



NAFO Northwest Atlantic
Fisheries Organization



The 2021 Overview of the Biogeochemical Oceanographic Conditions in the Northwest Atlantic in NAFO Subareas 2-3-4

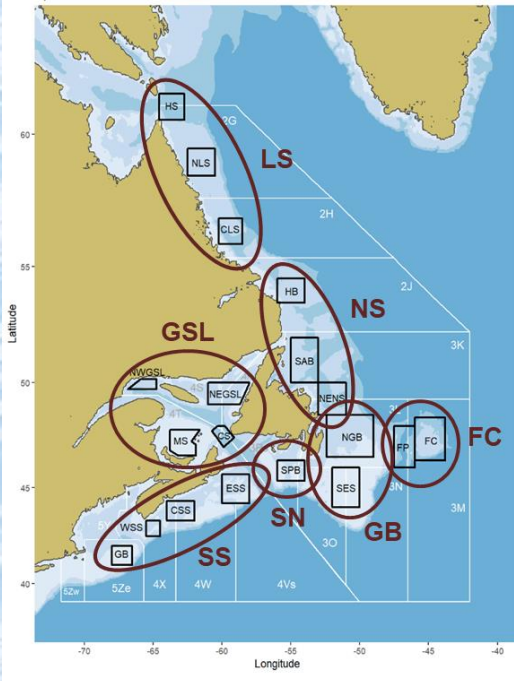


Fisheries and Oceans Pêches et Océans
Canada Canada

Atlantic Zone Monitoring Program (AZMP)
NAFC Oceanography Section

NAFO Subareas 2, 3 & 4 – Map of satellite boxes and AZMP oceanographic sections grouped by NAFO Ecosystem Production Units

A) Satellite ocean colour boxes



Oceanographic sections —

Sampled seasonally (spring, summer and fall)

High-frequency monitoring sites •

Sampled from weekly to bimonthly

Labrador Shelf (**LS**): 3 boxes, 2 sections

Newfoundland Shelf (**NS**): 3 boxes, 2 sections

Grand Bank (**GB**): 2 boxes, 2 sections, 1 site

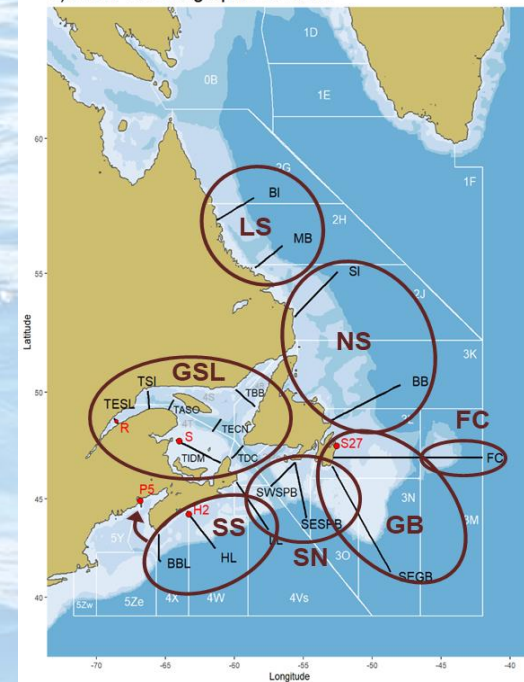
Flemish Cap (**FC**): 2 boxes, 3M part of FC section

