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A Detailed Stock by Stock Overview of the Impacts of Comparative Fishing Results on the Availability of Canadian-NL Multispecies Survey Data for Stock Assessments and other Science Advisory Processes

by

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Abstract

More than a decade of issues achieving full spatial coverage of the Canada-NL multispecies survey domain have sometimes led to the need to consider survey-years incomplete and to exclude them from the survey data time series used in stock assessments and other science advisory processes. These issues have now been further complicated by the fact that some species/stocks do not have conversion factors between new and previous Canadian research vessels, requiring time series to be discontinued and new series to begin. In addition, the assumption of equal catchability between other vessels previously used in the RV survey is also now considered inappropriate for some species and could result in some previously accepted survey-years being considered incomplete (with respect to any one vessel) and dropped from the data time series. Many of these aspects have been explored across various documents and years. The goal here is to summarize this information on a stock-by-stock basis in one comprehensive document and make recommendations as to how to treat these data for stock assessment purposes going forward.

Introduction

Over the last four years, Fisheries and Oceans Canada (DFO) in the Newfoundland and Labrador (NL) region have been collecting data and conducting meetings to appropriately calibrate new research vessels by developing conversion factors through comparative fishing. The old vessels included the Canadian Coast Guard Ship (CCGS) Alfred Needler ("Needler"), CCGS Wilfrid Templeman ("Templeman"), and CCGS Teleost ("Teleost"), and the new vessels are the CCGS Capt. Jacques Cartier ("Cartier"), and the CCGS John Cabot ("Cabot"), collectively referred to as "CAX" as the vessels are considered sister ships with equal catchability (Trueman et al. 2025). Similarly, the Needler and Templeman are also considered sister ships with equal catchability and referred to as "Needler/Templeman" throughout. .

For many stocks, conversion factors were developed that will allow the continuation of longstanding time series, but for others no conversions could be derived and therefore data from the new vessels will have to be considered a separate time series (“Modified Campelen Series”) that is not directly comparable to the old time series (“Campelen Series”). The details and conclusions of the comparative fishing work and the analyses related to conversion factors have been extensively documented in a series of Canadian documents (Wheeland et al. 2023a, DFO 2024, Silver et al. 2024, Wheeland and Trueman 2024, DFO 2025, Trueman et al. 2025, Trueman et al. In Press-a, Trueman et al. In Press-b) and summarized for NAFO Scientific Council (SC) as well (Wheeland et al. 2023b, Wheeland et al. 2024). In some cases, however, the breadth of documentation may make it difficult to know exactly where to find the details necessary for a stock assessor to understand the implications for a particular species/stock, and work to estimate conversion factors did not necessarily delve into the implications on existing series used in any particular assessment.

Analyses performed during the Canada-NL comparative fishing work also indicated that the previous assumptions of equal fishing selectivity between the Needler/Templeman and Teleost were unfounded for some species (DFO 2024, DFO 2025, Wheeland et al. 2024). For stocks and years where both research vessels were used in the collection of survey data, decisions will have to be made about how to handle these data for future advisory processes. In the short-term SC has generally been including these years as valid data points in the survey plots included in Interim Monitoring Reports, with the caveat that decisions on how to handle these years of mixed data will need to be made during relevant stock assessments or framework meetings (NAFO 2024). However, until those meetings take place, it is difficult to know how to present and use survey data.

Within the previously accepted Campelen series there may be many years with survey coverage by both the Needler/Templeman and the Teleost for any given stock, depending on the survey, year, and area being examined. Most areas have a primary research vessel (i.e. the vessel that is planned to be used in that area, and which is used in most years). For the NL-Canada spring survey the primary vessel was historically the Needler/Templeman, with the Teleost a secondary vessel only used in the case the primary vessel was unavailable or unable to complete the survey. For the fall survey, typically the Teleost would be the primary vessel for the northern divisions (Divs. 2GHJ3K), and the Needler/Templeman for the southern divisions (Divs. 3KLNO), with both vessels meeting in Div. 3K. Therefore, the data from the primary vessel for the stock region is considered the default time series for that stock, however the question then becomes whether data collected from the secondary vessel can still be used in the Campelen series given the new evidence of potentially unequal catchability between these Campelen vessels. Initially it may seem like dropping the years with mixed vessel coverage would be the most technically sound approach since it is not possible to quantify the difference in catchability between the vessels in absence of appropriate conversion factors, but this could result in many years of the time series no longer having sufficient spatial coverage to be accepted as representative indices of the stock. Therefore the consequences of eliminating or keeping the mixed vessel coverage years needs to be weighed against the potential uncertainty introduced by continuing to assume equal catchability between the two vessels.

In this report we intend to: 1) summarize what conversion factors are available, or not available, for each respective stock, including extension of conversion factors across areas and seasons if not previously examined elsewhere, 2) apply these conversion factors (or lack thereof) to provide the recommended time series data available for future science advisory processes, and 3) make an attempt to evaluate the inclusion/exclusion of survey years with mixed vessel coverage. It should be emphasized that any of the recommendations made here could be rejected/changed during upcoming assessment/framework meetings and these are our recommendations given the documentation available for each stock at the time of writing this report. We do not intend to revisit decisions made for the Engel-Campelen conversion factors, or to

revisit past decisions made for survey points based on spatial coverage for the stocks. Additionally, if work is completed after this document is published that uses additional methods to fill in survey gaps (e.g. spatial modelling) then that would supersede recommendations from this document.

Methods

Implications based on the results of comparative fishing and the inability to continue to consider the Teleost and Needler/Templeman interchangeable were considered on a stock by stock basis to identify the most appropriate path forward for future assessment and monitoring. Simple sensitivity analyses were conducted for each stock, whereby we doubled and halved the catches of the Teleost (generally the secondary vessel) in any given year, and recalculated survey indices. This exercise is intended to reflect a reasonable range of hypothetical conversion factors that could exist between the Needler/Templeman and Teleost (DFO 2025, Trueman et al. 2025), with resulting sensitivity runs examined compared to the trends previously produced assuming equal catchability between the two vessels. If the differences from the sensitivity tests were not large and did not influence the overall interpretation of trends in indices then we conclude it is reasonable to continue including these data points in the time series. While this does not necessarily assume equal catchability between vessels, it suggests that the impact of any difference between the vessels is relatively small and within the normal scope of uncertainty and fluctuation observed in survey indices. In the years where the sensitivity tests demonstrated that there is a high sensitivity to these analyses and the trends would be different as a result of difference in catchability between the vessels within the tested range, then dropping the data for those years is recommended.

The primary vessel for Divs. 3LNO and Subdiv. 3Ps was the Needler/Templeman. The Teleost was used sporadically to complete some, or all, of the survey area, and was the primary vessel for deep (>732m) strata in 3L and 3NO. This has resulted in mixed-vessel coverage in the fall survey in 1995-1998, 2000-2007, 2009-2011, and 2013-2015. Additionally, surveys in 2012, 2014, and 2015 were not fully sampled. In the spring survey there were coverage issues in 2006, 2014, 2015, and 2017, and the Teleost was used to assist with the survey in 2007-2009, 2014, 2016, and 2018. The Teleost completed a large portion of the survey for spring 2014, and the whole survey area in 2016 and therefore for some stocks where conversion factors have been estimated (DFO 2025, Trueman et al. in press-b) these years may be included in the new Modified Campelen series.

Divisions 2HJ3K are only surveyed during the autumn survey, and the primary vessel has historically been the Teleost, though the survey is designed that typically the two vessels meet in Div. 3K at the end of the survey and both survey that division. Since conversion factors exist for both CAX-Needler/Templeman and CAX-Teleost in Div. 3K for many species (Trueman et al. 2025), mixed vessel coverage is less of a concern for the northern regions of the autumn survey and for the most part, stocks in this area will be able to continue their time series using appropriate conversion factors where required. There are also some years where the Needler/Templeman surveyed parts of Divs. 2HJ (2001, 2005, 2008, and 2013), and there are several years where Div. 2H was incomplete (2000, 2002, 2003, 2005, 2007, and 2009).

In addition to mixed-coverage or partially complete years noted above, surveys were impacted by the COVID-19 pandemic and comparative fishing: There was no spring survey in 2020 or 2021, and in 2023 Subdiv. 3Ps was not sampled; the autumn survey did not sample Div. 3LNO in fall 2021 and there was no fall survey in 2022. (Rideout et al. 2025).

Results

American Plaice in Divs. 2+3K

Autumn Survey

Comparative Fishing: No conversion is required for CAX-Teleost for Divs. 2HJ3K (DFO 2024), and this conclusion can be extended into Div. 2G. A length-based conversion factor exists for CAX-Needer/Templeman in Div. 3KL (Trueman et al. 2025). Consistency in American plaice habitat (e.g. depth, temperature) (**Figure 1**) supports the extension of the 3KL CAX-Needer/Templeman conversion northward within the stock area. The length-based conversion is applied to set specific catch abundance at length. Converted catch weights (biomass) are then calculated through the application of the following length weight relationship: $\log(\text{weight}) = -12.835 + 3.348 \log(\text{length})$

Survey Coverage: Only data from Divs. 2J3K are used to calculate indices for this stock due to limited and inconsistent coverage of Divs. 2GH (DFO 2021). There was no autumn survey in 2022.

Conclusion: The entire time series can be converted to Modified Campelen units (**Figure 2**).

- Autumn Modified Campelen Series: 1984-2021, 2023-onward

American Plaice in Divs. 3LNO

Autumn Survey

Comparative Fishing: Conversions are not available for CAX-Teleost or CAX-Needer/Templeman (DFO 2024, DFO in press, Wheeland et al. 2024).

Survey Coverage: The years 2004, 2014, and 2021-2022 were dropped from the data series due to incomplete or no survey coverage of Divs. 3LNO (NAFO 2024). For years with mixed vessel coverage, sensitivity tests of a hypothetical range (0.5-2.0) of conversion factors applied to the Teleost catches revealed there was not a large impact on the overall estimates and trends of abundance and biomass (**Figure 3**). The lack of a meaningful impact is a result of most catches and the largest catches generally being from the Templeman/Needler (**Figure 4** and **Figure 5**) so scaling the Teleost catches does not have a large influence on the overall indices. Additionally, use of the Teleost in 3LNO fall is primarily associated with deep strata in Div. 3L which have inconsistent coverage and generally small catches of American plaice. It is therefore recommended to keep years with mixed vessel coverage as part of the Campelen time series.

Conclusion: The autumn Campelen series for 3LNO American plaice will end after 2020 and the new Modified Campelen series begins in 2023 (**Figure 6**). These recommendations are in line with recent reporting on the stock (NAFO 2024).

- Autumn Campelen Series: 1990-2003, 2005-2013, 2015-2020
- Autumn Modified Campelen Series: 2023-onward

Spring Survey

Comparative Fishing: No conversion factor is required for CAX-Teleost and no conversion is available for CAX-Needer/Templeman (DFO 2024, DFO in press, Wheeland et al. 2024).

Survey Coverage: The years 1984, 2006, 2015-2017 and 2020-2022 were dropped from the data series due to incomplete or no survey coverage of Divs. 3LNO (NAFO 2024). For years with mixed vessel coverage, sensitivity tests of a hypothetical range (0.5-2.0) of conversion factors applied to the Teleost catches generally demonstrated minimal impacts on the overall estimates and trends of abundance or biomass in most years (**Figure 7**). In 2014, however, the majority of sets were completed by the Teleost (**Figure 8 - Figure 9**) so it is recommended to include this year with the Modified Campelen series..

Conclusion: The spring Campelen series for 3LNO American plaice will end after 2019 and the new Modified Campelen series begins in 2023 but also includes previous years (2014, 2016) that were surveyed all or primarily by the Teleost (**Figure 10**). These recommendations are in line with recent reporting on the stock (NAFO 2024), with the exception of our recommendation to move 2014 into the Modified Campelen series.

- Spring Campelen Series: 1985-2005, 2007-2013, 2018-2019
- Spring Modified Campelen Series: 2014, 2016, 2023-onward

American Plaice in Subdiv. 3Ps

Spring Survey

Comparative Fishing: Conversions are not available for CAX-Teleost or CAX-Needer/Templeman (DFO 2024, DFO in press). The extension of conversion factors from other regions is not supported due to the spatial sensitivity of catchability for the species (Cadigan et al. 2023).

Survey Coverage: The years 2006, 2020, and 2023 were dropped from the data series due to incomplete or no survey coverage of Subdiv. 3Ps. For years with mixed vessel coverage, sensitivity tests of a hypothetical range (0.5-2.0) of conversion factors applied to the Teleost catches demonstrated minimal impacts on the overall estimates and trends of abundance or biomass (**Figure 11**). It is therefore recommended to keep years with mixed vessel coverage as part of the Campelen time series. In 2016 and 2021 the survey of 3Ps was completed exclusively by the Teleost (Figure 12-Figure 13). Here we have dropped these two years from the Campelen time series (but they could also hypothetically be included as a separate two-point time series).

Conclusion: The Campelen time series for 3Ps American plaice will end after 2019 and the new Modified Campelen series begins in 2022 (**Figure 14**).

- Spring Campelen Series: 1983-2005, 2007-2013, 2015, 2017-2019,
- Spring Modified Campelen Series: 2022, 2024-onward

Atlantic Cod in Divs. 2J3KL

Autumn Survey

Comparative Fishing: No conversion is necessary for CAX-Teleost and CAX-Needer/Templeman (Wheeland and Trueman, 2024).

Survey Coverage: The years 2021 and 2022 were dropped from the data series due to incomplete or no survey coverage of Divs. 2J3KL.

Conclusion: The entire time series can be used as modified Campelen units (**Figure 15**).

- Autumn Modified Campelen Series: 1983 – 2020, 2023-onward

Atlantic Cod in Divs. 3NO

Autumn Survey

Comparative Fishing: No conversion is necessary for CAX-Teleost and CAX-Needer/Templeman (Wheeland and Trueman, 2024).

Survey Coverage: The years 2014, 2021 and 2022 were dropped from the data series due to incomplete or no survey coverage of Divs. 3NO.

Conclusion: The entire time series can be used as modified Campelen units (Figure 16).

- Autumn Modified Campelen Series: 1990-2013, 2015-2020, 2023-onward

Spring Survey

Comparative Fishing: No conversion is necessary for CAX-Teleost and CAX-Needer/Templeman (Wheeland and Trueman, 2024).

Survey Coverage: The years 2006, 2020 and 2021 were dropped from the data series due to incomplete or no survey coverage of Divs. 3NO.

Conclusion: The entire time series can be used as modified Campelen units (Figure 17).

- Spring Modified Campelen Series: 1984-2005, 2007-2019, 2022-onward.

Atlantic Cod in Subdiv. 3Ps

Spring Survey

Comparative Fishing: No conversion is necessary for CAX-Teleost and CAX-Needer/Templeman (Wheeland and Trueman, 2024).

Survey Coverage: The years 2006, 2020 and 2023 were dropped from the data series due to incomplete or no survey coverage of Subdiv. 3Ps.

Conclusion: The entire time series can be used as modified Campelen units (Figure 18).

- Spring Modified Campelen Series: 1983-2005, 2007-2019, 2021-2022, 2024-onward

Yellowtail Flounder in Divs. 3LNO

Autumn Survey

Comparative Fishing: A length-based conversion factor is available for CAX-Needer/Templeman. No conversion factor is available for CAX-Teleost (DFO 2024, Trueman et al. 2025, Wheeland et al. 2024).

Survey Coverage: The years 2014, and 2021-2022 were dropped from the data series due to incomplete or no survey coverage of Divs. 3LNO (NAFO 2024). Sensitivity tests of a hypothetical range (0.5-2.0) of conversion factors applied to the Teleost catches for that year had minimal impacts on the overall estimates and trends of abundance and biomass (**Figure 19**). The portion of Divs. 3LNO primarily occupied by Yellowtail flounder has been almost exclusively covered by the Needer/Templeman for the autumn Campelen survey time series (**Figure 20, Figure 21**). The only year where the Teleost did fish within the primary area of Yellowtail

flounder was 1996, and given minimal sensitivity of indices it is recommended to keep this year as part of the Campelen time series.

Conclusion: The entire time series can be converted to Modified Campelen units (**Figure 22**). This recommendation is in line with recent reporting on the stock (NAFO 2024, Wheeland et al. 2025).

- Autumn Modified Campelen Series: 1990-2013, 2015-2020, 2023-onward

Spring Survey

Comparative Fishing: A length-based conversion is available for CAX-Needer/Templeman, and no conversion is required for CAX-Teleost (DFO 2024, DFO 2025, Trueman et al. 2025, Wheeland et al. 2024).

Survey Coverage: The years 2006, 2015, and 2020-2021 were dropped from the data series due to incomplete or no survey coverage of Divs. 3LNO (NAFO 2024). For years with mixed vessel coverage, there are no concerns about the uncertainty around the relative fishing efficiency of the Needler vs. the Teleost since there are conversion factors that can be used to convert data from both vessels to Modified Campelen units.

Conclusion: The entire time series can be converted to Modified Campelen units (**Figure 23**). This recommendation is in line with recent reporting on the stock (NAFO 2024).

- Spring Modified Campelen Series: 1984-2005, 2007-2014, 2016-2019, 2022-onward

Yellowtail Flounder in Subdiv. 3Ps

Spring Survey

Comparative Fishing: A length-based conversion is available for CAX-Needer/Templeman (Trueman et al. 2025). No conversion factor is required for CAX-Teleost for Divs. 3LNO (DFO 2025), and given the consistency observed across 3LNOPs for the CAX-Needer/Templeman (DFO 2024) the extension of this conclusion to subdivision 3Ps is considered a reasonable assumption.

Survey Coverage: The years 2006, 2020, and 2023 were dropped from the data series due to incomplete or no survey coverage of Subdiv. 3Ps (NAFO 2024). For years with mixed vessel coverage, there are no concerns about the uncertainty around the relative fishing efficiency of the Needler vs. the Teleost since there are conversion factors that can be used to convert data from both vessels to Modified Campelen units.

Conclusion: The entire time series can be converted to Modified Campelen units (**Figure 24**).

- Spring Modified Campelen Series: 1983 – 2005, 2007 – 2019, 2021-2022, 2024-onward

Witch Flounder in Divs. 2J3KL

Autumn Survey

Comparative Fishing: A length-based conversion is available for CAX-Needer/Templeman and for CAX-Teleost across the stock area (Wheeland et al. 2024, Trueman et al. 2025).

Survey Coverage: The years 2021 and 2022 were dropped from the data series due to incomplete or no survey coverage of Divs. 2J3KL. Coverage issues of deep strata in other years were previously determined to have little to no influence on interpretation of survey indices for this stock (DFO 2023). For years with mixed

vessel coverage, there are no concerns about the uncertainty around the relative fishing efficiency of the Needler vs. the Teleost since there are conversion factors that can be used to convert data from both vessels to Modified Campelen units.

Conclusion: The entire series can be converted to Modified Campelen units (**Figure 25**).

- Autumn Modified Campelen Series: 1983 – 2020, 2023-onward

Witch Flounder in Divs. 3NO

Autumn Survey

Comparative Fishing: No conversion is available for CAX-Teleost or CAX-Needler/Templeman (DFO 2024). Extension of conversion factors from elsewhere is not considered appropriate given known spatial sensitivity of catchability for Witch Flounder between Div. 3NO and the more northern stock area based on factors such as bottom temperature and size distribution (Wheeland et al. 2024).

Survey Coverage: The years 2014, 2021 and 2022 were dropped from the data series due to incomplete or no survey coverage of Divs. 3NO. For years with mixed vessel coverage, sensitivity tests of a hypothetical range (0.5-2.0) of conversion factors applied to the Teleost catches demonstrated minimal impacts on the overall estimates and trends of abundance or biomass (**Figure 26**). In 1996, however, the Teleost covered a larger portion of the stock area (**Figure 27 –Figure 28**) so the impacts on the sensitivity tests were larger for that year. However, the sensitivity in that year appears to be driven by a few large sets and the indices that year are associated with a relatively high degree of uncertainty. Given this, and that the decision to keep or drop this year so far back in the time series will likely have minimal influence on perception of stock trends/status, we recommend maintaining 1996 in the Campelen series.

Conclusion: The autumn Campelen series for 3NO Witch flounder will end after 2020 and the new Modified Campelen series begins in 2023 (**Figure 29**).

- Autumn Campelen Series: 1990- 2013, 2015-2020
- Autumn Modified Campelen Series: 2023-onward

Spring Survey

Comparative Fishing: No conversion is required for CAX-Teleost (Wheeland et al. 2024, DFO in press). No conversion is available for CAX-Needler/Templeman (Wheeland et al. 2024, DFO 2024).

Survey Coverage: The years 2006, 2020 and 2021 were dropped from the data series due to incomplete or no survey coverage of Divs. 3NO (Maddock Parsons et al. 2024). The majority of the spring survey for 3NO Witch flounder was covered by the Needler/Templeman. It was previously decided that Campelen years for which the stock was surveyed all (2014 and 2016) or primarily (2018) by the Teleost (**Figure 30, Figure 31**) can be converted to Modified Campelen units and included with the Modified Campelen series (Maddock Parsons et al. 2024).

Conclusion: The spring Campelen series for 3NO witch flounder will end after 2019 and the new Modified Campelen series will start in 2022 but also include previous years (2014, 2016, 2018) that were surveyed all or primarily by the Teleost (**Figure 32**).

- Spring Campelen Series: 1984-2005, 2007-2013, 2015, 2017, 2019

- Spring Modified Campelen Series: 2014, 2016, 2018, 2022-onward

Witch Flounder in Subdivision 3Ps

Spring Survey

Comparative Fishing: No conversion is available for CAX-Needer/Templeman or CAX-Teleost (DFO 2024, DFO in press), and the extension of any conversion factors from other areas is not supported given poor representation of habitats (e.g. by depth and temperature (**Figure 33**), mid-shelf channels and other benthic conditions (DFO 2025)) occupied by 3Ps witch flounder in comparative fishing sets.

Survey Coverage: The years 2006, 2020, and 2023 were dropped from the data series due to incomplete or no survey coverage of Subdiv. 3Ps. For years with mixed vessel coverage, sensitivity tests of a hypothetical range (0.5-2.0) of conversion factors applied to the Teleost catches generally demonstrated minimal impacts on the overall estimates and trends of abundance and biomass (**Figure 34**). In 2014, however, the majority of fishing sets within witch flounder habitat were completed by the Teleost (**Figure 35 - Figure 36**) so the impacts of the sensitivity tests were much larger for that year. It is therefore recommended to drop 2014 from the Campelen time series. In 2016 and 2021 the survey of 3Ps was completed entirely by the Teleost. Here we dropped these two years from the Campelen time series (but they could also hypothetically be included as a separate two-point time series).

Conclusion: The Campelen time series for 3Ps Witch flounder will end after 2019 and the new modified Campelen series begins in 2022 (**Figure 37**).

- Spring Campelen Series: 1983-2005, 2007-2013, 2015, 2017-2019
- Spring Modified Campelen Series: 2022, 2024-onward

Redfish in Divs. 2+3K

Autumn Survey

Comparative Fishing: No conversion is required for CAX-Teleost (DFO 2024) and a length-based conversion is available for CAX-Needer/Templeman in Div. 3KL (Trueman et al. 2025). Based on consistency in habitat (e.g. bathymetry, temperature) (Figure 38, Figure 39) and size and distribution across the stock area it is considered appropriate to extend these conclusions across the entire stock area. The length-based conversion is applied to set specific catch abundance at length. Converted catch weights (biomass) are then calculated through the application of the following length weight relationship: $\log(\text{weight}) = -11.690 + 3.156\log(\text{length})$

Survey Coverage: Survey indices for tracking this stock are based primarily on Divs. 2J3K, due to limited and inconsistent coverage of Divs. 2GH. There was no survey in 2022.

Conclusion: The entire time series can be converted to Modified Campelen units (**Figure 40**).

- Autumn Modified Campelen Series: 1984–2021, 2023-onward

Redfish in Divs. 3LN

Autumn Survey

Comparative Fishing: Conversion factors are not available for CAX-Teleost or CAX-Needer/Templeman (Wheeland et al. 2024, DFO 2024, DFO 2025)

Survey Coverage: The years 2014, 2021 and 2022 were dropped from the data series due to incomplete or no survey coverage in Divs. 3LN. For years with mixed vessel coverage, sensitivity tests of a hypothetical range (0.5-2.0) of conversion factors applied to the Teleost catches revealed there was minimal impact on the overall estimates and trends of abundance and biomass (**Figure 41**). The minimal influence is due to the fact that in the years when the Teleost was used it generally fished in areas that were not redfish habitat so catches were low or zero (**Figure 42- Figure 43**). It is therefore recommended to keep years with mixed vessel coverage as part of the Campelen time series.

Conclusion: The autumn Campelen series for 3LN redfish will end after 2020 and the new Modified Campelen series begins in 2023 (**Figure 44**).

- Autumn Campelen Series: 1990-2013; 2015 -2020
- Autumn Modified Campelen Series: 2023-onward

Spring Survey

Comparative Fishing: No conversion factor is required for CAX-Teleost (Wheeland et al. 2024, DFO 2025). No conversion is available for CAX-Needer/Templeman (Wheeland et al. 2024, DFO 2024).

Survey Coverage: The years 2006, 2017, 2020 and 2021 were dropped from the data series due to incomplete or no survey coverage in Divs. 3LN. For years with mixed vessel coverage, sensitivity tests of a hypothetical range (0.5-2.0) of conversion factors applied to the Teleost catches generally demonstrated minimal impacts on the overall estimates and trends of abundance and biomass (**Figure 45**). In 2014, however, several of the largest fishing sets were completed by the Teleost (**Figure 46 - Figure 47**) so the impacts of the sensitivity tests were much larger for that year. It is therefore recommended to drop 2014 from the Campelen time series. In 2016 and 2018 the core redfish area was surveyed all or primarily by the Teleost and therefore estimates from those years can be converted to Modified Campelen units and included with the Modified Campelen series.

Conclusion: The spring Campelen series for 3LN redfish will end after 2019 and the new Modified Campelen series will start in 2022 but also include previous years (2016, 2018) that were surveyed all or primarily by the Teleost (**Figure 48**).

- Spring Campelen Series: 1984-2005, 2007-2013, 2015, 2019
- Spring Modified Campelen Series: 2016, 2018, 2022-onward

Redfish in Div. 3O

Autumn Survey

Comparative Fishing: No conversion is available for CAX-Teleost or CAX-Needer/Templeman (Wheeland et al. 2024, Trueman et al. 2025).

Survey Coverage: The years 1996, 2014, 2021 and 2022 were dropped from the data series due to incomplete or no survey coverage of Div. 30. Mixed vessel coverage within a single year is not an issue in the 30 autumn survey (**Figure 49, Figure 50**).

Conclusion: The Campelen series will end in 2020 and the Modified Campelen series will start in 2023 (**Figure 51**).

- Autumn Campelen Series: 1991-1995, 1997-2013, 2015-2020
- Autumn Modified Campelen Series: 2023-onward

Spring Survey

Comparative Fishing: No conversion factor is required for CAX-Teleost (Wheeland et al. 2024, DFO in press). No conversion is available for CAX-Needer/Templeman (Wheeland et al. 2024, DFO 2024).

Survey Coverage: The years 2006, 2020, and 2021 were dropped from the data series due to incomplete or no survey coverage of Div. 30. Mixed vessel coverage within a single year is not an issue in the 30 spring survey for redfish (**Figure 52- Figure 53**). In 2014, 2016 and 2018 the Teleost was the only vessel used in the redfish strata in Div. 30 so these years can be used as part of the Modified Campelen series.

Conclusion: The spring Campelen series for 30 redfish will end after 2019 and the new Modified Campelen series will start in 2022 but also include previous years (2014, 2016, 2018) that were surveyed all or primarily by the Teleost (**Figure 54**).

- Spring Campelen Series: 1991-2005, 2007-2013, 2015, 2017, 2019
- Spring Modified Campelen Series: 2014, 2016, 2018, 2022-onward

Redfish in Subdiv. 3Ps

Spring Survey

Comparative Fishing: Conversions are not available for CAX-Teleost or CAX-Needer/Templeman (DFO 2024, DFO in press). The extension of conversion factors from other areas is not supported as sampling during comparative fishing is not representative of conditions in 3Ps (Figure 39, DFO 2025)

Survey Coverage: The years 2006, 2020, and 2023 were dropped from the data series due to incomplete or no survey coverage of Subdiv. 3Ps. For years with mixed vessel coverage, sensitivity tests of a hypothetical range (0.5-2.0) of conversion factors applied to the Teleost catches generally demonstrated minimal impacts on the overall estimates and trends of abundance and biomass (**Figure 55**). In 2014, however, much of the survey area was completed by the Teleost (**Figure 56 - Figure 57**) and the impacts of the sensitivity tests were larger for that year. It is therefore recommended to drop 2014 from the Campelen time series. In 2016 and 2021 the survey was completed entirely by the Teleost. Here we have removed those two years from the Campelen time series (but they could also hypothetically be included as a separate two-point time series).

Conclusion: The spring Campelen series for 30 redfish will end after 2019 and the new Modified Campelen series will start in 2022 (**Figure 58**).

- Spring Engel Series: 1983-1995
- Spring Campelen Series: 1996-2005, 2007-2013, 2015, 2017-2019
- Spring Modified Campelen Series: 2022, 2024-onward

Thorny Skate in Divs. 3LNOPs

Autumn Survey

Comparative Fishing: Conversions are not available for CAX-Teleost or CAX-Needer/Templeman (Wheeland et al. 2024, DFO 2024).

Survey Coverage: The autumn survey does not cover Subdiv. 3Ps and therefore autumn indices only represent a portion of the stock area. The years 2014, 2021 and 2022 were dropped from the data series due to incomplete or no survey coverage of Divs. 3LNO. For years with mixed vessel coverage, sensitivity tests of a hypothetical range (0.5-2.0) of conversion factors applied to the Teleost catches generally demonstrated only small impacts on the overall estimates and trends of abundance and biomass (**Figure 59**). In 1996, however, impacts of the sensitivity tests were larger, as the Teleost fished most of the skate territory within Div. 3O and along the slope portion of 3LN (**Figure 60 - Figure 61**). Interpretation of indices of abundance in that year are greatly impacted by the assumption of relative catchability between vessels and it is therefore recommended to drop 1996 from the Campelen time series.

Conclusion: The autumn Campelen series for 3LNOPs thorny skate will end after 2020 and the new Modified Campelen series begins in 2023 (**Figure 62**).

- Autumn Campelen Series: 1990 -1995, 1997-2013, 2015-2020
- Autumn Modified Campelen Series: 2023-onward

Spring Survey

Comparative Fishing: No conversion is available for CAX-Needer/Templeman (Wheeland et al. 2024, DFO 2024). A length-based conversion is available for CAX-Teleost in Divs. 3LNO, but it is not appropriate to extend this conversion to Subdiv. 3Ps (Wheeland et al. 2024, Trueman et al. in press-b).

Survey Coverage: The years 2006, 2020, 2021, and 2023 were dropped from the data series due to incomplete or no survey coverage of Divs. 3LNOPs. While the survey in 2017 missed most of Div. 3L, this index continues to be included as the missed strata account for a relatively low proportion of the index in a typical year (Rideout and Wheeland, 2019). For years with mixed vessel coverage, sensitivity tests of a hypothetical range (0.5-2.0) of conversion factors applied to the Teleost catches demonstrated small impacts on the overall estimates of abundance and biomass for some years (**Figure 63**). In 2014 and 2018, however, a large proportion of the total fishing sets were completed by the Teleost, including some of the largest catches in the survey in those years (**Figure 64-Figure 65**), and indices are highly sensitive to these. It is therefore recommended to drop 2014 and 2018 from the Campelen time series. In 2016 the survey was completed entirely by the Teleost and therefore this year should not be included in either the Campelen series where Needer/Templeman was the primary vessel or the Modified Campelen series.

Conclusion: The spring Campelen series for 3LNOPs thorny skate will end after 2019 and the new Modified Campelen series begins in 2022 (**Figure 66**).

- Spring Campelen Series: 1984-2005, 2007-2013, 2015, 2017, 2019
- Spring Modified Campelen Series: 2022, 2024-onward

3NOPs White Hake

Autumn Survey

Comparative Fishing: Conversions are not available for CAX-Needer/Templeman or CAX-Teleost (Wheeland et al. 2024, DFO 2024).

Survey Coverage: The autumn survey does not cover Subdiv. 3Ps and therefore autumn indices only represent a portion of the stock area. The years 2014, 2021 and 2022 were dropped from the data series due to incomplete or no survey coverage of Divs. 3NOPs. For years with mixed vessel coverage, sensitivity tests of a hypothetical range (0.5-2.0) of conversion factors applied to the Teleost catches generally demonstrated only small impacts on the overall estimates and trends of abundance and biomass (**Figure 67**), due to the fact that the Teleost in most years operated primarily outside of white hake territory in the deep strata of Div. 3N (**Figure 68-Figure 69**). While a higher degree of sensitivity is observed in 1996, this does not impact overall interpretation of the indices or stock trends. It is therefore recommended to keep the years with mixed vessel coverage as part of the Campelen time series.

Conclusion: The autumn Campelen series for 3NOPs white hake will end after 2020 and the new Modified Campelen series begins in 2023 (**Figure 70**).

- Autumn Engel Series: 1990-1994
- Autumn Campelen Series: 1995 - 2013, 2015 – 2020
- Autumn Modified Campelen Series: 2023-onward

Spring Survey

Comparative Fishing: No conversion is available for CAX-Needer/Templeman (DFO 2024). No conversion is required for CAX-Teleost (Wheeland et al. 2024, DFO in press).

Survey Coverage: The years 2006, 2020-2023 were dropped from the data series due to incomplete or no survey coverage of Divs. 3NOPs. For years with mixed vessel coverage, sensitivity tests of a hypothetical range (0.5-2.0) of conversion factors applied to the Teleost catches demonstrated small impacts on the overall estimates of abundance and biomass for some years (**Figure 71**). In 2018, however, the Teleost covered most of the stock area on the southern Grand Bank while the Needler sampled Subdiv. 3Ps. Given that sensitivity tests show larger impacts in 2018, especially for biomass, and that the vessel split is effectively on a Divisional scale, it is recommended to drop 2018 from the Campelen time series. In 2014 and 2016 the stock area was surveyed all or primarily by the Teleost (**Figure 72, Figure 73**) and therefore values for those years can be converted to Modified Campelen units and included with the Modified Campelen series (Wheeland et al. 2024).

Conclusion: The spring Campelen series for 3NOPs white hake will end after 2019 and the new Modified Campelen series begins in 2022 but also includes previous years (2014, 2016) that were surveyed all or primarily by the Teleost (**Figure 74**).

- Spring Engel Series: 1984-1995
- Spring Campelen Series: 1996-2005, 2007-2013, 2015, 2017, 2019
- Spring Modified Campelen Series: 2014, 2016, 2022, 2024-onward

Roughhead Grenadier in Div. 2+3

Autumn Survey

Comparative Fishing: No conversion factor is required for CAX-Needer/Templeman or CAX-Teleost (Wheeland et al 2024, DFO 2024, DFO in press).

Survey Coverage: Survey indices for tracking this stock are based primarily on Divs. 2J3K due to limited and inconsistent coverage of Divs. 2GH (NAFO 2024). The years 2008, 2018, 2019, 2021, 2022 and 2024 were dropped from the data series due to incomplete or no survey coverage (González-Costas 2019, NAFO 2024). In most years, coverage issues were primarily related to poor coverage of deep strata.

Conclusion: The autumn Campelen series can be converted to Modified Campelen units (**Figure 75**) .

- Fall Engel Series: 1978-1994
- Fall Modified Campelen Series: 1995-2007, 2009-2017, 2020, 2023

Greenland Halibut in SA 2 + Div. 3KLNO

Autumn Survey

Comparative Fishing: No conversion factor is required for CAX-Needer/Templeman (DFO 2024), and a length-based conversion is available for CAX-Teleost (Wheeland et al. 2024, Trueman et al. in press-a).

Survey Coverage: Although considered to be one single wide-ranging stock, the trends in the autumn survey for Greenland halibut are monitored separately for SA2+3K and Divs 3LNO. Survey indices for SA2+3K are based primarily on Divs. 2J3K due to limited and inconsistent coverage of Divs. 2GH. The years 2008 and 2022 were dropped from the 2J3K series due to incomplete or no survey coverage. For 3LNO, the years 2014 and 2021-2022 were dropped from the series due to incomplete or no survey coverage.

Conclusion: The entire time series for Divs. 2J3K can be converted to Modified Campelen units (**Figure 76**). For Divs. 3LNO the Engel series remains separate and the remainder of the time series can be converted to Modified Campelen units (**Figure 77**).

- 2J3K Autum Modified Campelen Series: 1978-2007, 2009-2021, 2023-onward
- 3LNO Autumn Engel Series: 1990-1994
- 3LNO Autumn Modified Campelen Series: 1995-2013, 2015-2020, 2023-onward

Spring Survey

Comparative Fishing: No conversion factor is available for CAX-Needer/Templeman (DFO 2024) and no conversion is required for CAX-Teleost (Wheeland et al. 2024, DFO in press).

Survey Coverage: The years 2006, 2015, 2017, 2020-2022 were dropped from the data series due to incomplete or no survey coverage. For years with mixed vessel coverage, sensitivity tests of a hypothetical range (0.5-2.0) of conversion factors applied to the Teleost catches generally demonstrated small impacts on the overall estimates of abundance and biomass (**Figure 78**). In 2016 and 2018 the core Greenland halibut area was surveyed all or primarily by the Teleost and therefore estimates from those years can be converted to Modified Campelen units and included with the Modified Campelen series (**Figure 79-Figure 80**).

Conclusion: The spring Campelen series for 3LNO Greenland halibut will end after 2019 and the new Modified Campelen series begins in 2023 but also includes previous years (2016, 2018) that were surveyed all or primarily by the Teleost (**Figure 81**).

- Spring Engel: 1985-1995
- Spring Campelen: 1996-2005, 2007-2014, 2019
- Spring Modified Campelen: 2016, 2018, 2023-onward

Greenland Halibut in Subdivision 3Ps

Spring Survey

Comparative Fishing: Conversions are not available for CAX-Needer/Templeman or CAX-Teleost (DFO 2024, DFO in press), and the extension of conversion factors from other regions is not supported.

Survey Coverage: The years 2006, 2020, and 2023 were dropped from the data series due to incomplete or no survey coverage of Subdiv. 3Ps. For years with mixed vessel coverage, sensitivity tests of a hypothetical range (0.5-2.0) of conversion factors applied to the Teleost catches demonstrated small impacts on the overall estimates of abundance and biomass for some years (**Figure 82**). In 2014, however, approximately half of the 3Ps survey was conducted by the Teleost (**Figure 83-Figure 84**) so the impacts of the sensitivity tests were larger for that year. It is therefore recommended to drop 2014 from the Campelen time series. In 2016 and 2021 the survey of 3Ps was completed entirely by the Teleost. Here we dropped these two years from the Campelen time series (but they could also hypothetically be included as a separate two-point time series).

Conclusion: The Campelen time series for 3Ps Greenland halibut will end after 2019 and the new modified Campelen series begins in 2022 (**Figure 85**).

- Spring Engel Series: 1985-1995
- Spring Campelen Series: 1996-2005, 2007-2013, 2015, 2017-2019
- Spring Modified Campelen Series: 2022, 2024-onward

Discussion

Over the last decade the Canada-NL surveys have struggled with survey coverage issues in both the spring and fall, which was only further impacted with the introduction of new research vessels and the need for comparative fishing. Further complications during the comparative fishing program did not allow for conversion factors to be developed for every stock area across both seasons for both the Needler and Teleost, therefore resulting in a break in the time series for some stocks, while some stocks may have appropriate conversions for all areas allowing for a continuous time series from old to new vessels. Comparative fishing analysis also revealed the previous assumption of equal catchability between the Needler/Templeman and Teleost could no longer be upheld (DFO 2024, DFO in press), and therefore a thorough investigation into all years with mixed vessel coverage was required to assess the impact of non-equal catchability between the Needler/Templeman and Teleost.

Stocks on the Grand Bank (Div. 3LNO) are most affected by missing conversion factors, and thereby also mixed vessel coverage issues since past data from Needler/Templeman and Teleost can't be converted to new vessel equivalents. Additionally any stock within Subdiv. 3Ps are also heavily affected since no conversion

factors could be developed for the area outside the few exceptions (Trueman et al. 2025, Trueman et al. in press-b). Stocks utilizing Divs. 2J3K for indices are largely unaffected as conversion factors for Div. 3KL were developed for many species for both CAX-Needer/Templeman (Divs. 3KL) and CAX-Teleost (Divs. 2HJ3KL) where majority of mixed vessel coverage for the autumn survey occurs, and therefore old vessels can both be converted to new vessel equivalents.

Initial work was done to determine the path forward on a stock by stock basis in Wheeland et al. 2024 with a focus on NAFO stocks assessed at SC. Here we presented a continuation of that work for remaining fish stocks within the NL region, as well as examined the mixed vessel coverage implications for all stocks. The impact of mixed vessel coverage for majority of stocks was considered minimal and years to be removed because of mixed coverage are only recommended in the more extreme cases, usually when the Teleost completed a large portion of the stock region in comparison to the Needler/Templeman. Continued efforts into spatial modelling, or other techniques, could result in these years still being used in future assessments, and our recommendations carry over depending on what is decided on in framework or assessment meetings for each stock.

