Comparison of NMFS survey results from `crabpack` with the 2024 Tanner crab assessment

William T. Stockhausen

2025-02-25

0.1 Introduction

The ASFC's Shellfish Assessment Program has introduced `crabpack`, a new R package (R Core Team 2022) to access NMFS EBS crab survey data and subsequently estimate annual abundance, biomass, and size compositions by year for several population categories (e.g., sex, maturity state). The tcsamSurveyData R package has been used previously with survey haul data files downloaded from AKFIN Answers to provide similar information for the Tanner crab assessment (e.g., Stockhausen 2024). Here, the two approaches are compared for EBS-wide abundance, biomass, and size compositions for NMFS EBS crab survey data from 1975 to 2024.

0.2 Survey abundance estimates

Estimates of EBS-wide abundance from the NMFS bottom trawl survey for male and female Tanner crab by maturity state are compared by year in Figure 1 for calculations made in the 2024 assessment (Stockhausen 2024) and with the `crabpack` R package. Absolute differences and percent differences between the two methods are shown, respectively, in Figures 2 and 3. The percent differences are also shown in Table 1 to two decimal places. The figures and table show excellent agreement between the two methods in all survey years except 1979, when estimates from the two methods differ substantially ($> 10\%$). The estimates from the assessment are less than those from `crabpack` in 1979. The differences in the two methods apparently reflect differences in the hauls included in the calculation (`crabpack` appears to include hauls at corner stations that were only conducted in 1979, while these were excluded in the standardized time series used in the assessment).

0.3 Survey biomass estimates

Estimates of EBS-wide biomass from the NMFS bottom trawl survey for male and female Tanner crab by maturity state are compared by year in Figure 4 for calculations made in the 2024 assessment (Stockhausen 2024) and with the `crabpack` R package. Absolute differences and percent differences between the two methods are shown, respectively, in Figures 5 and 6. The percent differences are also shown in Table 2 to two decimal places.

As with abundance, the figures and table demonstrate excellent agreement between the two methods in all survey years prior to 2016 except 1979, when estimates from the two methods differ substantially ($> 10\%$). Unlike the abundance estimates, the two methods also exhibit small differences ($< 5\ \%$) in 2016 and subsequent years. The estimates from the assessment for 2016 and later are larger than those from `crabpack` in all years. The post-2015 differences between the two methods may reflect differences in the size used to calculate the weight of individual crab: the assessment uses carapace width to the first decimal place while `crabpack` apparently uses the carapace width to 1-mm.

References

R Core Team. 2022. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. Available from https://www.R-project.org/.

Stockhausen, W.T. 2024. 2024 Stock Assessment and Fishery Evaluation Report for the Tanner crab fisheries of the Bering Sea and Aleutian Islands regions. *In* Stock Assessment and Fishery Evaluation Report for the KING AND TANNER CRAB FISHERIES of the Bering Sea and Aleutian Islands regions 2024 final crab SAFE. North Pacific Fishery Management Council, Anchorage, AK.

Tables

List of Tables

Table 1. Percent difference, by year, in design-based NMFS survey abundance trends from the 2024 assessment and the `crabpack` R package, by sex and maturity state.

