

Data for DSAF POC

Kiyomi Ferguson

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Assembled in **Prepare data for POC.R**, the **Data_SHinyApp_Proof_of_Concept** folder contains data for the temporal (and spatial where applicable*) timeseries for the 6 shift indicators, calculated based on Atlantic halibut abundance estimates from SDM output. All data have been subset to spring estimates.

1. Abundance*: total annual estimated abundance
2. Area Occupied: the total area containing 90% of the abundance
3. Abundance-Weighted Depth: the average depth, weighted by abundance, the average depth where most of the population is found, (telling us the depth preference)
4. Range Edge*: the geographical minimum (5%) and maximum (95%) of modeled abundance
5. Centre of Gravity*: the average latitude and longitude, weighted by abundance
6. Distance from COG to shared border : the shortest path (without crossing land) from the COG to the nearest point on the international border
7. Scaled Slopes: lm slopes for 2006-2023 (the period when the water began warming rapidly), scaled so that all indicators are in the same units

1. Abundance

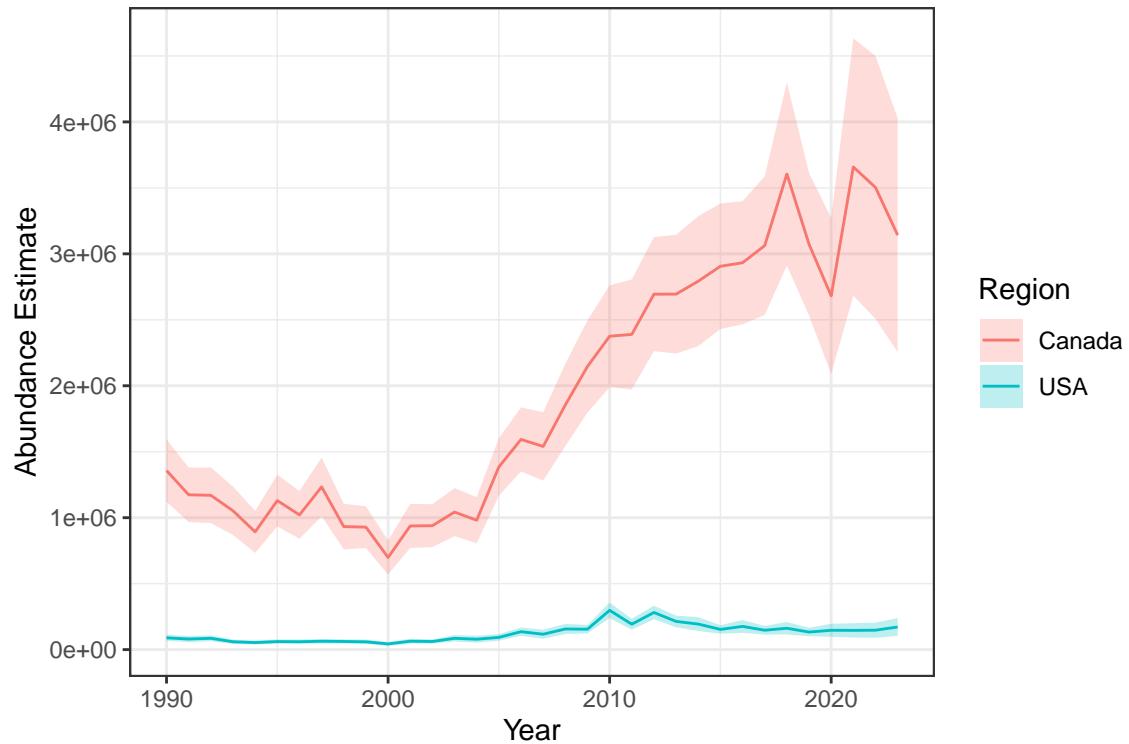
Data: POC_Abundance.csv

Total annual estimated spring-time abundance per region. Derived from indexed estimates calculated with the model run.

