



Space-time modelling of survey data

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PURPOSE

To provide results of the space time modelling of Pacific halibut survey data for the period 1993-2022.

INTRODUCTION

Since 2016 space-time modelling has been used by the IPHC to produce estimates of mean O32 WPUE (weight per unit effort), all sizes WPUE and all sizes NPUE (numbers per unit effort) indices of Pacific halibut density and abundance. The modelling depends primarily on data from the IPHC's fishery-independent setline survey (FISS, [Ualesi et al. 2022](#)), but in the Bering Sea also integrates data from the National Marine Fisheries Service annual trawl survey and the Alaska Department of Fish and Game's annual Norton Sound trawl survey. Both surveys are fishery-independent data sources.

Since 2019, weighing of Pacific halibut onboard FISS charter vessels has meant that the weight data used to compute WPUE now comes almost entirely from observed weights of fish rather than estimates from a length-net weight relationship. For fish without directly measured weights, weights are predicted from a year- and IPHC Regulatory Area-specific length-net weight relationship estimated from the FISS length and weight data. For U32 fish with round weight recorded, net weights are estimated from a round-net weight relationship estimated from coastwide sample data from the 2019 FISS.

RESULTS OF SPACE-TIME MODELLING IN 2022

[Figures 1 to 3](#) show time series estimates of O32 WPUE (most comparable to fishery catch-rates), all sizes WPUE and all sizes NPUE over the 1993-2022 period included in the 2022 space-time modelling. Coastwide, we estimate declines in all three series since 2021, with greatest decline for O32 WPUE (18%) and least for all sizes NPUE (8%). These declines were largely due to decreases in the indices for Region 3, with Region 4 also contributing to the O32 WPUE decrease. Indices in Region 2 have been generally stable since 2021. Estimated 1993-22 time series by IPHC Regulatory Area are in [Appendix A](#).

Tables of model output (time series, stock distribution estimates) are updated annually on the IPHC website at <https://www.iphc.int/data/time-series-datasets>.

FISS model output may also be explored interactively using the link on this page of the IPHC website: <https://www.iphc.int/data/datatest/fishery-independent-setline-survey-fiss>.

