

# Micronekton / small pelagic fish nutrition and its spatial-temporal variability – *a call for data synthesis*

Brian, Hunt

Institute for the Oceans and Fisheries

University of British Columbia



PELAGIC  
ECOSYSTEMS  
LABORATORY

8 May 2026

# Nutrition focused talks at SPF-2026

- **Cláudia Namiki** et al - Nutritional stress in *Myctophum affine* (Myctophidae) larvae in the Southeastern Brazilian Bight (S03)
- **Anna McLaskey** et al - Species and life stage variability in thiamine (vitamin B1) and thiaminase concentrations of forage fish confers nutritional tradeoffs for predators in the northeast Pacific (S04)
- **Joseph Watson** et al - Beyond TAC: The nutritional wealth of northeast Atlantic pelagic fish stocks (Poster) S08
- **Martin Huret** et al - Proximate composition and water to derive condition state and energy density of small pelagic fish (S03)
- **Karlee Orvis** et al - Energetics of “the savior fish”: The phenology of Eulachon (*Thaleichthys pacificus*) energy reserves and potential survival bottlenecks in British Columbia marine and freshwater systems (S03)
- **Susan Kenyon** et al Decline in muscle fat content of northeast Atlantic mackerel (*Scomber scombrus*) on traditional feeding grounds between 2004 and 2021

# Outline

- What do we mean when we talk about nutrition?
- Drivers of nutritional differences in SPF / micronekton nutrition – the fatty acid example
- The value of SPF / micronekton nutritional data synthesis

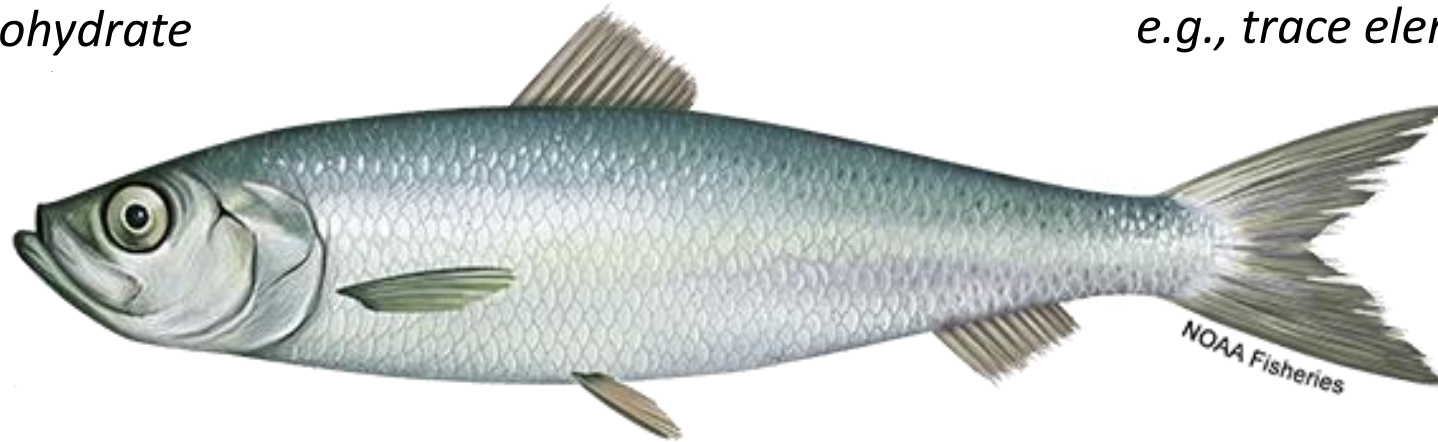
\* *I might use SPF and micronekton interchangeably during this talk*

