16. Assessment of the Other Rockfish stock complex in the Bering Sea and Aleutian Islands

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Executive Summary

The Bering Sea/Aleutian Islands (BSAI) Other Rockfish complex is currently managed in Tier 5 and is assessed on even years to coincide with the Aleutian Islands (AI) bottom trawl survey. The Other Rockfish complex is assessed in two parts: (1) shortspine thornyhead (SST, *Sebastolobus alascanus*), which comprise approximately 95% of the estimated total Other Rockfish exploitable biomass; and (2) the remaining "non-SST" species, which are dominated by dusky rockfish (*Sebastes variabilis*) but include at least eleven other *Sebastes* and *Sebastolobus* species. The assumed natural mortality differs between SST (0.03) and the remaining non-SST species in the Other Rockfish complex (0.09). Therefore, they have different definitions of F_{OFL} and F_{ABC}.

New assessment definitions were introduced delineating "full" vs. "update" assessments. A full assessment updates all background and life history information, considers alternative model formulations for operational use, and responds to Plan Team and SSC comments as needed. In contrast, an update assessment uses the most recent approved assessment model, cites the most recent full assessment for background information, and responds to Plan Team and SSC comments when possible. In 2024, the BSAI Other Rockfish assessment is presented as an update. Relative to the last full assessment (Sullivan et al. 2022a), the following substantive changes have been made.

Summary of Changes in Assessment Inputs

Changes in the input data

1) Catch updated through September 28, 2024 (accessed October 1, 2024).
2) The 2024 AI bottom trawl survey (BTS) biomass estimates for both SST and non-SST species.
3) The 2023 and 2024 Eastern Bering Sea (EBS) shelf BTS biomass for non-SST species.
4) The 2023 NMFS longline survey (LLS) relative population weights (RPWs) for SST on the EBS slope.
5) Database updates resulted in new survey biomass and error estimates for the following non-SST species/species groups in the AI BTS: black rockfish, broadfin thornyhead, redstripe rockfish, silvergray rockfish, rockfish unid., and thornyhead unid.
6) Database updates resulted in new survey biomass and error estimates for the following non-SST species/species groups in the EBS shelf BTS: darkblotched rockfish and rockfish unid.

Changes in the assessment methodology
This is an update assessment, and therefore there are no changes to the assessment methods. The recommended model is Model 22 (Sullivan et al. 2022a).

Summary of Results

For the 2025 fishery, we recommend the maximum allowable ABC of 1,054 t for the Other Rockfish stock complex. This ABC is a decrease of 16% from the 2024 ABC of 1,260 t. The OFL is 1,406 t. Reference values for the BSA Other Rockfish complex are summarized in the table below, with the recommended ABC and OFL values in bold. The stock was not being subjected to overfishing last year.

	As estimated or *specified last* year for:		As estimated or *recommended this* year for:	
Quantity	2024	2025	2025	2026
M (natural mortality rate) for SST	0.03	0.03	0.03	0.03
M for non-SST	0.09	0.09	0.09	0.09
Tier	5	5	5	5
RE Model Combined Biomass (t)	52,733	52,733	40,559	40,559
F_{OFL} (*F=M)* for SST	0.03	0.03	0.03	0.03
F_{OFL} (*F=M)* for non-SST	0.09	0.09	0.09	0.09
$maxF_{ABC}$ for SST	0.0225	0.0225	0.0225	0.0225
$maxF_{ABC}$ for non-SST	0.0675	0.0675	0.0675	0.0675
F_{ABC} for SST	0.0225	0.0225	0.0225	0.0225
F_{ABC} for non-SST	0.0675	0.0675	0.0675	0.0675
OFL (t)	1,680	1,680	**1,406**	**1,406**
maxABC (t)	1,260	1,260	**1,054**	**1,054**
ABC (t)	1,260	1,260	**1,054**	**1,054**
	As determined *last* year for:		As determined *this* year for:	
Status	2022	2023	2023	2024
Overfishing	No	No	No	n/a

Area apportionment
The ABCs for the BSAI Other Rockfish complex are apportioned to the AI and EBS by summing the proportion of biomass in each region estimated by the random effects (RE) model for the SST and non-SST components of the complex. Separate ABCs and OFLs are presented below for each area and species/species group to illustrate how ABCs and OFLs are calculated for the complex. In recent years BSAI Other Rockfish have been managed with a BSAI-wide OFL and ABCs for the AI and EBS (in bold). The apportionment of ABCs and calculation of the OFL is as follows for 2025 and 2026:

		AI	**EBS**	**Total BSAI**
SST	RE model biomass (t)	14,033	23,375	37,408
	Proportion biomass by region	0.38	0.62	
	Area ABC (t)	316	526	842
	OFL (t)	421	701	1,122
non-SST	RE model biomass (t)	1,473	1,678	3,151
	Proportion biomass by region	0.47	0.53	
	Area ABC (t)	99	113	213
	OFL (t)	133	151	284

Total Other Rockfish	RE model biomass (t)	15,507	25,052	40,559
	ABC (t)	**415**	**639**	**1,054**
	OFL (t)			**1,406**

Summaries for Plan Team

The following table gives the projected biomass in the year harvest specifications were recommended, OFL, ABC, TAC and estimated catch to date for 2021-2024.

Species	Year	Biomass	OFL	ABC	TAC	Catch
Other rockfish	2023	52,733	1,680	1,260	1,260	1,223
	2024	52,733	1,680	1,260	1,260	1,125*
	2025	40,559	1,406	1,054		
	2026	40,559	1,406	1,054		

*Catch updated through September 28, 2024 (accessed on October 1, 2024) Source: NMFS AKRO Catch Accounting System, AKFIN database

Responses to SSC and Plan Team Comments to Assessments in General

SSC Oct 2023: The SSC recommends continued exploration of the Tweedie or other alternative distributions for use in the rema smoother.

The Tweedie distribution is implemented in REMA and available for exploration by individual authors. The Tweedie was presented in 2022 in the BSAI Other Rockfish assessment (Sullivan et al., 2022a). Based on information presented, the SSC agreed with the continued treatment of zero's as NA observations in the assessment model (Dec SSC 2022).

Responses to SSC and Plan Team Comments Specific to this Assessment

There were no SSC recommendations specific to this assessment in this cycle; however, they made several encouragements in the Dec SSC 2022, which are addressed below.

1. The SSC encouraged the authors to continue to monitor non-SST catches. Please see Tables 16.2 and 16.3 and Figure 16.1 for detailed catch trends. Exploitation rates for non-SST in the EBS and AI are reported in Table 16.9 and have declined in 2023 and 2024. The opposite is true for SST. Catches of SST have increased in recent years, primarily in flatfish and sablefish trawl targets in the EBS (NMFS reporting area 517; Figure 16.1, Table 16.3). Exploitation rates of SST, while still quite low compared to non-SST, have more than doubled in the EBS (Table 16.9). For this assessment we rated the fishery performance consideration a level 2 due to a large increase in SST catch in the EBS region in the last several years and potential risk of exceeding the OFL in 2025/2026.

2. The SSC encouraged the authors to bring forth essential fish habitat (EFH) information to contextualize estimates of survey biomass. The authors caution against using EFH to inform this question, because EFH is defined using survey observations. EFH is only defined for dusky rockfish in the non-SST component of the Other Rockfish stock. EFH maps for dusky rockfish are found in Figures E-172 – E-180 of Appendix E in the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area. Link to the appendices: https://www.npfmc.org/wp-content/PDFdocuments/fmp/BSAI/BSAIfmpAppendix.pdf

3. The SSC encouraged future efforts to re-evaluate the current assumed natural mortality for non-SST species for the next full assessment. The authors thank the SSC for their

feedback and will prioritize this development in the next full assessment using recently published studies on dusky and harlequin rockfish natural mortality (Sullivan et al. 2022b, TenBrink et al. 2023).

The BSAI Plan Team had no recommendations specific to this assessment in this cycle.

Introduction

The Other Rockfish complex includes all species of *Sebastes* and *Sebastolobus*, except Pacific ocean perch (POP, *Sebastes alutus*), northern rockfish (*S. polyspinis),* rougheye rockfish (*S. aleutianus*), and shortraker rockfish (*S. borealis*). Current definitions of the complex do not specifically exclude blackspotted rockfish (S. *melanostictus)*, a recently recognized species (Orr and Hawkins 2008) that had historically been identified as rougheye rockfish in research surveys. However, blackspotted are currently not distinguished from rougheye rockfish in the fishery catches, and are therefore managed under the BSAI blackspotted/rougheye complex. The two most abundant species for Other Rockfish complex are SST and dusky rockfish. Other species include redstripe rockfish (*S. proriger*), redbanded rockfish (*S. babcocki*), yelloweye rockfish (*S. ruberrimus*), harlequin rockfish (*S. variegatus*), sharpchin rockfish (*S. zacentrus*), longspine thornyhead (*Sebastolobus altivelis*), and broadbanded (also called broadfin) thornyhead (*Sebastolobus macrochir*).

The Other Rockfish complex is managed through annual catch limits (Table 16.1). ABCs and OFLs for SST are calculated separately from non-SST Other Rockfish because SST is the most abundant species in the BSAI Other Species complex, and because it is managed under a lower natural mortality estimate (M=0.03) than the non-SST Other Rockfish (M=0.09). However, the OFL and ABC reference points are for the entire Other Rockfish complex and are apportioned to the EBS and AI.

For a full description of BSAI Other Rockfish biology, distribution, life history, prey and predators, and evidence of stock structure, please refer to the last full assessment (Sullivan et al. 2022a).

Fishery and Management History

The Other Rockfish category has added to the BSAI Fishery Management Plan (FMP) in 1986, and is managed through annual catch limits (Table 16.1). Before 2002, BSAI Other Rockfish were managed with separate OFLs in the EBS and AI management areas (Sullivan et al. 2022a). In 2002, Reuter and Spencer (2002) recommended a BSAI-wide OFL. Since then, BSAI Other Rockfish has been managed with a BSAI-wide OFL with apportioned ABCs to the AI and EBS.

There is no directed fishing for any of the Other Rockfish species; however, incidental catch occurs in multiple fisheries and gear types, including the Atka mackerel trawl fishery, rockfish trawl fishery, flatfish trawl fishery, and sablefish hook-and-fishery (Figure 16.1). Tables 16.2 and 16.3 report catches of the most common species in commercial catches since 2003 (dusky, SST and other thornyheads, harlequin, yelloweye, redbanded, redstripe, and black rockfish). While landings of thornyheads are not identified to species, samples from observer data are used to partition the catch in order to estimate a percent of SST in the thornyhead catch in Tables 16.2 and 16.3.

Since 2003, Other Rockfish have been primarily caught by bottom trawl (77.5%) and hook-and-line gear types (19.5%). Discard rates are higher on average for the non-SST species like dusky

and harlequin rockfish (37% and 52% in the AI and EBS, respectively) compared to SST (23% and 15% in the AI and EBS, respectively), which are a higher value species (Tables 16.4 and 16.5). Discard rates are lower in fixed gear fisheries, which account for a higher proportion of SST catch and yield a higher quality product than trawl gear (Hiatt et al. 2002).

A full description of the BSAI Other Rockfish fishery, history of management measures, and historical catches (1977-2002), are provided in the last full assessment (Sullivan et al. 2022a). Catch from non-commercial sources, including removals incurred during research, subsistence, personal use, recreational, and exempted fishing permit activities in Table 16A-1 of Appendix 16A. Non-commercial catches are generally very low, making up less than 0.5% of the total catch in 2022 and 2023.

Data

Fishery

Detailed catch information for BSAI Other Rockfish is listed in Tables 16-1, 16-2, and 16-3 and trends for target fishery and gear type by NMFS reporting area is shown in Figure 16.1.

Survey

Bottom trawl surveys (BTS)

Exploitable biomass of Other Rockfish is estimated using bottom trawl survey biomass from the AI, EBS shelf, and EBS slope BTS (Table 16.6).

In 2024, the Groundfish Assessment Program (GAP) updated their design-based survey estimation methods and database tables (Markowitz et al. 2024, Appendix E). The historical database tables were limited to a predefined set of species that did not include biomass estimates for all other rockfish species. The new database tables now include biomass for all other rockfish species. In alignment with the new GAP database, we include biomass estimates for all species, except when there is no associated variance estimate (i.e., observations were limited to one haul). In the AI BTS, these updates resulted in new biomass estimates for six non-SST species codes (black rockfish, broadfin thornyhead, redstripe rockfish, silvergray rockfish, rockfish unid., and thornyhead unid) that were previously not included in this assessment (Figure 16.2). In the EBS shelf BTS, database updates resulted in new biomass estimates for darkblotched rockfish and rockfish unid. species codes (Figure 16.2). The EBS shelf survey frequently does not catch non-SST species, and prior to the database updates there were 14 zero biomass observations in the time series. With the updated database assumptions, there are now 11 zero biomass observations (Table 16.6). In the EBS slope BTS, no new species codes or other large changes were identified (Figure 16.2). All surveys exhibited small changes in biomass estimates for some species in some years due to the rounding.

