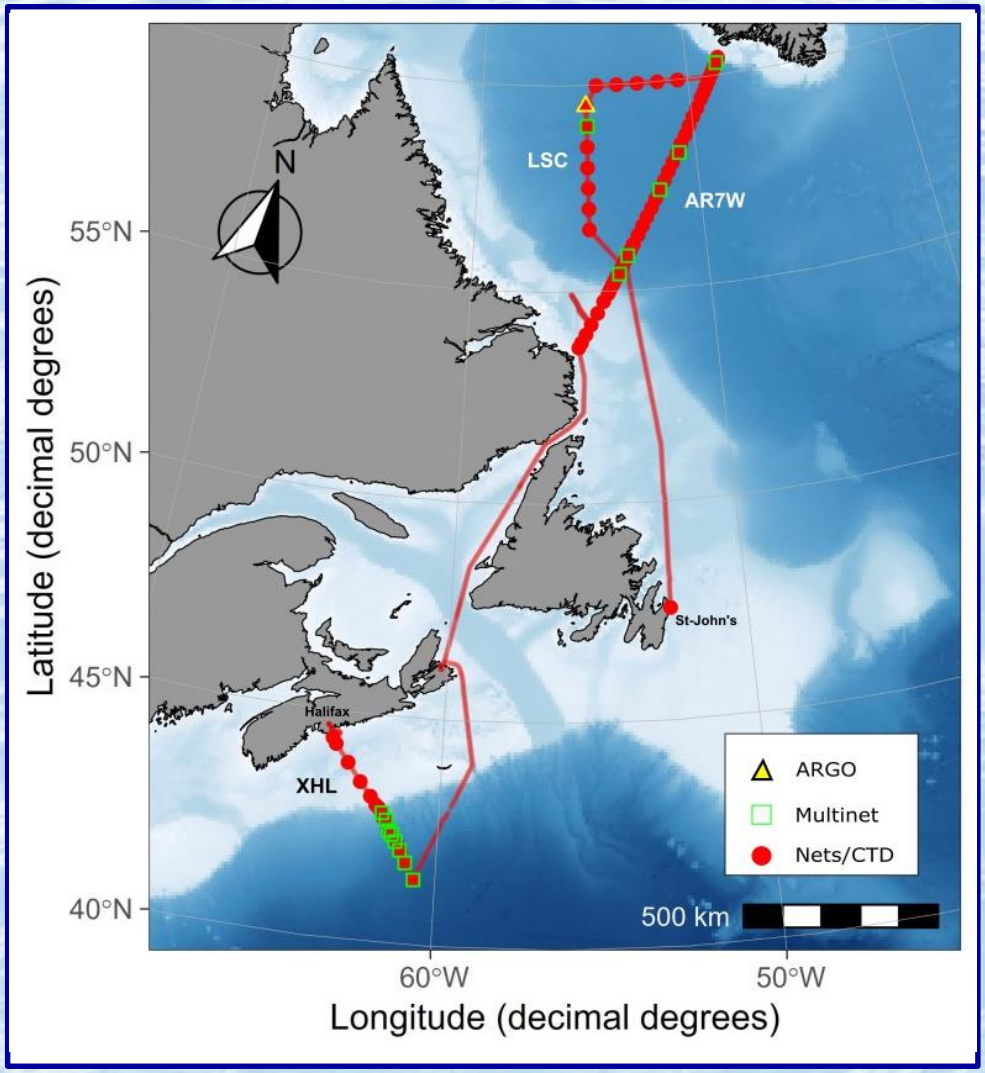
Northwest Atlantic Fisheries Organization

Labrador Sea chemical and biological conditions in 2024

Fisheries and Oceans Canada | Pêches et Océans Canada

Atlantic Zone Off-Shelf Monitoring Program (AZOMP)
Bedford Institute of Oceanography

