

Technology Transfer: University Research to Industry

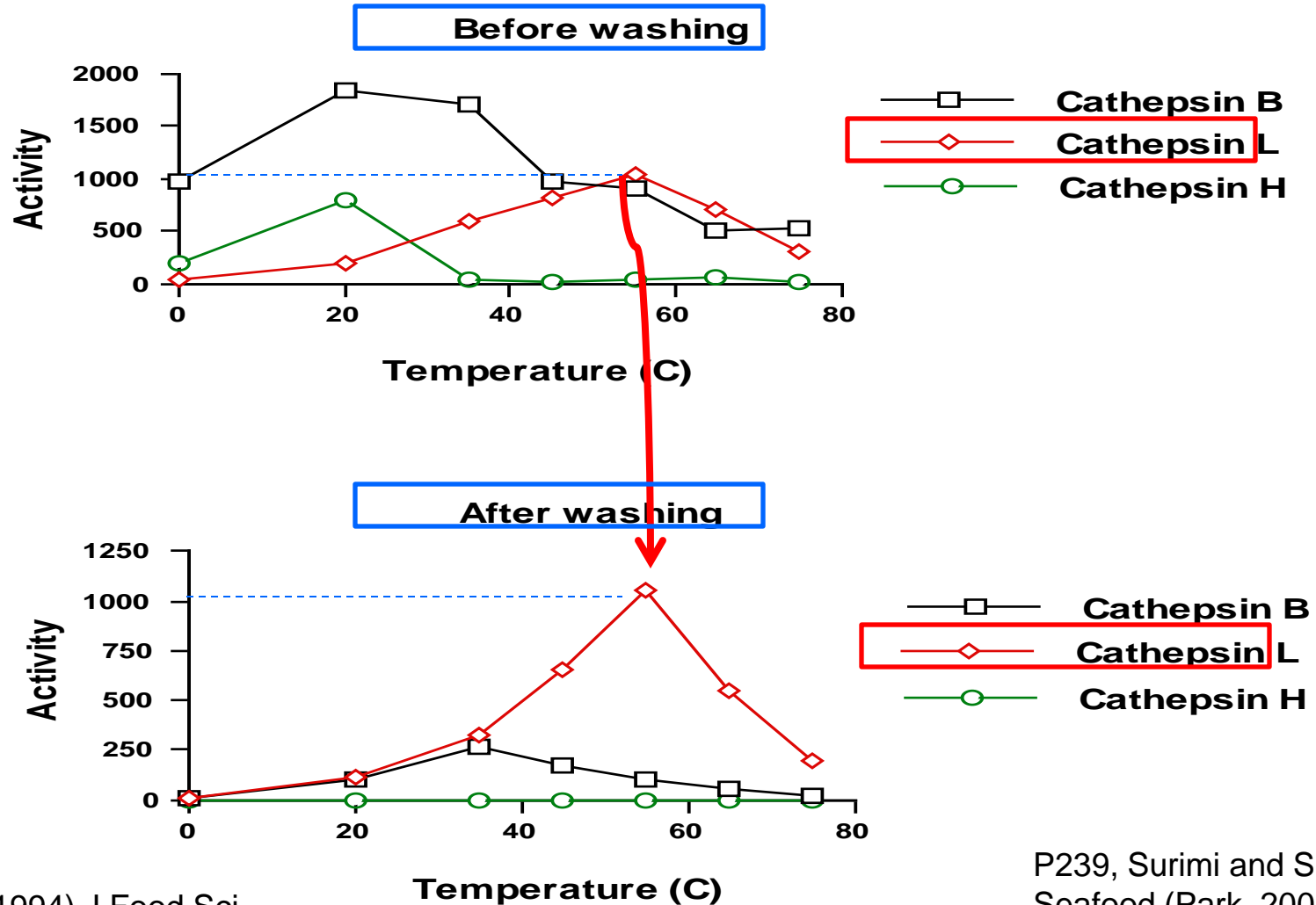
Ohmic Cooking for Accurate Evaluation of Surimi Gels



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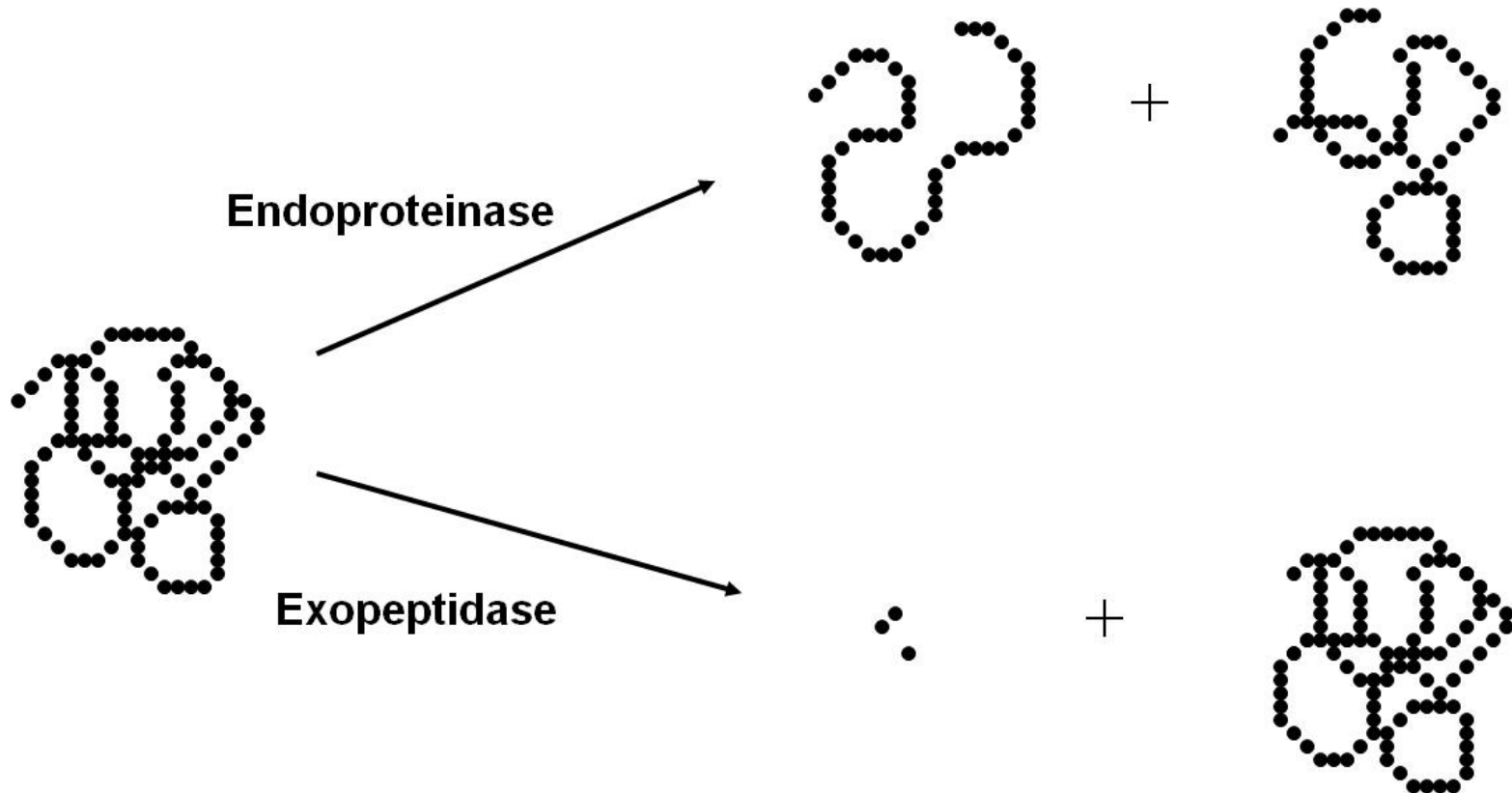
Background

- Surimi Processing (**water washing**) does not remove all proteolytic enzymes:

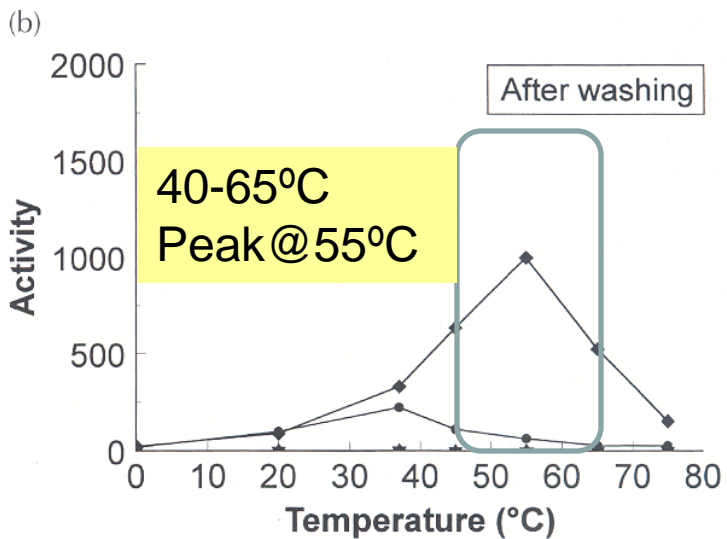
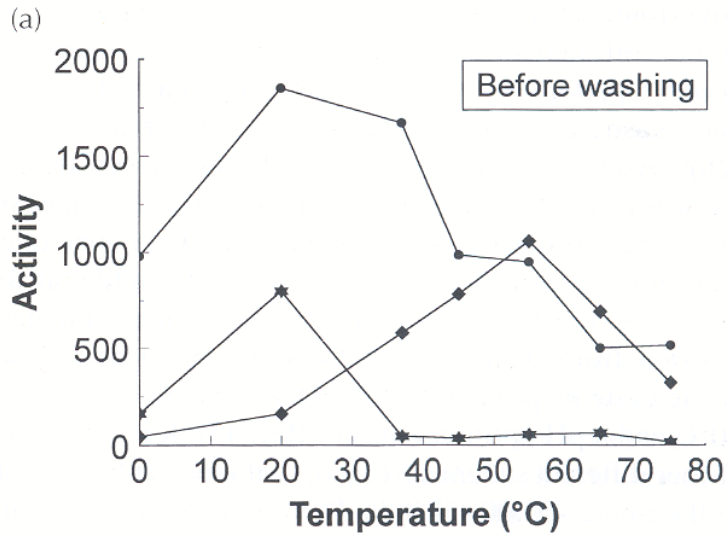


Background

- Proteolytic enzymes degrade myofibrillar proteins at **40-75C** depending on species:

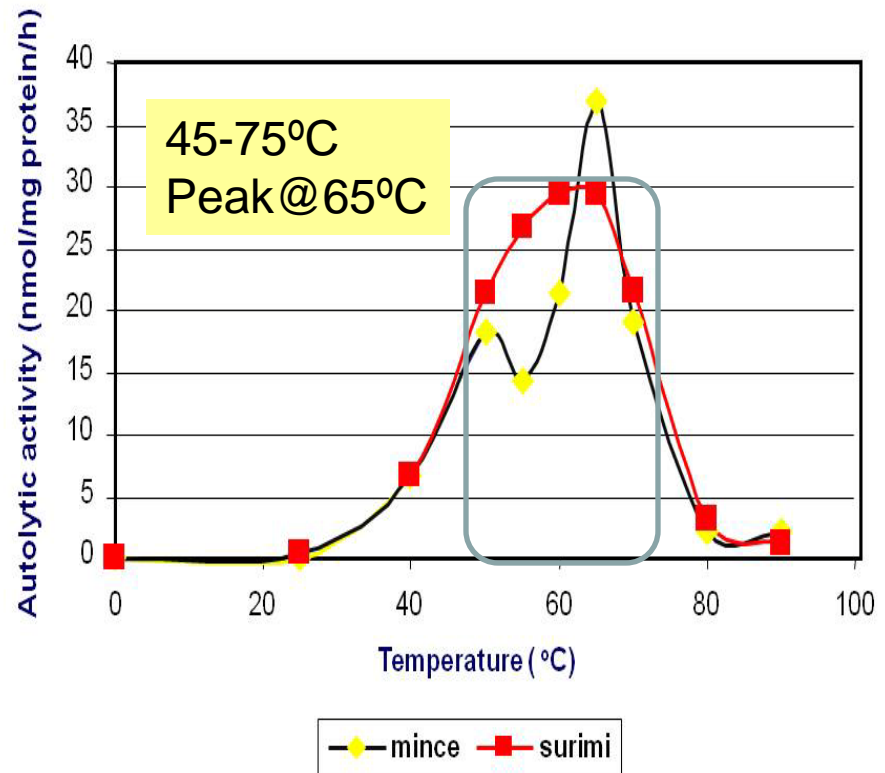


Cold/Temperate Water Species
Pacific Whiting



Tropical/Warm Water Species
Lizard Fish

Autolytic activity of lizardfish

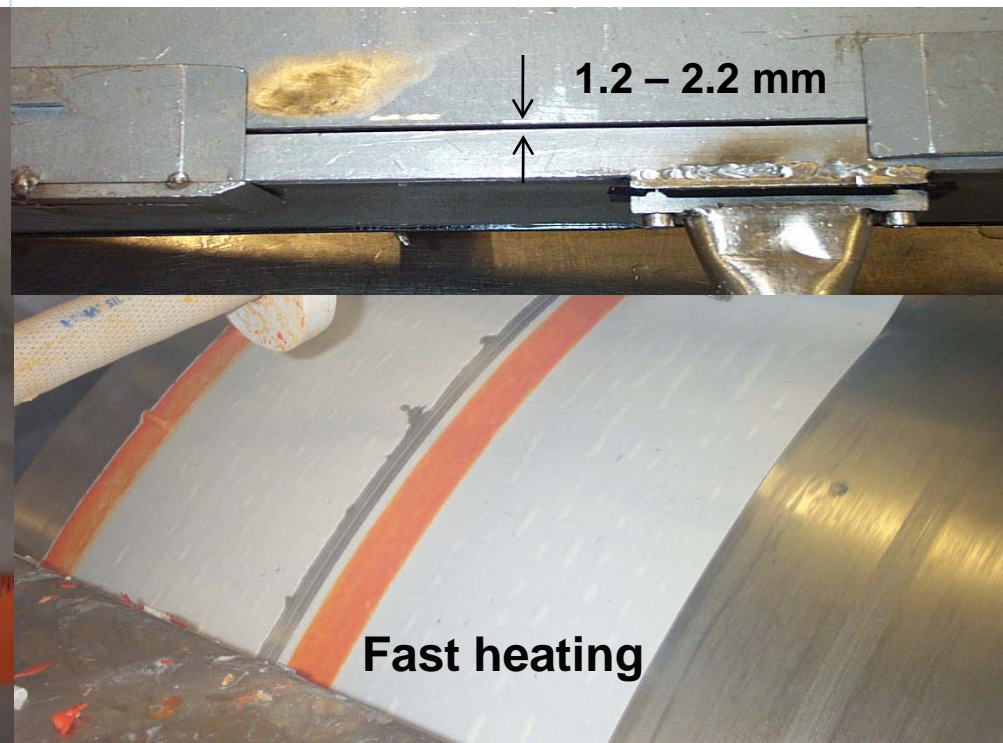
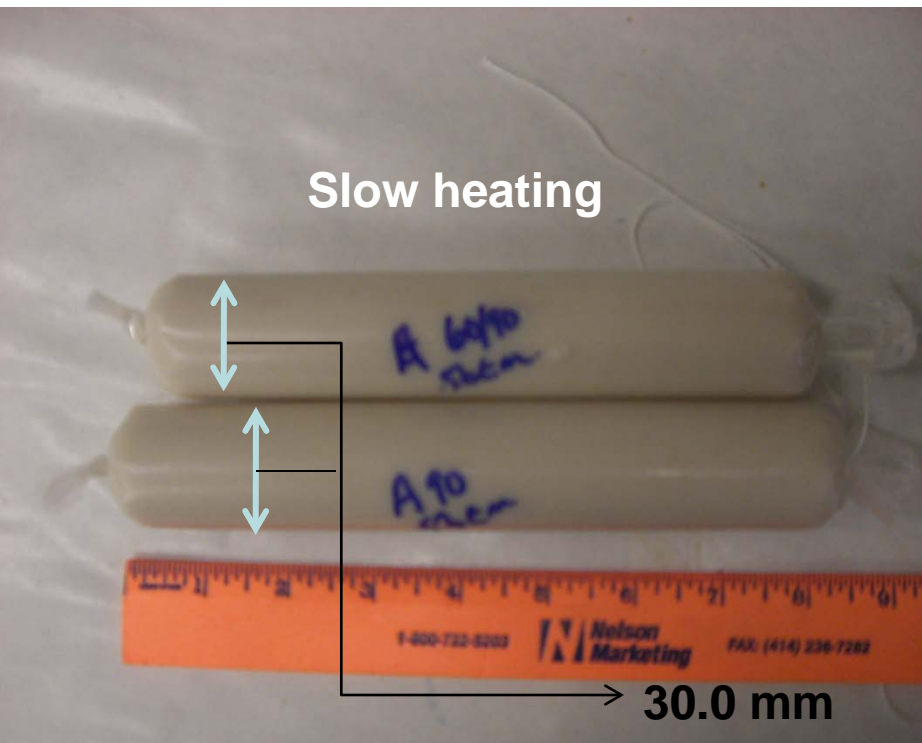


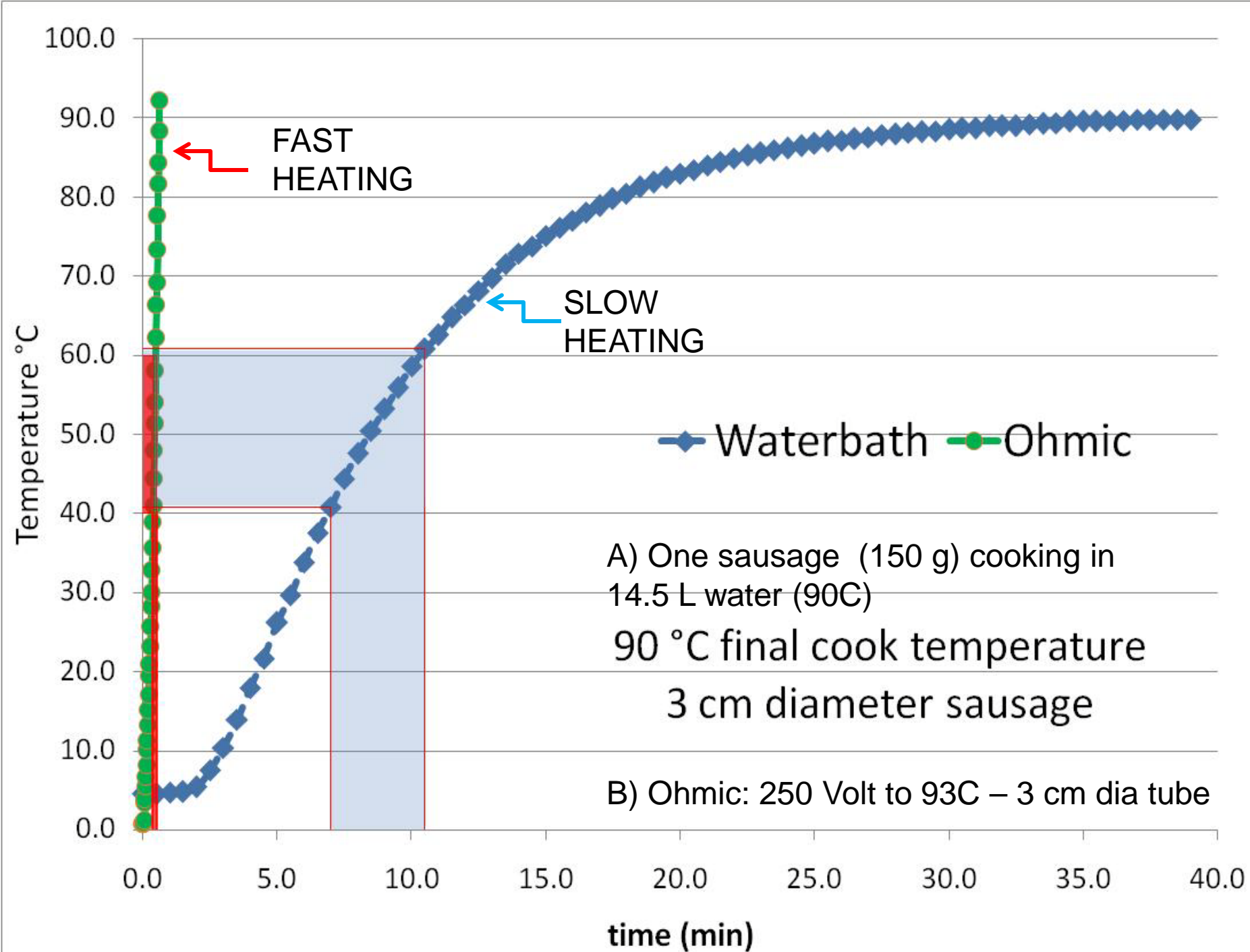
Dr. Yongsawatdigul's Lab

Background

A) Gelation properties of surimi is evaluated using gels cooked in water bath (**Slow heating**)