Southern Newfoundland (**SN**): 1 box, 2 sections

Gulf of St. Lawrence (**GSL**): 4 boxes, 7 sections, 2 sites

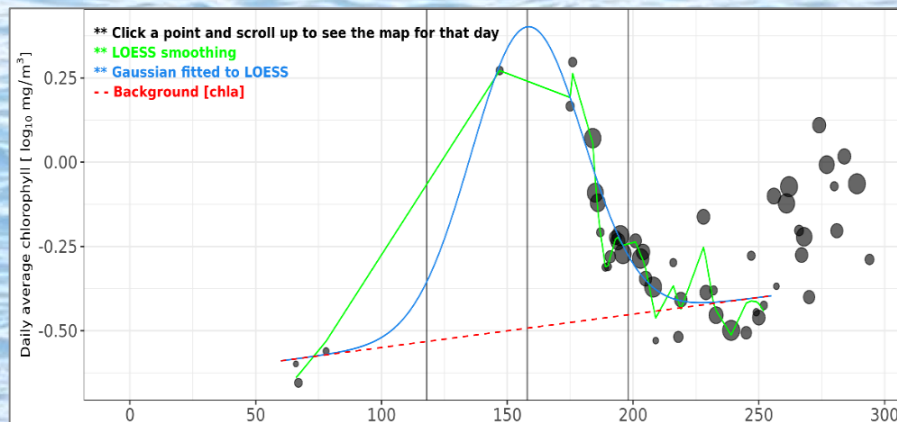
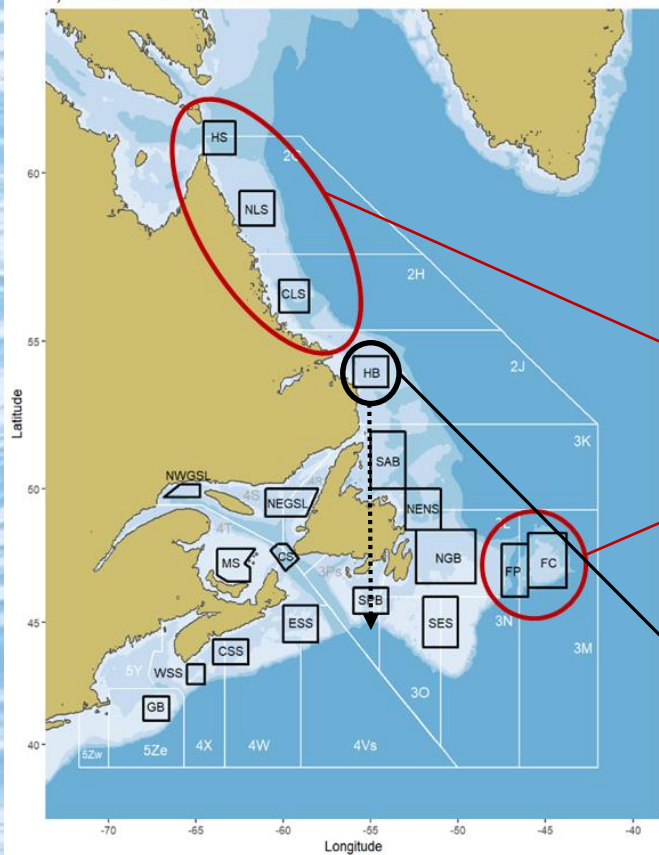
Scotian Shelf (**SS**): 4 boxes, 2 sections, 2 sites

