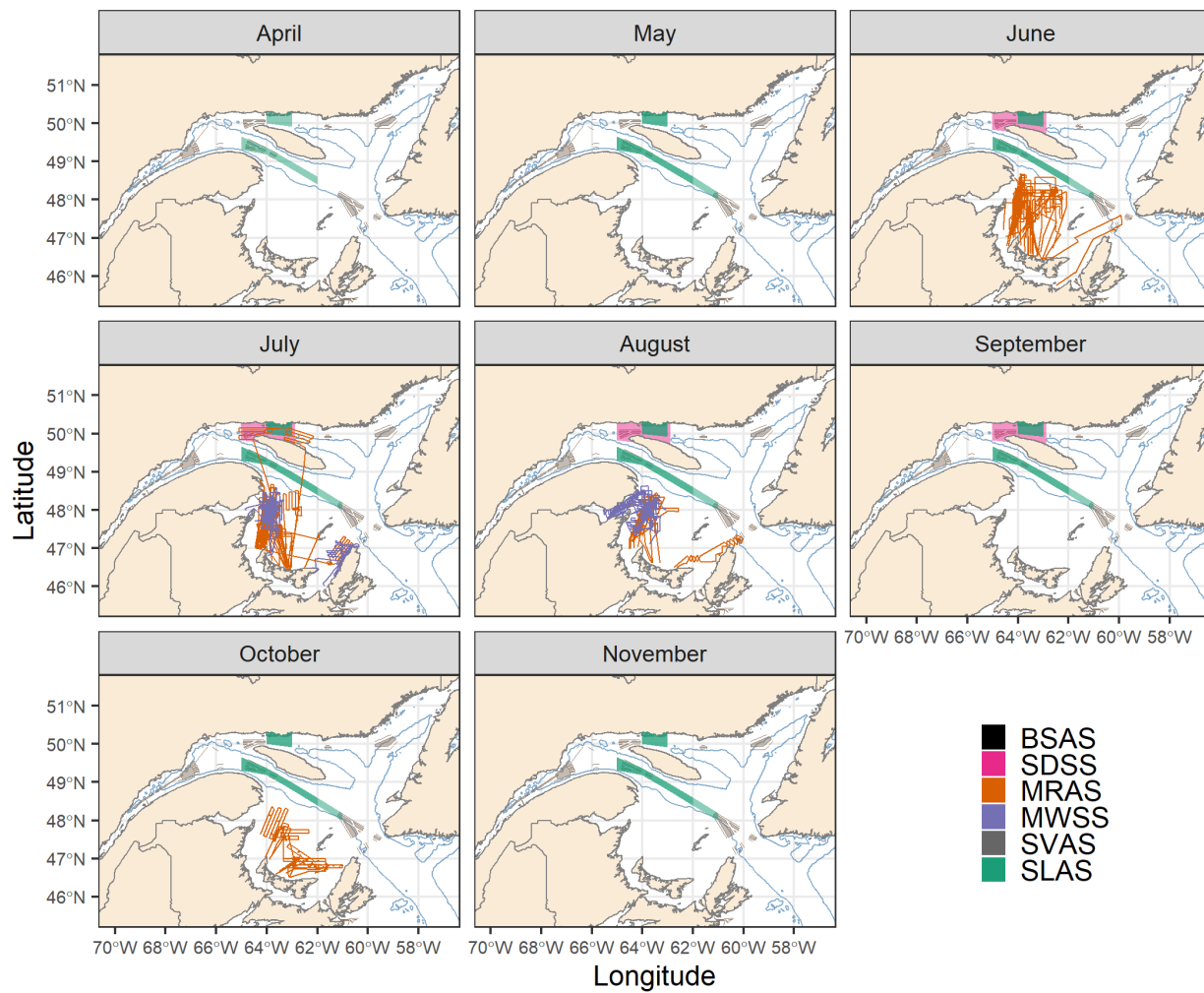


Supplement 1

A



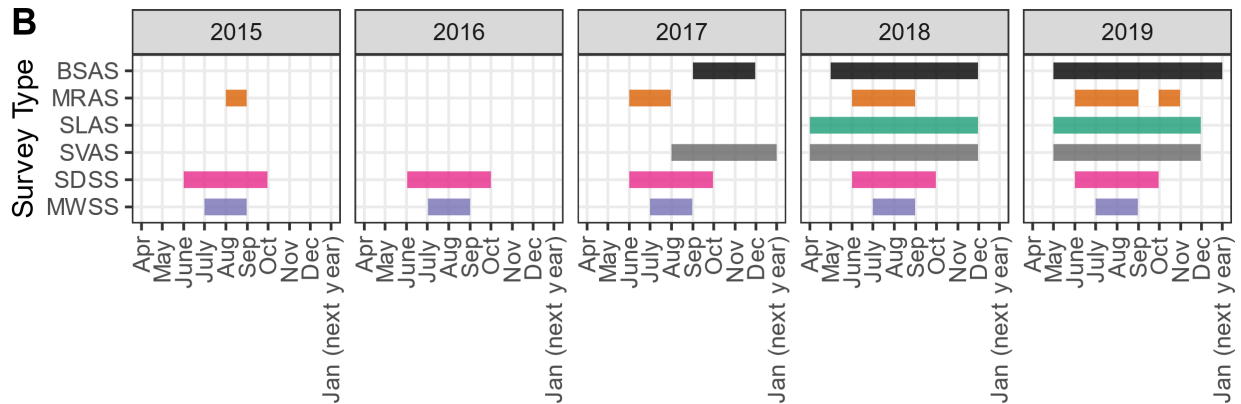


Fig. S1.

Effort details for the different dedicated right whale survey efforts in the GSL that contributed photo data to this study, 2015–2019. Aerial surveys included broad-scale (BSAS), mark-recapture (MRAS), surveillance in the shipping lanes and corridor (SLAS), and surveillance throughout the entire GSL (SVAS). Shipboard surveys included single-day shipboard surveys (SDSS), and multi-week shipboard surveys (MWSS). The 2019 data used in this study only includes data from BSAS, SVAS and SLAS that occurred before June, in September, and after October.

- A) Available monthly effort details including all trackline data for MRAS, trackline data for the MWSS efforts included in this study, and general target areas for SDSS and SLAS efforts. For effort details on BSAS and SVAS efforts, see DFO (2020) and Johnson (2018).
- B) Yearly timelines indicating the months when the different dedicated surveys occurred.

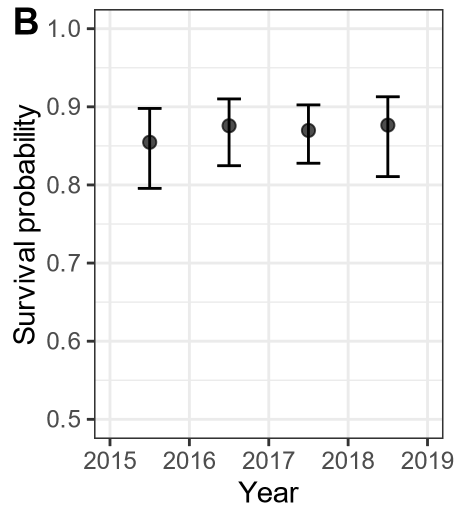


Fig. S2. Model averaged estimates of survival probability across all years (2015–2019).

Results

Goodness of fit results for each dataset used to estimate abundance.

```
library(R2ucare)

GOF_CJS<-function(x){

  n<-as.matrix(x[1])
  n[n==0]<-1

  overall_gof<-overall_CJS(as.matrix(x), n)