Acknowledgements

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Tables and Figures

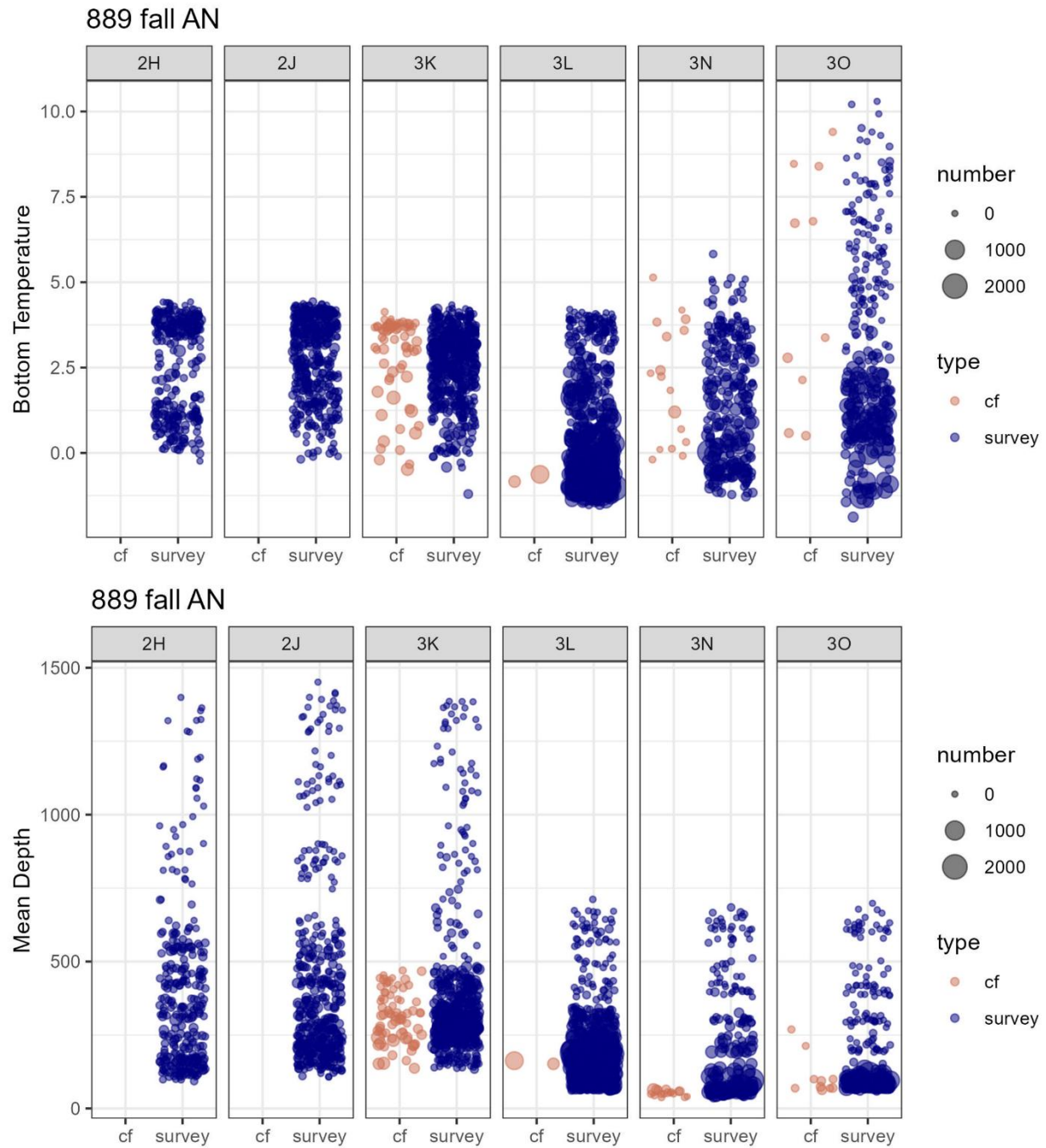


Figure 1. Bottom temperature (°C, top figure) and depth (m, bottom figure) for catches of American plaice during the autumn survey and for comparative fishing (cf) sets across NAFO Divs. 2HJ3KLNO, to demonstrate consistency in habitat occupied in Divs. 2HJ3K for American plaice.

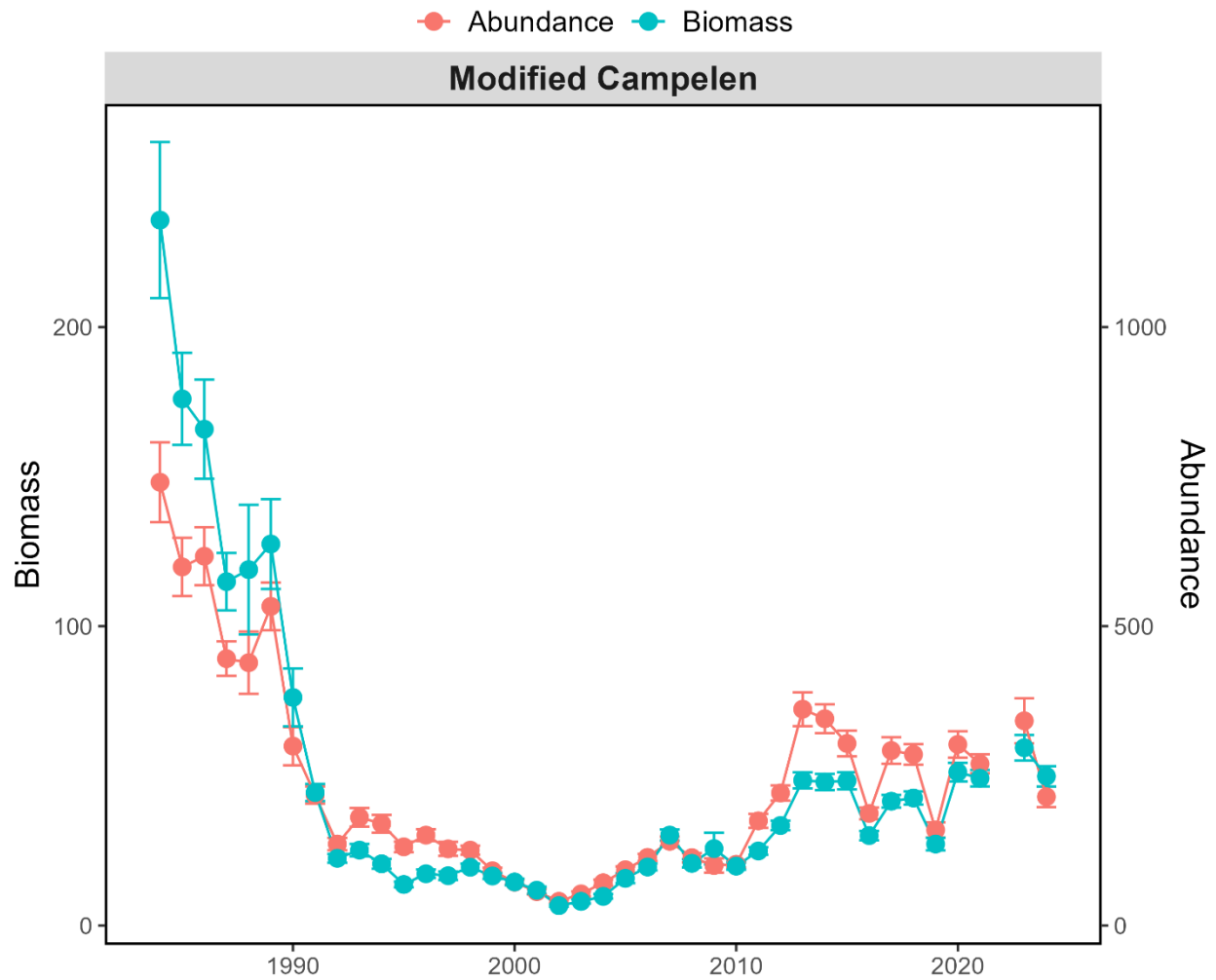


Figure 2. Recommended autumn survey time series for American plaice in NAFO Div. 2+3K.

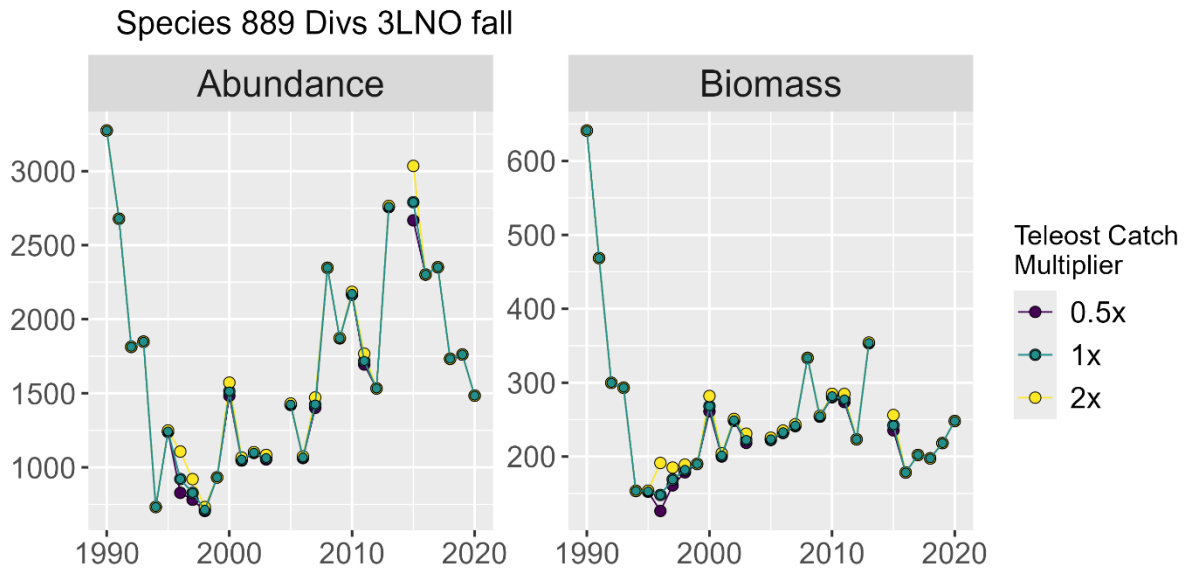


Figure 3. Sensitivity run adjusting autumn CCGS Teleost catches of American plaice in NAFO Div. 3LNO by 0.5x (purple) and 2.0x (yellow) the observed catches (green) in order to explore the impact of hypothetical conversion factors on the survey time series.

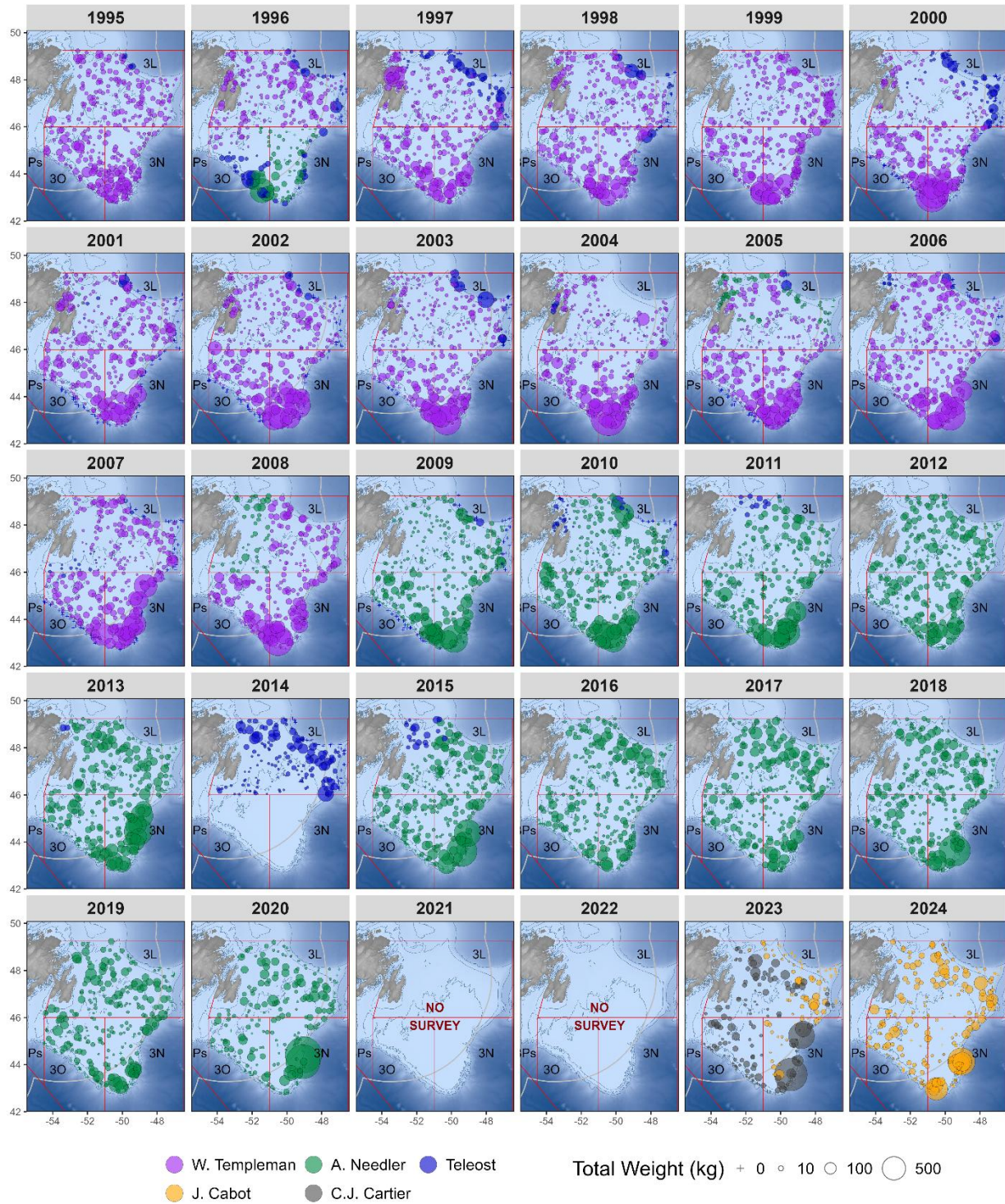


Figure 4. Autumn survey catches (weight) of American plaice in NAFO Divs. 3LNO. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

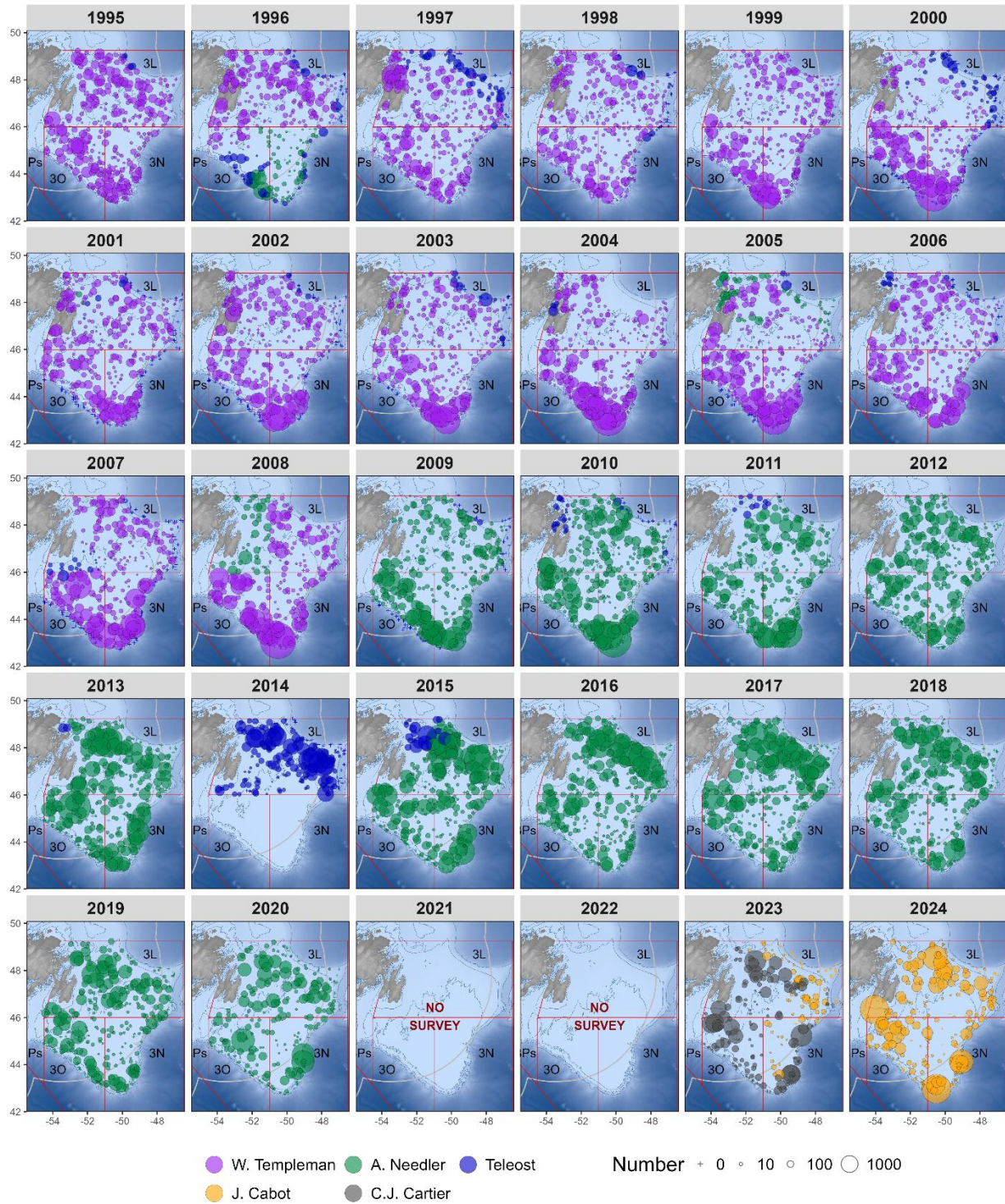


Figure 5. Autumn survey catches (number) of American plaice in NAFO Divs. 3LNO. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

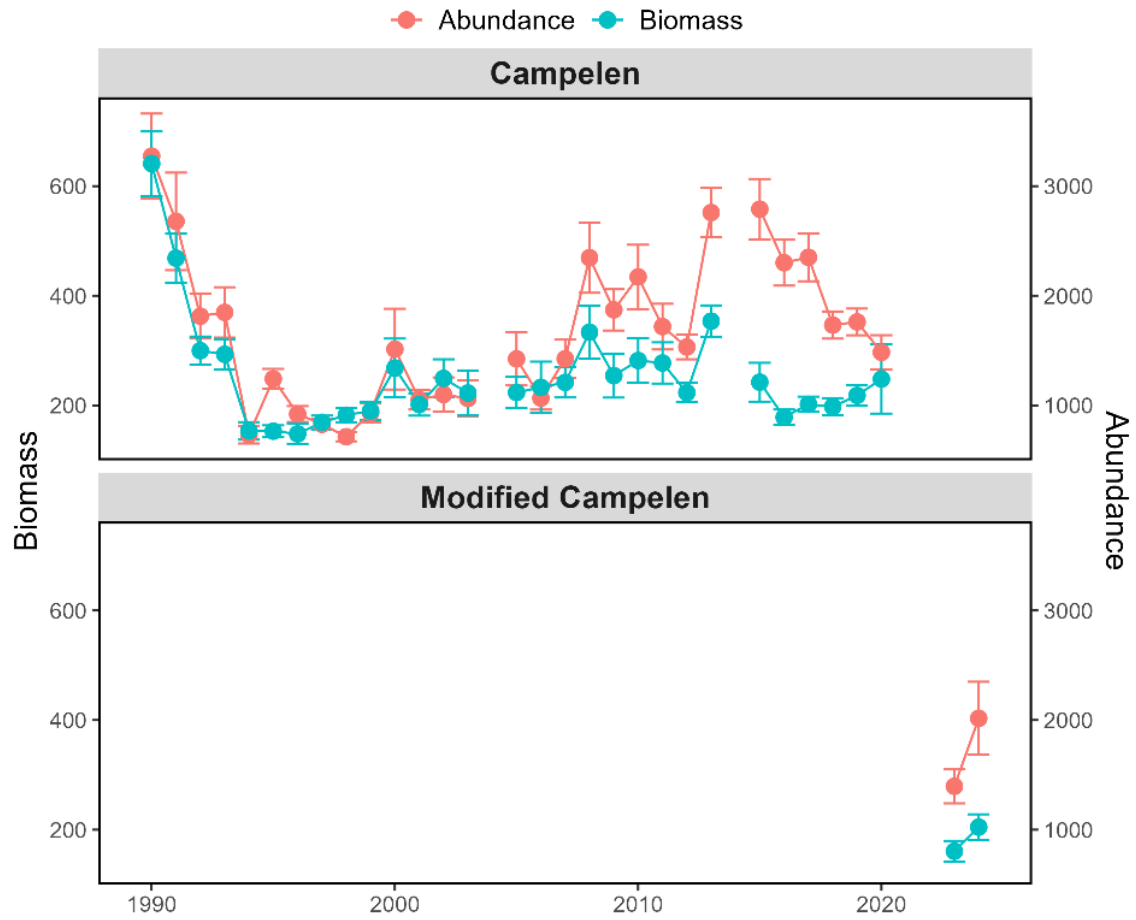


Figure 6. Recommended autumn survey time series for American plaice in NAFO Divs. 3LNO.

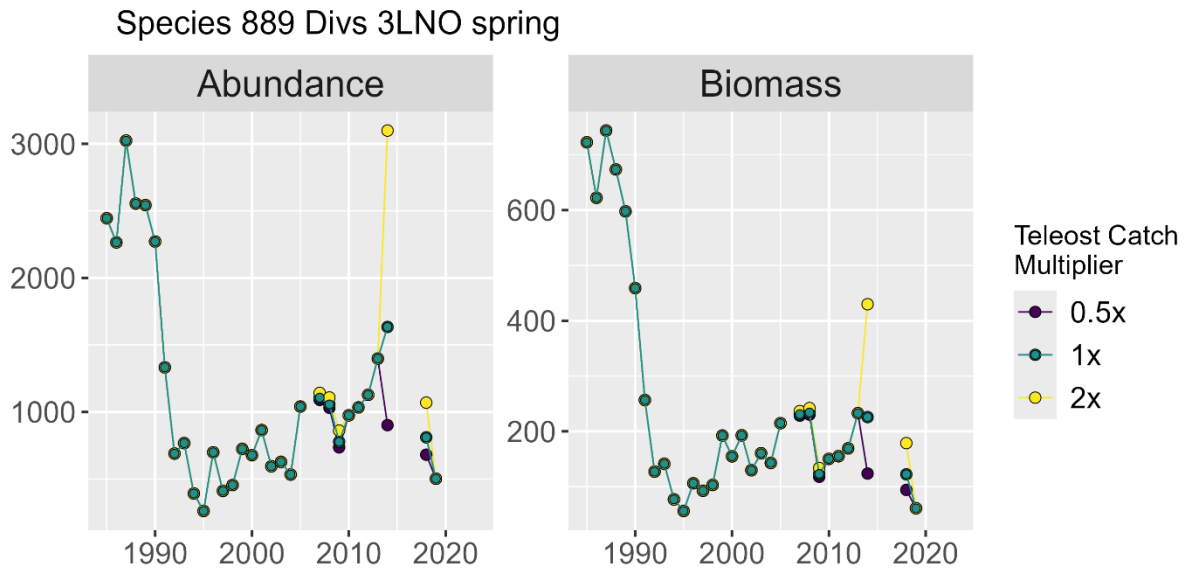


Figure 7. Sensitivity run adjusting spring CCGS Teleost catches of American plaice in NAFO Div. 3LNO by 0.5x (purple) and 2.0x (yellow) the observed catches (green) in order to explore the impact of hypothetical conversion factors on the survey time series.

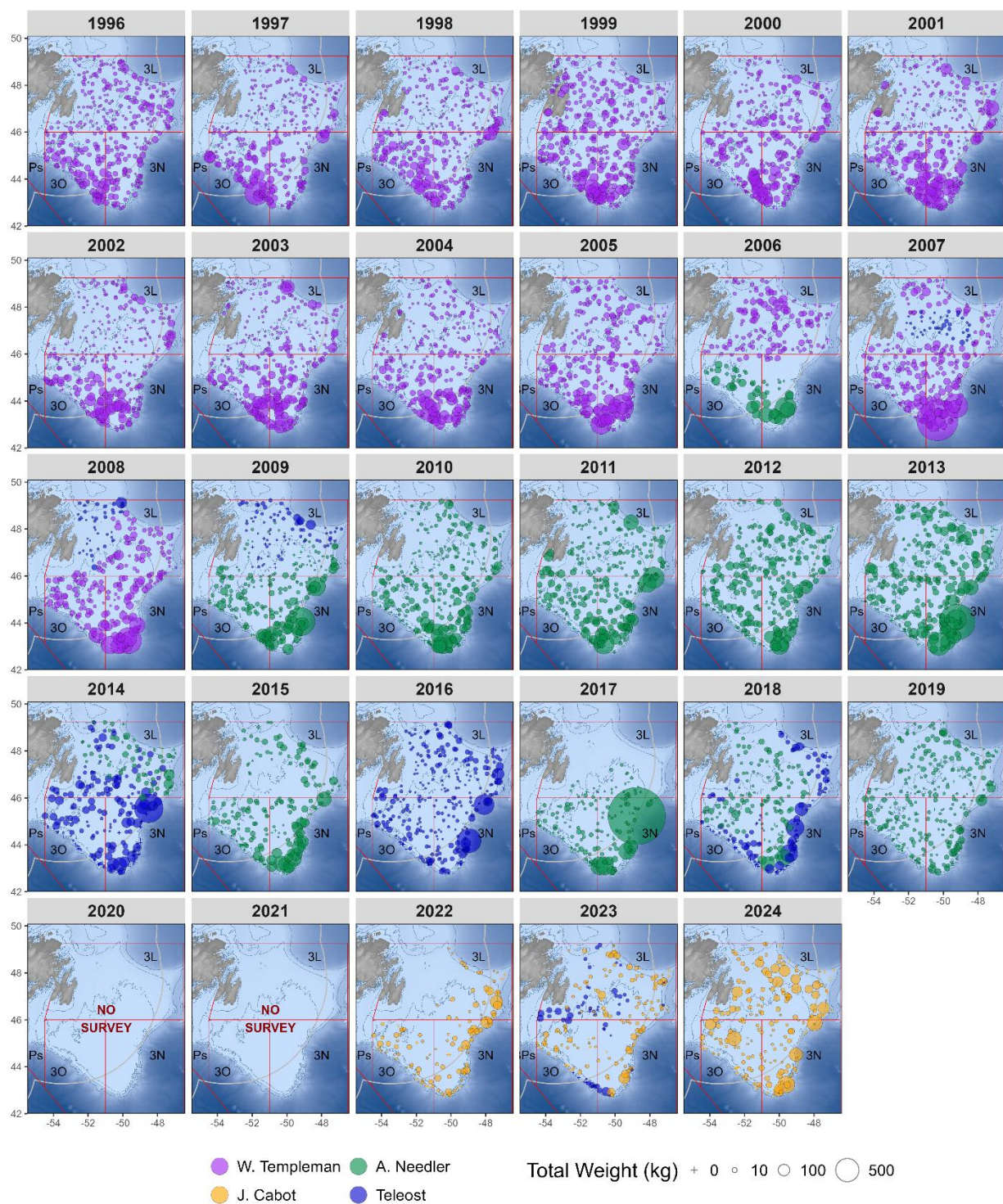


Figure 8. Spring survey catches (weight) of American plaice in NAFO Divs. 3LNO. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

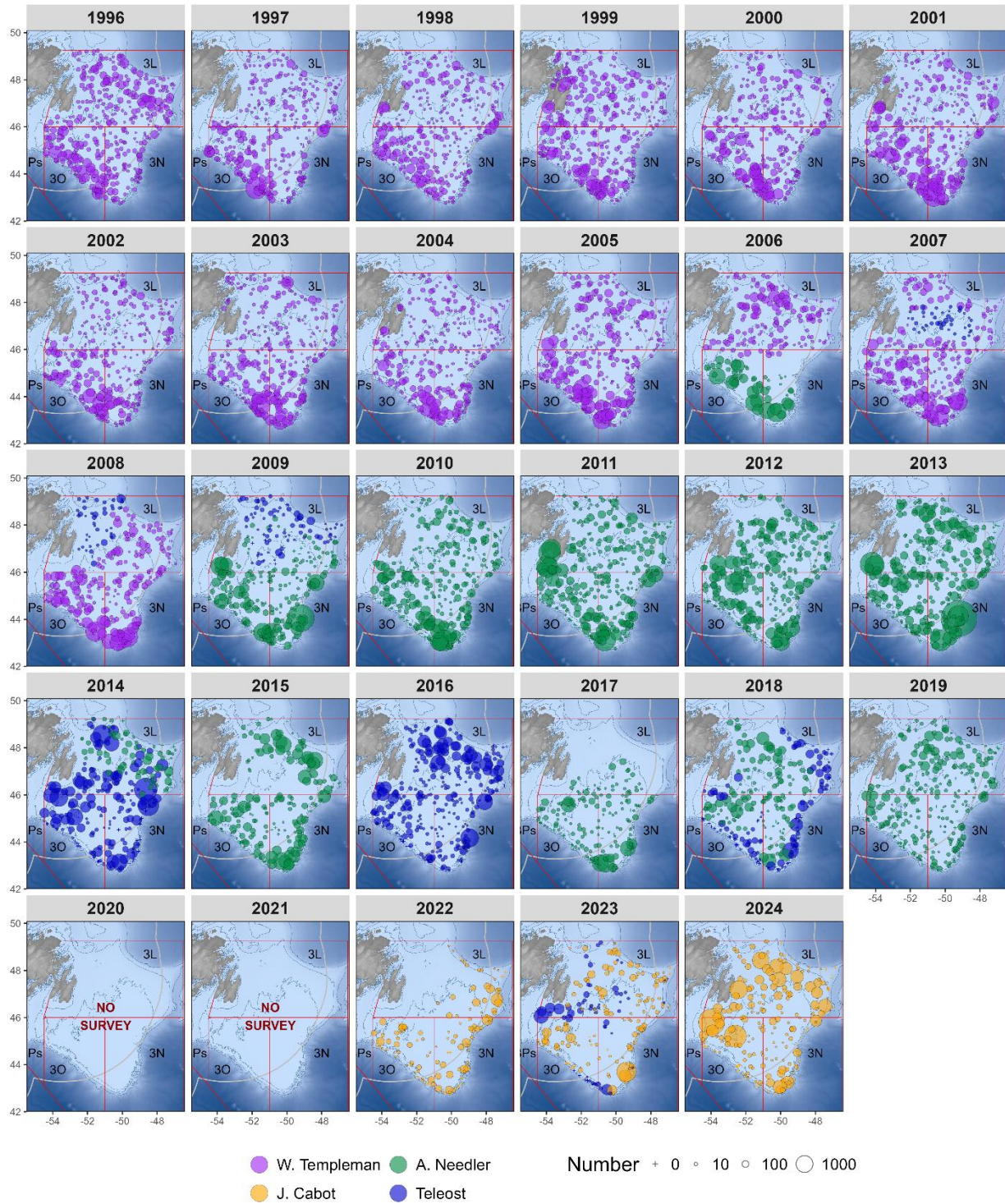


Figure 9. Spring survey catches (number) of American plaice in NAFO Divs. 3LNO. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

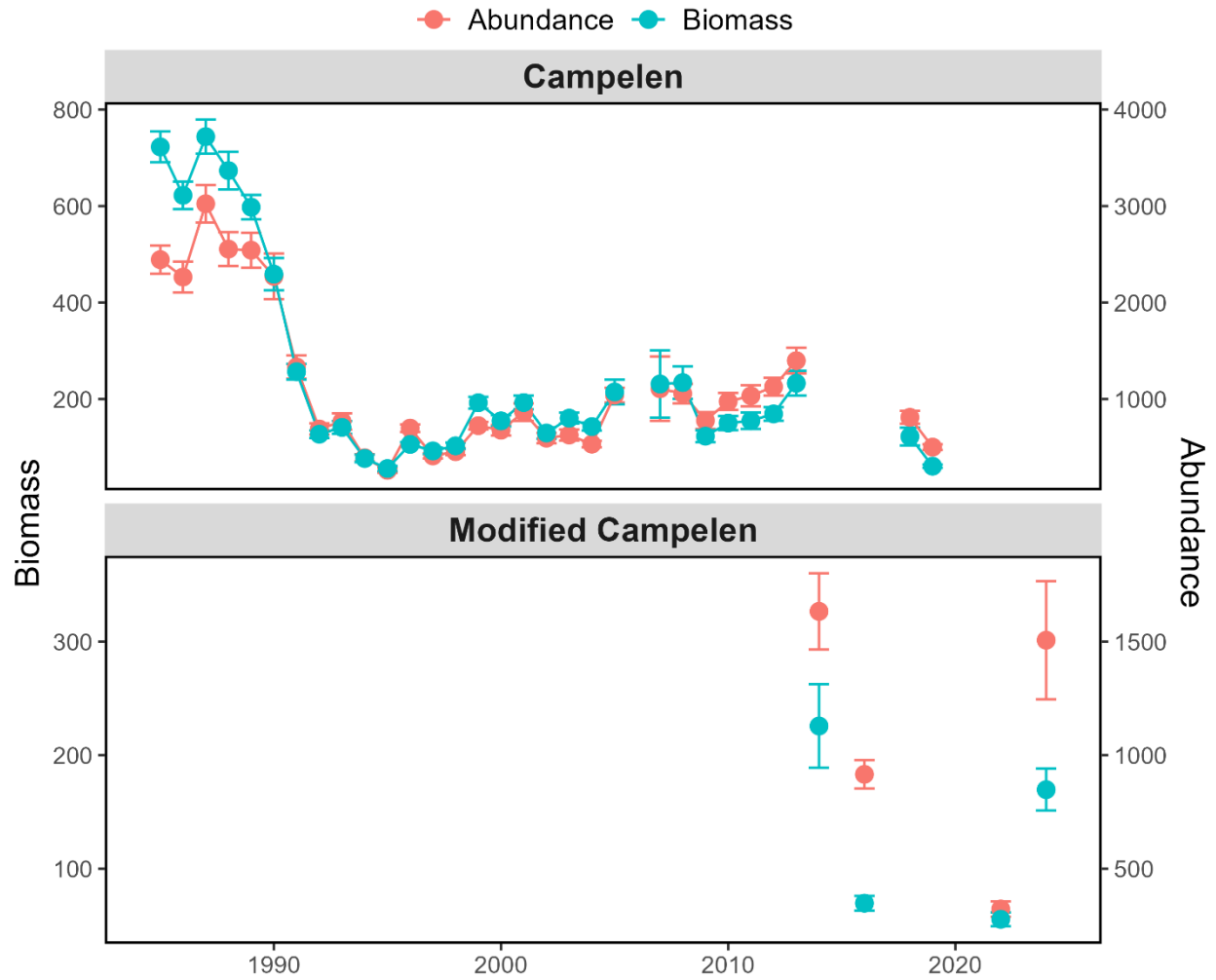


Figure 10. Recommended spring survey time series for American plaice in NAFO Divs. 3LNO.

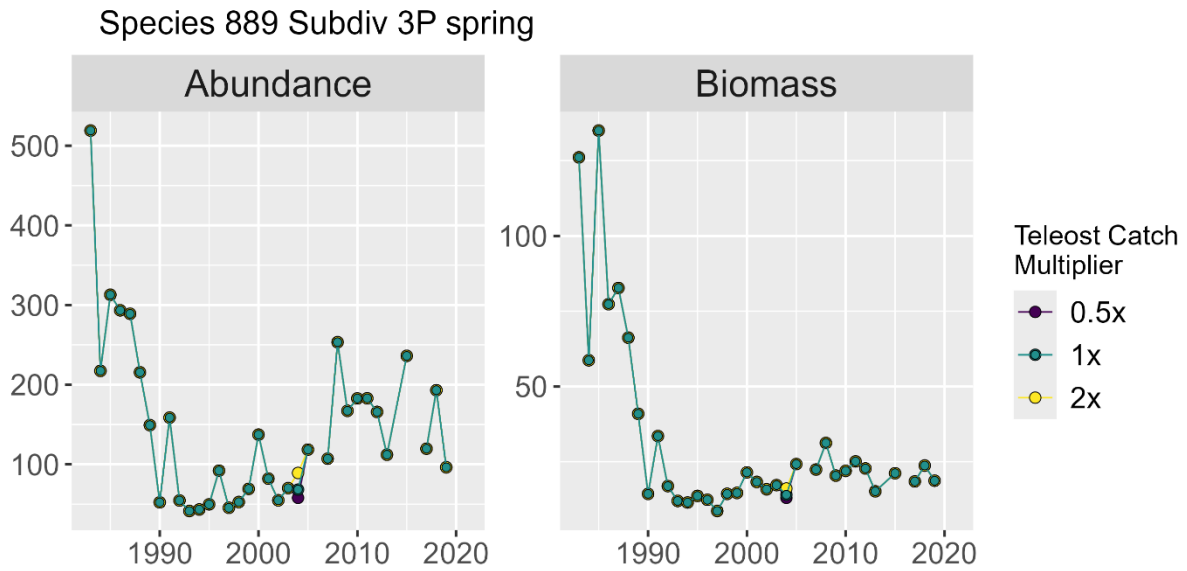


Figure 11. Sensitivity run adjusting spring CCGS Teleost catches of American plaice in NAFO Subdivision 3Ps by 0.5x (purple) and 2.0x (yellow) the observed catches (green) in order to explore the impact of hypothetical conversion factors on the survey time series.