This is an update assessment. For a full description of the trawl surveys and long-term trends in the SST and non-SST species groups, please refer to the last full assessment (Sullivan et al. 2022a).

NMFS longline survey (LLS)

This assessment uses the LLS relative population weights (RPWs) as a relative index of abundance for SST on the EBS slope, where the LLS has been conducted biennially in odd years since 1997 (Table 16.6; Rodgveller et al. 2011). RPWs are computed using survey catch per unit of effort (CPUE) rates that are multiplied by the area size of the stratum within each geographic area and the mean weight of fish caught by station and stratum. For a full description of the LLS

and rationale for using this survey (Sullivan et al. 2022a).

Analytic Approach

Model structure

Exploitable biomass is estimated using a state-space random walk model using the *rema* R library (Sullivan et al., 2022c). The REMA model is fit to design-based estimates of trawl survey biomass and observation error by species group (SST and non-SST) in the EBS and AI. True population biomass is modeled as a time series of random effects, and the overall smoothness of the population relative to survey biomass is governed by the process error variance. The recommended model is Model 22, which was accepted 2022.

Model 22 for SST

In the recommended Model 22, SST biomass is estimated with three strata, where the AI BTS is split into two strata, the AI (eastern, central, and western AI combined) and southern Bering Sea (SBS), and the EBS slope BTS is treated as a single stratum. Model 22 also fits to LLS RPWs for SST on the EBS slope, where the EBS slope BTS stopped sampling in 2016. There are no SST on the EBS shelf, therefore that BTS is not used for this component of the model.

Model 22 for non-SST

The non-SST biomass is estimated using four strata, where the AI BTS biomass is split into the AI and SBS, and the EBS slope and shelf BTS biomass are estimated as separate strata. As described in the bottom trawl survey data section, the EBS shelf survey frequently has zero biomass observations (n=11). Consistent with past assessments, we assume these zeros are failed surveys and treat them as NAs in the model (Sullivan et al. 2022a).

For a full description of the accepted Model 22 see Sullivan et al. 2022a.

Reference points

For Tier 5 stocks, F_{OFL} and F_{ABC} are defined as M and 0.75M, respectively. The acceptable biological catch (ABC) is obtained by multiplying F_{ABC} by the estimated biomass, and the overfishing level (OFL) is obtained by multiplying F_{OFL} by the estimated biomass. The SST M of 0.03 is borrowed from the current GOA thornyhead stock assessment and is the average M over a range of published values for SST (Echave and Hulson 2018). The non-SST M of 0.09 is the M previously used for dusky rockfish, the most abundant species in the non-SST component of the complex (Clausen and Heifetz 2001). ABC and OFL (and F_{OFL} and F_{ABC}) are calculated separately for SST and non-SST Other Rockfish. Apportionments between the AI and the EBS are based on the estimated biomass of SST and non-SST in those regions. In this case, the SBS, EBS slope, and EBS shelf are summed to be obtain the EBS biomass.

Results

Figures 16.3 and 16.4 show Model 22 fits to the SST and non-SST survey indices with total predicted biomass. Results from Model 22 from the 2022 assessment are shown for comparison. The EBS slope LLS RPW for SST decreased by 61% between 2021 and 2023, which had a large impact on predicted biomass trajectories for SST and the Other Rockfish complex as a whole. SST comprise approximately 95% of the total estimated biomass of Other Rockfish and approximately 60% of this biomass is estimated to be on the EBS slope. Therefore, a large reduction of biomass of SST in this region will result in a substantial decline for the entire complex. Comparisons of the model-predicted biomass of SST, non-SST, and total Other Rockfish from the 2022 and current assessments are provided in Table 16.7. There was a 23%

decline in total predicted biomass in the terminal year between assessments (2024 assessment year=2024=40,559 t; 2022 assessment year = 2022 = 57,733 t).

Despite declines in predicted biomass, Model 22 performs well for SST in all survey regions (Figure 16.3). The fit to SST survey biomass shows an increase on the EBS slope from 2002-2016, an increase in the AI from 1991-2005 followed by a slight decrease after 2010, as well as a slight increase in the Southern Bering Sea since 1980. Prior to the 2023 survey, the LLS RPWs showed a slow decline in SST on the EBS slope since 2016. The 2024 SBS biomass was also one of the lowest of the time series, though this region makes up a very small amount of the total biomass. Relative to the 2022 assessment, the 2024 assessment indicates a steeper negative trend for SST and substantially downgraded biomass estimates for 2021-present in order to fit the 2023 LLS RPW on the EBS slope (Table 16.7). However, parameter estimates were very similar between the 2022 and 2024 assessment years, with process error increasing from 0.17 to 0.18 in 2024 (Table 16.8). This indicates that the predicted trend for 2024 is within the realm of what was previously estimated for the stock in terms of variability in dynamics.

The 2024 non-SST predicted biomass is greatest in the AI and SBS, followed by the EBS shelf and lastly EBS slope. The REMA model effectively dampens the spasmodic survey biomass estimates of non-SST, because estimates in most years are highly uncertain (Figure 16.4). The 2024 SBS suggests a large increase of non-SST in that region, which led to an upward trend in predicted total biomass for non-SST in the terminal year (Figure 16.4). Dusky rockfish are the dominant species in the non-SST group in all survey areas (Figure 16.5). Process error variance increased from 0.67 to 0.76 between the 2022 and 2024 assessments due to the sensitivity of the model to large increases in biomass (Table 16.8).

Although SST make up the vast majority of the biomass in the BSAI, catch is dominated by non-SST. Fishery exploitation rates, estimated as the total catch estimates divided by the Model 22 predicted biomass, differ substantially between the species groups (Table 16.9). The exploitation rate for SST since 2003 has been less than 1% in most years, though it is estimated to be slightly over 2% in the EBS in 2023 and 2024 due to a combination of decreased estimated biomass and increased catch (Table 16.3). The recent increase in SST catch in the EBS is attributed to bycatch in the Amendment 80 bottom trawl fishery in NMFS reporting area 517 while targeting sablefish and flatfish (Figure 16.1).

Non-SST exploitation rates have averaged 41% and 14% in the AI and EBS, respectively (Table 16.9). Notably, the exploitation rate exceeded 1 in 2012 for non-SST in the AI, indicating catch was greater than the estimated biomass. This reflects the highly variable non-SST biomass estimates from bottom trawl surveys in all areas (Figure 16.4). Additionally, catches of dusky and harlequin rockfish in the AI were high between 2017 and 2022, though they seem to have leveled off (Table 16.2). These catches are primarily from bycatch in the Atka mackerel bottom trawl fishery in the eastern Aleutian Islands (NMFS reporting area 541; Figure 16.1).

Harvest recommendations

Amendment 56 Reference Points

We recommend keeping BSAI Other Rockfish rockfish as Tier 5 under the NPFMC definitions for ABC and OFL based on Amendment 56 to the BSAI FMP. The population dynamics information available for Tier 5 species consists of reliable estimates of biomass and natural mortality M, and the definition states that for these species, the fishing rate F that determines ABC (i.e., F_{ABC}) is $\leq 0.75M$. Thus, the recommended F_{ABC} for SST is 0.0225 (i.e., 0.75 x M, where M = 0.03), and the F_{ABC} for non-SST is 0. 0675 (i.e., 0.75 x M, where M = 0.09). As described in the

previous section, the recommended Model 22 was fit separately to survey data for SST and non-SST species groups. The total predicted biomass for the BSAI from Model 22 was 40,559 t (Table 16.7).

Specification of OFL and Maximum Permissible ABC

In recent years, BSAI Other Rockfish (SST and non-SST combined) have been managed with a BSAI-wide OFL level with apportioned ABCs for the AI and EBS. Total Other Rockfish catches in the AI region exceeded ABC in all but three of the last ten years and BSAI catch exceeded TAC in 2018-2022 (Table 16.1). The overall BSAI OFL, however, remains above the recent catch.

The 2024 biomass estimate of the BSAI Other Rockfish complex from the random effects model results is 40,559 t; 37,408 t for the SST component and 3,151 t for the non-SST component (Table 16.7). For the 2025 and 2026 fisheries, we recommend a BSAI-wide OFL of 1,406 t for the entire complex. The SST and non-SST reference values provided in the table below are for informational purposes.

2025/2026	SST	non-SST	Total Other Rockfish
M	0.03	0.09	-
Biomass	37,408	3,151	**40,559**
F_{OFL}	0.03	0.09	-
$maxF_{ABC}$	0.0225	0.0675	-
F_{ABC}	0.0225	0.0675	-
OFL	1,122	284	**1,406**
maxABC	842	213	**1,054**
ABC	842	213	**1,054**

Risk Table and ABC Recommendation

Since 2020, the SSC has requested that full or update assessments fill out a risk table with assessment, population dynamics, environmental and ecosystem, and fishery performance considerations to inform potential reductions from maximum permissible ABC. The guidelines for risk table definitions are now available to reference in the Introduction to the BSAI SAFE.

Assessment considerations (Level 2)

The BSAI Other Rockfish complex is split into SST, which comprises ~95% of the total exploitable biomass for the complex, and the smaller non-SST component, which is dominated by dusky rockfish but includes at least eleven other *Sebastes* and *Sebastolobus* species. Both SST and non-SST components of the complex are assessed under Tier 5, and exploitable biomass is estimated by fitting the standard RE model to AI, EBS shelf, and EBS slope trawl survey biomass estimates (and the LLS RPWs for SST; Table 16.6, Figures 16.5 and 16.6).

The most recent trawl survey on the EBS slope was in 2016 (Table 16.6). The 2016 survey estimate for SST is the highest of the time series and, in the absence of new data, indefinitely sets the scale of the population at its highest level on record. To address this issue, we added the LLS RPWs for SST on the EBS slope to the REMA model to inform trend information in this region in the 2022 assessment (Sullivan et al. 2022a). There is a high level of agreement between the EBS slope BTS biomass index and LLS RPWs in overlapping years, lending support to the use of

the LLS data for SST. But, in 2023, there was a 61% decrease in the LLS RPW. An examination into the 2023 LLS data did not reveal any consistent factors (e.g., hook competition or killer whale depredation) among survey strata that can explain the large decrease in SST RPWs in 2023 (Figure 16.6). Additionally, while the mode of the length frequencies was shifted towards smaller fish in 2023 relative to 2021, the length distribution was typical of SST captured in the LLS and does not suggest a large shift in selectivity (Figure 16.7).

The lack of an EBS slope trawl survey, coupled with the uncertainty introduced by the 2023 LLS estimate of SST RPWs, warrants an increase to level 2 for assessment considerations.

Population dynamics considerations (Level 2)
As described in the Assessment considerations, there was a 61% decrease in the EBS slope LLS RPW for SST, which makes up ~60% of the total Other Rockfish biomass. A steep decline in biomass is atypical for a long-lived, low productivity species like SST. Therefore, it warrants an increase to level 2 concern for population dynamics considerations. Both assessment and population dynamics considerations were rated level 2s; however, the assessment considerations are related to monitoring concerns, whereas the population dynamics considerations are attributed to the steep decline in estimated biomass.

Environmental/Ecosystem considerations (Level 1)
Provided by Ivonne Ortiz and Elizabeth Siddon

Environment: The average bottom temperature from the 2024 AI BTS (165°W – 172°E, 30-500 m) was close to but still above the 20-year mean (defined as 1991–2012). This is in contrast with the four survey years prior to 2024 (2014, 2016, 2018, and 2022), which were generally warmer than average for bottom temperatures. The bottom temperature means are similar across all four regions (Howard and Laman 2024) and values close to the long-term mean are considered a positive indicator. Satellite sea surface temperatures show a step increase in 2024 with higher temperatures both in summer and winter (Xiao and Ren 2023). Sea surface temperatures were above the mean through winter across all subregions. Over the eastern Aleutian Islands, there were few days of marine heat wave (MHW) status relative to the mean over the last decade, which was also the case in 2021 and 2022. At times during late summer over 75% of the western Aleutians were in MHW status. While there were also warm anomalies and MHWs over 25% of the central and eastern Aleutians in summer, these were not sufficient to register in the spatial mean (Lemagie and Callahan 2024). In the Bering Sea slope, temperature from the LLS had a step increase in 2015 increasing from average temperatures around 3.5°C prior to 2015 to temperatures above 4°C after 2015; in 2023 the temperature from the longline survey was 4.4°C (Figure 16.8). Temperature profiles from the LLS in the eastern Aleutians show temperature at 150 to 250 m around 5.5°C in 2023. These shifts in temperature may have impacted the depth distribution of SST locally, although in general both are maintaining their same depth interval over time in the Aleutians (Conrath and Dowlin 2024).