# What do we mean when we talk about nutrition?

Macromolecules  
*lipid, protein, carbohydrate*

Fatty Acids

Micronutrients  
*e.g., trace elements, vitamins*



Elemental stoichiometry  
*C:N:P*

Amino Acids

Energy content

# Why nutrients matter

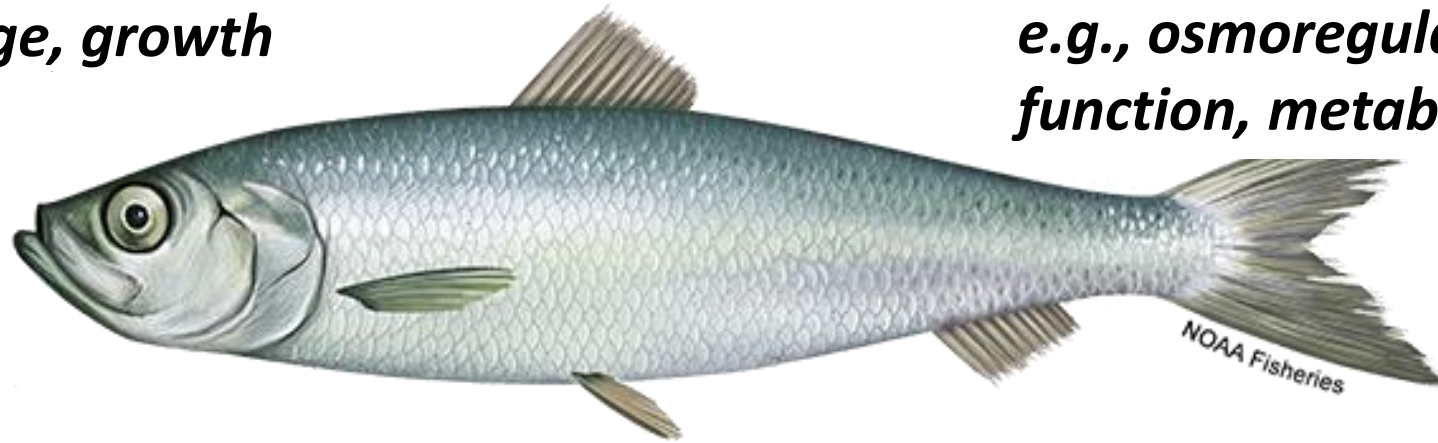
Macromolecules

*e.g., energy storage, growth*

Fatty Acids

Micronutrients

*e.g., osmoregulation, muscle function, metabolism, respiration*



NOAA Fisheries

Elemental stoichiometry

*biomolecular synthesis*

Amino Acids

*e.g., protein synthesis, disease resistance*

Energy content

**metabolism**

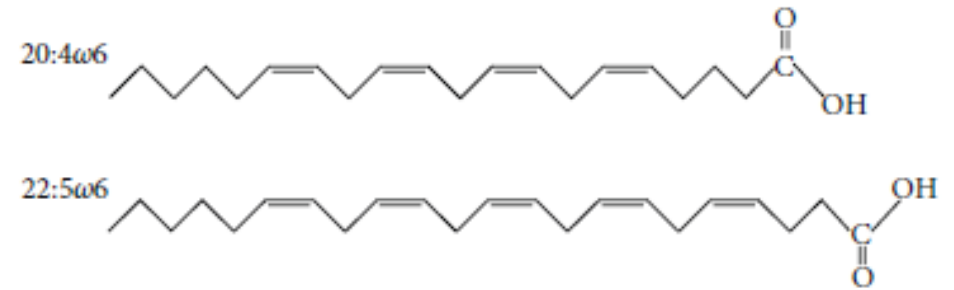
# The Fatty Acid example

Needed by all organisms

## Required for metabolic function

- neural development
- cell membranes, including homeoviscous adaptation
- growth
- stress resistance

**Energy store**



# Fatty acid nutritional metrics

Fatty acid metrics	Nutritional function
Total fatty acids (TFA) <i>Reflect total lipid</i>	Metabolic energy
Essential fatty acids (EFA) <i>Only acquired from diet; e.g., DHA,EPA</i>	Physiological function, e.g., neural development, membrane function, growth, stress resistance
Saturated fatty acids (SFA)	Metabolic energy
Monounsaturated fatty acids (MUFA)	Metabolic energy
Polyunsaturated fatty acids (PUFA)	Physiological function and metabolic energy
DHA/EPA <i>DHA:EPA <math>\geq 2</math> optimal; <math>\sim 1</math> sufficient</i>	Physiological function

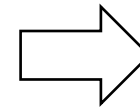
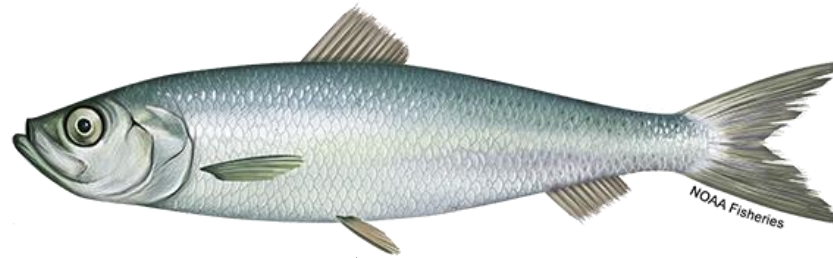
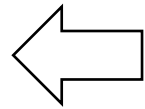
# Role of small pelagics in fatty acid transfer

## Fatty Acids

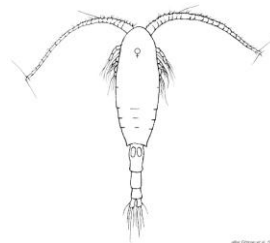
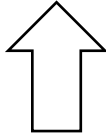
Maternal transfer

Individual health

Trophic transfer



- Assimilate EFAs
- Build lipid stores



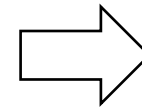
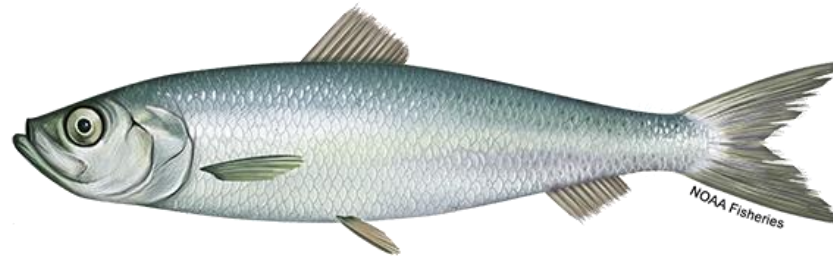
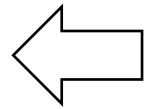
# Role of small pelagics in fatty acid transfer

