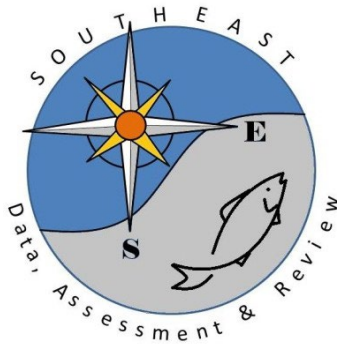




SEDAR

Southeast Data, Assessment, and Review

SEDAR 101

HMS Sandbar Shark

SECTION II: Data Workshop Report

August 2026

Updated September 2026

SEDAR

4055 Faber Place Drive, Suite 201

North Charleston, SC 29405

** Updated to correct error in Section 4 table 5

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1. INTRODUCTION

1.1 WORKSHOP TIME AND PLACE

The SEDAR 101 Data Workshop was held April 21- April 24, 2026, in Charleston, SC. In addition to the in-person workshop, a series for webinars were held before (February to March 2026) and after (May to June 2026) the meeting.

1.2 TERMS OF REFERENCE

1. Review, discuss, and tabulate available life history information.
 - a. Evaluate and update as appropriate the stock definition, age, growth, natural mortality, and reproductive characteristics.
 - b. As needed, provide appropriate models to describe population growth, maturation, and fecundity by age, sex, or length as applicable.
 - c. As appropriate, evaluate the adequacy of available life history information for conducting stock assessments and recommend life history information for use in population modeling.
 - d. As appropriate, evaluate and discuss the sources of uncertainty and error and data limitations (such as temporal and spatial coverage) for each data source. Provide estimates or ranges of uncertainty for all life history information, where applicable.
 - e. As appropriate, identify key life history uncertainties that should comprise axes of uncertainty.
2. Review and update measures of population relative abundance focusing on identifying or developing one or a few of the most representative time series.
 - a. Consider all available and relevant fishery-dependent and fishery-independent data sources, including those used in previous assessments and any new ones.
 - b. Document all data sources evaluated; address sampling objectives, methods, coverage, sampling intensity, and other relevant characteristics.
 - c. Provide maps of fishery-dependent and fishery-independent survey coverage.
 - d. Develop and standardize fishery and survey catch-per-unit-effort (CPUE) indices by appropriate strata (e.g., age, size, area, and fishery) and include measures of precision and accuracy, using appropriate statistical methods.
 - e. Document pros and cons of available indices regarding their ability to represent abundance.
 - f. Categorize the available indices into Recommended and Not Recommended; provide justifications for the categorization; include whether any indices should be considered in some or all operating models.
 - g. For recommended indices, document any known or suspected spatial or temporal patterns not accounted for by standardization.
 - h. Provide appropriate measures of uncertainty for the abundance indices to be used in stock assessment models and projections.
 - i. As appropriate, identify uncertainties in relative abundance that should be considered within the model.

3. Provide commercial catch statistics for each stock being assessed, including landings, dead discards, live discards, and potential post-release mortality in both weight and number. Consider species identification issues and correct for these instances as appropriate.
 - a. Evaluate and discuss the adequacy of available data for accurately characterizing landings and discards by fishery sector or gear.
 - b. Provide length and age distributions for both landings and discards if feasible.
 - c. Provide maps of fishery effort and harvest by fishery sector or gear.
 - d. Provide estimates of uncertainty around each set of commercial landings (if possible) and discard estimates.
 - e. If major uncertainties exist in historical catch composition, consider provision of multiple hypotheses.
 - f. Provide estimates of discard mortality rate by gear.
 - g. As appropriate, identify uncertainties in catch statistics that should be considered within the model.
4. Provide recreational catch statistics for each stock being assessed, including landings, dead discards, live discards, and potential post-release mortality in both weight and number. Consider species identification issues and correct for these instances as appropriate.
 - a. Evaluate and discuss the adequacy of available data for accurately characterizing landings and discards by fishery sector or gear.
 - b. Provide length and age distributions for both landings and discards if feasible.
 - c. Provide maps of fishery effort and harvest by fishery sector or gear.
 - d. Provide estimates of uncertainty around each set of recreational landings and discard estimates.
 - e. Provide estimates of discard mortality rate by gear.
 - f. As appropriate, identify uncertainties in commercial catch statistics that should be considered within the model.
5. If concluded at the data scoping webinar that there is sufficient data identified and available on ecosystem, climate, species interactions, habitat considerations, and/or episodic events that would be reasonably expected to affect population dynamics, then these should be provided as appropriate.
 - a. As appropriate, provide key levels of historical and projected uncertainty to be considered in the model.
 - b. Identify data that can contribute to how future non-stationarity should be characterized and treated within the model.
6. Categorize key axes of uncertainty into reference (primary) or robustness (secondary) uncertainties. Identify an appropriate set of parameter values to serve as the base-case scenario.
7. Collate recommendations for future research in areas such as biological sampling, fishery monitoring, and stock assessment resulting from the data and assessment processes. Include specific guidance on sampling intensity (number of length samples) and appropriate strata and coverage.

8. Prepare a Data Workshop report providing complete documentation of workshop actions and decisions in accordance with project schedule deadlines.

NOT PEER REVIEWED

1.3 LIST OF PARTICIPANTS

Assessment Team

Dean Courtney, Co-Lead Analyst	HMS
Molly Stevens, Co-Lead Analyst	SEFSC/NMFS
Cassidy Peterson	SEFSC/NMFS
Katie Siegfried	SEFSC/NMFS

Data Process Participants

Annsli Hilton	CIMAS
Bob Zales	Industry Representative
Bryan Frazier	SCDNR
Cliff Hutt	NOAA/HMS
Gaitlyn Malone	SEFSC/NMFS
Heather Baertlein	NOAA/HMS
John Carlson	NOAA/HMS
Max Lee	Mote Marine Lab
Michelle Passerotti	NOAA/HMS
Rob Latour	VIMS
Sascha Cushner	SEFSC/NMFS
Scott Vaeth	Industry Representative
Vivian Matter	SEFSC/NMFS

Data Process Participants via Webinar

Alex Hansell	NOAA
Camilla McCandless	NOAA/HMS
Charles Locke	Industry Representative
Hannah Aycock	UMiami
Toby Curtis	NOAA
Trey Driggers	NOAA
Walter Ingram	NOAA

Workshop Attendees

Christina Vaeth	Industry Representative
Haley Stephens	Industry Representative

Staff

Emily Ott	SEDAR
Julie Neer (via webinar)	SEDAR
Karyl Brewster-Geisz	NOAA/HMS

Workshop Attendees via Webinar

Adam Pollack	NOAA
Aracelis Jimenez	UMiami
Carole Neidig	Mote Marine Lab
Christopher Bradshaw	FWC

Daniel Daye NOAA
 Djohra Badache.....
 Guy DuBeck..... NOAA
 Heather Hackney.....
 Jeanette Huber..... FWC
 Joe Curtis Industry Representative
 Judd Curtis SAFMC
 Katie Harrington Mote Marine Lab
 Kelly Klasnick SAFMC
 Lew Childre Industry Representative
 Lillie Callaway.....
 Manuel Cofill-Rivera.....
 Marcus Drymon MS State
 Meaghan Emory..... NOAA
 Peter Barile.....
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 Richard McBride..... NOAA
 Ryan McMullen SAFMC
 Sabine Zemik.....
 Sean Meehan NOAA
 Spencer Roberts UMiami
 Suzanna Thomas SAFMC

1.4 LIST OF DATA WORKSHOP WORKING PAPERS & REFERENCE DOCUMENTS

Document #	Title	Authors	Date Submitted
Documents Prepared for the Data Workshop			
SEDAR101-DW-01	Highly Migratory Species Sandbar Sharks Management History	Becky Curtis, Karyl Brewster-Geisz and Ann Williamson	17 March 2025
SEDAR101-DW-02	Electronic Monitoring Documentation of Sandbar Sharks (<i>Carcharhinus plumbeus</i>) and Depredation in the Eastern Gulf of America Commercial Reef Fish Fishery	Katie Harrington, Max Lee, Carole Neidig, and Ryan Schloesser, Ph.D.	3 April 2026
SEDAR101-DW-03	Estimates of Sandbar Shark for the U.S. Atlantic pelagic longline fleet for the period 1992-2024	Guillermo A. Diaz	3 April 2026
SEDAR101-DW-04	Potential use of Large Pelagic Intercept Survey data (LPIS) to estimate catch-per-unit-effort for	Guillermo A. Diaz	3 April 2026

	Sandbar Sharks		
SEDAR101-DW-05	Large Pelagics Survey Catch Data for Sandbar Shark in the Northeast	Clifford P Hutt	14 April 2026
SEDAR101-DW-06	Regional and temporal trends in sandbar depredation risk on the West Florida Shelf	Hannah Aycock and Elizabeth Babcock	13 April 2026
SEDAR101-DW-07	Updated growth parameters for sandbar shark <i>Carcharhinus plumbeus</i> based on mark recapture data from the Western North Atlantic	Michelle S. Passerotti ¹ , Camilla T. McCandless ¹ , John K. Carlson ² , Annsli Hilton ³ , Lisa J. Natanson ^{4*}	14 April 2026 Updated 23 April 2026
SEDAR101-DW-08	Standardized abundance indices of sandbar shark from the Pelagic Longline Observer Program, 1992-2025	John Carlson	13 April 2026
SEDAR101-DW-09	Bycatch estimates of Sandbar Shark in the Shark Research Fishery	John Carlson ¹ and Alyssa Mathers ² ,	13 April 2026
SEDAR101-DW-10	Standardized catch rates of Sandbar Shark (<i>Carcharhinus plumbeus</i>) surveyed during bottom longline surveys in coastal waters of the Northern Gulf of America, 2006-2025	Lindsay Mullins ¹ , Sean Powers ² , and Marcus Drymon ¹	13 April 2026
SEDAR101-DW-11	Long-term trends in sandbar shark (<i>Carcharhinus plumbeus</i>) CPUE from 2003 – 2023 near Sarasota, Florida	Krystan A. Wilkinson ^{1,2} , Demian D. Chapman ^{1*} , John J. Morris ¹ , Valerie	13 April 2026 Updated 16 June 2026
		Hagan ¹ , Camryn Marshall ¹ , Robert E. Hueter ¹	
SEDAR101-DW-12	Standardized catch rates for juvenile sandbar sharks caught during northeast COASTSPAN longline surveys	Camilla T. McCandless and Robert J. Latour	22 April 2026 Updated: Later in the day 22 April 2026

SEDAR101-DW-13	Standardized index of abundance for sandbar sharks from the NOAA Cooperative Atlantic States Shark Popping and Nursery longline survey conducted in South Carolina, Georgia, and northern Florida	Camilla T. McCandless, Bryan S. Frazier, James Gelsleichter, Carolyn B. Belcher	20 April 2026 Updated: 22 April 2026
SEDAR101-DW-14	Standardized catch rates for sandbar sharks from the NMFS Northeast Longline Survey	Camilla T. McCandless and Michelle S. Passerotti	20 April 2026
SEDAR101-DW-15	Standardized catch rates for sandbar sharks from SEAMAP longline surveys conducted by GADNR and SCDNR	Camilla T. McCandless, Bryan Frazier and Donna McDowell	20 April 2026 Updated: 23 April 2026
SEDAR101-DW-16	DEL BAY 16/0 LL	Camilla McCandless	Was not produced
SEDAR101-DW-17	Relative abundance indices for sandbar sharks (<i>Carcharhinus plumbeus</i>) in the northwest Atlantic Ocean from the Shark Bottom Longline and Shark Research Fishery	John Carlson and Alyssa Mathers	14 April 2026 Updated 9 June 2026
SEDAR101-DW-18	General Recreational Survey Data for HMS Sandbar Shark	Gaitlyn Malone	14 April 2026
SEDAR101-DW-19	Northeast Fisheries Observer Program Catch Per Unit Effort Time Series for 1 Sandbar Sharks	Alexander Hansell ¹ , Tobey Curtis ² , Camilla McCandless ³	14 April 2026
SEDAR101-DW-20	Sandbar Shark Discard Estimates from the Northeast Fisheries Observer Program	Alexander Hansell ¹ , Tobey Curtis ² , Camilla McCandless ³	14 April 2026
SEDAR101-DW-21	An Updated Literature Review of Post-Release Live-Discard Mortality Rate Estimates in Sharks for use in SEDAR 101	Dean Courtney ¹ and Annsli Hilton ²	14 April 2026
SEDAR101-DW-22	Sandbar Shark Length Composition Submitted for Use in the SEDAR 101 Data Workshop	Annsli Hilton ¹ and Dean Courtney ²	14 April 2026 Updated 17 June 2026 Updated 22 July 2026 Updated 21 August 2026
SEDAR101-DW-23	Bycatch estimates of sandbar shark in the reefish bottom longline	John Carlson and Alyssa Mathers	14 April 2026

	fishery		
SEDAR101-DW-24	Age and growth of sandbar sharks (<i>Carcharhinus plumbeus</i>) in US waters of the western North Atlantic Ocean, 2015-2025	William B. Driggers III ¹ , Bryan S. Frazier ² , Annsli Hilton ¹ , Walter Ingram ¹ , Lisa Natanson ³ and Michelle Passerotti ³	15 April 2026 Updated 23 April 2026
SEDAR101-DW-25	Indices of Relative Abundance for Sandbar Sharks from the	Adam G. Pollack ¹ , David S. Hanisko ¹ , Kristin Hannan ² , and William B. Driggers III ²	16 April 2026 Updated: 23 April 2026
SEDAR101-DW-26	Spatiotemporal indices of relative abundance for sandbar shark <i>Carcharhinus plumbeus</i> from the NEFSC Coastal Shark Bottom Longline Survey	Robert J. Latour ¹ Michelle S. Passerotti ²	17 April 2026
SEDAR101-DW-27	Updated reproductive parameters for sandbar sharks (<i>Carcharhinus plumbeus</i>) in US waters of the western North Atlantic Ocean	Walter Ingram, Jr. ¹ , William B. Driggers III ¹ , Bryan S. Frazier ² , Annsli Hilton ¹ , Heather Moncrief-Cox ¹ , Lisa J. Natanson ³ , and Michelle S. Passerotti ³	20 April 2026 Updated: 22 May 2026
SEDAR101-DW-28	Updated Commercial Catches of Sandbar in the U.S. Atlantic and Gulf of America (1993-2024)	Heather Baertlein and Sarina Atkinson	22 April 2026, Updated: 2 July 2026 Updated: 23 July 2026 Updated: 14 August 2026
SEDAR101-DW-29	Discards of sandbar shark, <i>Carcharhinus plumbeus</i> , from the menhaden purse seine fishery	Molly Stevens	25 June 2026
SEDAR101-DW-30	Relative abundance indices for multiple life stages of sandbar shark (<i>Carcharhinus plumbeus</i>) in	Robert J. Latour	29 July 2026

	coastal Virginia waters		
Reference Documents			
SEDAR101-RD-01	Effects of unregulated international fishing on recovery potential of the sandbar shark within the southeastern United States	Cassidy D. Peterson ^{a,b} , Michael J. Wilberg ^c , Enric Cortés ^d , Dean L. Courtney ^d , and Robert J. Latour ^b	25 March 2025
SEDAR101-RD-02	Effects of Altered Stock Assessment Frequency on the Management of a Large Coastal Shark	Cassidy D. Peterson*, Michael J. Wilberg, Enric Cortés, Dean L. Cortes and Robert J. Latour	25 March 2025
SEDAR101-RD-03	High survivorship of sandbar sharks (<i>Carcharhinus plumbeus</i>) following catch and release in a growing land-based fishery in Massachusetts	Jeff Kneebone ¹ , Connor F. White ² , Caroline Collatos ^{1,3} and Nicholas M. Whitney ¹	5 February 2026
SEDAR101-RD-04	Morphometric Conversions for 33 Shark Species from the Western North Atlantic Ocean	Lisa J. Natanson, Camilla T. McCandless, Michelle S. Passerotti, Carolyn N. Belcher, Heather Bowlby, William B. Driggers III, Bryan S. Frazier, James Gelsleichter, Simon J.B. Gulak, Jill M. Hendon, Eric	17 February 2026

		R. Hoffmayer, and Warren Joyce	
SEDAR101- RD-05	An integrated approach for assessing the survival of discarded sandbar sharks, <i>Carcharhinus plumbeus</i> , captured in scientific longlines	Taylor Grosse ^{A,B,*} , Cynthia Awruch ^{C,D} , Euan Harvey ^B , Chris Dowling ^A , Daniela Waltrick ^A , Benjamin Saunders ^B and Matias Braccini ^A	17 February 2026
SEDAR101- RD-06	Characterization of the U.S. Eastern Gulf of Mexico Reef Fish Bottom Longline Catch through Fishery Collaboration with Electronic Monitoring	Carole L. Neidig, Max Lee, Daniel E. Roberts, and Ryan W. Schloesser	3 March 2026
SEDAR101-RD-7	The impacts of warming and hypoxia on the performance of an obligate ram ventilator	Daniel P. Crear ^{1,*} , Rich W. Brill ¹ , Peter G. Bushnell ² , Robert J. Latour ¹ , Gail D. Schwieterman ¹ , Rachel M. Steffen ³ and Kevin C. Weng ¹	22 April 2026

SEDAR101-RD-08	Sensitivity of a shark nursery habitat to a changing climate	Daniel P. Crear*, Robert J. Latour, Marjorie A. M. Friedrichs, Pierre St-Laurent, Kevin C. Weng	22 April 2026
SEDAR101-RD-09	SEDAR11-DW-06: Estimation of catch of sandbar (<i>Carcharhinus plumbeus</i>) and blacktip (<i>C. limbatus</i>) sharks in the Mexican fisheries of the Gulf of Mexico	Ramón Bonfil* and Elizabeth Babcock	22 April 2026
SEDAR101-RD-10	Bomb radiocarbon and tag-recapture dating of sandbar shark (<i>Carcharhinus plumbeus</i>)	Andrews, Allen H.; Natanson, Lisa J.; Kerr, Lisa A.; Burgess, George H.; Cailliet, Gregor M.	22 April 2026
SEDAR101-RD-11	Using oxytetracycline validation for confirmation of changes in vertebral band-pair deposition rates with ontogeny in sandbar sharks (<i>Carcharhinus plumbeus</i>) in the western North Atlantic Ocean	Lisa J. Natanson ¹ and Bethany M. Deacy ²	22 April 2026
SEDAR101-RD-12	Niche structure and habitat shifts for coastal sharks of the US Southeast Atlantic and Gulf of Mexico	Kaitlyn A. O'Brien ¹ , Enric Cortés ² , William B. Driggers III ³ , Bryan S. Frazier ⁴ and Robert J. Latour ¹	22 April 2026
SEDAR101-RD-13	Evaluation of a spatiotemporal index standardization method for coastal shark species; implications for future stock assessments	Kaitlyn A. O'Brien ^{1,*} , John K. Carlson ² , Enric Cortés ² , William B. Driggers III ³ , Bryan S. Frazier ⁴ and Robert J. Latour ¹	22 April 2026

SEDAR101-RD-14	A Test of a Revised Design of the NOAA Fisheries Fishing Effort Survey 2025	NOAA Fisheries	23 April 2026
SEDAR101-RD-15	Improving Precision of Data-Limited Recreational Catch Estimates Through Multi-Year Catch Rate Aggregation	NOAA Fisheries Office of Science and Technology	23 April 2026
SEDAR101-RD-16	Connecting post-release mortality to the physiological stress response of large coastal sharks in a commercial longline fishery	Nichola M. Whitney ¹ , Karissa O. Lear ² , John J. Morris ³ , Robert E. Hueter ^{3,4} , John K. Carlson ⁵ , and Heather M. Marshall ^{3,6}	23 April 2026
SEDAR101-RD-17	Capture time, size and hooking mortality of bottom longline-caught sharks	Alexia Morgan ^{a,*} and John K. Carlson ^b	23 April 2026
SEDAR101-RD-18	Incidental capture of elasmobranchs by commercial prawn trawlers on the Tugela Bank, Natal, South Africa	S.T. Fennessy	23 April 2026
SEDAR101-RD-19	At-vessel and post-release mortality of the dusky (<i>Carcharhinus obscurus</i>) and sandbar (<i>C. plumbeus</i>) sharks after longline capture	Heather Marshall ^{a,b,*} , Gregory Skomal ^c , Paige G. Ross ^d and Diego Bernal ^a	23 April 2026

SEDAR101-RD-20	Movements and mortality of two commercially exploited carcharhinid sharks following longline capture and release off eastern Australia	Christopher J. Barnes ¹ , Paul A. Butcher ^{1, 2,*} , William G. Macbeth ³ , John W. Mandelman ⁴ , Stephen D. A. Smith ¹ , Victor M. Peddemors ⁵	23 April 2026
SEDAR101-RD-21	The Mexican artisanal shark fishery in the Gulf of Mexico: towards a regulated fishery	J. L. Castillo-Géniz ^A , J. F. Márquez-Farias ^{AD} , M. C. Rodríguez de la Cruz ^B , E. Cortés ^C , and A. Cid del Prado ^A	23 April 2026
SEDAR101-RD-22	Coastal fisheries of Mexico	Fernández, J.I., Álvarez-Torres, P., Arreguín-Sánchez, F., López-Lemus, L.G., Ponce, G., Díaz-de-León, A., Arcos-Huitrón, E. and del Monte-Luna, P.	23 April 2026
SEDAR101-RD-23	2025 State of the Ecosystem Mid-Atlantic	NOAA Fisheries	23 April 2026
SEDAR101-RD-24	Evidence of a potential sandbar shark (<i>Carcharhinus plumbeus</i>) nursery in the Western Gulf of Mexico	Kesley Gibson-Banks ^{1*} , P. Dominguez Rein-Loring ² , Jensen M. Smith ¹ , J. Marcus Drymon ³ , R. J.	5 May 2026

		David Wells ² , Fernando Martinez- Andrade ⁴ , William T. Driggers ⁵ and Matthew K. Streich ¹	
SEDAR101- RD-25	Less Soak Time Saves Those upon the Line: Capture Times and Hooking Mortality of Sharks Caught on Bottom Longlines	Simon J.B. Gulak* and John K Carlson	9 July 2026
SEDAR101- RD-26	Hooking mortality of scalloped hammerhead <i>Sphyrna lewini</i> and great hammerhead <i>Sphyrna mokarran</i> sharks caught on bottom longlines	SJB Gulak ^a , AJ de Ron Santiago ^a & JK Carlson ^b	9 July 2026
SEDAR101- RD-27	At -Vessel Fishing Mortality for Six Species of Sharks Caught in the Northwest Atlantic and Gulf of Mexico	Alexia Morgan and George H. Burgess	9 July 2026
SEDAR101- RD-28	A review of capture and post-release mortality of elasmobranchs	J.R Ellis*, S.R. Phillips* and F. Possion	9 July 2026
SEDAR101- RD-29	Bycatch and Catch-Release Mortality of Small Sharks in the Gulf Coast Nursery Grounds of Tampa Bay and Charlotte Harbor	Rober E. Hueter	9 July 2026
SEDAR101- RD-30	High Post-Capture Survival for Sharks, Rays and Chimaeras Discarded in the Main Shark Fishery of Australia?	Matias Braccini ^{1*} , Jay Van Rijn ² and Lorenz Frick ²	9 July 2026
SEDAR101- RD-31	Respiratory mode and gear type are important determinants of elasmobranch immediate and post- release mortality	Derek R Dapp ¹ , Terence I Walker ¹ , Charlie Huveneers ² & Richard D Reina ¹	22 July 2026
SEDAR101- RD-32	Overview of the U.S. East Coast Bottom Longline Shark Fishery, 1994–2003	Alexia Morgan, Peter W. Cooper, Tobey Curtis and George H. Burgess	22 July 2026

SEDAR101-RD-33	Catch rate and at-vessel mortality of circle hooks versus J-hooks in pelagic longline fisheries: A global meta-analysis	James F. Reinhardt ¹ , Jennifer Weaver ² , Pamela J. Latham ³ , Andrea Dell'Apa ⁴ , Joseph E. Serafy ^{5,6} , Joan A. Browder ⁵ , Mary Christman ⁷ , Daniel G. Foster ⁸ , David R. Blankinship ⁹	22 July 2026
SEDAR101-RD-34	A comparison of circle hook and J hook performance in the recreational shark fishery off Maryland	Angel L. Willey, Linda S. Barker and Mark Sampson	22 July 2026

2. LIFE HISTORY

2.1 OVERVIEW

The Life History Working Group (LHWG) was tasked with compiling all relevant data, analyzing, and providing recommendations to the panel as outlined in the Terms of Reference for HMS Sandbar Shark. In each section, we discuss the data inputs, analyses undertaken, and recommendations of data to use in the assessment model.

2.1.1 Work Group members and participants in Life History Work Group

William Driggers, Co-Leader - National Marine Fisheries Service, Pascagoula, MS
Michelle Passerotti, Co-Leader - National Marine Fisheries Service, Narragansett, RI

Bryan Frazier - South Carolina DNR, Charleston, SC
Annsli Hilton - CIMAS in support of NMFS, Panama City, FL
Walter Ingram - National Marine Fisheries Service, Pascagoula, MS
Heather Moncrief - CIMAS in support of NMFS, Panama City, FL
Lisa Natanson - National Marine Fisheries Service, Retired
Jose Castro - National Marine Fisheries Service, Miami, FL

2.1.2 Topics Reviewed by the Life History Group

1. Age Data
2. Reproduction
3. Growth
4. Research Recommendations

2.2 SUMMARY OF LIFE HISTORY DATA WORKING PAPERS

SEDAR101-DW07: Updated growth parameters for sandbar shark *Carcharhinus plumbeus* based on mark recapture data from the Western North Atlantic.

Michelle S. Passerotti, Camilla T. McCandless, John K. Carlson, Annsli Hilton, Lisa J. Natanson

Growth parameter estimates were produced using mark-recapture data collected for 315 individuals from 1964-2024 (n=121 male, n=190 female, n=4 unknown sex). Four recaptures were sourced from the Southeast Fisheries Science Center (SEFSC) and 311 from the Northeast Fisheries Science Center (NEFSC). Males ranged 46-162 cm FL at tagging and 50-184 cm fork length (FL) at recapture, and females ranged 47-183 cm FL at tagging and 51-189.3 cm FL at recapture. Time at liberty ranged 0.25-26.7 years.

Five models were fit for males and females separately and for sexes combined: Gulland & Holt (1959), Fabens (1965), Francis (1988), and Bayesian versions of the Fabens (1965) and Francis (1988) models following Dureil et al. (2022). Separate GROTAG models (Francis 1988) were also fit following the parameterizations used in Natanson & Deacy (2019) for comparison to previous work. Growth models produced biologically relevant von Bertalanffy growth

parameters, with asymptotic lengths (L_{∞}) ranging 164.9-188.4 cm FL and growth coefficient (k) values ranging 0.099-0.125 yr⁻¹.

Results indicate sandbar sharks exhibit overall smaller L_{∞} and higher k relative to previously published tag-recapture growth models, but slower k and smaller L_{∞} in comparison with vertebral growth models calculated for SEDAR 101 (Driggers et al. 2026), SEDAR 54 (Driggers et al. 2017) and SEDAR 21 (Hale & Baremore 2010).

SEDAR101-DW24: Age and growth of sandbar sharks (*Carcharhinus plumbeus*) in US waters of the western North Atlantic Ocean, 2015-2025

William B. Driggers III, Bryan S. Frazier, Annsli Hilton, G. Walter Ingram, Jr., Lisa J. Natanson and Michelle S. Passerotti

Vertebrae were collected from 1,106 sandbar sharks off the east coast of the United States (hereafter Atlantic) and within the Gulf of America (hereafter Gulf), including 824 females and 282 males. Females and males ranged in size from 75-201 cm FL (mean = 155.47 cm, SD = 17.86) and 75-201 cm FL (mean = 155.45 cm, SD = 17.87), respectively. The sample set lacked vertebrae from neonate sharks, therefore, in order to anchor the curve at a biologically meaningful position on the y-axis, length data were obtained from South Carolina Department of Natural Resources (B. Frazier, unpublished data) collected from 70 neonate sandbar sharks with umbilical remains or an open umbilicus captured in May, June and July within the coastal waters of South Carolina. Neonate shark data added to the age model included 39 females ranging in size from 42-53 cm FL (mean = 46.80, SD = 2.77) and 31 males ranging in size from 41-54 cm FL (mean = 46.86, SD = 2.92). A random subset of 52 vertebrae was selected and independently aged by four readers to evaluate between-reader reliability. The variance components estimated from the linear mixed model were 0.0138 for the rater effect and 0.5471 for the residual variance. Utilizing these components, the Intraclass Correlation Coefficient (ICC) was calculated to be 0.906. This high ICC value (close to 1) indicated strong agreement among the four readers. It was assumed that bands two and above were deposited annually and that growth prior to the birthmark (first growth band) represented gestational growth and the second band was deposited six months after parturition. Therefore, 1.5 was subtracted from each band count and the resulting value represented the age in years of each individual. The oldest aged female and male in the sample set were 27.5 and 24 years old, respectively.

Sandbar shark growth was modeled using the von Bertalanffy Growth Function (VBGF; von Bertalanffy, 1938). To determine if growth patterns differed significantly between males and females, a Likelihood Ratio Test (LRT) was conducted (Kimura, 1980). A “Full Model,” which estimated separate parameters (L_{∞} , k , t_0) for each sex, was compared with a “Reduced Model” (Combined Model), in which a single set of parameters was shared across both sexes. For males, L_{∞} was estimated at 170.6 cm (95% CI: 167.4–173.9 cm), with a k of 0.157 year⁻¹ (95% CI: 0.142–0.172 year⁻¹) and a theoretical age at length zero (t_0) of -2.01 years. Females attained a larger L_{∞} of 178.9 cm (95% CI: 176.5–181.2 cm), but exhibited a k of 0.137 year⁻¹ (95% CI: 0.129–0.145 year⁻¹) and a t_0 of -2.31 years. When sexes were combined ($n = 1176$), the population-level parameters were $L_{\infty} = 177.0$ cm, $k = 0.141$ year⁻¹, and $t_0 = -2.22$ years. The LRT revealed a highly significant difference in growth patterns between males and females ($\Lambda = 32.24$, $df = 3$, $p < 0.01$). The significant test statistic indicates that the “Full Model,” which

allows sex-specific growth parameters, provides a statistically superior fit to the “Reduced Model,” in which parameters are shared across sexes.

Theoretical longevity was calculated using the formula $5(\ln 2/k)$ using sex-specific growth coefficients and was calculated to be 22.07 years for males and 25.30 years for females; both values similar to the maximum aged individuals in this study.

SEDAR101-DW27: Updated reproductive parameters for sandbar sharks (*Carcharhinus plumbeus*) in US waters of the western North Atlantic Ocean

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Maturity at length and age was evaluated for sandbar sharks from the Atlantic) and Gulf of America (hereafter Gulf. Binomial maturity data were fit to length and age data using generalized linear models with a logit link, following the methods of Natanson et al. (2019). Ages for sandbar sharks were provided by Driggers et al. (SEDAR101-DW24).

Reproductive data were available for 1,553 sandbar sharks, of which 1,536 had maturity status information and 1,032 had associated age information. Males ranged in size from 50.0 – 201.0 cm FL, with the median length at maturity (L_{50}) being 142.87 cm FL ($L_{50} SE = 3.67$, $a = -26.1467$, $b = 0.1830$) for both regions combined. The age at which 50% of males were mature (A_{50}) for both regions combined was 10.05 years ($A_{50} SE = 1.0$, $a = -5.7782$, $b = 0.5750$). In the Atlantic, male L_{50} and A_{50} were 145.17 cm FL ($L_{50} SE = 4.06$, $a = -27.7511$, $b = 0.1912$) and 10.65 years ($A_{50} SE = 1.11$, $a = -6.0892$, $b = 0.5718$), respectively. In the Gulf, L_{50} was estimated at 138.54 cm ($L_{50} SE = 10.17$, $a = -21.0334$, $b = 0.1518$) and A_{50} was 8.65 years ($A_{50} SE = 2.78$, $a = -4.2092$, $b = 0.4865$). There was no significant difference in both L_{50} and A_{50} for males between the regions ($p = 0.1956$ and $p = 0.1501$), respectively. Females ranged in size from 68.0 - 210.0 cm FL, with L_{50} estimated to be 147.26 cm FL ($L_{50} SE = 1.64$; $a = -37.1393$, $b = 0.2522$) for regions combined. Age at median maturity was determined to be 11.0 years for females ($A_{50} SE = 0.45$, $a = -8.7015$, $b = 0.7913$) for regions combined. Females in the Atlantic had L_{50} estimated at 148.73 cm FL ($L_{50} SE = 1.8$, $a = -40.1917$, $b = 0.2702$), and A_{50} was 11.6 years ($A_{50} SE = 0.48$, $a = -10.0922$, $b = 0.8701$). Within the Gulf, 50% of females matured at 143.15 cm FL ($L_{50} SE = 5.0$, $a = -28.0962$, $b = 0.1963$) and 8.96 years ($A_{50} SE = 1.91$, $a = -4.8184$, $b = 0.5376$). Likelihood Ratio Tests (LRTs) confirmed the regional difference in length-based and age-based ogives for females is statistically significant ($p = 0.03$ and $p < 0.01$), respectively. These data revealed distinct differences in the size at which male and female sandbar sharks reach maturity. The LRTs confirmed that this sex-specific difference in the length-based maturity was statistically significant ($p = 0.05$). However, the LRTs indicated that the sex-specific differences in age-based maturity were not statistically significant ($p = 0.12$).

Mean brood size from 201 female sandbar sharks was determined to be 7.78 pups per brood (S.D. = 2.33), which was not statistically different from the mean brood size in data used for SEDAR 21 (mean = 7.80, S.D. = 2.47; $t = 0.11$, $p = 0.91$). Data from all years (i.e., 2006-2024) were combined to compare mean brood size between the Atlantic and Gulf, and there was no statistical difference between regions ($t = 0.66$, $p = 0.51$). Brood size was positively and significantly correlated with both maternal age and maternal length. The relationship between brood size and maternal age is described by: Brood Size = $\exp(1.630 + 0.025(\text{AGE}))$. The

relationship between brood size and maternal length is described by: $\text{Brood size} = \exp(0.544 + 0.009(\text{FL}))$. Geographic area (Gulf vs. Atlantic) and temporal timeframe (SEDAR 21, 54 and 101) did not have a statistically significant effect on brood size ($p > 0.05$).

Based on previously published literature, gestation occurs over 11-12 months. Pupping occurs over a relatively protracted period from April through September, with a peak in parturition in May and June (Baremore & Hale 2012, Castro 2011).

Reproductive periodicity was evaluated for samples collected 2015 to 2024 ($n=830$). Mean ova diameter in non-gravid females was assessed as a function of date between January-April to identify individuals exhibiting no ovarian development as an indicator of a triennial cycle. In females above length at 100% maturity ($n=35$), mean ova diameter was 24.4 mm (range 13.7-40.0 mm), indicating follicle diameter was increasing and vitellogenesis was occurring in all non-gravid individuals. These data provide strong support for a biennial reproductive cycle with two distinct states observed in mature females (gravid and non-gravid/developing ova) during the January-April timeframe. Among females above L_{50} ($n=120$), there were two size classes of ova found among non-gravid sharks: the majority ($n=69$) had developing ovaries with mean follicle sizes of 23.0 mm, and a minority of individuals ($n=9$) had small, non-vitellogenic ova, with a mean diameter of 8.4 mm. Only two of these nine could be confirmed as mature based on oviducal gland and uterine width (Baremore and Hale 2012). The other seven individuals were of questionable maturity status. Given the reproductive condition of the two anomalous individuals, we cannot entirely rule out that triennial reproduction could occur in sandbar sharks, but conclude biennial reproduction is the primary reproductive mode in sandbar sharks.

2.3 LIFE HISTORY INFORMATION SUMMARY AND CONSENSUS

2.3.1 Age and Growth Datasets and Decisions

Age estimates for 1176 sandbar sharks (863 females and 313 males) were used to generate combined and sex-specific growth curves for the Gulf and Atlantic regions combined. Age estimates reported in Driggers et al. 2026 (SEDAR101-DW24) were considered accurate and reliable as ICC of 0.906% and 76.0% of age estimates were within ± 1 band. This conclusion was supported by a low inter-reader index of average percentage error (3.44%) and coefficient of variation (4.49%). Three parameter VBGF models were fit to age and length data for female, male, and combined sexes age for the combined Atlantic and Gulf regions. The LRTs indicated females and males had highly significantly different growth patterns between females and males $\Lambda = 32.24$, $df = 3$, $p < 0.01$). The significant test statistic indicated that the “Full Model,” which allows sex-specific growth parameters, provides a statistically superior fit to the “Reduced Model,” in which parameters are shared across sexes. Among all vertebral samples aged, the oldest observed female was 27.5 years and the oldest observed male was 24.0 years. Theoretical Longevity was calculated using the Fabens (1965) formula using sex-specific growth coefficients and was calculated to be 25.30 years for females and 22.07 years for males. Both of these values are similar to the maximum ages observed for individuals in this study.

Growth parameter estimates for sandbar sharks were also produced using mark-recapture data collected for 315 individuals from 1964-2024 (n=121 male, n=190 female, n=4 unknown sex). Growth models produced biologically relevant VBGF parameter estimates, with L_{∞} ranging 164.9-188.4 cm FL and k values ranging 0.099-0.125 yr⁻¹. Tag-recapture models suggest slower growth and smaller L_{∞} in comparison with vertebral growth models calculated in Driggers et al. (SEDAR101-DW24). This may be due to differences in representative samples comprising tagging data relative to vertebral age data, the latter of which have much larger sample sizes and spatial distributions and have varying temporal scales for sample inclusion within each data set. The maximum age estimated for a sandbar sharks based on tag recapture information from the Cooperative Shark Tagging Program was 39.1 years (CI = 37.4 - 42.4 years) based on a female shark that was measured at 203 cm total length at time of tagging (2000) and was at liberty for 21.4 years (2022). Age at initial tagging was calculated from FL (168.5cm) using sex-specific VBGF coefficients and added to time at liberty to estimate maximum age. Additional tagging records support these estimates, with 18 sandbar sharks reported with time at liberty of 20-27.8 years.

The Life History Group concluded that the vertebral age data presented in SEDAR101-DW24 represent the most reliable dataset for estimating sex-specific growth models for sandbar sharks in the combined Gulf and Atlantic regions. The Life History Group concluded that the estimated maximum age ($A_{\max}$) from tag-recapture data of 39.1 years (CI = 37.4 - 42.2 years) is the best estimate of longevity for sandbar sharks.

The Life History Group also evaluated length-frequency records for plausible minimum and maximum size bins. A new minimum size of 35cm FL was determined based on over 2000 records of young of the year sharks captured in nursery area surveys off South Carolina. A maximum size of 200 cm FL was determined based on the largest measured lengths recorded in NEFSC, SEFSC, and SCDNR surveys. Records of sharks larger than 200 cm FL are few, and may represent misidentified species (i.e. dusky sharks).

Decision: Use updated growth parameters from SEDAR101-DW24 as summarized in Table 2.6.1. Use longevity ($A_{\max}$) of 39.1 years (CI = 37.4 - 42.2 years) from SEDAR101-DW07. Use minimum size of 35 cm FL and maximum size of 200 cm FL, with the potential to use a 200+cm size bin for the few records above 200cm.

2.3.2 Reproduction Datasets and Decisions

Age and size at maturity ogives, brood size estimates, gestation period, timing of parturition, and reproductive periodicity for sandbar sharks were presented in SEDAR101-DW27. The resulting reproductive parameters were based on a robust sample size (n=1553, 1019 females and 517 males) from fish recently collected (2015-2024) from both the Gulf and Atlantic regions of the stock. The analysis of the SEDAR 101 dataset revealed distinct differences in the size and age at which male and female sandbar sharks reach 50% maturity (L_{50} and A_{50}). A geographic comparison of the SEDAR 101 data showed that females in the Atlantic (n=427) matured at a larger size and an older age than those in the Gulf (n=339). Similar to females, male sandbar sharks in the Atlantic (n=109) generally matured at a larger size and greater age than their Gulf (n=140) conspecifics, though the statistical significance of these variations differed. Analysis

across different SEDAR assessment periods (21, 54, and 101) also indicated substantial temporal shifts in maturity for both sexes and regions. While region-specific differences in age and size at maturity were apparent, the prevailing data from tag-recapture (e.g. Kohler & Turner 2019) and genetic studies (e.g. Heist & Gold 1999) indicate movement and gene flow of sandbar sharks across regions; hence, we recommend using sex-specific maturity ogives for regions combined.

Parameters for brood size, size at birth, length of gestation and timing of parturition presented in SEDAR101-DW27 are in close agreement with those presented in previous SEDAR assessments. Likewise, the relationship between brood size and maternal length and age did not vary significantly with time, and demonstrated no regional differences. We recommend using the parameters and equations derived for SEDAR 101, laid out in SEDAR101-DW27.

Reproductive periodicity has been a point of debate in past assessments, with questions surrounding a biennial vs. triennial female reproductive cycle. Baremore & Hale (2012) found evidence for at least a biennial cycle, but proposed that some females have a triennial cycle based on available data. During our analysis, we re-examined data collected 2007-2014 and identified methodological differences in ova measurements relative to those used for SEDAR 101, namely that only maximum ova diameter was recorded prior to 2015, whereas from 2015 to 2024 the five largest ova were recorded allowing mean follicle diameter calculation. Maximum follicle diameter measurements could include atretic ova rather than only viable follicles, which would obscure resting ovary conditions and could confound periodicity calculations. Based on this information and the analyses presented in SEDAR101-DW27, we conclude that biennial reproduction is the primary reproductive mode of sandbar sharks. However, based on the presence of 9 anomalous individuals (7.5%) with potentially differing reproductive states (7 of which may not be mature), we recommend exploring an axis of uncertainty of 2.2 years in the MSE analysis.

Decision: Use sex-specific age and size at maturity ogives for regions combined, and other reproductive parameters reported for sandbar sharks in SEDAR101-DW27 and summarized in Table 2.6.1. Maturity schedules are listed in Table 2.6.2. A biennial reproductive cycle is recommended, with an axis of uncertainty of 2.2 for use within an MSE framework.

2.4 RESEARCH RECOMMENDATIONS

- 1) Continue collection of reproductive data for sandbar sharks with recommendations to collect the diameter of the five largest ova, at a minimum, from all females sampled for internal reproduction measurements. Further, when possible, photo documentation of ovarian condition prior to dissection is desirable.
- 2) Assess the degree of movement of sandbar sharks between the Atlantic and Gulf using acoustic and satellite tags. We recommend these tags be randomly deployed throughout the range of sandbar sharks in US waters, rather than in a limited number of discrete locations, by taking advantage of fishery-independent survey platforms for deployment of tags throughout the range of sandbar sharks in US waters of the western North Atlantic. This is highly preferable over deployment of multiple tags in a limited number of geographically discrete areas.

- 3) Further examine potential life history and genetic haplotype frequency differences of sandbar sharks between Atlantic and Gulf.

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2.6 TABLES

Table 2.6.1 Summary of life history parameters for sandbar sharks (*Carcharhinus plumbeus*) in the western North Atlantic Ocean. Values in parentheses are standard error.

Life History Workgroup	Region	Summary of sandbar sharks biological inputs	Reference
Growth parameters		Female / Male / Combined	
L_{∞} (cm FL)	Combined	178.88 (1.20)/ 170.62 (1.64)/ 176.97 (0.99)	SEDAR101-DW-24
k	Combined	0.141 (0.004)/ 0.157 (0.007)/ 0.141 (0.004)	SEDAR101-DW-24
t_0 (years)	Combined	-2.31 (0.11)/ -2.01 (0.11)/ -2.22 (0.08)	SEDAR101-DW-24
Maximum vertebral age	Combined	28 years	SEDAR101-DW-24
Sample size	Combined	863 / 313 / 1176	SEDAR101-DW-24
Longevity (A_{max})	Combined	39.1 years (CI = 37.4 - 42.2 years)	SEDAR101-DW07
Length-weight relationships			
PCL in cm	Combined	PCL = (0.904)FL-0.023	Natanson et al 2022
TL in cm	Combined	TL = (1.20)FL-1.11	Natanson et al 2022
STL in cm	Combined	STL = (1.09)FL+1.22	Natanson et al 2022
WT in kg	Combined	WT=(1.20e-5)FL ^{2.99}	Natanson et al 2022
Age at 50% maturity ogive			
Female (n =1,019)		$A_{50} = 11.00$ years $a = -8.701$ (0.876), $b = 0.791$ (0.069)	SEDAR101-DW27
Male (n= 517)		$A_{50} = 10.05$ years $a = -5.778$ (1.161), $b = 0.575$ (0.093)	SEDAR101-DW27
Size at 50% maturity ogive			
Female (n = 1,019)		FL _{mat} = 147.26 cm FL $a = -37.139$ (3.817), $b = 0.252$ (0.025)	SEDAR101-DW27
Male (n= 517)		FL _{mat} = 142.87 cm FL $a = -26.147$ (4.940), $b = 0.183$ (0.0327)	SEDAR101-DW27
Reproductive cycle			
		Biennial	SEDAR101-DW27
Fecundity		7.78 (0.13); range 1-13 (n=314)	SEDAR101-DW27
Size at birth		46.86 cm FL (0.35) (n = 70)	SEDAR101-DW27
Gestation		11-12 months	Baremore and Hale 2012
Pupping month		May – June	Baremore and Hale 2012
Fecundity-maternal size relationship		Brood size = exp(0.544 + 0.009(FL))	SEDAR101-DW27
Fecundity-maternal age relationship		Brood Size = exp(1.630 + 0.025(AGE))	SEDAR101-DW27

Table 2.6.2. Proportion of mature sandbar sharks (*Carcharhinus plumbeus*) in 10 cm size classes by sex.

FL (cm)	Female	Male	Age (years)	Female	Male
50	0	0	0	0	0
60	0	0	0.5	0	0
70	0	0	1.5	0	0.01
80	0	0	2.5	0	0.01
90	0	0	3.5	0	0.02
100	0	0	4.5	0.01	0.04
110	0	0	5.5	0.01	0.07
120	0	0.01	6.5	0.03	0.11
130	0.01	0.09	7.5	0.06	0.19
140	0.14	0.37	8.5	0.12	0.29
150	0.67	0.79	9.5	0.23	0.42
160	0.96	0.96	10.5	0.4	0.56
170	1	0.99	11.5	0.6	0.7
180	1	1	12.5	0.77	0.8
190	1	1	13.5	0.88	0.88
200	1	1	14.5	0.94	0.93
210	1	1	15.5	0.97	0.96
			16.5	0.99	0.98
			17.5	0.99	0.99
			18.5	1	0.99
			19.5	1	1
			20.5	1	1

3. CATCH STATISTICS (including Bycatch)

3.1 OVERVIEW

The Catch Statistics Working Group (CSWG) was tasked with compiling all relevant data, analyzing, and providing recommendations to the panel as outlined in the Terms of Reference for HMS Sandbar Shark. In each section, we discuss the data inputs, analyses undertaken, and recommendations of data to use in the assessment model.

3.1.1 Work Group members and participants in Catch Statistics Work Group

Leads

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John Carlson - NMFS SEFSC SFD

Panel Members

Alex Hansell - NMFS Northeast Fisheries Science Center (NEFSC) Resource Evaluation and Assessment Population Dynamics

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Tobey Curtis - NMFS Office of Sustainable Fisheries Atlantic Highly Migratory Species Division

3.1.2 Topics Reviewed by the Catch Statistics Group

1. Review of Working Papers and Reference Documents
2. Recreational Statistics
3. Commercial Statistics

4. Bycatch
5. Research Recommendations

3.2 REVIEW OF WORKING PAPERS AND REFERENCE DOCUMENTS

SEDAR101-DW-02: Electronic Monitoring Documentation of Sandbar Sharks (*Carcharhinus plumbeus*) and Depredation in the Eastern Gulf of America Commercial Reef Fish Fishery

Summary: Electronic monitoring (EM) data collected from 15 commercial bottom longline vessels operating in the Eastern Gulf of America from 2016–2024 were used to characterize Sandbar Shark (*Carcharhinus plumbeus*) bycatch, distribution, condition, and potential involvement in depredation within the reef fish fishery. Analysis of 3,010 reviewed hauls documented 1,248 Sandbar Sharks. A zero-inflated negative binomial model showed that catch rates increased with soak time and decreased with depth, with deeper sets also more likely to produce zero catches. Spatial analyses identified catch hotspots near the Middle Grounds, The Edges, Boca Grande, and areas between Pulley Ridge and the Dry Tortugas. Mortality was low (0.24%), with most sharks arriving alive and considered to be adults. Comparisons of overlapping EM and observer coverage with NOAA Reef Fish Observer Program data indicated that EM documented nearly one additional Sandbar Shark per haul when at least one Sandbar Shark was captured. This difference suggests that EM may improve the detection of large coastal shark interactions in the fishery. Depredation rates remained relatively low but were spatially associated with several Sandbar Shark hotspots. Where depredation could be linked to the species level, Sandbar Sharks accounted for the largest proportion of observed events.

SEDAR101-DW-03: Estimates of Sandbar Shark for the U.S. Atlantic Pelagic Longline fleet for the period 1992-2024.

Summary: The estimation of Sandbar Shark dead discards for the Atlantic pelagic longline fleet (1992-2024) followed the methodology described by Brown (2001). This methodology is based on fishing effort levels (i.e., number of hooks) reported through the Pelagic Logbook Program (PLP), and scientific observer records of catch rates estimated from data collected by the SEFSC Pelagic Observer Program (POP). The methodology developed by Brown (2001) estimates the number of discarded individuals by applying the Delta-lognormal method as described by Pennington (1983) while considering possible geographical and time of year effects. Catch rate samples were pooled as necessary across strata to achieve a minimum sample size of 30 observations. The method produces a number of individuals discarded dead by spatial and temporal strata. The number of individuals were converted into total weight using fork lengths collected by scientific observers and estimating an average weight using the L-W relationship developed by Natanson et al. (2022).

SEDAR101-DW-05: Large Pelagics Survey Catch Data for Sandbar Shark in the Northeast

Summary: The Large Pelagics Survey (LPS) collects data used to estimate fishing effort and catch of large pelagics and highly migratory species (HMS) by private and charter boats in the Northeast (Maine to Virginia). The LPS primarily targets vessels with open access Atlantic HMS fishing permits that are fishing out of known offshore fishing access sites. Massachusetts and New York to Virginia are sampled each year from June through October. Rhode Island, Connecticut, New Hampshire, and Maine are sampled from July to October. While the LPS has gone through several design iterations, the current design has largely been in use since 2002. While pelagic sharks are regularly sampled and observed by the LPS, Sandbar Sharks are one of the few coastal shark species that are regularly reported in the LPS. Between 2002 and 2025, the LPS estimated a total catch of 21,850 Sandbar Sharks of which only 2.2% were harvested. Even prior to their retention prohibition, only 4.6% of Sandbar Sharks reported caught to the LPS were harvested. LPS estimates of Sandbar Shark total catch were unusually high from 2006 to 2009. It was determined that this was likely due to a change in the dockside portion of the LPS, which stopped surveying incidental trips for large pelagics in 2010. Due to this change in the intercept survey methodology, and the resultant disruption to the catch time series for Sandbar Sharks, the working group decided not to use the LPS data for the stock assessment.

SEDAR101-DW-06: Regional and temporal trends in sandbar depredation risk on the West Florida Shelf.

Abstract: Sandbar sharks are commonly implicated in shark depredation, when a shark bites a hooked fish. However, the wide-scale rate of sandbar depredation is unknown. To estimate regional depredation risk, a geostatistical sandbar species distribution model was overlaid with a for-hire fishing event distribution model on the West Florida Shelf. Between 2009 and 2023, sandbar depredation risk increased by 207%. Sandbar sharks accounted for 77% of the total risk in the Northwest region compared to only 18% in the Florida Keys. These findings suggest that regions differ in the composition of shark species contributing to depredation, highlighting the potential for developing targeted, area-specific mitigation strategies

SEDAR101-DW-09: Bycatch estimates of Sandbar Shark in the Shark Research Fishery

Summary: Amendments to the Consolidated Atlantic Highly Migratory Species Fishery Management Plan based on stock assessments have eliminated the major directed shark fishery in the US South Atlantic (NMFS 2007). These amendments also implemented a Shark Research Fishery, which allows the National Marine Fisheries Service (NMFS) to select a limited number of commercial shark vessels on an annual basis to collect life history data and catch data for future stock assessments. Since 2008, only commercial shark fishers participating in the Shark Research Fishery are allowed to land Sandbar Sharks, *Carcharhinus plumbeus*, and must carry an observer on 100% of all trips. Estimates of dead and live discards are reported for the Shark Research Fishery from 2008-2025. As vessels in the shark research fishery are monitored 100%,

no extrapolations of the discards are needed. Total dead discards and live discards were highest from 2008-2011 due to trip limit regulations.

SEDAR101-DW-18: General Recreational Survey Data for HMS Sandbar Shark

Summary: General recreational survey data for Sandbar Shark from the Marine Recreational Information Program (MRIP), Texas Parks and Wildlife Department (TPWD), and Louisiana Creel Survey (LA Creel) are summarized from 1981 to 2024 for the U.S. Atlantic and Gulf of America states from Maine to Texas. Charter, Headboat, Private, and Shore fishing modes are presented. These fully calibrated MRIP estimates take into account the change in the Fishing Effort Survey (FES, which replaced CHTS in 2018), the redesigned Access Point Angler Intercept Survey (APAIS), and the For Hire Survey (FHS) (Papacostas and Foster 2021). Tables and figures presented include calibration comparisons, landing and discard estimates, associated CVs, sample sizes, fish sizes, and effort estimates.

SEDAR101-DW-20: Sandbar Shark Discard Estimates from the Northeast Fisheries Observer Program.

Summary: Dead and live discards of Sandbar Sharks were estimated from the Northeast Region's gillnet and trawl fisheries. Both numbers and weights were estimated from 1995-2025. Historical discard estimates (1964-1994) were produced for each gear type using a variety of different methods.

SEDAR101-DW-22: Sandbar Shark Length Composition Submitted for Use in the SEDAR101 Data Workshop.

Summary: To support the SEDAR 101 HMS Sandbar Shark (*Carcharhinus plumbeus*) stock assessment, this report summarizes 115,744 length records collected between 1974 and 2024. These data, collected from fishery-independent scientific surveys and fishery-dependent commercial and recreational sources, were compiled to help the assessment team select suitable modeling software. Measurements were standardized into 2, 5, and 10 cm fork length (FL) bins across three geographical designations: the Atlantic Ocean, the Gulf of America, and a combined region. With the Atlantic Ocean further split into the North Atlantic and South Atlantic for the commercial fishery longline gear. A total of 22 sources submitted data, which included both estimated and measured lengths. Measurements were classified as estimated when an animal could not be landed and an at-sea observer or scientist made an estimate of the animal's length. Conversely, a length was categorized as measured if the animal was landed or brought on board and measured with a tape measure to the nearest centimeter. A size-selectivity filter established by the life-history working groups was recommended, reclassifying any values outside the 35–200 cm FL range as outliers. Furthermore, length-frequency histogram visualizations relied exclusively on non-outlier measured lengths to identify any categories or years that might require exclusion from the final assessment.

SEDAR101-DW-23: Bycatch estimates of Sandbar Shark in the reefish bottom longline fishery.

Summary: This document details the use of the delta-lognormal method (Pennington, 1983) to calculate discard rates of Sandbar Shark in the reefish bottom longline fishery operating in the Gulf of America (i.e. Gulf of Mexico) to produce total discard estimates for this fishery and associated uncertainty. Observer-reported Sandbar Shark discard rates from 2016-2020 for both live and dead discards were estimated and extrapolated to total estimates using effort from the Coastal Fisheries Logbook Program. However, no dead discards of Sandbar Shark were reported by observers and estimates of live discards were only available.

SEDAR101-DW-29: Discards of sandbar shark, *Carcharhinus plumbeus*, from the menhaden purse seine fishery

Summary: This document summarizes and updates methodology from previous SEDAR assessments to estimate dead Sandbar Shark discards from the menhaden fishery. This source of mortality was included as a separate fleet in previous SEDARs, but represents <1% of total removals over the past 50 years. Ultimately, the overall number of dead discards from this fishery is low and there is high uncertainty in Sandbar Shark landings. The methodology was updated and documented here for continuity, but it is recommended to reconsider how to include this source of mortality in this and future Sandbar Shark stock assessments.

3.3 RECREATIONAL STATISTICS

Commercial landings of Red Snapper were compiled from 1950 through 2024. Sources for landings in the U.S. South Atlantic included Florida Fish and Wildlife Conservation Commission (FWC), South Carolina Department of Natural Resources (SCDNR), North Carolina Division of Marine Fisheries (NCDMF), and Atlantic Coastal Cooperative Statistics Program (ACCSP). Red Snapper landings from Georgia and the Mid and North Atlantic (north of the NC-VA border) were solely from ACCSP.

3.3.1 Recreational Data Sources

3.3.1.1 Marine Recreational Information Program (MRIP)

The Marine Recreational Information Program (MRIP), formerly the Marine Recreational Fisheries Statistics Survey (MRFSS), conducted by NOAA Fisheries (NMFS), provides estimates of catch per unit effort, total effort, landings, and discards for six two-month periods (waves) each year. In all states where MRIP samples, MRIP provides estimates for three main recreational fishing modes: shore-based fishing (Shore), private and rental boat fishing (Priv), and for-hire charter and guide fishing (Cbt). MRIP also provides estimates for headboat mode (Hbt) in the mid and north Atlantic regions. MRIP covers all coastal Atlantic states from Maine to Florida and Gulf states from Florida to Mississippi. Louisiana was covered by the survey until 2014, and Texas is not covered to avoid overlap with the TPWD survey (discussed below in 3.3.1.2). When the survey first began in Wave 2 (Mar/Apr) of 1981, headboats were included in the for-hire mode, but this component has been excluded after 1985 to avoid overlap with the

Southeast Region Headboat Survey (SRHS), conducted by the NMFS Beaufort laboratory.

Across the MRIP dataset, catch is categorized into three catch types. Type A catch, also called observed harvest, includes fish that are caught and brought back to the dock in a form that can be identified by samplers. Type B1 catch, or unobserved harvest, includes fish that are caught and released dead, used for bait, or filleted and are identified by individual anglers. Type B2 catch, also called released catch, includes fish that are released alive and identified by individual anglers. Throughout the recreational section of this report, landings refer to types A and B1 catch, and discards refer to Type B2 catch.

Recreational catch, effort, and participation were estimated through a suite of independent but complementary surveys that are described in SEDAR 68-DW-13. Over the years, effort data have been collected from three different surveys: (1) the Coastal Household Telephone Survey (CHTS) which used random digit dialing of coastal households to obtain information about recreational fishing trips, (2) the weekly For-Hire Survey which interviews charterboat operators (captains or owners) to obtain trip information and replaced the CHTS for the charter mode (in 2000 for the Gulf of America and East Florida and 2004 for the Atlantic coast north of Georgia), and (3) the Fishing Effort Survey which is a mail based survey whose sample frame consists of anglers from the National Saltwater Angler Registry and replaced the CHTS for the private and shore modes in 2018. Catch data are collected through dockside angler interviews in the Access Point Angler Intercept Survey (APAIS), which samples recreational fishing trips after they have been completed. In 2013, MRIP implemented a new APAIS procedure to remove sources of potential bias from the sampling process. Catch rates from dockside intercept surveys are combined with estimates of effort to estimate total landings and discards by wave, mode, and area fished (e.g., inland, state, and federal waters).

Catch estimates from the early years of the survey are highly variable with high proportional standard errors (PSE's), and sample sizes in the dockside intercept portion have been increased over time to improve the precision of catch estimates. Several quality assurance and quality control improvements were implemented for the intercept surveys in 1990. Prior to 1990, the contractor did not have regional representatives hired to supervise the samplers in any given area. All samplers were hired as independent subcontractors and communicated directly with the contractor's home office staff. It is more likely that the samplers who worked in the 1980s would have varied more in their interpretation of sampling protocols and their ability to identify at least some of the more difficult-to-recognize species. There were a number of other changes made to enhance consistency in sampling protocols and improve error-checking in the Statement of Work for the 1990-1992 contracts. Improvements have continued over the years, but the biggest changes happened during that time (personal communication, NMFS). Catch rate data have improved through increased sample quotas and additional sampling (requested and funded by the states) to the intercept portion of the survey.

In order to maintain a consistent time series, charter estimates were calibrated on the Gulf coast prior to 2000 and on the Atlantic coast prior to 2004 (SEDAR 64-RD-12), and MRIP estimates for private and shore prior to 2018 were calibrated to FES (Papacostas and Foster 2021). CHTS and calibrated FHS charter catch estimates for HMS Sandbar Shark from 1981 to 1999 are shown in Figure 1 of SEDAR 101-DW-18. Calibrated APAIS and FES estimates for HMS

Sandbar Shark from 1981 to 2024 are shown in Figure 2 of SEDAR 101-DW-18. It is important to note that SEDAR 54 recreational estimates were reflective of MRIP's historical survey design, relying on CHTS for private and shore mode estimates and FHS for charter mode estimates.

