



**NOAA
FISHERIES**

Northeast Fisheries
Science Center



Golden Tilefish Research Track Assessment

Kristan Blackhart

Chief, Population Dynamics Branch

Mid-Atlantic Fishery Management Council

4/10/2024



RT Goals and Objectives

Objective: Develop the assessment and projection methodology to support continued, incremental improvement in future Management Track assessments

Terms of Reference (ToRs)

1. Identify relevant ecosystem and climate influences on the stock
2. Estimate catch from all sources including landings and discards
3. Present the survey data used in the assessment
4. Estimate annual fishing mortality, recruitment and stock biomass
5. Update or redefine Status Determination Criteria
6. Define appropriate methods for producing projections
7. Report on the status of research recommendations
8. Develop a backup assessment approach

Intro

TOR 1

TOR 2

TOR 3

TOR 4

TOR 5

TOR 6

TOR 7

TOR 8


Conclusions



NOAA
FISHERIES

RT Contributors



Working Group	Invited Contributors	Review Panel	Additional Contributors
Jose Montañez, MAFMC, Chair	Dan Hennen, NEFSC	Mike Wilberg, MAFMC SSC, Chair	Chuck Adams, NEFSC
Paul Nitschke, NEFSC, Lead	Kim Hyde, NEFSC	Matt Cieri, CIE	Fred Akers, MAFMC Tilefish Advisory Panel
Jason Boucher, NEFSC	Andy Jones, NEFSC	Joe Powers, CIE	Russ Brown, NEFSC
Nikolai Klibansky, SEFSC	Anthony Kaufman, NOAA	Sam Subbey, CIE	Alex Dunn, NEFSC
Sean Lucey, NEFSC	Adelle Molina, NEFSC		Skip Feller, Industry/MAFMC
John Maniscalco, NYSDEC	Stephanie Owen, NEFSC		Frank Green, Industry
	Sara Salois, NEFSC		Scott Large, NEFSC
			Chris Legault, NEFSC
			Laurie Nolan, Industry
			Michele Traver, NEFSC
			Mark Terceiro, NEFSC (ret.)
			Tony Wood, NEFSC

Intro

TOR 1

TOR 2

TOR 3

TOR 4

TOR 5

TOR 6

TOR 7

TOR 8

Conclusions





RT Schedule & Approach

- October 2022 – February 2024
- 10 working group meetings
- Stakeholder input invited at most meetings
 - Industry contributed to socioeconomic input for ToR1 and discussions related to the CPUE index, recreational angler effort, and the study fleet
- Consensus decision making
- 14 working papers developed

- Intro
- TOR 1
- TOR 2
- TOR 3
- TOR 4
- TOR 5
- TOR 6
- TOR 7
- TOR 8
- Conclusions



Meet the Golden Tilefish



- Long-lived, non-migratory demersal species
- Sexual dimorphic growth (males > females)
- Inhabit submarine canyons near the shelf break, depths of 80-440m
- Like to dig burrows, which makes them difficult to survey
- Narrow temperature preference (9-14°C) makes ageing challenging
- Recruit to the fishery ~age 4, mature ~age 5

Intro

TOR 1

TOR 2

TOR 3

TOR 4

TOR 5

TOR 6

TOR 7

TOR 8

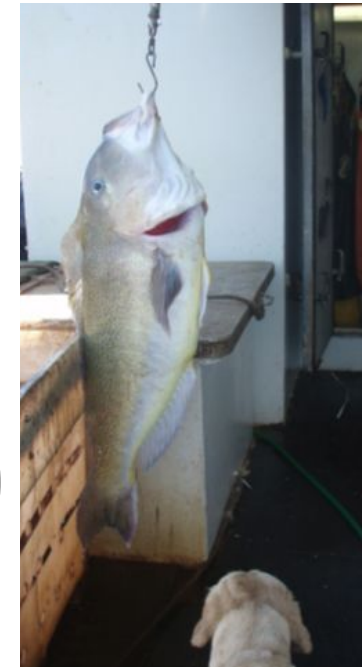
Conclusions



NOAA
FISHERIES

Previous Assessment

- Last assessed in 2021 via Management Track
- ASAP model, terminal year 2020
 - Commercial landings and size/age data
 - Commercial CPUE index of abundance
- Reference points
 - $F_{40\%} = 0.261$ (proxy for F_{MSY})
 - $SSB_{40\%} = 10,995$ mt (proxy for SSB_{MSY}/SSB_{target})
- Stock status
 - Not overfished, F/F_{MSY} proxy = $0.160/0.261$
 - Overfishing not occurring, SSB/SSB_{MSY} proxy = $10,562/10,995$ mt



Intro

TOR 1

TOR 2

TOR 3

TOR 4

TOR 5

TOR 6

TOR 7

TOR 8

Conclusions



NOAA
FISHERIES

Top RT Achievements

- Transitioned assessment from ASAP to WHAM
- Investigations into the use of WHAM for data-limited applications
- Work with industry and other partners to investigate new indices for the assessment
 - Developed new recreational catch time series, discard time series for directed and non-directed fisheries
 - Researched available resources of abundance information
- Produced an ESP for tilefish to evaluate ecosystem indicators and provide a framework for further investigations



Intro

TOR 1

TOR 2

TOR 3

TOR 4

TOR 5

TOR 6

TOR 7

TOR 8

Conclusions



NOAA
FISHERIES

ToR1: Ecosystem and Climate



- Work aimed to develop a suite of environmental indicators to better understand geographical distribution and potential drivers of recruitment
- Developed an Ecosystem and Socioeconomic Profile (ESP) for Golden Tilefish
- Utilized linear regressions and generalized additive models (GAMs) to determine the effects of ecosystem indicators on catch and recruitment

Intro

TOR 1

TOR 2

TOR 3

TOR 4

TOR 5

TOR 6

TOR 7

TOR 8

Conclusions



**NOAA
FISHERIES**

Conceptual Model



Intro

TOR 1

TOR 2

TOR 3

TOR 4

TOR 5

TOR 6

TOR 7

TOR 8

Conclusions



**NOAA
FISHERIES**

Eggs

8-19 °C, 200 m, 34-36 ppt
Non-adhesive, buoyant
Hatch after ~ 40 hrs

Spawning

Peaks in summer, 10.16-14.9C
Fractional spawners
~ 5-7 years of age
Spawn: Mar-Nov (peak in June)

Good for Golden Tilefish
Bad for Golden Tilefish

Larvae

13-18 °C, 50-150 m, 33-35 ppt
Size range ~2.6 - 9.0 mm
Pelagic
Timing/age of settlement unknown



