Fette in Algen
–
Bedeutung für die menschliche Verwertung und Gesundheit

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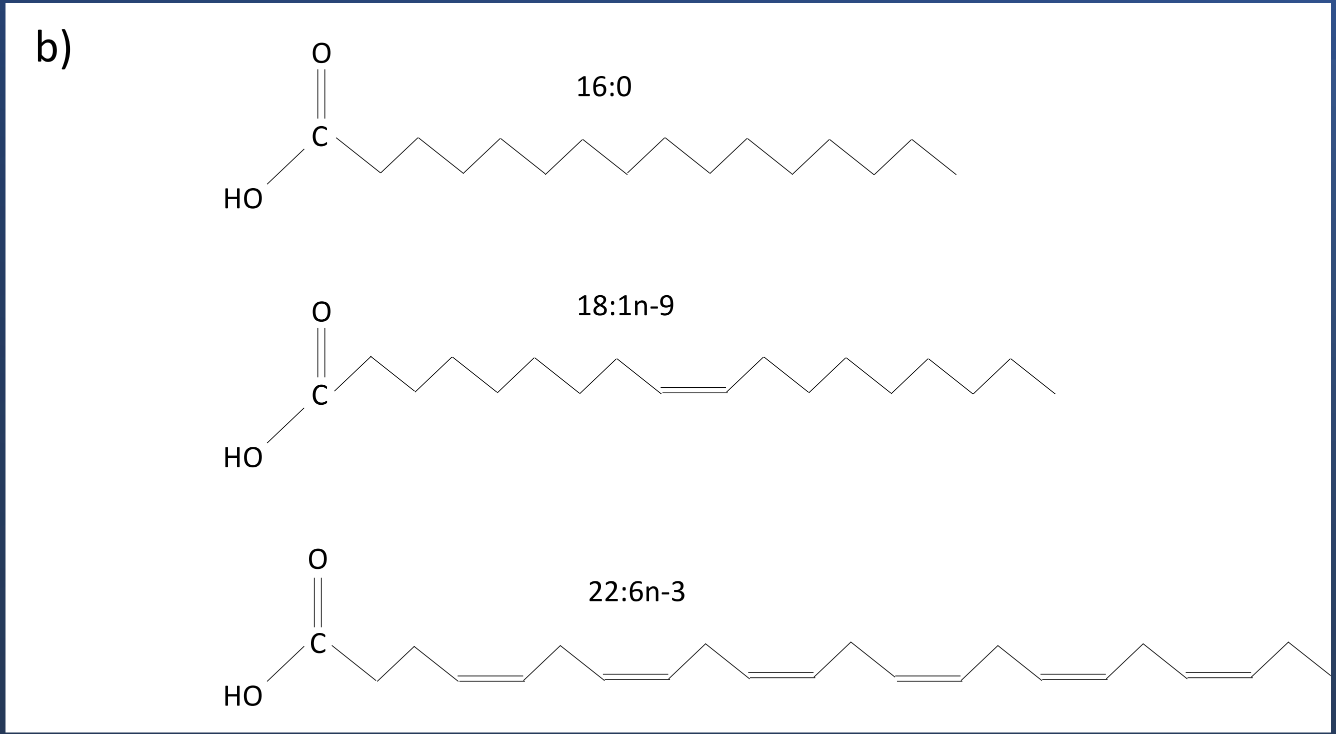
Fatty acids in algae



Kainz et al. (2023): Unravelling the Food Web: Quantitative approaches to describing wildlife feeding relationships (book chapter)

Table 1. Essential fatty acids of zooplankton, fish, and humans. All of the ω-3 and ω-6 fatty acids can be synthesized by microalgae

Polyunsaturated fatty acid	Common name	Abbreviation
ω-3 family		
18:3ω3	α-linolenic acid	ALA
18:4ω3	Stearidonic acid	SDA
20:5ω3	Eicosapentaenoic acid	EPA
22:5ω3	Docosapentaenoic acid	DPA
22:6ω3	Docosahexaenoic acid	DHA
ω-6 family		
18:2ω6	α-linoleic acid	LIN
18:2ω6	γ-linolenic acid	GLA
20:4ω6	Arachidonic acid	ARA

Taipale et al. (2013) Aquat. Microb. Ecol.

Fatty acids in algae

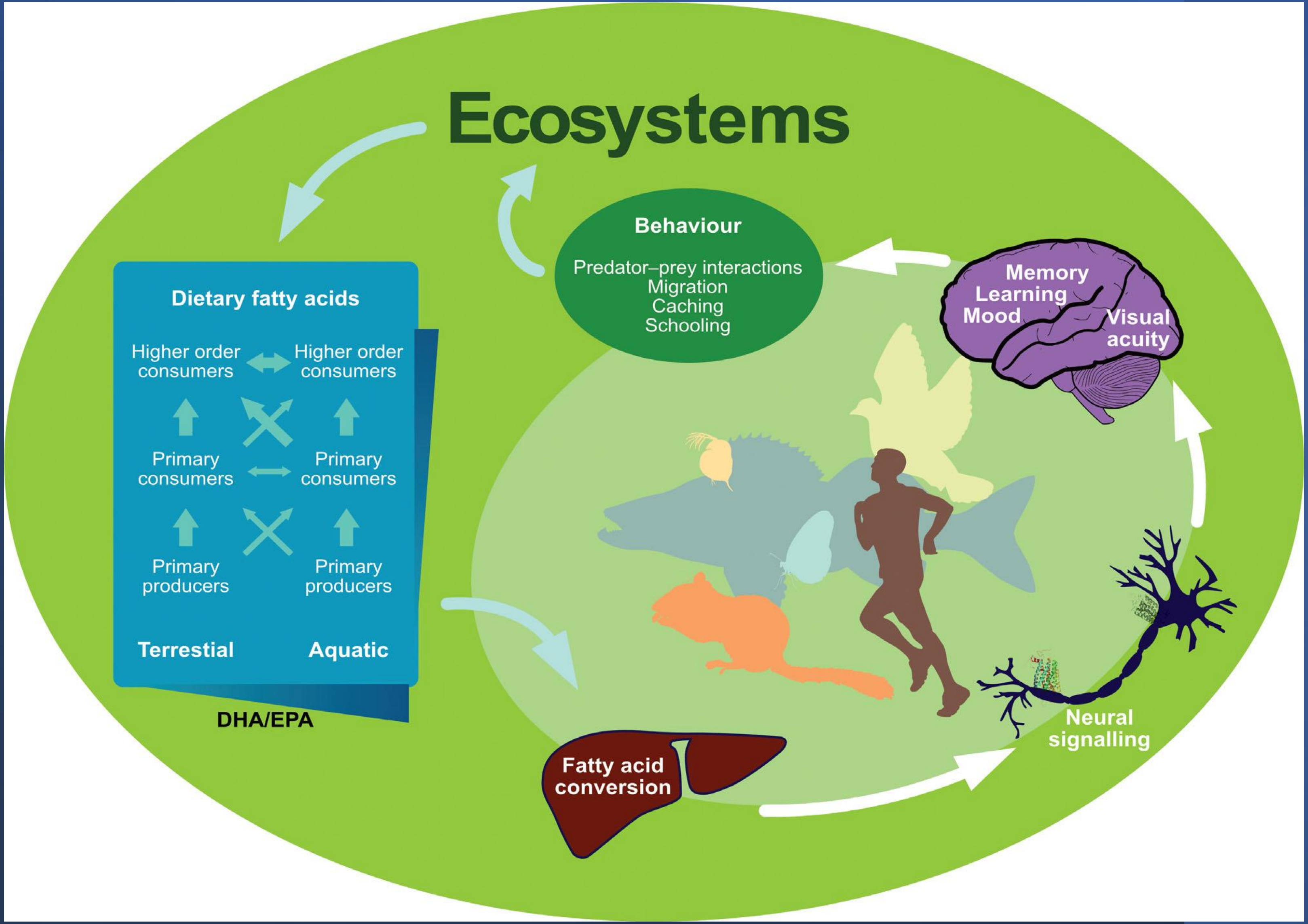
Table 6. Major fatty acids (FAs) and potential biomarkers for each algal class. FA abbreviations shown in Table 1. Asterisks indicate FAs that were only found in their respective phytoplankton group