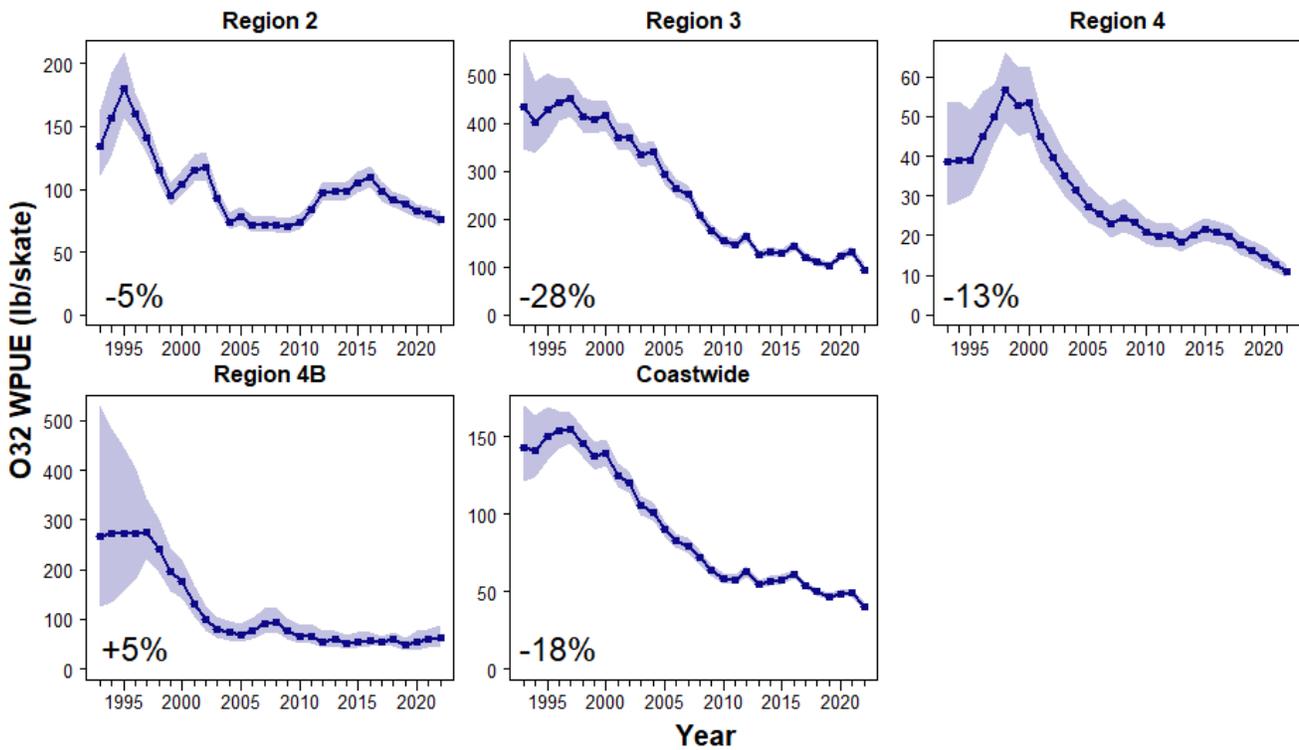


Figure 1. Space-time model output for O32 WPUE for 1993-2022 for Biological Regions. Filled circles denote the posterior means of O32 WPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean O32 WPUE from 2021 to 2022.

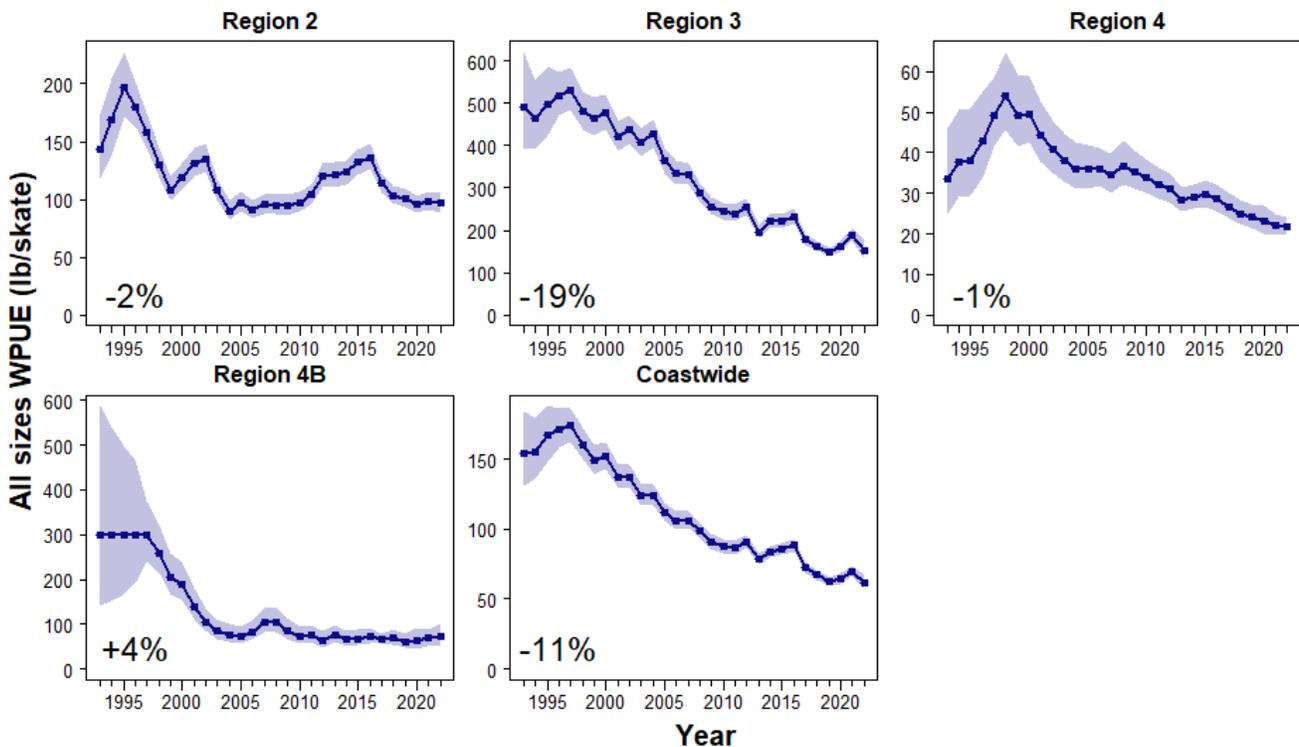


Figure 2. Space-time model output for all sizes WPUE for 1993-2022 for Biological Regions. Filled circles denote the posterior means of all sizes WPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean all sizes WPUE from 2021 to 2022.