year	immature female	mature female	undetermined male
1975	0	0.0	0.0
1976	0	0.0	0.0
1977	0	0.0	0.0
1978	0	0.0	0.0
1979	−40	−72.4	−13.7
1980	0	0.0	0.0
1981	0	0.0	0.0
1982	0	0.0	0.0
1983	0	0.0	0.0
1984	0	0.0	0.0
1985	0	0.0	0.0
1986	0	0.0	0.0
1987	0	0.0	0.0
1988	0	0.0	0.0
1989	0	0.0	0.0
1990	0	0.0	0.0
1991	0	0.0	0.0
1992	0	0.0	0.0
1993	0	0.0	0.0
1994	0	0.0	0.0
1995	0	0.0	0.0
1996	0	0.0	0.0
1997	0	0.0	0.0
1998	0	0.0	0.0
1999	0	0.0	0.0
2000	0	0.0	0.0
2001	0	0.0	0.0
2002	0	0.0	0.0
2003	0	0.0	0.0
2004	0	0.0	0.0
2005	0	0.0	0.0
2006	0	0.0	0.0
2007	0	0.0	0.0
2008	0	0.0	0.0
2009	0	0.0	0.0
2010	0	0.0	0.0
2011	0	0.0	0.0
2012	0	0.0	0.0
2013	0	0.0	0.0
2014	0	0.0	0.0
2015	0	0.0	0.0
2016	0	0.0	0.0
2017	0	0.0	0.0
2018	0	0.0	0.0
2019	0	0.0	0.0
2021	0	0.0	0.0
2022	0	0.0	0.0
2023	0	0.0	0.0
2024	0	0.0	0.0

Table 2. Percent difference, by year, in design-based NMFS survey biomass trends from the 2024 assessment and the `crabpack` R package, by sex and maturity state.