B) AZMP oceanographic sections

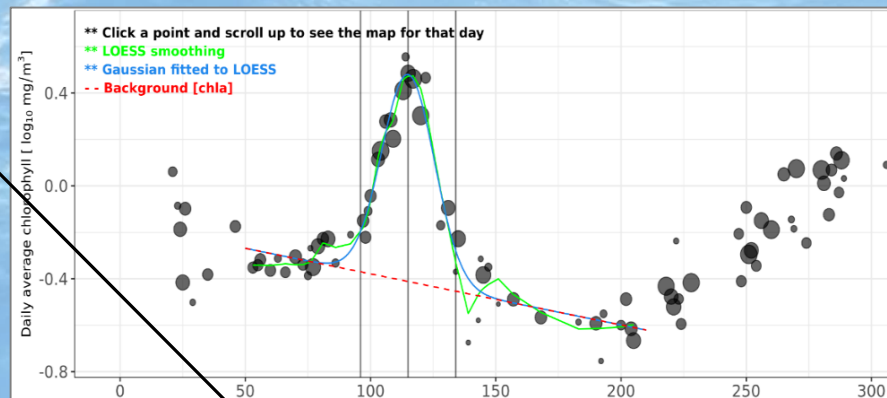


Spring Bloom Indices

A) Satellite ocean colour boxes



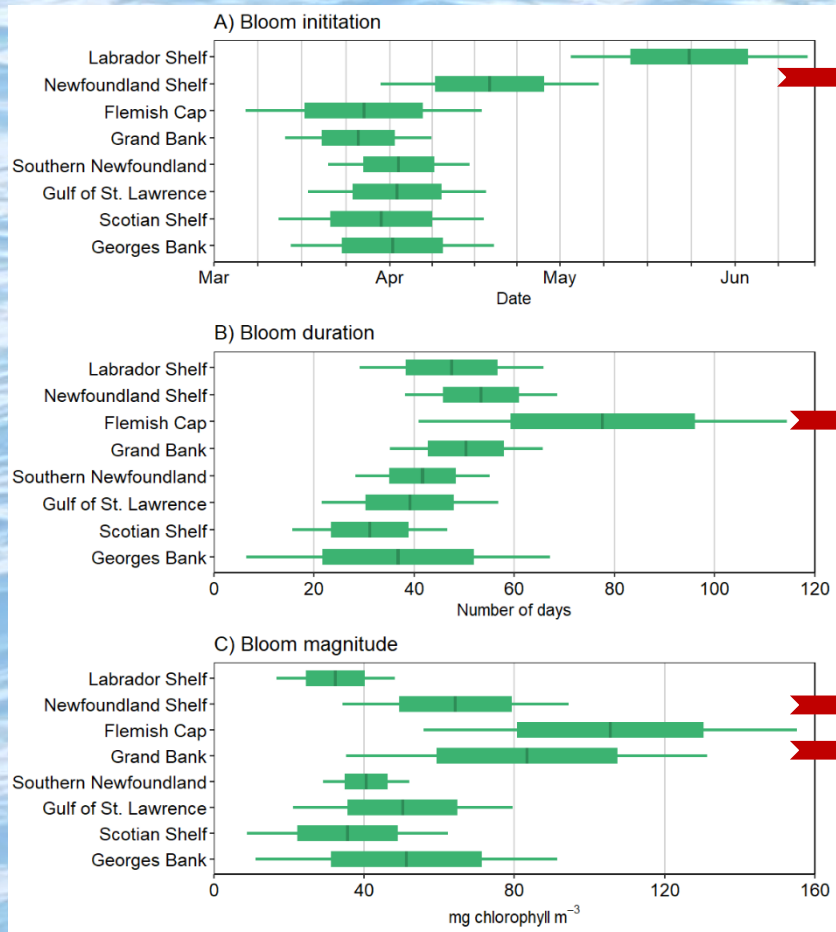
Higher uncertainty for Labrador Shelf and Flemish Cap
(red circles)



