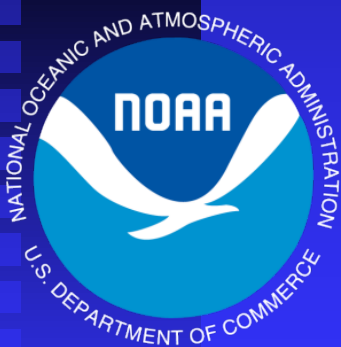


# Incorporation of Plant Proteins into Marine Finfish Feeds

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Houguo Xu<sup>2</sup>, Peter Nicklason<sup>1</sup>

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**NOAA**  
**FISHERIES**



## Research goals

- Scientific Exchange
  - NWFSC to host a visiting scientist from YSFRI
  - Tour fishery processing operations in Washington and Oregon, USA
- Technology exchange
  - Fishery by-product processing technologies
- Alternative feeds study
  - Sablefish
  - Increase feed intake
  - Maximize nutrient retention

# Visiting scientist, Houguo Xu, Ph.D.



# Tour of US fish processing plants

- Seattle, WA
  - Icicle Seafoods
- Newport, OR
  - Depoe Bay Fish
  - OSU Hatfield Science Center
- Astoria, OR
  - OSU Seafood Lab
- Ilwaco, WA
  - Jessie's Seafood
- Westport, WA
  - Ocean Gold Seafoods

