Evaluation of Methods to Estimate Monkfish Discards for Calculating Total Allowable Landings

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New England Fishery Management Council
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Introduction

- Fishery Applications Consulting Team, LLC
  - Consulting business specializing in science-based solutions for sustainable fisheries management
  - Established in February 2020
  - Services:
    - Fishery Management Plan evaluation
    - Technical peer review
    - Science communication and outreach
    - Analysis of fishery dependent data
    - Meeting facilitation

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- Cate O'Keefe
  - Massachusetts Division of Marine Fisheries
  - UMass School for Marine Science and Technology (SMAST)

Overview

- Background – reminder of process to set Total Allowable Landings (TALs)
- 2020 NEFMC Monkfish Priority – purpose of the project
- Evaluation of discard estimation methods – current and alternative methods
- Factors that influence monkfish discards – ranking of influences
- Findings and recommendations – possible alternative approach for TALs
- Questions and discussion

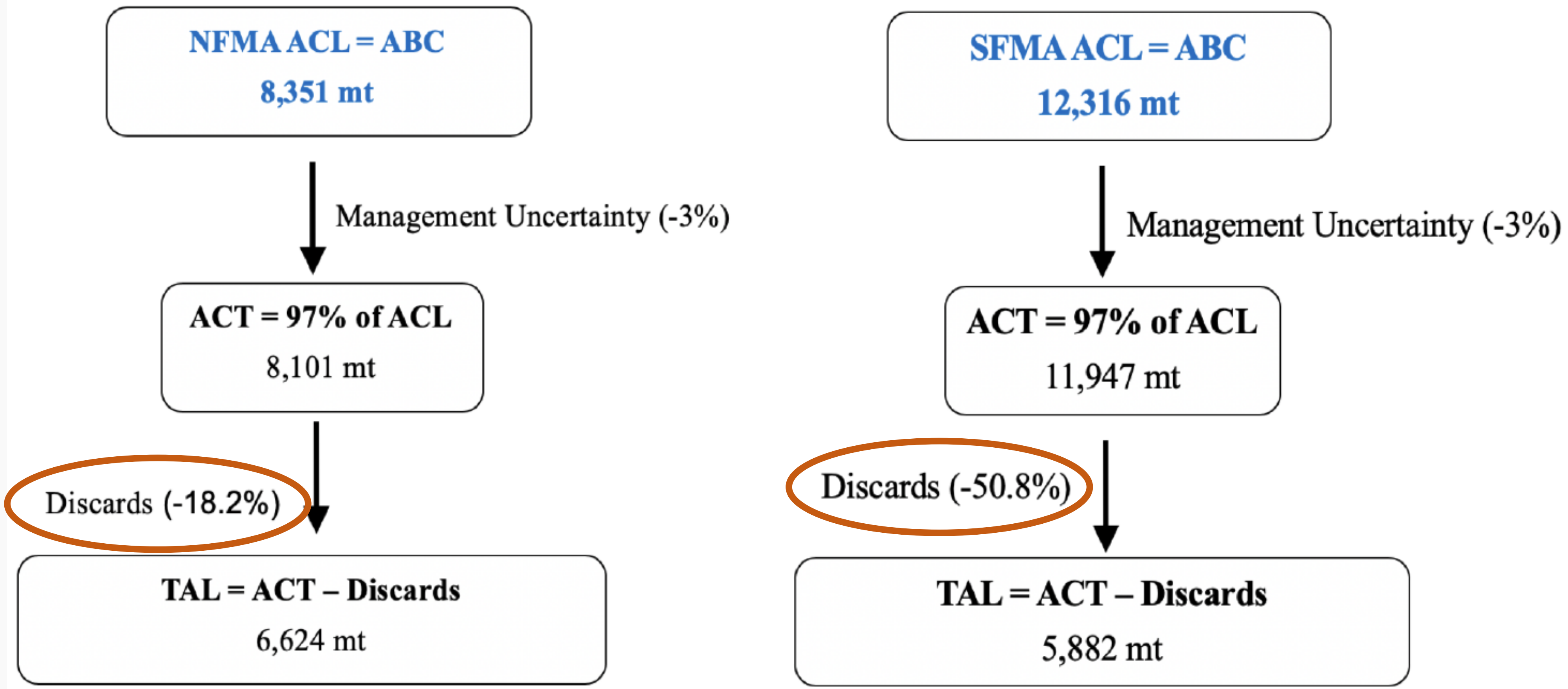
Background – Monkfish TAL

- 2019 Monkfish Operational Assessment (NEFSC, 2020)
  - Index-based method that calculates the proportional rate of change in smoothed NEFSC survey indices over three most recent years (2016-2018)
  - Rate of change is applied to current ABC to revise catch limits
    - Survey increase for Northern area (range of change 1.2 – 1.3 = ~20% increase)
    - Survey stable for Southern area (range of change 0.96 – 1.04 = no change)

- 2020-2022 Monkfish Specification (NEFMC, 2019)
  - ABC: Updated based on assessment results – 10% increase North; Status Quo South
  - ACT: 3% Management Uncertainty Buffer
  - TAL: ACT minus discards (discards “taken off the top”)
  - Discards: Monkfish discards and total catch from three most recent years (2016-2018) averaged (all gears combined) to calculate Discard % of Catch
    - North: 18.2%; South: 50.8%

Monkfish Specifications 2020-2022

NORTH | **SOUTH**



ABC = Acceptable Biological Catch
ACL = Annual Catch Limit
ACT = Annual Catch Target
TAL = Total Allowable Landings

NEFMC 2020 Priority – Monkfish Discards

- Monkfish specs are set every three years using data from previous three years
    - 2020-2022 specs were set in 2019 using data from 2016-2018
- Assumption that most recent discards are best estimate of future discards
    - North: increase in discard % of catch from 13.9% to 18.2%
    - South: increase in discard % of catch from 24.0% to 50.8%
- 2015 monkfish recruitment was a factor in increased discarding 2016-2018
    - Growth of 2015 year class – entering the fishery 2019 and beyond
- Applying data from high discard period to future period may not accurately characterize actual discarding or available biomass to TALs

NEFMC 2020 Priority – Monkfish Discards

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- NEFMC 2020 Priority for Monkfish (December, 2019):

Conduct an analysis of alternative methods for estimating discards of monkfish to apply to future specifications and consider available information on discard mortality. If warranted, consider adjusting specifications for FY2021-2022.

