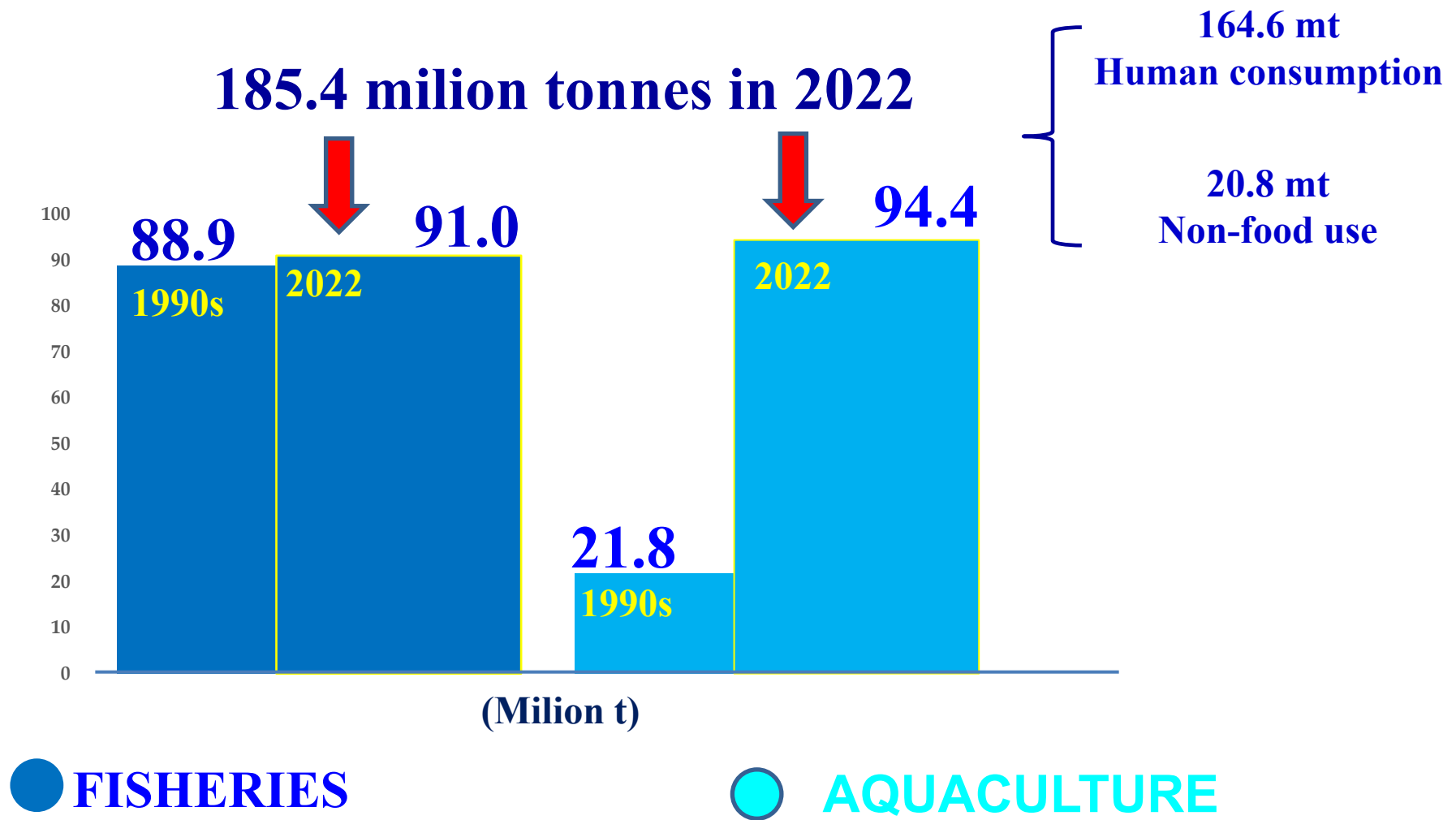


The sustainable “4 F” for rainbow trout (*Oncorhynchus mykiss*) feeding: Feedstuffs from the Fish Farmer Farmhouse

Roncarati A.

