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Variations of n-3 highly unsaturated fatty acid (n-3 HUFA) content in muscle of sardines fed with different sizes and quantities of food

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Introduction

Small pelagic fish = key components of marine ecosystems [1]
account for 25% of worldwide landings

But: reduction in the size and body condition index of sardines

→ Gulf of Lions since 2008 [2]

→ Bay of Biscay since 2012 [3]

Result of a change in prey quantity and/or quality?



Sardina pilchardus

Growth and body condition of sardines are [4]:

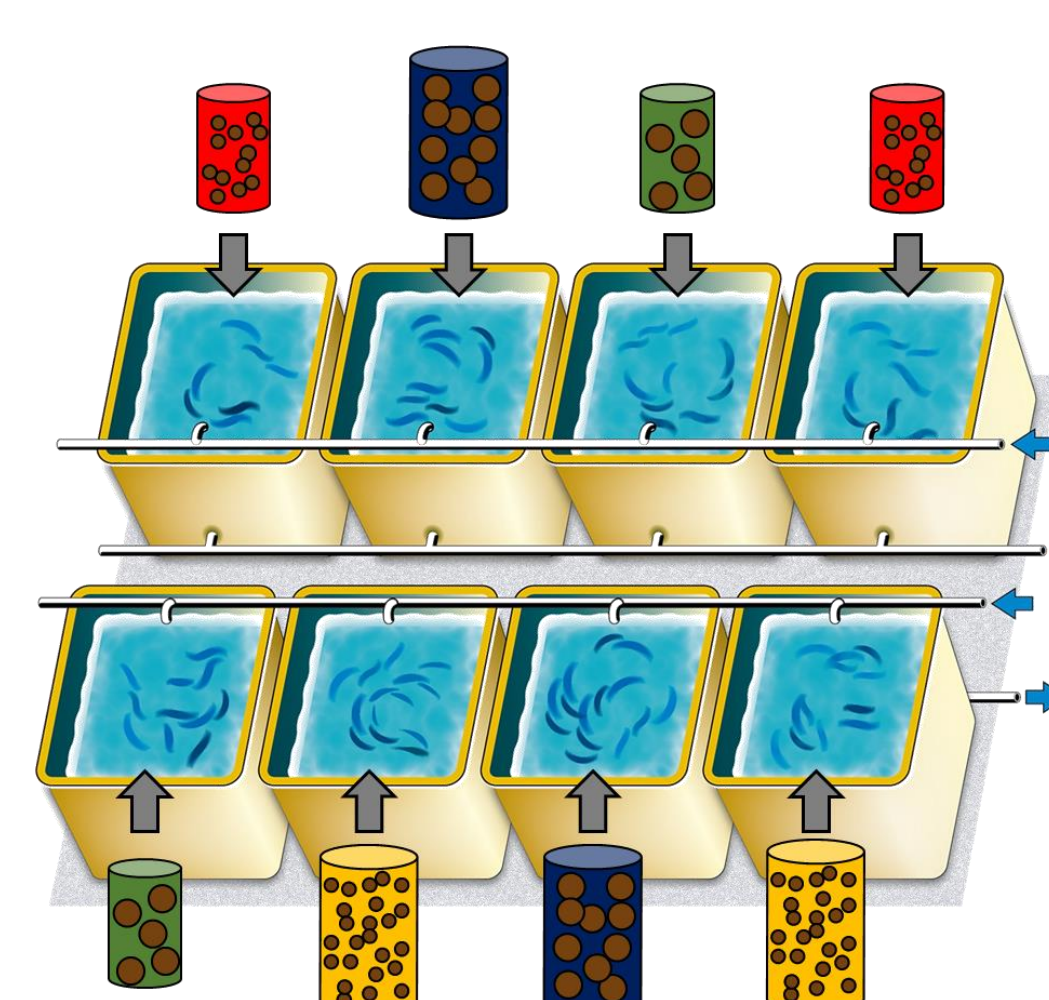
- an immediate response to food quantity and pellet size
- optimal when sardines consume large amount of large pellets

n-3 highly unsaturated fatty acids (n-3 HUFA) = essential to vital functions and fitness [5]
food-dependent in fishes [6]
the best known: EPA and DHA

Hypothesis: small food items and/or reduced food quantity induce insufficient intake of n-3 HUFA in muscle and constrain the individuals' growth

Objective : assess the n-3 HUFA composition of structure and reserve lipids in muscle of sardines exposed to different diets varying in quantity and in supply size

Materials and methods

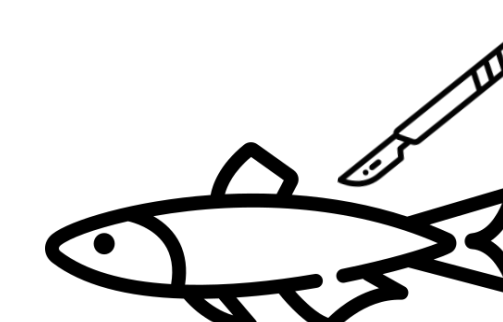


Conditioning of sardines [4]