Duskies and SST are generally found in temperatures between 3.5-5.7°C and 3.5-5°C, respectively. For this risk table, ecosystem information is largely based on relevance to SST and dusky rockfish. SST and dusky rockfish depth distributions have remained stable over time in the AI bottom trawl survey, unlike that of other Sebastes (Laman 2022) which are shifting to shallower depths. The increasing temperatures at mid-depth, bottom and surface waters observed in the data from both the longline survey and the bottom trawl survey, indicate duskies and SSTs are vulnerable to these increases despite being distributed up to 400 m (duskies) and >500 m depth (SST, within survey; max. depth recorded 1500 m.). In general, higher ambient temperatures incur bioenergetic costs for ectothermic fish such that, all else being equal,

consumption must increase to maintain fish condition. Thus, the persistent higher temperatures may be considered a negative indicator for rockfish. However, increased bioenergetic demands may be mitigated by their generalist diet and for SST, depths greater than 500 m.

In terms of their reproduction, duskies are viviparous while SST spawn pelagic gelatinous egg masses, making them more vulnerable to environmental conditions during this stage compared to duskies. Duskies release larvae in late spring, early summer while SST spawn at similar times (Conrath 2019; Pearson and Gunderson 2003). This timing makes the larvae/ eggs vulnerable to the more intense and frequent MHWs that occur in summer in the western Aleutians or the increased temperatures observed in 2023 along the Bering Sea slope. SST larvae have a pelagic phase of up to 15 months, and juveniles are often found over mud bottoms 100–600 m before migrating into deeper depths as they mature.

Prey: Based on stomachs of dusky and SST rockfish sampled during the AI bottom trawl survey, the Other Rockfish can be split between planktivorous (duskies) and generalists (SSTs). Duskies feed largely on pelagic gelatinous filter feeders, such as jellyfish, which increased in 2023 (Whitehouse 2024), and shrimp, which decreased in 2024 (Friedman et al. 2024), in the western and central Aleutians (areas 543, 542). In the eastern Aleutians (area 541 and S. Bering Sea) Duskies feed more heavily on euphausiids, pelagic amphipods, copepods, and mysids. In contrast, SSTs prey on shrimp, benthic amphipods and general fish when small (< 20 cm), while larger fish (> 20 cm) feed primarily on sculpin, Atka mackerel, shrimp, cephalopods, snow and King crab, and occasionally on skates among other prey. The fish condition of both planktivorous fish and apex predators in the Aleutians was below the long term mean, suggesting foraging conditions were suboptimal and there might be increased competition for prey (Howard et al. 2024). This may particularly be the case for the western Aleutians where diving piscivorous and planktivorous seabirds had below average reproductive success at Buldir (western Aleutians). Foraging conditions appear to be more favorable towards the east as signaled by the above average reproductive success of piscivorous and planktivorous seabirds in Aiktak Island (Rojek et al. 2024). In the eastern Bering Sea, the fish condition of Pacific cod and Arrowtooth flounder (which have the most similar diets to SST) was average and below average, respectively.

Competitors and predators: Duskies may compete somewhat with Pacific Ocean perch for prey, while shortspine thornyheads share prey items with shortraker (sculpins, general fish and shrimp) and rougheye rockfish (Atka mackerel, shrimp and squid). Among these prey, sculpin, shrimp and Atka mackerel have decreased since 2022. There are no recorded fish predators of dusky and/ or shortspine thornyhead rockfish in the Aleutian Islands. Steller sea lions have been found to consume SST occasionally (Sinclair et al. 2013). Steller sea lions were found to be decreasing in the western Aleutians; these declines were offset by increases in the eastern Aleutians, with declines in some colony complexes offset by increases at other colony complexes (Sweeney and Gelatt 2024).

The indicator most relevant to reflecting habitat disturbance is the estimated area disturbed by trawls from the fishing effects model (Olson 2021). Trends in potential habitat disturbance are relevant for adult dusky and shortspine thornyhead as they can be found on soft substrates, where shrimp are abundant, and in areas with frequent boulders and steep slopes, which are generally not targeted by bottom trawlers. Rooper et al. (2019) concluded the removal of deep coral and sponges is likely to reduce the overall density of rockfishes. The fishing effects model has not indicated large changes in habitat disturbance trends, and has remained below 3% for the Aleutian Islands (eastern, central and western AI) since 2009, so we assume that the level of habitat disturbance for the Other Rockfish complex has been stable.

Taken together, these indicators suggest no clear concerns for the Other Rockfish stock complex aside from the recent stretch of increased temperatures. However, the lack of ecological data relevant to the stock complex limit our assessment of more detailed potential recent ecosystem impacts on this stock complex. We therefore set the concern level to 1 for this consideration.

Fishery performance (Level 2)

There are no directed fisheries for Other Rockfish. Traditionally, most of catch has been non-SST dusky rockfish in the Atka mackerel bottom trawl fishery in the eastern AI (Figure 16.1). Exploitation rates of non-SST have slightly decreased in 2023 and 2024 (Table 16.9). The exploitation rate for SST since 2003 has been less than 1% in most years, though it is estimated to be slightly over 2% in the EBS in 2023 and 2024 due to a combination of decreased biomass and increased catch (Table 16.3). The recent increase in SST catch in the EBS is attributed to bycatch in the Amendment 80 bottom trawl fishery in NMFS reporting area 517 while targeting sablefish and flatfish (Table 16.3 and Figure 16.1). The recommended OFL for 2025/2026 is 1,406 t, which is only 98 t and 183 t above the final catches in 2022 (1,308 t) and 2023 (1,223 t), respectively. Given increasing trends in BSAI Other Rockfish catch, along with projected increases in Alaska sablefish and BSAI Atka mackerel ABCs, there is a risk that catches could approach or exceed OFL if not mitigated. We therefore set the concern level to 2 for this consideration.

Summary and ABC recommendation

Assessment-related considerations	*Population dynamics considerations*	*Environmental/ ecosystem considerations*	*Fishery Performance considerations*
Level 2: Substantially increased assessment uncertainty/ unresolved issues, such as residual patterns and substantial retrospective patterns, especially positive ones.	Level 2: Stock population dynamics are unusual; trends increasing or decreasing faster than has been seen recently, or patterns are atypical.	Level 1: No apparent ecosystem concerns related to biological status (e.g., environment, prey, competition, predation), or minor concerns with uncertain impacts on the stock.	Level 2: Several indicators with adverse signals related to biological status (e.g., stock abundance, distribution, fish condition).

We increased the assessment-related risk to a level 2 due to a continued lack of trawl surveys on the EBS slope, where approximately 60% of this stock is estimated to inhabit. We increased the population dynamics-related risk to a level 2 following the 61% decrease in LLS RPWs for SST, which is highly atypical for a low productivity species. We increased the fishery performance-related risk to a level 2 due to increased risk related to biological status (stock abundance) and potential of approaching or exceeding OFL. The environmental and ecosystem consideration was rated level 1, though there were clear signals of warming at depth on the EBS slope in the LLS temperature data (Figure 16.8). Despite increased levels of concern for BSAI other rockfish, the Tier 5 harvest control rules are conservative, and **we recommend the maximum permissible ABC of 1,054 t.**

Area Allocation of ABC

For the 2025 and 2026 fishery, we recommend an ABC of 639 t for the Other Rockfish complex in the EBS and 415 t in the AI. The species-group reference points below are provided for informational purposes.

2025/2026	**SST**	**non-SST**	**Total Other Rockfish**

OFL	1,122	284	**1,406**
maxABC	842	213	**1,054**
ABC	842	213	**1,054**
Aleutian Islands ABC	316	99	**415**
Eastern Bering Sea ABC	526	113	**639**

Status Determination
The stock/complex is not being subjected to overfishing as determined by comparing the catch from the most recent complete year to the specified OFL for that year. The 2023 catch of 1,223 t is below the 2023 OFL of 1,680 t (Table 16.1); therefore, the stock is not being subjected to overfishing.

Ecosystem Considerations

Ecosystem Effects on the Stock

The average bottom temperature from the 2024 AI BTS (165°W – 172°E, 30-500 m) was close to but still above the 20-year mean (defined as 1991–2012). This is in contrast with the four survey years prior to 2024 (2014, 2016, 2018, and 2022), which were generally warmer than average for bottom temperatures. SST and dusky rockfish depth distributions have remained stable over time in the AI BTS, unlike that of other *Sebastes* (Laman 2022) which are shifting to shallower depths. In the Bering Sea slope, temperature from the LLS had a step increase in 2015 increasing from average temperatures around 3.5°C prior to 2015 to temperatures above 4°C after 2015; in 2023 the temperature from the longline survey was 4.4°C (Figure 16.8). Temperature profiles from the LLS in the eastern Aleutians show temperature at 150 to 250 m around 5.5°C in 2023. These shifts in temperature may have impacted the depth distribution of SST locally, although in general both are maintaining their same depth interval over time in the Aleutians (Conrath and Dowlin 2024).

Dusky rockfish in the western and central Aleutians (areas 543, 542) feed largely on pelagic gelatinous filter feeders, jellyfish, which increased in 2023 (Whitehouse 2024), and shrimp, decreased in 2024 (Friedman et al. 2024). Dusky rockfish in the eastern Aleutians (areas 541 and S. Bering Sea) feed more heavily on euphausiids, pelagic amphipods, copepods and other prey such as general crustacean mysids. In contrast, SSTs prey on shrimp, benthic amphipods and general fish when small (< 20 cm), while larger fish (> 20 cm) feed primarily on sculpin, Atka mackerel, shrimp, cephalopods, snow and King crab, and occasionally on skates among other prey. The fish condition of both planktivorous fish and apex predators in the Aleutians was below the long term mean, suggesting foraging conditions were suboptimal and there might be increased competition for prey (Howard et al. 2024).

Dusky rockfish may compete somewhat with Pacific Ocean perch for prey, while shortspine thornyheads share prey items with shortraker (sculpins, general fish and shrimp) and rougheye rockfish (Atka mackerel, shrimp and squid). Among these prey, sculpin, shrimp and Atka mackerel decreased compared to 2022 (Friedman et al. 2024, Ortiz 2024). There are no recorded fish predators of dusky and/ or shortspine thornyhead rockfish in the Aleutian Islands. Steller sea lions have been found to consume SST occasionally (Sinclair et al. 2013). Steller sea lions were found to be decreasing in the western Aleutians; these declines were offset by increases in the eastern Aleutians, with declines in some colony complexes offset by increases at other colony complexes (Sweeney and Gelatt 2024).

Fishery Effects on the Ecosystem

There are no directed fisheries for species in the BSAI Other Rockfish complex. For a discussion of the contribution to discards and offal production or to bycatch of prohibited species, forage fish, HAPC biota, marine mammals, seabirds, sensitive species or non-target species from these fisheries, the reader should refer to the stock assessments for which Other Rockfish are common bycatch, including BSAI Atka mackerel and BSAI Pacific ocean perch.

Data Gaps and Research Priorities

Our priorities in the next cycle will be as follows:

1. Updating natural mortality parameters for Other Rockfish;
2. Implementing diagnostics for the *rema* R library (Baldstad et al. 2024);
3. Continuing to improve documentation and reproducibility for the stock assessment; and
4. Updating the life history section of the Introduction.

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Tables

Table 16.1. Regulatory catch limits (OFL, ABC, and TAC), total catch, and associated management measures for Other Rockfish in the Bering Sea/Aleutian Islands (BSAI), 2003-2024, from the NMFS AKRO Catch Accounting System, AKFIN database, accessed October 1, 2024. Shading highlights years catch exceeded TAC and/or ABC.