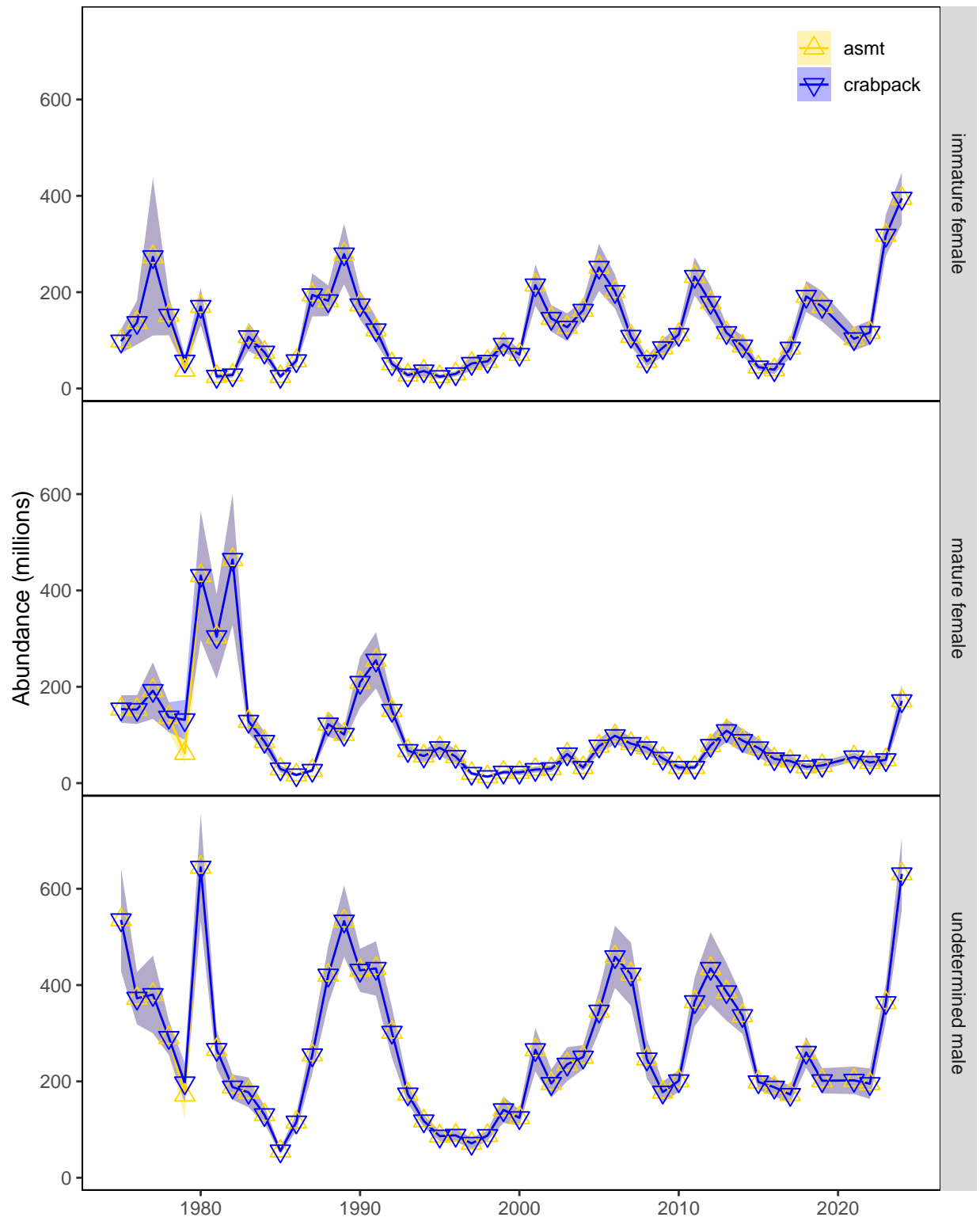| year	immature female	mature female	undetermined male
1975	0.0	0.0	0.4
1976	0.0	0.0	0.0
1977	0.0	0.0	0.0
1978	0.0	0.0	0.0
1979	−36.1	−59.6	2.7
1980	0.0	0.0	0.0
1981	0.0	0.0	0.0
1982	0.0	0.0	0.0
1983	0.0	0.0	0.0
1984	0.0	0.0	0.0
1985	0.0	0.0	0.0
1986	0.0	0.0	0.0
1987	0.0	0.0	0.0
1988	0.0	0.0	0.0
1989	0.0	0.0	0.0
1990	0.0	0.0	0.0
1991	0.0	0.0	0.0
1992	0.0	0.0	0.0
1993	0.0	0.0	0.0
1994	0.0	0.0	0.0
1995	0.0	0.0	0.0
1996	0.0	0.0	0.0
1997	0.0	0.0	0.0
1998	0.0	0.0	0.0
1999	0.0	0.0	0.0
2000	0.0	0.0	0.0
2001	0.0	0.0	0.0
2002	0.0	0.0	0.0
2003	0.0	0.0	0.0
2004	0.0	0.0	0.0
2005	0.0	0.0	0.0
2006	0.0	0.0	0.0
2007	0.0	0.0	0.0
2008	0.0	0.0	0.0
2009	0.0	0.0	0.0
2010	0.0	0.0	0.0
2011	0.0	0.0	0.0
2012	0.0	0.0	0.0
2013	0.0	0.0	0.0
2014	0.0	0.0	0.0
2015	0.0	0.0	0.0
2016	2.5	1.6	1.2
2017	3.0	1.5	1.2
2018	2.6	1.6	1.3
2019	2.4	1.7	1.4
2021	2.3	1.6	1.5
2022	2.8	1.5	1.4
2023	2.5	1.6	1.6
2024	2.0	1.6	1.6