Adjustment to Fishing Modes

Between 1981 and 1985, MRIP charter and headboat modes were combined into a single mode for estimation purposes. Since the NMFS Southeast Region Headboat Survey (SRHS) began in the Atlantic in 1981, the MRIP combined charter/headboat mode must be split in order not to double the estimated headboat landings in these early years. The MRIP charter/headboat mode (1981-1985) was split by using a ratio of SRHS headboat angler trip estimates to MRIP charterboat angler trip estimates for 1986-1990. In accordance with SEDAR Best Practices, the mean ratio was calculated by state (or state equivalent to match SRHS areas to MRIP states) and then applied to the 1981-1985 estimates to split out the headboat component when needed (SEDAR-PW-07). To avoid duplication of headboat estimates, the MRIP headboat component from this split was deleted for the South Atlantic region (North Carolina to the Florida Keys), and SRHS estimates are used to represent headboat fishing for all years in this region (1981+). In the Florida Keys, headboats primarily operate along the South Atlantic side and are covered by SRHS areas 12 and 17. For the Gulf of America (Texas to Florida), the MRIP headboat component from this split was used to represent fishing from 1981-1985, and SRHS headboat estimates were used for all years after 1985.

Between 1981 and 2003 in the Mid and North-Atlantic, MRIP charter and headboat modes were combined into a single (for-hire) mode for estimation purposes. To provide complete time series for both the charter and MRIP headboat modes, the MRIP for-hire mode in the Mid and North-Atlantic was separated using ratios of MRIP charterboat:headboat effort from raw MRIP intercept data. These effort-based ratios were calculated by year (1981-2003), state, and mode and applied to the combined for-hire estimates for both catch and effort.

Unidentified Catch

Catch estimates of unidentified Sandbar Shark are present in the MRIP dataset.

Recommendation: For SEDAR 101, the working group agreed to evaluate Sandbar Shark recreational catch estimates developed using two approaches to account for unidentified catches, specifically those that were reported as Requiem Shark Genus, Requiem Shark Family, and Unidentified Sharks. The two approaches were applied to both recreational landings and discards.

Overall, four states were developed to evaluate uncertainty in the recreational catch estimates for the Management Strategy Evaluation: Default State, Alternative State 1, Alternative State 2, and Alternative State 3. The approaches to develop each of these states are described in the paragraphs below.

Under the first approach, which is provided as the reference case for the Management Strategy Evaluation and referred to as the Default State, catches reported as Requiem Shark Genus and Requiem Shark Family were allocated among those species that were classified within those groupings, including Sandbar Shark. Annual species composition proportions were calculated using identified catches of the species within the Requiem Shark Genus and Requiem Shark

Family groups. Based on these annual proportions, catches reported as Requiem Shark Genus (*Carcharhinus*) and Requiem Shark Family (*Carcharhinidae*) were distributed among the corresponding species (Figures 3.9.1.1 & 3.9.1.2). The allocated Sandbar Shark catches were then combined with the observed Sandbar Shark catches to produce annual landings estimates. The results of this approach are provided as the reference case as catch reported as Requiem Shark Genus and Requiem Shark Family likely contains Sandbar Shark along with other requiem shark species. Therefore, there is higher confidence in partitioning based on the annual species composition.

Under the second approach, which is provided as an alternative case for the Management Strategy Evaluation and referred to as Alternative State 2, catches reported as Unidentified Sharks were additionally allocated among all identified shark species reported, including Sandbar Shark. Annual species composition proportions were calculated using the catches of all identified shark species. Based on these annual proportions, catches reported as Unidentified Sharks were distributed among the corresponding species (Figure 3.9.2). The resulting Sandbar Shark allocations were then combined with observed Sandbar Shark catches and the Sandbar Shark catches allocated through the first approach to produce an alternative recreational catch time series that could be evaluated under the Management Strategy Evaluation. The results of this second approach are provided as an alternative case as the broader Unidentified Sharks category includes species from multiple shark families, incorporating additional uncertainty that the annual species composition of identified sharks reflects the composition of this grouping.

Uncertainty

Coefficient of variation (CV) estimates for Marine Recreational Information Program (MRIP) survey catch totals are provided for stock assessments by the Southeast Fisheries Science Center (SEFSC). Variances of total catch-in-number estimates are computed directly from the raw survey data to obtain CVs appropriate for custom aggregations by year, wave, sub-region, state, and mode using standard survey methods (SEDAR 68-DW-10).

MRIP Fishing Effort Survey Update

In January 2026, NOAA implemented an improved Fishing Effort Survey design as part of the continuous improvement to the national MRIP survey. The revised FES design increased the frequency of survey administration from every two months to monthly and modified the sequence of fishing activity questions to reduce reporting error and improve the accuracy of recreational fishing effort estimates. Evaluation of the revised survey design indicated that recreational fishing effort estimates were generally lower than those produced under the previous FES design (NMFS 2026). Across the study period, mean effort estimates were approximately 22% lower for private boat fishing and 9% lower for shore fishing relative to estimates produced under the previous FES design.

Recommendation: For SEDAR 101, the working group agreed to develop an alternative recreational catch scenario to evaluate the potential implications of the revised FES methodology within the Management Strategy Evaluation. Under these scenarios, catch originating from the private mode was reduced by 22%, and catch originating from the shore mode was reduced by 9%. Estimates from the other recreational fishing modes were unchanged. This reduction is applied in Alternative State 1 using the Requiem Shark

Genus and Requiem Shark Family allocation method with a 22% reduction applied to private mode and a 9% reduction applied to shore mode and in Alternative State 3 using the Requiem Shark Genus, Requiem Shark Family, and Unidentified Sharks allocation method with a 22% reduction applied to private mode and a 9% reduction applied to shore mode. Additionally, NOAA Fisheries is scheduled to release newly calibrated estimates later in 2026. The working group also agreed that following the release of these estimates, the recreational catch series should be updated by applying the newly calibrated estimates, reestimating the current Default State and Alternative State 2 and eliminating the need for the current Alternative States 1 and 3. This update will address some of these mode-specific concerns described above.

Improving Precision of Data-Limited Recreational Catch Estimates Through Multi-Year Catch Rate Aggregation

While MRIP's statistical methods have undergone peer review (NASEM 2017) and have been found to be robust, challenges remain when estimating catches for species that are infrequently encountered in recreational fisheries. Low encounter rates may occur for a variety of reasons, including species rarity, restricted spatial or temporal distribution, or management measures such as seasonal closures. As a result, estimates for species that are encountered infrequently often exhibit high levels of uncertainty.

To provide guidance on the appropriate use of recreational catch estimates, the NOAA Fisheries Recreational Fishing Survey and Data Standards (NMFS 2025) identified a precision threshold for statistical reliability of a percent standard error (PSE) of 50, above which estimates should be used with caution in assessment and management applications. Therefore, NOAA Fisheries Office of Science and Technology and SEFSC collaborated to develop an interim moving average estimation method designed to improve the precision of MRIP catch estimates that are imprecise when using the standard MRIP design-based estimation method.

Under this alternative method, data from two-month sampling periods, or waves, over a range of years are used to calculate catch rates. These catch rates are then multiplied by standard design-based effort estimates. Evaluation of this methodology through simulation testing supported its application in cases where MRIP estimates exceed the 50 percent PSE threshold.

Recommendation: For SEDAR 101, the working group agreed to evaluate the application of a moving average estimation method on the MRIP Sandbar Shark recreational catch time series. The resulting estimates will be provided as an alternative case for the Management Strategy Evaluation following the release of new estimates using the improved FES methodology, later in 2026. In preparation for this work, the working group examined the Sandbar Shark catch time series to develop a proposed methodology for applying the moving average. Examination of the landings time series indicated that PSE values were consistently elevated following implementation of the 2008 prohibition. Since these elevated PSE values persisted throughout the post-prohibition period, the working group concluded that they likely reflect the true uncertainty associated with the survey under low catch conditions. Therefore, smoothing is not recommended for post-prohibition landings estimates.

For the discard time series, as well as landings estimates prior to 2008, the working group determined that application of the moving average methodology is appropriate. Years identified for smoothing will be determined at the annual level with all strata (e.g. State, Mode) collapsed. Once identified, smoothing will be applied within individual survey strata to preserve the underlying survey design and retain important strata-specific patterns in catch and effort. Following the release and application of the newly calibrated MRIP estimates, this smoothing approach will be applied to the updated Default State and Alternative State 2. The resulting catch estimates will be provided as additional alternative cases for the Management Strategy Evaluation.

3.3.1.2 Texas Parks and Wildlife Department's (TPWD) Marine Sport-Harvest Monitoring Program

The TPWD Coastwide Creel Survey samples fishing trips made by sport-boat anglers fishing in Texas marine waters. Sampling occurs at public recreational boat access sites along the Texas coast. Data collected from dockside interviews includes information regarding trip satisfaction, angler county of origin, species sought and landed, geographical area of fish landed, length composition, bait utilized, as well as trip length for sampled boat-trips. Texas Parks and Wildlife began dockside survey methods for recreational anglers in 1974, but only generated recreational catch and effort estimates beginning in May 1983, when methods became largely standardized (SEDAR 70-WP-03). The Coastwide Creel Survey is designed to estimate landings and effort by parsing out seasons based on fishing pressure, for high-use (May 15-November 20) and low-use seasons (November 21-May 14). From there, TPWD disaggregates seasons into waves for all estimates, using the fraction of the total catch for each species from each two-month wave, to make the TPWD time series compatible with the MRIP time series. TPWD surveys private and charterboat fishing trips. While TPWD samples all trips (private, charterboat, ocean, bay/pass), most of the sampled trips are associated with private boats fishing in bay/pass areas, as these trips represent most of the fishing effort in Texas waters. Charterboat trips in ocean waters are the least encountered by the survey. Additional information on the TPWD survey can be found in SEDAR 70-WP-03.

Calibration to MRIP-FES units

The MRIP-FES was implemented in Texas in 2016 (SEDAR 74-RD-110) to compare MRIP-FES effort estimates with the associated effort estimates from the TPWD survey. A ratio estimator was calculated from these two sets of estimates and reviewed during the data workshop for SEDAR 74. This calibration is described in SEDAR 74-DW-10 and may be applied to landings, discards, and effort estimates to calibrate private TPWD estimates into MRIP-FES units. The MRIP-FES has never been conducted in Texas, and so an appropriate TPWD:MRIP calibration for the Texas charter mode is not available.

Recommendation: The working group was tasked with providing a continuous and consistent time series of recreational catch statistics by area for the combined recreational fleet. In accordance with the Terms of Reference, state survey catch estimates were

calibrated to a common data unit to be comparable across time and Gulf states. While concerns were raised regarding the current calibration approach in adjusting TPWD private estimates into MRIP FES units (SEDAR 74-DW-10), the SEDAR 101 working group recommended the application of this approach in the absence of a better alternative. This decision is in agreement with that from a joint TPWD/SEFSC collaboration that explored potential calibrations between TPWD and MRIP during SEDAR 98 and supported use of the SEDAR 74-DW-10 approach until additional benchmarking becomes feasible (Gulf Transition Plan 2025).

To maintain consistency with the alternative recreational catch scenario developed for the Management Strategy Evaluation regarding the January 2026 update to the MRIP Fishing Effort Survey, calibrated TPWD private-mode landings and discards were also reduced by 22% in Alternative States 1 and 3. The calibrated TPWD estimates included in the Default State and Alternative State 2 were not subject to this reduction.

Catch and Uncertainty Estimates

TPWD provides catch estimates by matching high- and low-use seasons (the months included in each) to MRIP waves. Data are summarized by daily angler hours, trips, number of anglers, total catch, length measurement, mean length, and mean weight. These summaries are joined with seasonal and yearly relative pressure to calculate TPWD and NOAA pound estimates. Estimates for trips, anglers, angler hours, total catch, and mean weight incorporate relative pressure from boat ramps. Further breakdown includes estimates by Gulf area, day type, and wave. Overall totals are provided, along with standard errors for effort (angler hours), landings (fish count), and catch per unit effort (fish per angler hour), which are applied as measures of uncertainty. These variances, in TPWD units, are then scaled into MRIP-FES units using a Taylor Series expansion that assumes the MRIP and TPWD point estimates are independent (i.e., correlation = 0). This approach is described in SEDAR 74-DW-10.

3.3.1.3 Southeast Region Headboat Survey (SRHS)

The Southeast Region Headboat Survey estimates landings and effort for headboats in the South Atlantic and Gulf of America. The SRHS incorporates two components for estimating catch and effort. 1) Information about the size of fish landed is collected by port samplers during dockside sampling, where fish are measured to the nearest mm and weighed to the nearest 0.01 kg. These data are used to generate mean weights for all species by area and month. Port samplers also collect samples (e.g. otoliths, spines) for aging studies during dockside sampling events. However, port samplers do not collect ageing structures from sharks. 2) Information about total landings, discards (numbers), and effort (trip duration and number of anglers) are collected via the logbook, a form (electronic since 2013) filled out by vessel personnel for individual trips. These logbooks are summarized by vessel and expanded for known missing trips to generate estimated landings by species, area, and time strata. Regarding discards, SRHS does not

distinguish between live and dead discards. Therefore, discard estimates from SRHS represent total discards regardless of release condition.

The SRHS was started in 1972, but only included vessels from North Carolina and South Carolina. In 1975, the survey was expanded to northeast Florida (Nassau-Indian River counties), followed by Georgia in 1976 and southeast Florida (St. Lucie-Monroe counties) in 1978. In 1986, the survey expanded to include West Florida, Alabama, Louisiana, and Texas. There have been a few changes to the spatial strata definitions within the SRHS over the years. Most notably, Mississippi was added to the survey in 2010, and Alabama was split from Northwest Florida in 2013.

Texas Headboat Landings (1981-1985)

Landings estimates for Gulf of America headboats between 1981 and 1985 come from the MRFSS/MRIP survey for all states except Texas. As in previous SEDARs, Texas headboat landings for 1981 to 1985 were estimated as a five-year average (1986-1989) from SRHS Texas headboat landings.

Uncertainty

The SRHS is designed to be a census, and so reporting compliance and accuracy are the primary components of the uncertainty in landings and discard estimates over time. Headboat activity is monitored by port agents to validate trips. Two proxy estimates of SRHS uncertainty were provided for consideration in the assessment model: (1) unweighted and (2) weighted by combined landings and discards. Unweighted proxy uncertainty estimates (CV) applied the annual proportions of reported to estimated trips by region as a proxy for CV, with an additional buffer of 0.05 to prevent the estimate from reaching a zero value:

$$proxyCV = 1 - \frac{n}{N} + 0.05$$

where n is the number of reported trips, and N is the number of estimated trips. Weighted proxy CVs were developed to approximate uncertainty by scaling the unweighted CVs with the combined number of landings and discards within each state grouping:

$$proxyCV_i = 1 - \sum_{j=1}^n \left[\frac{n_{i,j}}{N_{i,j}} * \frac{L_{i,j}}{L_i} \right] + 0.05$$

where n is the number of reported trips, N is the number of estimated trips, and L is the combined landings and discards (in numbers) for year i and state grouping j . State groupings included Texas (TX), Louisiana/Mississippi (LA/MS), Florida West Coast/Alabama (FLW/AL), Southeast Florida (SEFL), Georgia/North Florida (GaNFL), South Carolina (SC), and North Carolina (NC).

State-level weighting was used to better reflect the distribution of fishing activity across the SRHS while minimizing the influence of areas with limited catch. Combined landings and

discards were used because landings became sparse during portions of the time series, resulting in weighted CVs approaching zero when based on landings alone.

3.3.1.4 Other Data Sources Considered

Recommendation: The following recreational data sources were discussed and considered by the working group but not recommended for use in the SEDAR 101 Sandbar Shark assessment.

3.3.1.4.1 Large Pelagics Survey

The LPS, which began in 2002, collects information regarding the recreational fishery directed at large pelagic species (e.g., tunas, billfishes, swordfish, sharks, wahoo, dolphinfish, amberjack) in the offshore waters from Maine through Virginia from June through October. The purpose of LPS is to collect more precise estimates of fishing effort and catch for large pelagic species that are rarely encountered in the general MRIP surveys. The LPS includes two independent surveys: the Large Pelagics Telephone Survey (LPTS) and the Large Pelagics Intercept Survey (LPIS). These provide effort and average catch-per-trip estimates needed to estimate total catch by species.

The LPIS is a dockside survey of known offshore fishing access sites primarily designed to collect catch data from private and charter boat captains who completed fishing trips directed at large pelagic species. LPIS data are used to estimate the average recreational catch per large pelagic boat trip by species. Unlike the APAIS, the LPIS collects aggregate catch data for all anglers fishing on a given vessel. The LPTS is a telephone survey that collects data used to estimate the total number of boat trips on which anglers fished for large pelagic species with rod and reel or handline. For-hire HMS vessels are covered by the For-Hire Survey (FHS), and private boats are covered by the LPTS, a biweekly survey. The LPTS covers both commercial fishing by vessels with Atlantic Tunas General category permits and true recreational fishing by vessels with HMS Angling category permits. The LPS estimates total annual catch and harvest per large pelagic species and mode (i.e., private boat or for-hire) by multiplying the average catch rates obtained by the LPIS by estimates of total fishing effort obtained by the LPTS and the FHS. Thus, LPS estimates are extrapolated estimates of catch.

The LPS catch estimates for Sandbar Sharks were reviewed and considered at the SEDAR 101 Data Workshop, but it was recommended that they not be used in the stock assessment. There were two primary reasons for this recommendation: 1) the complete spatial and temporal overlap of the MRIP and LPS, and 2) a change to the LPIS sampling and estimation procedures in 2010 that significantly impacted the survey's time series of Sandbar Shark catch estimates. First, while the LPS conducts more focused sampling on offshore fishing access sites, and limits its effort surveys to HMS permit holders, the states and months covered by the survey are also fully covered by the MRIP surveys. As such, use of the LPS estimates was not required to fill a coverage gap in the estimated recreational

catches. Second, in 2010 the LPIS stopped interviewing fishing vessels with incidental catch of large pelagic fish (i.e., vessels with catch of large pelagics that did not identify any large pelagic species as their target species) (NMFS 2025). This change was made to remove an inconsistency with the sampling procedures of the LPTS, which only collects effort data on vessel trips targeting large pelagic species, that was felt to be a potential source of bias in catch estimation. An examination of the trips intercepted from 2006-2009 with Sandbar Shark catch showed that the plurality (~48%) of them did not list large pelagic species as their primary target species. Approximately 22% of these trips were targeting sharks, while an additional 30% targeted other large pelagics (mostly tunas). While it is believed this change in procedure had minimal effect on catch estimates for most HMS-managed species, it had a significant impact on catch estimates for non-target species such as Sandbar Sharks, which saw their catch estimates drop by 75% or more. Given the overlap of the two survey programs, and the fact that Sandbar Sharks are by definition a non-target species in the recreational fishery given their prohibited status, it was decided by the working group that the MRIP estimates provided a fuller picture of the recreational fishing catches in the region.

The LPS length data obtained for Sandbar Sharks were reviewed and considered at the SEDAR 101 Data Workshop. However, the working group recommended that these specific length data not be utilized for the stock assessment. The primary reasoning behind this decision was the critical lack of sufficient length measurements, with only 14 individual records (n=14) available. Furthermore, the dataset was characterized by extreme temporal sparsity, as data were only collected in 4 years out of the 23-year survey period. This limited sample size and inconsistent sampling across the time series were deemed insufficient to provide a representative biological profile of the Sandbar Shark population for assessment purposes.

3.3.1.4.2 Louisiana Creel Survey

The Louisiana Department of Wildlife and Fisheries (LDWF) began conducting the Louisiana Creel (LA Creel) survey program on January 1, 2014, to monitor marine recreational fishery catch and effort. The program is designed to sample guided (e.g., charter) and unguided (i.e., combined private/shore) fishing modes and is comprised of three separate surveys: an intercept survey, a private telephone/email survey, and a for-hire telephone/email survey. The dockside/shoreside survey is used to collect data needed to estimate the mean numbers of fish landed by species for each of five different inshore basins and one offshore area. The private telephone/email survey samples from a list of people who possess either a LA fishing license or a LA offshore fishing permit and provides a valid telephone number. The for-hire telephone/email survey samples from a list of Louisiana's registered for-hire captains who provided a valid telephone number. Both telephone/email surveys are conducted weekly. Dockside/shoreside discard information has been collected since 2016, but only for a subset of finfish species, which does not include Sandbar Shark. No landings or discards of Sandbar Shark were reported in Louisiana following the transition from MRIP to LA Creel.

3.3.1.4.3 Maryland Department of Natural Resources: Mark Sampson logbooks

Personal logbooks from recreational charter captain Mark Sampson, covering the period from 2007 to 2024, are archived within a Maryland Department of Natural Resources database. While these records were reviewed for potential inclusion during the SEDAR 101 data workshop, the working group ultimately decided to exclude them from the assessment. This decision was made to prevent the data from disproportionately influencing the recreational discard length compositions, as the Sampson logbook contains 18.4% more records ($n = 2,218$) than all other recreational sources combined. Additionally, the Mark Sampson logbook data was limited geographically to Maryland and to one vessel. Length distributions were plotted in Figures 10, 11a, and 22 of SEDAR 101-DW-22 to compare this data to other recreational data sources and no major difference in size selectivity was apparent.

3.3.2 Recreational Landings

3.3.2.1 MRIP Landings

The Southeast Fisheries Science Center used the MRIP and TPWD sample data to obtain an average weight by strata using the following hierarchy: species, region, year, state, mode, wave, and area (SEDAR 32-DW-02). The minimum number of weights used at each level of substitution is 15 fish, except for the final species level, where the minimum is 1 fish (SEDAR 67-WP-06). Average weights are then multiplied by the landings estimates in numbers to obtain estimates of landings in weight. These estimates are provided in pounds whole weight. Uncertainties for average weights were calculated from approach #2 in SEDAR 74-DW-12. All observations of fish weight are averaged at the trip level, from which the mean and standard error of these trip-level summaries are calculated at the same strata used in SEFSC weight estimation (e.g., symsmwa), combined to the year/mode level (e.g., year and mode), and converted to coefficients of variation (CV). These uncertainty estimates for SEFSC average weights are then combined with those landings-in-number (Goodman 1960) as an uncertainty estimate for landings in weight.

Catch Estimates

Final MRIP landings estimates, in numbers of fish, are shown by year and mode in Tables 3.8.1.1-3.8.1.4, for the reference case as well as the alternative cases, and respective associated coefficients of variation by year in Table 3.8.2.

3.3.2.2 TPWD Landings

TPWD average estimates from 1983 to 1985 (by wave and mode) were used to impute missing estimates for Texas charter and private boat fishing from 1981 until the survey started in May 1983. TPWD Sandbar Shark landings estimates calibrated to MRIP-FES units for the private mode (SEDAR 74-DW-10), from 1981 to 2024, are provided in Tables 3.8.3.1-3.8.3.2. These landings-in-number estimates are then multiplied by the corresponding SEFSC average weights to estimate landings-in-weight. Uncertainties for average weight and landings-in-weight are

calculated using the same approach described above for MRIP (approach #2 in SEDAR 74-DW-12).

3.3.2.3 SRHS Headboat Logbook Landings

Final SRHS landings estimates (in number and weight) are shown in Table 3.8.4, respectively. CVs are provided for landings estimates in number of fish and can be used as a proxy for uncertainty of estimates in weight. This would assume there is no additional uncertainty from the average weights calculated from the SRHS dockside biological sampling.

The paper headboat logbook forms have changed multiple times throughout the history of the SRHS. The primary changes have been which species are explicitly listed on the forms, although there have always been blank lines to write in species not listed. Electronic reporting started in 2013, and all species were available for selection.

3.3.2.4 Total Recreational Landings

Combined landings estimates from all sources and each catch scenario, including the reference case and alternative cases, are shown in Tables 3.8.5.1-3.8.5.4, Figures 3.9.3.1-3.9.3.4, and mapped in Figures 3.9.4.1-3.9.4.4. Across all four approaches (i.e., proportioning of Requiem Shark Genus and Requiem Shark Family under the Default State; proportioning of Requiem Shark Genus, Requiem Shark Family, and Unidentified Sharks under Alternative State 2; and reduction of private and shore modes for both approaches under alternative states 1 and 3) the overall pattern in recreational landings was similar. Landings were highest during the early to mid-1980s, with a pronounced peak in 1983, followed by a gradual decline through the late 1990s and early 2000s. Since approximately 2010, landings have remained low. Geographically, most landings come from South Carolina (approximately 25%).

The primary difference among the catch scenario cases was the treatment of unidentified catches and the application of reductions to private and shore mode estimates. Under approach 1 (reference case), the total landings estimate is 2.62 million fish. Allocating catch from the Unidentified Sharks category as an alternative case (approach 2) increased total recreational landings by 204,503 fish, resulting in a total landings estimate of 2.82 million fish. A similar increase was observed after the application of the private and shore mode reductions for both approaches as additional alternative cases. The landings estimate for approach 1 was reduced to 2.16 million fish. Allocating catch from the Unidentified Sharks category under approach 2 produced 169,644 additional fish and total landings estimates of 2.33 million fish.

Across all approaches, the private mode contributed the majority of recreational landings, which accounted for approximately 69-70% of total landings, followed by the shore mode at approximately 27-30%, while the charter and headboat modes together contributed less than 5% of total landings.

Uncertainty

To provide an associated measure of uncertainty for total recreational landings estimates, coefficients of variation (CVs) are calculated from the sum total of variance across all recreational data sources (i.e., SRHS logbook landings, MRIP landings data, and calibrated TPWD landings data). Details of this approach are outlined in SEDAR 68-DW-31 and are applied to estimates of both landings-in-number and landings-in-weight.

3.3.3 Recreational Discards

3.3.3.1 MRIP Discards

Fish reported to have been discarded alive are not seen by MRIP interviewers for the shore, private, and charter, and so neither the identity nor the quantities of discarded fish can be verified. The size and weight of discarded fish are also unknown for these modes of fishing. In the north and mid-Atlantic, APAIS samplers do sample headboats at sea and collect information on species composition, abundance, and size of fish discarded alive (ACCSP 2025). MRIP discard estimates, in numbers of fish, are shown by year and mode in Tables 3.8.1.1-3.8.1.4 and by year in Table 3.8.6.

3.3.3.2 TPWD Discards

Self-reported catch is not monitored by the TPWD survey, and so discards of Sandbar Shark from Texas are not estimated by this survey (SEDAR 70-WP-03). Typically, as a proxy for recreational discards from Texas private and charter boat anglers, discard-to-landings ratios (B2:AB1) are calculated (by year) from Louisiana or Gulf-wide catch estimates and multiplied by TPWD landings estimates. Discard ratios from the LA Creel and MRIP surveys are typically applied to TPWD landings (by year and mode) as a proxy for Texas discards (SEDAR-PW-07).

Recommendation: The working group reviewed the suitability of the LA Creel discards-to-landings ratios for use as a proxy for Texas recreational discards. However, due to their inconsistent nature, they were not suitable for use. Additionally, the working group did not believe a Gulf-wide discards-to-landings ratio was representative of fishing behavior in Texas, as a large portion of discards in the Gulf come from West Florida. As an alternative, the working group explored a Texas landings-to-Gulf landings ratio and a Texas discards-to-landings ratio for data after 2008 using the SRHS dataset. However, neither alternative was viable. Therefore, Texas discards were not imputed and were assumed to be negligible.

3.3.3.3 SRHS Headboat Logbook Discards

The SRHS logbook form was modified in 2004 to include a category to collect self-reported discards for each reported trip. This category is described on the form as the number of fish, by species, released alive and the number released dead. Port agents instructed each captain on the criteria for determining the condition of discarded fish. A fish is considered “released alive” if it is able to swim away on its own. If the fish floats off or is obviously dead or unable to swim, it is considered “released dead.” As of January 1, 2013, the SRHS began collecting logbook data electronically. Changes to the trip report were also made at this time, one of which removed the condition category for discards (i.e., released alive vs. released dead) due to difficulties in

standardizing these determinations. The form now collects only the total number of fish released, regardless of condition. The SRHS discard data provided for this assessment is in total discards for 2008-2024 (Table 3.8.7).

Uncertainty

Uncertainty proxies for SRHS discards between 2008-2024 were calculated using the same methods described in Section 3.3.1.3. Two proxy estimates of uncertainty were developed for consideration in the assessment model: (1) unweighted and (2) weighted CVs scaled according to the relative contribution of combined landings and discards (in numbers) within each state grouping. State groupings included TX, LA/MS, FLW/AL, SEFL, GaNFL, SC, and NC.

3.3.3.4 Total Recreational Discards

Combined discard estimates from all sources and each catch scenario, including the reference case and alternative cases, are shown in Tables 3.8.8, Figures 3.9.5.1-3.9.5.4, and mapped in Figures 3.9.6.1-3.9.6.4. Total recreational discards across each catch scenario are composed of the B2 estimates obtained from MRIP as well as total recreational discards from SRHS. Across all four approaches (i.e., proportioning of Requiem Shark Genus and Requiem Shark Family under the Default State; proportioning of Requiem Shark Genus, Requiem Shark Family, and Unidentified Sharks under Alternative State 2; and reduction of private and shore modes for both approaches under alternative states 1 and 3), the overall pattern in recreational discards was similar. Discards increased in the mid-1990s to early 2000s and have remained high in recent years. Geographically, most discards were higher in the Atlantic than in the Gulf across all approaches, with the Atlantic accounting for approximately 60-67% of total discards. The largest state contribution came from Florida West, which accounted for approximately 20-23% of total discards across the alternative cases.

Similar to the recreational landings, the primary difference among the catch scenario cases was the treatment of unidentified catches and the application of reductions to private and shore mode estimates. Across the reference cases and the alternative cases, the majority of the recreational discards came from the private and shore modes. Under approach 1, total recreational discards were approximately 23.23 million fish, with most discards from the private mode (14.65 million fish) and shore mode (8.11 million fish). Allocating catch from the Unidentified Sharks category under approach 2 increased total discards by approximately 3.57 million fish, resulting in 26.80 million total discards. Application of the private and shore mode reduction decreased total discards by approximately 3.95 million fish under approach 1 and 4.48 million fish under approach 2, resulting in total discard estimates of 19.28 million fish and 22.32 million fish, respectively.

Uncertainty

Uncertainties for total recreational discards-in-number are calculated using the same approach as that described above for total recreational landings (in Section 3.3.2.4).

3.3.4 Recreational Effort

3.3.4.1 MRIP Effort

MRIP effort estimates are produced via the Fishing Effort Survey (FES) for private/rental boats and shore mode and the For-Hire Survey (FHS) for charterboat and headboat modes. MRIP effort is calculated in units of angler trips, which represents a single day of fishing in the specified mode that does not exceed 24 hours, and is included in the year and mode summaries provided by Tables 3.8.1.1-3.8.1.4.

3.3.4.2 TPWD Effort

Texas effort estimates (in angler trips) are provided by TPWD for the years 1983-2024. TPWD average estimates from 1983 to 1985 (by wave and mode) were used to impute estimates for Texas charter and private boat fishing from 1981 until the survey started in May 1983. These estimates are included in Tables 3.8.3.1-3.8.3.2, which summarizes effort by year and mode and includes the calibration of TPWD private effort estimates into MRIP-FES units (SEDAR 74-DW-10).

3.3.4.3 SRHS Effort

Effort data from the SRHS is self-reported by headboat captains as the number of anglers on and the duration of a given trip in their logbooks, which is standardized to “angler days” based on the length of the trip (e.g., 40 anglers on a half-day trip would yield $40 * 0.5 = 20$ angler days). Angler days are summed by month for individual vessels. Each month, port agents collect these logbook trip reports and check for accuracy and completeness. Although reporting via the logbooks is mandatory, compliance is not 100% and is variable by location. To account for non-reporting, a correction factor is developed based on sampler observations, angler numbers from office books, and any available information. This information is used to provide estimates of total catch by month and area, along with estimates of effort.

SRHS effort estimates (in angler days) are provided in Tables 3.8.9 and 3.8.10 and Figure 3.9.7. Estimated headboat angler days have decreased in recent years.

To standardize recreational fishing effort, SRHS effort estimates are also provided in the coarser units of angler trips to match estimates provided by the MRIP and TPWD surveys. Monthly estimates of angler trips are calculated as the product of the reported number of anglers and ratios for the estimated number of total trips to the reported number of total trips.

3.3.4.4 Total Recreational Fishing Effort

Combined effort estimates from all sources in angler trips are shown in Table 3.8.11, Figure 3.9.8, and mapped in Figure 3.9.9. These effort estimates depict all recreational fishing activity and are not specific to Sandbar Shark. Effort estimates have steadily increased between the early 1980s and mid-2000s and have since remained consistently high. The majority of the recreational effort comes from the shore mode (61%). Geographically, recreational effort is higher in the Atlantic compared to the Gulf, with the Atlantic accounting for 56.5% of total angler-days and

the Gulf accounting for 43.5%. At the state level, the largest contribution came from the Florida West-Alabama area, which accounted for 30.3% of total angler days, followed by SFL at 27.3%.

3.3.5 Recreational Biological Sampling

3.3.5.1 Recreational Biological Sampling - Landed Fish

3.3.5.1.1 MRIP Biological Sampling

The Marine Recreational Information Program (MRIP) Access Point Angler Intercept Survey (APAIS) is designed to sample recreational fishing trips immediately following their completion. During these dockside interviews, field staff measure up to 15 individual specimens of each landed species per angler. Measurements recorded for sharks include the individual fork length to the nearest millimeter. Additionally, when feasible, the weight of the fish is recorded in kilograms. Due to concerns regarding the potential introduction of sampling bias, biological samples such as aging structures are not collected during MRIP assignments. Additionally, the APAIS does not record size information for discarded fish.

For data related specifically to Sandbar Sharks sampled by MRIP in the Atlantic Ocean and Gulf of America, length summaries are provided in Figure 10 and 11a of SEDAR101-DW-22. Further details regarding the specific number of Sandbar Shark length samples collected ($n = 1,754$) by MRIP can be found in Tables 2 and 3 of SEDAR101-DW-22.

3.3.5.1.2 TPWD Biological Sampling

Texas Parks and Wildlife Department (TPWD) has routinely collected length composition data from Texas sport-boat anglers since 1983, specifically during the months of April through October. As part of TPWD dockside interviews, interviewers measure every fish of a particular species up to a count of six. If more than six fish are present, a random sample of six individuals is selected for measurement. Size data is recorded as maximum total length, measured to the nearest millimeter by compressing the upper caudal fin dorsoventrally. Summaries of the number of Sandbar Sharks measured by the TPWD ($n = 52$) are included within the MRIP data summaries found in Tables 2 and 3 of SEDAR101-DW-22.

3.3.5.1.3 SRHS Biological Sampling

Southeast Region Headboat Survey (SRHS) dockside sampling has been operational in the Gulf of Mexico since 1986 (with Mississippi sampling commencing in 2010) and along the Atlantic coast since 1988. During these surveys, interviewers record fork length and natural total length to the nearest millimeter, while whole weight is documented in grams.

Comprehensive data regarding the specific number of Sandbar Sharks sampled for length by the SRHS ($n = 105$) can be found in Tables 2 and 3 of SEDAR101-DW-22. Length frequency histograms detailing the distribution of Sandbar Sharks sampled by SRHS port samplers are available in figure 10 and 11a of SEDAR101-DW-22.

3.3.5.1.4 Length Frequency Distributions of Recreational Landings

Length data from the recreational fisheries of the Gulf of America and the Atlantic Ocean are collected by multiple federal surveys (MRIP and SRHS) and state agencies. Length-frequency distributions showed that mostly immature individuals are caught as determined by comparing to the median sizes at maturity for males and females (142.87 and 147.26 , respectively; SEDAR 101-DW-27). Detailed length sample sizes across all contributing data sources are cataloged in Tables 2 and 3 of SEDAR101-DW-22. To visualize these data, the distribution of length measurements categorized by their specific survey source is presented in Figure 10 and 11a, while the length distributions categorized by fishing mode (such as private boat or for-hire) are illustrated in Figure 11 and 12 of SEDAR101-DW-22. Furthermore, yearly length density curves and yearly cumulative size distributions were developed to illustrate spatial and temporal variations by region and fishing mode, which can be reviewed in figure 18,18a, and 19 of SEDAR 101-DW-22 and Figure 3.9.10 in Section 3.9.

3.3.5.1.5 Aging Data

Age composition data for Sandbar Shark were considered at the SEDAR101 data workshop. While SRHS port samplers do collect ageing structures (e.g. otoliths, spines) from several finfish species, ageing structures are not sampled from sharks and because the MRIP APAIS samplers do not collect age samples, catch-at-age information remains unavailable through recreational dockside sampling. Consequently, age compositions were not utilised in the assessment because the lack of direct biological sampling prevents the conversion of length-frequency data into reliable age-based metrics for the recreational sector.

3.3.5.2 Recreational Biological Sampling - Discarded Fish

3.3.5.2.1 For-Hire At-Sea Observer Biological Sampling

MRIP Headboat Survey

In states where MRIP produces headboat catch estimates (ME-VA), APAIS samplers board randomly-selected headboat vessels with permission from the captain and observe anglers as they fish on the recreational trip. The APAIS samplers record the length of the trip and area fished (e.g. inland, state, or federal waters) for all trips. For trips with only a few anglers, APAIS samplers will monitor the discards from all anglers. For trips with a large number of anglers, the APAIS samplers select a sub-sample of anglers and monitor their catch for discards. Data collected from the discarded fish includes the species, number, final disposition, and size. APAIS samplers will also collect data on the species composition, number, and size of the harvested fish (ACCSP 2025). Collecting the information on discarded fish is the priority of the APAIS samplers and information on the harvested fish is not always recorded if the sampler does not have time to accurately record information on both harvested and discarded fish.

An observer survey for the recreational headboat fishery was launched in NC and SC in 2004 and in GA and FL in 2005 to characterize the size distribution of live discarded fish. While MRIP does not produce headboat catch estimates in the South Atlantic, MRIP does provide the headboat sample assignment draws and the state APAIS samplers follow the Northeast Region (ME-VA) APAIS headboat procedures. The South Atlantic states decide on sample sizes and sample allocations and this work is funded separately by the states, independent of APAIS sampling of shore, private, and charter modes (J. Foster, personal comm 2025).

FL For-Hire Observer Survey (Headboat and Charter)

In 2011, a Florida FWC led observer project was expanded to the Atlantic coast and replaced the MRIP Headboat Survey, effectively expanding the sampling coverage by increasing trip coverage and incorporating for-hire charter trips. This transition from MRIP to the state survey began in the Gulf in 2009 and resulted from changes in funding and opportunity to enhance and refine the focus of discard-oriented observer methods. The new observer survey provides more detailed information on the size and condition of discarded fish. For-Hire vessels are randomly selected each week from a list of participating vessels in each region statewide. Selected vessels are contacted in advance to schedule trips during the selected week and availability is based on vessel capacity and trip demand. Participating vessel operators permit up to two FWC biologists to board during a scheduled trip, and captains and mates actively assist biologists by permitting them to observe and collect data from fish as they are removed from anglers' gear and before fish are released or placed in the fish box. Vessel operators also provide biologists with information on depth and area fished (commercial statistical area and degrees and minutes latitude and longitude) for each fishing station during each observed trip. For each fish, biologists record the species, number, disposition, size (fork length in mm), hook location, and the condition of fish that were released. Additionally, a subset of anglers is tracked by the biologist(s) for the entirety of the trip. For these anglers, hook type, hook size, and fishing time are recorded for each station and all fish that they catch. These methods are consistent for both the charter and headboat modes in Florida.

Return 'Em Right

In 2022, the Return 'Em Right program began in Florida, Alabama, and Mississippi. Return 'Em Right is an ongoing program where at-sea observers sample both headboat and charter trips.

3.3.5.2.2 Length Frequency Distributions of Recreational Discards

From 2004 to 2023, 107 lengths are available from discarded Sandbar Sharks in eight states ranging from New Jersey to Florida (Table 3.8.12). The majority of lengths are from Virginia. No lengths are available north of New Jersey or from the Gulf of America and no lengths were available from any state in 2024. All discard lengths are from the headboat mode.

Nominal discard length compositions were requested with 2 cm, 5 cm, and 10 cm bins. The bin label represents the bin floor. The length type used for the discard length compositions was fork length. This is the length unit that is recorded by APAIS and FL at-sea samplers. Since sample sizes are low, the discard lengths were pooled into two time blocks for analysis. The time blocks are from 2004-2007 and 2008-2023. These time blocks were chosen because they pool the lengths into pre-closure and post-closure time blocks.

Discard length compositions are shown in Figures 3.9.11-3.9.13. There is no clear pattern between the discard length distributions between the two time blocks. There is an increase in the number of larger fish discarded in the later time block after the closure in 2008. However, there are no smaller Sandbar Sharks discarded during this time period, so it is unclear whether observed differences are indicative of a true trend or the result of low sample sizes.

3.4 COMMERCIAL STATISTICS

3.4.1 Commercial Data Sources

Commercial landings were compiled using several data sources: PDC (Pelagic Dealer Compliance, referred to as QMS in previous data workshop papers), eDealer, the Atlantic Highly Migratory Species (HMS) Division's electronic collection program for HMS commercial landings, ALS (Accumulated Landings System, referred to as general canvass data in earlier data workshop papers for commercial catches), and the FIN (Fisheries Information Network) databases – GulfFIN (Gulf Fisheries Information Network) and ACCSP (Atlantic Coastal Cooperative Statistics Partners). Various observer programs were used to inform decisions related to commercial landings as well as estimates of bycatch of Sandbar Sharks.

3.4.1.1 Pelagic Dealer Compliance Data

The PDC program began in 1993 and was maintained by staff at the Southeast Fisheries Science Center. It was first referred to as the Swordfish Dealer Compliance (1993-1997), and later as the Quota Monitoring System (1997-2002). This program ended in mid-2013 and was replaced by the Atlantic Highly Migratory Species (HMS) Division's eDealer reporting system, maintained by Atlantic HMS Division staff.

PDC data were collected by the SEFSC from dealers located in the southeast region (North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, Puerto Rico, and the U.S. Virgin Islands) who maintain a federal HMS dealer permit [Atlantic sharks and/or Atlantic swordfish issued by SERO, and/or Atlantic tuna in the BAYS group (bigeye, albacore, yellowfin, and skipjack) issued by NERO]. Dealers must have a federal permit in order to purchase these species from federally permitted vessels. Federally permitted dealers were required to submit landings reports of their purchases for any species in the HMS management groups purchased from U.S. vessels fishing in the Gulf of America and/or Atlantic Ocean (including adjoining state waters) on the "Dealer Reporting for Highly Migratory Species" form (OMB#0648-0040). Reports were summarized by species and were submitted

twice a month within 10 days of each reporting period (by the 25th for the period from the 1st to the 15th; and by the 10th for the period from the 16th to the end of the month). All dealers with one or more of these HMS permits were selected to report.

Data collected for the PDC include federal permit number(s), dates of the reporting period, species purchased (if any), total dressed weight for each species over the reporting period, price paid per pound for those species on the last day of the reporting period, names and identification numbers of the vessel(s) from which HMS products were purchased, and the vessel's date, port and state of landing. If no HMS transactions were conducted during the reporting period, a report indicating this was still required. All submitted reports were date-stamped with the date received, and then both visually and electronically checked for potential errors before the data were transferred into master Oracle tables. The PDC database contained a higher degree of species-specific shark landings than the data collected in the Accumulated Landings System (ALS; discussed below). Landings data were received within one to twenty-five days of purchase, which is sufficient for quota monitoring purposes.

Despite the enhanced information on shark species composition and timeliness of the data, some limitations existed with the PDC data. For example, although a federal HMS permit is required for dealers to purchase sharks from federally permitted vessels, it is not required for dealers purchasing sharks from vessels that fish only in state waters (i.e. no federal permit). Therefore, this database does not represent total shark landings, but should represent all shark landings made by a majority of shark dealers. During the PDC data collection period, Atlantic coast states (e.g., Florida and states managed by the Atlantic Fishery Management Council) began to adopt changes to their regulations requiring all state dealers who purchase sharks to obtain a federal shark permit regardless of the area where the shark was caught (state or federal waters). Due to the summary nature of the reporting form, precise locations of landed sharks cannot typically be determined, nor can any information be determined concerning the areas of catch of the HMS species. Because catch locations are unknown, shark landings are reported to the HMS Division by the state where the dealer's facility is located rather than the actual landing location. The state of Florida is split into East Coast, West Coast, and Inland, and sharks purchased at dealer facilities in the Florida Keys are assigned to the West Coast (and thus the Gulf of America). Price per pound and vessel information is not submitted by all dealers, and gear information is not collected. No enforcement process existed for non-compliant (under- or non-reporting) dealers; therefore, despite measures that are taken to encourage compliance, some under-reporting of shark landings was likely, especially for historical records.

3.4.1.2 Electronic Dealer Reporting System Data

The eDealer program began in 2013 and is maintained by staff at the Atlantic Highly Migratory Species (HMS) Division. Similar to the PDC program it replaced, the eDealer program is used to monitor quotas with data submitted on a weekly basis through existing electronic state and federal pathways. The eDealer program pulls in all federally submitted Atlantic non-Bluefin

Tuna (BFT) HMS landings from other electronic dealer reporting systems from Maine to Texas, including the U.S. Caribbean. These programs include the Atlantic Coastal Cooperative Statistics Program's Standard Atlantic Fisheries Information System (SAFIS), dealer reporting programs from Maine to Virginia, South Carolina, and Georgia; file upload programs by large dealers in the Northeast with their own proprietary software, state trip tickets programs, and an HMS-specific data entry program for Caribbean dealers. The eDealer database provides one complete dataset for all electronically submitted Atlantic non-BFT HMS dealer data. Dealer reported BFT data are housed in a separate database.

NOAA Fisheries regularly cross-validates information like fish weights and purchase dates provided in dealer reports with those provided in logbooks from those HMS fisheries that require logbooks and weigh-out slips, to ensure all HMS fish have been reported. When discrepancies are found, NOAA Fisheries works to ensure the fish are correctly entered in the appropriate dealer reporting system and/or in the logbook report.

3.4.1.3 General Canvass Data in the Accumulated Landings System (ALS)

The ALS is a regional database for landings statistics for the southeast region (excluding Puerto Rico and the US Virgin Islands), and has been maintained by NOAA Fisheries and its predecessor since the early 1960s. Historically, landings information was collected by field agents stationed at fishing ports throughout the southeast. Beginning in 1985, states began implementing trip ticket programs, with all eight southeastern coastal states (from Texas to North Carolina) maintaining such programs by 2005. Through these state programs and because of previous cooperative agreements, the SEFSC continues to receive landings data (summarized, see below) from the respective state agencies and stores these data in the ALS. States require all seafood dealers to maintain licenses, therefore all seafood dealers, not only those with federal permits for sharks, report to the states. This program was also known in the past as southeast general canvass, which includes some landings back to 1926.

A trip ticket is a record completed by the dealer, which lists information about the marine resources landed/sold per fishing trip. It is submitted to the state where the landing occurred and/or where the dealer is located, dependent upon the state's regulations. These tickets include data on dealer name and license number, species, weight (dressed or whole), fishing location, gear, price per pound, vessel name and identification number, date of landing, and state of landing. Prior to each state implementing trip tickets, information on gear and fishing location was solely estimated by the port agent, eventually graduating to reports submitted directly by dealers. Trip information, such as fishing location and gear, was summarized for the entire trip. Additionally, this information is not always supplied or may be estimated by the dealer, who must get this information from the vessel. For this reason, port agents remain involved in assessing accuracy of trip ticket data; however, even this information may be

estimated and thus not always accurate.

Trip ticket data from each state are summarized by species, dealer, month, gear, fishing area, and state of landing prior to submitting to ALS. Although shark landings are reported to states in dressed weight, all weight information contained within ALS is whole weight. Therefore, each state first converts their data to whole weight before submitting to SEFSC. Most states use a conversion of 1.39 for shark landings; however, North Carolina began using a conversion factor of 2.0 for sharks in 1994 and Alabama used a factor of 1.60 prior to 2002. Various individuals within the SEFSC, primarily port agents, are responsible for coordinating the transfer of data from the respective states fisheries data collection program to the SEFSC.

The ALS data represent total landings from all licensed seafood dealers located in the southeast region for all commercially important marine species over a long period of time, but several caveats should be noted. The most notable drawback to ALS for shark stock assessment purposes is the high degree of reported “unclassified sharks” (rather than to species) on state trip tickets, particularly for the earlier part of the time series. This may stem, at least in part, from the fact that prior to July 2008, sharks were mostly landed as “logs”, i.e. gutted, with fins and heads removed, making species identification difficult. Recent regulatory changes (federally required in 2008, state required in 2008-2009) now require fins to remain attached to sharks through landing. Another deficiency of the system, particularly for quota monitoring purposes, was the time that elapsed between landings and the availability of the data coupled with the lack of compliance for submitting landings of all purchases. Although trip tickets were required to be submitted generally by the end of the next month following a transaction (the submission date may vary slightly by state), an average lag of three to six months exists between report submission by the dealers to the state and data availability to the SEFSC. Some data from states are available to the SEFSC in as few as two months, while others have taken as long as 18 months. It should be noted that due to confidentiality agreements, North Carolina dealers are not identifiable in ALS, and thus landings by these dealers cannot be compared between federally collected and state collected data to remove duplicate landings. Finally, landings within ALS with a state of landing recorded as ‘00’, typically indicate the landings occurred in Florida but were transported to another state and will be reported by that state.

3.4.1.4 Gulf Fisheries Information Network Data

The Gulf Fisheries Information Network, or GulfFIN, is a state-federal cooperative program to collect, manage, and disseminate self-reported statistical data and information on the marine and estuarine commercial and recreational fisheries. It includes data for the states from Texas to Florida with the addition of some landings data from Puerto Rico beginning in 1985.

Commercial data in GulfFIN include landings by both state-only licensed dealers (purchasing fish caught within the Exclusive Economic Zone) and federally permitted dealers (purchasing fish caught outside the Exclusive Economic Zone). This program originally housed data

collected by the states through paper trip tickets, but information is now collected from dealers through both paper and electronic methods.

When combined with the Atlantic Coastal Cooperative Statistics Program data, GulfFIN information reflects landings across all states from Maine to Texas.

3.4.1.5 Atlantic Coastal Cooperative Statistics Program Data

The Atlantic Coastal Cooperative Statistics Program, or ACCSP, is the Atlantic coast complement to GulfFIN. The ACCSP integrates all fisheries-dependent data, including state and federal reports from seafood dealers, who purchase fish in both state and federal fisheries, vessel data, and recreational data. The program covers landings from Maine to Florida. The ACCSP database contains data since 1950 for HMS; however, not all data are reported to species or were required to be reported with the same data elements that are now collected. Some historical landings from the general canvass data in ALS also exist in the ACCSP database.

Like GulfFIN, data were originally collected via paper methods through state programs and now are collected either solely through electronic submissions or through a combination of paper and electronic methods. Data undergo a series of quality control measures prior to being made available to the public.

When combined with GulfFIN data, ACCSP information mainly reflects trip ticket landings across all states from Maine to Texas.

3.4.1.6 Northeast Fisheries Observer Program Biological Sampling

The Northeast Fisheries Observer Program (NEFOP) operates from North Carolina to Canada, deploying scientists on commercial vessels to document catch and discard data. While Sandbar Sharks were historically targeted in this area, they have been prohibited since 2008; nonetheless, they continue to be caught as bycatch as far north as the Gulf of Maine. Commercial gillnet and trawl fishery records from 1995 through the 2024 terminal year provided data on the number of sharks captured, their fork length (cm), gear type, haul duration, and environmental factors such as water temperature, location, and target species.

3.4.1.7 Pelagic Longline Observer Program

In 1992, NMFS established a scientific sampling program for the U.S. large pelagic longline fleet. This initiative was initially mandated under the U.S. Swordfish Fisheries Management Plan and was later integrated into the 1998 Atlantic Highly Migratory Species Plan. To ensure rigorous data collection, trained scientific observers are deployed aboard commercial vessels participating in the Atlantic Pelagic Longline fishery. The SEFSC Pelagic Observer Program (POP) is responsible for training these observers to document comprehensive data on fishing effort (gear characteristics, location, gear set and haul times) and catch (length, weight, sex, and species identification). Observers measure or estimate the fork length and stretch total length of captured sharks to the nearest centimeter. The

program also facilitates the collection of biological samples, such as vertebrae, stomachs, and reproductive tracts, to support research into fish biology and life history. Notably, in 1999, the POP expanded its scope to include the collection of vertebral centra from shark species to aid in age and growth studies.

3.4.1.8 Reef Fish Observer Program

In 2006, in collaboration with the commercial fishing industry and the Gulf Fishery Management Council's (GFMC) reef fish management plan, SEFSC implemented a mandatory observer program to characterize the commercial reef fishery operating in the U.S. Gulf of America. This program was designed to provide critical data on the interaction between commercial fishing operations and various marine species, particularly focusing on the reef fish complex. The primary gears utilized in this fishery include bottom longlines and vertical longlines. While the predominant target species for this fishery are groupers and snappers, Sandbar Sharks are frequently captured as bycatch. Observers collect detailed morphometric data on all fish captured in this fishery. Measurements are recorded from captured sharks as straight-line fork length to the nearest centimeter. In instances where a direct measurement is not feasible due to environmental conditions or animal handling constraints, the fork length is estimated to the nearest centimeter. Information on the shark's status and sex is also recorded.

3.4.1.9 Southeast Gillnet Observer Program

Initiated in 1992, observer coverage for the Florida-Georgia shark gillnet fishery has tracked extensive shifts in effort, gear specifications, and target species resulting from various regulatory changes. The program grew in 2005 to encompass all vessels utilizing sink gillnets that held active directed shark permits, including those previously exempt because they targeted non-highly migratory species or did not use drift or sink methods. This expansion aimed to assess the impact on shark populations even when they were not the primary target. By 2006, at the request of the NMFS Southeast Regional Office, coverage was further extended to include all gillnet-fishing vessels across their entire geographic range in the Southeast U.S., regardless of their target species. Observers collect morphometric data on landed species, recording sex and measuring fork length to the nearest centimeter; lengths are estimated when direct measurement is not possible.

3.4.1.10 University of Florida Bottom Longline

The University of Florida established a voluntary observer program for the commercial shark bottom longline fishery in 1994, managing data collection through February 2005 before transferring responsibility to SEFSC. The program's geographic scope included the Gulf of America and the Atlantic Ocean up to the Mid-Atlantic Bight. Observers documented catch and effort for longline sets targeting coastal sharks, recording the sex, maturity state, and fork/total length of captured individuals. Lengths were measured to the nearest centimeter whenever possible or estimated when direct measurement could not be performed.

3.4.1.11 Shark Bottom Longline Observer Program

The Shark Bottom Longline Observer Program (SBLOP) monitors catch, bycatch, and discards within the shark bottom longline fishery across the Gulf of America and the South Atlantic Ocean. Originally managed by the University of Florida, the program's oversight was transferred to SEFSC in 2005. The selection process involves a random draw of vessels from a designated pool each trimester. This pool was broadened in 2006 to include all bottom longline vessels, irrespective of whether they are specifically targeting sharks. During monitoring, observers document the species identification, sex, and length of every organism. For landed sharks, fork length is recorded as a straight-line measurement to the nearest centimeter. In cases where the organism is not brought on board, observers provide an estimated fork length, also to the nearest centimeter. Observers are able to opportunistically collect biological samples, such as vertebrae, stomachs, and reproductive tracts, to support research into fish biology and life history.

3.4.1.12 Shark Research Fishery

To facilitate the collection of life history and catch data for future stock assessments, NOAA Fisheries established the shark research fishery in 2007 through amendments to the Consolidated Atlantic HMS Fishery Management Plan. This initiative was specifically designed to address the protected status of Sandbar Sharks, whose low population estimates necessitated strict management while still allowing for the gathering of essential scientific data. Each year, a limited number of commercial shark vessels are selected to participate, and they are uniquely permitted to land Sandbar Sharks, which are otherwise prohibited for commercial take. Participation requires mandatory observer coverage on 100% of all research trips. The operational regulations for these trips have evolved to improve data quality and reduce waste. In 2012, the HMS Management Division mandated that fishers land all shark species legal under a directed permit, including Sandbar Sharks, unless the specimens could be released alive, thereby minimizing the unnecessary discard of dead sharks. The sex and fork length (to the nearest centimeter) for every shark captured is recorded; if a direct measurement is not possible, the length is estimated. Observers systematically sample every "nth" specimen for biological data, though they maintain discretion to adjust this frequency based on catch rates, vessel conditions, and weather. Recent efforts have intensified the collection of vertebrae and reproductive tissues to maintain a robust time series of age distribution and to provide critical inputs for upcoming stock assessments.

3.4.2 Commercial Landings

3.4.2.1 Data Assemblage for U.S. Commercial Landings

Commercial landings were compiled from 1950 through 2024 for the Gulf of America and Atlantic Ocean regions. Sources for landings included general canvass data in the Accumulated Landings System (ALS), the Atlantic Coastal Cooperative Statistics Program (ACCSP), Gulf

Fisheries Information Network (GulfFIN), the SEFSC's Pelagic Data Compliance (PDC) program, and the Atlantic Highly Migratory Species Division's eDealer reporting program.

Data sources were compiled as described in the SEDAR 101 DW-28, with the initial step of integrating FINS data (GulfFIN and ACCSP) with ALS data, where FINS data was given precedence after the implementation year of each states' electronic trip-level dealer reporting program. Following the consolidation of these two sources, the data were compared to the HMS eDealer data, where eDealer data were preferred after a state discontinued their paper reporting collections. The time periods for each data source by state is presented in Table 3.8.13.

Landings data contained in the PDC database supplemented this consolidated data from 1994 to 2012 to create the species assemblages used in apportioning reports of unclassified sharks (see Section 3.4.2.2, below).

Regions are assigned to Gulf of America, South Atlantic, and North Atlantic regions based on catch location. The boundary between the Gulf of America (GOA) and the South Atlantic (SAT) is defined in the Code of Federal Regulations § 635.27(b)(1) as "a line beginning on the East Coast of Florida at the mainland at 25°20.4' N lat., proceeding due east. Any water and land to the south of that boundary is considered, for the purposes of setting and monitoring quotas, to be within the Gulf of America region." The boundary between North Atlantic (NAT) and South Atlantic regions is generally considered to be the state line between North Carolina and Virginia, with catch off the coast of Virginia and north to be in the North Atlantic, and catch off of North Carolina and waters south to be in the South Atlantic. Area codes used in the FINS data, however, do not align with state boundaries, and as such, a small portion of the waters off of the northern portion of North Carolina are included with the North Atlantic region. If area information was not available, then the state of landing was used to identify the region. In cases where the state of landing was not available, such as in PDC, then the location of the dealer fish house was used.

Gear groups were assigned to the gears reported in the shark landings data. These category types were examined to identify the main gear types used in sandbar landings and to further minimize the number of categories used in further analyses. The details of gears included in each gear group are described in the working paper, S101-DW-28. In summary, all gears were grouped into the categories listed here: LONG LINES, GILL NETS, HANDLINE, TRAWLS, and OTHER GEARS.

Prior to defining the shark species assemblage for unclassified apportionment, reports of dogfish sharks were removed from the entire data set. Dogfish sharks make up a majority of the landings beginning in 1981, which is well before species-specific reporting of other sharks (1994). Early Shark Evaluation Workshops (SEW) and SEDAR assessments, including SEDAR 11 for

Sandbar Shark, also excluded dogfish sharks prior to apportionment but included dogfish sharks in the assemblage for the state of North Carolina. The next Sandbar Shark assessment, SEDAR 21, appears to have excluded dogfish sharks prior to species assemblages calculations.

Recommendation: The workgroup recommends the removal of dogfish shark landings prior to the creation of species assemblages. This recommendation was approved by the plenary.

3.4.2.2. Unclassified Sharks in U.S. Commercial Landings

Unclassified shark reporting codes. Unclassified sharks have been reported in the landings data through a variety of codes, including general sharks, family Carcharhinidae, genus *Carcharhinus*, “large coastals”, “small coastals”, and “pelagics”. Issues surfaced at using these unclassified shark reports at face value. Not all of these unclassified codes were available in each of the data sources, their use was inconsistent across states, nor were the same unclassified shark codes available for the entire data series within a data source. Concerns were also expressed by the Catch Working Group that the available unclassified shark codes could have been used incorrectly. Points brought forward included the likelihood for young, large coastal sharks to be reported as unknown “small coastals”, as well as questioning the accuracy of sharks being reported as part of the Carcharhinidae versus *Carcharhinus*. To further complicate the reliability of these codes, three of these unclassified shark species codes were reassigned in 2013 to represent general shark fin species and general shark bellies. Therefore, it was decided to combine reports of all unclassified shark variations into a single type of “Unclassified shark” before allocating to species-specific landings.

Recommendation: The workgroup recommends combining all codes of unclassified sharks into a single “unclassified shark” group. This decision was approved by the plenary.

Strata for unclassified shark landings allocations. The methodology for apportioning unclassified sharks was reassessed for SEDAR 101. Previous shark assessments involved various methods of proportional allocation which were not considered in recreating the landings series (see SEDAR101-DW28 for more information on previous methods). Instead, factors regarding species-composition, gear information, and catch areas from commercial landings and shark observer data were investigated to determine alternative methods of allocating unclassified shark landings for the entire time series.

Landings data, beginning in 1999, show a sharp decrease of unclassified reporting and an increase of species richness, where total species-specific reporting increases to over 75% of the annual landings and more than three-quarters of the dealers reporting to species. This increase in specificity is in conjunction with the shark regulations in the FMP for Atlantic Tunas, Swordfish, and Sharks, which were implemented that year and added 14 species to the prohibited list. Prior to 1999, a second period of time was observed from 1994-1998 where species-specific reporting

first began in earnest, in conjunction with the 1993 Fisheries Management Plan for Sharks of the Atlantic Ocean. Thus, the Catch WG proposed to handle unclassified sharks in three time periods: 1999-terminal year; 1994-1998; initial year-1993.