	BSAI				AI				BS				Management measures
Year	OFL	ABC	TAC	Catch	OFL	ABC	TAC	Catch	OFL	ABC	TAC	Catch	
2003		1594	1594	685	846	634	634	390	1280	960	960	295	Separate OFLs for AI and BS
2004		1594	1094	633	846	634	634	331	1280	960	460	302	
2005	1,870	1,400	1,050	447		590	590	282		810	460	165	Combined OFL for BSAI
2006	1,870	1,400	1,050	570		590	590	422		810	460	149	
2007	1,330	999	999	646		585	585	429		414	414	217	
2008	1,330	999	999	596		585	585	382		414	414	214	
2009	1,380	1,040	1,040	566		555	555	372		485	485	193	
2010	1,380	1,040	1,040	766		555	555	498		485	485	268	
2011	1,700	1,280	1,000	945		570	500	617		710	500	328	
2012	1,700	1,280	1,070	919		570	570	711		710	500	208	
2013	1,540	1,159	873	789		473	473	597		686	400	192	
2014	1,550	1,163	773	913		473	473	589		690	300	324	
2015	1,667	1,250	880	651		555	555	467		695	325	184	
2016	1,667	1,250	875	768		555	550	490		695	325	278	
2017	1,816	1,362	875	828		571	550	568		791	325	260	
2018	1,816	1,362	845	986		571	570	775		791	275	211	
2019	1,793	1,345	663	1,274		388	388	570		956	275	704	
2020	1,793	1,345	1,088	1,095		388	388	740		956	700	355	
2021	1,751	1,313	916	1,001		394	394	609		919	522	392	
2022	1,751	1,313	1,144	1,308		394	394	657		919	750	651	
2023	1,680	1,260	1,260	1,223		380	380	569		880	880	653	
2024	1,680	1,260	1,260	1,125		380	380	422		880	880	703	

Table 16.2. Catch (t) of Other Rockfish species in the Aleutian Islands (AI), 2003-2024. Source: NMFS AKRO Catch Accounting System, AKFIN database, NMFS AFSC FMA Observer Debriefed Haul and Length tables, accessed October 1, 2024.

Year	Area	dusky rockfish	SST	other thornyheads	% SST in thornyhead catch	harlequin rockfish	yelloweye rockfish	redbanded rockfish	redstripe rockfish	black rockfish	other rockfish	Total (t)
2003	AI	151.5	129.3	47.8	73.0%	34.5	2.4	0.2	0.9	0.2	3.2	389.6
2004	AI	129.5	60.3	37	62.0%	36.9	0.9	0.2	3.1	1.4	47.9	331.2
2005	AI	134.2	78.1	35.1	69.0%	14.3	5.6	0.2	0	0	14.1	281.6
2006	AI	161.4	118.7	39.7	74.9%	25.2	0.4	0.1	1.7	0.1	72.2	421.6
2007	AI	231.7	115.9	15.4	88.3%	39.9	0.6	1.4	0.5	0.1	23.9	429.4
2008	AI	179.8	107.4	7.8	93.2%	34.3	4.5	1	0.6	3.2	43.3	382
2009	AI	142	131.7	10.9	92.4%	22.8	0.2	0.4	0	1.2	63	372.3
2010	AI	226.2	154.8	14.9	91.2%	42.6	0.5	3.6	0.9	0.4	53.5	497.6
2011	AI	380.5	152.9	10.7	93.4%	59.3	0.3	0.7	0	0.1	12.2	616.7
2012	AI	435.2	171.1	2.7	98.4%	51.9	0.1	3.7	0	0.3	46.3	711.4
2013	AI	334.3	226.2	4.6	98.0%	25.9	0.7	0.9	0	0.5	3.7	596.8
2014	AI	349.3	202.3	8.8	95.8%	20	0.1	1.5	0.3	0.4	6.2	588.9
2015	AI	294.4	119.7	2.3	98.1%	32.7	0.1	0.3	0	0.1	17.6	467.1
2016	AI	337.6	113.5	0	100.0%	36.1	1.3	0.5	0.1	0.3	0.7	490.2
2017	AI	403.5	99.6	0.8	99.2%	47.9	0.1	1.7	4.5	0.5	9.6	568.2
2018	AI	570.6	90.2	1.3	98.6%	95.4	0.8	0.9	0	0.3	15.3	774.8
2019	AI	332.4	135	0	100.0%	92.2	0.3	2	0	0.8	7.2	569.9
2020	AI	426.6	186	0.1	99.9%	97.8	1	2.3	0.1	1.1	24.3	739.5
2021	AI	361.4	164.5	6	96.5%	67.6	0.6	0.6	0	0.1	8.2	609.2
2022	AI	380.6	159.1	0	100.0%	90.5	0.6	0.6	0.3	0	25.5	657.3
2023	AI	355.1	141.2	0	100.0%	69.2	0.9	1.8	0	0.8	0.3	569.4
2024	AI	230.3	107.1	0	100.0%	76.8	0.2	2.2	2	0.2	0.4	422.1
Average	AI	297.6	134.8	11.2	91.9%	50.6	1	1.2	0.7	0.6	22.7	522.1

Table 16.3. Catch (t) of Other Rockfish species in the Bering Sea (EBS), 2003-2024. Source: NMFS AKRO Catch Accounting System, AKFIN database, NMFS AFSC FMA Observer Debriefed Haul and Length tables, accessed October 1, 2024.

Year	Area	dusky rockfish	SST	other thornyheads	% SST in thornyhead catch	harlequin rockfish	yelloweye rockfish	redbanded rockfish	redstripe rockfish	black rockfish	other rockfish	Total (t)
2003	EBS	22.2	218.9	20.8	91.3%	0	1.1	17	1	0.3	13.6	295
2004	EBS	31.9	224.3	17.7	92.7%	0.4	1.4	10.4	0	0.9	15	301.9
2005	EBS	36.2	103	15.9	86.6%	0.2	0.7	0.3	0	7.2	1.6	165.2
2006	EBS	46.6	89	4.3	95.4%	0	1.4	0.4	0.1	0.2	6.9	148.8
2007	EBS	44.9	163.1	5.1	97.0%	0	1.7	0	0	0.3	1.8	217.1
2008	EBS	15.4	179	7.4	96.0%	0	1	0	0.1	2.2	9.2	214.3
2009	EBS	10.2	177.6	1	99.4%	0.1	1.1	0.2	0	0.2	2.8	193.3
2010	EBS	33.3	200.2	7.1	96.6%	0.3	1.4	0.5	0	1.5	23.8	268.3
2011	EBS	46.1	258	1.7	99.3%	4.6	1.4	0.5	0	3.5	12.7	328.4
2012	EBS	35.9	134.5	9.5	93.4%	0.1	0.5	2.6	0.1	7.2	17.3	207.6
2013	EBS	33.3	142.7	3	97.9%	0.6	0.7	0.2	0	4.6	7	192.2
2014	EBS	42.2	245.9	3.4	98.6%	1.5	1.5	0.1	4.6	1.8	22.8	323.9
2015	EBS	47.7	99.8	2.3	97.8%	2.3	1.4	0.2	0	1.7	28.5	183.9
2016	EBS	36.4	210.1	9.4	95.7%	3.1	2.5	0.1	0	6.2	10.2	278.1
2017	EBS	30.2	210.9	1	99.5%	1.7	1.3	1.6	0.3	0.8	11.9	259.8
2018	EBS	38.4	148.6	0.7	99.6%	0.5	1	0.2	0.1	5.2	16.7	211.4
2019	EBS	88.3	599.7	1.9	99.7%	3.4	1.3	0.6	0.1	0.7	7.6	703.6
2020	EBS	64.3	247.8	0.4	99.8%	0.3	0.8	0	0	7.6	33.8	355
2021	EBS	65.4	310.5	0.1	100.0%	3.4	0.8	0	0	0.2	11.6	391.8
2022	EBS	122.7	506.4	1	99.8%	7	1.9	0.5	0	1.2	10.4	651.2
2023	EBS	92.4	506.9	0	100.0%	30.9	2.9	0.2	0	2.6	17.3	653.2
2024	EBS	92.2	586.4	0	100.0%	3.3	1.3	0.1	0	1.4	18.6	703.3
Average	EBS	48.9	252.9	5.2	97.1%	2.9	1.3	1.6	0.3	2.6	13.7	329.4

Table 16.4. Discarded catch (t), total catch (t), and discard rate (%) in the Aleutian Islands and eastern Bering Sea for the non-shortspine thornyhead (non-SST) species in the Other Rockfish complex from 2003-2024. Accessed October 1, 2024 from the NMFS AKRO Catch Accounting System, AKFIN database.

non-shortspine thornyhead (non-SST)						
	Aleutian Islands			Eastern Bering Sea		
Year	Discarded Catch	Total Catch	Discard Rate	Discarded Catch	Total Catch	Discard Rate
2003	157	260	60%	37	76	48%
2004	158	271	58%	44	78	57%
2005	86	203	42%	17	62	27%
2006	158	303	52%	20	60	33%
2007	194	313	62%	39	54	73%
2008	108	275	39%	18	35	51%
2009	101	241	42%	7	16	43%
2010	100	343	29%	42	68	62%
2011	102	464	22%	32	70	45%
2012	83	540	15%	34	73	47%
2013	104	371	28%	32	50	65%
2014	61	387	16%	46	78	59%
2015	53	347	15%	56	84	66%
2016	20	377	5%	38	68	56%
2017	88	469	19%	27	49	56%
2018	190	685	28%	43	63	68%
2019	210	435	48%	36	104	35%
2020	289	554	52%	65	107	60%
2021	236	445	53%	43	81	53%
2022	251	498	50%	69	145	48%
2023	202	428	47%	78	146	53%
2024	80	315	25%	40	117	34%
Average	138	387	37%	39	77	52%

Table 16.5. Discarded catch (t), total catch (t), and discard rate (%) in the Aleutian Islands and eastern Bering Sea for shortspine thornyhead (SST) from 2003-2024. Accessed October 1, 2024 from the NMFS AKRO Catch Accounting System, AKFIN database.

Shortspine thornyhead (SST)						
	Aleutian Islands			Eastern Bering Sea		
Year	Discarded Catch	Total Catch	Discard Rate	Discarded Catch	Total Catch	Discard Rate
2003	31	129	24%	8	219	4%
2004	8	60	13%	29	224	13%
2005	9	78	12%	4	103	4%
2006	18	119	15%	6	89	7%
2007	23	116	20%	34	163	21%
2008	6	107	6%	52	179	29%
2009	16	132	12%	16	178	9%
2010	24	155	16%	23	200	12%
2011	41	153	27%	18	258	7%
2012	16	171	9%	10	134	7%
2013	48	226	21%	14	143	10%
2014	86	202	43%	21	246	9%
2015	13	120	10%	12	100	12%
2016	21	114	19%	47	210	22%
2017	14	100	14%	30	211	14%
2018	7	90	8%	17	149	12%
2019	45	135	33%	125	600	21%
2020	105	186	56%	34	248	14%
2021	41	164	25%	47	310	15%
2022	70	159	44%	132	506	26%
2023	71	141	51%	186	507	37%
2024	19	107	18%	99	586	17%
Average	33	135	23%	44	253	15%

Table 16.6. Bottom trawl survey (BTS) biomass estimates (t) and longline survey (LLS) relative population weights (RPW) with coefficient of variations in parentheses from the Aleutian Islands (AI), Eastern Bering Sea (EBS) shelf, and EBS slope. These abundance estimates were used as inputs to the random effects model for shortspine thornyhead (SST) and non-SST components of the Other Rockfish complex. The Southern Bering Sea is defined by the International North Pacific Fisheries Commission (INPFC) and is sampled during the AI trawl survey. SST do not occur on the EBS shelf. Zero biomass observations are treated as NA values in the random effects model.