## Fatty Acids

Maternal transfer

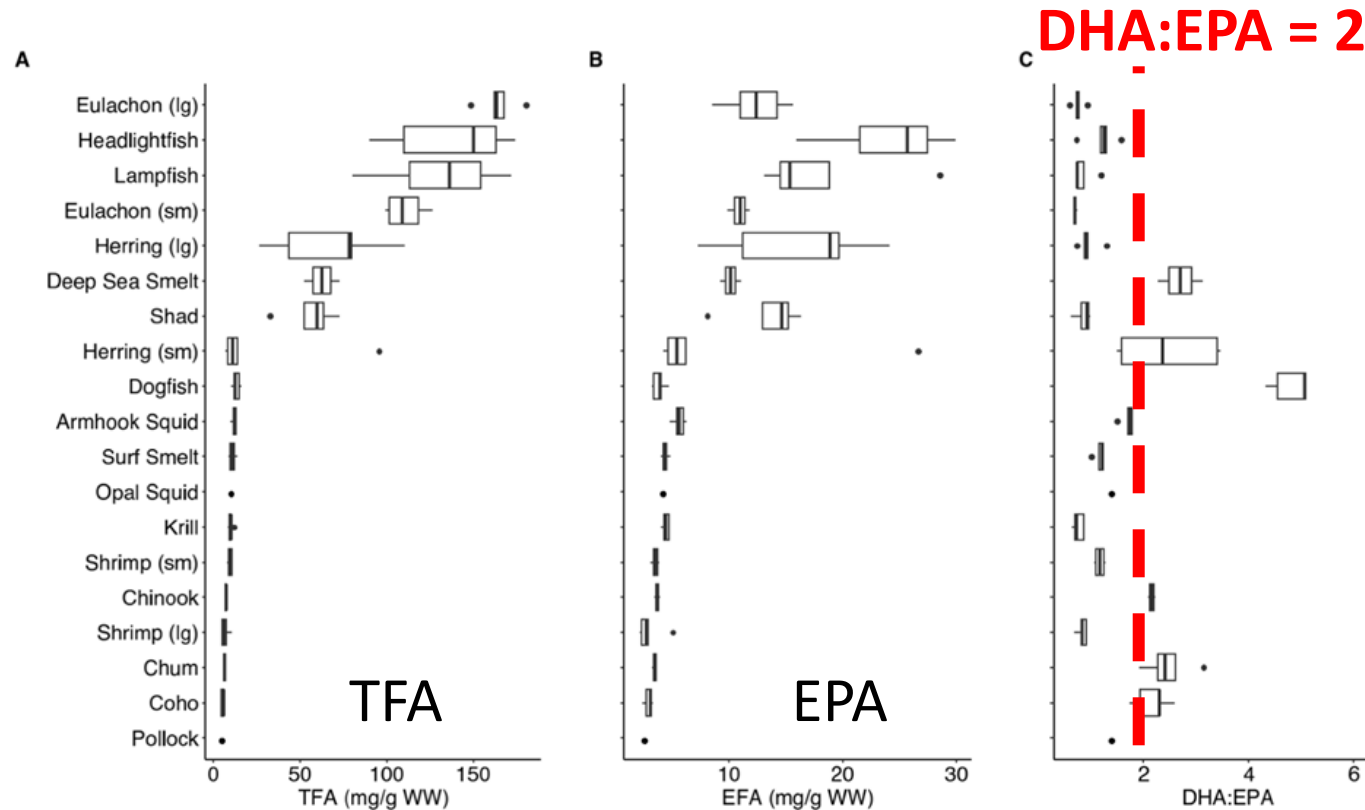
Individual health

Trophic transfer



*Important to understand  
small pelagics nutritional  
variability and its drivers*

# Interspecific variation – western Canada



- Substantial variation among species in FA metrics
- DHA/EPA above optimum ( $\geq 2$ ) for 33% of taxa

# Interspecific differences in FA nutrition

e.g., Fatty acid (mg / 100g) content of Tasman Sea mesopelagic micronekton (Zhang et al 2025)

Species	DHA	EPA
<i>Cubiceps caeruleus</i>	402 ± 21.7 a	114 ± 13.1 a
<i>Chauliodus sloani</i>	231 ± 140 bcd	62.9 ± 53.8 abc
<i>Persparsia kopua</i>	178 ± 95.0 cd	72.8 ± 42.7 abc
<i>Bolinichthys supralaterali</i>	166 ± 87.6 d	50.1 ± 36.0 bc
<i>Diaphus hudsoni</i>	298 ± 133 ab	64.7 ± 30.7 abc
<i>Diaphus ostenfeldi</i>	157 ± 21.2 d	49.2 ± 7.17 bc
<i>Electrona risso</i>	261 ± 117 abc	63.2 ± 15.3 abc
<i>Hygophum hanseni</i>	185 ± 32.2 cd	66.9 ± 7.68 abc
<i>Lampanyctus australis</i>	205 ± 117 bcd	85.4 ± 37.9 abc
<i>Lobianchia dofleini</i>	186 ± 98.4 cd	74.4 ± 42.3 abc
<i>Lampichthys procerus</i>	154 ± 59.6 d	55.7 ± 25.2 bc
<i>Metelectrona ventralis</i>	184 ± 144 cd	74.4 ± 54.9 abc
<i>Nannobrachium achirus</i>	254 ± 77.1 abc	72.4 ± 14.5 abc
<i>Protomyctophum norman</i>	262 ± 100 abc	109 ± 71.8 ab
<i>Symbolophorus barnardi</i>	103 ± 26.0 e	28.0 ± 10.5c
<i>Scopelopsis multipunctatu</i>	402 ± 21.7 a	114 ± 13.1 a
Kruskal-Wallis test	*	*