Shark species diversity was noted in the landings by both states and regions and both were investigated as potential strata for unclassified landings allocation. As species-specific information was absent entirely from some states in some time-periods, and the state information available in the PDC data represents the location of the fish house, rather than the location of landing (more noticeable with dealers in the state of Florida), using 'region' rather than 'state' provided increased accuracy of species assemblages. Regional differences between the North Atlantic and South Atlantic regions were observed with higher landings of pelagics reported in the North Atlantic and higher landings of small coastal sharks reported in the South Atlantic. Differences in species assemblages were investigated between the eastern and western halves of the Gulf of America, however significant differences were not observed. Thus, three regions (North Atlantic, or NAT, South Atlantic, or SAT, and Gulf of America, or GOA) were used for defining species assemblages.

Landings data from 1999-2024 contain high proportions of species-specific reporting for apportioning to species by year, gear, and region, and since 2010, reports of "unknown" sharks account for 0% to less than 1% of the total commercial landings. Landings prior to 1999, however, lack sufficient species-richness to be used for allocations on an annual basis. A time period of data with sufficient species-richness, accurate species information, and landings representing the earlier time period (prior to regulations affecting shark catch) was needed to apply to landings data prior to 1999. A point was raised by a member of the commercial fisheries that accurate reporting to species was not as high of a priority at that time and the species-specificity reported in the data may not be representative of the catch. Since observer data from the Bottom Long Line Observer Program has included species-level catch information of sharks since 1994, comparisons of species-composition profiles between the two datasets were examined for the possibility of applying observer species assemblage proportions to the commercial shark landings data prior to 1999, under the assumption that data recorded by observers would provide more accurate species identification and reporting than the submitted landing records. For the comparison, commercial landings data were restricted to sharks reported in the same fishing areas and with the same gears as covered by the observer program. In the South Atlantic region, the comparison revealed similar species diversity between observer and landings data, however the proportions of species differed with greater proportions of sandbar and dusky sharks in the observer data (n=496 observed trips), and greater nurse and mako sharks in the commercial landings data. In the Gulf of America, higher proportions of blacktips, bulls and nurse sharks were recorded in the observer data (n=73 observed trips), and greater Sandbar Sharks in the landings data; however the low number of observed trips was a concern for these data sets to be comparable. No trips were observed in North Atlantic region catch areas for this

time period. The comparison of these data sources is provided in Figure 3.9.14. Due to the gears and geographical areas observed covering only a subset of the total gears and areas reported in the commercial fishery and the observer program was voluntary at that time, it was decided the observed species assemblages from these years was not sufficient to represent the species assemblages of the gears and regions covered by the commercial landings. Instead, the species assemblages reported commercially, from the years 1994-1998 for the reasons described above, would be combined and applied to the annual reports of unclassified sharks prior to 1999, by gear and region information.

In summary, for the years prior to 1999, it was decided to use the 1994-1998 species assemblages and apply those proportions by region and gear to the unclassified landings totals from 1950 to 1998. For unclassified landings reported from 1999 to the terminal year, annual species assemblages by region and gear were used to apportion all unclassified sharks to species.

Recommendation: The workgroup recommends the following methodology for apportioning unclassified sharks. This recommendation was approved by the plenary.

- a. Shark landings from 1999-2024 contained high species-specific reporting for apportioning to species by year, gear, and region. Therefore unclassified sharks during this time were apportioned from annual species-assemblages by gear and region.**
- b. Shark landings from 1994-1998 did not contain sufficient species-specific reporting to apportion unclassified sharks to species by year, gear, and region. Therefore, species-assemblages by gear and region from 1994-1998 were combined and applied to the unclassified shark landings for this time frame.**
- c. Shark landings from 1950-1993 contained little to no species-specific reporting. Species assemblages from 1994-1998 were applied to unclassified landings prior to 1994 by gear and region.**

3.4.2.3 Uncertainty for U.S. Landings

No measure of variance can be calculated for commercial landings, however, the uncertainty of the data was addressed using methodology presented in SEDAR 68 - GOM Scamp (SEDAR 68; pers comm. S Atkinson, M. Pawluk). Uncertainty estimates were high when unclassified shark landings were common, reporting for both state and federal waters was considered incomplete, and/or data quality controls were not common. Confidence in the data increased as species-specific reporting regulations were implemented, state and federal reporting programs switched from paper data collections to electronic reporting programs, reporting compliance methods and/or quality assurances and control processes were incorporated into systems. Data uncertainties are presented by year ranges and data sources in Table 3.8.14, and should be treated as CVs for the model.

Recommendation: The workgroup recommends the uncertainty estimates presented at the Data Workshop for commercial landings. This recommendation was approved by the plenary.

3.4.2.4 U.S. Landings in Pounds

The estimated Sandbar Shark landings are presented in dressed weight pounds by year and region in Figure 3.9.15 and Table 3.8.15. Sandbar shark landings are converted to whole weight pounds using a single conversion of 1.39 from NMFS (1981) and provided to the stock assessment analysts. Total estimated landings of Sandbar sharks show a sharp increase in the 1980s, first observed in the North Atlantic (1980), followed by the South Atlantic (1981) and then the Gulf of America (1984), due to increased efforts in the shark fishery and prior to implementation of shark regulations that began in 1993. During this time, the Gulf of America dominated the regional distribution of landings from 1987-1992, peaking at over 4.6 million lb dw in 1989. Landings in the South Atlantic rose to their highest levels in 1989, at just over 1.0 million lb dw dropping to 0.6 million lb dw before resurging to over 1.4 million lb dw in 1992. While the North Atlantic region initiated the rise in landings, Sandbar Sharks are not reported in amounts as high as the other two regions. Between 1993 and 2006, Sandbar Shark landings decreased from 3.37 mil lb dw in 1993 to 1.37 mil lb dw in 1998. Since 2008 management changes heavily curtail Sandbar landings to less than 200,000 lb dw. The management measures implemented in 2008 stipulated that only vessels accepted into the Shark Research Fishery (SRF), which requires a NOAA Fisheries observer on board every trip, could target and land Sandbar sharks. These consistently low landings persist through 2024.

A comparison of Sandbar Shark landings used in SEDAR 54 for the Gulf of America and the Atlantic (South and North combined) regions from 1960 to 2015 are compared to the Sandbar Shark landings constructed for SEDAR 101. Improvements with data source selection and unclassified shark apportionment caused a decrease in Sandbar Shark for both regions over the time series, particularly from 1990-2007 in the Gulf of America and 1986-2008 in the South Atlantic (Figure 3.9.16).

Previous methodologies for creating shark landings data series were often species-specific. In cases where species-specific landings was reported to one data source (e.g., PDC), and unclassified reporting of the same landings to a second data source (e.g., state reporting programs feeding into ALS), this methodology would likely have resulted in double counting of landings. Additionally, excluding the unreported catches from Brannon could also be contributing leading to the observed discrepancy from 1986-1991. Again, these unreported catches were not included to avoid double counting data. While the presented methodology for SEDAR 101 utilizes the best available information to improve the reconstruction of a comprehensive Sandbar shark landings time series, it may not address perceived misidentification issues for the species that was a concern raised at the Data Workshop.

3.4.2.5 U.S. Landings in Number

Landings in dressed weight pounds were converted to landings in number and presented at the Post Data Workshop Webinar II. Mean weights in pounds were calculated from the length data of retained fish collected from commercial observer programs across regions (Hilton and Courtney 2026). These lengths in fork length (cm) were converted to whole weight (kg) using the following equation from Natanson et al. (2022): $W = 1.22E05FL^{2.99}$. Weights were subsequently converted to pounds. The protocol of the observer programs is to collect straight line fork length measurements and Natanson et al. (2022) reports an over-the-body fork length equation. Based on the robust findings of Natanson et al. (2022), the Life History Working Group agreed to apply the over-the-body fork length combined equation to straight-line fork length data.

Observer data from gillnet, pelagic longline, and bottom longline fisheries recorded retained Sandbar sharks. Retained gillnet observer data for Sandbar sharks was available from 2017 to 2020 from mostly the North Atlantic region. Annual mean weights calculated from retained length data for longline gear showed minimal temporal variability between 1992 and 2024. However, mean weights calculated from retained longline length data varied by region (North Atlantic, South Atlantic, and Gulf of America). There was also a difference in the calculated mean weight by gear, with gillnets catching smaller Sandbar sharks than longlines. Only mean weights calculated from more than 30 fish were used, following standard practice from other assessments (SEDAR 90). The following hierarchy was applied to the landings data to convert dressed weights (lb) into numbers of fish: (1) use region-gear-specific mean weights, (2) then gear-specific mean weights if no data available for that gear and region, and (3) region-specific mean weights. The longline data drive the region-specific mean weights applied to all gears lacking observer coverage. For any stratum where the total reported weight was less than the mean weight, the number of Sandbar Sharks for that stratum was set to one. Landings in number are shown in Figure 3.9.17 and Table 3.8.16.

3.4.2.6 Mexican Landings

Mexican commercial catches of Sandbar Sharks were considered as in previous assessments (per protocol established in Bonfil and Babcock 2005 presented at SEDAR 11-DW-06). Catches of small sharks (“cazón” <1.5m) and large sharks (“tiburón” >1.5 m) are available in the annual fisheries statistics published by Mexico’s National Commission of Aquaculture and Fisheries, abbreviated as CONAPESCA

(http://www.conapesca.sagarpa.gob.mx/wb/cona/cona_anuario_estadistico_de_pesca). Bonfil and Babcock (SEDAR 11-DW-06) used these landings data and applied percentages based on scientific literature review of shark species compositions along the Gulf Mexican coast to estimate the number of Sandbar Sharks caught in the Mexican fishery by assuming that Sandbar Sharks were only caught in the “large shark” category and only in the states of Tamaulipas, Veracruz and Yucatán. They assumed that Sandbar Sharks were 7% of large sharks (in live weight) in Yucatán, and 7.3% in Tamaulipas and Veracruz. Based on their literature reviews,

Bonfil and Babcock used average weights of 38 kg (83.8 lb whole weight) in Tamaulipas and Veracruz and 29.5 kg (65.04 lb whole weight) in Yucatán to convert sandbar catch in weight to catch in numbers.

In the working paper, SEDAR 101-DW-28, Mexican sandbar landings were calculated from 2009-2024 and combined with estimates calculated from 1976-2008 for SEDAR 54 and summarized in dressed weight pounds. Following the Data Workshop, the entire series was recalculated (Table 3.8.17). This involved applying the same methodology by taking total Mexican “large sharks” landings, reported in kilograms, and estimating landings by state using the percentages listed above, and converting to pounds, dressed weight. The resulting landings presented in Table 3.8.17 yielded minor changes of sandbar estimates, particularly from 1976-2000, compared to SEDAR 101-DW-28.

Recommendation: The recommendation to continue to use the traditional process of estimating Sandbar Shark landings for the model was approved by the Panel at the second Post-Data Workshop Meeting.

Following the Data Workshop, an additional data set of Mexican landings data from 2000-2024 was provided by Dr. Juan Carlos Villaseñor-Derbez (RSMAS; Assistant Professor in the Department of Environmental Science and Policy). The data source of this dataset is also from CONAPESCA; however, as previous SEDAR assessments acquired shark landings data directly through the CONAPESCA website, Dr. Villaseñor-Derbez obtained landings through a FOIA-like request which included data reported to the species level. After receiving the data, Dr. Villaseñor-Derbez “cleaned and standardized [the data] by economic unit, vessel, and landing site, with species groups, weight, and value” (See https://mex-fisheries.github.io/mex_landings/). The data provided by Dr. Villaseñor-Derbez were examined to determine if the Sandbar Shark landings reported in the species-specific data from 2000-2024 could substitute the estimated Sandbar Shark landings calculated per the process outlined in SEDAR 11-DW-06.

These findings were discussed at the second Post-Data Workshop Webinar II. In summary, the new data set contained lower total shark landings for Mexico’s Gulf states compared to the traditional data set obtained through the CONAPESCA website, and a high percentage of unknown shark landings persisted in the new dataset. Without a better understanding of the new data set from reporting habits, confidence in species identification, thoroughness in reporting, and the details of the standardization process, it was decided to not replace the estimated Sandbar Shark landings calculated using the traditional method. However, it was decided to incorporate the information from the new dataset as an “Alternative State” for the model.

Recommendation: Continue to use the traditional process of estimating Sandbar Shark landings for the model as the default state, and to incorporate the new data in an “Alternative State” for the model.

Tiburón vs Cazón

During the initial examination of the species-specific dataset, it was observed that all Sandbar Shark reports were associated with the “large shark” (1.5 m or greater) category, indicated by “TIBURON” in the data file, and no Sandbar Shark reports were associated with the “small shark” (less than 1.5 m) category, indicated by ‘CAZON’. This evidence supports the assumption made at SEDAR 11 that Sandbar Shark landings should only be estimated from the “large shark” landings, and “small sharks” landings should not be considered.

Sandbar locations

In the traditional process, three states were used to estimate sandbar landings based upon literature searches of the presence of Sandbar Sharks. The new data set contained reports of sandbar beginning in 2007 and are primarily attributed to the same three states as used traditionally: Yucatan (n=11 years; 251,000 lb dw/yr); Veracruz (n=16 years; 23,000 lb dw/yr); and Tamaulipas (n=9 years; 17,000 lb dw/yr).

Sandbars have been reported intermittently in Tamaulipas beginning in 2007, ranging between 0-5,000 lb, dw/year over the 9 years reported, with a record high landing reported in 2024 at over 231,000 lb, dw. Sandbar landings in Veracruz have been reported consistently since 2009. Between 2009-2023, landings averaged approximately 15,000 lb dw/year with reported landings hitting a record high in 2024 at over 133,000 lb, dw. Sandbar landings have been reported for Yucatan since 2014, with an average over 251,000 lb dw/year. Yucatan’s record high was documented in 2023 at over 455,000 lb, dw and low in 2014 at over 143,000 lb dw. Minor amounts of landings have been reported, primarily in recent years, in Campeche (n=2 years; 4,000 lb dw in 2008 and 23,000 lb dw in 2024) and Tabasco (n=3 (2022-2024); 33,000 lb dw/yr). Reported Sandbar Shark landings for these five Mexican states from the new data set are presented in Figure 3.9.18.

Unclassified reports in the new (species-specific) data file

While reports of Sandbar Shark exist in the new data file, a majority of the “large shark” landings includes reports of “Unknown” sharks, with approximately 63% reported as unclassified shark in the data series (2000-2024). As a note to other shark species, more of the “small shark” landings include reports to species and when examining all shark landings combined, the “unknown” sharks drops to approximately 43% of all shark landings in the dataset.

Two sharp declines in the proportions of unclassified reporting to species-specific reporting are observed for all states for “large shark” landings. The first decline is observed in 2014, just prior to Mexico’s reporting program transition from paper to electronic (2015), where reports of unknown sharks drop from an average of 87% (82-93%) of the total large shark landings in all states, to 58% of the total reported landings in 2014-2022. Within this time frame, low reports of unknown sharks remains close to 30% from 2014-2015 and then gradually rises to up to a high of 82% in 2021. The second sharp decline observed is in 2022 where unknown shark reports first drop to approximately 15% of the total landings and then continue to fall to less than 2%, with an average of 6.1% of the total landings from 2022-2024.

Creating an alternative state for Mexican landings

Landings from 1976-1999 were not available in the new data set; therefore, the estimated Sandbar Shark landings, as calculated with the method described above, were used for initial years of the series.

For Mexican landings from 2000 to 2024, it was decided that species-compositions would be calculated from the species-specific data file (from Dr. Villaseñor-Derbez) for the three Mexican states traditionally used in the Mexican Sandbar Shark landings series during years of high species-specific reporting, and unknown shark reports were lowest. For Tamaulipas and Veracruz, species-compositions were calculated from the years 2022-2024. For Tamaulipas, this is a drop from the original Sandbar Shark landings rate of 7.3% to a new rate of 2.73%. For Veracruz, the species-composition rate is a minor change from 7.3% to 6.80%. For Yucatan, species-compositions were calculated from the years 2014-2024 with a Sandbar Shark composition rate of 59.41%. This state includes the greatest change from the original Sandbar Shark landings rate of 7.0%.

State	SEDAR 11+ Proportion	SEDAR 101 Proportion for Alternative State
Tamaulipas	7.3%	2.73%
Veracruz	7.3%	6.80%
Yucatan	7.0%	59.41%

In this alternative scenario, the application of these new, state-specific sandbar rates were applied to the total “tiburon”/“large shark” landings acquired from CONAPESCA’s website. It was decided to apply the new rates for these three states to the traditional dataset rather than using the species-specific dataset, since the standardization process and the lower “large shark” totals from Dr. Villaseñor-Derbez’ file was not completely understood, and questions remain regarding the reporting trends observed in the data, particularly in regards to reports of unknown sharks and confidence in species-specific reporting. It was not considered to replace the original rates for Sandbar Shark estimates used in SEDAR 11, SEDAR 23, and SEDAR 54 with the new state-specific species composition rates prior to 2000, as those state-specific rates were derived from literature reviews of studies published between late 1980s to mid-1990s, and thus more appropriate for that time period. The most appropriate year to apply the updated state-specific sandbar rates was discussed at length. For the sake of a longer timer series for an Alternative State to the model, it was decided to apply the newly calculated rates to the beginning of the new data time-series in 2000.

Figure 3.9.19 illustrates the difference in Mexican Sandbar shark landings by state between the default and alternative scenarios. Under the alternative scenario, Yucatán showed a sharp increase in 2000 due to the change in proportion from 7% (default) to 59%. Conversely, Tamaulipas decreases under the alternative scenario as its proportion drops from 7.3% to 2.7%. Total Mexican Sandbar shark landings follow a similar trend (Figure 3.9.20), with the alternative scenario yielding overall higher estimates than the default scenario, driven primarily by Yucatán. Table 3.8.17 shows the estimated Mexican Sandbar shark landings in dressed weight pounds and numbers of whole fish for both the default and alternative scenarios.

Recommendation: For an Alternative State of Mexican Sandbar Shark landings for the states of Tamaulipas, Veracruz, and Yucatan,

- a) **For 1976-1999: use sandbar estimates as calculated for the traditional time series.**
- b) **For 2000-2024: calculate species proportions by state from Mexican landings data provided by Dr. Villaseñor-Derbez and apply those proportions to CONAPESCA website-pulled “tiburon”/“large shark” landings data.**
 - **Tamaulipas and Veracruz species-compositions were calculated using 2022-2024 data from Dr. Villaseñor-Derbez.**
 - **Yucatan species-compositions were calculated using 2014-2024 data from Dr. Villaseñor-Derbez.**

As stated above, landings of Sandbar Sharks exist for the states of Campeche and Tabasco in the Dr. Villaseñor-Derbez dataset. Landings of Sandbar Sharks for these areas did not exist in the protocol established in SEDAR 11. Without additional information, it is believed that sandbar landings are emerging in these areas in recent years. Therefore, rather than calculating species-compositions for these two states and applying them to reports of unknown sharks, it was

decided the reports of sandbar in Campeche and Tabasco would be added to the sandbar estimates calculated above.

Recommendation: Include Sandbar shark landings from Campeche and Tabasco, as reported in the new species-specific landings data file, for the Alternative State of Mexican Sandbar Shark landings.

In the protocol established in SEDAR 11 for converting Mexican landings to numbers, rates are available for the three states of Tamaulipas, Veracruz, and Yucatan. No average weights are available for Campeche and Tabasco. In the SEDAR 11-DW-06 (Bonfil and Babcock 2005) paper, it is stated that the fishing grounds of Tabasco and Campeche overlap by at least 50% and the species compositions of the two states were nearly identical. Therefore, it was suggested to use the same average weight conversion for these two states. As these two states are nestled between Veracruz and Yucatan, it was suggested to use an average of the weights used for Veracruz (38 kg; 83.8 lb) and Yucatan (29.5 kg, 65.0 lb), resulting in a conversion of 33.75 kg (74.4 lb) for Campeche and Tabasco.

Recommendation: Use the average of the Yucatan and Veracruz Sandbar Shark average weight (33.75 kg (74.4 lb)) and apply to reported Sandbar Shark landings from Campeche and Tabasco to convert to numbers.

3.4.2.6 Total Commercial Landings

The total landings in dressed weight for all US and Mexican landings are presented in Figure 3.9.21 for 1950-2024. The top panel indicates the default state using SEDAR 11 methodology to estimate Sandbar shark landings from Mexico and the bottom panel is the proposed alternative scenario. In the alternative scenario, the Mexican Sandbar Shark landings include totals from the five states: Yucatan, Veracruz, Tamaulipas, Tabasco, and Campeche.

Figure 3.9.22 represents the numbers of Sandbar landed by region (North Atlantic, South Atlantic, Gulf of America, and Mexico) for the entire time series (1950-2024).

3.4.3 Commercial Bycatch

Several working papers were presented during the ad-hoc bycatch working group. The working papers discussed bycatch estimates from 5 fleets; the US pelagic longline fishery (SEDAR101-DW-03), the shark research fishery SEDAR101-DW-09 (SEDAR101-DW-23); the Northeast gillnet and trawl fisheries (SEDAR101-DW-20); and the Gulf reeffish bottom longline fishery (SEDAR101-DW-23). Working paper SEDAR101-DW-02 also reported on electronic monitoring of Sandbar Sharks and depredation in the Eastern Gulf of America Commercial Reef Fish Fishery whereas SEDAR101-DW-06 described regional and temporal trends in sandbar depredation risk on the West Florida Shelf. The working group noted that depredation “hotspots”

from this analysis corresponded with some industry observations especially in areas off northwest Florida. All bycatch estimates were developed from the monitoring of discards in the various fleets by on-board observers. These observed discard rates were extrapolated to total discards using total effort information from commercial fishery logbooks recorded by fishers. Bycatch estimates were evaluated using the coefficient of variation (CV) where estimates with $CV > 0.50$ were considered unreliable.

3.4.3.1 Electronic Monitoring

The working group determined that this was an alternate approach to estimating Sandbar Shark bycatch and has application to other stock assessments for reef fish species. The comparison between catch rates where both Electronic Monitoring (EM) and an observer were presented and documented within the working paper. Generally, it showed EM captured approx. 1 additional sandbar per haul. With similar trends for large coastal species, the assumption is the sampling workload may have kept observers away from the rail when large sharks were cut off. The authors discussed the issue that they couldn't scale up to the fishery as a whole during the meeting without access to logbook data (specifically hook counts or hauls/year) at the time. Since bycatch mortality was low, the group felt more comfortable with sticking with the observer data even though the two had notable differences. Random selection of vessels to participate in EM coverage was also recommended.

3.4.3.2 Pelagic Longline Observer Program Bycatch

From 1992-2024, the POP recorded a total of 2,112 Sandbar Sharks of which 469 were discarded dead, 1,001 discarded alive, 622 were landed, and 2 were discarded in an unknown condition. The number of observed Sandbar Sharks discarded dead on an annual basis ranged from 0 to 137. However, the observed number of 137 sharks discarded dead in 2015 is an outlier since the average number of sharks discarded by year (excluding 2015) was 10.4 individuals. Statistical analysis for extrapolation to total bycatch estimates for the Pelagic Longline Fishery followed the methodology developed by Brown (2001) by applying the Delta-lognormal method as described by Pennington (1983) while considering potential geographical and time of year effects. The number of estimated dead discards on an annual basis is presented in Table 3.8.18. Overall, annual dead discards ranged from 0 in 2002 and 2003 to 748 in 1994 and showed no discernable trend. The average annual dead discards were estimated to be 158.4 individuals. The working group accepted the analysis and recommended the estimates of dead and live discards be used in the stock assessment with post-release mortality estimates developed by the Discard Mortality Workgroup applied to live discards.

3.4.3.3 Shark Research Fishery Bycatch

The working group observed that discards were high (up to 926 individuals) during the initial period of the observer coverage (2008-2011) as compared to the remainder of the time series Table 3.8.19. The authors reported that during the early years of the Shark Research Fishery that

management had implemented trip limits which resulted in the higher discard rates. No extrapolation was required to estimate total bycatch as observer coverage is 100% and the fishery is covered as a census. The working group accepted the analysis and recommended the estimates of dead and live discards be used in the stock assessment with post-release mortality estimates developed by the Discard Mortality Workgroup applied to live discards.

3.4.3.4 Northeast Fisheries Observer Program Bycatch

There was considerable discussion relative to the estimates provided for the gillnet and trawl fisheries from the Northeast Fisheries Observer Program. Total bycatch was estimated using the ratio-estimators based on methodology in Wigley et al. (2007). Annual discard estimates ranged from 0 - 33,517 pounds for trawl and 1,142 - 81,012 pounds for gillnet. Together, the mean annual discards from these fleets totaled 26,951 pounds (SD = 21,250 pounds). The working group noted that the observed sample size (i.e., number of Sandbar Sharks observed caught) was low in many years (e.g., $n=1$ Sandbar Shark) which resulted in very high uncertainty ($CV>1.0$) in the annual bycatch estimates. The group noted that in most cases, discard estimates with a $CV>0.5$ are not considered reliable. The hindcast discard estimates to 1964 by fleet assuming an average discard ratio from 1995-1997 was also discussed given again the low numbers of Sandbar Sharks observed in the 1995-1997 estimates. While these are the only commercial discard data available from the northern range of the stock, the authors noted that there have been similar issues using bycatch estimates derived from these observer data for other species in northeast fisheries. Due to these factors, the working group recommended that these estimates not be used in the stock assessment.

3.4.3.5 Reef fish Bottom Longline Fishery Bycatch

Statistical analysis for extrapolation to total bycatch estimates for the Reef fish Bottom Longline Fishery followed the methodology developed by Brown (2001) by applying the Delta-lognormal method as described by Pennington (1983) while considering potential geographical and time of year effects Table 3.8.20. The working group accepted the analysis and recommended the estimates of live discards be used in the stock assessment with post-release mortality estimates developed by the Discard Mortality Workgroup applied to live discards.

3.4.3.6 Total Commercial Bycatch

The overall estimates of bycatch from the data workshop are in Table 3.8.21. Where bycatch was reported in numbers, estimates of discards were developed using the average size of Sandbar Sharks captured by the specific fishery and converted to weight (kg) using the length weight relationship from Natanson et al. (2022). The average size of Sandbar Shark from the shark research fishery over the period of observer coverage (2008-2025) was 153 cm FL and 159 cm FL from the Gulf reef fish bottom longline fishery (2006-2024). Weight in kilograms was converted to pounds (whole weight) and subsequently converted to pounds dressed weight using the pounds dressed weight to pounds whole weight factor of 1.39 (NMFS 1981). Of the 4 data sources considered, only the bycatch estimates from the Northeast Fisheries Science Center

(SEDAR101-DW-20) were not recommended due to the high coefficient of variation ($CV > 0.5$). Dead discards were highest in 1994, although this was based on data solely from the Pelagic Longline Fishery and was much higher than the remaining trend and could be considered anomalous (Figure 3.9.23). Live discards were highest in the mid-2000s, but were relatively stable since 2010. With years of overlapping estimates, dead discards were highest in the pelagic longline fishery and lowest in the Gulf reef fish bottom longline fishery (Table 3.8.21).

3.4.4 Commercial Biological Sampling

Between 1992 and 2024, at-sea observers gathered fishery-dependent length frequency records for 74,246 Sandbar Sharks across the Atlantic Ocean and the Gulf of America. This total included 63,315 retained sharks, 10,660 discarded sharks, and 271 individuals with an unknown disposition. Fork length (FL) in centimeters served as the standard metric, with alternative measurements converted using the combined-sex equation from SEDAR101-RD-04. The dataset was organized into three distinct geographical regions—the Gulf of America, the Atlantic Ocean, and a combined region—where data were further stratified by sex (male, female, unknown, or combined) and aggregated into annual 2, 5, and 10 cm FL bins to construct yearly capture matrices. For the longline gear types, Atlantic Ocean length data were further separated into the North Atlantic and the South Atlantic. The life history working group implemented a size-selectivity filter that classified any recorded lengths under 35 cm FL or over 200 cm FL as outliers; only verified (not-estimated), non-outlier measurements were used in the length compositions.

Although initial length composition evaluations aggregated all sharks without considering disposition, the catch working group subsequently requested separate analyses for landed and discarded fish. These distinct length compositions are addressed in Sections 3.4.4.1 and 3.4.4.2, with a comprehensive overview provided in Figure 3.9.24. Exploratory data analyses were conducted across various surveys, gear types, retention statuses, areas, and fishing modes to determine whether specific categories should be included in the final assessment.

3.4.4.1 Commercial Biological Sampling - Landed Fish

3.4.4.1.1 Pelagic Longline Observer Program Biological Sampling

Length data from the pelagic longline observer program were obtained for 218 retained sandbar sharks from 1992-2024 of which 209 were directly measured. Table 3.8.22 and Table 3 of SEDAR 101-DW-22 provides comprehensive summaries of Sandbar Shark captured and retained as well as the distribution of their lengths during the Pelagic Observer Program (POP), respectively. Length frequency histograms were created to show the distribution of Sandbar Sharks sampled (Figure 7) and retained (Figure 7a) in SEDAR 101-DW-22.

3.4.4.1.2 Reef Fish Observer Program Biological Sampling

Length data from the reef fish observer program were obtained for 6 retained Sandbar Sharks captured in the reef fish bottom longline from 2006-2024. There were no sandbar sharks retained in the reef fish vertical longline which operated from 2019-2024. Detailed summaries by gear type, and by status (retained vs. discarded) are available in table 3.8.21 and tables 2 and 3 of SEDAR 101-DW-22, respectively. The distribution of Sandbar Shark lengths recorded are available in figure 7 and 7 a of SEDAR 101-DW-22.

3.4.4.1.3 University of Florida Bottom Longline Biological Sampling

Length data from the University of Florida bottom longline survey were obtained for 21,125 retained Sandbar Sharks from 1993-2005. For detailed records of Sandbar Shark retained and length composition distributions from this fishery, refer to table 3.8.21 and table 3, figure 7, and figure 7a of SEDAR 101-DW-22.

3.4.4.1.4 Shark Bottom Longline Observer Program Biological Sampling

Length data from the shark bottom longline observer program were obtained for 3,187 retained Sandbar Sharks of which 2,877 were directly measured from 2005-2021. Detailed summaries of the number of Sandbar Shark retained in this fishery can be found in table 3.8.21 and tables 2 and 3 of SEDAR 101-DW22. The distribution and length composition of Sandbar Shark captured in this fishery can be found in figure 7, 7a, and 8b of SEDAR 101-DW-22.

3.4.4.1.5 Shark Research Fishery Biological Sampling

Between 2008 and 2024, length data were collected for 38,741 retained sandbar sharks through the shark research fishery, with direct measurements recorded for 29,370 of those individuals. Detailed summaries of the number of Sandbar Sharks captured in this fishery are available in table 3.8.21 and tables 2 and 3 of SEDAR 101-DW-22. Additionally, the distribution of available length data is available in figure 7, 7a, and 8b of SEDAR 101 DW-22.

3.4.4.1.6 Southeast Gillnet Observer Program

Between 2008 and 2024 length data from the Southeast Gillnet Observer Program were obtained for 38 retained sandbar shark, of which, 35 were directly measured. Detailed summaries of the number of Sandbar Sharks captured in this fishery are available in table 3.8.21 and tables 2 and 3 of SEDAR 101-DW-22. Additionally, the distribution of available length data is available in figure 7, 7a, and 8b of SEDAR 101 DW-22.

3.4.4.1.7 Length Frequency Distributions of Commercial Landings

At-sea observers documented length data for 74,246 Sandbar Sharks across the Atlantic Ocean and the Gulf of America. Of these individuals, 63,315 were retained, 10,660 were discarded, and 271 had an unknown disposition. The commercial length frequency

distributions for these retained sharks demonstrate that all maturity states were represented across the different gear types and surveys.

To perform a more robust statistical analysis of the overall impact of the longline fishery, data from bottom, pelagic, and vertical longlines were aggregated into a single "longline" classification. This consolidation, supported by the annual length density curves in Figures 14 and 14a of SEDAR101-DW-22, was implemented because bottom and pelagic longline gear targeted similar-sized sharks (mostly around 150 cm FL) and vertical longline data lacked adequate sample sizes for individual conclusions.

Analysis of the annual length density distributions for this combined longline category indicated clear geographical differences. In the Gulf of America, the catch consistently featured larger sharks around 150 cm FL, whereas the Atlantic Ocean exhibited a bimodal pattern, landing sharks both below and above 100 cm FL. When the Atlantic was partitioned at the North Carolina–Virginia border, both the North Atlantic and South Atlantic regions recorded sandbar sharks across the full size spectrum, from under 50 cm FL up to 200 cm FL. Landings were higher in the South Atlantic compared to the North Atlantic; the South Atlantic landings consisted predominantly of larger fish exceeding 100 cm FL alongside some smaller individuals under 100 cm FL, while the North Atlantic landings primarily comprised individuals larger than 100 cm FL (Figure 25b of SEDAR101-DW-22).

Comprehensive records of these length sample sizes, organized by their contributing data sources, are cataloged in Table 3.8.21 and Tables 2 and 3 of SEDAR 101-DW-22. To facilitate the visual interpretation of these trends, the distribution of length measurements is categorized by source in Figures 7 and 7a and by gear type in Figures 8, 8a, and 8b of SEDAR 101-DW022. Furthermore, yearly length density curves were developed to illustrate spatial and temporal variations by region and gear type, which can be reviewed in Figures 14, 15, and 16 of SEDAR 101-DW-22 and Figure 3.9.25.

3.4.4.1.7 Aging Data

Vertebrae were sampled from 1,106 Sandbar Sharks collected across the Atlantic Ocean and the Gulf of America and evaluated for inclusion in the SEDAR101 stock assessment. Detailed information regarding the collection and analysis of these age data is documented in SEDAR 101-DW-24. During the SEDAR 101 data workshop the suitability of these data for constructing age compositions was reviewed. Ultimately, it was determined that the available ageing information would not be utilized for age compositions in the current Sandbar Shark assessment. This decision was primarily driven by the fact that the entire collection of vertebral samples was sourced exclusively from the shark research fishery (SRF). Because the SRF is a specialized, managed fishery that may not be representative of the broader commercial fishery, the data were deemed insufficient for generating reliable, fleet-wide age composition metrics.

3.4.4.2 Commercial Biological Sampling - Discarded Fish

3.4.4.2.1 Northeast Fisheries Observer Program

Length data from the Northeast Fisheries Observer Program (NEFOP) were obtained for 4,184 discarded Sandbar Sharks from 1995-2024, of which 2,490 were directly measured. Table 3.8.21 and Table 3 of SEDAR101-DW-22 provides detailed summaries of the Sandbar Sharks captured and discarded in this fishery. Additionally, the distribution of Sandbar Shark lengths within the NEFOP is illustrated in Figures 7 and 7a of SEDAR101-DW-22.

3.4.4.2.2 Pelagic Longline Observer Program

Length data from the Pelagic Longline Observer Program were obtained for 1,422 discarded Sandbar Sharks from 1992-2024, of which 72 were directly measured. Comprehensive summaries of the number of Sandbar Sharks captured and discarded in the pelagic longline observer program are available in table 3.8.21 and table 3 of SEDAR101-DW-22. Distributions of their lengths are visualized in figures 7 and 7a of the same document.

3.4.4.2.3 Reef Fish Observer Program

Length data gathered by the Reef Fish Observer Program included 462 Sandbar Sharks discarded from bottom longline gear (2006–2024) with 30 directly measured. Additionally, 33 discarded Sandbar Sharks were recorded in vertical longline gear (2019–2024), including one directly measured. Detailed summaries on Sandbar Sharks captured and discarded in this fishery are available in table 3.8.21 and tables 2 and 3 of SEDAR 101-DW-22. The size distribution of fish discarded in this fishery are visualized with length frequency histograms in figures 7 and 7a of SEDAR101-DW-22.

3.4.4.2.4 University of Florida Bottom Longline

Length data from the University of Florida Bottom Longline observer program were obtained for 894 discarded Sandbar Sharks from 1993-2005. Detailed summaries of the number of Sandbar Sharks discarded are available in table 3.8.21 and tables 2 and 3 of SEDAR101-DW-22. Additionally, the distribution of their length measurements are visualized in figures 7 and 7a of SEDAR101-DW-22.

3.4.4.2.5 Shark Bottom Longline Observer Program

Length data from the shark bottom longline observer program were obtained for 624 discarded Sandbar Sharks from 2005-2021, of which 138 were directly measured. Table 3.8.22 and table 3 of SEDAR 101-DW22 provides detailed summaries of the number of Sandbar Shark discards within this fishery. Additionally, the length distributions of discarded fish observed in the shark bottom longline observer program are illustrated in figures 7 and 7a of SEDAR101-DW-22.

3.4.4.2.6 Shark Research Fishery

Between 2009 and 2024, length records were gathered for 2,928 Sandbar Sharks discarded in the shark research fishery, of which direct measurements were taken from 438 individuals. Table 3.8.22 and table 3 of SEDAR101-DW-22, provides comprehensive catch summaries for the Sandbar Sharks, while Figures 7 and 7a present length frequency histograms illustrating their size distribution.

3.4.4.2.7 Southeast Gillnet Observer Program

Between 2008 and 2024 length data from the Southeast Gillnet Observer Program were obtained for 113 discarded sandbar shark, of which 88 were directly measured. Detailed summaries of the number of Sandbar Sharks captured in this fishery are available in table 3.8.21 and tables 2 and 3 of SEDAR 101-DW-22. Additionally, the distribution of available length data is available in figure 7, 7a, and 8b of SEDAR 101 DW-22.

3.4.4.2.7 Length Frequency Distributions of Commercial Discards

Across the Atlantic Ocean and the Gulf of America, at-sea observers recorded length data for a total of 74,246 Sandbar Sharks. Among these sharks, 63,315 were retained, 10,660 were discarded, and the disposition of 271 individuals remained unknown.

Sandbar Shark discards were observed across all gear types and size classes, with larger individuals 100-200 cm FL making up the majority of the discarded catch. Trawl gear captured a broad size distribution of sandbar shark ranging from 35 cm FL - 200 cm FL with the entirety of the catch ($n = 1,580$) discarded. For gillnet gear, the majority of sandbar sharks captured were discarded. Gillnets primarily captured smaller sharks 100 cm FL or less. Conversely, longline operations accounted for 6,363 discarded individuals, spanning 50 cm to 200 cm FL.

A regional breakdown of the longline data revealed that most individuals landed in the North Atlantic were discarded, encompassing all size classes. Furthermore, comparing discard trends across two distinct time series (1992-2008 and 2009-2024) indicated that the density of discarded Sandbar Sharks in the North and South Atlantic increased after the species was designated as prohibited in 2008 under Amendment 2 to the 2006 Consolidated Highly Migratory Species (HMS) Fishery Management Plan (Figure 27 of SEDAR 101-DW-22).

Analysis of annual length density curves indicated a consistent pattern of discarding smaller Sandbar Sharks 150 cm FL and less. Further evaluation of discarded fish pre and post the prohibition of Sandbar Sharks under Amendment 2 of the Highly Migratory Species Management Plan demonstrated an increase in discard numbers after 2008, as illustrated in Figure 28 of SEDAR 101-DW-22, Figure 3.9.24 and Figure 3.9.26.

3.5 TASKS COMPLETED FOLLOWING THE DATA WORKSHOP

3.5.1 Recreational Statistics

- Final recreational catch estimates were produced after the Data Workshop following recommendations approved by the panel. These include calibrating TPWD estimates to MRIP-FES units (described in Section 3.3.1.2) and implementing the approaches to MRIP unidentified catch (described in Section 3.3.1.1). These results were presented at the Post-Data Workshop Webinar I.
- Recreational discard length frequencies were developed after the Data Workshop and presented at the Post-Data Workshop Webinar II.
- MRIP catch estimates using the improved Fishing Effort Survey will be provided during the assessment phase following their release in August 2026.
- As an alternative case for the Management Strategy Evaluation, a multi-year catch aggregation approach to improve the precision of data-limited recreational catch estimates was developed and approved during the Post-Data Workshop Webinar I. Application of this method will be completed during the assessment phase following the release of improved MRIP Fishing Effort Survey estimates.

3.5.2 Commercial Statistics

- Data prior to 1993 was examined and recommendations described in the updated SEDAR 101 DW-28 working paper were presented at the Post-Data Workshop Webinar I.
- Recommendations for proportioning unclassified commercial landings into Sandbar Shark landings described in Section 3.4.2.2 were presented at the Post-Data Workshop Webinar I.
- After the Data Workshop, species-specific Mexican landings were provided by Juan Carlos Villaseñor-Derbez, assistant-professor at the University of Miami. These data were analyzed and recommendations for use were presented at the Post-Data Workshop Webinar II.
- After the Data Workshop, length frequency distributions for commercial longline gear were further investigated, splitting the Atlantic Ocean region into the North and South Atlantic. These updated annual distributions were presented during the Post-Data Workshop Webinar I.
- Commercial retained and discarded length frequency distributions were developed and presented at Post-Data Workshop Webinar II.
- Weighted length frequency distributions from the commercial fishery will be explored and potentially developed during the assessment phase of SEDAR 101.

3.6 CATCH RESEARCH RECOMMENDATIONS

3.6.1 Evaluation and Progress of Catch Research Recommendations from Last Assessment (SEDAR 54)

- Continue work on reconstruction of historical catches, especially catches outside of the US EEZ
 - Additional data sources were incorporated, allowing the landings series to extend back to 1950.
 - Data for SEDAR 101 were reconstructed with extracted data of reported landings from 1950 to 2024, while SEDAR 54 landings series were appended with data reported since the previous sandbar SEDAR report.
 - In contrast to the SEDAR 54 approach, which selected data based on peak annual landings, this analysis prioritized selecting sources based on completeness and accuracy across specific time ranges.
 - Historically, PDC landings data have been compared to FINS and the highest weight by species between the two sources used in the landings series. For SEDAR 101, ALS and FINS data were consolidated and used for species-specific landings. Then a comparison of this consolidated data to PDC was used to create the species-assemblages by year, gear, and region, which were applied to apportioning unclassified shark reports to species. Since PDC data were not reported with gear information, these landings were imputed with gear based on species and region from ALS and FINS consolidated data prior to creating species-assemblages.
 - Methods of apportioning unclassified shark reports were reassessed. First, dogfish sharks were removed from the data set prior to apportioning unclassified reports to species, while in SEDAR 54, dogfish sharks remained in the assemblage for the state of North Carolina. Second, species-assemblages were calculated using landings which contained sufficient species-specific reporting and applied to unclassified shark reports by matching year, gear, and region from 1999-2024. Third, species assemblages by gear and region were calculated from 1994-1998 and applied to data prior to 1999.
- Investigate the length composition of the F3 Recreational and Mexican fisheries more in depth as this fishery is estimated to have a large impact on the stock mainly due to selecting age-0 fish.
 - As part of the SEDAR 54 assessment, it was recommended that the length compositions of the recreational and Mexican fisheries be examined more in depth, given that these sectors are estimated to have a significant impact on the stock, primarily due to the selection of age-0 fish. For the current SEDAR 101 assessment, these sectors are no longer combined in the analysis. Comprehensive details regarding the length compositions for Sandbar Sharks captured specifically

within the recreational fishery are documented in SEDAR101-DW-22. The length compositions utilized in SEDAR 54 were expanded for SEDAR 101 to facilitate a more granular analysis of the recreational fishery by fishing mode. These fishing mode length compositions were further scrutinized by region and year. This investigation involved the development of yearly length density curves and yearly cumulative size distributions to identify shifts in population structure. To provide a more robust visual review of size selectivity over time, additional analytical tools, including ridge plots and bubble plots, were generated to examine these recreational fisheries in greater depth by year.

- No length data is available for the Mexican landings.

3.6.2 Catch Research Recommendations for SEDAR 101

1. Continued evaluation and application of the multi-year catch rate aggregation methodology to improve the precision of data-limited recreational catch estimates.
2. Assess whether commercial logbook data can be incorporated into catch estimates and characterization efforts, such as analysis of gear-specific, spatial, or species composition information.
3. Investigate possible Sandbar Shark misidentification in commercial landings data.
4. Reexamine methodology used to estimate species-specific shark landings from the Mexican commercial data.
5. Review literature for evidence of shark nurseries along the Mexican coast.
6. Examine scientific literature to identify locations and determine to what degree Sandbar Sharks are commercially landed in Mexican Gulf states. As Sandbar Sharks are also landed in both small-scale and large-scale fisheries, information for both fleet sizes is preferred.

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3.8 TABLES

Table 3.8.1.1. Annual recreational landings (AB1), discard (B2), and effort (EFF) estimates for Sandbar Shark from the MRIP survey under the reference case using the **Requiem Shark Genus and Requiem Shark Family allocation method (Default State)**. Estimates are provided in numbers of fish and angler trips by mode.

Year	Cbt			Hbt			Priv			Shore			Total		
	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF
1981	1,068	6,619	2,503,524	119	1,962	1,193,938	92,764	112,004	36,032,087	18,214	112,491	73,045,972	112,165	233,076	112,775,522
1982	593	9,449	2,842,813	0	38,063	2,433,227	43,759	202,474	40,354,306	20,911	83,156	87,111,260	65,263	333,142	132,741,606
1983	3,428	766	2,424,006	468	449	2,015,423	621,108	469,399	42,150,251	68,939	316,209	92,007,925	693,943	786,823	138,597,605
1984	1,629	2,493	1,948,098	148	0	1,635,981	28,752	221,205	45,936,386	172,926	201,483	89,302,036	203,455	425,181	138,822,501
1985	18,376	7,697	2,241,141	1,075	5,093	1,441,591	91,594	95,369	47,193,414	9,175	71,958	87,148,071	120,220	180,117	138,024,217
1986	2,137	9,190	2,593,393	304	6,346	1,236,059	193,617	231,016	47,625,802	11,844	215,300	84,567,800	207,903	461,853	136,023,054
1987	4,051	2,187	2,364,495	329	351	621,674	31,764	262,926	47,686,450	10,482	148,458	86,150,897	46,627	413,922	136,823,516
1988	1,887	9,095	1,953,401	85	5,994	906,085	75,737	111,012	47,346,355	27,518	12,510	88,391,324	105,227	138,612	138,597,164
1989	5,476	714	2,118,082	2,865	487	738,940	33,327	52,054	48,773,048	33,001	10,308	89,698,944	74,669	63,562	141,329,014
1990	354	549	1,863,533	166	621	961,811	98,868	104,263	49,819,135	10,226	7,479	91,832,607	109,614	112,912	144,477,087
1991	238	618	2,152,767	182	53	809,359	29,237	68,773	51,685,035	14,786	134,335	100,814,851	44,443	203,779	155,462,012
1992	612	1,624	1,988,925	19	6	665,059	53,367	135,486	52,309,462	61,098	103,606	95,833,903	115,095	240,722	150,797,349
1993	1,429	1,785	2,122,439	1,423	442	1,266,815	38,095	229,485	54,445,245	20,994	65,106	98,789,844	61,941	296,817	156,624,342
1994	1,114	1,383	2,238,903	2	36	832,466	22,530	141,727	55,023,079	4,398	18,645	98,737,422	28,044	161,792	156,831,871
1995	2,357	3,249	2,413,454	196	1,525	900,293	30,912	148,344	54,810,358	10,796	81,406	93,829,881	44,261	234,525	151,953,987
1996	1,209	6,266	2,310,006	191	33	624,837	54,189	214,903	56,797,901	68,855	101,277	95,600,977	124,444	322,479	155,333,722
1997	664	4,566	2,247,724	114	701	735,581	60,596	334,001	60,542,746	7,253	218,381	98,260,777	68,627	557,649	161,786,828
1998	3,973	4,423	2,152,411	28	323	604,384	38,650	341,923	61,684,116	73,503	186,894	98,977,817	116,154	533,563	163,418,727

Year	Cbt			Hbt			Priv			Shore			Total		
	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF
1999	998	5,449	2,102,280	46	652	572,787	25,912	442,353	65,614,623	16,316	281,060	106,030,530	43,272	729,513	174,320,221
2000	433	5,738	1,957,200	0	275	686,028	19,755	321,283	70,411,365	404	169,553	114,976,856	20,592	496,849	188,031,448
2001	323	26,146	2,229,047	30	7,319	596,059	38,644	385,621	72,797,896	14,181	139,055	118,163,604	53,178	558,140	193,786,606
2002	527	14,259	2,078,371	225	742	657,798	11,303	928,088	73,331,518	573	449,522	113,994,132	12,629	1,392,611	190,061,819
2003	1,891	25,757	2,152,710	809	8,806	667,510	4,888	580,765	76,506,423	5,492	331,452	118,396,114	13,079	946,780	197,722,757
2004	751	2,627	2,055,989	0	55	674,260	7,392	161,655	80,146,109	0	94,046	123,358,609	8,144	258,383	206,234,968
2005	191	6,156	2,153,960	104	2,675	767,540	3,213	596,909	80,243,776	85	310,380	122,324,331	3,592	916,120	205,489,607
2006	923	3,021	2,006,921	0	24	649,374	1,562	126,266	80,533,217	89	56,814	122,184,762	2,574	186,125	205,374,274
2007	474	23,537	2,532,249	0	969	971,084	7,694	806,726	82,571,074	2,178	348,801	121,519,902	10,346	1,180,033	207,594,308
2008	395	6,810	2,027,365	2	10	871,784	5,005	282,335	83,506,813	2,800	90,537	123,709,488	8,203	379,692	210,115,451
2009	704	8,583	2,022,956	0	638	790,333	16,051	855,957	84,086,834	8,524	199,934	123,838,798	25,280	1,065,113	210,738,921
2010	230	5,321	1,570,646	0	3	580,114	15,269	484,826	89,234,730	498	174,752	128,392,353	15,997	664,902	219,777,843
2011	102	5,701	1,914,512	0	18	600,817	2,644	433,009	85,448,370	121	264,431	126,953,461	2,868	703,159	214,917,160
2012	39	2,987	1,984,492	0	87	628,596	1,211	287,066	84,454,246	180	96,008	124,463,856	1,430	386,148	211,531,191
2013	736	4,790	2,158,127	127	1,063	968,396	2,848	292,068	80,886,605	10	150,788	123,500,716	3,722	448,709	207,513,845
2014	69	8,841	2,077,262	0	153	831,745	1,130	483,057	72,949,505	47	316,628	119,376,496	1,246	808,680	195,235,008
2015	266	13,205	2,332,100	0	101	696,087	1,402	406,222	68,168,408	0	314,603	116,374,903	1,667	734,131	187,571,499
2016	282	8,894	1,888,478	0	12	470,309	68	437,018	68,616,425	8	355,201	118,908,849	358	801,126	189,884,060
2017	3	8,594	1,904,688	0	5	596,982	1,930	446,395	69,119,601	1,412	44,829	123,183,464	3,345	499,824	194,804,736
2018	206	9,266	1,973,884	0	367	535,555	5	240,266	64,212,092	8	117,659	114,745,465	220	367,558	181,466,995
2019	0	8,132	2,307,998	0	401	598,715	1,376	326,294	61,692,791	964	153,457	111,463,055	2,340	488,284	176,062,559

Year	Cbt			Hbt			Priv			Shore			Total		
	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF
2020	0	15,614	1,987,039	0	218	496,200	239	313,556	67,482,300	150	405,608	118,750,583	389	734,996	188,716,122
2021	5	7,575	2,640,492	0	179	495,785	665	131,470	64,240,579	5	80,435	118,711,400	676	219,659	186,088,257
2022	359	23,170	2,270,954	0	158	443,293	169	493,871	70,267,740	60	399,511	116,763,278	588	916,709	189,745,266
2023	0	15,803	2,294,154	0	206	488,299	3,401	406,608	68,992,499	94	260,418	122,997,491	3,495	683,035	194,772,444
2024	42	19,096	2,003,646	0	0	411,071	3,106	501,209	70,000,994	0	420,176	111,516,582	3,148	940,482	183,932,292

Table 3.8.1.2. Annual recreational landings (AB1), discard (B2), and effort (EFF) estimates for Sandbar Shark from the MRIP survey under the alternative case using the **Requiem Shark Genus and Requiem Shark Family allocation method with a 22% reduction applied to private mode and a 9% reduction applied to shore mode (Alternative State 1)**. Estimates are provided in numbers of fish and angler trips by mode.

Year	Cbt			Hbt			Priv			Shore			Total		
	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF
1981	1,068	6,619	2,503,524	119	1,962	1,193,938	72,356	87,363	36,032,087	16,575	102,367	73,045,972	90,118	198,311	112,775,522
1982	593	9,449	2,842,813	0	38,063	2,433,227	34,132	157,930	40,354,306	19,029	75,672	87,111,260	53,754	281,114	132,741,606
1983	3,428	766	2,424,006	468	449	2,015,423	484,464	366,131	42,150,251	62,735	287,751	92,007,925	551,094	655,097	138,597,605
1984	1,629	2,493	1,948,098	148	0	1,635,981	22,427	172,540	45,936,386	157,363	183,349	89,302,036	181,566	358,382	138,822,501
1985	18,376	7,697	2,241,141	1,075	5,093	1,441,591	71,444	74,388	47,193,414	8,349	65,482	87,148,071	99,243	152,659	138,024,217
1986	2,137	9,190	2,593,393	304	6,346	1,236,059	151,022	180,193	47,625,802	10,778	195,923	84,567,800	164,241	391,653	136,023,054
1987	4,051	2,187	2,364,495	329	351	621,674	24,776	205,082	47,686,450	9,538	135,097	86,150,897	38,695	342,717	136,823,516
1988	1,887	9,095	1,953,401	85	5,994	906,085	59,075	86,590	47,346,355	25,041	11,384	88,391,324	86,088	113,063	138,597,164
1989	5,476	714	2,118,082	2,865	487	738,940	25,995	40,602	48,773,048	30,031	9,380	89,698,944	64,367	51,182	141,329,014
1990	354	549	1,863,533	166	621	961,811	77,117	81,325	49,819,135	9,306	6,806	91,832,607	86,943	89,301	144,477,087
1991	238	618	2,152,767	182	53	809,359	22,805	53,643	51,685,035	13,455	122,245	100,814,851	36,680	176,559	155,462,012
1992	612	1,624	1,988,925	19	6	665,059	41,626	105,679	52,309,462	55,599	94,281	95,833,903	97,856	201,590	150,797,349
1993	1,429	1,785	2,122,439	1,423	442	1,266,815	29,714	178,998	54,445,245	19,104	59,246	98,789,844	51,671	240,471	156,624,342
1994	1,114	1,383	2,238,903	2	36	832,466	17,574	110,547	55,023,079	4,002	16,967	98,737,422	22,692	128,934	156,831,871
1995	2,357	3,249	2,413,454	196	1,525	900,293	24,112	115,708	54,810,358	9,824	74,080	93,829,881	36,489	194,562	151,953,987
1996	1,209	6,266	2,310,006	191	33	624,837	42,267	167,625	56,797,901	62,658	92,162	95,600,977	106,326	266,086	155,333,722
1997	664	4,566	2,247,724	114	701	735,581	47,265	260,520	60,542,746	6,600	198,727	98,260,777	54,643	464,515	161,786,828
1998	3,973	4,423	2,152,411	28	323	604,384	30,147	266,700	61,684,116	66,888	170,074	98,977,817	101,036	441,520	163,418,727
1999	998	5,449	2,102,280	46	652	572,787	20,212	345,035	65,614,623	14,847	255,765	106,030,530	36,103	606,900	174,320,221
2000	433	5,738	1,957,200	0	275	686,028	15,409	250,601	70,411,365	368	154,293	114,976,856	16,210	410,907	188,031,448
2001	323	26,146	2,229,047	30	7,319	596,059	30,143	300,784	72,797,896	12,904	126,540	118,163,604	43,400	460,789	193,786,606

Year	Cbt			Hbt			Priv			Shore			Total		
	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF
2002	527	14,259	2,078,371	225	742	657,798	8,816	723,909	73,331,518	522	409,065	113,994,132	10,090	1,147,975	190,061,819
2003	1,891	25,757	2,152,710	809	8,806	667,510	3,813	452,997	76,506,423	4,997	301,621	118,396,114	11,509	789,181	197,722,757
2004	751	2,627	2,055,989	0	55	674,260	5,766	126,091	80,146,109	0	85,582	123,358,609	6,517	214,355	206,234,968
2005	191	6,156	2,153,960	104	2,675	767,540	2,506	465,589	80,243,776	77	282,446	122,324,331	2,878	756,866	205,489,607
2006	923	3,021	2,006,921	0	24	649,374	1,219	98,488	80,533,217	81	51,700	122,184,762	2,222	153,233	205,374,274
2007	474	23,537	2,532,249	0	969	971,084	6,001	629,246	82,571,074	1,982	317,409	121,519,902	8,457	971,161	207,594,308
2008	395	6,810	2,027,365	2	10	871,784	3,904	220,221	83,506,813	2,548	82,389	123,709,488	6,849	309,430	210,115,451
2009	704	8,583	2,022,956	0	638	790,333	12,520	667,647	84,086,834	7,757	181,940	123,838,798	20,981	858,808	210,738,921
2010	230	5,321	1,570,646	0	3	580,114	11,910	378,164	89,234,730	453	159,024	128,392,353	12,593	542,513	219,777,843
2011	102	5,701	1,914,512	0	18	600,817	2,063	337,747	85,448,370	110	240,632	126,953,461	2,275	584,098	214,917,160
2012	39	2,987	1,984,492	0	87	628,596	945	223,912	84,454,246	164	87,368	124,463,856	1,147	314,353	211,531,191
2013	736	4,790	2,158,127	127	1,063	968,396	2,222	227,813	80,886,605	9	137,217	123,500,716	3,094	370,883	207,513,845
2014	69	8,841	2,077,262	0	153	831,745	881	376,785	72,949,505	42	288,132	119,376,496	993	673,911	195,235,008
2015	266	13,205	2,332,100	0	101	696,087	1,093	316,853	68,168,408	0	286,289	116,374,903	1,359	616,448	187,571,499
2016	282	8,894	1,888,478	0	12	470,309	53	340,874	68,616,425	7	323,233	118,908,849	342	673,014	189,884,060
2017	3	8,594	1,904,688	0	5	596,982	1,505	348,188	69,119,601	1,285	40,795	123,183,464	2,793	397,582	194,804,736
2018	206	9,266	1,973,884	0	367	535,555	4	187,408	64,212,092	8	107,069	114,745,465	218	304,110	181,466,995
2019	0	8,132	2,307,998	0	401	598,715	1,073	254,509	61,692,791	877	139,646	111,463,055	1,951	402,688	176,062,559
2020	0	15,614	1,987,039	0	218	496,200	186	244,574	67,482,300	136	369,103	118,750,583	323	629,509	188,716,122
2021	5	7,575	2,640,492	0	179	495,785	519	102,546	64,240,579	4	73,196	118,711,400	529	183,496	186,088,257
2022	359	23,170	2,270,954	0	158	443,293	132	385,219	70,267,740	55	363,555	116,763,278	545	772,101	189,745,266
2023	0	15,803	2,294,154	0	206	488,299	2,653	317,154	68,992,499	85	236,980	122,997,491	2,738	570,144	194,772,444
2024	42	19,096	2,003,646	0	0	411,071	2,423	390,943	70,000,994	0	382,360	111,516,582	2,465	792,400	183,932,292

Table 3.8.1.3. Annual recreational landings (AB1), discard (B2), and effort (EFF) estimates for Sandbar Shark from the MRIP survey under the alternative case using the **Requiem Shark Genus, Requiem Shark Family, and Unidentified Sharks allocation method (Alternative State 2)**. Estimates are provided in numbers of fish and angler trips by mode.