- Region: USA, Canada
- Year: 1990-2023
- Estimate: Total annual estimated spring-time abundance (count)
- SD: Standard Deviation
- X: Unique identifier

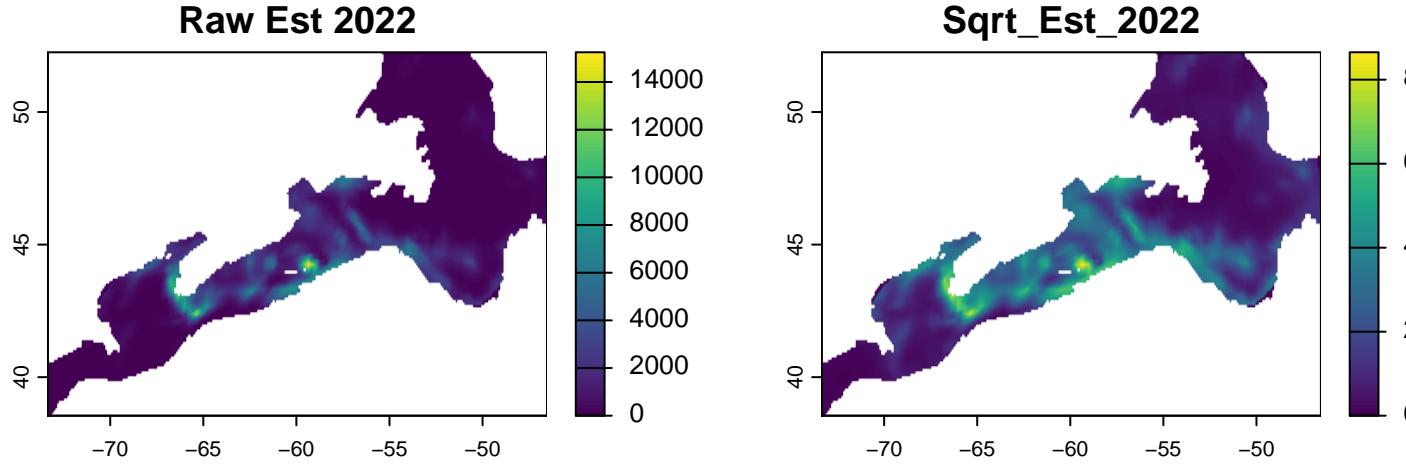
```
## 'data.frame':    68 obs. of  5 variables:  
## $ X      : int  2 3 14 15 20 21 29 30 38 39 ...  
## $ Region : chr  "USA" "Canada" "USA" "Canada" ...  
## $ Estimate: num  89419 1357352 80265 1173461 85720 ...  
## $ SD     : num  22687 236094 23520 206701 22291 ...  
## $ Year   : int  1990 1990 1991 1991 1992 1992 1993 1993 1994 1994 ...
```

Timeseries: Abundance Estimate



Annual rasters for total estimated abundance (Spring)

These are in the **EstAbundanceRasters** folder 1990-2023, for both raw and square root values. They were compiled in **EstAbundanceRasters.R**



2. Area Occupied

Data: POC_AreaOccupied.csv

The total area containing 50%, 75%, 90%, and 95% of the abundance. This calculation first took the Abundance estimates per grid location, subset for Spring, calculated the total annual spring abundance by region and year (\$TotalSpringAbundance). Next, it Calculated how much area (in km²) is needed to account for 50%, 75%, 90%, and 95% of total abundance within each Region and Year of the dataset using a running total of abundance as cells are added from highest to lowest abundance.