NAFO Subareas : AZOMP – Atlantic Zone Offshore Monitoring Area



Cruise CAR2024-924: 24 May - 20 June

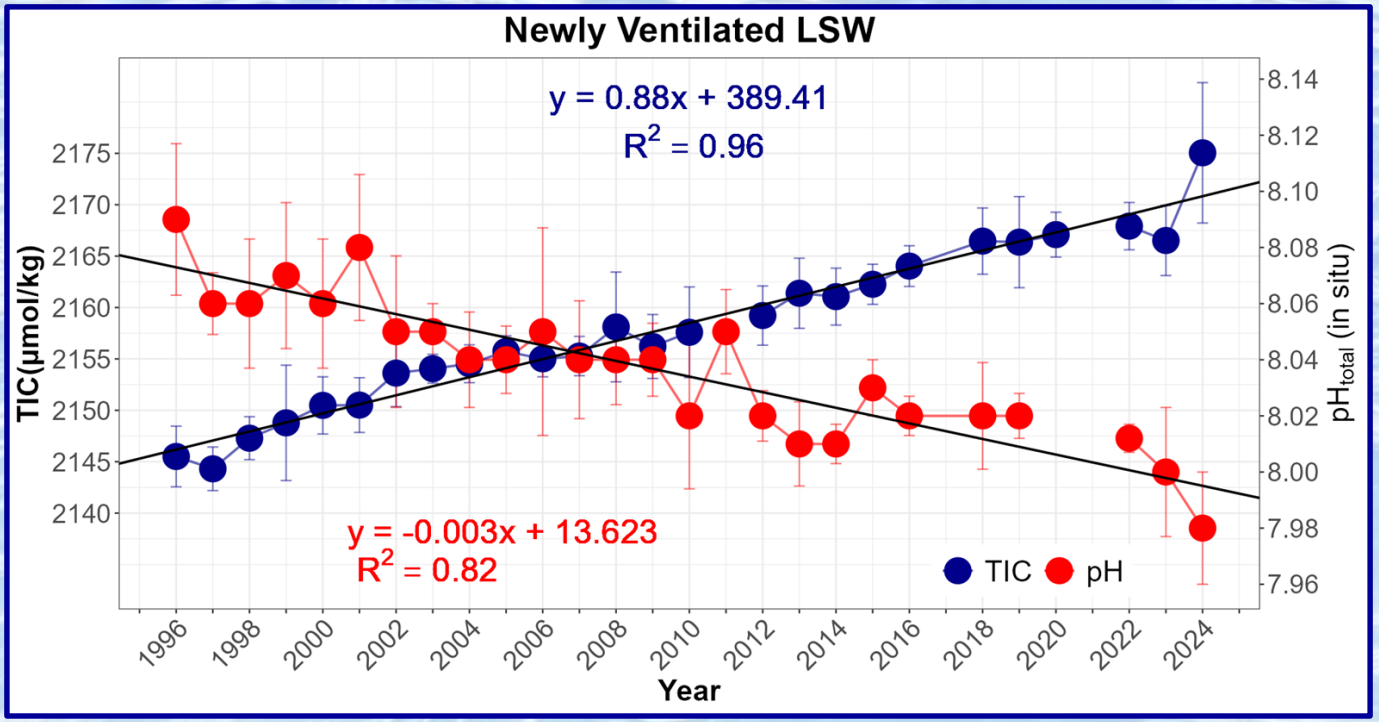
- Transepts/Stations:
  - **AR7W**
  - **LSC**
  - **XHL**
  - **St. John's**

- 87 CTD stations
- 6 Biological stations (200m)
- 72 Net operations
- 14 Multinet Stations
- 2 Argo floats

- Cover **NAFO subareas 1, 2, 3 & 4**

Chemical oceanography:

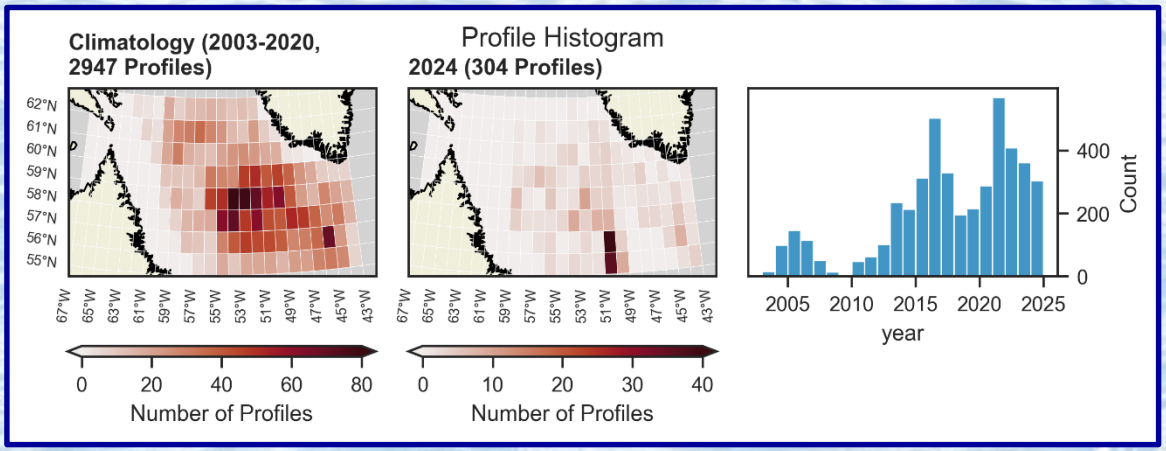
Total Inorganic carbon (TIC) and pH



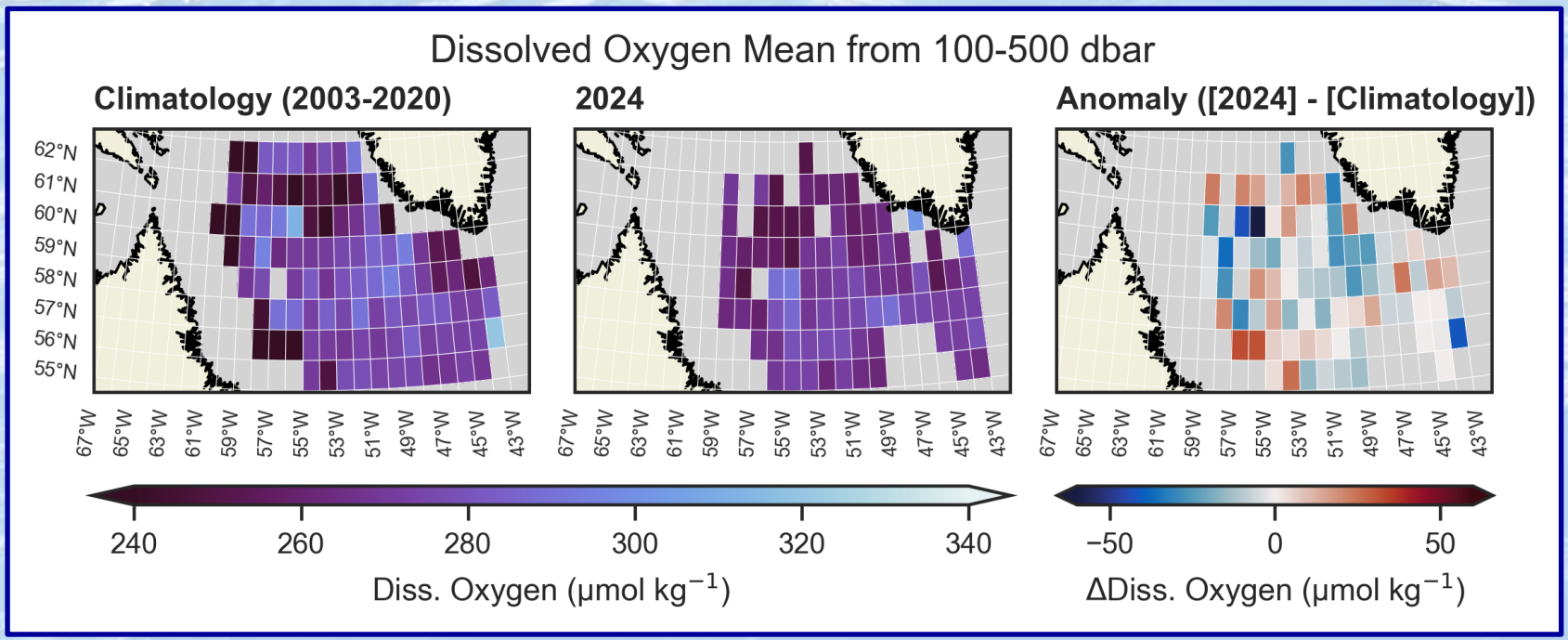
- Average **linear increase** of 0.88 µmol **TIC** kg^{-1} y^{-1} since 1996
- Corresponding **decline** in **pH_{total}** of 0.003 y^{-1} (global average is 0.002 y^{-1})
- Both align with the **rising atmospheric carbon dioxide levels** attributed to **human activities**