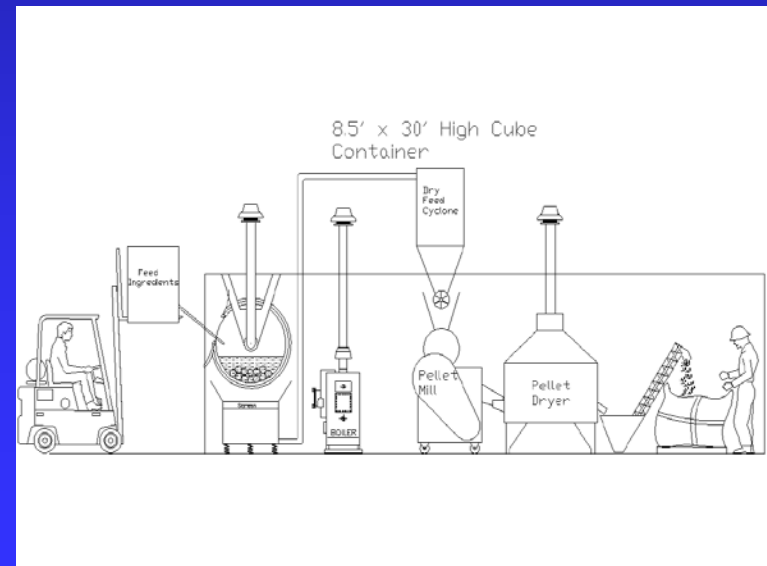




# Technology exchange

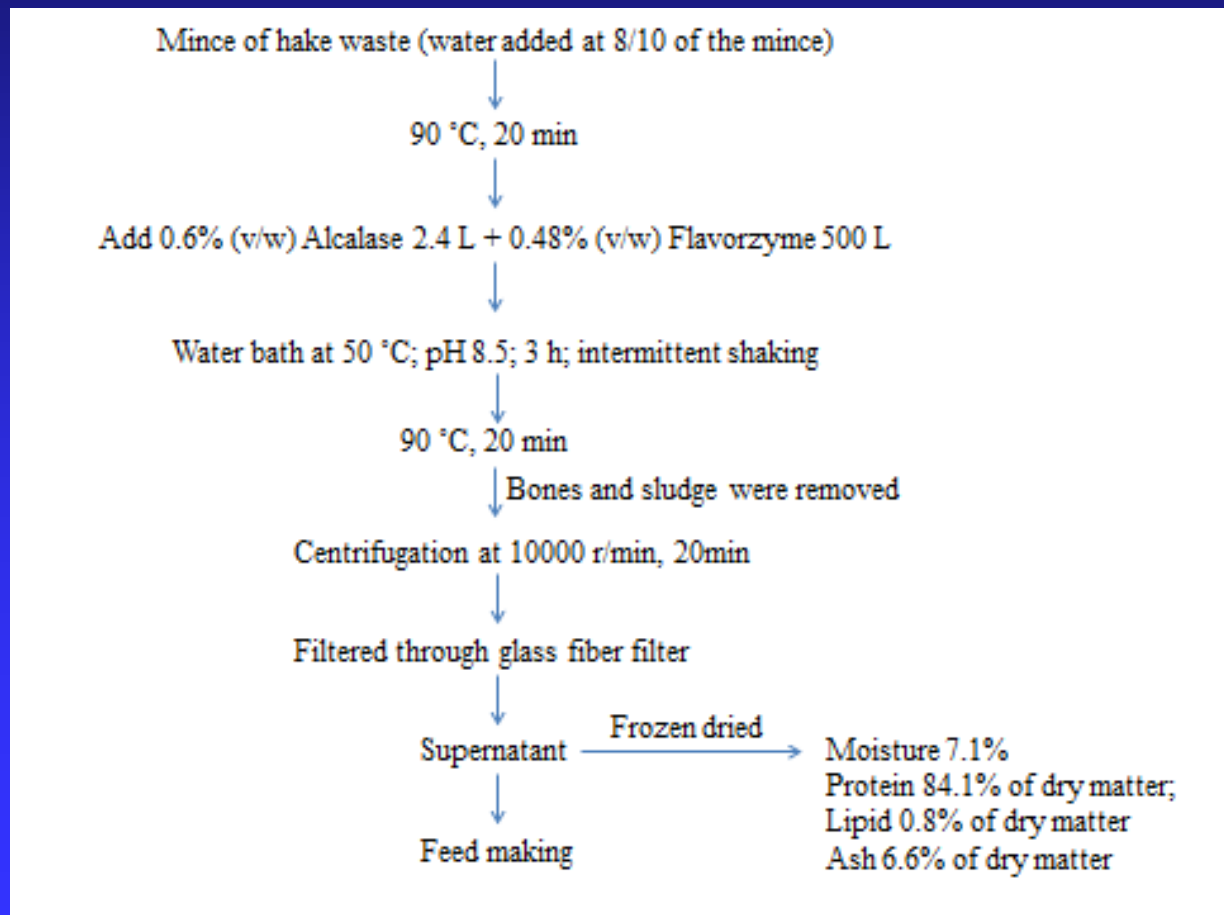


Fresh rendering with plant proteins- NWFSC



# Technology exchange

## Alkaline hydrolysis of fishery by-products - YSFRI



# Feeding study





# Sablefish, *Anoplopoma fimbria*





# Sablefish range, U.S. territories



# Sablefish

Black cod

Butterfish