Evaluation of Approaches

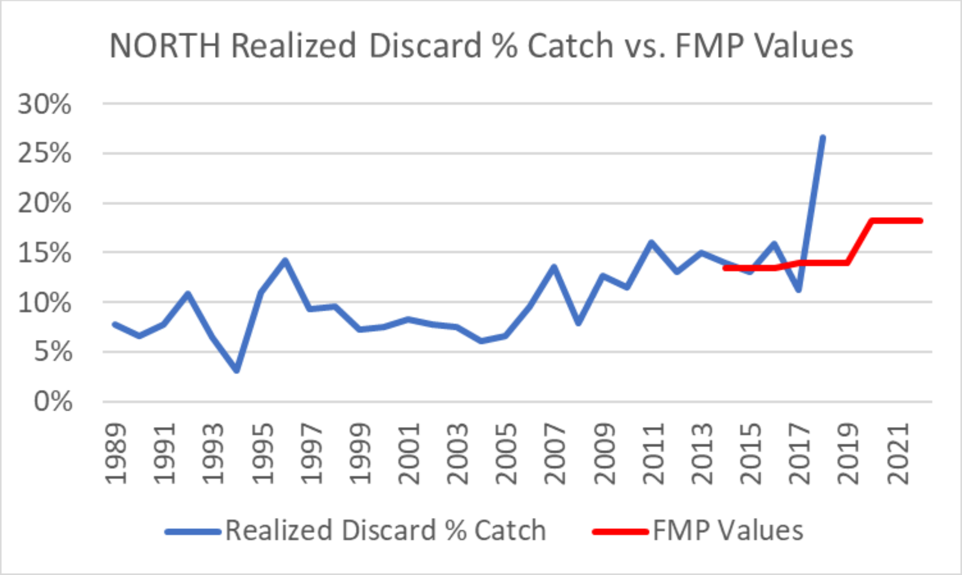
- Realized vs. estimated discards
- Multi-year averaging with different reference periods
- Gear-specific discard estimates
- Long-term discard trends
- Utility of recruitment indices
- Evaluation of factors that influence discarding

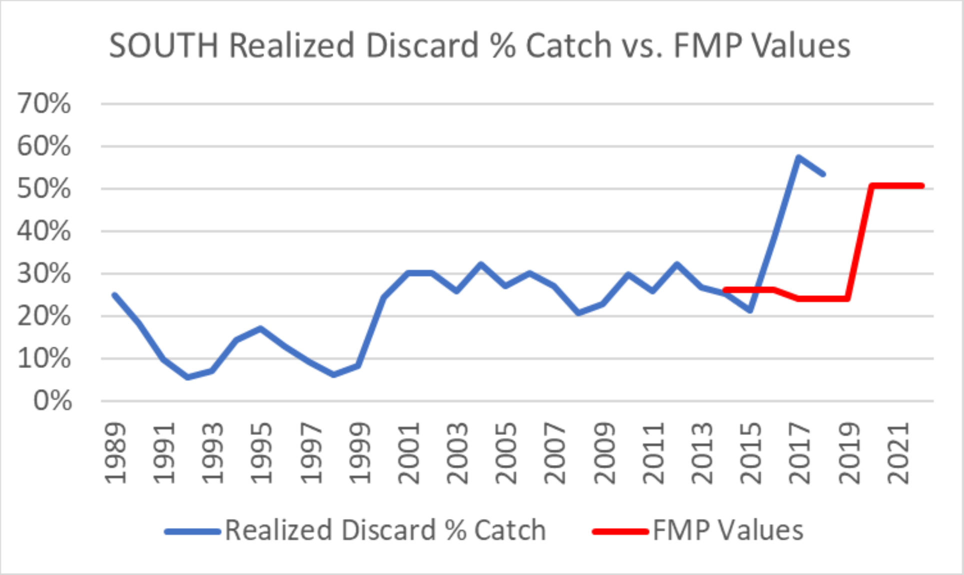
Summary of Findings

- Current approach (3-year average) performed well when discards were stable, but did not perform well after strong 2015 recruitment
  - Shorter and longer reference periods (2-year and 5-year) were not an improvement
- Gear-specific approach did not improve performance and has potential unintended consequences for management
- Longer term (2008-2015; SBRM period) mean and median discard % of catch performed well under average recruitment conditions
- Combining long-term mean or median discard % of catch to set TALs, with monitoring of recruitment indices and greater discard assumptions when strong recruitment occurs, may improve monkfish management
  - Recruitment indices are informative for predicting discards
  - Surveys and catch data can detect recruitment events
- Several factors influence monkfish discarding, but major driver over long-term appears to be monkfish recruitment and large year-classes

Realized vs. Estimated Discards

- Realized vs. estimated discard % of catch (2019 Monkfish Assessment; SBRM)