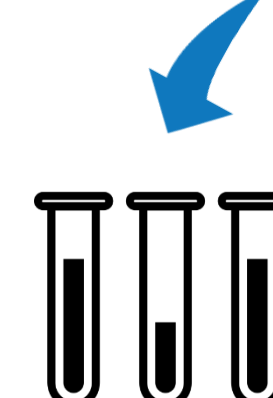
7 months to 4 feeding conditions:
small or large pellets (0.1 and 1.2 mm)
in small or large quantities (0.3% and 0.6% of the total fish mass in tanks)

n = 15 individuals/tank

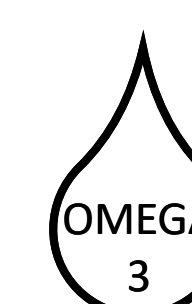
Analysis of n-3 HUFA in the muscle of 40 female sardines



Collection of a dorsal muscle sample
n = 5 females/tank

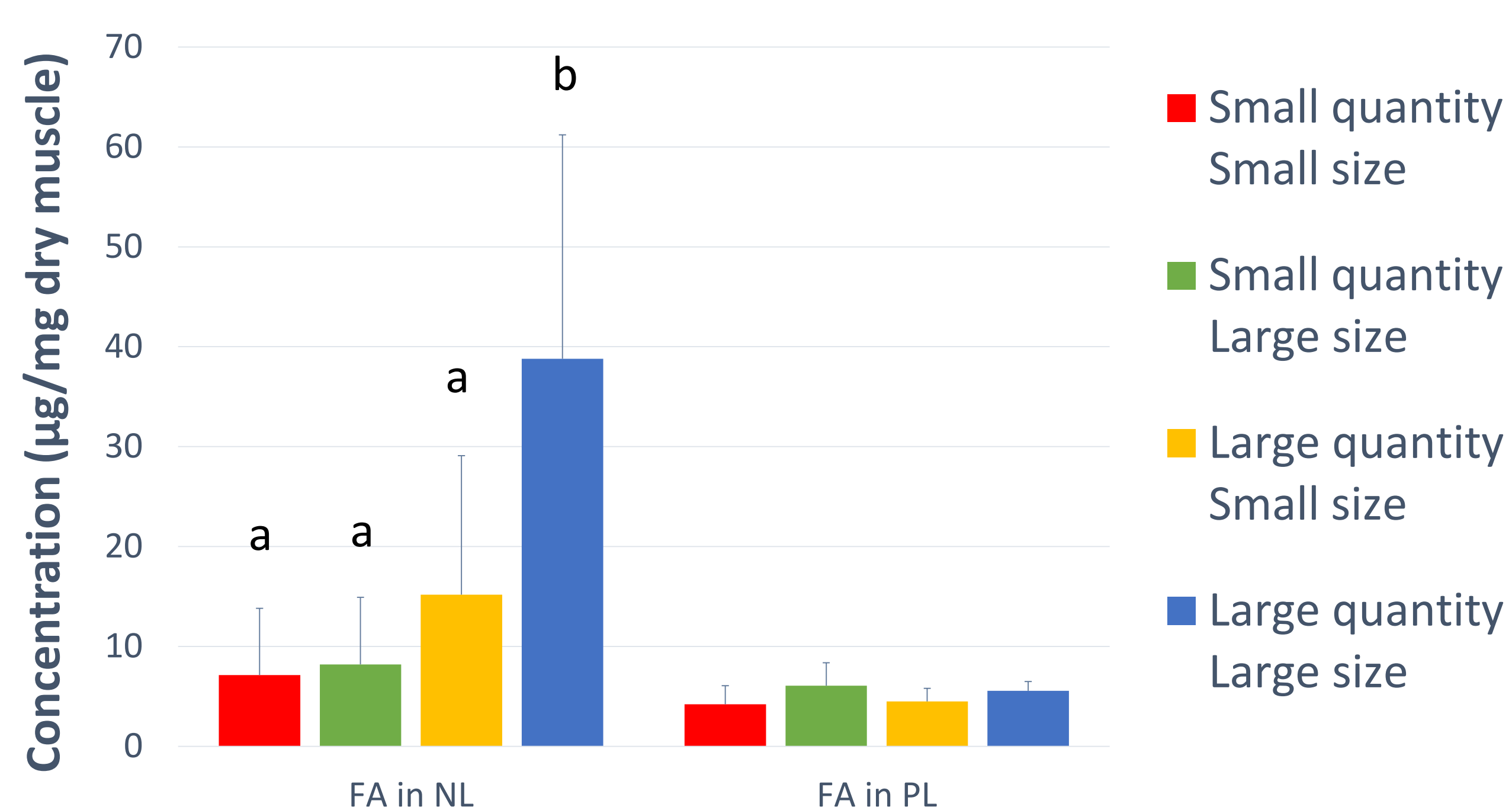


Extraction of lipids by the Folch method [7]
Separation of neutral lipids (NL = metabolic energy source) and polar lipids (PL = cell membrane structure)



Saponification and transmethylation of NL and PL samples
Gas chromatography analysis (GC-FID) of NL and PL FA

Results and discussion



Total fatty acids in neutral and polar lipids

Figure 1: Total fatty acid concentration in neutral and polar lipids, by experimental conditions.