Skil

Skilfish

Beshaw

Coalfish



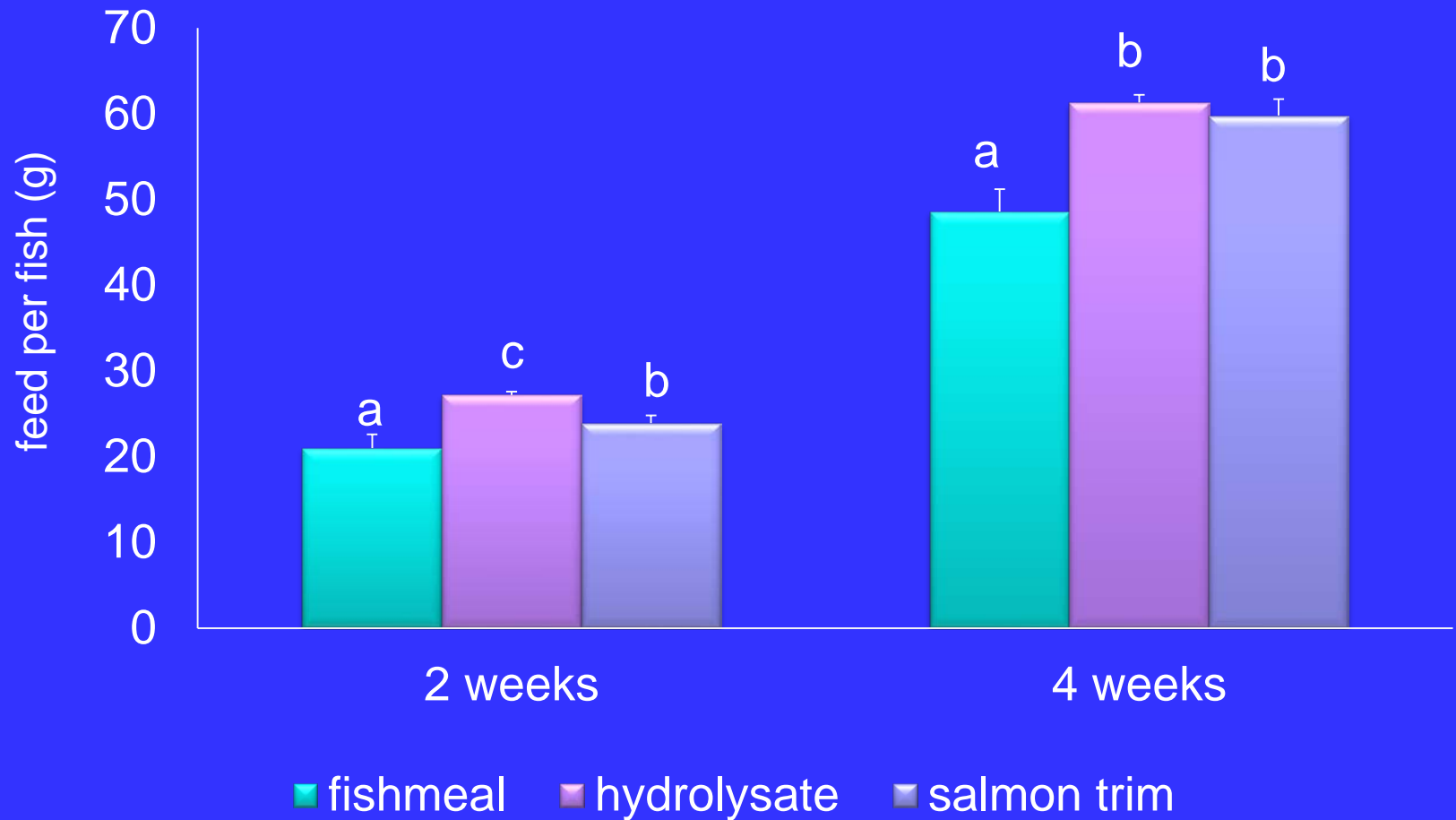
# Experimental Diets

Ingredient	Ingredient level (% dry weight)		
	Fishmeal	Hydrolysate	Salmon trim
Soy protein	24.3	24.3	24.3
Corn protein	24.3	24.3	24.3
Wheat flour	13.9	13.9	13.9
Fishmeal	13.4	9.4	-
YSFRI hydrolysate	-	4.0	-
Salmon trim	-	-	30.4
Salmon oil	16.0	17.0	-
Other	8.1	7.1	7.1