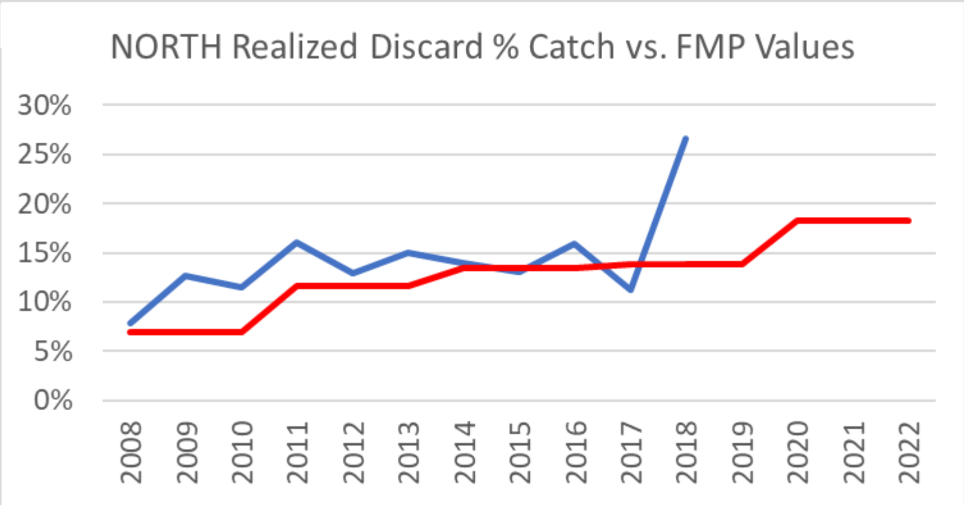


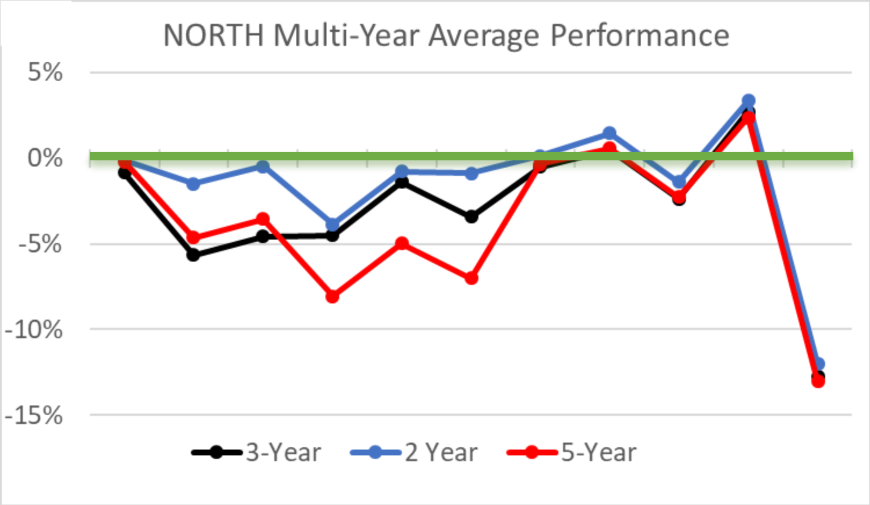


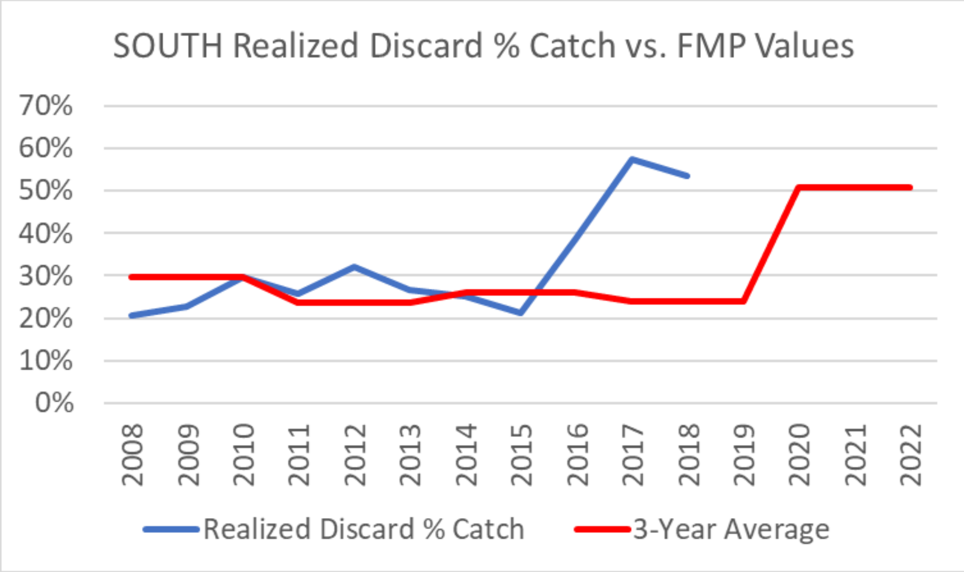
Fishing Year	Land	Discard	Total Catch	Realized Discard % Catch	FMP Discard % Catch	Land	Discard	Total Catch	Realized Discard % Catch	FMP Discard % Catch
2014	3402	552	3954	14.0%	13.4%	5135	1724	6859	25.1%	26.0%
2015	4027	603	4630	13.0%	13.4%	4609	1235	5844	21.1%	26.0%
2016	4633	875	5508	15.9%	13.4%	4422	2777	7199	38.6%	26.0%
2017	7008	886	7894	11.2%	13.9%	3893	5250	9143	57.4%	24.0%
2018	5954	2161	8115	26.6%	13.9%	4465	5150	9615	53.6%	24.0%
2019					13.9%					24.0%
2020					18.2%					50.8%
2021					18.2%					50.8%
2022					18.2%					50.8%

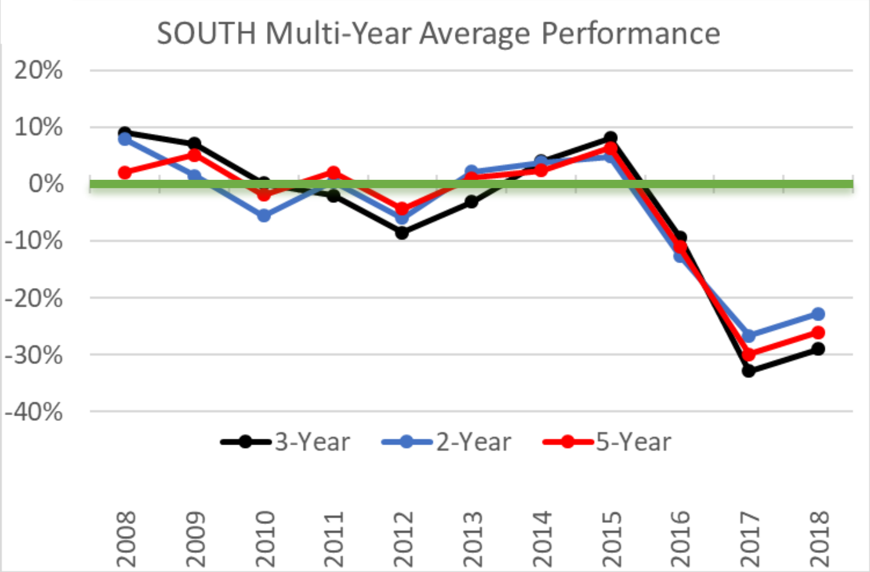
Multi-Year Average Discards

- Alternative reference periods (2-year and 5-year)









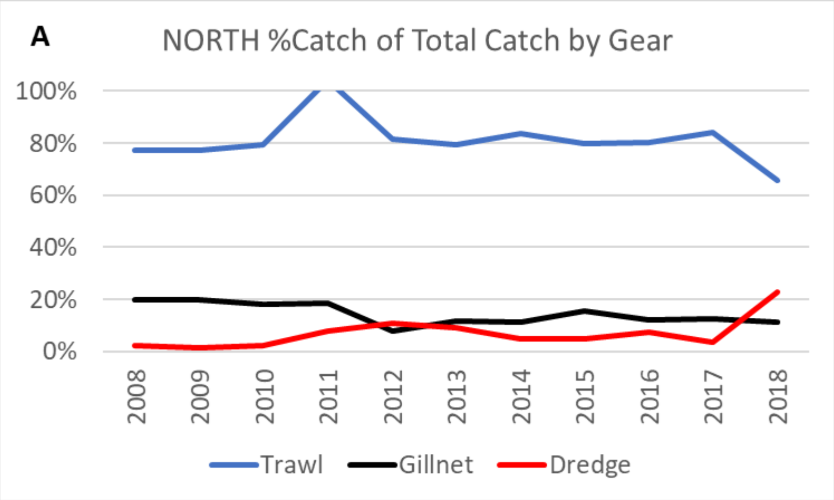
- Current approach
  - 3-year average
  - “chasing” discards
- 5-year and 2-year
  - Similar performance to current approach in most recent years
- Underestimated discards related to recruitment in 2015
- Potential overestimate for 2020-2022