- Region: USA or Canada
- Year: 1990-2023
- Threshold: 50%, 75%, 90%, 95%
- Total_Abundance: Total springtime abundance in that Region and Year (sum of all cells).
- Total_Area: Total area (km²) of all grid cells in that Region and Year (cumulative running total).
- Area_Threshold: The total area (km²) required to reach that abundance threshold.
- Percent_Area_Used: The percentage of total area needed to contain the threshold proportion of abundance.
- n_cells: Number of spatial cells required to reach the threshold abundance.
- Area_Efficiency: = space used per unit of abundance... is abundance more concentrated or dispersed

```

## 'data.frame': 272 obs. of 9 variables:
## $ Region      : chr "Canada" "Canada" "Canada" "Canada" ...
## $ Year        : int 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 ...
## $ Threshold   : int 50 50 50 50 50 50 50 50 50 50 ...
## $ Area_Threshold : num 38775493 30315386 44415565 33135422 38775493 ...
## $ Total_Area  : num 7.97e+08 7.97e+08 7.97e+08 7.97e+08 7.97e+08 ...
## $ Percent_Area_Used: num 4.86 3.8 5.57 4.16 4.86 ...
## $ Total_Abundance : num 1130383 1562602 998483 927750 791192 ...
## $ n_cells     : int 55 43 63 47 55 28 47 46 58 43 ...
## $ Area_Efficiency : num 34.3 19.4 44.5 35.7 49 ...

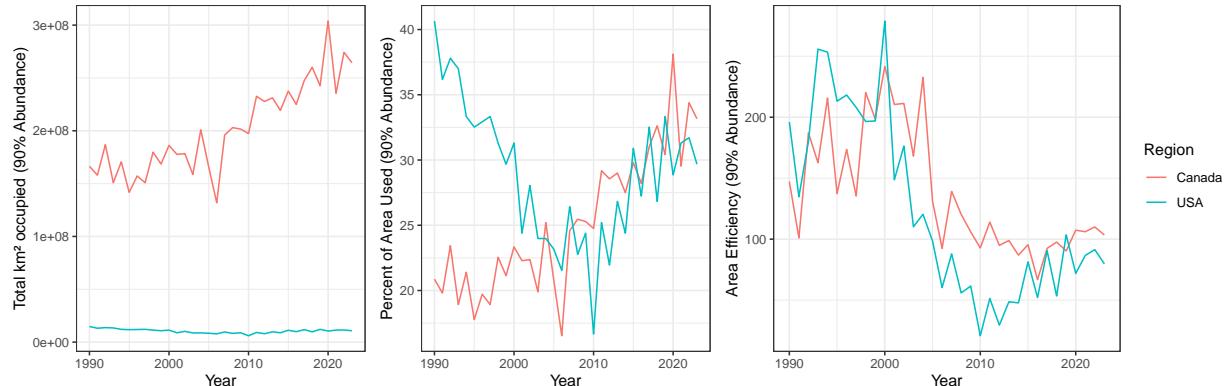
```

Timeseries : Total area occupied (90% of abundance), Percent of the total area used, Area Efficiency

```

## Ignoring unknown labels:
## * fill : "Region"
## Ignoring unknown labels:
## * fill : "Region"
## Ignoring unknown labels:
## * fill : "Region"

```



3. Abundance-Weighted Depth

Data: POC_AWD.csv

The mean, median, Q5, and Q95 depth, weighted by estimated abundance values

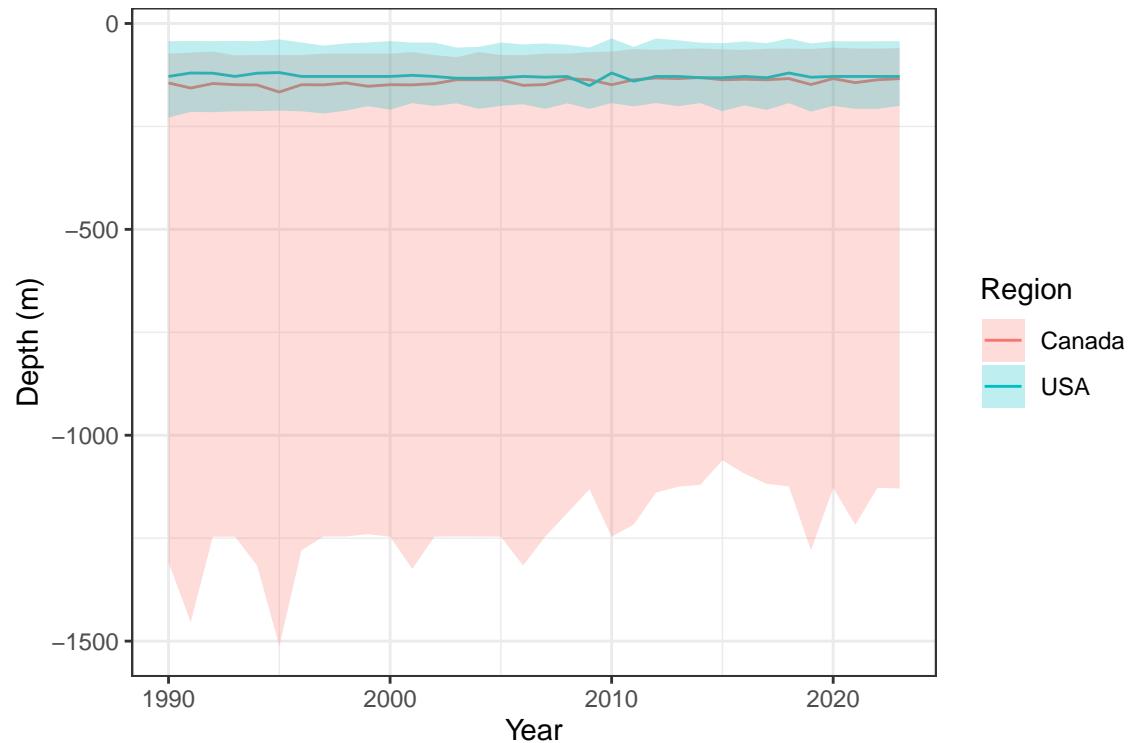
- Region: USA, Canada
- Year: 1990-2023
- Depth distribution values (m): Mean, Median, Q5, Q95

```

## 'data.frame': 68 obs. of 6 variables:
## $ Year        : int 1990 1990 1991 1991 1992 1992 1993 1993 1994 1994 ...
## $ Region      : chr "Canada" "USA" "Canada" "USA" ...
## $ Depth_Mean  : num -326 -130 -377 -124 -302 ...
## $ Depth_Median: num -144 -129 -157 -120 -146 ...
## $ Depth_Q5    : num -73.3 -42.9 -70.7 -42.5 -68.2 ...
## $ Depth_Q95   : num -1309 -229 -1454 -215 -1246 ...