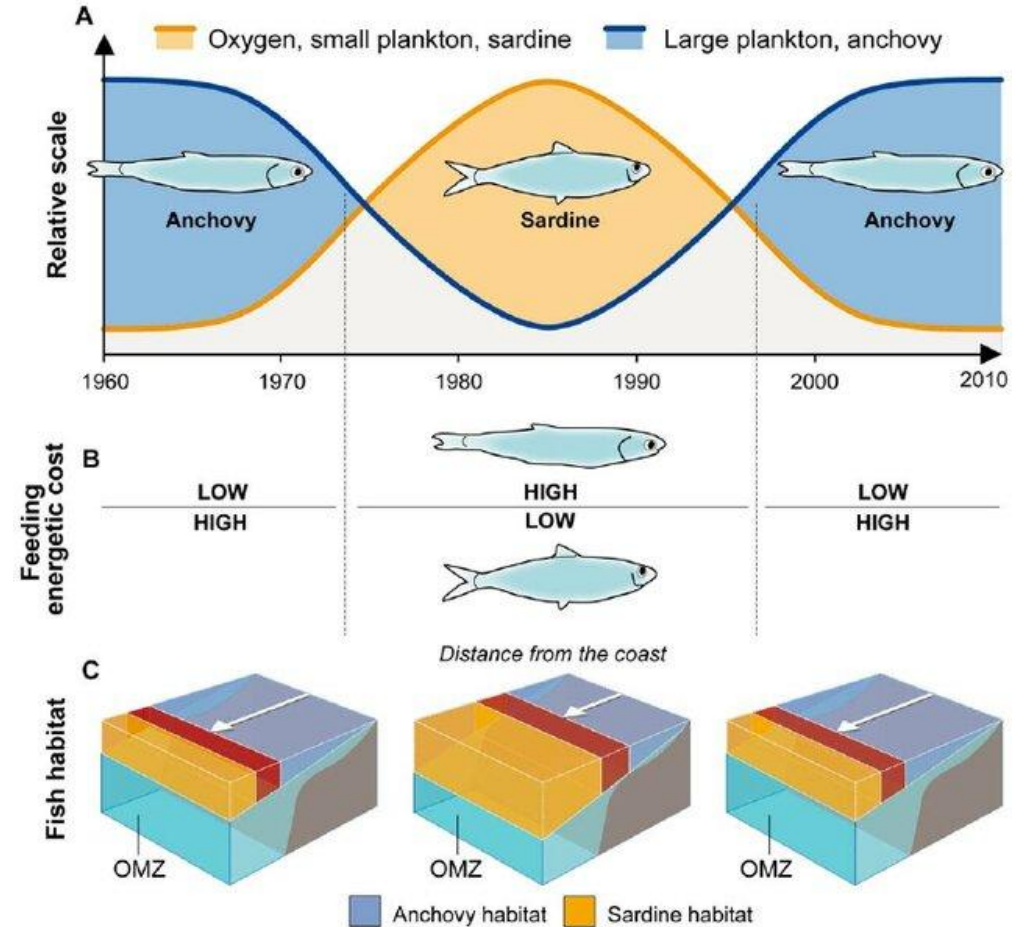
Up to fourfold difference  
among species  
[DHA/EPA = 2-4]



# Interspecific differences in FA nutrition

Changes in contribution of species in space and time have implications for the nutritional profile of small pelagic prey

e.g., sardine have higher TFA and Omega 3 concentrations than anchovy in eastern Mediterranean Sea (Zlatonos & Lakaridis 2007)