Chemical oceanography:

Dissolved oxygen



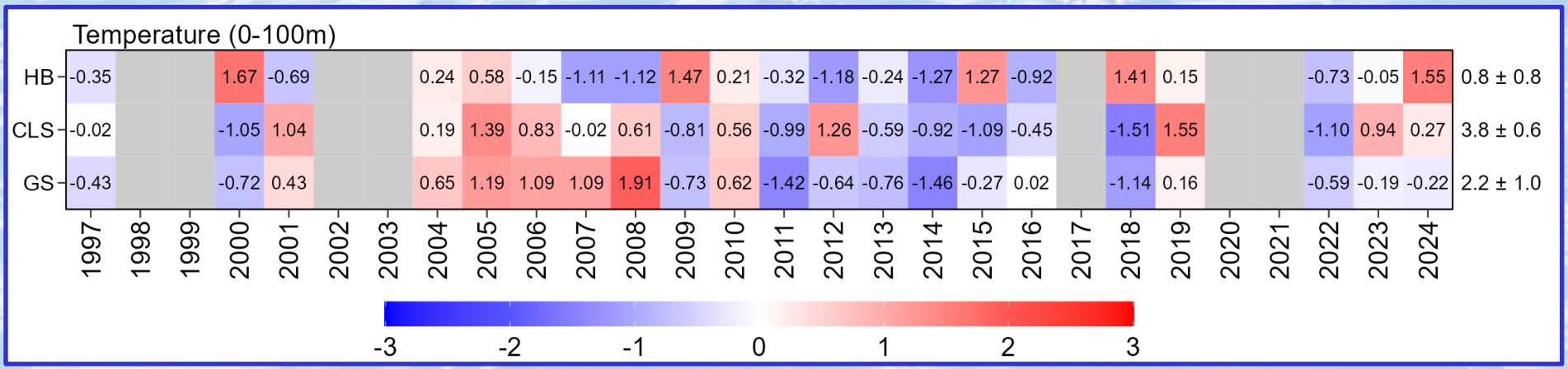
- Dissolved Oxygen is mainly **average or below** average in **CLS**