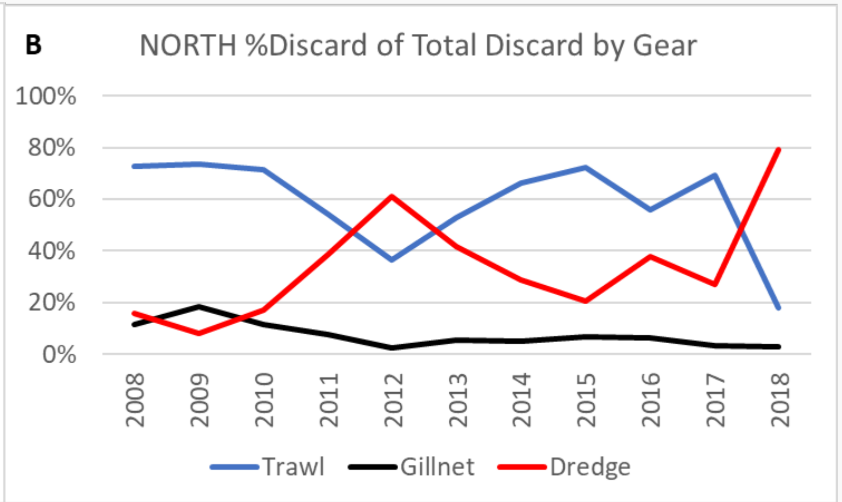
Gear-Specific Discards

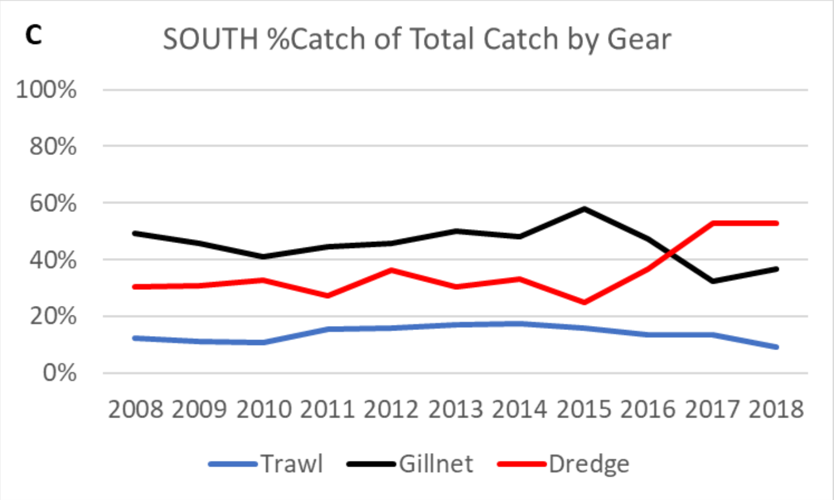
- Long-term (2008-2018; SBRM) trends in catch and discards by gear
  - North:
    - Consistent catch by all gears
      - *2011 data issue
    - Variability in discards by trawl and dredge
    - Discard estimates driven by trawl catch
  - South:
    - Consistent catch and discards by all gears, except most recent years
    - High dredge discards, but low trawl and gillnet discards
  - Combined:
    - Estimates are weighted by total catch to account for differences in catch by gear