Bertrand et al 2012

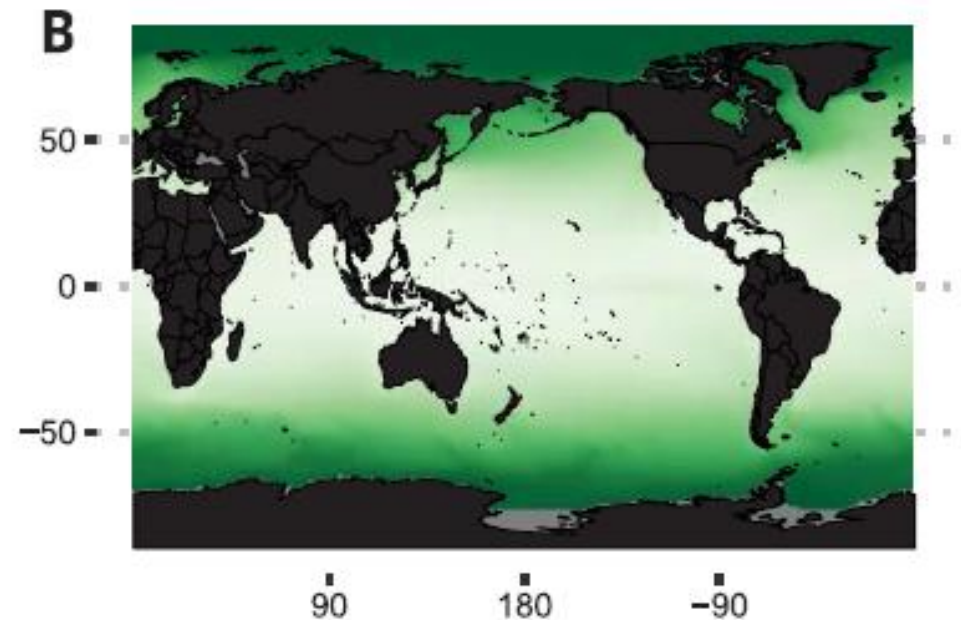
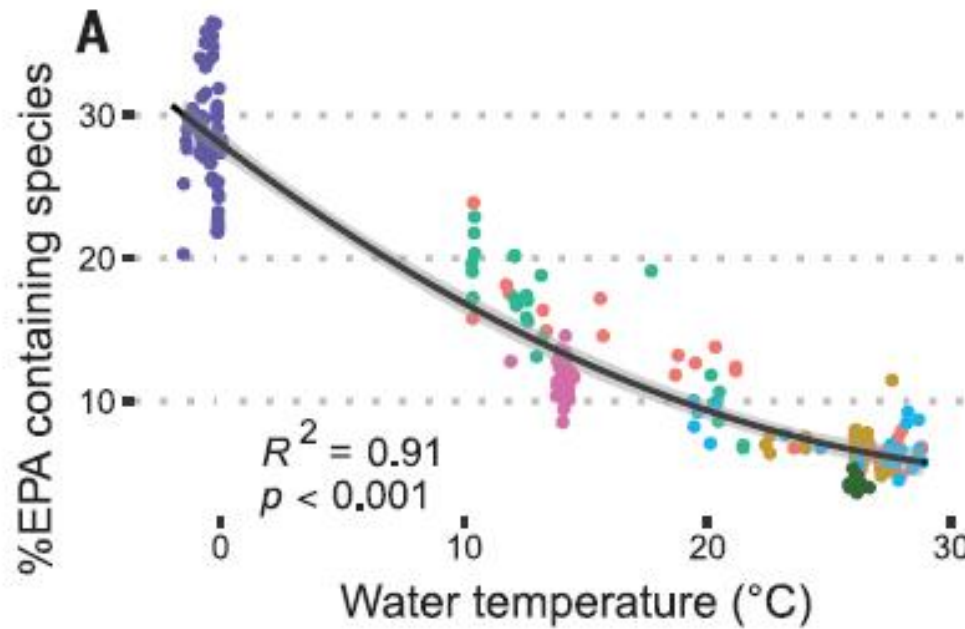
# Sources of variation in fatty acid profiles