  trap<-test2ct(as.matrix(x), n) # test of trap dependence
  trans<-test3sr(as.matrix(x), n) # test of transience
  # tests of over-dispersion
  od1<-test2cl(as.matrix(x), n)
  od2<-test3sm(as.matrix(x), n)

  list(overall_gof=overall_gof,trap=trap,trans=trans,od1=od1,od2=od2)
}

#MRAS 2017
GOF_CJS(ch.MRAS17)

## $overall_gof
##                chi2 degree_of_freedom p_value
## Gof test for CJS model: 4.64                4    0.326
##
## $trap
## $trap$test2ct
##      stat      df      p_val sign_test
##    1.208    1.000    0.272   -1.099
##
## $trap$details
## component dof  stat p_val signed_test test_perf
## 1          2   1 1.208 0.272   -1.099 Chi-square
##
##
## $trans
## $trans$test3sr
##      stat      df      p_val sign_test
##    2.782    2.000    0.249    0.115
##
## $trans$details
## component stat p_val signed_test test_perf
## 1          2 1.582 0.209    1.258 Chi-square
## 2          3   1.2 0.273   -1.095 Chi-square
##
##
## $od1
```

```

## $od1$test2cl
##  stat    df p_val
##    0     0   1
##
## $od1$details
##  component dof stat p_val test_perf
## 1         2  0   0   0      None
##
##
## $od2
## $od2$test3sm
##  stat    df p_val
## 0.65  1.00  0.42
##
## $od2$details
##  component stat df p_val test_perf
## 1         2 0.65  1  0.42 Chi-square
## 2         3  0   0   0      None