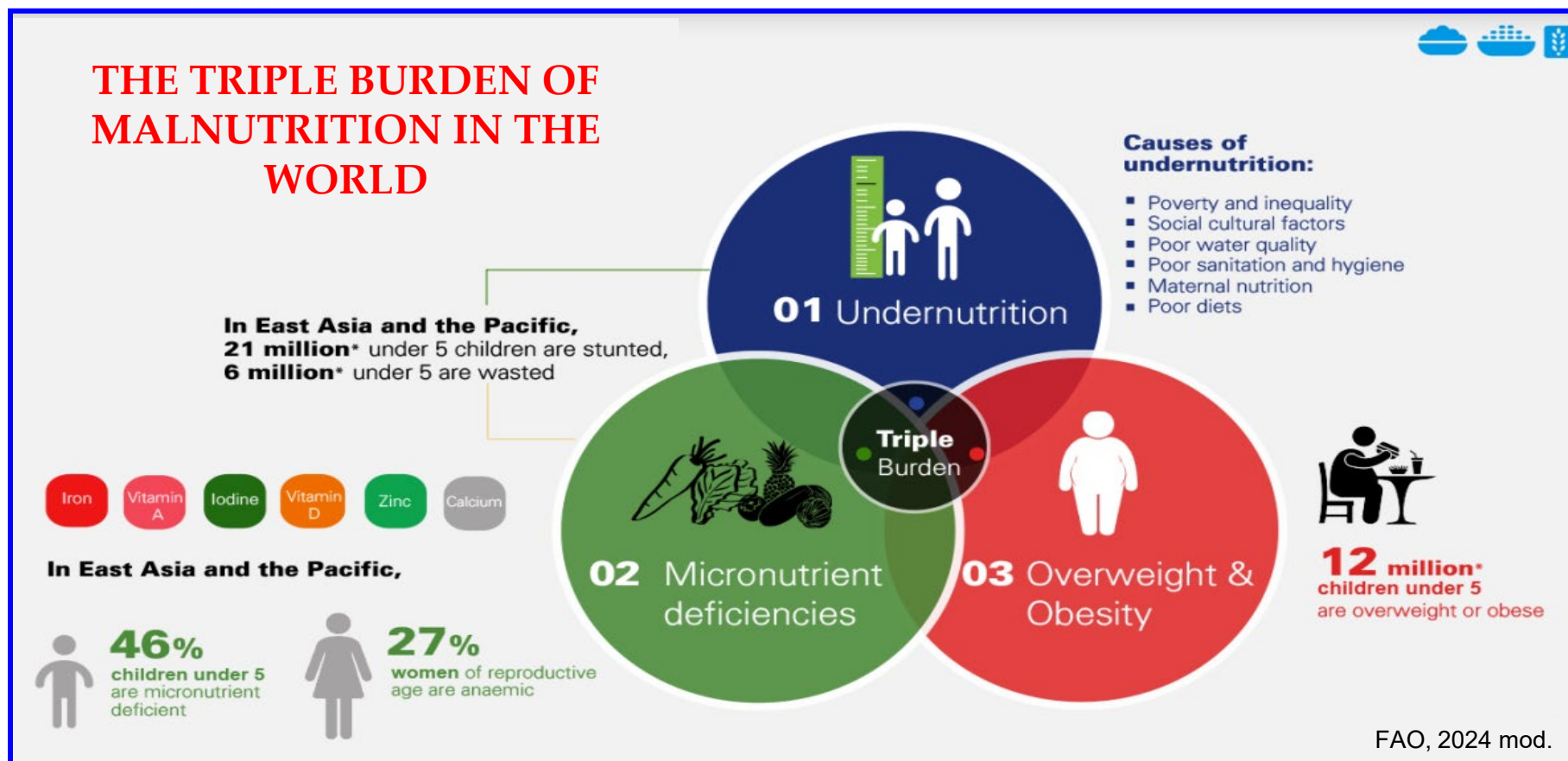
School of Biosciences and Veterinary Medicine, University of Camerino, Italy

BACKGROUND IN 2022 AQUACULTURE OVERCOME FISHERIES PRODUCTION



BACKGROUND

Fish and seafood contribute to sustainable healthy diets
and their consumption can help to solve



AQUACULTURE ISSUES

- Aquaculture has been criticized for increasing existing **shortages of fish meal and oil (fish in-fish out)→** wild-caught fish

overexploitation and depletion of wild fish stocks

- Most high-value **aquaculture species are carnivorous** and most conventional aquafeeds having **high content of fish meal and fish oil**

Challenges in finding feed alternatives

1. sustainable
2. nutritionally balanced
3. cost-effective



News

Norwegian government appoints steering group to achieve sustainable aquafeed goals

The government wants to increase the proportion of Norwegian-produced raw materials for fish feeds from the current 8% to 25% by 2034.