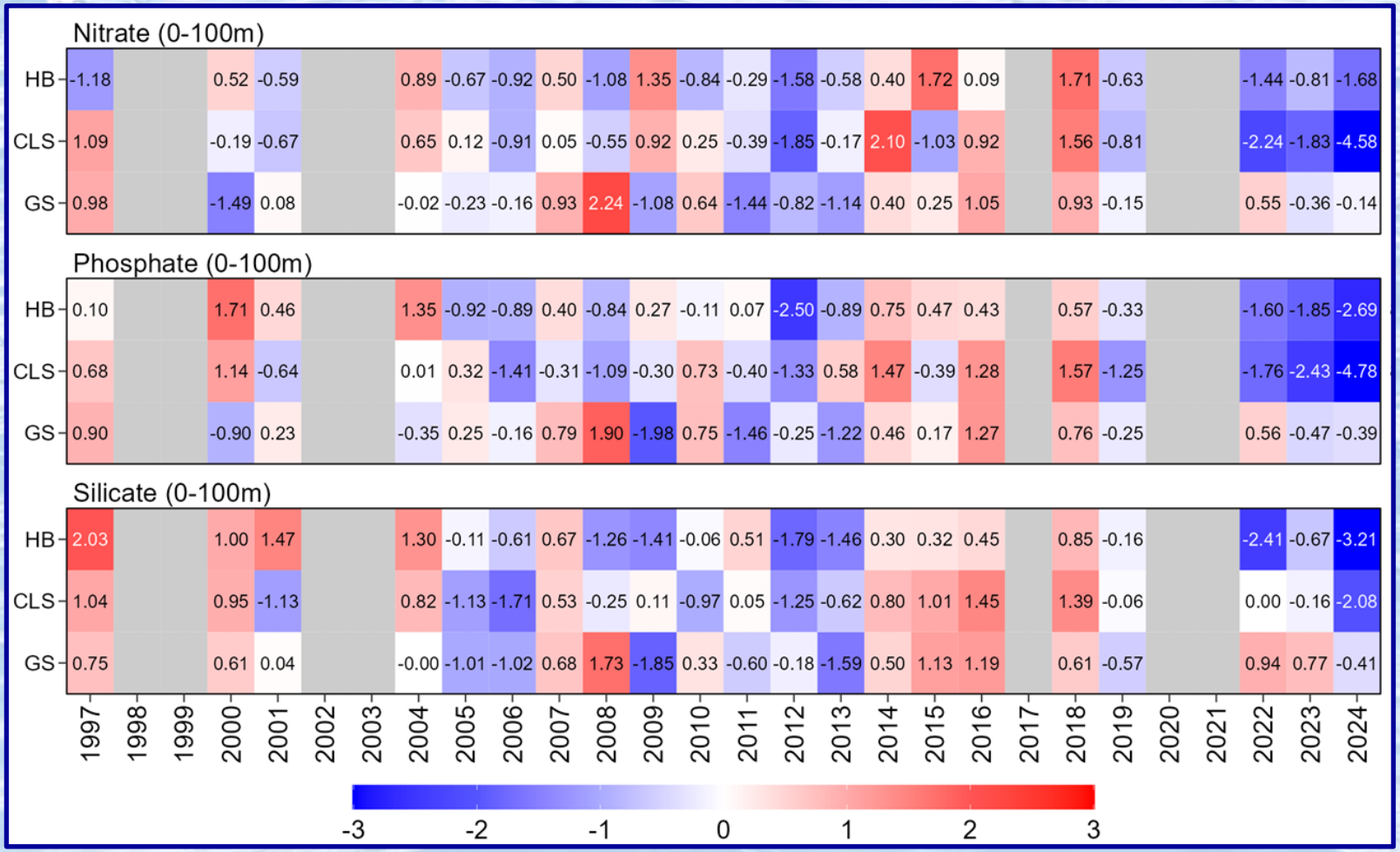
Chemical oceanography:

Temperature

- **HB** and **CLS** temperatures in 2024 were **above normal**, with **high interannual variability** over the time series
- **GS** temperature was **below** average in 2024, a trend that has been observed since 2011 (except 2016 and 2019).

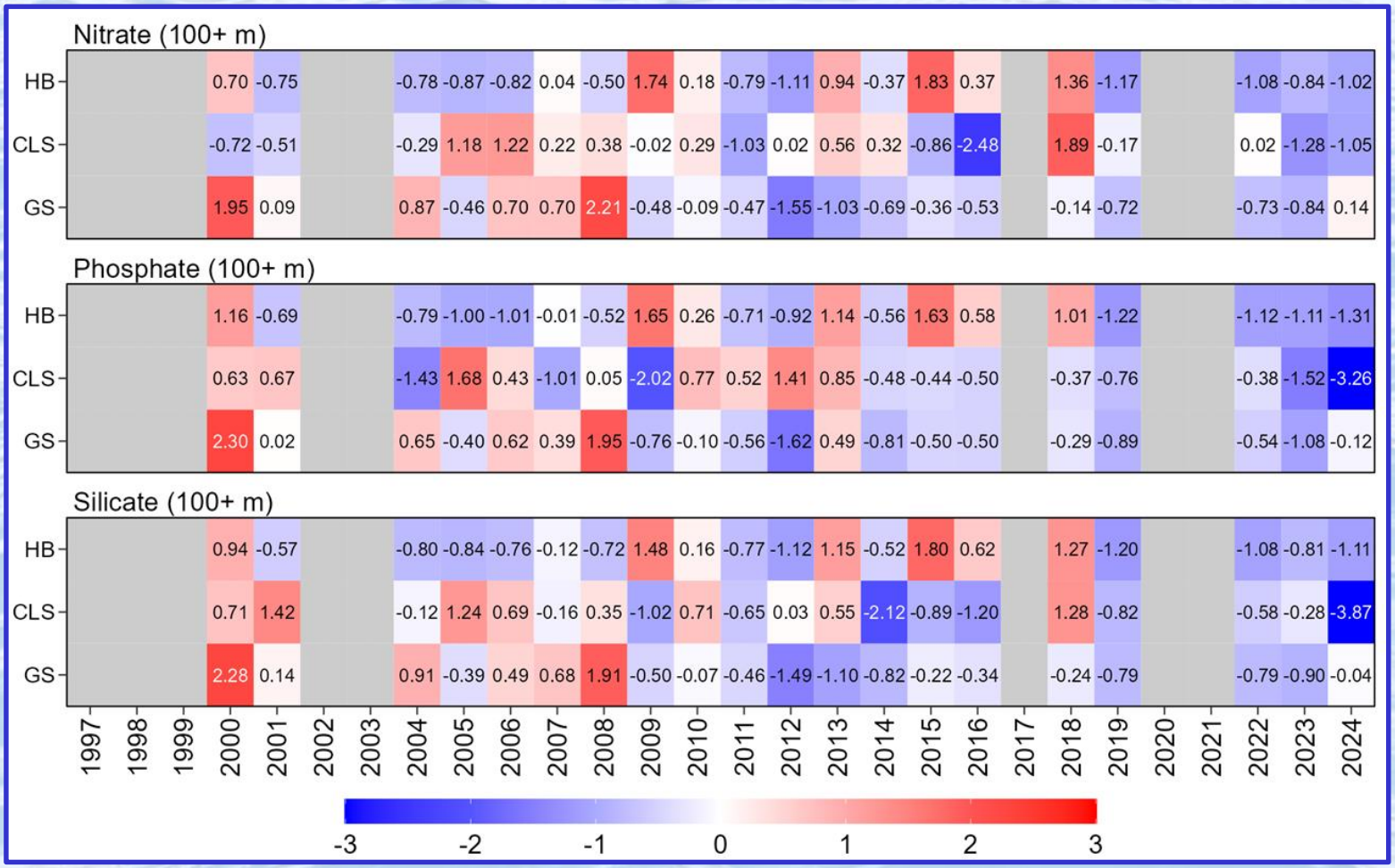


Nutrients (shallow water)