```

#MRAS 2018
GOF_CJS(ch.MRAS18)

```

## $overall_gof
##
##                                chi2 degree_of_freedom p_value
## Gof test for CJS model: 23.815                                19  0.203
##
## $trap
## $trap$test2ct
##  stat      df      p_val sign_test
##  8.970    4.000    0.062   -0.346
##
## $trap$details
##  component dof  stat p_val signed_test test_perf
## 1         2   1 2.446 0.118     1.564 Chi-square
## 2         3   1 0.191 0.662    -0.437 Chi-square
## 3         4   1 5.949 0.015    -2.439 Chi-square
## 4         5   1 0.384 0.536     0.62  Chi-square
##
##
## $trans
## $trans$test3sr
##  stat      df      p_val sign_test
##  2.443    4.000    0.655    0.785
##
## $trans$details
##  component stat p_val signed_test test_perf
## 1         2 0.434 0.51    -0.659   Fisher
## 2         3 1.012 0.315    1.006   Fisher
## 3         4 0.565 0.452     0.752   Fisher
## 4         5 0.432 0.511     0.657 Chi-square

```

```

## 5          6          0          0          0          None
##
##
## $od1
## $od1$test2cl
##   stat      df  p_val
## 11.503  5.000  0.042
##
## $od1$details
##   component dof  stat p_val  test_perf
## 1           2   2 6.346 0.042 Chi-square
## 2           3   2 4.917 0.086 Chi-square
## 3           4   1 0.24 0.624 Fisher
##
##
## $od2
## $od2$test3sm
##   stat      df  p_val
## 0.899  6.000  0.989
##
## $od2$details
##   component  stat df  p_val  test_perf
## 1           2 0.215  3 0.975 Chi-square
## 2           3 0.366  1 0.545 Chi-square
## 3           4 0.316  1 0.574 Fisher
## 4           5 0.002  1 0.968 Chi-square
## 5           6      0  0      0      None

#MRAS 2019
GOF_CJS(ch.MRAS19)

## $overall_gof
##
##                               chi2 degree_of_freedom p_value
## Gof test for CJS model: 22.638                               20  0.307
##
## $trap
## $trap$test2ct
##   stat      df      p_val sign_test
##   7.893    5.000    0.162   -1.411
##
## $trap$details
##   component dof  stat p_val signed_test  test_perf
## 1           2   1  2.73 0.099   -1.652 Chi-square
## 2           3   1 0.358  0.55   -0.598 Chi-square
## 3           4   1 0.109 0.742   -0.33 Chi-square
## 4           5   1 3.214 0.073   -1.793 Chi-square
## 5           6   1 1.482 0.223    1.217 Chi-square
##
##
## $trans

```

```

## $trans$test3sr
##      stat      df      p_val sign_test
##      7.474     6.000     0.279    0.432
##
## $trans$details
##  component  stat p_val signed_test  test_perf
## 1          2     0     1           0     Fisher
## 2          3 3.114 0.078     -1.765 Chi-square
## 3          4 3.403 0.065      1.845     Fisher
## 4          5     0     1           0     Fisher
## 5          6 0.957 0.328      0.978     Fisher
## 6          7     0     1           0     Fisher
##
##
## $od1
## $od1$test2cl
##  stat  df p_val
## 6.520 4.000 0.164
##
## $od1$details
##  component dof  stat p_val  test_perf
## 1          2   1 1.597 0.206     Fisher
## 2          3   1 1.518 0.218     Fisher
## 3          4   1 3.333 0.068 Chi-square
## 4          5   1 0.072 0.789 Chi-square
##
##
## $od2
## $od2$test3sm
##  stat  df p_val
## 0.751 5.000 0.980
##
## $od2$details
##  component  stat df p_val  test_perf
## 1          2 0.001 1 0.972 Chi-square
## 2          3 0.75 2 0.687 Chi-square
## 3          4 0 1 1     Fisher
## 4          5 0 1 1     Fisher
## 5          6 0 0 0     None
## 6          7 0 0 0     None

#ALL data 2017
GOF_CJS(ch.alldata_s17)

## $overall_gof
##                                chi2 degree_of_freedom p_value
## Gof test for CJS model: 4.811                                4 0.307
##
## $trap
## $trap$test2ct

