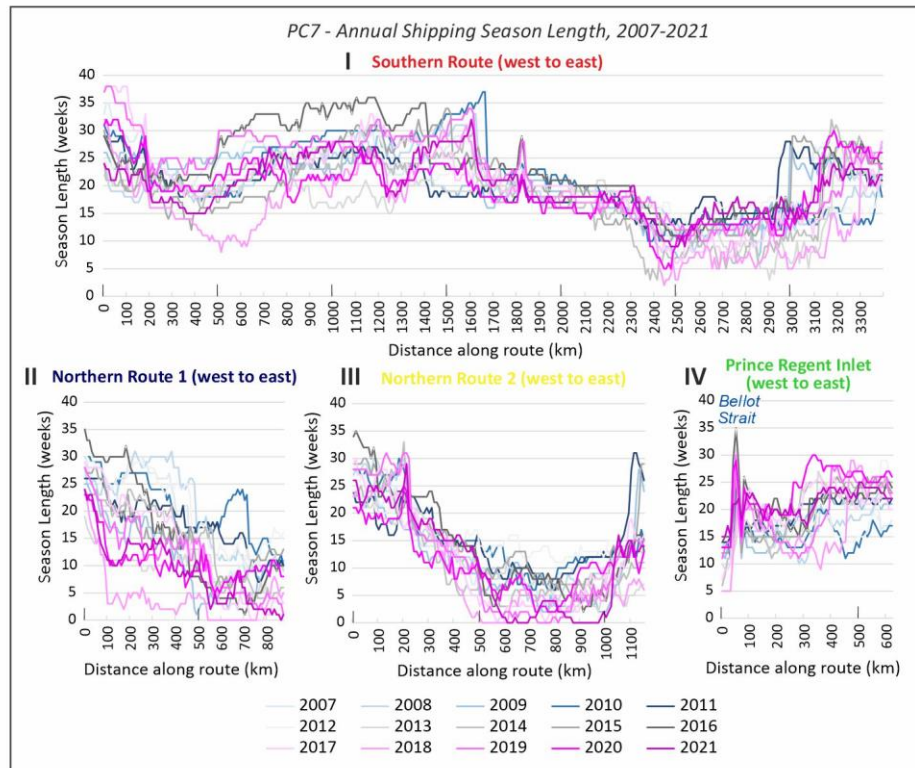
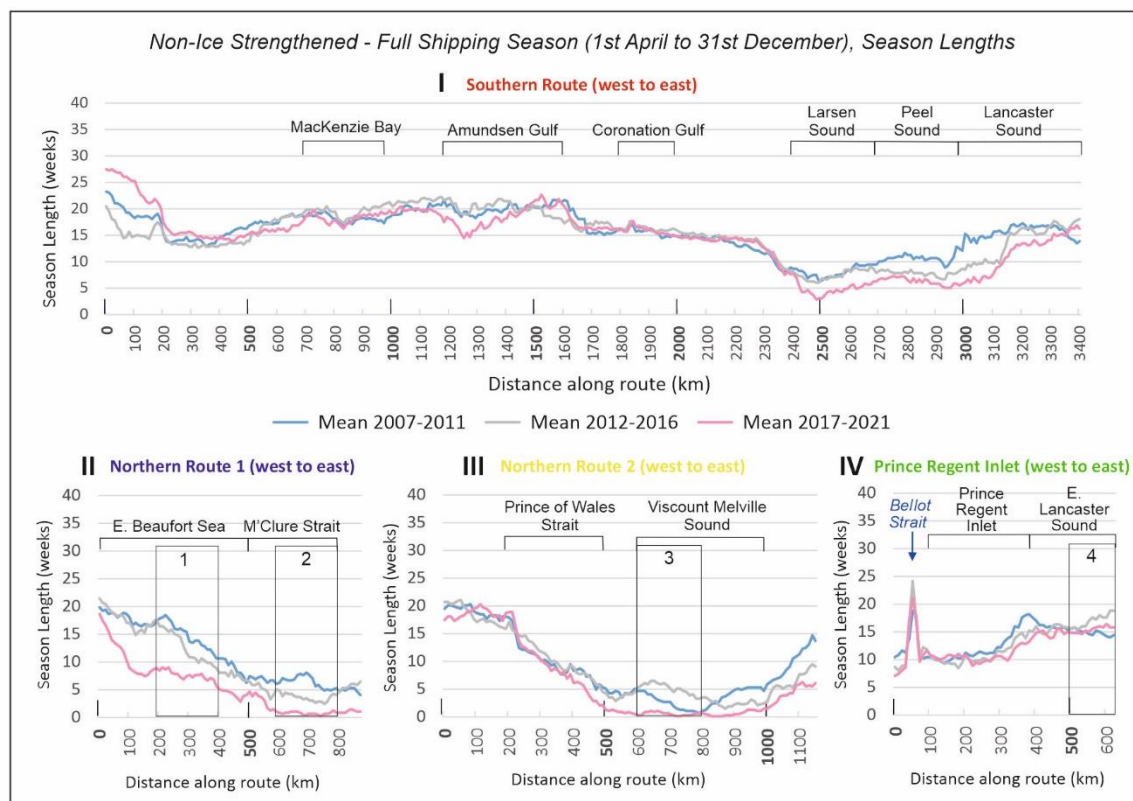


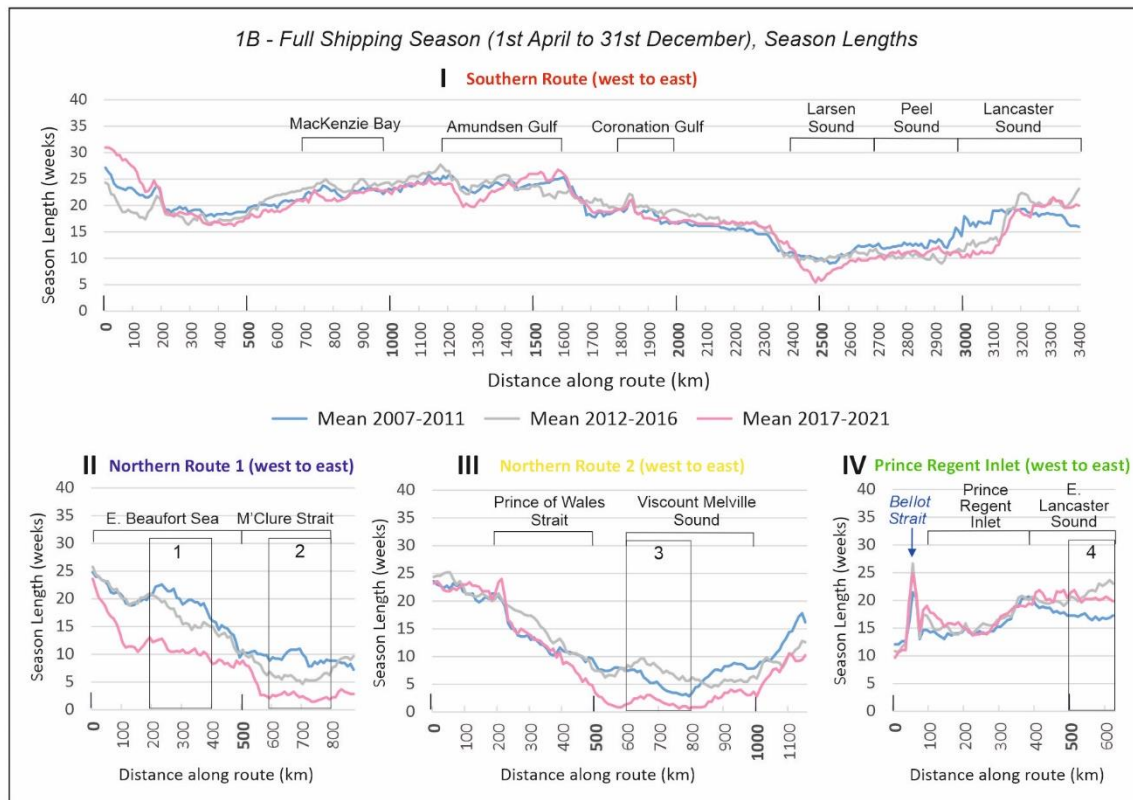
Supplementary Information



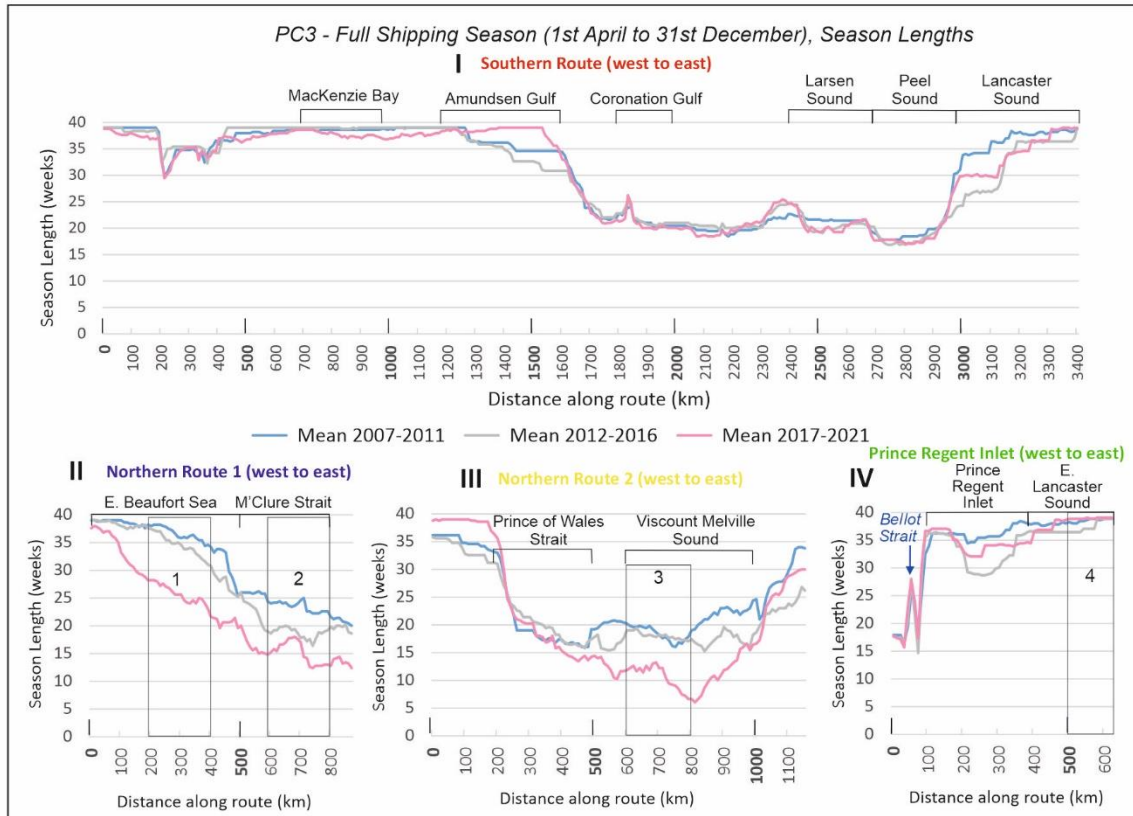
Supplementary Figure 1: Annual Season Lengths for Ice Class PC7 vessels along NWP routes (see Fig. 2a for route locations), ranging from 2007 (pale blue) to 2021 (medium pink). Graphs I to IV are marked as routes I-IV on Fig 2a, and each graph x-axis is the distance along the route from west to east.



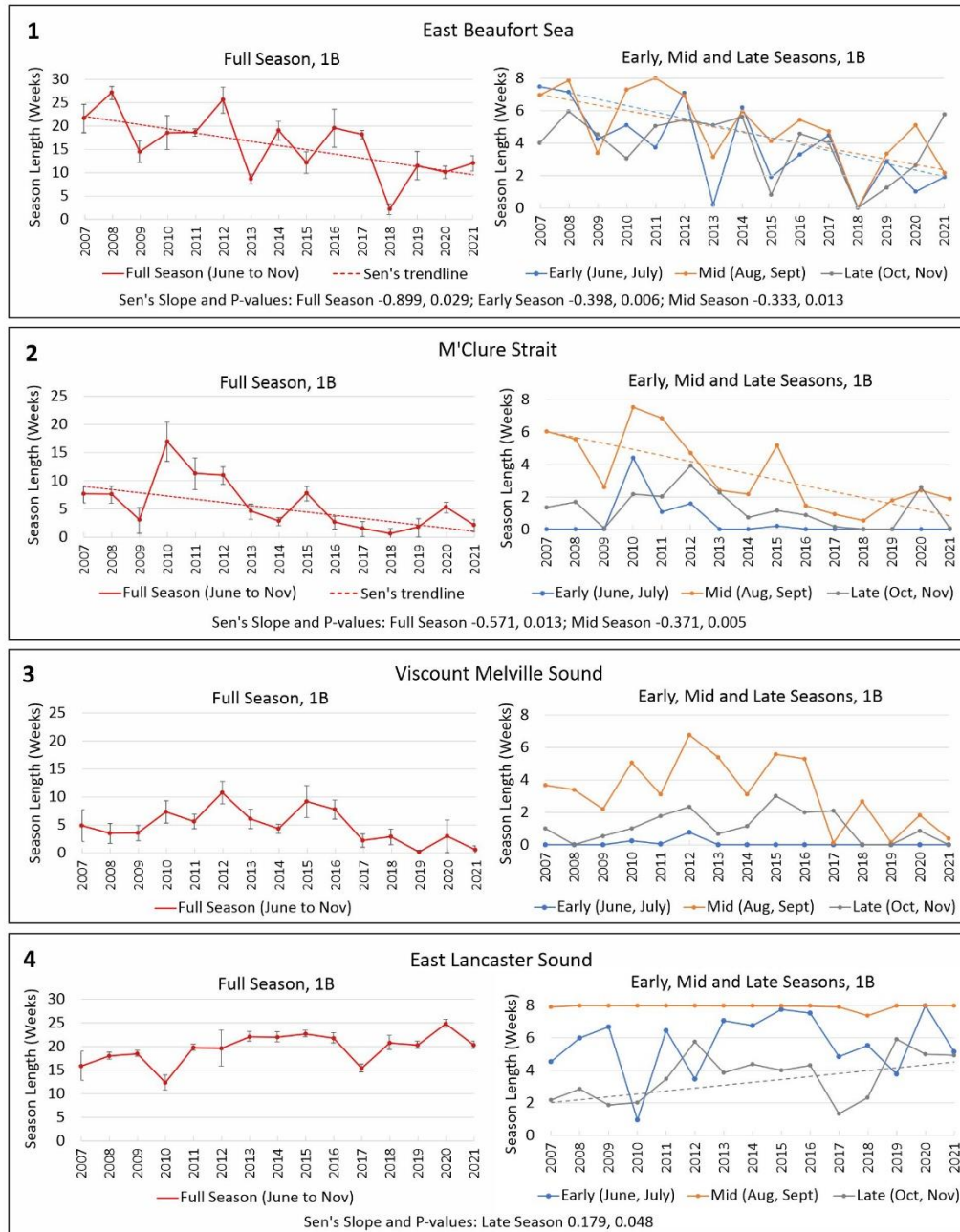
Supplementary Figure 2: Graphs showing 5-year mean shipping season lengths for Non-Ice Strengthened (Non IS) Vessels