→ Reserve lipids (NL) accumulation in muscle is significantly influenced by the amount and size of supplied feed. The highest accumulation is obtained with large quantity and large size feed supply (Figure 1).

→ Structural lipids (PL) do not vary according to dietary conditioning, revealing a tight conservation of this cellular compartment (Figure 1).

→ Accretion of EPA and DHA in fish reserves (NL) is dependent on their quantitative supply more notably with large size feed. The accumulation of EPA in structural lipids (PL) is significantly higher with large quantity and large size feed supply (Figure 2A).

→ Proportions of EPA and DHA in structure and reserve lipids (PL and NL) are well regulated when the diet is not limiting in these two essential nutrients (Figure 2B).

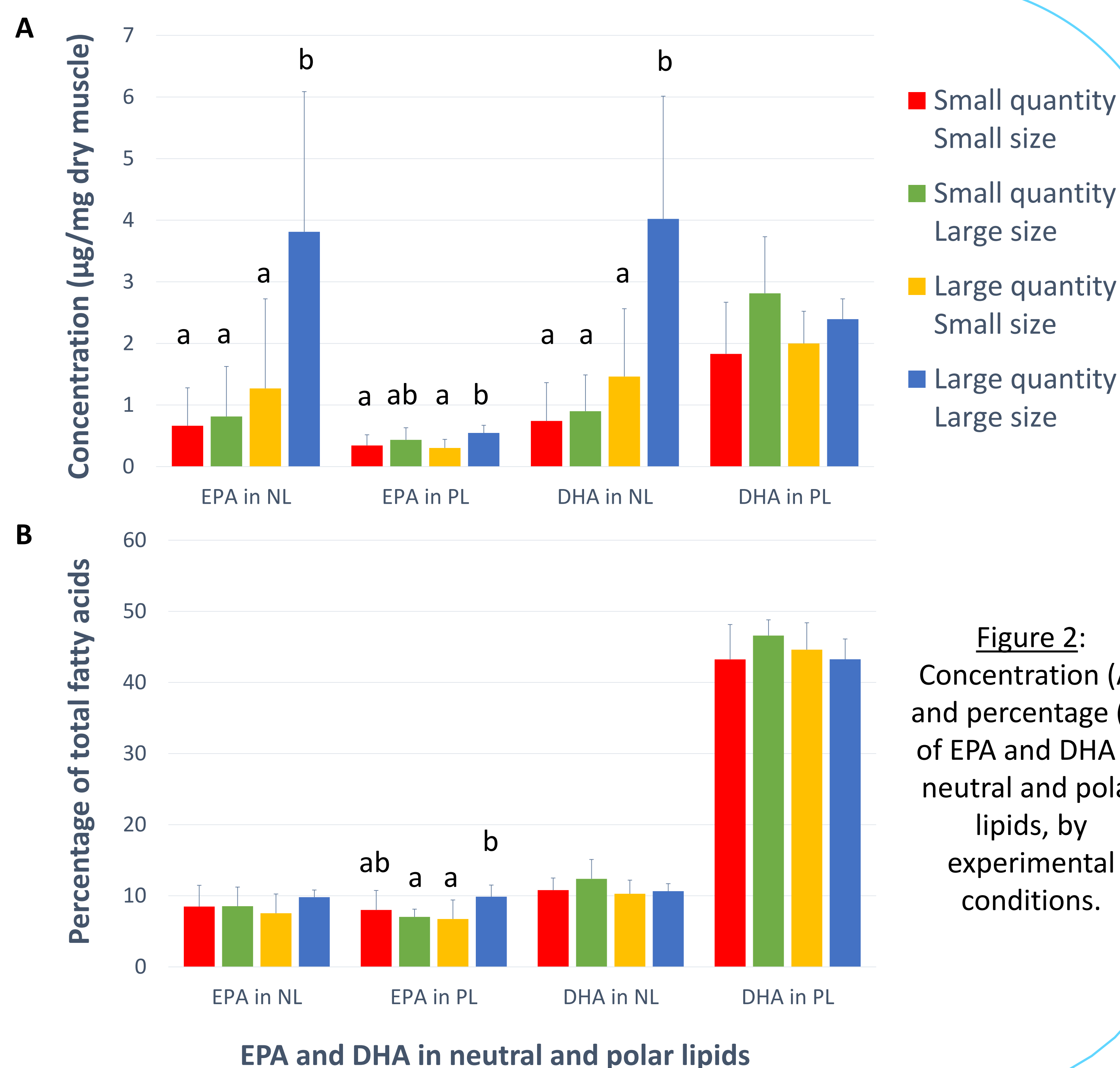


Figure 2: Concentration (A) and percentage (B) of EPA and DHA in neutral and polar lipids, by experimental conditions.

Conclusion

→ After this first step of analysing muscle lipid composition, we will explore the relationship between muscle composition and growth performance at the individual level.

→ Beyond food quantitative supply, it would be interesting to explore the effect of EPA and/or DHA deficient feed on growth and behavioural performances.

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