Chlorophyll a generally fits to the model from
subarea 2J to the South



Spring Bloom Phenology - 2021



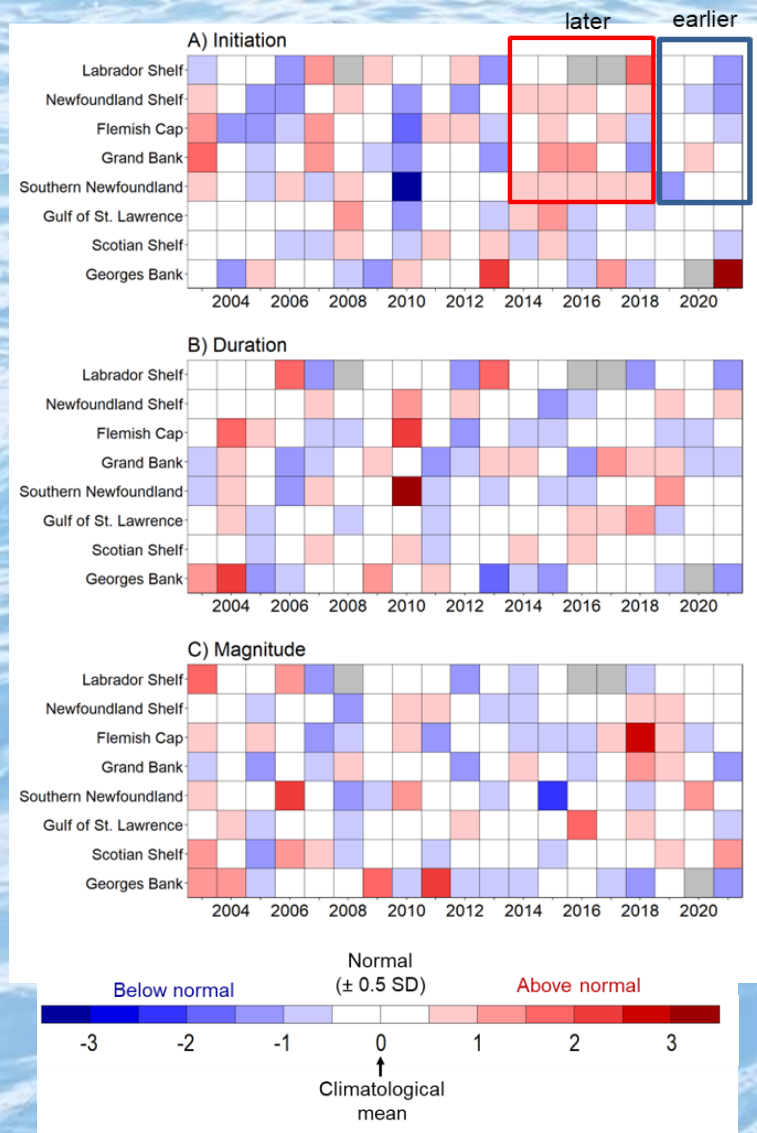
Bloom initiation on the **Newfoundland** and **Labrador** shelves is delayed by sea ice.

Bloom duration generally increase with latitude and is longest on the **Flemish Cap**.

Spring bloom production is typically higher on the **Newfoundland** Shelf, the **Grand Bank**, and the **Flemish Cap** regions.



Spring Bloom Phenology – decadal variability



Earlier bloom initiation in the **NL Region** since 2019.

Near or earlier-than-normal bloom timing in 2021 except for **Georges Bank**.

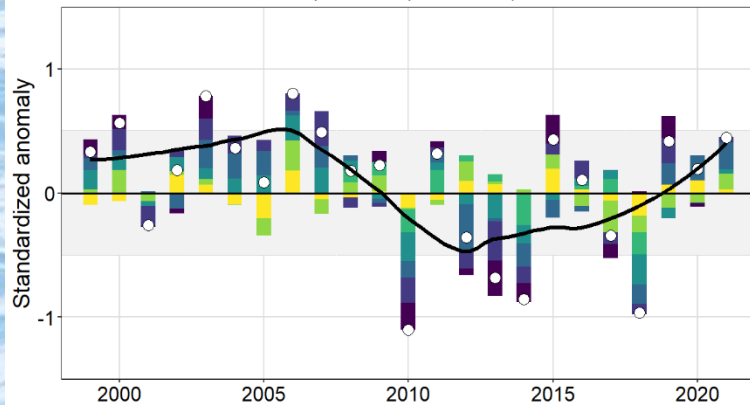
Near or shorter-than-normal bloom duration in 2020-2021 except for the slightly longer blooms on the **NL Shelf**.

Mostly near or lower-than-normal magnitude in 2020-2021, except for a few higher production events in **Southern NL** (2020) and on the **Scotian Shelf** (2021).

