Update on Plan Team and SSC requests for the BSAI Blackspotted/rougheye stock assessment, with preliminary model runs

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Introduction

In 2022, the Bering Sea/Aleutian Islands Plan Team and the Statistical and Scientific Committee of the North Pacific Fisheries Management Council made several recommendations regarding the BSAI blackspotted/rougheye rockfish (BSRE) assessment model:

(SSC, October 2022). *The SSC acknowledged the changes in the IPHC longline survey sampling design in 2020 but noted that the survey was highly correlated with the bottom trawl survey prior to 2020. Given the retrospective bias in the current model and its difficulty in assessing the scale of the stock, the SSC recommends the author explore use of the pre-2020 data in the assessment with emphasis on sampling in untrawlable habitats.*

(BSAI Plan Team, November 2022). *The Team discussed the lack of larger fish in fishery composition data and recommended examining the NMFS and IPHC longline survey data to determine if larger fish may be in the population and not showing up in the fishery. The Team also recommended looking at the rate of blackspotted/rougheye to Pacific ocean perch in the survey tows over the time series.*

(SSC, December 2022). *Recognizing that the proportion of rougheye rockfish is much smaller in the BSAI than in the GOA and that species identification remains an issue, the SSC requests the author, to the extent possible, separate survey trends by species to refine understanding of species-specific impacts.*

The purpose of this report is to address the items above that concern the BSAI blackspotted/rougheye stock assessment and its input data, and present potential options for the 2024 assessment.

1) Inclusion of the IPHC longline survey in the model

Estimates of the Relative Population Number (RPN) are available from the IPHC longline survey beginning in 1998. The sampling design for this survey was substantially changed beginning in 2021, with no sampling in the WAI.

In a 2022 document presented to the BSAI Plan Team, it was noted that the IPHC RPN values are generally consistent with the AFSC trawl survey (r^2 = 0.71). However, this correlation only used the years in common for both time series and does not reflect the period in the late 1990s when the AI longline survey was relatively stable but the IPHC survey declined sharply (Figure 1).

A model that includes the IPHC was run (model 24.1), and was compared to the 2022 assessment model (model 20) with respect to several quantities. The fit to the IPHC longline survey generally shows a poor residual pattern with the early 1990s years with high IPHC RPNs being underfit and most years between 2005 and 2015 being overfit (Figure 2).

The fit to the AI trawl survey was similar between the two models, with the exception of the years since 2015 in which the model 24.1 shows a relative stable biomass trend, in contrast with model 20 which showed a more pronounced biomass increase (Figure 3). This pattern also holds for the AI total biomass (Figure 4).

Inclusion of the IPHC longline survey had very little effect on the fits to the age and length composition data. In Figure 5 and 6, the observed and predicted age and length compositions, respectively, are shown for the two models, aggregated across years and weighted by the year-specific data weightings within each data type used in the 2022 assessment. The predicted age compositions for the AI trawl survey are nearly identical to each other (Figure 5, upper panel), and the predicted fishery age compositions are differ only slightly from each other (Figure 5, lower panel). The fit to the fishery length composition data are also very similar between the models (Figure 6).

The IPHC longline survey does not have any size or age composition data available for blackspotted-rougheye rockfish, as length and otoliths are only routinely sampled for halibut. Thus, there is no information by which to estimate a survey selectivity curve for the IPHC survey, and the estimated IPHC selectivity in model 24.1 is 1 for all ages (Figure 7). The assumption that young fish are fully selected in this survey is in contrast with the AI trawl survey, and accounts for the differences in the biomass trends between the two models. In the 2022 assessment, the cause of the rapid increase in biomass in recent years was the observation of young fish for which AI trawl survey selectivity is typically small, which leads to an inference of large recent recruitment. If all ages are equally selected in the IPHC longline survey, then large recent year classes are not necessary to fit the scale of the IPHC index, and the lower level of recruitments results in a flatter trend of total biomass in recent years.

2) Comparison of size compositions between survey and fishery data

Comparisons between fishery and survey size compositions can help assess whether a portion of the size groups exist in the survey data but not the fishery data. As mentioned above, size composition data for blackspotted/rougheye rockfish are not available in the IPHC longline survey. The available data sets with size composition data are the AI trawl survey, the AFSC longline survey, and the fishery data separated by the trawl and longline gear types. The length compositions for the AFSC longline survey were restricted to the AI area covered by this survey, which is the EAI and a portion of the CAI. The length compositions for the fishery and the AFSC trawl survey were restricted to the EAI and CAI and shown separately for each of these areas. Comparisons between the fishery and survey size compositions are shown in Figure 8 by area for different time periods. Each of the time periods shows the combined size composition for 3 years of fishery catch that bracket a year in which both the AI trawl survey and the AI portion of the AFSC longline survey were conducted.