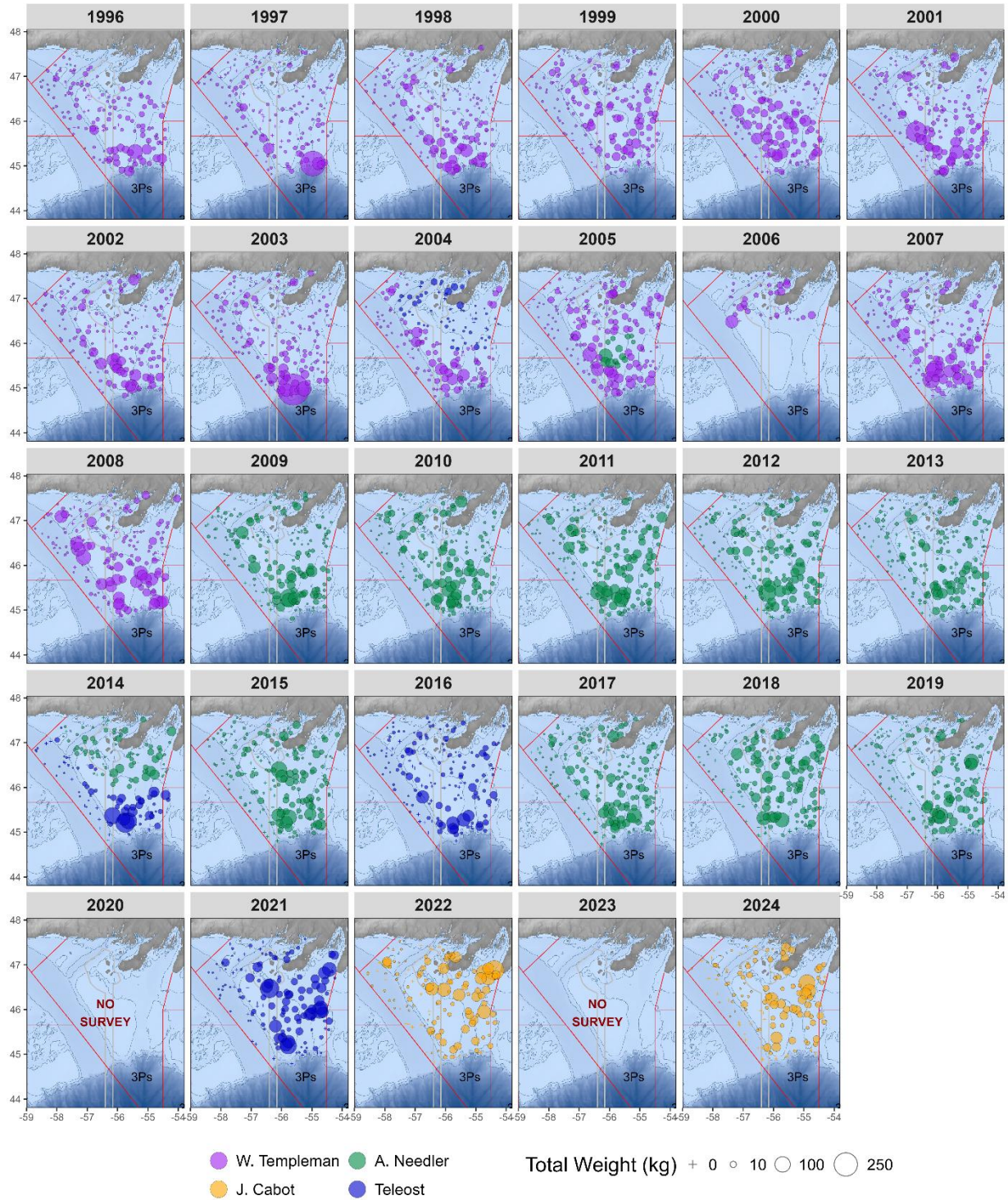


Figure 12. Spring survey catches (weight) of American plaice in NAFO Subdiv. 3Ps. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

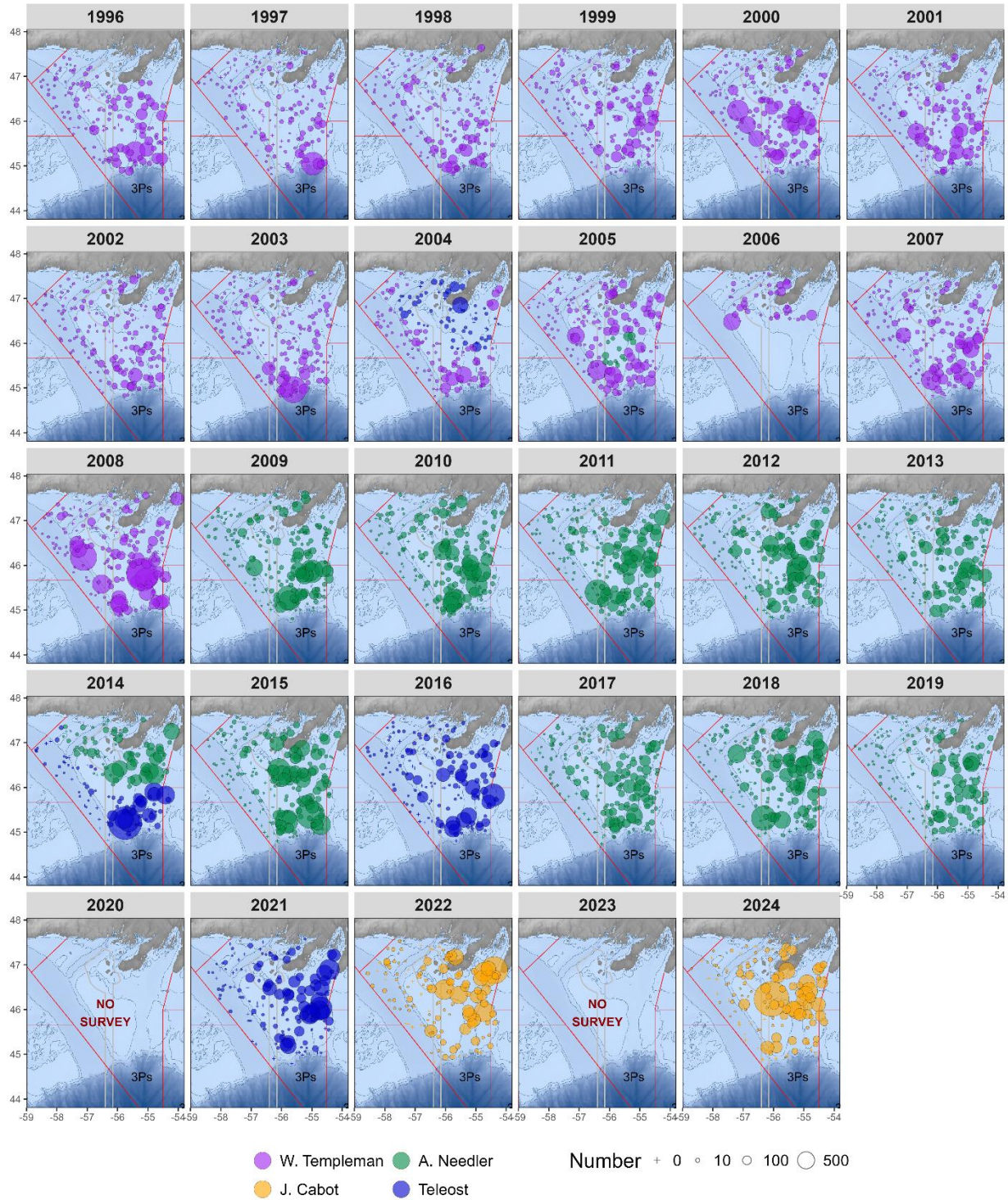


Figure 13. Spring survey catches (number) of American plaice in NAFO Subdiv. 3Ps. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

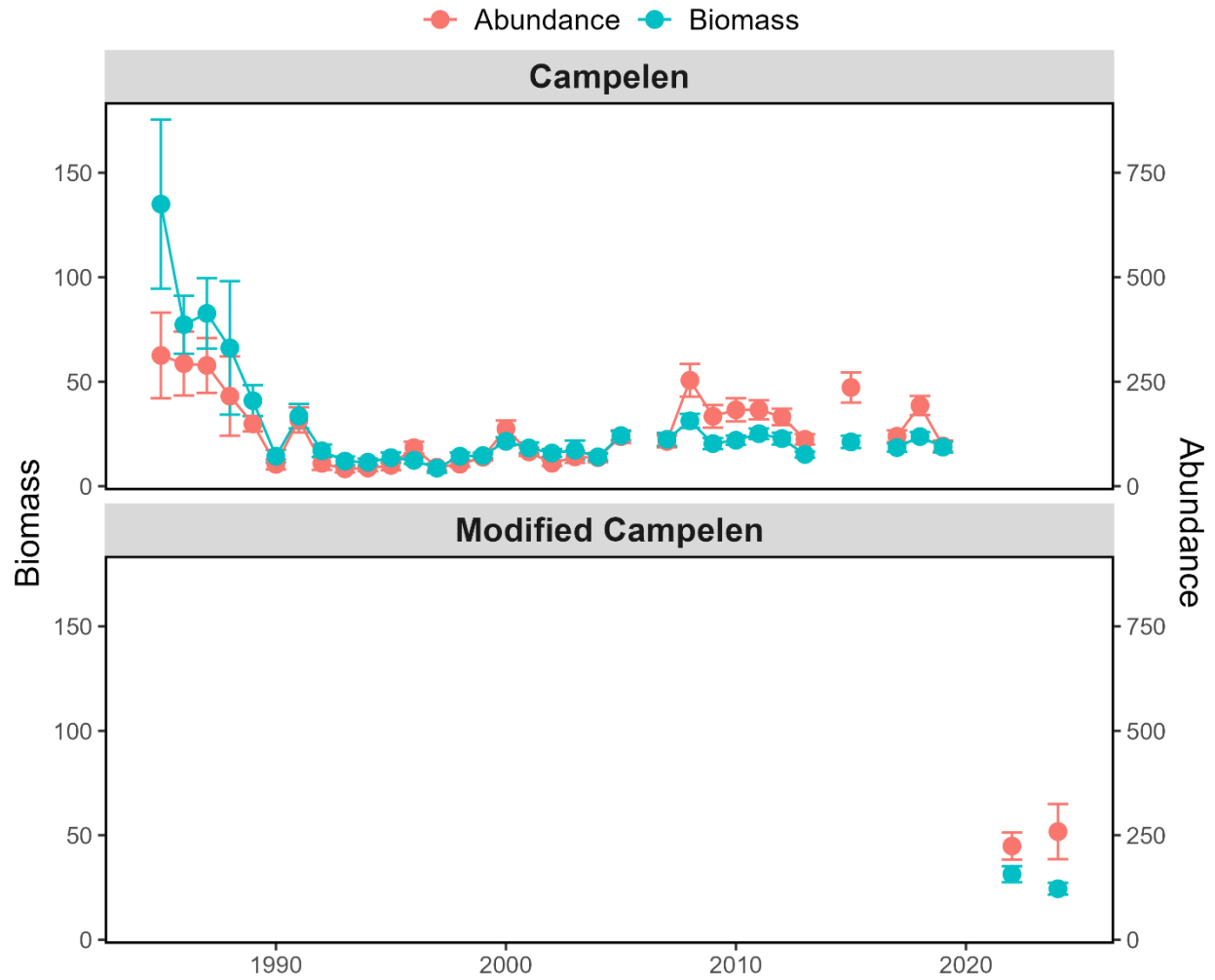


Figure 14. Recommended spring survey time series for American plaice in NAFO Subdiv. 3Ps.

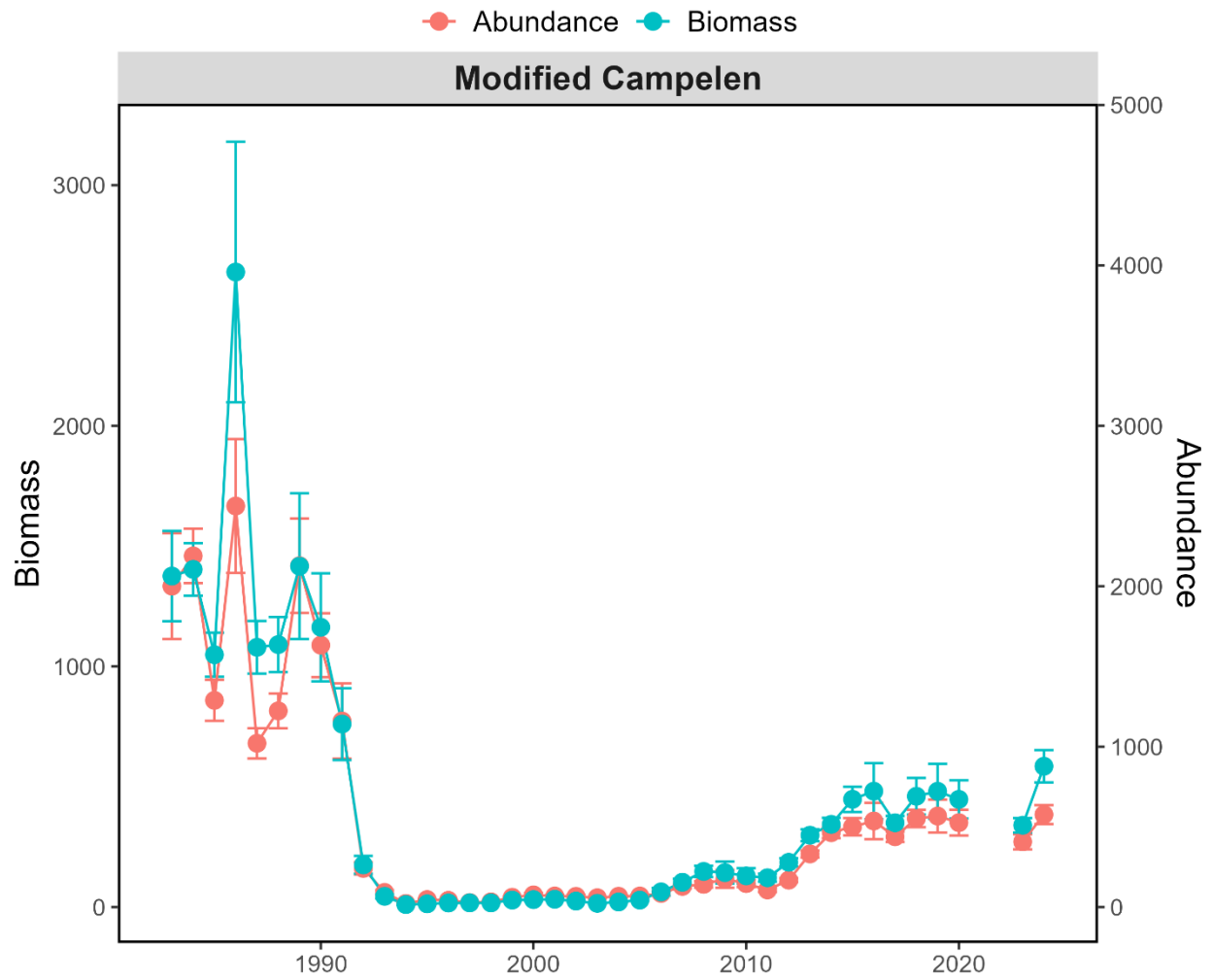


Figure 15. Recommended autumn survey time series for Atlantic cod in NAFO Divs. 2J3KL.

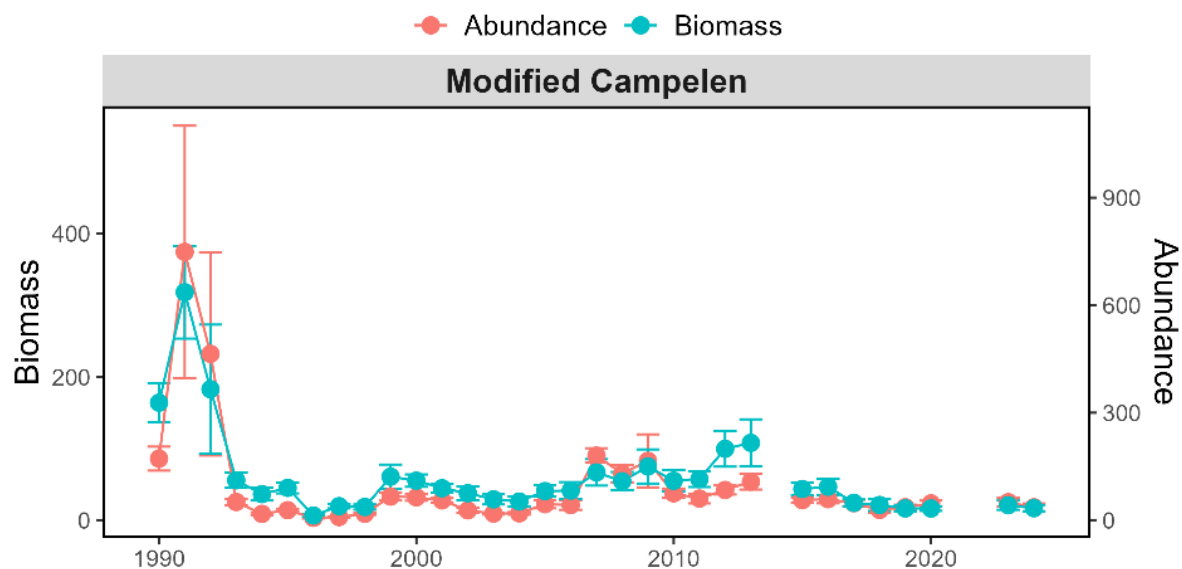


Figure 16. Recommended autumn survey time series for Atlantic cod in NAFO Divs. 3NO.

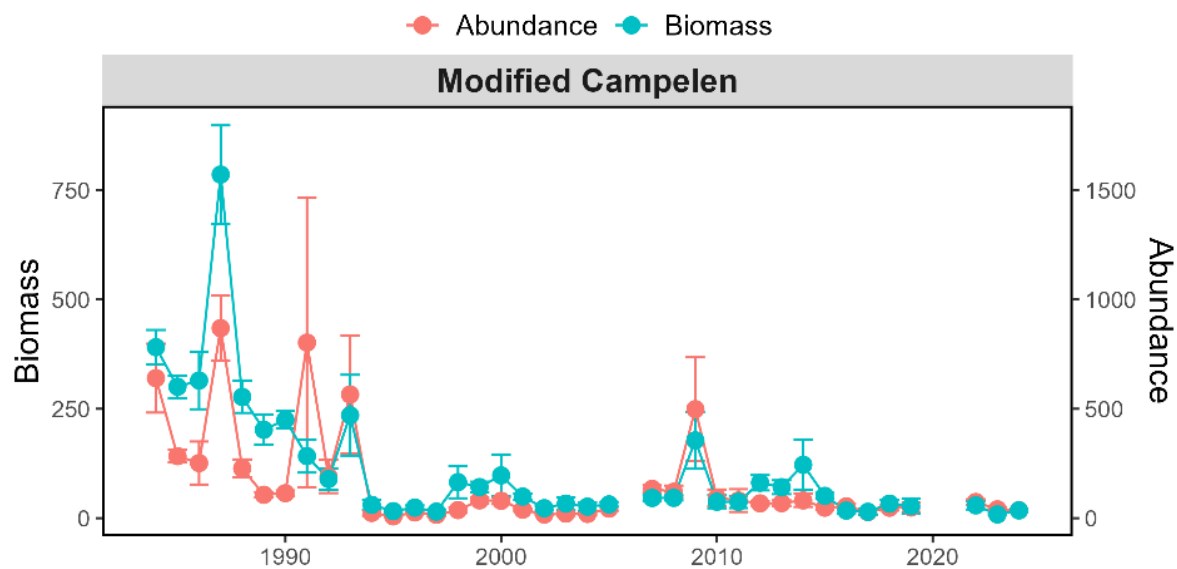


Figure 17. Recommended spring survey time series for Atlantic cod in NAFO Divs. 3NO.

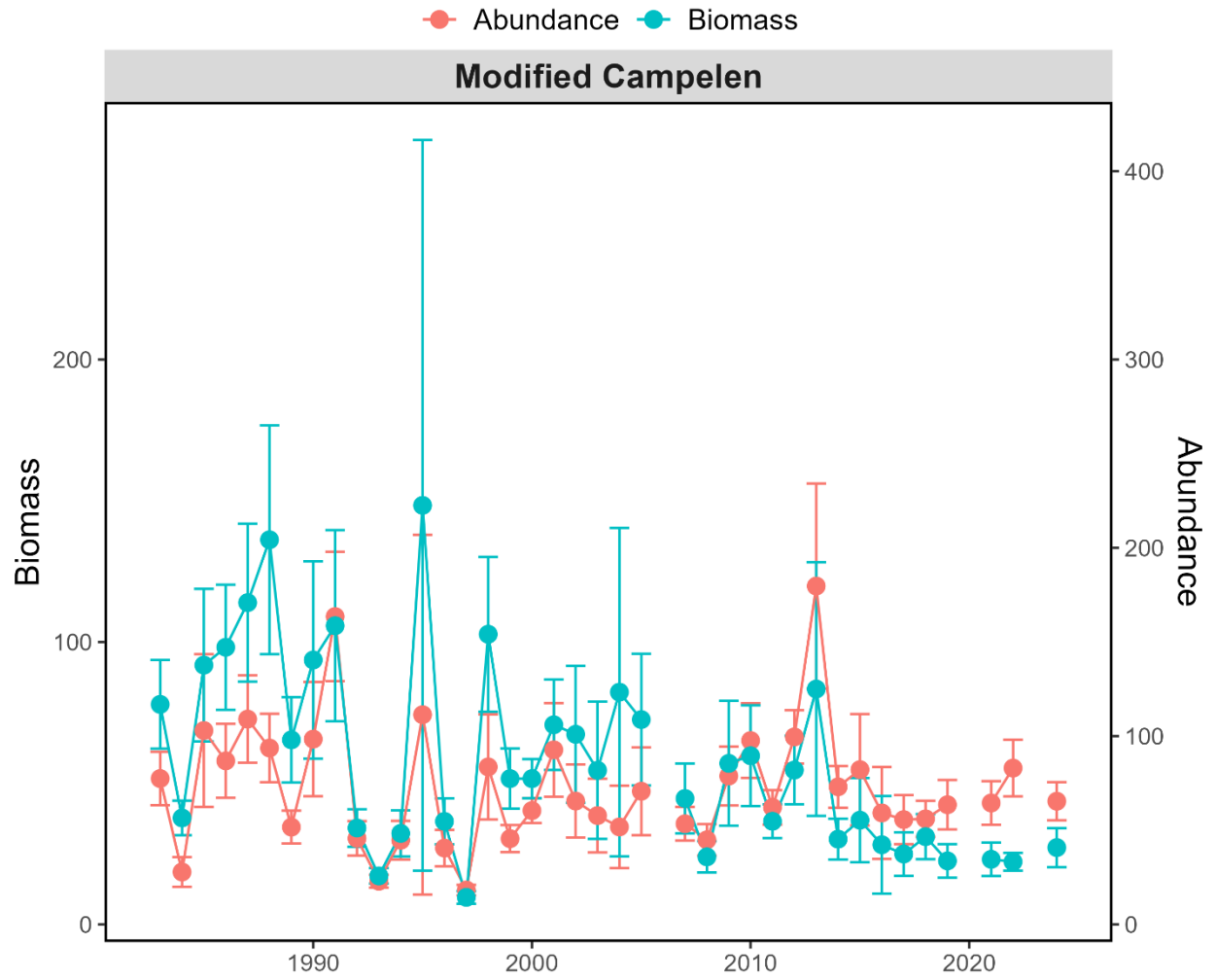


Figure 18. Recommended spring survey time series for Atlantic cod in NAFO Subdiv. 3Ps.

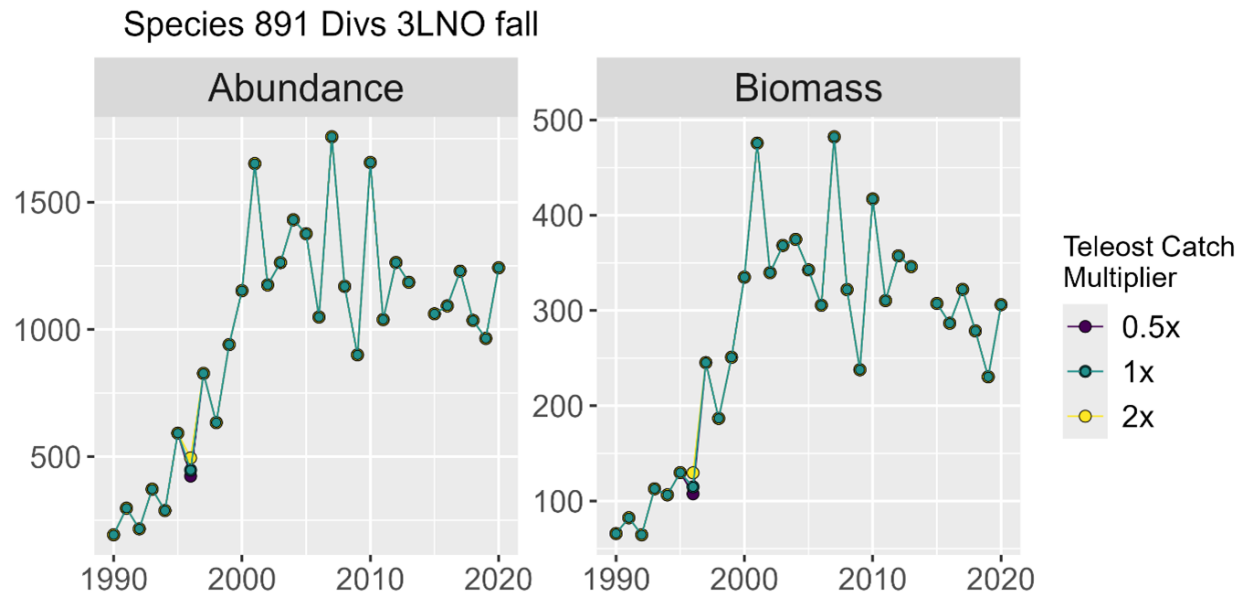


Figure 19. Sensitivity run adjusting fall CCGS Teleost catches of Yellowtail flounder in NAFO Div. 3LNO by 0.5x (purple) and 2.0x (yellow) the observed catches (green) in order to explore the impact of hypothetical conversion factors on the survey time series.

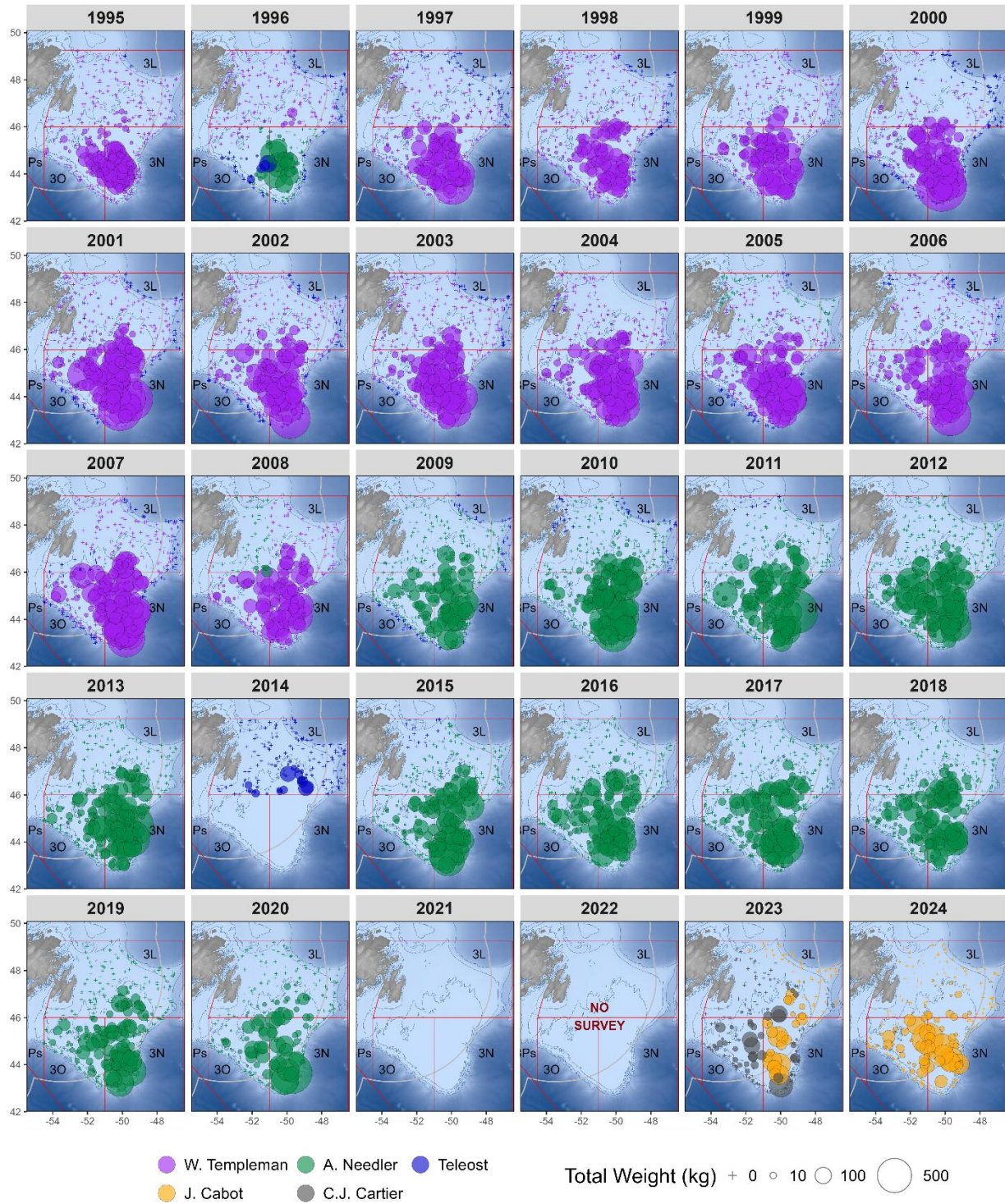


Figure 20. Autumn survey catches (weight) of Yellowtail flounder in NAFO Divs. 3LNO. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

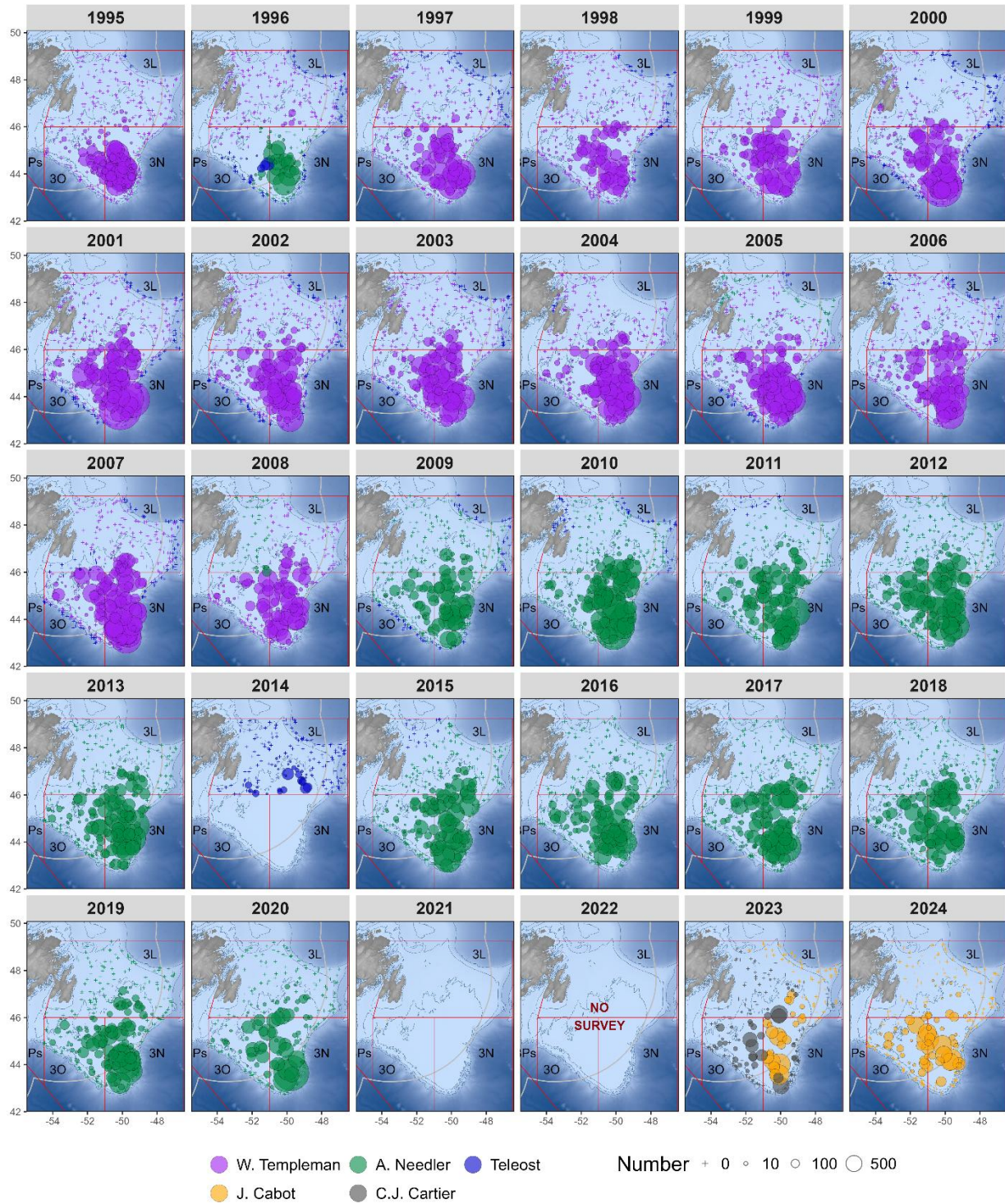


Figure 21. Autumn survey catches (number) of Yellowtail flounder in NAFO Divs. 3LNO. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

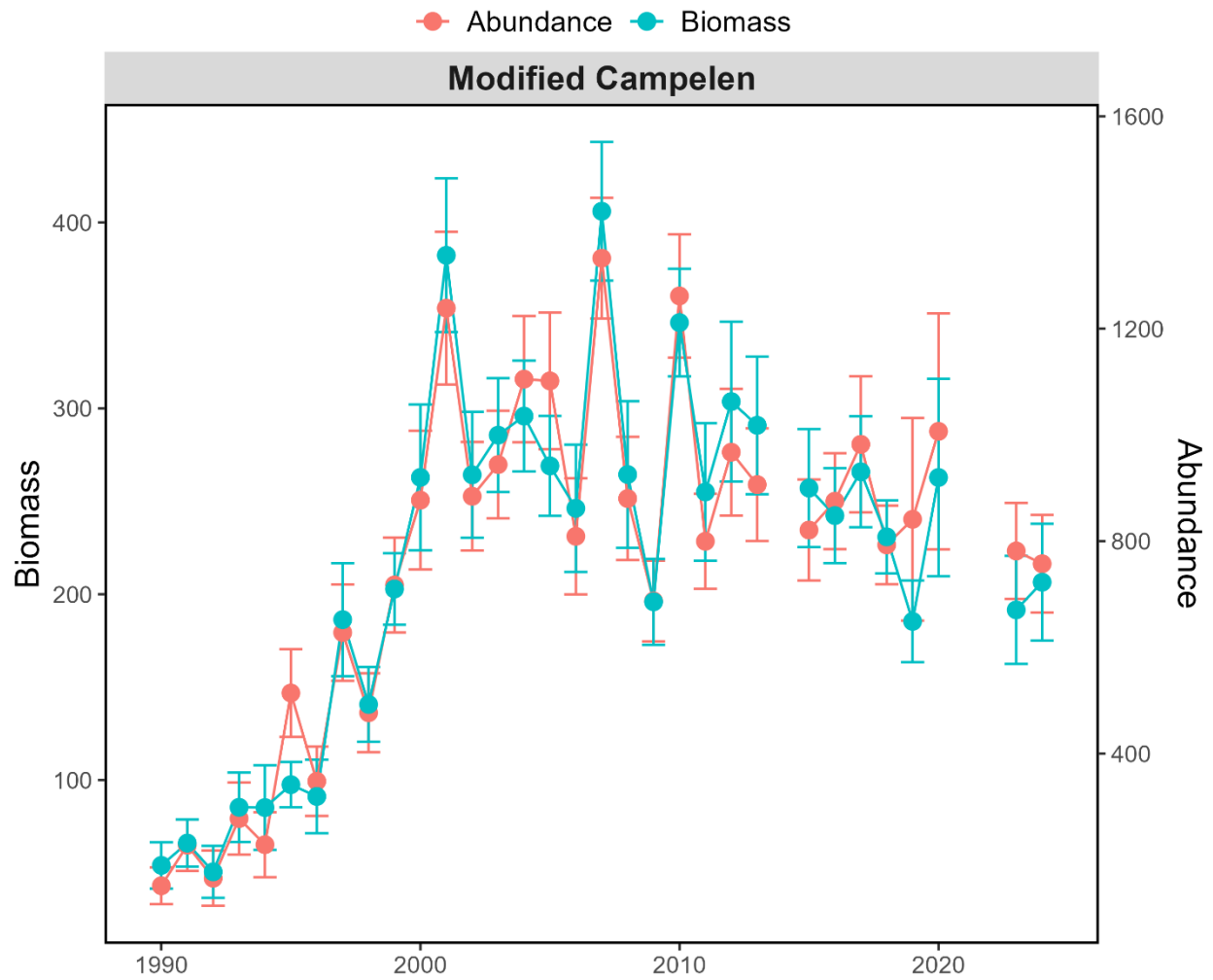


Figure 22. Recommended autumn survey time series for Yellowtail flounder in NAFO Divs. 3LNO.

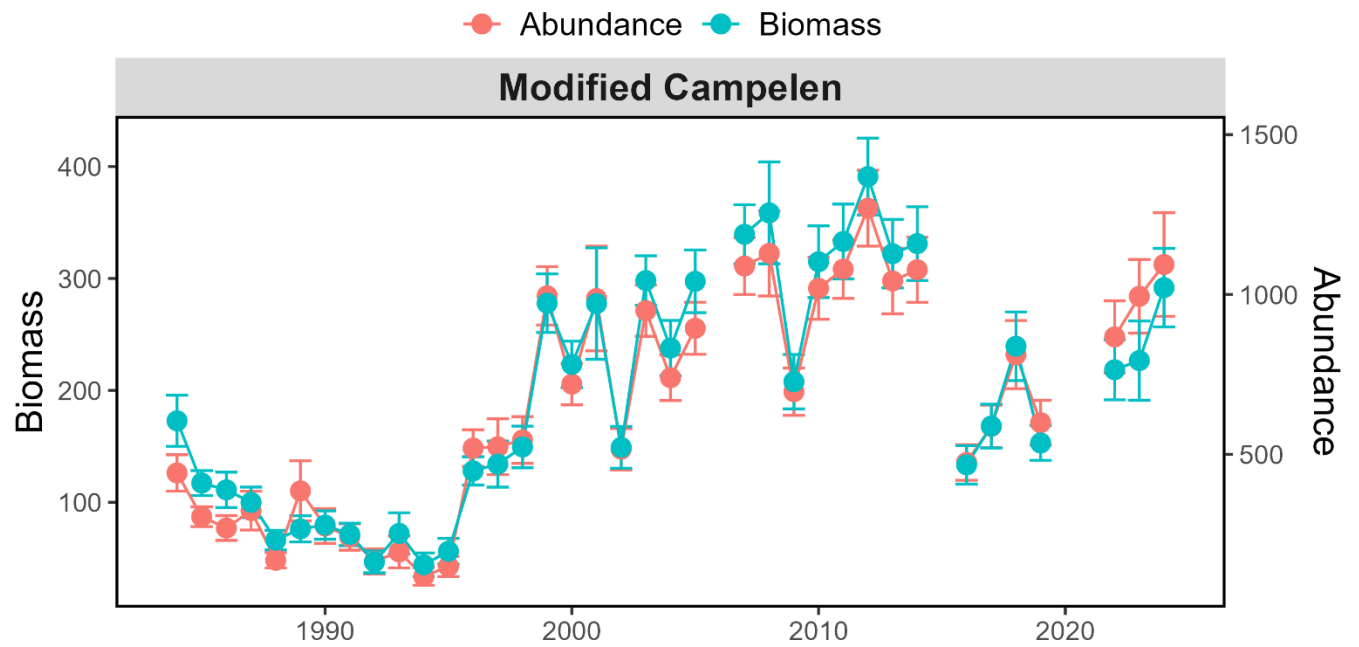


Figure 23. Recommended spring survey time series for Yellowtail flounder in NAFO Divs. 3LNO.

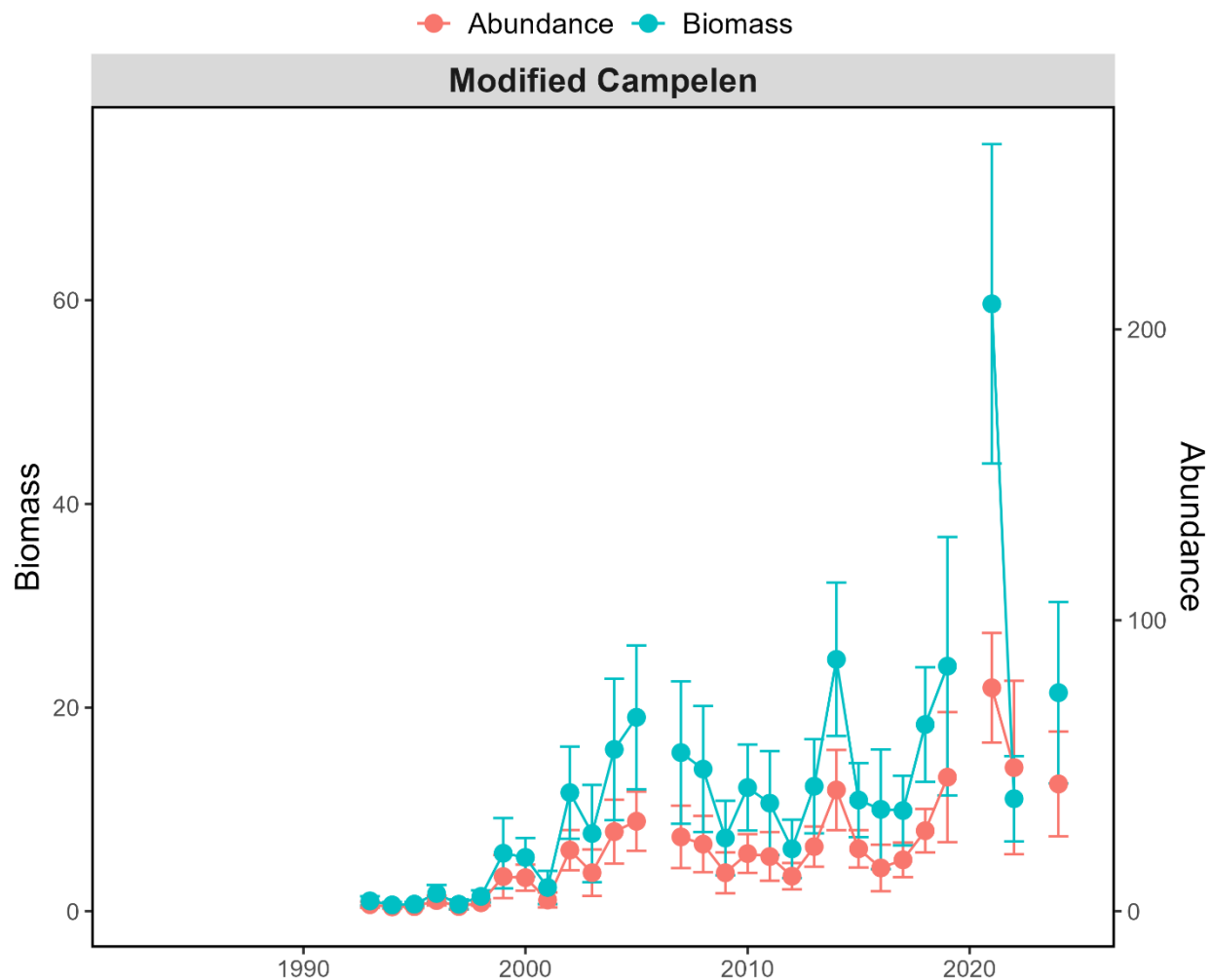


Figure 24. Recommended spring survey time series for Yellowtail flounder in NAFO Subdiv. 3Ps.