along the four NWP routes (graphs I-IV are marked as routes I-IV on Fig. 2a), where the mean 2007-2011 values are blue, 2012-2016 are grey and 2017-2021 are pink. Each graph x-axis is the distance along the route from west to east, and place names and distances can be located on the map. The numbered boxes (1 to 4) are where the 5-year groups ANOVA P-value is < 0.05 , which are located as white dashed lines on the map with their corresponding numbers.



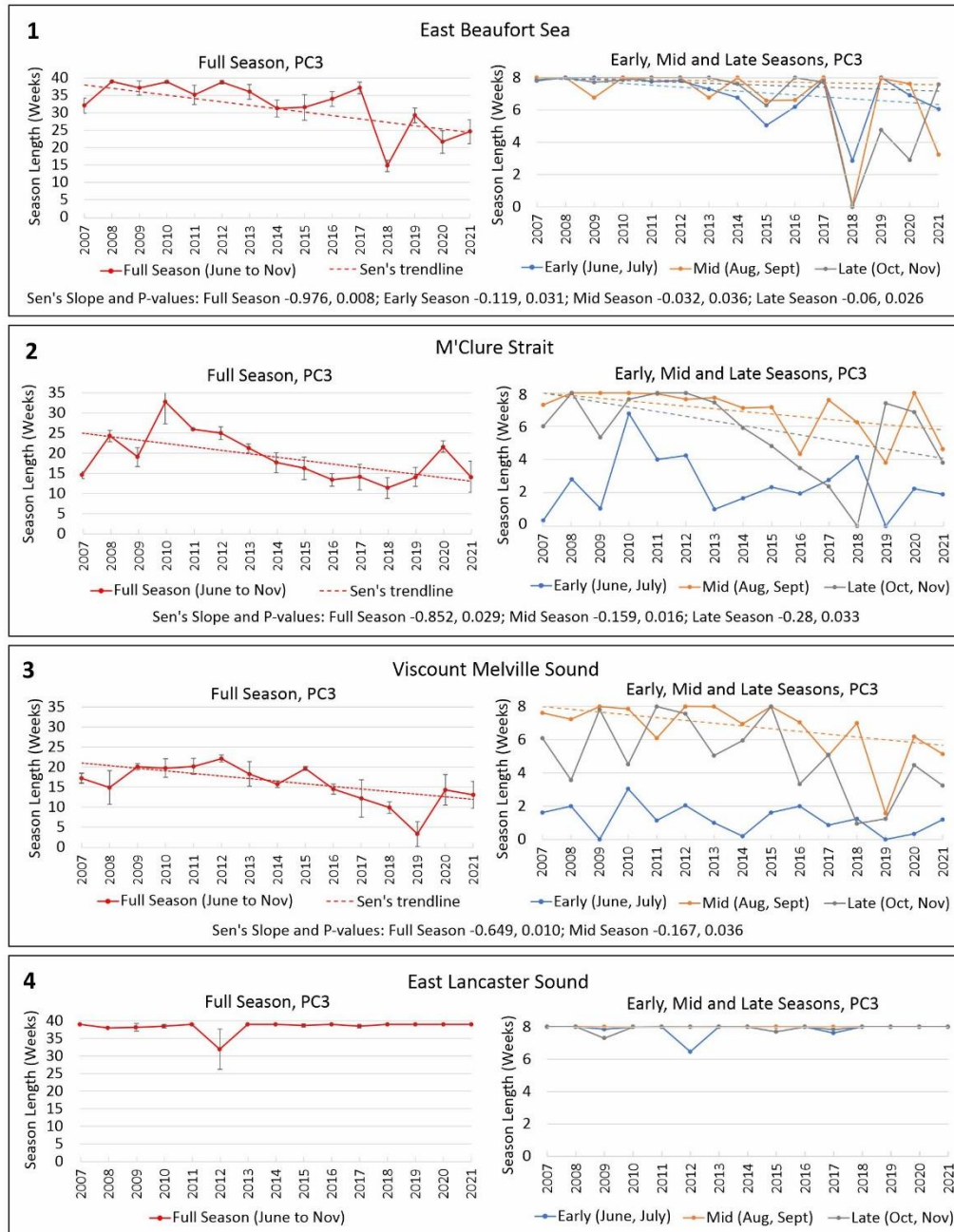
Supplementary Figure 3: Graphs showing 5-year mean shipping season lengths for Ice Class 1B (low ice strength) vessels along the four NWP routes (graphs I-IV