Regional Information Report No. 1J26-13

2026 Northern Southeast Inside Subdistrict Sablefish Management Plan and Stock Assessment

by

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and

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July 2026

Alaska Department of Fish and Game Division of Commercial Fisheries

Symbols and Abbreviations

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat or long
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	′
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	″
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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July 2026

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This document should be cited as follows:
Lambert, A. W., and R. K. Ehresmann. 2026. 2026 Northern Southeast Inside Subdistrict sablefish management plan and stock assessment. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 1J26-13, Douglas.

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ABSTRACT

This report provides an overview of the stock assessment, harvest strategy, and regulations effective for the 2026 Northern Southeast Inside (NSEI) sablefish *Anoplopoma fimbria* commercial fishery. The NSEI sablefish commercial fishery is scheduled to open August 15 and close November 15 and is open to both longline and pot gear. The 2026 NSEI sablefish commercial fishery annual harvest objective is 2,142,882 round lb and is based on decrements from an acceptable biological catch of 2,392,501 round lb. The annual harvest objective is allocated to 73 limited entry Commercial Fisheries Entry Commission C61A permits through an equal quota share system, resulting in a 2026 equal quota share of 29,355 round lb for each permit holder.

Keywords: sablefish, black cod, *Anoplopoma fimbria*, stock assessment, annual harvest objective, AHO, catch per unit effort, CPUE, Northern Southeast, Chatham Strait, NSEI, mark–recapture, tagging

INTRODUCTION

The Alaska Department of Fish and Game (ADF&G) evaluates sablefish *Anoplopoma fimbria* stock status and establishes the Northern Southeast Inside (NSEI) acceptable biological catch (ABC) and subsequent annual harvest objective (AHO). The NSEI Subdistrict management area (Figure 1) consists of all waters as defined in 5 AAC 28.105(a)(2).

The recommended 2026 ABC for sablefish is 2,392,501 round lb ($F_{ABC} = 0.054$), a 15% increase from the 2025 ABC (Table 1). After making decrements for sablefish mortalities in other fisheries, the 2026 NSEI Subdistrict commercial sablefish fishery AHO is 2,142,882 round lb (Table 3). There are 73 valid Commercial Fisheries Entry Commission (CFEC) permits for 2026, which is the same number as 2025. The individual equal quota share (EQS) is 29,355 round lb, a 20% increase from the 2025 EQS of 24,516 round lb (Table 2).

The 2026 assessment was conducted using a modified version (v23a) of model v23 (used in the 2022–2025 assessments). During initial model exploration, it was discovered that retention and discard mortality functions were applied twice when calculating retained catch and discards, and this was corrected in model v23a (see *2026 Sablefish Stock Assessment* and *2026 Recommended ABC* section for details). Given these changes to the model, the values in this assessment are not directly comparable to abundance estimates, F_{50}, and ABC values from previous assessments (2021–2025). Historical F estimates, recruitment, and biomass trends show similar patterns but differ in absolute scale (Appendix A1 and A2). Model v23a indicates that the 2026 estimated total abundance is lower than model v23 (12%), but that the stock can sustain a higher level of harvest, resulting in a larger maximum ABC (32% increase).

The increase in the 2026 ABC compared to the 2025 ABC is primarily attributed to model changes. Changes to the spawner-per-recruit calculations to include age-specific retention and discard mortality resulted in F_{50} increasing from 0.06 to 0.07. This increase reflects the protective effect of a size-selective fishery, where young fish are released with a high survival rate (84%; Stachura et al. 2012; Gilroy and Stewart 2013). Model v23a indicates that the NSEI stock can sustain a moderately higher fishing rate while maintaining the 50% spawning biomass target.

Additionally, the continued growth and maturation of strong year classes from 2015–2019, as well as an increase in the model estimated recruitment in 2022 and 2023 (2020- and 2021-year class) contribute to the increased maximum ABC. The data indicate that the large recruitments between 2015 and 2019 were underestimated in assessments prior to 2024, and recruitments in 2022 and 2023 were underestimated in the 2024 assessment. More informed estimation of those recruitment events has led to increased estimated spawning biomass in the 2024, 2025, and 2026 assessments.

This variance is common in age-structured assessments, as it takes multiple years of cohort observations to bring into focus the true size of a recruitment event.

Recent indicators suggest improving trends for NSEI sablefish, though the stock has not reached historical levels. The 2025 fishery catch-per-unit-effort (CPUE) estimates were larger than in 2024, while 2025 longline survey CPUE estimates increased from 2023 and 2024 levels; both fishery and survey CPUE estimates remain above their respective long-term averages. There was no mark–recapture experiment in 2023, 2024, or 2025 due to budget shortfalls. Catches increased in 2025 as the 2013 through 2019 year classes reached marketable size and ex-vessel value increased 26.6% from 2024 (Figure 2). Fishery catch and ex-vessel values remain depressed in comparison to historical values (Table 2, Figure 2) and estimates suggest sablefish spawning stock biomass remains at lower levels compared to the 1980s and 1990s. Though recent high catch rates of small sablefish across multiple geographic areas signal increasing trends for sablefish stocks (Goethel et al. 2022), the department maintains a precautionary approach to setting harvest limits.

The ABC determination process uses a statistical catch-at-age (SCAA) model, which was first implemented in 2020 (Sullivan et al. 2020). The model reduces the reliance on the annual mark–recapture project to estimate recruitment, abundance, and spawning stock biomass of NSEI sablefish by integrating multiple indices of abundance and biological data. Data sources used in the model include catch, mark–recapture abundance estimates, longline survey and fishery CPUE, and longline survey and fishery length and age compositions. As in previous years, the ABC is defined by F_{50}, the fishing mortality rate that reduces spawning biomass to 50% of equilibrium unfished levels.

The process ADF&G uses to determine the ABC, AHO, and EQS includes compiling fishery and survey data, running the stock assessment, and applying decrements to account for additional sources of mortality. Although the ABC is determined prior to the AHO and EQS, this report is organized to make management-related information accessible to stakeholders and improve documentation of the assessment process by organizing this report into two sections:

1. *2026 Sablefish Management Plan*: details the decrements process leading to the AHO and EQS and effective regulations for the 2026 NSEI fishery.
2. *2026 Sablefish Stock Assessment* and *2026 ABC Determination*: highlights stock assessment data inputs, methods, results, and subsequent analyses using data from the 2025 fishery that informed the recommended ABC for the 2026 fishing season.

2026 SABLEFISH MANAGEMENT PLAN

ANNUAL HARVEST OBJECTIVE DETERMINATION

The 2026 sablefish AHO was determined by making the following decrements from the recommended ABC (2,392,501 round lb; Table 3):

- estimated sablefish bycatch mortality in the commercial Pacific halibut *Hippoglossus stenolepis* fishery
- ADF&G longline and pot survey removals
- sport fishery guided and unguided harvest
- mortality from fishery deadloss
- subsistence and personal use harvest

Bycatch mortality in the halibut fishery

Sablefish caught in NSEI during the Pacific halibut individual fishing quota (IFQ) fishery prior to the sablefish fishery opening (August 15) must be released; however, because not all are expected to survive, bycatch mortality is estimated. Prior to 2003, a 50% bycatch mortality rate was applied as bycatch sablefish were permitted to be retained as bait. In 2003, the Alaska Board of Fisheries disallowed retaining bycatch sablefish for bait, and a 25% bycatch mortality rate was assumed for all sablefish caught and released due to the larger hook size in the Pacific halibut fishery. Released sablefish bycatch is calculated as the product of the 3-year average of the sablefish to Pacific halibut ratio from the International Pacific Halibut Commission (IPHC) annual survey and the 3-year average of the Pacific halibut catch in NSEI areas deeper than 99 fathoms.

ADF&G sablefish survey removals

Permit holders will not participate in the NSEI pot survey in 2026 due to low sablefish prices and the need to stabilize survey revenue as the project is experiencing ongoing budgetary deficits (Table 2, Figure 2). The survey removal decrement was determined by calculating the average survey total harvest from the previous 3 years for 3 survey vessels.

Sport fish harvest (guided and unguided)

Sablefish sport fish preliminary harvest and release mortality from the guided and unguided sectors are estimated using charter logbooks and the statewide harvest survey (Romberg et al. 2017). Estimates of harvested and released fish are based on the total number of fish and converted to weight using a 3-year average weight of fish sampled from the guided and unguided sectors. A 10% release mortality rate is applied to the sport fishery; this rate was based on the 11.7% estimated in Stachura et al. (2012) and modified to account for difference in gear type (rod and reel versus longline) and handling time.

Mortality from fishery deadloss

Deadloss mortality in the directed sablefish fishery was estimated by applying the recent 3-year (2023–2025) average percentage of dead sablefish caught on the NSEI longline survey (0.36%) to the NSEI sablefish commercial AHO. Dead sablefish in this instance are considered anything recorded as predated by sand fleas or sharks, dead from hooking injury, or succumbed to other cause of mortality.

Personal use and subsistence harvest

A total of 870 personal use and subsistence sablefish permits were issued in 2025. Annual subsistence and personal use harvest of sablefish is estimated from these permits by adding the total number of retained sablefish reported to the proportion of released sablefish reported after applying a 16% discard mortality rate to released sablefish (Gilroy and Stewart 2013). The discard mortality rate comes from the discard mortality rate used in the Pacific halibut fishery, which is assumed to be a reasonable proxy for sablefish because the fisheries utilize similar gear and frequently the same vessels and crew participate in both fisheries. Also, both species are considered resilient and do not experience barotrauma. The 2025 longline survey average weight (5.9 lb) was applied to the harvest and release numbers to obtain a decrement total.

Since 2015, personal use harvest has been limited to 50 fish per household annually. Beginning in 2018, participants of the personal use fishery may use pot gear with no more than 2 pots per permit and a maximum of 8 pots per vessel when 4 or more permit holders are on board the same vessel. Pots may be longlined in this fishery.

REGULATIONS

Registration and logbook requirements

Commercial fishers must register prior to fishing [5 AAC 28.106 (b)] and keep a logbook during the fishery. Completed logbook pages must be attached to the ADF&G copy of the fish ticket at the time of delivery. Confidential envelopes for logbook pages may be requested when registering.

Permit holders will receive a personal quota share (PQS) tracking form at the time of registration. This form is used to record the total round weight landed for each delivery. Each permit holder must, upon request, provide the buyer with the total round weight of sablefish the permit holder has landed to date. ADF&G requests that a copy of the completed PQS tracking form is included with the final fish ticket of the season for that permit.

Logbooks must include the trip's target species, port of landing, the date the vessel left port and the date the vessel landed, crew size, bait used, and gear specifications. For each set, the logbook must include: the set's target species; the date and time gear is set and retrieved; the specific location of harvest by latitude and longitude for start and ending positions; the hook spacing; the amount of gear (number of hooks, skates, or pots) used; the amount of gear lost or impacted by depredation; the depth of set; the estimated number or weight of the target species; the estimated number or weight of bycatch by species retained and released at sea; and the tag number of any tagged fish captured [5 AAC 28.175 (b)(1)]. A permit holder must retain all visibly injured or dead sablefish. Sablefish that are not visibly injured or dead may be released unharmed, and the permit holder must record in the logbook, by set, the number of live sablefish released [5 AAC 28.170 (f)]. Permit holders must record release reasons (e.g., fish are small) and whether their personal quota share has been met.

Tagged sablefish

Fishers are requested to watch for tagged sablefish, record tag number(s), and attach tags directly in the logbook with the corresponding set information. All tags returned will receive a reward and entry into an annual drawing for one $1,000, two $500, and four $250 cash rewards. To qualify for entry in the annual drawing, ADF&G requires the following information: the physical tag, set location (latitude and longitude), date of capture of the fish, and the name and address of the person recovering the tag.

Sablefish possession and landing requirements

In the NSEI Subdistrict, the holder of a CFEC permit for sablefish may not retain more sablefish from the directed fishery than the annual allocation of sablefish EQS specified by ADF&G [5 AAC 28.170 (f)]. However, if a permit holder's harvest exceeds the EQS for that year by no more than 5%, ADF&G shall reduce the permit holder's EQS for the following year by the amount of overage. If a permit holder's harvest exceeds the permit holder's EQS by more than 5%, the proceeds from the sale of the overage in excess of 5% shall be surrendered to the state and the permit holder may be prosecuted under AS 16.05.723 [5 AAC 28.170 (j)]. If a permit holder's harvest is less than the permit holder's EQS established for the year, ADF&G shall increase the permit holder's PQS only for the following year by the amount of the underage that does not exceed 5% of the EQS [5 AAC 28.170 (k)]. For the 2026 fishing season, 5% of the annual EQS is 1,468 round lb.

Fish ticket requirements

Landed weights must be recorded on a fish ticket at the time of delivery. If a fisher delivers fish in the round, the total round weight delivered must be recorded on the fish ticket. If a fisher delivers dressed fish, the fish ticket must include the total landed dressed weight as well as the round weight equivalent, determined by using the standard 0.63 recovery rate. There is a 2% allowance for ice and slime when unrinsed whole iced sablefish are weighed. A fish ticket must be completed prior to the resumption of fishing, and each permit holder must retain, on board their vessel, copies of all NSEI sablefish tickets from the current season and their updated PQS tracking form. When delivering fish out of state, a completed fish ticket must be submitted to ADF&G prior to transporting fish out of Alaska. Fish tickets must be submitted to ADF&G within 7 days of landing.

Bycatch allowances for other species

Full retention and reporting of rockfish *Sebastes* spp., including thornyhead rockfish *Sebastolobus* spp., is required [5 AAC 28.171 (a)]. The allowable bycatch that may be legally landed and sold on an NSEI sablefish permit is based on round weight of sablefish and bycatch species or species group on board the vessel:

- All rockfish, including thornyhead: 15% in aggregate, of which 1% may be demersal shelf rockfish (DSR), which includes yelloweye *Sebastes ruberrimus*, quillback *Sebastes maliger*, canary *Sebastes pinniger*, tiger *Sebastes nigrocinctus*, copper *Sebastes caurinus*, China *Sebastes nebulosus*, and rosethorn rockfish *Sebastes helvomaculatus*
- Lingcod *Ophiodon elongatus*: 0%
- Pacific cod *Gadus macrocephalus*: 20%
- Spiny dogfish *Squalus suckleyi*: 35% longline/hook and line gear; 20% pot gear
- Other groundfish: 20%

All rockfish retained in excess of allowable bycatch limits shall be reported as bycatch overage on an ADF&G fish ticket. All proceeds from the sale of excess rockfish bycatch shall be surrendered to the state.

When fishing in waters of NSEI that are open to directed fishing for Pacific cod, a CFEC permit holder operating a vessel fishing for groundfish or halibut shall retain all Pacific cod brought on board [5 AAC 28.070 (e)(1)]. Additionally, a Miscellaneous Finfish permit (M-card) holder may retain and sell all Pacific cod taken when fishing with the gear designated on that permit card. Overages from areas open to the directed fishery may be landed on the fisher's M-card, designated for the gear type used, provided that the permit holder registered for the directed Pacific cod fishery and maintained an ADF&G pot-longline logbook separate from their sablefish logbook.

When fishing in waters of NSEI that are closed to directed fishing for Pacific cod, a CFEC permit holder operating a vessel fishing for groundfish or halibut shall retain all Pacific cod up to the maximum retainable bycatch (20%); a CFEC permit holder fishing these areas may not sell Pacific cod that exceeds the allowable bycatch amount. Fishers with halibut IFQ in regulatory area 2C and a CFEC halibut permit card must retain all halibut over 32 inches in length, up to the amount of their IFQ.

Sablefish live market

The holder of a CFEC or interim use permit for sablefish may possess live sablefish for delivery as live product allowing that, upon the request of a local representative of ADF&G or law enforcement, the permit holder must present sablefish for inspection and allow biological samples to be taken [5 AAC 28.170 (l)].

Prohibitions

The operator of a fishing vessel may not take sablefish in the NSEI area with sablefish from another area on board. Also, the operator of a vessel taking sablefish in the NSEI area shall unload those sablefish before taking sablefish in another area [5 AAC 28.170 (a) and (b)].

A vessel or CFEC permit holder onboard a vessel that participates in a commercial sablefish fishery in the NSEI or Southern Southeast Inside (SSEI) Subdistricts may not operate subsistence, sport, or personal use halibut or groundfish fishing gear during the 72 hours immediately before the start of the commercial sablefish fishery in that subdistrict [5 AAC 28.180 (a)]. A vessel or CFEC permit holder onboard a vessel that participates in a commercial sablefish fishery in the NSEI or SSEI Subdistricts may not operate subsistence, sport, or personal use halibut or groundfish fishing gear during a commercial sablefish opening or during the 72 hours immediately following the closure of a commercial sablefish fishery in that subdistrict unless the vessel or CFEC permit holder is not registered for the commercial sablefish fishery in that subdistrict; the vessel or CFEC permit holder has harvested their EQS and at least 72 hours have passed since the commercially harvested sablefish were offloaded from the vessel; commercial fishing gear used in the commercial fishery by the vessel or the CFEC permit holder onboard a vessel has been removed from the water for at least 72 hours; or at least 72 hours have passed since the vessel owner, or owner's agent, has contacted a local representative of the department and requested that the department cancel the vessel's commercial sablefish registration, and the department has canceled the vessel's commercial sablefish registration [5 AAC 28.180 (b)].

2026 SABLEFISH STOCK ASSESSMENT AND 2026 RECOMMENDED ABC

Sablefish are a highly migratory, long-lived species broadly distributed in the North Pacific Ocean (Wolotira et al. 1993). Although research to date suggests that sablefish comprise a single, panmictic population (Jasonowicz et al. 2017), they are managed as separate stocks in Alaska state and federal waters, in British Columbia, and in state and federal waters off the U.S. west coast. After 30 years of declining or suppressed spawning stock biomass in the North Pacific, persistent high catch rates of small sablefish in recent years across multiple surveys and fisheries signal strong recruitment and increasing trends for the stock (Goethel et al. 2022; Goethel and Cheng 2024).

Despite these positive population trends, ADF&G continues to follow a precautionary approach to setting harvest limits. The target fishing mortality rate of F_{50}, which defines the maximum ABC, is based on female spawning stock biomass and does not account for the relative economic value of sablefish. Because sablefish begin contributing to the spawning stock biomass as young as age 3, ABCs can increase quickly even if average fish size is small. These small sablefish are worth significantly less per pound, making them subject to high release rates in the NSEI area, where fishery releases are legal. Steep annual increases in ABCs in response to large recruitment events can result in low fishery value, and the unobserved fishery releases introduce an uncertain source of mortality into the stock assessment. As the 2013–2023 year classes mature, these strong recruitment events are beginning to translate into larger harvests (Table 2, Figure 2). As fish grow from these strong years, they are more likely to be retained and sold. Similarly, as these fish mature, they are increasing the size of the spawning biomass. However, as these fish approach full maturity, biomass will likely peak and begin to decline as continued maturation and growth of these strong year classes is counteracted by cumulative mortality.

In response to concerns about release practices and large changes in annual ABC estimates attributed to assessment modeling methods (i.e., model improvements or structural choices), a maximum 15% change in ABC management procedure was introduced in 2020; this limit constrains the recommended ABC to a 15% annual maximum change. The management procedure was well received during 2 stakeholder and industry meetings in April 2020 and 2021, showing support from the fleet. The procedure has been shown to increase fishery stability, maximize catch, and successfully achieve biological goals in long-term simulations conducted by the IPHC (IPHC 2019). The current NSEI harvest policy continues to define maximum permissible ABCs at F_{50}, and recommended ABCs will be constrained to a maximum 15% change between years.

In 2020, the previous authors of the NSEI stock assessment implemented an integrated SCAA model for the NSEI stock, which had been in development for several years (Sullivan et al. 2020). The SCAA model is structured similarly to the federal sablefish model (Goethel et al. 2022) and allows for the estimation of recruitment, spawning stock biomass, and abundance. The model configuration for the 2026 assessment is similar to that of the 2025 assessment model; however, estimates are not directly comparable to past assessments as it was found that retention and discard functions were being applied twice. In previous versions (model v23), the total instantaneous fishing mortality rate included retention and discard mortality terms ($F_{total} = F(selectivity)(Retention + Discard\_mortality(1 - Retention)$; see Eq. 9 in Weinstein et al. 2025). However, when calculating the predicted landed catch, the retention function was applied again to this already adjusted fishing mortality. This double application caused the model to underestimate the predicted landed catch per fish. To match the observed catch data during likelihood evaluation, the model compensated by inflating the total abundance estimates. The same equation was also present in the calculation of dead discards (wastage; Eq. 19) and ABC projections under F_{50}.

In model v23a (used in the 2026 assessment), F was redefined as the base instantaneous fishing mortality multiplied by selectivity, with retention and discard mortality applied once in the total mortality rate (Z; Eq. 8). Predicted landed catch and discard mortality are now calculated using the Baranov catch equation with retention applied appropriately once (Eq. 18).

Additionally, in the previous model, the spawner potential ratio (SPR) calculation (Eq. 23 and 24) used only base fishing mortality ($F = F * Selectivity$) without accounting for age-specific retention or discard mortality. This caused the model to overestimate fishing mortality on young fish (which are mostly released with low mortality) and to underestimate F_{50}. Model v23a recognizes that young fish experience lower total fishing mortality due to high discard rates and 84% survival (discard mortality is fixed at 16%). In model v23a, the retention function and discard mortality was added to the SPR calculations as described for the landed catch, accounting for the survival of young fish until the following year. Model v23a indicates that the total abundance is lower than previously estimated, but that the stock can sustain a higher level of fishing, resulting in a larger maximum ABC than in previous years (Table 1).

The SCAA model results in a maximum permissible ABC of 3,150,994 round lb at a target fully selected fishing mortality of F_{50} (Table 1)[1]. This is a 1,051,099 lb. increase (50.1%) from the 2025 maximum permissible ABC of 2,099,895 round lb. Under the max 15% change management procedure—given the 2025 recommended ABC of 2,080,436 round lb—the recommended 2026 ABC is limited to 2,392,501 round lb. To account for legal releases of small sablefish in NSEI, fixed retention probabilities and an assumed discard mortality of 16% were incorporated directly into the SCAA model following Sullivan et al. (2019). The mortality from fishery releases under F_{50} is estimated to be 178,603 lb and is incorporated directly into the max ABC calculation (see section titled *ABC Recommendations* for more information).

The following are notable results from the SCAA model and reflect potential conservation or assessment concerns for this stock:

1. 2025 was the fourth full season in which pot gear was permitted, and participation in the pot fishery increased from 18.1% (2022) to 37.6% of the landed catch in 2025; this is a 6.5% increase from 2024 (Figure 2a). As in the 2024 and 2025 assessments, a third time block was included for fishery selectivity to account for this gear change (i.e., the period since the fishery became a mixed gear fishery), but further modifications to the assessment may be prioritized if and as the dynamics of the fishery change. For now, participation in the longline fishery remains robust and has provided adequate sample sizes for tracking CPUE trends in the longline fleet. If the pot fishery overtakes the longline fishery and participation in the longline fishery becomes limited, it may be necessary to develop a new CPUE index using methods like those used in the federal fishery (Cheng et al. 2023).

2. Stock status (i.e., stock size relative to its unfished state, as approximated by the spawning potential ratio estimate) remains uncertain and sensitive to data weighting methodology and to fishery selectivity values that are fixed to the federal assessment values. The department manages the NSEI fishery for F_{50} (the fishing mortality that results in a spawning potential ratio of 50%) and changes in model structure and assumptions result in changes to where the population is relative to this target (Figure 3). The 2024–2026 assessments indicated that previous assessments underestimated the magnitude of the large recruitment events in recent years, and stock status appeared to be much higher than estimated in the 2022 and 2023 assessments. While the trend in the NSEI stock is clear, managers should be aware of the uncertainty inherent in the current operating model. The max 15% change rule helps to prevent overreaction to swings in the results of a given assessment and helps to accommodate this uncertainty. As the data weighting for this model continues to evolve to be in line with best practices, a goal remains to remove subjective assignment of variances or weighting and allow the model to estimate variance beyond that calculated from the data. Initial steps were taken to address these concerns but more work is required before they are adopted.