- Species phylogeny

# Global fatty acid distribution

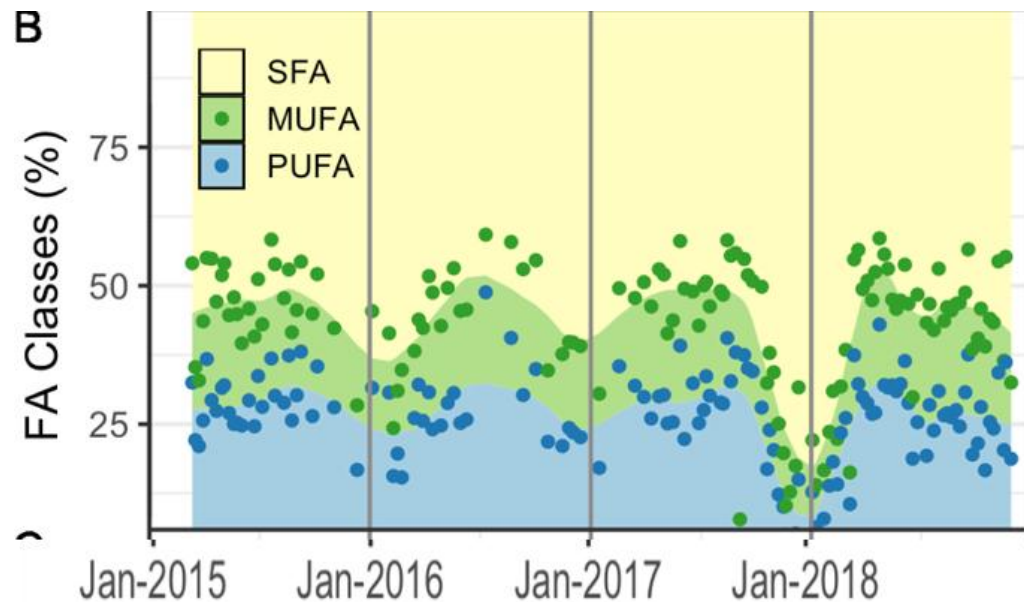
% EPA containing species in mixed layer

Current (1995-2014) EPA % in mixed layer



# Local fatty acids driven by seasonal cycles in plankton composition

Seasonal change in fatty acid groups in the Salish Sea, Western Canada



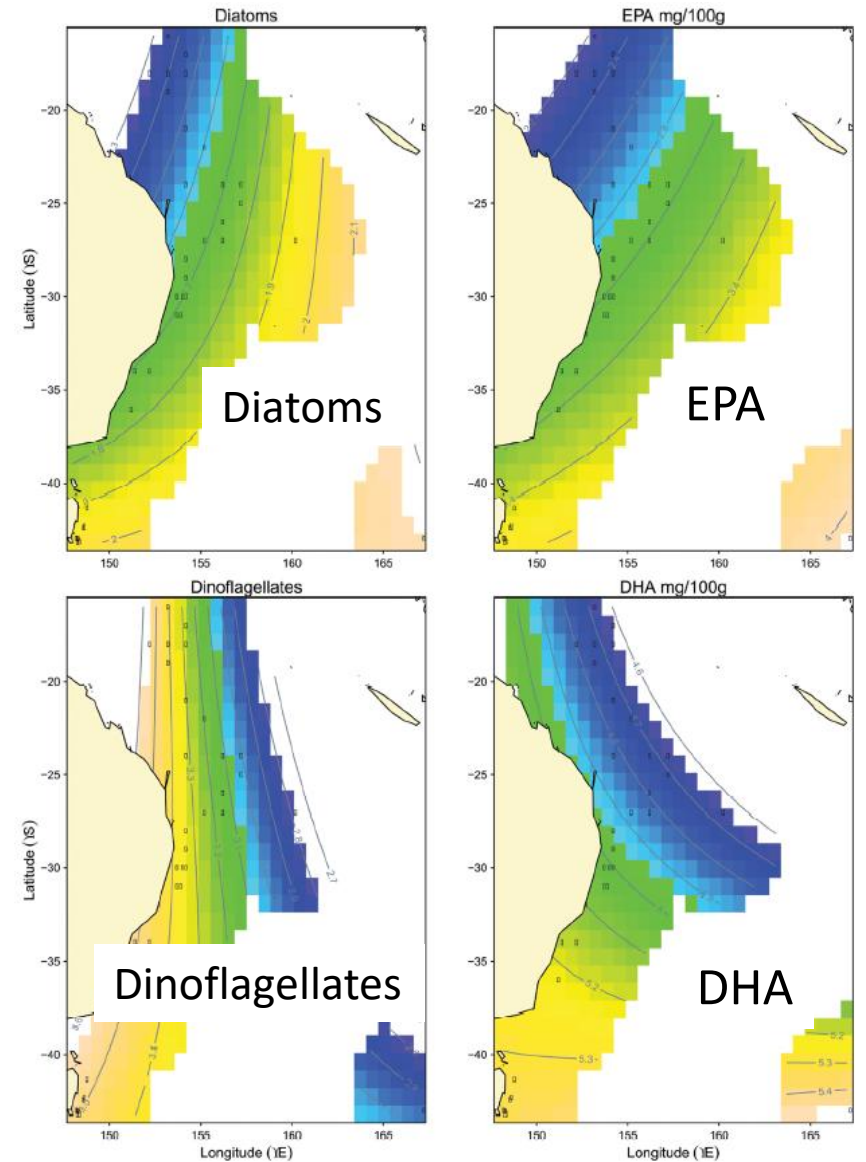
Spatial and temporal changes in plankton fatty acid production are expected to result in intraspecific variation in small pelagic FA profiles

**Few studies have explicitly examined this**

# Intraspecific variation

e.g., Albacore tuna, East Australian Current (Pethybridge et al 2015)

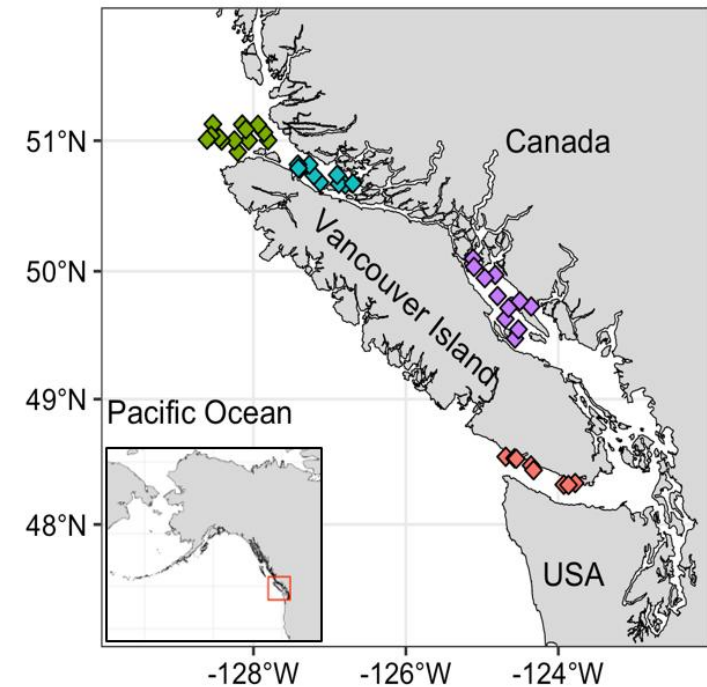
- Correspondence of diatom markers and albacore EPA
- Correspondence of dinoflagellate markers and albacore DHA