Phytoplankton group	Major FA	FA biomarker
Chlorophyceae	ALA, 16:0, 18:1ω9, LIN	16:4ω3, 16:3ω3, 16:2ω6
Trebouxiophyceae	ALA, 16:0, 18:1ω9, LIN	16:4ω3, 16:3ω3, 16:2ω6
Cryptophyceae	ALA, 16:0, SDA	22:5ω6, 18:4ω3
Synuraphyceae	SDA, 14:0, ALA, 16:0	22:5ω6, 18:4ω3
Ocromonadales	16:1ω7c, 16:0, LIN, 18:1ω7	16:3ω1, 18:4ω3, 22:5ω6
Raphidophyceae	16:0, EPA, SDA, ALA	16:2ω4, 16:3ω4*, 16:3ω1, 20:3ω3
Bacillariophyceae	16:1ω7c, EPA, 16:0, 14:0	16:2ω7*, 16:2ω4, 16:3ω4, 16:4ω1*, 18:4ω4*
Euglenophyceae	16:0, ALA, EPA, DHA	15:3ω3*, 15:3ω1, 15:4ω3, 17:3ω2*, 17:2ω7/5*, 20:4ω3, 20:2ω6, 20:3ω6, 22:4ω6

Taipale et al. (2013) Aquat. Microb. Ecol.

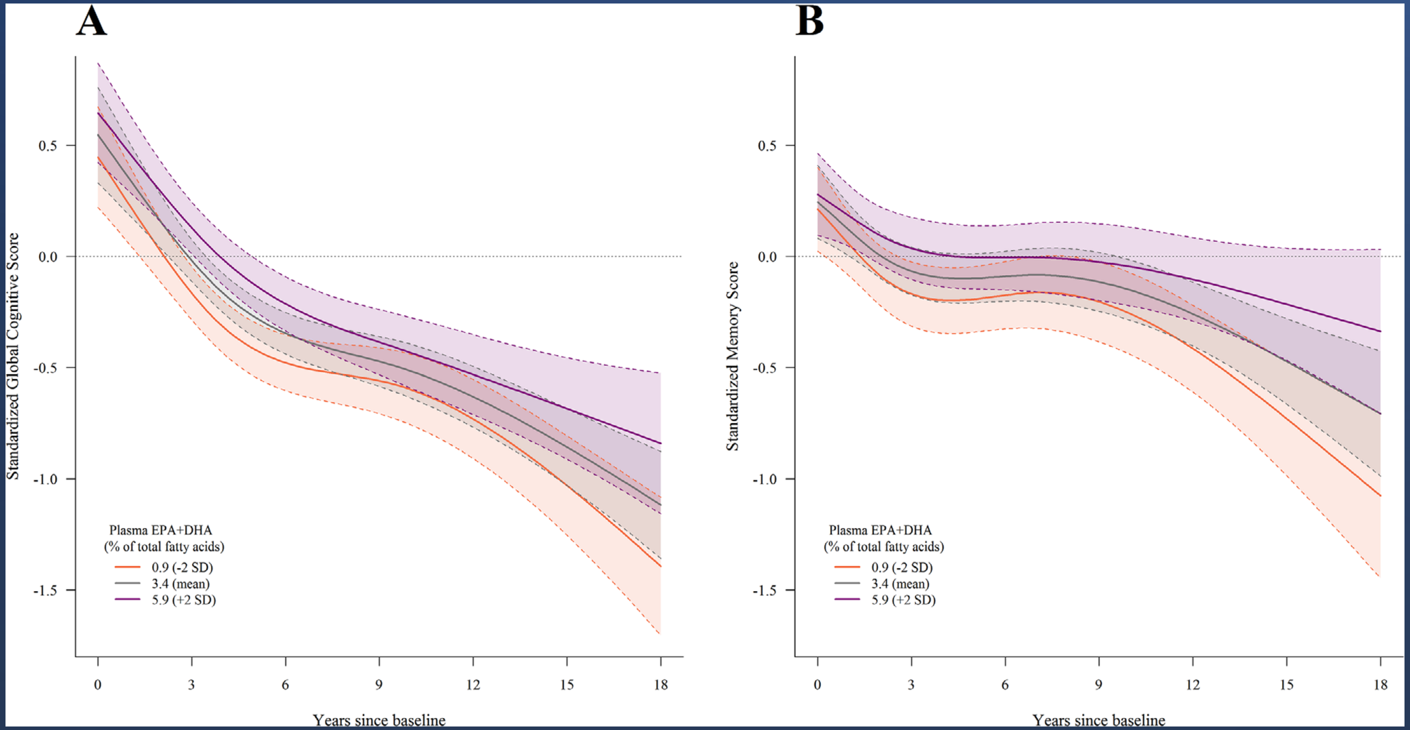
Wie bekommen wir diese Algenfette zu den Menschen?