	SST				non-SST			
	BTS Biomass			LLS RPW	BTS Biomass			
Year	AI	SBS	EBS Slope	EBS Slope	AI	SBS	EBS Shelf	EBS Slope
1982							4,904 (1)	
1983							0 (NA)	
1984							34 (0.71)	
1985							40 (0.9)	
1986							22 (1)	
1987							49 (1)	
1988							0 (NA)	
1989							0 (NA)	
1990							370 (0.79)	
1991	6,153 (0.24)	187 (0.58)			511 (0.37)	61 (0.83)	851 (0.93)	
1992							173 (0.92)	
1993							86 (1)	
1994	6,244 (0.16)	1,071 (0.52)			225 (0.58)	101 (0.49)	47 (1)	
1995							74 (0.7)	
1996							35 (1)	
1997	8,894 (0.18)	1,545 (0.69)		12,110 (0.23)	644 (0.68)	138 (0.46)	127 (1)	
1998							527 (0.68)	
1999				4,192 (0.12)			390 (0.75)	
2000	10,648 (0.19)	1,051 (0.48)			1,276 (0.33)	56 (0.36)	0 (NA)	
2001				9,444 (0.24)			0 (NA)	
2002	14,244 (0.2)	1,012 (0.41)	17,202 (0.11)		558 (0.31)	99 (0.36)	0 (NA)	38 (0.42)
2003				11,050 (0.27)			54 (0.7)	
2004	17,335 (0.19)	945 (0.56)	19,085 (0.09)		1,240 (0.41)	5,530 (0.78)	0 (NA)	32 (0.35)
2005				13,503 (0.15)			36 (1)	
2006	17,878 (0.12)	968 (0.55)			6,005 (0.88)	738 (0.95)	351 (0.84)	
2007				13,135 (0.28)			0 (NA)	
2008			26,330 (0.12)				0 (NA)	27 (0.45)

	SST				non-SST			
	BTS Biomass			LLS RPW	BTS Biomass			
Year	AI	SBS	EBS Slope	EBS Slope	AI	SBS	EBS Shelf	EBS Slope
2009				16,118 (0.22)			120 (0.58)	
2010	18,075 (0.16)	1,052 (0.73)	29,676 (0.12)		611 (0.31)	120 (0.44)	57 (0.92)	147 (0.7)
2011				28,630 (0.17)			55 (1)	
2012	14,443 (0.15)	452 (0.77)	29,987 (0.11)		250 (0.3)	135 (0.57)	36 (1)	52 (0.49)
2013				24,760 (0.09)			39 (1)	
2014	17,611 (0.24)	2,567 (0.67)			5,645 (0.81)	232 (0.5)	28 (1)	
2015				31,782 (0.14)			142 (1)	
2016	16,541 (0.16)	1,607 (0.53)	36,448 (0.11)		1,773 (0.33)	218 (0.54)	20 (1)	31 (0.33)
2017				28,295 (0.14)			170 (0.73)	
2018	13,216 (0.2)	1,605 (0.68)			914 (0.32)	1,639 (0.77)	1,562 (0.7)	
2019				26,073 (0.16)			0 (NA)	
2020								
2021				25,497 (0.18)			0 (NA)	
2022	12,936 (0.16)	1,278 (0.75)			1,506 (0.48)	299 (0.39)	43 (1)	
2023				9,605 (0.3)			168 (0.97)	
2024	14,239 (0.13)	382 (0.66)			1,475 (0.31)	1,973 (0.53)	196 (0.61)	

Table 16.7. Model 22 predicted total biomass for shortspine thornyhead (SST), non-SST, and SST and non-SST combined in the Bering Sea and Aleutian Islands (BSAI) between the 2022 and current assessments.

	SST		non-SST		Total	
Year	M22 2022	M22 2024	M22 2022	M22 2024	M22 2022	M22 2024
1991	18,613	18,917	734	951	19,346	19,868
1992	18,778	19,083	577	713	19,355	19,795
1993	18,951	19,257	531	573	19,482	19,830
1994	19,134	19,443	486	492	19,619	19,935
1995	19,814	20,135	584	585	20,398	20,720
1996	20,557	20,892	706	705	21,264	21,598
1997	21,369	21,722	919	928	22,289	22,650
1998	19,865	19,982	1,179	1,213	21,043	21,195
1999	18,843	18,802	1,326	1,360	20,169	20,162
2000	21,872	21,906	1,440	1,471	23,312	23,377
2001	25,954	26,142	1,117	1,118	27,072	27,261
2002	30,489	30,851	895	879	31,384	31,730
2003	32,809	33,127	1,374	1,406	34,183	34,533
2004	35,821	36,192	2,537	2,821	38,358	39,014
2005	37,336	37,628	2,737	2,993	40,073	40,621
2006	39,240	39,487	3,286	3,678	42,526	43,165
2007	40,547	40,758	2,330	2,546	42,877	43,304
2008	43,391	43,725	1,659	1,771	45,050	45,496
2009	44,503	44,748	1,208	1,260	45,711	46,008
2010	47,806	48,184	887	909	48,694	49,093
2011	50,989	51,599	703	700	51,691	52,299
2012	48,143	48,346	568	552	48,710	48,897
2013	52,012	52,402	1,050	1,084	53,063	53,487
2014	55,316	55,880	2,208	2,468	57,524	58,349
2015	58,159	58,852	2,142	2,282	60,301	61,134
2016	54,977	55,282	2,061	2,091	57,037	57,373
2017	55,165	55,365	1,944	1,995	57,109	57,360
2018	53,547	53,151	2,205	2,422	55,752	55,573
2019	52,556	51,665	1,934	2,175	54,490	53,840
2020	51,943	49,220	1,767	2,032	53,711	51,251
2021	51,339	46,912	1,674	1,968	53,013	48,880
2022	51,098	41,310	1,635	1,965	52,733	43,275
2023	51,098	37,110	1,635	2,382	52,733	39,492
2024	-	37,408	-	3,151	-	40,559

Table 16.8. Parameter estimates with standard errors (SE) and lower/upper 95% confidence intervals (LCI/UCI) for the recommended random effects (RE) Model 22 fit to the shortspine thornyhead (SST) and non-SST species biomass estimates. The 2022 assessment model results are compared with the current assessment. Estimates are shown on the natural (i.e., arithmetic scale) for ease of interpretation but are estimated in log-space. Process error is pooled across all survey regions for both species groups.

Assessment Year	Species group	Model 22	Parameter	Estimate	SE	LCI	UCI
2024	SST	Model 22	Process error	0.18	0.04	0.12	0.26
2024	SST	Model 22	Scaling parameter (q)	0.69	0.06	0.58	0.83
2024	non-SST	Model 22	Process error	0.76	0.12	0.55	1.04
2022	SST	Model 22	Process error	0.17	0.03	0.11	0.25
2022	SST	Model 22	Scaling parameter (q)	0.70	0.06	0.59	0.84
2022	non-SST	Model 22	Process error	0.67	0.13	0.46	0.97

Table 16.9. Time series of catch (t), predicted biomass (t) from Model 22 fit using the random effects model (t), and exploitation rate expressed as catch/biomass for the shortspine thornyhead (SST) and non-SST components of the Other Rockfish complex in the Aleutian Islands (AI) and eastern Bering Sea (EBS). Catch accessed October 1, 2024 from the NMFS AKRO Catch Accounting System, AKFIN database.

		Shortspine Thornyhead (SST)			non-SST		
Subarea	Year	Catch	Biomass	Catch/Biomass	Catch	Biomass	Catch/Biomass
AI	2003	129	15,021	0.009	260	881	0.295
	2004	60	16,366	0.004	271	1,255	0.216
	2005	78	16,951	0.005	203	1,868	0.109
	2006	119	17,558	0.007	303	2,782	0.109
	2007	116	17,493	0.007	313	1,907	0.164
	2008	107	17,428	0.006	275	1,307	0.210
	2009	132	17,364	0.008	241	896	0.269
	2010	155	17,300	0.009	343	614	0.559
	2011	153	16,315	0.009	464	433	1.070
	2012	171	15,385	0.011	540	306	1.765
	2013	226	15,838	0.014	371	813	0.456
	2014	202	16,303	0.012	387	2,159	0.179
	2015	120	16,095	0.007	347	1,927	0.180
	2016	114	15,889	0.007	377	1,720	0.219
	2017	100	14,935	0.007	469	1,296	0.362
	2018	90	14,039	0.006	685	976	0.701
	2019	135	13,857	0.010	435	1,079	0.403
	2020	186	13,677	0.014	554	1,192	0.464
	2021	164	13,499	0.012	445	1,317	0.338
	2022	159	13,324	0.012	498	1,456	0.342
	2023	141	13,674	0.010	428	1,464	0.292
	2024	107	14,033	0.008	315	1,473	0.214
	Avg.			0.009			0.405
EBS	2003	219	18,106	0.012	76	525	0.145
	2004	224	19,827	0.011	78	1,567	0.050
	2005	103	20,676	0.005	62	1,125	0.055
	2006	89	21,929	0.004	60	896	0.067
	2007	163	23,266	0.007	54	639	0.084
	2008	179	26,297	0.007	35	464	0.076
	2009	178	27,384	0.006	16	365	0.043
	2010	200	30,884	0.006	68	295	0.231
	2011	258	35,284	0.007	70	266	0.265
	2012	134	32,960	0.004	73	246	0.298
	2013	143	36,565	0.004	50	271	0.183
	2014	246	39,577	0.006	78	310	0.252
	2015	100	42,757	0.002	84	355	0.237
	2016	210	39,394	0.005	68	371	0.183
	2017	211	40,430	0.005	49	699	0.070
	2018	149	39,112	0.004	63	1,446	0.043
	2019	600	37,808	0.016	104	1,096	0.095
	2020	248	35,542	0.007	107	840	0.128
	2021	310	33,412	0.009	81	651	0.125
	2022	506	27,985	0.018	145	510	0.284
	2023	507	23,436	0.022	146	917	0.159
	2024	586	23,375	0.025	117	1,678	0.070
	Avg.			0.009			0.143

Figures

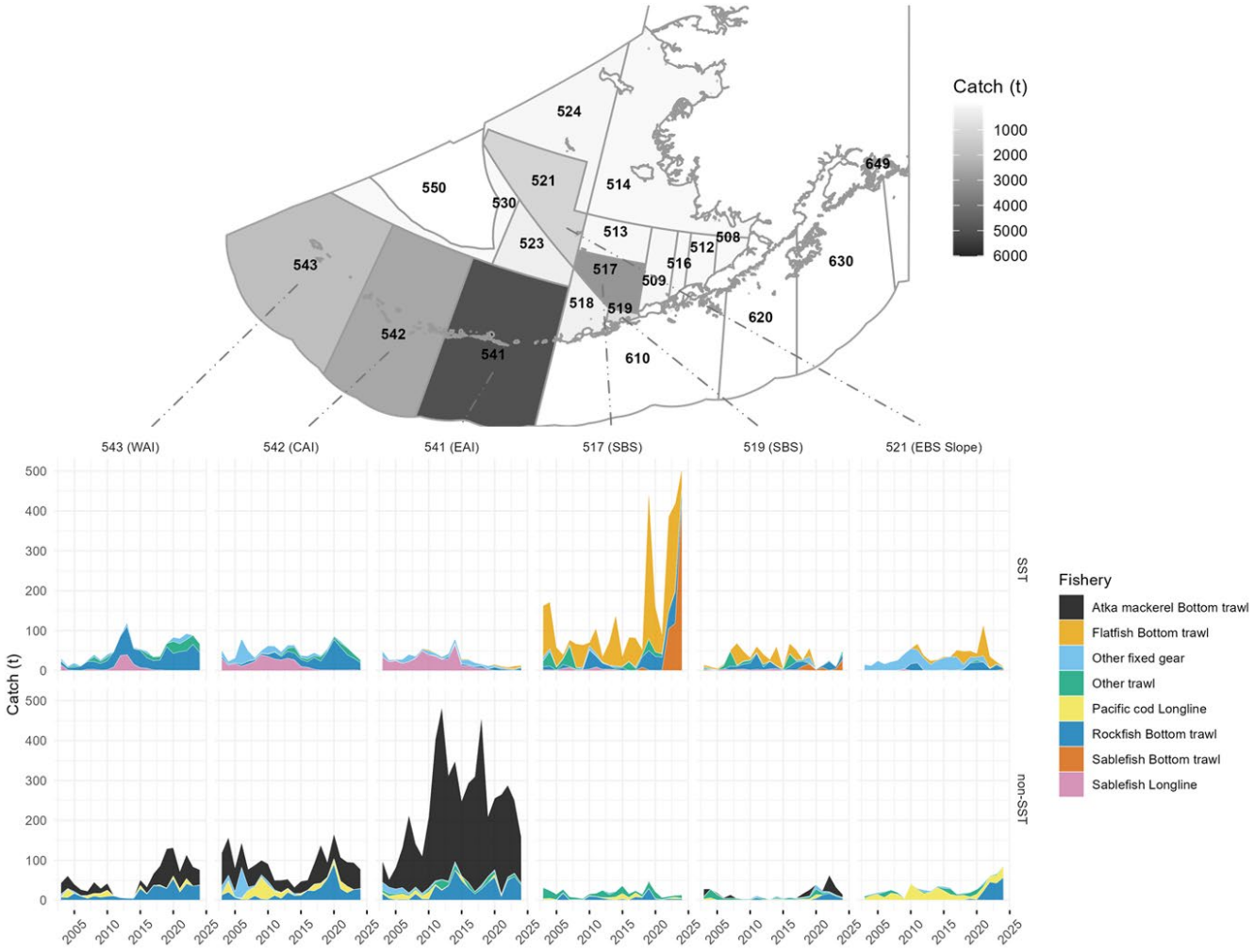

Figure 16.1. Upper panel: Map of aggregated catch of all Other Rockfish in the Bering Sea and Aleutian Islands (BSAI) by NMFS reporting area, 2003-2024. Lower panel: Annual catches of shortspine thornyhead (SST) and non-SST rockfish by dominant fishery and gear type for the NMFS reporting areas with the greatest catch. Source: NMFS AKRO Catch Accounting System, AKFIN database, updated through September 28, 2024 (accessed on October 1, 2024).