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[1] After the assessment was complete, it was discovered that the 2024 survey age composition data were unintentionally triplicated (i.e., all observations were repeated 3 times), inflating the input sample size for that data source. The model was rerun and retuned (i.e., iterative reweighting of age and length composition data) with the corrected data and results were minimally affected. The minimal impact is attributable to 2 factors: age compositions are entered as proportions-at-age, so triplication does not alter the observed signal, and iterative reweighting during tuning adjusted the effective sample size such that the final weight given to the 2024 age data was similar between model runs. Specifically, the maximum ABC decreased by 5,335 lb (−0.1%) and all other stock status estimates (SSB, F_{50}, unfished biomass, etc.) changed by less than 1.5%.

3. Fit of the model to the abundance indices remains poor and reliant on the inflated variance terms assigned to fishery CPUE and mark–recapture estimates of abundance. In particular, the abundance estimates derived from the mark–recapture assumption that have underpinned the NSEI sablefish assessment since 2005 and provide scale to the population appear to underestimate abundance prior to 2017 relative to the model estimates (Figure 4). Though the 2026 assessment model (v23a) estimates a smaller total population that aligns more closely with mark–recapture estimates from 2018 onward, there is still tension between the other data sources (age and length compositions) that force the aforementioned data weighting to keep the model tethered to those abundance estimates. A thorough review of the mark–recapture experiment to identify and correct biases in the estimate remains a priority for this project. Bias correction may result in better fits to the data both by correcting estimates and modifying the modeling prior (penalized likelihood) describing the relationship between actual abundance and the mark–recapture estimate (currently assumed to be a 1:1 ratio).

4. Fixing fishery selectivity to values estimated in the federal assessment continues to be a principal weakness in this model and assessment. Thus far, the model has failed to converge or reliably estimate fishery selectivity; therefore, it remains necessary to leave fishery selectivity fixed to federal values in the model. The model's failure to reliably estimate fishery selectivity is likely related to the retention curve used to describe the probability that a fish is retained or released based on size. This curve is based on the price per pound given to fish graded on size and is fixed within the model with no interannual variation. Improving the model's ability to estimate fishery selectivity will require exploration of how to model this retention curve. Ideally, the retention curve parameters could be freely estimated in the model which may be achievable using priors on those parameters. However, before attempting to estimate that curve it would be advisable to explore different retention curves that could be developed based on the length compositions of the survey and the fishery. The model and stock status estimates remain sensitive to these selectivity values and allowing the model to estimate fishery selectivity in the NSEI fishery continues to be a high priority going forward.

5. The fit of the model to sablefish age data continues to improve relative to past assessments (prior to 2024). This improvement is the result of model tuning that led to higher estimates of effective sample size than those used in past assessments (a conservative estimate derived from the square root of the raw sample size). The fit is still not satisfactory, likely due to the use of fixed selectivity values for the fishery. More appropriate estimated selectivity curves remain a priority for addressing the fit of the age data.

6. Similarly, while the fit to length data has also improved relative to 2023 and earlier, it is far from desirable (Figure 5–8); there is a consistent pattern in the residuals whereby mid-size fish are underestimated and larger fish are overestimated in the model (Figure 9). In conjunction with the retrospective results (Figure 10), this pattern suggests that the model may be underestimating large recruitment events. Better estimation of selectivity in both the fishery and the survey will be necessary to improve the fit to length data.

7. Recruitment of the 2015, 2016, 2018–2020, and the 2022 and 2023 year classes was substantial and above the long-term median (median recruitment = 892,000; 1975–2025; Figure 11). These strong year classes are driving the increase in biomass that has occurred

over the last several years. These recruitment events are in line with the scale of increase seen in the federal assessment. These fish are beginning to mature but are still not fully mature or fully grown and thus biomass may continue increasing over the next several years as these fish grow and mature in the population. However, they are likely smaller than the optimal size from a price standpoint and may still be subject to high release rates.

8. Retrospective patterns in the model are mixed. The model demonstrates a slightly negative and negligible retrospective pattern in spawning biomass (Figure 12; Mohn's $\rho = -0.01$), indicating that historical spawning biomass estimates are stable and reliable. However, the recruitment retrospective is more concerning, with a Mohn's ρ of -0.27. This negative bias indicates that the model consistently underestimates recruitment, particularly during periods of high recruitment. Given strong evidence that the population has experienced a recruitment boom over the last several years, it is likely that the size of those year classes is underestimated. While the spawning biomass trajectory suggests the population is growing, the degree of underestimation in recent recruitment indicates that continued population growth is probable, but the magnitude of the increase is uncertain.

CHANGES TO THE 2026 NSEI ASSESSMENT RELATIVE TO 2025 NSEI ASSESSMENT

Updates to the stock assessment are listed here:

1) The 2026 assessment was conducted using a modified version of model v23 (used in the 2022–2025 assessments). During initial model exploration, 2 related mathematical errors were discovered in how retention and discard mortality were implemented in the model code.

   a) Previously, the total instantaneous fishing mortality rate included retention and discard mortality terms (see equation 9 in the 2025 NSEI stock assessment; Weinstein et al. 2025). However, when calculating the predicted landed catch, the retention function was applied again to this already adjusted fishing mortality, effectively applying retention twice. This double application caused the model to underestimate the predicted landed catch per fish. To match the observed catch data during likelihood evaluation, the model compensated by inflating the total abundance estimates. The same error was also present in the calculation of dead discards (wastage; equation 19) and ABC projections under F_{50}. To correct these errors, F was redefined as the base fishing mortality multiplied by selectivity, with retention and discard mortality applied once in the total mortality rate (Z; Eq. 8). Predicted landed catch and discard mortality are now calculated using the Baranov catch equation with retention applied appropriately once (Eq. 18).

   b) Additionally, the SPR calculations (Eq. 23 and 24) used only base fishing mortality without accounting for age-specific retention or discard mortality. This caused the model to overestimate fishing mortality on young fish (which are mostly released with low mortality) and to underestimate F_{50}. The corrected model recognizes that young fish experience lower total fishing mortality due to high discarding rates and 84% survival (discard mortality is fixed at 16%). This error was corrected by adding the retention function and discard mortality to the SPR calculations as described for the landed catch, correctly accounting for the survival of young fish to the following year.

c) Given these corrections to the model, abundance estimates, F_{50}, and ABC values from previous assessments (2021–2025) are not directly comparable to the values in this assessment. Historical F estimates and biomass trends show similar patterns but differ in absolute scale (Appendices A1 and A2).

2) As in the 2024 and 2025 assessments, a 3rd fixed time block was used for fishery selectivity in the SCAA model using the federal values that reflect the mixed gear fishery in federal waters (Goethel et al. 2022); all 3 time-blocks for fishery selectivity are fixed based on values estimated in the federal sablefish stock assessment and correspond to the same periods. A 3rd time block was also again used for survey selectivity to account for apparent changes associated with the large recruitment events in recent years. The time blocks were kept the same as in the previous assessment. For the survey, the time blocks were: 1975–1999 (pre-survey standardization), 2000–2016 (survey standardization), and 2017–2025 (post-large recruitment class). For the fishery, the time blocks were: 1975–1994 (pre-EQS), 1995–2021 (longline fishery), and 2022–2025 (mixed gear fishery).

3) In the 2026 assessment, survey selectivity for males was fixed for the first time-block and estimated for females in the first time-block, and selectivity for both sexes were estimated in the 2nd and 3rd time blocks. This is a notable change from the 2025 assessment, where survey selectivity was fixed for all 3 time blocks in the model due to model convergence issues.

4) Beginning with the 2023 assessment, model v23 was configured to use a random effects likelihood formula for recruitment deviations. However, during 2026 model exploration it was discovered that the corresponding Template Model Builder (TMB; Kristensen et al. 2016) random effects specification was not enabled in the R-fitting procedure. Not specifying random effects in the TMB function resulted in the model using a hybrid approach, whereby recruitment deviations were estimated as fixed effect parameters (1 parameter per year) but penalized using the random effects likelihood formula rather than the standard penalized likelihood formula. When the TMB random effects integration was properly configured (using random = "log_rec_devs" in MakeADFun), the model failed to converge with numerical errors (NaN values in the objective function). Due to these convergence issues, the 2026 assessment returns to the standard penalized likelihood approach used prior to the 2023 assessment. For the 2026 assessment, recruitment deviations are estimated as fixed effects with a penalized likelihood that assumes deviations are distributed lognormally with a standard deviation (σ_R) that is fixed at 1.2 (based on the federal assessment value; Goethel et al. 2022).

No additional changes to the SCAA model structure or assumptions, estimation of biological reference points, or population dynamics equations were made. Status quo methods to update estimates of weight-at-age, maturity-at-age, catch, survey CPUE, mark–recapture abundance, and age/length compositions were used. For detailed technical information on the SCAA model and data preparation, please visit the GitHub repository for this project.[2]

[2] Southeast Alaska Sablefish GitHub Repository. 2022–. Alaska Department of Fish and Game, Division of Commercial Fisheries. Sitka, Alaska. https://github.com/commfish/seak_sablefish (accessed July 2026).

MODEL STRUCTURE

The SCAA assessment model presented here was coded in TMB, an R library that leverages C/C++ functionality to calculate 1st and 2nd order derivatives and was inspired by a similar C/C++ templating software, ADMB (Fournier et al. 2012; Kristensen et al. 2016). The TMB code replicates or makes refinements to methods used in a previous ADMB-based, age-structured model for the NSEI sablefish stock (Mueter 2010) that was based on code from an older federal assessment of sablefish that has also been adapted for several Alaska rockfish stocks (Kimura 1990; Sigler 1999). The model can be run as either a single-sex or sex-structured model; however, data inputs are only shown for the sex-structured model. Variable definitions for all equations used in the SCAA assessment model can be found in Tables 4–6. Uncertainty in parameters is estimated using a maximum likelihood approach.

DATA INPUTS

Weight-at-age

Data from the 2002–2025 longline fishery and 1997–2025 ADF&G longline survey were used to obtain fishery and survey weight-at-age used in the SCAA model. A weight-based von Bertalanffy growth model was fit to weight-at-age data,

$$ln(w_a) = lnW_\infty + \beta \, ln\left(1 - exp\left(-k(a - t_0)\right)\right) + \varepsilon, \quad (1)$$

where w_a is weight (lb) at a given age; W_∞ is the mean asymptotic weight (lb); β is the power in the allometric equation; k relates to the rate at which W_∞ is reached; and t_0 is the theoretical age (years) at weight zero. Residuals ε were assumed to be lognormally distributed to account for increasing variability by age, and the variance of these residuals (σ_R) was estimated. Models were fit separately for each sex and data source using the maximum likelihood and the mle function in the base package stats4 in R (R Core Team 2026).

Because discarding is permitted in the NSEI fishery, there are large differences in survey and fishery weight-at-age, especially at younger ages (Figure 13Figure 15). Consequently, fishery weight-at-age was fit to landed catch biomass, whereas survey weight-at-age was used to estimate exploitable biomass, spawning biomass, and other quantities of interest in the model.

Maturity-at-age

Maturity data from the 1997–2025 ADF&G longline surveys was used to fit a maturity ogive for female sablefish using logistic regression and the glm function in the base package stats in R. Maturity-at-length data for this time period were more abundant than maturity-at-age data and appeared to provide the best estimates of maturity; therefore, maturity curves were fit using maturity-at-length data.

Predicted maturity-at-length was transformed to maturity-at-age using fitted values from a length-based von Bertalanffy growth curve fit to survey data. The length at 50% maturity is 60.3 cm; the k_{mat} (the slope at the length at 50% maturity) is 0.38; and the age at 50% maturity is 5.9 years (Figure 13). Predicted proportions of maturity-at-age were used as inputs to the SCAA model and in the calculation of spawning stock biomass.

Annual fits of maturity, though not explicitly used in the SCAA model, can provide insight into changes in the population or cohort-specific dynamics. Of note, the fit to maturity data in the last

5 years suggests that fish matured at younger ages and smaller sizes compared to previous years (Figure 14). It is possible that earlier maturation can be linked to warm environmental conditions in the North Pacific since 2014 (Bond et al. 2015), or to density-dependent effects driven by the large recruitment events in recent years. Trends in maturity and growth should be monitored in future assessments; moving forward, it may be useful to incorporate time blocks for maturity-at-length in the model.

Catch

Catch data from 1975–2025 include harvest in the directed sablefish longline and pot fishery, ADF&G longline survey removals, and sablefish retained in other fisheries such as the IFQ halibut longline fishery (Figure 2). Catch estimates from 1975–1984 were obtained from Carlile et al. (2002), and 1985–present catch data were obtained from the Region I ADF&G Commercial Fisheries fish ticket database. Catch was estimated in the SCAA model assuming a lognormal distribution with a fixed log standard deviation of 0.05. Changes in the management structure during this period included a move to limited entry in 1985 and adoption of the EQS program in 1994 (Olson et al. 2017). Additional sources of mortality that are not currently included in this model include sport, subsistence, and personal use harvest; estimated bycatch mortality in the halibut fishery; and estimated deadloss including mortality from sand fleas, sharks, and whales. Currently, these additional sources of mortality are accounted for in the decrements process (see the section titled *Annual Harvest Objective Determination* for more information).

Fishery CPUE

Fishery CPUE, defined as retained lb per hook, was used as an index of abundance for 1980–2025 (Figure 16). Fishery CPUE was estimated in the SCAA model assuming a lognormal distribution with a fixed log standard deviation of 0.1 for the historical data from dockside interviews (1980–1996; Carlile et al. 2002) and 0.08 for the contemporary logbook data (1997–present).

In 2020, ADF&G reviewed and re-entered logbook data to standardize how trip and set targets were identified using the raw logbook data. In past years, this was done ad-hoc on an annual basis and the methods were not documented, leading to confusion following the retirement and turnover of staff. The 2020 project established guidelines for identifying trips and set targets based on the raw data written in the logbook by the fisher.[3] Prior data entry applications did not allow for target species information to be captured, so these data were not entered until 2020 when the advent of the new logbook application allowed for trip- and set-specific target species. Only sets targeting sablefish were used to calculate fishery CPUE values for use in the assessment. Additionally, when information on depredation was provided, all sets where depredation had occurred were removed; when this information was not available, all sets were included.

Fishery CPUE since 1997 was fully standardized in this year's assessment to account for shifts in fishing practices and vessel participation over time. Standardization accounts for variability in hook size, fishing depth, soak time, statistical area (fishing location), fishing vessel (as a random effect), Julian day, gear, and set length. CPUE was estimated as the predicted value from generalized additive models (GAMs) fitting CPUE to these variables using the mgcv package (Wood 2011) in R and the gamma smoothing feature. Relative to the nominal index, the

[3] Southeast Alaska Sablefish Github Repository. 2022. Alaska Department of Fish and Game, Division of Commercial Fisheries. Sitka, Alaska. https://github.com/commfish/seak_sablefish (accessed April 2026).

standardized index more accurately reflects the increase in biomass that has occurred in recent years (Figure 17).

Because discarding sablefish is legal in the NSEI fishery, estimating fishery selectivity within the model is not currently possible. To address this issue, the federal selectivity curve is used in the model, which was estimated in the 2022 federal sablefish assessment assuming 100% retention. A sex- and age-specific retention probability, coupled with a fixed discard mortality rate, is used to estimate mortality from fishery releases. Research is needed to better understand discarding behavior in the NSEI fishery as it relates to economic and biological factors.

Survey CPUE

Longline survey CPUE in numbers per hook for 1997–2025 was used as an index of abundance (Figure 16). This index was assumed to be log-normally distributed, with a fixed log standard deviation derived from the data. The 1988–1996 longline surveys used a shorter soak time of 1 hour instead of the current 3–11 hours (Carlile et al. 2002; Dressel 2009). Consequently, these data were omitted because the 1-hour soak time was likely too short to provide an accurate measure of relative abundance (Sigler 1993).

Survey CPUE has remained substantially above the long-term mean since 2020, with minimal variation between 2020 and 2023 and an increase in 2024 that continued in 2025 (Figure 16).

Mark–recapture abundance

Currently, ADF&G conducts a mark–recapture survey as funding allows (every 1–5 years) that serves as the basis for stock assessment and management (Stahl and Holum 2010; Green et al. 2015). Fish are tagged during a pot survey in May and June, with recaptures occurring in the ADF&G longline survey in late July or early August and the longline fishery from August through November (Beder and Stahl 2016).

The mark–recapture abundance estimates provide an index of exploitable abundance for years when a marking survey occurred (2003–2010; 2012; 2013; 2015; 2017–2020; 2022; Figure 16). This index was assumed to be lognormally distributed with a fixed log standard deviation of 0.05. The mark–recapture abundance index increased from 3.01 to 3.14 million fish (+4.3%) between 2020 and 2022, and the 2022 estimate is the highest on record (Figure 16). The 2022 marking survey released 8,654 tagged fish (Table 7). Following methods in past assessments, the following were accounted for: tags recovered outside of the NSEI area or period of recapture, natural and fishing-related mortality, and differences in the size of fish captured in the pot survey and longline fishery (Appendix A in Sullivan et al. 2019).

Mark–recapture abundance estimates were obtained using a time-stratified Petersen mark–recapture model implemented in the Bayesian software JAGS 4.3.0 (Depaoli et al. 2016). For any given time period i, the number of tagged fish in Chatham Strait (K) and subsequent abundance (N) were modeled as:

$$K_i = \begin{cases} (K_0 - D_0)e^{(-Mt_i)} & i = 1 \\ (K_{i-1} - k_{i-1} - D_{i-1})e^{(-Mt_i)} & i > 1 \end{cases} \tag{2}$$

and

$$N_i = \begin{cases} N_i e^{(-Mt_i)} & i = 1 \\ (N_{i-1} - C_{i-1}) e^{(-Mt_i)} & i > 1 \end{cases} \tag{3}$$

where K_0 is the number of tags released in the ADF&G pot survey; D_0 is the number of tagged fish that are not available to either the ADF&G longline survey or to the fishery (tags recovered in the halibut fishery or outside of Chatham Strait); M is the assumed natural mortality of 0.10 (Johnson and Quinn 1988); k is the number of marked fish recovered; and C is the total catch or number of sablefish removed. N_1 was assumed to follow a normal distribution with an uninformed prior (precision = 1×10^{-12}) centered on past assessments' forecasts of abundance.

The probability that a sablefish caught in a given time period is marked p_i is informed by the ratio of marks in the population to the total population at that time $\frac{K_i}{N_i}$. Each p_i is assumed to follow a beta prior distribution $p_i = \beta(\alpha, \beta)$, where $\alpha = (\frac{K_i}{N_i})x$, $\beta = (1 - K_i/N_i)/x$, and a large x indicates confidence in K_i/N_i. Because N_i was previously assumed to follow a vague normal prior, p_i was assigned to an informed prior by setting x equal to 10,000.

In each time period, the likelihood of recapturing k marked sablefish given n sampled fish follows a binomial distribution, where:

$$Pr(k|n,p) = \binom{n}{k} p^k (1-p)^{n-k}. \tag{4}$$

Additional information on mark–recapture modeling, alternative methods considered, and model selection methodology is detailed in Appendix A of Sullivan et al. (2019).

The mark–recapture experiment likely overestimates precision; it is also likely biased to some degree, given that there are currently no diagnostics that examine differences in capture probability based on fish size or location. Furthermore, the project relies on *reported* marked fish, and the accounting done at processing plants by ADF&G staff seldom agrees with the tag returns from industry. A thorough re-evaluation of this project remains a priority both to detect and potentially correct biases in the estimates and produce more accurate estimates of uncertainty in the estimate.

Age compositions

Fishery age compositions from the 2002–2025 longline fishery and survey age compositions from the 1997–2025 longline surveys (Figure 18) were included in the model. In 2020, to be consistent with the federal assessment, the plus group age in the model was updated to be above 31 years old (instead of 43 years; Sullivan et al. 2020). Sample sizes were deemed insufficient to fit age compositions by sex, so age data have been aggregated for both the survey and fishery. The McAllister and Ianelli (1997) method of tuning composition data by iteratively reweighting the sample size has been applied to the SCAA model and was implemented in the assessment.

Currently, no NSEI-specific ageing error matrix exists. Until this has been fully developed and reviewed, the federal sablefish ageing error matrix has been made available and used for this assessment (Heifetz et al. 1999; Hanselman et al. 2018; D. Hanselman, Fisheries Research Biologist, NOAA, Juneau, personal communication, April 2019). The ageing error matrix ($\Omega_{a',a}$) is the proportion observed at age a given the true age a'. Ageing error matrices are critical for correcting observed age compositions and estimating recruitment (Fournier and Archibald 1982).

Future research should include the development of an ageing error matrix for NSEI in conjunction with the ADF&G Age Determination Unit.

Length compositions

Sex-structured length data from the longline fishery (2002–2025) and the ADF&G longline surveys (1997–2025; Figure 19) were summarized using the federal conventions for length compositions (Hanselman et al. 2018). The federal assessment uses 2 cm length bins ranging from 41–99 cm. Fish less than 41 cm (l_0) were omitted from the analysis, and fish greater than 99 cm were aggregated into the 99 cm length bin ($l+$). Effective sample sizes were estimated using the McAllister and Ianelli (1997) method of tuning composition data by iteratively reweighting the sample size.

Length distributions in the fishery have dramatically different patterns than the survey (Figures 15 and 19), with few lengths in the fishery less than 60 cm. Full retention is not a requirement in state waters and the length differences between the survey and fishery are attributed to fishery releases of small fish. Because of the bias introduced by allowing fish to be released in the fishery, fishery age and length compositions tend to be poorly fit by the model.

Finally, the selective harvest of larger-bodied fish results in large differences between survey and fishery size-at-age. Until an age-length key is developed for NSEI, the federal age-length keys ($\Lambda_{a,l,k}$) will be used to fit both survey and fishery length compositions (Echave et al. 2012; Hanselman et al. 2018;). Ultimately, separate age-length keys should be developed for each data source to account for the differences in survey and fishery size-at-age.

Retention probability

The release of healthy (i.e., not dead, sand flea-bitten, etc.) sablefish is allowed in state waters. To model the discard behavior in the NSEI fishery, processor grade and price per pound data were used to inform retention probabilities-at-size (Figure 21). Based on conversations with groundfish port sampling staff and fishers, the lower bound of the Grade 2/3 (3.2 round lb) was assigned a 10% retention probability, the lower bound of the Grade 3/4 (4.8 round lb) was assigned a 50% retention probability, and everything greater than 8 round lb was assigned a 100% retention probability (A. Olson, Groundfish project leader, ADF&G, personal communication, July 2018). Remaining retention probabilities were interpolated between these fixed values. Weight-based retention probabilities were translated to sex and age using the longline survey sex- and weight-based von Bertalanffy growth curves (Figure 13).

MODEL PARAMETERS

Natural mortality

Natural mortality M was assumed to be constant over time and age and was fixed at 0.10 (Johnson and Quinn 1988). Code infrastructure has been developed to estimate M using a prior as is done in the federal assessment, but this methodology will not be implemented until prior distributions can be thoroughly analyzed.

Discard mortality

Stachura et al. (2012) estimated discard mortality D of sablefish to be 11.7% using release–recapture data from a longline survey in Southeast Alaska. Due to careful fish handling on survey vessels during tagging experiments, it is likely that fishery discard mortality is higher. Therefore, the discard mortality rate from the Pacific halibut fishery, *D* = 16%, was used in this assessment (Gilroy and Stewart 2013). The Pacific halibut fishery is likely a reasonable proxy for the sablefish fishery because the fisheries utilize similar gear, and the same vessels and crew frequently participate in both fisheries. Both species are also considered hardy and do not experience barotrauma.

Selectivity

The longline fishery and survey are assumed to follow a logistic selectivity pattern. The current parameterization of the logistic curves uses s_{50} and δ, which represent the ages at which 50% of fish are selected by the gear (s_{50}) and the shape or slope of the logistic curve (δ). Selectivity-at-age (s_a) for this parameterization is defined as

$$s_a = \frac{1}{1 + exp\left(-\delta(a - s_{50})\right)}. \tag{5}$$

Selectivity is fitted separately for the longline fishery (*fsh*) and survey (*srv*). There is flexibility to define discrete time blocks for both fishery and survey selectivity.