Omega-3 PUFA, neurophysiology, and ecology

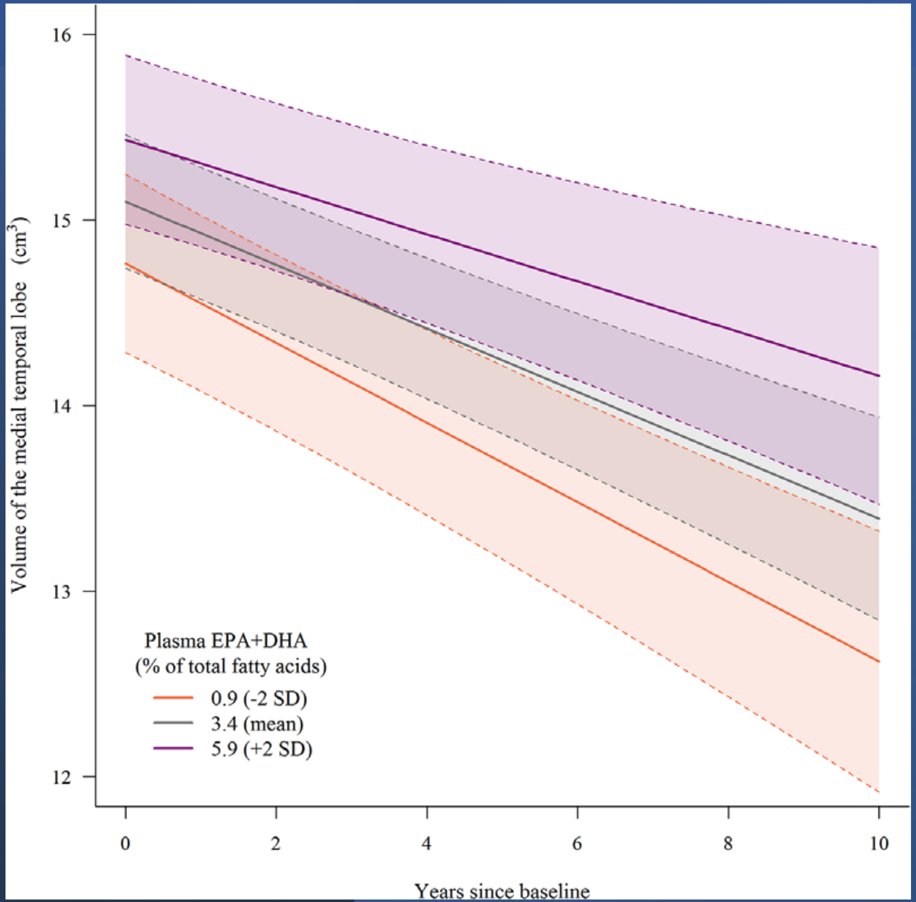


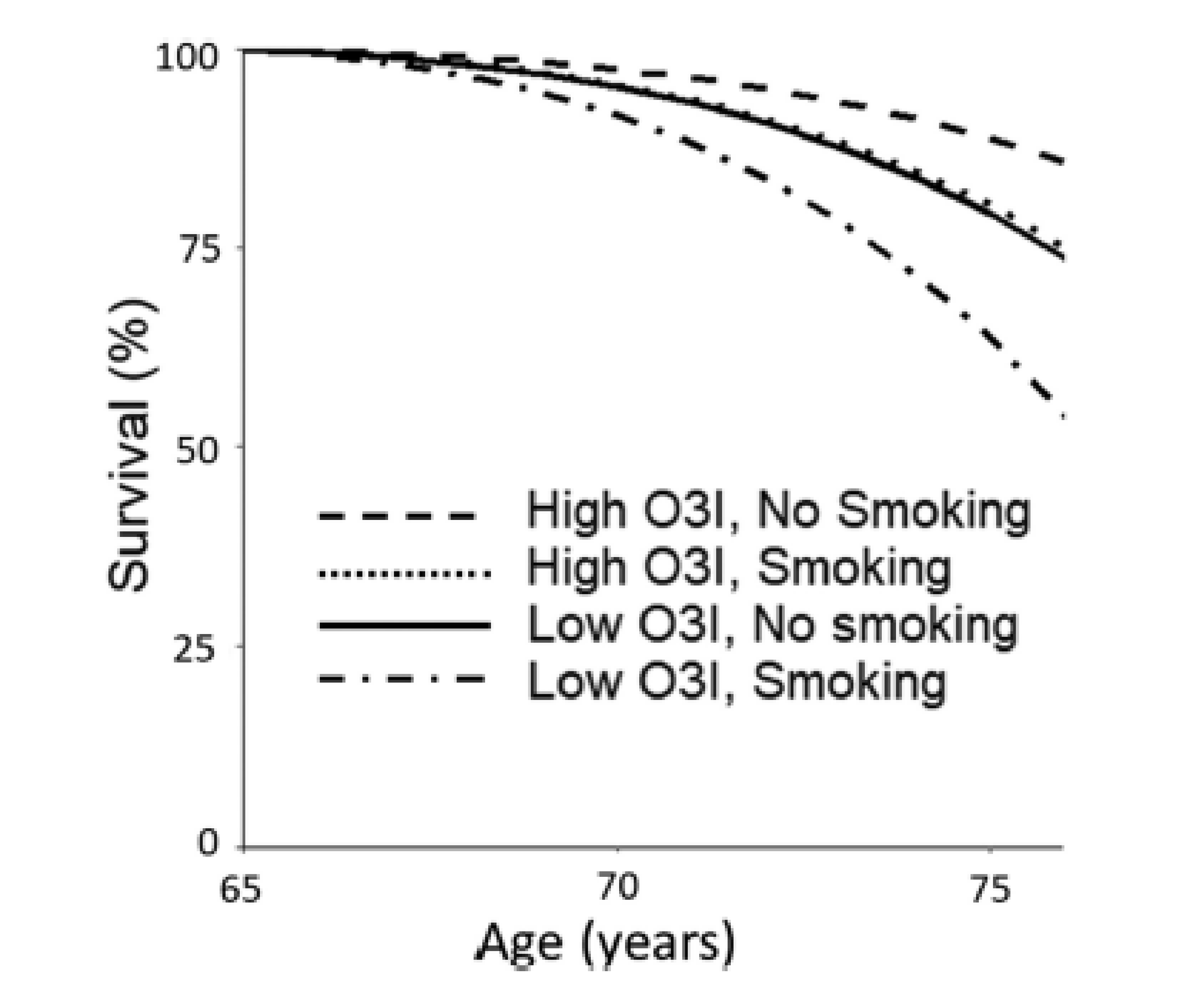
Pilecky et al. (2021) Biol. Rev.