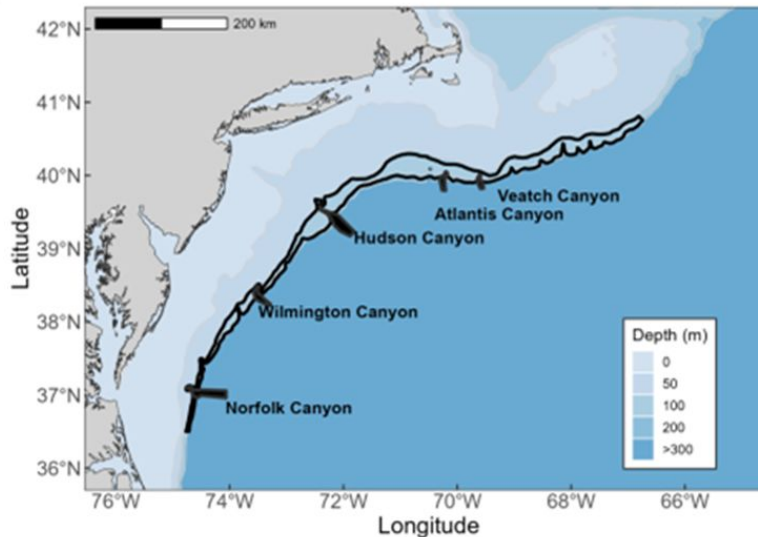
Adults

9-14 °C, 100-200 m (warmer water), 34.2-35.3 psu
<9 °C (colder water)
Depth range 80-305 m
Grow 10 cm/yr
Mature 2-5 years of age
Non-migratory
Secondary consumer
May use seasonal habitats
Demersal/benthic
medium sand (0.25–0.5 mm grain size)



Juveniles/Recruits

9-11 °C, <170 m, 33-36 ppt
Can be found in 8 °C
Growth rate ~ 10 cm FL yr-1 for first 4 years
Size range 15-82 mm
6-7 yr class pulse



Golden Tilefish ESP Overview



	CPUE No Lag (Year 4)	CPUE 3y Lag (Year 1)	Rec. Estimate (Year 1)	Rec. 1y Lag (Year 0)
SST	↓	↓	-	-
BT	-	-	-	-
Salinity	-	-	-	↓
SW Volume	-	↓	↓	↑ spring
SW Temp.	↓	↑	-	-
SW Salinity	-	↑	-	-
GSI	↓	↑ winter ↓ summer	-	-
CP Extent	-	↓	↓	↓
CP Persistence	-	↓	↓	↓
CP Index	-	-	↑	-
Microplankton	↑	↑ fall	-	↑ fall
CHL-a	↑		-	-

↓	No trend, but matches literature
↓	Not tested
-	No trend
↑	Positive significant trend
↓	Negative significant trend
↑ ↓	Non-significant trend (+ or -)

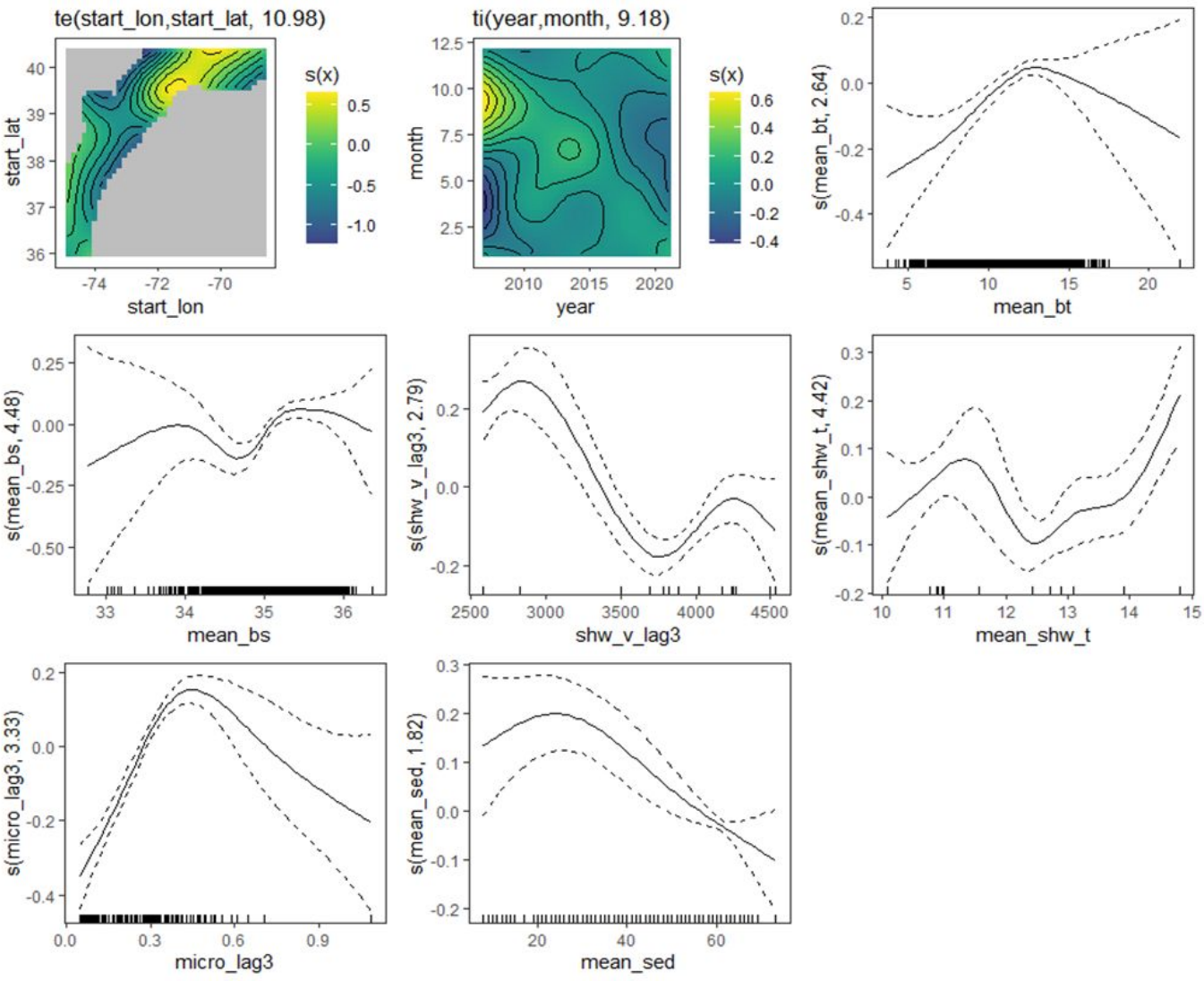
- Intro
- TOR 1**
- TOR 2
- TOR 3
- TOR 4
- TOR 5
- TOR 6
- TOR 7
- TOR 8
- Conclusions