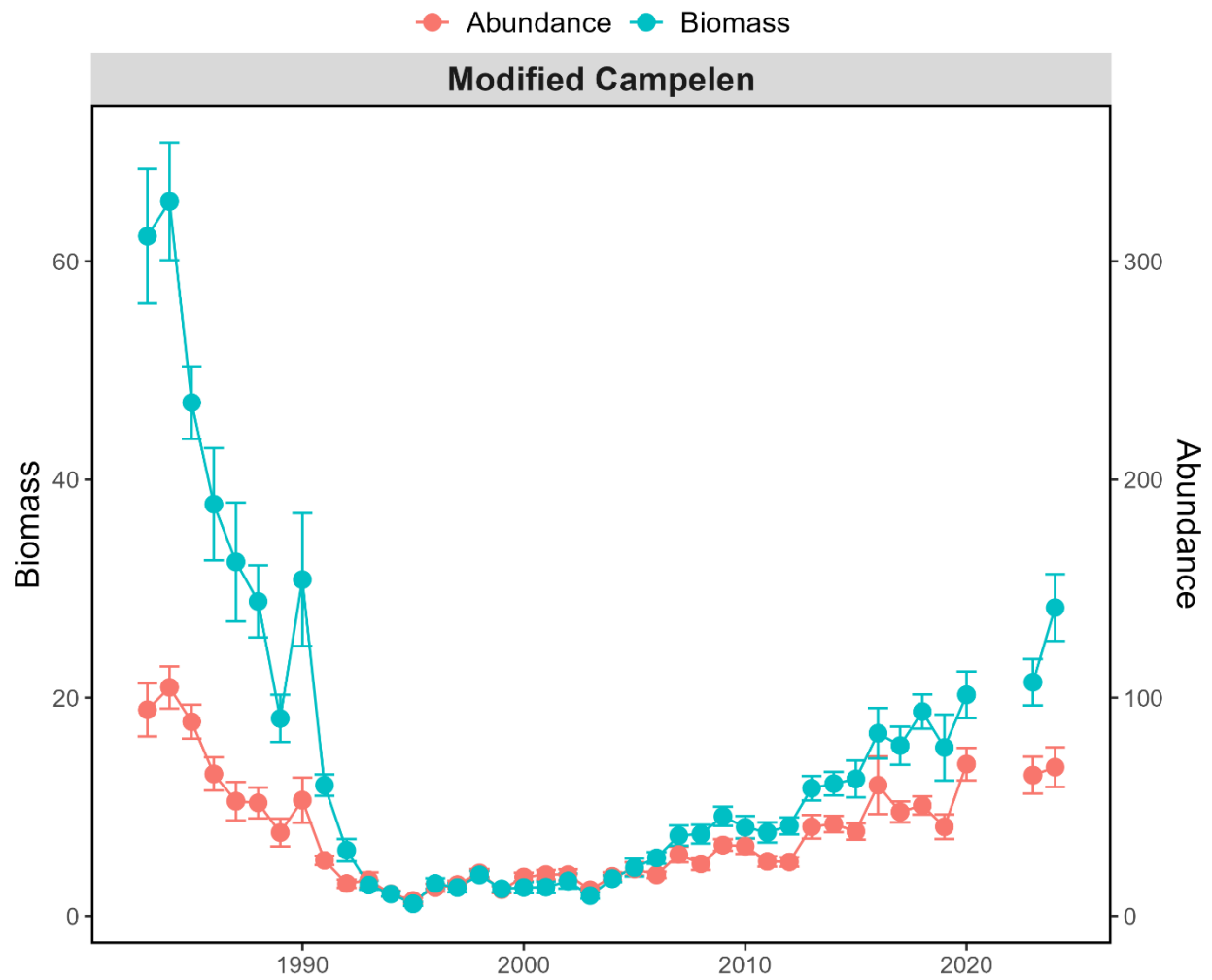


Figure 25. Recommended autumn survey time series for Witch flounder in NAFO Divs. 2J3K.

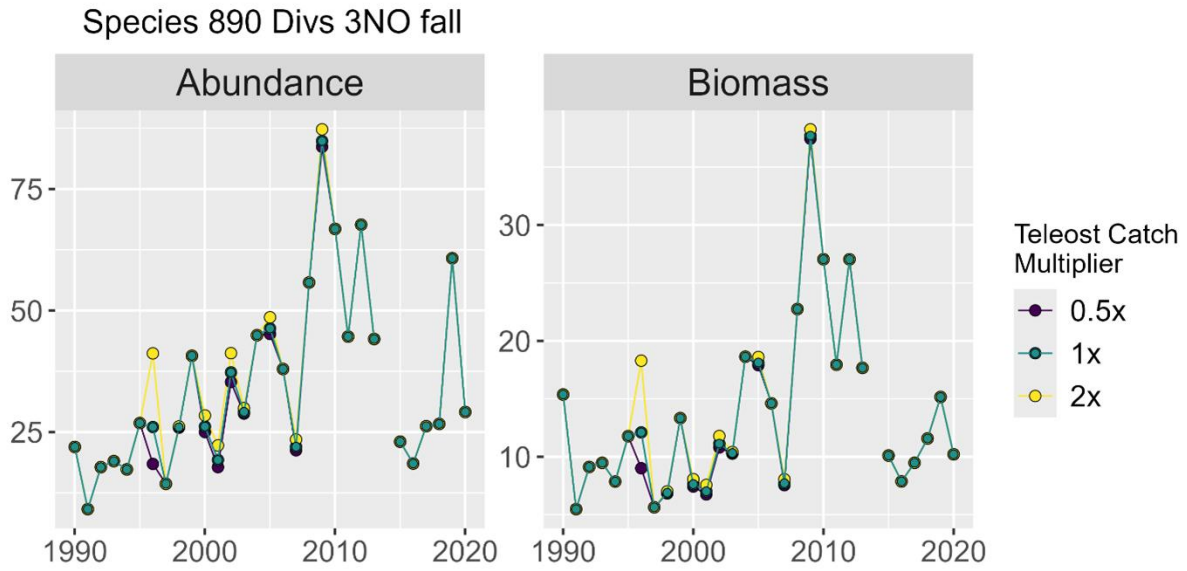


Figure 26. Sensitivity run adjusting fall CCGS Teleost catches of Witch flounder in NAFO Div. 3NO by 0.5x (purple) and 2.0x (yellow) the observed catches (green) in order to explore the impact of hypothetical conversion factors on the survey time series.

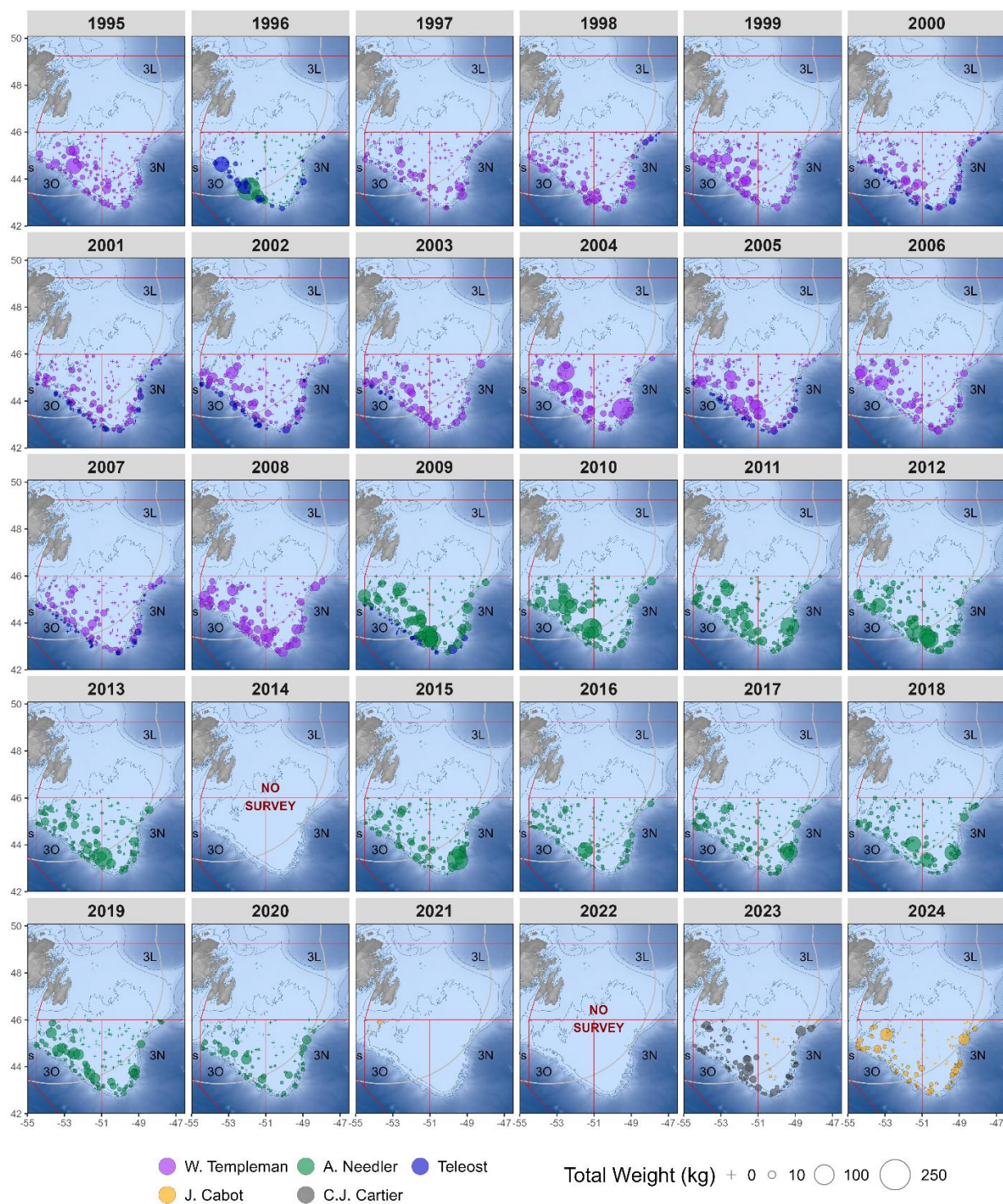


Figure 27. Autumn survey catches (weight) of Witch flounder in NAFO Divs. 3NO. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

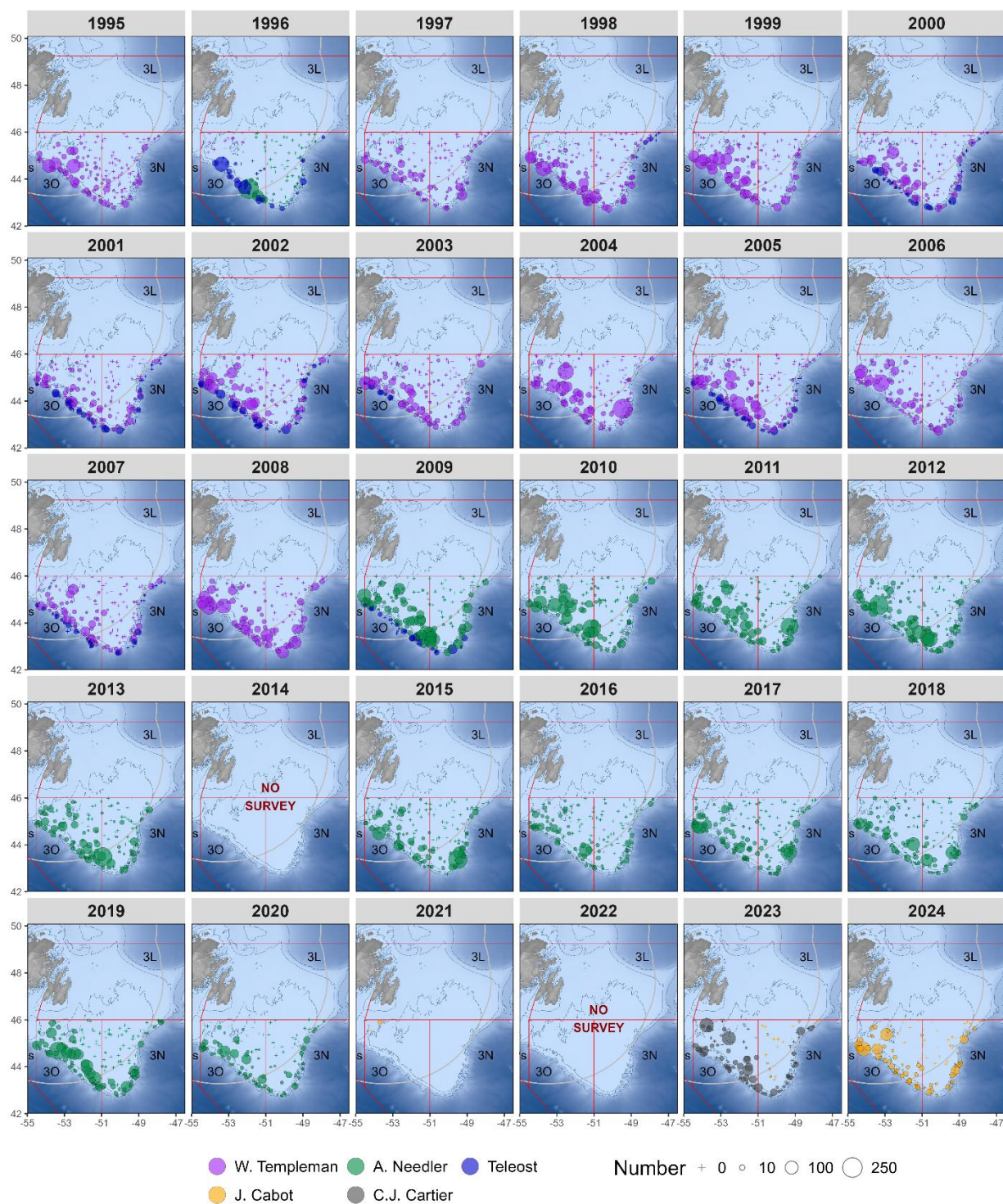


Figure 28. Autumn survey catches (number) of Witch flounder in NAFO Divs. 3NO. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

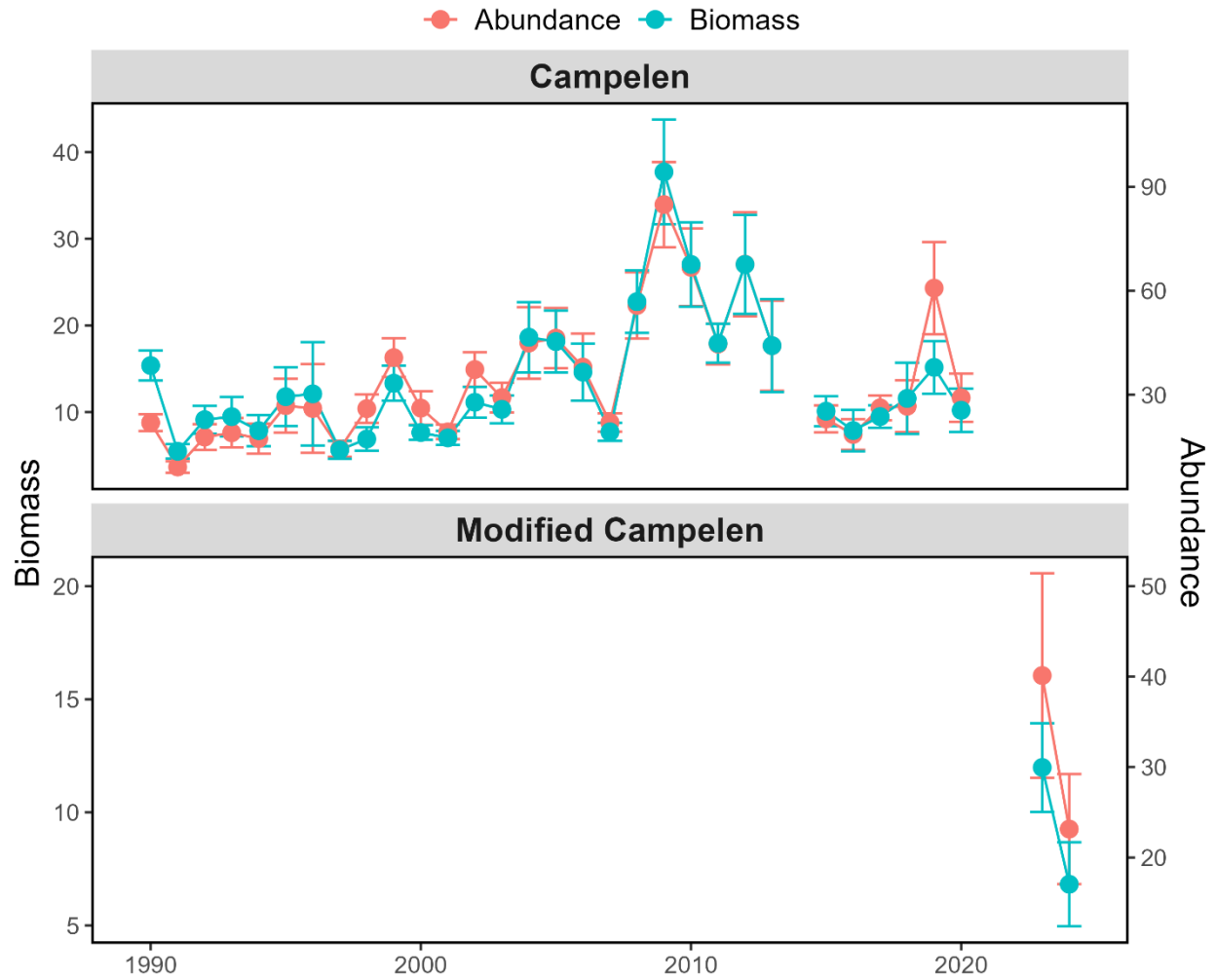


Figure 29. Recommended autumn survey time series for Witch flounder in NAFO Divs. 3NO.

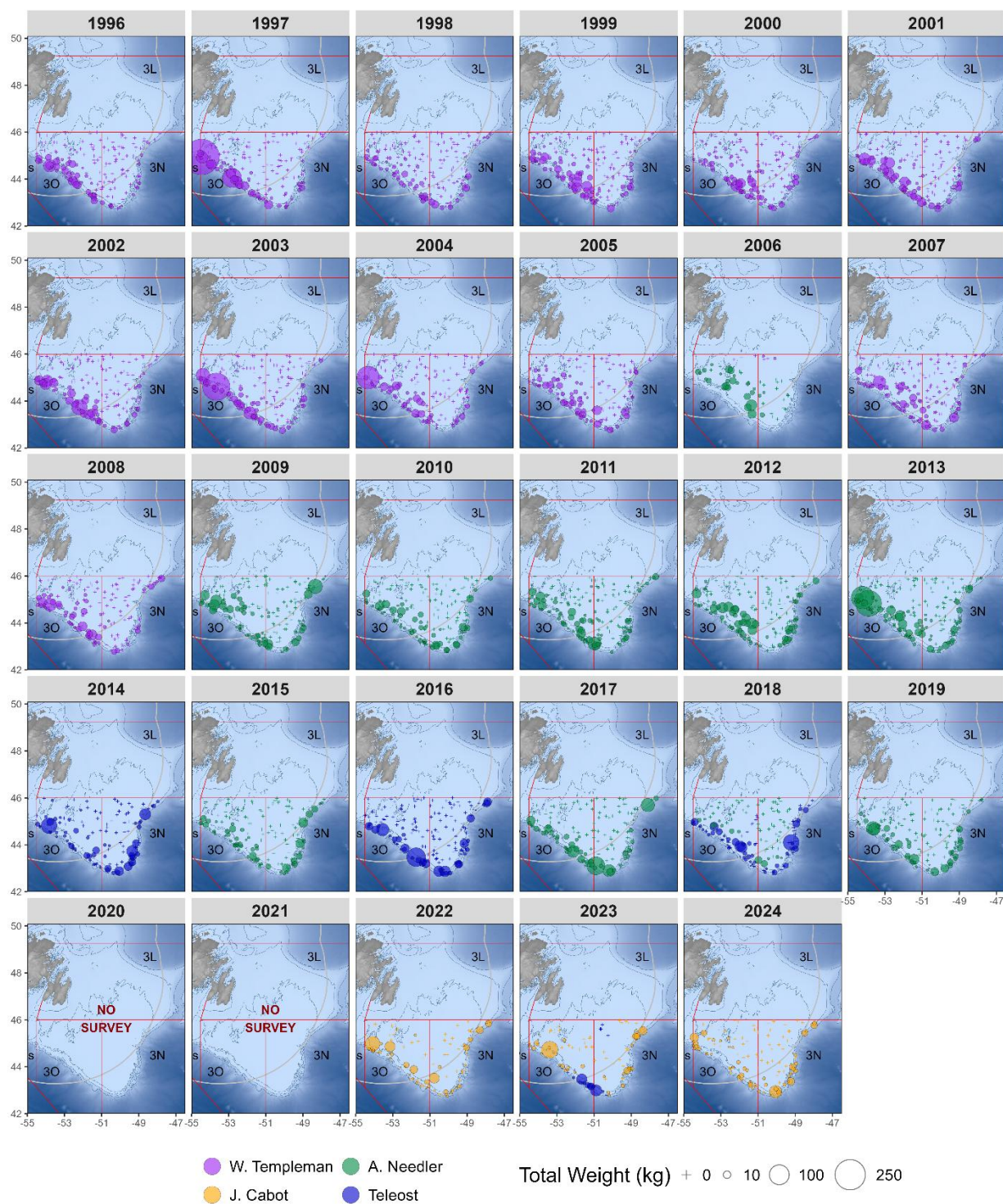


Figure 30. Spring survey catches (weight) of Witch flounder in NAFO Divs. 3NO. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

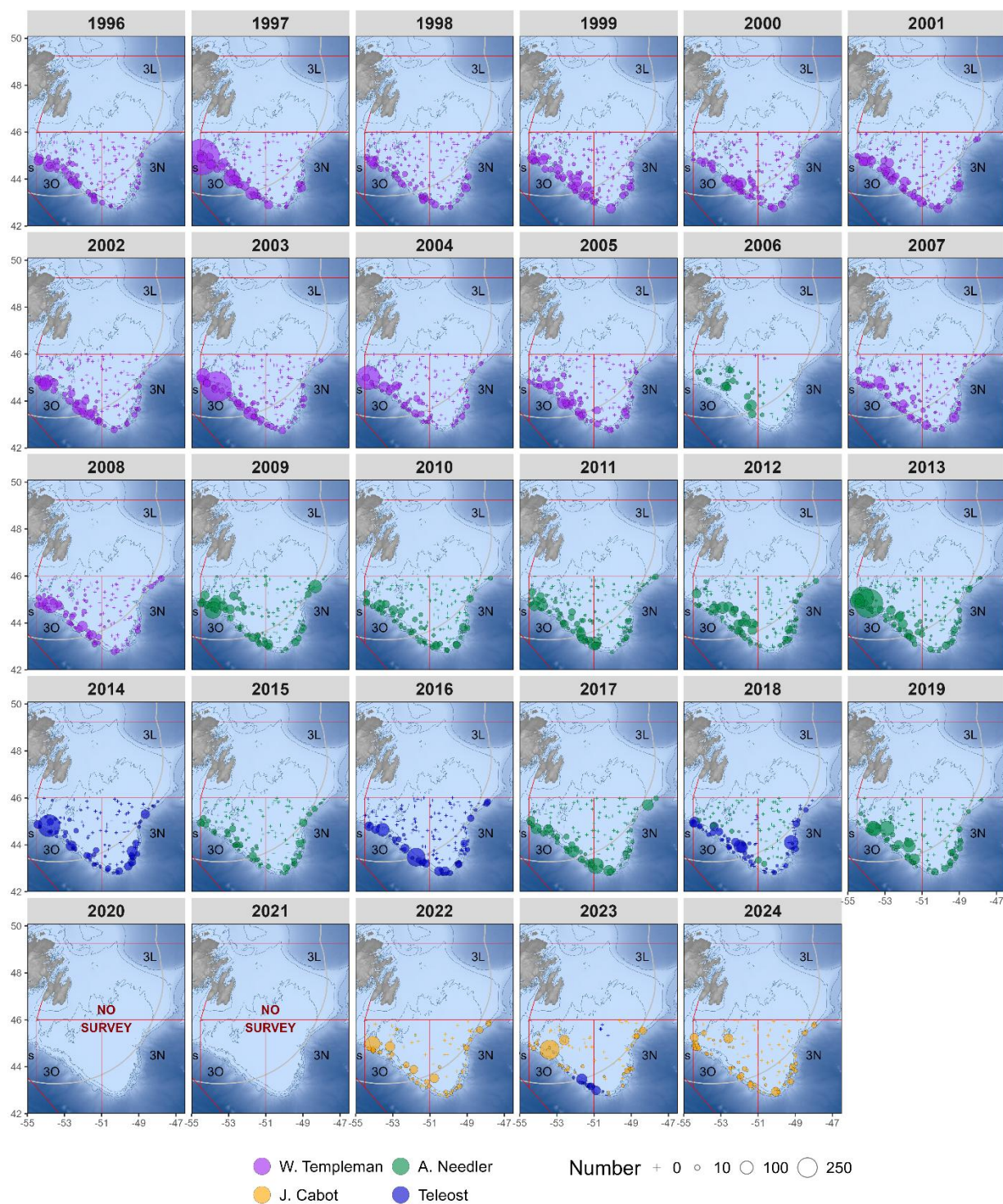


Figure 31. Spring survey catches (weight) of Witch flounder in NAFO Divs. 3NO. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

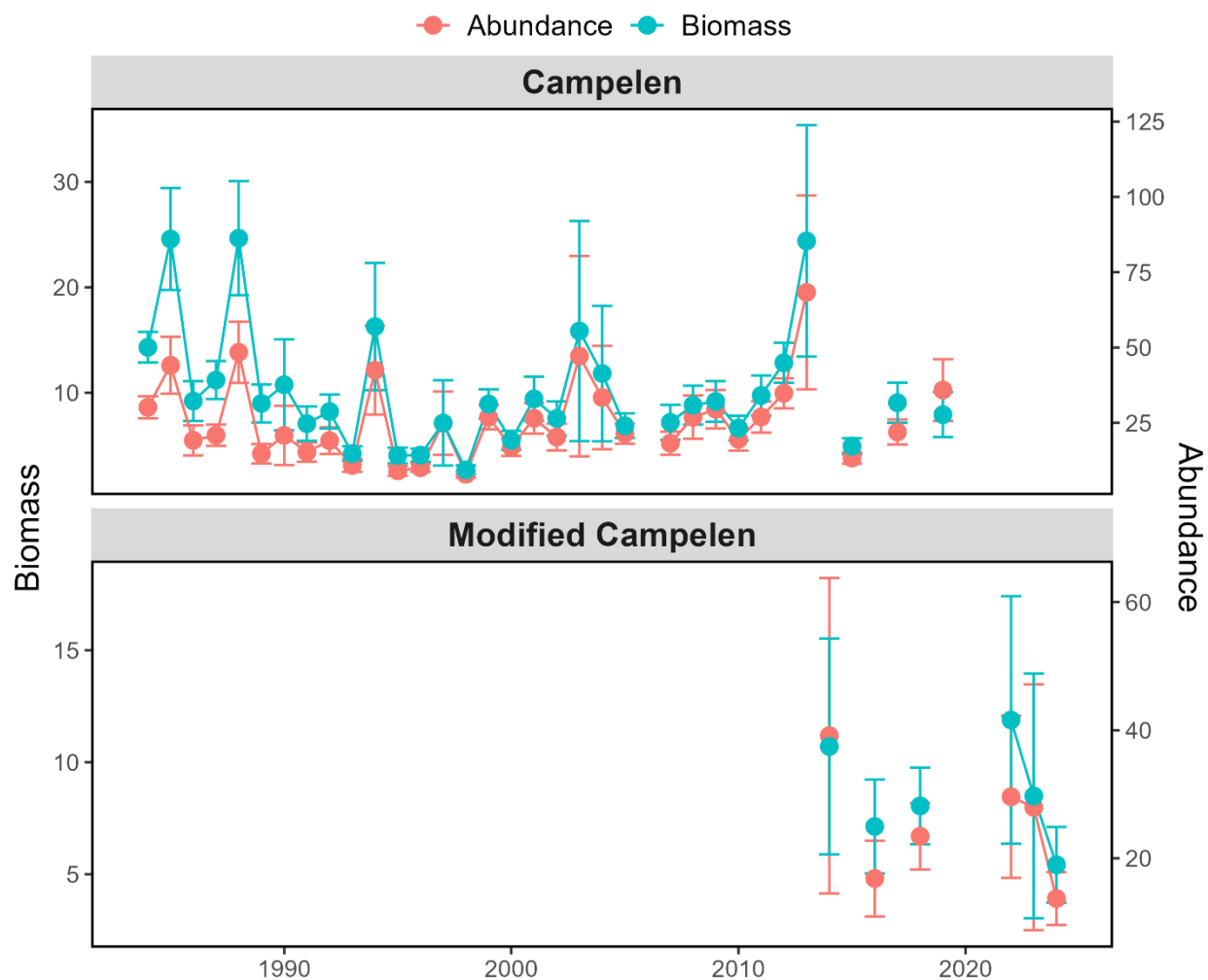


Figure 32. Recommended spring survey time series for Witch flounder in NAFO Divs. 3NO.

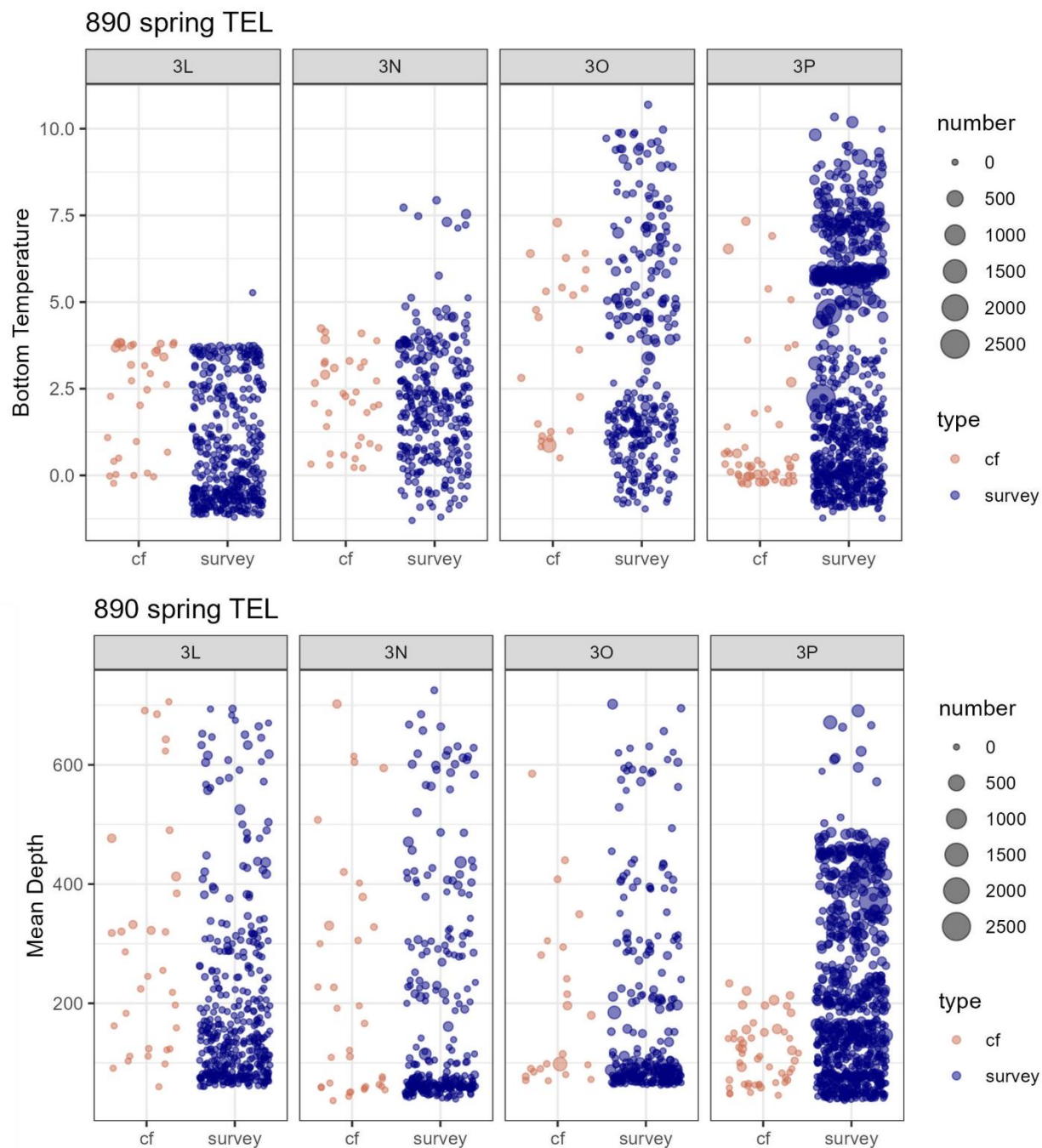


Figure 33. Bottom temperature (°C, top figure) and depth (m, bottom figure) for catches of Witch flounder during the spring survey and for comparative fishing (cf) sets across NAFO Divs. 3LNOPs, to demonstrate inconsistency in habitat occupied in Subdivs. 3Ps compared to Divs. 3LN0 for Witch flounder.

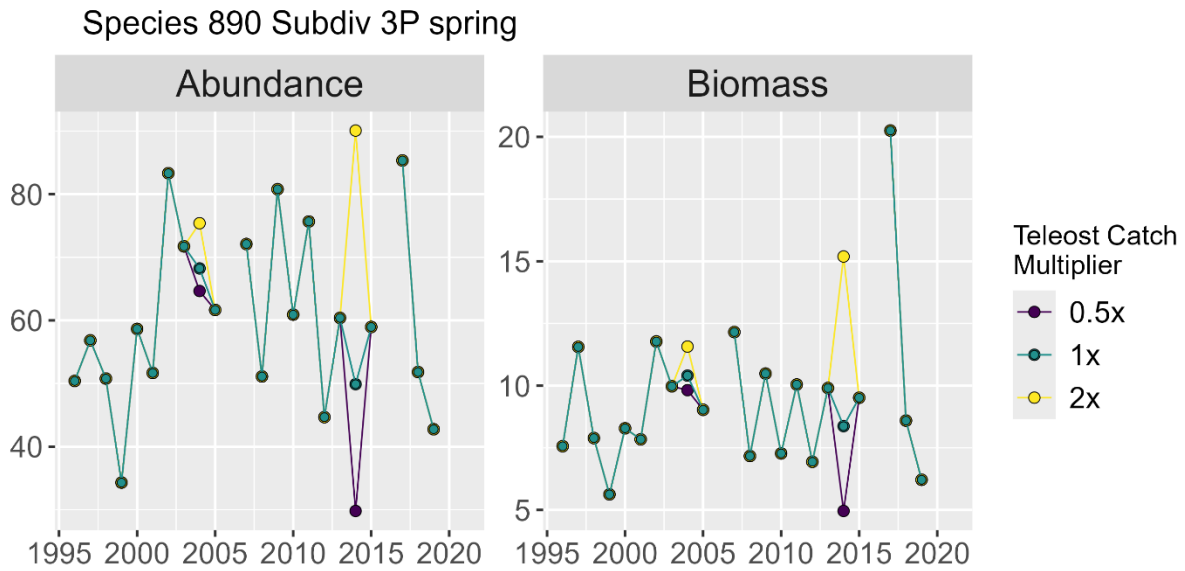


Figure 34. Sensitivity run adjusting fall CCGS Teleost catches of Witch flounder in NAFO Subdivision 3Ps by 0.5x (purple) and 2.0x (yellow) the observed catches (green) in order to explore the impact of hypothetical conversion factors on the survey time series.