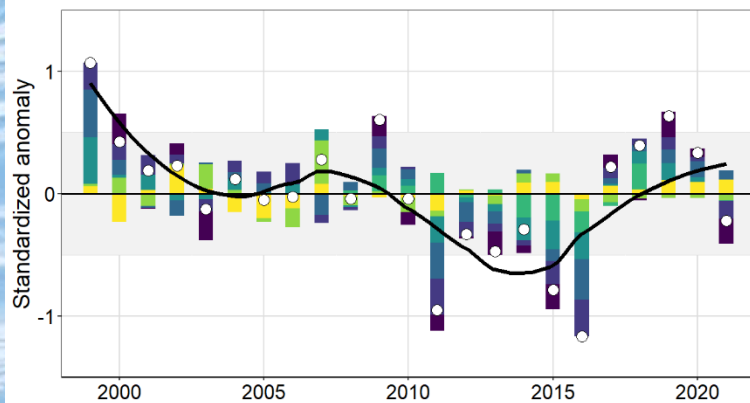


Nitrate & Chlorophyll-a Inventories

A) Nitrate (50-150 m)



B) Chlorophyll a (0-100 m)



➤ Nitrate

- Overall decrease from the mid-2000s to the mid-2010s.
- Has remained mostly near normal since 2015 with positive anomalies in 2021.

➤ Chlorophyll-a

- Similar trend to nitrate with a 1-2 year delay.
- Inconsistent data in 2021.



Zooplankton Abundance



Copepod

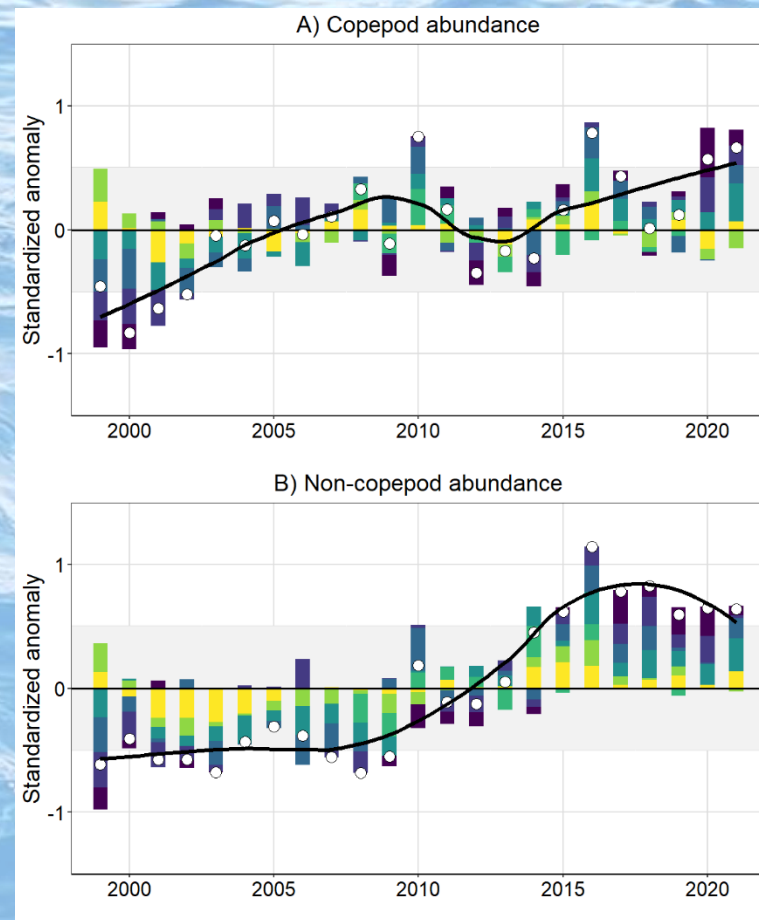
Constant increase from 1999 to 2010 followed by another **period of increasing abundance starting 2014**.

Higher abundances (stronger positive anomalies) in **the NL Region** in past 2 years compared to the Scotian Shelf and the Gulf of St. Lawrence.