Proximate Analysis: 53% protein; 17% lipid

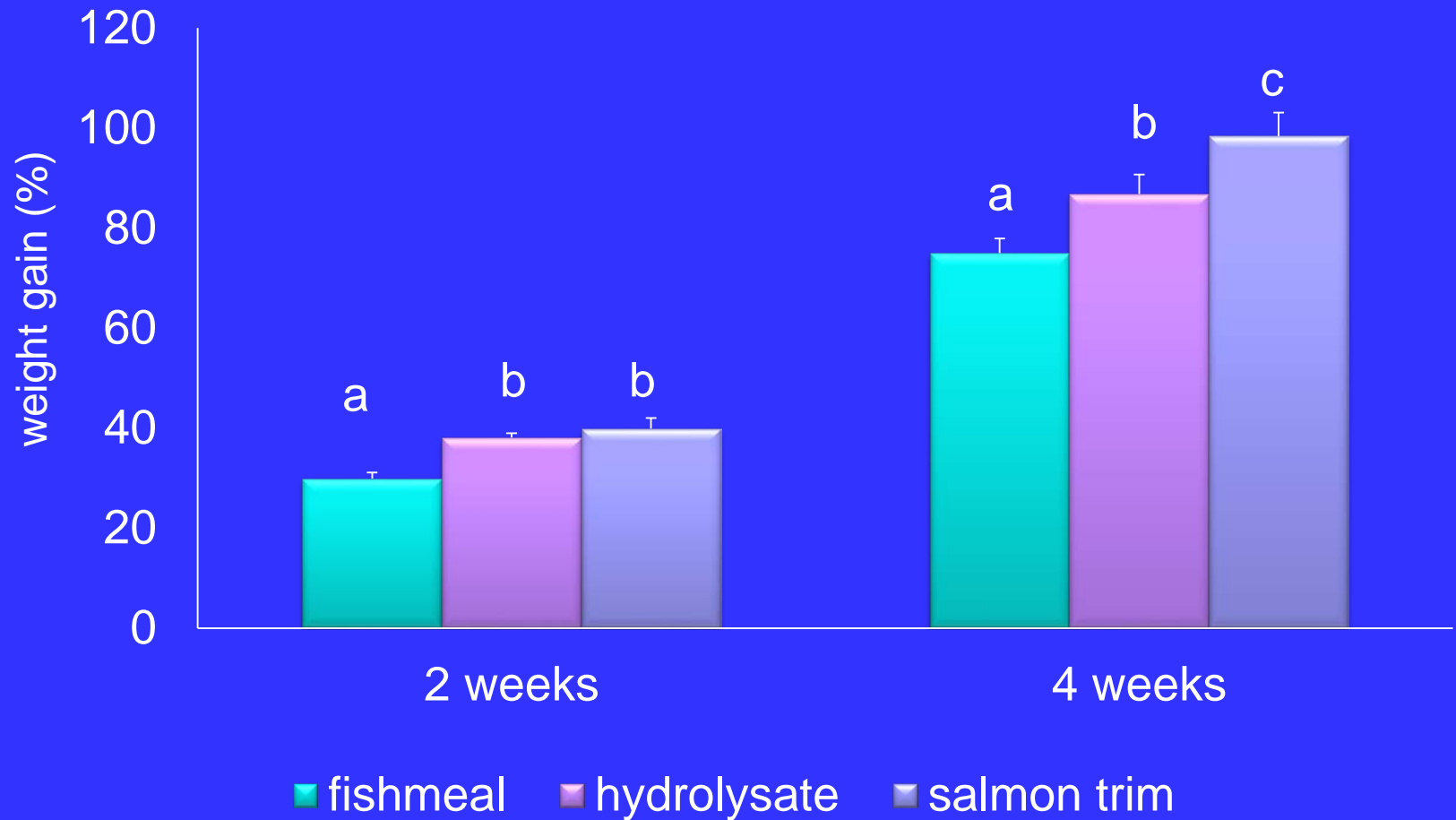


# Feed Intake



