat. A/B (LA directed fishery) vessels were active in recent years - these vessels landed >98% of the total catch; ~10 of 44 Cat. C vessels (LA incidental catch) are active; over 1,700 open access (Cat. D) permits that land <1% of total ~100 active dealers, mostly bait; major processing companies in Gloucester, New Bedford, and Cape May.
% Food, % Recreational	100% commercial fishery, no recreational fishery 70% commercial fishery utilized for lobster bait (and recreational fishery bait); 30% for food - frozen whole export and sardines; Primary market is for lobster bait (June - November), food export is primarily for overseas markets, small market for sardine cannery in Black's Harbor, Canada;
Fishing Communities	Fishing communities in ME most directly dependent on herring fishery (Rockland, Vinalhaven); also large processors in Gloucester, New Bedford, and Cape May NJ;
Other Economic/Social Factors	Direct linkage between lobster fishery and herring (utilization of herring for bait); linkage between herring and recreational fishing industry; linkage between herring and eco-tourism industry
Major Sources of Scientific Uncertainty	**From the Stock Assessment** - (1) Size of the 2008 year class; (2) Estimate of Natural Mortality; (3) Biological Reference Points (BRPs) -Retrospective pattern apparent in previous assessments was addressed by changing assumptions about natural mortality and changes to maturity-at-age. **Other Sources of Uncertainty** - Stock Structure/Stock Component Mixing (inshore/offshore)
Major Sources of Management Uncertainty	Canadian catch (NB weir fishery) currently the only source of management uncertainty accounted for in buffer between ABC and stockwide ACL (uncertainty re. discards and state waters catch also considered, but not accounted for in 2013-2015 specifications)
How is the probability of overfishing addressed?	Currently, the FMP focuses on reducing the risk of overfishing - metrics available include OFL distribution, probability of exceeding OFL (assessment); Risk of overfishing the stock complex (high F) and reducing biomass to overfished (low B) addressed ad-hoc during three-year specifications
What is the consequence of overfishing?	If F exceeds the target F or F MSY, legal mandates apply. If overfishing occurs, fishery yield would be reduced in the following year(s). In the short-term, B would be reduced, but not likely below threshold (overfished). Long-term impacts on other species/ecosystem of prolonged overfishing (REVISIT THIS FOR LONG-TERM)
How are expected net benefits to the Nation currently measured/evaluated?	Yield (mt and $); are there data on costs?
Interactions with Other Fisheries/Stocks, Bycatch Issues	-Atlantic Mackerel (southern New England/Mid-Atlantic fishery overlap); -Northeast Multispecies, especially haddock (GOM and GB haddock catch caps for midwater trawl vessels); -River Herring and Shad (RH/S catch caps by gear type and area) -Direct linkage to lobster fishery (bait)
Ecosystem Considerations: Trophic Interactions	Important forage for fish, mammals, seabirds; Diet and consumption considered in M assumption in stock assessment; -Herring's role as a consumer and competitor in the ecosystem -Concerns about localized depletion of herring schools
Ecosystem Considerations: Habitat	Not sure about habitat sensitivity for herring? Concentrations/vulnerability of herring egg beds? LOOK AT OHA - risk of these elements managed through habitat amendment -MSA language re. habitat of prey species (EFH)
Ecosystem Considerations: Climate	Climate change may be affecting important prey/forage species for herring (calanus); herring do not exhibit significant response to temperature change; distribution of species does not appear to be changing significantly due to climate change; LOOK AT Climate Vulnerability Assessment (Draft, NER)
Other Important Considerations/Notes	-Sub-ACLs are allocated to reduce the risk of overfishing one of the stock components (inshore/offshore) -Important overlap with Canadian (New Brunswick) weir fishery - all catch from NB weir fishery assumed to come from inshore component of Atlantic herring stock -ASFMC Spawning Restrictions apply seasonally in inshore GOM to reduce risk of impacting spawning herring