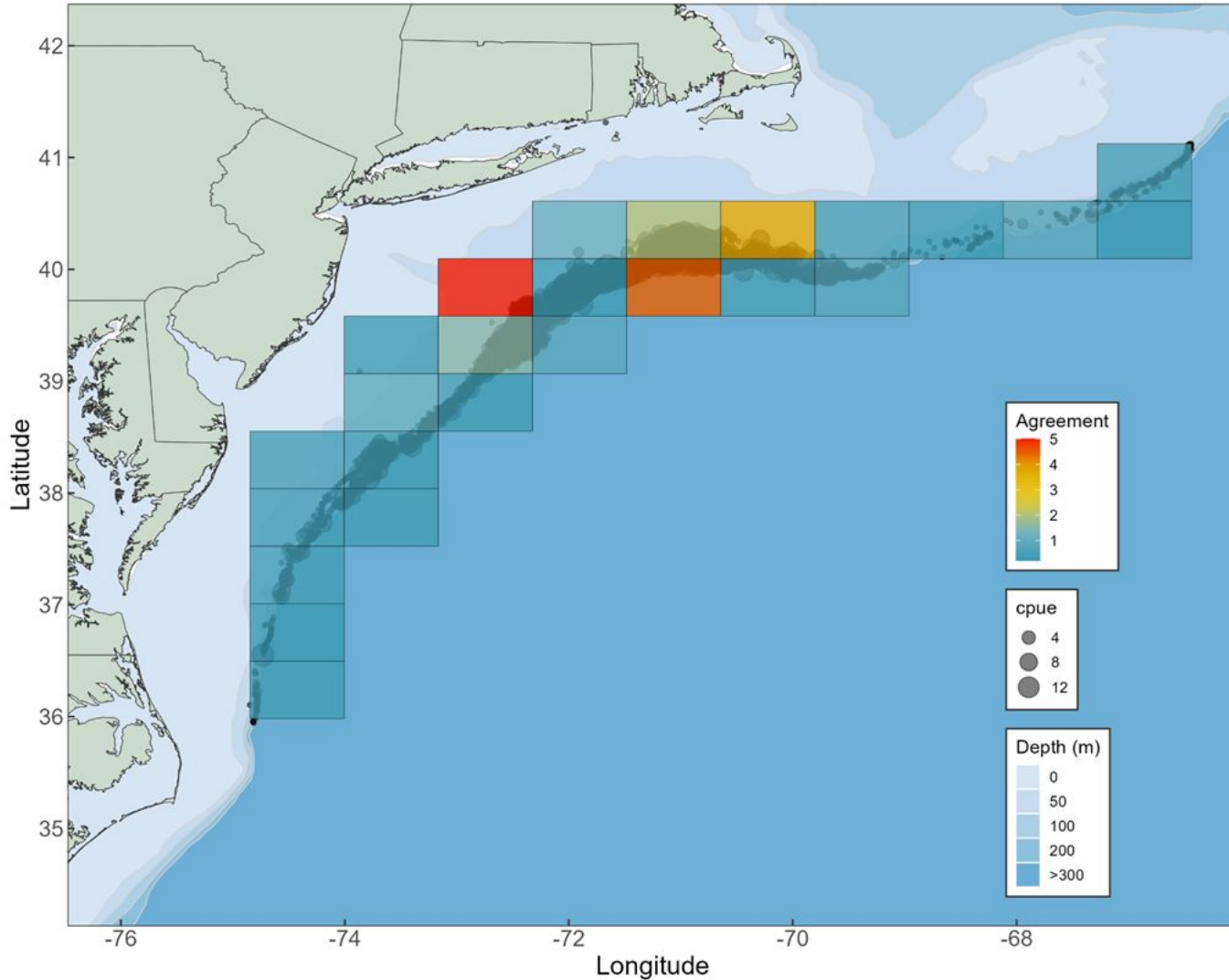
Generalized Additive Model (GAM)



- Intro
- TOR 1**
- TOR 2
- TOR 3
- TOR 4
- TOR 5
- TOR 6
- TOR 7
- TOR 8
- Conclusions



GAM Predictive Ability



- Deviance explained = 28%
- RMSE = 2.85
- Predictions moderately followed the model data

- Intro
- TOR 1**
- TOR 2
- TOR 3
- TOR 4
- TOR 5
- TOR 6
- TOR 7
- TOR 8
- Conclusions



ToR2: Catch

- Most commercial landings are taken by the directed longline fishery
- Managed under IFQ; top 4 permits hold 80%
- TAL since 2021 have been 800 mt based on the last MT assessment
- WG developed a new recreational catch time series
 - Recreational landings estimated to be ~3% of total removals



Intro

TOR 1

TOR 2

TOR 3

TOR 4

TOR 5

TOR 6

TOR 7

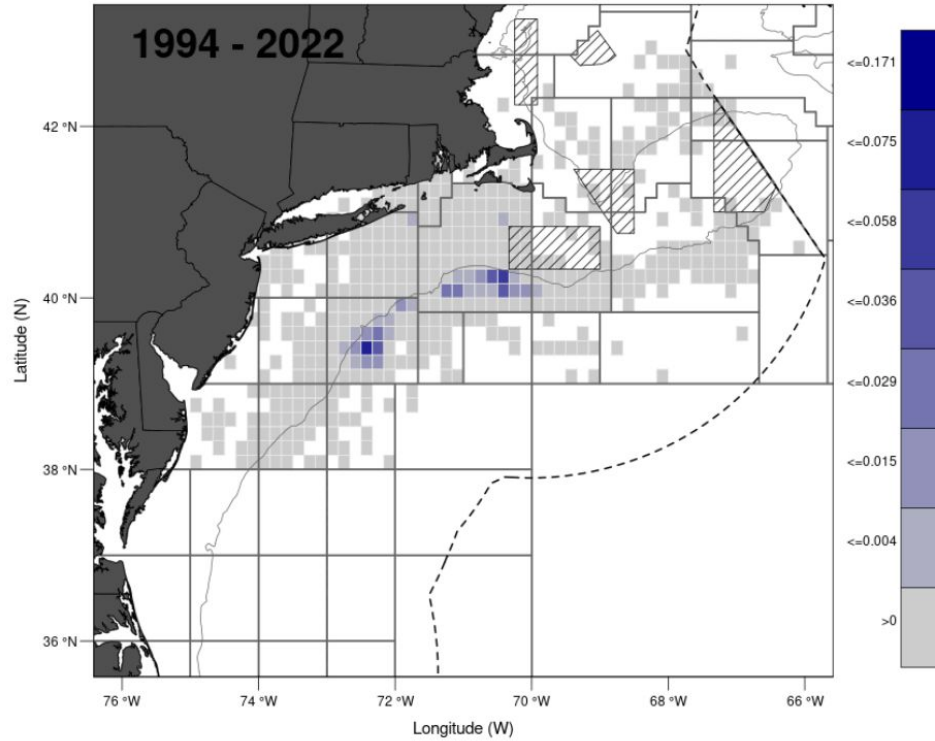
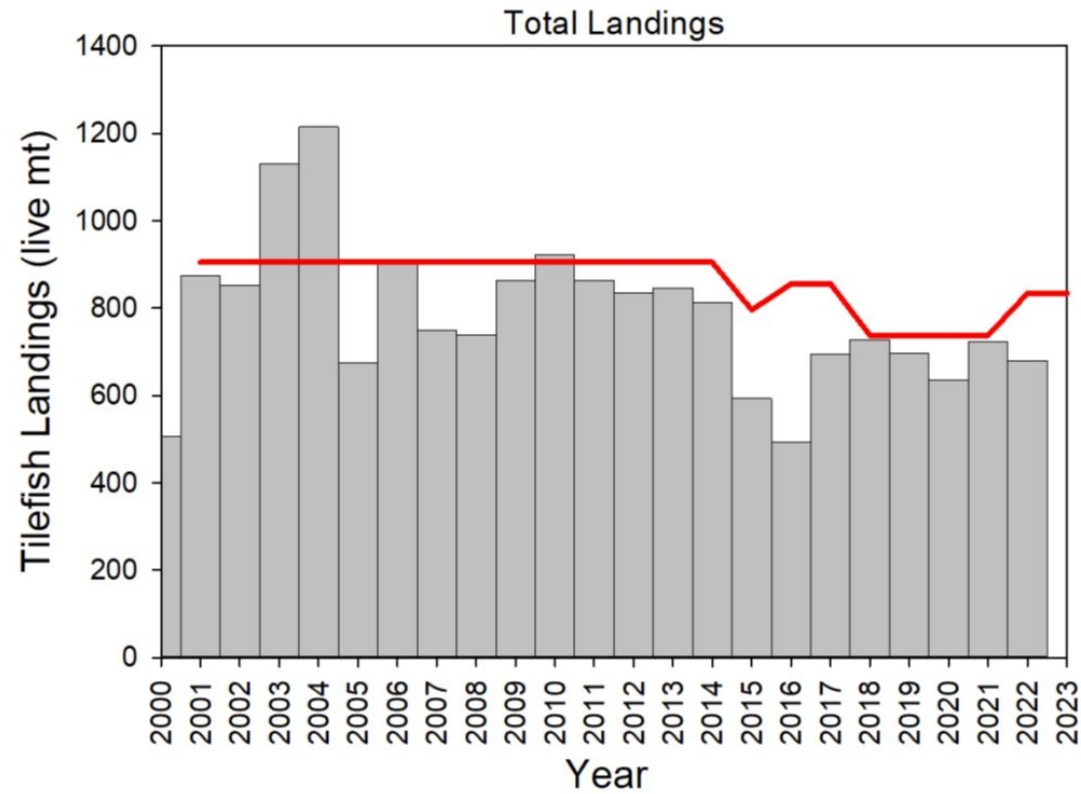
TOR 8