```

Timeseries: Abundance-Weighted Depth



4. Range Edge

Data: POC_RangeEdge.csv

Annual location of leading and trailing edges for the entire stock. The 5th percentile (trailing edge), 50th, and 95th percentile (leading edge) of the species' spatial distribution were calculated using a weighted quantile of the coordinate values (weighted by abundance estimates).

Units are in km East/West, so here, we also convert them to a geographic coordinate system so that they can be plotted on a map (convert_km_to_wgs84)

- Year: 1990-2023
- Trailing Edge Variables (5th, USA): Estimate_km_E_quantile_0.05, Estimate_km_N_quantile_0.05, Std_Dev_km_N_quantile_0.05, Std_Dev_km_E_quantile_0.05
- Centroid Variables (50th): Estimate_km_E_quantile_0.5, Estimate_km_N_quantile_0.5, Std_Dev_km_E_quantile_0.5, Std_Dev_km_N_quantile_0.5
- Leading Edge Variables (95th, Canada): Estimate_km_E_quantile_0.95, Estimate_km_N_quantile_0.95, Std_Dev_km_E_quantile_0.95, Std_Dev_km_N_quantile_0.95

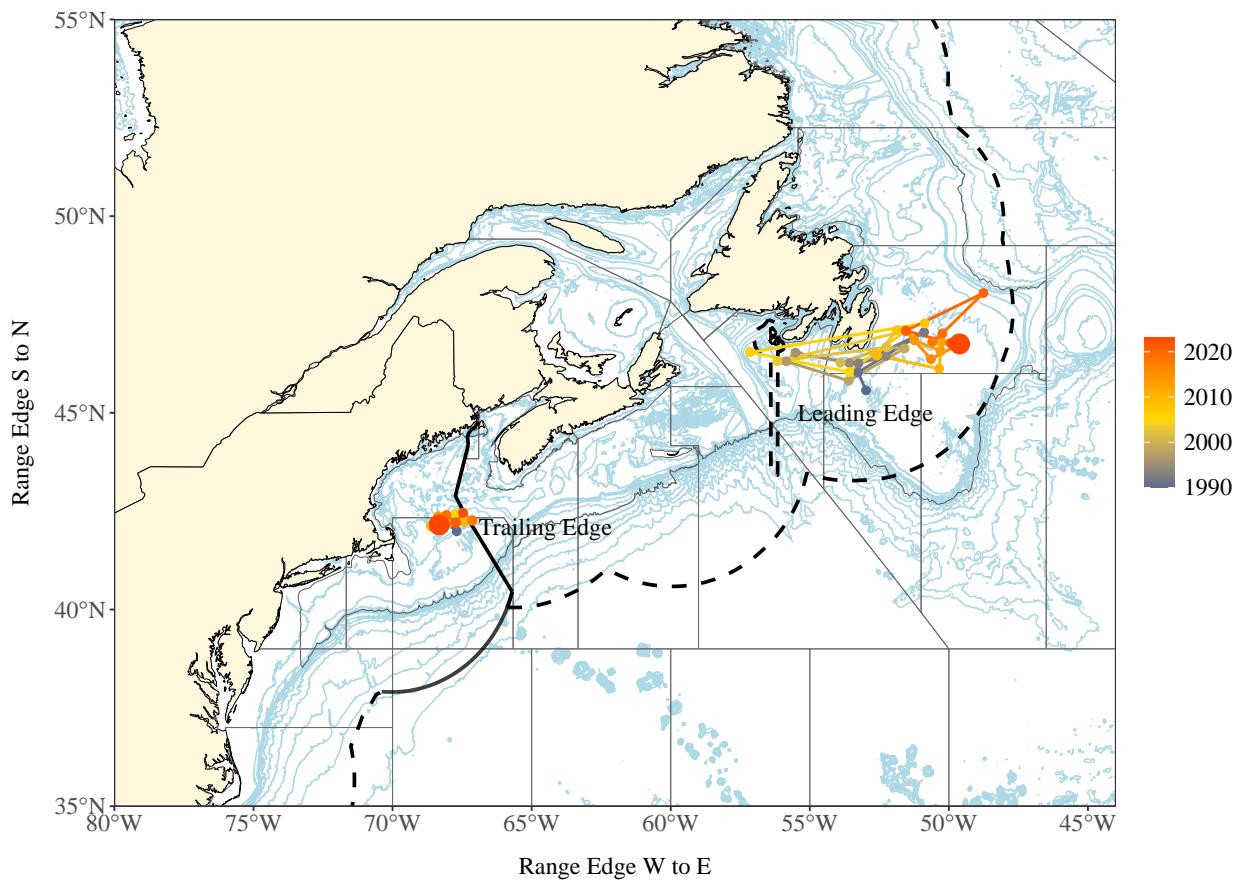
```
## 'data.frame':    34 obs. of  13 variables:
## $ Year           : int  1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 ...
## $ Estimate_km_E_quantile_0.05: num  -386 -411 -411 -436 -361 ...
## $ Estimate_km_E_quantile_0.5 : num  -136.1 113.9 38.9 63.9 38.9 ...
## $ Estimate_km_E_quantile_0.95: num  814 789 964 789 864 ...
```