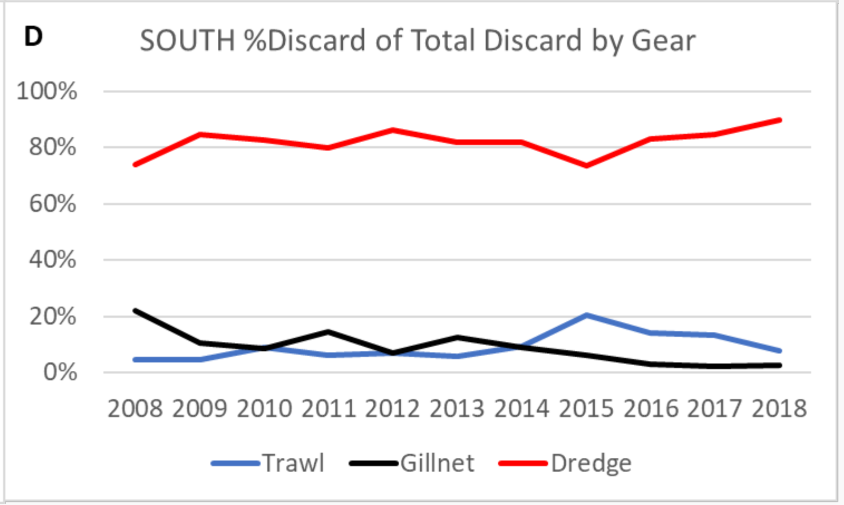
CATCH

DISCARD



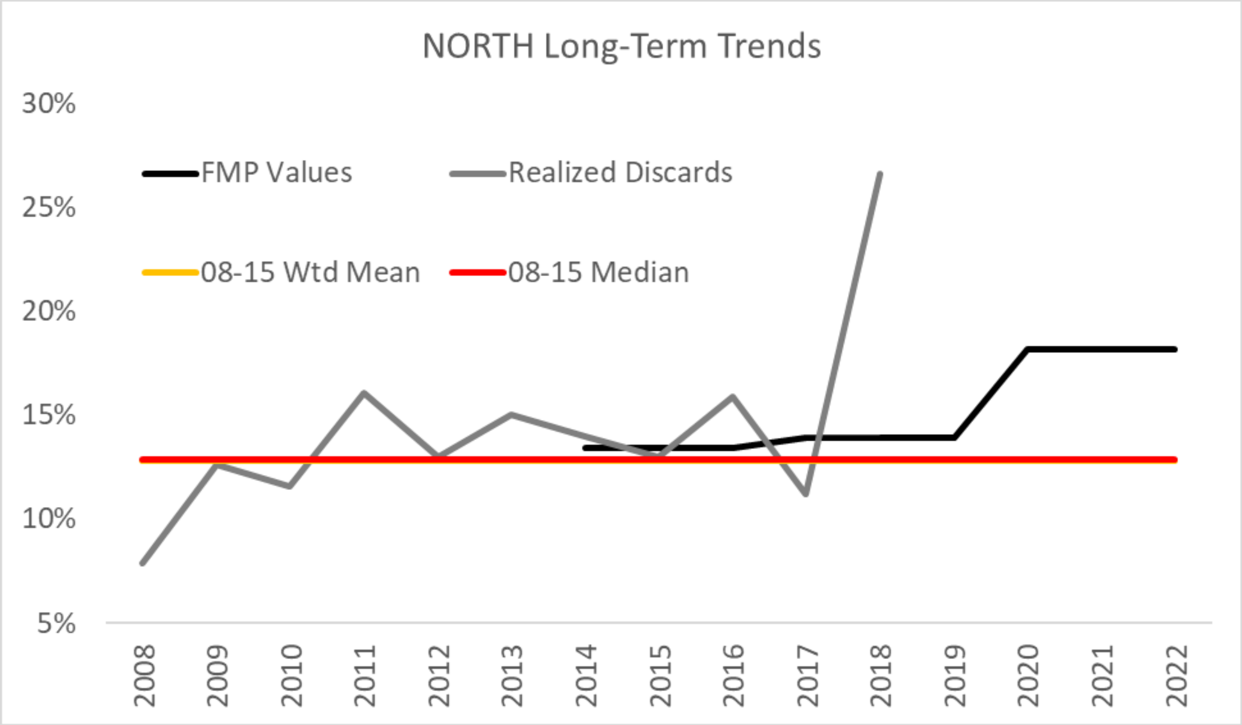


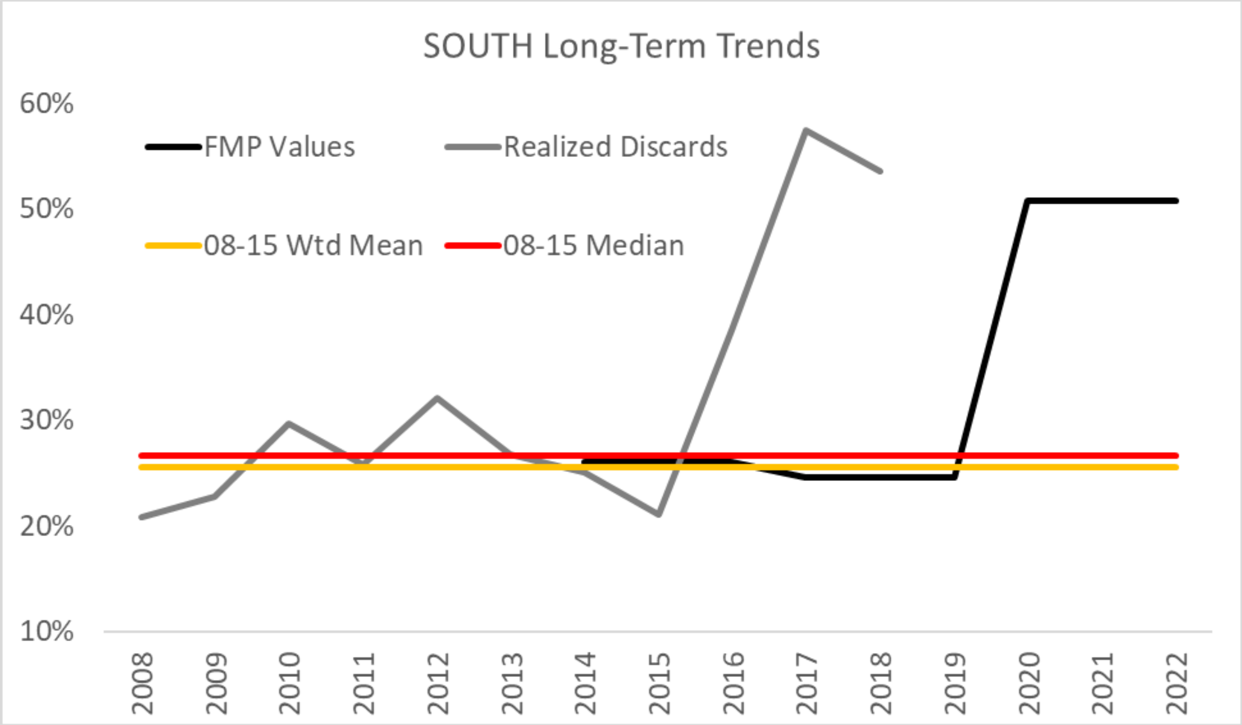




Long-Term Trends

- Long-term (2008-2015; SBRM) weighted mean and median discard % of catch performed well compared to realized discards – period of average recruitment





Area	08-15 Wtd Mean	08-15 Median
NORTH	12.8%	12.9%
SOUTH	25.6%	26.7%

Recruitment Index - Surveys

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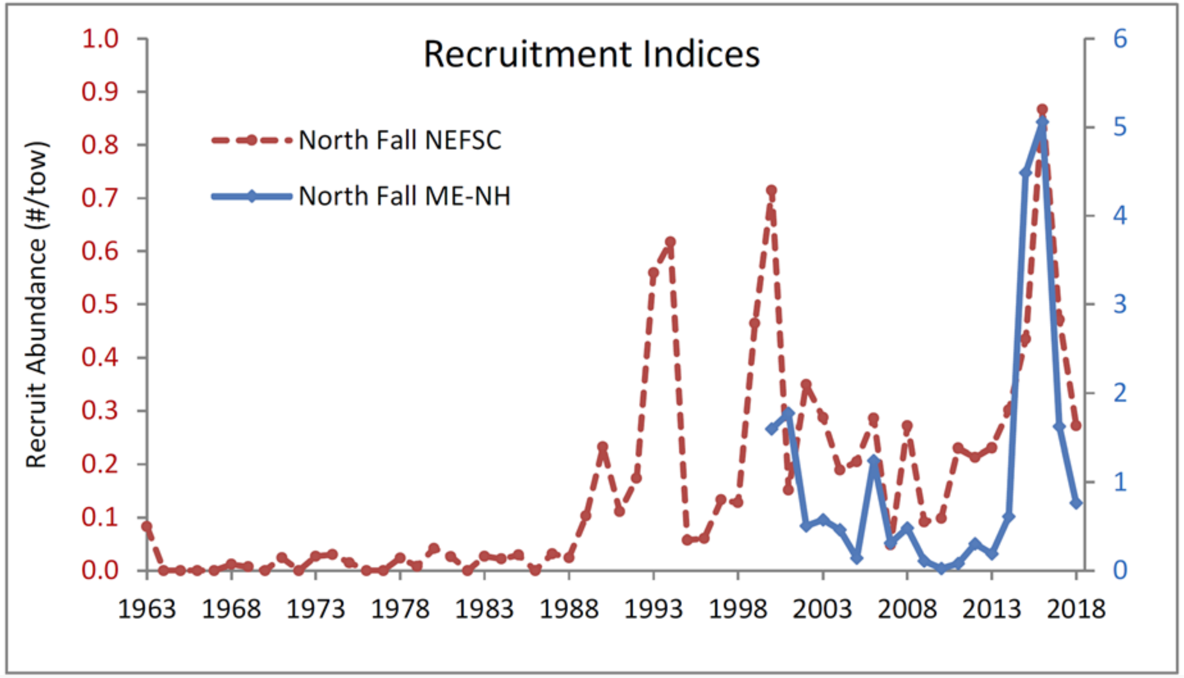
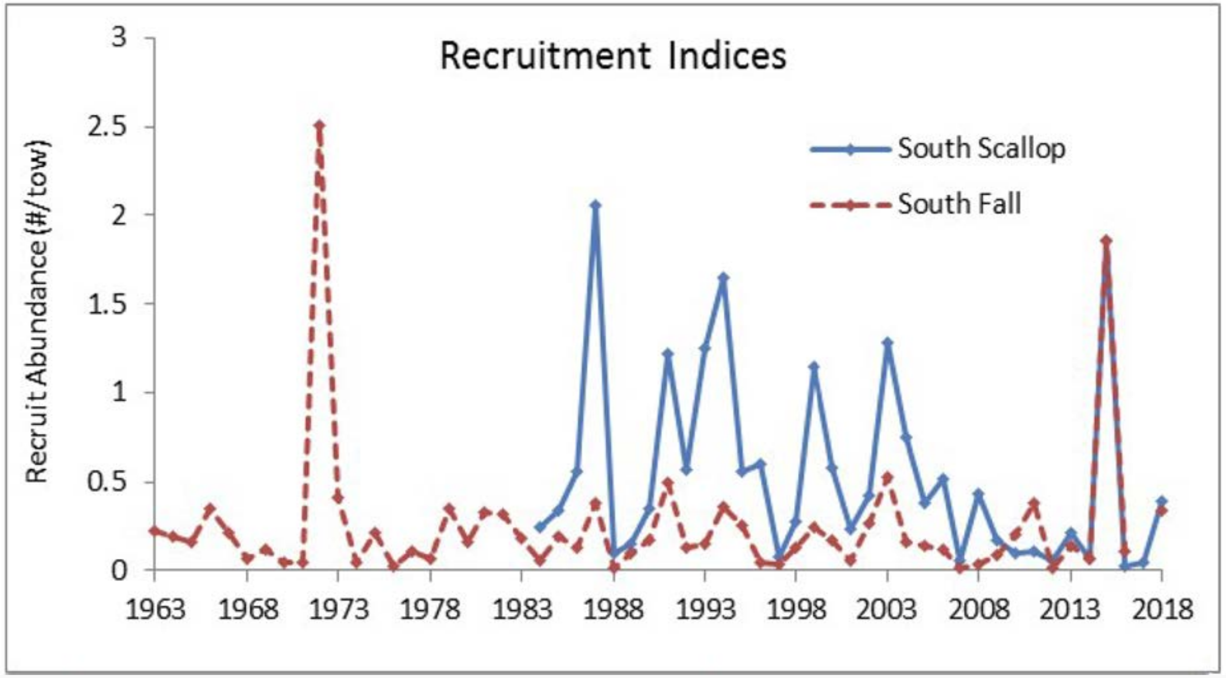
- Monkfish recruitment indices may be useful indicators of future discards
  - Several regional surveys and commercial catch data can detect strong recruitment events
    - NEFSC Fall and Spring Surveys, ME/NH Inshore Survey, NEFSC/VIMS Scallop Dredge Survey
  - Identifying "strong" recruitment events could be based on survey observations of recruit abundance (e.g., above 75th percentile)