Conclusions



**NOAA
FISHERIES**

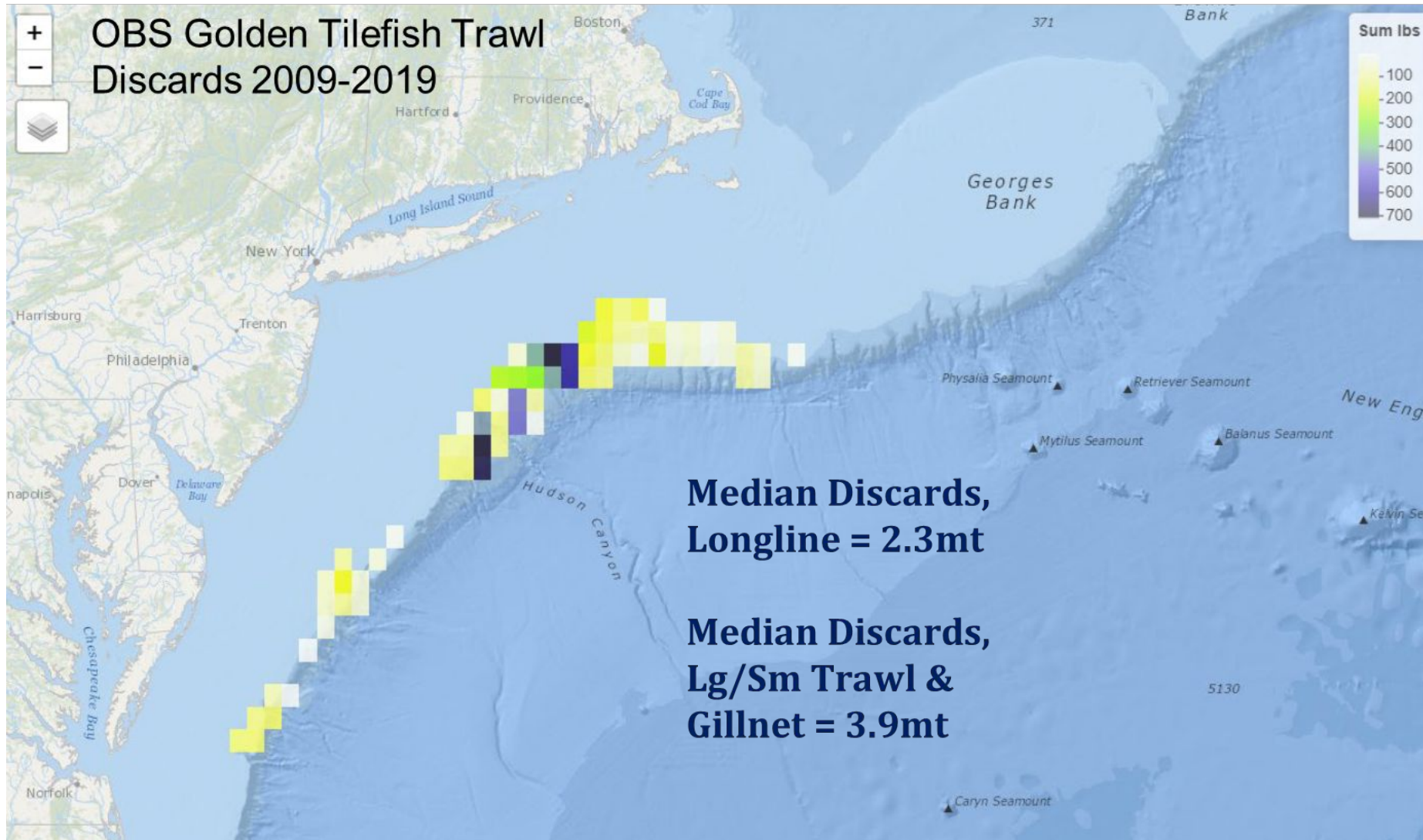
Commercial Landings



- Intro
- TOR 1
- TOR 2**
- TOR 3
- TOR 4
- TOR 5
- TOR 6
- TOR 7
- TOR 8
- Conclusions



Commercial Discards



- Intro
- TOR 1
- TOR 2**
- TOR 3
- TOR 4
- TOR 5
- TOR 6
- TOR 7
- TOR 8
- Conclusions



Recreational Catch

- Appears to be a minor component of total removals
- Rec time series is not available for prior assessments
- RTWG developed a best estimate of recreational catches based on:
 - VTR party and charter data
 - LPS private data
 - Turner (1986) estimates



Intro

TOR 1

TOR 2

TOR 3

TOR 4

TOR 5

TOR 6

TOR 7

TOR 8

Conclusions



NOAA
FISHERIES

ToR3: Survey Data

- Tilefish are poorly sampled by regional surveys
- Fishery-independent index of abundance is not available
- Additional data sources are vital to better understand trends in abundance
- WG analyzed longline effort data, trawl study fleet and observer data, and longline survey data



Intro

TOR 1

TOR 2

TOR 3

TOR 4

TOR 5

TOR 6

TOR 7

TOR 8

Conclusions



NOAA
FISHERIES



Commercial LPUE

- NEFSC weighout and VTR LPUE series standardized using a GLM with year and vessel effects
 - Re-examined month and crew size effects but did not find large influence
- WG developed method to transition VTR LPUE index to CAMS-based LPUE index
 - VTR to CAMS transition recommended in 2010

- Intro
- TOR 1
- TOR 2
- TOR 3**
- TOR 4
- TOR 5
- TOR 6
- TOR 7
- TOR 8
- Conclusions



Longline Study Fleet



What is the best effort metric to utilize VTR data for an index of abundance → **IFQ Study Fleet**

Conclusions

- Support using DA-1 effort metric
- DF could be used as an alternate effort metric based on number of hooks or miles