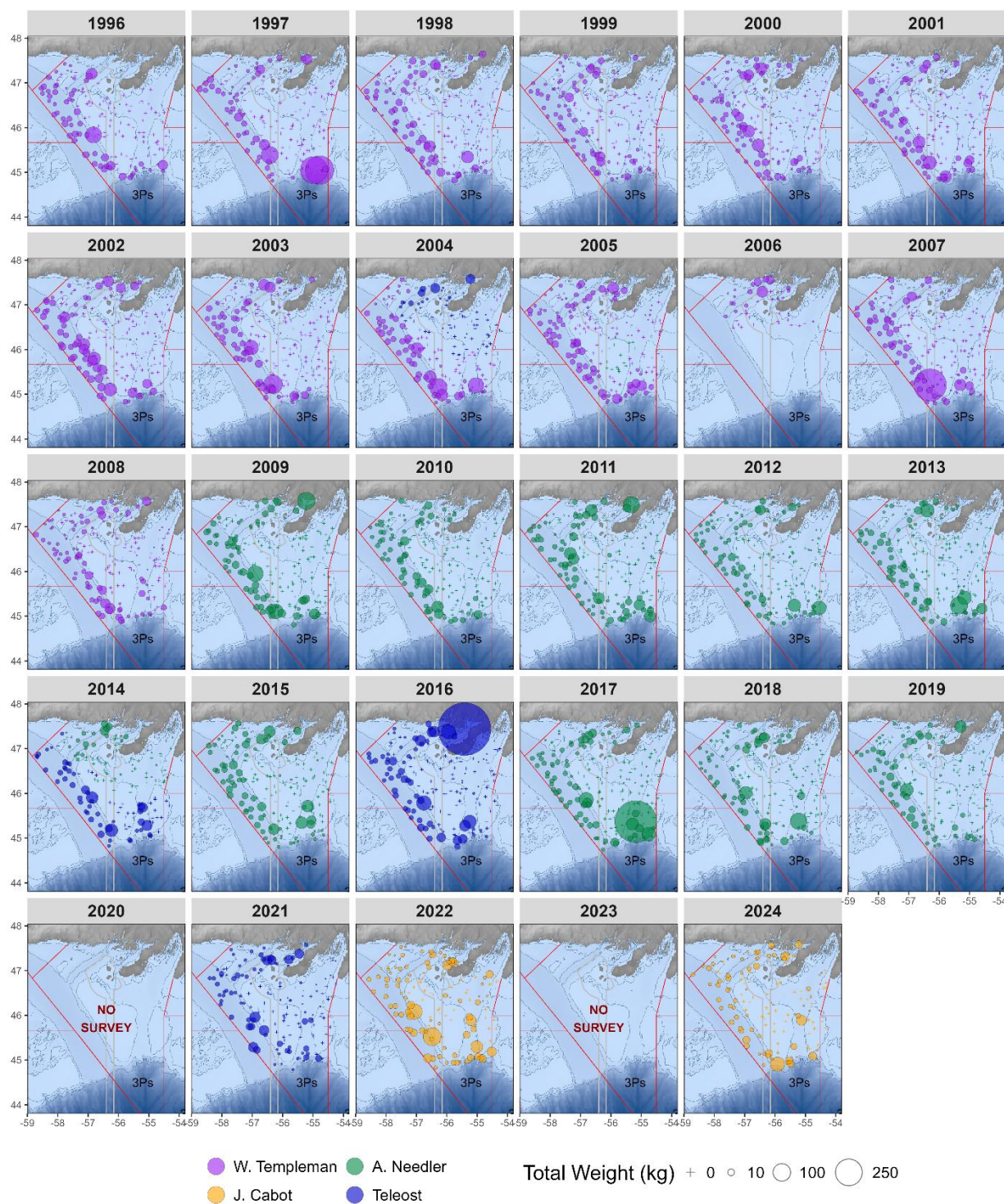


Figure 35. Spring survey catches (weight) of Witch flounder in NAFO Subdiv. 3Ps. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

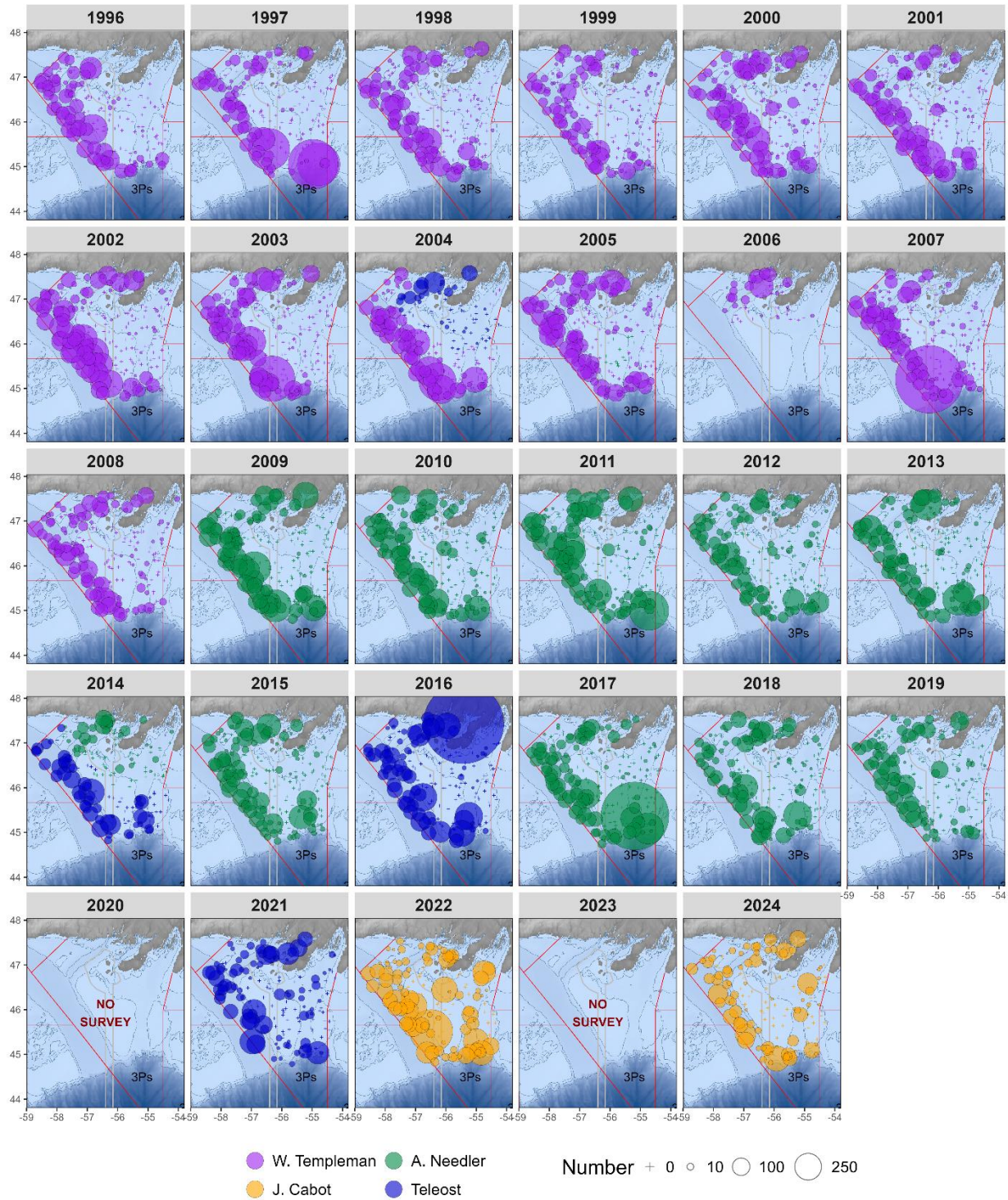


Figure 36. Spring survey catches (number) of Witch flounder in NAFO Subdiv. 3Ps. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

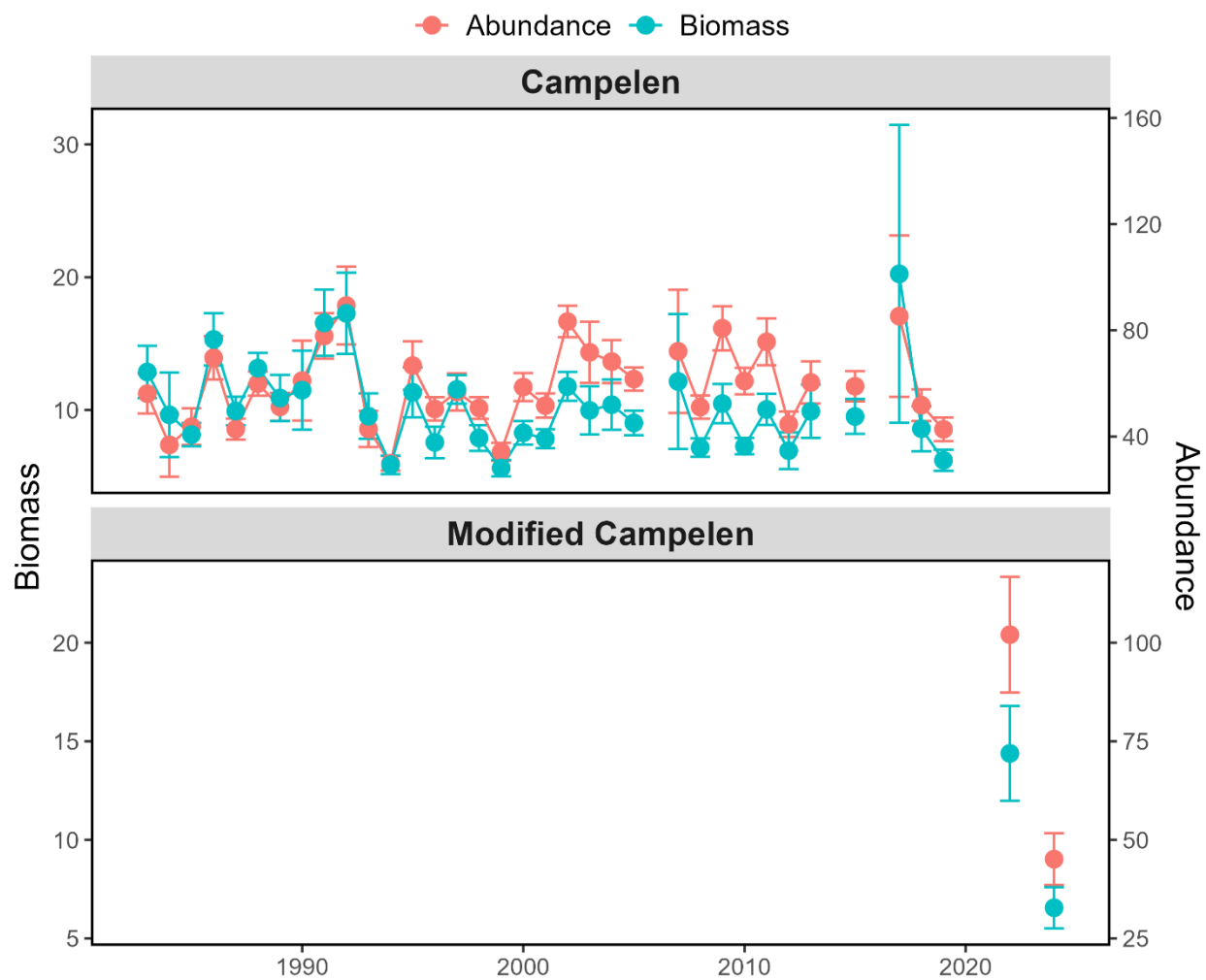


Figure 37. Recommended spring survey time series for Witch flounder in NAFO Subdivision 3Ps.

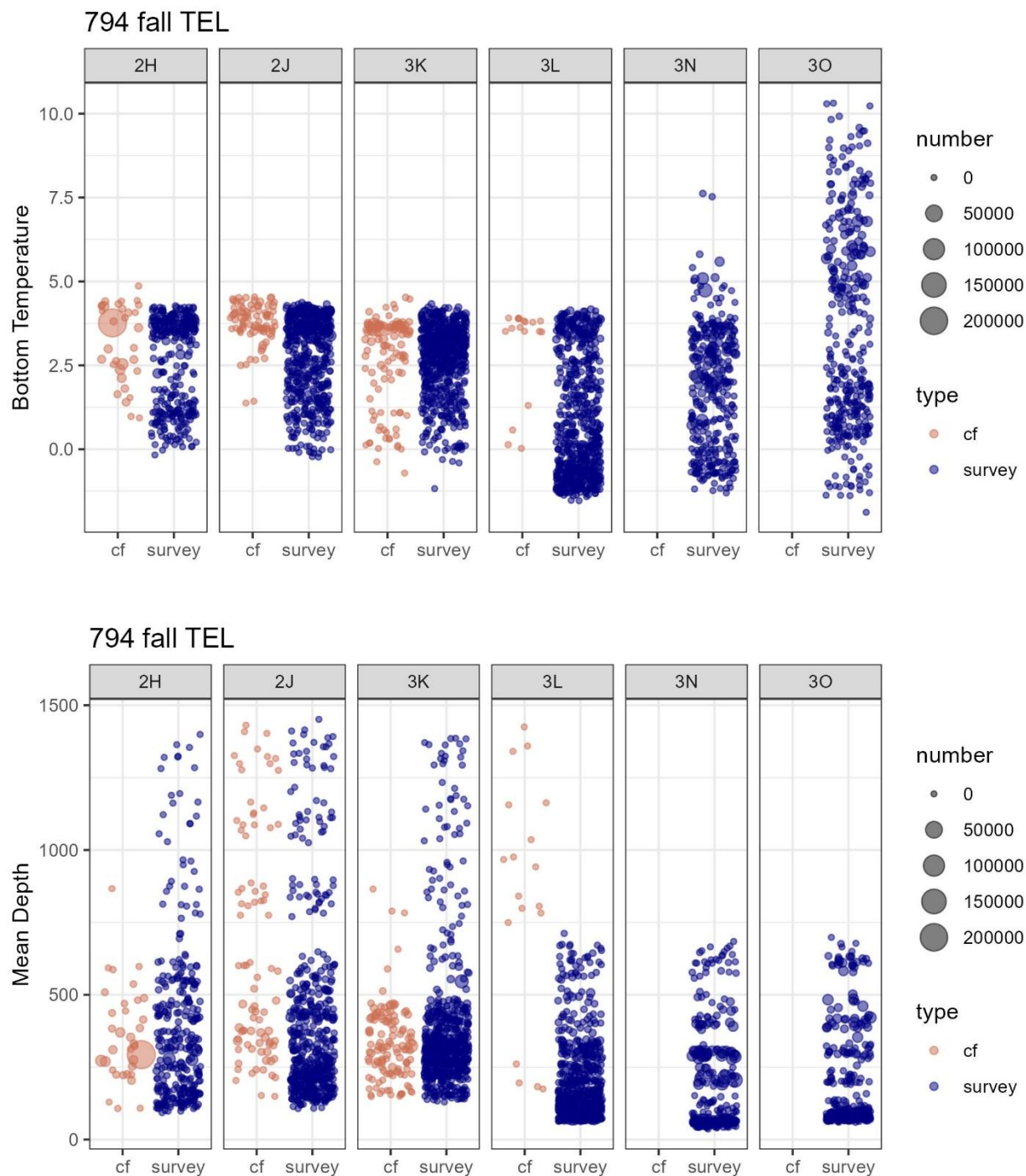


Figure 38. Bottom temperature (°C, top figure) and depth (m, bottom figure) for catches of Redfish during the fall survey and for comparative fishing (cf) sets across NAFO Divs. 2HJ3KLNO with the Teleost, to demonstrate consistency in habitat occupied across the 2+3K stock area and with associated cf sets.

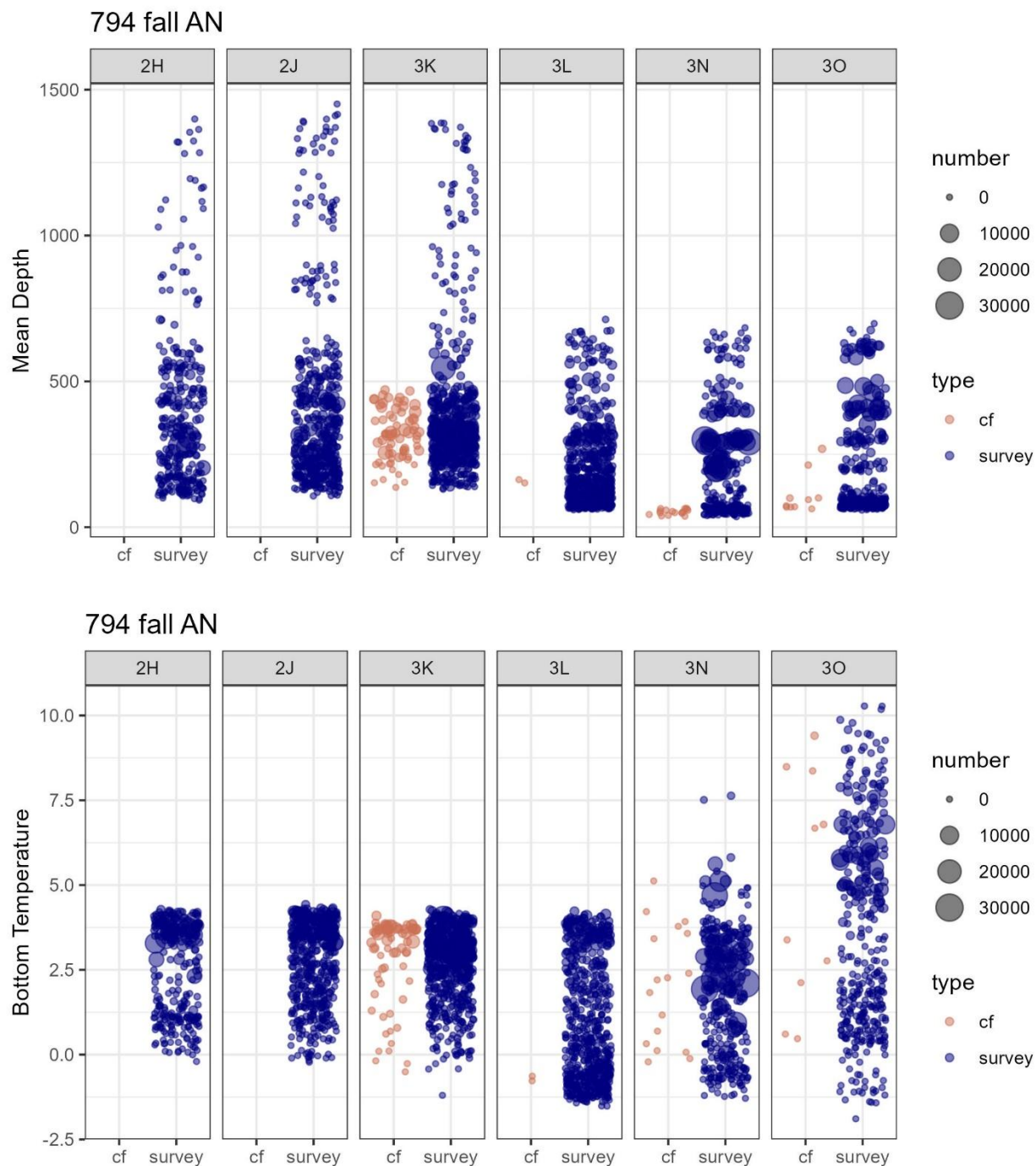


Figure 39. Bottom temperature (°C, top figure) and depth (m, bottom figure) for catches of Redfish during the fall survey and for comparative fishing (cf) sets across NAFO Divs. 2HJ3KLNO with the Needler, to demonstrate consistency in habitat occupied within the stock area, and with cf sets in 3K.

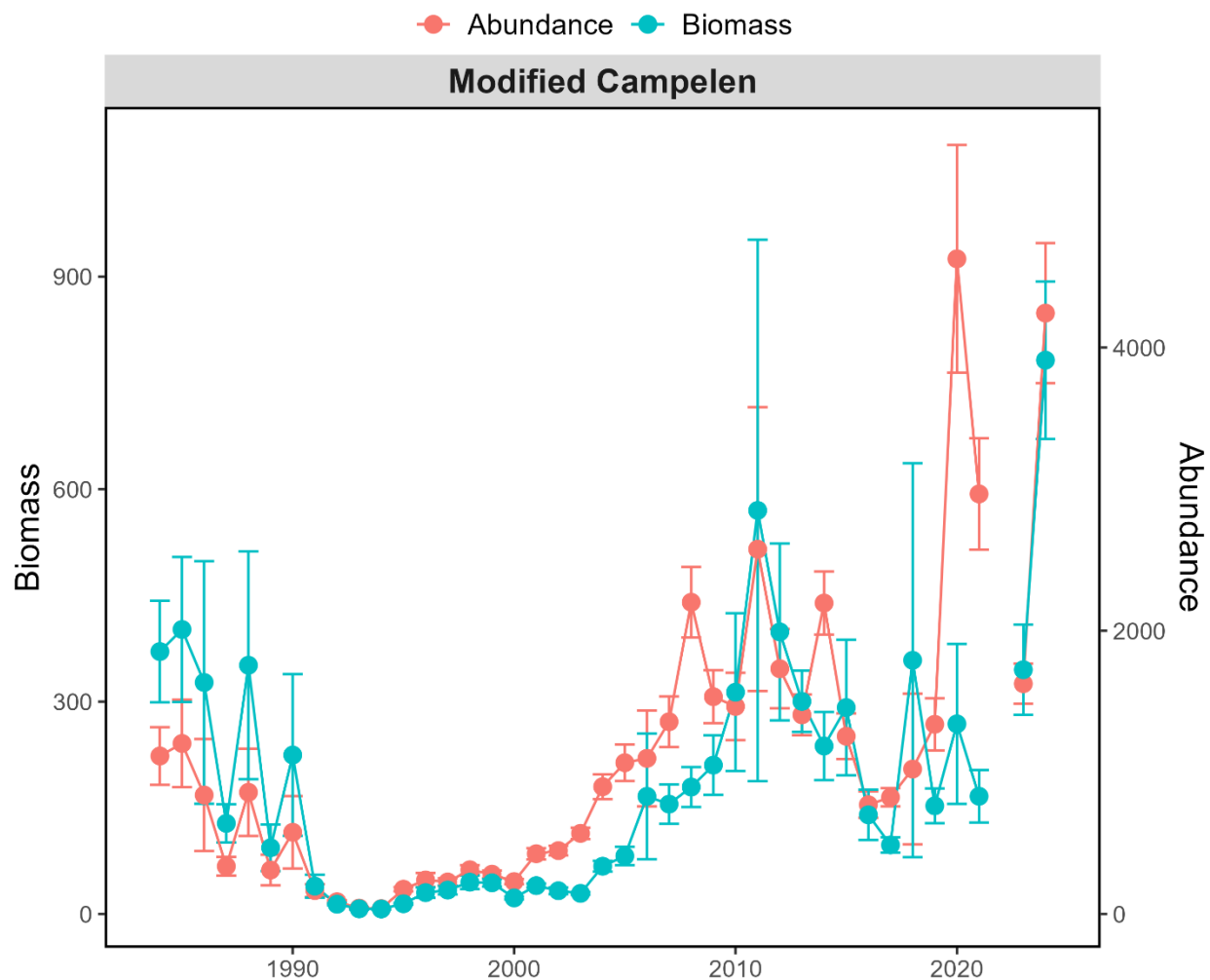


Figure 40. Recommended autumn survey time series for Redfish in NAFO Divs. 2+3K.

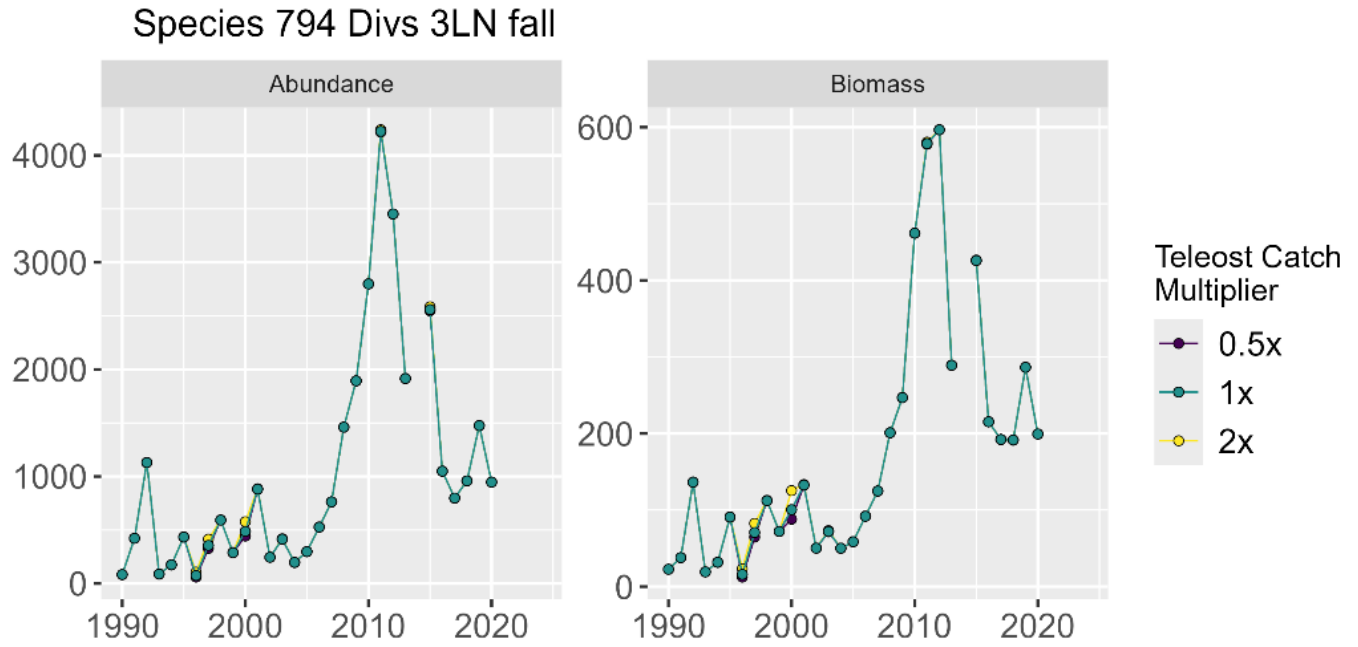


Figure 41. Sensitivity run adjusting fall CCGS Teleost catches of Redfish in NAFO Div. 3LN by 0.5x (purple) and 2.0x (yellow) the observed catches (green) in order to explore the impact of hypothetical conversion factors on the survey time series.

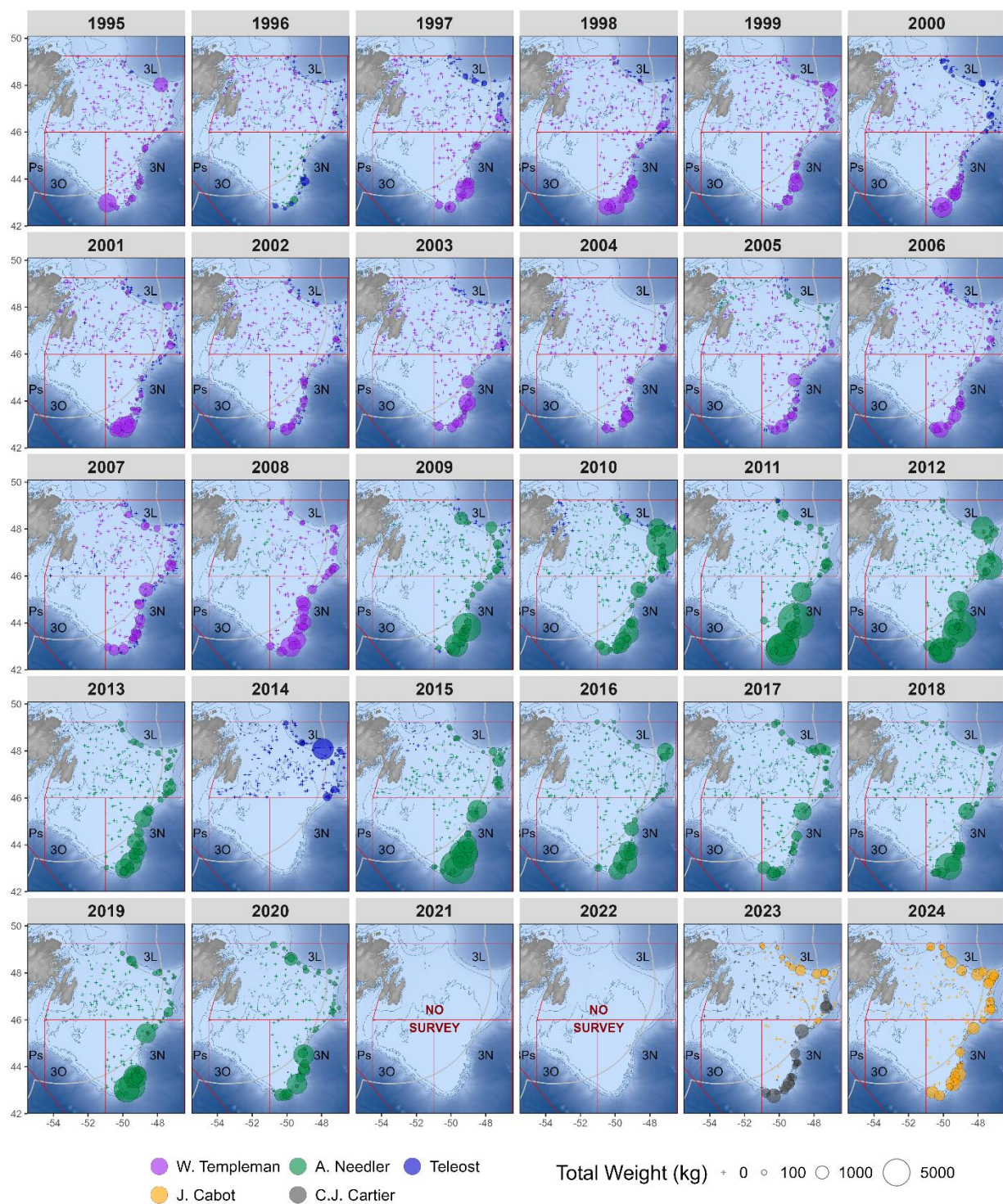


Figure 42. Autumn survey catches (weight) of Redfish in NAFO Divs. 3LN. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

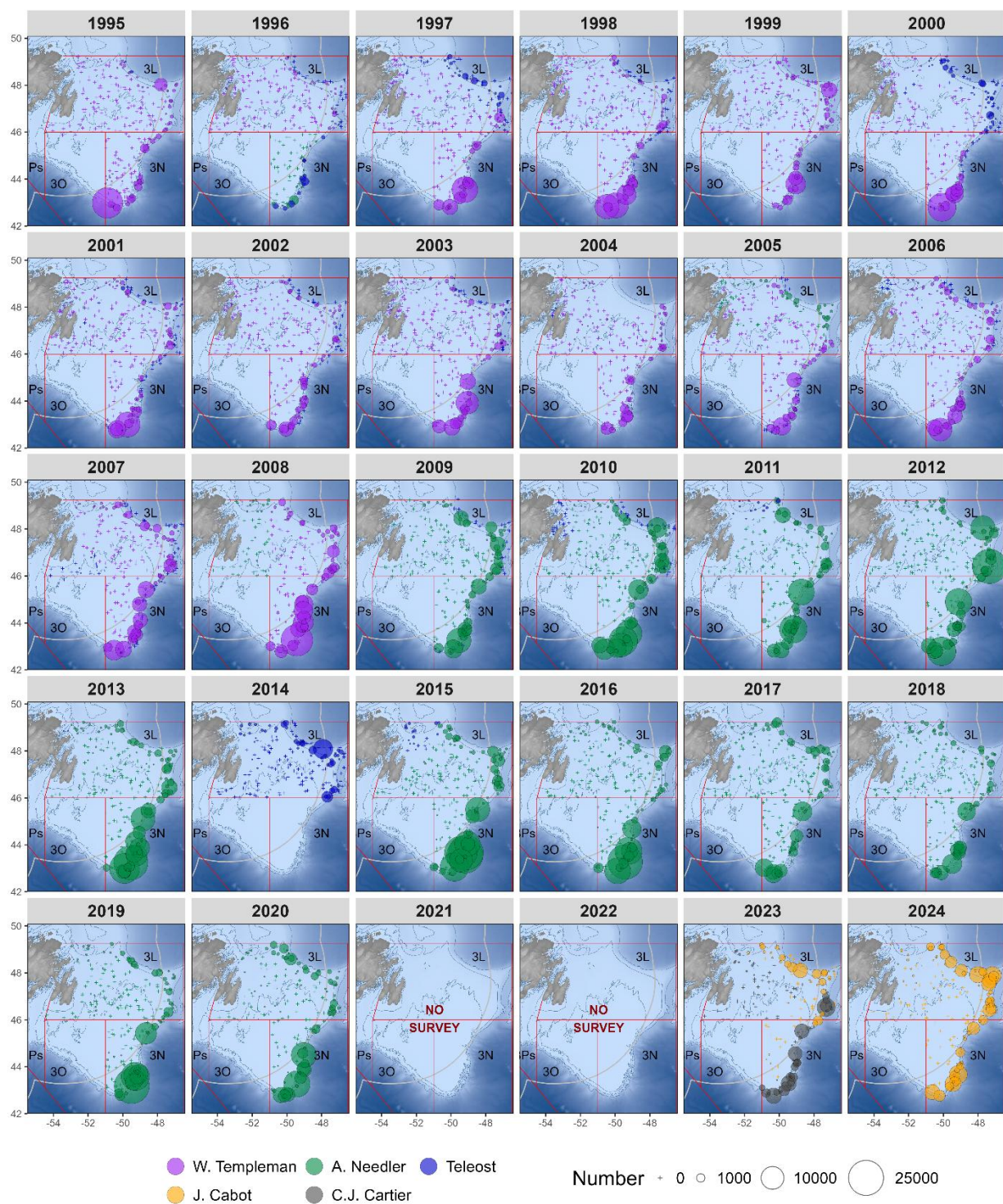


Figure 43. Autumn survey catches (number) of Redfish in NAFO Divs. 3LN. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

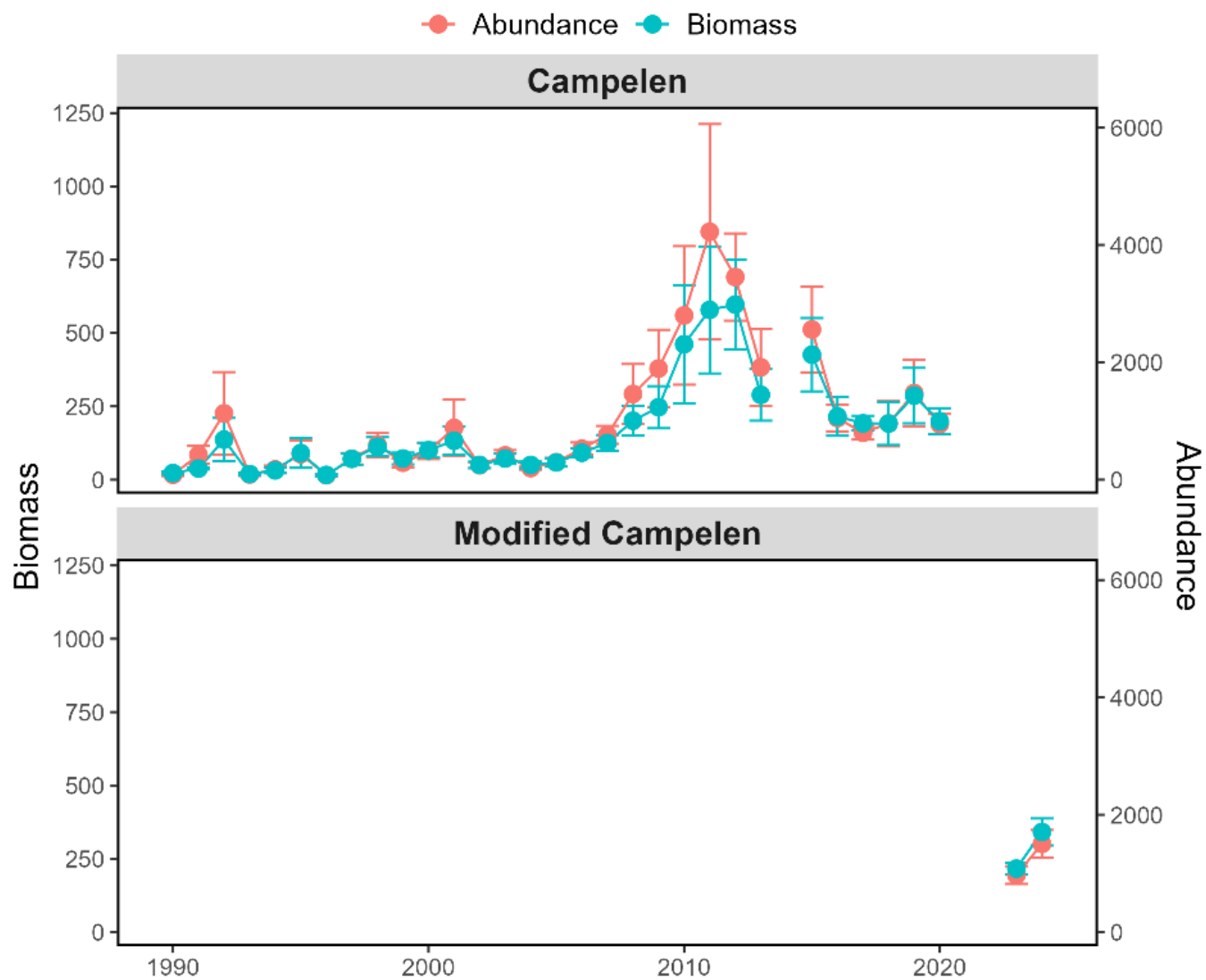


Figure 44. Recommended autumn survey time series for Redfish in NAFO Divs. 3LN.

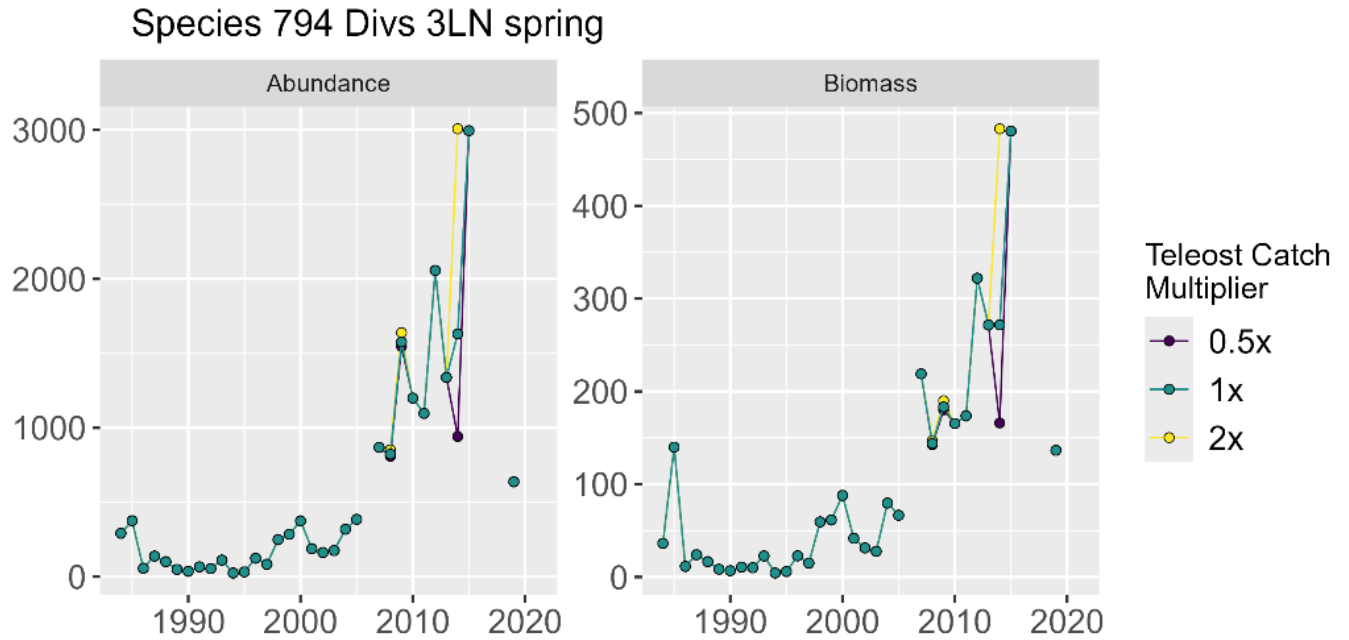


Figure 45. Sensitivity run adjusting spring CCGS Teleost catches of Redfish in NAFO Div. 3LN by 0.5x (purple) and 2.0x (yellow) the observed catches (green) in order to explore the impact of hypothetical conversion factors on the survey time series.