Omega-3 PUFA in human blood decreases memory loss



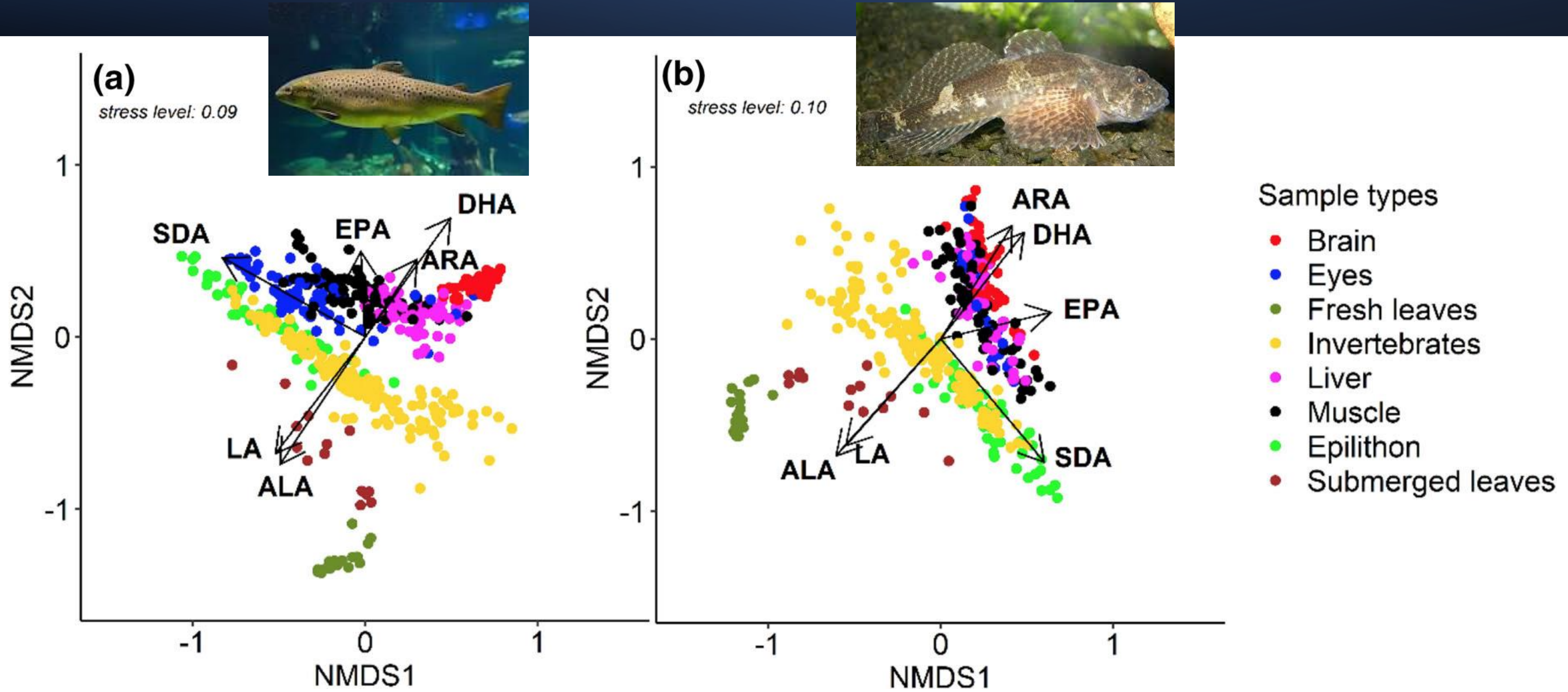
Thomas et al. (2020) Alzheimer's Dement.





McBurney et al. (2021) Orig. Res. Comm.

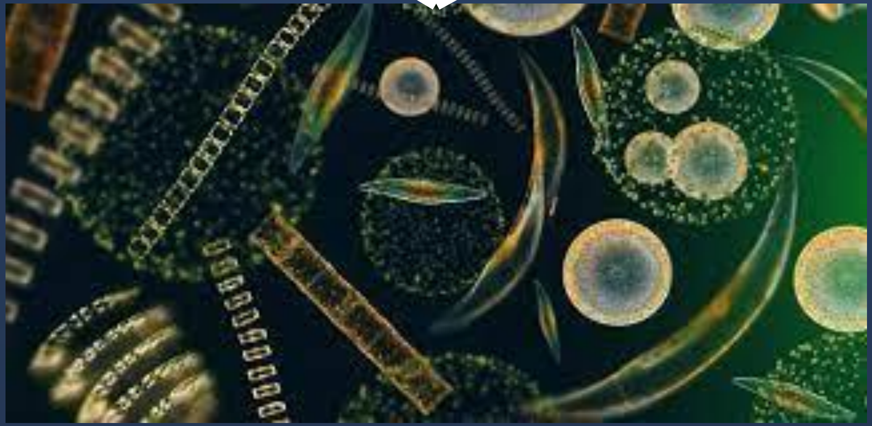
Omega-3 PUFA, neurophysiology, and aquatic ecology



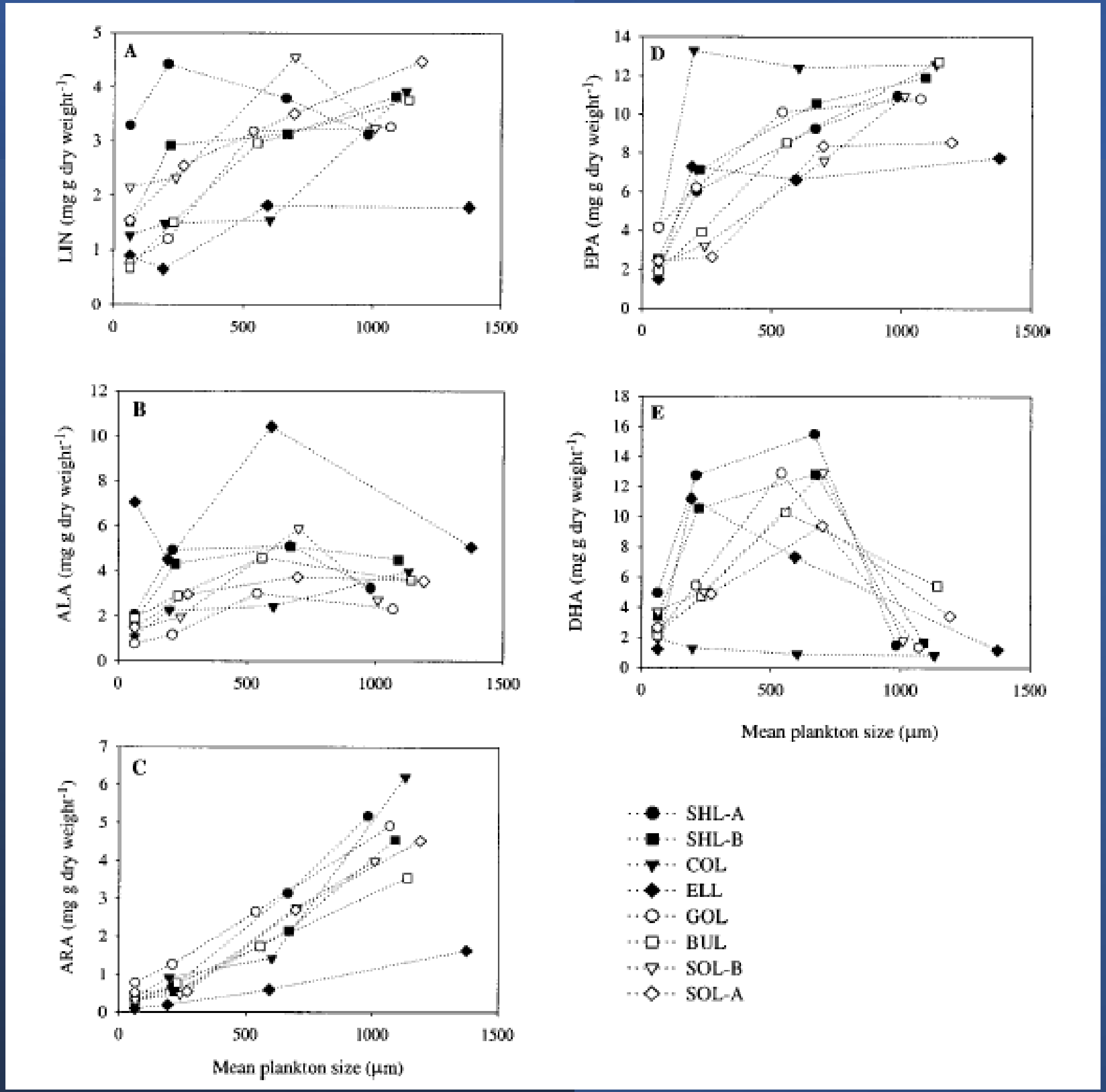
Wie kommen diese Fette in die Fische?