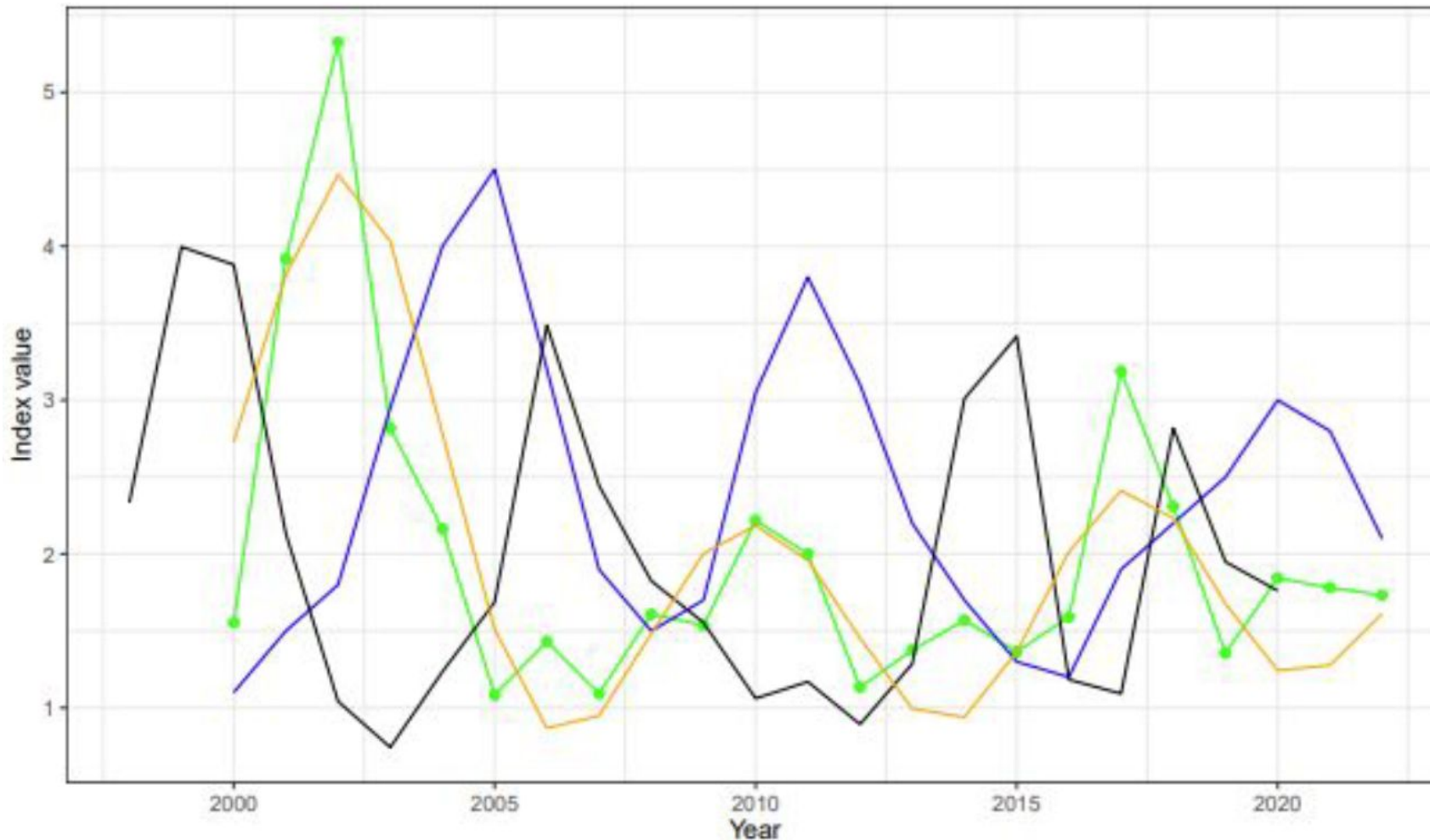


- Intro
- TOR 1
- TOR 2
- TOR 3**
- TOR 4
- TOR 5
- TOR 6
- TOR 7
- TOR 8
- Conclusions



NOAA
FISHERIES

Trawl Gear CPUE



Data source
— age1 rec
— GAM CPUE
— Longline CPUE
— Trawl CPUE

- Intro
- TOR 1
- TOR 2
- TOR 3**
- TOR 4
- TOR 5
- TOR 6
- TOR 7
- TOR 8
- Conclusions



Tilefish Longline Survey

GOALS:

1. Standardize effort
2. Year class strength
3. Inform domed selectivity

→ Pilot survey in 2017

→ 2020 survey, with design modifications



Intro

TOR 1

TOR 2

TOR 3

TOR 4

TOR 5

TOR 6

TOR 7

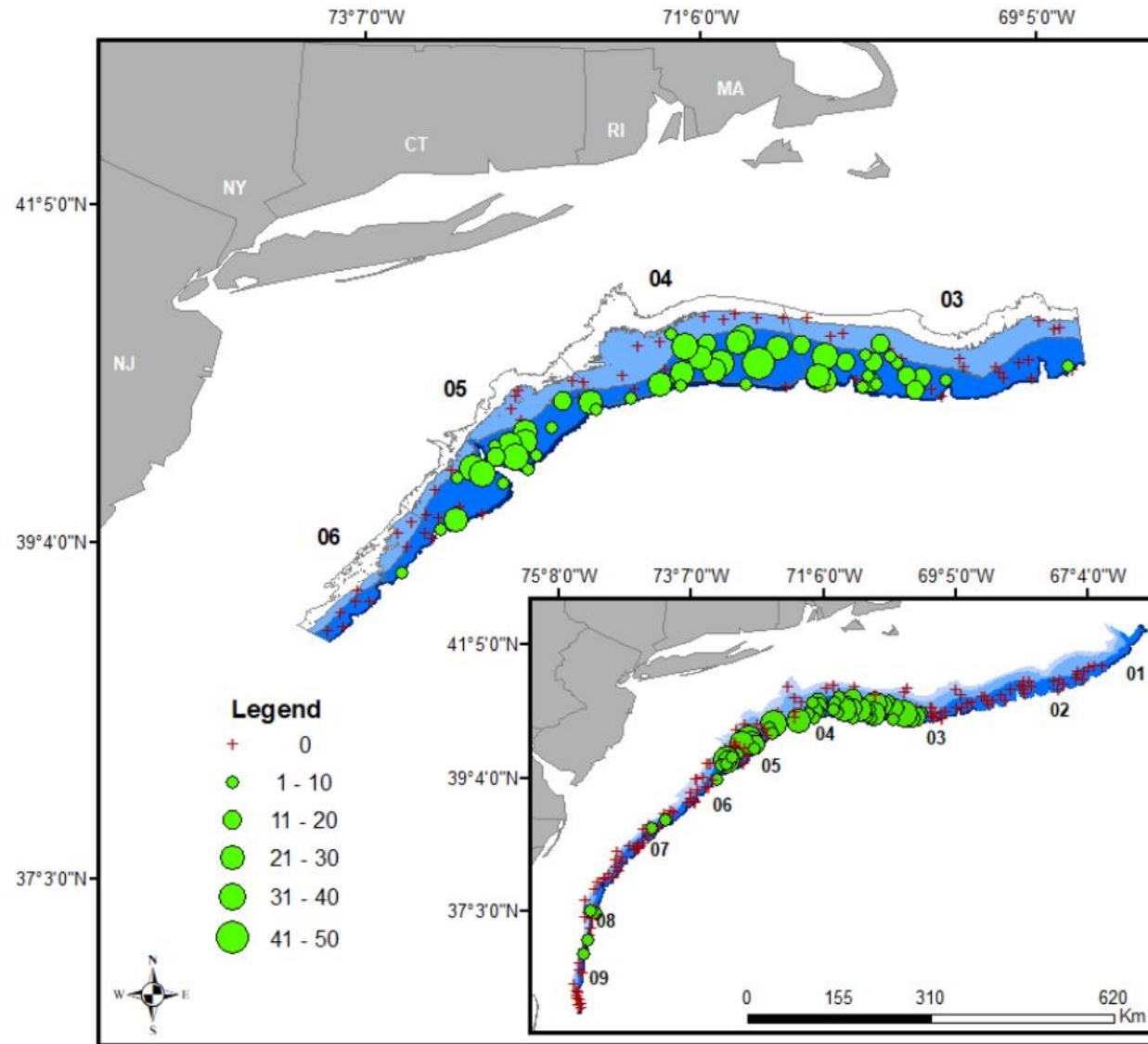
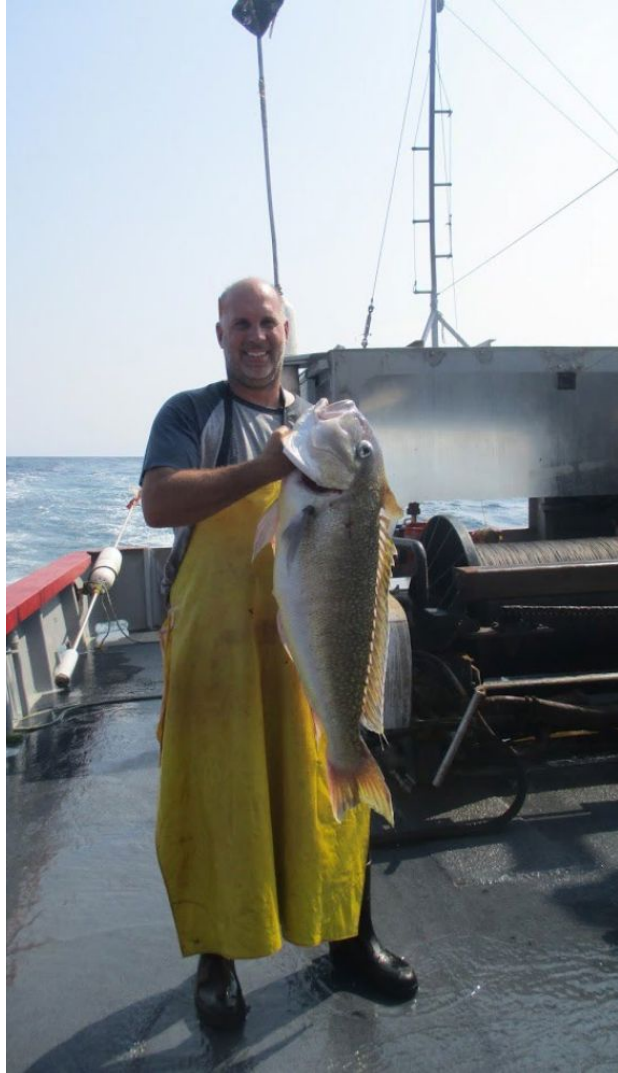
TOR 8