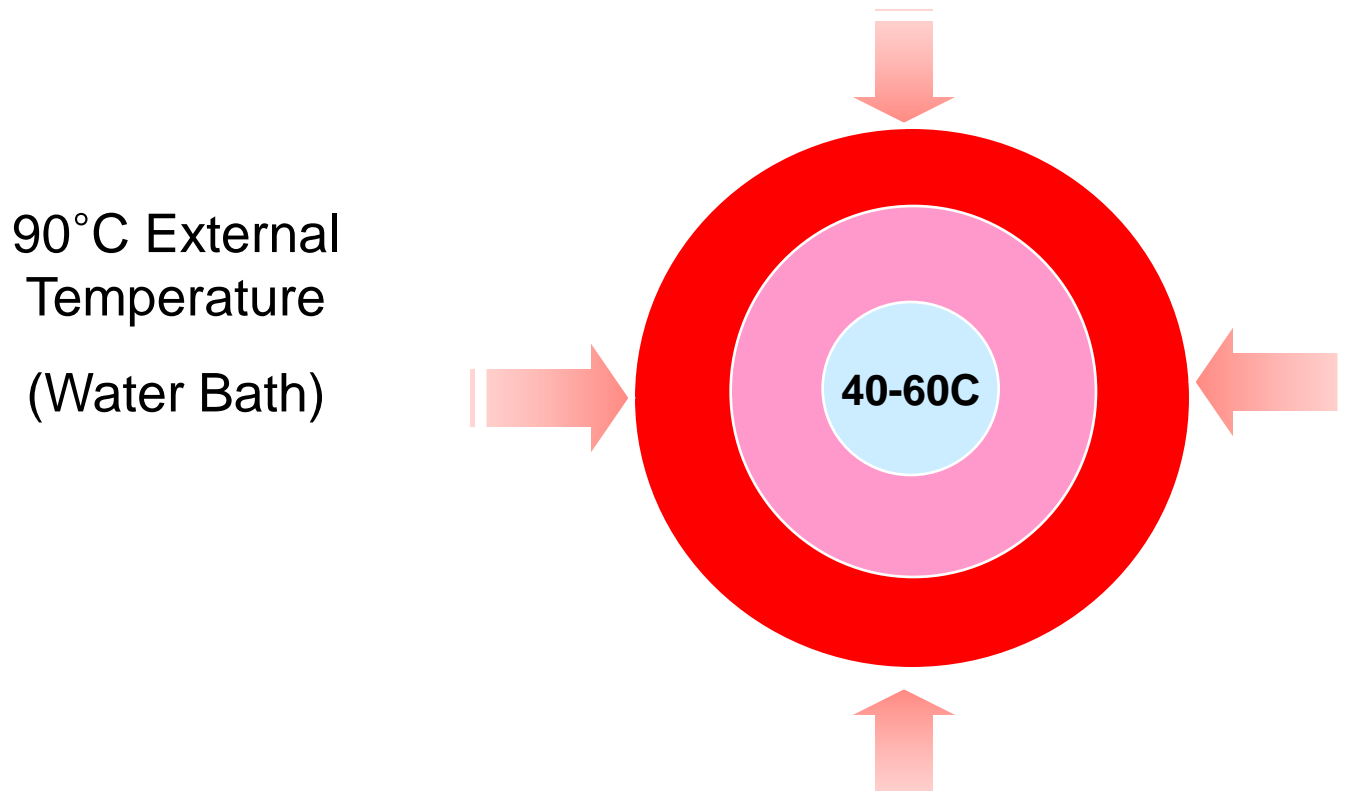
B) Surimi seafood (Crabstick) is processed in a continuous thin sheet (**Fast heating**)



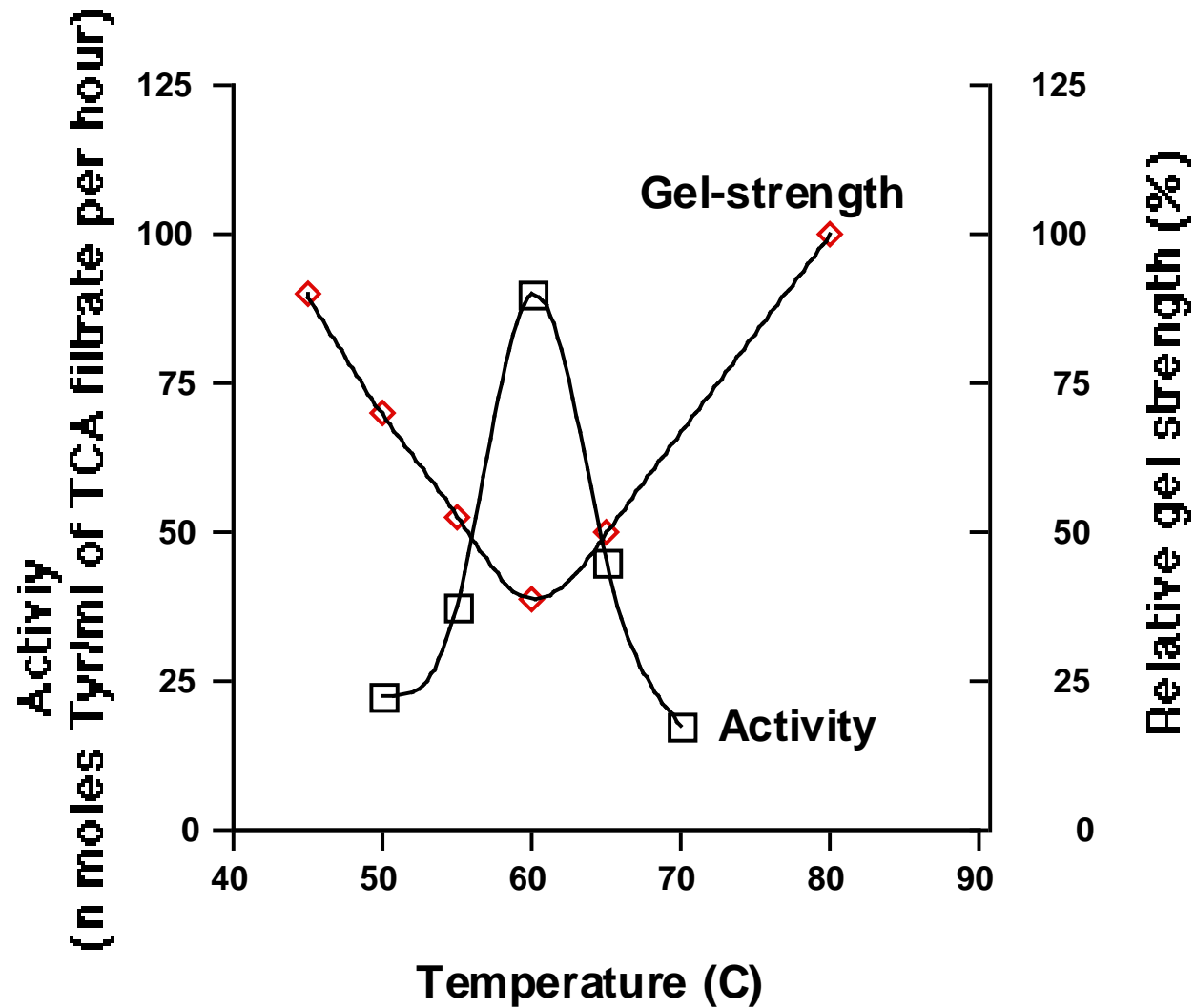


Heating of a surimi test gel cross-section
with 3 cm (ID)... *requires*

>35 min to reach 90 °C in the center



The center, where gel punch is made, is **exposed to enzyme active temperatures for > 4 min**, resulting in poor gel value (**inaccurate analysis**)



Discrepancy

- **Slow cooking** for Test Gels
- **Fast cooking** for Finished Products (Crabstick)

Test Gel Cooking Device that
mimics *Fast Cooking* (Crabstick Line)
is

Greatly Needed!

Heat is generated by **Electrical Resistance** between two electrodes.

OSU: 2006 -
3 cm sausage tube

Objectives

- To measure the feasibility of ohmic heating that **mimics crabstick production** for accurate gel quality assessment.
- To determine gel softening phenomena according to their grade and/or species.

Materials

- Pacific whiting surimi
- Alaska pollock surimi (AA, KA, RA)
- Catfish surimi
- Arrowtooth Flounder surimi
- Giant squid surimi
- Surimi added with dried egg white
- Surimi added with whey protein concentrate

Cooking Methods

- **Water Bath**

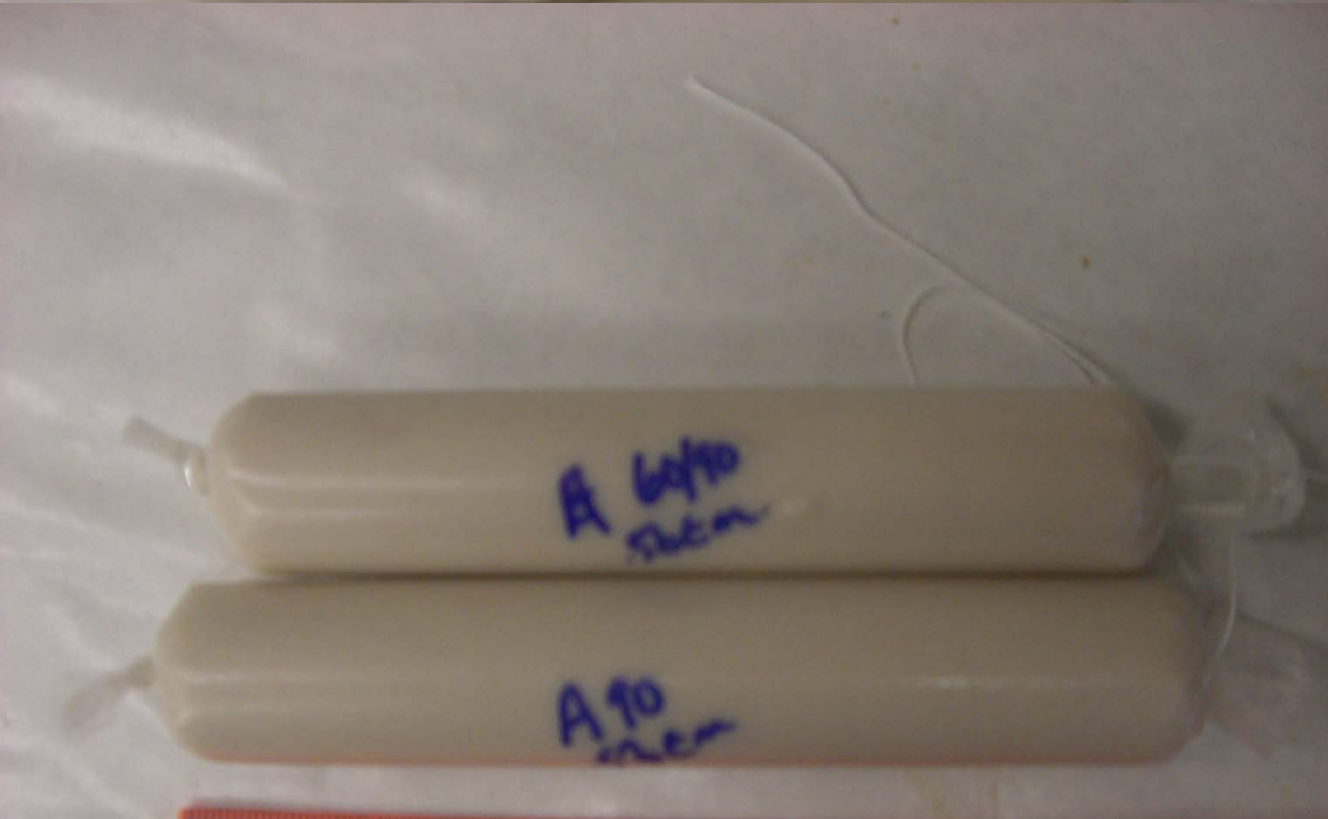
- Sausage casing (3.0 cm Dia) at **90C for 30 min**

- **Ohmic Cooking**

- **200 V** or **250 V** heating (50 - 35 sec cooking) with or without holding at 90C for 0, 45, 90 sec