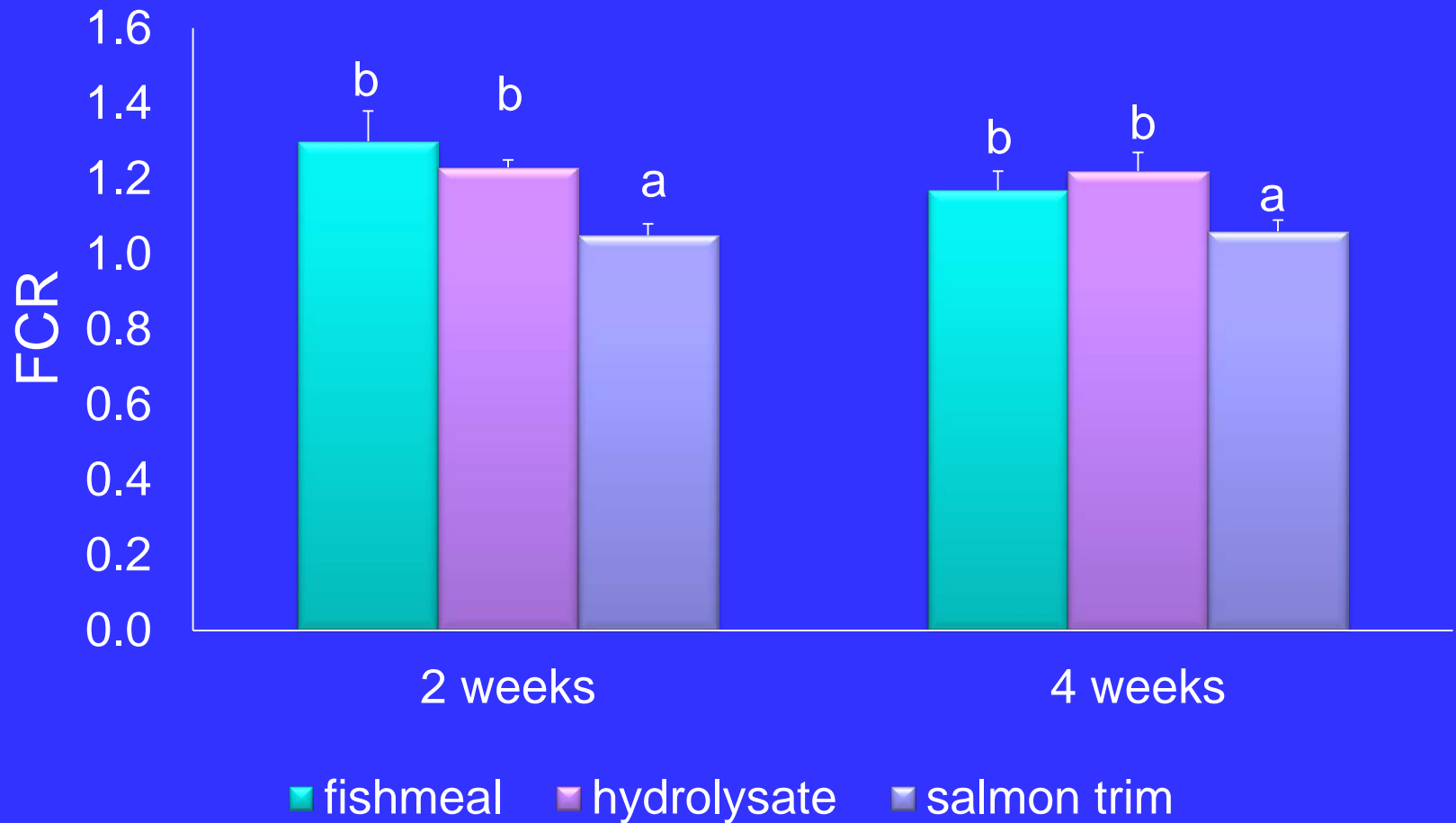
Different lowercase letters denote significant difference at  $p < 0.05$