August 15, 2024



The Norwegian government has launched a community mission with the goal that all feed for farmed fish and livestock must come from sustainable sources by 2034. The government has appointed a steering group that will provide professional and strategic advice to achieve the goals set for the community mission.

“Fish is good for the climate and health. At the same time, we see that we source too much raw material from abroad. A sustainable production of feed based on more Norwegian raw materials will be able to reduce climate emissions and strengthen our degree of self-sufficiency,” said Fisheries and Oceans Minister Marianne Sivertsen Næss.

MAIN FISH SPECIES PRODUCED IN ITALY (2022)

Gilthead seabream
10.100 t



Rainbow trout (size portion)
27.800 t



European seabass
7.500 t



Common carp



Brown trout



Catfish



European eel



TOTAL = 50.330 t

AIM OF THE TRIAL

A growing trial of rainbow trout (*Oncorhynchus mykiss*) was performed in field in order to evaluate the effects of 2 feeds (D1, D2), differing in raw materials included as protein and lipid sources, on growth performance and quality fillet

**INCREASE THE
DIETARY
FRACTION OF:**

- Vegetable feedstuffs (grain, corn, pea) production from cultivation crops obtained by the farmhouse owned by the fish farmer's company

**REPLACEMENT
OF FISH MEAL
(100%):**

- Fish trimming meal (FTM) and protein hydrolysates (FPH) obtained by discards from local artisanal fisheries

**REPLACEMENT
OF FISH OIL
(100%):**

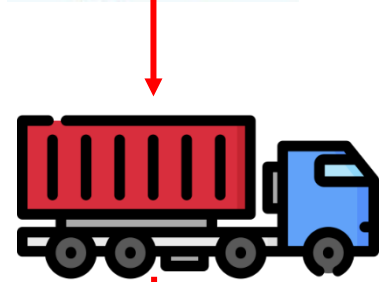
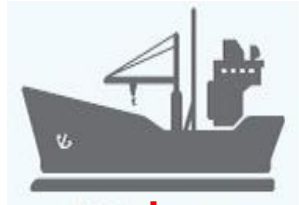
- Oil from algae (microalgal oil) available on the market

MATERIALS AND METHODS

PROTEIN AND LIPID SOURCES USED IN D2 DIET

-PARTS OF FISH
-HEAD
-TAIL

-WHITING FISH (*Merlangius merlangius*)
-TUB GURNARD (*Trigla* sp.)
-HORSE MACKEREL (*Trachurus trachurus*)

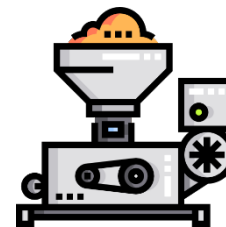


FPH

FTM



ALGAL OIL
was included
(obtained on the
market)
EPA 16% tot.FA
DHA 39% tot.FA



MATERIALS AND METHODS

EXPERIMENTAL CONDITIONS

- 600 specimens rainbow trout (m.b.w. 48 ± 3 g; mean size 17 ± 1 cm)
- 6 tanks (6 x 1 x 0.5 m), 3 m³ vol. each
- 3 replicates for each diet (D1, D2)
- Same stocking density in all the basins (n.100/tank)
- Temp. 14.8 ± 1 °C, D.O. >7 mg/l