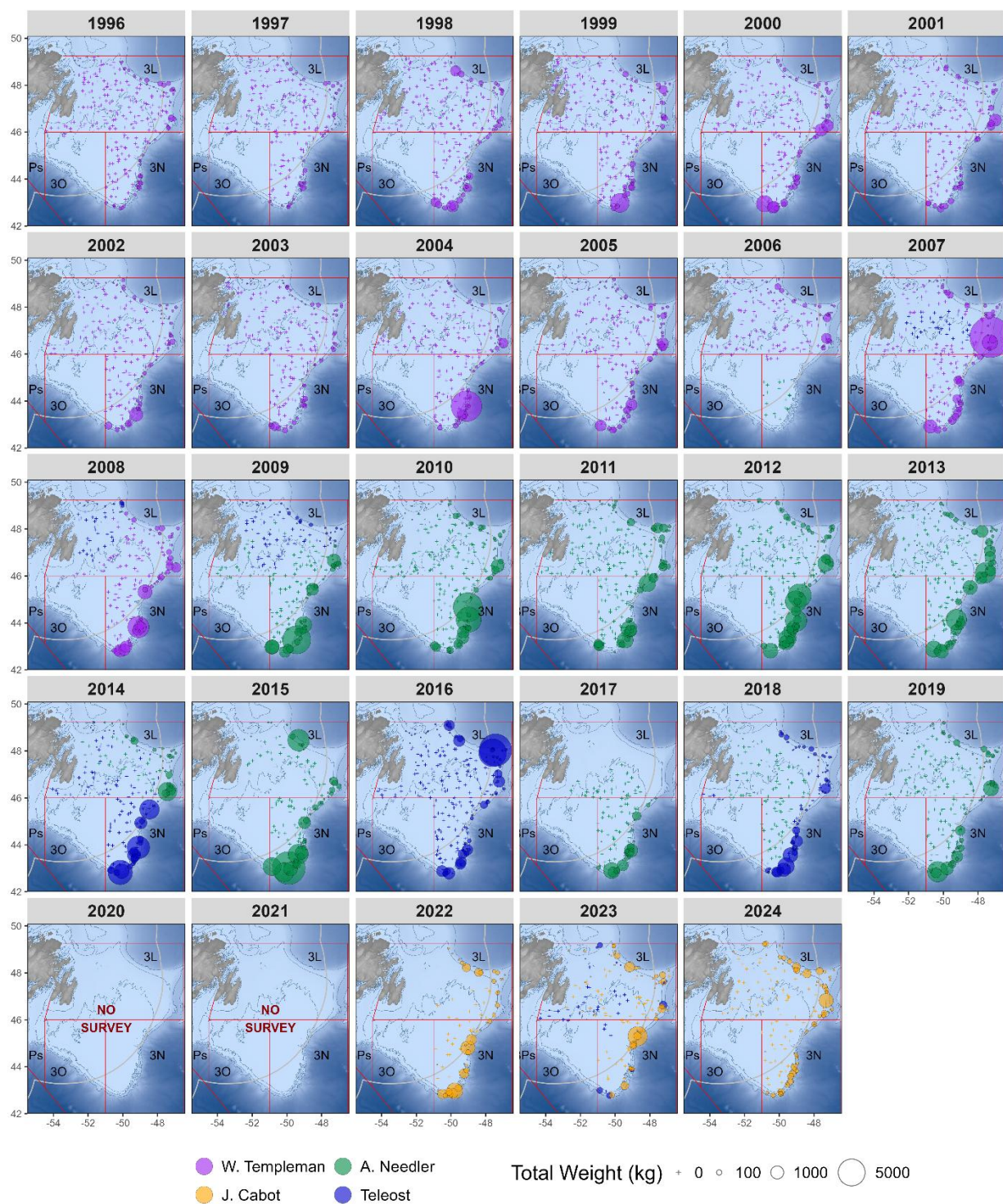


Figure 46. Spring survey catches (weight) of Redfish in NAFO Divs. 3LN. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

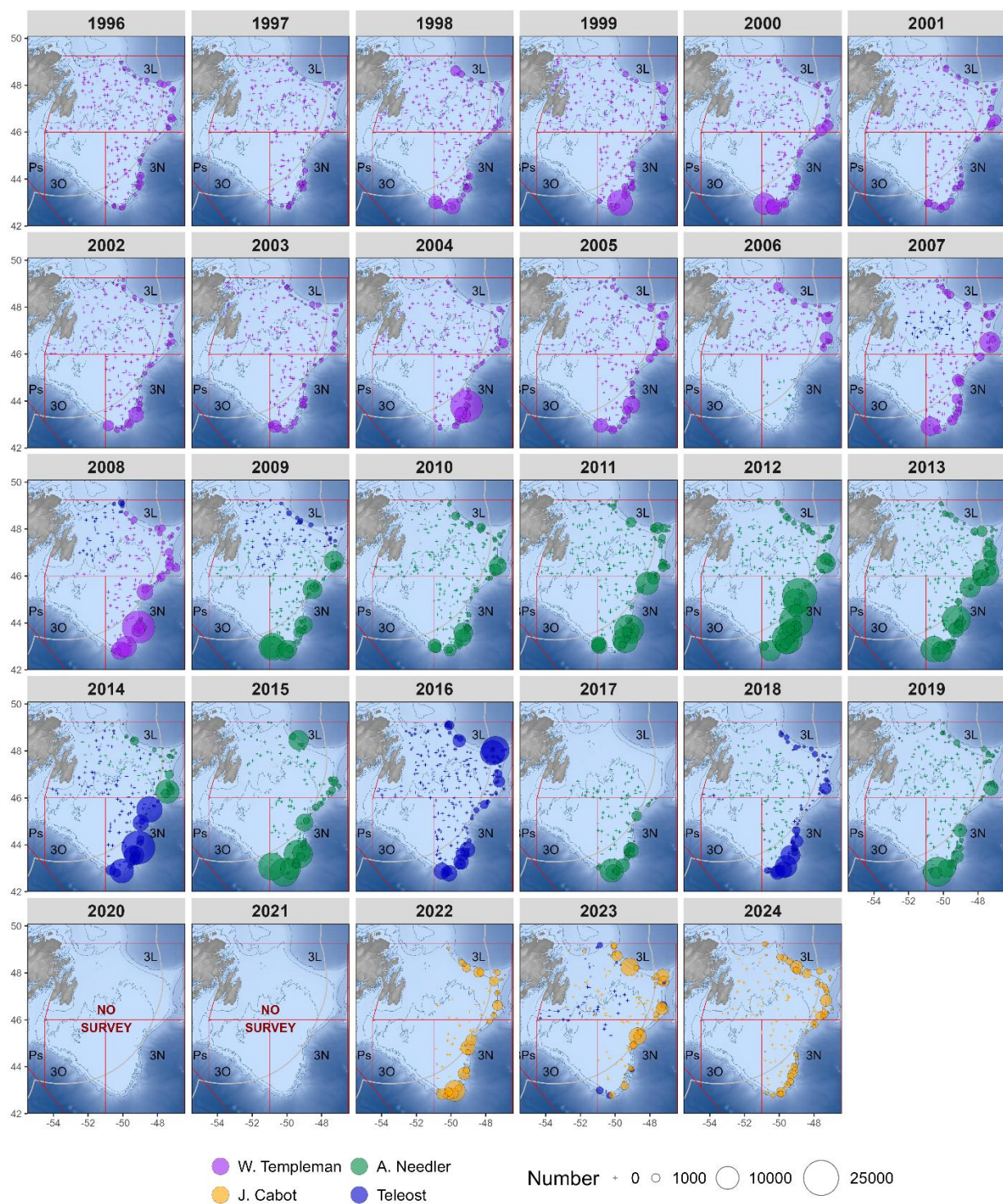


Figure 47. Spring survey catches (number) of Redfish in NAFO Divs. 3LN. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

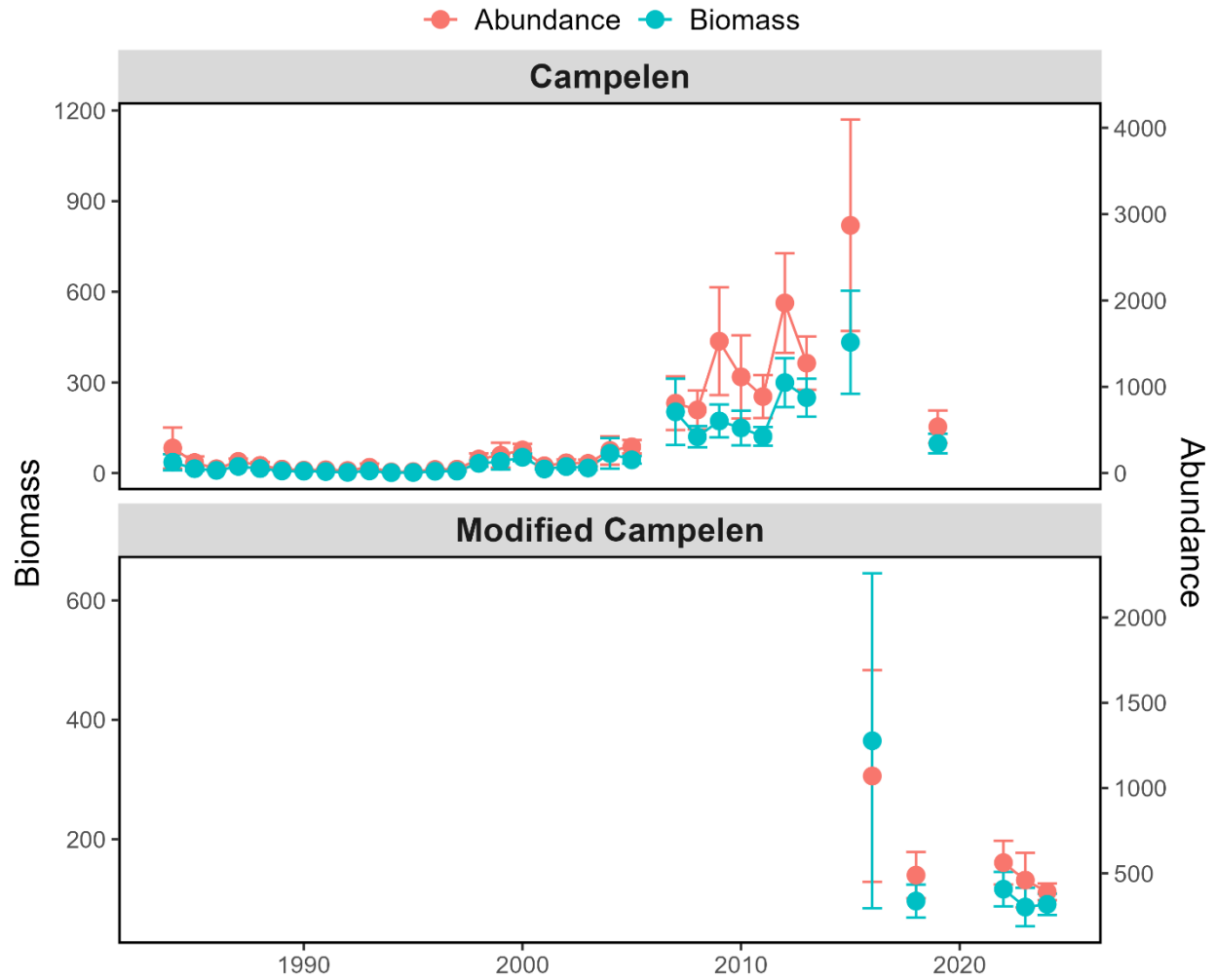


Figure 48. Recommended spring survey time series for Redfish in NAFO Divs. 3LN.

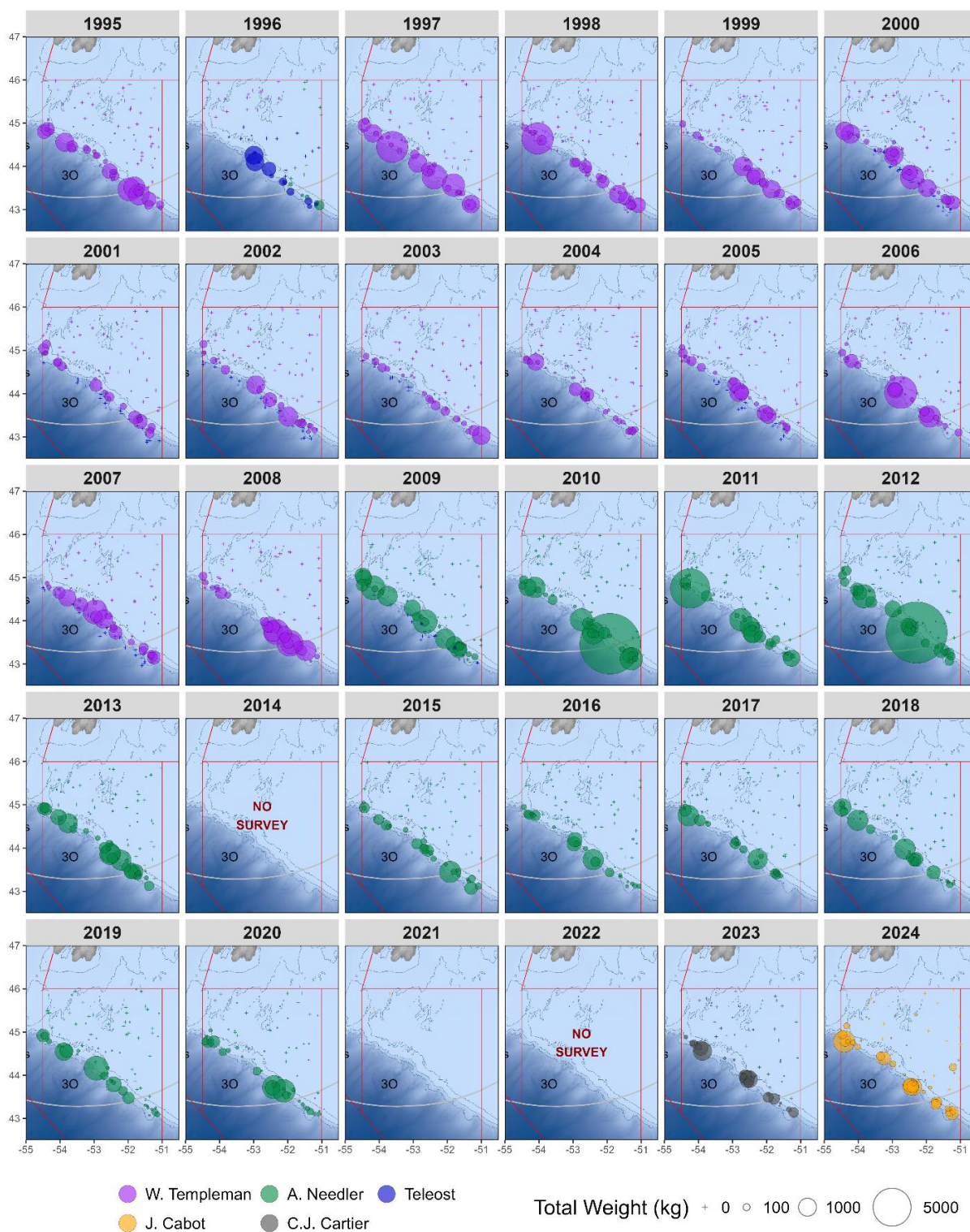


Figure 49. Autumn survey catches (weight) of Redfish in NAFO Div. 30. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

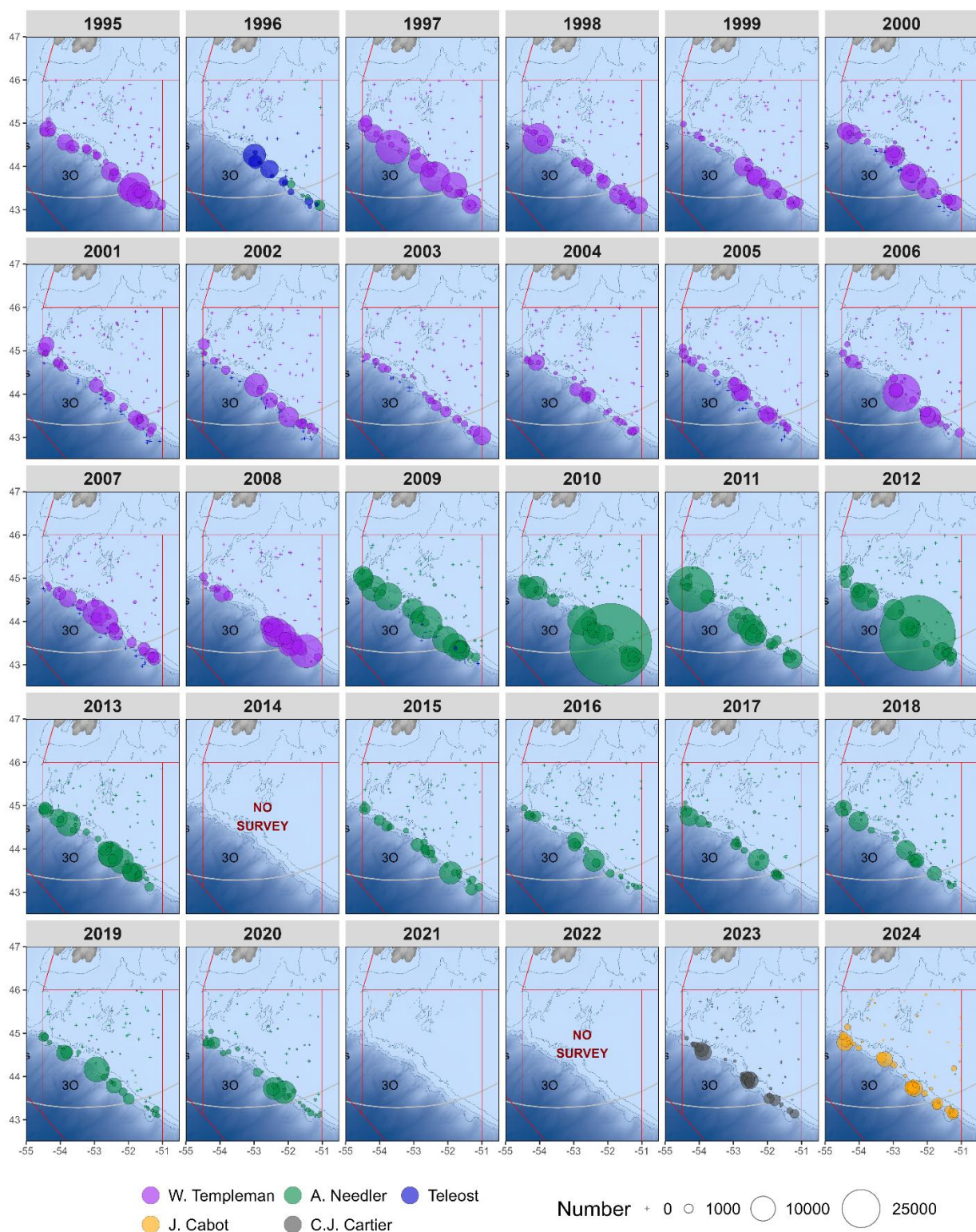


Figure 50. Autumn survey catches (number) of Redfish in NAFO Div. 30. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

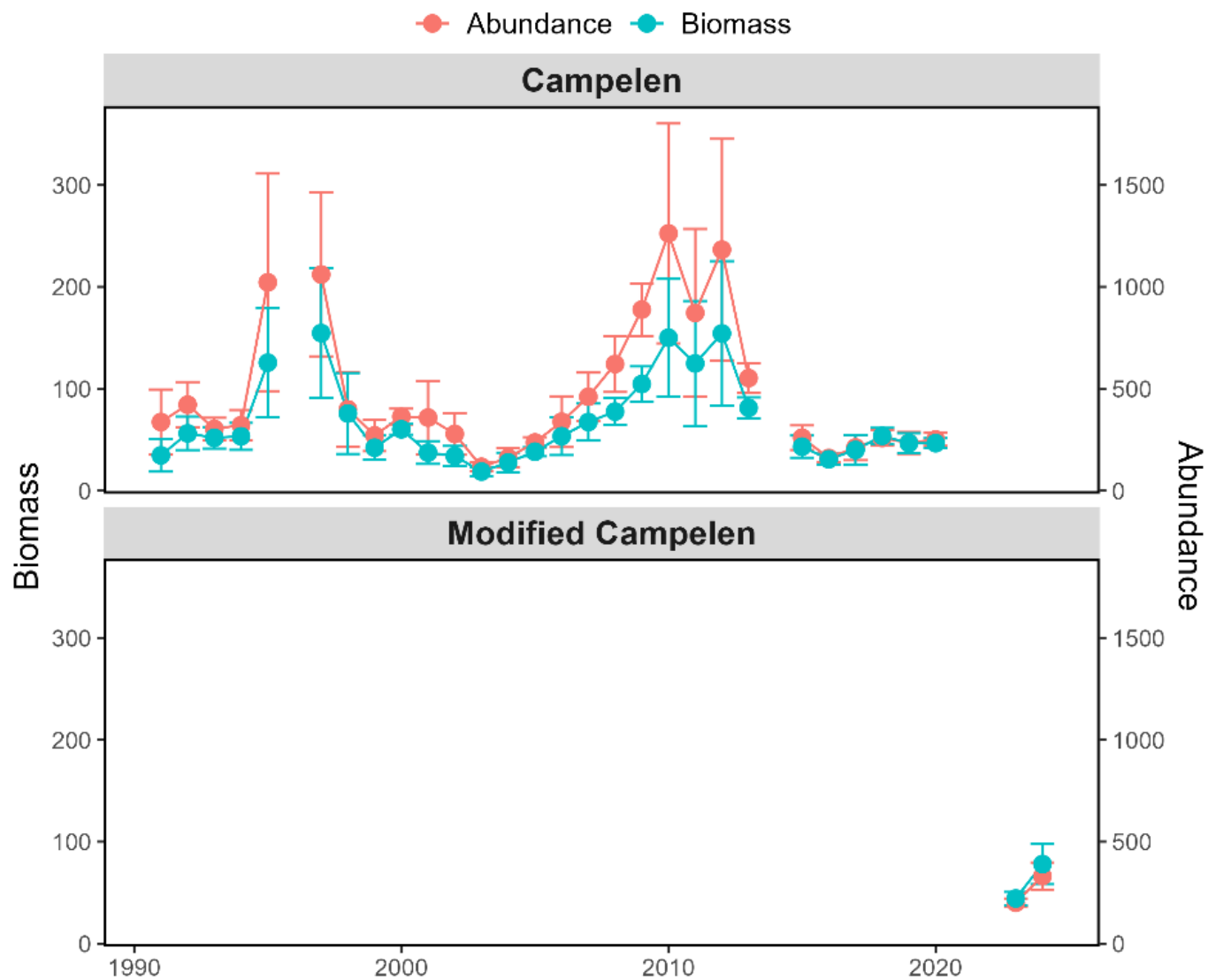


Figure 51. Recommended autumn survey time series for Redfish in NAFO Div. 30.

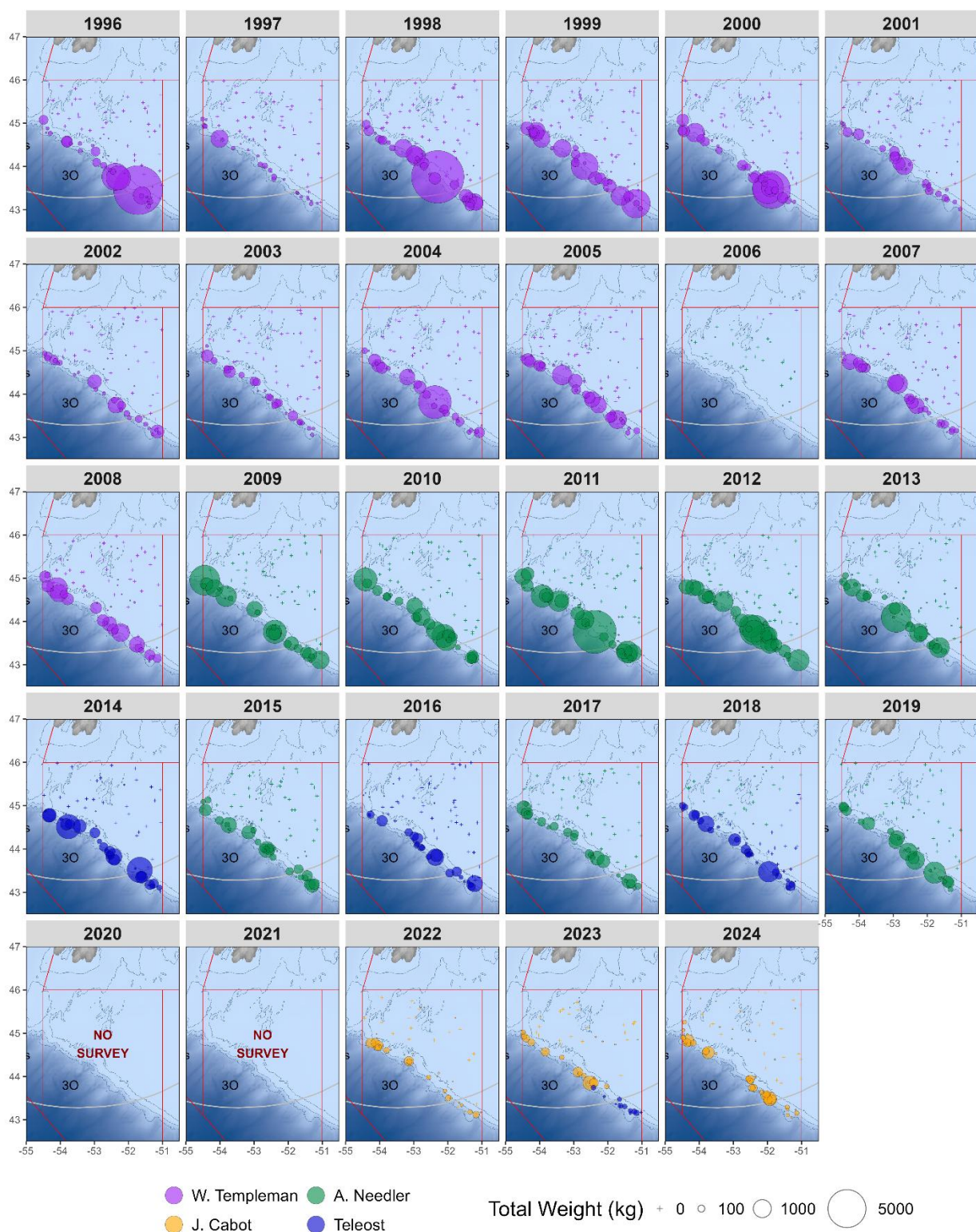


Figure 52. Spring survey catches (weight) of Redfish in NAFO Div. 30. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

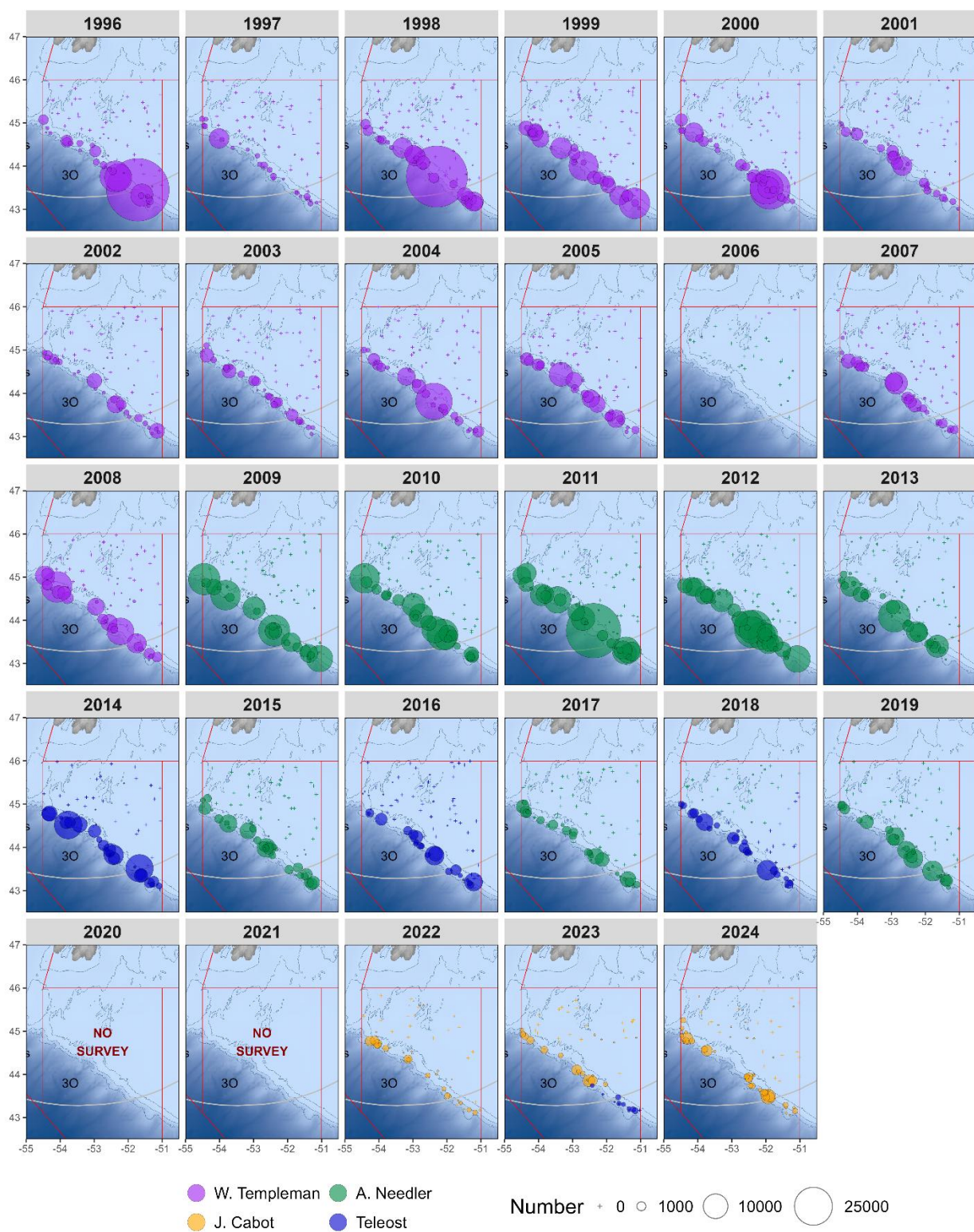


Figure 53. Spring survey catches (number) of Redfish in NAFO Div. 30. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

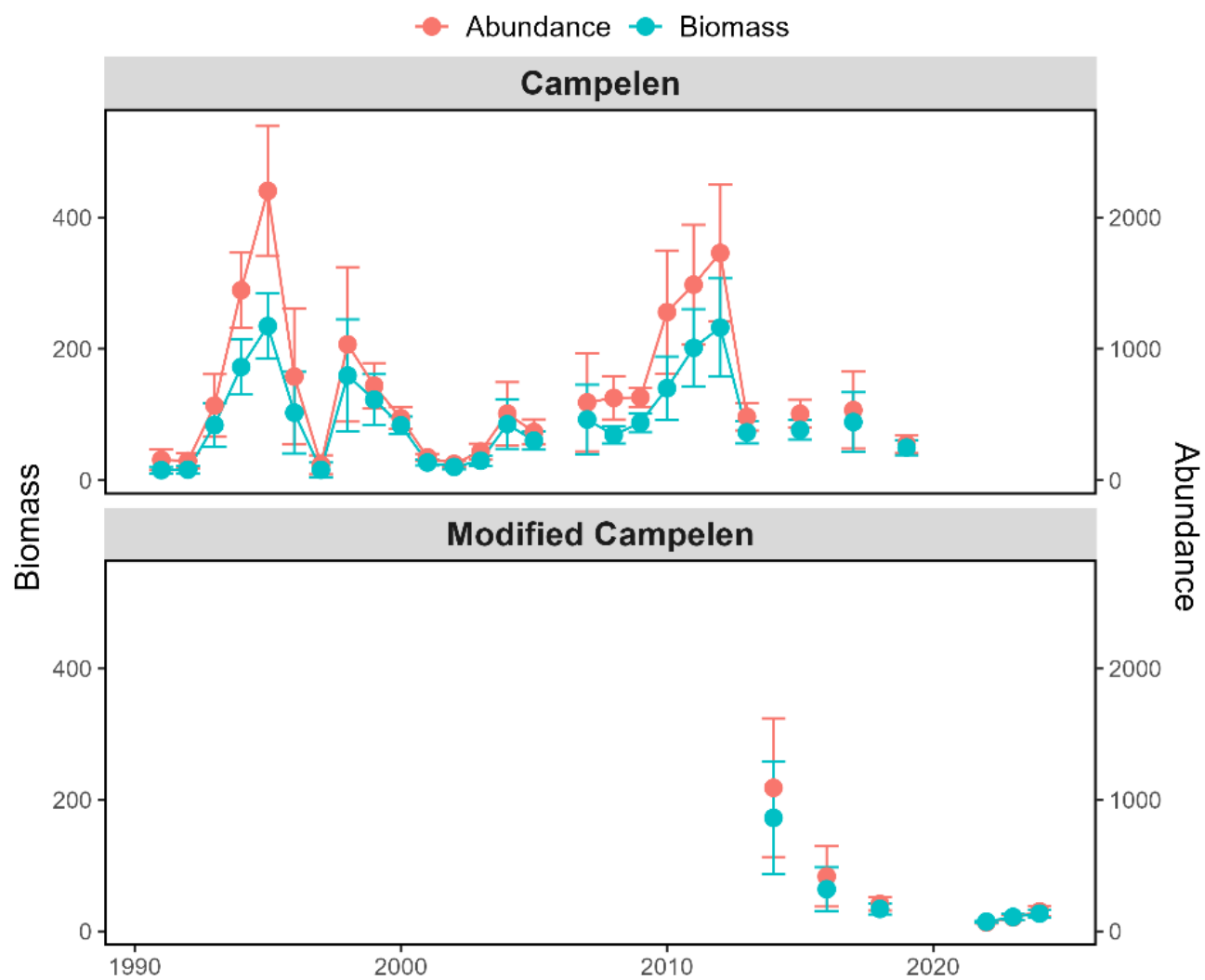


Figure 54. Recommended spring survey time series for Redfish in NAFO Div. 30.

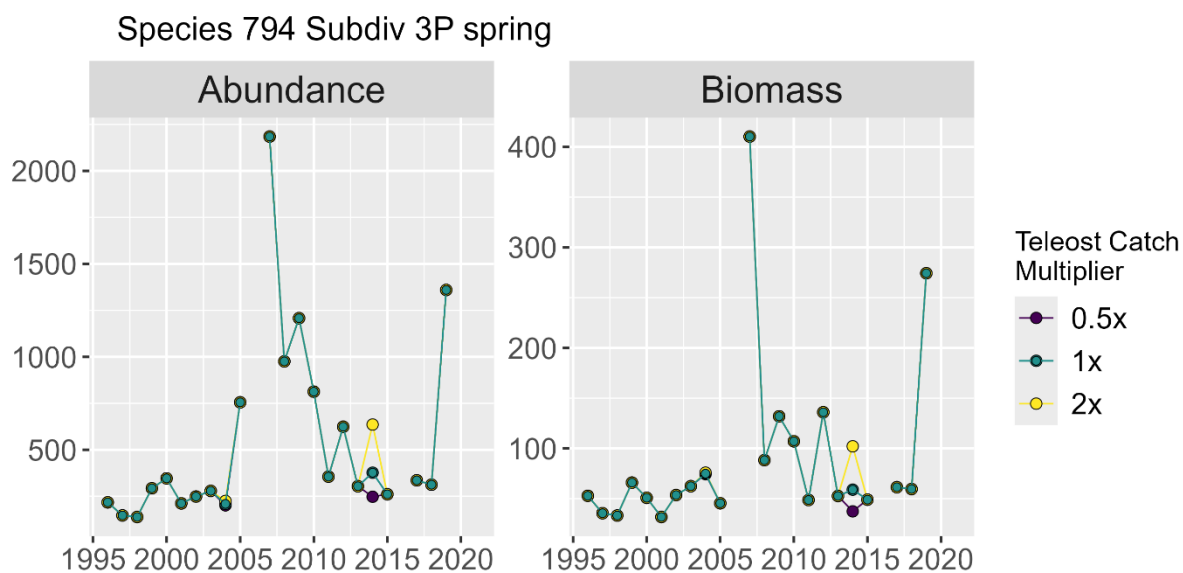


Figure 55. Sensitivity run adjusting spring CCGS Teleost catches of Redfish in NAFO subdivision 3Ps by 0.5x (purple) and 2.0x (yellow) the observed catches (green) in order to explore the impact of hypothetical conversion factors on the survey time series.

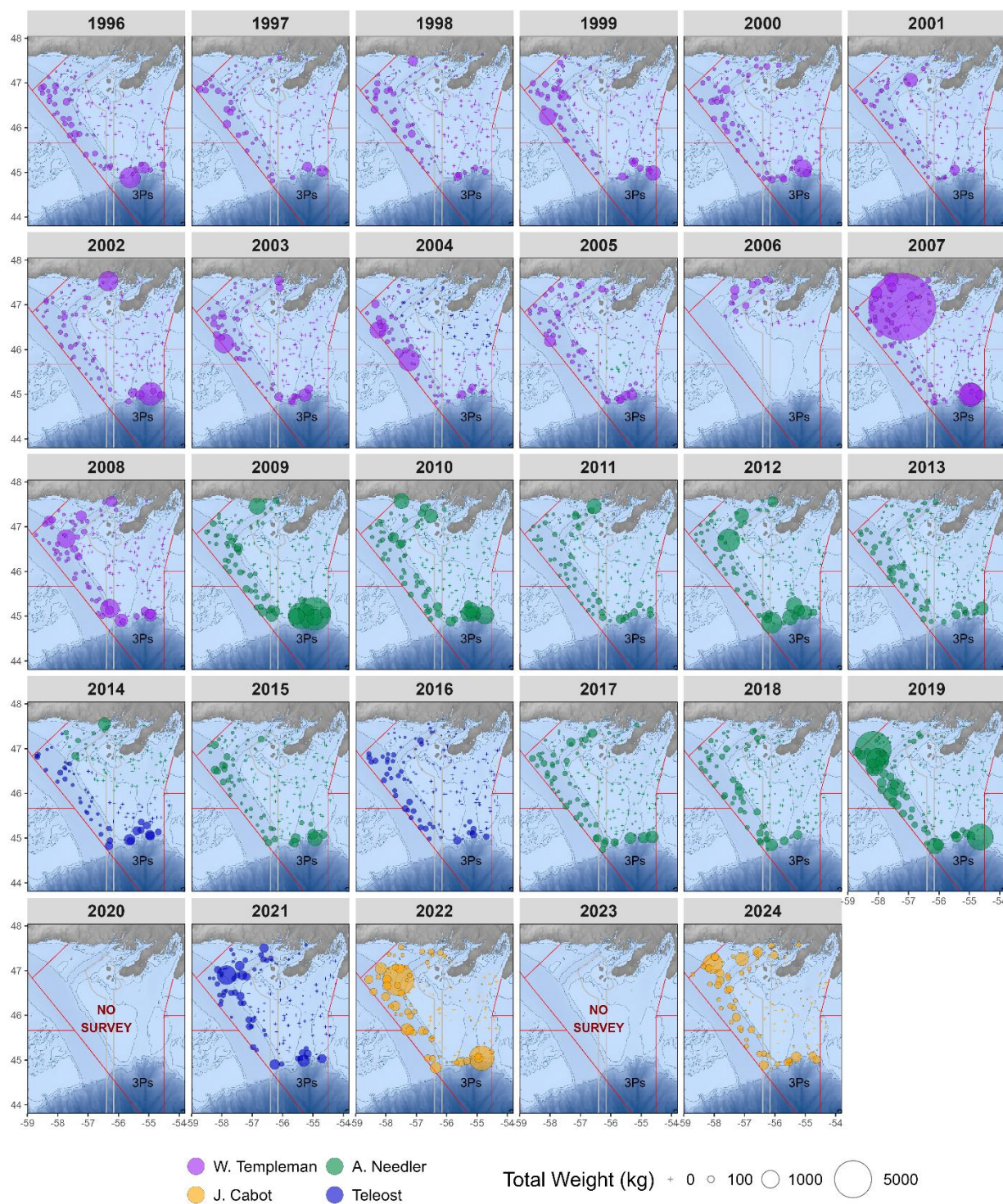


Figure 56. Spring survey catches (weight) of Redfish in NAFO Subdiv. 3Ps. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

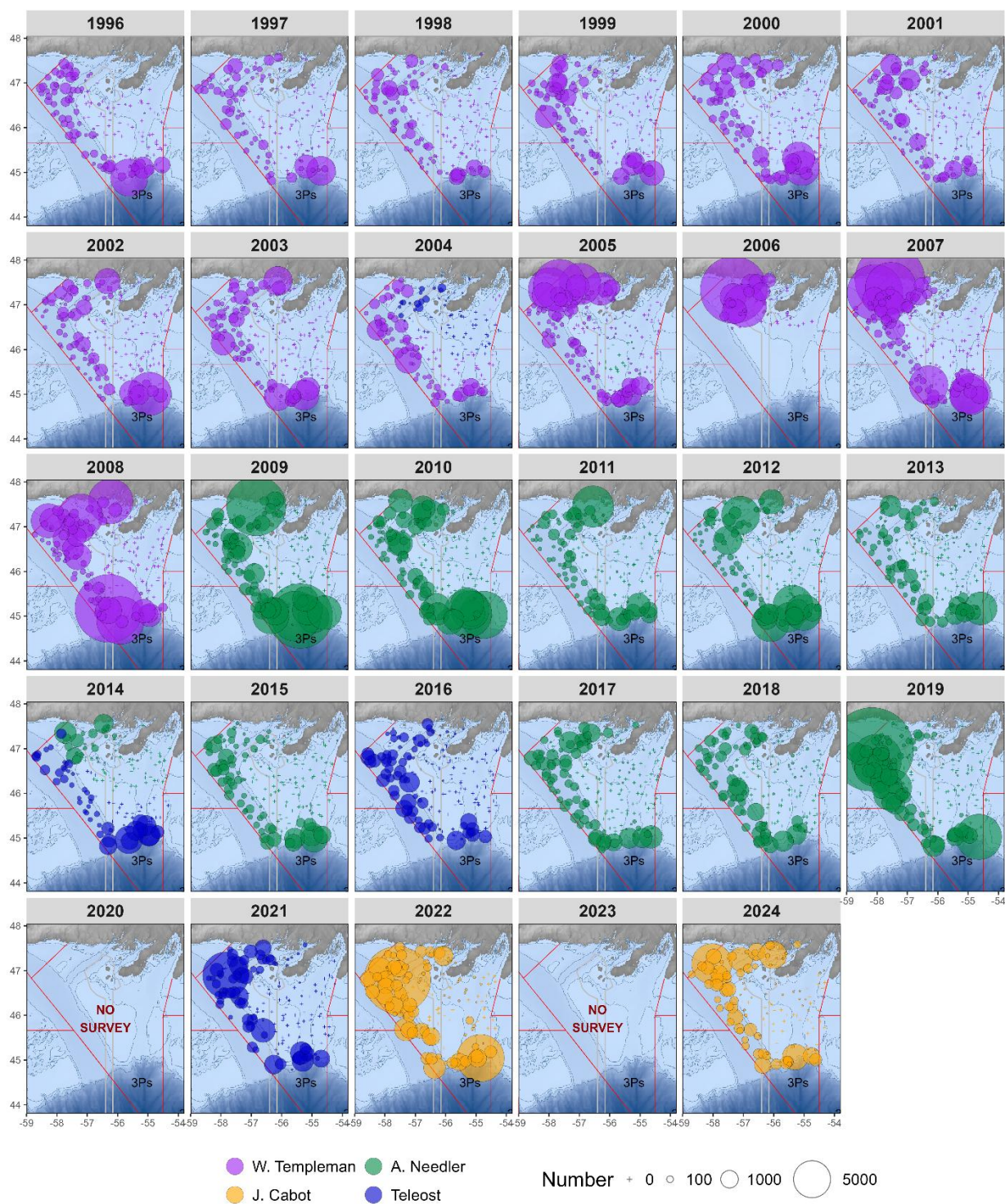


Figure 57. Spring survey catches (number) of Redfish in NAFO Subdiv. 3Ps. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

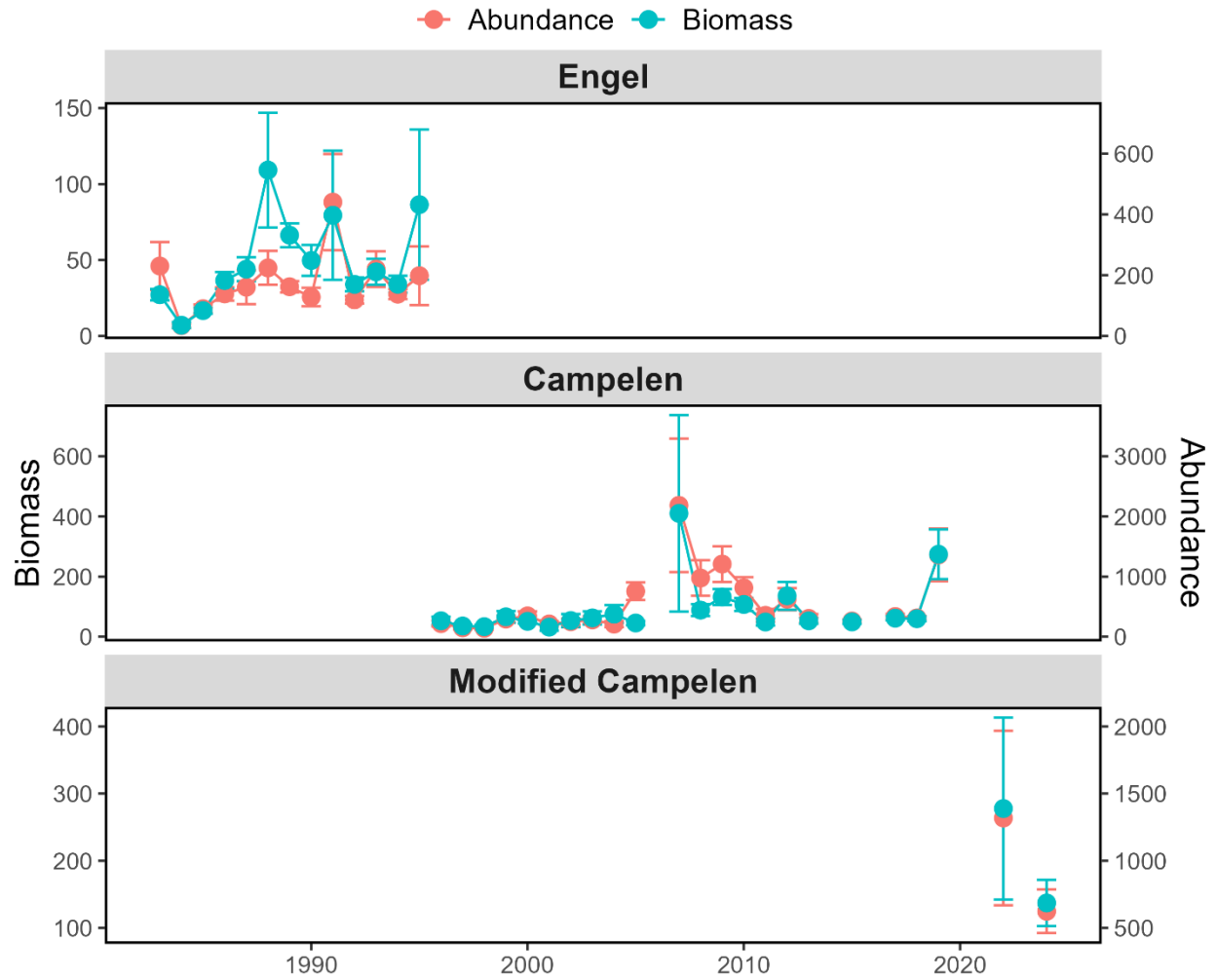


Figure 58. Recommended spring survey time series for Redfish in NAFO Subdiv. 3Ps.