Currently, fishery selectivity is fixed in the model, and 3 time blocks are used based on federal selectivity values for: 1) the fishery before the EQS program began (through 1994); 2) the fishery since the implementation of EQS while it was solely longline gear (1995–2021), and; 3) the fishery since it became a mixed gear fishery (2022–present; Goethel et al. 2022; Figure 13, Table 6). Selectivity for all time blocks is shown in Figure 20. Estimating selectivity is challenging when accounting for fishery releases because no age or length data are available for the released fish. Further research is needed to better characterize how discard behavior has changed over time and if discarding was common pre-EQS.

Selectivity in the longline survey is estimated in the model using 3 time blocks representing the unstandardized survey (pre-2000), the fully standardized survey (2000–2016), and a third block representing a period of high recruitment (2017–2025).

Catchability

Currently, 7 parameters for catchability are estimated: 3 for fishery catchability (pre-EQS; EQS 1995–2021; EQS 2022–2025), $\ln\left(q_{fsh}\right)$; 3 for the ADF&G longline survey corresponding to pre-survey standardization, post survey standardization, and post 2016 large recruitment (pre-2000; 2000–2016; 2017–2025) , $\ln(q_{srv})$; and 1 for the mark–recapture abundance index, $\ln(q_{MR})$.

Recruitment and initial numbers-at-age

The numbers-at-age matrix *N* is parameterized with mean log recruitment μ_R, 50 (*T*) log recruitment deviations τ, mean log initial numbers-at-age μ_N , and 28 (*A* - 2) deviations from mean log initial numbers-at-age ψ. Recruitment deviations are estimated as fixed effects using a penalized likelihood approach with σ_R fixed at 1.2 based on the federal assessment value.

Fishing mortality

There is 1 parameter estimated for mean log fishing mortality, μ_f, and 50 (*T*) log fishing mortality deviations ϕ.

POPULATION DYNAMICS

The population dynamics of this model are governed by the following state dynamic equations, where the number of sablefish *N* in year $t = 1$, age a, and sex k are defined as:

$$N_{1,a,k} = \begin{cases} \frac{1}{2} exp\left(\mu_R - M(a - a_0) + \Psi_a\right) & a_o < a < a_+ \\ \frac{1}{2} exp\left(\mu_R - M(a_+ - 1)\right) / \left(1 - exp(-M)\right) & a = a_+ \end{cases}. \quad (6)$$

Recruitment to age-2 in all years and the remaining projected N_a matrix is defined as:

$$N_{t,a,k} = \begin{cases} \frac{1}{2} e^{(\mu_R + \tau_t)} & a = a_0 \\ \frac{1}{2} N_{t-1,a-1,k} e^{(-Z_{t-1,a-1,k})} & a_o < a < a_+ \\ \frac{1}{2} N_{t-1,a-1,k} e^{(-Z_{t-1,a-1,k})} + N_{t-1,a,k} e^{(-Z_{t-1,a,k})} & a = a_+ \end{cases} \quad (7)$$

where the total instantaneous mortality, $Z_{t,a,k}$, is the sum of natural mortality M, fishing mortality $F_{t,a,k}$, retention probability $R_{a,k}$ (the age specific probability of being landed given being caught), and discard mortality D as:

$$Z_{t,a,k} = M + F_{t,a,k}\left(R_{a,k} + D\left(1 - R_{a,k}\right)\right). \quad (8)$$

Sex ratios are assumed 50/50 at the time of recruitment, thus any changes in sex ratios in the population over time are the result of sex-specific, fully selected fishing mortality. Total annual fishing mortality F_t is defined as

$$F_t = exp\left(\mu_F + \phi_t\right). \quad (9)$$

Fishing mortality is modeled as a function of fishery selectivity $s_{t,a,k}$,

$$F_{t,a,k} = s^{fsh}_{t,a,k} F_t. \quad (10)$$

PREDICTED VALUES

Predicted fishery CPUE (lb per hook) in the year t, $\widehat{I}_t^{fsh}$, is defined as a function of fishery catchability q_{fsh} and biomass available to the fishery:

$$\hat{I}_t^{fsh} = q_{fsh} \sum_{k=1}^{2} \sum_{a=a_0}^{a+} w^{srv}_{a,k}\, s^{fsh}_{t,a,k}\, N_{t,a,k}\, S^{fsh}_{t,a,k}, \quad (11)$$

where $w^{srv}_{a,k}$ is estimated mean weight-at-age by sex in the longline survey. Survival ($S^{fsh}_{t,a,k}$) to the beginning of the fishery in August is defined as:

$$S_{t,a,k}^{fsh} = exp\left(-\frac{8}{12}\left(M + F_{t,a,k}\right)\right). \tag{12}$$

Survival equations include natural and fishing mortality because the model assumes continuous fishing mortality.

Predicted longline survey CPUE (numbers per hook) in year t, ($\widehat{I_t}^{srv}$) is defined as a function of survey catchability q^{srv}, abundance available to the survey, and survival to the beginning of the survey in July $\left(S_{t,a,k}^{srv}\right)$:

$$\hat{I}_t^{srv} = q_{srv} \sum_{k=1}^{2} \sum_{a=a_0}^{a+} s_{t,a,k}^{srv} N_{t,a,k} S_{t,a,k}^{srv} \, . \tag{13}$$

Predicted mark–recapture abundance in year t ($\widehat{I_t}^{MR}$) is defined as a function of mark–recapture catchability q^{MR}, abundance available to the fishery, and survival to the beginning of the NSEI fishery in August $\left(S_{t,a,k}^{fsh}\right)$:

$$\hat{I}_t^{MR} = q_{MR} \sum_{k=1}^{2} \sum_{a=a_0}^{a+} s_{t,a,k}^{fsh} N_{t,a,k} S_{t,a,k}^{fsh} \, . \tag{14}$$

Spawning biomass SB is calculated as:

$$SB = \sum_{a=a_0}^{a+} w_{a,f}^{srv} \, N_{t,a,f} \, S_{t,a,f}^{spawn} \, p_a \, , \tag{15}$$

where $w_{a,f}^{srv}$ is mean weight-at-age of females in the longline survey, $S_{t,a,f}^{spawn}$ is the fraction of females surviving to spawn in February, and p_a is the proportion of mature females-at-age. In the single sex model, proportion of females-at-age in the survey, r_a, is used to obtain the female proportion of the N matrix.

Predicted survey age compositions (sexes combined) are computed as:

$$\widehat{P}_{t,a}^{srv} = \Omega_{a'a} \frac{\sum_{k=1}^{2} N_{t,a,k} s_{a,k}^{srv}}{\sum_{k=1}^{2} \sum_{a=a_0}^{a+} N_{t,a,k} s_{a,k}^{srv}} \, , \tag{16}$$

where $\Omega_{a',a}$ is the ageing error matrix. Predicted fishery age compositions (sexes combined) are computed as:

$$\widehat{P}_{t,a}^{fsh} = \Omega_{a'a} \frac{\sum_{k=1}^{2} C_{t,a,k}}{\sum_{k=1}^{2} \sum_{a=a_0}^{a+} C_{t,a,k}} \, , \tag{17}$$

where $\hat{C}_{t,a,k}$ is the predicted landed catch in numbers-at-age by sex derived from a modified Baranov catch equation:

$$\hat{C}_{t,a,k} = N_{t,a,k} \frac{R_{a,k} F_{t,a,k}}{Z_{t,a,k}} \left(1 - e^{\left(-Z_{t,a,k}\right)}\right), \tag{18}$$

where $R_{a,k}$ is the assumed probability of retention by age and sex (Figure 13).

Predicted landed catch in biomass $\hat{Y}$ is calculated as the product of fishery weight-at-age $w_{a,k}^{fsh}$ and landed catch in numbers-at-age:

$$\hat{Y}_t = \sum_{k=1}^{2} \sum_{a=a_0}^{a+} w_{a,k}^{fsh} \hat{C}_{t,a,k} \,. \tag{19}$$

The predicted biomass of discarded sablefish that die ($\widehat{W}_t$) with an assumed discard mortality ($D = 0.16$) is:

$$\widehat{W}_t = \sum_{k=1}^{2} \sum_{a=a_0}^{a+} w_{a,k}^{srv} N_{t,a,k} \frac{D\left(1 - R_{a,k}\right) F_{t,a,k}}{Z_{t,a,k}} \left(1 - e^{\left(-Z_{t,a,k}\right)}\right) . \tag{20}$$

Predicted survey length compositions are calculated using the sex-specific age-length keys ($\Lambda_{a,l,k}$), such that:

$$\widehat{P}_{t,l,k}^{srv} = \Lambda_{a,l,k} \frac{N_{t,a,k} s_{a,k}^{srv}}{\sum_{a=a_0}^{a+} N_{t,a,k} s_{a,k}^{srv}} \,. \tag{21}$$

Similarly, fishery length compositions are calculated as:

$$\widehat{P}_{t,l,k}^{fsh} = \Lambda_{a,l,k} \frac{\widehat{C}_{t,a,k}}{\sum_{a=a_0}^{a+} \widehat{C}_{t,a,k}} \,. \tag{22}$$

BIOLOGICAL REFERENCE POINTS

Biological reference points for NSEI sablefish were developed for the SCAA model following the federal assessment ADMB code (D. Hanselman, Fisheries Research Biologist, NOAA, Juneau, personal communication, April 2019). They are based on SPR, defined as the average fecundity of a recruit over its lifetime divided by the average fecundity of a recruit over its lifetime when the stock is unfished. Spawning stock biomass is used as a proxy for fecundity, which assumes that weight-at-age and fecundity-at-age are proportionally related.

The theoretical numbers-at-age per recruit (N_a^{SPR}) under the current harvest policy F_{50} (the fishing mortality that results in an SPR of 50%) is initialized with 1, then populated assuming the most recent year's values (T) for female fishery selectivity-at-age and estimated F_{50}:

$$N_a^{SPR50} = \begin{cases} 1 & a = a_0 \\ N_{a-1}^{SPR50} e^{\left(-M - F_{50} s_{a-1,fem}^{fsh}\left(R_{a,k} + D\left(1 - R_{a,k}\right)\right)\right)} & a_0 < a < a_+ \\ N_{a-1}^{SPR50} e^{\left(-M - F_{50} s_{a-1,fem}^{fsh}\left(R_{a,k} + D\left(1 - R_{a,k}\right)\right)\right)} + N_a^{SPR50} e^{\left(-M - F_{50} s_{T,a,fem}^{fsh}\left(R_{a,k} + D\left(1 - R_{a,k}\right)\right)\right)} & a = a_+ \end{cases} \tag{23}$$

The N_a^{SPR} under unfished conditions (relating to an SPR of 100%) collapses to

$$N_a^{SPR100} = \begin{cases} 1 & a = a_0 \\ N_{a-1}^{SPR100} e^{-M} & a_0 < a < a_+ \\ N_{a-1}^{SPR100} e^{-M} + N_a^{SPR100} e^{-M} & a = a_+ \end{cases} \tag{24}$$

The spawning biomass per recruit ($SBPR_{SPR}$) under fished (e.g., SPR=50%) and unfished (SPR=100%) conditions is:

$$SBPR_{SPR} = \sum_{a=a_0}^{a+} w_{a,f}^{srv} \, N_a^{spr} \, S_{T,a,f}^{spawn} \, p_a. \tag{25}$$

Equilibrium recruitment is assumed to be equal to the geometric mean of the full estimated recruitment time series such that

$$\dot{R} = \left(\prod_{t=1}^{T} e^{(\mu_R + \tau_t)} \right)^{\frac{1}{T}}. \tag{26}$$

Assuming a 50/50 sex ratio for recruitment, equilibrium female spawning biomass (SB_{SPR}) under fished and unfished conditions is calculated as:

$$SB_{SPR} = \frac{1}{2} \dot{R}(SBPR_{SPR}). \tag{27}$$

The SPR-based fishing mortality rate of F_{50} is estimated using penalized likelihood. The SPR-based biological reference points are estimated using penalized likelihood, where:

$$lnL(SPR) = 100 \left(\frac{SBPR_{50}}{SBPR_{100}} - \frac{1}{2} \right)^2. \tag{28}$$

In addition to F_{50}, F_{35}, F_{40}, F_{60}, and F_{70} are estimated for comparison.

The maximum permissible ABC is calculated as the difference between the predicted landed proportion of the catch ($\hat{Y}_{T+1}$) and the estimated mortality from releases ($\widehat{W}_{T+1}$) under F_{50} using forecasted estimates of abundance (N_{T+1}). Equation details for $\hat{Y}_{T+1}$ and $\widehat{W}_{T+1}$ are detailed in the section of this report titled 'Predicted Values.'

LIKELIHOOD COMPONENTS

The objective function, or the total negative log-likelihood to be minimized, includes the sum of the following likelihood components L, which received individual weights λ:

1. Landed catch biomass (Y) is modeled using a lognormal likelihood where σ_Y is assumed to be 0.05:

   $$lnL(Y) = \lambda_Y \frac{1}{2\sigma_Y^2} \sum_{t=1}^{T} \left(ln(Y_t + c) - ln(\hat{Y}_t + c) \right)^2, \tag{29}$$

   where $\lambda_Y = 1.0$ and c is a small constant set at 0.0001 to allow approximately zero catches in log-space.

2. Fishery CPUE, survey CPUE, and the mark–recapture abundance index are modeled using lognormal likelihoods, where σ_I was assumed to be 0.08 for the fishery and survey CPUEs and 0.05 for the mark–recapture abundance index:

   $$lnL(I) = \lambda_I \frac{1}{2\sigma_I^2} \sum_{t=1}^{T} \left(ln(I_t + c) - ln(\hat{I}_t + c) \right)^2, \tag{30}$$

   where T_I is the number of years of data for each index and λ_I is set to 1.0.

3. Fishery and survey age compositions were modeled using the multinomial likelihood (P_{age}), where effective sample size ω_t is calculated as the square root of the total sample size in year t:

$$lnL(P^{age}) = \lambda_{P^{age}} \sum_{t=1}^{T_P^{age}} -\omega_t \sum_{a=a_0}^{a+} (P_{t,a} + c)(\hat{P}_{t,a} + c) \tag{31}$$

where $T_{P^{age}}$ is the number of years of data for each age composition, $\lambda_{P_{age}}$ is set to 1.0, and c prevents the composition from being 0 in the likelihood calculation.

The Dirichlet-multinomial likelihood is also available in the SCAA code, which derives effective sample size through the estimation of an additional parameter θ (Thorson et al. 2017):

$$\begin{aligned} lnL(P^{age}) = \sum_{t=1}^{T_P^{age}} -\Gamma(n_t + 1) - \sum_{a=a_0}^{a+} \Gamma(n_t P_{t,a} + 1) + \Gamma(n_t \theta) - \Gamma(n_t + \theta n_t) \\ + \sum_{a=a_0}^{a+} [\Gamma(n_t P_{t,a} + \theta n_t \hat{P}_{t,a}) - \Gamma(\theta n_t \hat{P}_{t,a})], \end{aligned} \tag{32}$$

where n is the input sample size. The relationship between n, θ, and ω is

$$\omega_t = \frac{1 + \theta n_t}{1 + \theta}. \tag{33}$$

Further exploration is needed to implement the Dirichlet-multinomial as the model failed to converge when the Dirichlet-multinomial was implemented. Only results for the multinomial likelihood tuned using McAllister and Ianelli (1997) are presented in the current assessment.

4. Fishery and survey length compositions by sex are modeled using the multinomial likelihood (P^{len}), where effective sample size ω_t was calculated as the square root of the total sample size in year t:

$$lnL(P^{len}) = \lambda_{P^{len}} \sum_{k=1}^{2} \sum_{t=1}^{T_P^{len}} -\omega_t \sum_{l=l_0}^{l+} (P_{t,l} + c)\, ln(\hat{P}_{t,l} + c) \tag{34}$$

where T_P^{len} is the number of years of data for each length composition and λ_{Plen} is set to 1.0.

The Dirichlet-multinomial likelihood is also available for length compositions but failed to converge for this assessment. The multinomial likelihoods tuned using McAllister and Ianelli (1997) are used in this assessment.

5. Annual log-fishing mortality deviations (ϕ_t) were modeled using a sum of squares penalized lognormal likelihood, where:

$$lnL(\phi) = \lambda_\phi \sum_{t=1}^{T} \phi_t^2, \tag{35}$$

and λ_ϕ= 0.1.

6. Recruitment deviations (τ_t) were modeled using a penalized likelihood approach where:

$$lnL(\tau) = \frac{\lambda_\tau}{\sigma_R^2} \sum_{t=1}^{T} (\tau_t - \frac{1}{2}\sigma_R^2)^2 \quad (36)$$

where -0.5σ^2 is a bias correction needed to obtain the expected value (mean) instead of the median, λ_τ is a penalty weight fixed to 1.0, and σ_R is fixed to 1.2 based on the federal sablefish assessment. The initial numbers-at-age deviations ψ_a are implemented in the same way as recruitment deviations and are governed by the same σ_R. This penalized likelihood approach estimates each recruitment deviation as a fixed effect while regularizing extreme values through the penalty term.

Priors

Because the mark–recapture abundance index scales the exploitable population, a normal prior is imposed on q_{MR} of 1.0 with a standard deviation of 0.1. Vague priors are assigned to fishery and survey q. Future work on this model should include the development of priors for fishery and survey q.

MODEL RESULTS

A total of 155 parameters were estimated in the SCAA model, which converged with a maximum gradient component less than 0.001. The objective function value (negative log likelihood) was 2068 (Tables 8 and 9). In most years, the model fits catch, survey CPUE, and pre-EQS fishery CPUE reasonably well (Figure 4). Contemporary fishery CPUE (EQS) is not fitted well (Figure 4), with long runs of positive or negative residuals. The model performs poorly during the period directly following the implementation of EQS in 1994 for all indices, including catch (Figure 4).

The mark–recapture estimate of abundance is likely biased and has not been conducted since 2022. The project relies on tag returns from the fishery and tag accounting rarely matches the count of fin clips performed at processor plants by ADF&G staff. Under- and over-reporting of tag recoveries likely biases the results, and the bias may be different from year to year depending on retention incentives. Furthermore, the removal of tags by fishers prior to examination by ADF&G staff prevents the ability to identify and correct for tag loss. Lastly, the current mark–recapture analysis does not correct for size or geographic differences in capture probabilities, which could also bias results. Examining these sources of bias remains a priority. Additionally, resuming the mark–recapture survey should be a priority for 2026.

Variability in catch, survey and fishery CPUE indices, and the mark–recapture abundance estimate, was assumed. Future enhancements could include estimating this variability using available data and allowing the SCAA model to estimate extra variance based on the fit to the entire data set.

Derived indices of age-2 recruitment, female spawning stock biomass, and exploitable abundance and biomass (i.e., available to the fishery) suggest that this stock has been in a period of low productivity since the mid-1990s but has experienced a surge in recruitment in recent years (2018–2020, 2021, 2022), highlighted by the strong 2016 year class (Figure 11). Recruitment trends are comparable with federal values, as are estimates of spawning stock biomass, exploitable biomass, and exploitable abundance (Sullivan et al. 2019; Goethel et al. 2022; Goethel and Cheng 2024). Although recruitment has been strong in recent years and biomass is clearly expanding as these fish grow and mature, the population remains below levels observed in the early 1990s. While the dominance of the younger age classes is the result of these strong recruitment events, the lack of older sablefish, which can live into their 90s, remains concerning given the likely outsized contribution these older fish make to the spawning population.

As in the 2024 and 2025 assessments, the model fit to age composition data in the 2026 assessment has improved from previous years (prior to 2024; Figures 22 and 23). Although the model fits the general shape of the age compositions in most years, there are residual patterns (Figure 24). Additionally, the model appears to underestimate abundance of the plus group ages, which should be explored in future assessments.

Fits to the length composition data are poor and suffer from distinct residual patterns, signifying that the model is underestimating smaller and mid-size classes and overestimating larger and the smallest size classes (Figures 5–9).

The lack of fit to the age and length composition data likely results from restrictions imposed on fishery and survey selectivity in the model, as well as issues surrounding the assumed retention function used to estimate fishery catch and retention. Survey selectivity is currently estimated in 3 time blocks (fixed for males in the first time-block), though slope parameters in the most recent block (2017–2025) are imprecisely estimated for both sexes. Allowing the model to estimate annual time-varying survey selectivity may improve fits to the data, particularly in recent years when large pulses of small, young fish have entered the population. Fishery selectivity is also restricted, as the values are fixed to the federal model values; this is owing to the inability of the model to estimate these values due to discarding in the fishery. Because no data on fishery releases exist, it may not be possible to estimate fishery selectivity values that fit the composition data. Stock assessments that account for discarded catch frequently have observer data and overcome this challenge through the estimation of a separate selectivity curve for discarded catch (e.g., Zheng and Siddeek 2018). The model also underestimates abundance in the plus group ages. This result may reflect overestimation of natural mortality or fishing mortality on older fish, underestimation of initial numbers-at-age, or insufficient catchability of the oldest individuals. Methods to improve fits to fishery composition data should be developed in future assessments, including modeling changes in retention probability over time using price-per-pound and catch composition data. It may also be possible to reduce reliance on the federal curves by placing a prior around the selectivity parameters rather than fixing those values.

Retrospective analysis

Following recommendations from the North Pacific Fishery Management Council's Groundfish Plan Team (Hanselman et al. 2013), a retrospective analysis was performed by dropping the last 10 years of data, sequentially adding years back into the model, and plotting the relative changes in spawning biomass and recruitment time series for each model run in reference to the 2026 assessment model terminal year (2025). Mohn's ρ was calculated for spawning biomass and recruitment such that:

$$Mohn's\ \rho = \sum_{p=1}^{P} \frac{X_{Y-p,p} - X_{Y-p,0}}{X_{Y-p,0}} \Big/ P \quad (36)$$

where Y is the last year in the full time series, p is the number of years at the end of the peeled data series, and X denotes the estimate of the quantity of interest (i.e., spawning biomass, fishing mortality, or recruitment; Mohn 1999; Hanselman et al. 2013;).

Retrospective patterns in the model are mixed. The model demonstrates a slightly negative and negligible retrospective pattern in spawning biomass of 1% (Figure 12; Mohn's ρ = -0.01), indicating that historical spawning biomass estimates are stable and reliable. However, the recruitment retrospective is more concerning, with a Mohn's ρ of -0.27 (Figure 10). This negative bias indicates that the model consistently underestimates recruitment particularly during periods of high recruitment. Given strong evidence that the population has experienced a recruitment boom over the last several years, it is likely that the size of those year-classes is underestimated. While the spawning biomass trajectory suggests the population is growing, the degree of underestimation in recent recruitment means that continued population growth is probable, but that the magnitude of the increase is uncertain.

ABC RECOMMENDATIONS

The recommended ABC for 2026 is derived from the maximum ABC and adjusted to be no more than 15% change from last year's ABC. The 2026 maximum ABC reflects current stock productivity under the corrected model structure. Fixes to landed catch and discard model calculations and reference point estimation in the 2026 assessment prevent direct comparison with previous years' results; however, key biological trends remain consistent. The current assessment indicates that the NSEI sablefish stock is healthy with realized fishing mortality well below F_{50} (Figure 3). Harvest rates and fishing mortality have remained stable over the past decade at sustainable levels, in contrast to the higher and more variable harvest rates observed in the 1990s and early 2000s (Figure 25).

The model results in a maximum permissible ABC (max ABC) of 3,150,994 round lb at the target fully selected fishing mortality of F_{50} (Table 1). This is a 1,051,099 round lb increase (50.1%) from the 2025 max ABC of 2,099,895 round lb. The 2026 max ABC is a 51.5% increase from last year's recommended ABC of 2,080,436 round lb, which is more than the recommended maximum 15% annual increase. Accordingly, the recommended ABC for 2026 is 2,392,501 round lb (a 15% increase from the 2025 recommended ABC). Mortality from fishery releases under F_{50}, assuming fixed retention probabilities and a discard mortality rate of 0.16, is estimated to be 178,603 lb, which was included in the max ABC calculation (Tables 1 and 3).