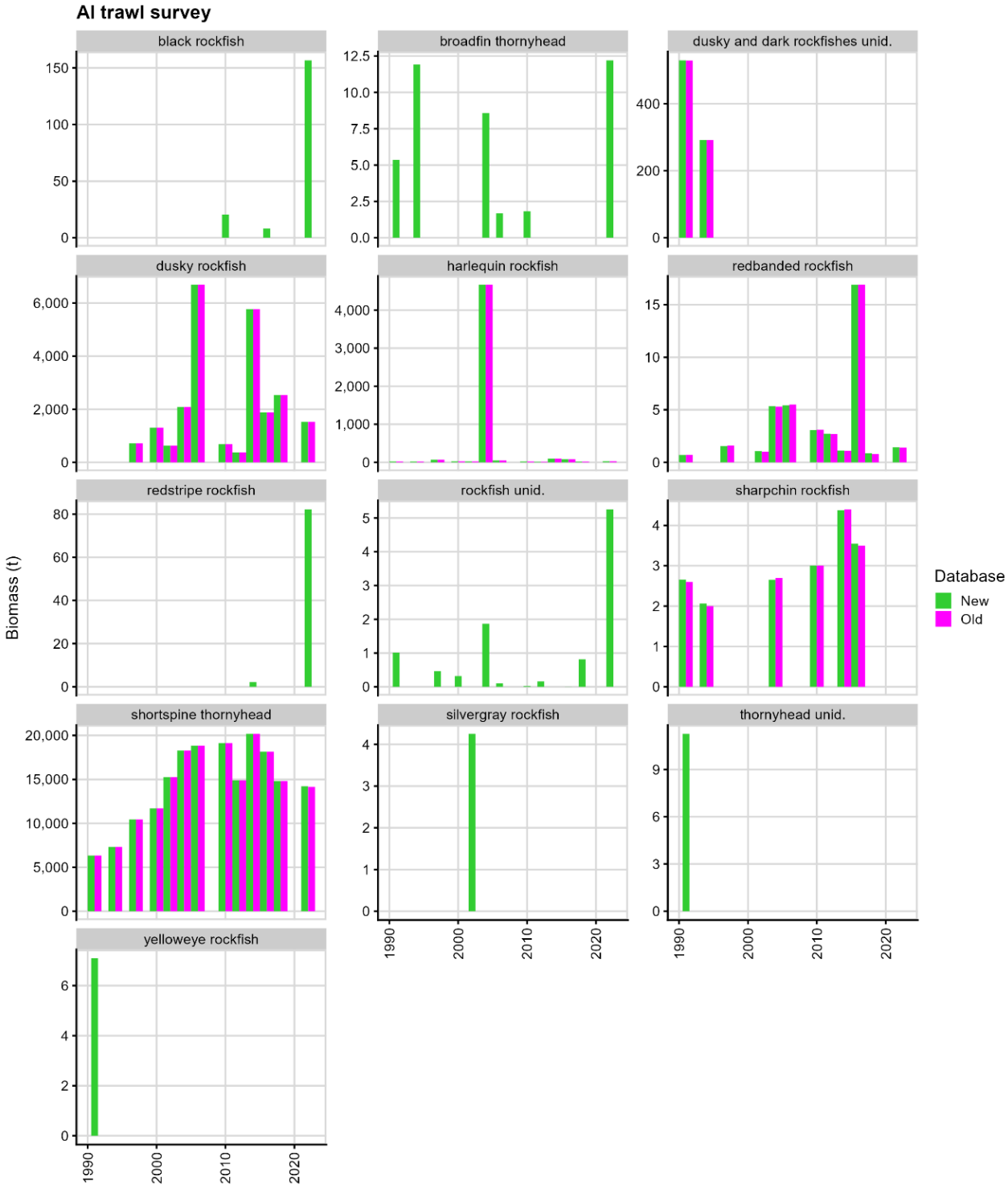

Figure 16.2. Comparison of survey biomass estimates in the new GAP_PRODUCTS database vs. old for all Other Rockfish species in the Aleutian Islands (AI), Eastern Bering Sea (EBS) shelf, and EBS slope surveys. Note the difference in *y*-axis scales.

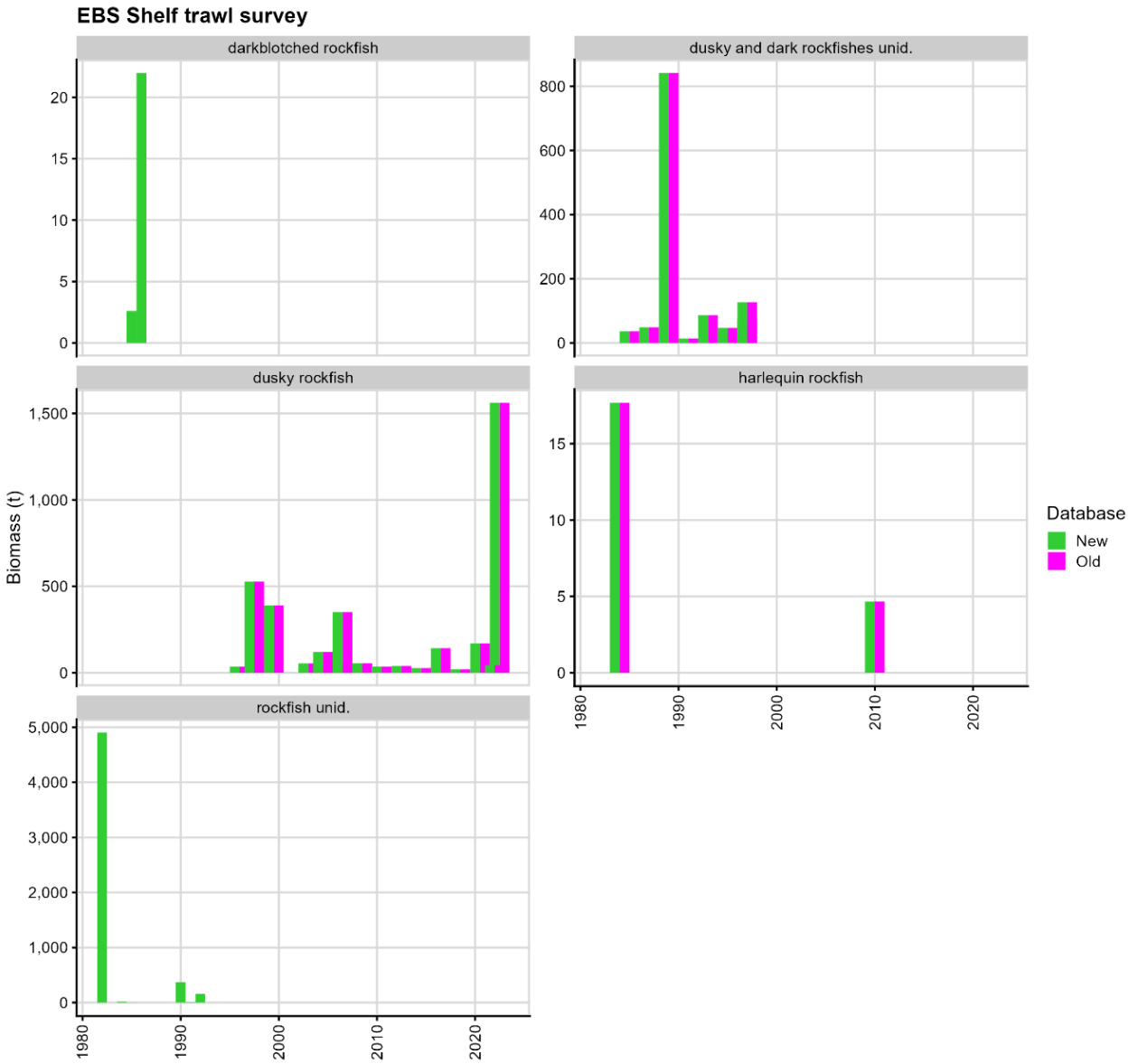

Figure 16.2. cont. Comparison of survey biomass estimates in the new GAP_PRODUCTS database vs. old for all Other Rockfish species in the Aleutian Islands (AI), Eastern Bering Sea (EBS) shelf, and EBS slope surveys. Note the difference in *y*-axis scales.

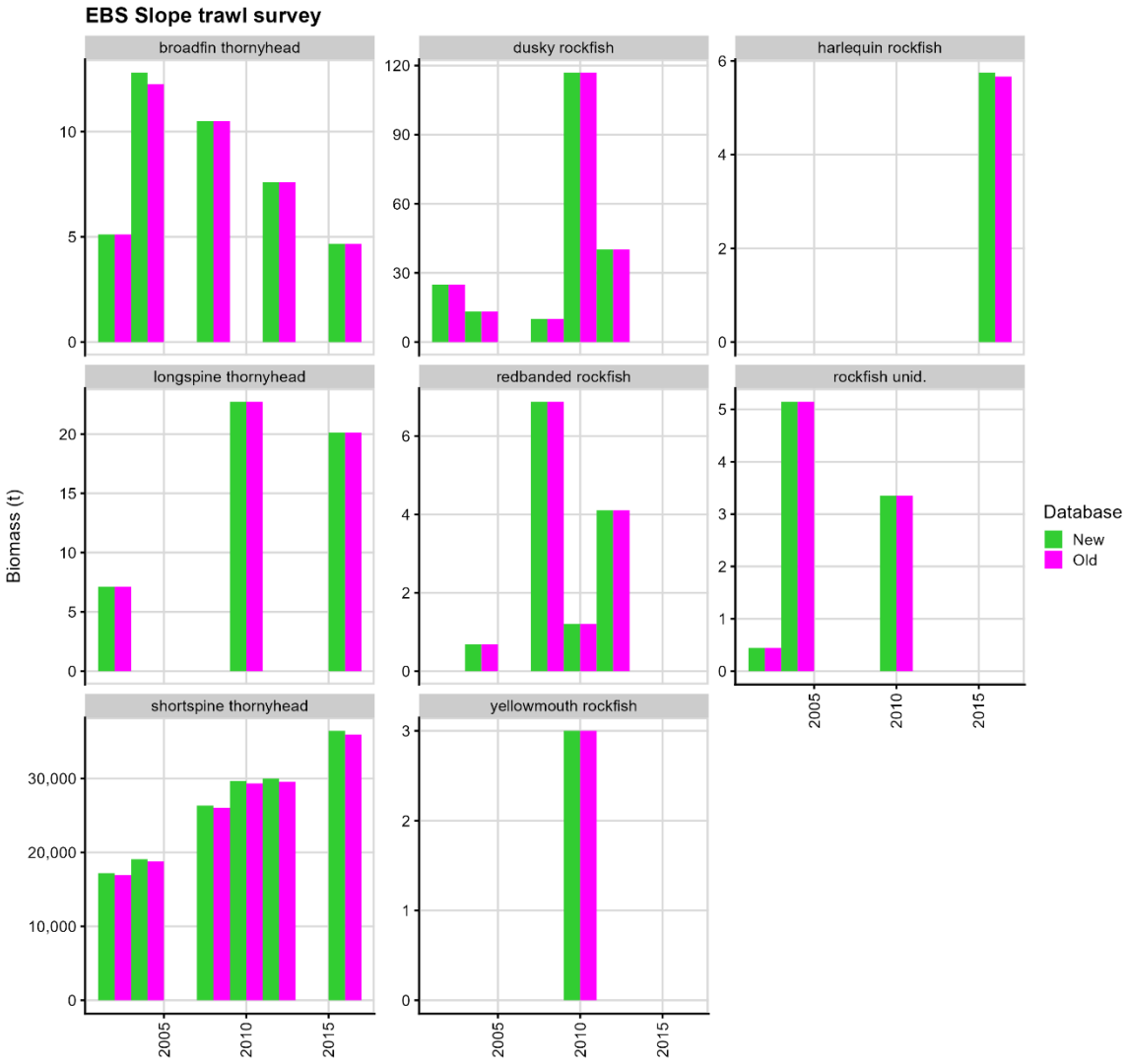

Figure 16.2. cont. Comparison of survey biomass estimates in the new GAP_PRODUCTS database vs. old for all Other Rockfish species in the Aleutian Islands (AI), Eastern Bering Sea (EBS) shelf, and EBS slope surveys. Note the difference in *y*-axis scales.