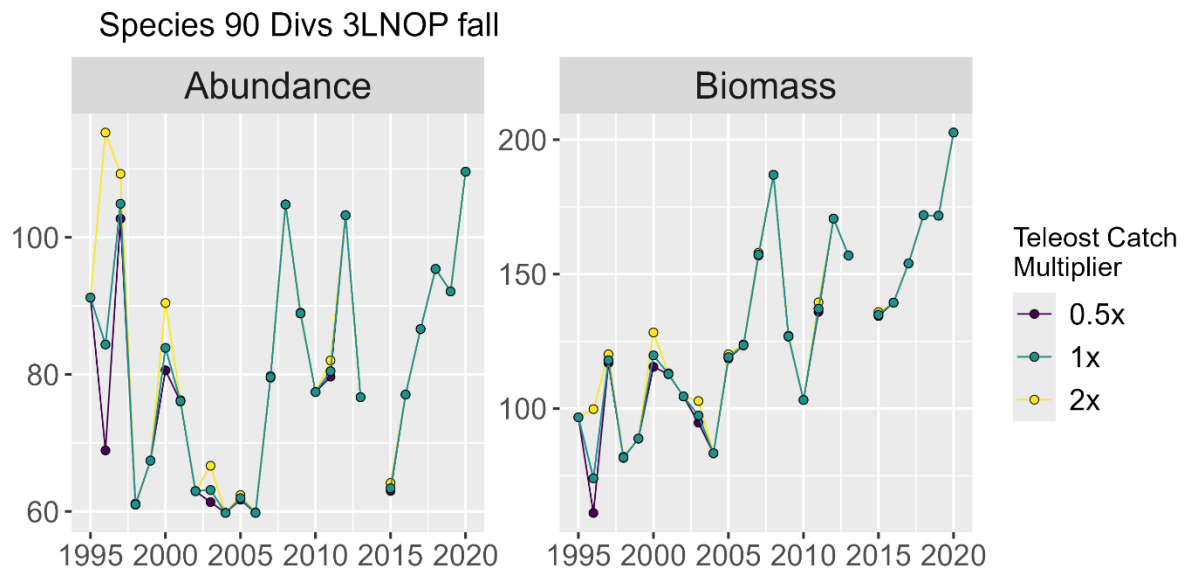


Figure 59. Sensitivity run adjusting autumn CCGS Teleost catches of Thorny skate in NAFO Div. 3LNOPs by 0.5x (purple) and 2.0x (yellow) the observed catches (green) in order to explore the impact of hypothetical conversion factors on the survey time series.



Figure 60. Autumn survey catches (weight) of Thorny skate in NAFO Divs. 3LNOPs. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.



Figure 61. Autumn survey catches (number) of Thorny skate in NAFO Divs. 3LNOPs. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

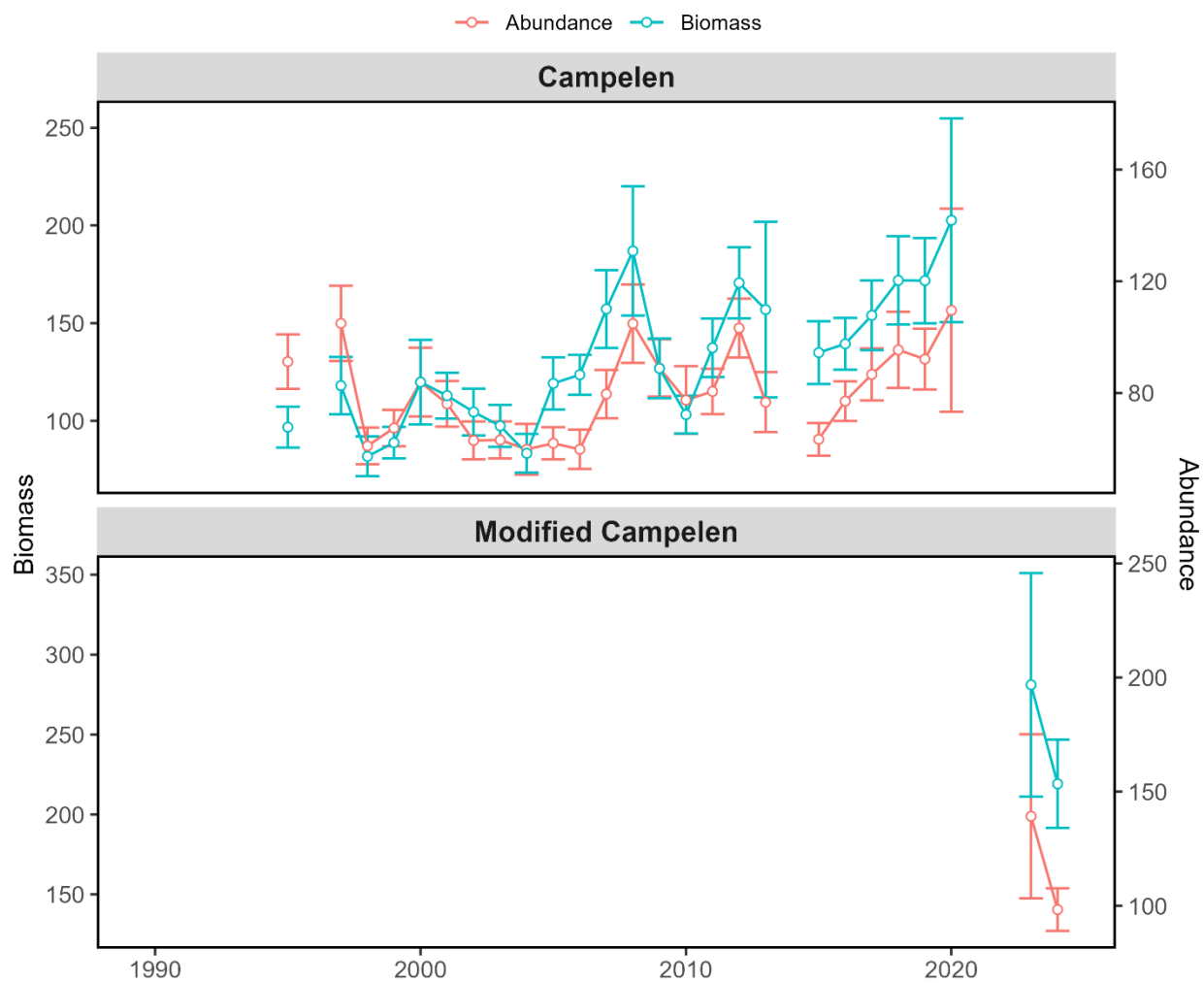


Figure 62. Recommended autumn survey time series for Thorny skate in NAFO Divs. 3LNOPs.

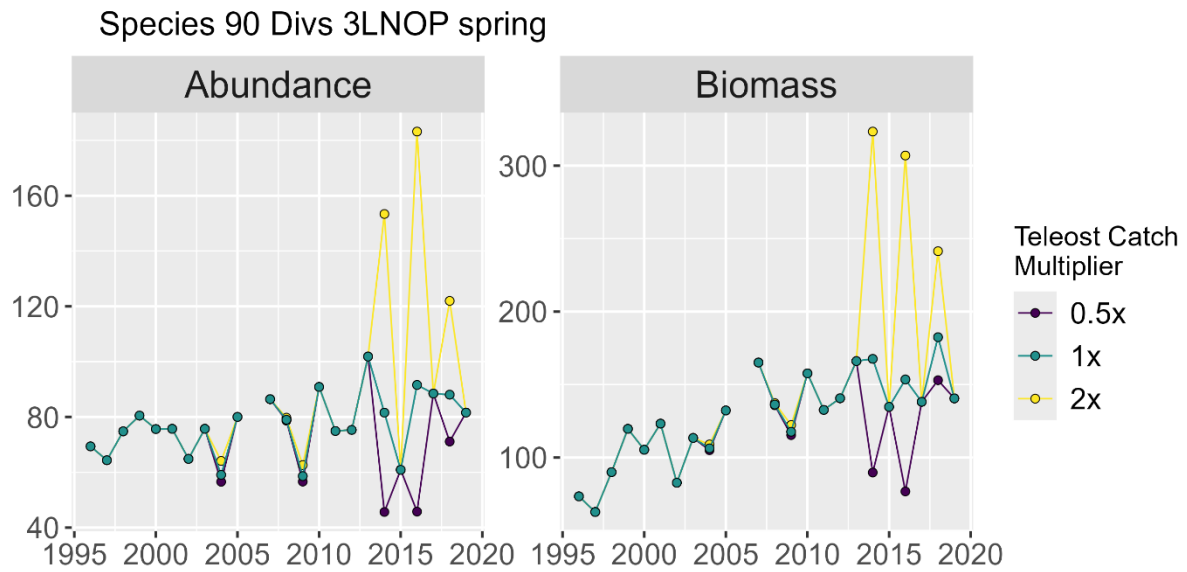


Figure 63. Sensitivity run adjusting spring CCGS Teleost catches of Thorny skate in NAFO Div. 3LNOPs by 0.5x (purple) and 2.0x (yellow) the observed catches (green) in order to explore the impact of hypothetical conversion factors on the survey time series.

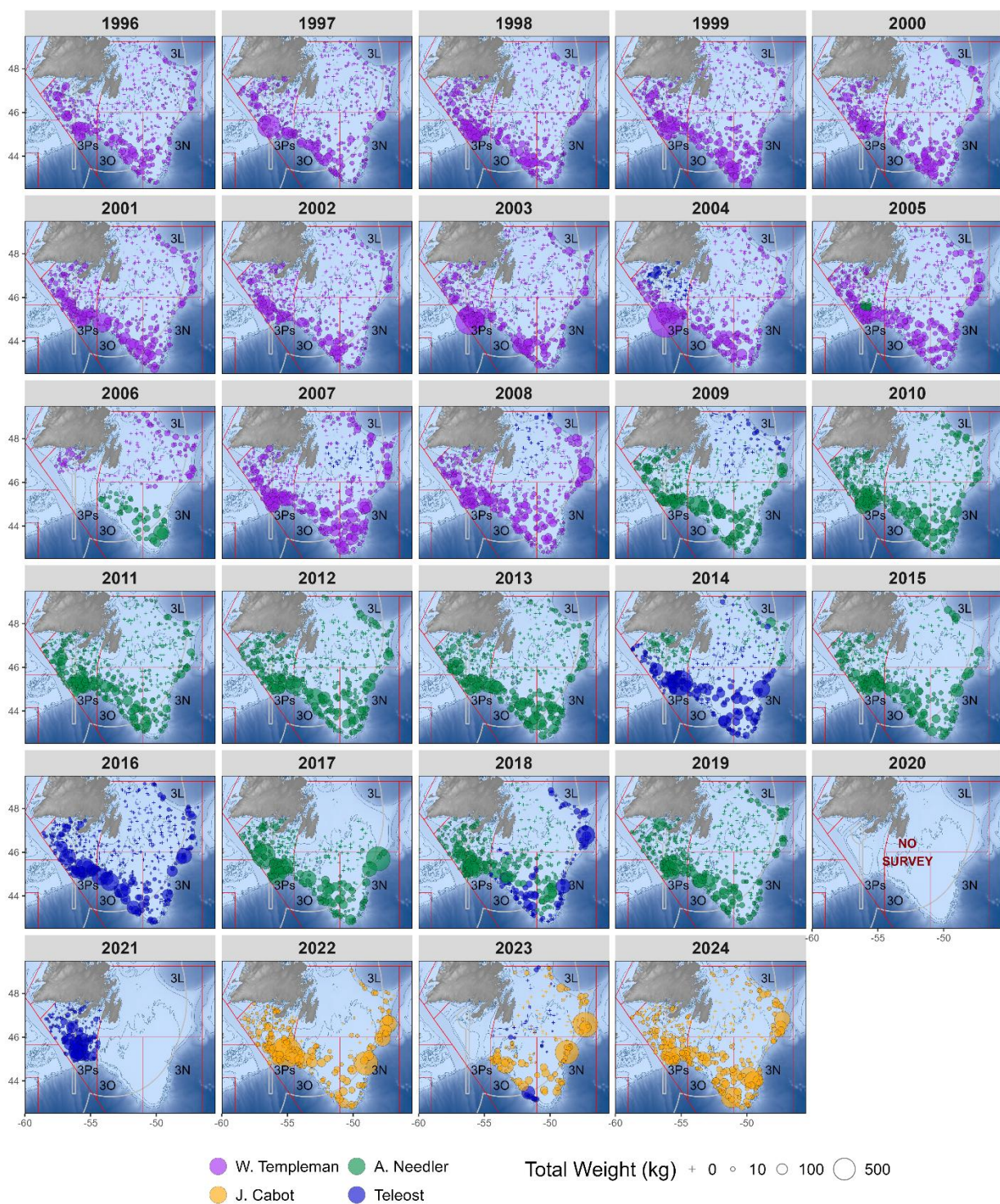


Figure 64. Spring survey catches (weight) of Thorny skate in NAFO Divs. 3LNOPs. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

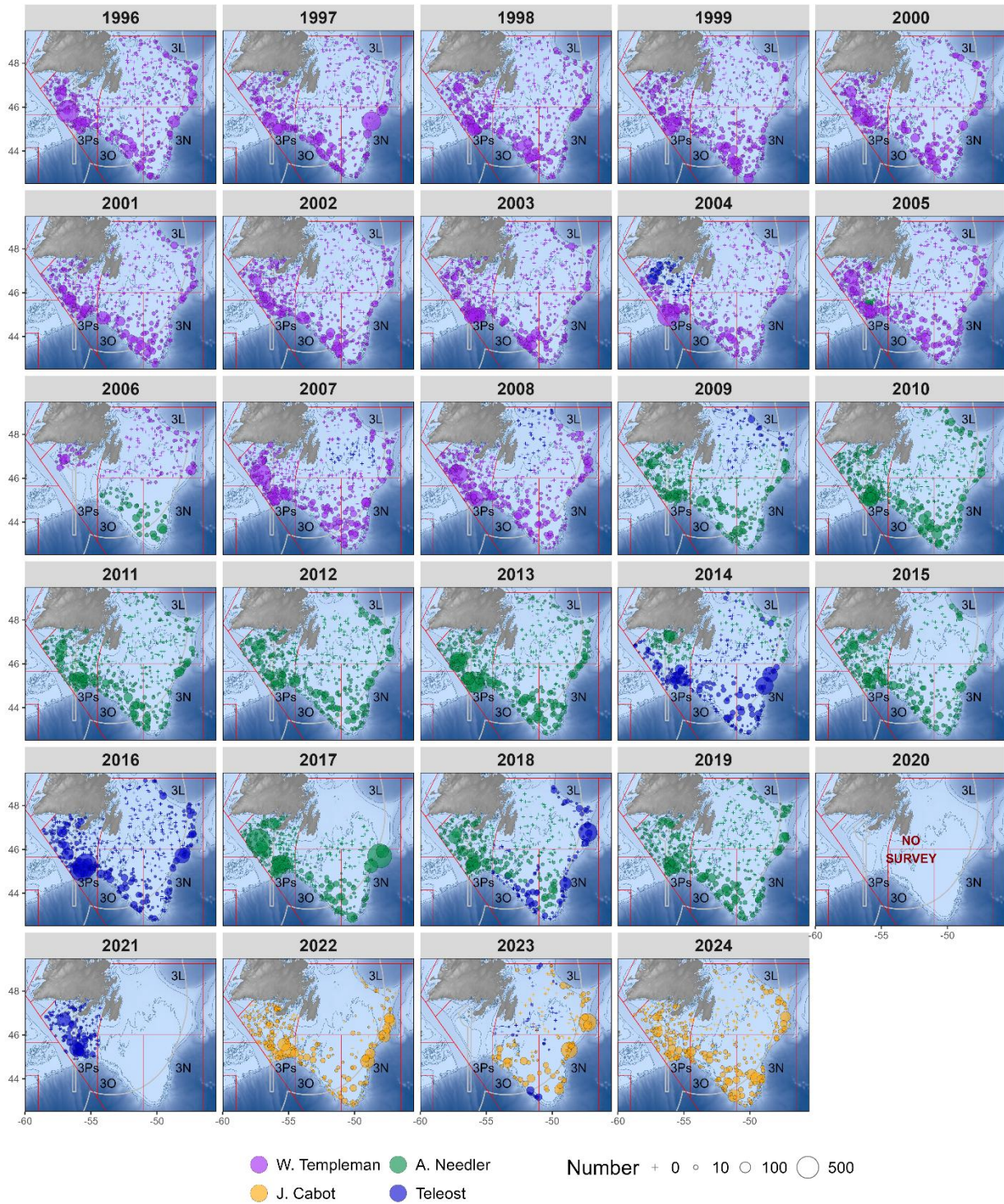


Figure 65. Spring survey catches (number) of Thorny skate in NAFO Divs. 3LNOPs. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

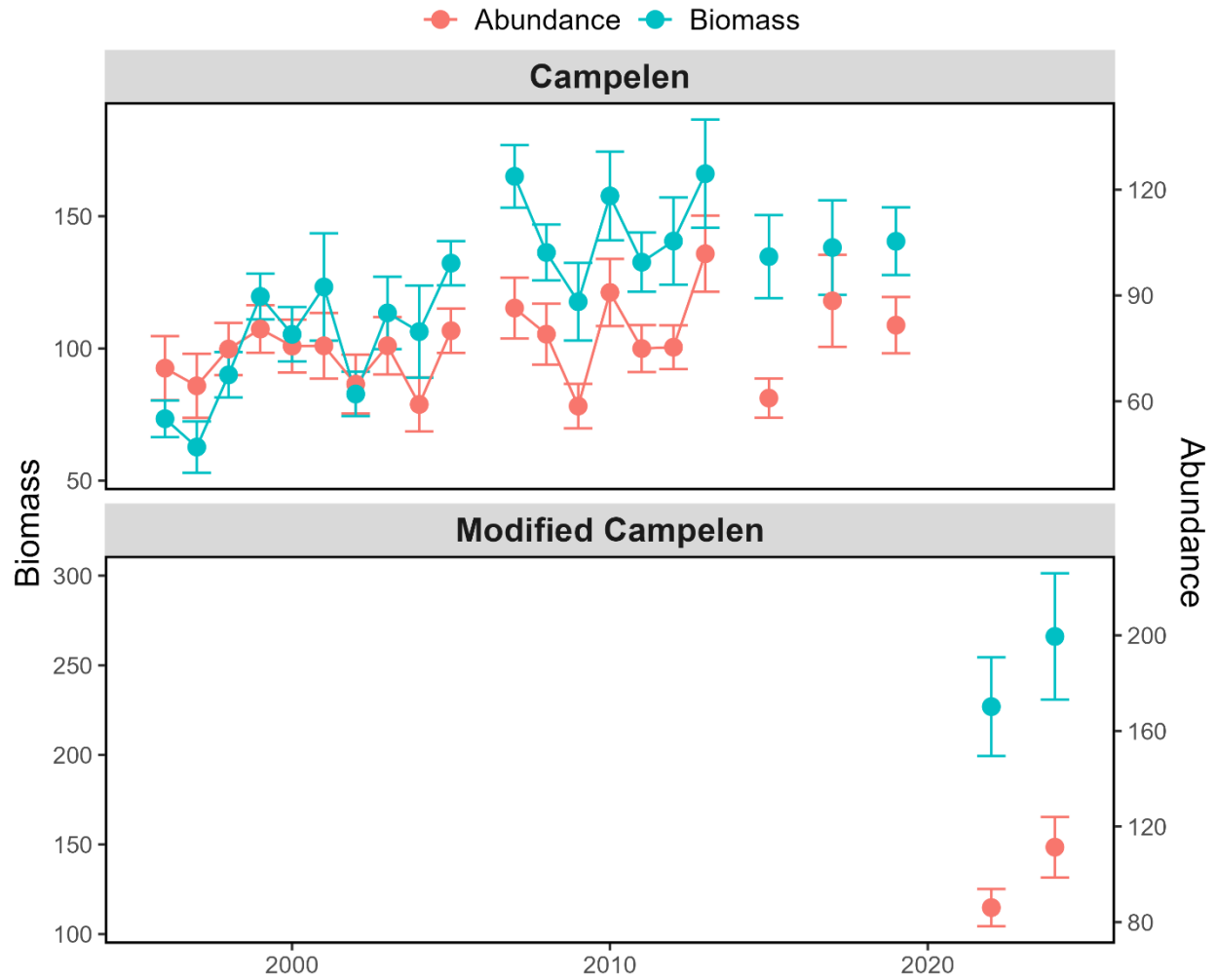


Figure 66. Recommended spring survey time series for Thorny skate in NAFO Div. 3LNOPs.

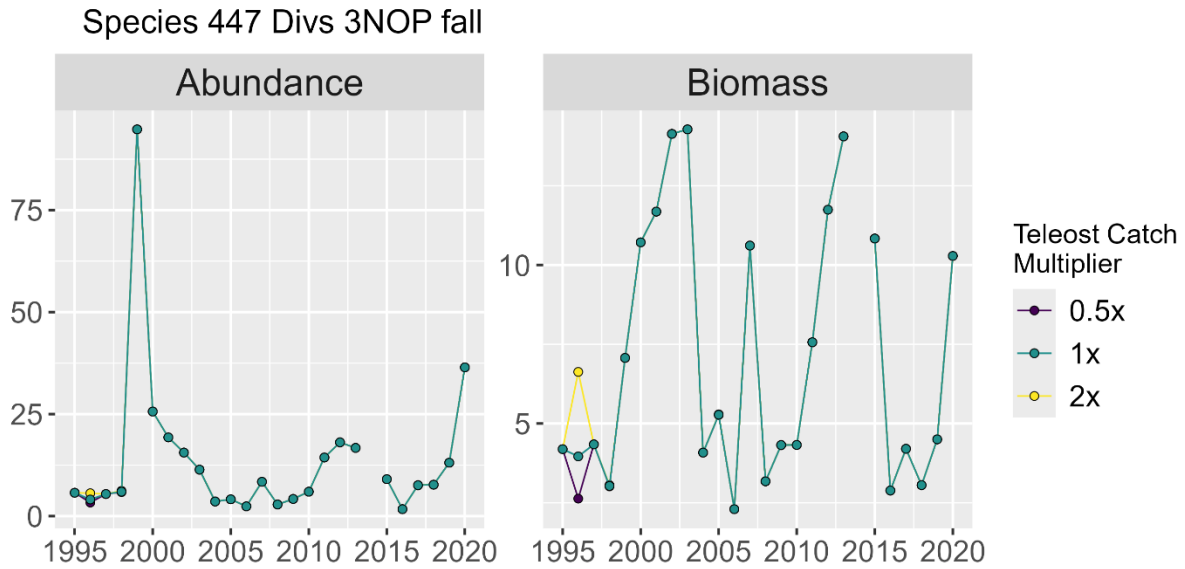


Figure 67. Sensitivity run adjusting autumn CCGS Teleost catches of White hake in NAFO Div. 3NOPs by 0.5x (purple) and 2.0x (yellow) the observed catches (green) in order to explore the impact of hypothetical conversion factors on the survey time series.



Figure 68. Autumn survey catches (weight) of White hake in NAFO Divs. 3NOPs. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.



Figure 69. Autumn survey catches (number) of White hake in NAFO Divs. 3NOPs. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

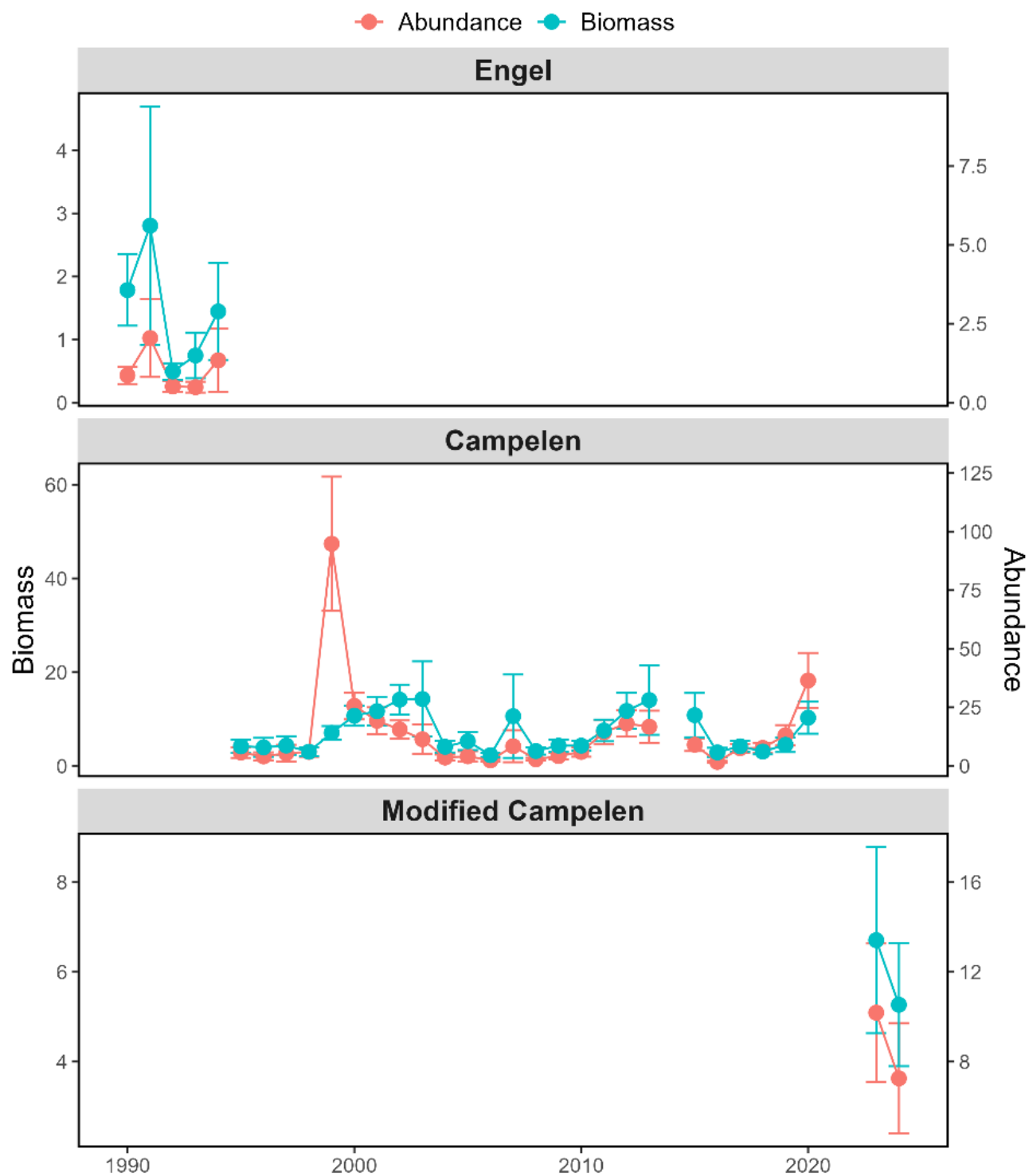


Figure 70. Recommended autumn survey time series for White hake in NAFO Divs. 3NOPs.

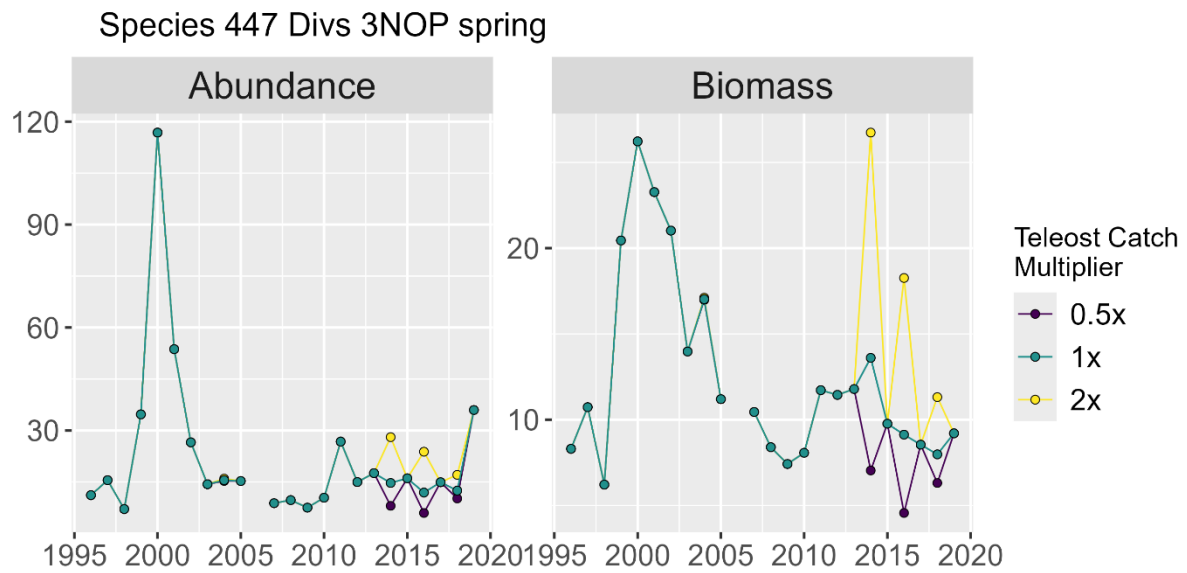


Figure 71. Sensitivity run adjusting spring CCGS Teleost catches of White hake in NAFO Div. 3NOPs by 0.5x (purple) and 2.0x (yellow) the observed catches (green) in order to explore the impact of hypothetical conversion factors on the survey time series.

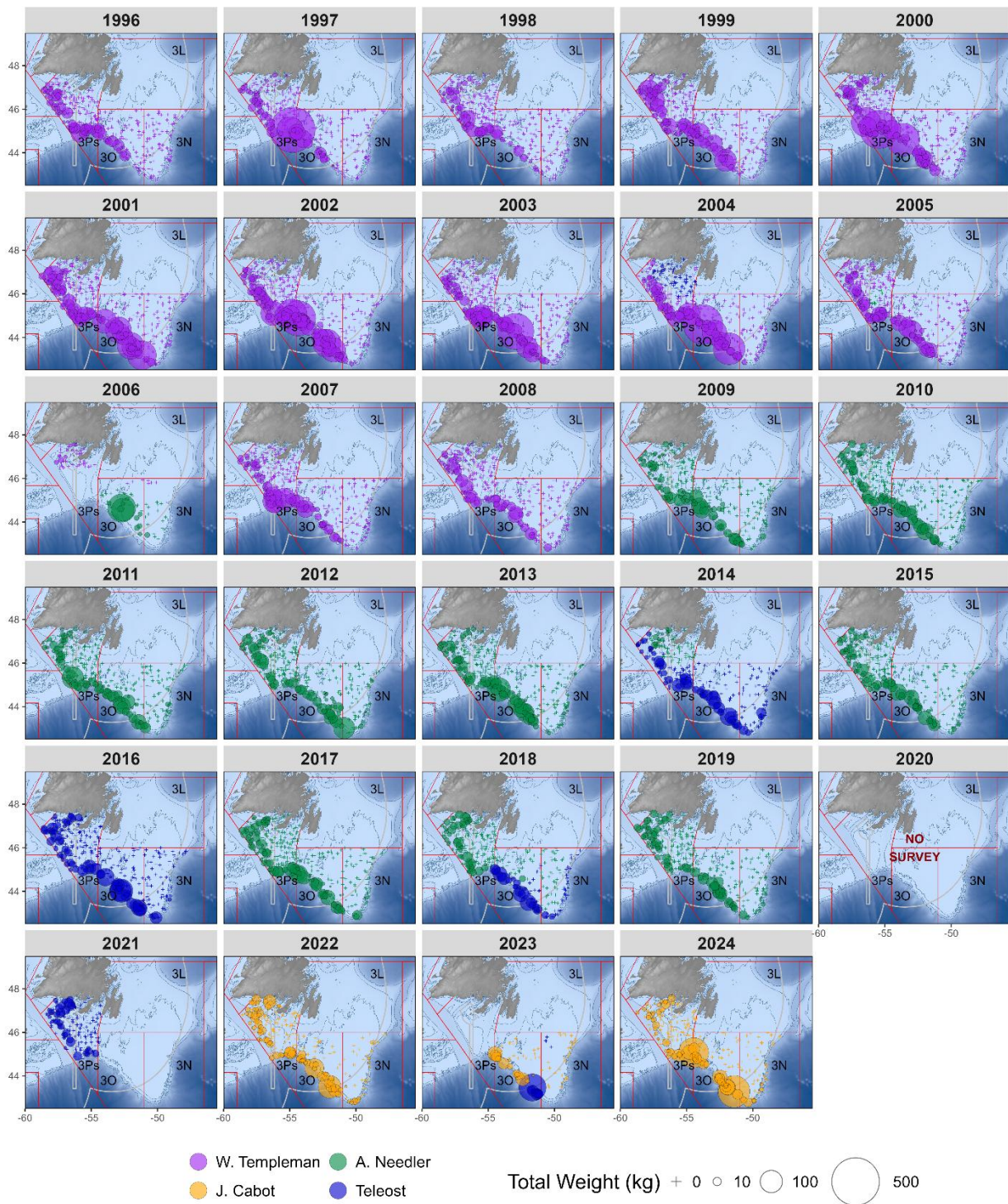


Figure 72. Spring survey catches (weight) of White hake in NAFO Divs. 3NOPs. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

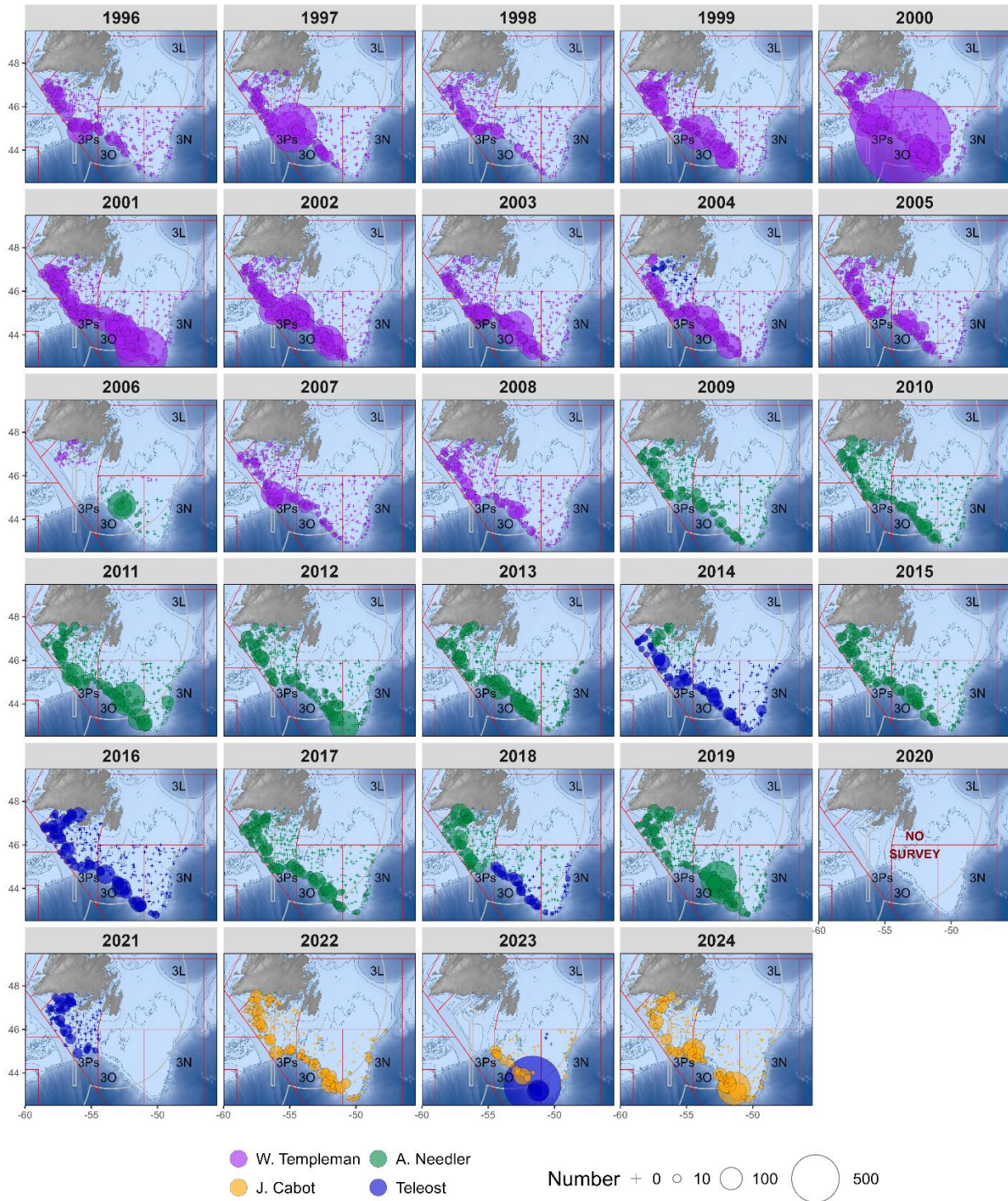


Figure 73. Spring survey catches (number) of White hake in NAFO Divs. 3NOPs. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

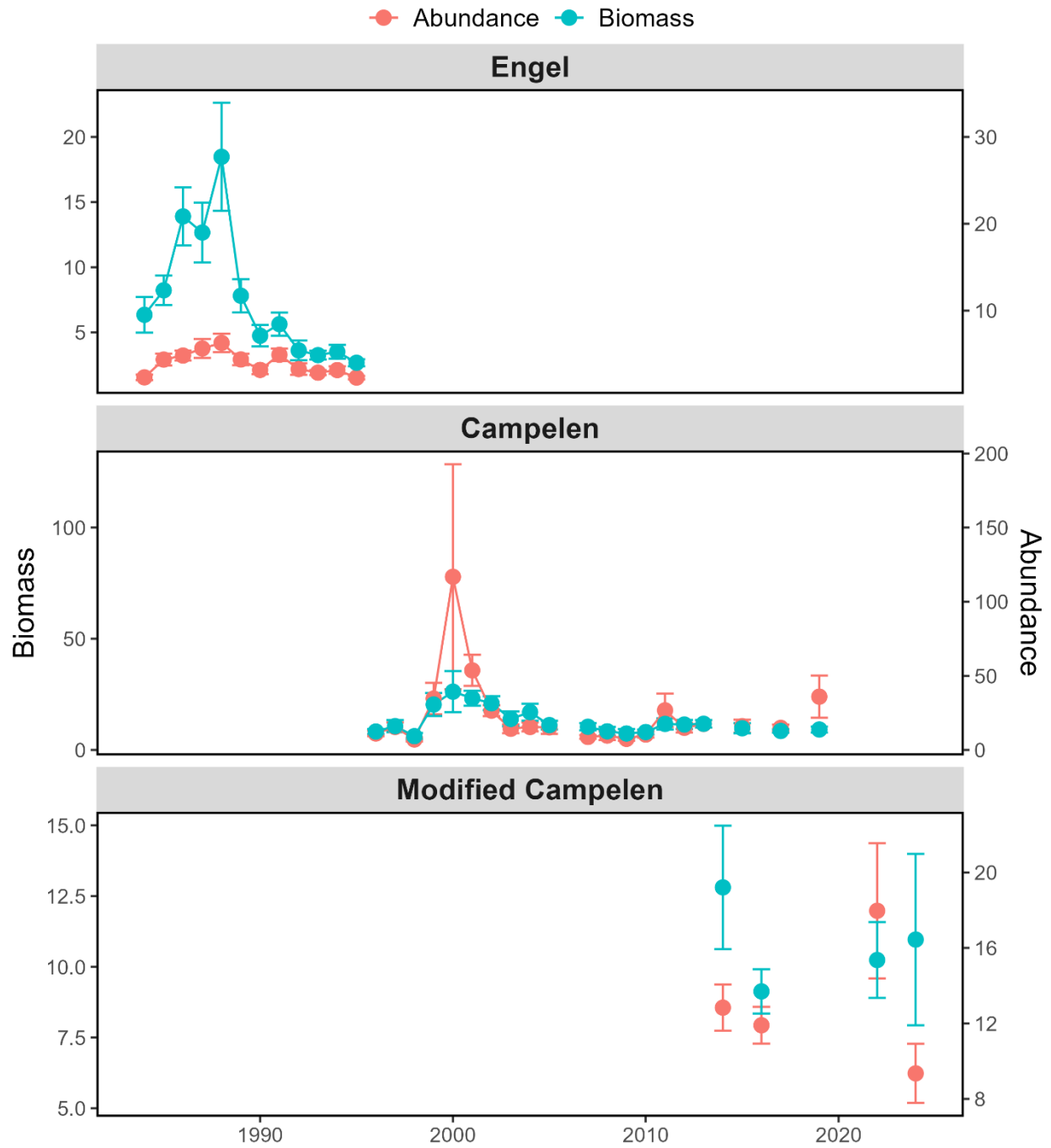


Figure 74. Recommended spring survey time series for White hake in NAFO Div. 3NOPs.