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## $ Estimate_km_N_quantile_0.05: num 4704 4729 4729 4729 4729 ...
## $ Estimate_km_N_quantile_0.5 : num 4804 4854 4854 4854 4829 ...
## $ Estimate_km_N_quantile_0.95: num 5054 5104 5229 5129 5154 ...
## $ Std_Dev_km_E_quantile_0.05 : num 84 50.2 64.4 62.9 71.2 ...
## $ Std_Dev_km_E_quantile_0.5 : num 64.2 54.2 82.1 41.5 80.1 ...
## $ Std_Dev_km_E_quantile_0.95 : num 133 143 155 169 130 ...
## $ Std_Dev_km_N_quantile_0.05 : num 27.2 14.4 30 17.5 18.3 ...
## $ Std_Dev_km_N_quantile_0.5 : num 25 22.9 24.8 25.4 28 ...
## $ Std_Dev_km_N_quantile_0.95 : num 152.8 107.5 119.3 90.1 111.3 ...

```

Timeseries: Leading and Trailing Edges



5. Centre of Gravity

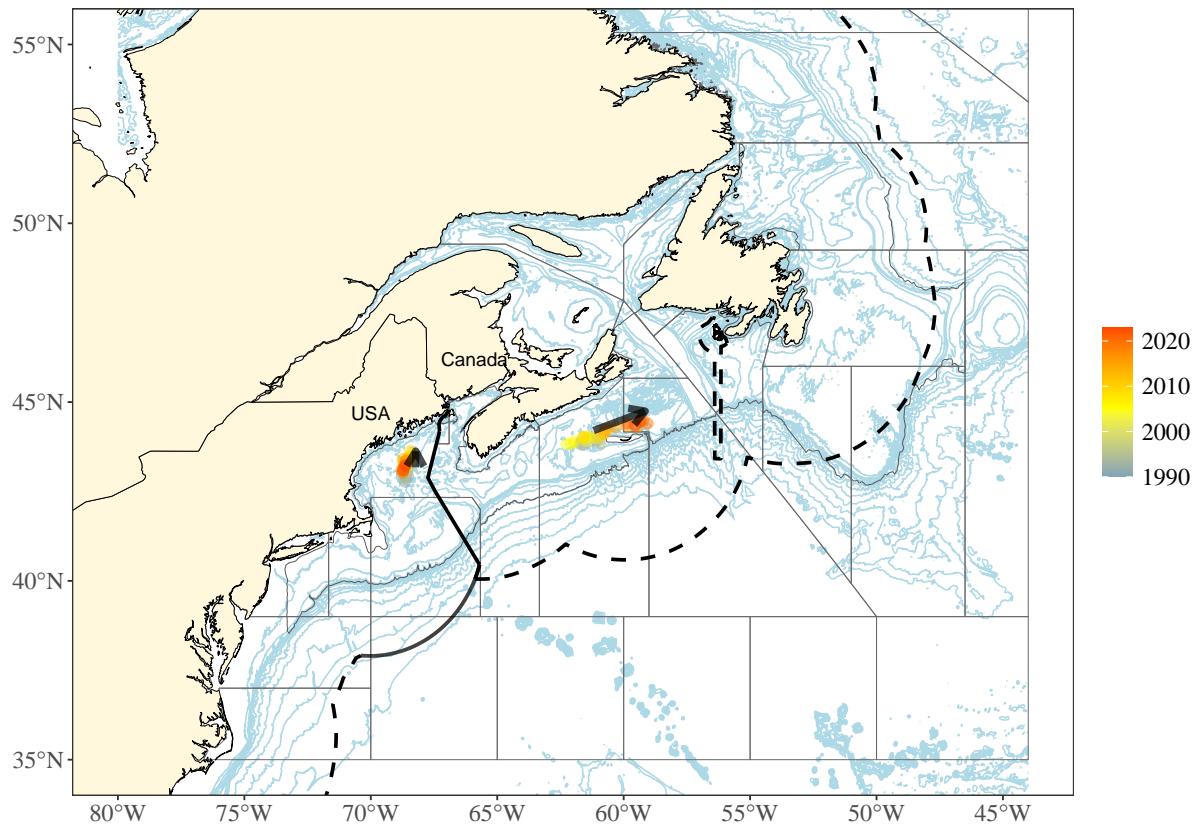
Data: POC_COG.csv

The average latitude and longitude, weighted by abundance

- Region: USA, Canada
- Year: 1990-2023
- centroid_longitude & centroid_latitude : weighted mean
- centroid_latitude_Median & centroid_longitude_Median: weighted median
- centroid_latitude_Quantile_05 & centroid_longitude_Quantile_05: weighted 5th percentile
- centroid_latitude_Quantile_95 & centroid_longitude_Quantile_95: weighted 95th percentile