While there is uncertainty in the absolute estimate of sablefish biomass in the NSEI, the population appears to be increasing as the 2013–2020 year classes continue to grow and mature. It is important to note, however, that the population remains below historical levels, and that there is a lack of older fish in the population. Older females likely contribute disproportionately to the spawning output in the population, and it remains desirable to maintain fishing pressure that allows the younger age classes to grow and mature.

FUTURE WORK AND RECOMMENDATIONS

Priorities to improve and further develop the SCAA:

1. Beginning in 2026, the NSEI sablefish survey will transition from longline hook to slinky pot gear. This change will effectively mark the beginning of a new survey, given that pot gear typically selects for smaller sablefish. Additionally, new survey indices require

multiple years of observations to establish temporal trends to inform abundance estimates. The switch in survey gear will necessitate changes to the SCAA model and decisions regarding the incorporation of the new gear type will need to be made. These decisions include how selectivity will be modeled and how many years of survey data will be required to incorporate the new survey CPUE into the SCAA model.

2. It is expected that participation in the pot fishery will continue to increase, as it has in the SSEI and federal fisheries where pots have been legal for several years. This fluctuation will need to be monitored closely to see how catch rates and fish size vary between the longline and pot fisheries. This issue will involve significant model development and will be of primary concern as the fleet changes fishing practices.

3. It is necessary to develop methods to estimate fishery selectivity by examining the effects of the fixed retention curve and exploring other values—including attempting to estimate the parameters of the retention curve within the model. As in the 2023–2025 assessments, initial efforts to estimate fishery selectivity in the 2026 assessment have failed, and it is strongly suspected that this problem will persist without further evaluations of how retention probability is estimated and applied in the model. In addition to evaluating and exploring different methods of modeling retention, efforts to estimate fishery selectivity may also consider including priors on fishery selectivity parameters and exploring time-varying selectivity, which could improve the fit of age and length data.

4. Proper data weighting for the model must continue to be refined by:
    a. Using estimated uncertainty in the indices and allowing the model to estimate extra uncertainty parameters; and,
    b. Continuing to develop the Dirichlet data weighting of the age and length composition data.

5. The mark–recapture analysis must be reviewed for 2 primary reasons:
    a. Determine if less biased estimates of abundance can be produced by modeling size and geographic differences in capture probabilities; and,
    b. Determine the level of bias in the abundance estimates by comparing recapture rates between the longline survey and the fishery.

ACKNOWLEDGEMENTS

Many thanks to ADF&G Region I Groundfish Project staff who have collected NSEI sablefish data, maintained documentation, and worked to improve the conservation and management of this unique fishery. Additionally, we would like to thank the Age Determination Unit staff, who provide age data in a timely manner for stock assessments. We are grateful to Region I analyst/programmers who provided database support and application development. We greatly appreciate the dedication and hard work of our survey vessels, crews, and scientific staff who continue to collect critical data at sea for this assessment. Thanks to Jane Sullivan, the original author of this model, who continues to offer insight and advice in developing the assessment. Finally, we are thankful to the NOAA scientists for their continued collaboration and sharing their sablefish knowledge.

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TABLES AND FIGURES

Table 1.–Summary of key assessment results used to inform management in 2024, 2025, and 2026.

Parameter	2024	2025	2026
Projected total (age 2+) biomass (lb)	61,986,177	68,857,964	69,555,961
Projected female spawning biomass (lb)	24,518,584	27,519,502	28,216,051
Unfished female spawning biomass ($SB_{100\%}$, lb)	30,388,516	30,736,010	30,266,573
Female spawning biomass at F_{50} ($SB_{50\%}$, lb)	15,194,258	15,368,005	15,133,287
max $F_{ABC} = F_{50}$	0.062	0.061	0.071
Recommended F_{ABC}	0.061	0.061	0.054
Mortality from fishery releases (lb)	75,682	81,270	178,603
max ABC (lb)	1,833,775	2,099,895	3,150,994
Recommended ABC (lb)	1,809,075	2,080,436	2,392,501

Note: Acceptable biological catch (ABC)

Table 2.–Annual harvest objective (round lb), equal quota share (EQS; round lb), reported harvest (round lb), exvessel value, number of permits, and effort (days) for the directed commercial Northern Southeast Inside (NSEI) Subdistrict sablefish fishery, 1985–2026.

Year	Annual harvest objective (AHO)	EQS	Harvest (lb)	Exvessel value (mil)	No. of permits	No. of days
1985	2,380,952	NA	2,951,056	$2.0	105	3
1986	2,380,952	NA	3,874,269	$2.9	138	2
1987	2,380,952	NA	3,861,546	$3.4	158	1
1988	2,380,952	NA	4,196,601	$4.4	149	1
1989	2,380,952	NA	3,767,518	$3.5	151	1
1990	2,380,952	NA	3,254,262	$3.1	120	1
1991	2,380,952	NA	3,955,189	$5.5	127	1
1992	2,380,952	NA	4,267,781	$5.4	115	1
1993	2,380,952	NA	5,795,974	$6.6	120	1
1994	4,761,905	38,889	4,708,584	$8.1	121	30
1995	4,761,905	38,889	4,543,272	$9.0	121	30
1996	4,761,905	38,889	4,676,032	$10.1	122	61
1997	4,800,000	39,300	4,752,285	$12.2	122	76
1998	4,800,000	41,700	4,689,713	$7.4	116	76
1999	3,120,000	28,000	3,043,272	$6.5	112	76
2000	3,120,000	28,600	3,081,797	$8.6	111	76
2001	2,184,000	19,600	2,142,619	$4.6	111	76
2002	2,005,000	18,400	2,009,379	$5.3	109	76
2003	2,005,000	18,565	2,003,083	$4.8	108	93
2004	2,245,000	20,787	2,230,396	$4.6	108	93
2005	2,053,000	19,400	2,027,187	$5.0	106	93
2006	2,053,000	19,550	2,031,227	$5.1	105	93
2007	1,488,000	14,500	1,501,483	$3.7	103	93
2008	1,508,000	15,710	1,513,043	$4.4	96	93
2009	1,071,000	12,170	1,069,217	$3.3	88	93
2010	1,063,000	12,218	1,054,279	$3.8	87	93
2011	880,000	10,602	882,777	$4.4	83	93
2012	975,000	12,342	969,775	$3.9	79	93
2013	1,002,162	12,848	972,740	$2.6	78	93
2014	745,774	9,561	773,534	$2.7	78	93
2015	786,748	10,087	781,702	$3.1	78	93
2016	650,754	8,343	646,329	$2.8	78	93
2017	720,250	9,234	714,404	$3.6	78	93
2018	855,416	10,967	855,600	$4.2	78	93
2019	920,093	11,796	909,341	$4.0	78	93
2020	1,108,003	14,773	1,101,094	$3.3	75	93
2021	1,137,867	15,587	1,083,363	$3.6	73	93
2022	1,233,633	16,899	1,184,115	$4.3	73	93
2023	1,393,659	19,091	1,277,328	$3.4	73	93
2024	1,542,444	21,129	1,392,959	$2.8	73	93
2025	1,789,671	24,516	1,571,054	$3.5	73	93
2026	2,142,882	29,355	–	–	73	93

Note: NA indicates information not applicable for the given year because the EQS was implemented in 1994. En dashes indicate forthcoming data.

Table 3.–Sablefish acceptable biological catch (ABC), model decrement types and amounts, 2021–2026.

	2021	2022	2023	2024	2025	2026
ABC	1,255,056	1,443,314	1,573,109	1,809,075	2,080,436	2,392,501
Decrement type (round lb)						
Bycatch mortality in halibut fishery[a]	38,124	35,406	38,653	77,436	78,849	70,146
ADF&G longline survey removal*[a]	42,499	95,502	75,636	117,849	140,080	112,476
Guided sport fish harvest[b]	753	33,990	34,395	41,464	43,087	38,141
Unguided sport fish harvest[b]	5,631	9,846	2,655	6,085	7,291	7,293
Mortality from fishery deadloss[a]	10,888	11,085	9,467	6,553	6,448	9,935
Subsistence and personal use harvest[b]	19,295	23,852	18,643	17,245	15,010	11,630
Total decrements	117,189	209,681	179,450	266,631	290,765	249,619
Annual harvest objective	1,137,867	1,233,633	1,393,659	1,542,444	1,789,671	2,142,882
Permit holders	73	73	73	73	73	73
Equal quota share	15,587	16,899	19,091	21,129	24,516	29,355

Note: Asterisk (*) indicates data excludes catch retained by permit holders for their equal quota share.

[a] Projected estimate of mortality for the current season.

[b] Estimate of mortality that occurred during the previous season and is applied as decrement for the current season.

Table 4.–Variable definitions for the statistical catch-at-age model: indexing and model dimensions.

Variable	Definition
T	Number of years in the model
t	Index for year in model equations
A	Number of ages in the model
a	Index for age in model equations
a_0	Recruitment age (age-2)
$a+$	Plus group age (age-31)
l	Index for length bin in model equations
l_0	Recruitment length bin (41 cm)
$l+$	Plus group length bin (99 cm)
fsh	NSEI longline fishery
srv	ADF&G longline survey
MR	Mark–recapture abundance

Table 5.–Variable definitions for the statistical catch-at-age model: parameters.

Variable	Definition
M	Instantaneous natural mortality
F	Instantaneous fishing mortality
Z	Total instantaneous mortality
S	Total annual survival
D	Discard mortality
S_{50}	Age at which 50% of individuals are selected to the gear
S_{95}	Age at which 95% of individuals are selected to the gear
δ	Slope parameter in the logistic selectivity curve
q	Catchability
μ_R	Mean log recruitment
τ_t	Log recruitment deviations
μ_N	Mean log initial numbers-at-age
ψ_a	Log deviations of initial numbers-at-age
σ_R	Variability in recruitment and initial numbers-at-age
μ_F	Mean log fishing mortality
ϕ_t	Log fishing mortality deviations
θ	Dirichlet-multinomial parameter related to effective sample size

Table 6.–Variable definitions for the statistical catch-at-age model: data and predicted variables.

Variable	Definition
w_a	Weight-at-age
p_a	Proportion mature-at-age
r_a	Proportion female-at-age
R	Retention probability
s_a	Selectivity-at-age
$\Omega_{a',a}$	Ageing error matrix (proportion obs. At age given the true age)
Λ_a, l, k	Age-length key (proportion in length bin given age and sex)
N	Numbers-at-age
C	Landed catch in numbers-at-age
$I, \hat{I}$	Indices of abundance, $\hat{I}$ are the predicted values
$P_l, \hat{P}_l$	Length compositions, $\hat{P}_l$ are the predicted values
$P_a, \hat{P}_a$	Age compositions, $\hat{P}_a$ are the predicted values
$Y, \hat{Y}$	Landed catch biomass, $\hat{Y}$ are the predicted values
$\widehat{W}$	Estimated mortality from discards (biomass)
λ	Weight for likelihood component
L	Likelihood
ω	Effective sample size
n	Input sample size for Dirichlet-multinomial likelihood
c	Small constant

Table 7.–A summary of data inputs to the mark–recapture models, including total individuals tagged (K), the total number of tags remaining once size selectivity is accounted for (K_0), tags not available to the longline survey or fishery (captured in other fisheries or outside Chatham Strait, D_0), recaptured individuals in the longline survey and fishery (k_{srv} and k_{fsh}), number of sampled individuals in the longline survey and fishery (n_{srv} and n_{fsh}), tags not available to the fishery (captured outside Chatham Strait or in other fisheries during the survey, D_{srv}, and tags recaptured in other fisheries or outside Chatham Strait during the fishery (D_{fsh}) for years with a tagging survey, 2005–2022.

Year	K	K_0	D_0	k_{srv}	n_{srv}	D_{srv}	k_{fsh}	n_{fsh}	D_{fsh}
2005	7,118	7,118	9	0	0	104	690	180,999	189
2006	5,325	5,325	3	0	0	46	503	203,878	123
2007	6,158	6,055	2	0	0	43	335	150,729	77
2008	5,450	5,412	4	40	15,319	54	431	156,313	104
2009	7,071	7,054	7	0	0	51	285	105,709	92
2010	7,443	7,307	4	54	14,765	60	331	106,201	38
2012	7,582	7,548	23	0	0	70	380	97,134	72
2013	7,961	7,921	24	0	0	89	374	99,286	113
2015	6,862	6,765	1	0	0	73	242	70,273	49
2017	7,096	6,933	3	0	0	42	197	60,409	11
2018	9,678	9,160	13	0	0	77	183	65,940	142
2019	11,094	10,208	6	0	0	51	201	71,044	122
2020	7,916	7,824	6	0	0	75	240	103,190	129
2022	8,654	8,638	8	46	22,745	62	334	162,074	233

Note: No mark–recapture experiment conducted in 2011, 2014, 2016, 2021, 2023, 2024 or 2025.

Table 8.–Negative likelihood (NLL) values and percent of each component to the total likelihood for the sablefish model.

Likelihood component	NLL	Percent of NLL
Catch	15.3	0.7
Fishery CPUE	271.3	13.3
Survey CPUE	92.5	4.5
Mark–recapture abundance	83.7	4.1
Fishery ages	281.7	13.8
Survey ages	262.7	12.9
Fishery lengths	446.8	21.9
Survey lengths	585.6	28.7
Data likelihood	2039.6	100.0
Fishing mortality penalty	1.4	0.1
Recruitment likelihood	17.3	0.9
SPR penalty	0.0	0.0
Sum of catchability priors	9.6	0.5
Total likelihood	2068.0	101.4

Table 9.–Statistical catch-at-age model parameter estimates for the sablefish model.

Parameter	Estimate	Standard error (log space)
Survey male selectivity pre-2000, s_{50}	7.27	fixed
Survey male selectivity 2000–2016, s_{50}	6.52	0.121
Survey male selectivity 2017–2025, s_{50}	3.07	1.025
Survey male selectivity pre-2000, δ	0.491	fixed
Survey male selectivity 2000–2016, δ	0.551	0.154
Survey male selectivity 2017–2025, δ	20.32	15.325
Survey female selectivity pre-2000, s_{50}	4.34	0.201
Survey female selectivity 2000–2016, s_{50}	4.41	0.078
Survey female selectivity 2017–2025, s_{50}	3.06	1.05
Survey female selectivity pre-2000, δ	1.209	0.33
Survey female selectivity 2000–2016, δ	1.349	0.157
Survey female selectivity 2017–2025, δ	18.63	18.154
Pre-EQS catchability $\ln(q_{fsh}$, pre-EQS)	-17.51	0.044
EQS catchability 1995–2021, $\ln(q_{fsh}$, EQS)	-16.36	0.026
EQS catchability 2022–2025, $\ln(q_{fsh}$, EQS)	-16.52	0.052
Survey catchability pre-2000, $\ln(q_{srv})$	-16.72	0.05
Survey catchability 2000–2016, $\ln(q_{srv})$	-16.56	0.041
Survey catchability 2017–2025, $\ln(q_{srv})$	-17.12	0.037
Mark–recapture catchability $\ln(q_{MR})$	-0.0439	0.01
Mean recruitment μ_R	474,568	0.11
Mean initial numbers-at-age μ_N	421,693	0.182
Mean fishing mortality μ_F	0.54	0.314

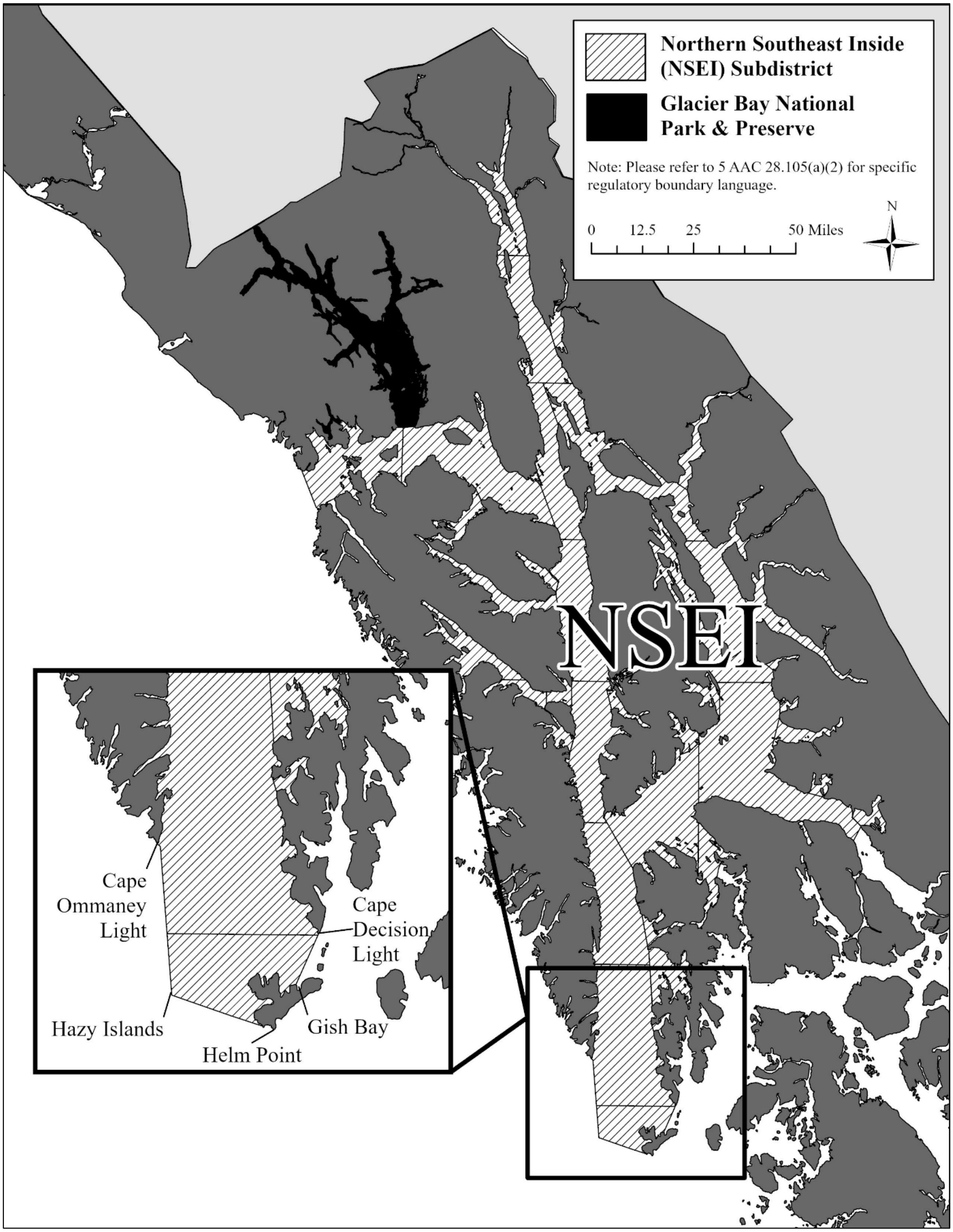


Figure 1.–Northern Southeast Inside (NSEI) Subdistrict including restricted waters of Glacier Bay National Park and Preserve.

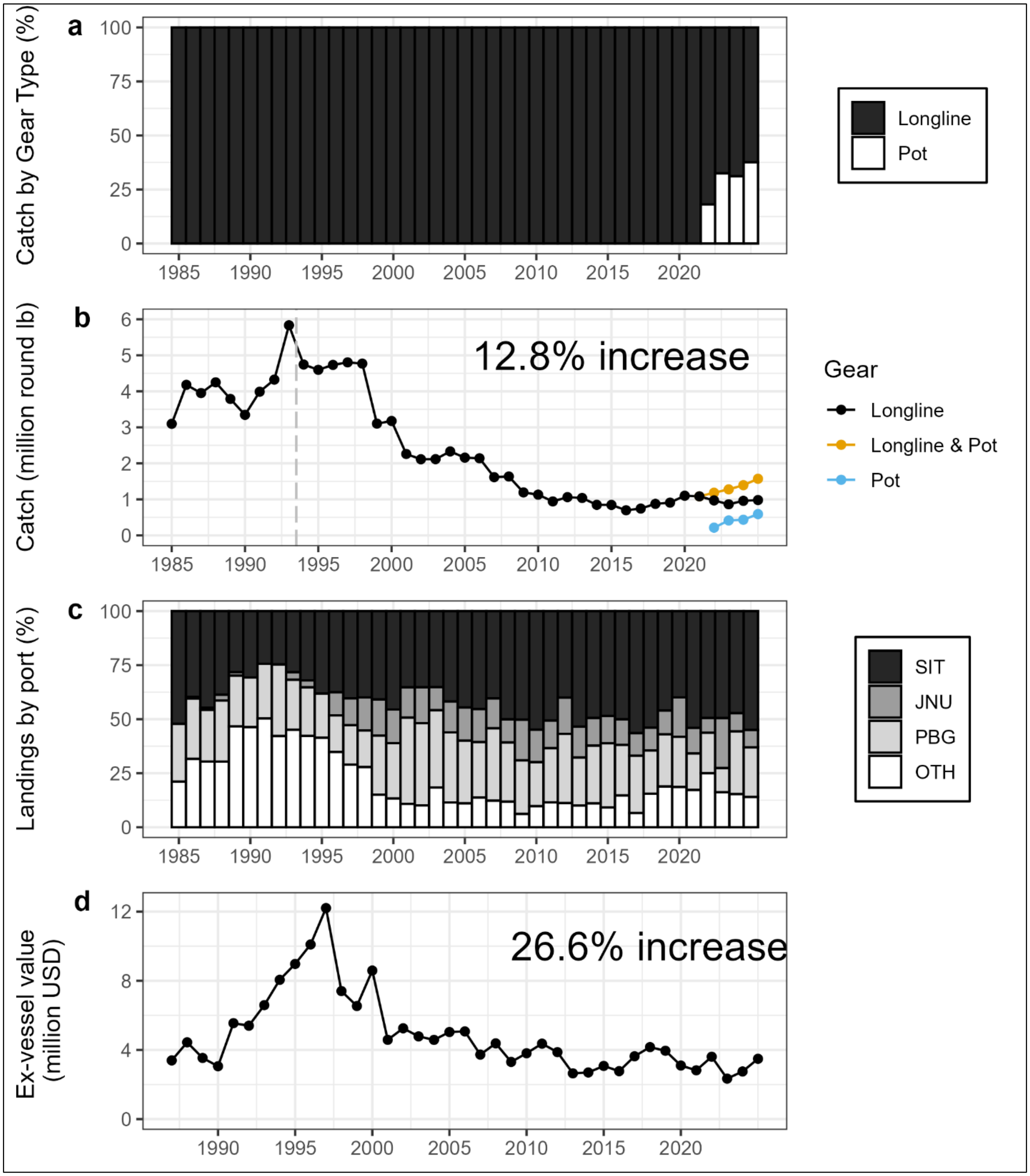


Figure 2.–Proportion of catch by (a) gear type, (b) catch, (c) landings by port, and (d) exvessel value for Northern Southeast Inside (NSEI) Subdistrict commercial sablefish 1985–2025. The noted increases are for 2024 to 2025 catch and exvessel value.