Ebm et al. (2021) Hydrobiologia

Bioaccumulation of PUFA from algae to zooplankton … and fishes



https://planktonforhealth.co.uk



Kainz et al. (2004) Limnol. Oceanogr.

Seesaibling, Regenbogenforelle, Bachforelle (mg Fettsäuren/100 g Nassgewicht)



Zucht	Saibling	Regenbogen	Bachforelle
PUFA	600	440	620
n-3	420	280	420
n-6	160	120	160
n-3/n-6	2,6	2,3	2,6

Wild	Saibling	Regenbogen	Bachforelle
PUFA	360	420	320
n-3	260	300	240
n-6	60	80	60
n-3/n-6	4,3	3,8	4,0

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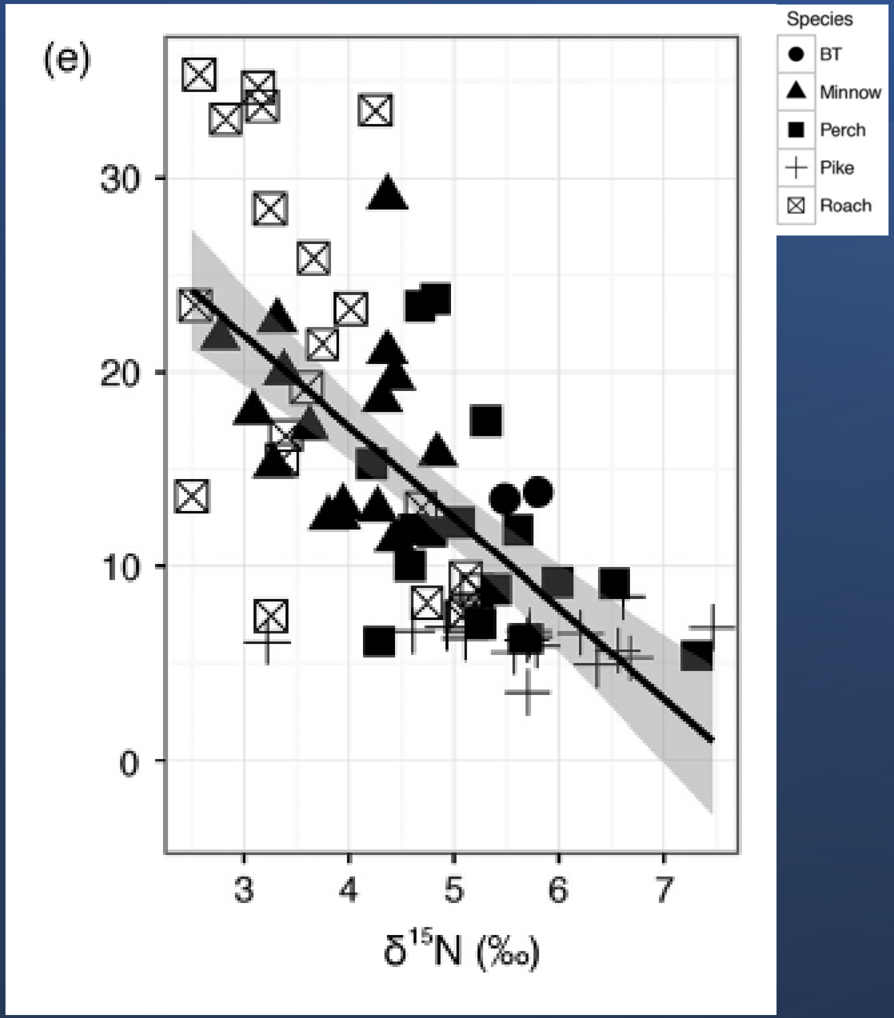
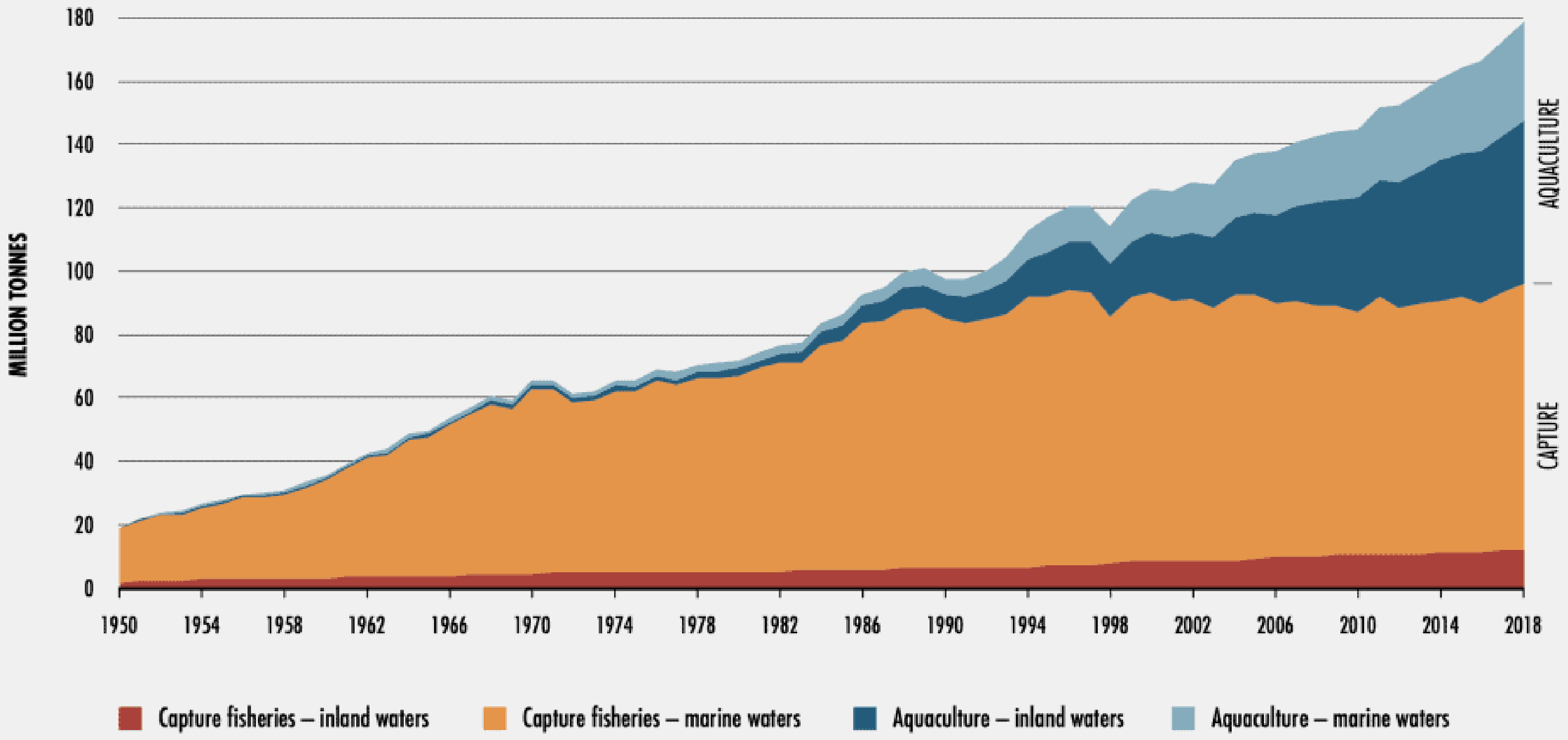
Abfall der wichtigen Omega-3 Fettsäuren (mg/g) in den grossen Raubfischen