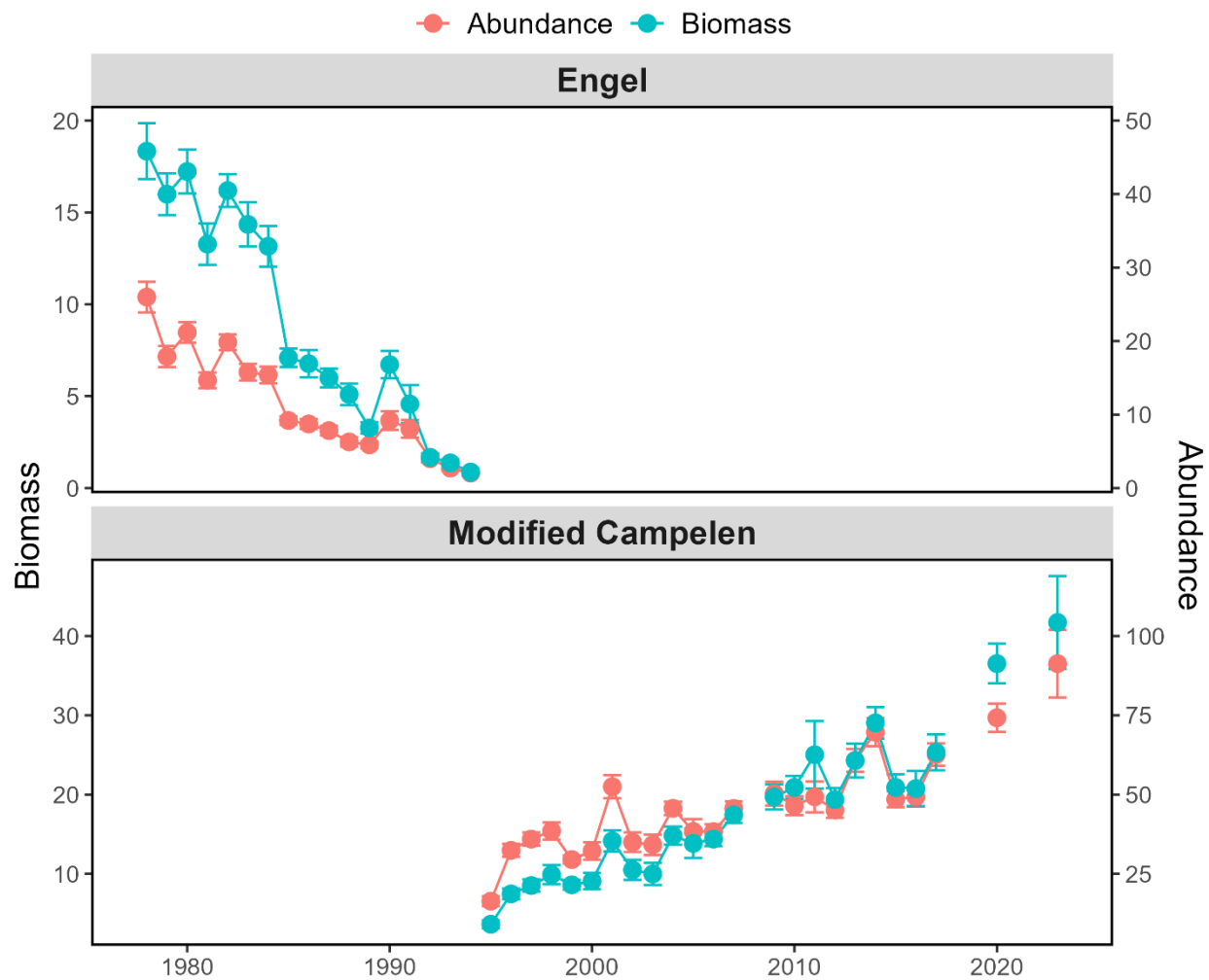


Figure 75. Recommended autumn survey time series for Roughhead grenadier in NAFO Divs. 2J3K.

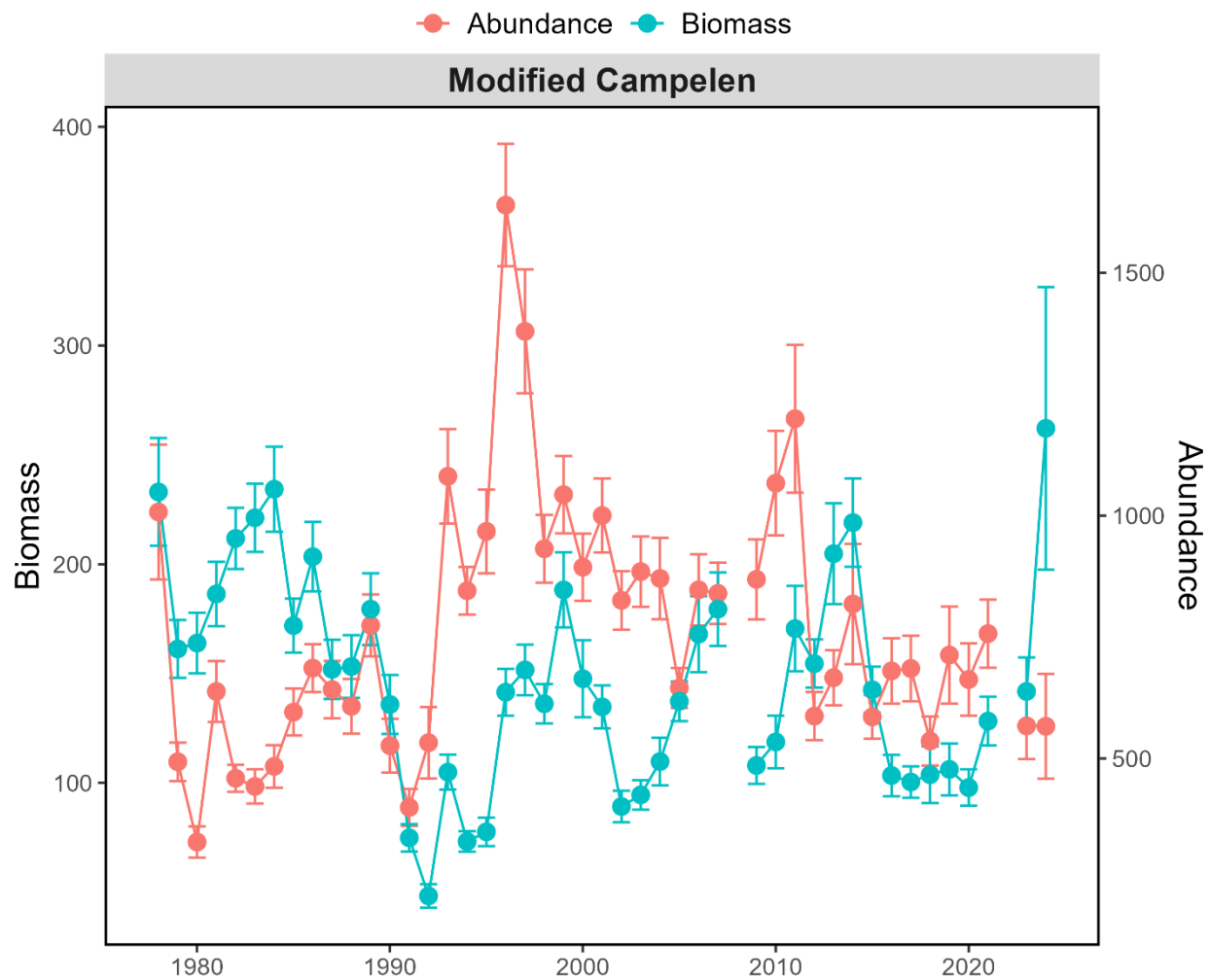


Figure 76. Recommended autumn survey time series for Greenland halibut in NAFO Divs. 2J3K.

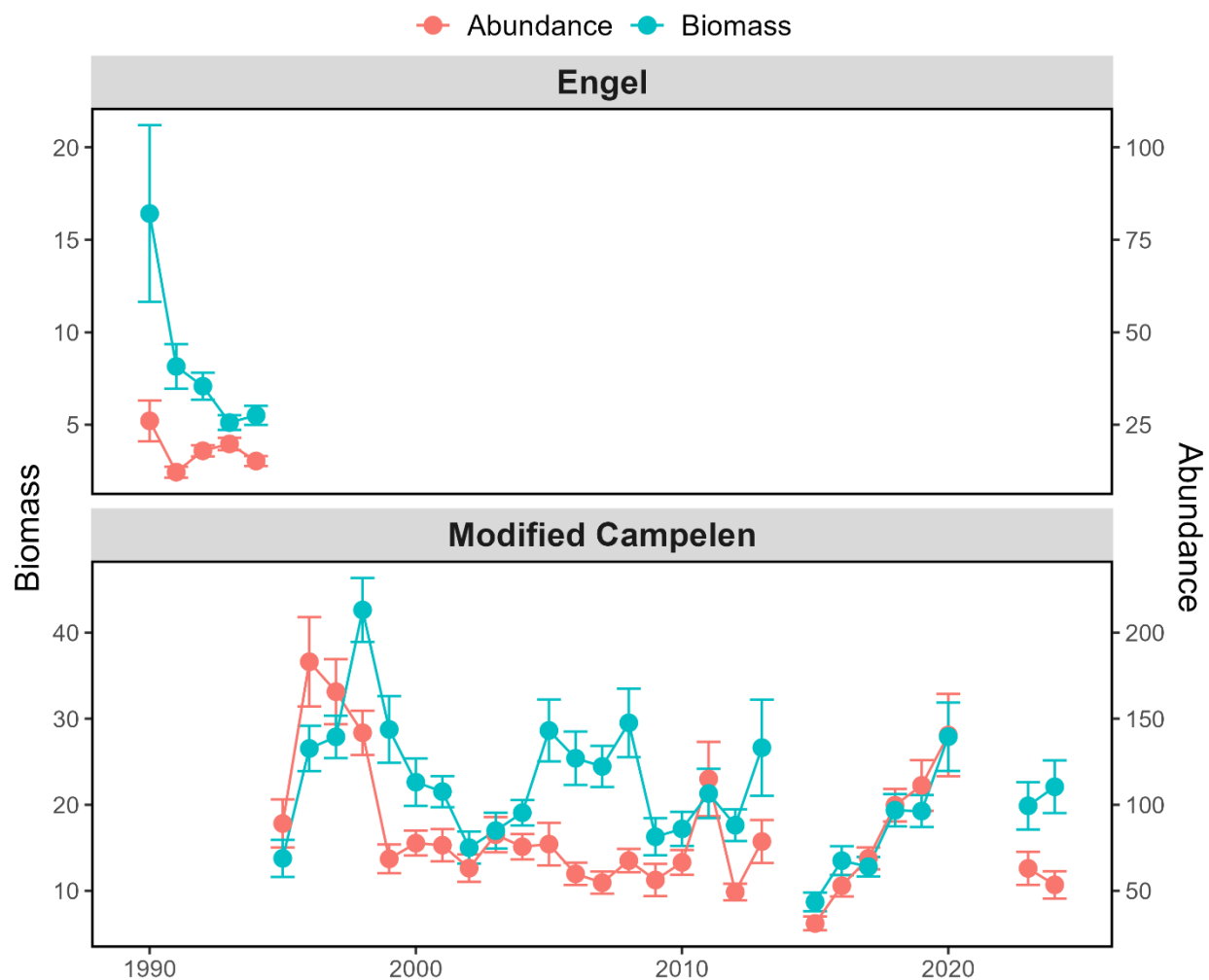


Figure 77. Recommended autumn survey time series for Greenland halibut in NAFO Divs. 3LNO.

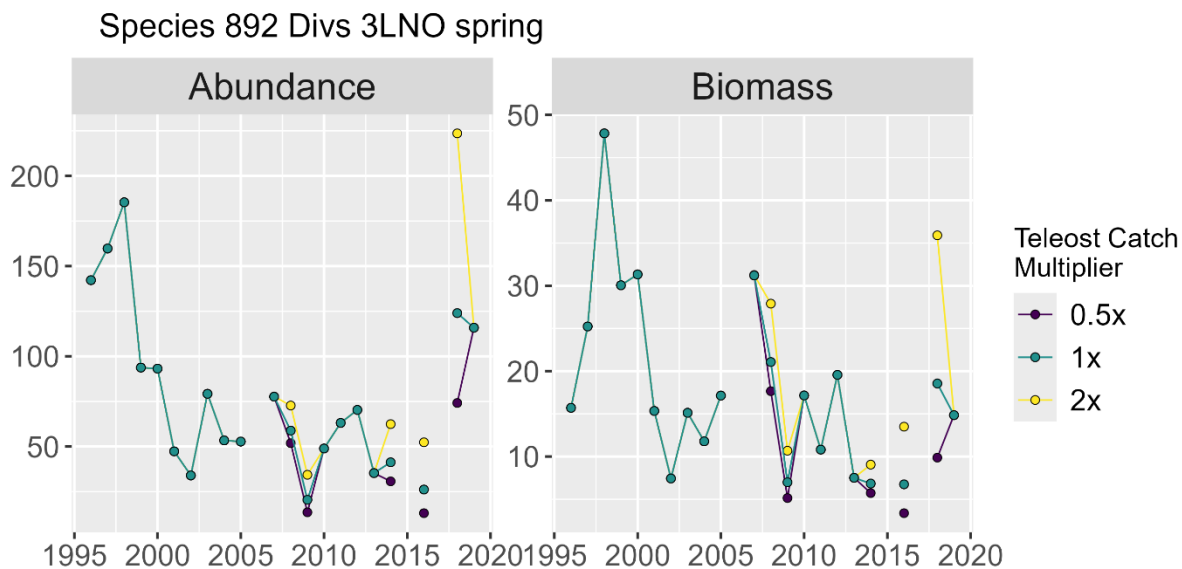


Figure 78. Sensitivity run adjusting spring CCGS Teleost catches of Greenland halibut in NAFO Div. 3LNO by 0.5x (purple) and 2.0x (yellow) the observed catches (green) in order to explore the impact of hypothetical conversion factors on the survey time series.

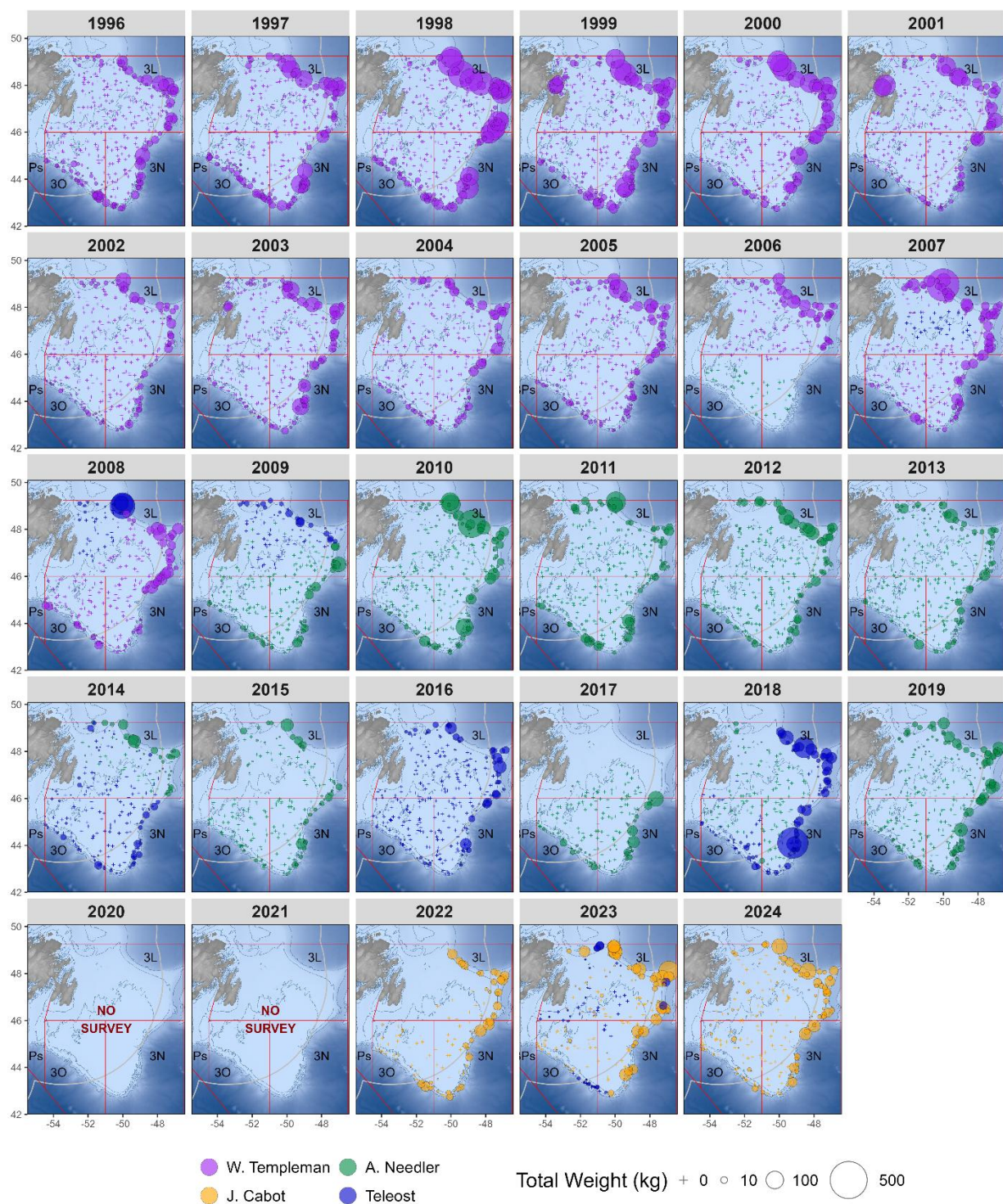


Figure 79. Spring survey catches (weight) of Greenland halibut in NAFO Divs. 3LNO. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

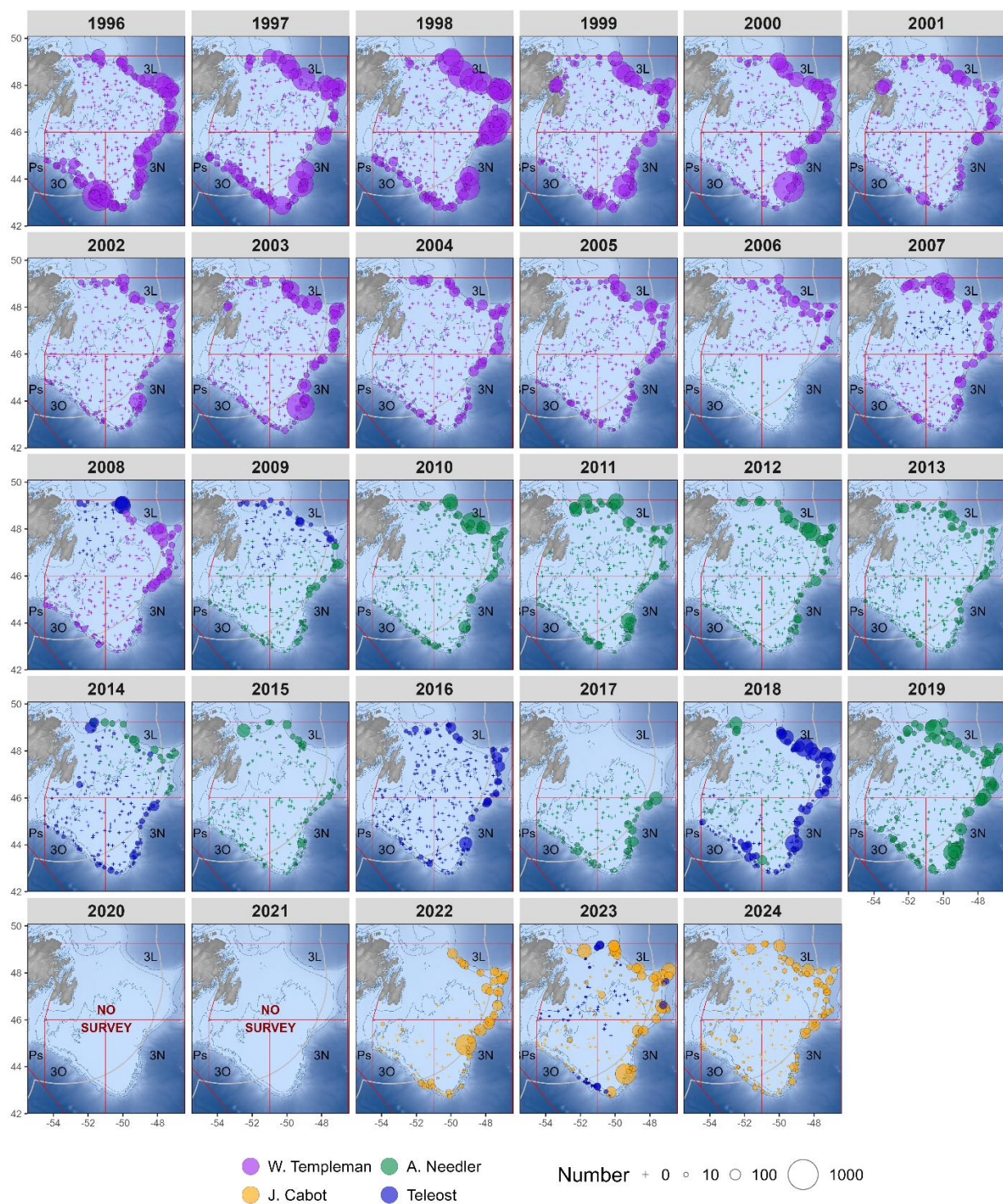


Figure 80. Spring survey catches (number) of Greenland halibut in NAFO Divs. 3LNO. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

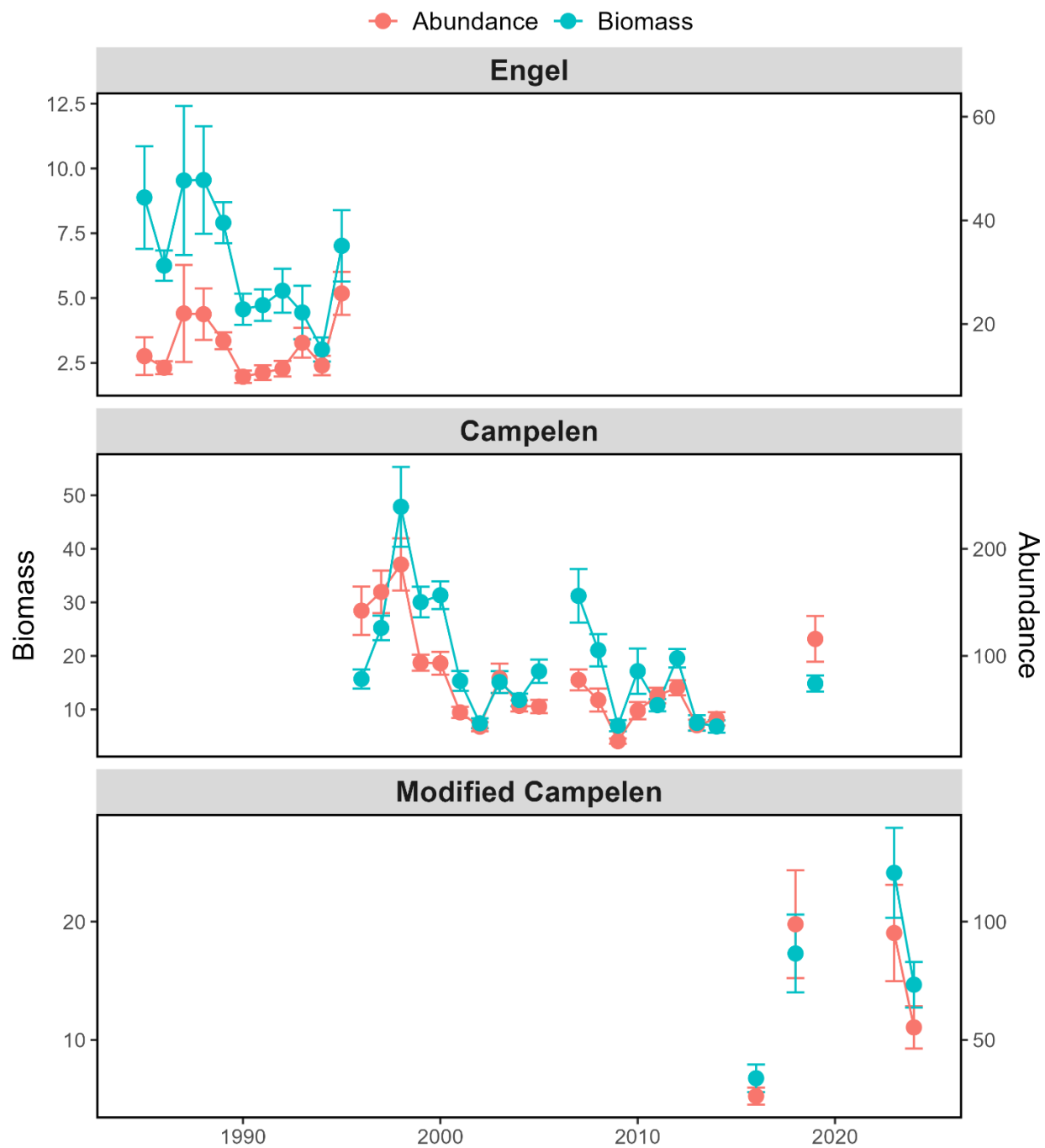


Figure 81. Recommended spring survey time series for Greenland halibut in NAFO Divs. 3LNO.

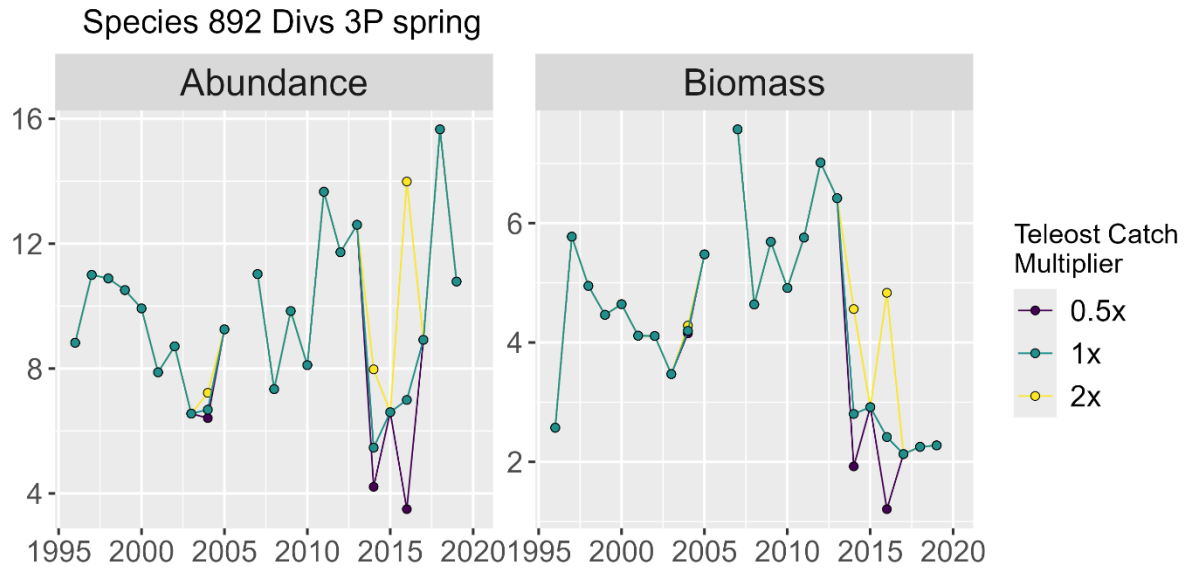


Figure 82. Sensitivity run adjusting spring CCGS Teleost catches of Greenland halibut in NAFO Subdiv. 3Ps by 0.5x (purple) and 2.0x (yellow) the observed catches (green) in order to explore the impact of hypothetical conversion factors on the survey time series.

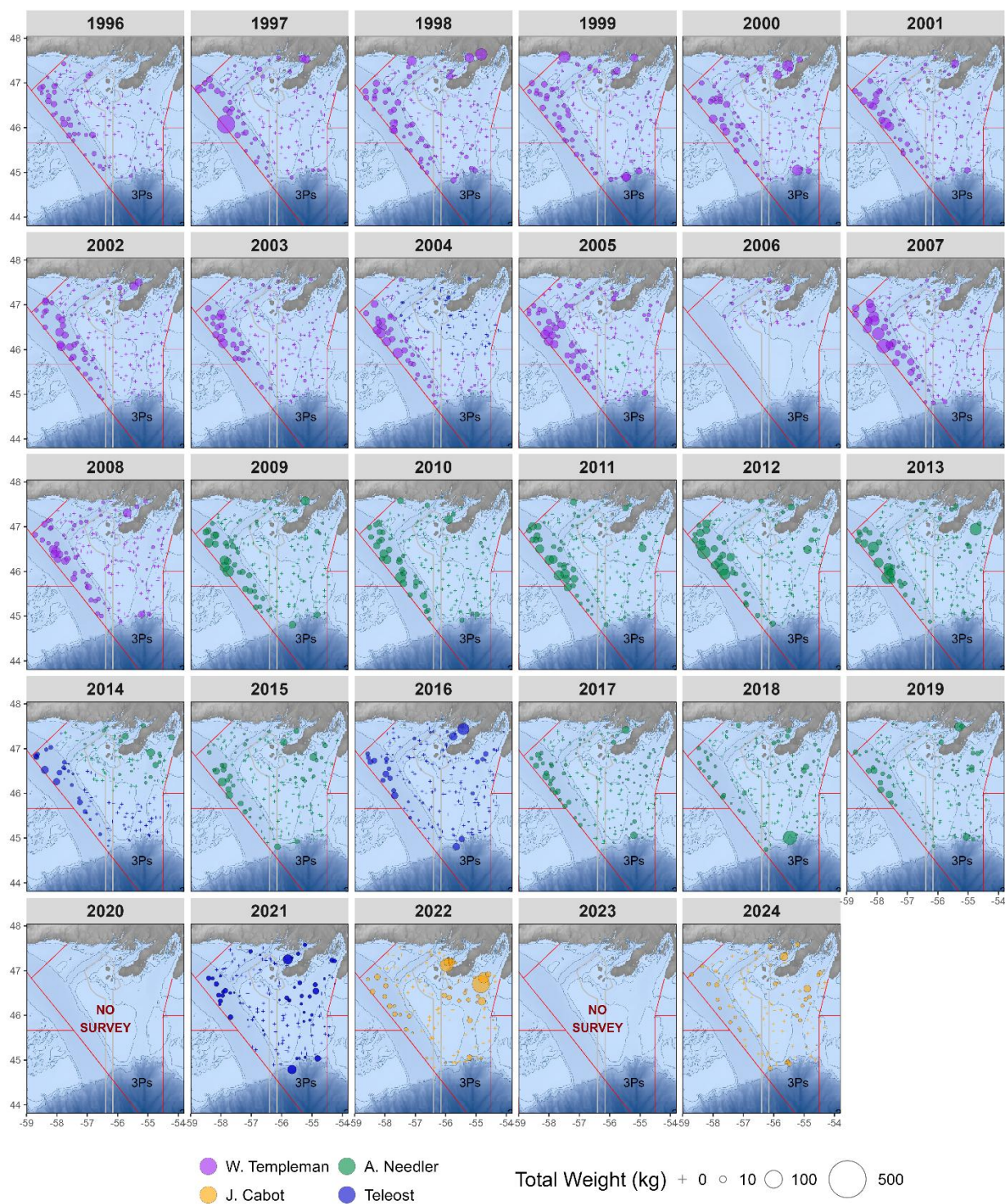


Figure 83. Spring survey catches (weight) of Greenland halibut in NAFO Subdiv. 3Ps. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

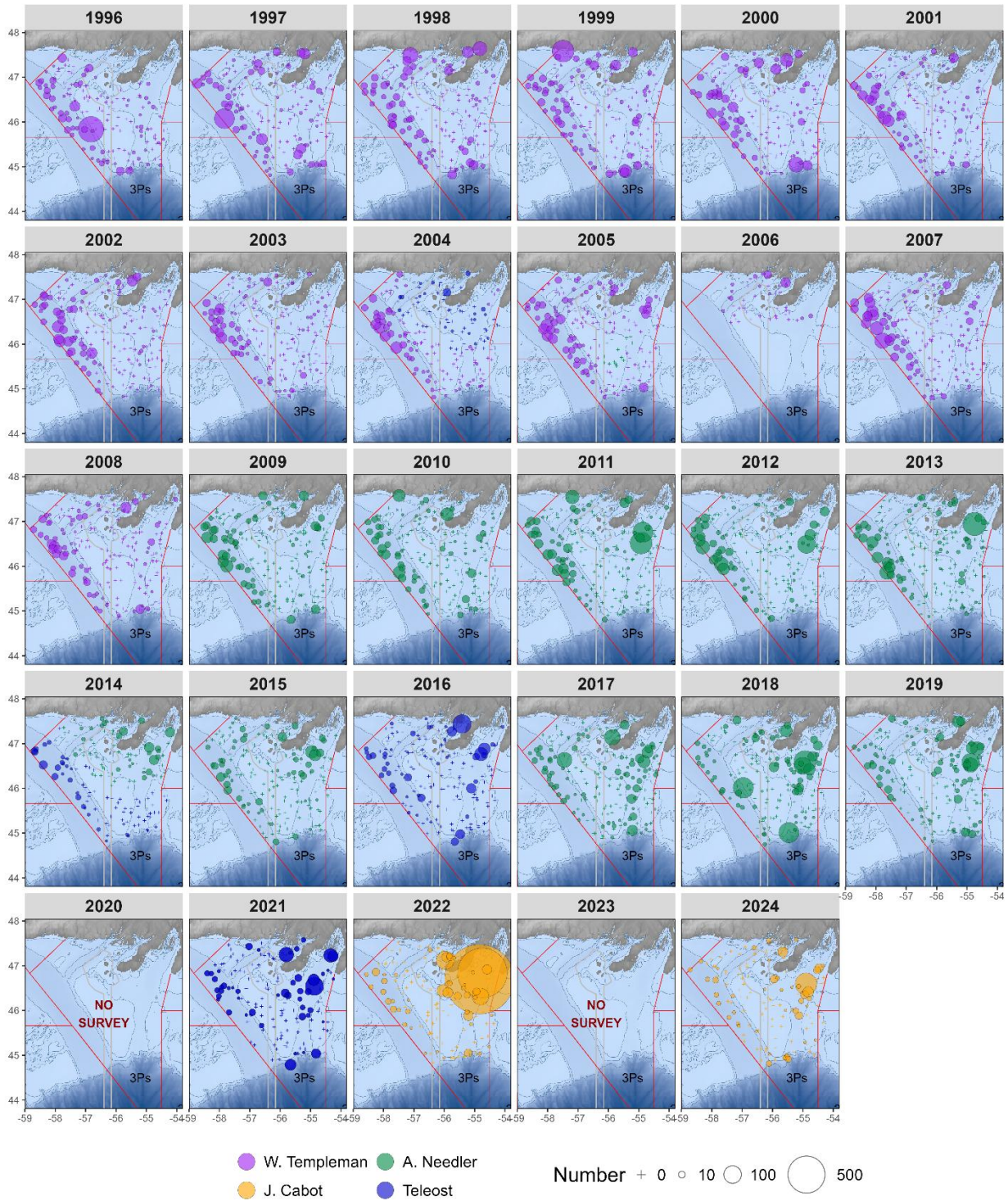


Figure 84. Spring survey catches (number) of Greenland halibut in NAFO Subdiv. 3Ps. Catches are colour-coded by research vessel and are not necessarily directly comparable between vessels.

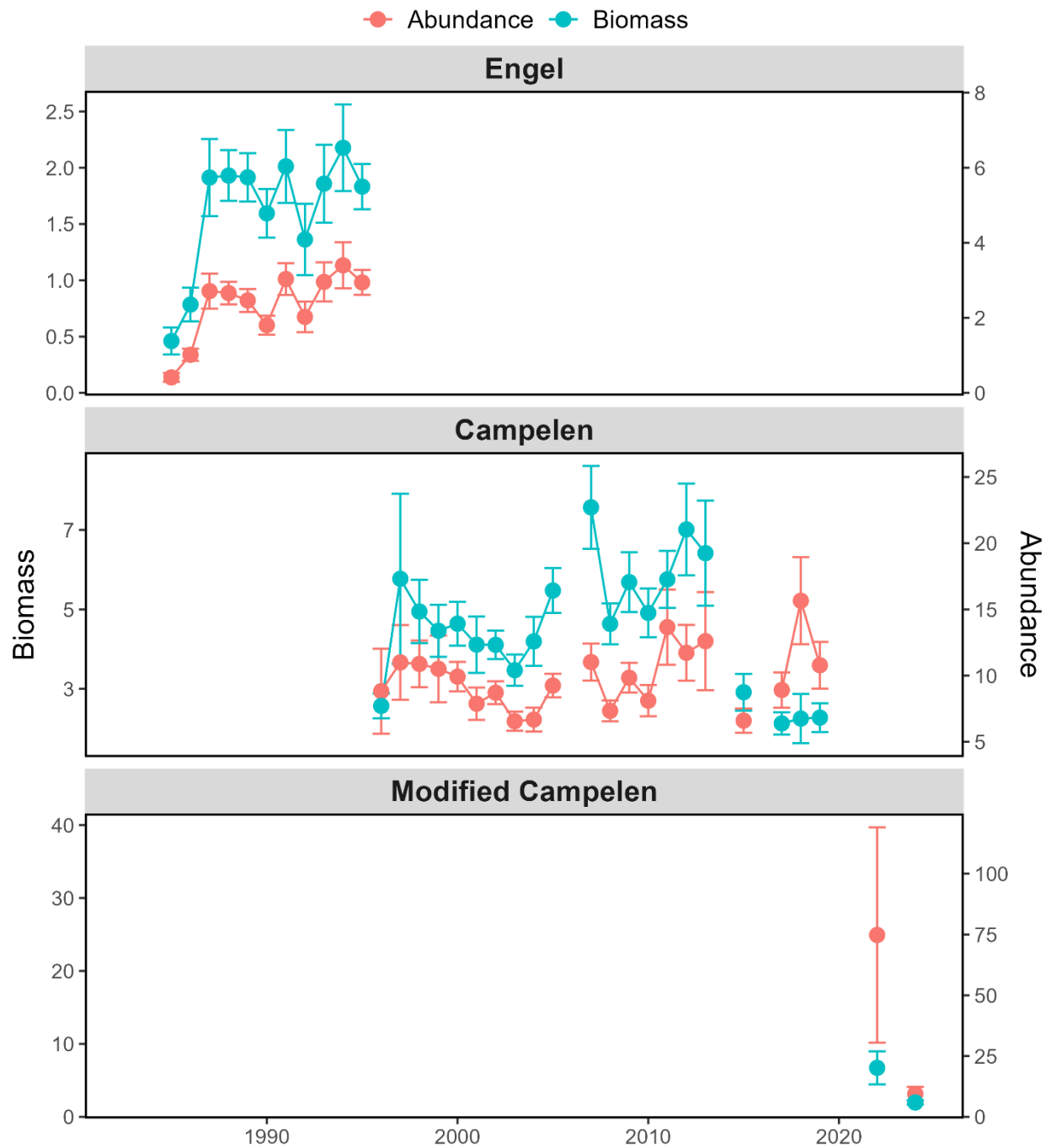


Figure 85. Recommended spring survey time series for Greenland halibut in NAFO Subdiv. 3Ps.