Figures

List of Figures

Figure 1. Comparison of annual estimates of design-based area-swept abundance from the NMFS
EBS bottom trawl survey by the 2024 assessment (*asmt*) and the `crabpack` R package
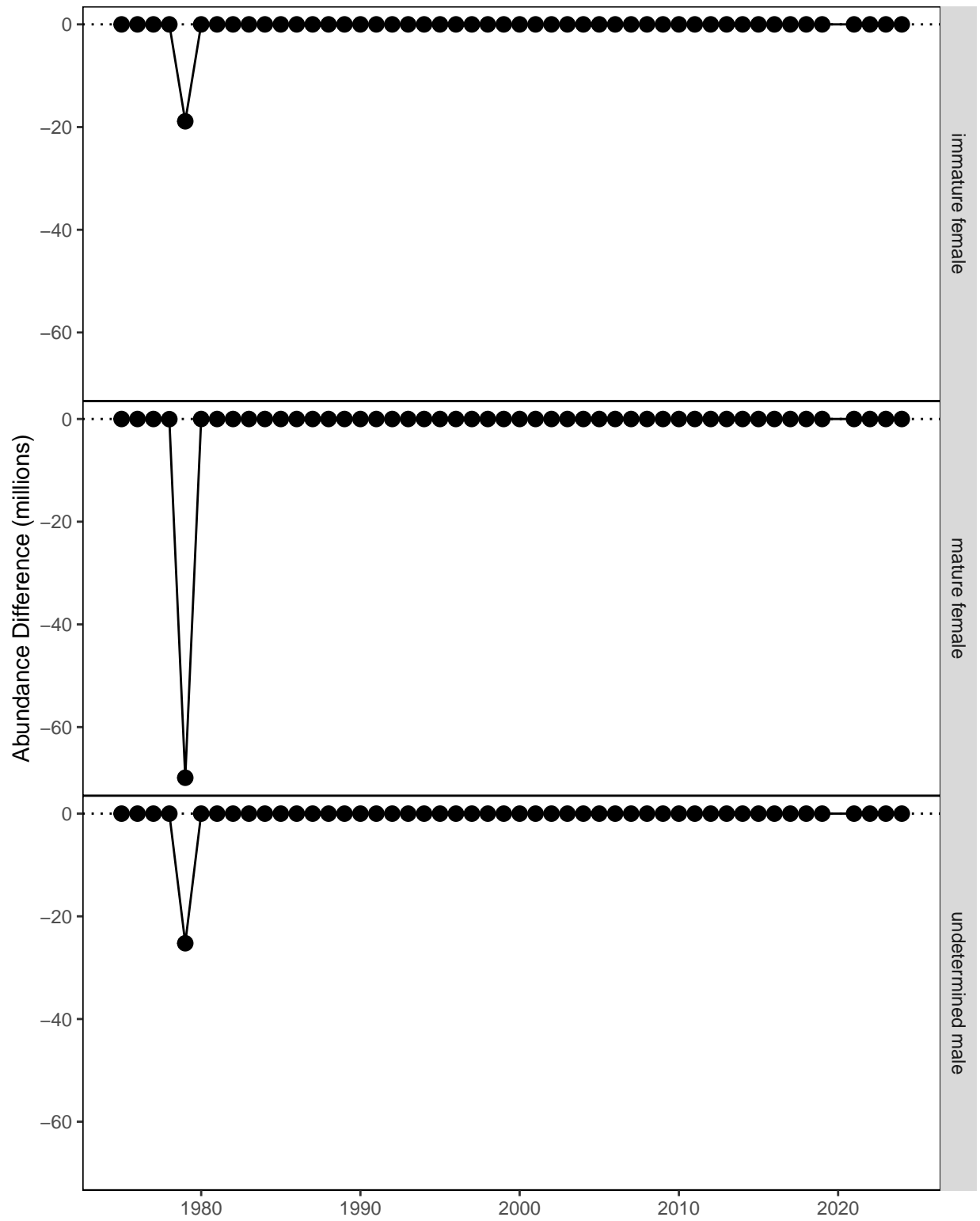(*crabpack*), by sex and maturity state.