For most of the early comparisons in the EAI, the cumulative size distributions for the AI trawl survey and the AFSC longline survey are very similar to each other, particularly for sizes above 40 cm, although in the 2009-2011 and 2001 – 2013 time periods the trawl survey has a larger proportion of smaller fish (i.e., ~ 30 cm). In the CAI, the size distributions between the two surveys are also similar to each other, but the longline survey shows slightly larger fish in the 1999-2001, 2001-2003, and 2003-2005 periods. In the most recent periods (i.e., 2013-2023), the trawl survey typically shows larger proportions of smaller fish than the longline survey.

The size compositions from the fishery trawl and longline gear show a variety of patterns relative to the survey data, either larger sizes (EAI, 1999-2001, 2001-2003), smaller sizes (CAI, 2011-2013), bracketing the survey compositions (EAI, 2011-2013), or sizes similar to the survey data (CAI, 1999-2001, 2001-2003, 2003-2005 and EAI 2015-2017).

In most of the time periods, the cumulative proportions are very similar at the upper end of the distributions (i.e., about the 90% percentile), indicating that the largest fish seen is similar between the fishery and surveys. In the EAI since 2015, the longline survey has observed larger fish than the trawl survey. However, the sizes observed at the 90% percentiles in both the trawl and longline fishery data are either similar to or larger than those in the longline survey.

In summary, there are a variety of patterns observed in comparing the fishery size compositions to the two surveys, but there is not an indication of larger sizes in the population than in the fishery.

3) Rate of blackspotted/rougheye catch to Pacific ocean perch catch in the AI survey tows.

Catches from the survey are expressed as catch per unit effort (CPUE; kg/km^2), and the rate catches are defined as (rougheye-blackspotted CPUE)/(POP CPUE). This rate is defined only for those hauls with a positive catch of POP. The proportion of AI survey tows with positive POP catches has increased from approximately 50% in the early 1990s to greater than 70% since 2014 (Figure 9a). For the tows with positive POP catch, the proportion that also had positive rougheye catch has been relatively consistent prior to the 2022 survey and averaged 34%; however, the value for the 2022 survey increased to 44%. The mean bycatch rate ranged between 0.84 and 2.37 between the 1991 and 2006 survey with an average of 1.45. However, in the 2010 – 2022 surveys the bycatch rates ranged between 0.16 and 0.59 with an average of 0.31. These data suggest that the decline in the bycatch rate is not due to increasing number of POP tows with no blackspotted/rougheye catch, but rather smaller sizes of blackspotted/rougheye being caught in the survey. This conclusion is also supported by the smaller sizes observed in the survey length composition data.

Summary, and recommendations for November 2024 assessment

Inclusion of the IPHC RPN values for blacksptted/rougheye in the assessment is not recommended. The lack of blackspotted/rougheye size and age composition data for this survey precludes the estimation of a survey selectivity curve, without which the scaling of the survey index to population abundance cannot be reliably estimated.

A variety of patterns were observed in comparing the fishery size compositions to the two surveys, but there is not an indication of larger sizes in the population than in the fishery. Additionally, examination of bycatch rates, and the percent occurrence of blackspotted rougheye in tows with positive POP catch, indicate that the decline in the bycatch rate is not due to increasing number of POP tows with no blackspotted/rougheye catch, but rather smaller sizes of blackspotted/rougheye being caught in the survey. Finally, the length compositions and the bycatch rates are consistent with previous data presented to the Plan Team, which noted that the declines in size were observed in both the fishery and AI trawl survey.