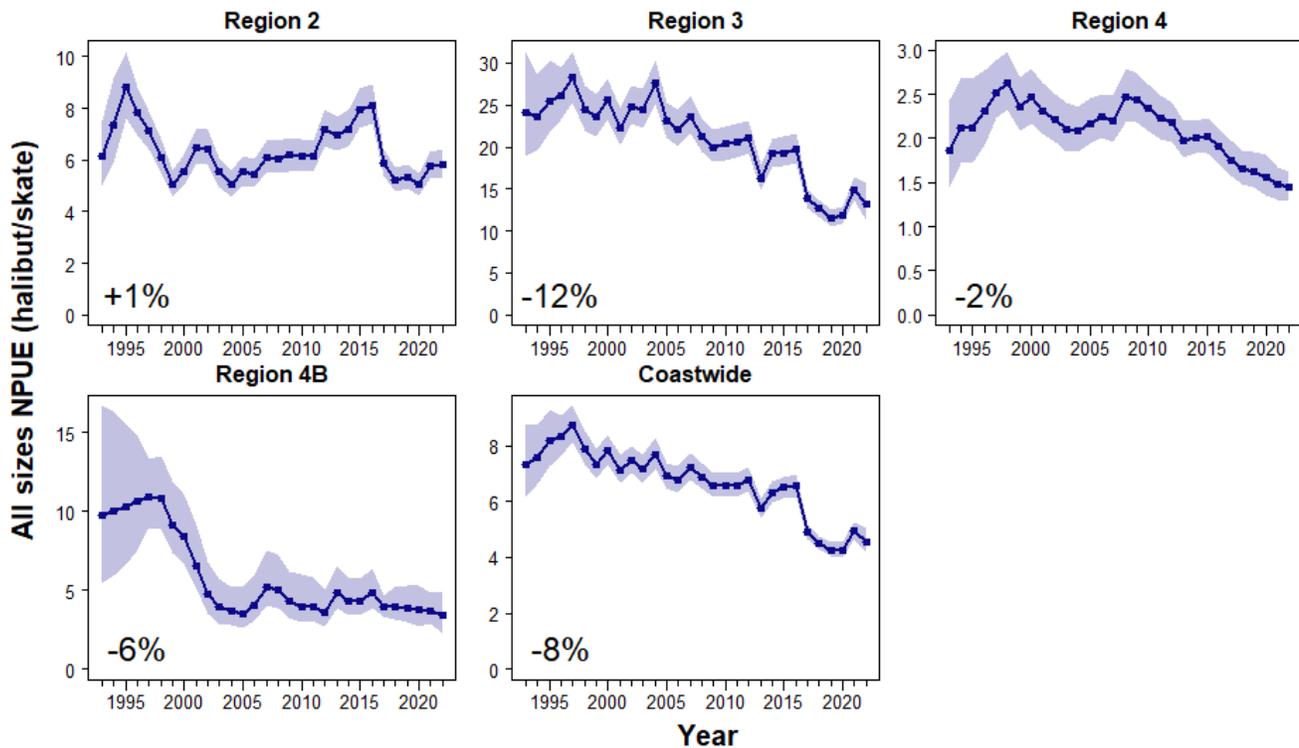


Figure 3. Space-time model output for all sizes NPUE for 1993-2022 for Biological Regions. Filled circles denote the posterior means of all sizes NPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean all sizes NPUE from 2021 to 2022.

RECOMMENDATION

That the Commission **NOTE** paper IPHC-2023-AM099-09 which provides results of the space-time modelling of Pacific halibut survey data for 1993-2022.