Ohmic Gels

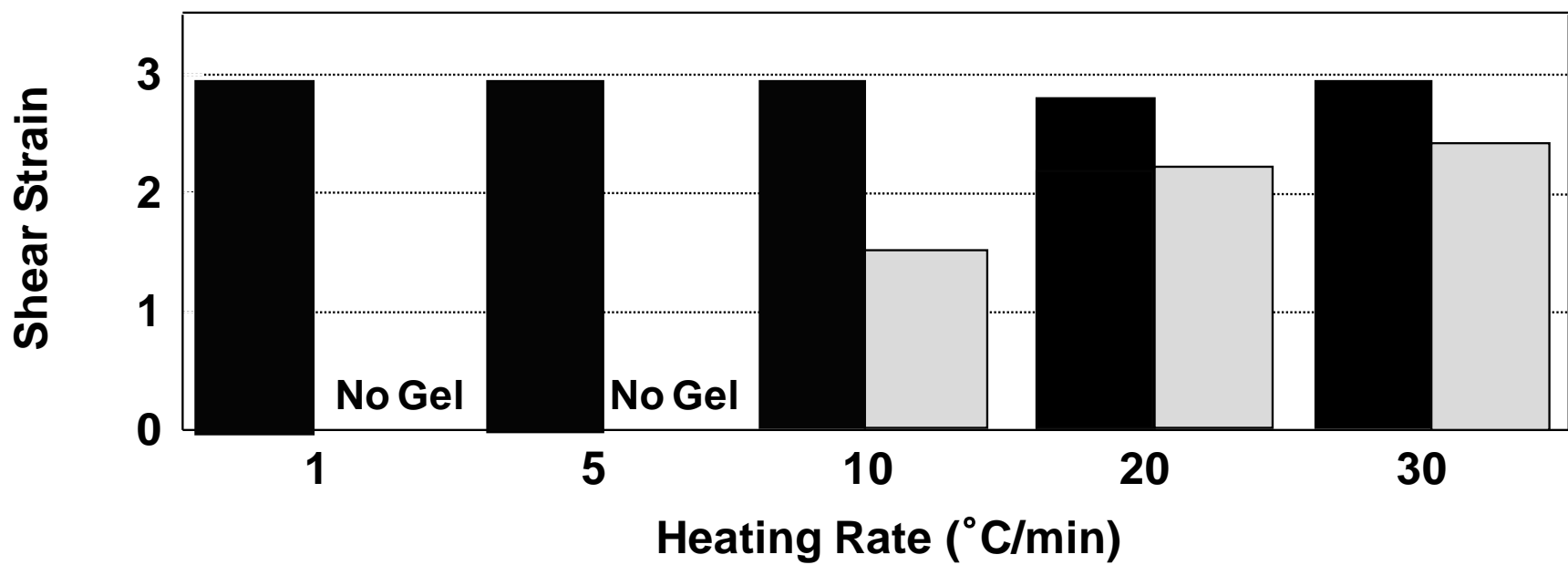
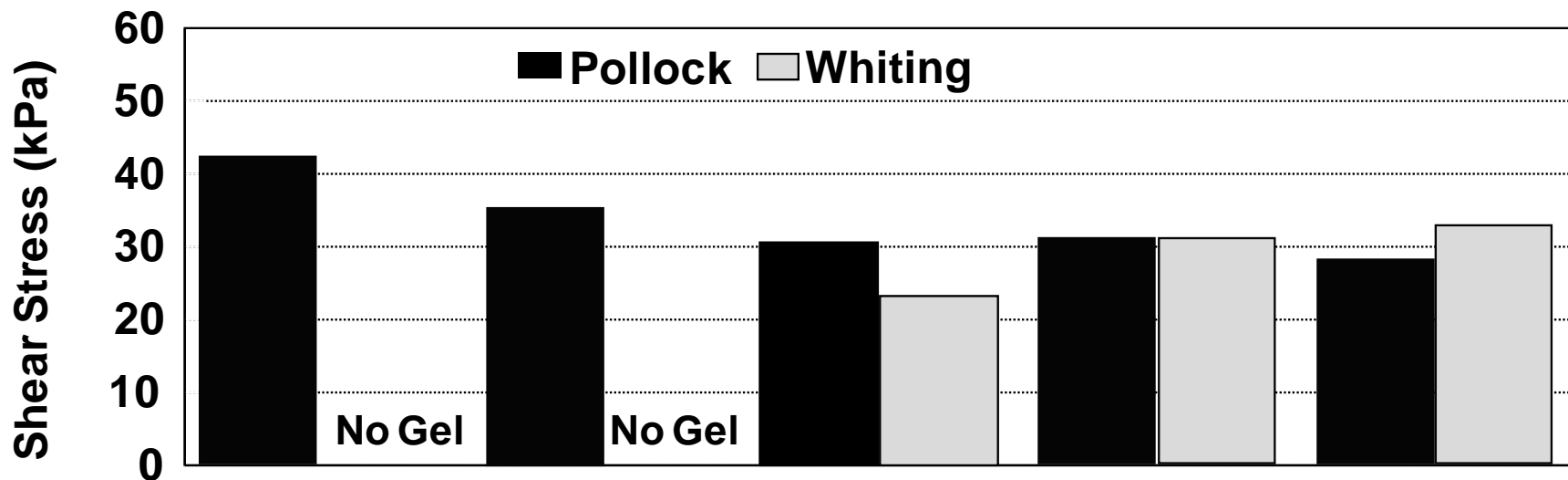


Water Bath Gels

Texture Analysis

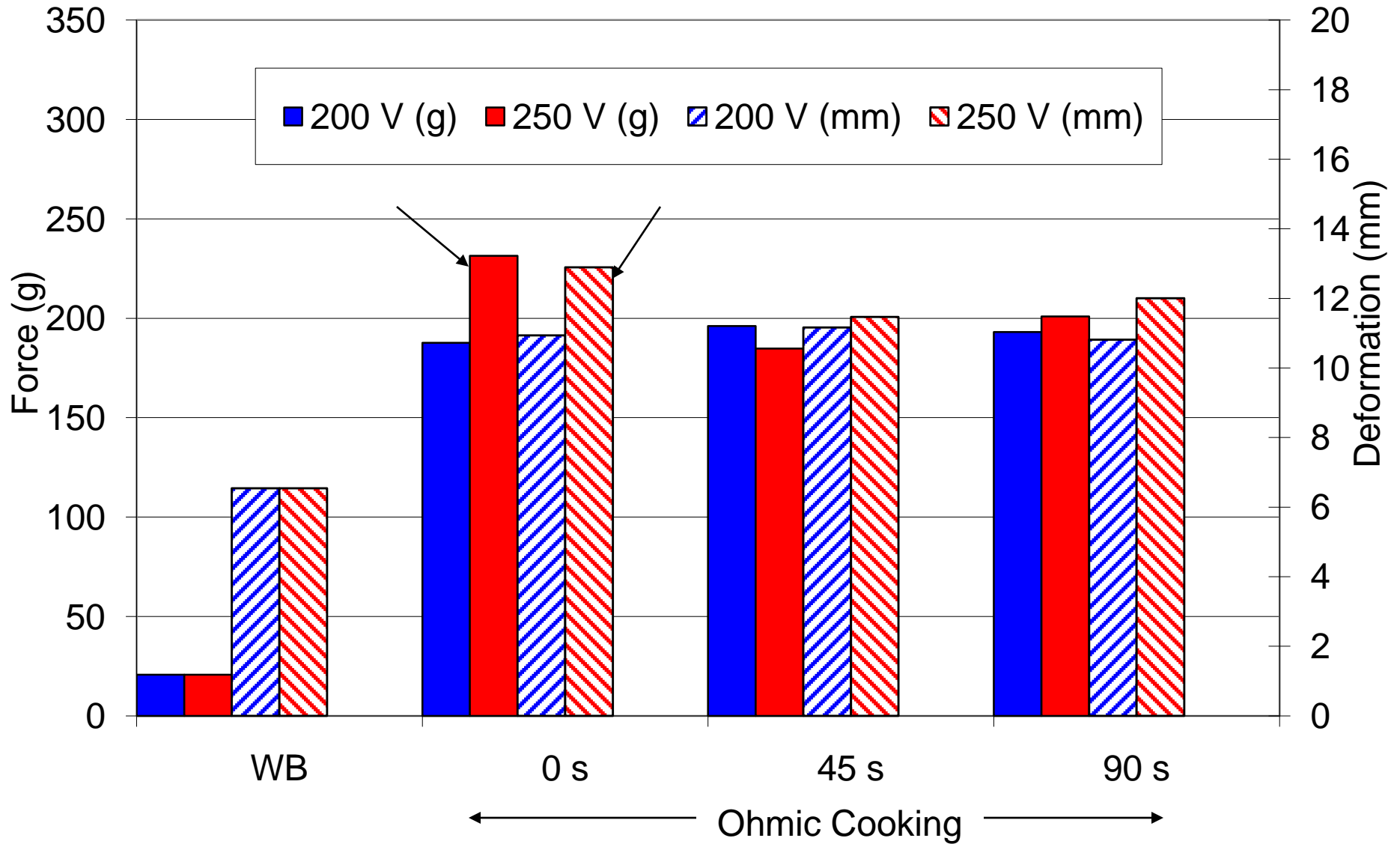
- All Gels were subjected to penetration using spherical probe (5 mm dia) after being equilibrated to room temp.
- Crosshead speed: 1mm/sec
- Measured breaking force (g) and deformation (mm) at rupture