```
## 'data.frame':   68 obs. of  10 variables:
## $ Year                  : int  1990 1990 1991 1991 1992 1992 1993 1993 1994 1994 ...
## $ Region                : chr  "Canada" "USA" "Canada" "USA" ...
## $ centroid_longitude     : num  -61.6 -68.6 -61.1 -68.5 -61.3 ...
## $ centroid_latitude       : num  43.8 42.8 43.9 42.9 44 ...
## $ centroid_latitude_Median: num  43.5 43.1 43.8 43.4 43.8 ...
## $ centroid_longitude_Median: num  -62.1 -68.7 -61.2 -68.6 -61.8 ...
## $ centroid_latitude_Quantile_05: num  42.4 40.4 42.4 40.7 42.4 ...
## $ centroid_longitude_Quantile_05: num  -66.7 -70.1 -66.7 -70.1 -66.7 ...
## $ centroid_latitude_Quantile_95 : num  46.3 44.2 46.3 44.2 47.2 ...
## $ centroid_longitude_Quantile_95: num  -52.5 -67.3 -53.7 -67.4 -52.2 ...
```

Timeseries: Centre of Gravity (Mean)



6. Distance from COG to Shared Border

Data: POC_DtoB.csv

The distance between the closest point on the border to each COG metric in the time series and grouping,

- Region: USA, Canada
- Year: 1990-2023
- Dist_Mean: Distance (km), between the closest point on the shared border and the COG(weighted mean) for each year/region
- Dist_Mean, Dist_Q5, Dist_Q95: Distance to COG (weighted median, weighted 5th percentile, and 95th percentile, respectively)

```

## 'data.frame':   68 obs. of  6 variables:
## $ Year      : int  1990 1990 1991 1991 1992 1992 1993 1993 1994 1994 ...
## $ Region    : chr  "Canada" "USA" "Canada" "USA" ...
## $ Dist_Mean: num  503.1 -74.4 542.8 -64.7 538.1 ...
## $ Dist_Med : num  445.1 -77.9 525.7 -81.3 491.5 ...
## $ Dist_Q5  : num  45.8 -319.2 47.9 -301 46.1 ...
## $ Dist_Q95 : num  1245.44 -4.79 1044.99 -7.57 1170.47 ...