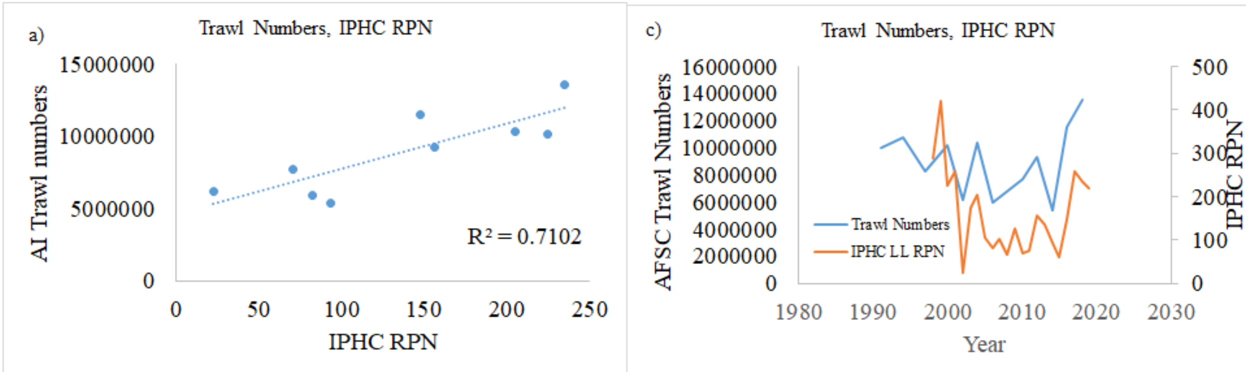

Figure 1). Correlation between IPHC longline survey RPN estimates and AFSC trawl survey abundance estimates from the Aleutian Islands (areas WAI, CAI, and EAI).