Figure 2. Differences in annual estimates of design-based area-swept abundance from the NMFS EBS bottom trawl survey by the 2024 assessment and the `crabpack` R package, by sex and maturity state.
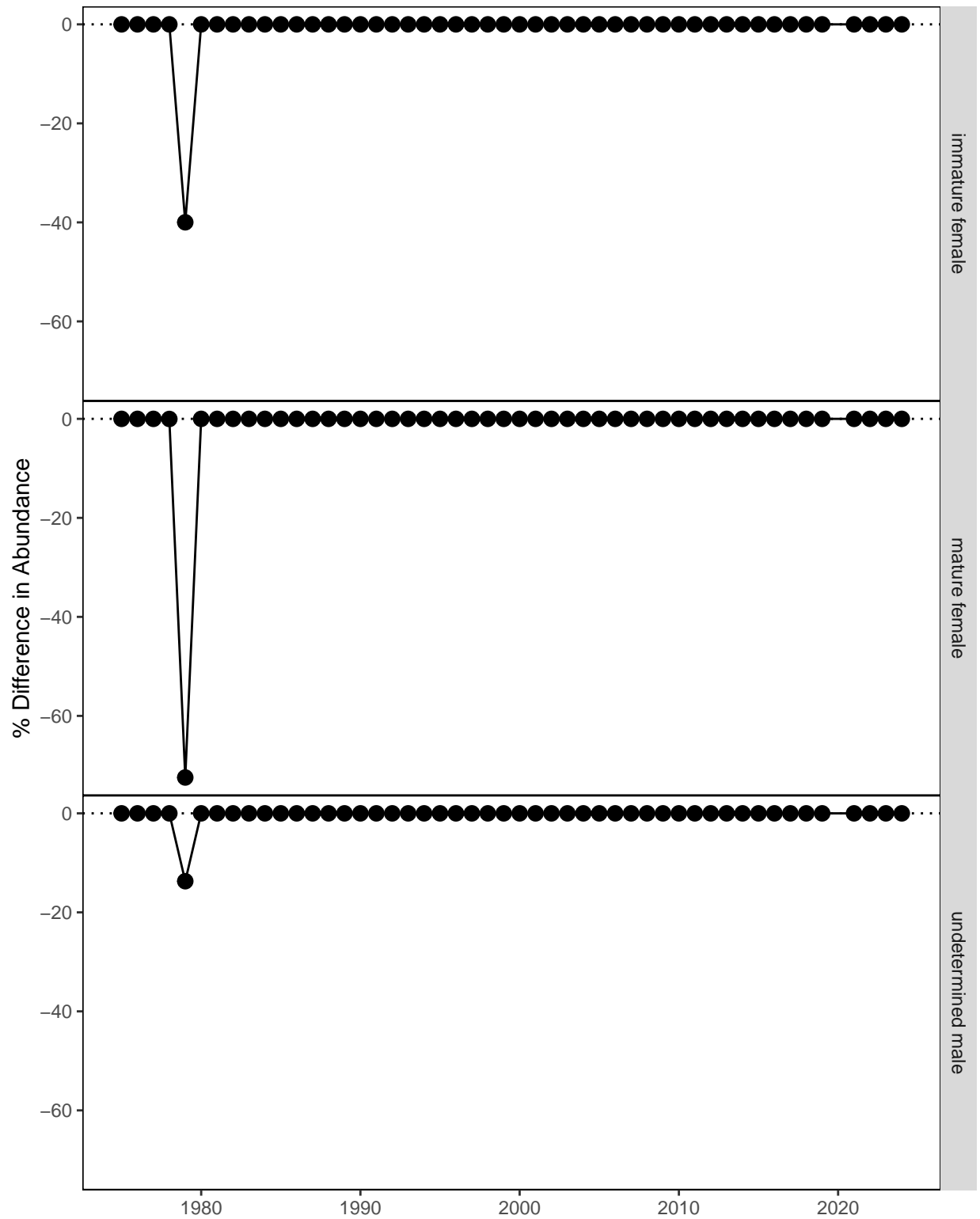
Figure 3. Percent differences in annual estimates of