MRI and confocal microscopy: New tools to study the lipid distribution of New Zealand King Salmon (*Oncorhynchus tshawytscha*) during thermal processing

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INTRODUCTION

- NZ King Salmon is the largest of the Salmon species
- Rich source of omega-3 (n-3) fatty acids (FA)
- No literature on changes that occur during thermal processing (cooking)
  - sensory properties
  - lipid distribution
  - fatty acid profile

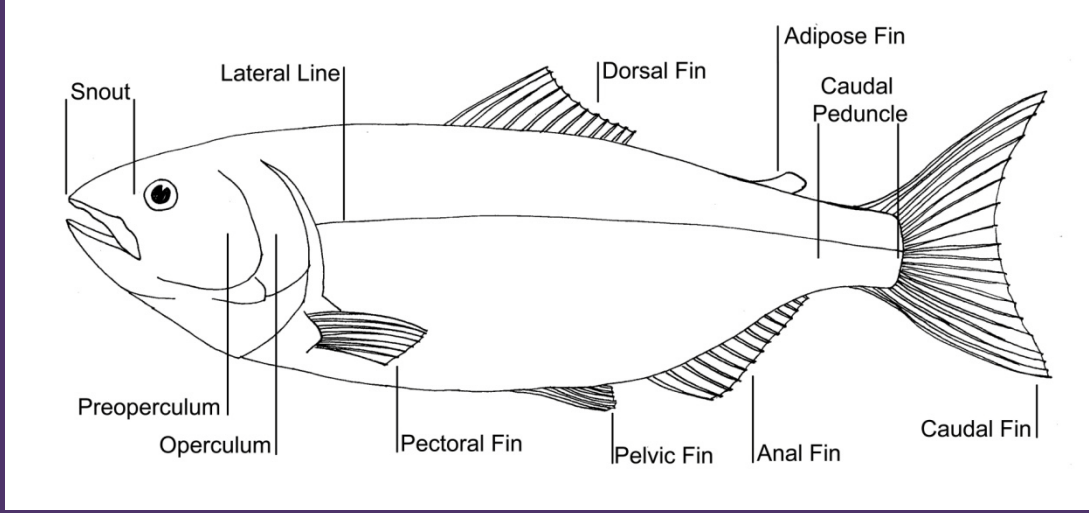
AIMS

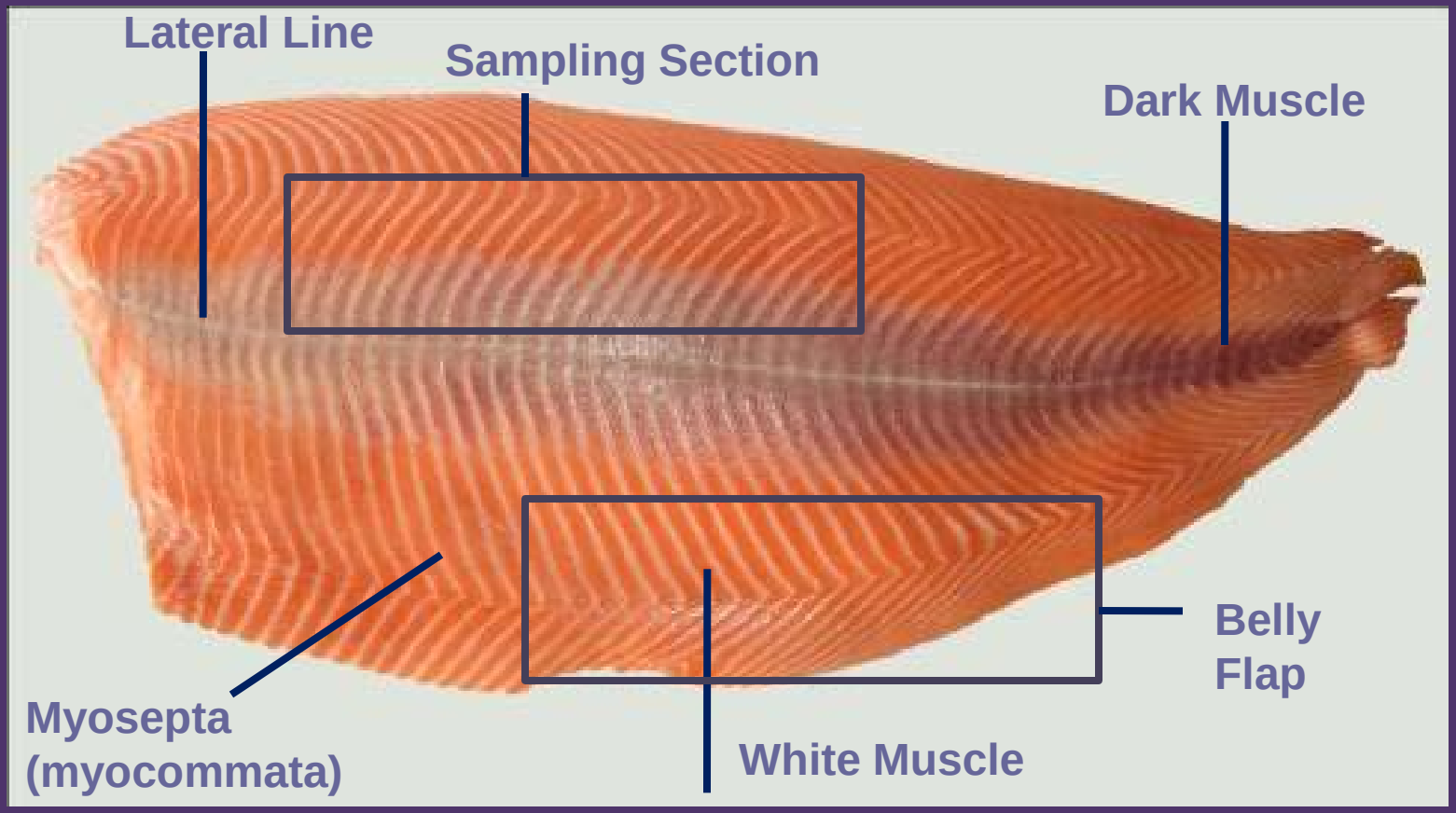
- Determine effect of common preparation methods on:
  - fatty acid profile
  - lipid arrangement and distribution