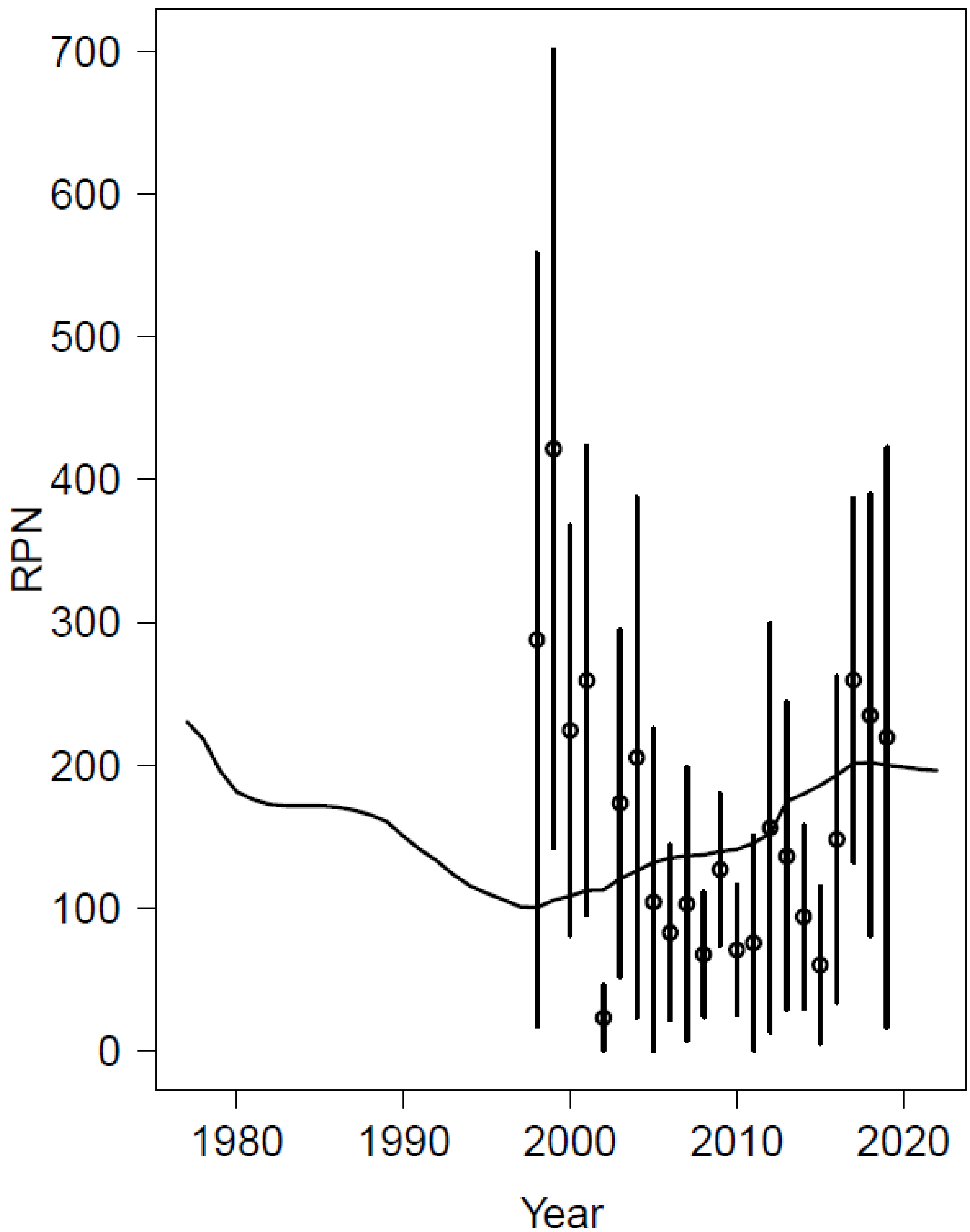

Figure 2) Fit to the IPHC RPN time series for model 24.1.

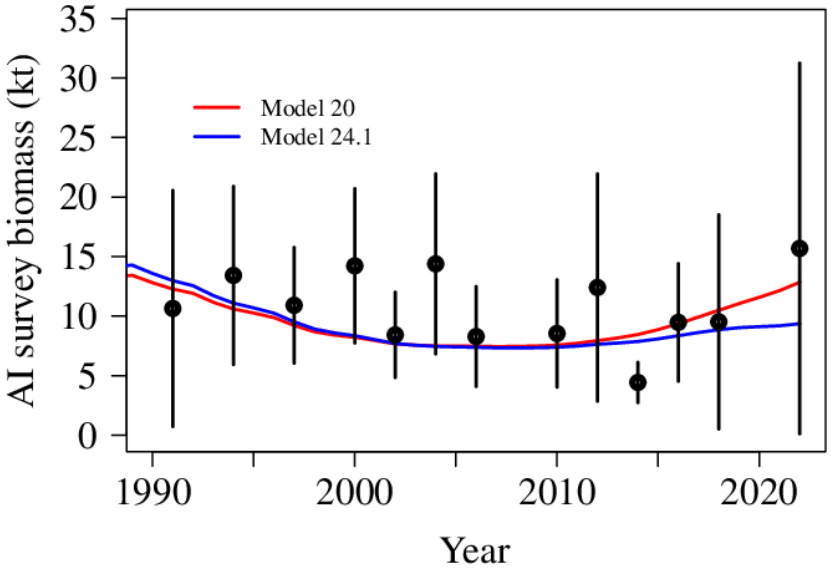

Figure 3) Fit to the AI survey biomass time series for models either with (model 24.1) and without (model 20) inclusion of the IPHC RPN values for blackspotted/rougheye.

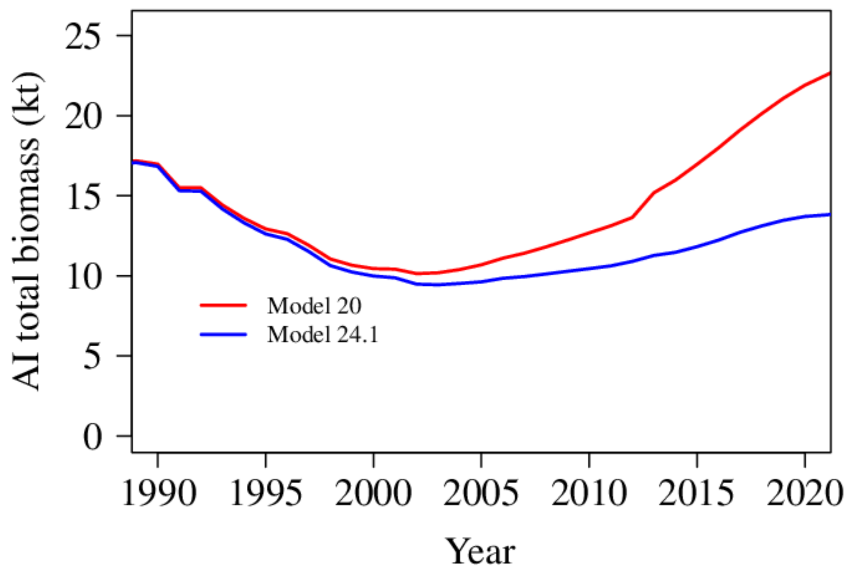

Figure 4) Estimated total biomass for models either with (Model 24.1) and without (Model 20) inclusion of the IPHC RPN values for blackspotted/rougheye rockfish.