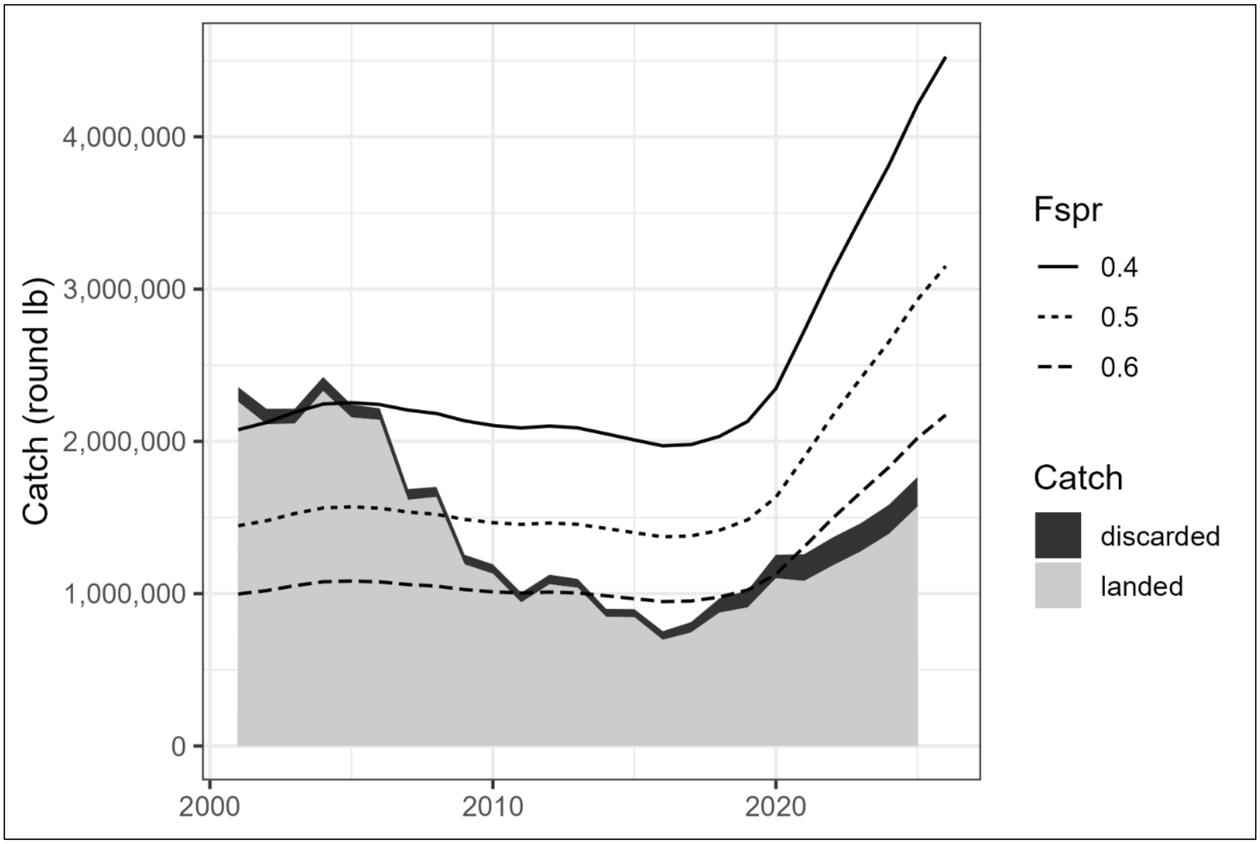


Figure 3.–Estimated catch in the Northern Southeast Inside (NSEI) Subdistrict fishery from 2000–2025 and the relationship to F_{40}, F_{50} and F_{60} (F_{spr}), the fishing mortality that results in a spawning potential ratio (SPR) of 40, 50, and 60% of the population's virgin state, respectively, in the model. The 2026 F_{spr} values reflects the model projections.

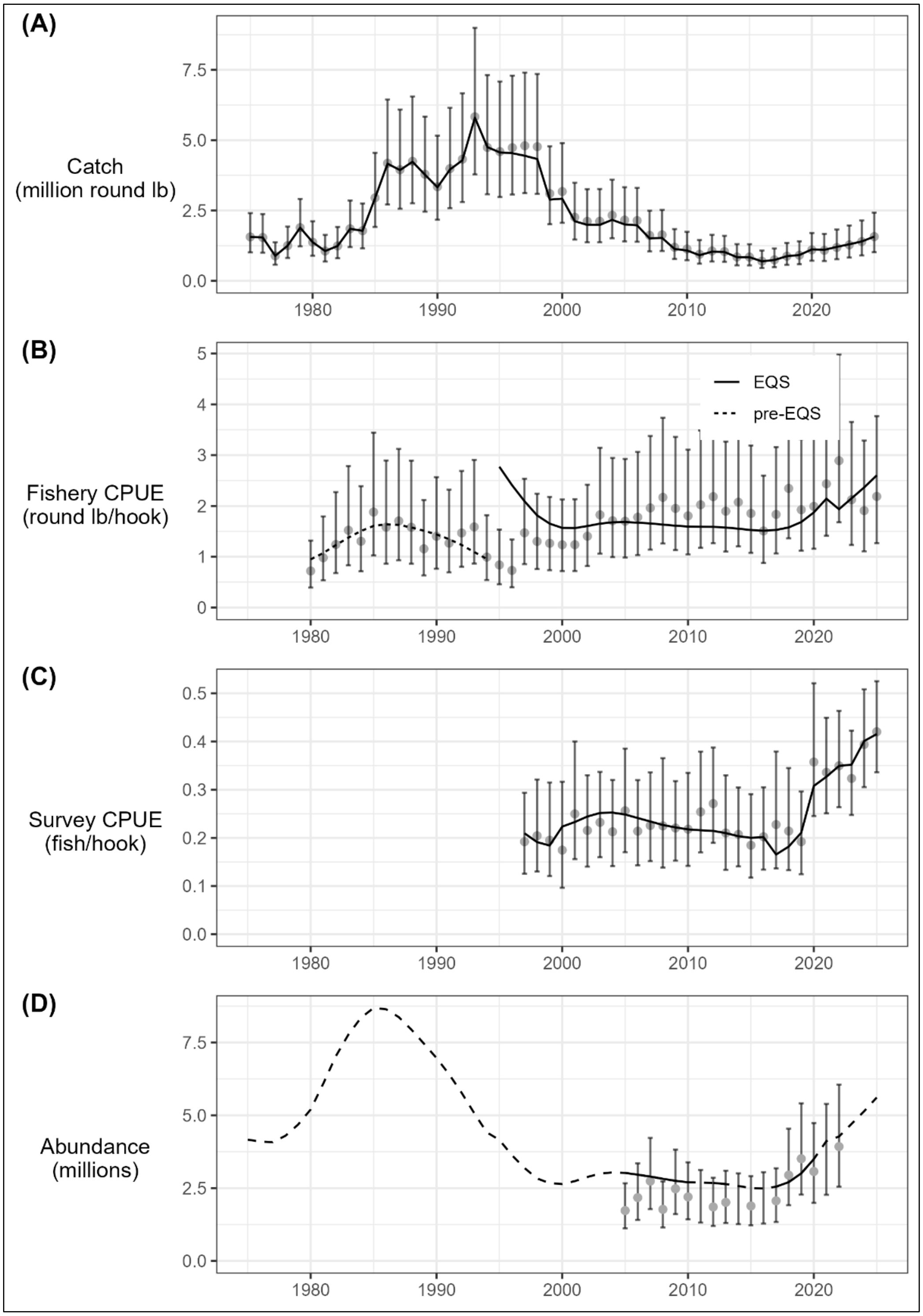


Figure 4.– Fits to indices of catch and abundance with the assumed error distribution shown as shaded grey polygons. Input data are shown as grey points and model fits are shown in black. Indices include: (A) harvest (million round lb); (B) fishery CPUE in round lb per hook with separate selectivity and catchability time periods before and after the implementation of the EQS program in 1994; (C) survey CPUE in number of fish per hook; and (D) mark–recapture abundance estimates in millions. Solid and dashed lines in (D) reflect years for which data were and were not available, respectively.

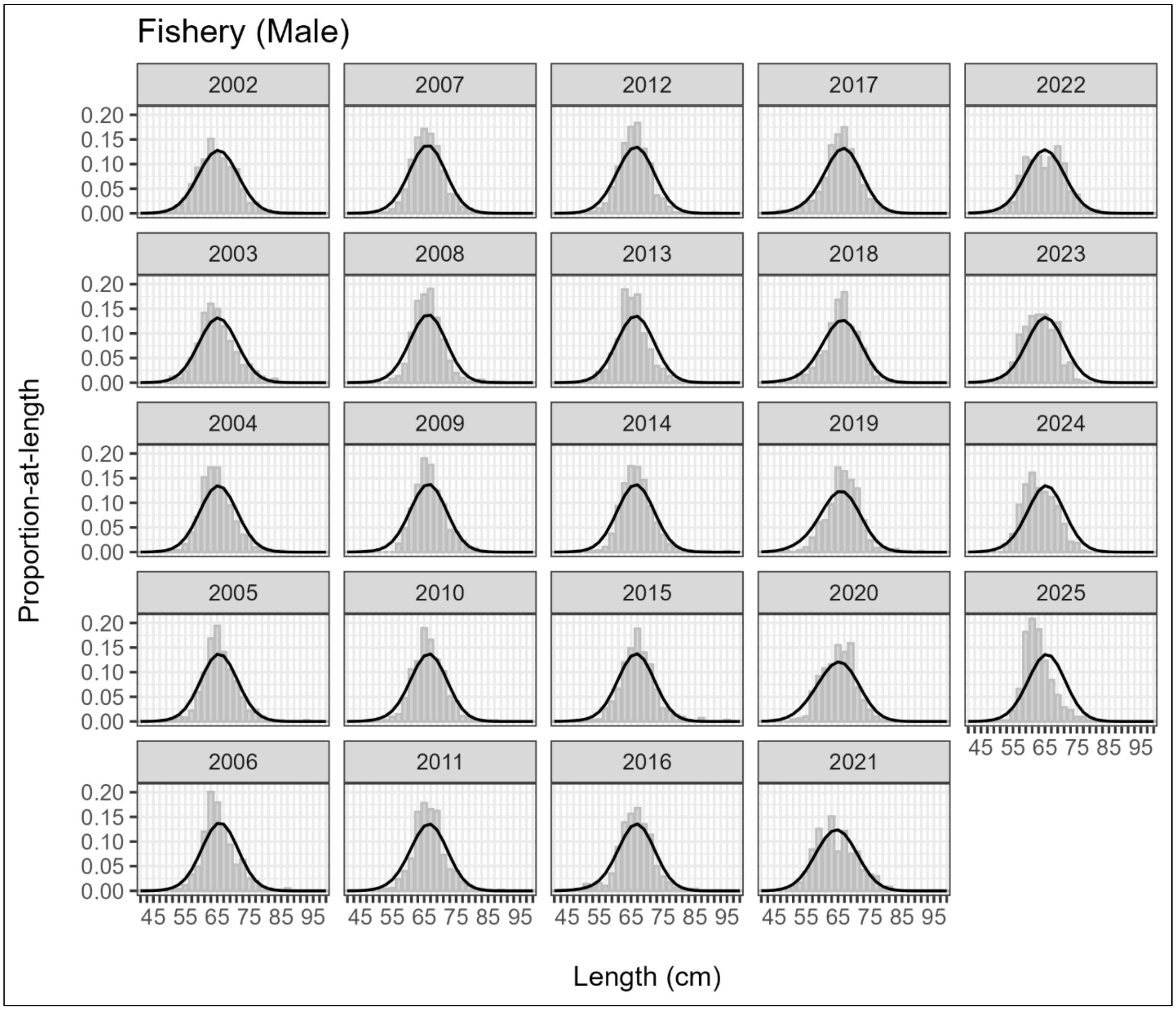


Figure 5.–Fits to male fishery length compositions, 2002–2025. Observed and predicted proportions-at-age shown as grey bars and black lines, respectively.

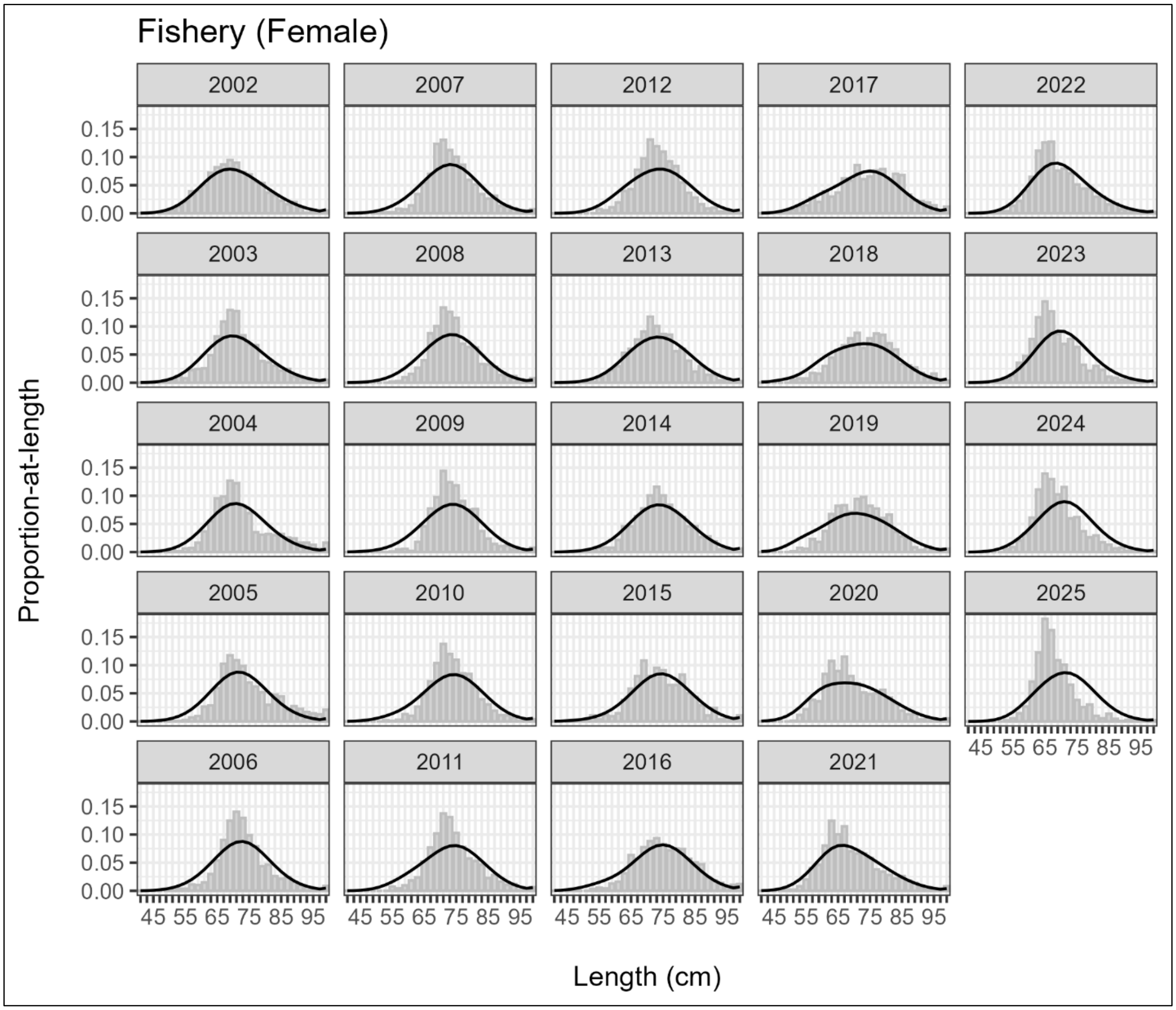


Figure 6.–Fits to female fishery length compositions, 2002–2025. Observed and predicted proportions-at-age shown as grey bars and black lines, respectively.

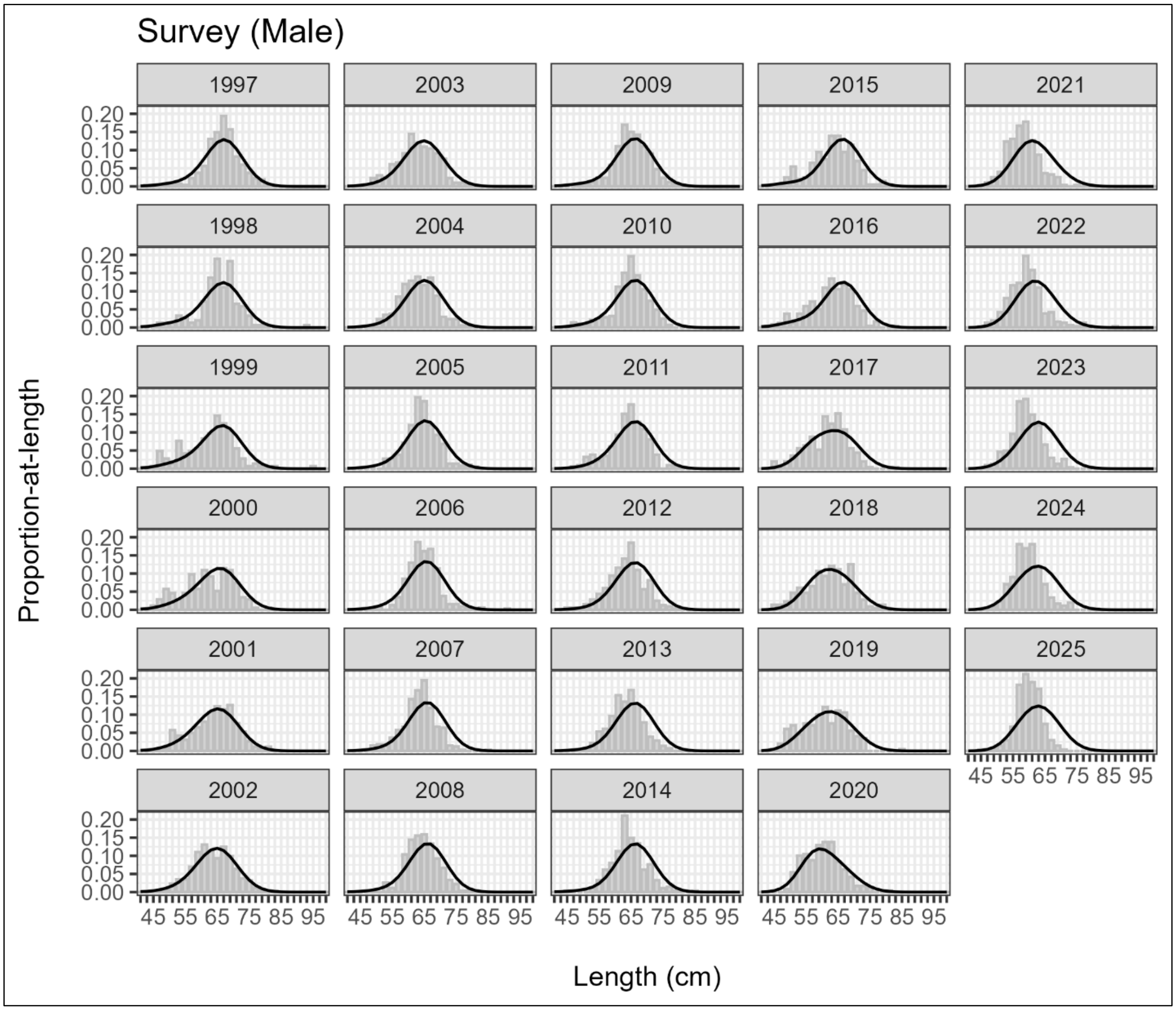


Figure 7.–Fits to male survey length compositions, 1997–2025. Observed and predicted proportions-at-age shown as grey bars and black lines, respectively.

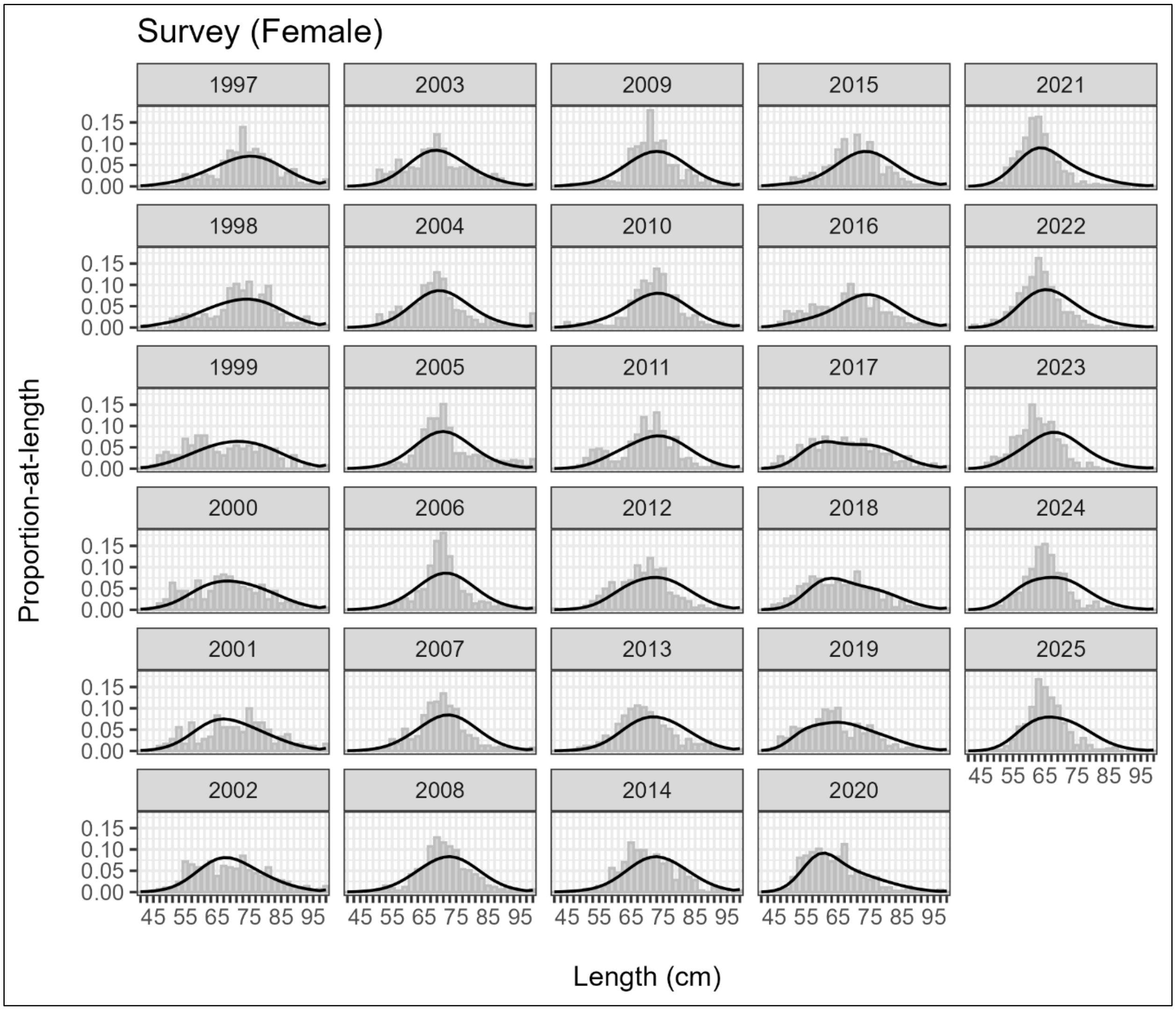


Figure 8.–Fits to female survey length compositions, 1997–2025. Observed and predicted proportions-at-age shown as grey bars and black lines, respectively.