Conclusions



NOAA
FISHERIES

Tilefish Survey Results



- Intro
- TOR 1
- TOR 2
- TOR 3**
- TOR 4
- TOR 5
- TOR 6
- TOR 7
- TOR 8
- Conclusions



ToR4: Assessment Approach

- A primary goal was to advance from ASAP to WHAM assessment platform
- Bridge run gave similar results to ASAP model from 2021 MT
- RTWG struggled with modeling tradeoffs from the influences of random effects
- Recommended base configuration is ASAP-like model in WHAM, allows for continued model development in MT



Intro

TOR 1

TOR 2

TOR 3

TOR 4

TOR 5

TOR 6

TOR 7

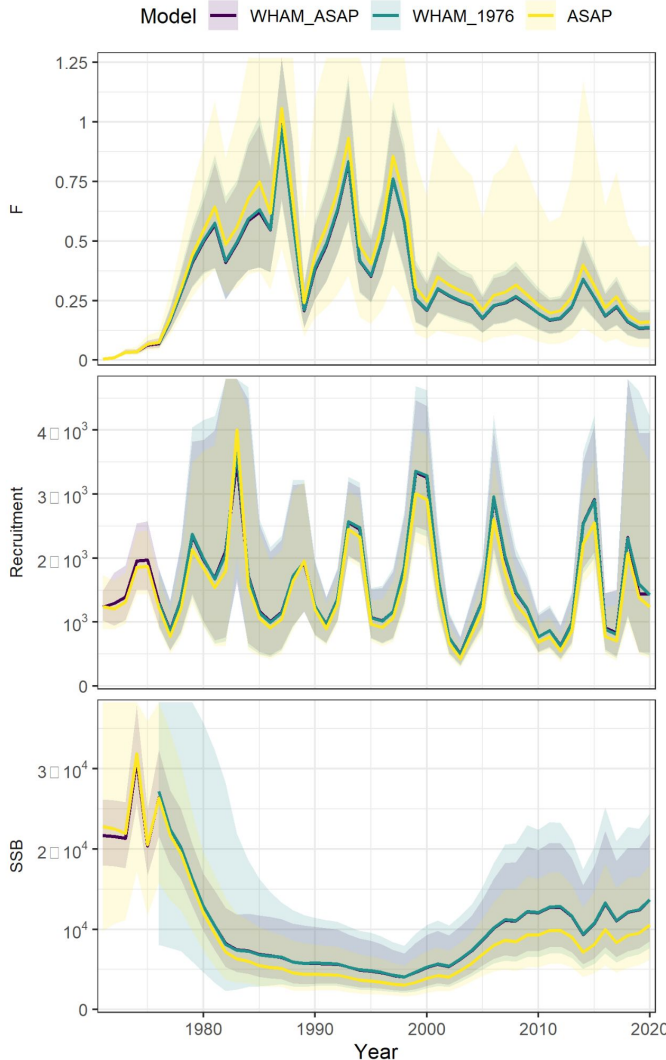
TOR 8

Conclusions



NOAA
FISHERIES

Model Challenges



- Use of WHAM for data-limited stocks largely untested
 - Model results were sensitive to the inclusion of random effects
- NRCC AWG recommended RTWG move forward using the 2021 MT data to focus on model development
 - Work under ToRs 1-3 was reviewed on its own merit