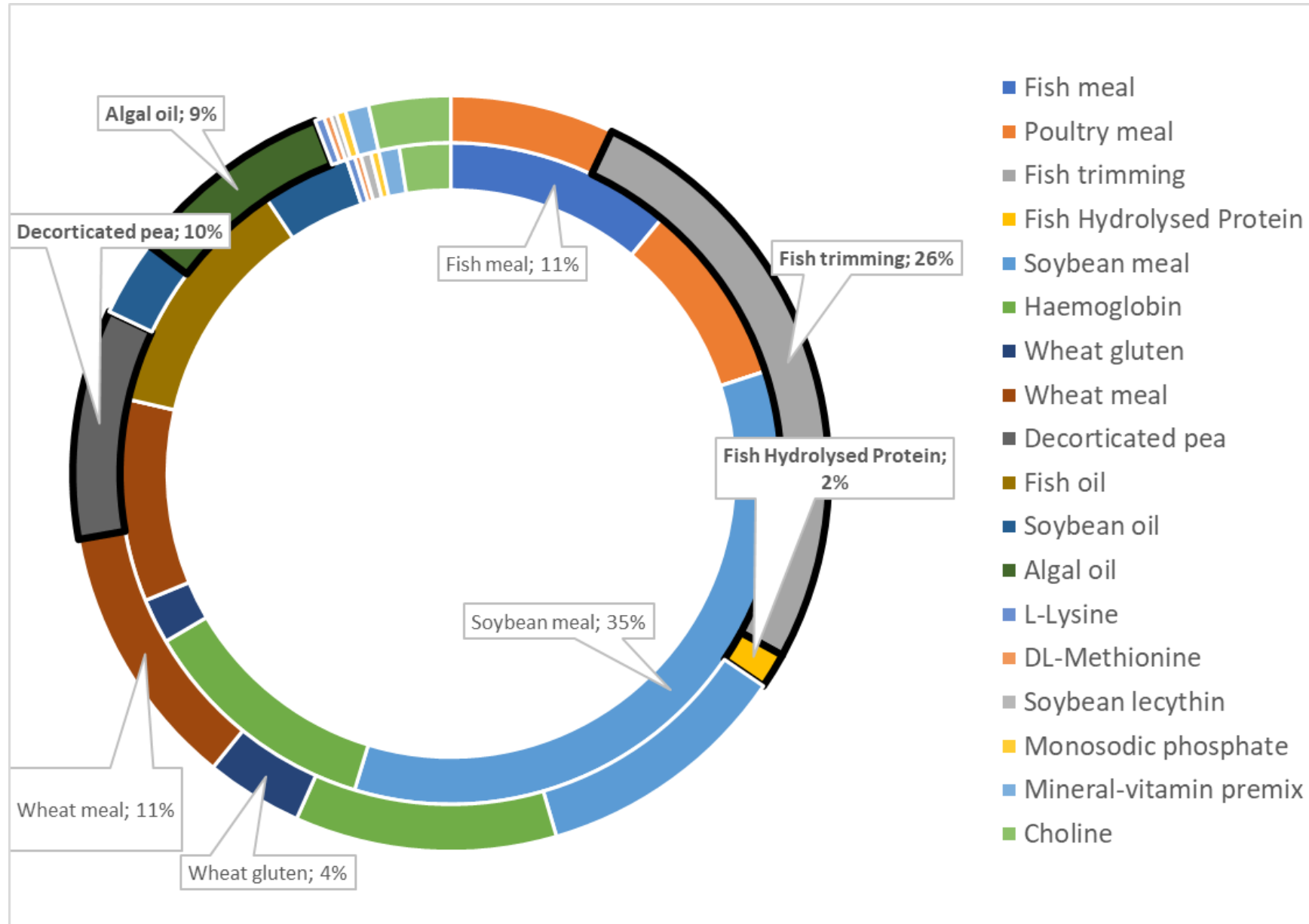
DIETS PROXIMATE COMPOSITION

	D1	D2
Moisture (%)	8.39	9.06
Protein (%)	44.16	44.25
Lipid (%)	20.91	21.08
Ash (%)	8.14	11.01
Energy (MJ/kg)	17.95	18.06

Test duration: 8 weeks

MATERIALS AND METHODS

PECULIARITIES OF THE DIETS



PHYSICO-CHEMICAL PARAMETERS OF WATER QUALITY

- Water temperature (°C)
 - Dissolved oxygen (mg/l)
 - pH
 - NH₄-N
 - NO₂-N
 - NO₃-N
- weekly analysed following APHA standard methods (APHA, 1995) (HACH mod. DR 6000 UV-VIS, HACH Lange GmbH Düsseldorf, Germany)



GROWTH PERFORMANCE

FMBW = Final mean body weight (g)