# Weight gain



Different lowercase letters denote significant difference at  $p < 0.05$

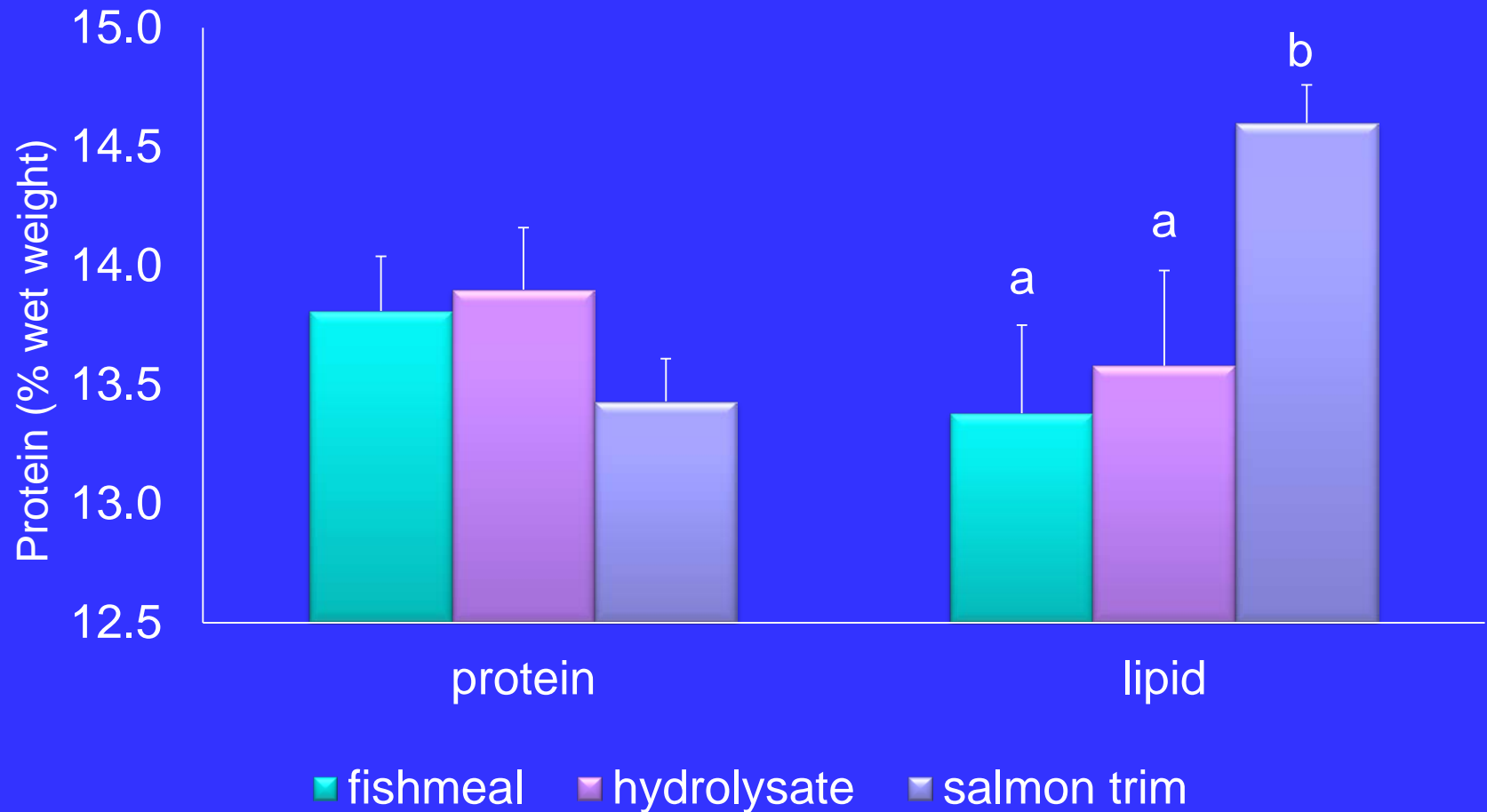
# Feed Conversion Ratio (FCR)



Different lowercase letters denote significant difference at  $p < 0.05$



# Chemical composition, fish



Different lowercase letters denote significant difference at  $p < 0.05$

## Conclusions, feeding study

- Weight gain
  - Both technologies improved weight gain
- Feeding value
  - Both technologies increased feed intake
  - Fresh rendering improved FCR
- Chemical composition
  - Fresh rendering improved lipid retention

# Future NWFSC-YSFRI studies

## Incorporation of Macroalgae Protein into Marine Finfish Feeds





Thank you