NORTH



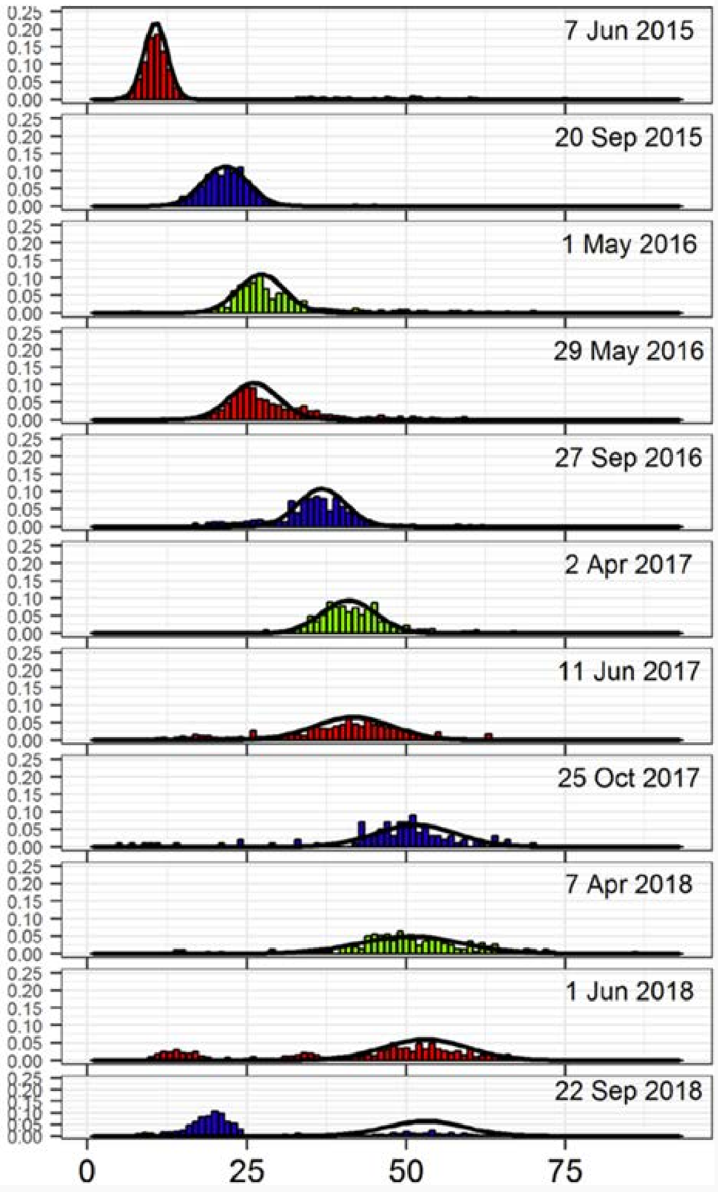
SOUTH



Growth Rate

- Information about growth rate at early ages could inform future discards
    - Growth estimated from modal progression of 2015 year-class (NEFSC, 2020)
    - Age 1 growth to ~25cm
    - Age 2 growth to ~40cm (maturity)
    - Age 3 growth over 43+cm (exploitable)

- Enter fishery within 3-5 years of recruitment to surveys
    - 2021-2022 realized discards likely will be lower than values assumed in FMP



Discard Mortality

- Monkfish discard mortality is currently assumed at 100% for all gear types

- Scallop Dredge: recent studies of monkfish survival post capture
  - Estimate of ~27% discard mortality from dredge gear (Rudders and Sulikowski, 2019)
  - Low level of physical trauma (~20% of sampled fish) in assessment of reflex response and injury condition after being caught in dredge gear (Weissman et al., 2018)

- Trawl gear: older studies of monkfish discard mortality
  - ~70% mortality assumed in original Monkfish FMP (1998)
  - MA Division of Marine Fisheries inshore study estimated 8-57% discard mortality

- Still a lot of uncertainty about monkfish discard mortality in all gears
  - Possible future research priority (Monkfish RSA; Research Track Assessment)

Influencing Factors

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1. Monkfish biology

- Recruitment
  - 2015 year-class – largest observed in North and South since 1970s
  - No known stock-recruit relationship
  - Lack of information about recruitment drivers
  - Surveys can detect strong recruitment events

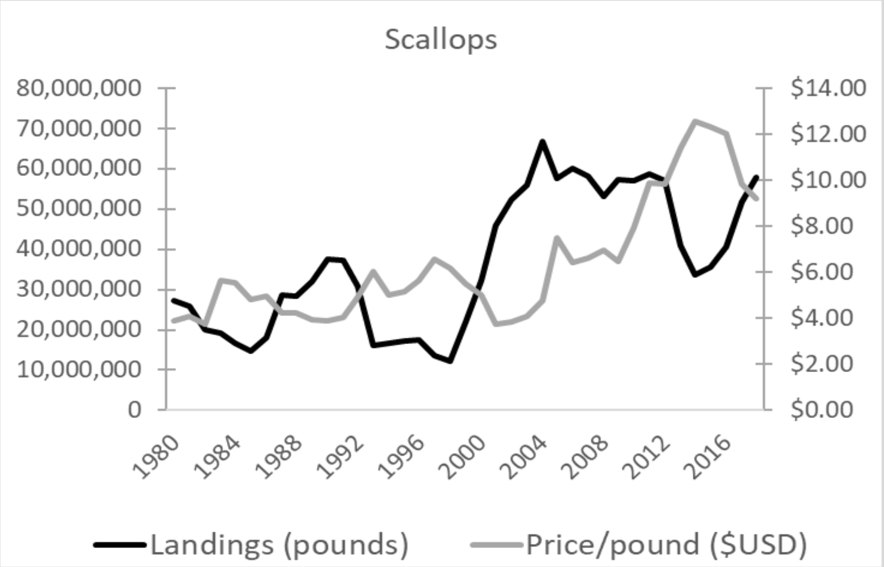
- Growth
  - Rapid growth at early age
  - Enter fishery within 3-4 years of recruitment to surveys
  - Year-classes can be tracked through survey observations
- Distribution
  - Widely distributed in both management areas
  - Overlap with non-target fisheries