KI = (fish weight/fish length³) × 100

WG (%) = (final weight – initial weight) × 100 / initial weight

SGR (%/day) = {Ln (final weight) – Ln (initial weight) / days} × 100

FCR = live weight gain / feed administered

SR (%) = final number of fish / initial number of fish × 100

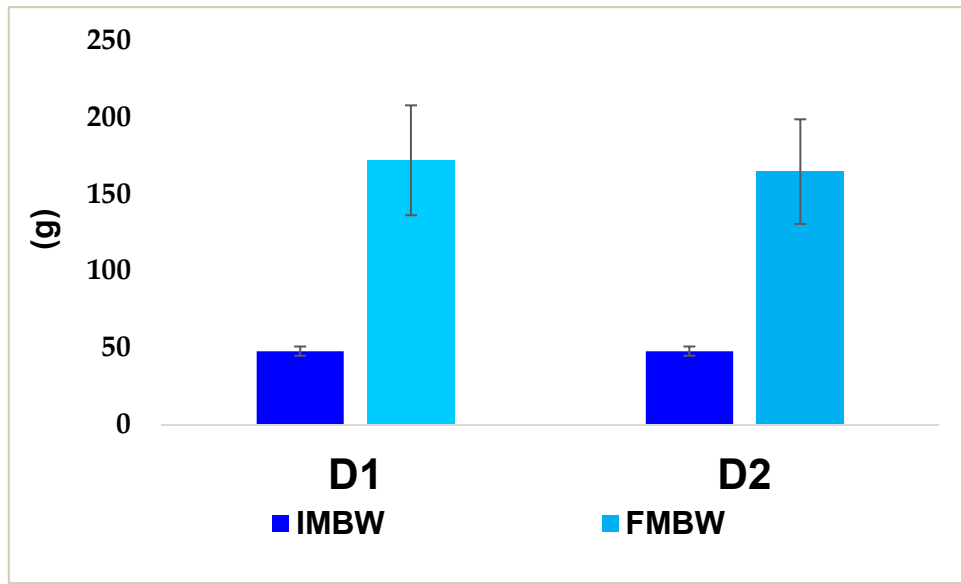
QUALITATIVE TRAITS OF MUSCLE TISSUE

- Proximate composition (A.O.A.C., 2010)
- Total lipids (Folch et al., 1957)
- Fatty acid profile (Sukhija & Palmquist, 1988)