- Use MRI and microscopy to determine changes in lipid distribution during cooking

  - Why do some methods loose significant amounts of lipid during the cooking process?

  - Do bound lipids effect lipid extraction?


Adipose Fin
Lateral Line
Dorsal Fin
Snout
Caudal
Peduncle
Preoperculum
Operculum
Pectoral Fin
Pelvic Fin
Anal Fin
Caudal Fin


Lateral Line
Sampling Section
Dark Muscle
Belly
Flap
Myosepta
(myocommata)
White Muscle

PREPARATION METHODS

Raw

Steaming

Poaching

Oven Baking (no oil)

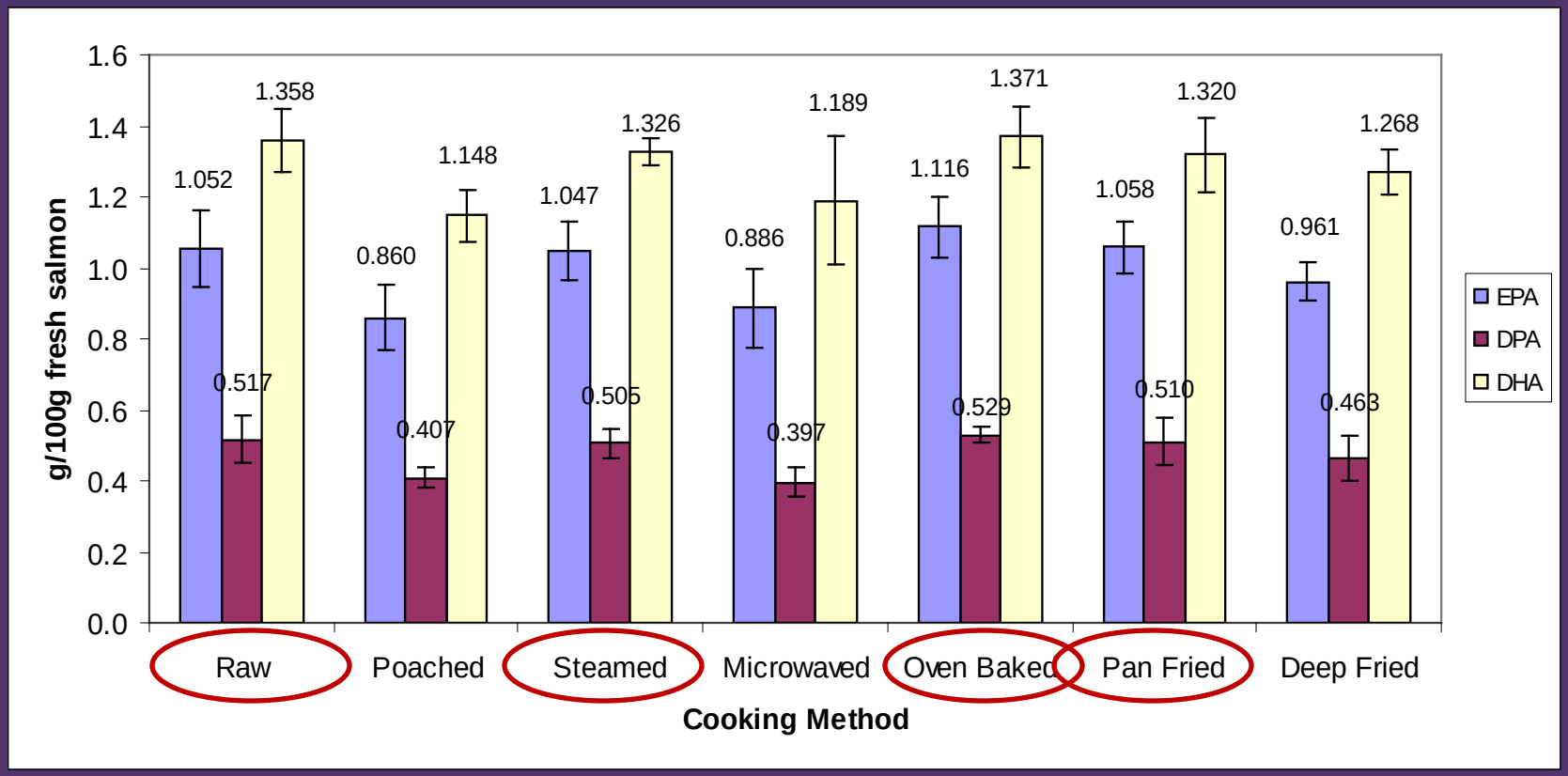
Microwaving

Deep Frying (sunflower oil)