Year	Cbt			Hbt			Priv			Shore			Total		
	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF
1981	1,093	7,268	2,503,524	135	2,207	1,193,938	96,463	147,823	36,032,087	20,456	161,377	73,045,972	118,147	318,675	112,775,522
1982	1,039	9,488	2,842,813	132	38,250	2,433,227	48,104	219,097	40,354,306	21,957	86,179	87,111,260	71,232	353,014	132,741,606
1983	3,934	1,033	2,424,006	468	488	2,015,423	625,023	580,813	42,150,251	69,623	371,199	92,007,925	699,047	953,533	138,597,605
1984	4,516	2,940	1,948,098	2,407	91	1,635,981	53,010	249,747	45,936,386	179,593	217,035	89,302,036	239,526	469,813	138,822,501
1985	18,949	7,989	2,241,141	1,289	5,093	1,441,591	97,922	152,605	47,193,414	11,602	91,496	87,148,071	129,762	257,183	138,024,217
1986	2,259	10,695	2,593,393	305	6,432	1,236,059	208,638	315,909	47,625,802	21,854	261,645	84,567,800	233,057	594,682	136,023,054
1987	4,213	2,676	2,364,495	330	399	621,674	34,739	335,866	47,686,450	14,652	185,669	86,150,897	53,934	524,611	136,823,516
1988	2,395	10,161	1,953,401	197	6,144	906,085	85,106	139,957	47,346,355	29,176	47,980	88,391,324	116,874	204,242	138,597,164
1989	5,714	1,579	2,118,082	2,865	494	738,940	44,165	65,270	48,773,048	37,845	16,166	89,698,944	90,588	83,508	141,329,014
1990	564	821	1,863,533	174	1,406	961,811	119,436	119,009	49,819,135	12,368	14,810	91,832,607	132,542	136,046	144,477,087
1991	238	1,068	2,152,767	182	163	809,359	31,948	103,491	51,685,035	20,079	163,534	100,814,851	52,446	268,256	155,462,012
1992	801	2,690	1,988,925	24	24	665,059	57,639	172,168	52,309,462	62,082	126,883	95,833,903	120,545	301,765	150,797,349
1993	1,571	2,164	2,122,439	1,434	443	1,266,815	41,631	250,285	54,445,245	22,914	111,539	98,789,844	67,550	364,430	156,624,342
1994	1,182	1,723	2,238,903	12	51	832,466	25,136	160,820	55,023,079	6,285	58,105	98,737,422	32,615	220,699	156,831,871
1995	2,544	3,655	2,413,454	196	1,528	900,293	32,555	159,892	54,810,358	14,297	110,091	93,829,881	49,592	275,166	151,953,987
1996	1,343	6,748	2,310,006	191	34	624,837	62,671	226,864	56,797,901	71,168	121,854	95,600,977	135,373	355,499	155,333,722
1997	664	4,780	2,247,724	114	702	735,581	63,490	355,322	60,542,746	8,678	245,628	98,260,777	72,945	606,432	161,786,828
1998	4,132	4,741	2,152,411	28	323	604,384	40,214	368,278	61,684,116	76,260	246,615	98,977,817	120,634	619,957	163,418,727
1999	1,034	5,721	2,102,280	46	656	572,787	26,417	476,376	65,614,623	16,471	316,434	106,030,530	43,969	799,187	174,320,221
2000	440	6,032	1,957,200	1	276	686,028	20,194	342,537	70,411,365	859	207,945	114,976,856	21,494	556,789	188,031,448
2001	380	27,203	2,229,047	30	7,330	596,059	39,401	426,104	72,797,896	16,393	199,155	118,163,604	56,203	659,792	193,786,606

Year	Cbt			Hbt			Priv			Shore			Total		
	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF
2002	527	14,759	2,078,371	225	749	657,798	11,394	965,099	73,331,518	594	539,127	113,994,132	12,741	1,519,735	190,061,819
2003	1,896	27,369	2,152,710	809	8,862	667,510	5,448	620,946	76,506,423	5,832	381,380	118,396,114	13,985	1,038,558	197,722,757
2004	759	2,913	2,055,989	0	55	674,260	7,539	174,827	80,146,109	307	110,935	123,358,609	8,605	288,730	206,234,968
2005	192	6,838	2,153,960	104	2,685	767,540	3,256	644,549	80,243,776	356	365,405	122,324,331	3,908	1,019,477	205,489,607
2006	923	3,246	2,006,921	1	97	649,374	1,615	133,449	80,533,217	123	63,903	122,184,762	2,662	200,695	205,374,274
2007	497	24,218	2,532,249	0	972	971,084	7,829	848,060	82,571,074	2,448	421,028	121,519,902	10,774	1,294,277	207,594,308
2008	399	7,205	2,027,365	2	12	871,784	5,152	305,839	83,506,813	3,011	150,370	123,709,488	8,564	463,426	210,115,451
2009	867	10,394	2,022,956	4	753	790,333	16,901	982,366	84,086,834	9,215	286,299	123,838,798	26,986	1,279,811	210,738,921
2010	230	5,529	1,570,646	0	5	580,114	15,290	522,274	89,234,730	556	245,480	128,392,353	16,076	773,289	219,777,843
2011	107	6,103	1,914,512	0	23	600,817	2,681	459,752	85,448,370	157	298,697	126,953,461	2,946	764,575	214,917,160
2012	39	3,392	1,984,492	0	88	628,596	1,221	304,726	84,454,246	180	119,172	124,463,856	1,440	427,378	211,531,191
2013	736	4,984	2,158,127	127	1,073	968,396	3,000	312,630	80,886,605	383	217,459	123,500,716	4,246	536,146	207,513,845
2014	69	9,257	2,077,262	0	286	831,745	1,141	509,200	72,949,505	47	349,487	119,376,496	1,256	868,230	195,235,008
2015	266	13,703	2,332,100	0	120	696,087	1,416	452,210	68,168,408	0	362,229	116,374,903	1,682	828,262	187,571,499
2016	282	9,190	1,888,478	0	25	470,309	70	461,770	68,616,425	12	384,653	118,908,849	364	855,638	189,884,060
2017	3	9,489	1,904,688	0	27	596,982	2,138	489,501	69,119,601	1,412	121,944	123,183,464	3,553	620,960	194,804,736
2018	206	9,935	1,973,884	0	393	535,555	8	263,824	64,212,092	8	173,129	114,745,465	222	447,281	181,466,995
2019	5	9,289	2,307,998	0	403	598,715	1,400	376,690	61,692,791	964	196,481	111,463,055	2,369	582,864	176,062,559
2020	0	16,766	1,987,039	0	228	496,200	242	356,663	67,482,300	151	448,239	118,750,583	393	821,896	188,716,122
2021	6	8,317	2,640,492	0	180	495,785	666	146,979	64,240,579	6	102,968	118,711,400	677	258,443	186,088,257
2022	361	26,578	2,270,954	0	179	443,293	170	572,852	70,267,740	60	472,790	116,763,278	591	1,072,398	189,745,266
2023	18	17,533	2,294,154	0	212	488,299	3,415	455,059	68,992,499	193	329,234	122,997,491	3,626	802,038	194,772,444
2024	42	22,822	2,003,646	0	45	411,071	3,118	552,010	70,000,994	67	512,485	111,516,582	3,226	1,087,362	183,932,292

Table 3.8.1.4. Annual recreational landings (AB1), discard (B2), and effort (EFF) estimates for Sandbar Shark from the MRIP survey under the alternative case using the **Requiem Shark Genus, Requiem Shark Family, and Unidentified Sharks allocation method with a 22% reduction applied to private mode and a 9% reduction applied to shore mode (Alternative State 3)**. Estimates are provided in numbers of fish and angler trips by mode.

Year	Cbt			Hbt			Priv			Shore			Total		
	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF
1981	1,093	7,268	2,503,524	135	2,207	1,193,938	75,241	115,302	36,032,087	18,615	146,853	73,045,972	95,084	271,630	112,775,522
1982	1,039	9,488	2,842,813	132	38,250	2,433,227	37,521	170,896	40,354,306	19,981	78,423	87,111,260	58,673	297,057	132,741,606
1983	3,934	1,033	2,424,006	468	488	2,015,423	487,518	453,034	42,150,251	63,357	337,791	92,007,925	555,276	792,346	138,597,605
1984	4,516	2,940	1,948,098	2,407	91	1,635,981	41,348	194,802	45,936,386	163,430	197,502	89,302,036	211,700	395,335	138,822,501
1985	18,949	7,989	2,241,141	1,289	5,093	1,441,591	76,379	119,032	47,193,414	10,558	83,261	87,148,071	107,175	215,376	138,024,217
1986	2,259	10,695	2,593,393	305	6,432	1,236,059	162,738	246,409	47,625,802	19,887	238,097	84,567,800	185,190	501,634	136,023,054
1987	4,213	2,676	2,364,495	330	399	621,674	27,096	261,976	47,686,450	13,334	168,959	86,150,897	44,973	434,010	136,823,516
1988	2,395	10,161	1,953,401	197	6,144	906,085	66,383	109,167	47,346,355	26,550	43,662	88,391,324	95,525	169,133	138,597,164
1989	5,714	1,579	2,118,082	2,865	494	738,940	34,448	50,910	48,773,048	34,439	14,711	89,698,944	77,466	67,693	141,329,014
1990	564	821	1,863,533	174	1,406	961,811	93,160	92,827	49,819,135	11,255	13,477	91,832,607	105,153	108,531	144,477,087
1991	238	1,068	2,152,767	182	163	809,359	24,919	80,723	51,685,035	18,272	148,816	100,814,851	43,611	230,770	155,462,012
1992	801	2,690	1,988,925	24	24	665,059	44,958	134,291	52,309,462	56,494	115,464	95,833,903	102,277	252,469	150,797,349
1993	1,571	2,164	2,122,439	1,434	443	1,266,815	32,473	195,222	54,445,245	20,851	101,500	98,789,844	56,329	299,329	156,624,342
1994	1,182	1,723	2,238,903	12	51	832,466	19,606	125,440	55,023,079	5,719	52,875	98,737,422	26,519	180,089	156,831,871
1995	2,544	3,655	2,413,454	196	1,528	900,293	25,393	124,716	54,810,358	13,010	100,183	93,829,881	41,143	230,081	151,953,987
1996	1,343	6,748	2,310,006	191	34	624,837	48,884	176,954	56,797,901	64,763	110,887	95,600,977	115,180	294,622	155,333,722
1997	664	4,780	2,247,724	114	702	735,581	49,522	277,151	60,542,746	7,897	223,522	98,260,777	58,197	506,154	161,786,828
1998	4,132	4,741	2,152,411	28	323	604,384	31,367	287,257	61,684,116	69,397	224,419	98,977,817	104,924	516,741	163,418,727
1999	1,034	5,721	2,102,280	46	656	572,787	20,606	371,573	65,614,623	14,988	287,955	106,030,530	36,675	665,905	174,320,221
2000	440	6,032	1,957,200	1	276	686,028	15,751	267,179	70,411,365	782	189,230	114,976,856	16,974	462,716	188,031,448

Year	Cbt			Hbt			Priv			Shore			Total		
	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF
2001	380	27,203	2,229,047	30	7,330	596,059	30,732	332,361	72,797,896	14,917	181,231	118,163,604	46,060	548,125	193,786,606
2002	527	14,759	2,078,371	225	749	657,798	8,887	752,777	73,331,518	541	490,606	113,994,132	10,181	1,258,892	190,061,819
2003	1,896	27,369	2,152,710	809	8,862	667,510	4,249	484,338	76,506,423	5,307	347,056	118,396,114	12,261	867,625	197,722,757
2004	759	2,913	2,055,989	0	55	674,260	5,880	136,365	80,146,109	279	100,951	123,358,609	6,918	240,284	206,234,968
2005	192	6,838	2,153,960	104	2,685	767,540	2,539	502,748	80,243,776	324	332,518	122,324,331	3,160	844,789	205,489,607
2006	923	3,246	2,006,921	1	97	649,374	1,260	104,090	80,533,217	112	58,152	122,184,762	2,296	165,585	205,374,274
2007	497	24,218	2,532,249	0	972	971,084	6,107	661,486	82,571,074	2,228	383,135	121,519,902	8,832	1,069,811	207,594,308
2008	399	7,205	2,027,365	2	12	871,784	4,019	238,555	83,506,813	2,740	136,836	123,709,488	7,160	382,608	210,115,451
2009	867	10,394	2,022,956	4	753	790,333	13,183	766,245	84,086,834	8,385	260,532	123,838,798	22,438	1,037,924	210,738,921
2010	230	5,529	1,570,646	0	5	580,114	11,926	407,374	89,234,730	506	223,387	128,392,353	12,662	636,295	219,777,843
2011	107	6,103	1,914,512	0	23	600,817	2,091	358,606	85,448,370	143	271,815	126,953,461	2,342	636,546	214,917,160
2012	39	3,392	1,984,492	0	88	628,596	953	237,687	84,454,246	164	108,447	124,463,856	1,156	349,613	211,531,191
2013	736	4,984	2,158,127	127	1,073	968,396	2,340	243,852	80,886,605	348	197,887	123,500,716	3,551	447,796	207,513,845
2014	69	9,257	2,077,262	0	286	831,745	890	397,176	72,949,505	42	318,033	119,376,496	1,001	724,753	195,235,008
2015	266	13,703	2,332,100	0	120	696,087	1,105	352,724	68,168,408	0	329,628	116,374,903	1,370	696,175	187,571,499
2016	282	9,190	1,888,478	0	25	470,309	55	360,180	68,616,425	11	350,034	118,908,849	348	719,429	189,884,060
2017	3	9,489	1,904,688	0	27	596,982	1,668	381,811	69,119,601	1,285	110,969	123,183,464	2,955	502,295	194,804,736
2018	206	9,935	1,973,884	0	393	535,555	7	205,783	64,212,092	8	157,547	114,745,465	220	373,658	181,466,995
2019	5	9,289	2,307,998	0	403	598,715	1,092	293,819	61,692,791	877	178,798	111,463,055	1,975	482,308	176,062,559
2020	0	16,766	1,987,039	0	228	496,200	189	278,197	67,482,300	138	407,898	118,750,583	327	703,089	188,716,122
2021	6	8,317	2,640,492	0	180	495,785	519	114,643	64,240,579	5	93,700	118,711,400	530	216,841	186,088,257
2022	361	26,578	2,270,954	0	179	443,293	132	446,824	70,267,740	55	430,239	116,763,278	548	903,819	189,745,266
2023	18	17,533	2,294,154	0	212	488,299	2,664	354,946	68,992,499	176	299,603	122,997,491	2,858	672,294	194,772,444

Year	Cbt			Hbt			Priv			Shore			Total		
	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF	AB1	B2	EFF
2024	42	22,822	2,003,646	0	45	411,071	2,432	430,568	70,000,994	61	466,362	111,516,582	2,535	919,796	183,932,292

Table 3.8.2. Sandbar Shark recreational landings (AB1), in numbers of fish, with associated coefficients of variation (CV; Dettloff et al. 2020) by year for all modes combined from the MRIP survey under the reference case (Default State) and all alternative approaches (alt state 1-3).

Year	Default State		Alt State 1		Alt State 2		Alt State 3	
	Total	CV	Total	CV	Total	CV	Total	CV
1981	112,165	0.35	90,118	0.35	118,147	0.35	95,084	0.36
1982	65,263	0.27	53,754	0.27	71,232	0.27	58,673	0.27
1983	693,943	0.57	551,094	0.57	699,047	0.57	555,276	0.57
1984	203,455	0.70	181,566	0.70	239,526	0.70	211,700	0.70
1985	120,220	0.31	99,243	0.31	129,762	0.31	107,175	0.31
1986	207,903	0.34	164,241	0.34	233,057	0.34	185,190	0.34
1987	46,627	0.29	38,695	0.29	53,934	0.29	44,973	0.29
1988	105,227	0.26	86,088	0.26	116,874	0.26	95,525	0.26
1989	74,669	0.56	64,367	0.56	90,588	0.57	77,466	0.57
1990	109,614	0.42	86,943	0.42	132,542	0.43	105,153	0.43
1991	44,443	0.27	36,680	0.27	52,446	0.27	43,611	0.27
1992	115,095	0.37	97,856	0.37	120,545	0.37	102,277	0.37
1993	61,941	0.32	51,671	0.32	67,550	0.32	56,329	0.32
1994	28,044	0.27	22,692	0.27	32,615	0.26	26,519	0.27
1995	44,261	0.23	36,489	0.23	49,592	0.22	41,143	0.22
1996	124,444	0.53	106,326	0.53	135,373	0.52	115,180	0.52
1997	68,627	0.32	54,643	0.32	72,945	0.32	58,197	0.32
1998	116,154	0.45	101,036	0.45	120,634	0.44	104,924	0.44
1999	43,272	0.30	36,103	0.30	43,969	0.30	36,675	0.30
2000	20,592	0.61	16,210	0.61	21,494	0.61	16,974	0.61
2001	53,178	0.30	43,400	0.30	56,203	0.30	46,060	0.30
2002	12,629	0.42	10,090	0.42	12,741	0.42	10,181	0.42
2003	13,079	0.49	11,509	0.49	13,985	0.49	12,261	0.49
2004	8,144	0.40	6,517	0.41	8,605	0.41	6,918	0.41
2005	3,592	0.32	2,878	0.33	3,908	0.35	3,160	0.37
2006	2,574	0.28	2,222	0.31	2,662	0.29	2,296	0.32
2007	10,346	0.47	8,457	0.47	10,774	0.47	8,832	0.47
2008	8,203	0.45	6,849	0.45	8,564	0.45	7,160	0.45

Year	Default State		Alt State 1		Alt State 2		Alt State 3	
	Total	CV	Total	CV	Total	CV	Total	CV
2009	25,280	0.57	20,981	0.57	26,986	0.57	22,438	0.57
2010	15,997	0.50	12,593	0.50	16,076	0.50	12,662	0.50
2011	2,868	0.52	2,275	0.52	2,946	0.52	2,342	0.53
2012	1,430	0.97	1,147	0.97	1,440	0.97	1,156	0.97
2013	3,722	0.57	3,094	0.57	4,246	0.57	3,551	0.57
2014	1,246	0.94	993	0.94	1,256	0.94	1,001	0.94
2015	1,667	0.27	1,359	0.29	1,682	0.28	1,370	0.29
2016	358	1.00	342	1.00	364	1.00	348	1.00
2017	3,345	0.58	2,793	0.58	3,553	0.58	2,955	0.59
2018	220	1.00	218	1.00	222	0.99	220	0.99
2019	2,340	0.73	1,951	0.73	2,369	0.73	1,975	0.73
2020	389	1.00	323	1.00	393	1.00	327	1.00
2021	676	0.48	529	0.48	677	0.48	530	0.48
2022	588	1.00	545	1.00	591	1.00	548	1.00
2023	3,495	1.00	2,738	1.00	3,626	1.00	2,858	1.00
2024	3,148	1.00	2,465	0.99	3,226	1.00	2,535	0.99

Table 3.8.3.1. Annual recreational landings (LAND) and effort (EFF) estimates for Texas Sandbar Shark from the TPWD survey. Estimates are provided in numbers of fish and angler trips by mode, and those for the private mode are calibrated into MRIP-FES units (SEDAR 74-DW-10). **These estimates are used in the Default State and Alternative State 2.**

Year	Cbt		Priv		Total	
	LAND	EFF	LAND	EFF	LAND	EFF
1981	74	29,441	4,753	650,765	4,827	680,205
1982	74	29,441	4,753	650,765	4,827	680,205
1983	220	33,666	7,409	650,623	7,629	684,290
1984	0	23,029	2,292	601,309	2,292	624,338
1985	3	31,627	4,557	700,362	4,561	731,989
1986	0	27,050	5,069	676,271	5,069	703,321
1987	0	31,084	3,195	873,880	3,195	904,964
1988	8	28,090	7,613	830,613	7,621	858,703
1989	17	42,075	2,146	731,824	2,163	773,899
1990	0	35,645	3,975	731,751	3,975	767,396
1991	0	47,448	1,501	712,454	1,501	759,902
1992	0	49,213	2,183	822,626	2,183	871,839
1993	0	54,657	1,705	826,802	1,705	881,459
1994	0	90,317	208	901,114	208	991,431
1995	0	74,001	958	912,953	958	986,954
1996	0	75,918	157	935,219	157	1,011,137
1997	0	93,868	1,249	778,262	1,249	872,130
1998	16	108,462	1,197	819,894	1,214	928,356
1999	0	112,579	4,899	989,598	4,899	1,102,177
2000	12	161,994	1,125	940,619	1,137	1,102,614
2001	0	141,584	173	816,670	173	958,254
2002	3	136,232	1,424	787,776	1,427	924,008

Year	Cbt		Priv		Total	
	LAND	EFF	LAND	EFF	LAND	EFF
2003	0	117,498	39	862,561	39	980,059
2004	2	118,538	1,840	855,548	1,842	974,086
2005	0	106,073	2,218	811,091	2,218	917,163
2006	0	150,840	1,393	843,404	1,393	994,244
2007	0	148,253	1,194	759,487	1,194	907,739
2008	0	144,898	27	726,957	27	871,855
2009	0	117,112	251	785,214	251	902,326
2010	0	122,375	59	763,438	59	885,813
2011	0	161,208	688	812,780	688	973,988
2012	0	220,969	0	808,435	0	1,029,404
2013	46	142,993	3	833,789	49	976,782
2014	0	138,603	0	817,819	0	956,422
2015	9	144,328	1,373	772,029	1,382	916,358
2016	0	157,452	0	913,477	0	1,070,929
2017	0	188,501	311	835,675	311	1,024,177
2018	0	298,884	0	777,746	0	1,076,630
2019	0	377,936	7	854,878	7	1,232,814
2020	0	237,375	0	963,431	0	1,200,806
2021	0	243,182	362	821,013	362	1,064,195
2022	0	318,026	2	835,486	2	1,153,512
2023	0	552,716	0	1,027,304	0	1,580,021
2024	14	214,393	0	828,194	14	1,042,587

Table 3.8.3.2. Annual recreational landings (LAND) and effort (EFF) estimates for Texas Sandbar Shark from the TPWD survey. Estimates are provided in numbers of fish and angler trips by mode, and those for the private mode are calibrated into MRIP-FES units (SEDAR 74-DW-10) and **reduced by 22%. These estimates are used in alternative states 1 and 3.**

Year	Cbt		Priv		Total	
	LAND	EFF	LAND	EFF	LAND	EFF
1981	74	29,441	3,707	650,765	3,782	680,205
1982	74	29,441	3,707	650,765	3,782	680,205
1983	220	33,666	5,779	650,623	5,999	684,290
1984	0	23,029	1,788	601,309	1,788	624,338
1985	3	31,627	3,555	700,362	3,558	731,989
1986	0	27,050	3,953	676,271	3,953	703,321
1987	0	31,084	2,492	873,880	2,492	904,964
1988	8	28,090	5,938	830,613	5,946	858,703
1989	17	42,075	1,674	731,824	1,691	773,899
1990	0	35,645	3,100	731,751	3,100	767,396
1991	0	47,448	1,171	712,454	1,171	759,902
1992	0	49,213	1,702	822,626	1,702	871,839
1993	0	54,657	1,330	826,802	1,330	881,459
1994	0	90,317	162	901,114	162	991,431
1995	0	74,001	747	912,953	747	986,954
1996	0	75,918	123	935,219	123	1,011,137
1997	0	93,868	974	778,262	974	872,130
1998	16	108,462	934	819,894	950	928,356
1999	0	112,579	3,821	989,598	3,821	1,102,177
2000	12	161,994	877	940,619	890	1,102,614
2001	0	141,584	135	816,670	135	958,254
2002	3	136,232	1,111	787,776	1,114	924,008

Year	Cbt		Priv		Total	
	LAND	EFF	LAND	EFF	LAND	EFF
2003	0	117,498	30	862,561	30	980,059
2004	2	118,538	1,435	855,548	1,437	974,086
2005	0	106,073	1,730	811,091	1,730	917,163
2006	0	150,840	1,087	843,404	1,087	994,244
2007	0	148,253	931	759,487	931	907,739
2008	0	144,898	21	726,957	21	871,855
2009	0	117,112	196	785,214	196	902,326
2010	0	122,375	46	763,438	46	885,813
2011	0	161,208	537	812,780	537	973,988
2012	0	220,969	0	808,435	0	1,029,404
2013	46	142,993	2	833,789	48	976,782
2014	0	138,603	0	817,819	0	956,422
2015	9	144,328	1,071	772,029	1,080	916,358
2016	0	157,452	0	913,477	0	1,070,929
2017	0	188,501	243	835,675	243	1,024,177
2018	0	298,884	0	777,746	0	1,076,630
2019	0	377,936	5	854,878	5	1,232,814
2020	0	237,375	0	963,431	0	1,200,806
2021	0	243,182	282	821,013	282	1,064,195
2022	0	318,026	1	835,486	1	1,153,512
2023	0	552,716	0	1,027,304	0	1,580,021
2024	14	214,393	0	828,194	14	1,042,587

Table 3.8.4. SRHS recreational landings for Sandbar Shark by region in number (weight in pounds shown in parentheses), with corresponding unweighted and weighted CVs. Estimates used under the reference case (Default State) and alternative approaches (alternatives states 1-3).

Year	Gulf	Atlantic	Total Landings	Unweighted CV	Weighted CV
1986	1,401 (8,648)	0 (0)	1,401	0.52	0.41
1987	1,422 (13,536)	100 (866)	1,522	0.53	0.34
1988	2,694 (18,769)	13 (198)	2,707	0.52	0.28
1989	1,656 (15,138)	760 (5,488)	2,416	0.54	0.26
1990	884 (5,352)	189 (572)	1,073	0.47	0.27
1991	1,265 (13,724)	164 (1,435)	1,429	0.49	0.20
1992	595 (8,998)	1,976 (11,748)	2,571	0.30	0.19
1993	490 (6,229)	523 (2,531)	1,013	0.26	0.15
1994	151 (3,873)	150 (1,140)	301	0.36	0.19
1995	480 (6,137)	222 (1,986)	702	0.38	0.20
1996	295 (2,913)	104 (1,334)	399	0.48	0.27
1997	490 (4,343)	410 (2,212)	900	0.35	0.25
1998	270 (2,005)	1,273 (6,932)	1,543	0.38	0.35
1999	435 (7,576)	1,236 (7,053)	1,671	0.48	0.37
2000	13 (1,485)	241 (3,528)	254	0.51	0.42
2001	34 (2,342)	179 (1,513)	213	0.50	0.25
2002	29 (3,297)	86 (793)	115	0.48	0.08
2003	60 (6,569)	169 (916)	229	0.52	0.30
2004	154 (5,858)	259 (2,950)	413	0.49	0.14
2005	116 (6,815)	773 (5,481)	889	0.51	0.17
2006	193 (9,312)	89 (1,637)	282	0.53	0.28
2007	296 (21,984)	99 (1,853)	395	0.50	0.34
2008	211 (18,486)	836 (33,447)	1,047	0.18	0.13
2009	65 (5,631)	363 (14,863)	428	0.10	0.15

Year	Gulf	Atlantic	Total Landings	Unweighted CV	Weighted CV
2010	18 (1,562)	194 (1,483)	212	0.09	0.15
2011	29 (2,545)	477 (4,283)	506	0.07	0.09
2012	14 (1,210)	407 (15,186)	421	0.09	0.08
2013	23 (1,970)	2 (83)	25	0.09	0.06
2014	2 (178)	3 (92)	5	0.05	0.05
2015	4 (355)	2 (88)	6	0.06	0.05
2016	1 (83)	5 (156)	6	0.13	0.06
2017	0 (0)	4 (166)	4	0.06	0.06
2018	6 (525)	1 (41)	7	0.06	0.05
2019	5 (427)	1 (47)	6	0.06	0.07
2020	0 (0)	0 (0)	0	0.05	0.05
2021	2 (176)	2 (83)	4	0.05	0.05
2022	0 (0)	18 (747)	18	0.07	0.05
2023	6 (551)	14 (581)	20	0.06	0.05
2024	4 (367)	5 (207)	9	0.06	0.05

Table 3.8.5.1. Total recreational landings estimates in numbers (LAND #) and pounds (LAND LBS) for Sandbar Shark combined across all surveys by year and mode under the reference case using the **Requiem Shark Genus and Requiem Shark Family allocation method (Default State)**. Estimates and their associated coefficients of variation (CV) are provided for recreational landings in numbers of fish (LAND # CV) and in pounds whole weight (LAND LBS CV).

YEAR	LAND #	LAND # CV	LAND LBS	LAND LBS CV
1981	113,871	0.36	1,467,779	0.46
1982	66,969	0.27	2,224,071	0.39
1983	695,649	0.57	5,351,804	0.59
1984	205,161	0.66	2,678,666	0.60
1985	121,926	0.30	3,053,282	0.36
1986	209,304	0.36	1,874,235	0.36
1987	48,149	0.28	1,323,933	0.36
1988	107,934	0.25	2,228,993	0.28
1989	77,085	0.47	1,451,171	0.36
1990	110,687	0.42	1,574,250	0.43
1991	45,872	0.26	547,206	0.25
1992	117,666	0.35	1,166,635	0.37
1993	62,954	0.31	1,359,325	0.34
1994	28,345	0.28	786,022	0.42
1995	44,963	0.23	1,068,285	0.25
1996	124,843	0.51	1,416,777	0.53
1997	69,527	0.32	833,218	0.33
1998	117,697	0.42	1,276,571	0.40
1999	44,943	0.29	804,607	0.31
2000	20,846	0.61	483,228	0.56
2001	53,391	0.31	924,963	0.51
2002	12,744	0.39	280,938	0.34
2003	13,308	0.47	488,341	0.47

YEAR	LAND #	LAND # CV	LAND LBS	LAND LBS CV
2004	8,557	0.40	359,005	0.51
2005	4,481	0.25	475,563	0.19
2006	2,856	0.20	429,322	0.09
2007	10,741	0.45	491,826	0.52
2008	9,250	0.41	755,485	0.53
2009	25,708	0.56	1,240,364	0.61
2010	16,209	0.49	3,060,367	0.64
2011	3,374	0.42	1,083,405	0.46
2012	1,851	0.65	808,181	0.52
2013	3,747	0.58	538,265	0.85
2014	1,251	0.91	277,431	0.66
2015	1,673	0.26	150,968	0.26
2016	364	0.77	174,893	0.03
2017	3,349	0.57	196,830	0.64
2018	227	0.91	98,631	0.05
2019	2,346	0.43	1,040,031	0.07
2020	389	0.61	414,206	0.02
2021	680	0.46	93,467	0.33
2022	606	0.59	345,781	0.09
2023	3,515	0.97	103,142	0.52
2024	3,157	0.98	49,672	0.79

Table 3.8.5.2. Total recreational landings estimates in numbers (LAND #) and pounds (LAND LBS) for Sandbar Shark combined across all surveys by year and mode under the alternative case using **Requiem Shark Genus and Requiem Shark Family allocation method with a 22% reduction applied to private mode and a 9% reduction applied to shore mode (Alternative State 1)**. Estimates and their associated coefficients of variation (CV) are provided for recreational landings in numbers of fish (LAND # CV) and in pounds whole weight (LAND LBS CV).

YEAR	LAND #	LAND # CV	LAND LBS	LAND LBS CV
1981	91,824	0.36	1,189,280	0.46
1982	55,460	0.28	1,841,377	0.40
1983	552,800	0.56	4,241,661	0.58
1984	183,272	0.67	2,365,320	0.61
1985	100,949	0.29	2,518,318	0.35
1986	165,642	0.35	1,487,270	0.36
1987	40,217	0.29	1,100,842	0.37
1988	88,795	0.25	1,842,330	0.27
1989	66,783	0.48	1,277,448	0.35
1990	88,016	0.42	1,250,532	0.43
1991	38,109	0.26	442,222	0.25
1992	100,427	0.37	981,251	0.38
1993	52,684	0.32	1,166,886	0.35
1994	22,993	0.29	656,401	0.45
1995	37,191	0.22	861,530	0.24
1996	106,725	0.54	1,217,203	0.56
1997	55,543	0.32	660,654	0.33
1998	102,579	0.43	1,095,897	0.41
1999	37,774	0.30	666,561	0.32
2000	16,464	0.60	387,237	0.54
2001	43,613	0.32	787,470	0.53
2002	10,205	0.38	229,598	0.32
2003	11,738	0.47	410,810	0.47

YEAR	LAND #	LAND # CV	LAND LBS	LAND LBS CV
2004	6,930	0.38	284,603	0.50
2005	3,767	0.24	400,034	0.18
2006	2,504	0.23	349,861	0.09
2007	8,852	0.44	415,040	0.52
2008	7,896	0.41	660,963	0.54
2009	21,409	0.56	1,057,472	0.62
2010	12,805	0.48	2,410,000	0.63
2011	2,781	0.40	865,218	0.45
2012	1,568	0.60	684,541	0.48
2013	3,119	0.55	424,933	0.84
2014	998	0.89	228,695	0.63
2015	1,365	0.28	118,598	0.25
2016	348	0.81	148,509	0.03
2017	2,797	0.56	160,834	0.62
2018	225	0.91	85,478	0.06
2019	1,957	0.40	933,174	0.06
2020	323	0.58	375,974	0.02
2021	533	0.46	78,052	0.31
2022	563	0.64	299,205	0.10
2023	2,758	0.96	87,023	0.48
2024	2,474	0.98	41,027	0.75

Table 3.8.5.3. Total recreational landings estimates in numbers (LAND #) and pounds (LAND LBS) for Sandbar Shark combined across all surveys by year and mode under the alternative case using the **Requiem Shark Genus, Requiem Shark Family, and Unidentified Sharks allocation method (Alternative State 2)**. Estimates and their associated coefficients of variation (CV) are provided for recreational landings in numbers of fish (LAND # CV) and in pounds whole weight (LAND LBS CV).

YEAR	LAND #	LAND # CV	LAND LBS	LAND LBS CV
1981	119,853	0.36	2,306,367	0.47
1982	72,938	0.27	3,183,954	0.37
1983	700,753	0.57	5,520,757	0.58
1984	241,232	0.59	3,553,825	0.51
1985	131,468	0.30	3,732,693	0.34
1986	234,458	0.35	2,591,174	0.36
1987	55,456	0.31	6,807,799	0.52
1988	119,581	0.25	5,622,262	0.28
1989	93,004	0.47	11,627,312	0.50
1990	133,615	0.43	3,411,001	0.43
1991	53,875	0.27	759,836	0.26
1992	123,116	0.35	1,370,955	0.34
1993	68,563	0.31	1,828,679	0.33
1994	32,916	0.30	1,417,313	0.46
1995	50,294	0.23	1,552,922	0.25
1996	135,772	0.49	1,757,960	0.49
1997	73,845	0.32	1,227,646	0.32
1998	122,177	0.42	1,412,206	0.40
1999	45,640	0.29	935,210	0.31
2000	21,748	0.59	1,055,728	0.35
2001	56,416	0.31	1,799,757	0.62
2002	12,856	0.39	392,271	0.33
2003	14,214	0.46	1,286,200	0.53

YEAR	LAND #	LAND # CV	LAND LBS	LAND LBS CV
2004	9,018	0.38	1,214,469	0.28
2005	4,797	0.24	2,604,442	0.07
2006	2,944	0.20	773,819	0.07
2007	11,169	0.45	993,002	0.57
2008	9,611	0.42	1,331,840	0.59
2009	27,414	0.56	1,692,799	0.59
2010	16,288	0.49	3,133,115	0.62
2011	3,452	0.42	1,458,250	0.40
2012	1,861	0.66	867,153	0.55
2013	4,271	0.54	2,169,293	0.36
2014	1,261	0.91	413,516	0.77
2015	1,688	0.26	402,577	0.26
2016	370	0.76	452,590	0.09
2017	3,557	0.59	475,537	0.76
2018	229	0.90	130,561	0.04
2019	2,375	0.43	1,147,076	0.11
2020	393	1.12	497,143	0.20
2021	681	0.46	127,981	0.26
2022	609	0.59	381,913	0.15
2023	3,646	0.94	347,977	0.22
2024	3,235	0.96	86,454	0.52

Table 3.8.5.4. Total recreational landings estimates in numbers (LAND #) and pounds (LAND LBS) for Sandbar Shark combined across all surveys by year and mode under the alternative case using the **Requiem Shark Genus, Requiem Shark Family, and Unidentified Sharks allocation method with a 22% reduction applied to private mode and a 9% reduction applied to shore mode (Alternative State 3)**. Estimates and their associated coefficients of variation (CV) are provided for recreational landings in numbers of fish (LAND # CV) and in pounds whole weight (LAND LBS CV).

YEAR	LAND #	LAND # CV	LAND LBS	LAND LBS CV
1981	96,790	0.36	1,889,487	0.48
1982	60,379	0.27	2,649,352	0.37
1983	556,982	0.56	4,387,779	0.57
1984	213,406	0.60	3,100,970	0.52
1985	108,881	0.29	3,099,143	0.33
1986	186,591	0.35	2,093,323	0.37
1987	46,495	0.32	5,825,924	0.55
1988	98,232	0.25	4,664,768	0.27
1989	79,882	0.48	9,830,457	0.51
1990	106,226	0.42	2,735,688	0.42
1991	45,040	0.28	625,263	0.27
1992	104,848	0.36	1,145,331	0.36
1993	57,342	0.32	1,557,680	0.34
1994	26,820	0.30	1,192,480	0.49
1995	41,845	0.23	1,281,317	0.25
1996	115,579	0.52	1,495,648	0.51
1997	59,097	0.31	978,205	0.32
1998	106,467	0.43	1,212,807	0.42
1999	38,346	0.29	777,252	0.32
2000	17,228	0.58	886,924	0.33
2001	46,273	0.32	1,570,523	0.65
2002	10,296	0.38	320,966	0.31
2003	12,490	0.47	1,087,641	0.55

YEAR	LAND #	LAND # CV	LAND LBS	LAND LBS CV
2004	7,331	0.37	1,026,471	0.26
2005	4,049	0.23	2,305,190	0.06
2006	2,578	0.22	646,066	0.07
2007	9,227	0.44	854,609	0.58
2008	8,207	0.42	1,159,624	0.61
2009	22,866	0.55	1,454,042	0.60
2010	12,874	0.48	2,474,310	0.62
2011	2,848	0.40	1,189,588	0.38
2012	1,577	0.60	730,939	0.51
2013	3,576	0.51	1,863,550	0.32
2014	1,006	0.89	334,855	0.75
2015	1,376	0.27	314,930	0.26
2016	354	0.80	401,046	0.10
2017	2,959	0.57	378,226	0.75
2018	227	0.90	112,390	0.05
2019	1,981	0.40	1,023,903	0.10
2020	327	1.19	445,838	0.20
2021	534	0.46	109,004	0.24
2022	566	0.64	333,272	0.17
2023	2,878	0.93	309,919	0.19
2024	2,544	0.96	73,803	0.47

Table 3.8.6. MRIP recreational discard estimates (B2), in numbers of fish, for Sandbar Shark with associated coefficients of variation (CV; Dettloff et al. 2020) by year for all modes combined under the reference case (Default State) and all alternative approaches (alt state 1-3).

Year	Default State		Alt State 1		Alt State 2		Alt State 3	
	B2	CV	B2	CV	B2	CV	B2	CV
1981	233,076	0.55	198,311	0.55	318,675	0.55	271,630	0.55
1982	333,142	0.28	281,114	0.28	353,014	0.28	297,057	0.28
1983	786,823	0.22	655,097	0.22	953,533	0.22	792,346	0.22
1984	425,181	0.29	358,382	0.29	469,813	0.29	395,335	0.29
1985	180,117	0.21	152,659	0.21	257,183	0.21	215,376	0.21
1986	461,853	0.39	391,653	0.39	594,682	0.39	501,634	0.39
1987	413,922	0.26	342,717	0.26	524,611	0.26	434,010	0.26
1988	138,612	0.33	113,063	0.33	204,242	0.33	169,133	0.33
1989	63,562	0.23	51,182	0.23	83,508	0.23	67,693	0.23
1990	112,912	0.24	89,301	0.24	136,046	0.24	108,531	0.24
1991	203,779	0.55	176,559	0.55	268,256	0.55	230,770	0.55
1992	240,722	0.32	201,590	0.32	301,765	0.32	252,469	0.32
1993	296,817	0.24	240,471	0.24	364,430	0.24	299,329	0.24
1994	161,792	0.31	128,934	0.31	220,699	0.31	180,089	0.31
1995	234,525	0.20	194,562	0.20	275,166	0.20	230,081	0.20
1996	322,479	0.23	266,086	0.23	355,499	0.23	294,622	0.23
1997	557,649	0.22	464,515	0.22	606,432	0.22	506,154	0.22
1998	533,563	0.31	441,520	0.31	619,957	0.31	516,741	0.31
1999	729,513	0.23	606,900	0.23	799,187	0.23	665,905	0.23
2000	496,849	0.36	410,907	0.36	556,789	0.36	462,716	0.36
2001	558,140	0.27	460,789	0.27	659,792	0.27	548,125	0.27
2002	1,392,611	0.24	1,147,975	0.24	1,519,735	0.24	1,258,892	0.24
2003	946,780	0.26	789,181	0.26	1,038,558	0.26	867,625	0.26

Year	Default State		Alt State 1		Alt State 2		Alt State 3	
	B2	CV	B2	CV	B2	CV	B2	CV
2004	258,383	0.44	214,355	0.44	288,730	0.44	240,284	0.44
2005	916,120	0.55	756,866	0.55	1,019,477	0.55	844,789	0.55
2006	186,125	0.38	153,233	0.38	200,695	0.38	165,585	0.38
2007	1,180,033	0.35	971,161	0.35	1,294,277	0.35	1,069,811	0.35
2008	379,692	0.22	309,430	0.22	463,426	0.22	382,608	0.22
2009	1,065,113	0.25	858,808	0.25	1,279,811	0.25	1,037,924	0.25
2010	664,902	0.22	542,513	0.22	773,289	0.22	636,295	0.22
2011	703,159	0.28	584,098	0.28	764,575	0.28	636,546	0.28
2012	386,148	0.39	314,353	0.39	427,378	0.39	349,613	0.39
2013	448,709	0.41	370,883	0.41	536,146	0.41	447,796	0.41
2014	808,680	0.50	673,911	0.50	868,230	0.50	724,753	0.50
2015	734,131	0.42	616,448	0.42	828,262	0.42	696,175	0.42
2016	801,126	0.49	673,014	0.49	855,638	0.49	719,429	0.49
2017	499,824	0.61	397,582	0.61	620,960	0.61	502,295	0.61
2018	367,558	0.34	304,110	0.34	447,281	0.34	373,658	0.34
2019	488,284	0.34	402,688	0.34	582,864	0.34	482,308	0.34
2020	734,996	0.39	629,509	0.39	821,896	0.39	703,089	0.39
2021	219,659	0.29	183,496	0.29	258,443	0.29	216,841	0.29
2022	916,709	0.42	772,101	0.42	1,072,398	0.42	903,819	0.42
2023	683,035	0.46	570,144	0.46	802,038	0.46	672,294	0.46
2024	940,482	0.38	792,400	0.38	1,087,362	0.38	919,796	0.38

Table 3.8.7. SRHS recreational discards for Sandbar Shark by region in number. Estimates used under the reference case (Default State) and alternative approaches (alternatives states 1-3).

Year	Gulf	Atlantic	Total Discards
2008	257	756	1013
2009	191	385	576
2010	119	250	369
2011	204	1028	1232
2012	474	323	797
2013	850	185	1035
2014	223	93	316
2015	80	305	385
2016	60	292	352
2017	90	314	404
2018	124	481	605
2019	131	491	622
2020	1036	809	1845
2021	3287	4550	7837
2022	421	4702	5123
2023	189	2479	2668
2024	264	2256	2520

Table 3.8.8. Total recreational discard estimates in number (DISC) for Sandbar Shark combined across all surveys by year and mode under the reference case (Default State) and all alternative approaches (alt state 1-3).

Year	Default State		Alt State 1		Alt State 2		Alt State 3	
	DISC	CV	DISC	CV	DISC	CV	DISC	CV
1981	233,076	0.53	198,311	0.55	318,675	0.55	271,630	0.57
1982	333,142	0.25	281,114	0.25	353,014	0.25	297,057	0.25
1983	786,823	0.23	655,097	0.23	953,533	0.24	792,346	0.23
1984	425,181	0.31	358,382	0.32	469,813	0.31	395,335	0.32
1985	180,117	0.21	152,659	0.22	257,183	0.21	215,376	0.21
1986	461,853	0.38	391,653	0.40	594,682	0.37	501,634	0.38
1987	413,922	0.31	342,717	0.32	524,611	0.30	434,010	0.32
1988	138,612	0.33	113,063	0.32	204,242	0.30	169,133	0.30
1989	63,562	0.26	51,182	0.27	83,508	0.28	67,693	0.29
1990	112,912	0.24	89,301	0.24	136,046	0.24	108,531	0.25
1991	203,779	0.55	176,559	0.58	268,256	0.52	230,770	0.54
1992	240,722	0.30	201,590	0.31	301,765	0.30	252,469	0.31
1993	296,817	0.25	240,471	0.24	364,430	0.24	299,329	0.23
1994	161,792	0.29	128,934	0.29	220,699	0.29	180,089	0.29
1995	234,525	0.20	194,562	0.21	275,166	0.21	230,081	0.22
1996	322,479	0.26	266,086	0.27	355,499	0.27	294,622	0.28
1997	557,649	0.22	464,515	0.22	606,432	0.22	506,154	0.22
1998	533,563	0.30	441,520	0.32	619,957	0.32	516,741	0.35
1999	729,513	0.24	606,900	0.25	799,187	0.24	665,905	0.26
2000	496,849	0.29	410,907	0.30	556,789	0.30	462,716	0.31
2001	558,140	0.25	460,789	0.25	659,792	0.27	548,125	0.28
2002	1,392,611	0.25	1,147,975	0.25	1,519,735	0.25	1,258,892	0.26
2003	946,780	0.26	789,181	0.26	1,038,558	0.26	867,625	0.26

Year	Default State		Alt State 1		Alt State 2		Alt State 3	
	DISC	CV	DISC	CV	DISC	CV	DISC	CV
2004	258,383	0.43	214,355	0.43	288,730	0.43	240,284	0.43
2005	916,120	0.44	756,866	0.44	1,019,477	0.44	844,789	0.43
2006	186,125	0.38	153,233	0.38	200,695	0.38	165,585	0.38
2007	1,180,033	0.34	971,161	0.34	1,294,277	0.34	1,069,811	0.35
2008	380,705	0.23	310,443	0.23	464,439	0.24	383,621	0.25
2009	1,065,689	0.26	859,384	0.26	1,280,387	0.26	1,038,500	0.27
2010	665,271	0.22	542,882	0.23	773,658	0.23	636,664	0.24
2011	704,391	0.36	585,330	0.38	765,807	0.36	637,778	0.39
2012	386,945	0.30	315,150	0.28	428,175	0.28	350,410	0.27
2013	449,744	0.41	371,918	0.41	537,181	0.41	448,831	0.42
2014	808,996	0.45	674,227	0.45	868,546	0.45	725,069	0.45
2015	734,516	0.38	616,833	0.38	828,647	0.38	696,560	0.38
2016	801,478	0.40	673,366	0.39	855,990	0.40	719,781	0.39
2017	500,228	0.56	397,986	0.55	621,364	0.51	502,699	0.49
2018	368,163	0.34	304,715	0.34	447,886	0.34	374,263	0.34
2019	488,906	0.33	403,310	0.34	583,486	0.34	482,930	0.35
2020	736,841	0.35	631,354	0.36	823,741	0.35	704,934	0.36
2021	227,496	0.27	191,333	0.27	266,280	0.28	224,678	0.29
2022	921,832	0.34	777,224	0.34	1,077,521	0.34	908,942	0.34
2023	685,703	0.32	572,812	0.33	804,706	0.33	674,962	0.34
2024	943,002	0.28	794,920	0.29	1,089,882	0.28	922,316	0.29

Table 3.8.9. SRHS estimates of total effort in angler days by state.

YEAR	GNFL	SFL	SC	NC	TX	LA	MS	AL	FLW_A L
1981	72,427	226,456	59,030	19,374					
1982	66,961	226,172	67,539	26,939					
1983	83,499	194,364	65,733	23,830					
1984	95,234	193,760	67,314	28,865					
1985	94,449	186,396	66,001	31,384					
1986	113,101	203,957	67,227	31,187	56,568	5,891			240,077
1987	114,144	218,897	78,806	35,261	63,363	6,362			217,049
1988	109,156	192,619	76,468	42,421	70,396	7,691			195,948
1989	102,920	213,944	62,708	38,678	63,389	2,867			208,325
1990	98,234	224,661	57,151	43,240	58,144	6,898			213,906
1991	85,111	194,911	67,982	40,936	59,969	6,373			174,312
1992	90,810	173,713	61,790	41,176	76,218	9,911			184,802
1993	74,494	162,479	64,457	42,786	80,904	11,256			207,898
1994	65,745	177,036	63,231	36,691	100,778	12,651			204,562
1995	59,106	151,608	61,739	40,295	90,464	10,498			182,410
1996	47,239	152,618	54,929	35,142	91,852	10,988			154,913
1997	52,764	120,509	60,150	37,189	82,207	9,008			149,442
1998	51,790	103,551	61,342	37,399	77,650	7,854			185,331
1999	57,010	107,042	55,499	31,596	58,235	8,026			176,117
2000	59,771	122,478	40,291	31,351	58,395	4,952			159,331
2001	55,797	107,592	49,265	31,779	55,361	6,222			157,243
2002	48,911	102,635	42,467	27,601	66,951	6,222			141,831
2003	52,795	92,216	36,556	22,998	74,432	6,636			144,211
2004	52,243	123,157	48,763	27,255	64,990				158,430
2005	49,539	123,300	34,036	31,573	59,857				130,233

YEAR	GNFL	SFL	SC	NC	TX	LA	MS	AL	FLW_A L
2006	48,908	126,614	56,074	25,736	70,789	5,005			124,049
2007	53,762	103,388	60,729	29,002	63,764	2,522			136,880
2008	52,345	71,598	47,287	17,158	41,188	2,945			130,176
2009	66,447	69,973	40,919	15,914	50,737	3,268			142,438
2010	53,676	69,986	44,951	16,813	47,154	217	498		111,018
2011	54,707	77,785	44,645	14,796	47,284	1,886	1,771		157,025
2012	58,901	88,798	41,003	16,774	51,776	1,839	1,841		161,975
2013	66,587	99,092	40,963	16,503	55,749	1,579	1,827	14,454	160,277
2014	60,752	135,138	42,025	18,710	51,231	1,634	1,623	16,766	174,599
2015	54,480	140,499	39,702	18,734	55,135	1,664	1,923	18,008	176,375
2016	53,387	143,273	42,207	17,733	54,083	1,285	1,670	16,831	183,147
2017	48,304	77,822	36,914	16,680	51,575	1,556	1,633	17,841	178,816
2018	43,586	76,974	37,611	13,693	52,160	1,538	1,697	19,851	171,996
2019	43,139	76,573	41,470	12,280	52,456	1,258	1,374	18,607	167,167
2020	30,750	53,255	34,080	11,605	51,498	670	1,058	13,091	126,794
2021	47,396	72,971	47,908	16,157	71,344	1,533	1,664	13,844	181,632
2022	33,962	71,027	38,748	12,639	62,705	1,858	1,817	14,588	149,368
2023	31,842	73,831	35,814	13,175	58,279	1,606	1,638	12,513	149,735
2024	28,473	80,863	32,529	9,999	57,074	1,363	750	10,761	146,544

Table 3.8.10. SHRS estimates of total effort in angler trips by state.

YEAR	GNFL	SFL	SC	NC	TX	LA	MS	AL	FLW_AL
1981	83,851	201,243	84,252	23,236					
1982	80,231	288,708	93,651	30,016					
1983	86,734	234,940	92,332	26,254					
1984	108,836	324,262	102,171	28,101					
1985	117,459	328,986	105,945	30,138					
1986	132,626	346,186	103,743	31,157	65,731	5,021			259,421
1987	121,517	354,321	121,679	31,967	74,345	7,404			269,791
1988	112,748	293,699	121,209	38,650	76,962	6,802			275,514
1989	119,207	327,858	97,509	32,154	73,115	2,761			282,971
1990	127,075	343,233	89,899	36,733	69,667	7,113			298,124
1991	111,168	315,222	102,160	39,724	75,092	6,245			237,248
1992	113,529	287,671	94,480	40,004	86,984	9,106			247,546
1993	86,316	250,953	95,647	44,312	89,152	10,892			262,058
1994	76,874	296,414	93,563	33,949	106,610	11,550			271,973
1995	69,107	259,480	90,161	37,666	95,852	9,920			258,612
1996	56,284	279,882	76,408	37,243	96,901	10,863			229,387
1997	65,080	210,335	83,275	36,906	85,255	8,903			205,804
1998	60,663	167,631	85,320	40,456	82,694	7,858			235,781
1999	68,043	195,102	76,416	36,054	42,468	5,967			170,939
2000	69,309	219,728	79,269	38,531	67,060	4,996			226,720
2001	67,778	187,573	71,318	36,618	57,508	7,009			207,453
2002	58,012	168,159	65,474	38,772	69,614	0			190,431
2003	65,684	178,843	69,131	32,010	76,160	6,543			193,858
2004	63,829	222,859	71,872	35,808	65,024				210,780
2005	61,316	234,251	55,633	41,262	62,093	0			178,366
2006	61,358	235,646	88,459	33,776	72,260	5,005			171,231

YEAR	GNFL	SFL	SC	NC	TX	LA	MS	AL	FLW_AL
2007	67,112	154,462	87,596	33,576	141,783	2,585			185,512
2008	66,304	122,866	74,182	19,948	26,540	2,713			185,729
2009	77,866	120,812	68,785	17,128	55,440	2,648			206,315
2010	63,650	123,176	74,256	18,795	49,105	168	652		159,185
2011	66,461	134,748	73,343	16,885	50,165	1,583	2,140		227,248
2012	77,490	156,087	71,169	18,611	59,623	1,692	2,241		237,521
2013	83,043	179,226	68,979	17,649	58,489	1,546	2,193	21,045	210,147
2014	75,363	248,835	70,707	19,410	54,625	1,520	1,998	24,417	230,323
2015	69,339	258,409	66,010	20,696	59,048	1,492	2,421	27,054	230,273
2016	68,132	257,773	71,615	19,653	57,038	1,152	1,989	25,108	241,519
2017	61,860	137,416	59,788	18,703	54,738	1,427	1,868	26,497	236,739
2018	54,714	132,018	61,598	14,731	54,349	1,338	1,992	30,639	227,887
2019	54,001	131,689	67,068	13,016	53,639	1,102	1,675	28,188	219,117
2020	37,451	88,111	55,054	11,972	52,415	532	1,267	19,080	164,275
2021	60,033	122,457	79,755	17,552	85,007	1,176	2,259	19,709	244,632
2022	42,296	120,218	64,004	14,051	78,377	1,446	2,594	22,176	213,099
2023	38,810	125,307	57,483	14,519	63,662	1,098	2,220	19,202	189,400
2024	34,050	120,980	49,766	11,203	55,363	945	997	15,363	171,517
2025	33,857	122,517	58,265	12,220					

Table 3.8.11. Total recreational fishing effort (in angler trips) for Sandbar Shark combined across all surveys and modes by year. MRIP headboat estimates are used for the Gulf of America from 1981 and SRHS from 1986+.

Year	Effort
1981	113,455,727
1982	133,421,811
1983	139,281,894
1984	139,446,839
1985	138,756,206
1986	136,726,375
1987	137,728,480
1988	139,455,867
1989	142,102,913
1990	145,244,483
1991	156,221,914
1992	151,669,188
1993	157,505,801
1994	157,823,302
1995	152,940,941
1996	156,344,859
1997	162,658,959
1998	164,347,083
1999	175,422,398
2000	189,134,062
2001	194,744,860
2002	190,985,827
2003	198,702,816

Year	Effort
2004	207,209,053
2005	206,406,770
2006	206,368,518
2007	208,502,047
2008	210,987,305
2009	211,641,247
2010	220,663,656
2011	215,891,149
2012	212,560,594
2013	208,490,627
2014	196,191,430
2015	188,487,857
2016	190,954,989
2017	195,828,912
2018	182,543,625
2019	177,295,373
2020	189,916,929
2021	187,152,452
2022	190,898,777
2023	196,352,464
2024	184,974,879

Table 3.8.12. The annual number of fish, by state, sampled from **discarded** Sandbar Sharks from the headboat mode.

Year	NJ	DE	MD	VA	NC	SC	GA	FL
2004	0	0	0	0	1	0	1	0
2005	14	0	0	0	0	0	0	1
2006	0	1	0	0	0	0	0	0
2007	1	10	0	11	0	0	0	0
2008	0	3	0	0	0	1	0	0
2009	0	0	0	1	0	0	0	0
2010	0	3	0	0	0	0	0	0
2011	0	1	0	1	0	0	0	0
2012	0	5	0	4	0	0	0	0
2013	1	0	1	2	0	0	0	0
2014	0	1	0	3	0	0	0	0
2016	0	1	0	0	0	0	0	0
2017	0	0	0	1	0	0	0	0
2018	0	0	0	1	0	0	0	0
2019	0	0	0	7	0	0	0	0
2020	0	0	0	8	0	0	0	0
2021	0	0	0	7	0	0	0	0
2022	0	0	0	8	0	0	0	0
2023	0	0	0	7	0	0	0	0

Table 3.8.13. Temporal and data source coverage of shark commercial landings by the state of landing.

State	ALS	FINS	eDealer
AL	1950-2001	2002-2013	2014-present
CN		1950-2013	2014-present
CT		1950-2013	2014-present
DE		1950-2013	2014-present
FL	1950-1985	1986-2013	2014-present
GA	1950-2000	2001-2013	2014-present
LA	1950-1999	2000-2013	2014-present
MA		1950-2013	2014-present
MD		1950-2019	2020-present
MS	1950-present*		
NC	1950-1993	1994-2019	2020-present
NJ		1950-2013	2014-present
NY		1950-2013	2014-present
RI		1950-2013	2014-present
SC	1950-2005	2006-2013	2014-present
TX	1950-2013		2014-present
VA		1950-present	
*no shark landings reported from Mississippi after 2006			

Table 3.8.14. Sandbar Shark U.S. commercial landings uncertainty estimates by data source and data collection time period.

Uncertainty table for commercial catch sources for Sandbar shark									
Year	ALS	GulfFIN	ACCSP	PDC	eDealer	Percentage of catch Per Uncertainty Level		Final Recommended Uncertainties (CV values)	Uncertainty Direction (Underreporting "-" or Overreporting "+")
	<i>TX-NC, Caribbean</i>	<i>TX-FL</i>	<i>FL-ME</i>	<i>TX-ME, Caribbean</i>	<i>TX-ME, Caribbean</i>	0.1	0.05		
1950 - 1971	0.3		0.3					0.3	" - "
1972 - 1986	0.3		0.3					0.3	either "+" / "-"
1987 - 1992	0.3	0.3	0.3					0.3	either "+" / "-"
1993 - 2007	0.2	0.2	0.2	0.2				0.2	either "+" / "-". Overreporting likely for SBR (<2006); but incomplete reporting by fishery
2008 - 2013	0.1	0.05	0.05	0.1		0%	100%	0.05	" - "
2014 - present	0.1	0.05	0.05		0.05				" - "

Table 3.8.15. Estimated U. S. Sandbar Shark U.S. commercial landings in dressed weight pounds by region (GOA: Gulf of America, SAT: South Atlantic, NAT: North Atlantic). (*) indicate years with confidential strata.

Year	GOA	SAT	NAT
1950	3,215	212	198,553
1951	1,331	3,037	147,774
1952	1,717	12,118	154,102
1953	1,141	2,639	136,219
1954	1,543	173	107,362
1955	1,687	3,029	103,152
1956	1,699	1,444	74,674
1957	811	1,791	77,350
1958	541	1,339	322,298
1959	634	4,459	406,571
1960	1,256	4,966	33,952
1961	393,998	1,211	20,263
1962	559	4,068	24,556
1963	398	4,067	29,361
1964	299	502	31,967
1965	121	1,318	48,563
1966	258	37,580	44,072
1967	444	285,716	26,464
1968	263	541	12,125
1969	1,801	370	24,060
1970	1,248	140	13,905
1971	2,791	340	12,101
1972	3,220	353	22,616
1973	170,071	3,281	19,108
1974	5,550	1,284	30,095
1975	5,043	3,674	41,221
1976	21,623	5,278	28,863
1977	61,084	21,562	54,200
1978	307	3,108	46,803
1979	574	4,462	43,504
1980	967	9,192	139,108
1981	1,629	41,005	100,707
1982	9,289	39,993	83,350
1983	1,731	47,292	86,745
1984	36,599	81,190	88,688
1985	113,794	31,405	90,426
1986	610,673	234,819	123,845

Year	GOA	SAT	NAT
1987	1,637,987	407,450	138,874
1988	3,170,265	711,809	123,383
1989	4,636,214	1,051,741	214,056
1990	3,351,007	879,611	148,137
1991	3,128,491	612,380	264,375
1992	2,674,004	1,435,895	490,130
1993	1,575,660	1,254,013	541,367
1994	1,400,758	711,066	764,398
1995	1,557,638	706,162	855,654
1996	1,123,608	639,817	655,711
1997	701,255	344,159	393,273
1998	670,371	350,551	358,567
1999	696,977	439,524	638,388
2000	676,865	441,522	544,076
2001	839,540	416,819	556,822
2002	961,320	544,436	840,428
2003	1,008,896	400,516	603,025
2004	760,406	462,140	410,122
2005	587,252	384,931	451,331
2006	857,169	446,124	449,292
2007	270,285	215,877	262,406
2008	28,824	31,158	43,051
2009	116,291	55,160	896
2010	46,842	58,603	29,643
2011	50,544	62,701	31,914
2012	25,827	35,739	16,621
2013	37,594	27,345	11,270
2014	*	*	35,651
2015	*	88,746	*
2016	*	*	28,807
2017	74,051	*	*
2018	63,324	*	*
2019	*	*	34,797
2020	*	*	*
2021	79,710	*	*
2022	*	*	
2023	*	*	*
2024	*	*	*

Table 3.8.16. Estimated Sandbar Shark U.S. commercial landings in numbers of whole fish by region (GOA: Gulf of America, SAT: South Atlantic, NAT: North Atlantic). (*) indicate years with confidential strata.

Year	GOA	SAT	NAT
1950	51	5	4,457
1951	20	55	3,355
1952	25	218	3,516
1953	16	47	3,052
1954	21	3	2,430
1955	23	54	2,339
1956	23	26	1,670
1957	12	34	1,722
1958	9	24	7,445
1959	10	81	9,393
1960	19	90	737
1961	5,399	22	448
1962	11	73	539
1963	6	73	637
1964	6	9	691
1965	3	24	1,045
1966	5	674	948
1967	10	5,125	571
1968	6	11	261
1969	27	7	520
1970	17	3	301
1971	41	6	263
1972	45	6	489
1973	2,331	60	414
1974	77	23	650
1975	72	66	893
1976	322	95	628
1977	885	388	1,218
1978	5	56	1,024
1979	9	81	950
1980	14	166	3,014
1981	24	736	2,218
1982	140	720	1,843
1983	31	851	1,902
1984	505	1,460	1,944
1985	1,568	567	1,984

Year	GOA	SAT	NAT
1986	8,473	4,239	2,689
1987	22,559	7,336	3,040
1988	43,528	12,800	2,703
1989	63,581	18,887	4,756
1990	45,936	15,790	3,342
1991	42,932	11,022	5,992
1992	36,804	25,769	10,799
1993	21,619	22,525	12,096
1994	19,233	12,767	16,579
1995	21,360	12,692	18,540
1996	15,395	11,532	14,270
1997	9,609	6,211	8,524
1998	9,202	6,292	7,842
1999	9,548	7,892	13,758
2000	9,315	7,940	11,770
2001	11,501	7,521	12,194
2002	13,226	9,779	18,278
2003	13,828	7,234	13,210
2004	10,417	8,301	8,986
2005	8,043	6,908	9,845
2006	11,742	8,058	9,912
2007	3,704	4,023	5,974
2008	395	618	990
2009	1,593	990	20
2010	642	1,076	637
2011	692	1,125	686
2012	355	638	368
2013	516	490	243
2014	*	*	765
2015	*	1,592	*
2016	*	*	618
2017	1,014	*	*
2018	867	*	*
2019	*	*	747
2020	*	*	16
2021	1,092	*	*
2022	*	*	
2023	*	*	*

Year	GOA	SAT	NAT
2024	*	*	*

Table 3.8.17. Reconstructed Mexican Sandbar Shark landings from 1976-2024 in dressed weight pounds and numbers of whole fish for the default and alternative scenarios. Note: The alternative state differs from the default state for only the years 2000-2024.