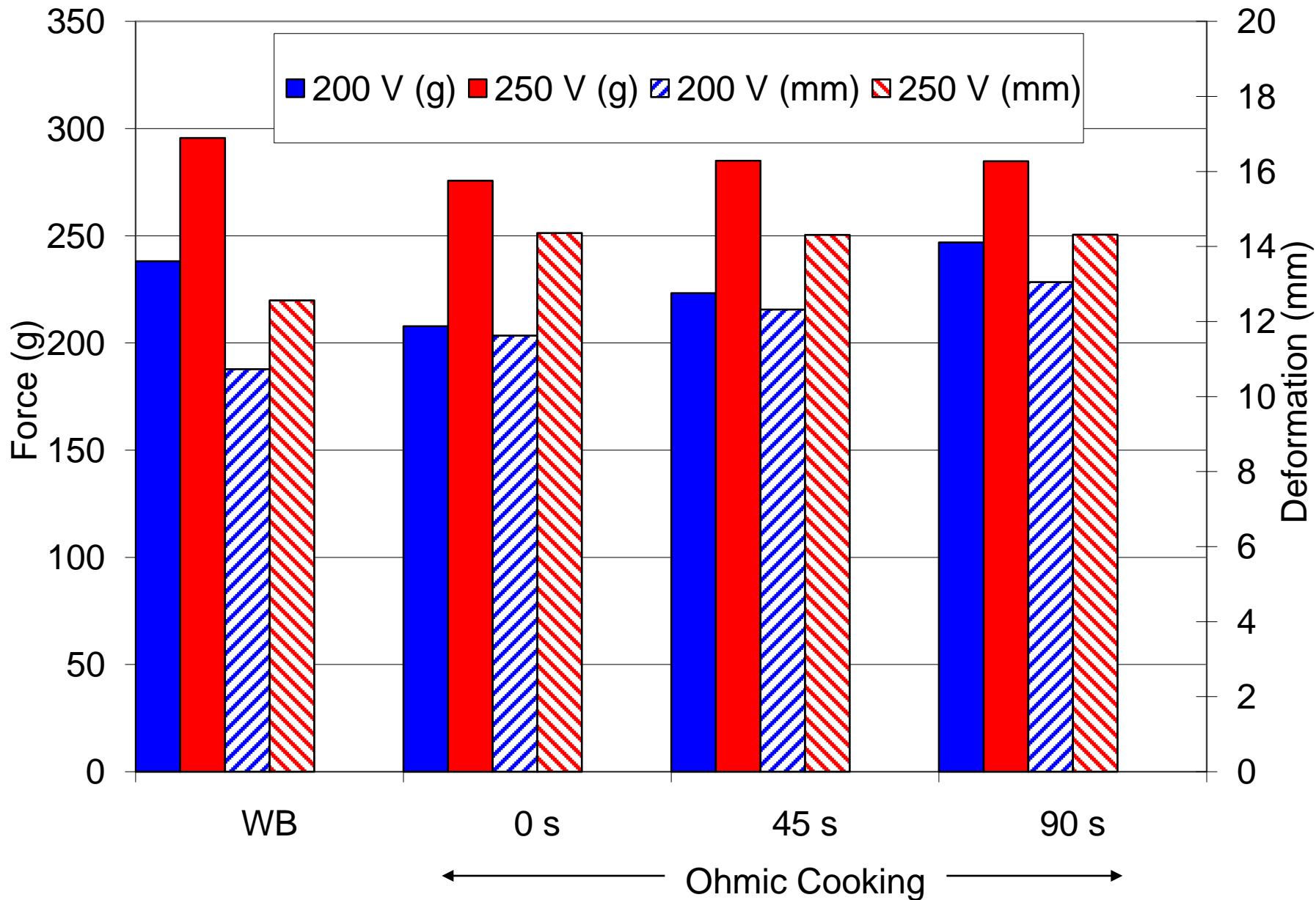
Pacific Whiting

2% salt, 78% moisture



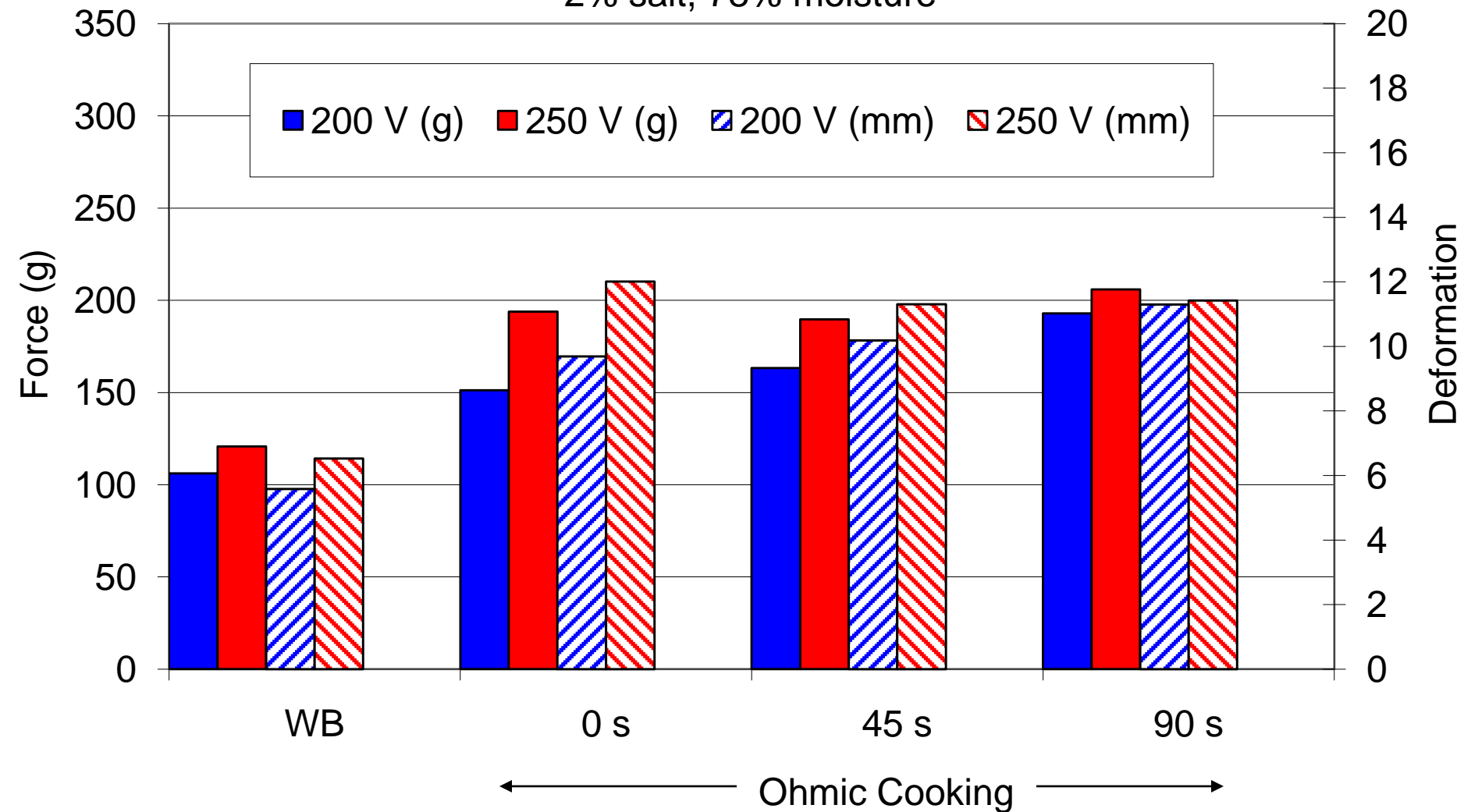
KA Alaska pollock

2% salt, 78% moisture



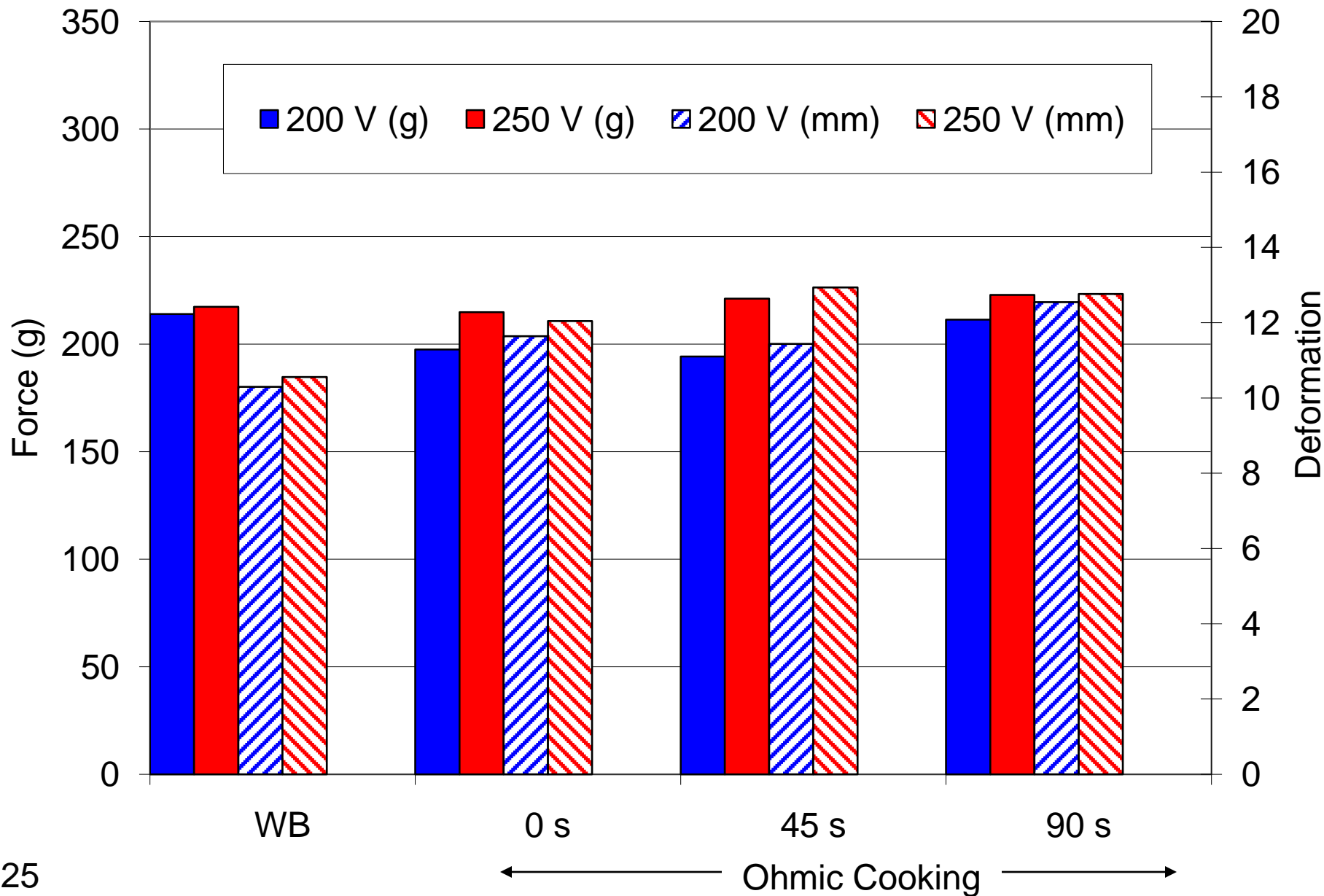
RA Alaska pollock

2% salt, 78% moisture