REFERENCE

Ualesi, K., Jones, C., Rillera, R. and Jack, T. (2022) IPHC Fishery-independent setline survey (FISS) design and implementation in 2022. [IPHC-2022-IM098-08](#).

APPENDIX A

Space-time modelling results by IPHC Regulatory Area

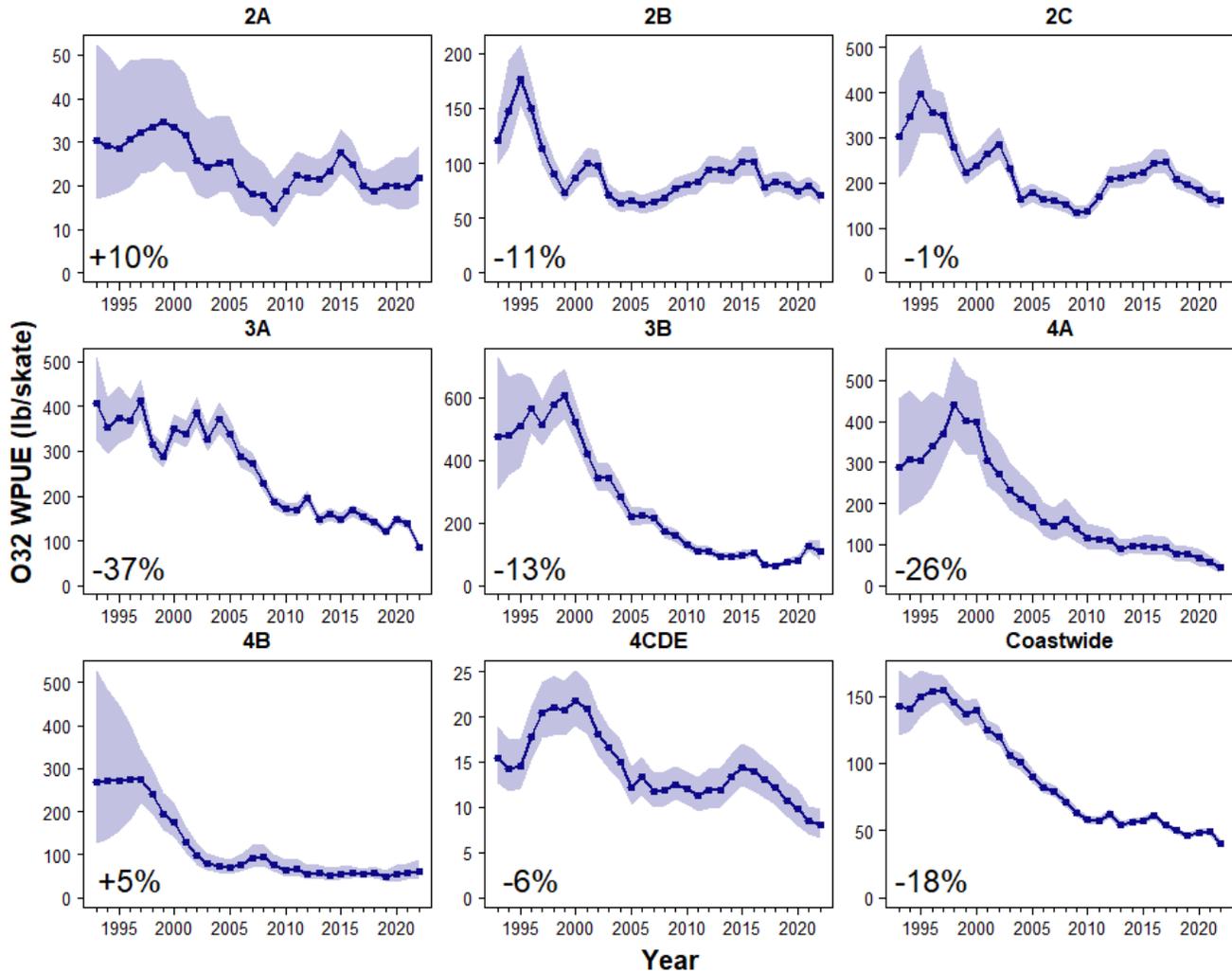


Figure A.1. Space-time model output for O32 WPUE for 1993-2022. Filled circles denote the posterior means of O32 WPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean O32 WPUE from 2021 to 2022.