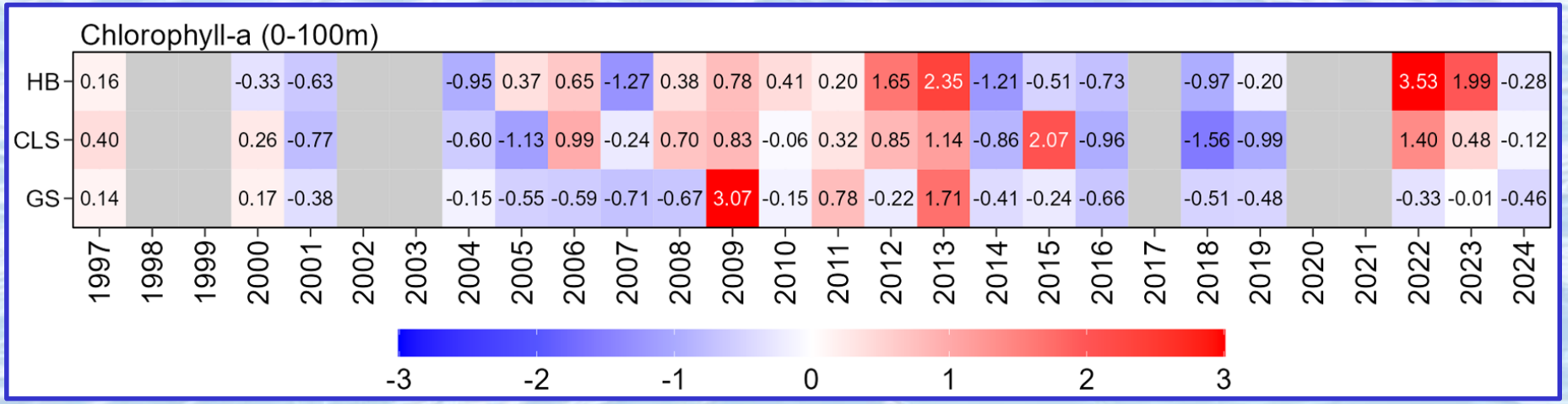
- All nutrients in all regions were **below normal** in 2024, with **record lows** in **CLS** for all three nutrients.
- This **low-nutrient trend** started in 2019, except on the **Greenland Shelf** which exhibited above normal values in 2022 (all nutrients) and 2023 (silicate only).

Nutrients (deep water)



- Patterns **similar** **to surface nutrients** are observed in deep nutrients dynamics.
- This suggests the **surface nutrient decrease** is not related to timing of sampling, but evidence of an **overall decrease of nutrients** in the **Labrador Sea ecosystem**