Year	Default		Alternative	
	Pounds	Number	Pounds	Number
1976	59,424	1,099	59,424	1,099
1977	67,811	1,259	67,811	1,258
1978	133,592	2,413	133,592	2,412
1979	122,384	2,095	122,384	2,095
1980	230,129	3,965	230,129	3,965
1981	582,390	10,024	582,390	10,023
1982	649,106	11,799	649,106	11,799
1983	601,263	11,112	601,263	11,112
1984	640,075	11,688	640,075	11,688
1985	412,040	7,911	412,040	7,911
1986	497,813	9,363	497,813	9,363
1987	375,063	6,954	375,063	6,954
1988	502,366	9,124	502,366	9,124
1989	446,852	8,338	446,852	8,338
1990	566,736	10,735	566,736	10,735
1991	481,305	9,058	481,305	9,058
1992	515,678	9,668	515,678	9,668
1993	484,682	9,072	484,682	9,073
1994	471,572	8,755	471,572	8,755
1995	535,221	9,878	535,221	9,879
1996	581,480	10,717	581,480	10,717
1997	469,951	8,340	469,951	8,340
1998	401,142	7,190	401,142	7,190
1999	429,681	7,966	429,681	7,967
2000	390,806	7,035	1,186,881	24,364
2001	366,195	6,415	822,915	16,524
2002	287,242	5,025	632,705	12,701
2003	247,129	4,327	539,903	10,882
2004	242,279	4,232	511,120	10,283

	Default		Alternative	
Year	Pounds	Number	Pounds	Number
2005	251,407	4,425	596,038	12,038
2006	261,857	4,647	684,113	13,910
2007	232,203	4,078	523,997	10,609
2008	150,135	2,572	230,695	4,526
2009	137,516	2,373	237,180	4,701
2010	184,089	3,183	323,418	6,462
2011	114,003	1,987	221,703	4,483
2012	146,390	2,548	289,797	5,808
2013	142,054	2,416	191,597	3,681
2014	165,241	2,809	217,803	4,184
2015	203,885	3,491	317,570	6,184
2016	279,213	4,705	320,135	5,937
2017	397,292	6,690	457,460	8,422
2018	479,973	8,099	536,820	10,052
2019	365,673	6,292	574,186	11,439
2020	389,625	6,663	543,482	10,702
2021	483,832	8,170	508,771	9,644
2022	505,155	8,607	690,906	13,407
2023	499,883	8,567	783,265	15,371
2024	515,954	8,842	823,409	16,208

Table 3.8.18. Number of Sandbar Sharks discarded dead, discarded alive, and kept from the Pelagic Longline Fishery, and estimated number of dead discards and estimated total weight (kg).

Year	OBSERVED			ESTIMATED	
	Discarded Dead	Discarded Alive	Kept	Discarded Dead	Total Weight
1992	8	20	187	211	11,459
1993	30	53	258	284	15,423
1994	16	45	8	748	38,706
1995	6	17	57	335	15,942
1996	1	15	105	50	1,804
1997	3	16	0	119	4,487
1998	1	9	4	55	3,313
1999	4	21	0	159	8,235
2000	5	9	1	162	8,455
2001	2	4	0	72	2,784
2002	0	1	0	0	-
2003	0	1	31	0	-
2004	4	13	0	40	2,411
2005	3	8	49	44	2,377
2006	1	3	11	12	336
2007	9	42	0	185	5,553
2008	7	50	0	46	1,852
2009	38	39	0	136	6,309
2010	8	20	0	93	3,034
2011	16	31	0	156	6,211
2012	7	32	0	71	2,928
2013	14	42	0	98	4,904
2014	5	21	0	25	1,210

Year	OBSERVED			ESTIMATED	
	Discarded Dead	Discarded Alive	Kept	Discarded Dead	Total Weight
2015	137	71	0	404	3,897
2016	47	115	1	388	3,442
2017	30	76	0	422	12,318
2018	13	47	0	141	4,889
2019	4	14	0	44	2,091
2020	5	2	0	156	5,926
2021	14	51	0	270	14,946
2022	9	30	0	24	1,471
2023	18	55	0	244	12,615
2024	5	28	0	32	1,755

Table 3.8.19. Yearly observed dead and live discards of Sandbar Shark from Shark Research Fishery. Discards are reported in numbers.

Year	Number Observed Sets	Total Dead Discards	Total Live Discards
2008	62	6	32
2009	111	195	401
2010	185	246	926
2011	236	104	386
2012	85	6	4
2013	93	3	1
2014	104	0	2
2015	99	2	9
2016	81	6	3
2017	104	4	8
2018	108	10	9
2019	100	11	1
2020	79	3	2
2021	77	8	0
2022	47	6	1
2023	25	2	0
2024	37	9	25
2025	40	7	0

Table 3.8.20. Estimates of live discards of Sandbar Shark from the Reefish Bottom Longline Fishery. Discards are in number of sharks

Logbook Year	Logbook Hooks	Estimated Discard	LCL	UCL
2005	1,459,306	3,067	600	15,683
2006	1,548,722	3,255	637	16,644
2007	1,264,828	2,658	520	13,593
2008	1,235,181	2,596	508	13,274
2009	552,116	1,160	227	5,933
2010	301,930	635	124	3,245
2011	429,879	904	177	4,620
2012	414,663	872	170	4,456
2013	452,025	950	186	4,858
2014	474,880	998	195	5,103
2015	482,299	1,014	198	5,183
2016	552,852	1,162	227	5,941
2017	499,663	1,050	205	5,370
2018	462,474	972	190	4,970
2019	452,823	952	186	4,866
2020	506,199	1,064	208	5,440
2021	489,120	1,028	201	5,256
2022	432,997	910	178	4,653
2023	430,975	906	177	4,632
2024	394,740	830	162	4,242
2025	376,300	791	155	4,044

Table 3.8.21. Estimates of dead and live discards (lb. dressed weight) from the Pelagic Longline, Shark Research, and Gulf Bottom Longline Reefish Fishery. An asterisk indicates an estimate was not provided due to no observer coverage, lack of logbook effort data, or was not determined

Year	Pelagic Longline Fishery		Shark Research Fishery		Gulf Reefish Bottom Longline Fishery	
	Live	Dead	Dead	Live	Dead	Live
1992	*	18,178	*	*	*	*
1993	*	24,466	*	*	*	*
1994	*	61,401	*	*	*	*
1995	*	25,289	*	*	*	*
1996	*	2,862	*	*	*	*
1997	*	7,118	*	*	*	*
1998	*	5,256	*	*	*	*
1999	*	13,063	*	*	*	*
2000	*	13,412	*	*	*	*
2001	*	4,416	*	*	*	*
2002	*	0	*	*	*	*
2003	*	0	*	*	*	*
2004	*	3,825	*	*	*	*
2005	*	3,771	*	*	0	22,819
2006	*	533	*	*	0	24,218
2007	*	8,809	*	*	0	19,778
2008	*	2,938	39	211	0	19,315
2009	*	10,008	1,284	2,640	0	8,634
2010	*	4,813	1,619	6,096	0	4,721
2011	*	9,853	685	2,541	0	6,722
2012	*	4,645	39	26	0	6,484
2013	*	7,779	20	7	0	7,068
2014	*	1,919	0	13	0	7,426
2015	*	6,182	13	59	0	7,542
2016	*	5,460	39	20	0	8,645
2017	*	19,540	26	53	0	7,813
2018	*	7,756	66	59	0	7,232
2019	*	3,317	72	7	0	7,081
2020	*	9,401	20	13	0	7,916
2021	*	23,709	53	0	0	7,648
2022	*	2,333	39	7	0	6,771
2023	*	20,012	13	0	0	6,739
2024	*	2,784	59	165	0	6,173
2025	*	*	46	0	0	5,884

Table 3.8.22. Fishery-dependent length data sources from commercial catches broken up by status (retained/discarded) for possible use in the assessment obtained from SEDAR101-DW-22, their Table 3.

Data Source	Years of Coverage	Status	Sandbar (Estimated)	Sandbar (Measured)	Total
Northeast Fisheries Observer Program (NEFOP)	1995-2024				
		Discarded	1694	2490	4184
Pelagic Longline Observer Program (POP)	1992-2024				
		Retained	9	209	218
		Discarded	1351	71	1422
		Unknown	2	0	2
Reef Fish Bottom Longline	2006-2024				
		Retained	0	6	6
		Discarded	432	30	462
		Unknown	1	0	1
Reef Fish Vertical Longline	2019-2024				
		Discarded	32	1	33
Shark Observer Program (SBLOP)	2005-2021				
		Retained	310	2877	3187
		Discarded	486	138	64
Shark Research Fishery (SRF)	2008-2024				
		Retained	9371	29370	38741
		Discarded	2490	438	2928
		Unknown	204	58	262
Southeast Gillnet (GILL)	2008-2024				
		Retained	3	35	38
		Discarded	26	87	113
Data Source	Years of Coverage	Status	Sandbar (Estimated)	Sandbar (Measured)	Total

University of Florida (UF) 1993-2005

Retained	0	21125	21125
Discarded	0	894	894
Unknown	0	6	6
Total(s)	16,411	57,835	74,246

3.9 FIGURES

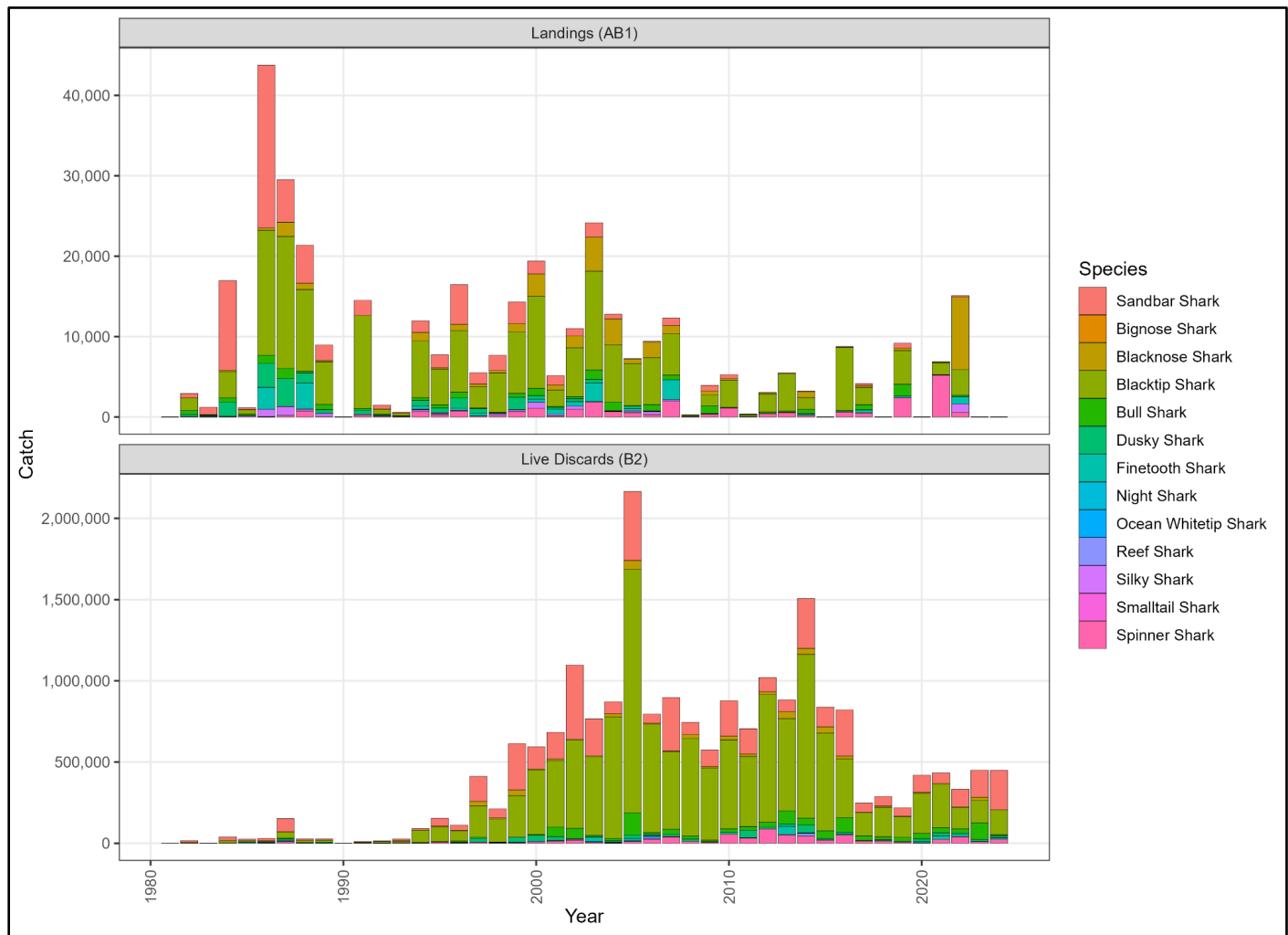


Figure 3.9.1.1. Unidentified Requiem Genus recreational catch apportioned to species, shown separately for landings (AB1) and live discards (B2) from MRIP. At the genus level, Sandbar Shark and Blacktip Shark comprise the largest proportional contributors within the unidentified Requiem Shark Genus grouping. These proportions are utilized in the Default state and in the alternative states 1-3.

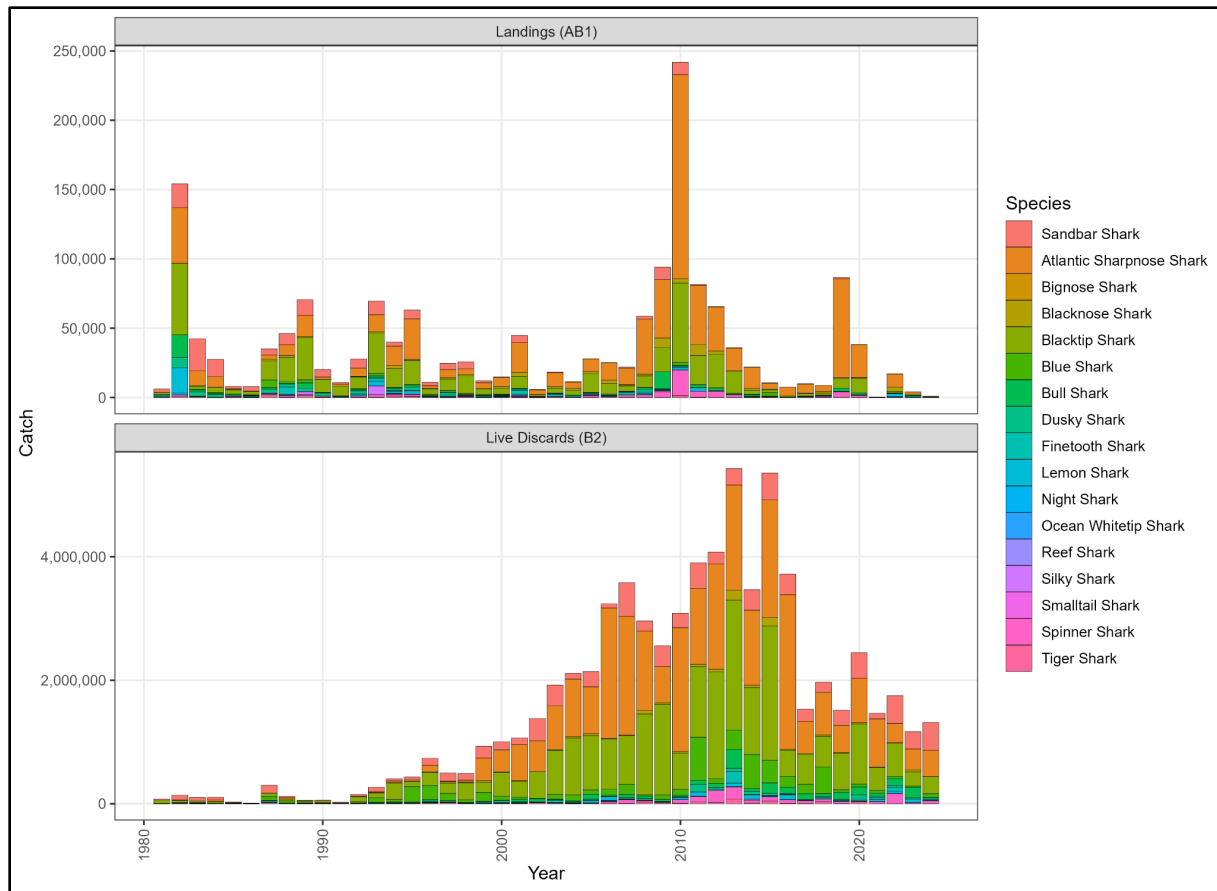


Figure 3.9.1.2. Unidentified Requiem Family recreational catch apportioned to species, shown separately for landings (AB1) and live discards (B2) from MRIP. At the family level, Atlantic Sharpnose Shark, Blacktip Shark, and Sandbar Shark represent the largest proportional contributors within the unidentified Requiem Shark Family grouping. These proportions are utilized in the Default state and in the alternative states 1-3.

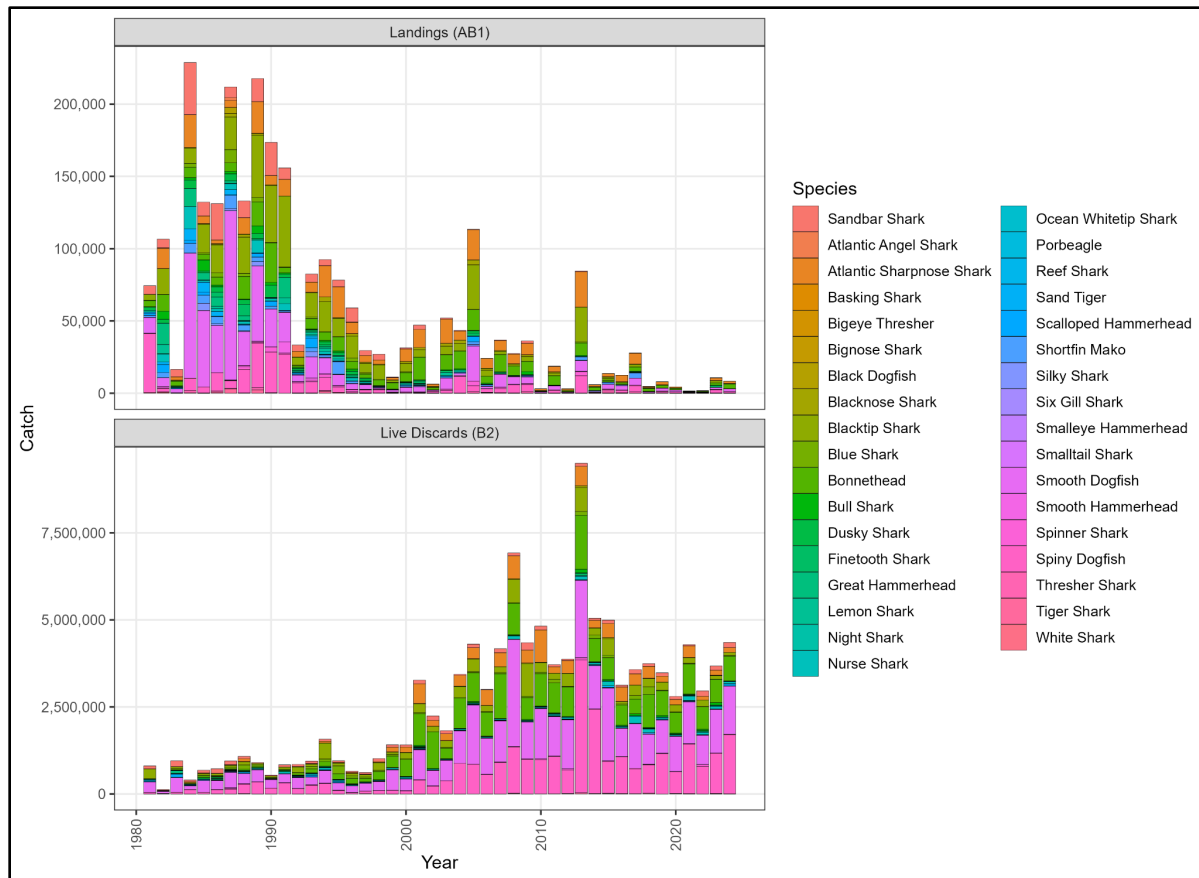
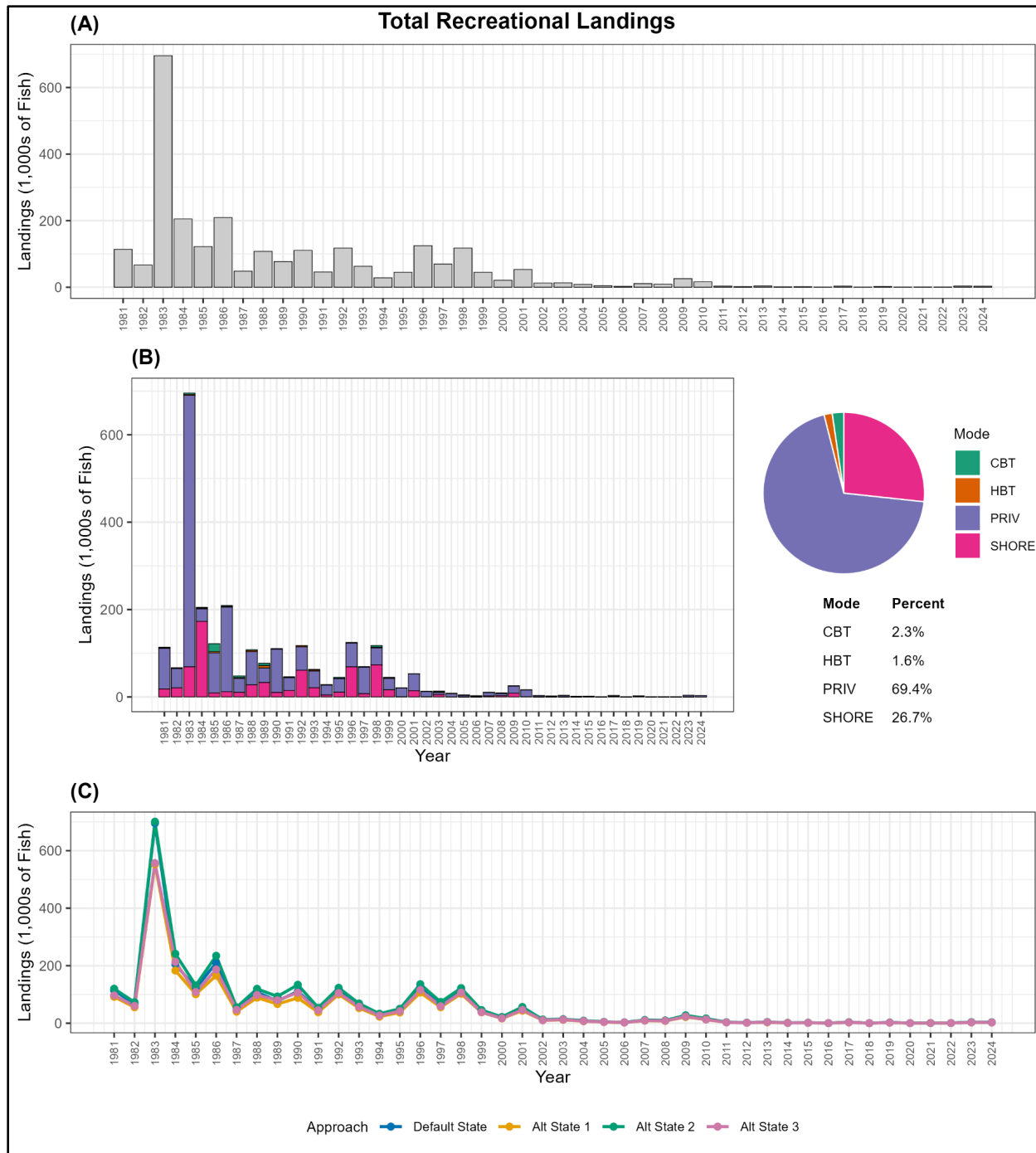
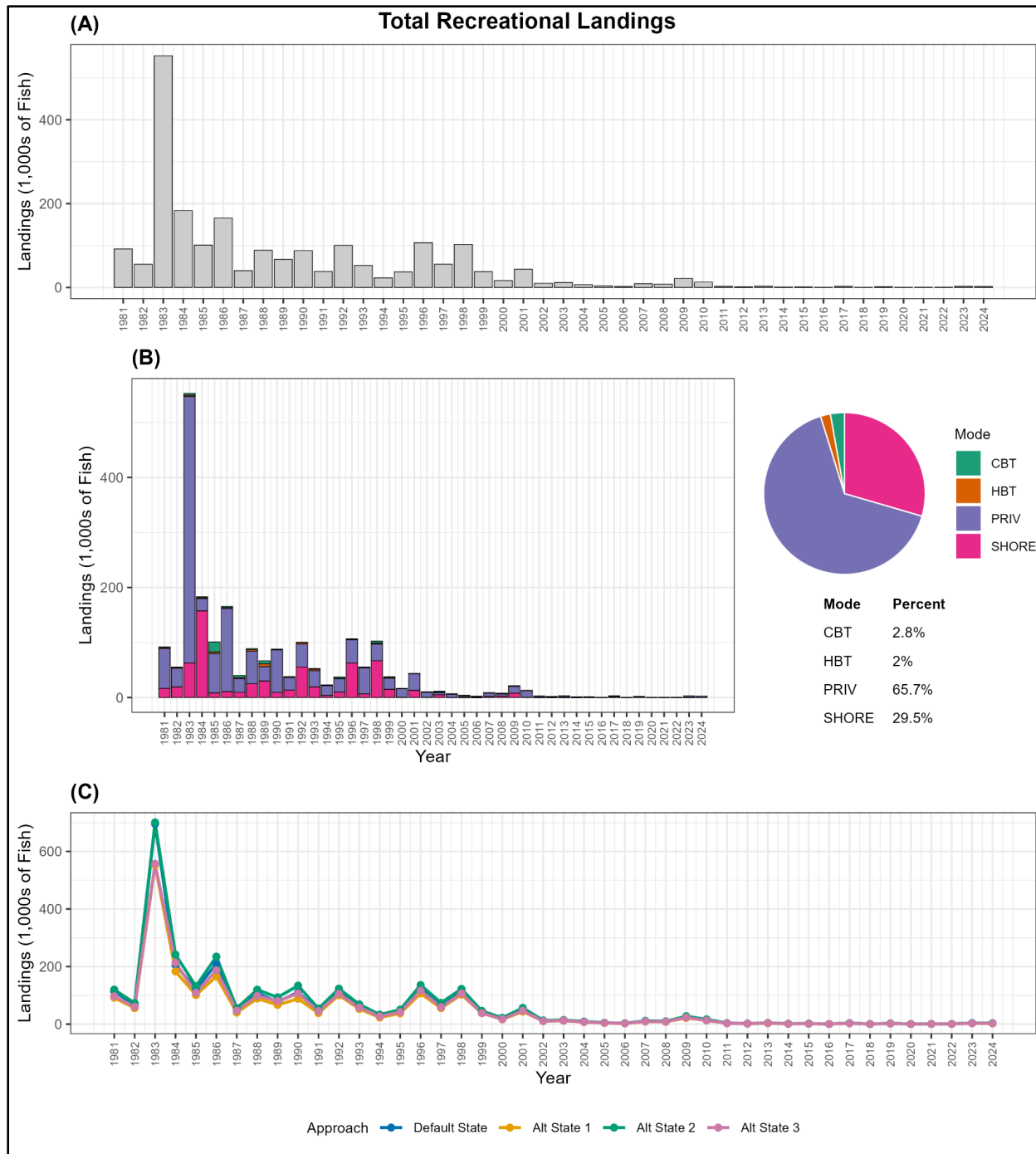


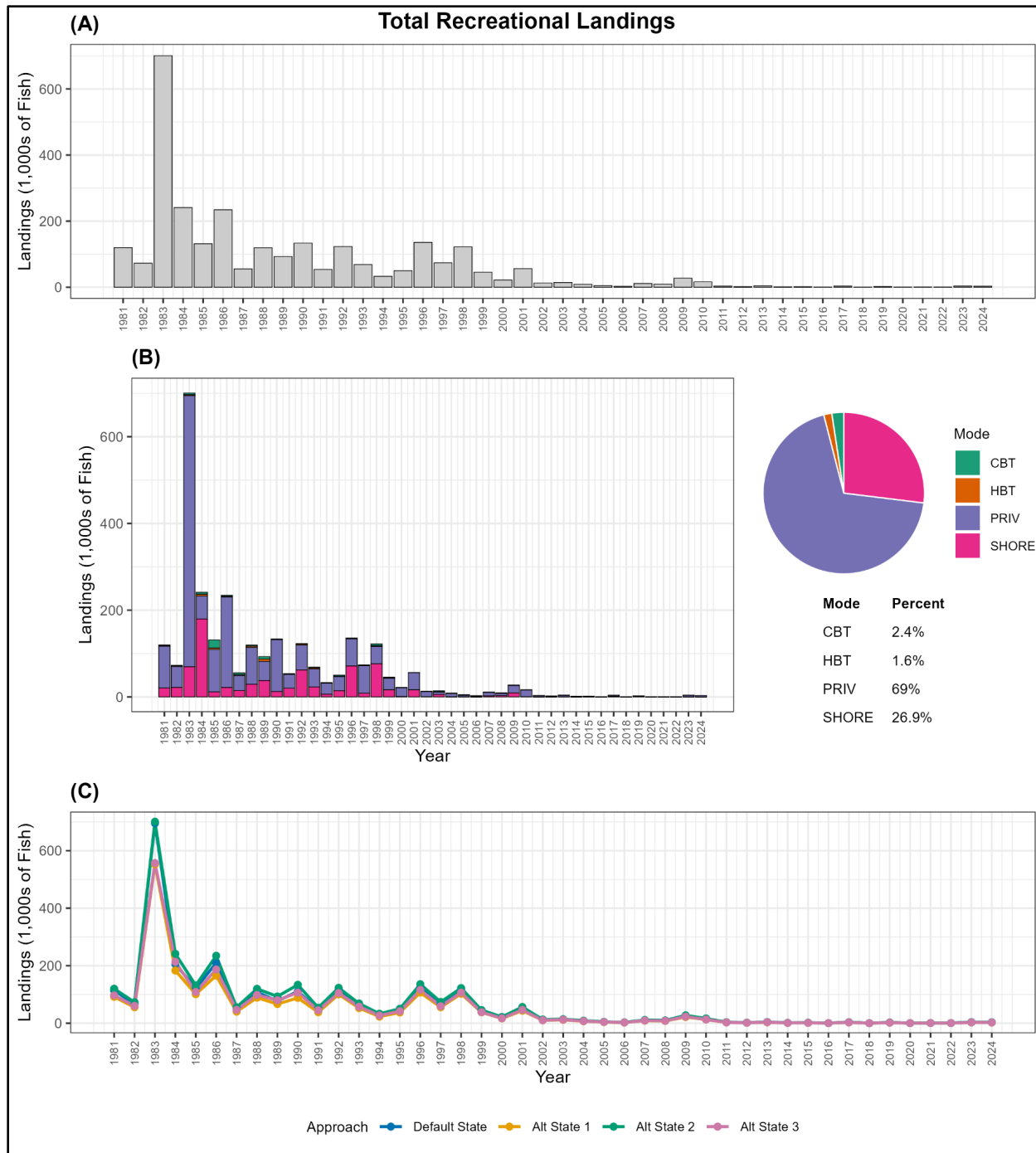
Figure 3.9.2. Unidentified sharks recreational catch apportioned to species, shown separately for landings (AB1) and live discards (B2) from MRIP. Atlantic Sharpnose Shark, Blacktip Shark, Bonnethead, Sandbar Shark, Smooth Dogfish, and Spiny Dogfish were among the largest proportional contributors within the Unidentified Sharks grouping. These proportions are utilized in the alternative states 2 and 3.



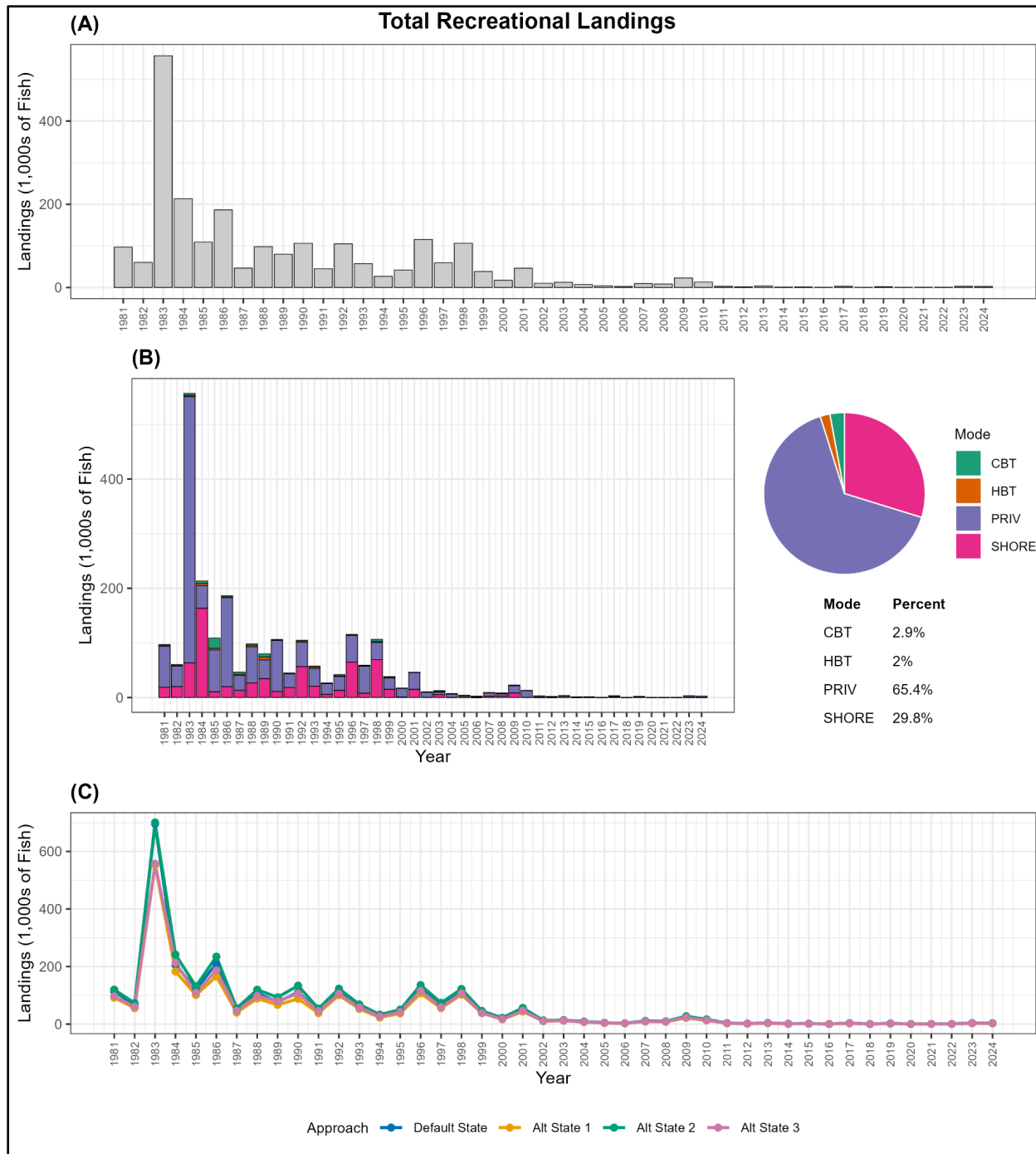
Figures 3.9.3.1. Total recreational landings for Sandbar Shark across all surveys under the reference case using the **Requiem Shark Genus and Requiem Shark Family allocation method (Default State)**. Landings are provided (A) by year in thousands of fish, (B) by mode and year in thousands of fish, and (C) by year in thousands of fish in comparison to alternative approaches 1-3.



Figures 3.9.3.2. Total recreational landings for Sandbar Shark across all surveys under the alternative case using the **Requiem Shark Genus and Requiem Shark Family allocation method with a 22% reduction applied to private mode and a 9% reduction applied to shore mode (Alternative State 1)**. Landings are provided (A) by year in thousands of fish, (B) by mode and year in thousands of fish, and (C) by year in thousands of fish in comparison to the Default State and alternative approaches 2 & 3.



Figures 3.9.3.3. Total recreational landings for Sandbar Shark across all surveys under the alternative case using the **Requiem Shark Genus, Requiem Shark Family, and Unidentified Sharks allocation method (Alternative State 2)**. Landings are provided (A) by year in thousands of fish, (B) by mode and year in thousands of fish, and (C) by year in thousands of fish in comparison to the Default State and alternative approaches 1 & 3.



Figures 3.9.3.4. Total recreational landings for Sandbar Shark across all surveys under the alternative case using the **Requiem Shark Genus, Requiem Shark Family, and Unidentified Sharks allocation method with a 22% reduction applied to private mode and a 9% reduction applied to shore mode (Alternative State 3)**. Landings are provided (A) by year in thousands of fish, (B) by mode and year in thousands of fish, and (C) by year in thousands of fish in comparison to the Default State and alternative approaches 1 & 2.

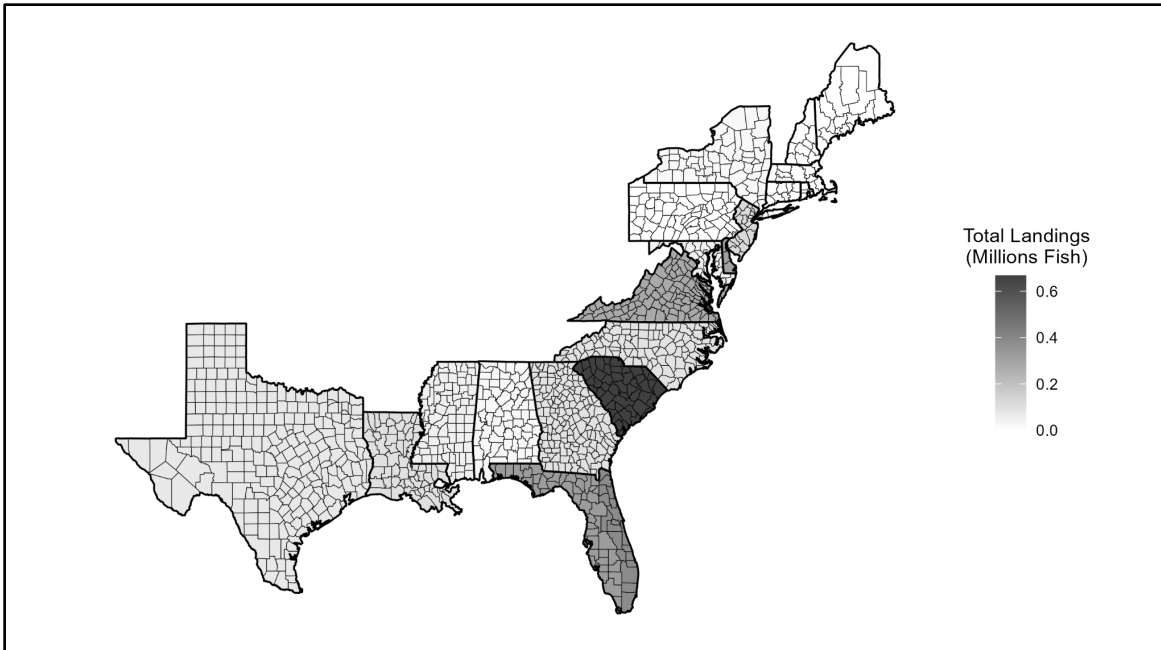


Figure 3.9.4.1. Total recreational landings, in millions of fish, for Sandbar Shark from Maine to Texas under the reference case using the **Requiem Shark Genus and Requiem Shark Family allocation method (Default State)**. Estimates are combined across all surveys and years.

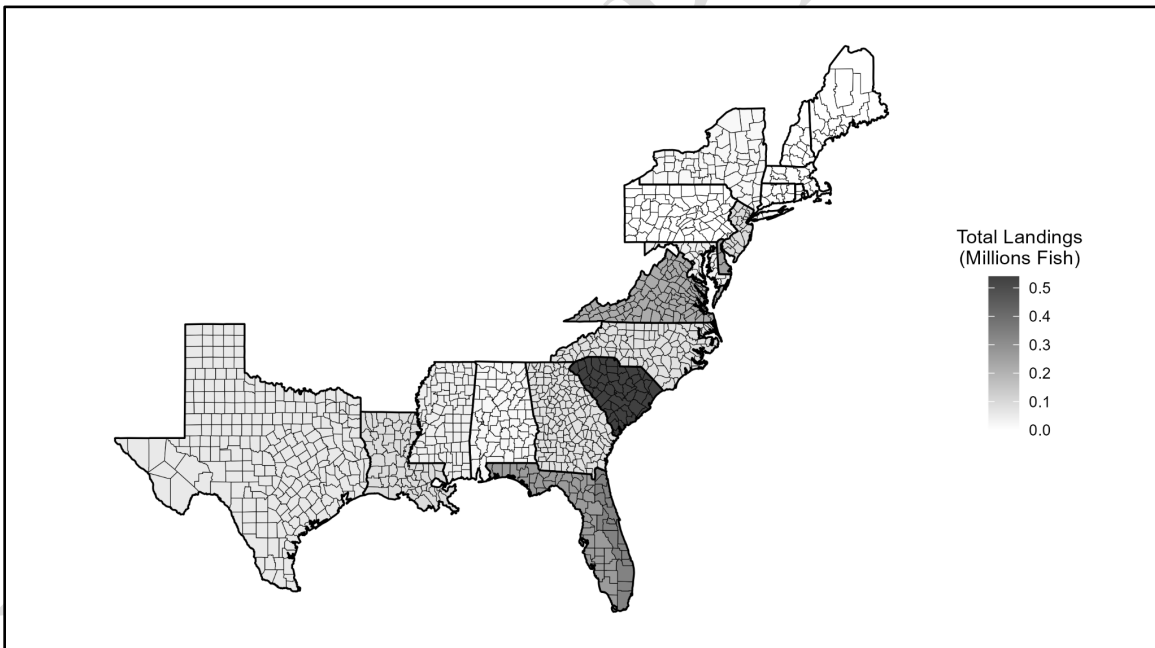


Figure 3.9.4.2. Total recreational landings, in millions of fish, for Sandbar Shark from Maine to Texas under the alternative case using the **Requiem Shark Genus and Requiem Shark Family allocation method with a 22% reduction applied to private mode and a 9% reduction applied to shore mode (Alternative State 1)**. Estimates are combined across all surveys and years.

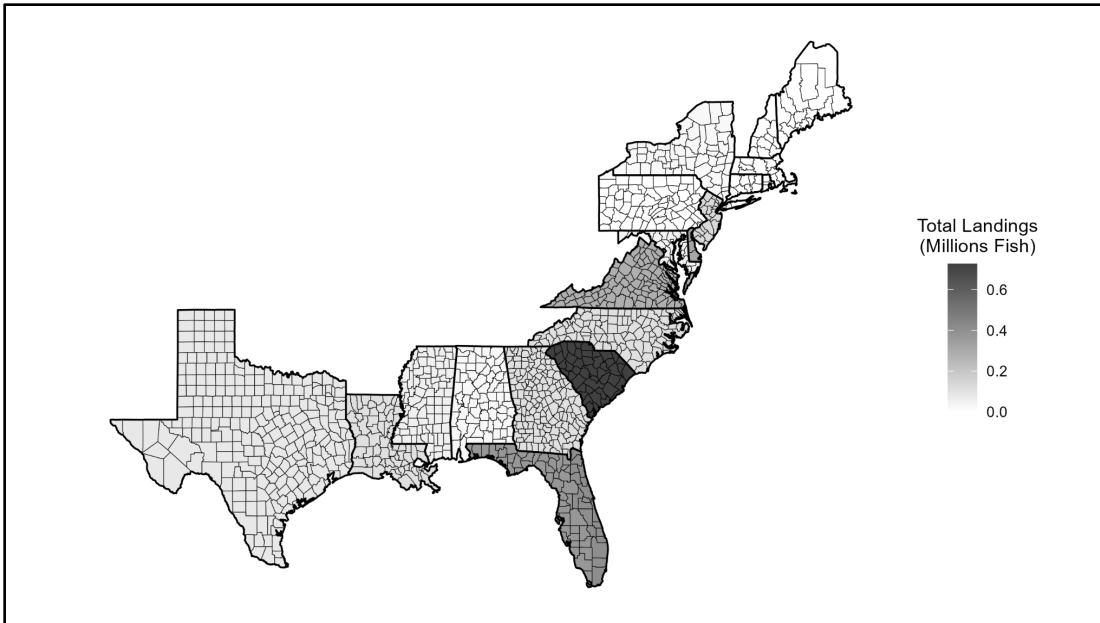


Figure 3.9.4.3. Total recreational landings, in millions of fish, for Sandbar Shark from Maine to Texas under the alternative case using the **Requiem Shark Genus, Requiem Shark Family, and Unidentified Sharks allocation method (Alternative State 2)**. Estimates are combined across all surveys and years.

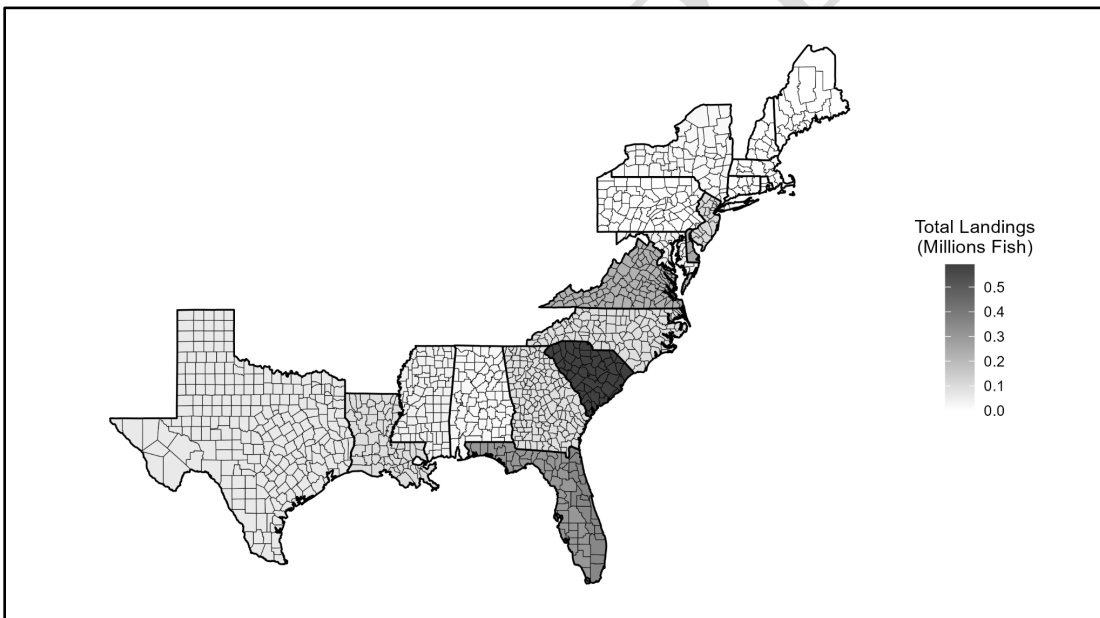


Figure 3.9.4.4. Total recreational landings, in millions of fish, for Sandbar Shark from Maine to Texas under the alternative case using the **Requiem Shark Genus, Requiem Shark Family, and Unidentified Sharks allocation method with a 22% reduction applied to private mode and a 9% reduction applied to shore mode (Alternative State 3)**. Estimates are combined across all surveys and years.

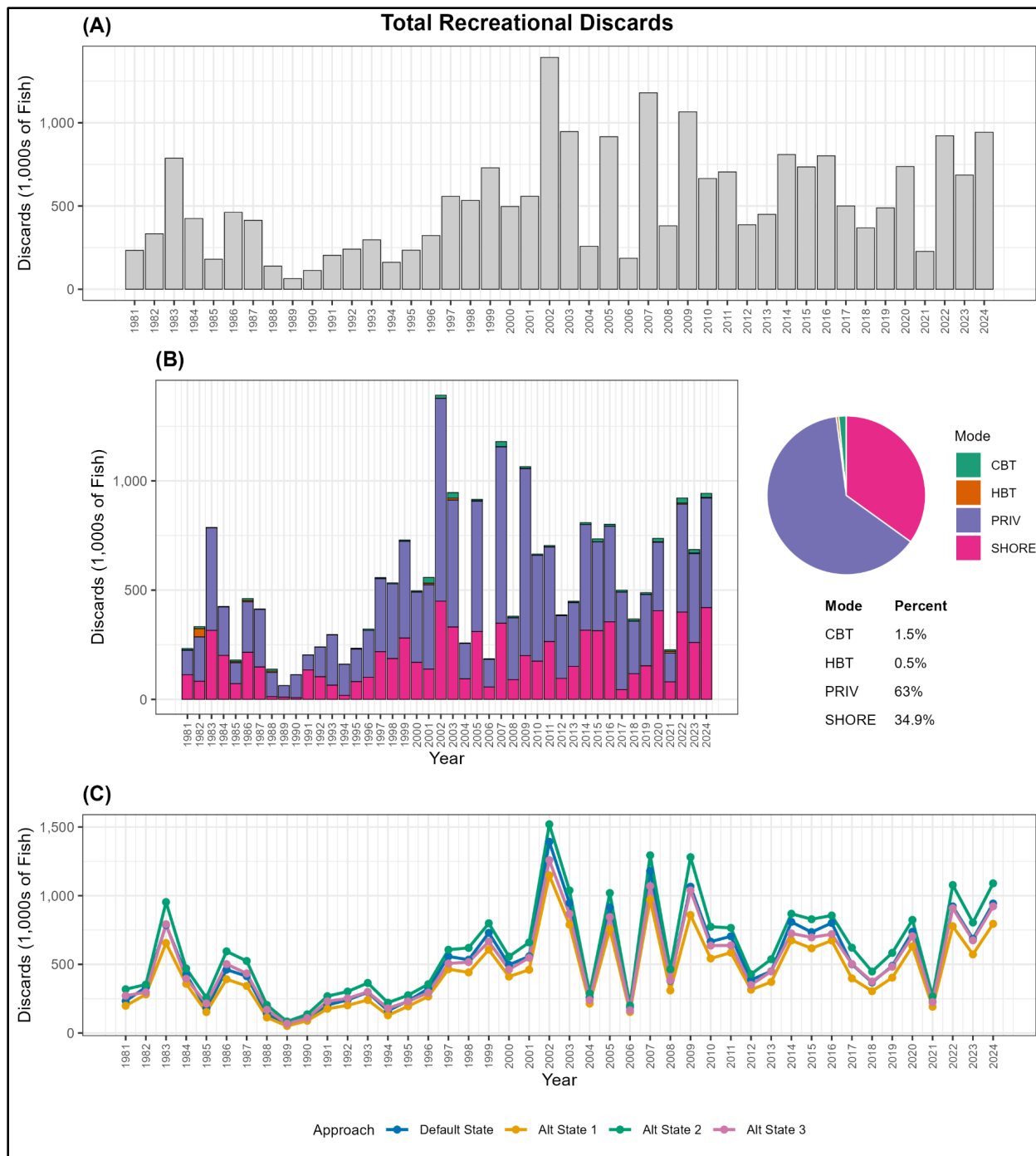


Figure 3.9.5.1. Total recreational discards for Sandbar Shark across all surveys under the reference case using the **Requiem Shark Genus and Requiem Shark Family allocation method (Default State)**. Discards are provided (A) by year in thousands of fish, (B) by mode and year in thousands of fish, and (C) by year in thousands of fish in comparison to alternative approaches 1-3.

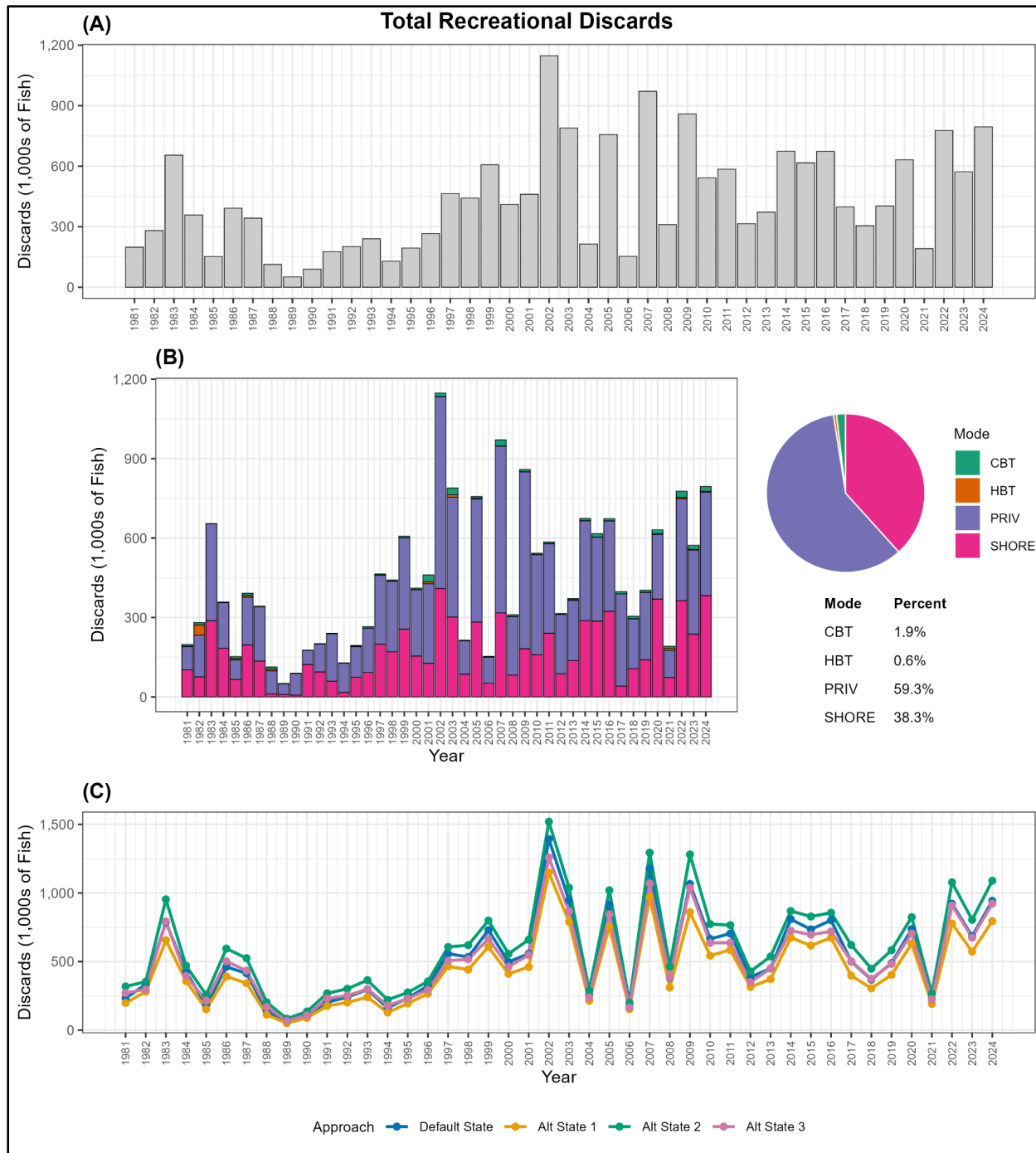


Figure 3.9.5.2. Total recreational discards for Sandbar Shark across all surveys under the alternative case using the **Requiem Shark Genus and Requiem Shark Family** allocation method with a **22% reduction applied to private mode** and a **9% reduction applied to shore mode (Alternative State 1)**. Discards are provided (A) by year in thousands of fish, (B) by mode and year in thousands of fish, and (C) by year in thousands of fish in comparison to the Default State and alternative approaches 2 & 3.

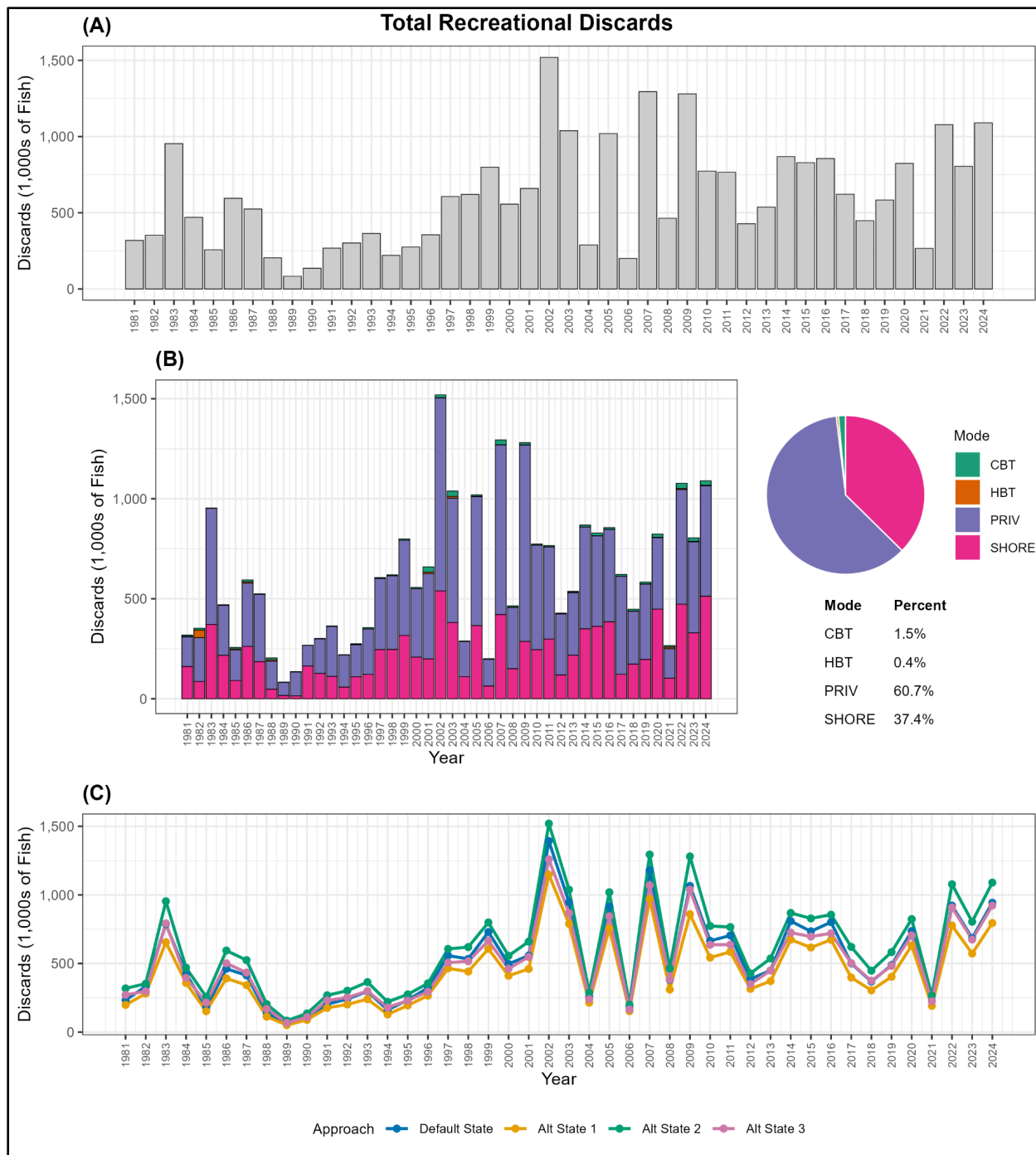


Figure 3.9.5.3. Total recreational discards for Sandbar Shark across all surveys under the alternative case using the **Requiem Shark Genus, Requiem Shark Family, and Unidentified Sharks allocation method (Alternative State 2)**. Discards are provided (A) by year in thousands of fish, (B) by mode and year in thousands of fish, and (C) by year in thousands of fish in comparison to the Default State and alternative approaches 1 & 3.