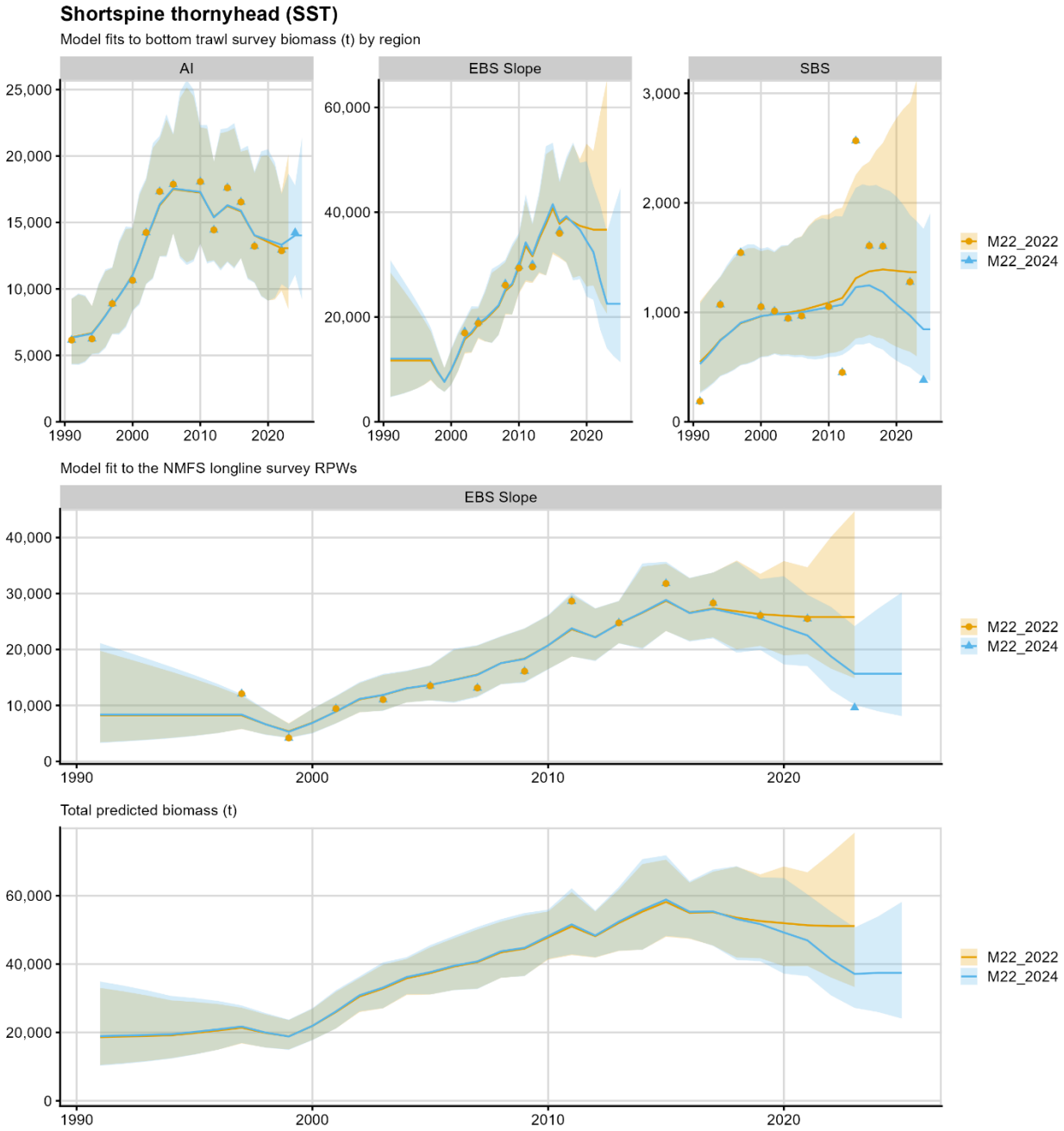

Figure 16.3. Model fits to the Aleutian Islands (AI) and eastern Bering Sea (EBS) bottom trawl surveys (BTS) by region (top), fits to the EBS slope longline survey relative population weights (RPWs; middle), and total predicted biomass for shortspine thornyhead (SST; bottom). The Southern Bering Sea (SBS) is an area defined by the International North Pacific Fisheries Commission (INPFC) northeast of Samalga Pass and is sampled in the AI BTS. Results are shown for the recommended Model 22 from the 2022 assessment (yellow) and the current assessment (blue). Note the difference in *y*-axis scales.

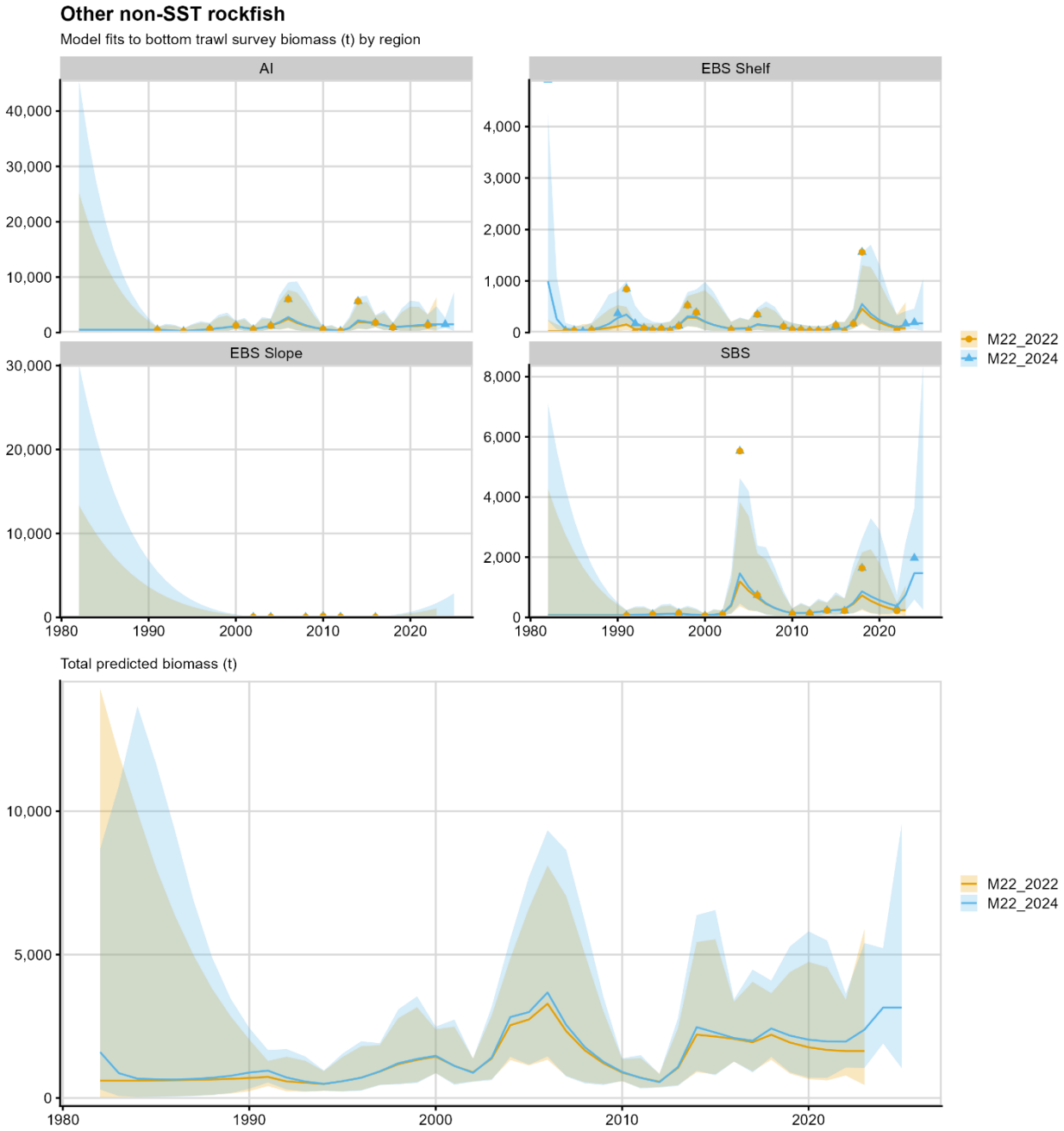

Figure 16.4. Model fits to the Aleutian Islands (AI) and eastern Bering Sea (EBS) bottom trawl surveys (BTS) by region (top), and total predicted biomass for all non-shortspine thornyhead (i.e., non-SST) species (bottom). The Southern Bering Sea (SBS) is an area defined by the International North Pacific Fisheries Commission (INPFC) northeast of Samalga Pass and is sampled in the AI BTS. Results are shown for the recommended Model 22 from the 2022 assessment (yellow) and the current assessment (blue). Note the difference in *y*-axis scales.

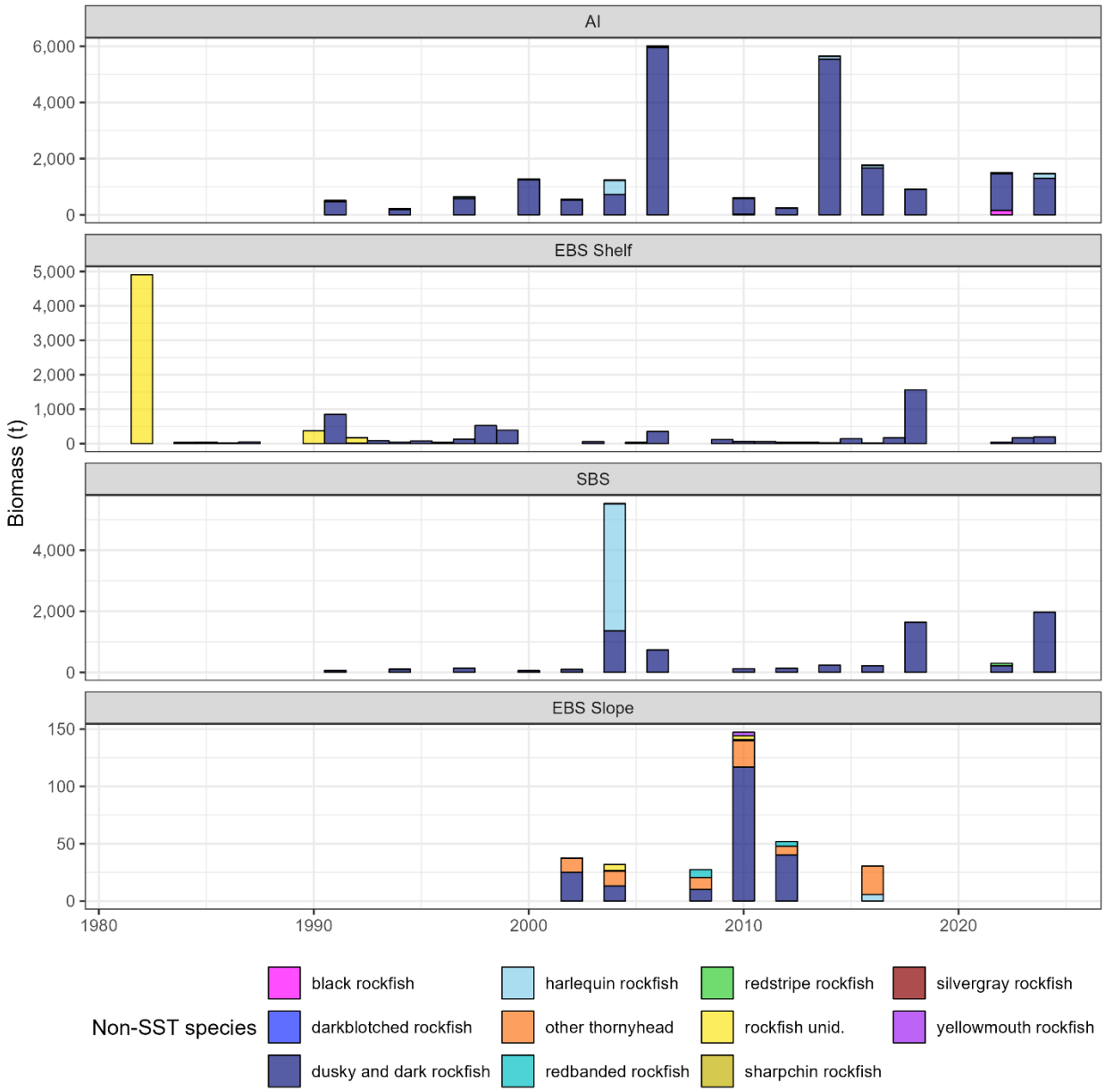

Figure 16.5. Survey biomass of non-SST (all Other Rockfish except shortspine thornyhead, SST) in the Aleutian Islands (AI), Southern Bering Sea (SBS), eastern Bering Sea (EBS) shelf, and EBS slope regions. The SBS is defined by the International North Pacific Fisheries Commission (INPFC) and is sampled during the Aleutian Islands (AI) survey. Note the difference in *y*-axis scales.