# Intraspecific variation

## Coastal SPF / micronekton study in Western Canada

- DHA:EPA differed significantly among regions at scales of 10-50km; always higher outside Juan de Fuca Strait



DHA:EPA	Juan de Fuca Strait	Queen Charlotte Sound	Queen Charlotte Strait	Strait of Georgia
<b>Chinook</b>	2.15 ± 0.1	ND	3.42 ± 0.74	3.81 ± 1
<b>Chum</b>	2.47 ± 0.5 <sub>x</sub>	ND	2.68 ± 0.33 <sub>x</sub>	4.20 ± 0.85 <sub>y</sub>
<b>Coho</b>	2.17 ± 0.34 <sub>x</sub>	2.77 ± 0.58 <sub>x</sub>	2.53 ± 0.15 <sub>x</sub>	3.52 ± 0.42 <sub>y</sub>
<b>Eulachon sml</b>	0.70 ± 0.02 <sub>x</sub>	ND	0.78 ± 0.08 <sub>y</sub>	ND
<b>Herring lrg</b>	0.95 ± 0.21	1.10 ± 0.56	1.84 ± 1.08	ND
<b>Herring sml</b>	2.46 ± 0.95 <sub>xy</sub>	2.62 ± 0.67 <sub>y</sub>	1.08 ± 0.69 <sub>x</sub>	ND

# Sources of variation in fatty acid profiles

- Species phylogeny
- Life history phase
- Diet and primary producers at food web base