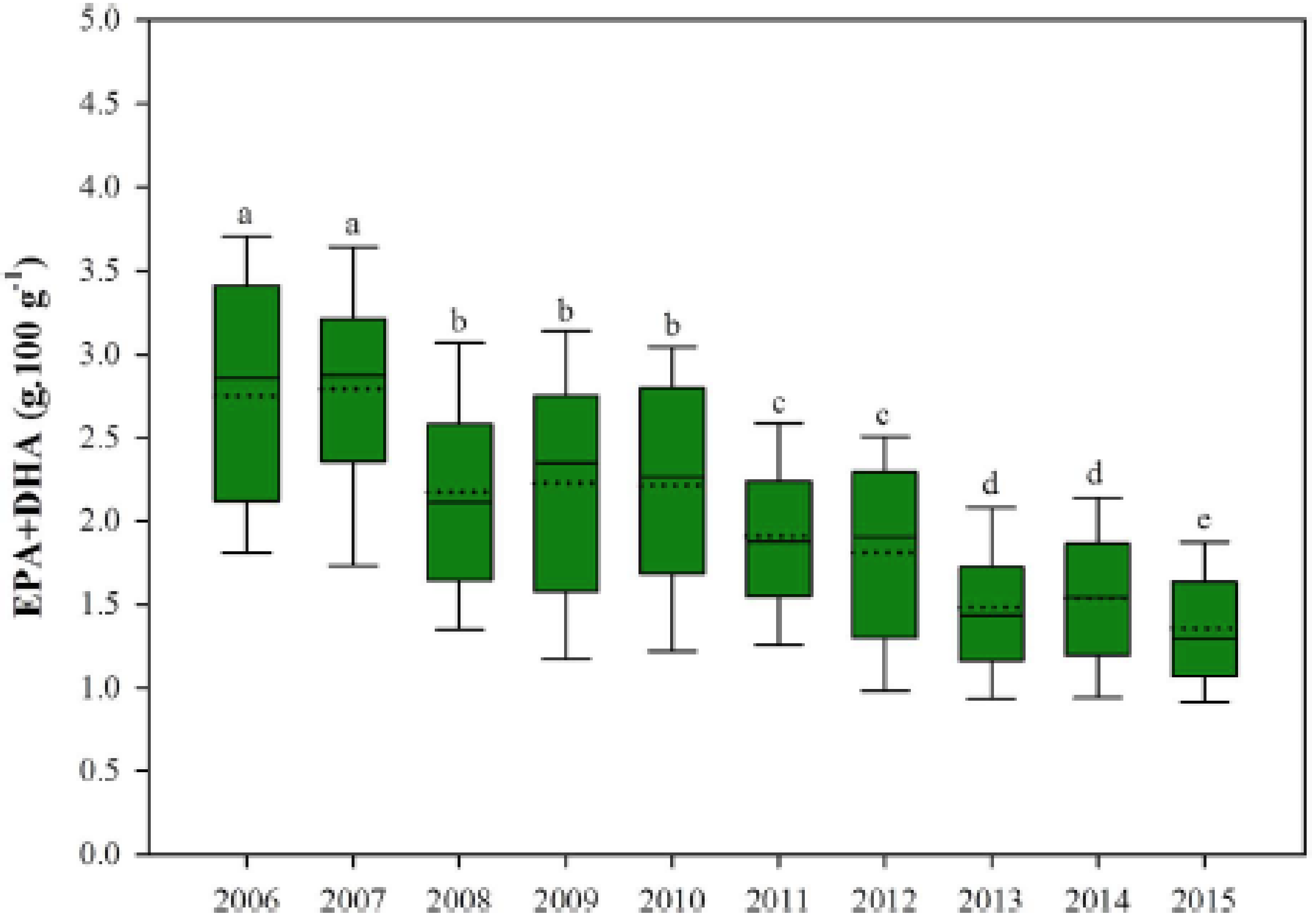
Kainz et al. (2017) EcoSphere

FIGURE 1
WORLD CAPTURE FISHERIES AND AQUACULTURE PRODUCTION



NOTE: Excludes aquatic mammals, crocodiles, alligators and caimans, seaweeds and other aquatic plants.
SOURCE: FAO.

https://sustainablefisheries-uw.org/fao-state-of-world-fisheries-2020/



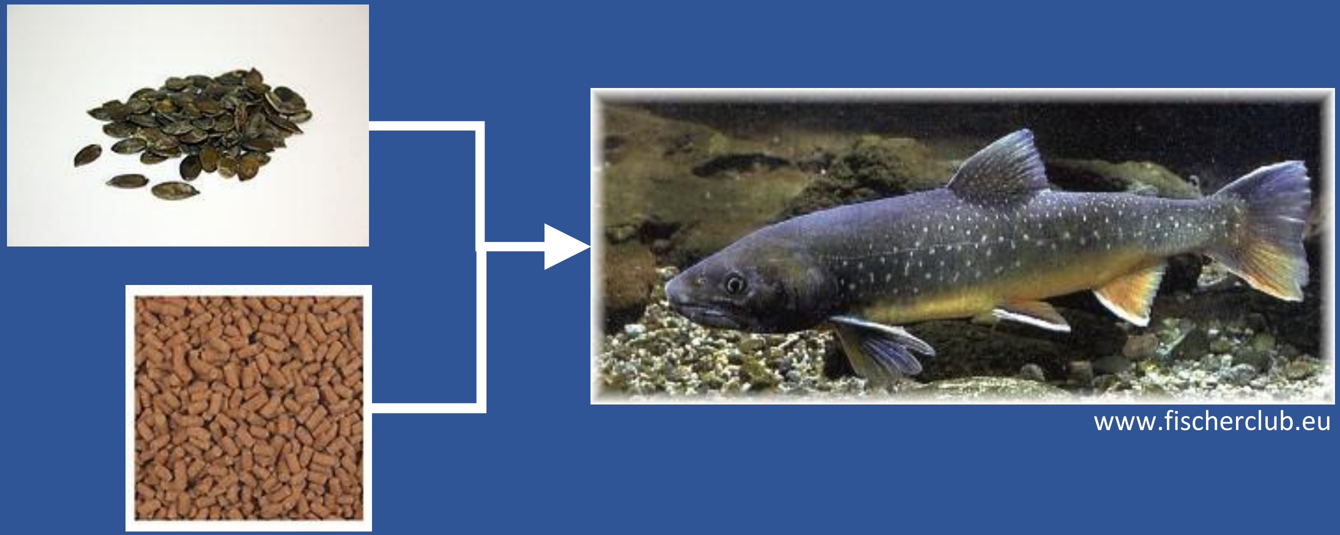
Rapider Abfall der langkettigen omega-3 Fettsäuren EPA + DHA im **Atlantischen Lachs** (*Salmo salar*)

Figure 2. Levels of EPA + DHA (g.100 g^{-1}) in farmed Scottish Atlantic salmon between 2006 and 2015. Median (—), mean (···), interquartile range (box) and 10th and 90th percentiles (whiskers) are presented. Significant differences ($P < 0.05$) between mean values are indicated by different lettering (n = 106, 174, 247, 81, 85, 393, 212, 523, 546 and 687 for 2006–2015 respectively).