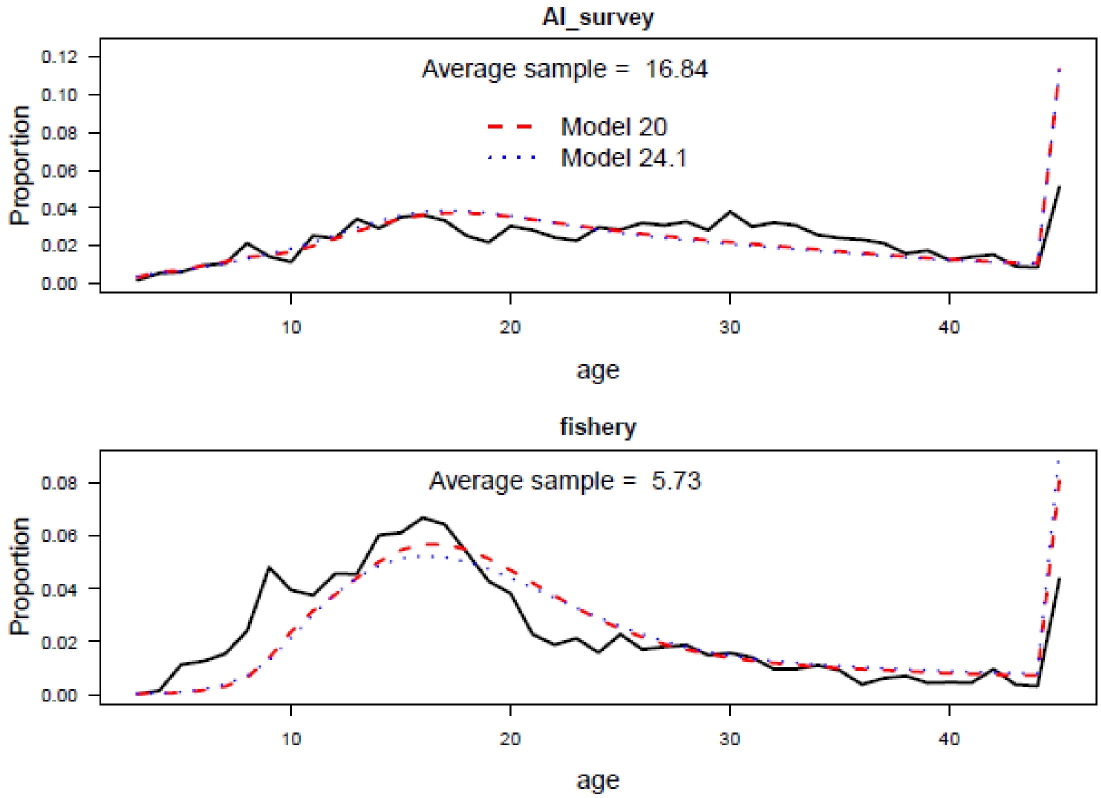

Figure 5) Aggregated age composition data and fits from models either with (model 24.1) and without (model 20) for the AI survey and fishery. Years within a data type were weighted by the year-specific sample size.

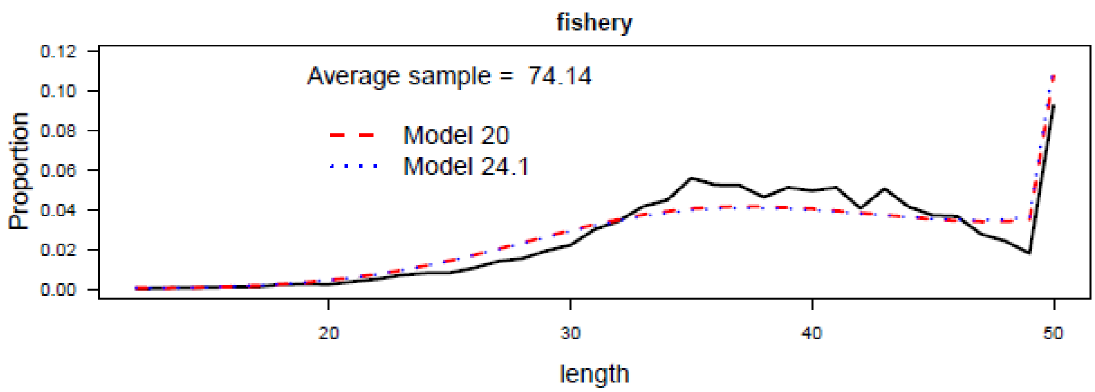

Figure 6) Aggregated length composition data and fits from models either with (model 24.1) and without (model 20) for the AI fishery. Years within a data type were weighted by the year-specific sample size.