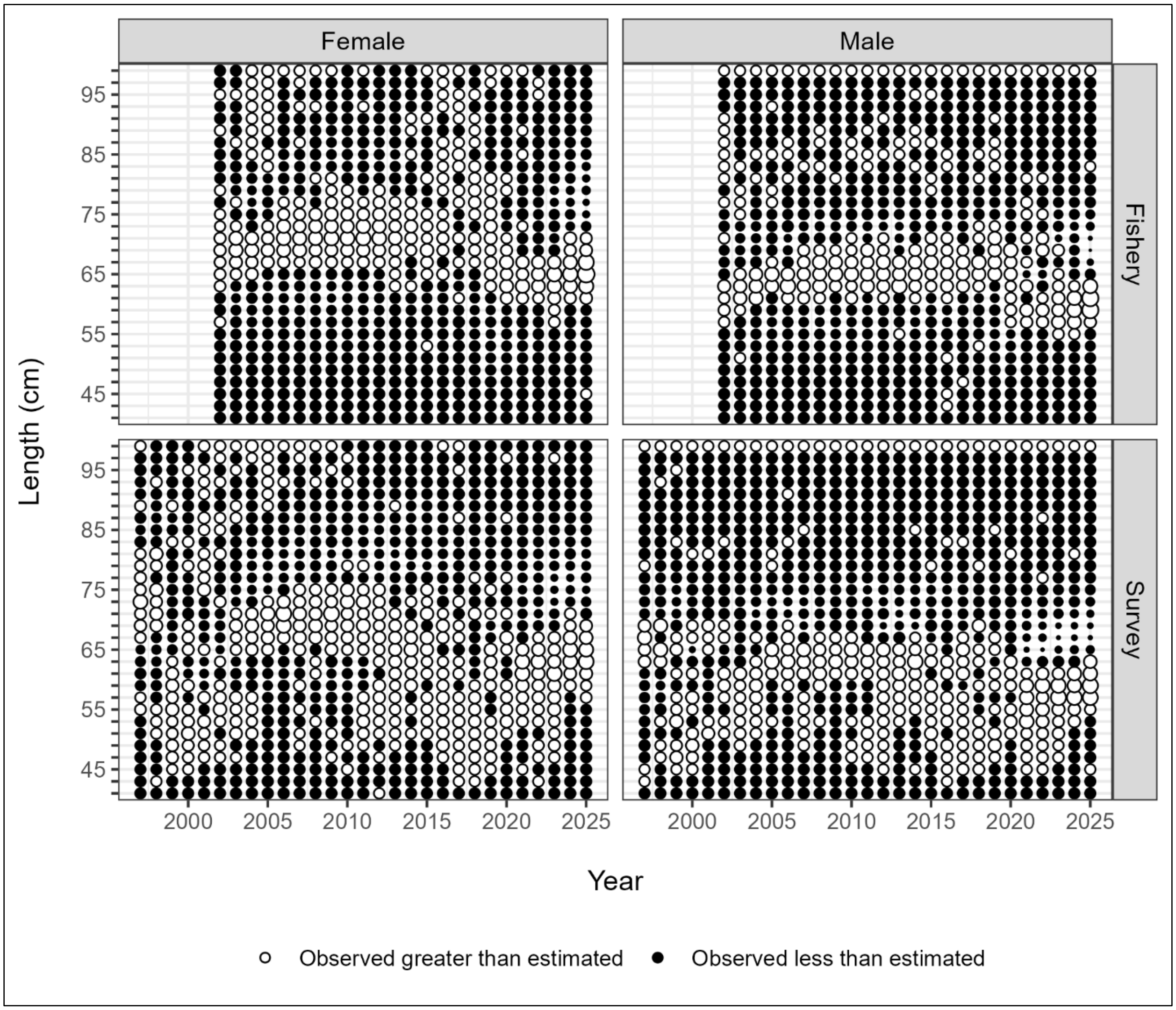


Figure 9.–Standardized residuals of fits to fishery (2002–2025) and survey (1997–2025) length compositions for males and females. Size of residual scales to point size. Black points represent negative residuals (observed < predicted); white points represent positive residuals (observed > predicted).

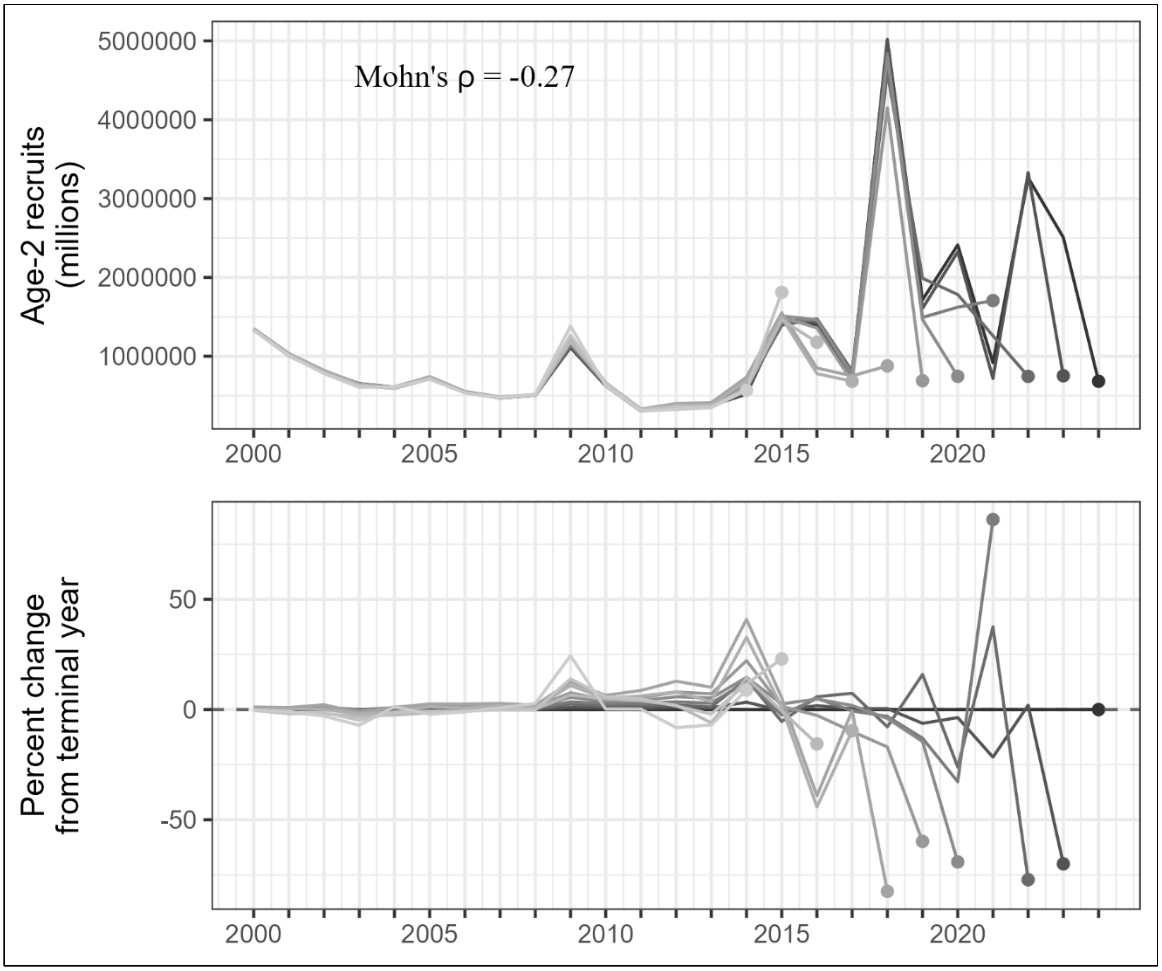


Figure 10.–Mohn's ρ and retrospective peels of estimated sablefish recruitment.

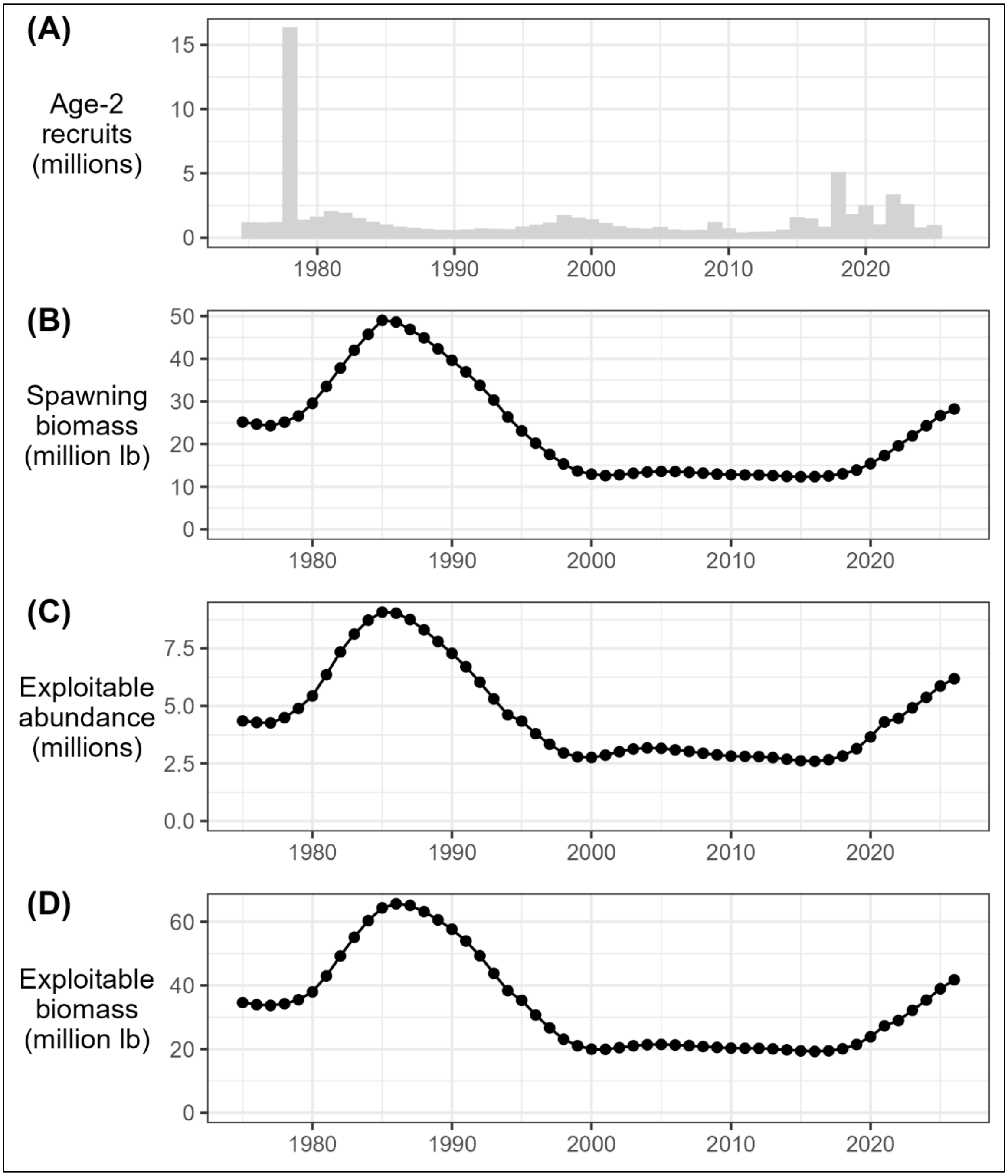


Figure 11.–Model estimates of (A) age-2 recruitment (millions); (B) female spawning stock biomass (million pounds); (C) exploitable abundance (millions); and (D) exploitable biomass (million pounds). The 2026 points are model predictions.

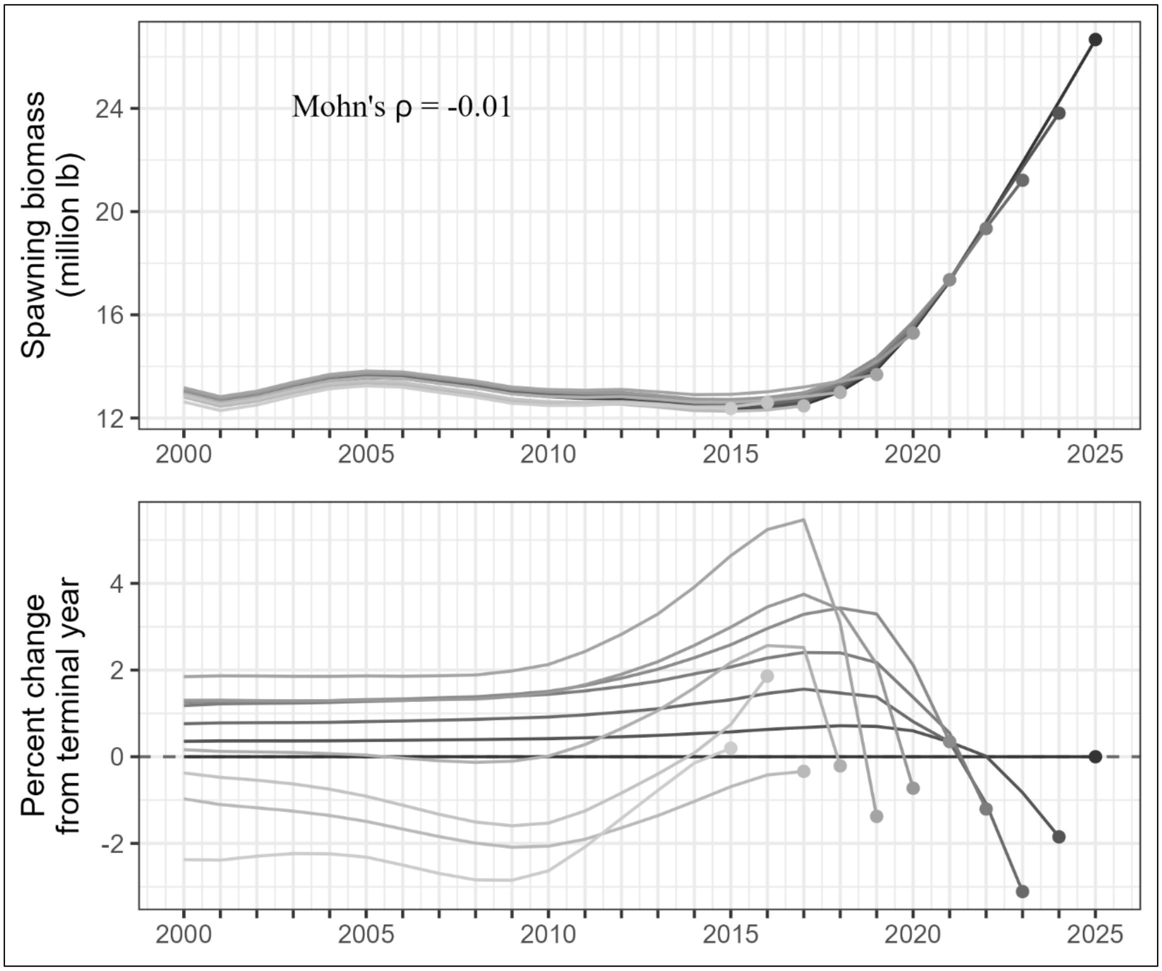


Figure 12.–Mohn's ρ and retrospective peels of estimated sablefish spawning biomass

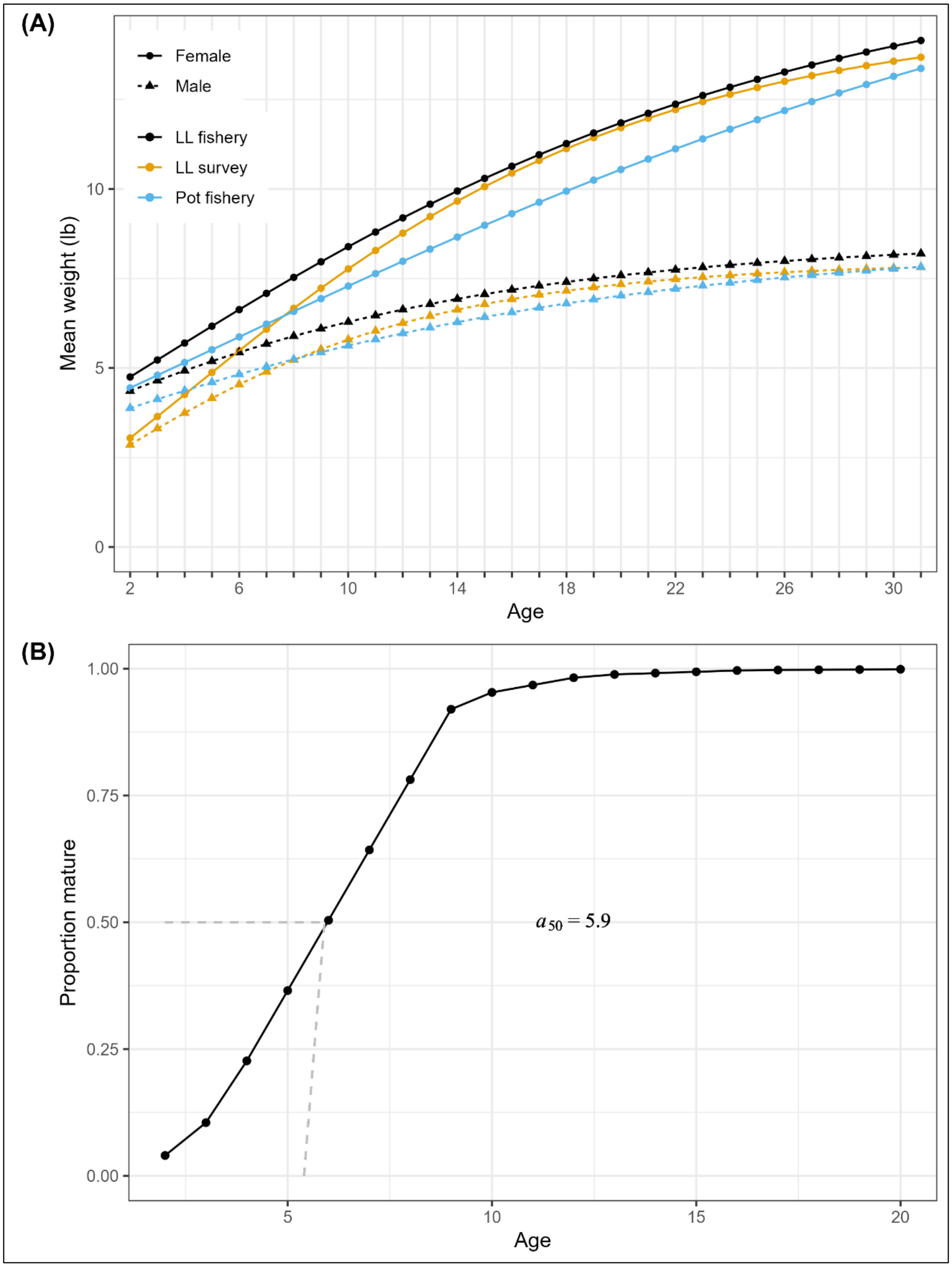


Figure 13.– Biological inputs to the statistical catch-at-age model, including: (A) von Bertalanffy growth model predictions of weight-at-age (lb) by sex from the longline fishery (black), pot fishery (blue), and ADF&G longline survey (gold), and (B) proportion mature at age for females estimated from the longline survey with the age at 50% maturity (a_{50} = 5.9 yr) indicated by the dashed grey line.

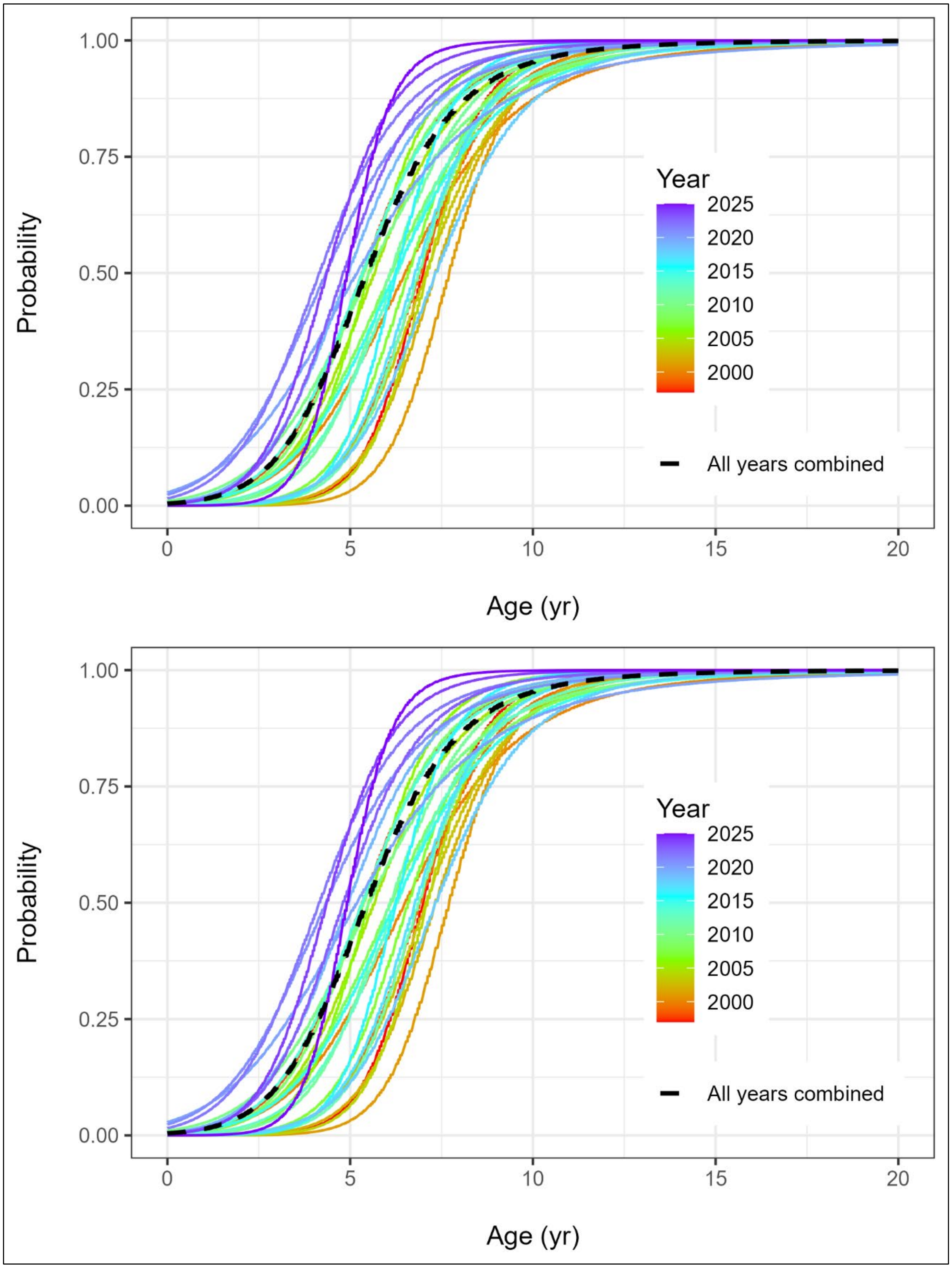


Figure 14.–Changes in maturity-at-age (top panel) and -length (bottom panel) over time in the Northern Southeast Inside (NSEI) Subdistrict sablefish population, showing a general trend of fish maturing at younger ages and smaller sizes.

Figure 15.–Comparison of the mean length and age in the longline (LL) and pot fisheries and longline survey since 1997 for male and female sablefish in the Northern Southeast Inside (NSEI) Subdistrict. The pot fishery is only included for 2022–2025 when pot gear became a legal gear type in the fishery. The fishery data is sampled from retained catch.