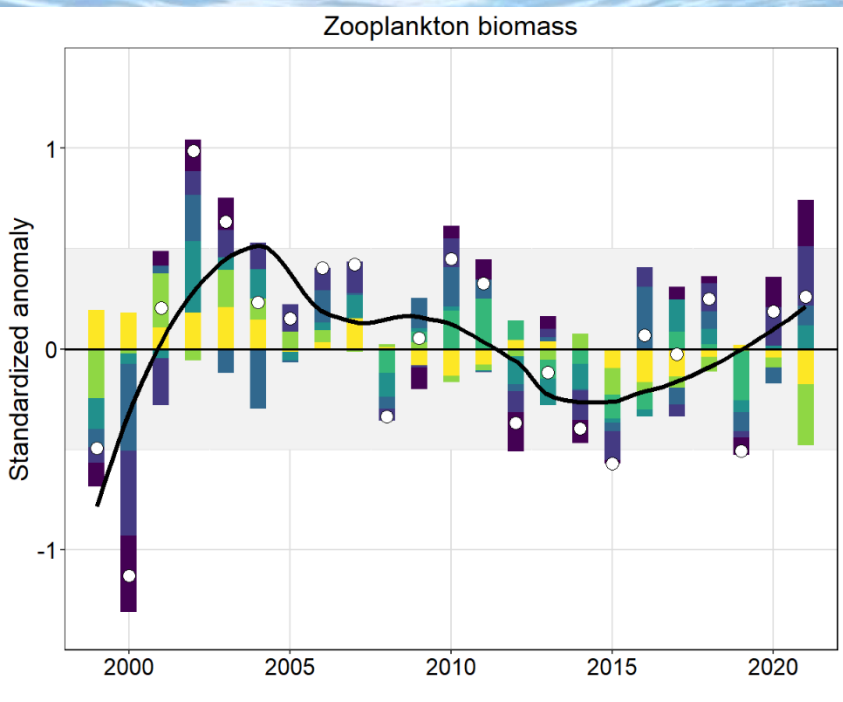
Non-copepod

Low and relatively stable throughout the 2000s **increasing to above normal from 2010 onwards**.

The increase in non-copepod abundance since 2010 was mainly driven by appendicularians and pteropods.



Zooplankton Biomass



- Labrador Shelf (2GH)
- Newfoundland Shelf (2J3K)
- Flemish Cap (3M)
- Grand Bank (3LNO)
- Southern Newfoundland (3Ps)
- Scotian Shelf (4VWX)
- Gulf of St. Lawrence (4RST)

Sharp increase in the early 2000s followed by a gradual decrease until 2015.

General increase in zooplankton biomass from 2015 to 2021.

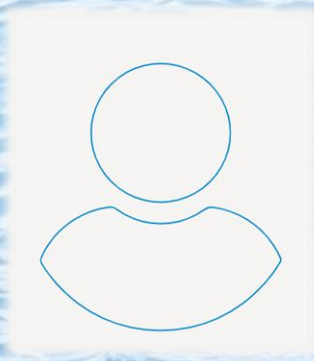
High biomass on the **Newfoundland** and **Labrador** shelves in 2021 and negative anomalies for the **Scotian Shelf** and the **Gulf of St. Lawrence**.



Highlights

- **Higher nitrate** inventories **favor** primary production (chlorophyll-*a* biomass).
- **Earlier bloom initiation** in the **Newfoundland Region** since 2019 compared to the 2014-2018 period.
- General increase of *Calanus finmarchicus* abundance since 2015, with a **positive impact** of total zooplankton biomass.
- **Above-normal abundance** of copepods and non-copepods in the last years associated with **warmer climate conditions** in the NL Region (**Labrador Shelf**, **Newfoundland Shelf** and **Grand Bank**).
- **Positive** zooplankton biomass anomalies across the **NL Region** vs. **negative** anomalies in the **Gulf of St. Lawrence** and **Scotian Shelf**.





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Source:

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