RESULTS

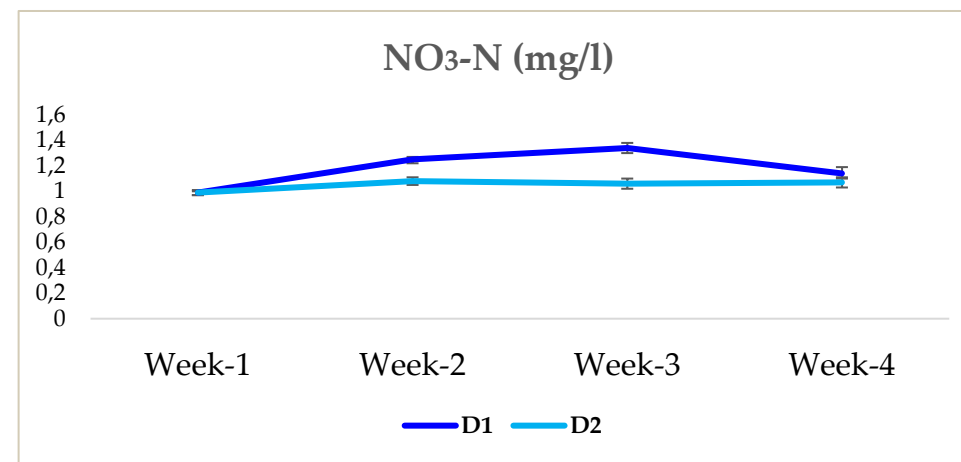
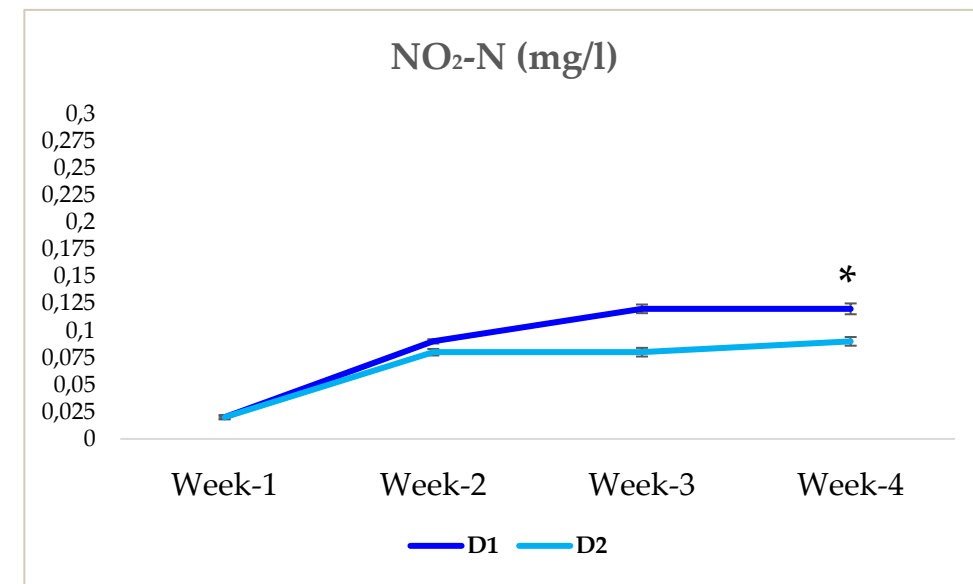
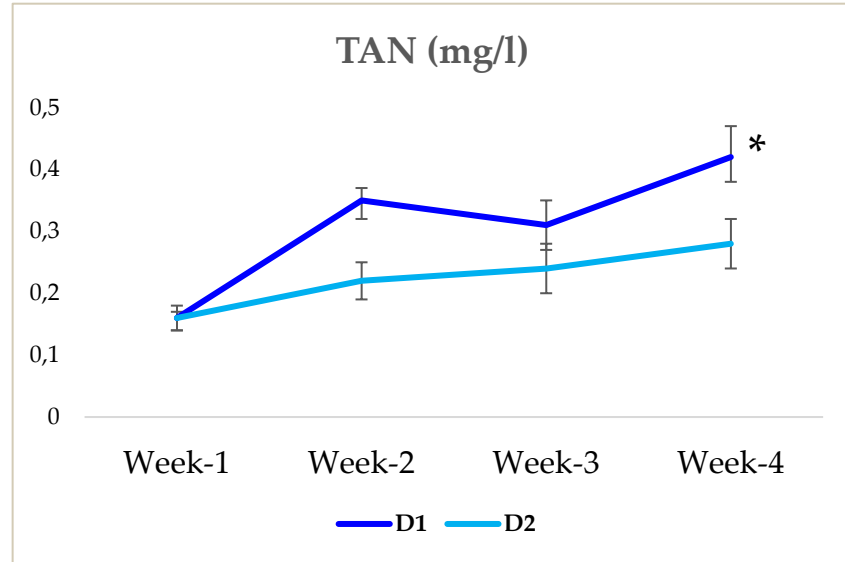
Growth performance



	D1	D2	P
k index	1.36	1.27	n.s.
Weight gain	124	116.65	n.s.
SGR	2.21	2.08	n.s.
SR	100	100	n.s.
FCR	1.3*	1.03**	P<0.05