Intro

TOR 1

TOR 2

TOR 3

TOR 4

TOR 5

TOR 6

TOR 7

TOR 8

Conclusions

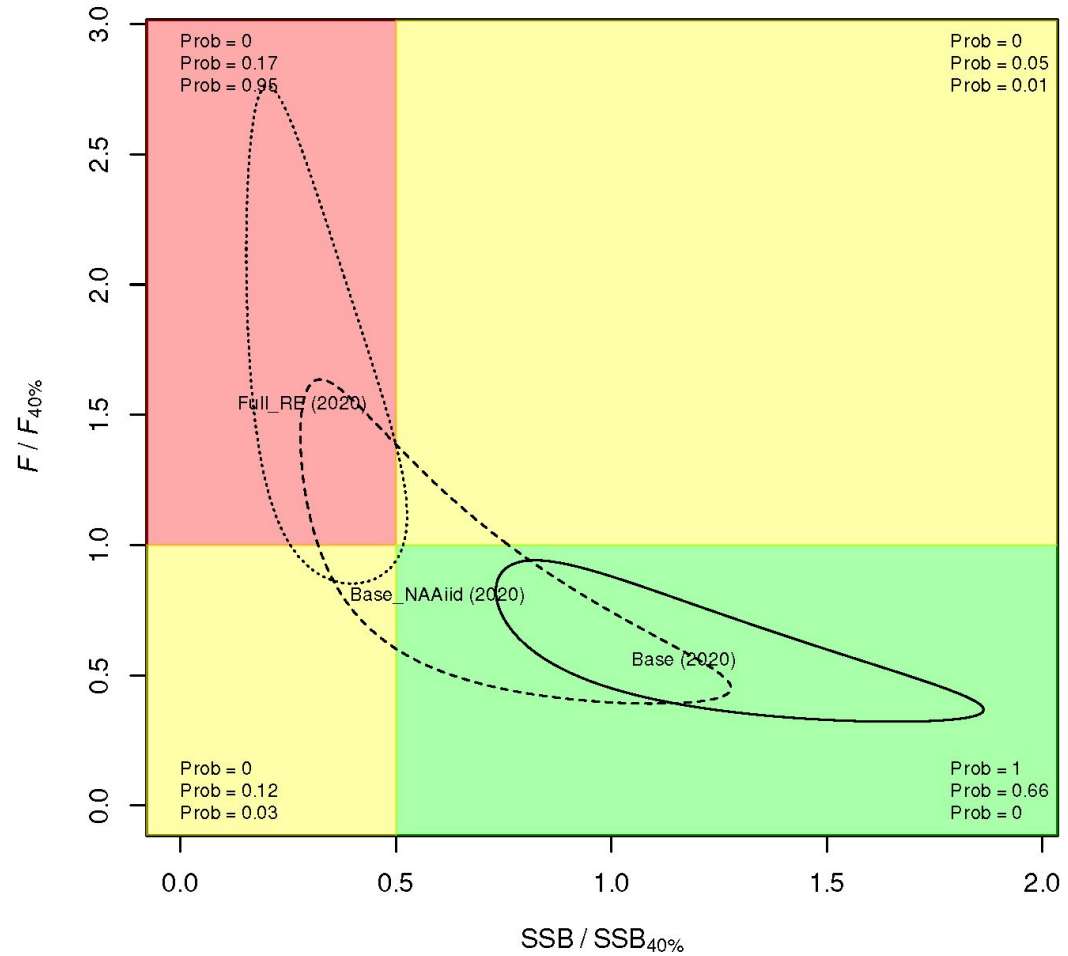
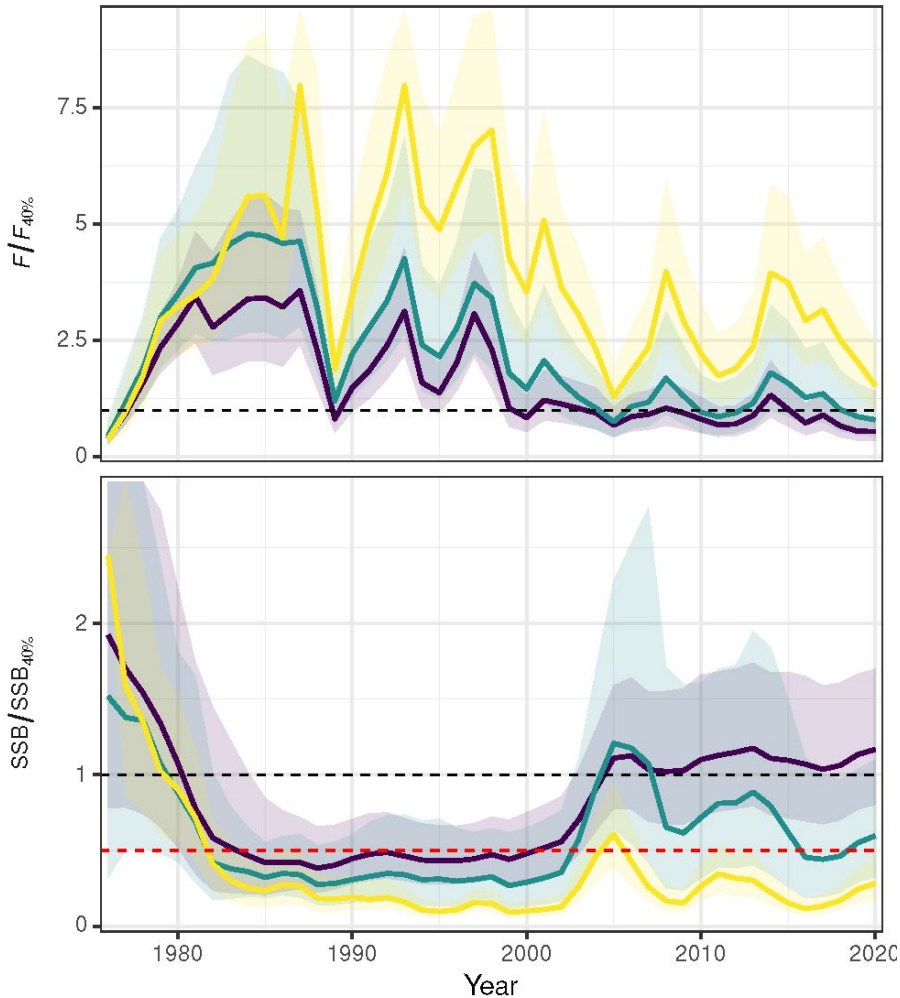


NOAA
FISHERIES

Modeling Results



Model ■ Base ■ Base_NAAiid ■ Full_RE



- Intro
- TOR 1
- TOR 2
- TOR 3
- TOR 4**
- TOR 5
- TOR 6
- TOR 7
- TOR 8
- Conclusions



ToR5: Status Determination Criteria



Model	$F_{40\%}$	$SSB_{40\%}$	MSY at $SSB_{40\%}$	Mean Recruitment	F_{2020}	SSB_{2020}	$F/F_{40\%}$ %	$SSB/SSB_{40\%}$
Base	0.265	9,314	855	1,139	0.146	11,980	0.55	1.29
Base_NAAiid	0.238	8,014	791	1,148	0.190	5,246	0.80	0.65
Full_RE	0.138	8,195	1,075	1,181	0.223	2,567	1.61	0.31