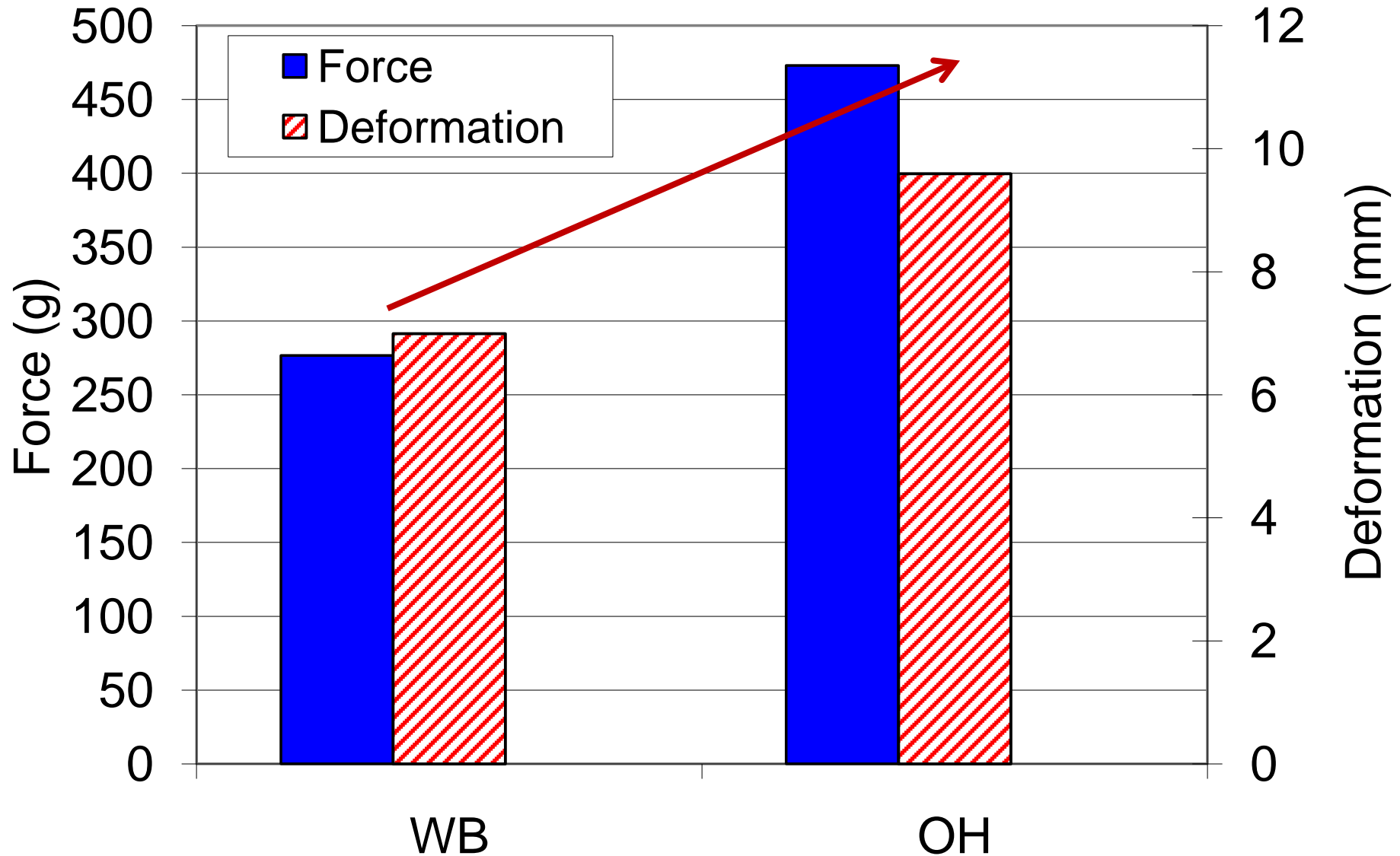
AA Alaska pollock

2% salt, 78% moisture

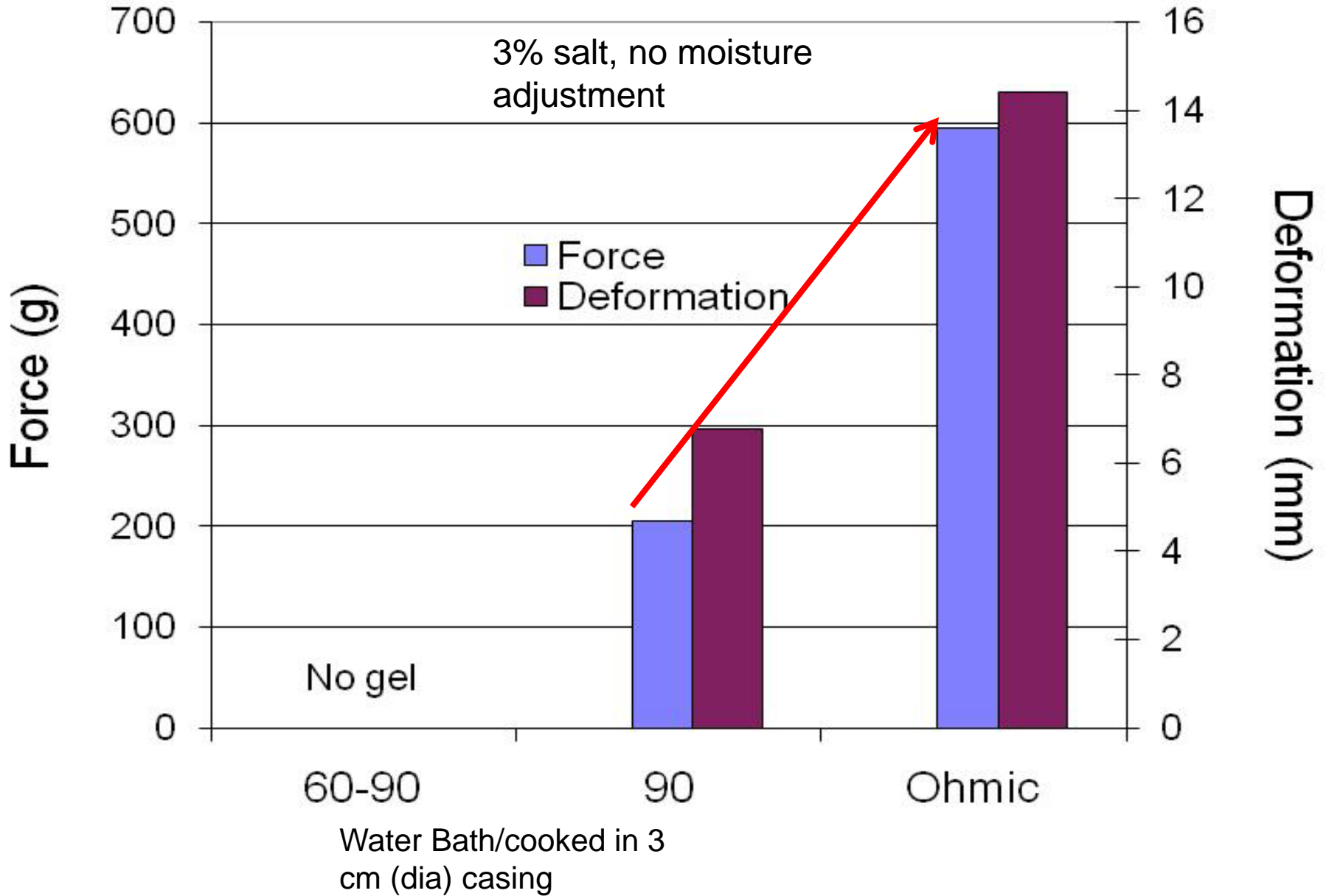


Catfish Surimi (200 V 90 s)

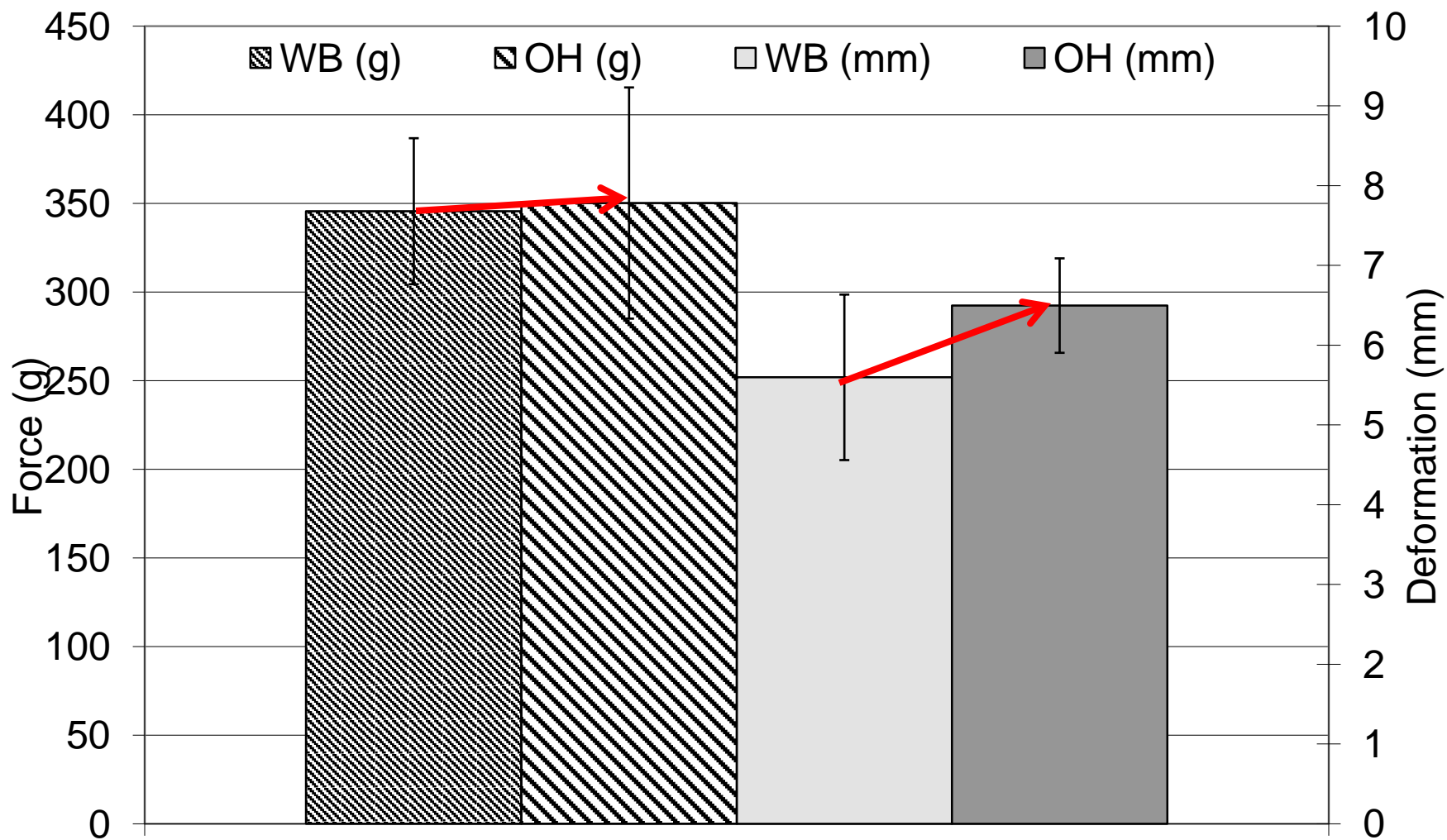
3% salt addition and no moisture adjustment