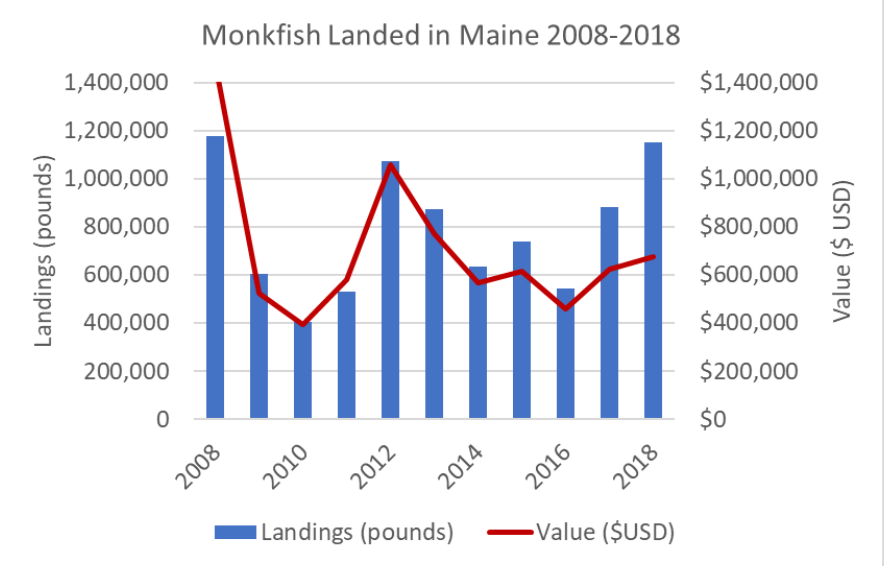
Influencing Factors

2. Non-Target Fisheries Management

- Scallop Fishery
  - Increased effort in Mid-Atlantic in 2016-2018 due to rotational management
  - Increased dredge tow time due to avoidance of nematodes and poor meat quality
  - Low to zero incentive to land monkfish due to price differential with scallops

- Groundfish Fishery
  - Historically low discards, over 80% of catch landed
  - Monkfish are targeted or caught incidentally
  - Increased targeting in recent years reflective of incentives to land monkfish despite price declines
  - TAL in northern area has been nearly fully utilized recently

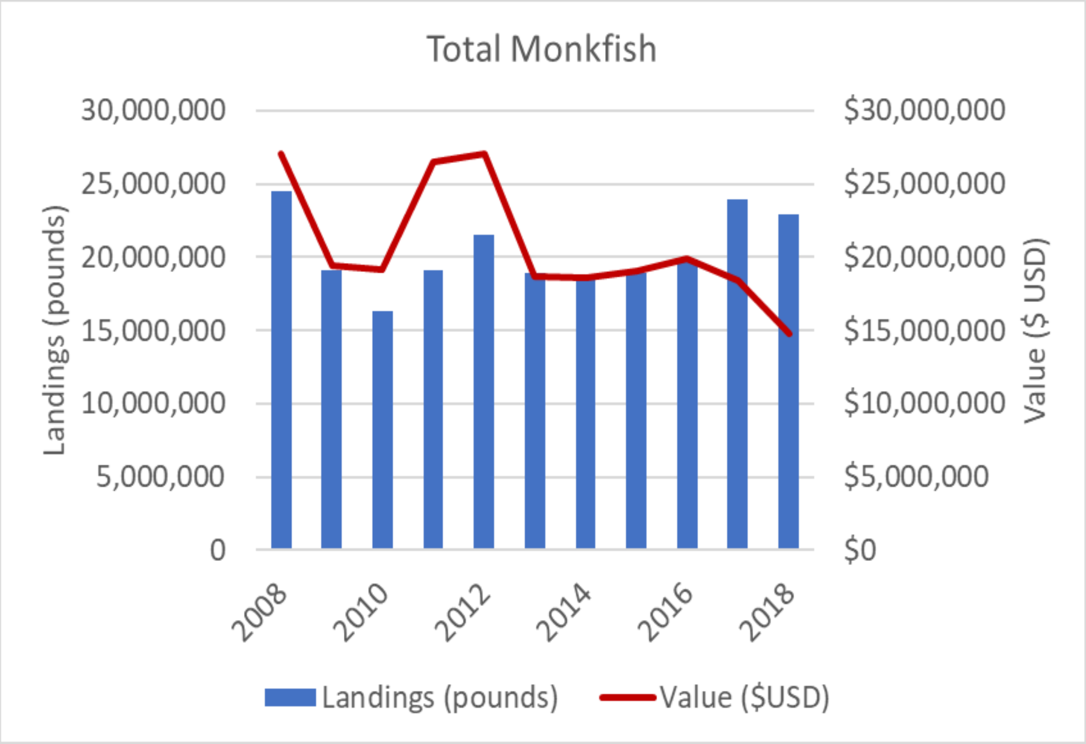




Influencing Factors

3. Monkfish Market and Price

- Increase in landings and decrease in price in recent years for all market categories
- Domestic – “oversupply” and reduced consumer demand (not a “value-added” product)
- Global market influences
    - Foreign products flooded market – lower price and differing qualities



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Acknowledgements

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  - Terry Alexander
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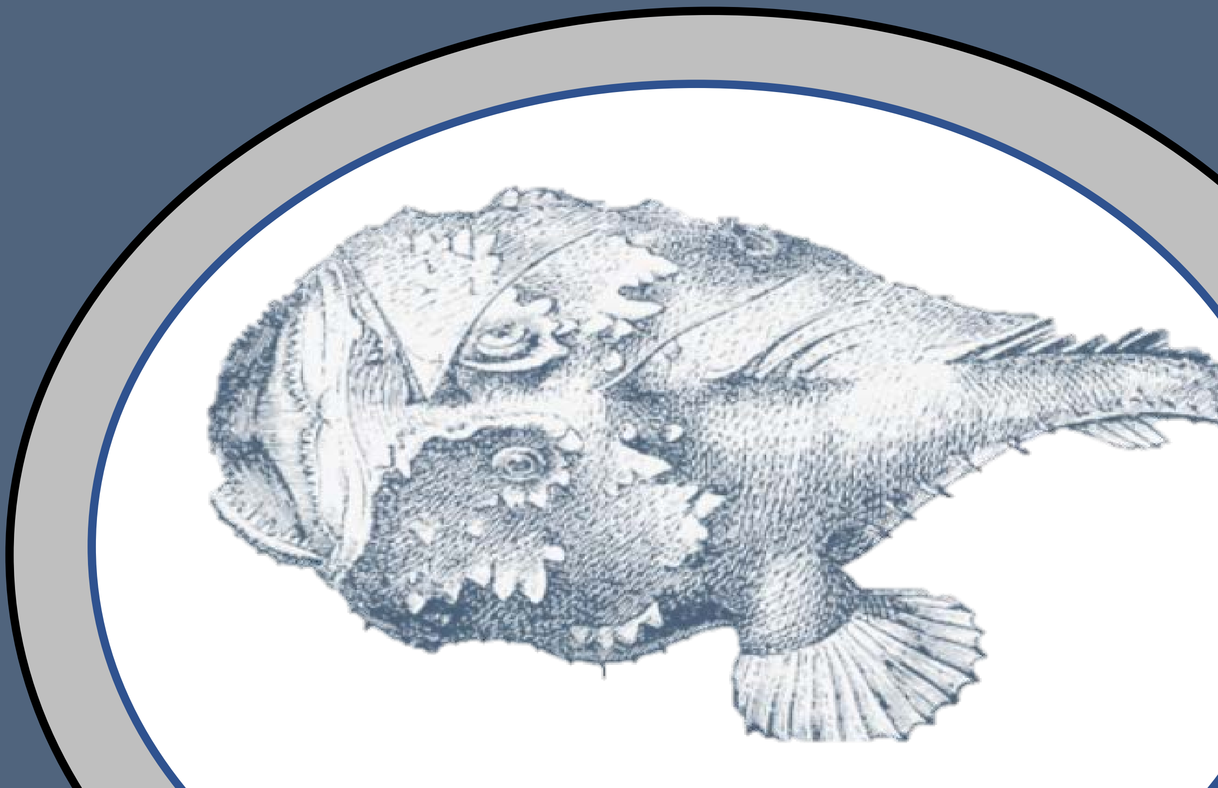
  - Eric Reid
  - Kevin Wark