design-based area-swept abundance from the NMFS EBS bottom trawl survey by the 2024 assessment and the `crabpack` R package, by sex and maturity state.
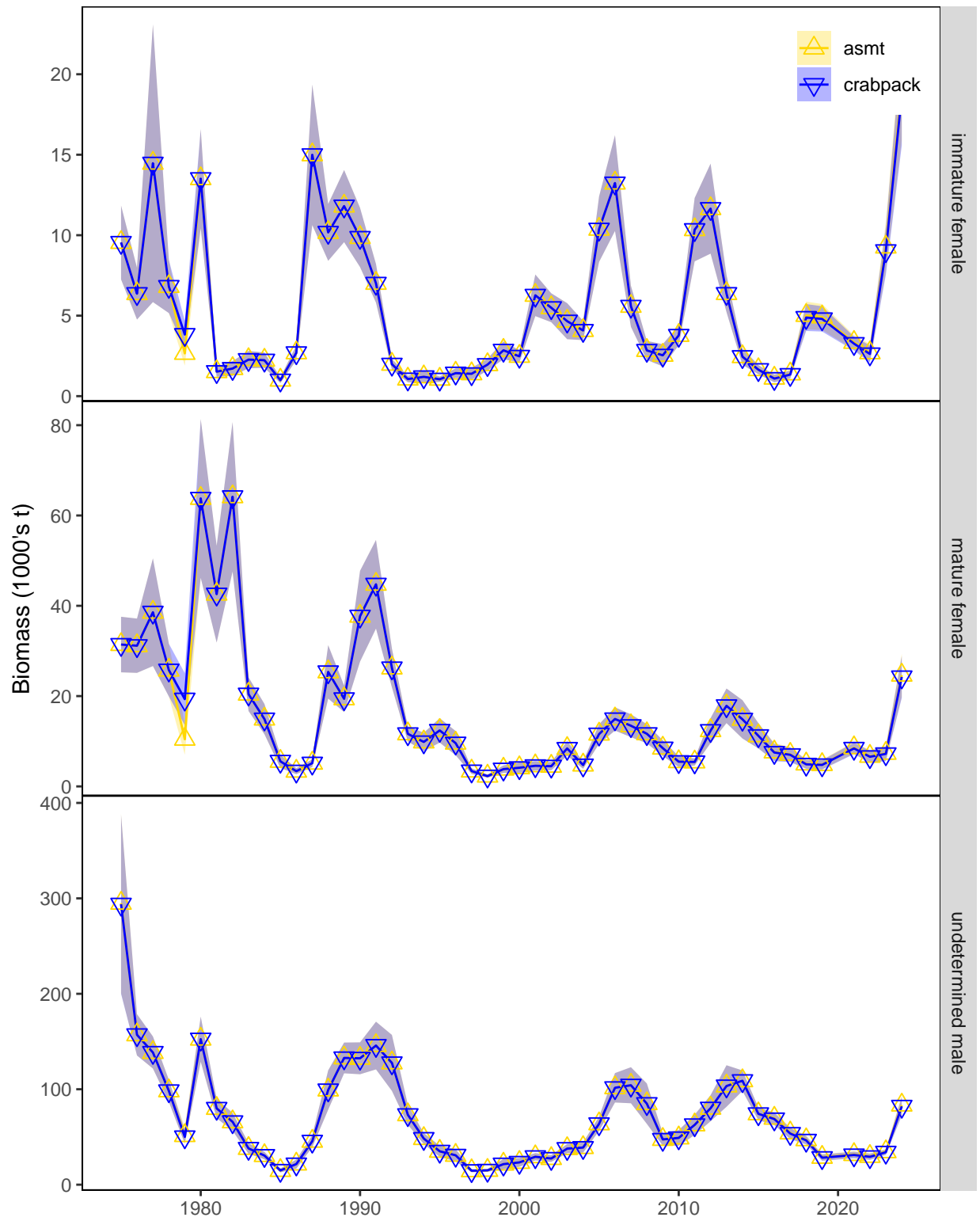
Figure 4. Comparison of annual estimates of design-based area-swept biomass from the NMFS EBS bottom trawl