Chlorophyll-a

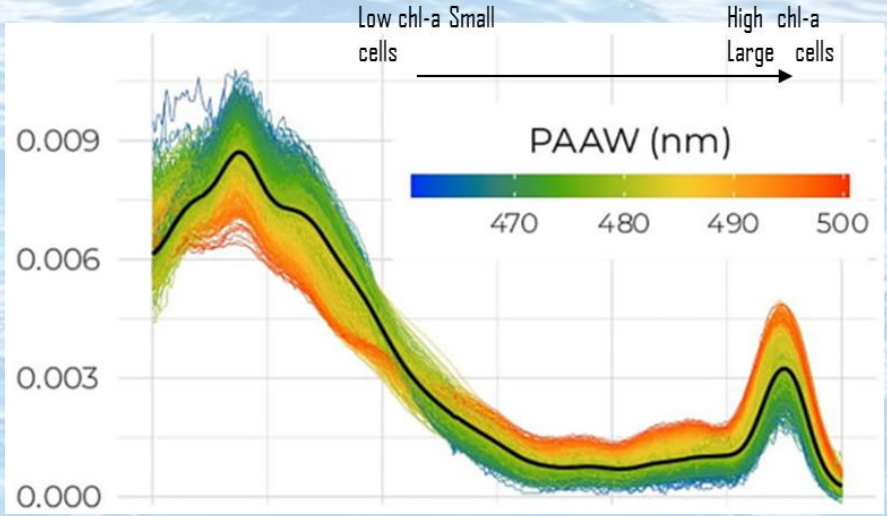


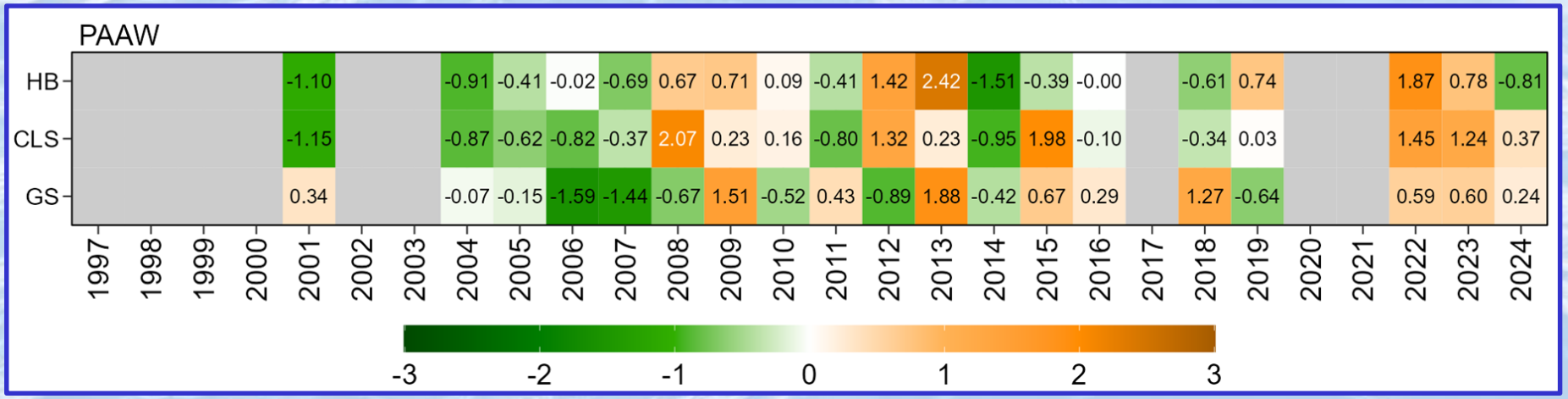
- **HB** and **CLS** chl-a concentrations were **below to near-normal** in 2024 after a two-year period of high concentrations, including a record-high in 2022 on HB

- **GS** chl-a concentration was **below normal** in 2024, continuing the trend that started in 2014.

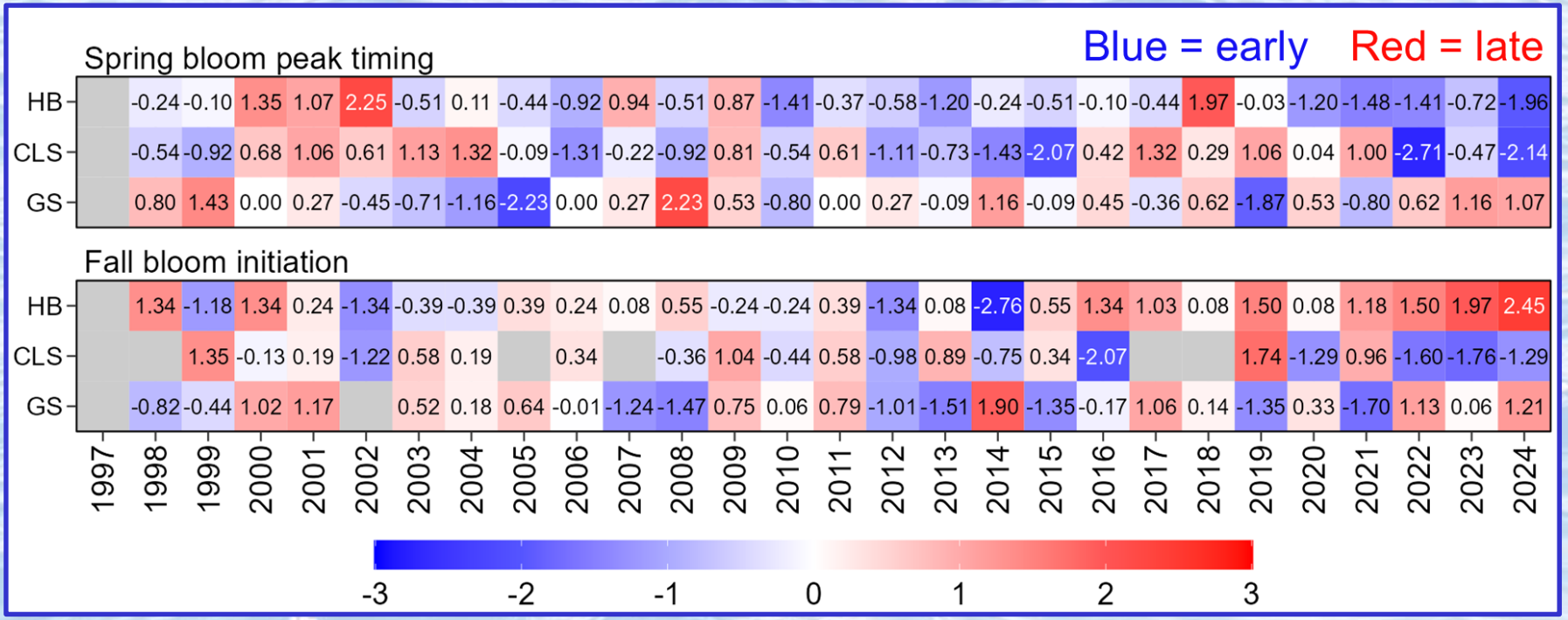
Phytoplankton Apparent Absorption Wavelength "Color of phytoplankton"

- A measure of phytoplankton color and biomass
- **Shift in community structure** since 2022 that coincides with **low** nutrient trends.