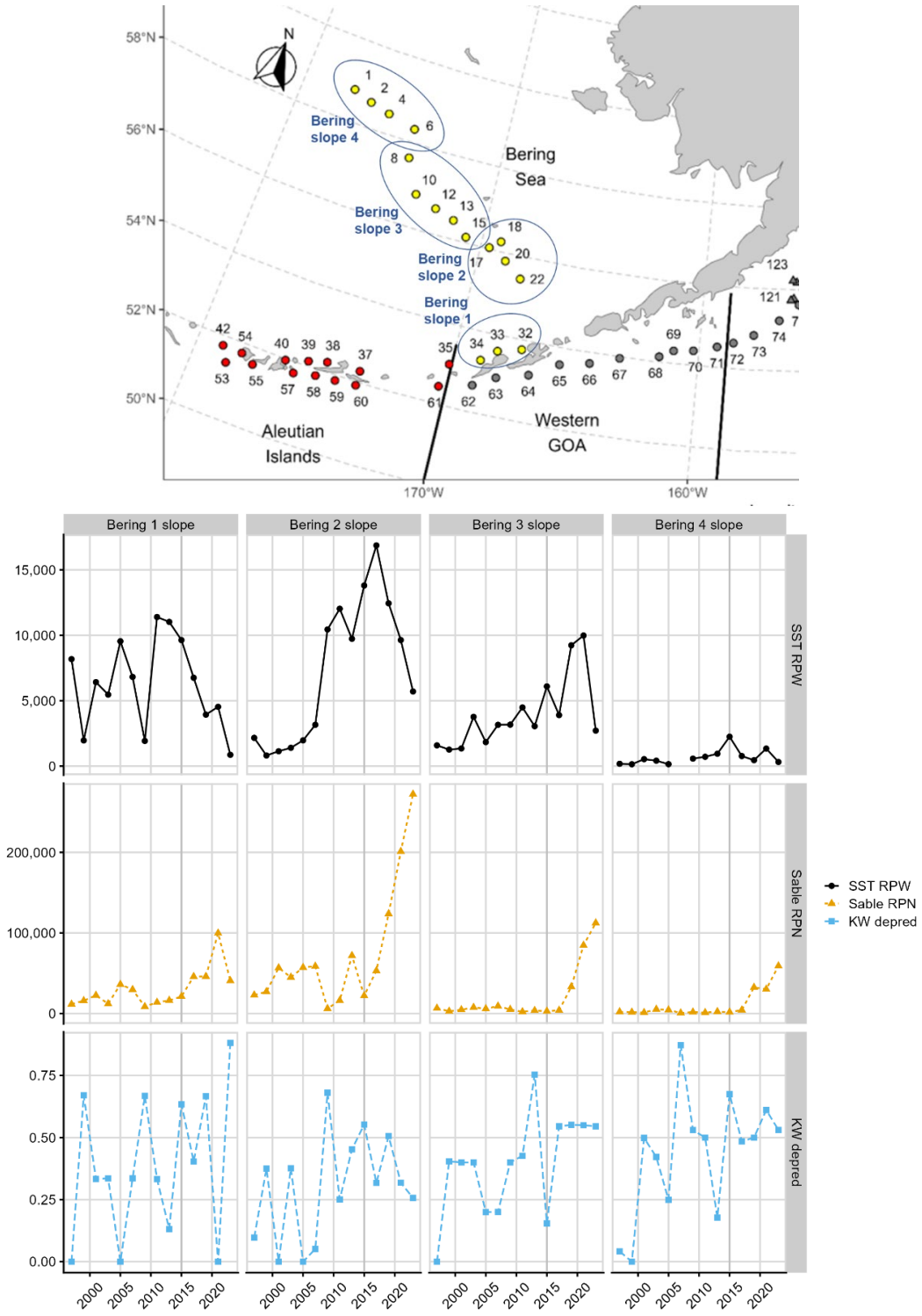

Figure 16.6. Map of longline survey (LLS) stations and strata on the EBS slope (top) with trends in shortspine thornyhead (SST) relative population weights (RPWs; black), sablefish relative population numbers (RPNs; yellow) as a proxy for hook competition), and proportion of LLS sets affected by killer whale (KW) depredation (blue). Map modified from Siwicke and Malecha (2024).

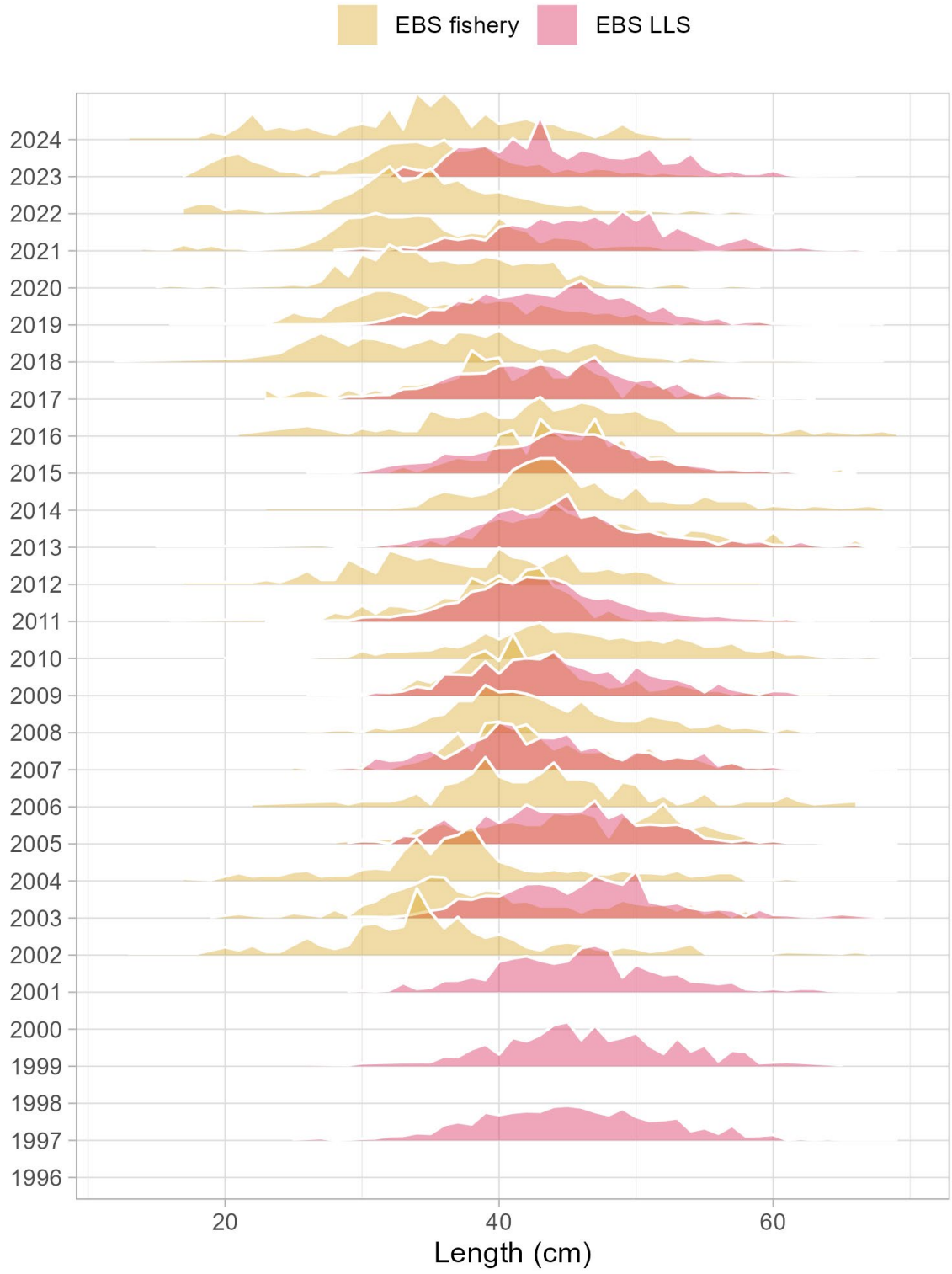

Figure 16.7. Longline survey (LLS) and fishery length frequencies for shortspine thornyhead (SST) on the EBS slope.

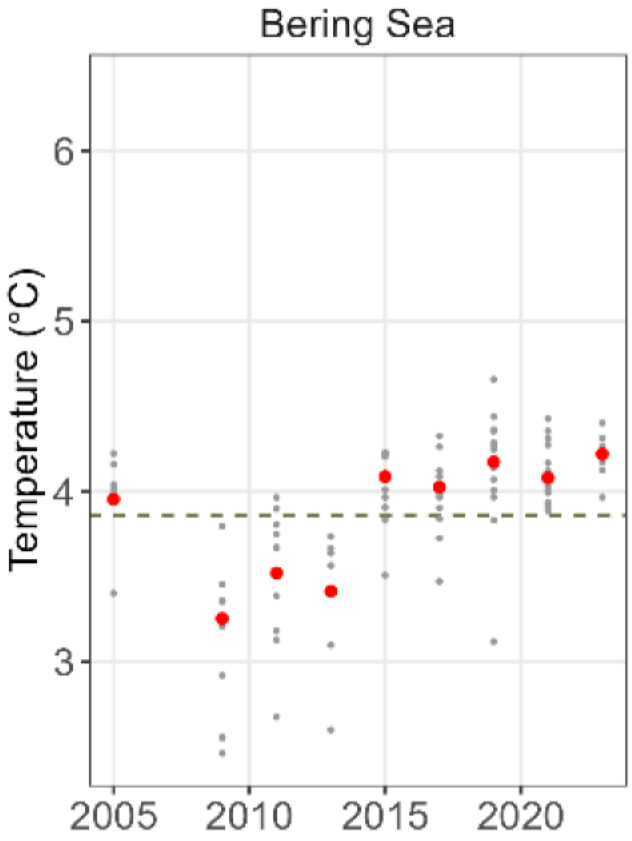

Figure 16.8. Eastern Bering Sea slope subsurface temperature trends from the NMFS longline survey averaged from 1-m increments in the 246–255 m depth bin, where grey points are individual measurements and the red dots are area-weighted means. Horizontal dashed lines are regional time series means. Figure from Siwicke and Malecha (2024).

Appendix 16A Supplemental catch data

In order to comply with the Annual Catch Limit (ACL) requirements, non-commercial removals in the Bering Sea/Aleutian Islands (BSAI) are presented. Non-commercial removals are estimated total removals that do not occur during directed groundfish fishing. These include removals incurred during research, subsistence, personal use, recreational, and exempted fishing permit activities, but do not include removals taken in fisheries other than those managed under the groundfish FMP. These estimates represent additional sources of removals to the existing Catch Accounting System (CAS) estimates. Research catches of Other Rockfish for the years 2004-2023 are listed in Table 16A-1.

Table 16A-1. Removals (t) from sources other than those included in the Alaska Region's official estimate of catch (e.g., removals due to scientific surveys, subsistence fishing, recreational fishing, fisheries managed under other FMPs) from the Alaska Department of Fish and Game (ADFG), International Pacific Halibut Commission (IPHC), and National Marine Fisheries Service (NMFS). Source: NMFS AKRO Catch Accounting System, AKFIN database, accessed October 29, 2024. Data for the current year are not yet available.

Year	ADFG	NMFS	IPHC	Total (t)
2004		1.47		1.47
2005		1.36		1.36
2006		1.68		1.68
2007		1.78		1.78
2008		1.49		1.49
2009		1.99		1.99
2010	0.01	12.81	0.73	13.54
2011	0.00	23.07	0.31	23.38
2012	0.01	9.88	0.33	10.22
2013	0.10	2.98	0.79	3.87
2014	0.02	4.83	0.84	5.69
2015	0.18	2.85	0.86	3.89
2016	0.08	12.05	0.27	12.40
2017	0.11	3.00	2.46	5.57
2018	0.39	4.26	0.39	5.04
2019	0.58	2.19	1.20	3.96
2020	0.36	1.42	0.38	2.16
2021	0.03	1.49	0.20	1.72
2022	0.01	3.94	0.51	4.47
2023	0.06	0.99		1.05