survey by the 2024 assessment (*asmt*) and the `crabpack` R package (*crabpack*), by sex and maturity state.
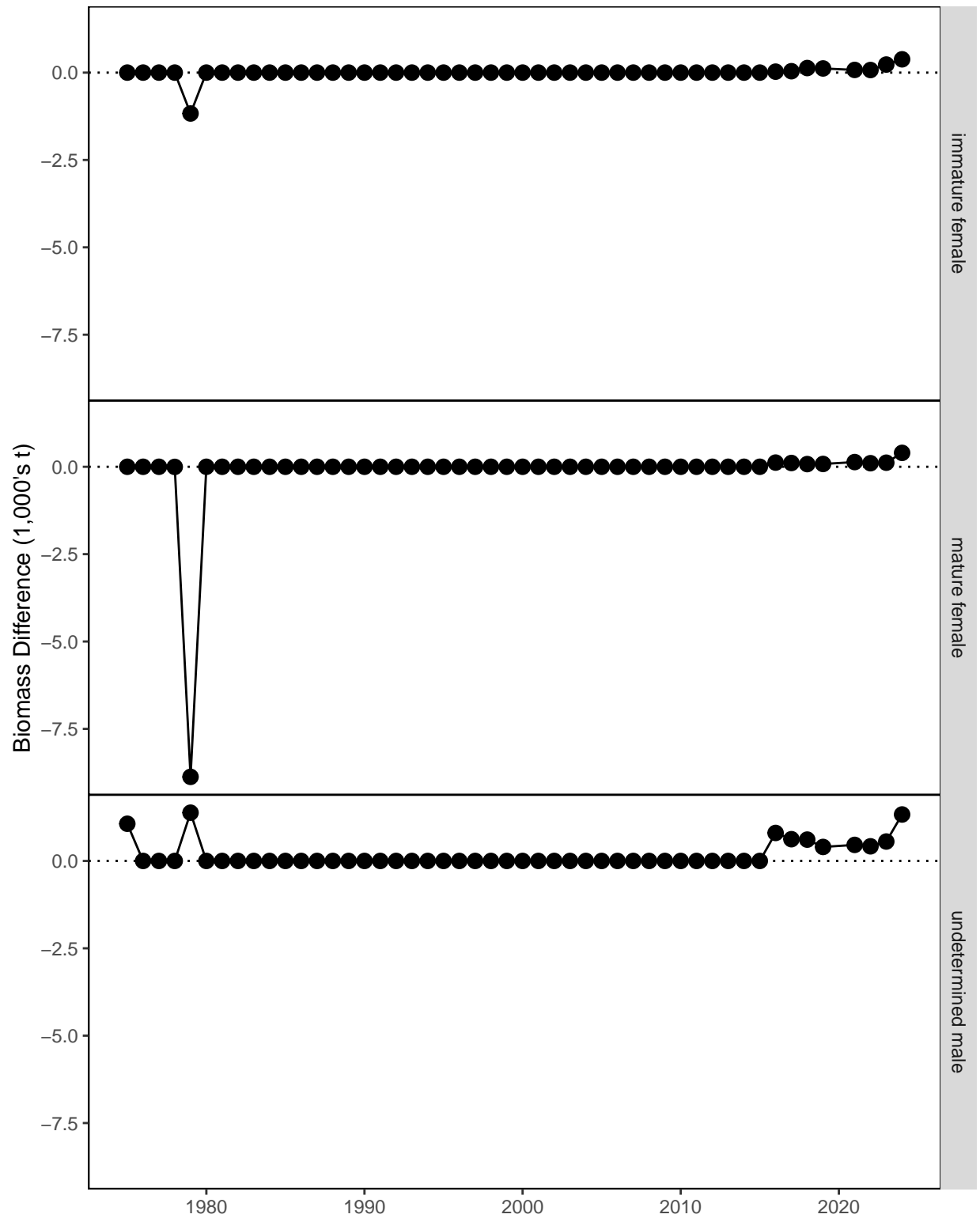
Figure 5. Differences in annual estimates of design-based area-swept biomass from the NMFS EBS
bottom trawl survey by the 2024 assessment and the `crabpack` R package, by sex and