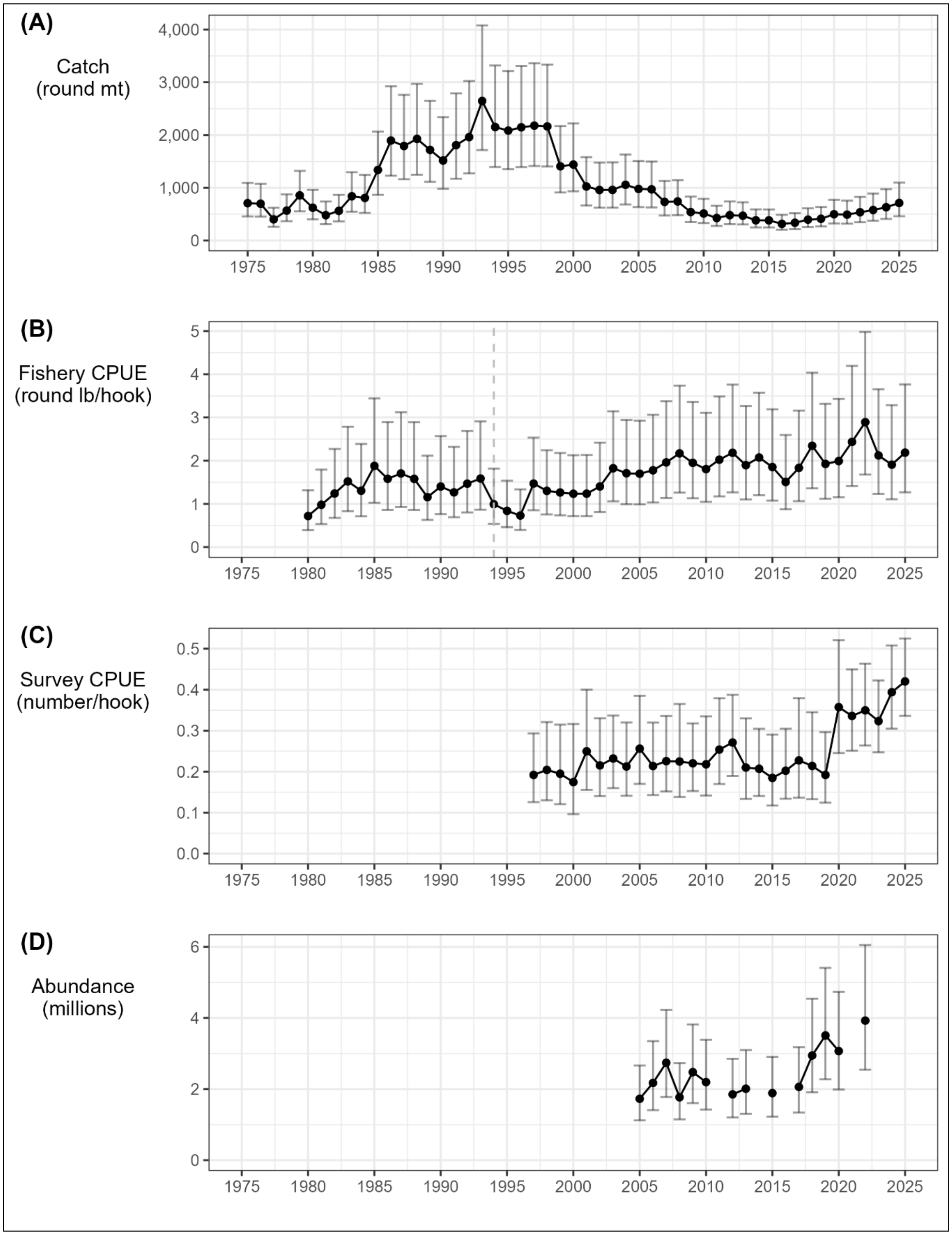


Figure 16.–Indices of catch and abundance with the assumed error distribution, including: (A) harvest (round mt); (B) fishery catch per unit effort in round lb per hook; (C) survey catch per unit effort in number of fish per hook; and (D) mark–recapture abundance estimates in millions. The dashed vertical line in 1994 marks the transition to the Equal Quota Share program.

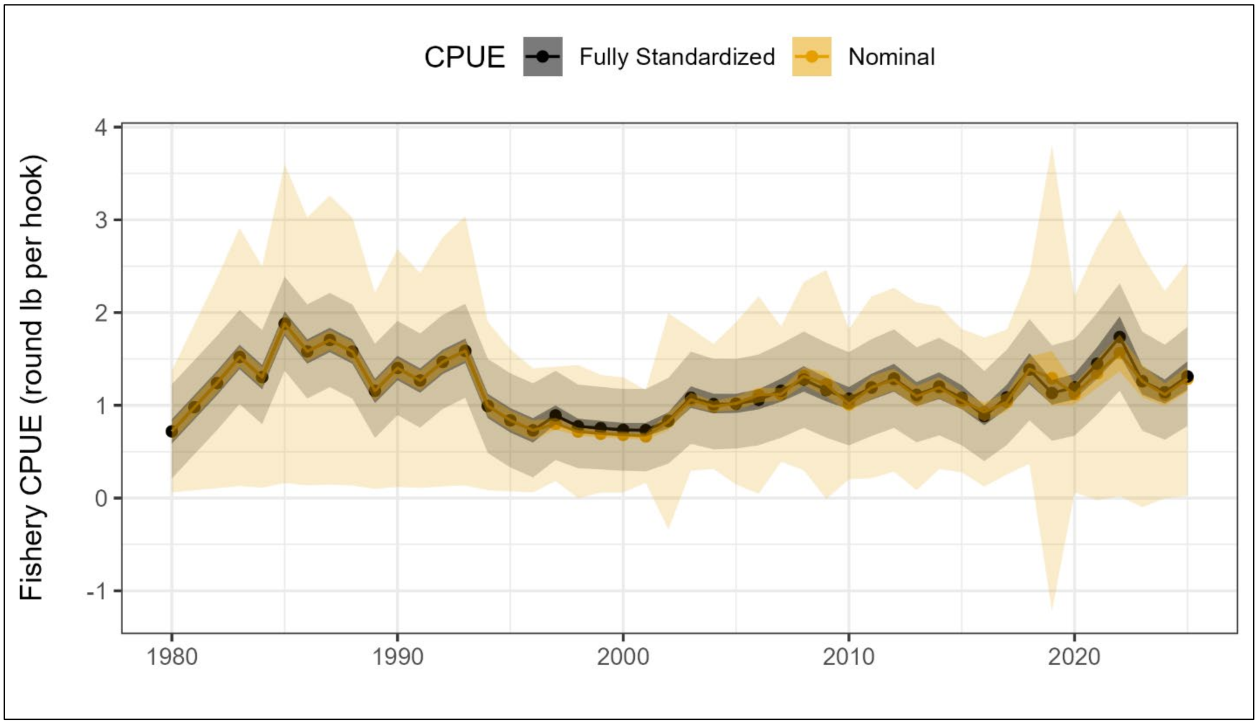


Figure 17.–Nominal (orange) versus fully standardized (black) catch per unit effort (CPUE) in the NSEI Subdistrict longline sablefish fishery in round lb per hook. The fully standardized CPUE values were used in this assessment.

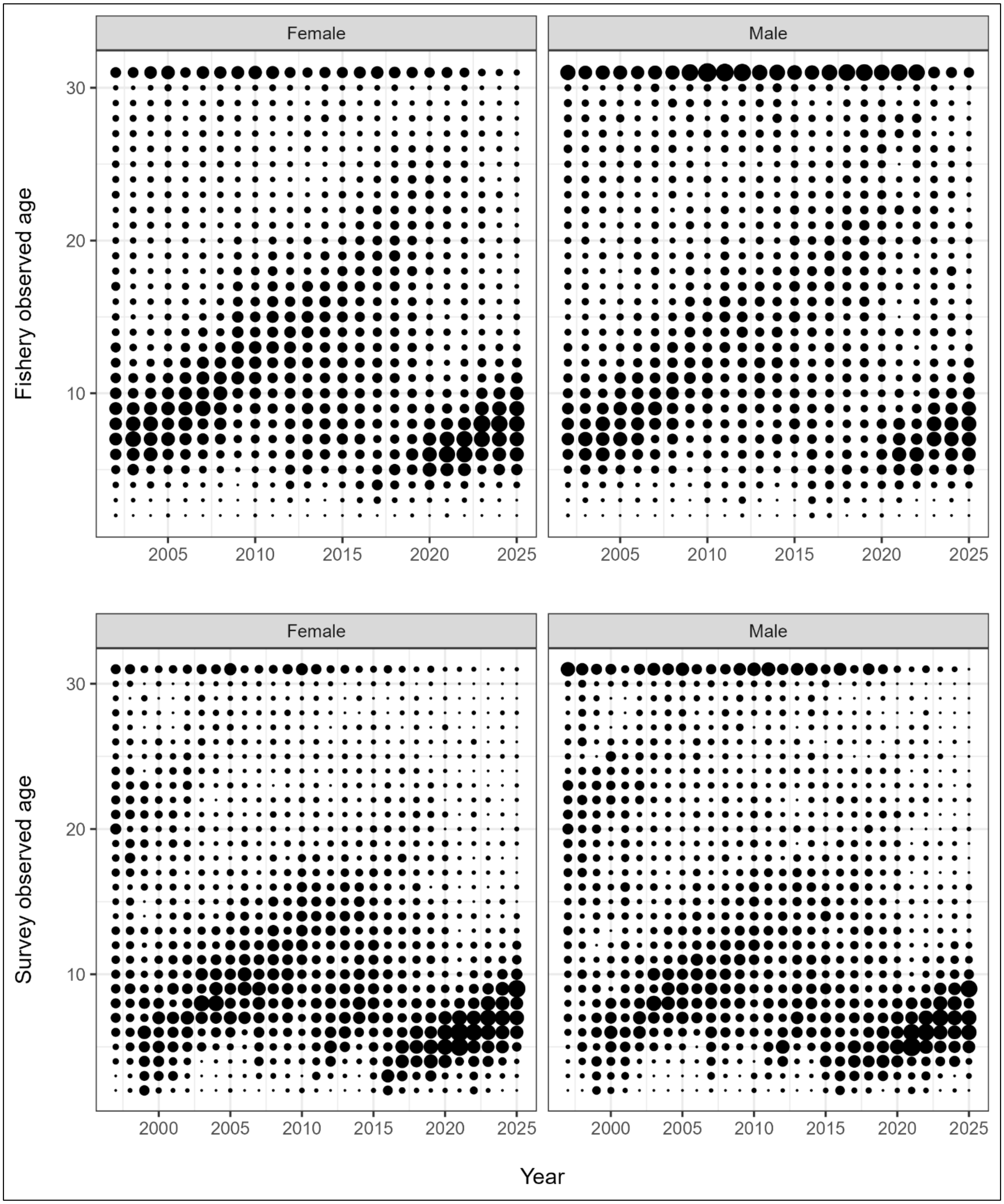


Figure 18.–Fishery age compositions by sex for the Northern Southeast Inside (NSEI) Subdistrict longline fishery (2002–2025, top row) and ADFG longline survey (1997–2025, bottom row).

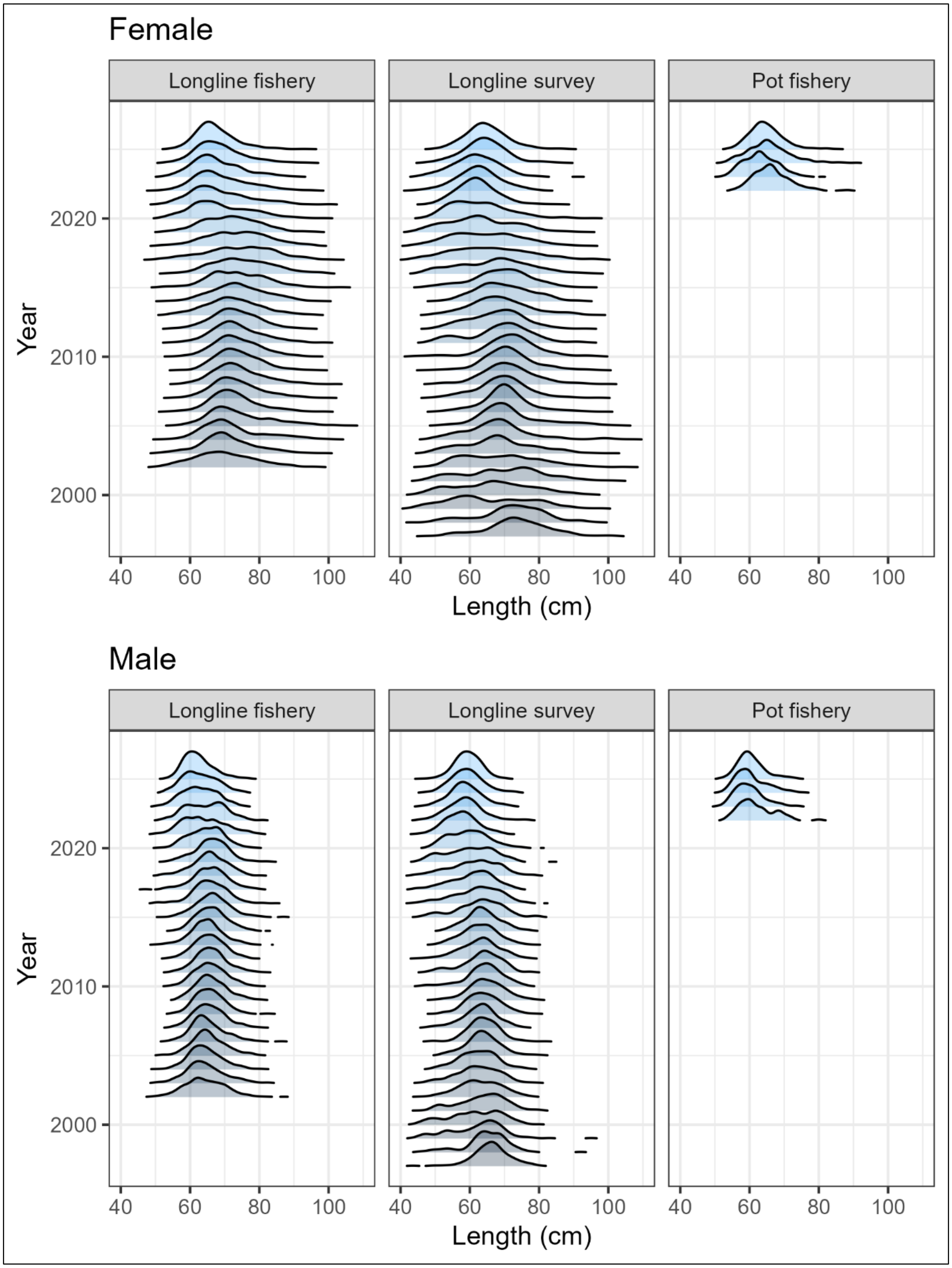


Figure 19.–Longline fishery, pot fishery, and survey length distributions by sex from 1997–2025.

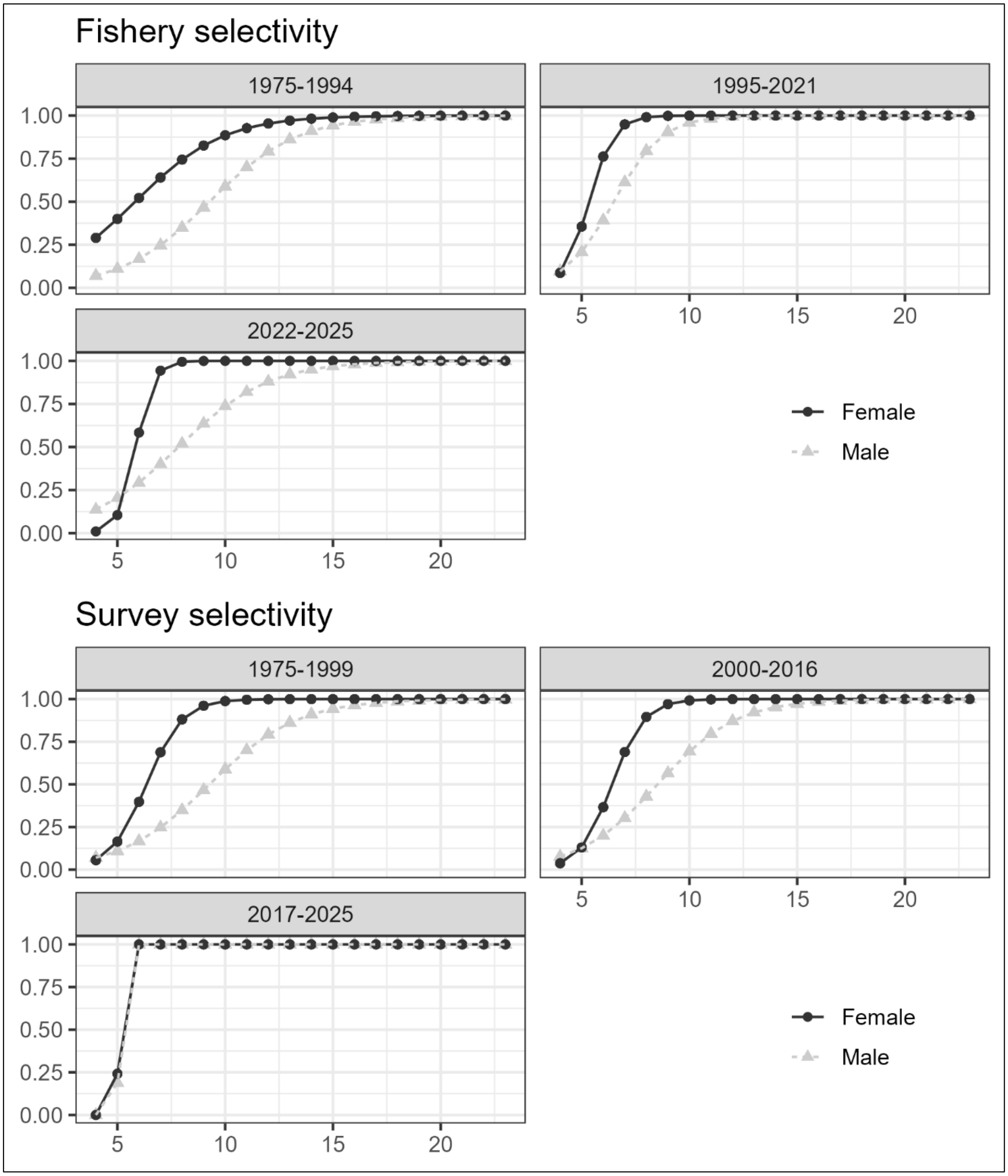


Figure 20.–Fishery selectivity (top): fixed age-based selectivity curves for the fishery before the Equal Quota Share (EQS) program started in 1994 (pre-EQS), the fishery since the implementation of EQS while it was solely longline gear (1995–2021), the fishery since it became a mixed gear fishery (2022–present). Survey selectivity (bottom): ADF&G longline survey for females (black) and males (grey) before the standardization of the survey in 2000, and for the time blocks of 2000–2016 and 2017–2025. In the 2026 assessment, survey selectivity was fixed for males in the first time-block (consistent with the 2023 and 2024 assessments) and all other selectivity parameters were freely estimated within the model.

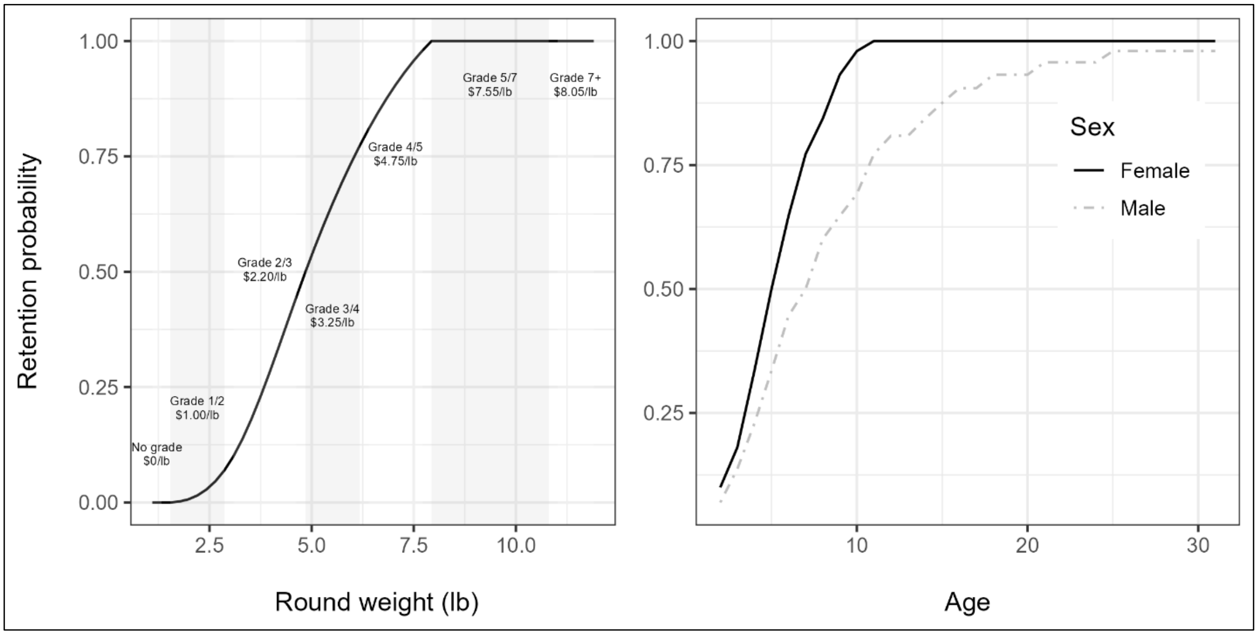


Figure 21.–Probability of retaining a fish as a function of weight (left), sex, and age (right).

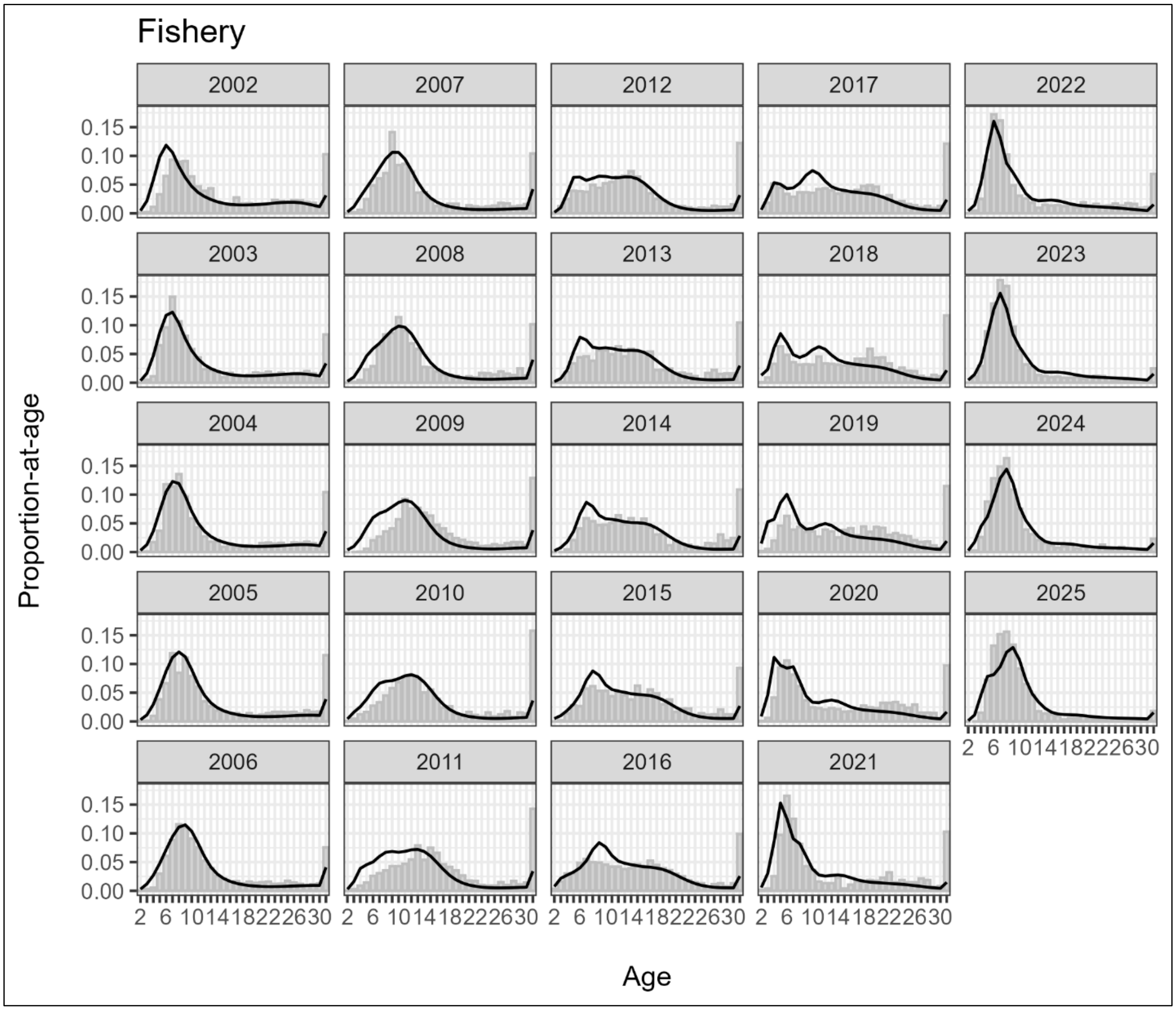


Figure 22.–Fits to fishery age compositions, 2002–2025. Observed and predicted proportions-at-age shown as grey bars and black lines, respectively.