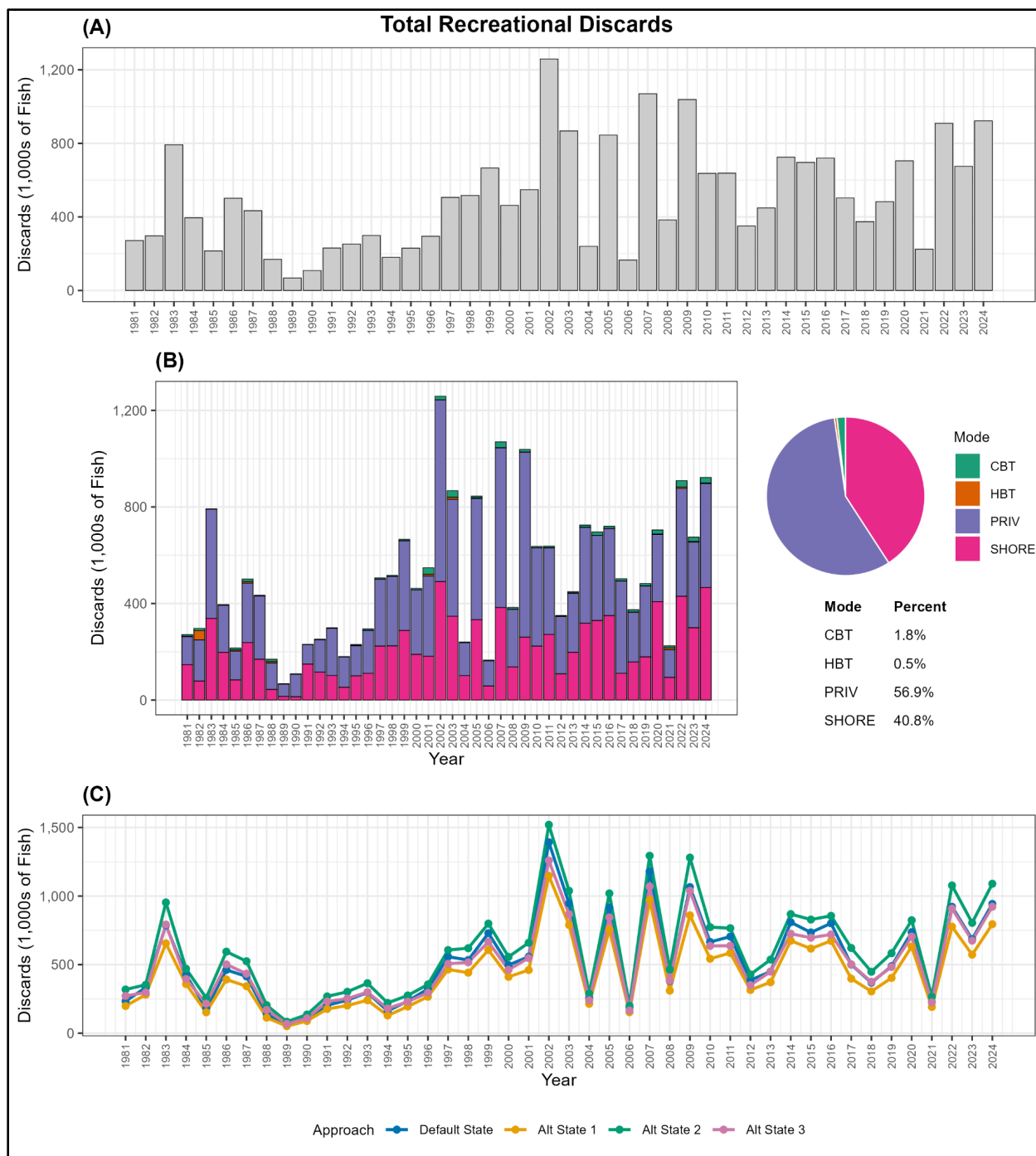


Figure 3.9.5.4. Total recreational discards for Sandbar Shark across all surveys under the alternative case using the Requiem Shark Genus, Requiem Shark Family, and Unidentified Sharks allocation method with a 22% reduction applied to private mode and a 9% reduction applied to shore mode (Alternative State 3). Discards are provided (A) by year in thousands of fish, (B) by mode and year in thousands of fish, and (C) by year in thousands of fish in comparison to the Default State and alternative approaches 1 & 2.

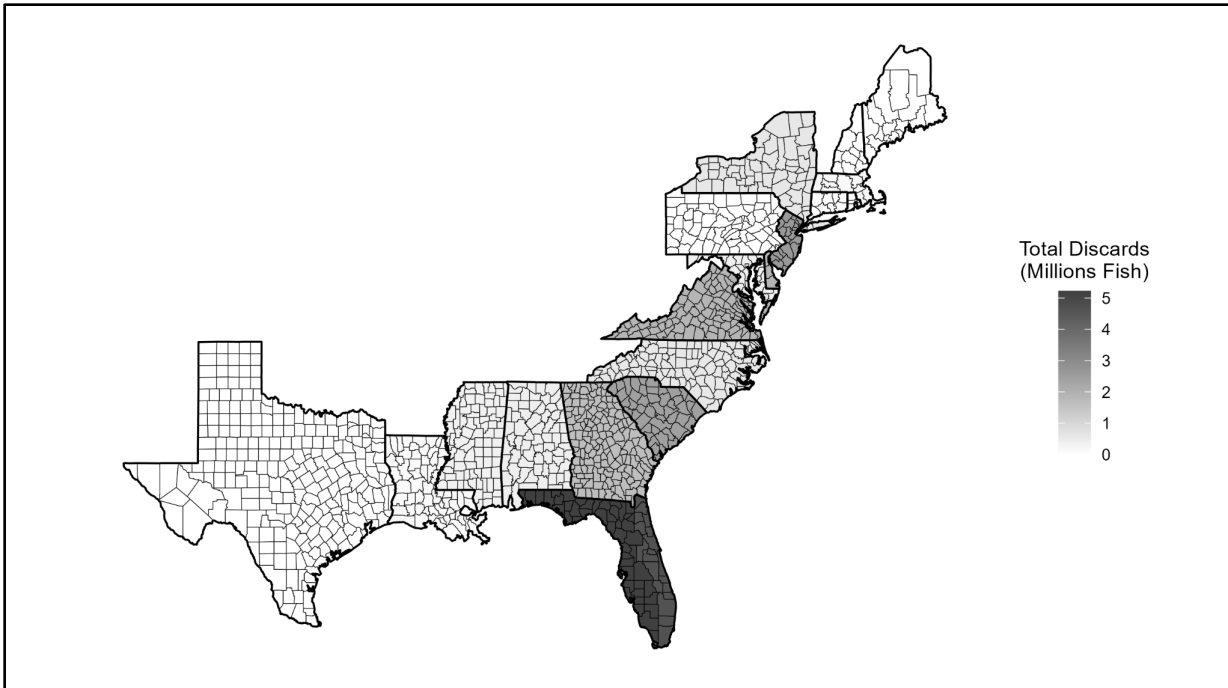


Figure 3.9.6.1. Distribution of total recreational discards, in millions of fish, for Sandbar Shark from Maine to Texas under the reference case using the **Requiem Shark Genus and Requiem Shark Family allocation method (Default State)**. Estimates are combined across all surveys and years.

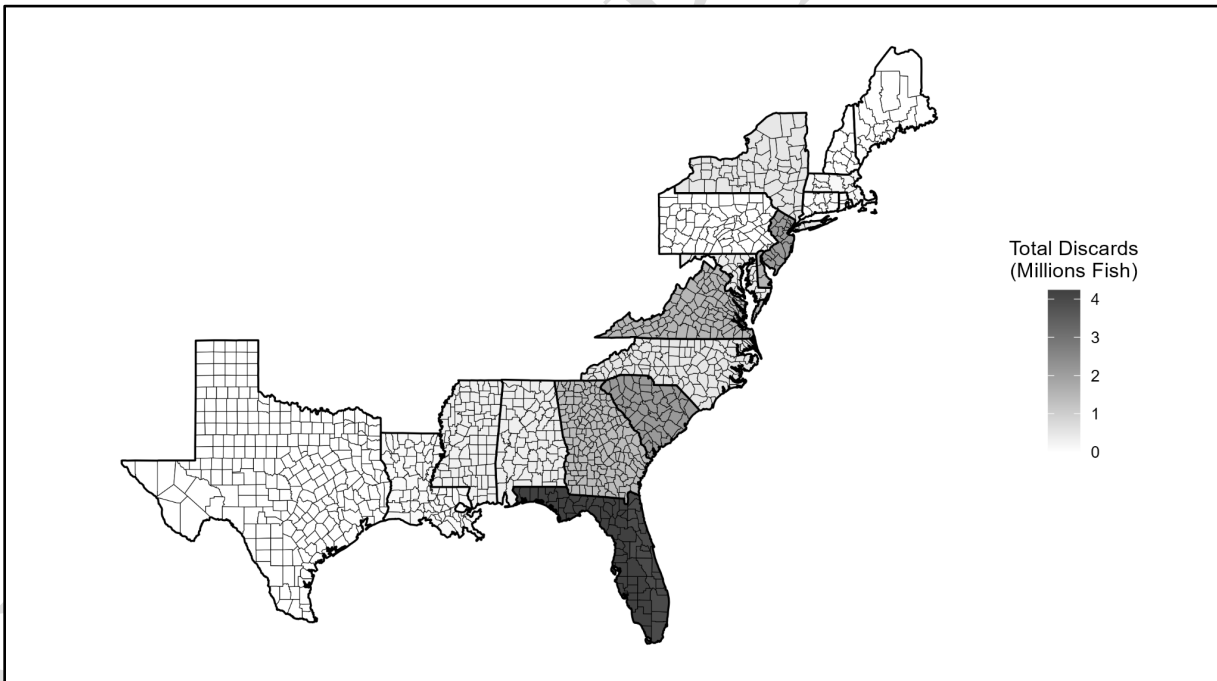


Figure 3.9.6.2. Distribution of total recreational discards, in millions of fish, for Sandbar Shark from Maine to Texas under the alternative case using the **Requiem Shark Genus and Requiem Shark Family allocation method with a 22% reduction applied to private mode and a 9% reduction applied to shore mode (Alternative State 1)**. Estimates are combined across all surveys and years.

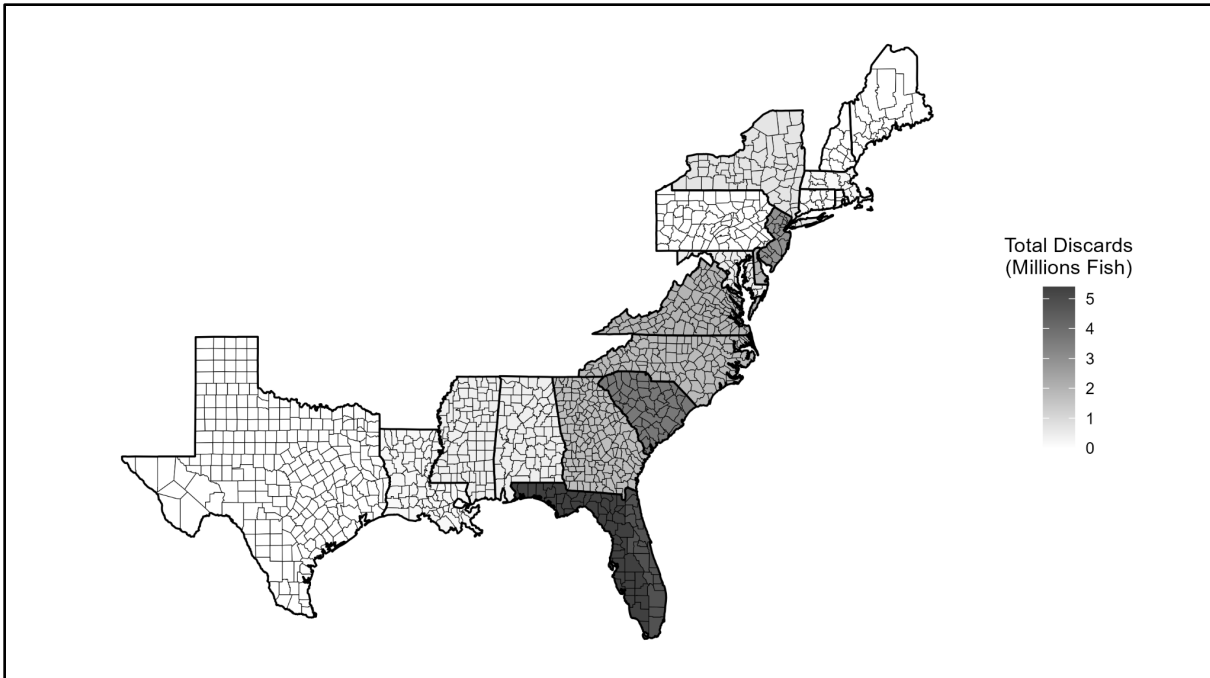


Figure 3.9.6.3. Distribution of total recreational discards, in millions of fish, for Sandbar Shark from Maine to Texas under the alternative case using the **Requiem Shark Genus, Requiem Shark Family, and Unidentified Sharks allocation method (Alternative State 2)**. Estimates are combined across all surveys and years.

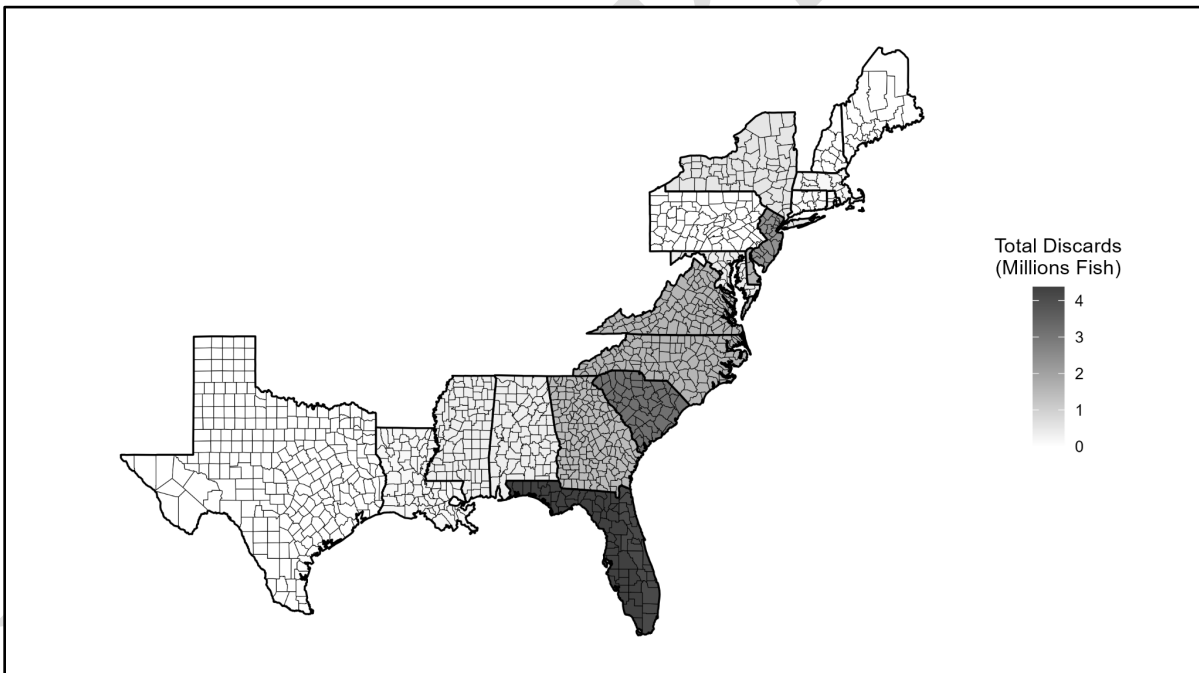


Figure 3.9.6.4. Distribution of total recreational discards, in millions of fish, for Sandbar Shark from Maine to Texas under the alternative case using the **Requiem Shark Genus, Requiem Shark Family, and Unidentified Sharks allocation method with a 22% reduction applied to private mode and a 9% reduction applied to shore mode (Alternative State 3)**. Estimates are combined across all surveys and years.

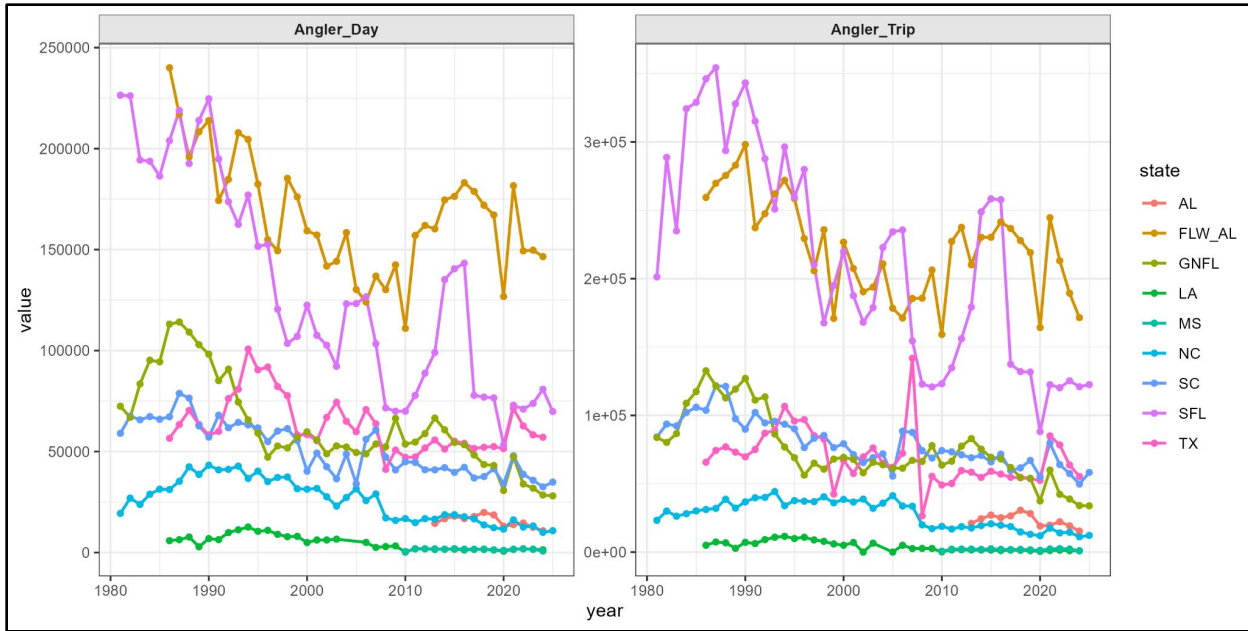


Figure 3.9.7. SRHS total estimated angler days and angler trips.

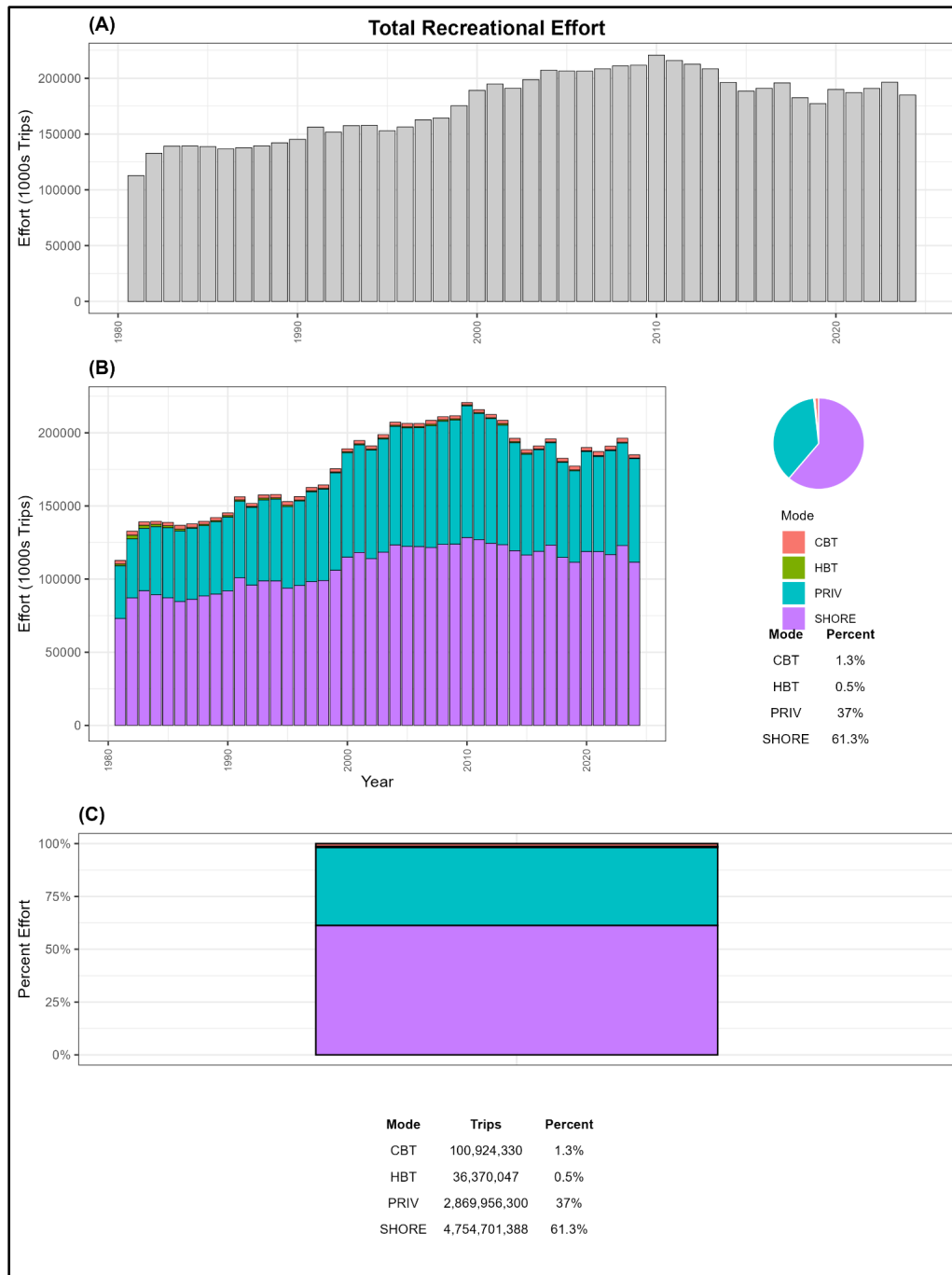


Figure 3.9.8. Total recreational effort (angler trips) for Sandbar Shark across all surveys. Effort is provided (A) by year in thousands of trips, (B) by mode and year in thousands of trips, and (C) by mode and area in percent numbers of trips.

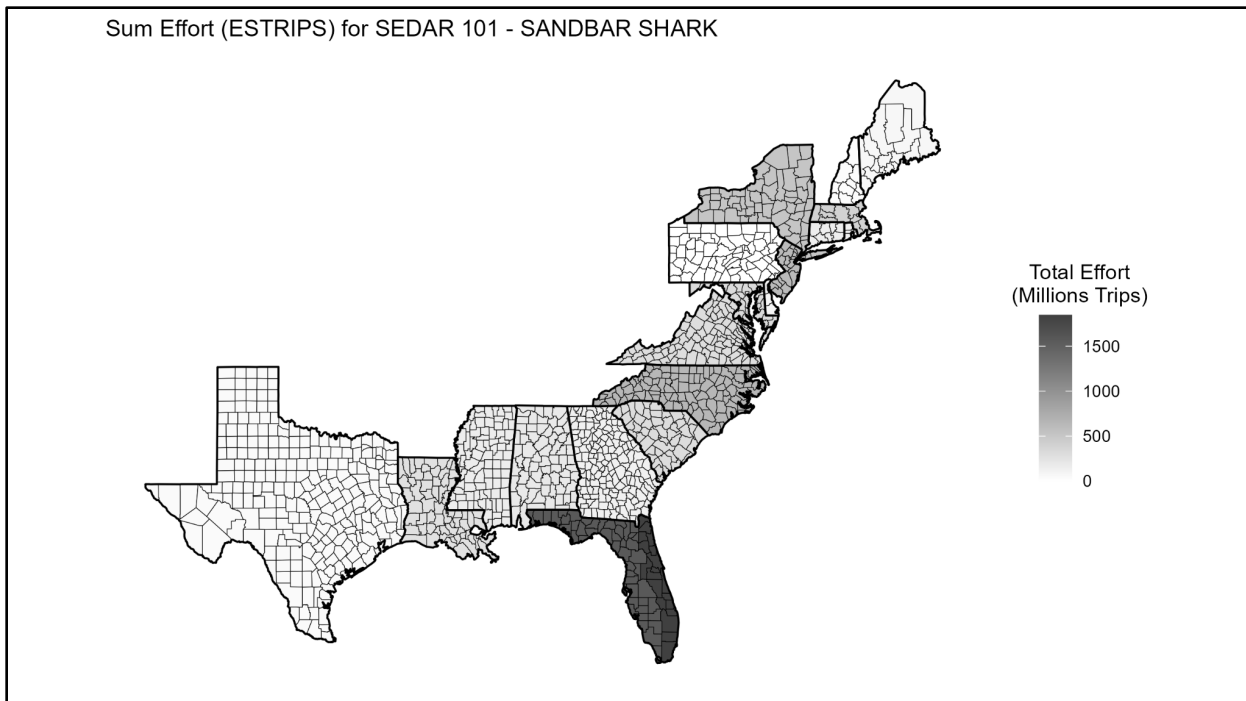


Figure 3.9.9. Distribution of total recreational effort (angler trips), in millions of trips, for Sandbar Shark from Maine to Texas. Estimates are combined across all surveys and year and summarized by region.

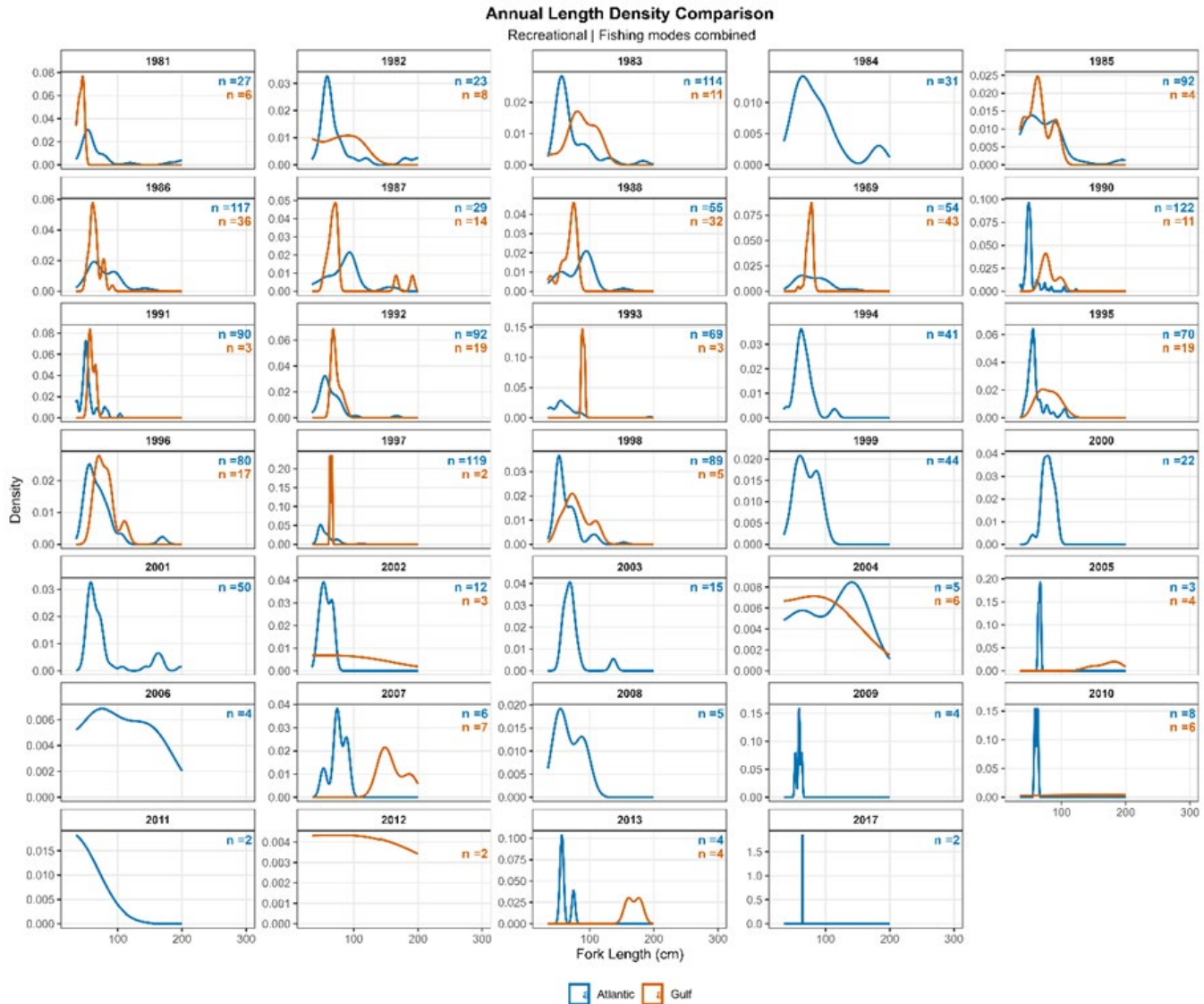


Figure 3.9.10. Yearly length-density curves for landed fish in the recreational fishery. Color indicates sampling region (Atlantic vs. Gulf) sampling modes are combined. Data are faceted by year to illustrate shifts in the size structure of the catch over time.

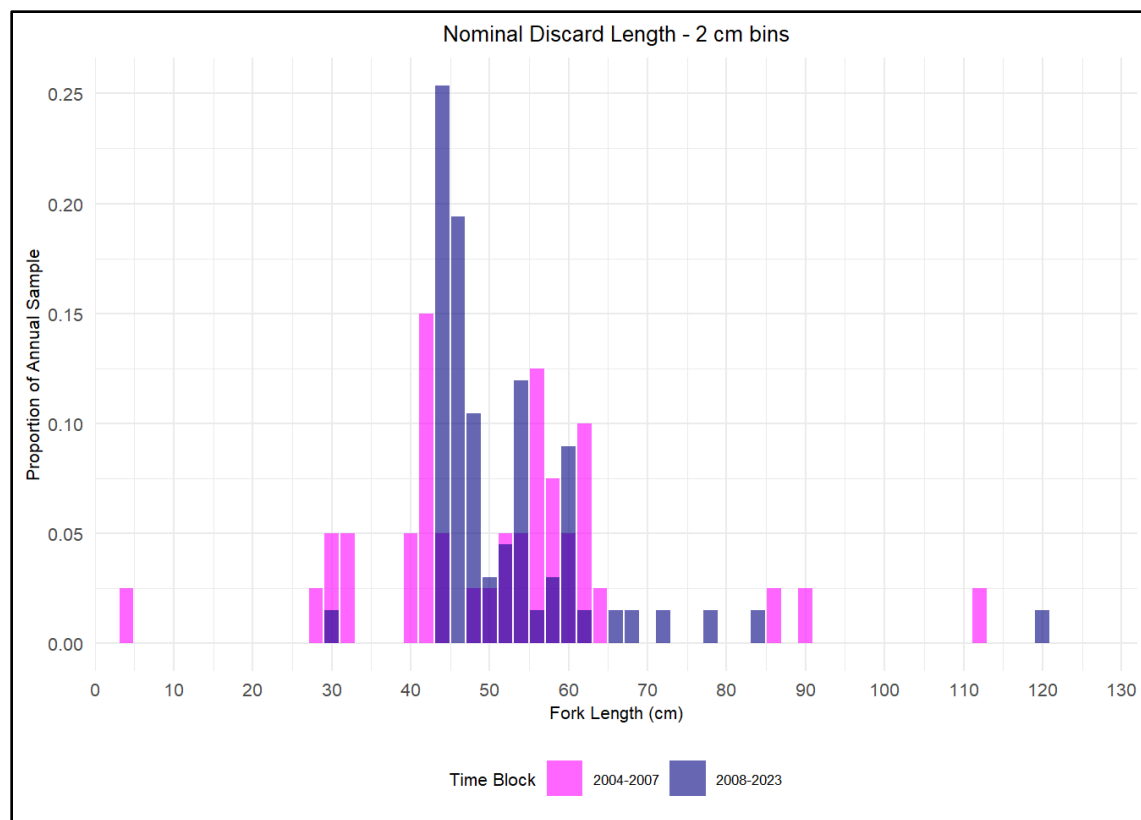


Figure 3.9.11. Nominal recreational discard length compositions for Sandbar Shark using 2 cm size bins.

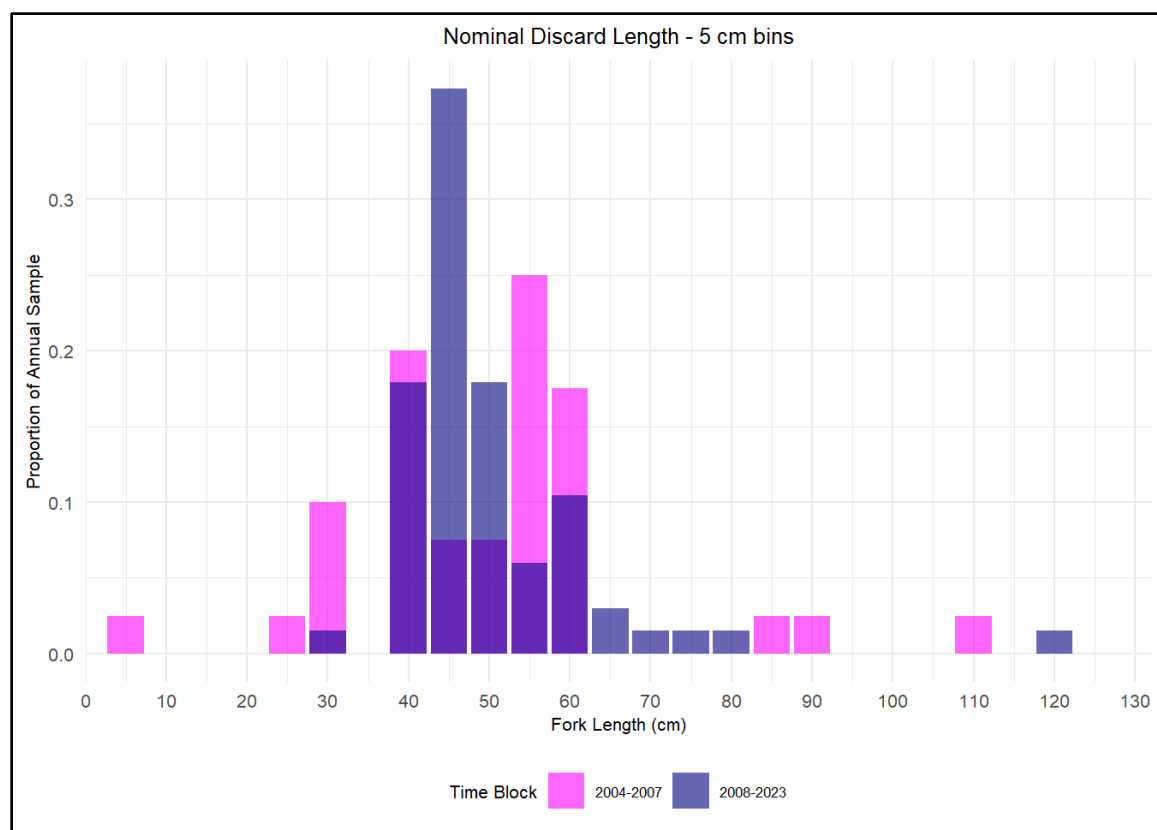


Figure 3.9.12. Nominal recreational discard length compositions for Sandbar Shark using 5 cm size bins.

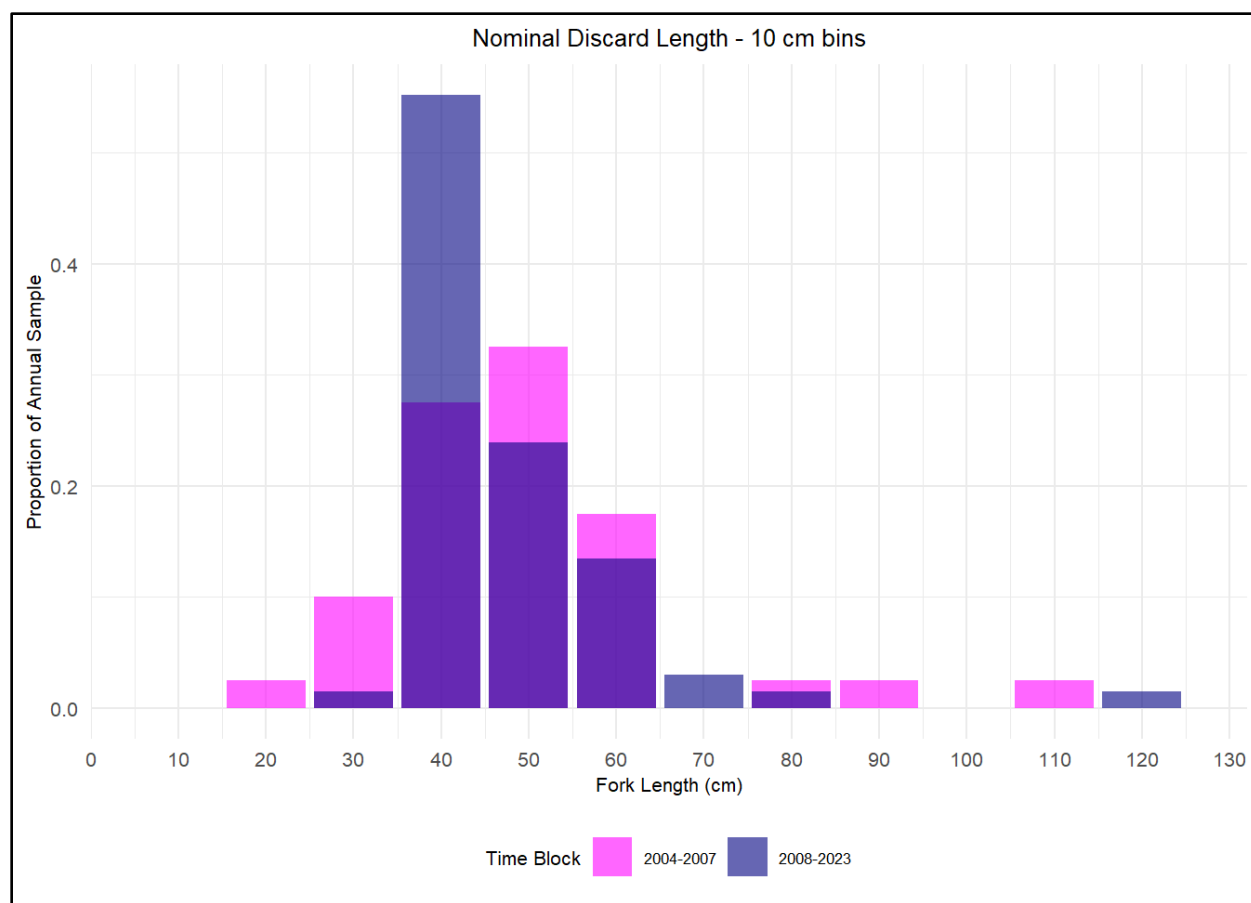


Figure 3.9.13. Nominal recreational discard length compositions for Sandbar Shark using 10 cm size bins.

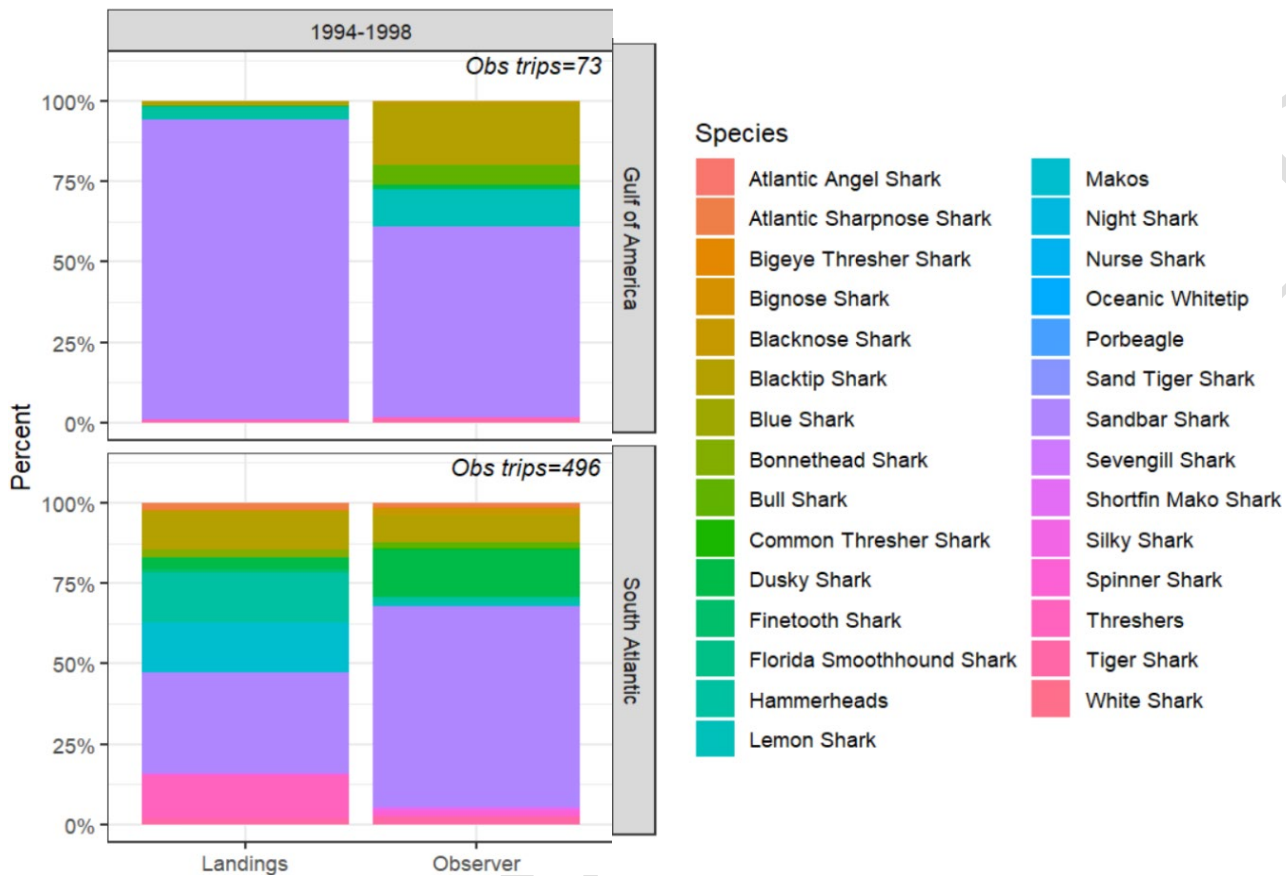


Figure 3.9.14. A comparison of the assembled commercial shark landings data to the observed data from the Bottom Longline Observer Program by region (1994-1998).

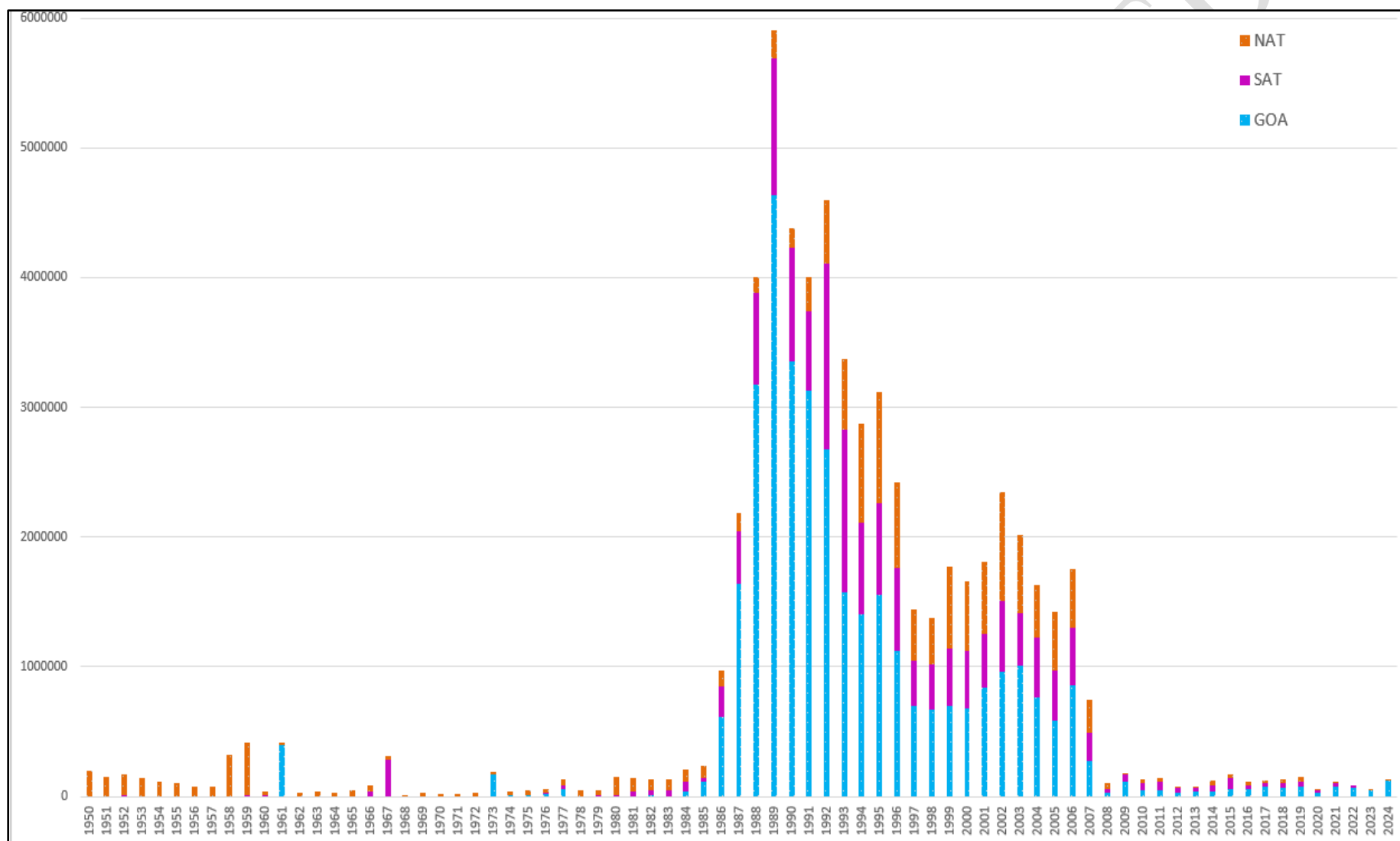


Figure 3.9.15. Estimated Sandbar shark landings from 1950-2024 by region (NAT: North Atlantic, SAT: South Atlantic, GOA: Gulf of America) in dressed weight pounds.

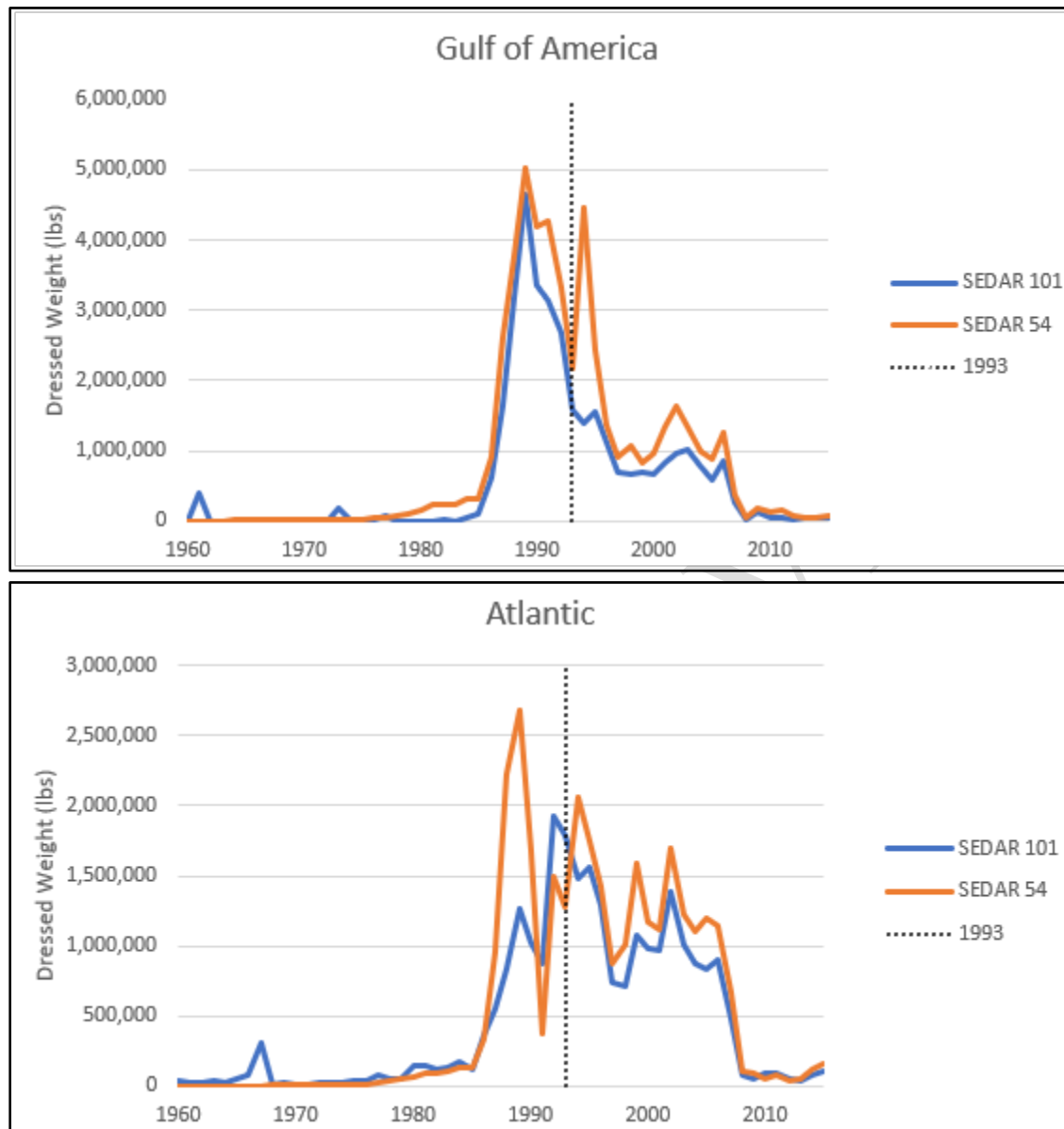


Figure 3.9.16. A comparison of the commercial landings series compiled for SEDAR 54 and SEDAR 101 by region (1960-2015). SEDAR 54 values were converted to pounds from metric tons to the first decimal place and are therefore not precise. Dashed line depicts the establishment of federal reporting, quotas, and observer program in 1993. Top Panel: Landings, lb dw, for the Gulf of America. Bottom Panel: Atlantic region. Note that Mexican landings were not considered in this comparison as they were combined with the recreational landings in SEDAR 54.

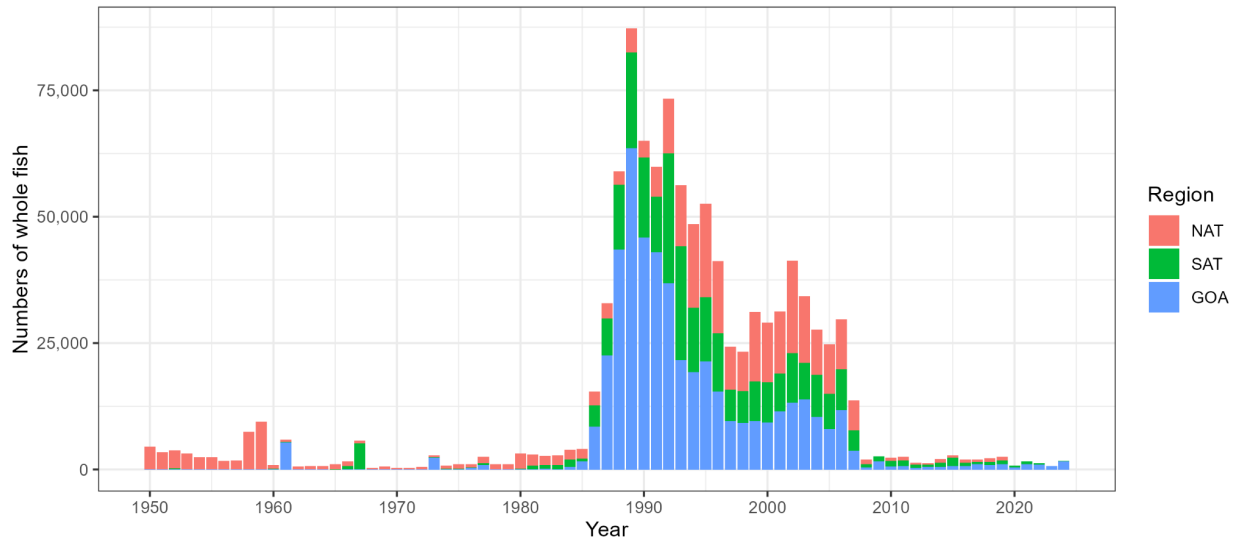


Figure 3.9.17. U.S. Sandbar shark landings in numbers of whole fish from 1950-2024 by region (NAT: North Atlantic, SAT: South Atlantic, GOA: Gulf of America).

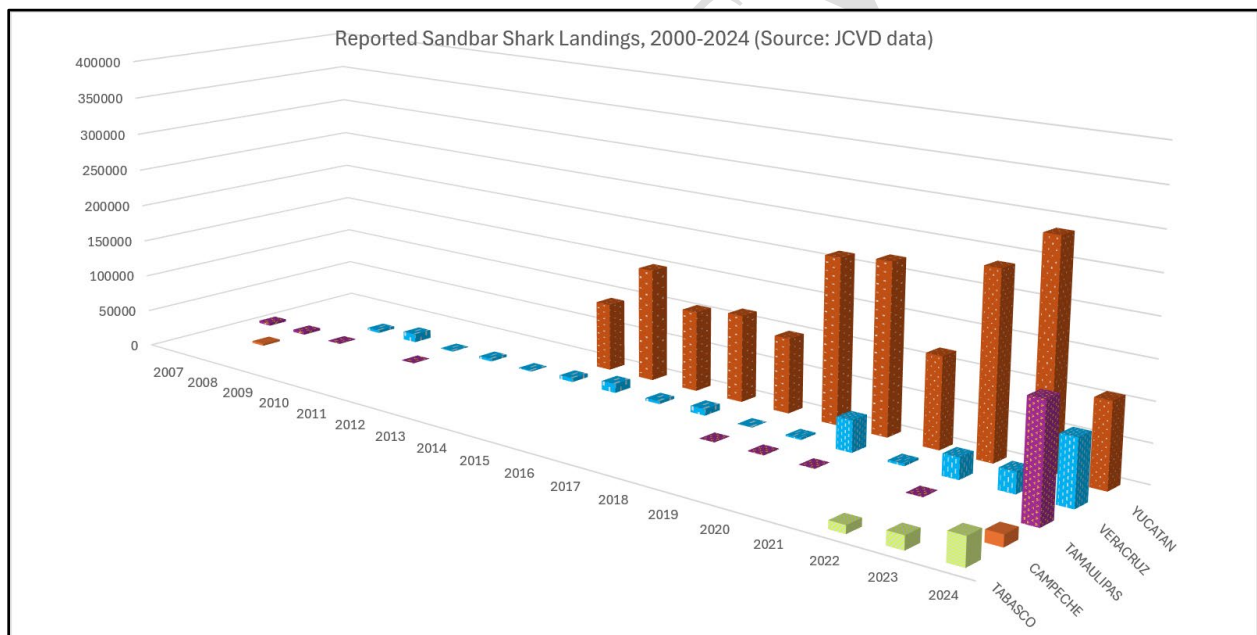


Figure 3.9.18. Mexican Sandbar Shark landings by the Mexican state as reported in the Mexican data provided by Dr. Juan Carlos Villaseñor-Derbez (JCVD).

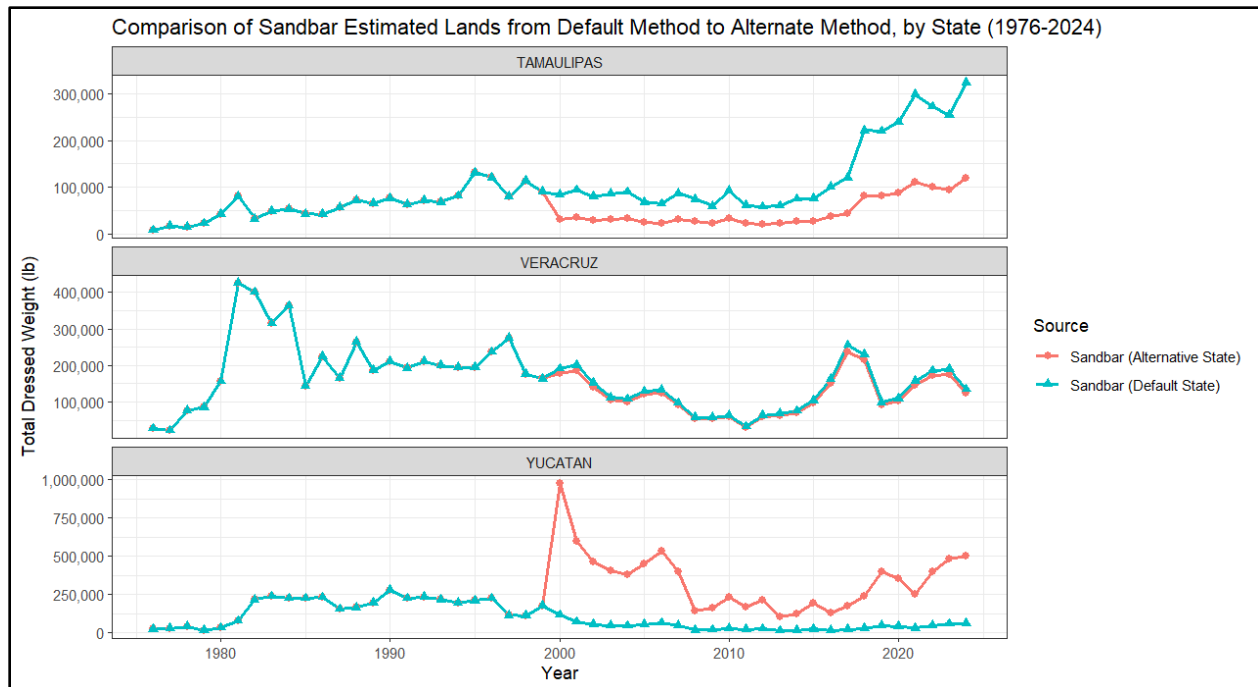


Figure 3.9.19. Mexican Sandbar Shark estimated landings by each Mexican state in dressed weight (lbs) compared between the Default State (blue line) and the Alternative State (red line) proposed for SEDAR 101.

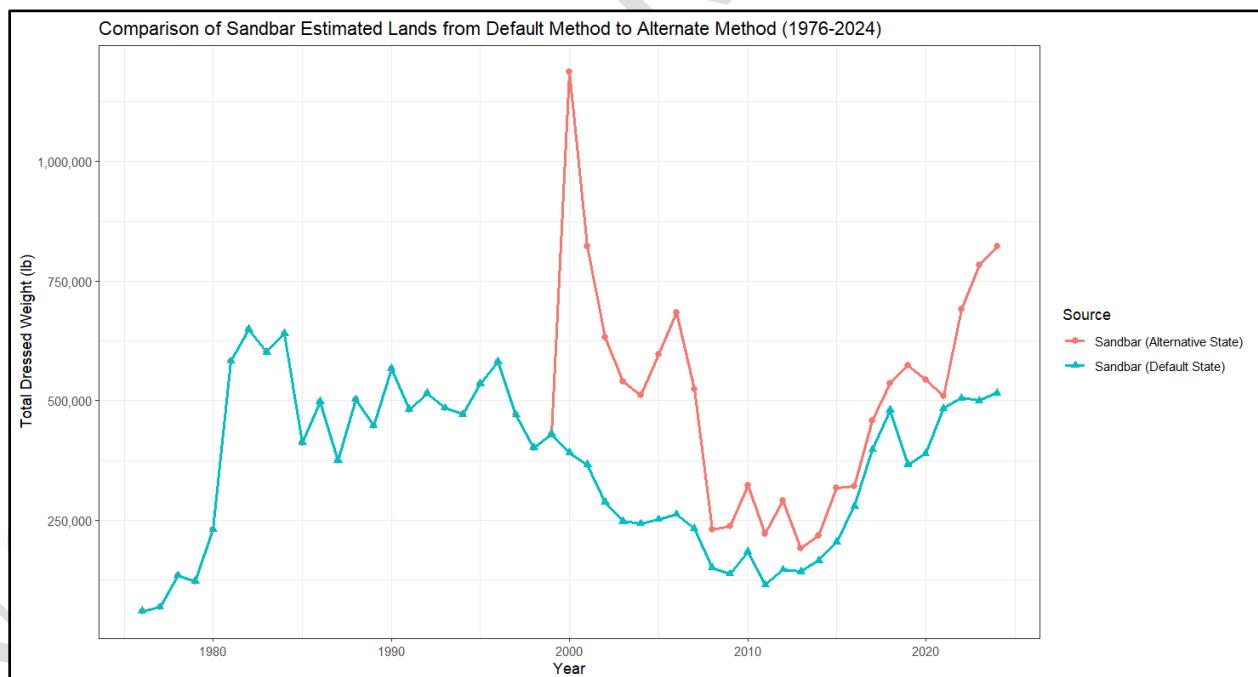


Figure 3.9.20. Total Mexican Sandbar Shark estimated landings in dressed weight (lbs) compared between the Default State (blue line) and the Alternative State (red line) proposed for SEDAR 101.