Sprague, M., J. R. Dick, and D. R. Tocher. 2016. Impact of sustainable feeds on omega-3 long-chain fatty acid levels in farmed Atlantic salmon, 2006–2015. Scientific Reports **6**:21892.

Auswirkungen von Kürbiskernpresskuchen als teilweiser Ersatz von Meeresfischmehl

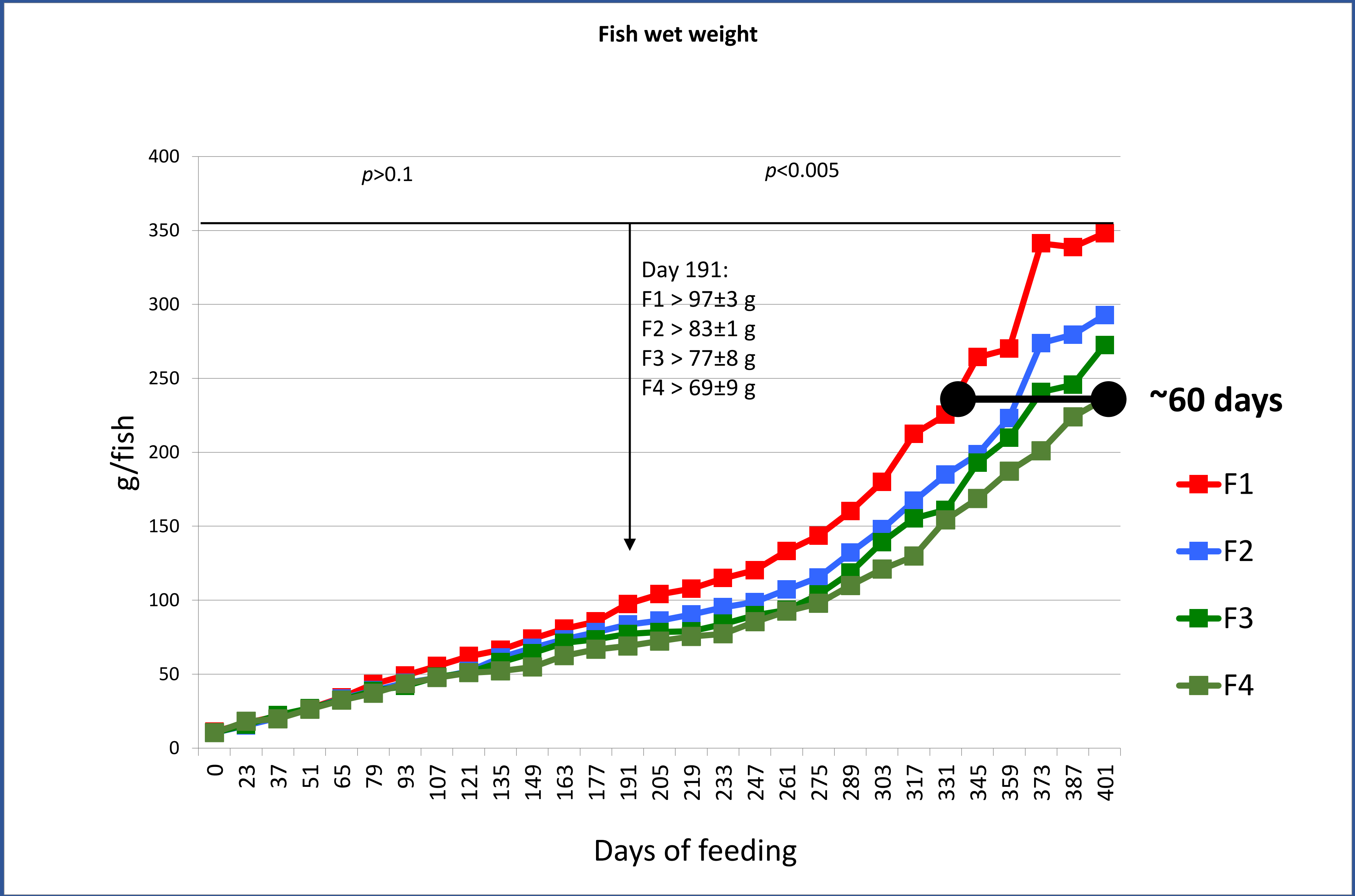
- Untersuchung der Auswirkungen von Kürbiskernpresskuchen als teilweiser Ersatz von Meeresfischmehl auf die somatische Entwicklung und die Fettsäurenzusammensetzung bei Seesaiblingen (*Salvelinus alpinus*)
- Bewertung der Fähigkeit von Seesaiblingen, Vorläufer-PUFA in n-3 LC-PUFA umzuwandeln (^{14}C-Leberzellen-Bioassays)



www.fischerclub.eu

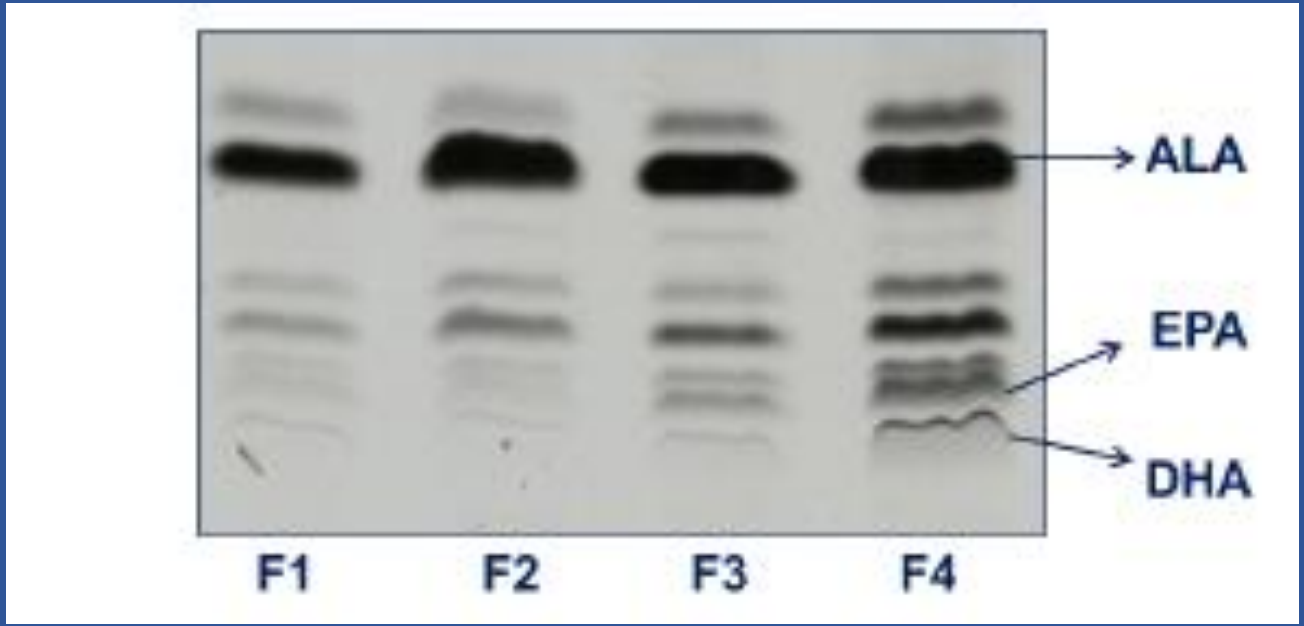
Murray et al. (2014)