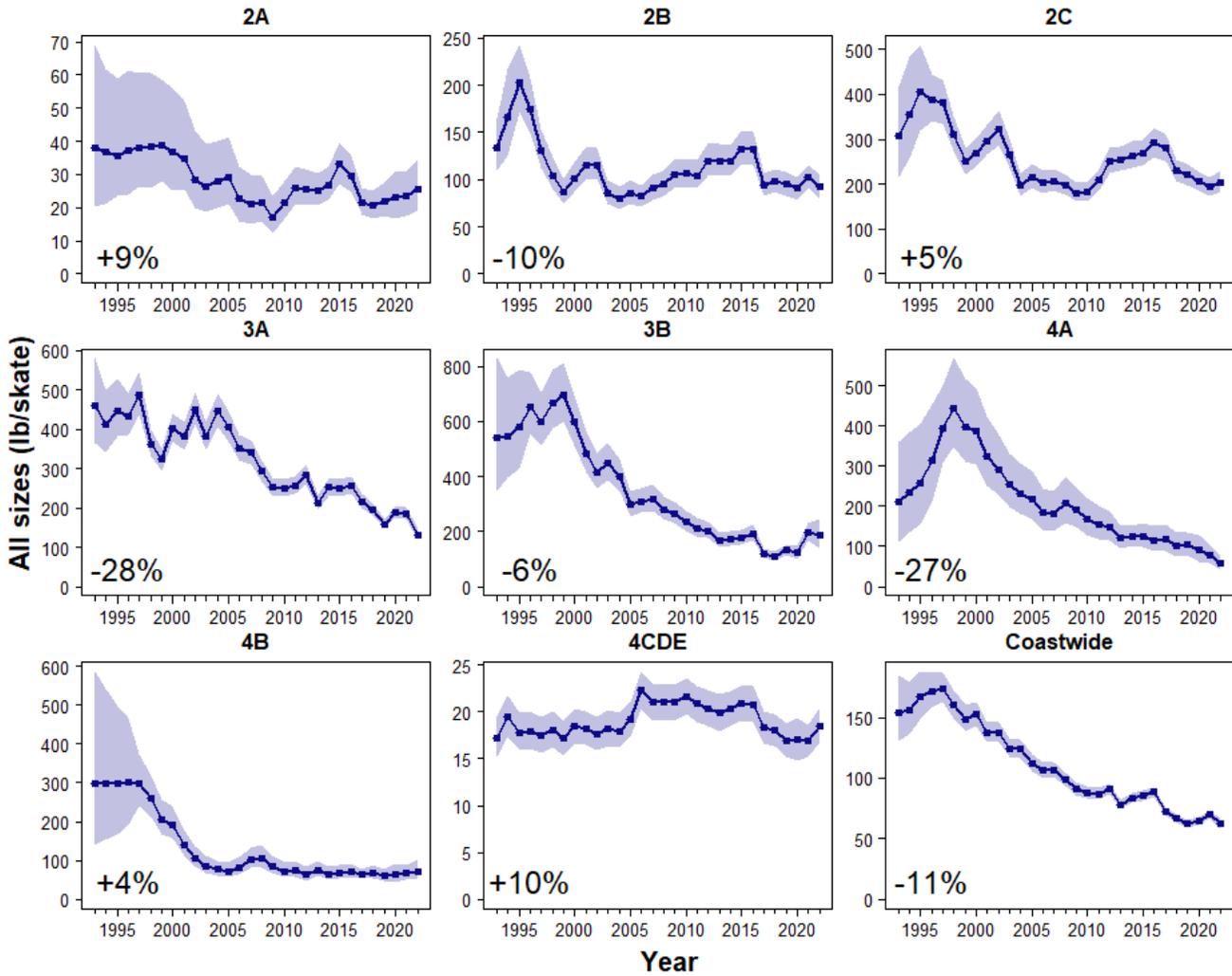


Figure A.2. Space-time model output for all sizes WPUE for 1993-2022. Filled circles denote the posterior means of all sizes WPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean total WPUE from 2021 to 2022.