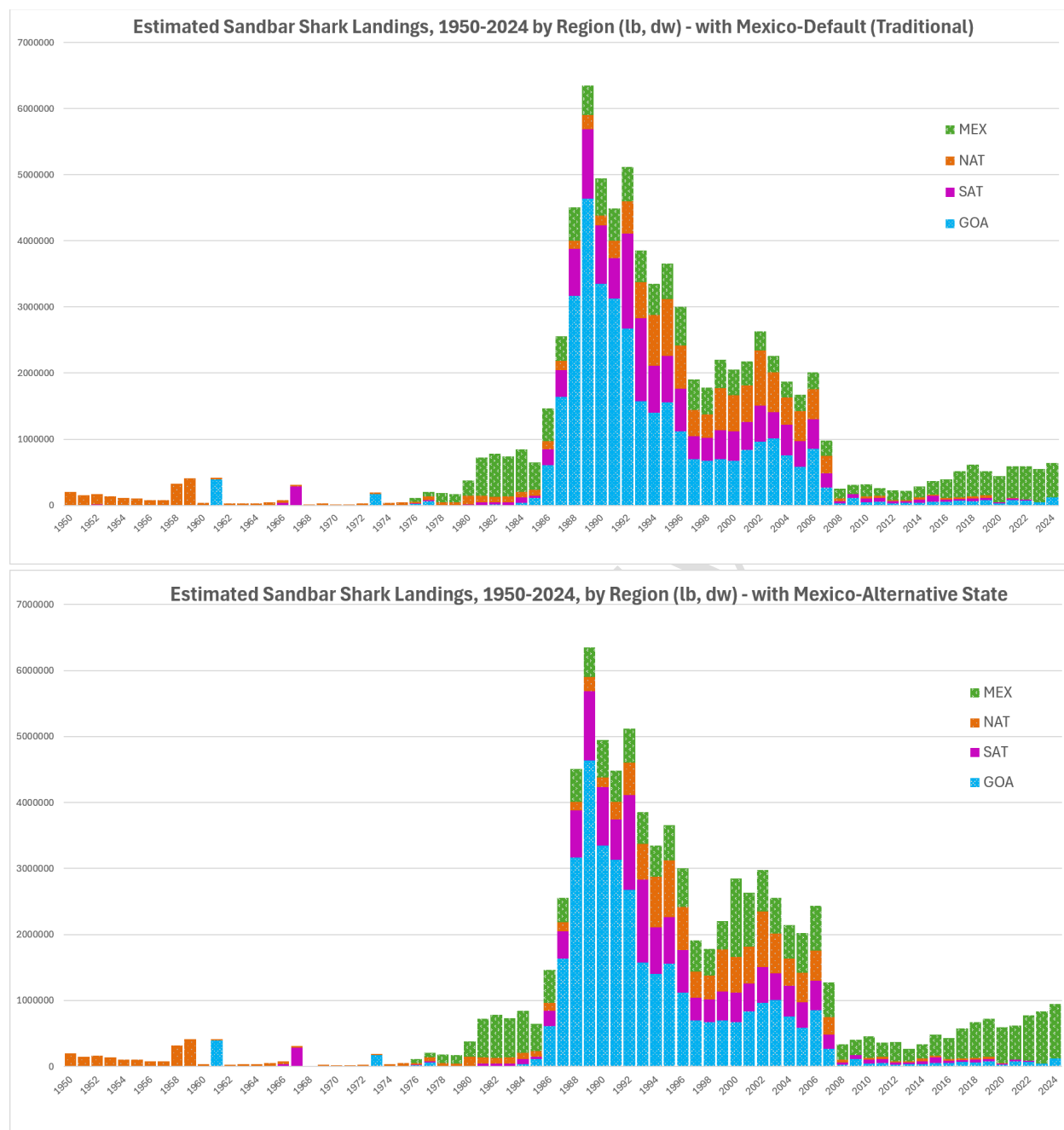


Figure 3.9.21. Total Sandbar Shark estimated landings (1950-2024) in **dressed weight (lbs.)** by region. The top panel represents landings in number for the default scenario using the SEDAR 11 methodology for estimated Sandbar Shark Mexican landings and the bottom panel is the alternative state for Mexican Sandbar Shark landings.

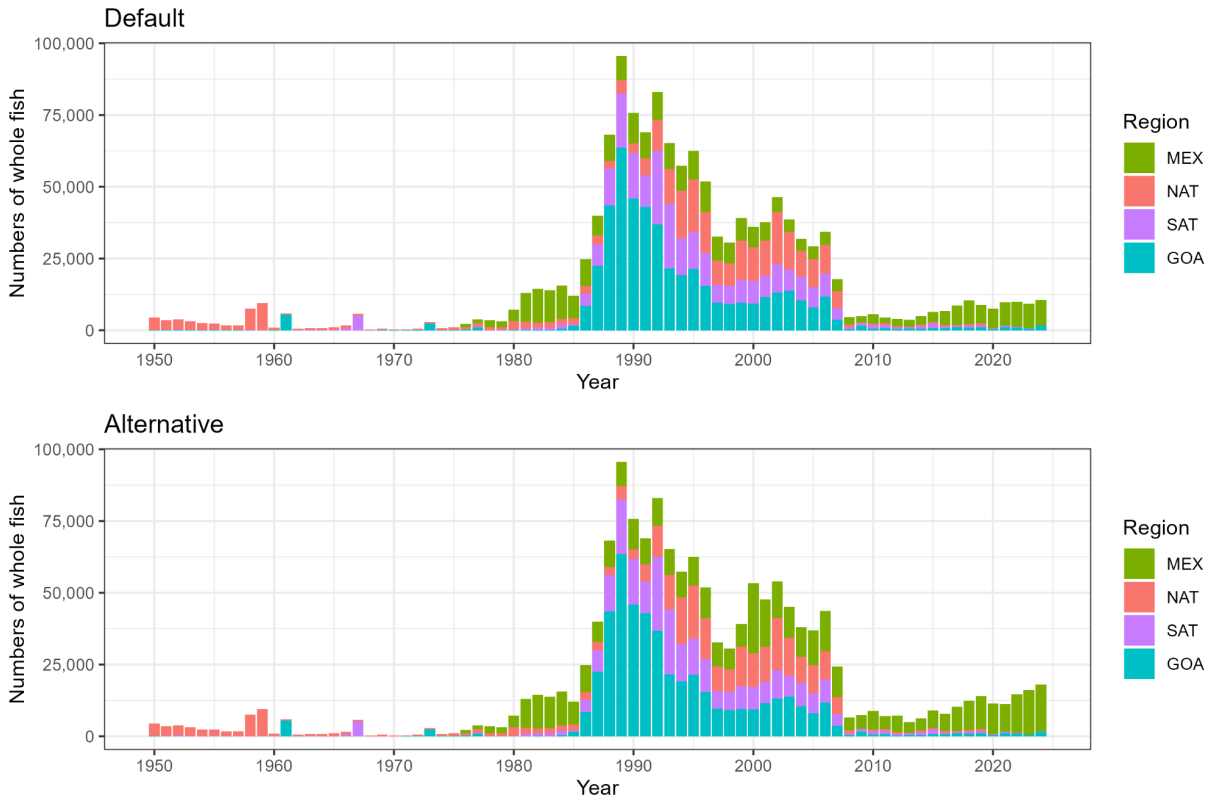


Figure 3.9.22. Total estimated Sandbar shark landings in **numbers of whole fish** by region from 1950-2024. The top panel represents landings in number for the default scenario using the SEDAR 11 methodology for estimated Sandbar shark Mexican landings and the bottom panel is the alternative state for Mexican Sandbar Shark landings.

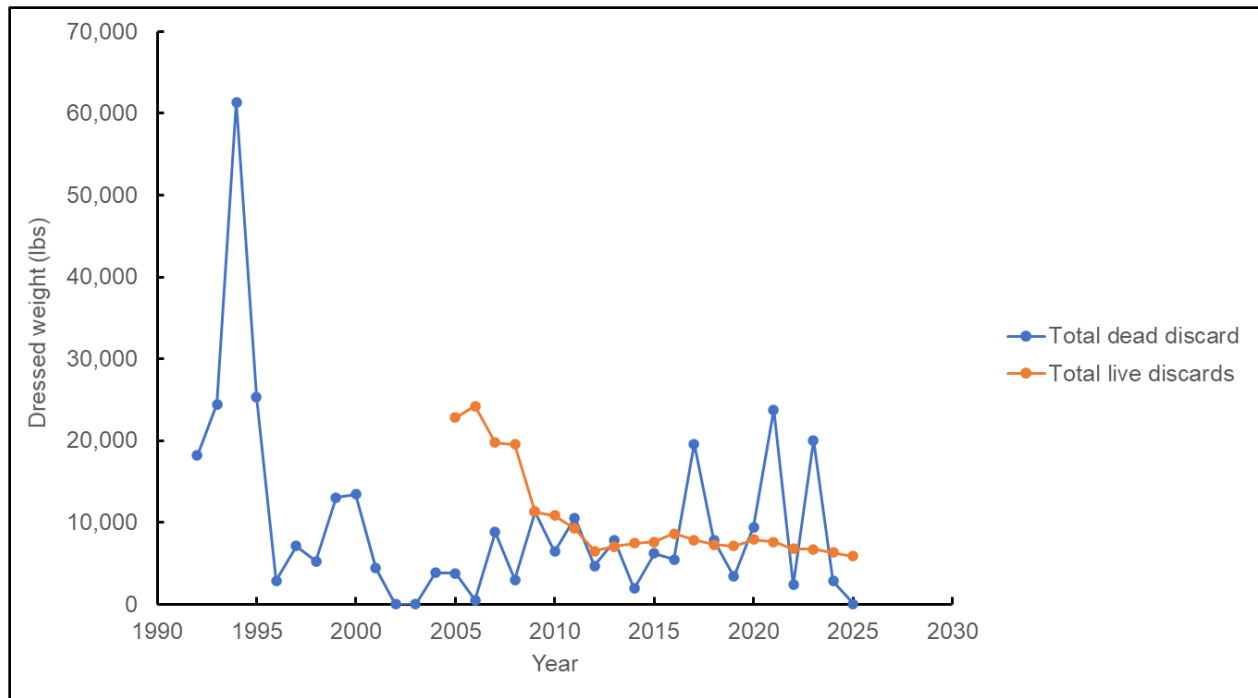


Figure 3.9.23. Trend in dead and live discards from the pelagic longline, shark research and Gulf reef fish bottom longline fishery. Estimates of dead discards are only available from 1992-2005 from the pelagic longline fishery.

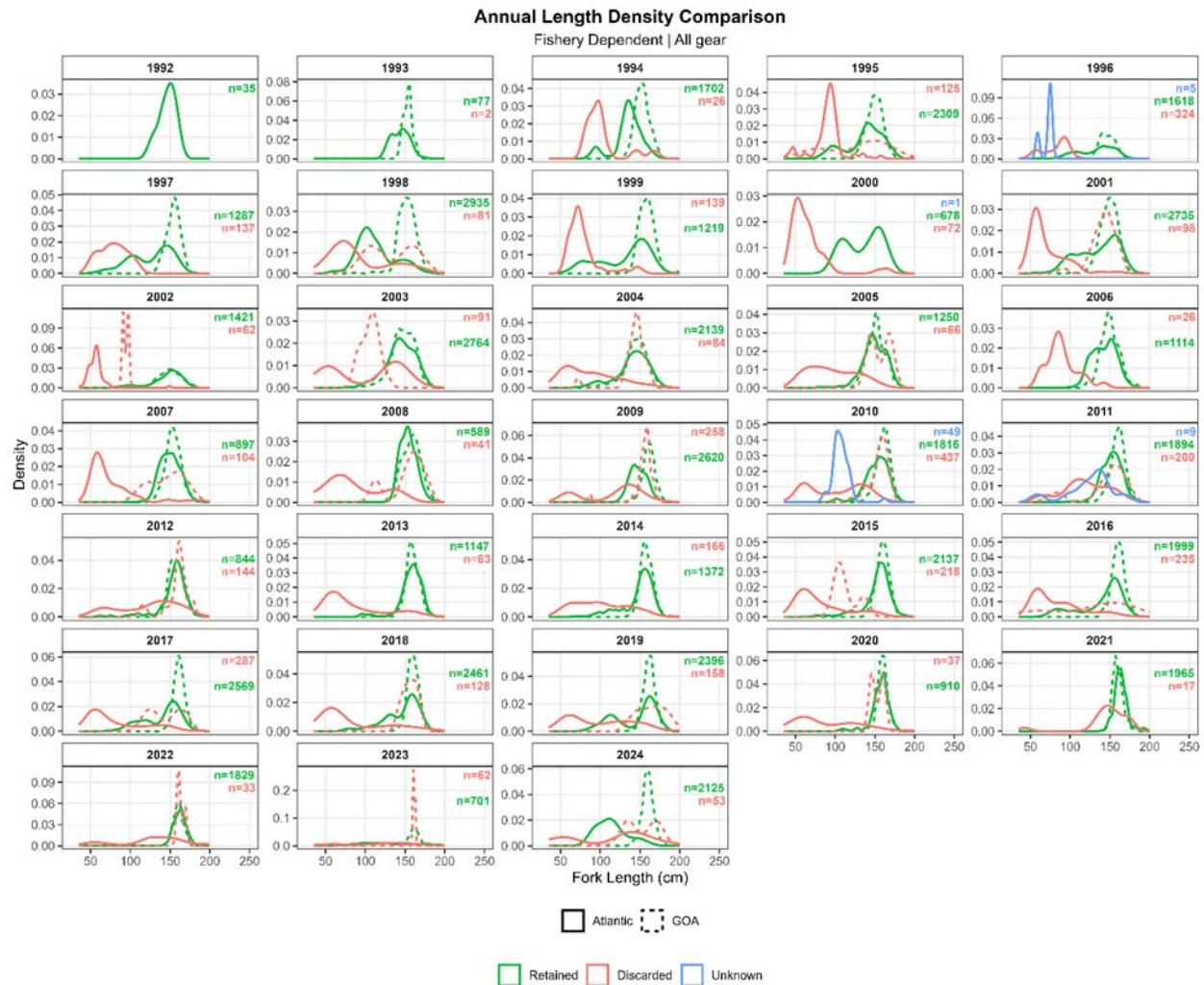


Figure 3.9.24. Yearly length-density curves for commercial fish landings and discards to show how the catch size structure changes over time. The data are faceted by year, where color denotes the disposition and line type represents the sampling region.

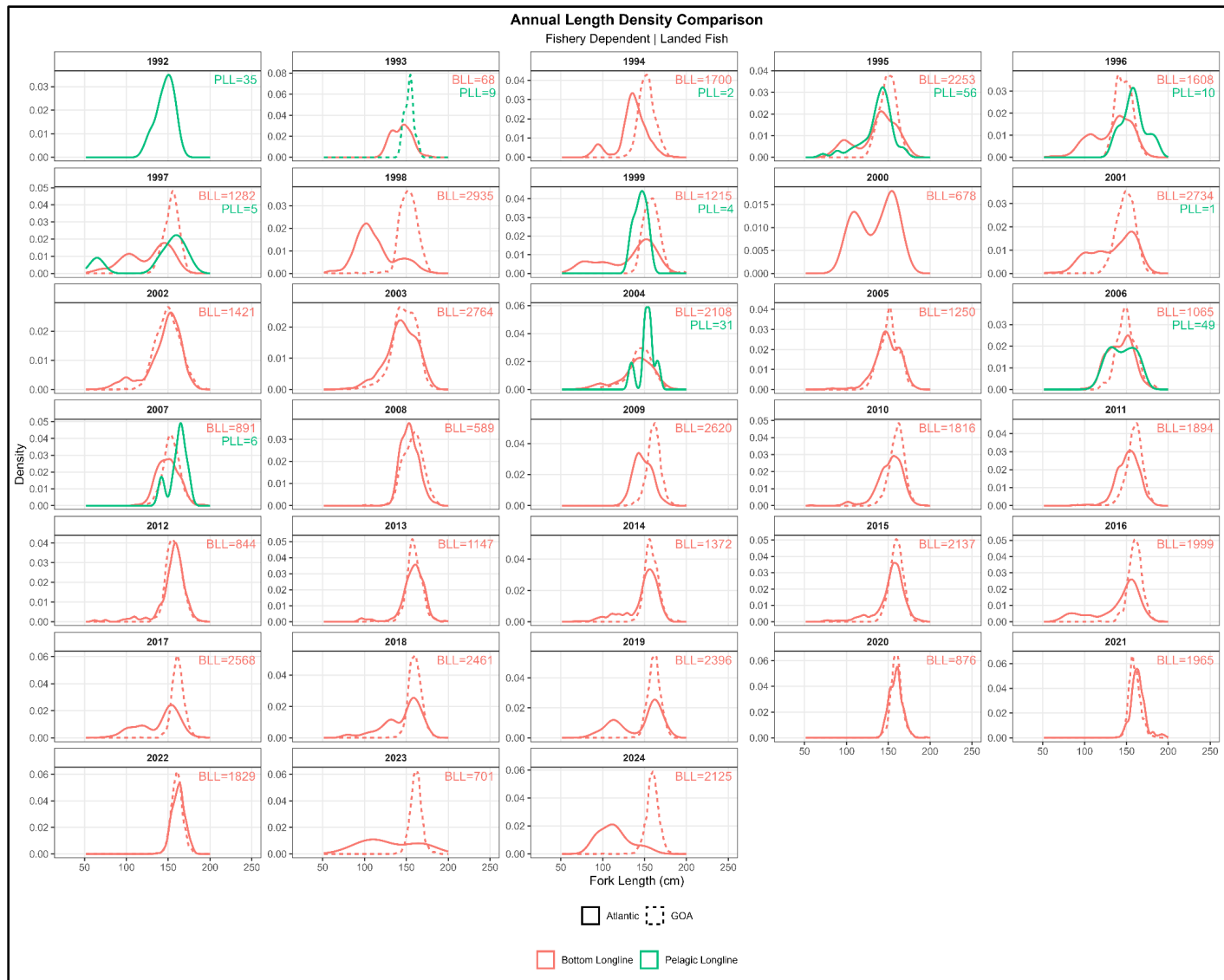


Figure 3.9.25. Yearly length-density curves for commercial fish landings to show how the catch size structure changes over time. The data are faceted by year, where color denotes the gear used and line type represents the sampling region.

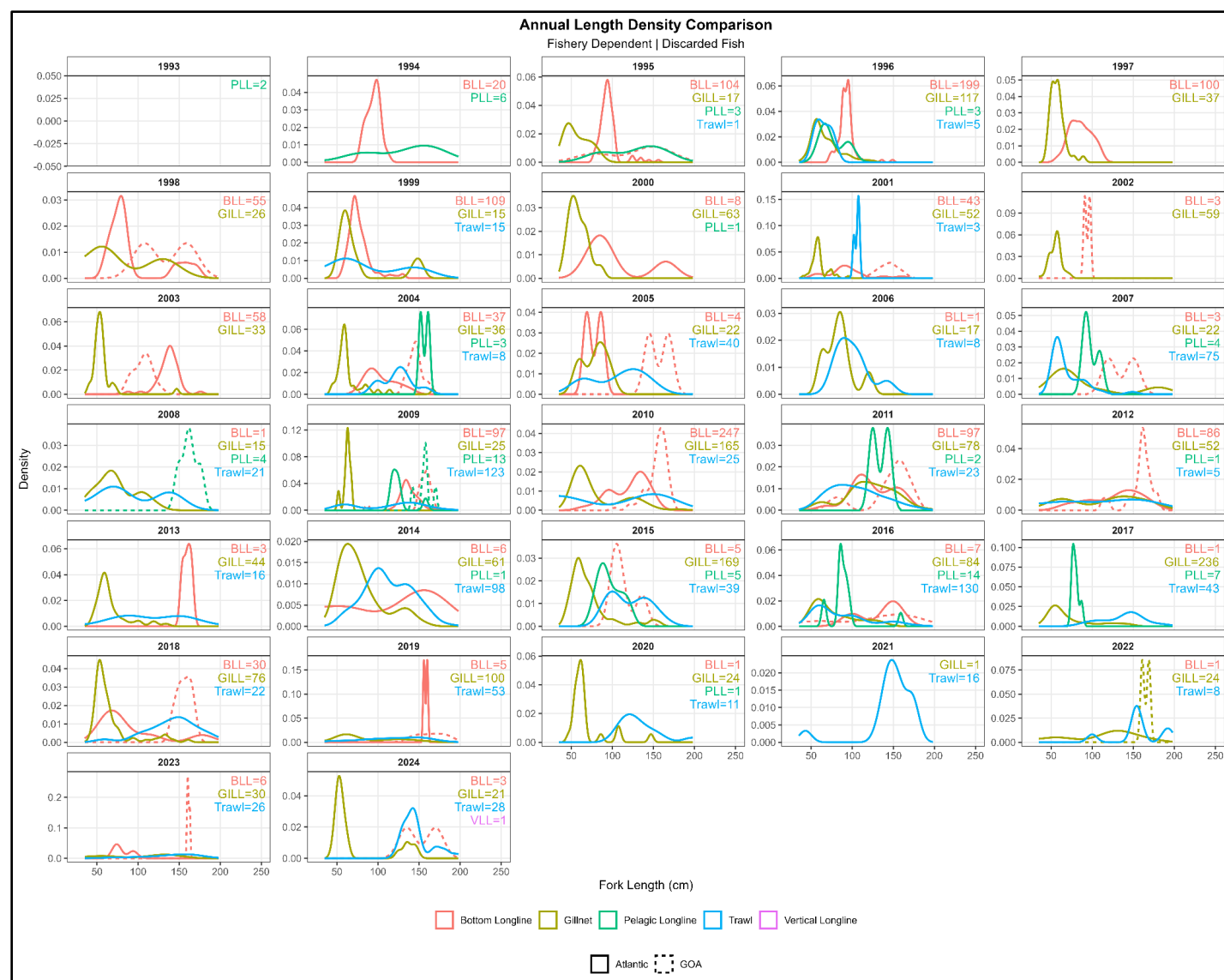


Figure 3.9.26 Yearly length-density curves for commercial fish discards to show how the catch size structure changes over time. The data are faceted by year, where color denotes the gear used and line type represents the sampling region.

4. INIDCES

4.1 OVERVIEW

During the initial webinars for SEDAR101, data sources were preliminarily examined in terms of their usefulness in developing an index of abundance for sandbar shark. Eighteen (18) data sources were considered for use in developing indices of abundance; eight (8) were from fishery dependent sources (i.e. commercial or recreational data) and ten (10) were from fishery independent sources (i.e. scientific surveys) (Table 1). Of those data series, five (5) were deemed not useful due to either the low occurrence of sandbar shark (proportion positive), small temporal and/or spatial coverage (≤ 5 years or spatially limited), or still required additional data refinement outside the SEDAR process.

At the Data Workshop, the Indices Working Group (referred to as “Group” henceforth) assessed the appropriateness of each time series by modifying guidelines developed by the International Commission for the Conservation of Atlantic Tunas (ICCAT) Scientific Committee on Research and Statistics (SCRS; ICCAT Doc. No. SCI-033 / 2012). Elements considered for each data series ranged from the statistical diagnostics of the analysis to the temporal and spatial coverage of the index (Table 2). In almost all considered data series, regardless of whether the data were from fishery-dependent or from scientific surveys, the data were standardized using a form of the generalized linear model (Aitchison, 1955). The delta-lognormal modeling methods were most often used to estimate relative abundance indices (Pennington, 1983; Bradu and Mundlak, 1970) although other approaches were used such as assuming a Negative binomial distribution. In some cases, sandbar shark datasets were subset to create an Age 0 index (i.e. Young-of-the-Year; ≤ 63.5 cm FL based on SEDAR101-DW24) to facilitate the creation of recruitment indices (Age 0).

In previous SEDARs for sharks, the indices working group ranked indices on a scale of 1-5 as a means of attributing relative weights for the stock assessment. As was done at SEDAR65 and SEDAR77, the Group discussed that there is likely little difference among several of the categorical designations and decided to drop that method and to simply recommend the retention of the index or recommend it be not utilized for the assessment. While all indices reviewed were judged to be appropriately constructed, in some cases revisions were recommended. Finally, the Group was tasked with identifying the most appropriate index/indices that best represented the current trend in abundance of sandbar shark. This was to facilitate these indices potential use within a management procedure to be developed within the Management Strategy Evaluation (MSE) framework (e.g. Walter et al. 2023).

4.1.1 Work Group members and participants in Recreational Fishery Work Group

Leads

John Carlson - National Marine Fisheries Service (NMFS) Southeast Fisheries Science Center (SEFSC) Sustainable Fisheries Division (SFD)
Cassidy Peterson - NMFS SEFSC Directorate
Molly Stevens - NMFS SEFSC SFD

Panel Members

Christina Vaeth - Industry, FL
Max Lee - Mote Marine Laboratory and Aquarium Center for Fisheries Electronic

Monitoring

Michelle Passerotti-NMFS Northeast Fisheries Science Center (NEFSC) Apex Predators

Robert Latour-Virginia Institute of Marine Science

Scott Vaeth - Industry, FL

Panel Members (Virtual)

Adam Pollack-NMFS SEFSC Population and Ecosystems Monitoring Division

Alex Hansell - NMFS NEFSC Resource Evaluation and Assessment Division

Cami McCandless-NMFS NEFSC Apex Predators Program

Demian Chapman-Mote Marine Laboratory

Krystan Wilkinson- Mote Marine Laboratory

Lindsay Mullins- Mississippi State University

Marcus Drymon-Mississippi State University

Tobey Curtis-NMFS Office of Sustainable Fisheries Atlantic Highly Migratory Species Division

4.1.2 Topics Reviewed by the Indices Group

1. Fishery Dependent Indices
2. Fishery Independent Indices

4.2 SUMMARY OF INDICES DATA WORKING PAPERS**Fishery Dependent Indices**

Five (5) data series were considered by the Group at the Data Workshop. These were from the Large Pelagic Intercept Survey data (SEDAR101-DW-04); Pelagic Longline Fishery (SEDAR101-DW-08), Shark Bottom Longline Fishery (SEDAR101-DW-17), Shark Research Fishery (SEDAR101-DW-17), and NEFSC Trawl/Gillnet Fishery (SEDAR101-DW-19). All of these data sources were based on data recorded by on-board observers rather than self-reported data such as fisherman logbooks. While observer coverage for some fisheries was low (<5%) of total effort, the Shark Research Fishery (SEDAR101-DW-17) has 100% observer coverage on all trips. The temporal coverage was the longest for the Pelagic Longline Fishery and NEFSC Trawl/Gillnet Fishery (SEDAR101-DW-08; SEDAR101-DW-19) and shortest for the Shark Bottom Longline Fishery (SEDAR101-DW-17). Spatial coverage encompassed a significant portion of the stock for all data series (Figure 1). Only the Pelagic Longline Fishery covered the full extent of the species range but covered an area offshore where sandbar sharks are less likely to be encountered.

SEDAR101-DW-04: Potential use of Large Pelagic Intercept Survey data (LPIS) to estimate catch-per-unit-effort for Sandbar Sharks

Summary: In preparation to the SEDAR 101, sandbar shark (*Carcharhinus plumbeus*) stock assessment, the SEFSC assessed the feasibility of estimating a time series of Catch-Per-Unit-Effort using data collected by the Large Pelagic Intercept Survey (LPIS) for the period 2002-2024. The LPIS data contained a total of 83,890 records (trips) of which 591 caught a total of 1,553 sandbar sharks. That corresponds to a 0.7% positive trips. The LPIS records also indicate the fate of the catch, i.e., if the catch was kept, discarded dead, or discarded alive. From 2002 to

2024 the LPIS showed that for the trips targeting sharks, 710 sharks were discarded alive, 0 were discarded dead, and 14 were kept. Therefore, 98% of the entire catch was not seen by the interviewer and it was self-reported by the fishers. Because interviewers were unable to identify almost all sandbar sharks caught, there is a significant possibility that an unknown fraction of the reported sandbar sharks caught were in reality dusky sharks (*Carcharhinus obscurus*) that were misidentified by the fishers as sandbar sharks. Taking into consideration that the uncertainty of the true level of catches, particularly prior to 2010; 98% of the entire sandbar catches from trips targeting sharks was self-reported and the possible misidentification of dusky sharks as sandbar sharks The SEFSC does not recommend that a time series of CPUE be estimated using LPIS data

Decision: Discussion during pre-data workshop webinars and at plenary during the data workshop that based on the analysis outlined in SEDAR101-DW-04, this data series was deemed not useful for the assessment.

SEDAR101-DW-08: Standardized abundance indices of sandbar shark from the Pelagic Longline Observer Program, 1992-2025.

Summary: In 1992, the National Marine Fisheries Service (NMFS) initiated scientific sampling of the U.S. large pelagic fisheries longline fleet, as mandated by the U.S. Swordfish Fisheries Management Plan and subsequently the Atlantic Highly Migratory Species Fishery Management Plan (1998). Scientific observers were placed aboard vessels participating in the Atlantic pelagic longline fishery. Relative abundance indices from data collected by observers have been previously developed and used in a variety of assessments of pelagic species, including sharks. A data set was developed based on the observer programs as described in Beerkircher et al. (2002) and Cortés et al. (2007). Relative abundances were developed using a generalized linear mixed modeling approach following methods outlined in Lo et al. (1992). Final models included covariates Year, Season and Mean Depth in the Binomial model and Year, Target and Season in the Lognormal model. The trend in relative abundance was initially high in 1992, declined in the late 1990s and remained relatively stable with yearly increases and decreases until 2025.

Decision: Initial discussion was related to the spike in relative abundance in the early portion of the time series, and the significant decline observed thereafter in the time series. It was pointed out that for other species of sharks where these data series have been used (scalloped hammerhead; SEDAR77), the same trend was observed. The initial peak in abundance has been related to the early years of the time series where shark identification by observers may have been an issue as well as sharks still recorded as a group rather than by species (see Beerkircher et al. 2002). The Group noted that because this series is stock wide and used in previous stock assessments, the series should be retained for consideration. However, it was recommended to re-analyze the time series and remove the initial years of time series (1992-1995) where species identification may have been an issue as well as sampling areas where sandbar sharks were unlikely to be captured (e.g. Northeast Distant Zone) to improve the proportion positive. A reanalysis was conducted at the data workshop. The revised trend (1996-2025) was recommended for consideration.

SEDAR101-DW-17: Relative abundance indices for sandbar sharks (*Carcharhinus plumbeus*) in the northwest Atlantic Ocean from the Shark Bottom Longline and Shark Research Fishery

Summary: Observations by at-sea observers of the shark bottom longline fishery in the Atlantic Ocean and Gulf of America have been conducted since 1994 (e.g. Morgan et al. 2009; Mathers et al. 2024). Historically, vessels in this fishery primarily targeted sandbar shark and fish from North Carolina to the eastern Gulf of America. With the introduction of the Shark Research Fishery in 2008, vessels outside of the research fishery were not permitted to target or land sandbar shark. This change in management regulations likely influenced the time series of abundance for sharks such that vessels fishing in the research fishery should be modeled separately from those outside the research fishery. Therefore, two indices of abundance were created from this data series; 1994-2007 for all vessels participating in the shark bottom longline fishery (i.e. Shark Bottom Longline Fishery Index) and from 2008-2025 for vessels only participating in the Shark Research Fishery (i.e. Shark Research Fishery Index). For Shark Bottom Longline data series, the CPUE was standardized using generalized linear mixed models in a two-step delta-lognormal approach that models the proportion of positive catch with a binomial error distribution separately from the positive catch, which is modeled using a lognormal distribution (Lo et al. 1992). As there were some years with 100% positive catches in the Shark Research Fishery, data was standardized using just a lognormal model. For the Shark Bottom Longline Fishery, Year, Soak Time, and Depth were factors retained in the final model whereas Year, Season and Target were final factors in the model for the Shark Research Fishery. Both time series showed a slight increase in abundance but the time series for the Shark Bottom Longline Fishery had more interannual variability than the Shark Research Fishery.

Decision: The Group determined that because the Shark Bottom Longline series is stock wide and used in previous stock assessments for sharks, the Shark Bottom Longline series should be retained for consideration in the sandbar stock assessment model. The Shark Research Fishery was subject to various management changes and is based on data from a few fishermen that may have been long term participants or either entered and exited the fishery at various times, which could have an impact on the time series and catchability. In particular, it was noted that some management changes may have affected the fisherman's tactics for maintaining yield while still adhering to regulations on other sharks including the limit on dusky shark captures implemented in 2013. A post-data workshop analysis was recommended for this data series introducing the "vessel identification" as a random variable in the generalized linear mixed model to attempt to account for these effects. The resulting Shark Research Fishery index is prioritized for consideration in the assessment.

SEDAR101-DW-19: Northeast Fisheries Observer Program Catch Per Unit Effort Time Series for Sandbar Sharks

Summary: Fishery catch rates from the Northeast observer program coverage of the trawl and gillnet fishery were standardized to produce catch per unit effort (CPUE) time series for sandbar sharks. Two different datasets were explored, a model with only positive trips and a model with targeted trips (e.g., zero observations). Model results varied depending on method with the targeted trips model suggesting an increasing trend since 2008, while the positive only model suggests interannual variability.

Decision: While this data series has broad spatial coverage (North Carolina to Canada), and contains both the Northeast trawl and gillnet fisheries, the time series demonstrated

much interannual variability. The Group discussed that this could be caused by years with low observer coverage, high proportion of zero observations or a combination of these factors. While this dataset is routinely used to produce discard estimates for stock assessment in the Northeast, it is typically not used to produce relative abundance indices because the region has many scientific surveys and the groundfish fishery has undergone multiple management changes. It was decided that this index should not be considered as an input to the assessment.

Fishery Independent Indices

Nine (9) data series were considered by the Group. These were Dauphin Island Sealab Longline Survey (SEDAR101-DW-10), Mote Marine Laboratory Longline and Drumline Survey (SEDAR101-DW-11), Coastspan NE Longline Survey (SEDAR101-DW-12), Coastspan SE Longline Survey (SEDAR101-DW-13), SE SEAMAP longline survey (SEDAR101-DW-15), NMFS Northeast Longline Survey (SEDAR101-DW-14; SEDAR101-DW-26), SEFSC Bottom Longline Survey (SEDAR101-DW-25) and the Virginia Institute of Marine Science Longline Survey (SEDAR101-DW-xx). The temporal coverage was the longest for the Virginia Institute of Marine Science (VIMS) Longline Survey which started in the 1970s and shortest for the Dauphin Island Sealab Longline Survey which began in 2010. Spatial coverage varied with some considered to be nearly stockwide (NEFSC and SEFSC Bottom Longline Survey) whereas others were limited to a smaller area of the species range (e.g. VIMS survey, Dauphin Island Sealab Longline Survey, Mote Marine Laboratory Longline and Drumline Survey (Figure 2).

SEDAR101-DW-10: Standardized catch rates of Sandbar shark (*Carcharhinus plumbeus*) surveyed during bottom longline surveys in coastal waters of the northern Gulf of America, 2006-2025

Summary: Sandbar sharks (*Carcharhinus plumbeus*) are a wide-ranging, large, coastal shark that occupy waters throughout the Western North Atlantic Ocean and Gulf of America. As the primary target of the U.S. shark bottom longline fishery in the 20th century, they were declared overfished and experiencing overfishing in 2006. Since 2008, they have been a prohibited species under the Atlantic Fishery Management Plan for Highly Migratory Species. At present, knowledge of stock status is limited; however, fishermen claim the population has increased significantly, resulting in increased human-wildlife interactions (i.e., depredation). Here, we generated a standardized index of sandbar shark relative abundance in the northern Gulf of America. Generalized linear models were developed using data from a fishery independent bottom longline survey conducted by the Dauphin Island Sea Lab (2010-2025). These data yielded 875 sandbar sharks captured during 763 sampling sets. The index extends from 2010-2025 and standardized catch rates were ultimately estimated using a two-step delta-lognormal model. Nominal and standardized sandbar shark catch rates varied throughout the survey period, with minimum values observed in 2016 and maximum values observed in 2013. Most individuals sampled were mature (mean =193 cm Total Length).

Decision: The Group determined that the time series is limited spatially (only off the coast of Alabama) and it overlaps with the SEFSC bottom longline survey (SEDAR101-DW-25). There was also considerable inter-annual variability in the index that could not be accounted for by the model. It is likely that due to the survey being conducted at various

times of the year, not consistent among years, combined with the stochastic environmental condition led to large fluctuation in annual indices. The recommendation was not to utilize this time series.

SEDAR101-DW-11: Long-term trends in sandbar shark (*Carcharhinus plumbeus*) CPUE from 2003 – 2023 near Sarasota, Florida

Summary: The Mote Large Shark Survey (LSS) was initiated in 2003 to assess population trends in large coastal sharks in the Sarasota, FL region. It has been maintained since that time with a few gaps occurring due to funding lapses. Sampling was conducted using both longlines and drumlines along the Gulf coast from south Tampa Bay to Sanibel Island, though four sampling locations were considered to be the “core” study area (Anna Maria, Longboat Pass, New Pass, Midnight Pass). All statistical analyses were completed using program R (v4.4.3, R Core Team 2025). Sandbar shark counts were analyzed using zero-inflated modeling to account for excess zeros in the data, specifically in seasons when sandbar sharks were not frequently caught in the Sarasota area (summer and fall). Both models agree that sandbar shark CPUE has increased over time in the sampling area. There is also a strong seasonal influence on sandbar shark abundance along the Sarasota coast, with the peak occurring in winter, lower abundance in spring, and a near absence in summer and fall. Red tide presence was not a significant factor, though there is some evidence that there may be an effect during spring. Sandbar presence was more variable during red tide periods and local abundance could be dictated by relative severity elsewhere (e.g., when red tide is present in Sarasota but it is not as severe as in other locations local abundance may increase).

Decision: The Group determined that the time series is limited spatially (only off the coast of Sarasota, FL) and it overlaps with the SEFSC bottom longline survey (SEDAR101-DW-25). However, sampling coincided with the potential movements of sandbar sharks through the area and was consistent annually. The Group recommended that it be considered for use in the assessment. The Group also recommended that a post-data workshop analysis be conducted with the factor “Year” as a categorical variable rather than a continuous variable as was used in the initial analysis.

SEDAR101-DW-12: Standardized catch rates for juvenile sandbar sharks caught during northeast COASTSPAN longline surveys

Summary: This document reviews the juvenile sandbar shark (<80 cm fork length) catch rates from the Cooperative Atlantic States Shark Popping and Nursery (COASTSPAN) surveys conducted in Delaware and Chesapeake Bays for development of a recruitment index. Catch per unit effort (CPUE) in the number of sharks per 50-hook set per hour was used to examine the relative abundance of juvenile sandbar sharks between the summer nursery seasons from 2001 to 2024. The CPUE was standardized using a two-step delta-lognormal approach that models the proportion of positive catch with a binomial error distribution separately from the positive catch, which is modeled using a lognormal distribution. The resulting index shows high variability across years that might be expected for a recruitment index, especially with a reproductive cycle of two to three years.

Decision: The Group determined that the time series represented a potential recruitment

index for the northern portion of the pupping areas for sandbar shark (Delaware Bay, DE to Chesapeake Bay, VA). However, the initial analysis of the data contained individuals that were likely older than Age 0. The life history group was requested to provide an upper limit of size (cm FL) to the analysts, so that the data set could be refined and re-analyzed to include only Age 0 sandbar sharks. The analyst reanalyzed the data and the index was recommended for consideration as a recruitment index for sandbar shark.

SEDAR101-DW-13: Standardized index of abundance for sandbar sharks from the NOAA Cooperative Atlantic States Shark Pupping and Nursery longline survey conducted in South Carolina, Georgia, and northern Florida

Summary: This document details the sandbar shark catches from the Cooperative Atlantic States Shark Pupping and Nursery (COASTSPAN) longline surveys conducted in estuarine and nearshore waters from South Carolina to northern Florida. Catch per unit effort (CPUE) in the number of sharks per 100 hook hours was used to examine juvenile sandbar shark relative abundance from 2000-2024. The CPUE was standardized using a two-step delta-lognormal approach that models the proportion of positive catch with a binomial error distribution separately from the positive catch, which is modeled using a lognormal distribution. This time series shows high uncertainty at the beginning of the time series, when it was as much exploration as survey. The resulting indices show a lot of variability across years that might be expected for a recruitment index, especially for a fish with a reproductive cycle of two to three years.

Decision: Similar to the discussion relative to SEDAR101-DW-12, the Group determined that the time series represented a potential recruitment index for the southern portion of the pupping areas for sandbar shark (South Carolina to northern Florida). However, similar to SEDAR101-DW-12, the initial analysis of the data contained individuals that were likely older than Age 0. The life history group was requested to provide an upper limit of size (cm FL) to the analysts, so that the data set could be refined and re-analyzed to include only Age 0 sandbar sharks. The analyst reanalyzed the data and the index was recommended for consideration as a recruitment index for sandbar shark.

SEDAR101-DW-14: Standardized catch rates for sandbar sharks from the NMFS Northeast Longline Survey

Summary: This document details sandbar shark catches from the Northeast Fisheries Science Center (NEFSC) coastal shark bottom longline survey, conducted by the Apex Predators Program, Narragansett Laboratory, Narragansett, RI from 1996-2024. Data from this survey were used to look at the trends in relative abundance of sandbar sharks in the waters off the east coast of the United States. Catch per unit effort (CPUE) by the number of sharks per 100 hook-hours were examined for each year of the bottom longline survey, 1996, 1998, 2001, 2004, 2007, 2009, 2012, 2015, 2018, 2021, and 2024. The CPUE was standardized using the delta-lognormal approach, which models the proportion of positive catch with a binomial error distribution separately from the positive catch, which is modeled using a lognormal distribution. Sandbar sharks show an increasing trend in relative abundance across the time series.

Decision: The Group acknowledged that this was a continuity analysis of the data using

the same methodology that was used in SEDAR54. This data was also used in SEDAR101-DW-26. The Group accepted the continuity analysis, but will move forward using the methods in SEDAR101-DW-26 as these incorporate spatiotemporal methods.

SEDAR101-DW-15: Standardized catch rates for sandbar sharks from SEAMAP longline surveys conducted by GADNR and SCDNR

Summary: This document details the sandbar shark catches from the Southeast Area Monitoring and Assessment Program (SEAMAP) longline surveys conducted by the Georgia Department of Natural Resources (GADNR) and the South Carolina Department of Natural Resources (SCDNR) from 2009-2024. The original series was updated after discussion from 2007 to 2009 due to differences in sampling strategies between Georgia and South Carolina. Catch per unit effort (CPUE) in the number of sharks per 100 hook-hours were used to standardize sandbar shark CPUE for sharks 80 cm fork length (FL) and greater. The CPUE was standardized using a two-step delta-lognormal approach originally proposed by Lo et al. (1992) that models the proportion of positive catch with a binomial error distribution separately from the positive catch, which is modeled using a lognormal distribution. Sandbar sharks (≥ 80 cm FL) showed a decreasing trend until 2011 when relative abundance appears to stabilize and then has an overall increasing trend throughout the remainder of the time series with increasing interannual variability after 2018.

Decision: Considerable discussion on this time series occurred. The time series was initially at its highest level in 2007, showed a decreasing trend until 2011 when relative abundance appears to stabilize and then has an overall increasing trend throughout the remainder of the time series with increasing interannual variability after 2018. There were no changes in sampling (different hook types/bait or a shift in area sampled) throughout the time period to explain this variability. The analyst pointed out that this survey is a multispecies survey originally designed to target red drum, but coastal sharks continue to be a large component of the catch. The Group recommended the time series for consideration in the assessment model.

SEDAR101-DW-25: Indices of Relative Abundance for Sandbar Sharks from the SEFSC Bottom Longline Survey in the Western North Atlantic Ocean.

Summary: The Oceanic and Coastal Pelagic Branch of the Southeast Fisheries Science Center (SEFSC) of NOAA Fisheries has conducted longline surveys in the western North Atlantic Ocean (Atlantic), including the Gulf of America (Gulf) from 1995 to 2025. In addition to the annual survey, the Congressional Supplemental Sampling Program (CSSP) was conducted in 2011, where increased levels of standardized bottom longline survey effort were maintained from April through October in the Gulf. Data from the SEFSC Bottom Longline Survey and the CSSP Survey (limited to August and September sampling) have been used during previous assessments of sandbar sharks (*Carcharhinus plumbeus*). A delta-lognormal model was used to calculate a relative abundance index for the Atlantic and Gulf from the SEFSC and CSSP data from 1995 to 2025. The index shows a relatively flat trend in the beginning of the time series

(1995-2008), with an increasing trend starting in 2009 that flattens at the increased abundance level towards the end of the time series.

Decision: The Group determined that because this series is stock wide and used in previous stock assessments for sharks, the series should be prioritized for use in the sandbar shark stock assessment base model. It was also noted that this series could be considered one of the most likely indices that reflect the current status of sandbar shark. It was also noted that abundance increased in 2005 which agreed with the time series developed for the NEFSC Bottom Longline Survey (SEDAR101-DW-26)

SEDAR101-DW-26: Spatiotemporal indices of relative abundance for sandbar shark *Carcharhinus plumbeus* from the NEFSC Coastal Shark Bottom Longline Survey

Summary: The Northeast Fisheries Science Center (NEFSC) Coastal Shark Bottom Longline Survey (CSBLLS) provides fishery-independent data on coastal shark species along the U.S. Atlantic coast from Florida to Delaware. This data working paper summarizes efforts to develop standardized indices of relative abundance for sandbar shark (*Carcharhinus plumbeus*) using spatiotemporal generalized linear mixed models (GLMMs). Trends in nominal catch-per-hook-hours (CPUE) and standardized indices of relative abundance based on spatiotemporal GLMMs fitted separately to sandbar shark counts and CPUE showed similar patterns from 1996-2024. Both models incorporated spatial and spatiotemporal random effects to account for uneven sampling effort and spatial structure in survey data. Estimated 95% confidence intervals and coefficients of variation (CV) for the standardized indices show good precision. Based on this analysis, it appears that the sandbar shark population has experienced an overall increase in abundance over the past two decades, with relatively stable relative abundance since 2015.

Decision: The Group determined that because this series is stock wide and used in previous sandbar shark stock assessment (SEDAR54), the series should be prioritized for use in the base model. It was noted that during SEDAR77, the initial standardized CPUE results showed an increasing trend in scalloped hammerhead shark relative abundance across the survey years that was not supported by the life history of the species, particularly the large increase in the final years of the survey. Following SEDAR77, a new spatiotemporal modelling analysis was undertaken to account for uneven sampling effort and spatial structure in survey data. This analysis was accepted by the Group. It was also noted that this series could be considered one of the most likely indices that reflect the current status of sandbar shark. It was also noted that abundance increase in this survey coincided with the time series developed for the SEFSC Bottom Longline Survey (SEDAR101-DW-25)

SEDAR101-DW-30: Virginia Shark Monitoring and Assessment Program

Summary: The Virginia Shark Monitoring and Assessment Program, which is based out of the Virginia Institute of Marine Science (VIMS), has been sampling shark populations in the coastal waters of Virginia since 1974 using standardized fisheries-independent longline gear. Data has been incorporated into stock assessments conducted by NOAA Fisheries for shark populations in the Atlantic, and are used by the Atlantic States Marine Fisheries Commission (ASMFC) and the Virginia Marine Resources Commission (VMRC) in their respective shark management policies.

Decision: The Group noted that although the series is limited spatially (based on 6 fixed stations in waters of Chesapeake Bay), the series is the longest temporally. The survey captures sandbar sharks as they recruit to the Bay to give birth and young sandbar sharks are found in the Bay throughout the summer. However, it was noted in recent years that there was a decline in relative abundance. The Group determined that this decline was not due to relative abundance but due to funding and logistics in recent years. Moreover, it was noted that Crear et al. (2020) predicted suitable juvenile sandbar shark habitat in Chesapeake Bay was negatively impacted by increases in water temperature. As the VIMS survey has documented recent increases in water temperature through the survey area, the Group concluded that the decline in abundance was due more to sandbar shark local availability (i.e., emigrating from the Bay to more suitable habitat along the coast of Virginia). The Group recommends this index for consideration in the model, with the recommendation to include time blocks or truncate the time-series, which may more representatively account for potential changes in catchability (e.g. treat early years of the survey, where there is no other information on sandbar shark abundance, separately from the latter years of the survey, wherein warming waters may have caused sandbar shark to emigrate from the historical survey area).

SEDAR101-DW-11: Long-term trends in sandbar shark (*Carcharhinus plumbeus*) CPUE from 2003 – 2023 near Sarasota, Florida

Summary: A revised analysis using Year as a categorical variable was conducted and results provided as an addendum to SEDAR101-DW-11.

Decision: The Group accepted the updated analysis.

SEDAR101-DW-17: Relative abundance indices for sandbar sharks (*Carcharhinus plumbeus*) in the northwest Atlantic Ocean from the Shark Bottom Longline and Shark Research Fishery

Summary: A post-data workshop analysis was conducted introducing the “vessel identification” as a random variable in the generalized linear mixed model to attempt to account for the effect of differences in fishing technique by the vessel to account for management changes. The initial models did not converge due to too many vessels over the length of the time series with varying levels of effort. To account for this, a categorical covariate “Research Fishery Participation” was developed that utilized the level of effort the vessel made over the length of the fishery as a proxy for a measure of Captain experience. If a vessel conducted >10.0% of total sets the vessel was ranked “High” experience, 5.0-9.9%= “Medium” experience and <4.9%= “Low” experience. The covariate was introduced into the model, and model selection followed SEDAR101-DW-17.

Decision: Despite being a significant factor, “Research Fishery Participation” did not meet the criteria for final retention in the model and the original relative abundance index presented at the data workshop was adopted. The Group accepted this decision.

Expanding Spatiotemporal indices of relative abundance for sandbar shark *Carcharhinus*

***plumbeus* from the NEFSC Coastal Shark Bottom Longline Survey (SEDAR101-DW-26) to include the SEFSC Bottom Longline Survey data (SEDAR101-DW-25)**

Summary: The top indices recommended during the Data Workshop included the NEFSC Bottom Longline (NE BLL) and SEFSC Bottom Longline (SE BLL). Combining these surveys to generate a single, stockwide indicator to support the development of an Empirical Management Procedure (MP) was investigated. The NE BLL data were already integrated in a spatiotemporal model (SEDAR101-DW-26), and this model was expanded to include the SE BLL data (SEDAR101-DW-25). Any index corrections that can take place outside of the integrated stock assessment model (particularly with greater spatial or temporal resolution as was possible here) should also be considered. The NE BLL survey is conducted from Florida to Delaware, typically April-May, using 300 J hooks soaking 3hrs at fixed stations. The SE BLL survey is conducted from Texas to North Carolina, typically July-September, using 100 circle hooks soaking 1hr at stratified randomly sampled stations. The SE BLL survey typically samples deeper and captures a larger composition of sandbar shark when compared to the NE BLL survey. While the SE BLL survey is conducted annually, the NE BLL is not conducted every year.

Decision: Combining the NE BLL and SE BLL survey within a single spatiotemporal index of abundance is recommended to continue to be pursued for generating an empirical MP for the MSE throughout the assessment process. It is not recommended to combine them for incorporation directly into the stock assessment framework in place of the two individual indices due to the multiple conflicting factors that are impossible to tease apart (e.g. impacts of seasonal differences when the surveys overlap annually in space, fixed station vs random sampling, depth, hook type) and are lumped into a single “survey” variable. Further, the disparity in size composition is recommended to be kept separate within the integrated stock assessment model, particularly considering the different survey selectivities, annual migration of sandbar shark, and seasonal and annual mismatch of surveys.

4.3 INDICES INFORMATION SUMMARY AND CONSENSUS

Of all the data series evaluated, the Group recommended thirteen (13) indices to be considered in the stock assessment (Table 3-5). Four (4) indices were prioritized for inclusion in the stock assessment (Figure 3). Seven (7) indices (Figure 4; including 2 recruitment indices, Figure 5) were recommended for consideration in the stock assessment (e.g., at the discretion of the lead analysts during model development). Two (2) indices were not recommended for use within the stock assessment (or MSE). The Working Group was also tasked with determining which indices most represented the current status of sandbar shark and for providing a recommendation as to which indices should be explored as management procedure indicators within a Management Strategy Evaluation (MSE) framework (Figure 6). The Working Group concluded the SEFSC Bottom Longline (SEDAR101-DW-25), NEFSC Bottom Longline (SEDAR101-DW26) and Shark Research Fishery (SEDAR101-DW-17) would be the most appropriate to be used in an MSE

framework with the SEFSC Bottom Longline classified as highest and the Shark Research Fishery lowest among the 3 indices.

4.4 RESEARCH RECOMMENDATIONS

1. Specific future research to continue to investigate combining the spatiotemporal indices of relative abundance for sandbar shark obtained from the NEFSC Coastal Shark Bottom Longline Survey (SEDAR101-DW-26) and the SEFSC Bottom Longline Survey data (SEDAR101-DW-25).
2. Exploration of the utility of combining multiple indices into a single index using the Bayesian hierarchical model (Conn 2009), Dynamic Factor Analysis (Peterson et al. 2017) or vector autoregressive spatiotemporal (VAST) models (O'Brien et al. 2025). Particular emphasis should be placed on treatment of length composition data and definition of selectivity of combined indices (e.g., Peterson et al. 2021).
3. Exploration of climate change impacts on nursery ground usage (particularly SEDAR101-DW-30: Virginia Shark Monitoring and Assessment Program long-term historic longline survey (1974–present)) where distribution of sandbar sharks from the historical survey area in the bays may be shifting to deeper, more exposed waters due to temperature thresholds
4. Future research to compare the characterization of index uncertainty methods

4.5 REFERENCES

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NOT PEER REVIEWED

4.6 TABLES

Table 1. Initial data series considered for developing an index of relative abundance for sandbar shark during the SEDAR 101 pre-Data Workshop webinars.

Data Series	Fishery Dependent/Fishery Independent	Temporal	Spatial	Initial Consideration	Reason for not considering
Coastspan NE Longline Survey	Fishery Independent	2001- 2024	Stockwide	Yes	
Coastspan SE Longline Survey	Fishery Independent	2000- 2024	Stockwide	Yes	
Dauphin Island Sealab Longline Survey	Fishery Independent	2010- 2025	Limited	Yes	
Gulf Reefish Bottom Longline Fishery	Fishery Dependent	2016- 2020	Stockwide	No	Limited temporally; Other surveys cover same spatial areas
Gulf SeaMap Longline Survey	Fishery Independent	2006- 2025	Limited	No	Limited spatially; Low proportion positive; Other surveys cover same spatial areas
Large Pelagic Intercept Survey	Fishery Dependent	2002- 2024	Limited	No	Low proportion positive; self-reported data
Mark Sampson Logbook Survey	Fishery Dependent	2004- 2025	Limited	No	Data requires Q/A and refinement
Mote Marine Laboratory Longline and Drumline Survey	Fishery Independent	2003- 2023	Limited	Yes	
NEFSC Bottom Longline Survey	Fishery Independent	1996- 2024	Stockwide	Yes	

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NEFSC Trawl/Gillnet Fishery	Fishery Dependent	1995-2025	Limited	Yes	Low proportion positive; Other surveys cover same spatial areas
Pelagic Longline Fishery	Fishery Dependent	1992-2025	Stockwide	Yes	
SE Coastal Gillnet Fishery	Fishery Dependent	1996-2025	Limited	No	
SE SEAMAP Longline Survey	Fishery Independent	2009-2024	Limited	Yes	
SEFSC Bottom Longline Survey	Fishery Independent	1995-2025	Stockwide	Yes	
Shark Bottom Longline Fishery	Fishery Dependent	1994-2007	Stockwide	Yes	
Shark Research Fishery	Fishery Dependent	2008-2025	Stockwide	Yes	
VIMS Bottom Longline Survey	Fishery Independent	1974-2024	Limited	Yes	

Table 2. Elements used to evaluate the adequacy and retention of CPUE series as an input to the stock assessment model.

ELEMENT	DESCRIPTION	ACTIONS AND REASONING
1	Diagnostics	Apply defensible model validations (i.e., Q-Q plots, residuals, etc.) and consider overdispersion
2	Appropriateness of data exclusions and classifications (e.g., to identify targeted trips).	How were trips identified and was this a shark directed survey
3	Geographical coverage	How does the series compare with the range of the stock
4	Catch fraction	Change to mean proportion positives through time series
5	Length of time series relative to the history of exploitation.	The length of catch series for assessment is 1950-2024. For inclusion, survey must be established for minimum of 10 years but consideration will be given to shorter time series if they satisfy other important criteria
6	Are other indices available for the same time period?	Evaluate and pick best survey or combine them at the data level (if methods are similar)
7	Does the index standardization account for known factors that influence catchability/selectivity?	Is there an attempt to account for catchability and are the appropriate factors being considered
8	Are there conflicts between the catch history and the CPUE response?	Does the trend follow the expected performance based on management
9	Is the interannual variability outside biologically plausible bounds	Look at interannual variability: Is the trend of increase biologically plausible?
10	Are biologically implausible	Covariates appropriate or accurate, change in design or stations appropriate

	interannual deviations severe?	
11	Assessment of data quality and adequacy of data for standardization purposes (e.g., sampling design, sample size, factors considered)	Are the covariates appropriate that were used in standardizing the data?
12	Is this CPUE time series continuous?	If not continuous, were there big changes in the survey?
13	Characterization of Index uncertainty	Method of characterization (e.g., bootstrap, delta method), magnitude of uncertainty (e.g., CV)

Table 3. Final sandbar shark data series recommended by the Indices Working Group including the corresponding SEDAR document number, the Series name, index type (fishery dependent=FD or fishery independent=FI), overall rank for Management Strategy Evaluation (MSE) analysis, if the series was recommended as a baseline or sensitivity, the temporal and spatial coverage, and life stage and season sampled.

SEDAR #	Series Name	Index Type	Overall Rank	Recommendation	Temporal	Spatial	Life stage	Season
SEDAR101-DW-08	Pelagic Longline Observer Program	FD		Sensitivity	1992-2025	Stockwide	Lrg juv/adult	Jan-Dec
SEDAR101-DW-10	Dauphin Island Sealab Longline	FI		Not considered	2010-2025	Limited	Juv/adult	Mar-Dec
SEDAR101-DW-11	Mote Marine Laboratory Longline and Drumline Survey	FI		Sensitivity	2003-2023	Limited	Juv/adult	Jan-Dec
SEDAR101-DW-12	Coastspan NE Longline	FI		Baseline	2001-2024	Stockwide	Young-of-the-Year	July-Aug
SEDAR101-DW-13	Coastspan SE Longline	FI		Baseline	2000-2024	Stockwide	Young-of-the-Year	July-Aug
SEDAR101-DW14/SEDAR101-DW26	NEFSC Bottom Longline	FI	2	Baseline	1996-2024	Stockwide	Juv/adult	Apr-May
SEDAR101-DW-15	SE SEAMAP longline	FI		Baseline/Sensitivity	2009-2024	Limited	Juvenile	May-Sep
SEDAR101-DW-17	Shark Research Fishery	FD	3	Baseline	2008-2025	Stockwide	Lrg juv/adult	Jan-Dec
SEDAR101-DW-17	Shark Bottom Longline Fishery	FD		Sensitivity	1994-2007	Stockwide	Lrg juv/adult	Jan-Dec
SEDAR101-DW-19	NEFSC Observer Trawl/Gillnet	FD		Not considered	1995-2025	Limited	All	Jan-Dec
SEDAR101-DW-25	SEFSC Bottom Longline	FI	1	Baseline	1995-2025	Stockwide	Juv/adult	July-Sep
SEDAR101-DW-30	VIMS Bottom Longline	FI		Baseline	1974-2024	Limited	Juv/adult	May-Oct

Table 4. Recommended Fishery Dependent (i.e., commercial or recreational data sources) absolute indices of abundance for sandbar shark (all life stages) including index name, the value of catch per unit effort, and SEDAR document number. CV is the coefficient of variation for the annual index value. Missing values in a given year correspond to zero catches (index value of 0 and no CV), where no sampling occurred (ns), or when the model did not converge (nc).

	Shark Bottom Longline Fishery			Shark Research Fishery			Pelagic Longline Fishery	
	SEDAR101-DW-17			SEDAR101-DW-17			SEDAR101-DW-08	
	sharks/10,000 hooks			sharks/10,000 hooks			sharks/1,000 hooks	
Year	Index	CV		Index	CV		Index	CV
1994	185.21	0.31						
1995	257.31	0.12						
1996	183.46	0.17					0.14	0.50
1997	296.98	0.19					0.23	0.43
1998	268.16	0.39					0.11	0.62
1999	264.66	0.27					0.13	0.48
2000	198.07	0.32					0.07	0.51
2001	431.74	0.26					0.06	0.58
2002	250.42	0.16					0.01	1.38
2003	344.92	0.12					0.01	1.38
2004	313.73	0.13					0.11	0.42
2005	349.34	0.16					0.04	0.58
2006	318.89	0.16					0.06	0.53
2007	534.18	0.18					0.06	0.47
2008				50.13	0.02		0.07	0.37
2009				64.65	0.02		0.08	0.34
2010				70.79	0.02		0.04	0.48
2011				74.98	0.01		0.06	0.43
2012				86.67	0.01		0.12	0.39
2013				67.46	0.02		0.10	0.32

2014				68.83	0.02		0.06	0.42
2015				74.00	0.01		0.11	0.38
2016				70.42	0.02		0.14	0.31
2017				76.71	0.01		0.33	0.31
2018				73.75	0.01		0.22	0.44
2019				75.25	0.01		0.06	0.55
2020				70.62	0.02		0.11	0.71
2021				78.66	0.01		0.32	0.41
2022				87.96	0.01		0.14	0.36
2023				102.79	0.01		0.36	0.36
2024				106.70	0.01		0.21	0.40
2025				77.62	0.01		0.04	0.85

Table 5. Recommended Fishery Independent (i.e. scientific survey) absolute indices of abundance for juvenile and adult sandbar shark including index name, the value of catch per unit effort, and SEDAR document number. CV is the coefficient of variation for the annual index value. Missing values in a given year correspond to zero catches (index value of 0 and no CV), where no sampling occurred (ns), or when the model did not converge (nc).