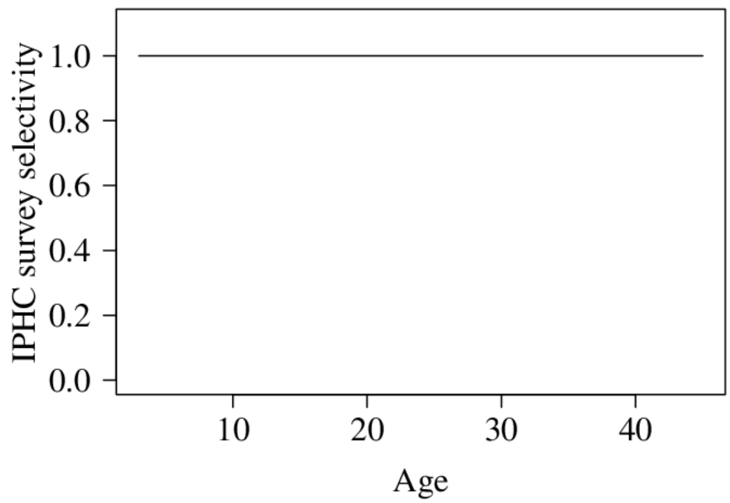

Figure 7. Estimated survey selectivity for the IPHC RPN survey index in model 24.1.