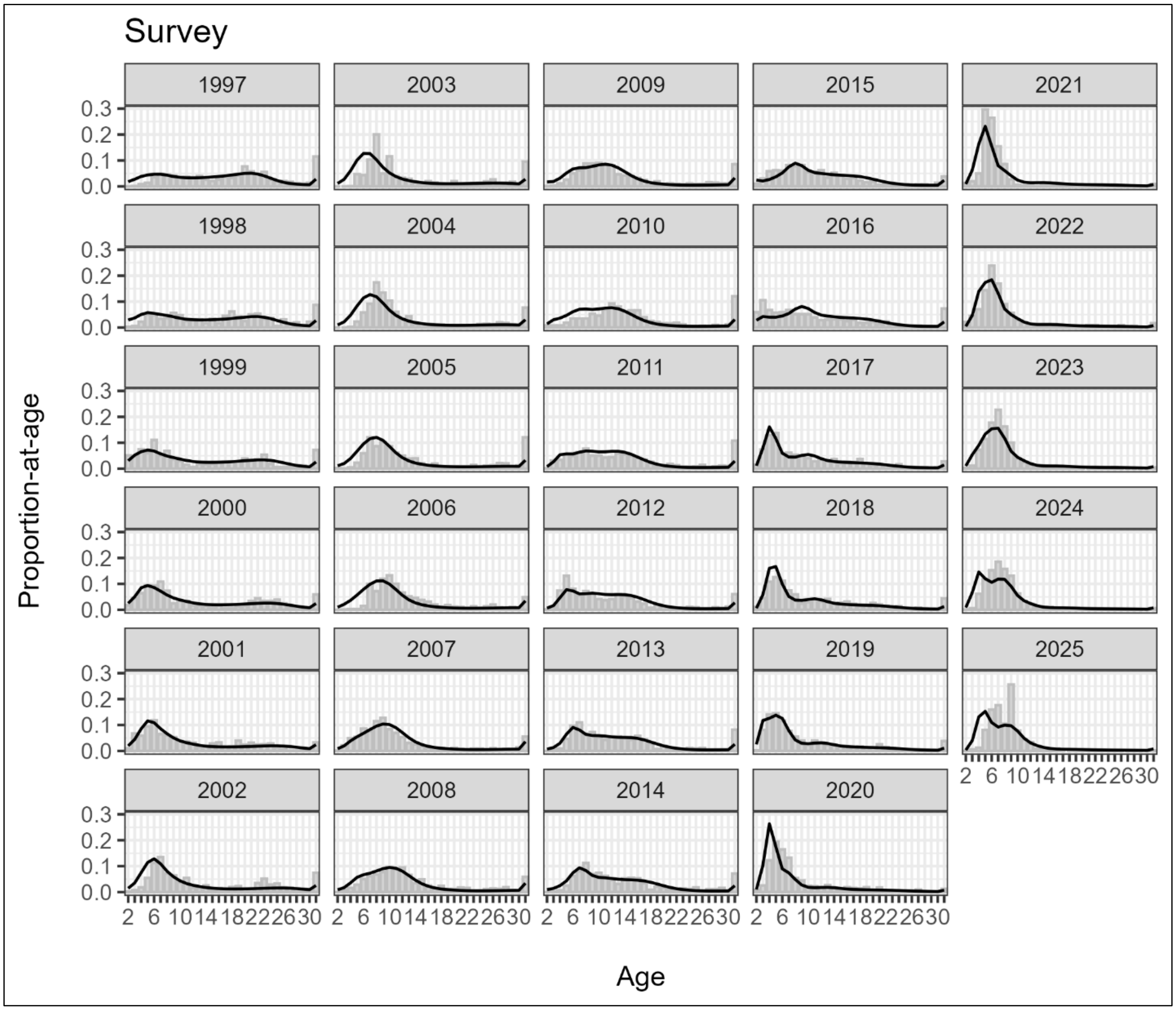


Figure 23.–Fits to survey age compositions, 1997–2025. Observed and predicted proportions-at-age shown as grey bars and black lines, respectively.

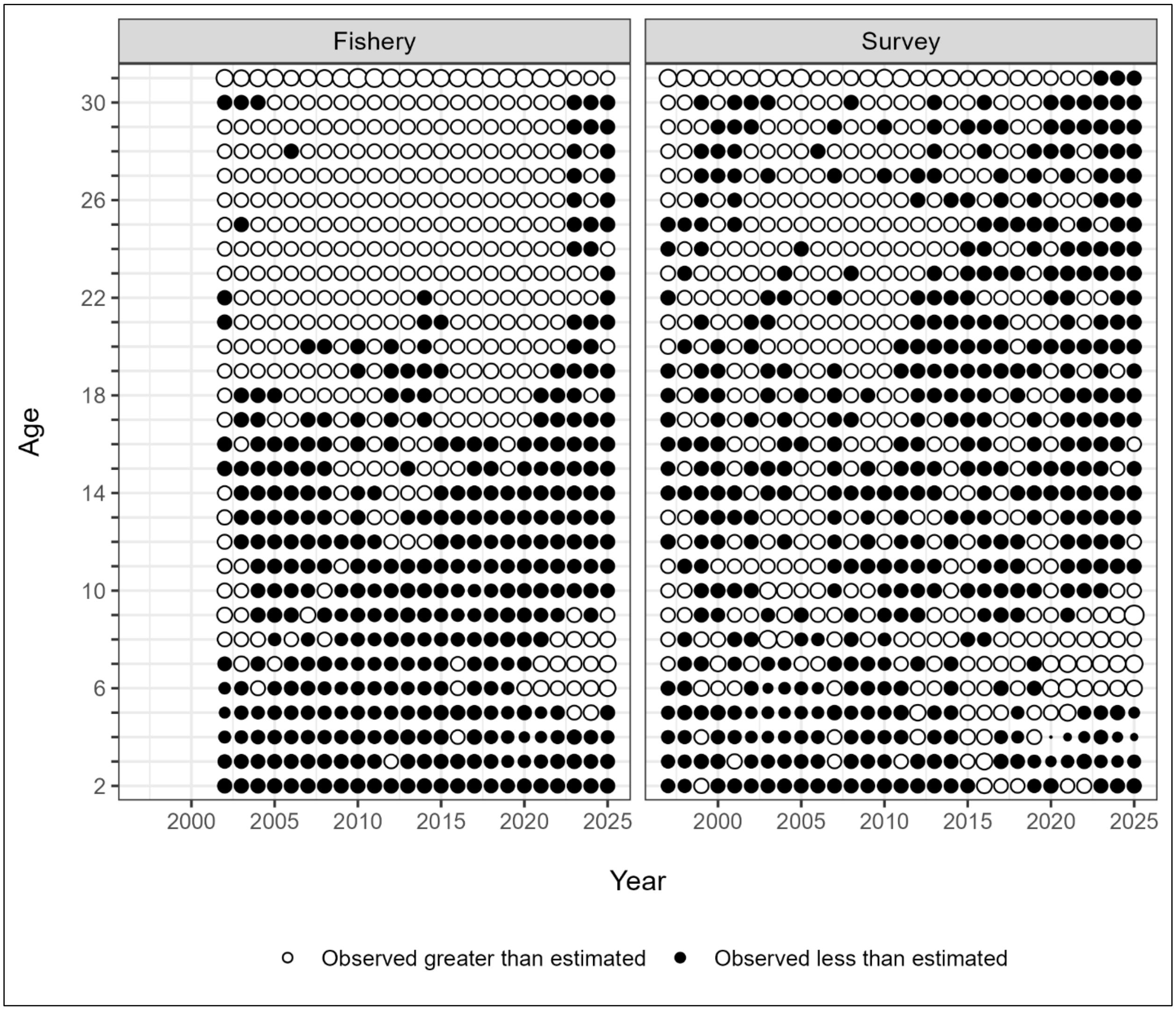


Figure 24.–Standardized residuals of fits to fishery (2002–2025) and survey (1997–2025) age compositions. Size of residual scales to point size. Black points represent negative residuals (observed < predicted); white points represent positive residuals (observed > predicted).

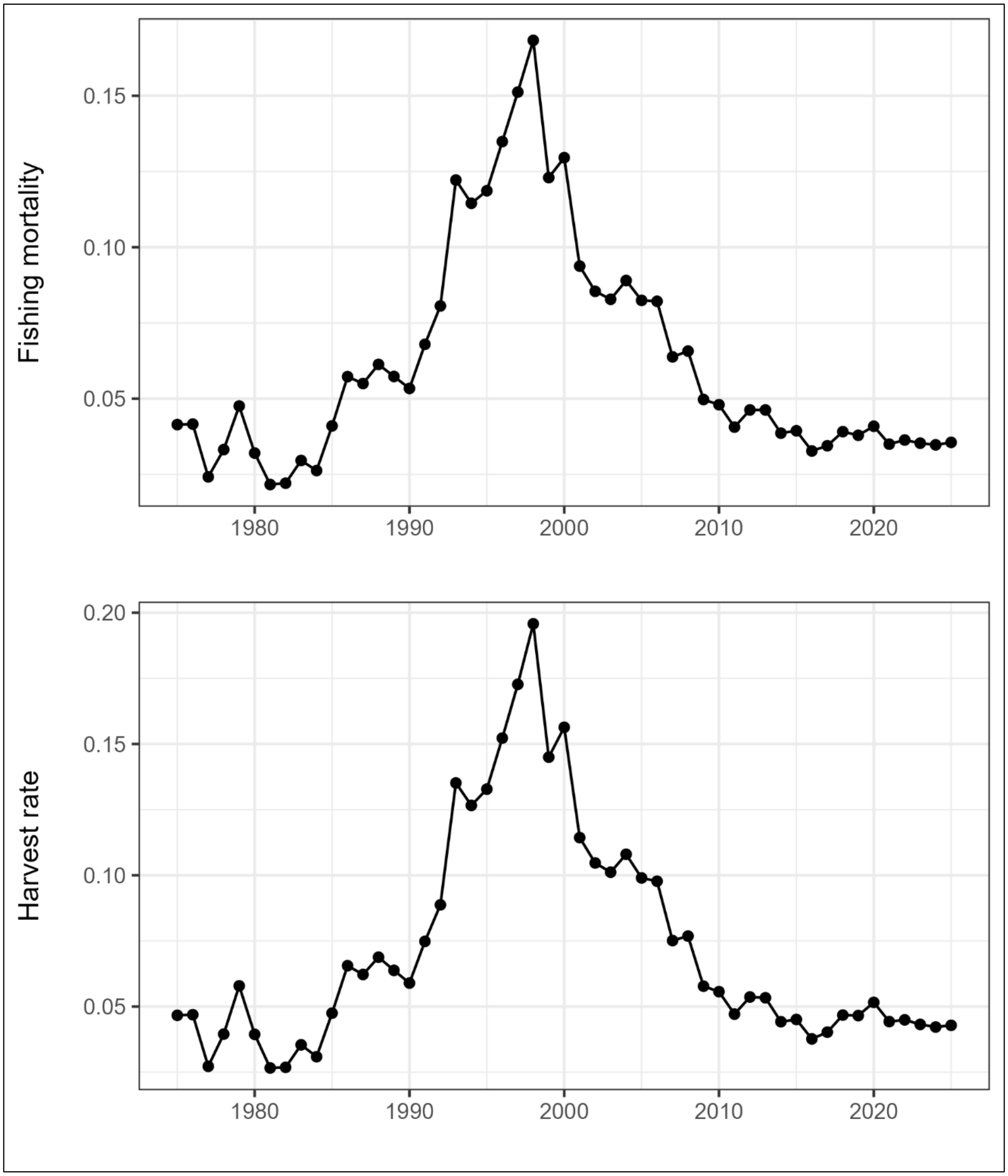
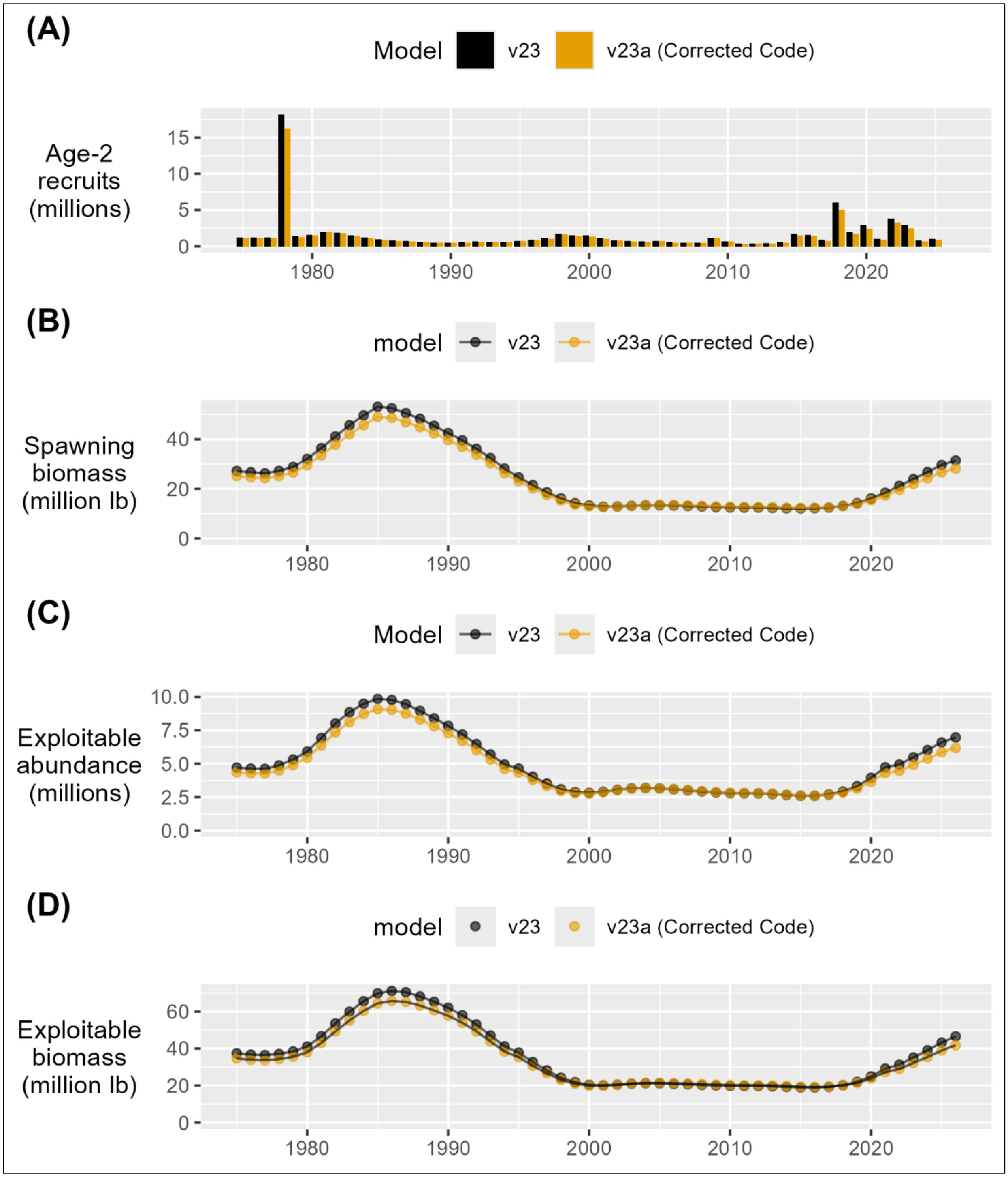
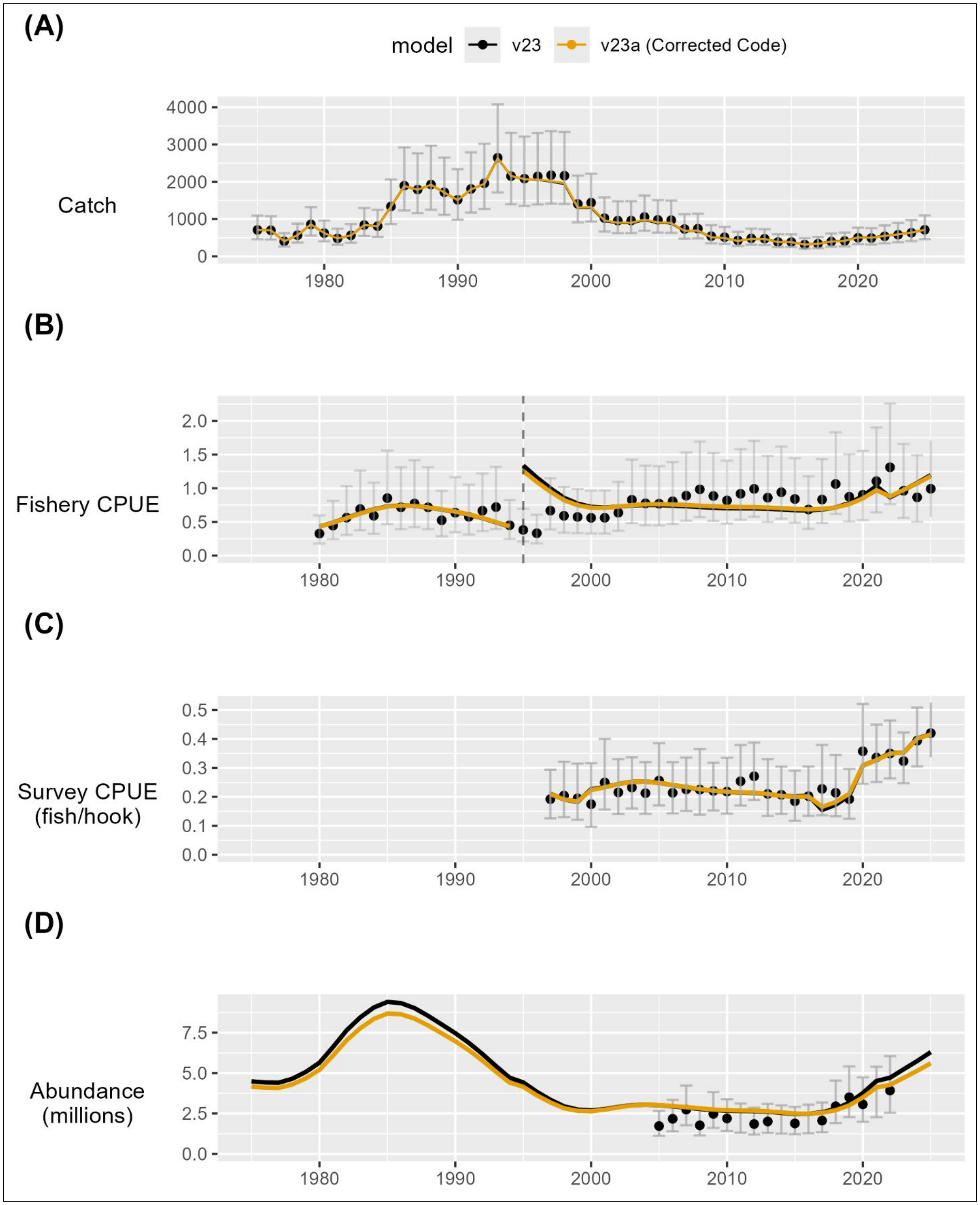


Figure 25.–Model-estimated fishing mortality rate (top) and realized harvest rate (bottom), defined as the ratio of total predicted catch to exploitable biomass. Total predicted catch is the sum of landed catch and discarded biomass assumed to die post-release.

APPENDIX A



Appendix A1.–Comparison of model v23 (uncorrected) and v23a (corrected) predictions of (A) age-2 recruitment (millions); (B) female spawning stock biomass (million pounds); (C) exploitable abundance (millions); and (D) exploitable biomass (million pounds). Note that the 2026 estimates are projections.



Appendix A2.–Comparison of model v23 (uncorrected; black line) and v23a (corrected; gold line) fits to (A) catch; (B) fishery CPUE (vertical dashed line marks the beginning of EQS in 1995); (C) survey CPUE; and (D) abundance (mark—recapture). Error bars represent the assumed error.

Appendix A3.–Assumed selectivity parameters for the Northern Southeast Inside (NSEI) sablefish fishery for females and males.

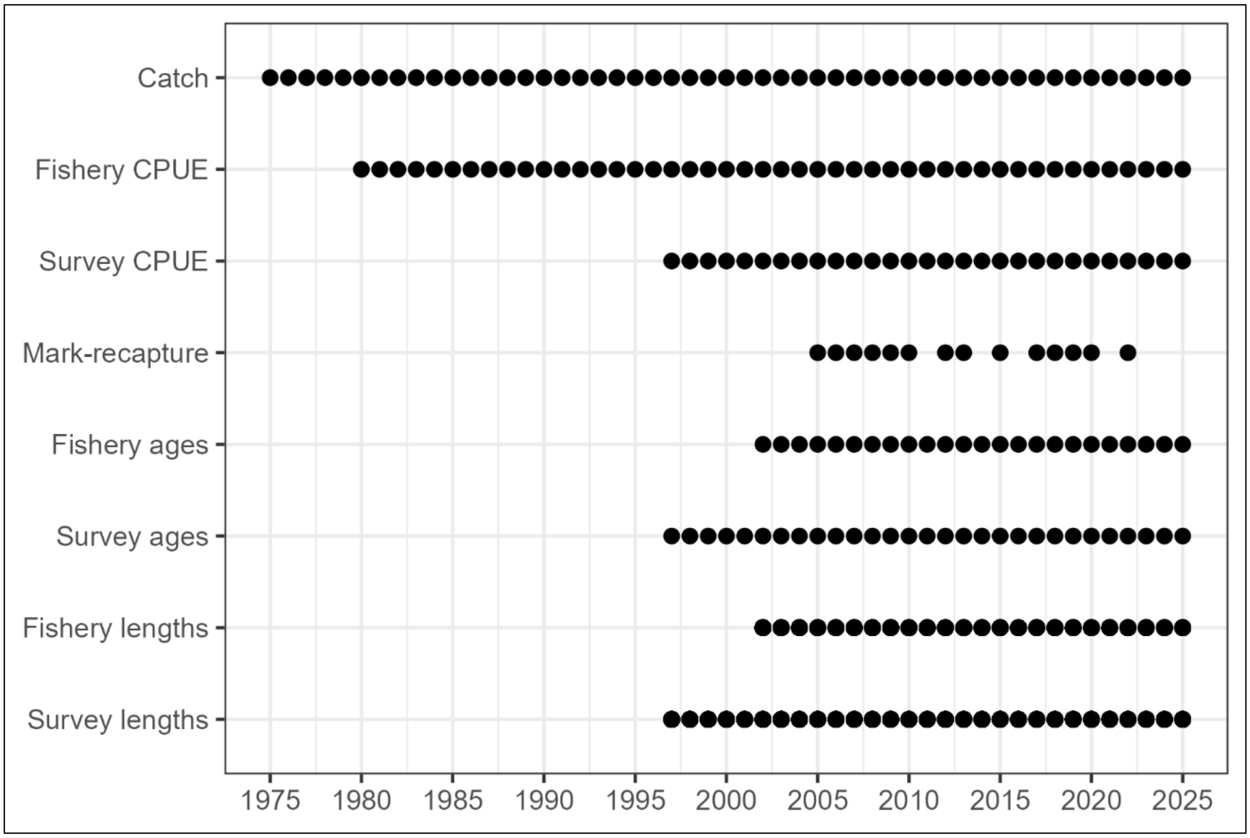
	Male		Female	
Fishery type	s_{50}	δ	s_{50}	δ
Pre-EQS fishery[a]	7.27	0.49	3.82	0.49
EQS longline fishery[b]	4.49	0.90	3.34	1.76
EQS mixed gear fishery[c]	5.84	0.48	3.86	2.48

Note: These parameters estimates were borrowed from the federal stock assessment, where the federal derby fishery and IFQ fishery were assumed to represent pre-EQS and EQS NSEI fisheries.

[a] Before the EQS program started in 1994

[b] Fishery was completely longline (1995–2021)

[c] Fishery when it was a mix of longline and pot gear (2022–2025).



Appendix A4.–Summary of the available data sources in the Northern Southeast Inside (NSEI) Subdistrict by year.