Alternative Approach Proposal

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- Maintain 3-year monkfish specification process
  - Seems to perform well in recent years; stability in resource and fishery
- Use of long-term (2008-2015; SBRM period) mean/median discard % of catch
  - North = 12.8%
  - South = 26.7%
- Review recruitment indices from survey and catch data for strong recruitment
  - Average recruitment
    - Maintain specifications – update long-term average as part of specification process
  - "Strong" recruitment detected
    - Increase discard estimate that is subtracted from ACT to set TALs for each area
  - Process
    - Define threshold for "strong" recruitment (e.g., above 75th percentile)
    - Define "increased discard level" (e.g., 2015 year class increased discards by 50% in 207-2018)
    - Define timing to update TAL (e.g., 3-year spec package; rule-making between spec years)

Example – Average Recruitment

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Framework 10 (17-19)

NFMA ACL = ABC
7,592 mt

Management Uncertainty (-3%)

ACT = 97% of ACL
7,364 mt

Discards (-13.9%)

TAL = ACT – Discards
6,338 mt

Specs 20-22

NFMA ACL = ABC
8,351 mt

Management Uncertainty (-3%)

ACT = 97% of ACL
8,101 mt

Discards (-18.2%)

TAL = ACT – Discards
6,624 mt

NEW Specs 20-22

NFMA ACL = ABC
8,351 mt

Management Uncertainty (-3%)

ACT = 97% of ACL
8,101 mt

Discards (-12.8%)

TAL = ACT – Discards
7,064 mt

Framework 10 (17-19)

SFMA ACL = ABC
12,316 mt

Management Uncertainty (-3%)

ACT = 97% of ACL
11,947 mt

Discards (-24.6%)

TAL = ACT – Discards
9,011 mt

Specs 20-22

SFMA ACL = ABC
12,316 mt

Management Uncertainty (-3%)

ACT = 97% of ACL
11,947 mt

Discards (-50.8%)

TAL = ACT – Discards
5,882 mt

NEW Specs 20-22

SFMA ACL = ABC
12,316 mt

Management Uncertainty (-3%)

ACT = 97% of ACL
11,947 mt

Discards (-26.7%)

TAL = ACT – Discards
8,757 mt

Example – Strong Recruitment

Framework 10 (17-19)

NFMA ACL = ABC
7,592 mt

↓ Management Uncertainty (-3%)

ACT = 97% of ACL
7,364 mt

↓ **Discards (-12.8%)**

TAL = ACT – Discards
6,421 mt

Specs Adjustment 18-19

NFMA ACL = ABC
7,592 mt

↓ Management Uncertainty (-3%)

ACT = 97% of ACL
7,364 mt

↓ **Discards (-26.6%)**

TAL = ACT – Discards
5,405 mt

Specs 20-22

NFMA ACL = ABC
8,351 mt

↓ Management Uncertainty (-3%)

ACT = 97% of ACL
8,101 mt

↓ **Discards (-12.8%)**

TAL = ACT – Discards
7,064 mt

Framework 10 (17-19)

SFMA ACL = ABC
12,316 mt

↓ Management Uncertainty (-3%)

ACT = 97% of ACL
11,947 mt

↓ **Discards (-26.7%)**

TAL = ACT – Discards
8,757 mt

Specs Adjustment 18-19

SFMA ACL = ABC
12,316 mt

↓ Management Uncertainty (-3%)

ACT = 97% of ACL
11,947 mt

↓ **Discards (-53.6%)**

TAL = ACT – Discards
5,543 mt

Specs 20-22

SFMA ACL = ABC
12,316 mt

↓ Management Uncertainty (-3%)

ACT = 97% of ACL
11,947 mt

↓ **Discards (-26.7%)**

TAL = ACT – Discards
8,757 mt

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Catch History

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Fishing Year	NORTH							SOUTH						
	ABC	ACT	TAL	Landings (mt)	% ABC Caught	% ACT Caught	% TAL Caught	ABC	ACT	TAL	Landings (mt)	% ABC Caught	% ACT Caught	% TAL Caught
2007			5,000	5,050			101%			5,100	7,180			141%
2008			5,000	3,528			71%			5,100	6,751			132%
2009			5,000	3,344			67%			5,100	4,800			94%
2010			5,000	2,834			57%			5,100	4,484			88%
2011	7,592	6,567	5,854	3,699	49%	56%	63%	12,316	11,513	8,925	5,801	47%	50%	65%
2012	7,592	6,567	5,854	3,920	52%	60%	67%	12,316	11,513	8,925	5,184	42%	45%	58%
2013	7,592	6,567	5,854	3,596	47%	55%	61%	12,316	11,513	8,925	5,088	41%	44%	57%
2014	7,592	6,567	5,854	3,403	45%	52%	58%	12,316	11,513	8,925	5,415	44%	47%	61%
2015	7,592	6,567	5,854	4,080	54%	62%	70%	12,316	11,513	8,925	4,733	38%	41%	53%
2016	7,592	6,567	5,854	5,447	72%	83%	93%	12,316	11,513	8,925	4,345	35%	38%	49%
2017	7,592	7,364	6,338	6,807	90%	92%	107%	12,316	11,947	9,011	3,802	31%	32%	42%
2018	7,592	7,364	6,338	6,168	81%	84%	97%	12,316	11,947	9,011	4,600	37%	39%	51%

Catch History

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	NORTH						SOUTH					
Fishing Year	TAL	Limit Cat. A,C	Limit Cat. B,D	DAS	Landings (mt)	% TAL Caught	TAL	Limit Cat. A,C,G	Limit Cat. B,D,H	DAS	Landings (mt)	% TAL Caught
2007	5,000	1,250	470	31	5,050	101%	5,100	550	450	23	7,180	141%
2008	5,000	1,250	470	31	3,528	71%	5,100	550	450	23	6,751	132%
2009	5,000	1,250	470	31	3,344	67%	5,100	550	450	23	4,800	94%
2010	5,000	1,250	470	31	2,834	57%	5,100	550	450	23	4,484	88%
2011	5,854	1,250	600	40	3,699	63%	8,925	550	450	28	5,801	65%
2012	5,854	1,250	600	40	3,920	67%	8,925	550	450	28	5,184	58%
2013	5,854	1,250	600	40	3,596	61%	8,925	550	450	28	5,088	57%
2014	5,854	1,250	600	45	3,403	58%	8,925	610	500	32	5,415	61%
2015	5,854	1,250	600	45	4,080	70%	8,925	610	500	32	4,733	53%
2016	5,854	1,250	600	45	5,447	93%	8,925	700	575	37	4,345	49%
2017	6,338	1,250	600	45	6,807	107%	9,011	700	575	37	3,802	42%
2018	6,338	1,250	600	45	6,168	97%	9,011	700	575	37	4,600	51%