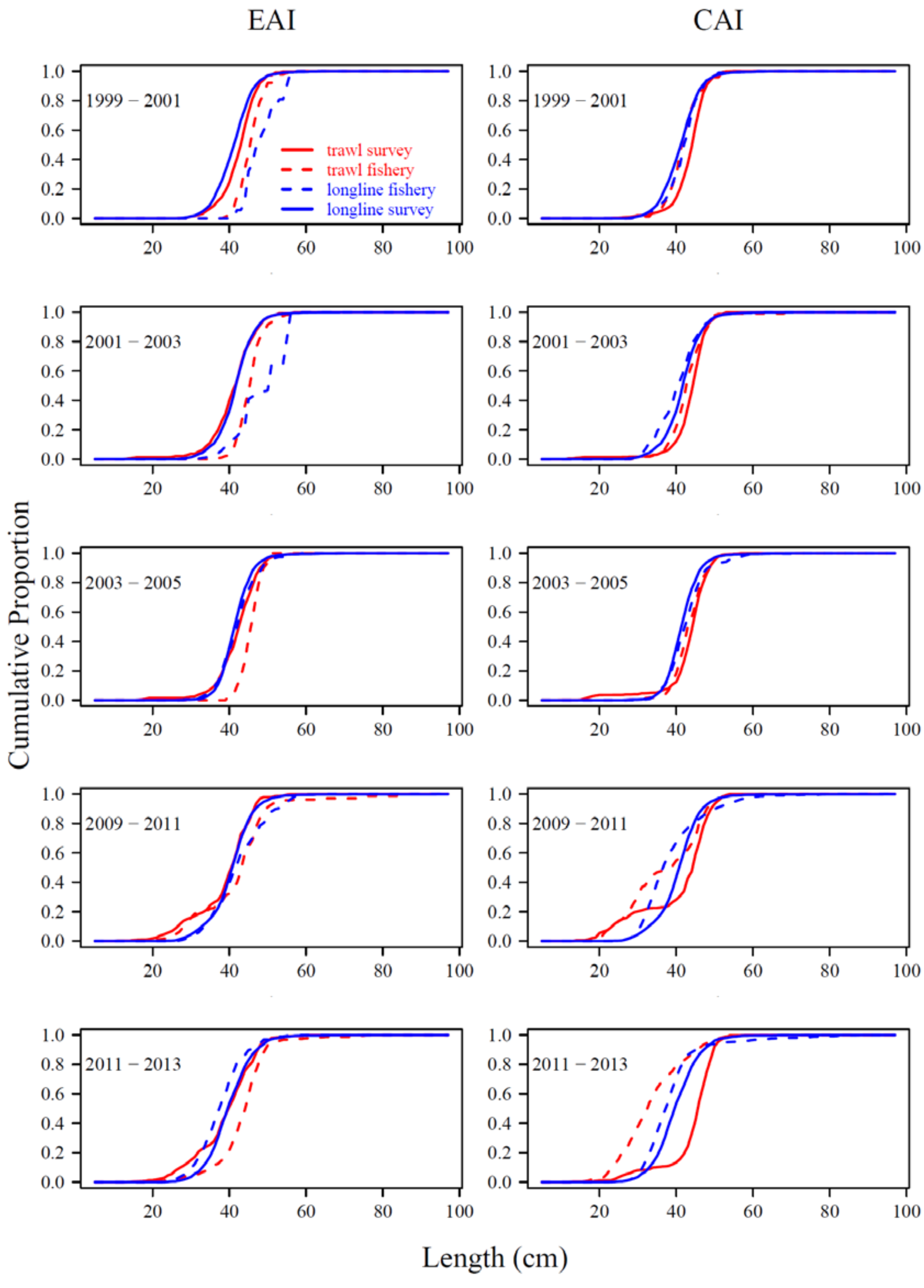

Figure 8. Cumulative distributions of fish size in the AI trawl survey, AFSC longline survey (AI area), and the AI fishery (separated by trawl and longline gear), by area and time periods.

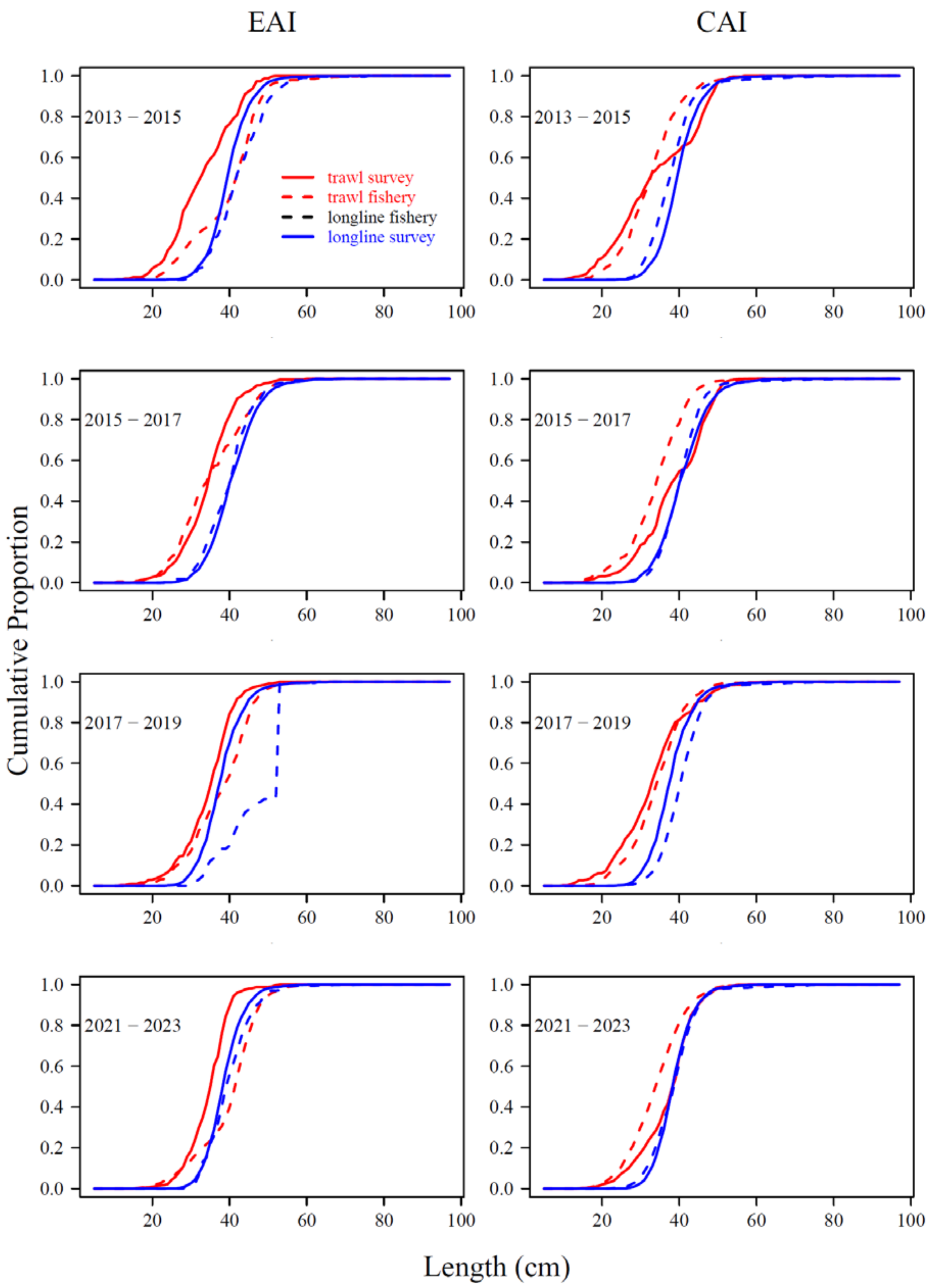

Figure 8, continued).