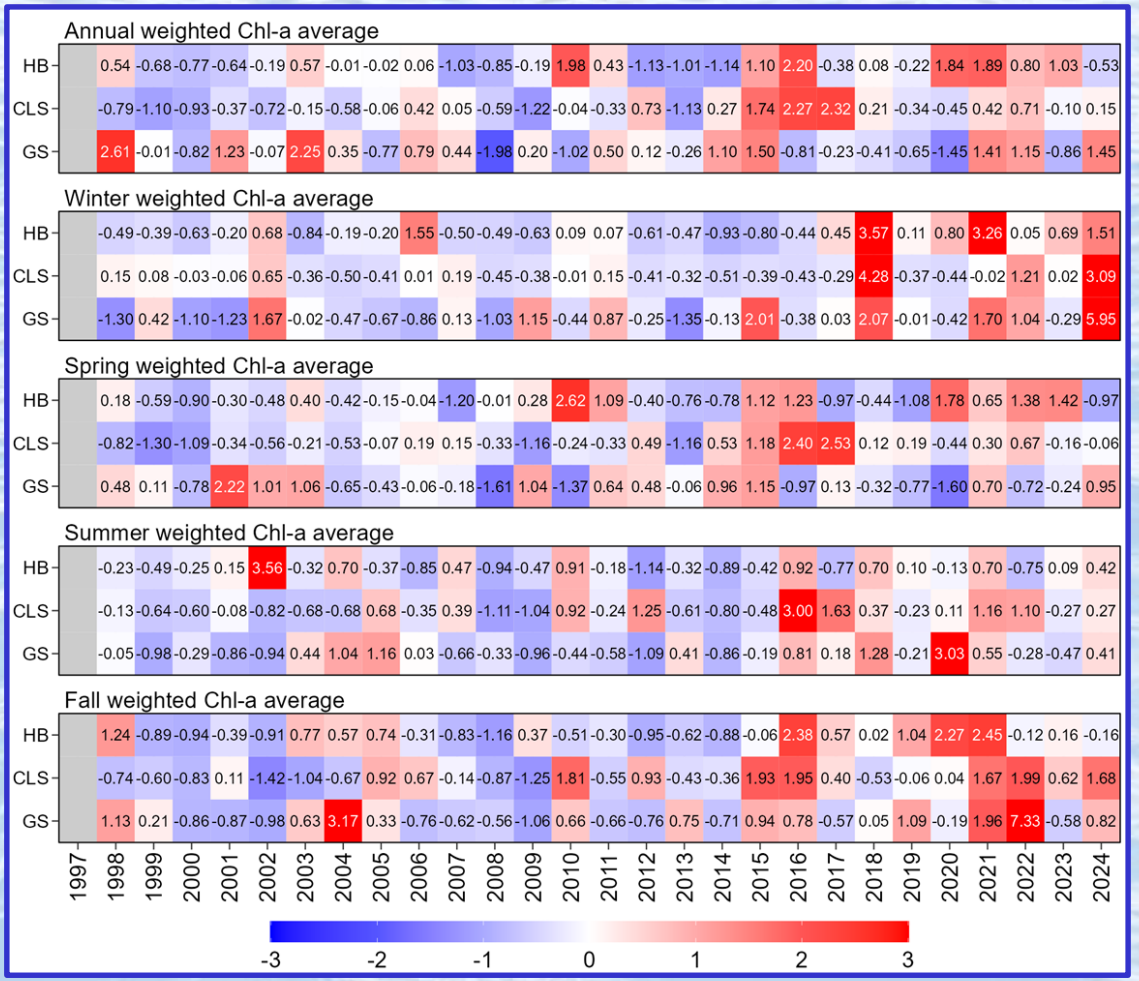
Satellite Ocean Colour
Bloom timing



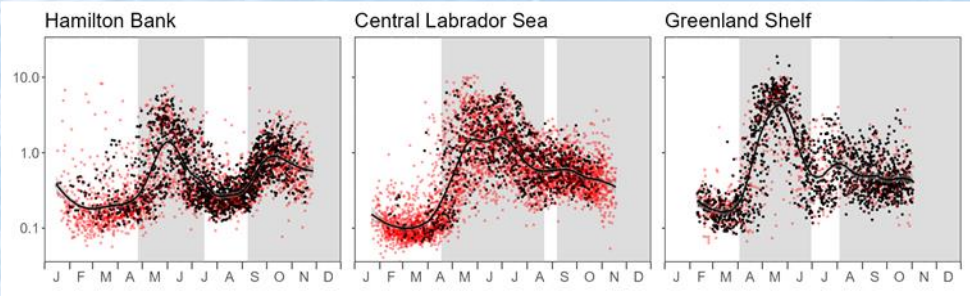
- Since 2020, **HB** has seen **earlier** **spring** blooms and **later** **fall** blooms, with records set in 2024
- **CLS** has experienced **early** **spring** and **fall** blooms since 2022
- **GS** has seen **late** **spring** and **fall** blooms since 2022, with **near-normal** **fall** bloom timing in 2023

Satellite Ocean Colour
Chl-a concentration

- **HB** shows **below** normal annual Chl-a, **close** to normal for **CLS**, and **above** normal for **GS**.
- Chl-a anomalies were **close** or **above** normal in all season/regions **except** for spring in **HB**, which was **below** normal
- High **positive** anomalies in all regions occurred mainly during the past decade