Somatisches Wachstum der Saiblinge (*S. alpinus*)



Murray et al. (2014)

Leberzellen-Bioassays – Herstellung von omega-3 Fetten in den Leberzellen

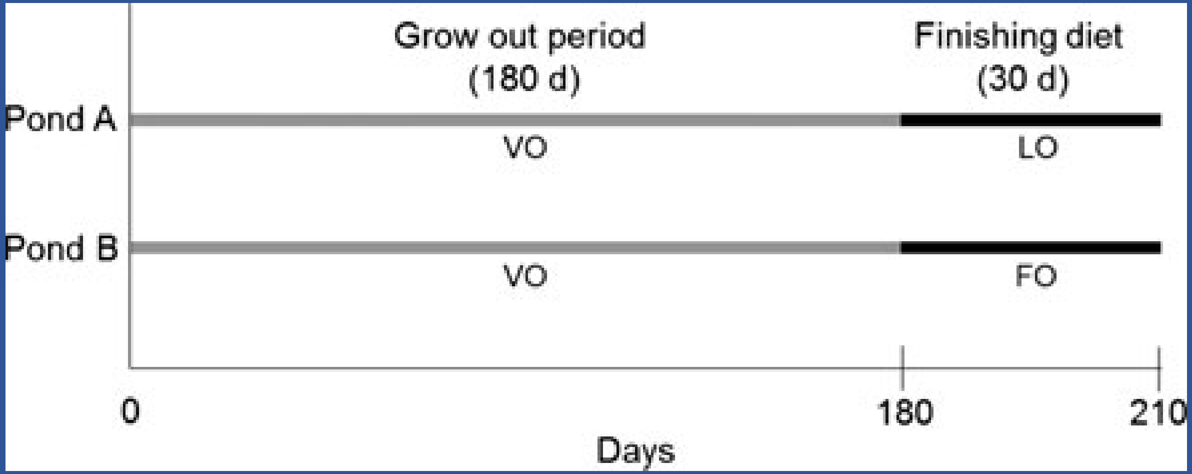


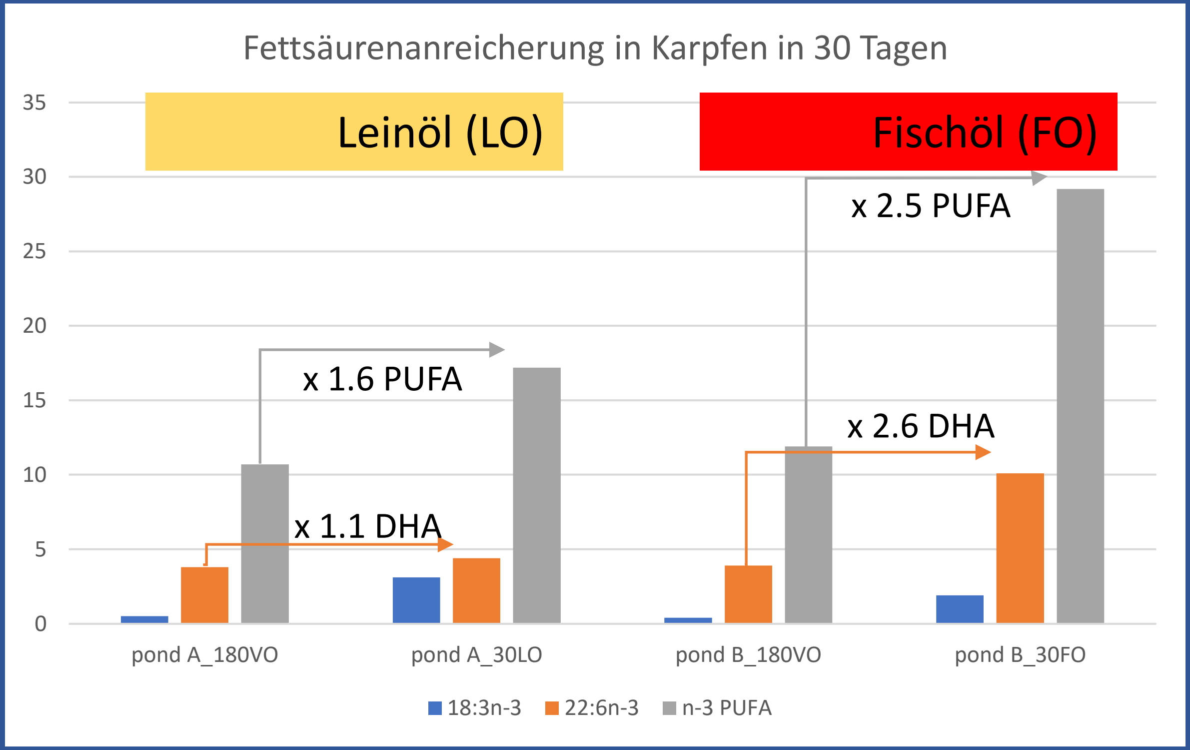
^{14}ALA 18:3n-3 —Δ6→ 18:4n-3 —elo→ 20:4n-3 —Δ5→ 20:5n-3 (EPA) —elo→ 22:5n-3 —elo→ 24:5n-3 —Δ6→ 24:6n-3 —short→ 22:6n-3 (DHA)

Δ5, Δ6 = desaturases
elo = elongases
short = chain shortening

Murray et al. (2014)

Fettsäuren in *Cyprinus carpio*





Schultz et al. (2014)

Perspektiven für die Zukunft

1. ‘Intelligent’ feeding design

- Welche Fette brauchen Fische und Menschen in ihren Lebenzyklen?
- Wie lange benötigen Fische qualitativ hochwertiges Futter?

2. Die Rolle von Wassertieren im „Trophic upgrading“

– Aufwertung des Futters durch Tiere in der aquatischen Nahrungskette

3. Schutz der Gewässer

– Erhalt der hochwertigen und schadstoffarmen Fette für Fische
- Erhalt der phylogenetischen Vielfalt → Endogene Herstellung von essentiellen Fettsäuren in Fischen

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