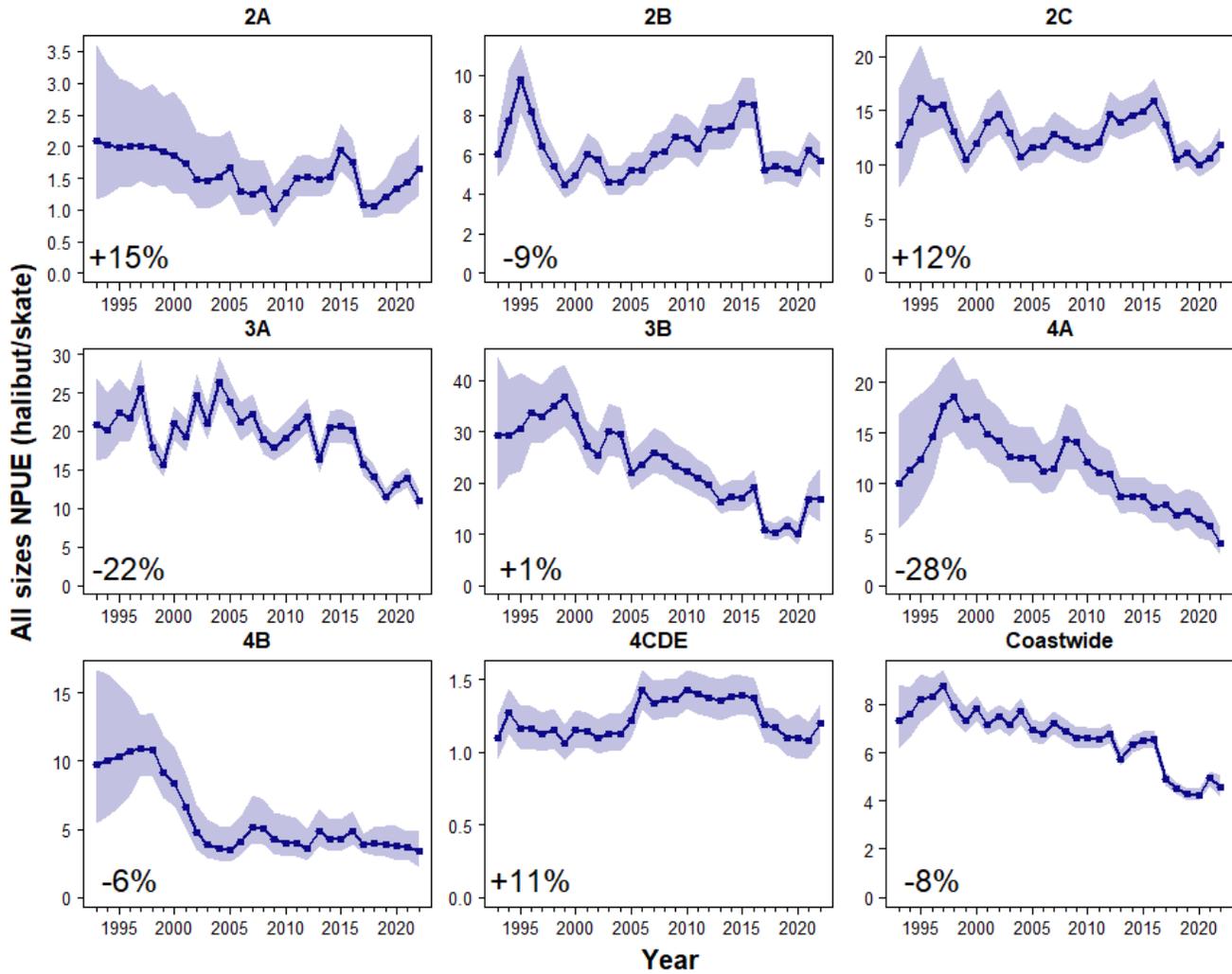


Figure A.3. Space-time model output for all sizes NPUE for 1993-2022. Filled circles denote the posterior means of all sizes NPUE for each year. Shaded regions show posterior 95% credible intervals, which provide a measure of uncertainty: the wider the shaded interval, the greater the uncertainty in the estimate. Numeric values in the lower left-hand corners are estimates of the change in mean total NPUE from 2021 to 2022.