are marked as routes I-IV on Fig. 2a), where the mean 2007-2011 values are blue, 2012-2016 are grey and 2017-2021 are pink. Each graph x-axis is the distance along the route from west to east, and place names and distances can be located on the map. The numbered boxes (1 to 4) are where the 5-year groups ANOVA P-value is < 0.05 , which are located as white dashed lines on the map with their corresponding numbers.



Supplementary Figure 4: Graphs showing 5-year mean shipping season lengths for PC3 (high ice strength) vessels along the four NWP routes (graphs I-IV are marked as routes I-IV on Fig. 2a), where the mean 2007-2011 values are blue, 2012-2016 are grey and 2017-2021 are pink. Each graph x-axis is the distance along the route from west to east, and place names and distances can be located on the map. The numbered boxes (1 to 4) are where the 5-year groups ANOVA P-value is < 0.05 , which are located as white dashed lines on the map with their corresponding numbers.



Supplementary Figure 5: The four route sections where mean trends are statistically significant (locations shown on Fig. 2a): per year, the number of weeks that Ice Class 1B ships could operate normally, for full season (up to 39 weeks) and early, mid and late seasons (up to 8 weeks each). Error bars are standard deviation of the mean values along the 200 km sections for sections 1-3, and along the 120 km for section 4, at 10 km intervals. Linear trendlines are shown where the P-value < 0.05.



Supplementary Figure 6: The four route sections where mean trends are statistically significant (locations shown on Fig. 2a): per year, the number of weeks that PC3 ships could operate normally, for full season (up to 39 weeks) and early, mid and late seasons (up to 8 weeks each). Error bars are standard deviation of the mean values along the 200 km sections for sections 1-3, and along the 120 km for section 4, at 10 km intervals. Linear trendlines are shown where the P-value < 0.05.