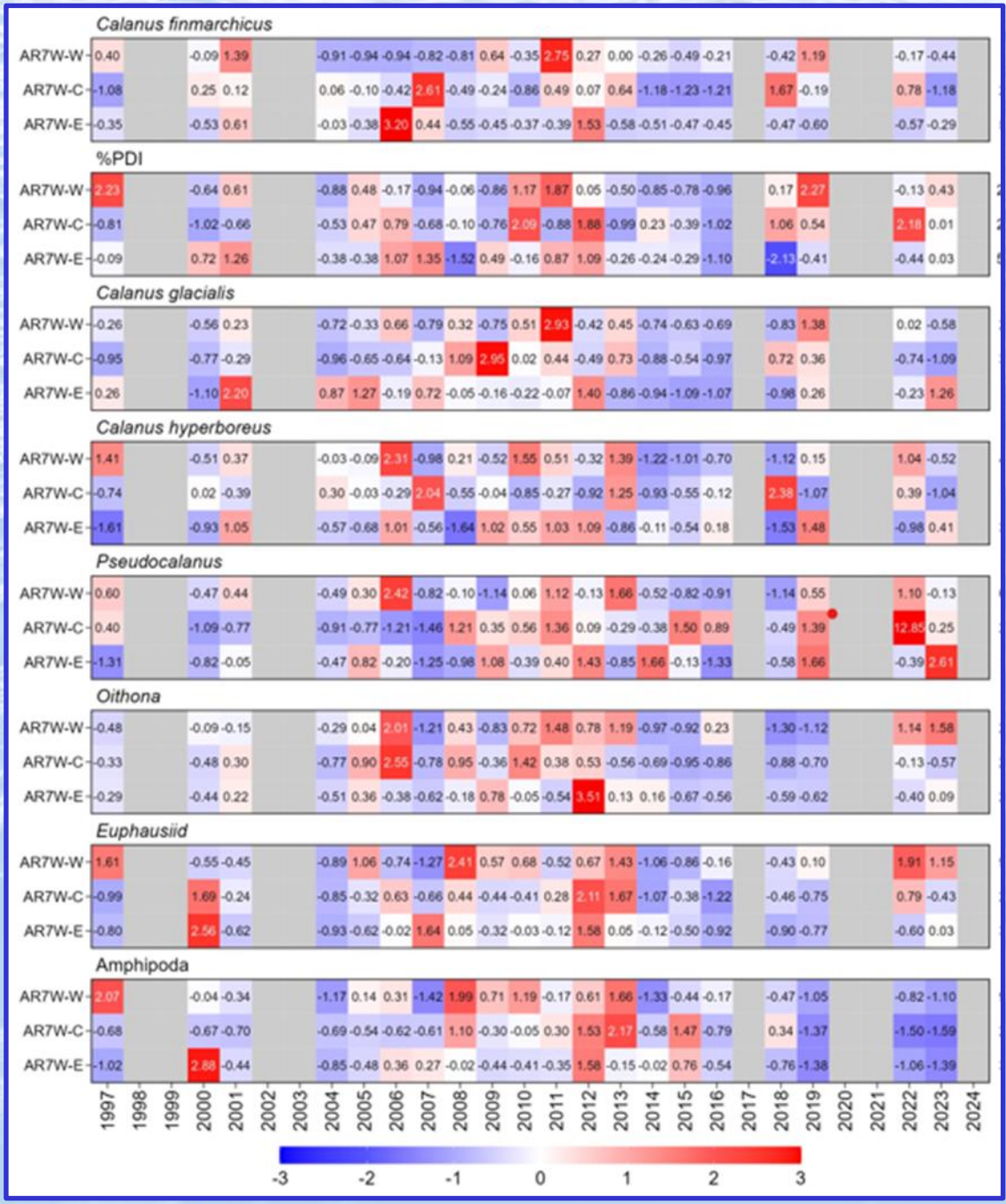
Bloom "season" boundaries



Mesozooplankton

- **Up** until 2023.
- *Calanus finmarchicus* in generally **lower** abundance, with a higher %PDI only in the **western region**.
- *Pseudocalnus* spp. in **higher** abundances in **all regions**. Chl-a Amphipoda in **lower** abundances since 2016

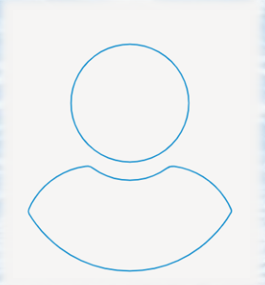

Calanus finmarchicus



Highlights

- **HB** and **CLS** temperatures were **above** normal, while GS continued a trend of **below** average temperatures (since 2011)
- Shallow and deep nutrients have been **below** normal since 2019, suggesting an **overall decrease** in nutrient inventories unrelated to mission timing. New metric PAAW shows color of biomass and is an indicator of community composition; a **change** in PAAW since 2022 coincides with these **low** nutrient **trends**
- 0-100m Chl-a concentrations were **below to near** normal in all regions – trends observed since 2014 on the **GS**
- In recent years, the spring bloom has been observed **earlier than** normal on **HB** and **CLS**, and **later** on the **GS**. Fall blooms have been **later** than normal on the **shelves**, and **earlier** in the **central basin**.
- Annual satellite Chl-a anomalies were **below** normal on **HB**, **near** normal in **CLS**, and **above** normal on the **GS**. Seasonal anomalies were **near** normal or **above** normal in most seasons/regions
- High **positive** Chl-a anomalies have occurred more frequently during the past decade in all regions


Marc Ringuette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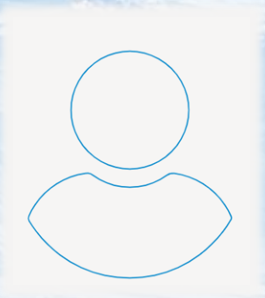
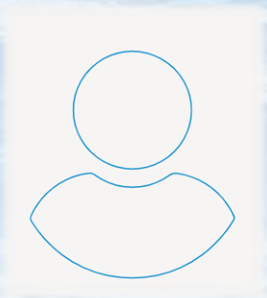
B. Greenan


C. Gordon


D. Childs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Source:

Clay, S., **Ringuette, M.**, Devred, E., Azetsu-Scott, K., Wang, Z., Greenan, B., Gordon, C., Childs, D., & Layton, C. 2025. Physical, Chemical, and Biological Oceanographic Conditions in the Labrador Sea in 2024, SCR Doc. 25/014: 1-50.