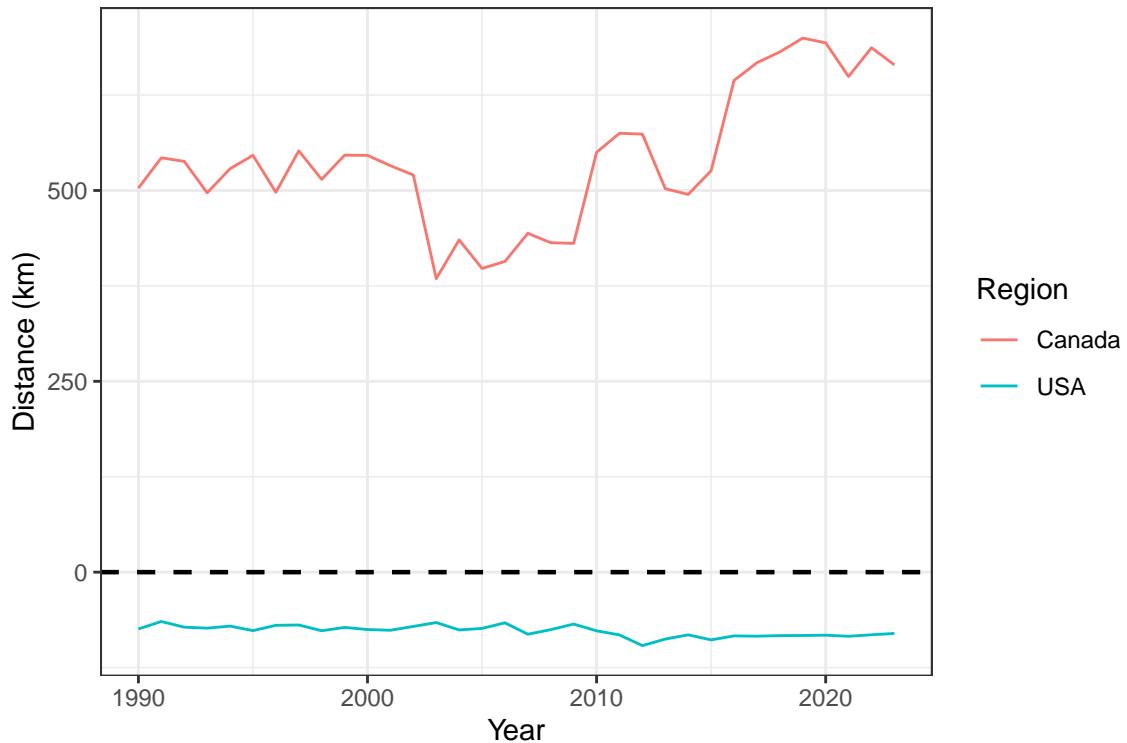
```

Timeseries: Distance to Shared Border

```

## Ignoring unknown labels:
## * fill : "Region"

```



7. Scaled Slopes

lm slopes for 2006-2023 (the period when the water began warming rapidly), scaled so that all indicators are in the same units

```

## 'data.frame':   16 obs. of  11 variables:
## $ Indicator  : chr  "Abundance" "Abundance" "Area Occupied" "Area Occupied" ...
## $ Region     : chr  "Canada" "USA" "Canada" "USA" ...
## $ Period      : chr  "2006-2023" "2006-2023" "2006-2023" "2006-2023" ...
## $ term        : chr  "scale(Year)" "scale(Year)" "scale(Year)" "scale(Year)" ...
## $ estimate    : num  0.897 -0.192 0.839 0.746 0.577 ...
## $ std.error   : num  0.111 0.245 0.136 0.167 0.204 ...
## $ statistic   : num  8.114 -0.783 6.156 4.477 2.823 ...
## $ p.value     : num  4.61e-07 4.45e-01 1.38e-05 3.82e-04 1.22e-02 ...

```

```

## $ conf.low      : num  0.663 -0.712 0.55 0.393 0.144 ...
## $ conf.high     : num  1.131 0.328 1.127 1.099 1.01 ...
## $ p.significant: chr  "Very strong" "Not significant" "Very strong" "Very strong" ...

```