Arrowtooth Flounder Surimi

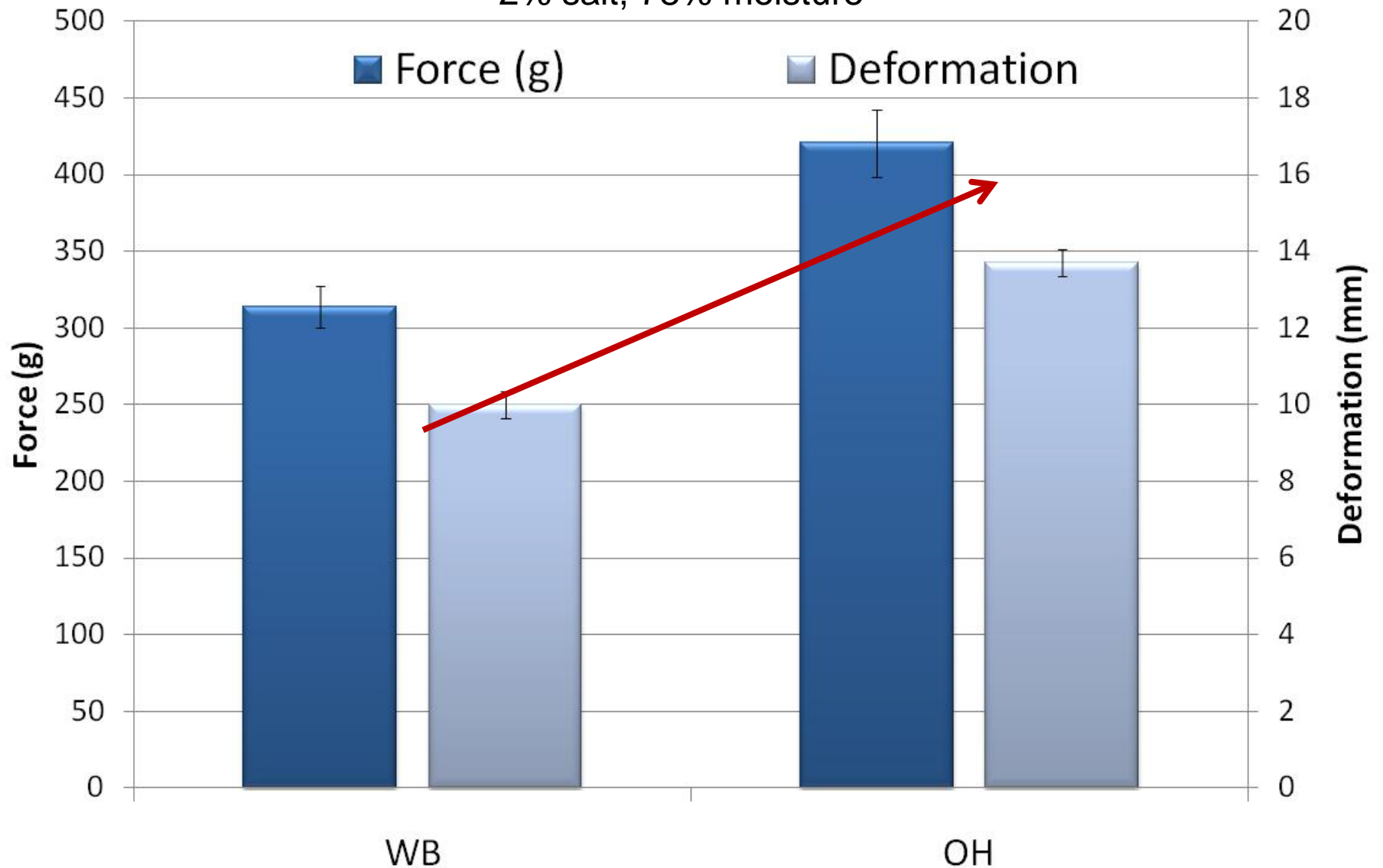


Giant Squid Surimi

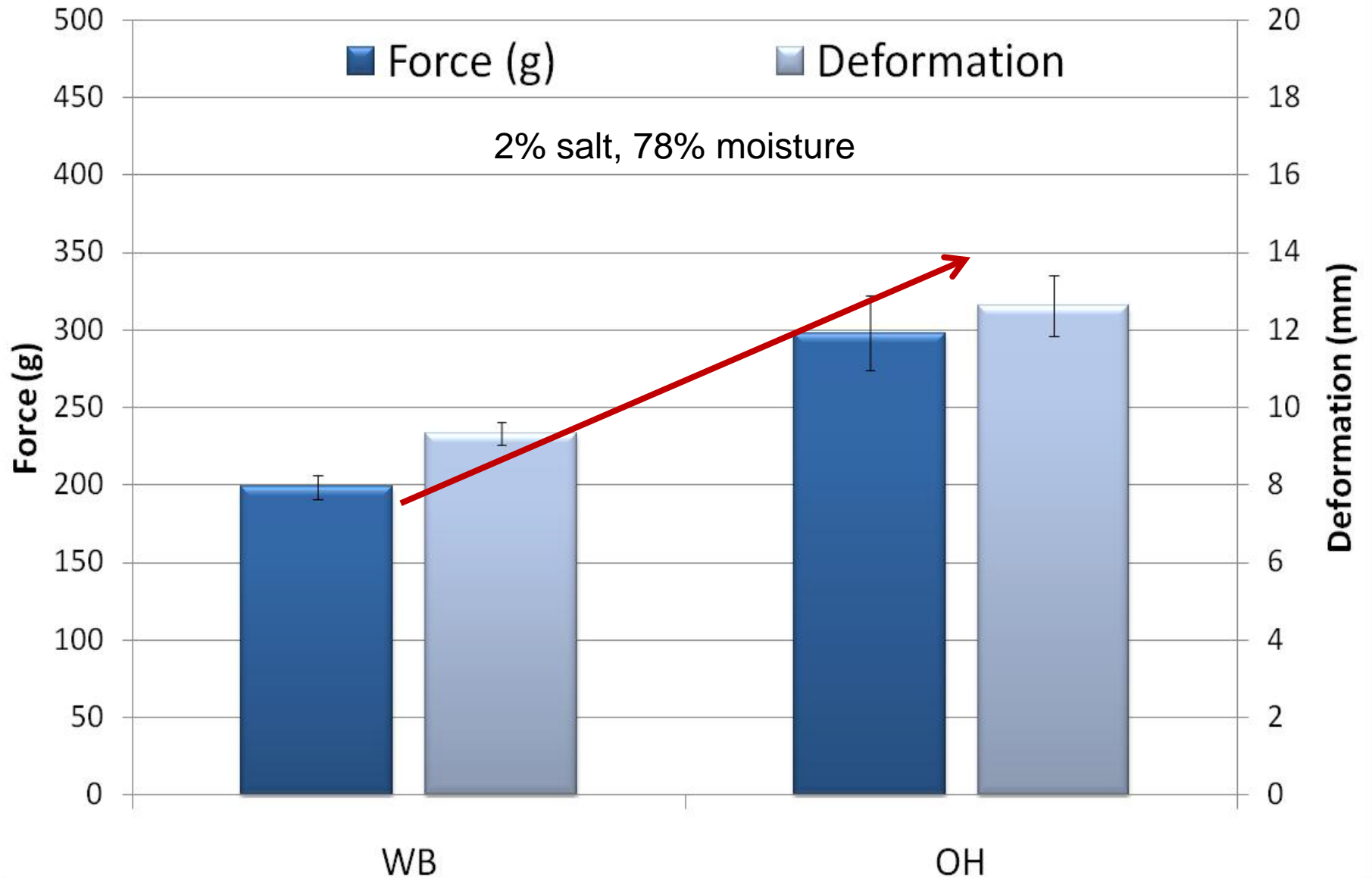


Threadfin bream

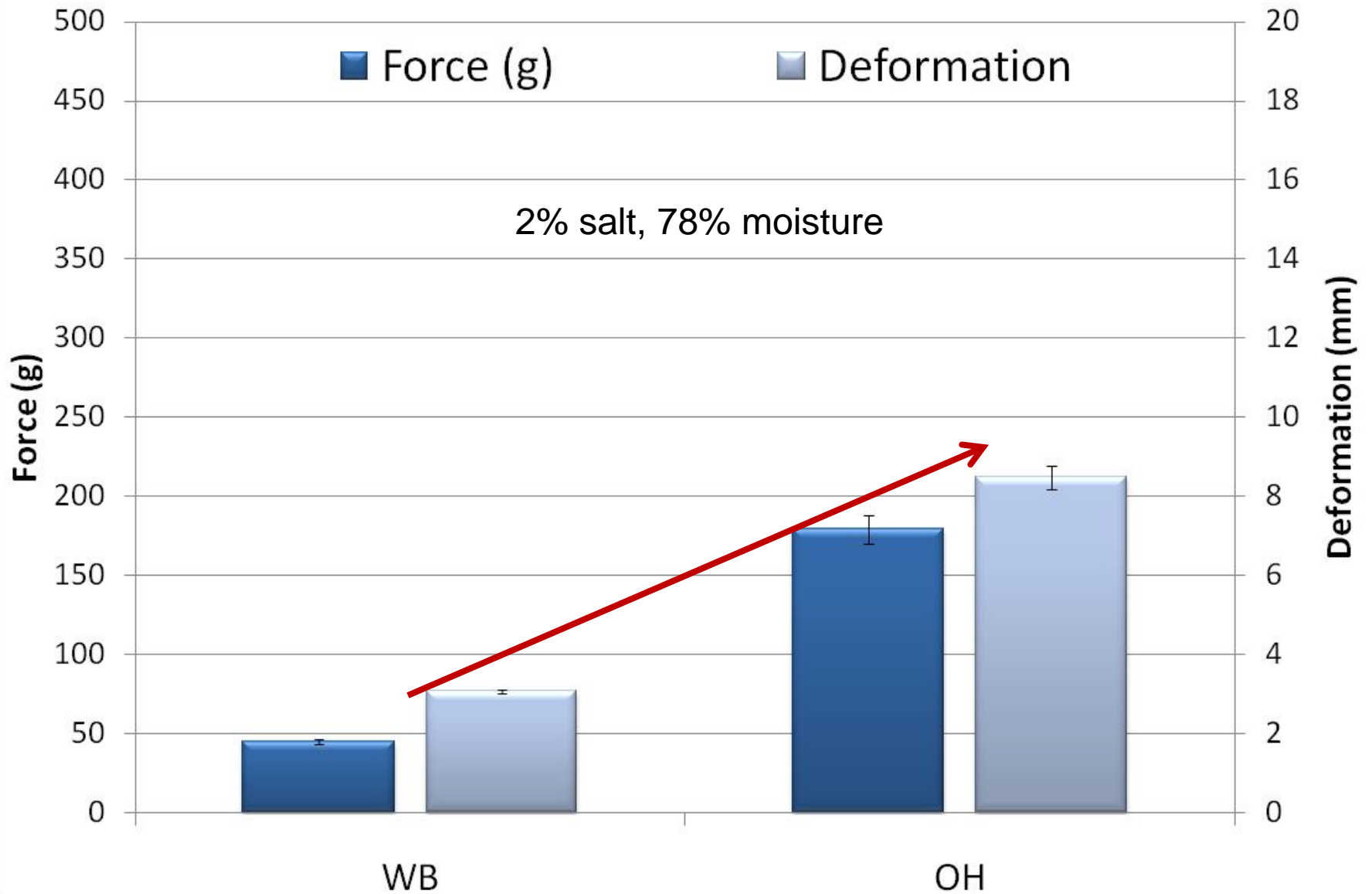
2% salt, 78% moisture



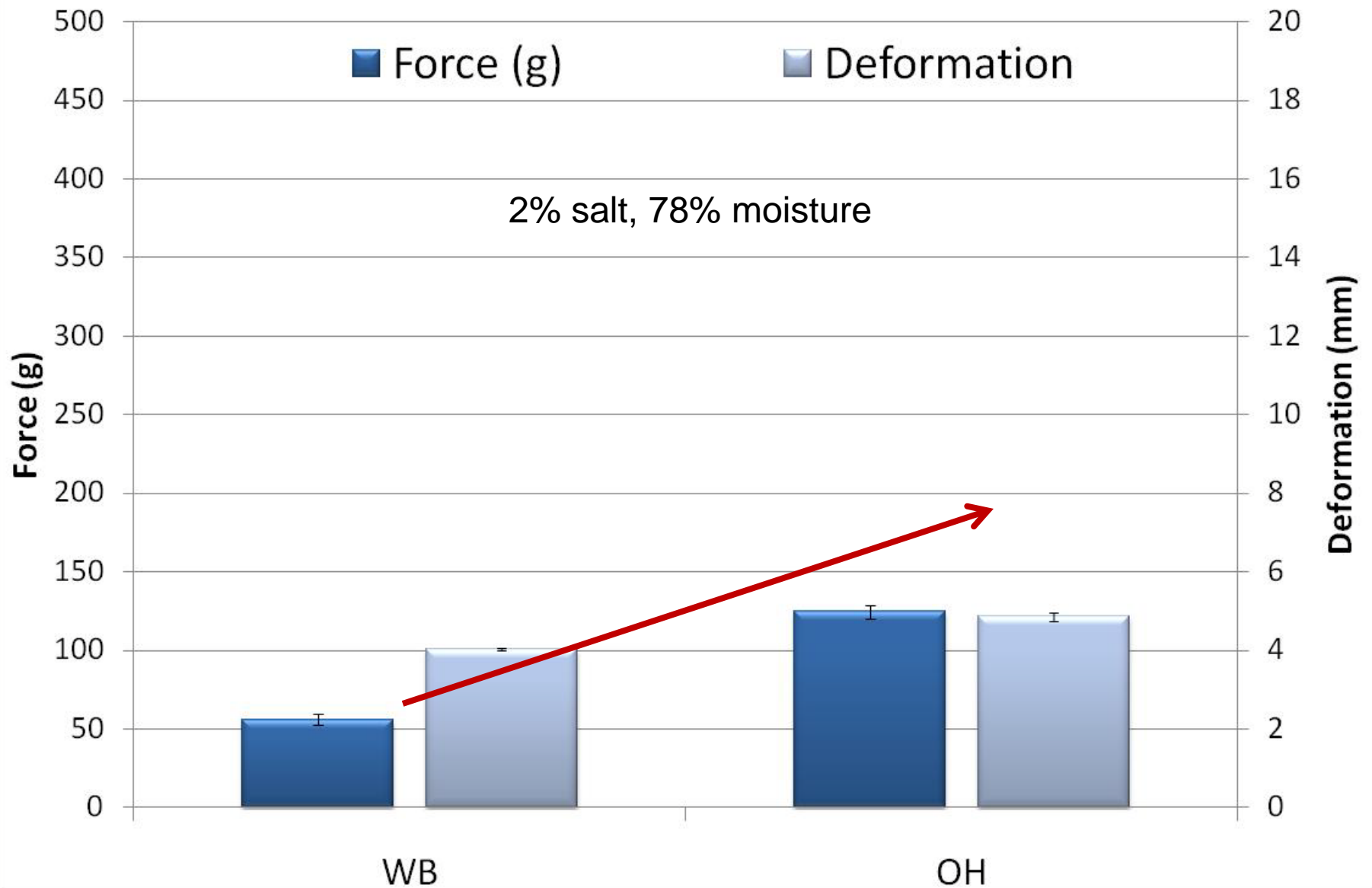
Bigeye snapper



Goatfish

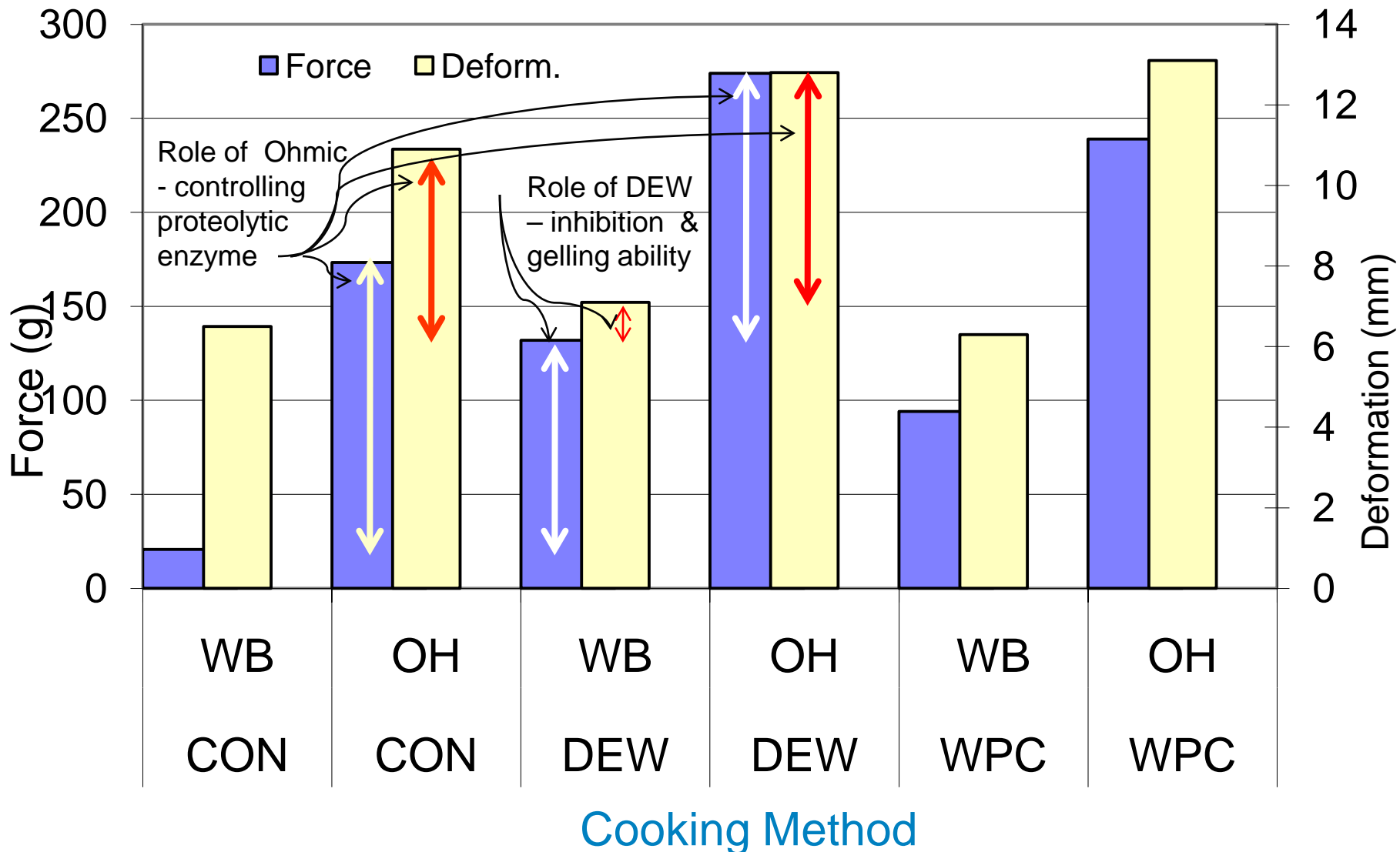


Lizardfish



Pacific Whiting Surimi Texture as Affected by Cooking Method and Protein Additives

2% salt, 78% moisture

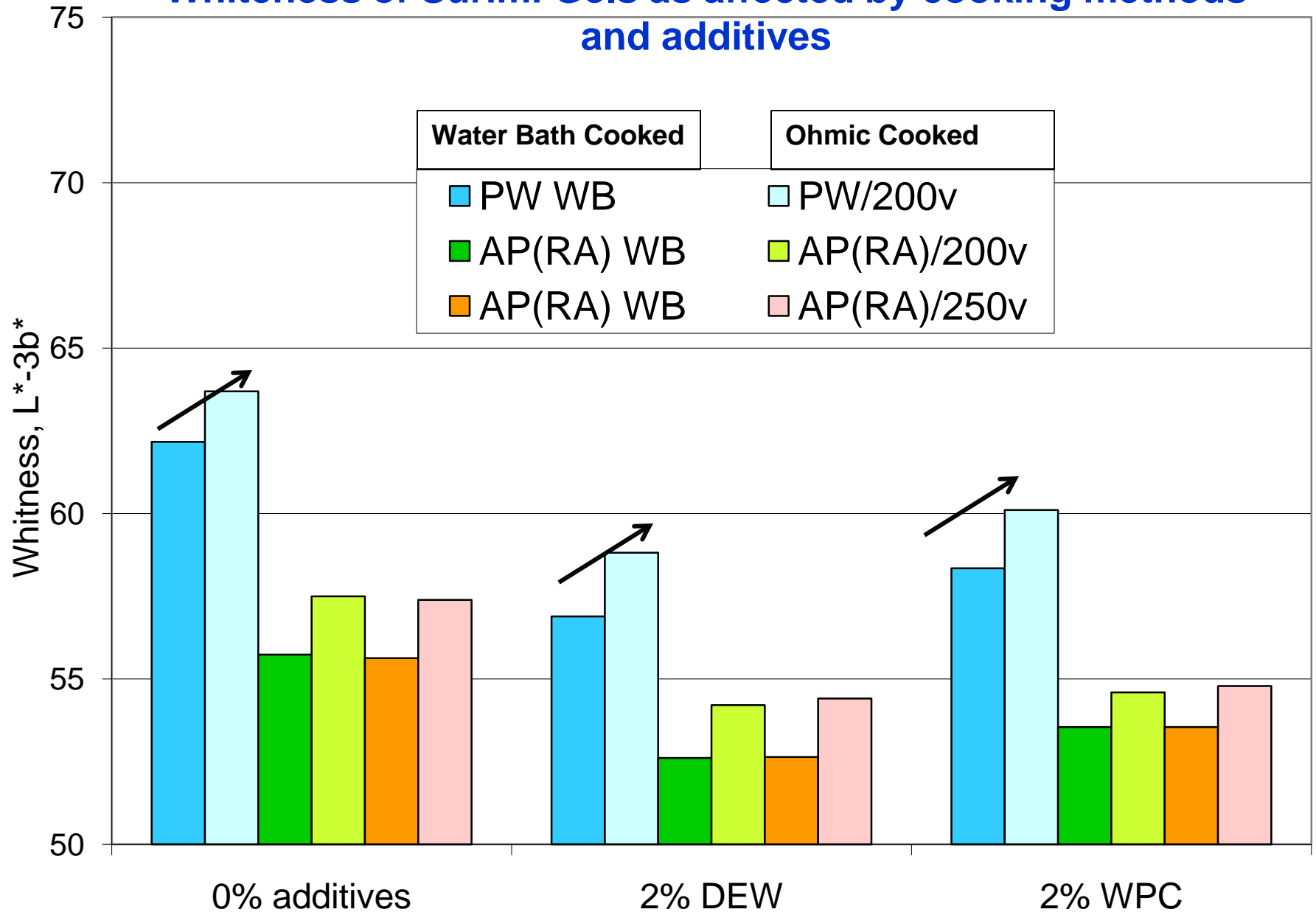


Alaska Pollock (RA) Surimi Texture as Affected by **Cooking Method** and **Protein Additives**

2% salt, 78% moisture



Whiteness of Surimi Gels as affected by cooking methods and additives



Current Efforts

- Microwave Cooker
 - Great results
 - Too large to be portable
 - >US\$ 60,000 ?
 - Failed to penetrate

- Ohmic Cooker
 - Great results
 - Small enough to be portable
 - About US\$15,000 ?
 - Just introduced by **Kami Steel** (Seattle, WA, USA)

CONCLUSIONS

- **Ohmic heating** enabled to cook 3 cm diameter sausage **properly and rapidly**.
- Pacific whiting surimi, catfish surimi, arrowtooth, RA grade pollock surimi and all tropical surimi **significantly improved their gel values** by ohmic cooking: ***Accurate Quality Assessment (Not Cheating) – More Values***
- **Ohmic gels** were relatively **whiter** than waterbath gels.



RAPSA

FAST COOKING FOR
BETTER VALUE



- Mimicking Crabstick Cooking
- Consistent Results
- Fully Automatic Operation
- Optional Manual Operation
- User Friendly
- UL / CSA Approved
- Advanced Safety Features
- **Patent Pending**

cooking time
35 seconds

For questions please contact
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***FAST* Cooking** Ohmic
(Joule) Heating:

- Better Utilization,
- More Value, and
- Accurate Analysis
of Surimi
- More Profit and
Better QC