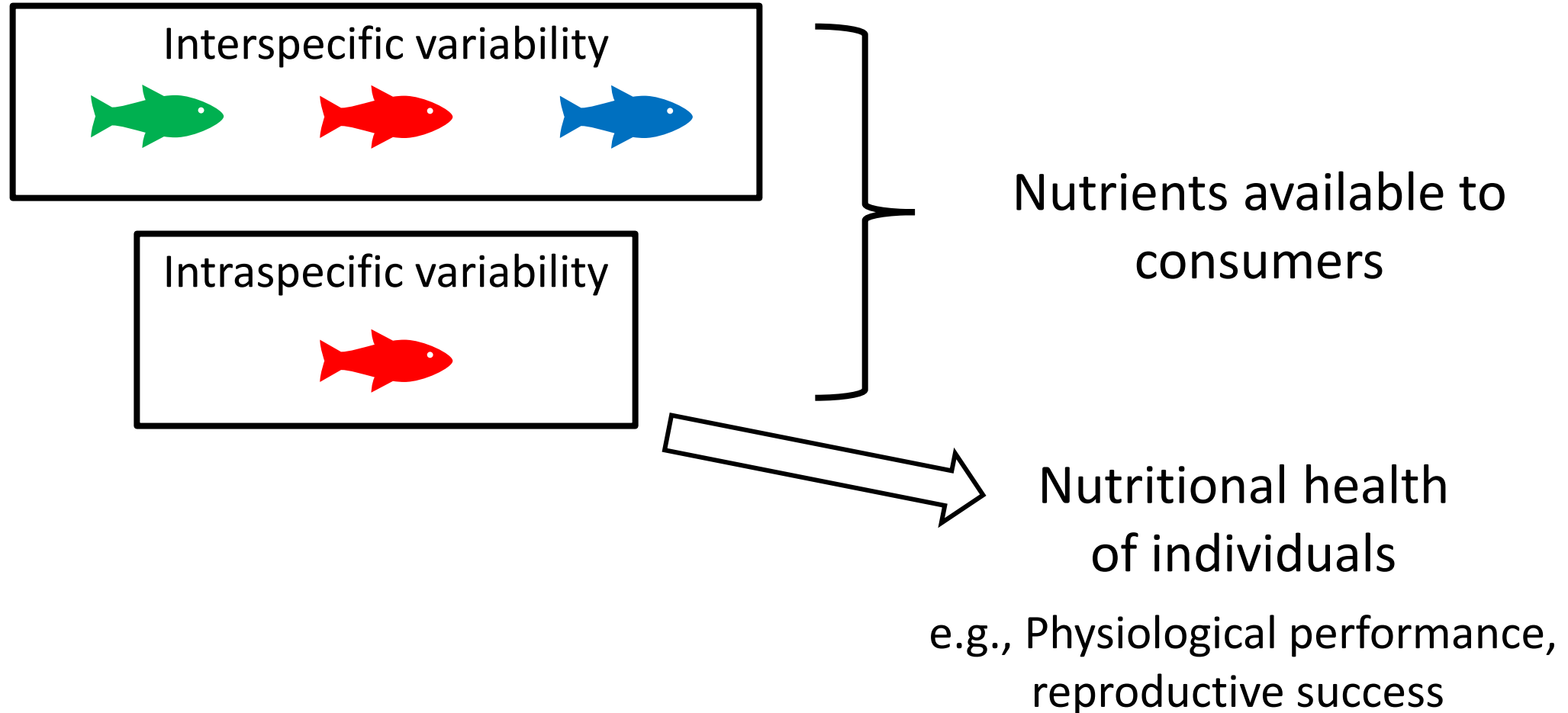


Temperature



- Individual fatty acid requirements

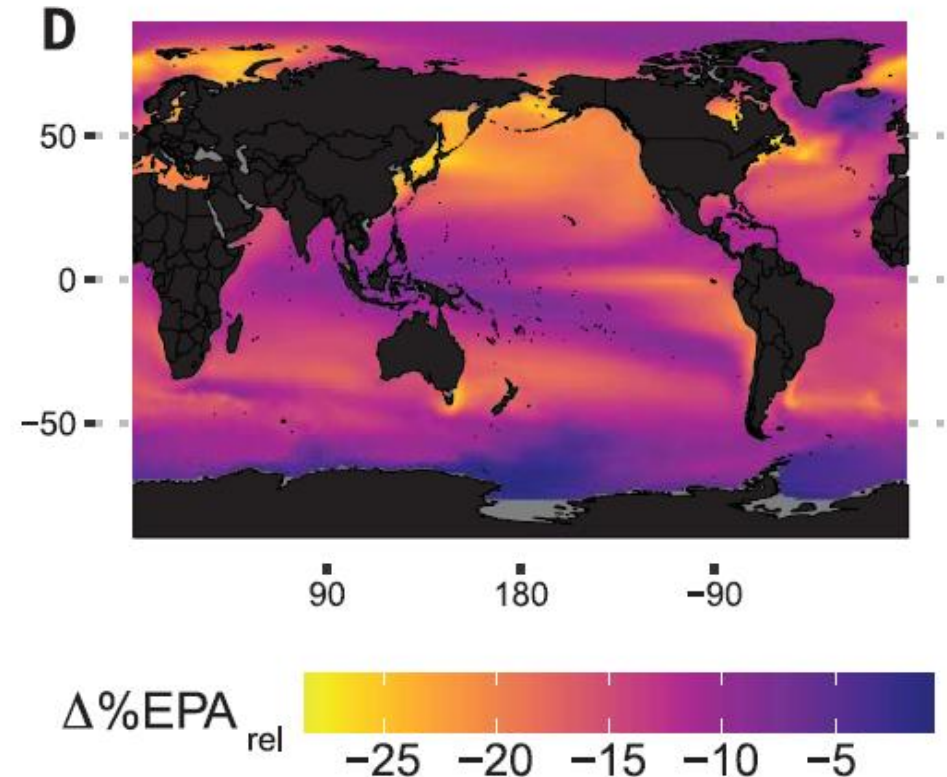
# Implications of small pelagic FA variability



# The need for data synthesis

Micronekton / SPF distributions are changing.

Nutrient provisioning is being impacted by climate and other anthropogenic stressors.



Projected loss of EPA (%) in mixed layer by end of the century under SSP5-8.5 (Holm et al 2022)

# The need for data synthesis

Data on small pelagic fish nutrition has been synthesized, but largely for the purpose of informing human health, e.g.:

- FAO
- Aquatic Food Composition Database

Not linked to data needed to understand the drivers and impacts of changing ocean conditions on SPF / micronekton nutrition

e.g., fish biology (e.g., size, sex), ocean properties (e.g., T, S, Chl-a), seasonal and regional coverage.

# PICES/ICES Working Group on Sustainable Pelagic Forage Communities (Working Group 53)

To address the nutrition knowledge gap the Food-web sub-group is proposing a synthesis of SPF / micronekton nutrition data.

Purpose:

1. Conduct regional comparisons of nutrition
2. Determine the scope of intraspecific variability
3. Inform drivers of nutritional change
4. Lay groundwork for deeper research into role of nutrition in small pelagic health, survival, and recruitment

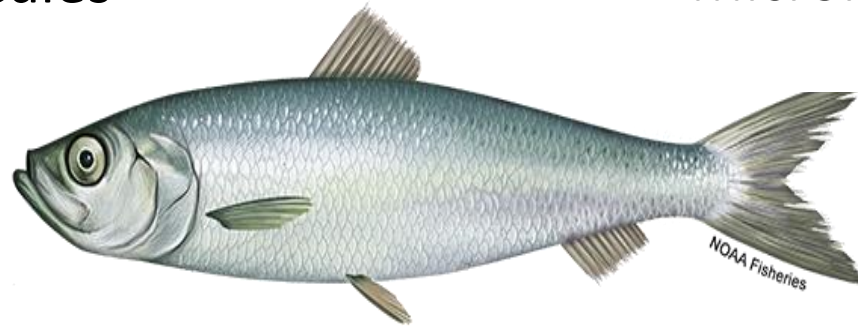
Please contribute your data and join us in this effort! Thank you.

Contact Brian Hunt: [b.hunt@oceans.ubc.ca](mailto:b.hunt@oceans.ubc.ca)

Macromolecules

Fatty Acids

Micronutrients



Elemental stoichiometry

Energy content

Amino Acids