```

```

##      stat      df      p_val sign_test
##      1.060    1.000    0.303   -1.030
##
## $trap$details
## component dof stat p_val signed_test test_perf
## 1          2    1 1.06 0.303        -1.03 Chi-square
##
##
## $trans
## $trans$test3sr
##      stat      df      p_val sign_test
##      1.492    2.000    0.474    0.356
##
## $trans$details
## component stat p_val signed_test test_perf
## 1          2 1.162 0.281        1.078 Chi-square
## 2          3 0.33 0.566        -0.574 Chi-square
##
##
## $od1
## $od1$test2cl
## stat df p_val
## 0    0    1
##
## $od1$details
## component dof stat p_val test_perf
## 1          2 0    0    0        None
##
##
## $od2
## $od2$test3sm
## stat df p_val
## 2.259 1.000 0.133
##
## $od2$details
## component stat df p_val test_perf
## 1          2 2.259 1 0.133 Chi-square
## 2          3    0 0    0        None

#ALL data 2018
GOF_CJS(ch.alldata_s18)

## $overall_gof
##                                chi2 degree_of_freedom p_value
## Gof test for CJS model: 25.749                                18 0.106
##
## $trap
## $trap$test2ct
##      stat      df      p_val sign_test
##      10.580    4.000    0.032   -0.210

```



```
## $overall_gof
##                               chi2 degree_of_freedom p_value
## Gof test for CJS model: 22.205                19    0.274
##
## $trap
## $trap$test2ct
##      stat      df      p_val sign_test
##      8.225    5.000    0.144   -1.054
##
## $trap$details
##  component dof  stat p_val signed_test test_perf
## 1         2   1 0.688 0.407    -0.829 Chi-square
## 2         3   1 0.519 0.471    -0.72  Chi-square
## 3         4   1 0.505 0.477    -0.711 Chi-square
## 4         5   1 3.431 0.064    -1.852 Chi-square
## 5         6   1 3.082 0.079     1.756 Chi-square
##
##
## $trans
## $trans$test3sr
##      stat      df      p_val sign_test
##      3.847    6.000    0.697    1.316
##
## $trans$details
##  component  stat p_val signed_test test_perf
## 1         2     0     1           0     Fisher
## 2         3 0.211 0.646    -0.459     Fisher
## 3         4 1.709 0.191     1.307     Fisher
## 4         5  0.51 0.475     0.714     Fisher
## 5         6 0.936 0.333     0.967     Fisher
## 6         7 0.481 0.488     0.694     Fisher
##
##
## $od1
## $od1$test2cl
##  stat  df p_val
## 6.602 4.000 0.158
##
## $od1$details
##  component dof  stat p_val test_perf
## 1         2   1 1.465 0.226     Fisher
## 2         3   1 3.637 0.057     Fisher
## 3         4   1  1.5 0.221 Chi-square
## 4         5   1   0     1     Fisher
##
##
## $od2
## $od2$test3sm
##  stat  df p_val
## 3.531 4.000 0.473
```

```

##
## $od2$details
##   component  stat df p_val  test_perf
## 1           2 0.291  1 0.59 Chi-square
## 2           3 2.434  1 0.119 Chi-square
## 3           4 0.806  1 0.369 Fisher
## 4           5 0      1 1      Fisher
## 5           6 0      0 0      None
## 6           7 0      0 0      None

#ALL years
GOF_CJS(ch.allyears)

## $overall_gof
##                               chi2 degree_of_freedom p_value
## Gof test for CJS model: 4.346                               7 0.739
##
## $trap
## $trap$test2ct
##   stat      df      p_val sign_test
##   1.118    2.000    0.572    0.747
##
## $trap$details
##   component dof  stat p_val signed_test test_perf
## 1           2  1 1.118 0.29      1.057 Fisher
## 2           3  1 0      1      0      Fisher
##
##
## $trans
## $trans$test3sr
##   stat      df      p_val sign_test
##   1.228    3.000    0.746    0.471
##
## $trans$details
##   component  stat p_val signed_test  test_perf
## 1           2 0.273 0.601    -0.522 Fisher
## 2           3 0.246 0.62     0.496 Chi-square
## 3           4 0.709 0.4      0.842 Fisher
##
##
## $od1
## $od1$test2cl
##   stat  df p_val
##   0     0  1
##
## $od1$details
##   component dof  stat p_val test_perf
## 1           2  0     0     0      None
##
##

```

```
## $od2
## $od2$test3sm
## stat df p_val
## 2.000 2.000 0.368
##
## $od2$details
## component stat df p_val test_perf
## 1 2 0.329 1 0.566 Fisher
## 2 3 1.671 1 0.196 Chi-square
## 3 4 0 0 0 None
```

LITERATURE CITED

- DFO (Department of Fisheries and Oceans) (2020) Updated information on the distribution of North Atlantic Right Whale in Canadian waters. DFO Can Sci Advis Sec Sci Advis Rep 2020/037.
- Gimenez O, Lebreton J-D, Choquet R, Pradel R (2018) R2ucare: An r package to perform goodness-of-fit tests for capture–recapture models. *Methods Ecol Evol* 9:1749–1754. doi: 10.1111/2041-210X.13014
- Johnson HD (2018) WhaleMap. <https://whalemap.ocean.dal.ca/>. [date accessed: 2020-11-25].