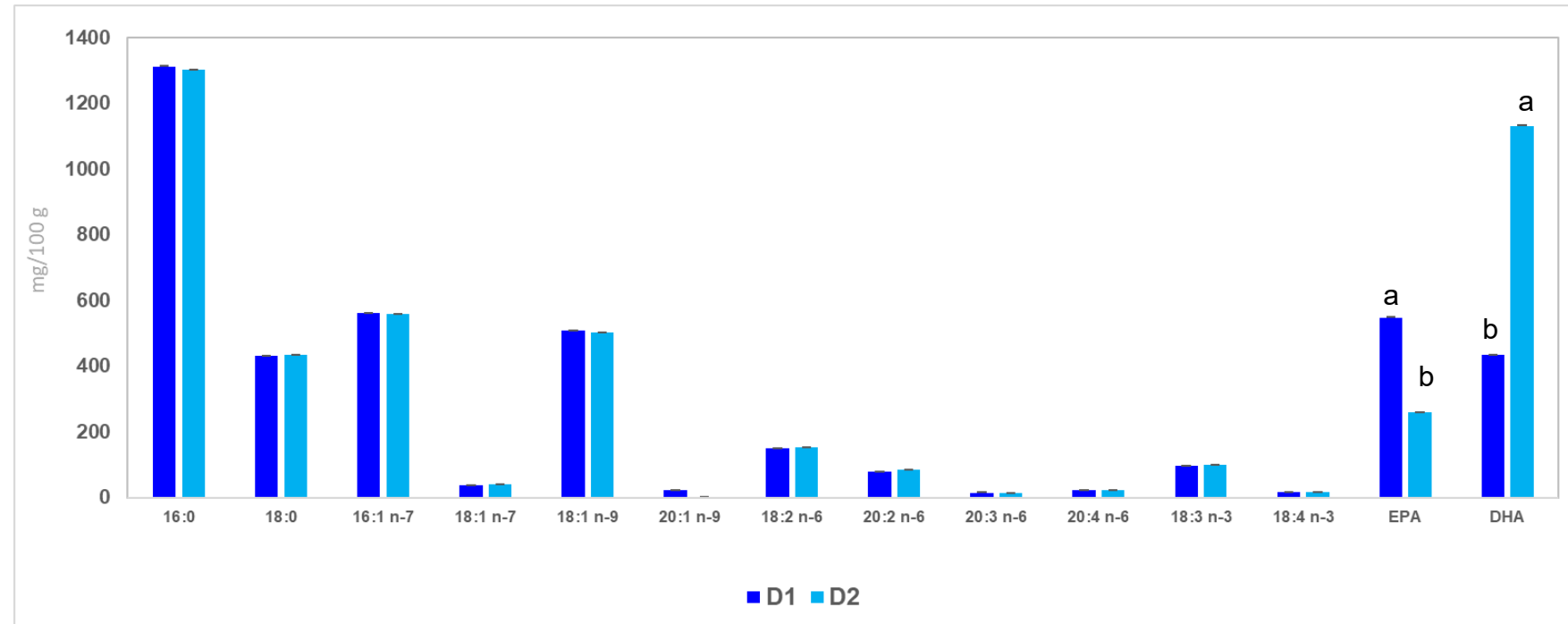
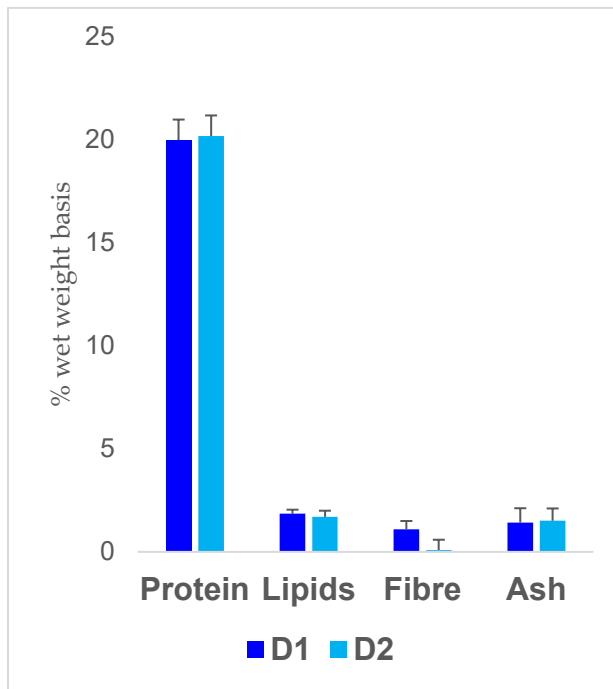
RESULTS

Water quality



RESULTS

Proximate composition and fatty acid profile



CONCLUSIONS

- In D2 diet, the inclusion of vegetable feedstuffs from the local farmhouse and replacement of fish meal and fish oil with trimming meal and fish protein hydrolysates did not compromise fillet quality of rainbow trout
- The use of algal oil, obtained on the market, in the feed assured the n-3 PUFA fatty acid profile in the trout muscle (fish rich in omega 3 fatty acids)
- The use of raw materials coming from the feedstuffs available from the agriculture farm of the fish farmer and artisanal fisheries can enhance synergies and collaborations among different stakeholders as new approach of aquaculture management and practice
- The Italian fish farmers are making great efforts, supported by science, to implement the farming's sustainability paying attention to the quality of seafood, known as valuable source of multiple essential nutrients
- Further trials need to determine indicators able to measure feed efficiency, environmental impact and economic cost



THANKS FOR THE ATTENTION!