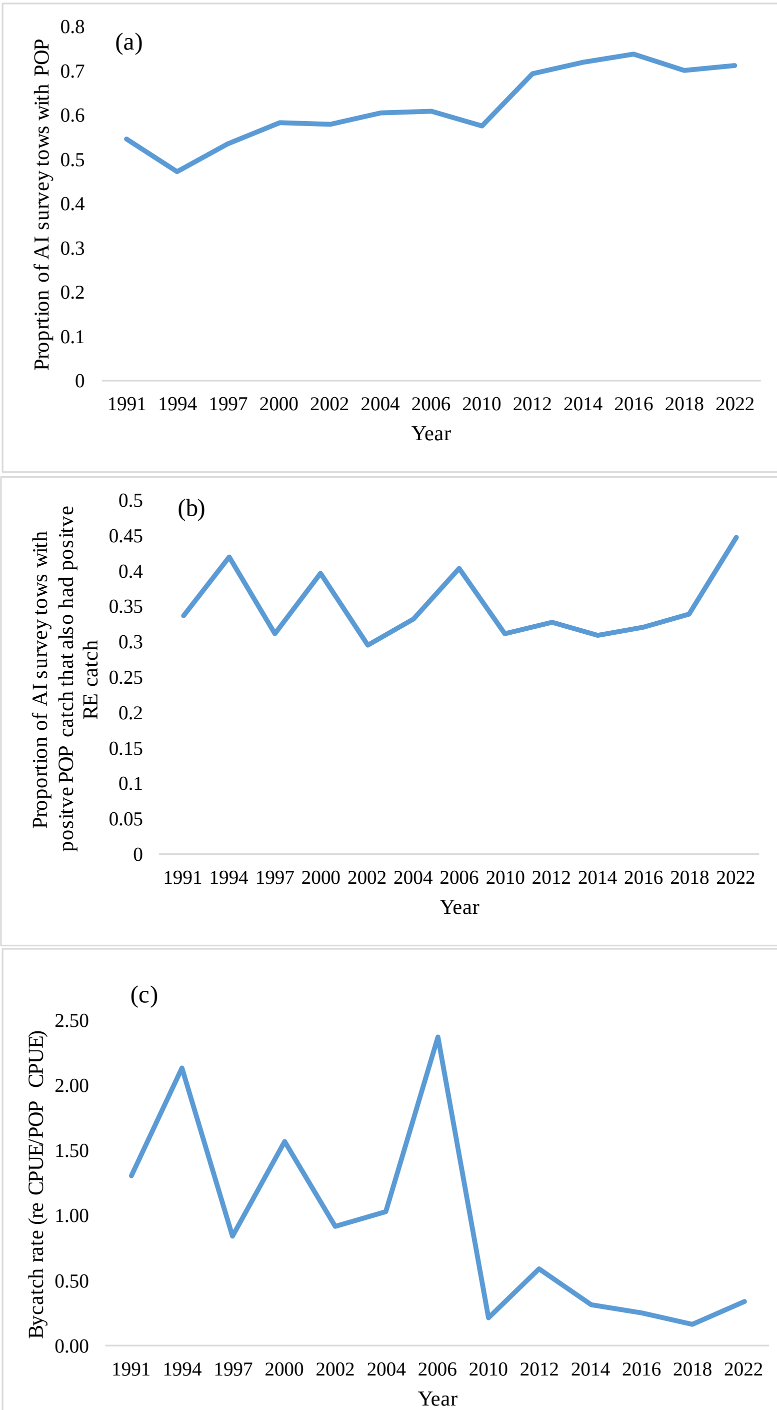

Figure 9) Proportion of AI survey tows with POP (a), occurrence of blackspotted/rougheye rockfish in AI survey tows with POP (b), and bycatch rates of rougheye to POP in the AI survey (c).