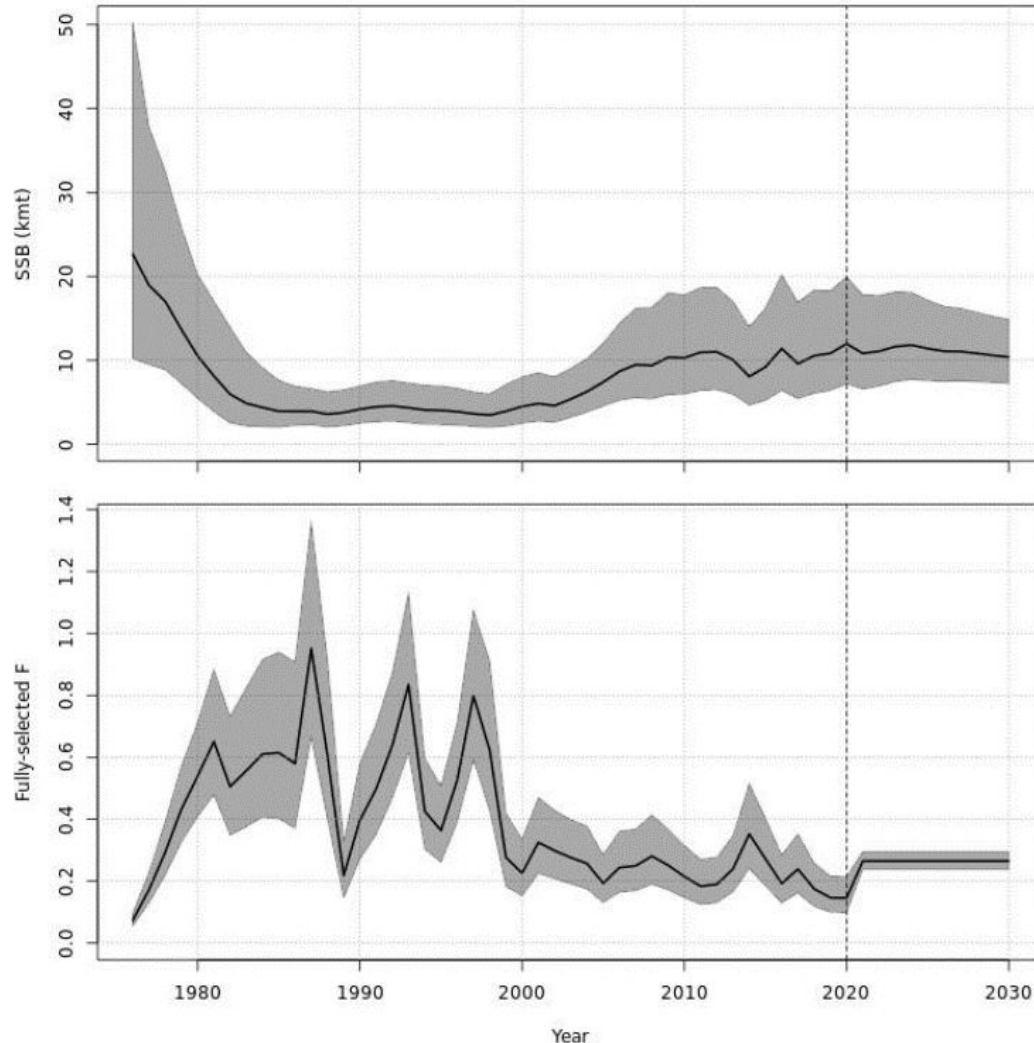
- Intro
- TOR 1
- TOR 2
- TOR 3
- TOR 4
- TOR 5**
- TOR 6
- TOR 7
- TOR 8
- Conclusions

- Previous reference points based on $SPR_{40\%}$
- 10-year average 2011-2020
- Recruitment based on the entire time series minus the last two years



NOAA
FISHERIES

ToR6: Projections



- Projections are integrated within WHAM model
- $F_{40\%}$ 10-year projections provided for informative purposes
- Terminal year is 2020
 - Next MT (June 2020) will add 3 years of data

Intro

TOR 1

TOR 2

TOR 3

TOR 4

TOR 5

TOR 6

TOR 7

TOR 8

Conclusions



NOAA
FISHERIES

ToR7: Research Recommendations



- RT addressed many of the current and historical research recommendations for Golden Tilefish
- RTWG provided new research recommendations for the stock:
 1. Collection of length samples on party/charter trips
 2. Evaluate WHAM performance for data-limited stocks using simulation testing
 3. Additional ecosystem recommendations (WP1)

Intro

TOR 1

TOR 2

TOR 3

TOR 4

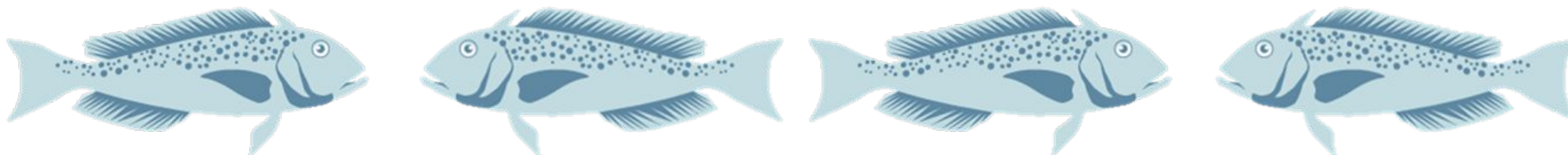
TOR 5

TOR 6

TOR 7

TOR 8

Conclusions



NOAA
FISHERIES

ToR7: Panel Research Recommendations



Necessary for Management Track

- Incorporation of more recent (to 2023) data
- Focus on an assessment model that produces stable results with acceptable diagnostics with good rates of convergence
- Additional sensitivity analyses
- Include data on all removals



Intro

TOR 1

TOR 2

TOR 3

TOR 4

TOR 5

TOR 6

TOR 7

TOR 8

Conclusions



NOAA
FISHERIES

ToR7: Panel Research Recommendations



Short Term

- Use tilefish longline survey results to estimate length-based selectivity of different hook sizes



Intro

TOR 1

TOR 2

TOR 3

TOR 4

TOR 5

TOR 6

TOR 7

TOR 8

Conclusions



NOAA
FISHERIES

ToR7: Panel Research Recommendations



Medium Term

- Use inverse age-length key (Ailloud and Hoenig, 2019) to estimate the age composition of the catch for years with inadequate ageing to avoid assumptions about relative yearclass strength from pooled age-length keys
- Collect additional sex data on fishery landings and consider the potential consequences of any sex specific differences on age-length keys
- Develop an approach to include the tilefish longline survey as a fishery-independent index in the assessment
- Develop a lifecycle model of golden tilefish to better understand potential environmental drivers on population and fishery dynamics
- Consider characterization and inclusion of ageing error in the assessment
- Examine the assumed value(s) for natural mortality

Intro

TOR 1

TOR 2

TOR 3

TOR 4

TOR 5

TOR 6

TOR 7

TOR 8

Conclusions



NOAA
FISHERIES

ToR7: Panel Research Recommendations



Long Term

- Collect and examine length frequency samples from observers to estimate age-composition of trawl bycatch for potential inclusion in the assessment
- Collect appropriate metrics and perform further analysis for LPUE standardization and estimation
- Increase observer coverage
- Develop and age- and length-structured assessment model that avoids needing to borrow age data for years with only length composition data

Intro

TOR 1

TOR 2

TOR 3

TOR 4

TOR 5

TOR 6

TOR 7

TOR 8

Conclusions



NOAA
FISHERIES

ToR8: Backup Approach

RTWG

Plan B: Use a simpler (i.e. fewer random effects) WHAM configuration

Plan C: Historical fishery performance

Review Panel

Plan B: Revert to ASAP

Plan C: ???



Intro

TOR 1

TOR 2

TOR 3

TOR 4

TOR 5

TOR 6

TOR 7

TOR 8

Conclusions



NOAA
FISHERIES

Next Steps for Tilefish



- April 4: Assessment Oversight Panel
- April-June: Preparing MT assessment
- Week of June 24: Management Track Assessment Review Panel
- 2025 and beyond: Continue to address research recommendations via MT

Intro

TOR 1

TOR 2

TOR 3

TOR 4

TOR 5

TOR 6

TOR 7

TOR 8

Conclusions



**NOAA
FISHERIES**

Questions?



NOAA
FISHERIES