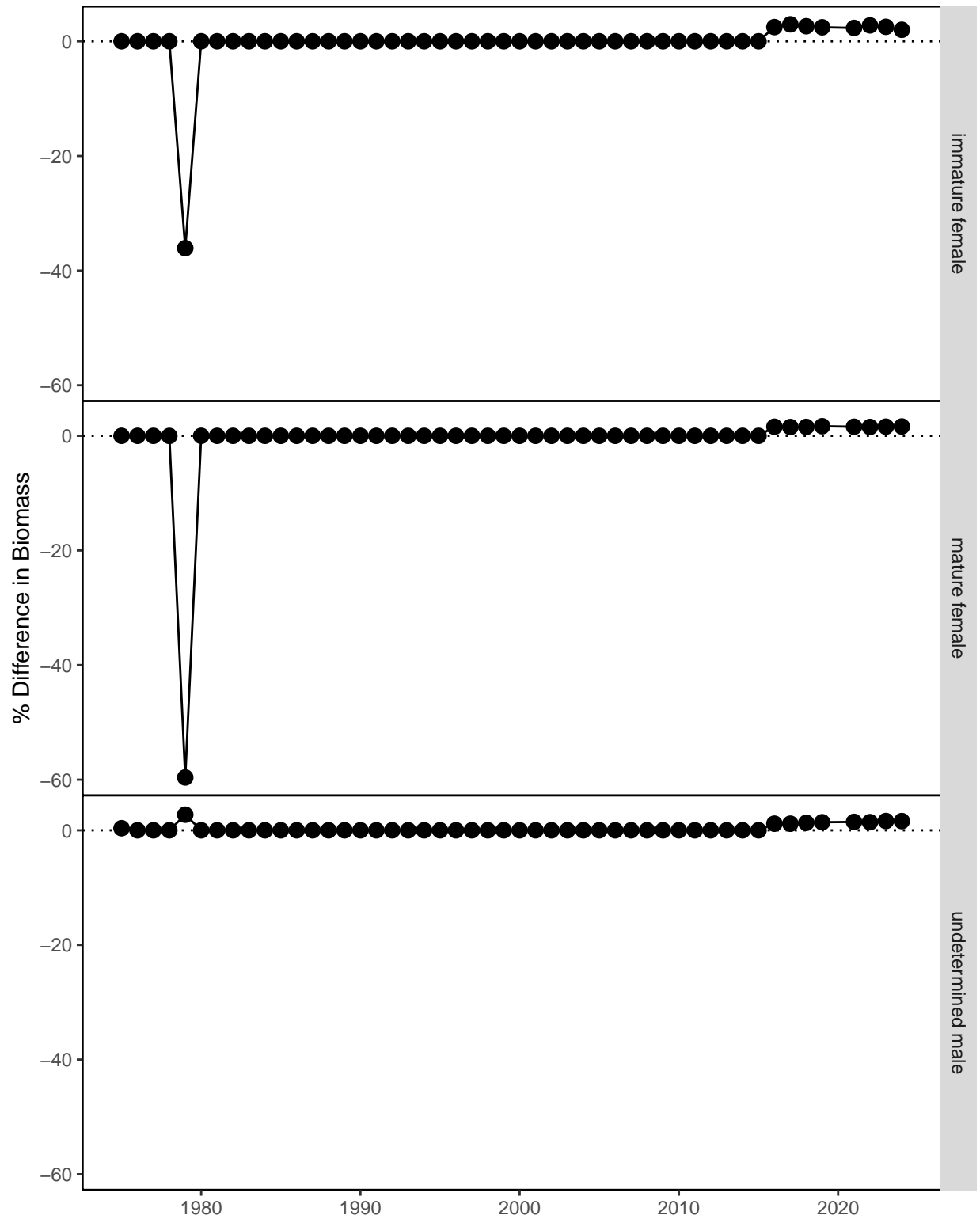maturity state.

Figure 6. Percent differences in annual estimates of design-based area-swept biomass from the NMFS EBS bottom trawl survey by the 2024 assessment and the `crabpack` R package, by sex and maturity state.