	SEFSC Bottom Longline Survey			NEFSC Bottom Longline Survey			Mote Longline Survey			Mote Drumline Survey			SEAMAP SE Longline Survey			VIMS Longline Survey	
	SEDAR77-DW24			SEDAR77-DW26			SEDAR77-DW11			SEDAR77-DW11			SEDAR77-DW15			SEDAR77-DW30	
	sharks/hook-hour			sharks/hook-hour			sharks/hook-hour			sharks/hook-hour			sharks/hook-hour			sharks/hook-hour	
Year	Index	CV		Index	CV		Index	CV		Index	CV		Index	CV		Index	CV
1974																4.12	0.35
1975																6.28	0.27
1976																9.82	0.36
1977																3.96	0.31
1978																4.25	0.53
1979																2.61	0.68
1980																3.35	0.22
1981																3.85	0.23
1982																6.63	0.37
1983																3.12	0.34
1984																2.35	0.48
1985																2.01	1.02
1986																1.85	0.59
1987																1.27	0.52
1988																1.31	0.58
1989																1.93	0.43
1990																1.54	0.24
1991																2.35	0.24
1992																1.99	0.26
1993																2.57	0.26
1994																3.69	0.40
1995	0.21	0.28														1.88	0.24
1996	0.11	0.38		0.81	0.46											1.70	0.23

1997	0.20	0.24	ns	ns											1.65	0.23
1998	.	.	3.09	0.44											2.22	0.23
1999	0.10	0.36	ns	ns											1.62	0.25
2000	0.11	0.25	ns	ns											1.68	0.25
2001	0.21	0.21	1.75	0.45											1.60	0.24
2002	0.14	0.19	ns	ns											1.34	0.28
2003	0.17	0.21	ns	ns	0.00040	1.32 592	0.0193	0.5 8							1.35	0.27
2004	0.14	0.21	1.58	0.46	0.00026	1.05 321	0.0010	2.1 4							1.06	0.28
2005	0.11	0.37	ns	ns	0.00108	1.09 174	0.0000								1.01	0.30
2006	0.08	0.33	ns	ns	0.00394	1.67 583	0.0047	0.7 9							1.97	0.24
2007	0.22	0.30	4.65	0.47	0.00351	1.34 240	0.0131	0.4 2							0.98	0.31
2008	0.16	0.28	ns	ns	0.00000	1.53 756	0.0000								1.43	0.27
2009	0.40	0.16	10.51	0.44	0.00889	0.89 734	0.0179	0.4 2	1.16	0.22					2.60	0.31
2010	0.48	0.17	ns	ns	ns	ns	ns	ns	1.04	0.21					2.52	0.25
2011	0.37	0.14	ns	ns	0.00169	1.04 197	0.0296	0.4 1	0.55	0.30					1.48	0.30
2012	0.61	0.14	10.92	0.44	0.00031	0.88 577	0.0138	1.0 0	0.46	0.30					2.63	0.24
2013	0.41	0.18	ns	ns	ns	ns	ns	ns	0.48	0.27					3.37	0.27
2014	0.45	0.19	ns	ns	ns	ns	ns	ns	0.68	0.22					2.19	0.27
2015	0.72	0.13	20.36	0.43	ns	ns	ns	ns	0.88	0.22					1.38	0.25
2016	0.41	0.16	ns	ns	ns	ns	ns	ns	0.78	0.19					1.36	0.26
2017	0.56	0.16	ns	ns	0.00000	114. 3460 9	0.0000		0.65	0.24					1.80	0.30
2018	0.49	0.16	17.11	0.43	ns	ns	ns	ns	0.75	0.23					2.25	0.25
2019	0.75	0.14	ns	ns	0.00000	108. 8297 4	0.0000		1.52	0.18					2.36	0.24

2020	.	.		ns	ns		0.01886	1.28 665		0.0328	0.3 3		1.31	0.18		1.85	0.25
2021	0.58	0.17		21.86	0.43		0.00886	0.69 567		0.0266	0.3 6		0.66	0.24		1.37	0.26
2022	0.50	0.15		ns	ns		0.00472	1.72 285		0.0012	1.6 6		1.31	0.21		0.93	0.29
2023	0.68	0.14		ns	ns		0.00929	1.73 074		0.0148	0.5 6		1.36	0.18		0.94	0.28
2024	0.61	0.15		19.05	0.44								1.13	0.18		1.27	0.28
2025	0.48	0.14															

Table 6. Recommended Fishery Independent (i.e. scientific survey) absolute indices of abundance for Age 0 (young-of-the-year) sandbar shark including index name, the value of catch per unit effort, and SEDAR document number. CV is the coefficient of variation for the annual index value. Missing values in a given year correspond to zero catches (index value of 0 and no CV), where no sampling occurred (ns), or when the model did not converge (nc).

	Coastspan Longline NE			Coastspan Longline SE	
	SEDAR101-DW-12			SEDAR101-DW-13	
	sharks/hook-hour			sharks/hook-hour	
Year	Index	CV		Index	CV
2000				0.18	1.19
2001	0.41	1.24		0.00	
2002	2.87	0.55		0.00	
2003	9.11	0.40		1.33	0.77
2004	7.41	0.34		1.76	0.75
2005	20.18	0.40		1.01	0.64
2006	4.19	0.55		1.98	0.63
2007	1.95	0.61		2.85	0.64
2008	2.80	0.97		2.45	0.39
2009	11.16	0.51		1.13	0.44
2010	7.31	0.95		2.58	0.28
2011	13.44	0.55		2.87	0.22
2012	5.54	0.50		2.35	0.23
2013	3.62	0.29		3.03	0.35
2014	2.16	0.34		2.25	0.38
2015	1.61	0.42		0.22	0.91
2016	3.87	0.35		1.48	0.37
2017	4.70	0.28		2.67	0.35
2018	10.70	0.30		1.93	0.22
2019	6.50	0.40		5.51	0.24
2020	10.05	0.68		3.63	0.23
2021	4.71	0.38		3.55	0.33
2022	2.45	0.41		0.86	0.42

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2023	2.59	0.47		1.22	0.44
2024	1.98	0.47		1.27	0.53
2025					

NOT PEER REVIEWED

4.7 FIGURES

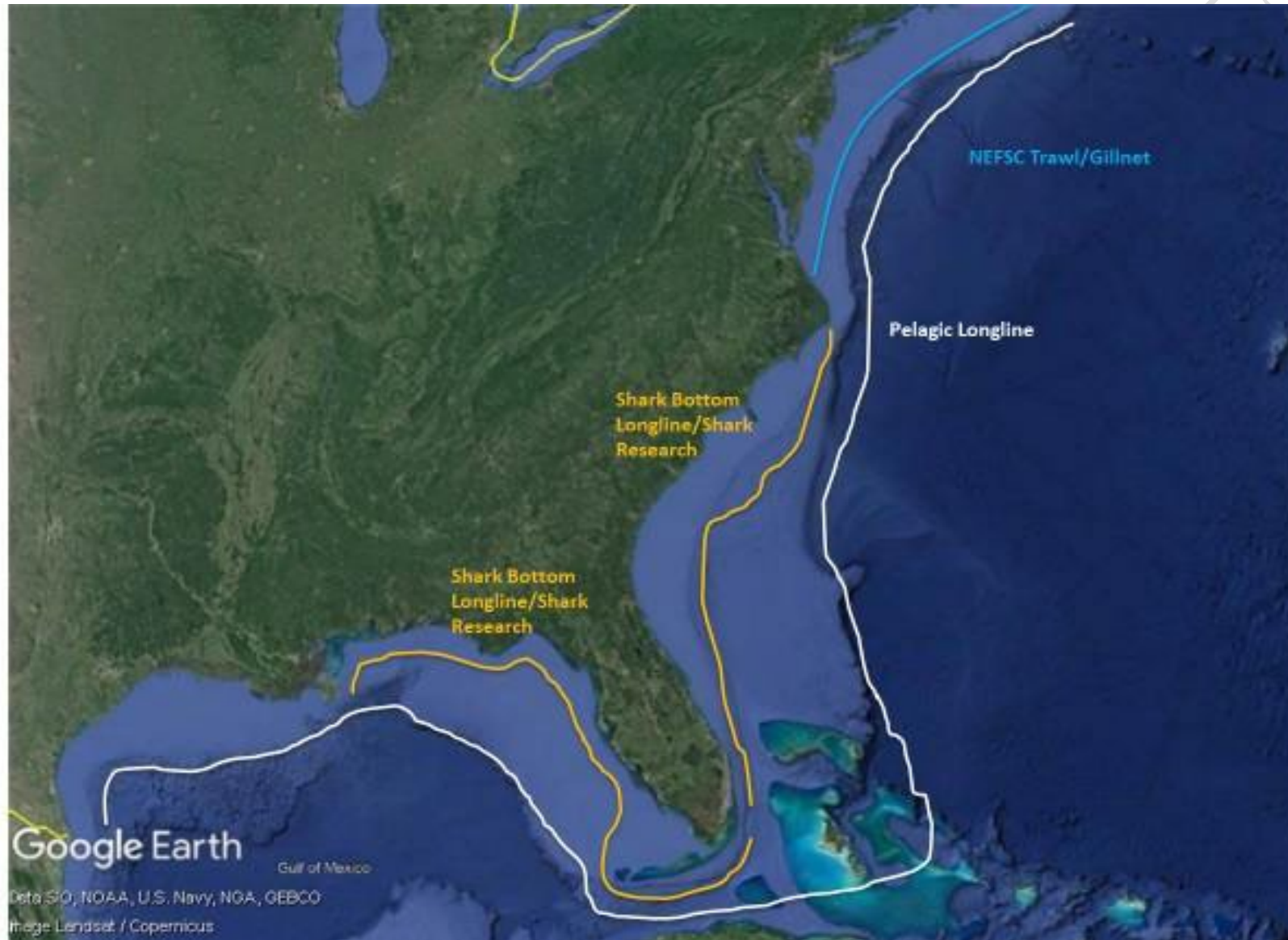


Figure 1. Approximate linear coverage of the fishery dependent abundance indices for the sandbar shark. Colors of the labeled abundance series correspond to the linear coverage.

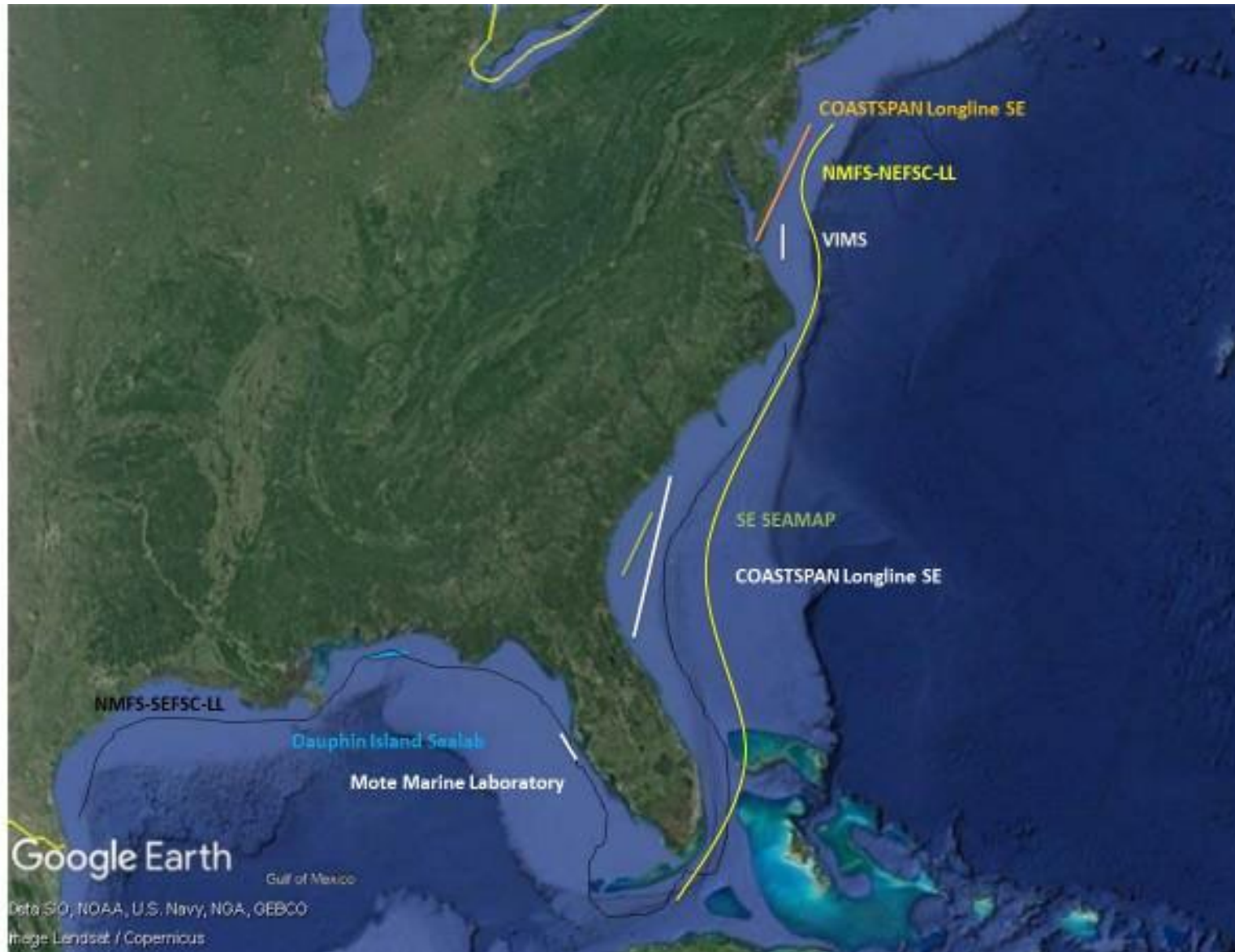


Figure 2. Approximate linear coverage of the fishery independent abundance indices for the sandbar shark. Colors of the labeled abundance series correspond to the linear coverage.

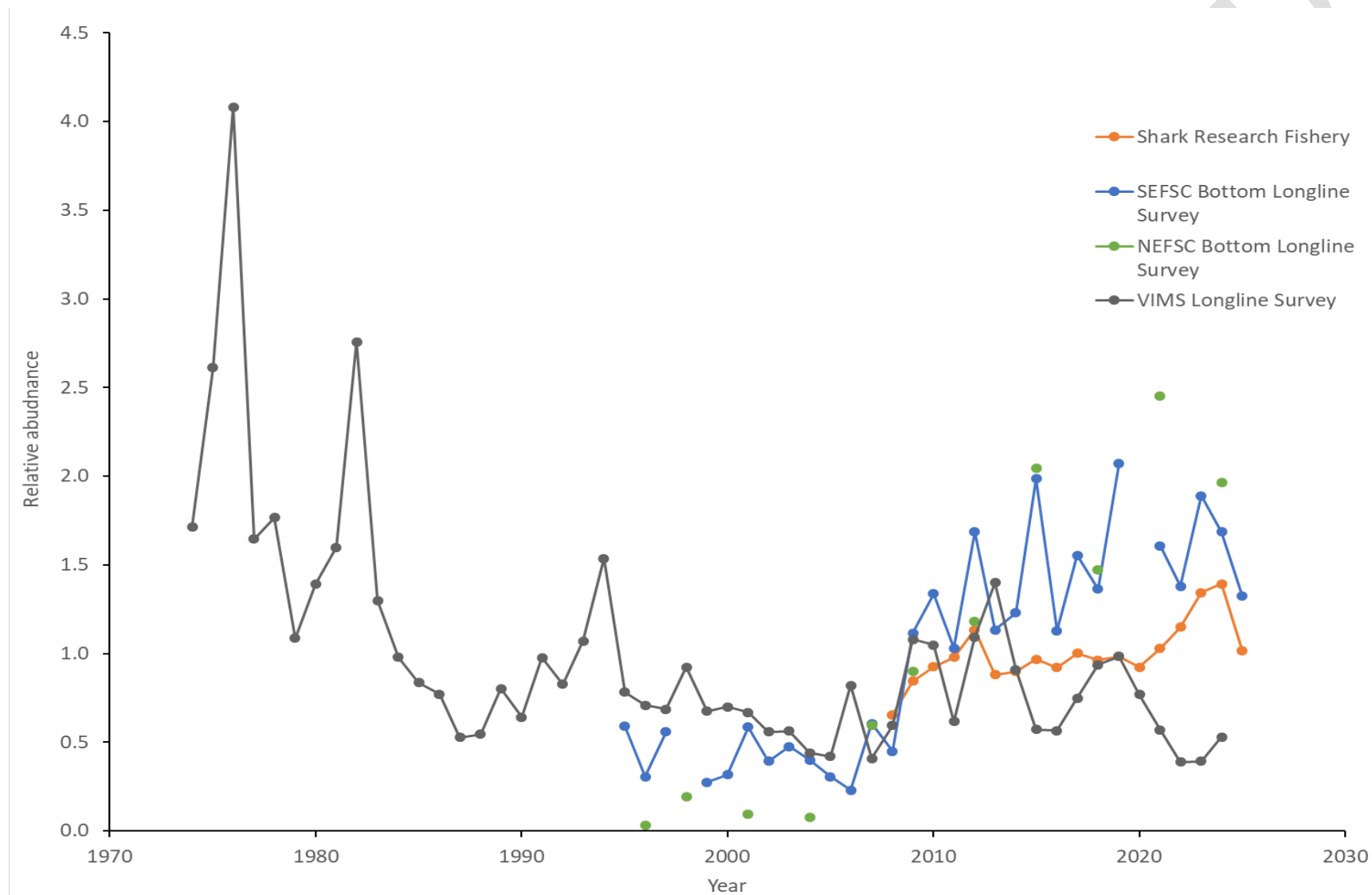


Figure 3. Plot of mean annual values of relative abundance for each base time series recommended for the sandbar shark assessment by the Indices Working Group. For each index, values were converted to a common scale for plotting purposes by dividing mean annual values for a time series by the average of all mean annual values for that specific time series.

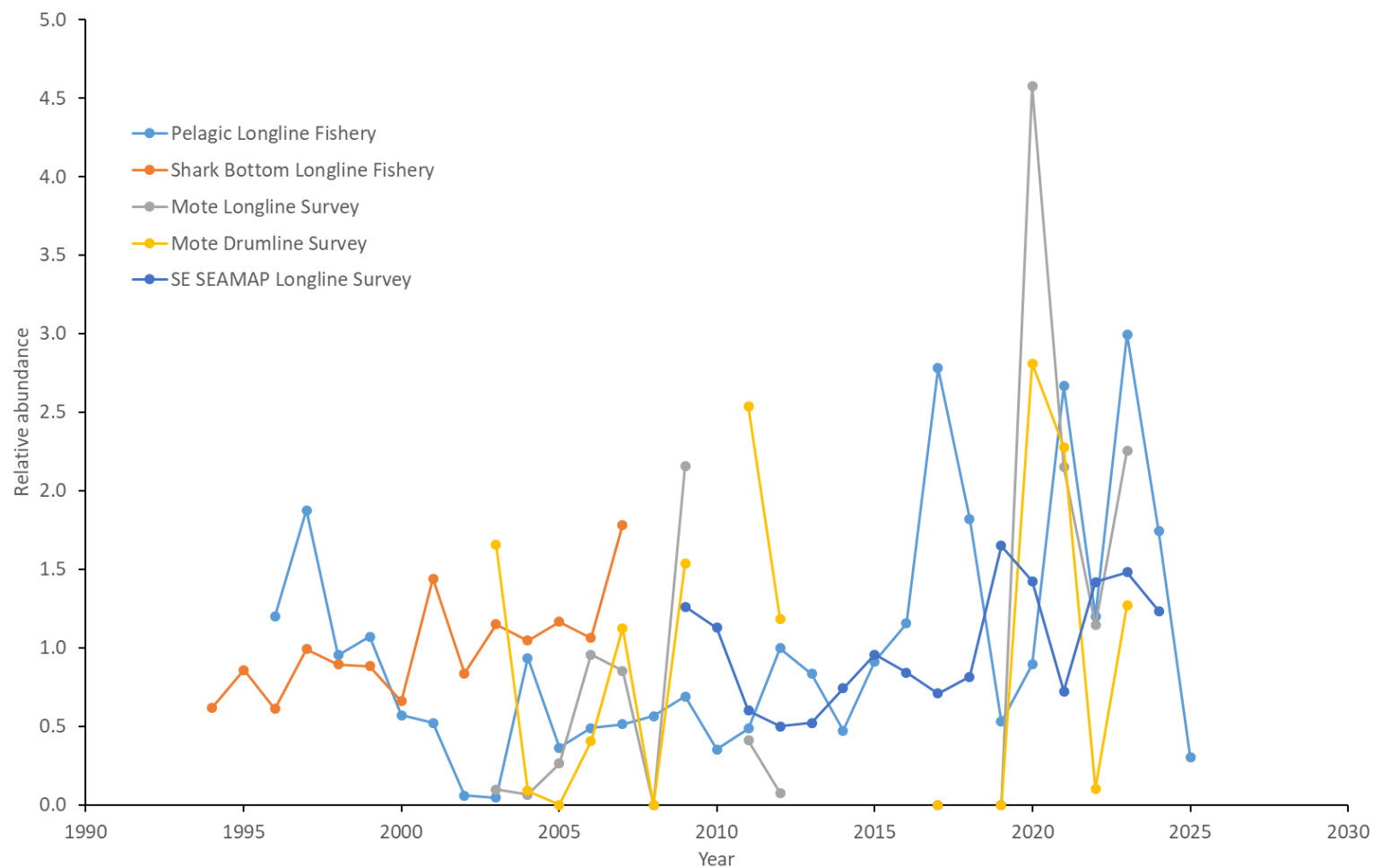


Figure 4. Plot of mean annual values of relative abundance for each sensitivity time series recommended for the sandbar shark assessment by the Indices Working Group. For each index, values were converted to a common scale for plotting purposes by dividing mean annual values for a time series by the average of all mean annual values for that specific time series.

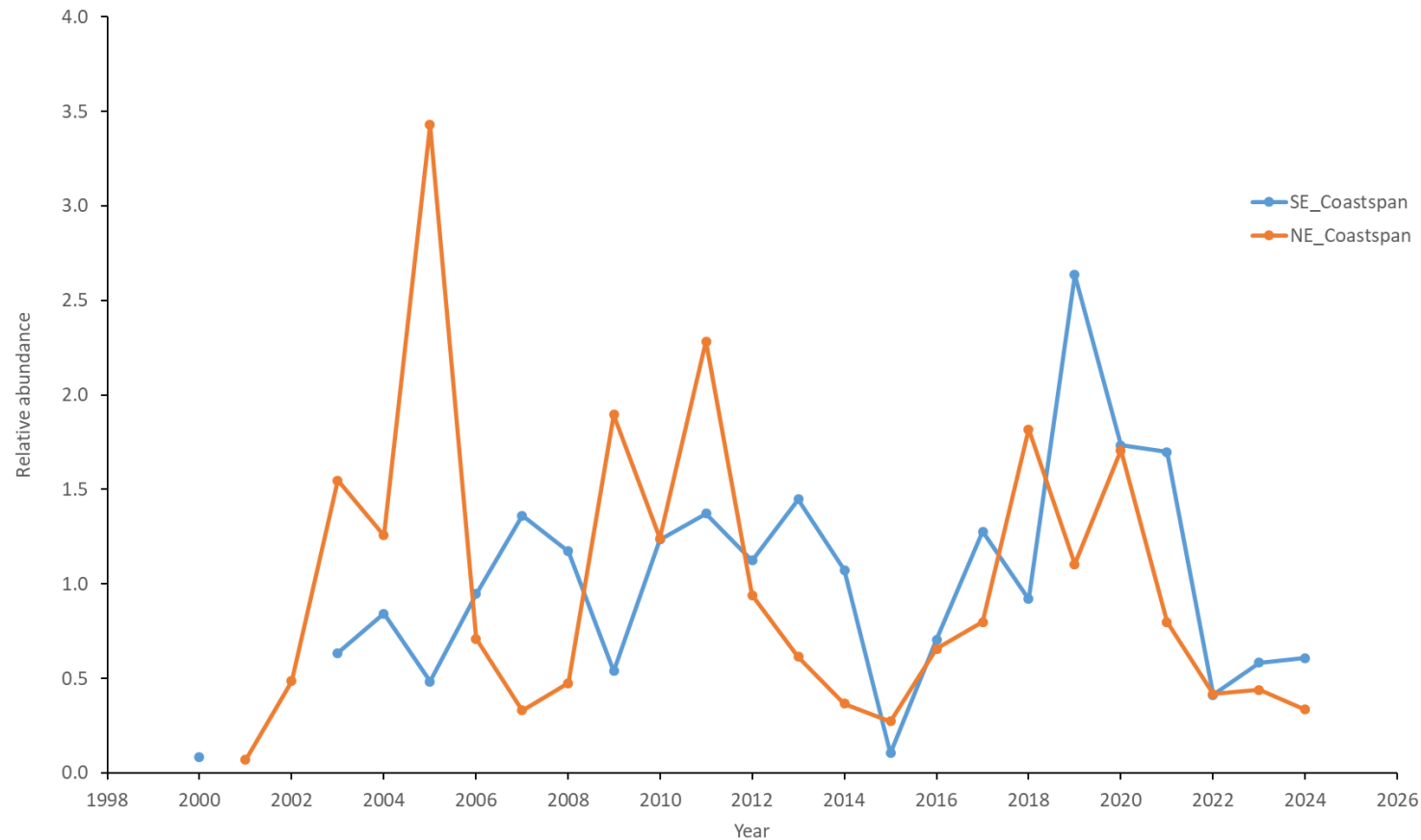


Figure 5. Plot of mean annual values of relative abundance for the recruitment (Age 0) time series recommended for the sandbar shark by the Indices Working Group. For each index, values were converted to a common scale for plotting purposes by dividing mean annual values for a time series by the average of all mean annual values for that specific time series.

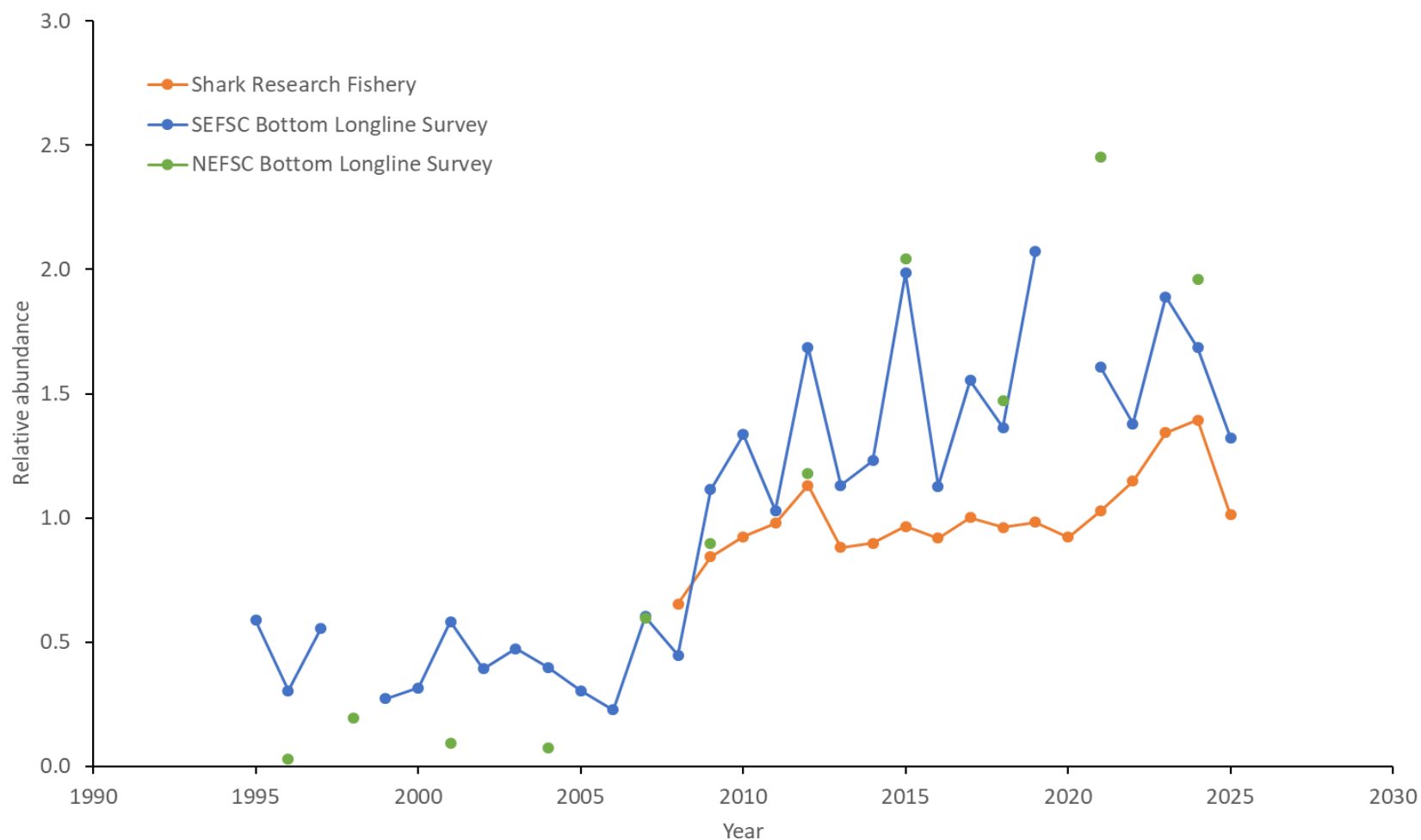


Figure 6. Plot of mean annual values of relative abundance for the time series recommended for use in the Management Strategy Evaluation (MSE) assessment by the Indices Working Group. For each index, values were converted to a common scale for plotting purposes by dividing mean annual values for a time series by the average of all mean annual values for that specific time series.

5. DISCARD MORTALITY

5.1 OVERVIEW

This report summarizes findings from panel discussions regarding Sandbar Shark (*Carcharhinus plumbeus*) post-release live-discard mortality (PRLDM) during the SEDAR 101 Data Workshop (DW) meeting (Charleston, SC, April 21-24, 2026) and subsequent Post-Workshop Webinar II (July 16, 2026).

The SEDAR 101 Ad Hoc Discard Mortality Working Group (DMWG) was convened during the in-person SEDAR 101 Data Workshop (DW) meeting in Charleston, SC (April 21-24, 2026), during online meetings June 3, 2026, and June 16, 2026, and during the SEDAR 101 Post Data Workshop Webinar II (July 16, 2026).

5.1.1 Work Group members and participants in the Discard Mortality Work Group

Leads

Dean Courtney – SEFSC/HMS, Panama City, Florida

Annsli Hilton – CIMAS, Panama City, Florida

Members

Karyl Brewster-Geisz -HMS, Silver Spring, Maryland

Bryan Frazier – SCDNR, Charleston, South Carolina

Cliff Hutt - HMS, Silver Spring, Maryland

Christina Vaeth - Industry Representative, Florida

Scott Vaeth - Industry Representative, Florida

Members via Webinar

Hannah Aycock – UMiami, Miami, Florida

Tobey Curtis - HMS, Gloucester, Massachusetts

Alex Hansell – NEFSC, Woods Hole, Massachusetts

Julie Neer - SEDAR, Charleston, South Carolina

5.1.2 Topics Reviewed by the Discard Mortality Group

5.2 SUMMARY OF PAST ASSESSMENTS

Previous SEDAR Assessment Process (AP) and Data Workshop (DW) PRLDM rate decisions for sharks are summarized in SEDAR 101 DW-21 (Courtney and Hilton 2026, their Table 4). Sandbar Shark were previously assessed during SEDAR 21 and SEDAR 54. However, SEDAR 54 was an update assessment. Consequently, no changes were introduced to the methods to develop the catch series used in SEDAR 21, and, as a result, SEDAR 54 also did not make any new decisions regarding post-release live-discard mortality for Sandbar Sharks.

Final commercial post-release live-discard mortality decisions for Sandbar Sharks from SEDAR 21 are provided from Data Workshop (DW) panel decisions adopted by SEDAR (2011, their section II Data Workshop Report, sub-section 3.4.2. Post-release Mortality):

“Decision 7: Post-release [live]-discard mortality for sandbar sharks caught on commercial bottom longline gear was estimated to range between 28.5-38.0%.

Decision 8: Post-release [live-discard] mortality for sandbar sharks caught on commercial pelagic longline gear was estimated to be 28.5%.

Decision 9: Post-release [live]-discard mortality for sandbar sharks caught on commercial gillnet gear was estimated to be between 5-10%.”

Final recreational post-release live-discard mortality decisions for Sandbar Sharks from SEDAR 21 are provided from Data Workshop (DW) panel decisions adopted by SEDAR (2011, their section II Data Workshop Report, sub-section 4.4.2. Post Release Mortality):

“Decision 3. A 3.25% post-release [live-discard] mortality rate was applied to B2 (released alive) sandbar sharks.”

5.2 INFORMATION AVAILABLE FOR SEDAR 101

This report summarizes findings from panel discussions regarding Sandbar Shark (*Carcharhinus plumbeus*) post-release live-discard mortality (PRLDM) information available for use in SEDAR 101 as identified in SEDAR 101 DW-21 (Courtney and Hilton 2026) and elsewhere. However, this report does not calculate total discard mortality rate from PRLDM which will be done elsewhere within the SEDAR 101 process. In addition, SEDAR 101 DW-21 (Courtney and Hilton 2026) and SEDAR 101-DW-20 (Hansell et al. 2026) identify at-vessel mortality (AVM) rates for Sandbar Sharks by gear type, which are also discussed below by the DMWG as an aid in their development of PRLDM rates for Sandbar Sharks. However, the DMWG does not make any recommendations on AVM rates for use in SEDAR 101, which will be done elsewhere within the SEDAR 101 process.

The DMWG emphasized that PRLDM rates recommended for use in SEDAR 101 are intended to be applied to live discards, for example as in Courtney and Hilton (2026, their equations 1 and 2) summarized below, which can be used interchangeably.

(1) Total discard mortality rate = (dead discard rate) + (PRLDM) * (live discard rate).

(2) $MT = MA + MD * SA$,

where MT is total discard mortality rate, defined as the immediate plus delayed discard mortality rate resulting from the fishing event; MA is immediate (i.e., at vessel or acute) discard mortality rate resulting from the fishing event; MD is delayed discard mortality rate resulting from the fishing event, defined as the proportion released alive that die as a result of the fishing event; and SA is acute survival rate (i.e., the proportion released alive).

As discussed below, the DMWG also noted the corresponding PRLDM (3.1%) and AVM (0.5%) values obtained for Sandbar Shark captured in commercial bottom longline gear (Whitney et al. 2021). Often, AVM is reported but not PRLDM. Therefore, this DMWG made the assumption that across all gears and years, PRLDM would be 2.6% above the reported AVM ($PRLDM - AVM = 3.1\% - 0.5\% = 2.6\%$) and applied the following equation to all reported AVM where PRLDM was not available:

(3) $PRLDM = AVM + 2.6\%$.

5.3 SUMMARY OF DISCARD MORTALITY WORKING PAPERS AND REFERENCE DOCUMENTS

Research Studies Discussed for Recreational PRLDM

SEDAR 101 RD-03 (Kneebone et al. 2024)

The SEDAR 101 DMWG discussed SEDAR 101 RD-03 (Kneebone et al. 2024). The DMWG noted that Kneebone et al. (2024) identified a recreational MD ($\pm$ 95% C.I.) of 0% ($\pm$ 5.6%) from 65 Sandbar Sharks equipped with acceleration data loggers (ADL). Sandbar Sharks were captured in directed recreational shore-based shark fishing conducted in Massachusetts. Sandbar Sharks were primarily captured with 8/0–18/0 circle hooks ($n = 58$, 86.6% of capture events), but 9 sharks (13.4% of events) were captured on 8/0–10/0 J-hooks (Kneebone et al. 2024, their Table 2). Kneebone et al. (2024) note that fight time ranged from 2.57 – 32.4 min (mean: 7 min) for 21 volunteer fishers (9 novice, 7 intermediate, and 5 expert). Kneebone et al. (2024) also note that behavioral recovery ranged from 1.33 – 17.18 hr after release (mean: 6.36 hr for 54 sharks with greater than 10 hr of recorded tag data). Condition at release was recorded as excellent (16), good (44), fair (5), or poor (2) (Kneebone et al. 2024, their Table 2). Kneebone et al. (2024) note that Sandbar Sharks hooked in the gills and classified in fair or poor condition took qualitatively longer to recover.

Based on the discussion of SEDAR 101 RD-03 (Kneebone et al. 2024), summarized above, the DMWG recommended using MD results obtained from the large sample size study of Kneebone et al. (2024) in the assessment as estimates of recreational PRLDM.

The SEDAR DMWG also noted that effective January 1, 2018, NOAA Fisheries implemented Amendment 5b to the 2006 Consolidated HMS Fishery Management Plan¹. Curtis et al. (2025) provide a description of Atlantic HMS management actions for Sandbar Sharks. The DMWG noted that, among other things, Amendment 5b required the mandatory use of non-offset, non-stainless steel circle hooks in the recreational fishery. The DMWG discussed that the mandatory use of circle hooks in the recreational fishery in 2018 may have also resulted in reduced post release mortality in the recreational fishery (the DMWG cited e.g., Willey et al. 2016 and Reinhardt et al. 2018). Consequently, the DMWG recommended using a value of 2.8%, calculated as 1/2 of the upper recreational PRLDM 95% C.I. (5.6%) obtained in Kneebone et al. (2024), as the base value in the assessment for recreational PRLDM and recommended using the upper 95% C.I. value (5.6%) as an alternative value for recreational PRLDM in Management Strategy Evaluation (MSE). The PRLDM values were recommended for both recreational shore based and boat based recreational hook and line.

¹ Available: <https://www.fisheries.noaa.gov/action/amendment-5b-2006-consolidated-hms-fishery-management-plan-atlantic-shark-management> (Accessed July 2026) “**Recreational Circle Hook Requirement:** In addition to being required to have a shark endorsement, as of January 1, 2018, anglers fishing recreationally for sharks on a vessel with the permits listed above must use non-offset, non-stainless steel circle hooks when fishing south of 41° 43' N latitude (near Chatham, Massachusetts, which is the northern extent of the dusky shark’s U.S. Atlantic range), except when fishing with flies or artificial lures....**Bottom Longline Circle Hook Requirement:** As of January 1, 2018, fishermen that have a directed shark limited access permit and who have bottom longline gear on board their vessels, are required to use non-stainless steel circle hooks when fishing for sharks”.

Research Studies Discussed for Bottom Longline PRLDM

SEDAR 101 RD-16 (Whitney et al. 2021)

The SEDAR 101 DMWG discussed SEDAR 101 RD-16 (Whitney et al. 2021). The DMWG noted that Whitney et al. (2021) identified a commercial bottom longline MD ($\pm 95\%$ C.I.) of 3.1% ($\pm 2.5\%$) from post-release mortalities ($n = 4$) out of 130 Sandbar Sharks equipped with ADL data loggers. Sandbar Sharks were captured with 18/0 circle hooks using experimental bottom longline gear deployed from a contracted commercial fishing vessel. Hook time ranged from 3 – 891 min (mean: 208 min). Fishing was conducted near Madeira Beach, FL ($n = 54$ longline sets), Key West, FL ($n = 10$ longline sets) and Naples, FL ($n = 6$ longline sets).

Based on the discussion of SEDAR 101 RD-16 (Whitney et al. 2021), summarized above, the DMWG recommended using MD results obtained from the large sample size study of Whitney et al. (2021) in the assessment as estimates of bottom longline PRLDM. The DMWG noted that the January 1, 2018, circle hook mandate, discussed above, required the use of non-stainless steel circle hooks in commercial bottom longline gear beginning in 2018. The DMWG discussed that the mandatory use of circle hooks in the bottom longline fishery in 2018 may also have resulted in reduced post release mortality in the bottom longline fishery. Consequently, the DMWG recommended using results from Whitney et al. (2021) only for years 2018 – 2024. The DMWG recommended using a value of 3.1% obtained from Whitney et al. (2021) in the assessment as the base PRLDM value for bottom longline PRLDM for the years 2018 – 2024 and using the $\pm 95\%$ C.I. of 3.1% ($\pm 2.5\%$) obtained from Whitney et al. (2021) as alternative PRLDM values for bottom longline PRLDM in MSE for the years 2018 – 2024.

The DMWG also noted that the corresponding PRLDM (3.1%) and AVM (0.5%) reported for Sandbar Shark obtained from Whitney et al. (2021) resulted in the following relationship for Sandbar Sharks captured in bottom longline gear: $\text{PRLDM} - \text{AVM} = 2.6\%$ (as summarized above in equation 3).

SEDAR 101 RD-25 (Gulak and Carlson 2021)

The SEDAR 101 DMWG discussed SEDAR 101 RD-25 (Gulak and Carlson 2021). The DMWG noted that time on the line (TOL) appeared to be the most important parameter in candidate models of commercial bottom longline at-vessel mortality rate of Sandbar Shark based on Akaike importance weights (Gulak and Carlson 2021, their Table 5). The DMWG also noted that commercial bottom longline at-vessel mortality rates of Sandbar Shark for circle hooks (4.8%) and J-hooks (11.4%) while different, did not differ significantly based on chi-square two-sample test (Gulak and Carlson 2021, their Table 3, $P\text{-value} = 0.15$). However, the DMWG also noted the effect of hook type on post-release live-discard mortality was not evaluated in Gulak and Carlson (2021) and, consequently, the effects may differ for post-release live-discard mortality rates.

The DMWG also noted that NOAA Fisheries Amendment 2 to the 2006 Consolidated HMS Fishery Management Plan² was published July 2008. Curtis et al. (2025) provide a description of Atlantic HMS management actions for Sandbar Sharks. The DMWG discussed that, among other things, Amendment 2 may have resulted in decreased soak time for shark directed bottom longline sets after 2008. Consequently, the DMWG noted that decreased soak time for shark directed bottom longline sets after 2008 may also have resulted in different values for Sandbar Shark post release mortality before and after 2008.

SEDAR 101 RD-26 (Gulak et al. 2015)

The SEDAR 101 DMWG discussed SEDAR 101 RD-26 (Gulak et al. 2015). The DMWG noted that Gulak et al. (2015, their Figure 1 and Table 2) identified a Sandbar Shark commercial bottom longline at-vessel mortality rate of 16.9% from 835 Sandbar Sharks. Sandbar Sharks were captured on bottom-longline gear equipped with hook timers between June 2010 and December 2013 on contracted commercial fishing vessels participating in the U.S. Highly Migratory Species Shark Research Fishery off the coast of the south-eastern United States. Sandbar Sharks were captured during 273 longline sets with soak times ranging from 1.5 to 22.6 hr (mean: 9.4 hr). Hook type included circle hook (sizes 16/0, 18/0 and 20/0) and J hook (size 12/0).

Based on the discussions of SEDAR 101 RD-26 (Gulak et al. 2015), summarized above, the DMWG recommended an AVM of 16.9% obtained for Sandbar Sharks captured in bottom longline gear between June 2010 and December 2013 as the stock assessment base value for years 2008 – 2017. The DMWG recommended using the relationship $PRLDM = AVM + 2.6\%$ (as summarized above in equation 3) to estimate commercial bottom longline PRLDM from AVM. Consequently, the DMWG recommended a PRLDM value of $16.9\% + 2.6\% = 19.5\%$ as the stock assessment base value for years 2008 – 2017. The DMWG also recommended using the $PRLDM \pm 95\% \text{ C.I. } (\pm 2.5\%)$ obtained from Whitney et al. (2021) to estimate uncertainty in commercial bottom longline PRLDM for years 2008 – 2017. Consequently, the DMWG recommended a commercial bottom longline PRLDM ($\pm 95\% \text{ C.I.}$) of $19.5\% (\pm 2.5\%)$ as alternative values for use in the MSE for years 2008 – 2017.

SEDAR 101 RD-27 (Morgan and Burgess 2007)

The SEDAR 101 DMWG discussed SEDAR 101 RD-27 (Morgan and Burgess 2007). The DMWG noted that Morgan and Burgess (2007, their Table 1) identified a commercial bottom longline at-vessel mortality rate of 36.1% from 8,583 Sandbar Sharks. Morgan and Burgess (2007) note that Sandbar Sharks were recorded by the Commercial Shark Fishery Observer Program on U.S. bottom longline vessels engaged in directed fishing for sharks between 1994 – 2005 off the coast of the United States from New Jersey to Louisiana. Gear typically was set at sunset and hauled back the following morning near dawn. Hooks ranged in size from 3/0 to 20/0 and primarily consisted of circle hooks, with some J hooks. Sandbar Sharks ranged in size from

² Available: <https://www.fisheries.noaa.gov/action/amendment-2-2006-consolidated-hms-fishery-management-plan-atlantic-shark-management-measures> (Accessed July 2026).

54 – 214 cm FL. Soak time and age group were significant predictors of commercial bottom longline at-vessel mortality rate for Sandbar Sharks in multiple stepwise linear regressions (Morgan and Burgess 2007, their Table 2).

Based on the discussion of SEDAR 101 RD-27 (Morgan and Burgess 2007), summarized above, the DMWG recommended an AVM of 36.1% obtained for Sandbar Sharks captured in bottom longline gear between 1994 – 2005 as the stock assessment base value for years < 2008. The DMWG recommended using the relationship $PRLDM = AVM + 2.6\%$ (as summarized above in equation 3) to estimate commercial bottom longline PRLDM from AVM. Consequently, the DMWG recommended a PRLDM value of $36.1\% + 2.6\% = 38.7\%$ as the stock assessment base value for years < 2008. The DMWG also recommended using the $PRLDM \pm 95\% \text{ C.I. } (\pm 2.5\%)$ obtained from Whitney et al. (2021) to estimate uncertainty in commercial bottom longline PRLDM for years 2008 – 2017. Consequently, the DMWG recommended a commercial bottom longline PRLDM ($\pm 95\% \text{ C.I.}$) of $38.7\% (\pm 2.5\%)$ as alternative values for use in the MSE for years < 2008.

SEDAR 101 RD-32 (Morgan et al. 2009)

The SEDAR 101 DMWG discussed SEDAR 101 RD-32 (Morgan et al. 2009). The DMWG noted that Morgan et al. (2009) identified a commercial bottom longline at-vessel mortality rate of 33.4% for Sandbar Sharks captured in the U.S. shark bottom longline fishery during the years 1994 – 2003. Sandbar Shark at-vessel mortality increased with longer soak times (Morgan et al. 2009, their Table 9).

The DMWG did not recommend using AVM results obtained from Morgan et al. (2009) directly in the assessment because AVM data obtained from Morgan et al. (2009) for the years 1994 – 2003 were already included in the analyses conducted by Morgan and Burgess (2007) for the years 1994 – 2005, summarized above.

SEDAR 101 RD-17 (Morgan and Carlson 2010)

The SEDAR 101 DMWG discussed SEDAR 101 RD-17 (Morgan and Carlson 2010). The DMWG noted that Morgan and Carlson (2010) identified a commercial bottom longline at-vessel mortality rate of 21% for Sandbar Sharks captured in experimental U.S. shark bottom longline fishery sets ($n = 55$) during the years 2005 – 2007 off the eastern and western coasts of Florida. Contracted vessels from the U.S. commercial large coastal shark bottom longline fleet set 8.0 – 9.7 km of bottom longline gear using 18/0 circle hooks (with offset). Soak times ranged from 6 to 10 hr for over-night sets and 4 – 6 hr for day sets. Hook timers were attached to each hook. Time depth recorders were attached at the beginning, middle, and end of the mainline to record temperature at depth at 1-min intervals. Hook time and shark size were significant predictors in Logistic Regression commercial bottom longline AVM (yes/no) for Sandbar Sharks ($n = 455$).

The DMWG did not recommend using AVM results obtained from Morgan and Carlson (2010) directly in the assessment because of relatively lower annual sample sizes obtained in Morgan and Carlson (2010) when compared with those obtained in Morgan and Burgess (2007).

SEDAR 101 RD-19 (Marshall et al. 2015)

The SEDAR 101 DMWG discussed SEDAR 101 RD-19 (Marshall et al. 2015). The DMWG noted that Marshall et al. (2015) identified a demersal longline post-release live-discard mortality rate of 20% ($n = 2$) from 10 Sandbar Sharks captured on bottom-longline gear and fitted with pop-up satellite archival transmitting tags (PSATs) for 30-day deployments. Sandbar sharks exhibited 100% post-release survival if captured up to 3 hr on the longline, and 2 post-release live-discard mortalities at ~7–8 hr on the longline. Marshall et al. (2015) conducted research demersal longline fishing operations off the coast of Virginia's Eastern Shore during June and July of 2011 and 2012 and noted that handling closely followed commercial fisheries: Sharks hauled onto gunnel for hook removal without irrigating the gills.

The DMWG did not recommend using PRLDM results from Marshall et al. (2015) directly in the assessment because of relatively low sample size (10 Sandbar Sharks fitted with PSATs) in comparison to that available annually for AVM for Sandbar Sharks captured in bottom longline gear (Gulak et al. 2015), as discussed above. However, the DMWG noted that the PRLDM value (20%) obtained from Marshall et al. (2015) for Sandbar Sharks captured on bottom-longline gear and fitted with PSATs is comparable to that recommended above by the DMWG (19.5%) as the stock assessment base value for years 2008 – 2017 obtained using AVM for Sandbar Sharks captured in bottom longline gear (Gulak et al. 2015) as discussed above.

SEDAR 101 RD-20 (Barnes et al. 2016)

The SEDAR 101 DMWG discussed SEDAR 101 RD-20 (Barnes et al. 2016). The DMWG noted that Barnes et al. (2016) identified a demersal longline post-release live-discard mortality rate of 25% ($n = 2$) from 8 Sandbar Sharks captured on bottom-longline gear and fitted with pop-up satellite archival transmitting tags (PSATs) tracked for up to 60 days. Time on hook for the PSAT tagged Sandbar Sharks longline-hooked and released (alive and in good condition) ranged from 3:30 - 14:54 (hr:min). Targeted demersal longlining for Sandbar Sharks and Dusky Sharks (*Carcharhinus obscurus*) was conducted off the coast of NSW, Australia over 9 d between March and July 2013 from chartered commercial fishing vessels using a longline configuration that is commonly used in this fishery to target sharks. The authors noted that post-release mortality did not appear to be correlated with time on the hook for this study.

The DMWG did not recommend using PRLDM results from Barnes et al. (2016) directly in the assessment because of relatively low sample size (8 Sandbar Sharks fitted with PSATs) in comparison to that available for AVM for Sandbar Sharks captured in bottom longline gear (Gulak et al. 2015), as discussed above. However, the DMWG noted that the PRLDM value (25%) obtained from Barnes et al. (2016) for Sandbar Sharks captured on bottom-longline gear and fitted with PSATs is comparable to that recommended above by the DMWG (19.5%) as the

stock assessment base value for years 2008 – 2017 obtained using AVM for Sandbar Sharks captured in bottom longline gear (Gulak et al. 2015).

SEDAR 101 RD-05 (Grosse et al. 2023)

The SEDAR 101 DMWG discussed SEDAR 101 RD-05 (Grosse et al. 2023). The DMWG noted that Grosse et al. (2023) identified a demersal longline post-release live-discard mortality rate of 0% ($n = 0$) from 13 Sandbar Sharks captured on bottom-longline gear after a maximum of 4 hr on the hook and fitted with pop-up satellite archival transmitting tags (PSATs) for 30-day deployment. However, Grosse et al. (2023) noted that five tags released prematurely and floated on the surface, most likely, because of improper anchorage into the tissue or tag malfunction. Grosse et al. (2023) tagged Sandbar Sharks on scientific demersal longline surveys conducted in 2020 and 2021 at 10 fixed stations along the continental shelf of northern WA, Australia. Thirty-nine longline sets were conducted over 10 sites with soak times ranging from 3 to 4 hr. In total, 240 sandbar sharks (mean FL $\pm$ s.e. 136.7 ± 0.3 cm) were captured. Estimated time on the hook (TOH) ranged from 46 to 250 min ($n = 28$) with mean TOH ($\pm$ s.e.) of 105 min (± 23).

The DMWG did not recommend using PRLDM results obtained from Grosse et al. (2023) directly in the assessment because results were obtained from a scientific survey conducted in Australia and, as a result, the PRLDM rates may not be consistent with those of the U.S. bottom longline commercial fishery.

Research Studies Discussed for Trawl and Gillnet PRLDM

SEDAR 101 DW-20 (Hansell et al. 2026)

The SEDAR 101 DMWG discussed SEDAR 101 DW-20 (Hansell et al. 2026). The DMWG discussed obtaining AVM rates for Sandbar Sharks discarded from the northeast trawl and gillnet fisheries directly from Hansell et al. (2026, their Tables 1 and 2, respectively) as described below.

The DMWG recommended calculating the AVM of Sandbar Shark discards from the northeast trawl and gillnet fisheries as follows. The DMWG obtained discarded catch disposition (dead, alive, unknown) from the northeast trawl fishery for the years 1995 – 2025 (Hansell et al. 2026, their Table 1) and pooled by disposition for the years 1996 – 2024 (Tobey Curtis, Pers. Comm., **Table 2**): Alive, $n = 1059$ (56.7%); Dead, $n = 389$ (20.8%), and Unknown, $n = 419$ (22.4%). AVM of Sandbar Shark trawl discards was then calculated three different ways: (1) Assuming all unknowns were dead, (2) assuming all unknowns were alive, and (3) assuming the proportional split of known statuses applied to the unknowns (**Table 2**). The DMWG recommended calculating the AVM of Sandbar Shark discards using method three, and, consequently, using method three the resulting AVM value for trawl was calculated by the DMWG as 26.9% (**Table 2**).

Similarly, discarded catch disposition (dead, alive, unknown) from the northeast gillnet fishery was obtained for the years 1995 – 2025 (Hansell et al. 2026, their Table 2) and pooled by disposition for the years 1995 – 2024 (Tobey Curtis, Pers. Comm., **Table 2**): Alive, $n = 1694$ (63.9%); Dead, $n = 855$ (32.3%), and Unknown, $n = 102$ (3.8%). The DMWG recommended calculating the AVM of Sandbar Shark discards using method three, and, consequently, using method three the resulting AVM value for gillnet was calculated by the DMWG as 33.5% (**Table 2**).

The DMWG discussed using the relationship $PRLDM = AVM + 2.6\%$ (as summarized above in equation 3) for trawl and gillnet gear. However, the DMWG also noted that Whitney et al. (2021) obtained the relationship $PRLDM = AVM + 2.6\%$ from commercial bottom longline which may result in less post-capture trauma than commercial trawl or gillnet. Consequently, the DMWG recommended using the upper 95% C.I. (2.5%) of PRLDM from Whitney et al. (2021) to obtain the relationship $PRLDM = AVM + 2.6\% + 2.5\%$ for trawl and gillnet gear. Using this relationship, the DMWG recommended a PRLDM of $26.9\% + 2.6\% + 2.5\% = 32.0\%$ for commercial trawl and a PRLDM of $33.5\% + 2.6\% + 2.5\% = 38.6\%$ for commercial gillnet.

SEDAR 101 RD-31 (Dapp et al. 2016)

The SEDAR 101 DMWG discussed SEDAR 101 RD-31 (Dapp et al. 2016). The DMWG noted that Dapp et al. (2016) identified separate gillnet and trawl PRLDM rates of 35.9% and 44.8% (average of 22.1%, 54.4% and 58.0%), respectively, from meta-analysis of 40 obligate ram-ventilating shark species (adapted from Dapp et al. 2016, their Table 2).

However, the DMWG did not recommend using PRLDM results from Dapp et al. (2016) directly in the assessment because AVM rates for Sandbar Shark gillnet and trawl catches were obtained from the NEFSC Observed Program data provided in Hansell et al. (2026), as described above.

SEDAR 101 RD-18 (Fennessy 1994) and SEDAR 101 RD-28 (Ellis et al. 2017)

The SEDAR 101 DMWG discussed SEDAR 101 RD-18 (Fennessy 1994) and SEDAR 101 RD-28 (Ellis et al. 2017). The DMWG noted that Fennessy (1994; also e.g., see Ellis et al. 2017, their Table 2) identified an AVM rate of 33.3% for Sandbar Sharks ($n = 6$) captured in trawl gear during 169 commercial prawn trawl sets.

However, the DMWG did not recommend using PRLDM results from Fennessy (1994) directly in the assessment because AVM rates for Sandbar Shark gillnet and trawl catches were obtained from the NEFSC Observed Program data provided in Hansell et al. (2026), as described above.

SEDAR 101 RD-29 (Hueter and Manire 1994) and SEDAR 101 RD-30 (Braccini et al. 2012)

The SEDAR 101 DMWG discussed SEDAR 101 RD-29 (Hueter and Manire 1994) and SEDAR 101 RD-30 (Braccini et al. 2012). The DMWG noted that Hueter and Manire (1994) identified a

PRLDM of 34.8% for juvenile and small adult coastal sharks during a gillnet survey in Florida. The DMWG also noted that Braccini et al. 2012 predicted the average risk of delayed post-capture survival (PCS) in a southern Australia commercial gillnet shark fishery for multiple species based on an assessment of at-vessel condition.

However, the DMWG did not recommend using PRLDM results from either Hueter and Manire (1994) or Braccini et al. (2012) directly in the assessment because the values obtained from Hueter and Manire (1994) and Braccini et al. (2012) were not species specific. In contrast, the DMWG noted that species specific AVM rates for Sandbar Shark gillnet and trawl catches were obtained from the NEFSC Observed Program data provided in Hansell et al. (2026), as described above.

5.4 DISCARD MORTALITY RECOMMENDATIONS FOR SEDAR 101

Recommended Sandbar Shark PRLDM

Recreational PRLDM

Based on the review and discussions of SEDAR 101 RD-03 (Kneebone et al. 2024), summarized above, the DMWG recommended a Sandbar Shark recreational PRLDM of 2.8% as the base value for the assessment (**Table 1**) and a Sandbar Shark recreational PRLDM of 5.6% as an alternative value for use in MSE (**Table 1**).

Bottom Longline PRLDM (2018 – 2024)

Based on the discussions of SEDAR 101 RD-16 (Whitney et al. 2021), summarized above, the DMWG recommended a Sandbar Shark bottom longline PRLDM of 3.1% as the stock assessment base value for years 2018 – 2024 (**Table 1**), and a Sandbar Shark bottom longline PRLDM of 3.1% ($\pm 2.5\%$) as alternative values for use in the MSE for years 2018 – 2024 (**Table 1**).

Bottom Longline PRLDM (2008 – 2017)

Based on the discussions of SEDAR 101 RD-26 (Gulak et al. 2015), summarized above, the DMWG recommended a Sandbar Shark bottom longline PRLDM of 19.5% as the stock assessment base value for years 2008 – 2017 (**Table 1**), and a Sandbar Shark bottom longline PRLDM of 19.5% ($\pm 2.5\%$) as alternative values for use in the MSE for years 2008 – 2017 (**Table 1**).

Bottom Longline PRLDM (< 2008)

Based on the discussions of SEDAR 101 RD-27 (Morgan and Burgess 2007), summarized above, the DMWG recommended a Sandbar Shark bottom longline PRLDM of 38.7% as the stock assessment base value for years < 2008 (**Table 1**), and a Sandbar Shark bottom longline PRLDM of 38.7 ($\pm 2.5\%$) as alternative values for use in the MSE for years < 2008 (**Table 1**).

Trawl PRLDM

Based on the discussion of SEDAR 101 DW-20 (Hansell et al. 2026), summarized above, the DMWG recommended a Sandbar Shark trawl PRLDM of 32.0% as the stock assessment base value (**Table 1**).

Gillnet PRLDM

Based on the discussion of SEDAR 101 DW-20 (Hansell et al. 2026), summarized above, the DMWG recommended a Sandbar Shark gillnet PRLDM of 38.6% as the stock assessment base value (**Table 1**)

5.5 RESEARCH RECOMMENDATIONS

Whitney et al. (2021) estimated AVM as 0.5% and PRLDM as 3.1% with a CV of 2.5% for longline gear in recent years. It's recommended to investigate PRLDM and associated CV beyond the constant additive levels recommended here (AVM + 2.6% with CV 2.5% across all gears and years) that may better capture the relative increase in PRLDM and error associated with higher AVM rates.

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5.7 TABLES

Table 1. Sandbar Shark post-release live-discard mortality (PRLDM) rate recommendations for SEDAR 101 by gear (recreational, bottom longline, trawl, and gillnet) and time block (year range if available).

Gear type (Years)	Base	MSE
Recreational	2.8%	5.6%
Bottom longline		
(2018 – 2024)	3.1%	3.1% ($\pm 2.5\%$)
(2008 – 2017)	19.5%	19.5% ($\pm 2.5\%$)
(< 2008)	38.7%	38.7 ($\pm 2.5\%$)
Trawl	32.0%	
Gillnet	38.6%	

Table 2. At-vessel mortality (AVM) rates for Sandbar Sharks discarded from the northeast trawl (**panel A**) and gillnet (**panel B**) fisheries (Tobey Curtis, Pers. Comm.) calculated as described in the main text above.

A. TRAWL			
	NUM	%	No Unk
Catch	1867		
No Unk	1448	77.6%	
Alive	1059	56.7%	73.1%
Dead	389	20.8%	26.9%
Unk	419	22.4%	
AVM (Unk=Dead)	43.3%		
AVM (Unk=Alive)	20.8%		
AVM (Obs Split)	26.9%		

B. GILLNET			
	NUM	%	No Unk
Catch	2651		
No Unk	2549	96.2%	
Alive	1694	63.9%	66.5%
Dead	855	32.3%	33.5%
Unk	102	3.8%	
AVM (Unk=Dead)	36.1%		
AVM (Unk=Alive)	32.3%		
AVM (Obs Split)	33.5%		