Pan Frying (no oil)

RESULTS

OMEGA-3 FA CONTENT – DHA, EPA, DPA



Docosahexaenoic acid (DHA) 22:6, n-3

Eicosapentaenoic acid (EPA) 20:5, n-3

Docosapentaenoic acid (DPA) 22:5, n-3

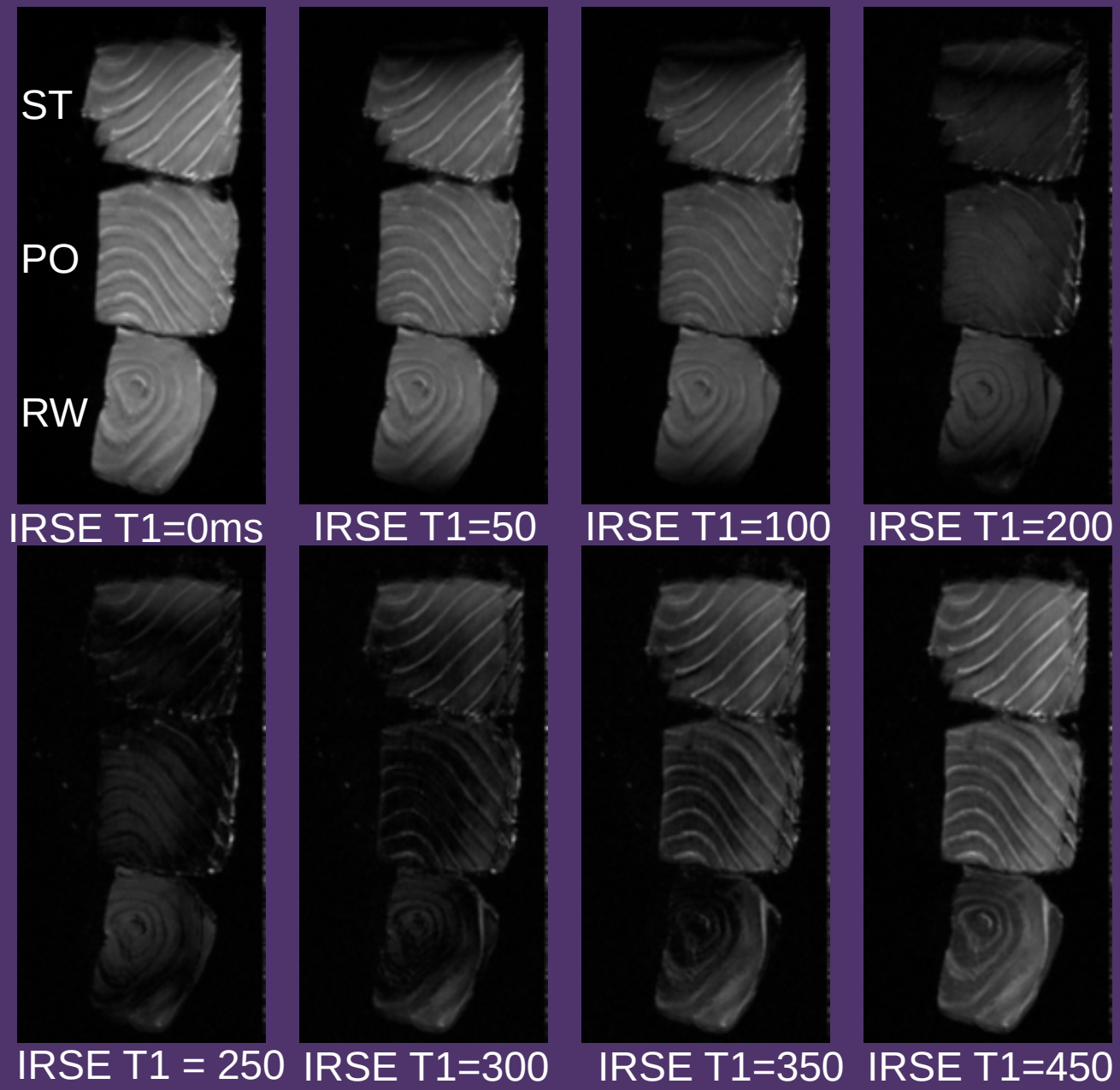
MAGNETIC RESONANCE IMAGING (MRI)

Lipids
(white)

Dark Muscle

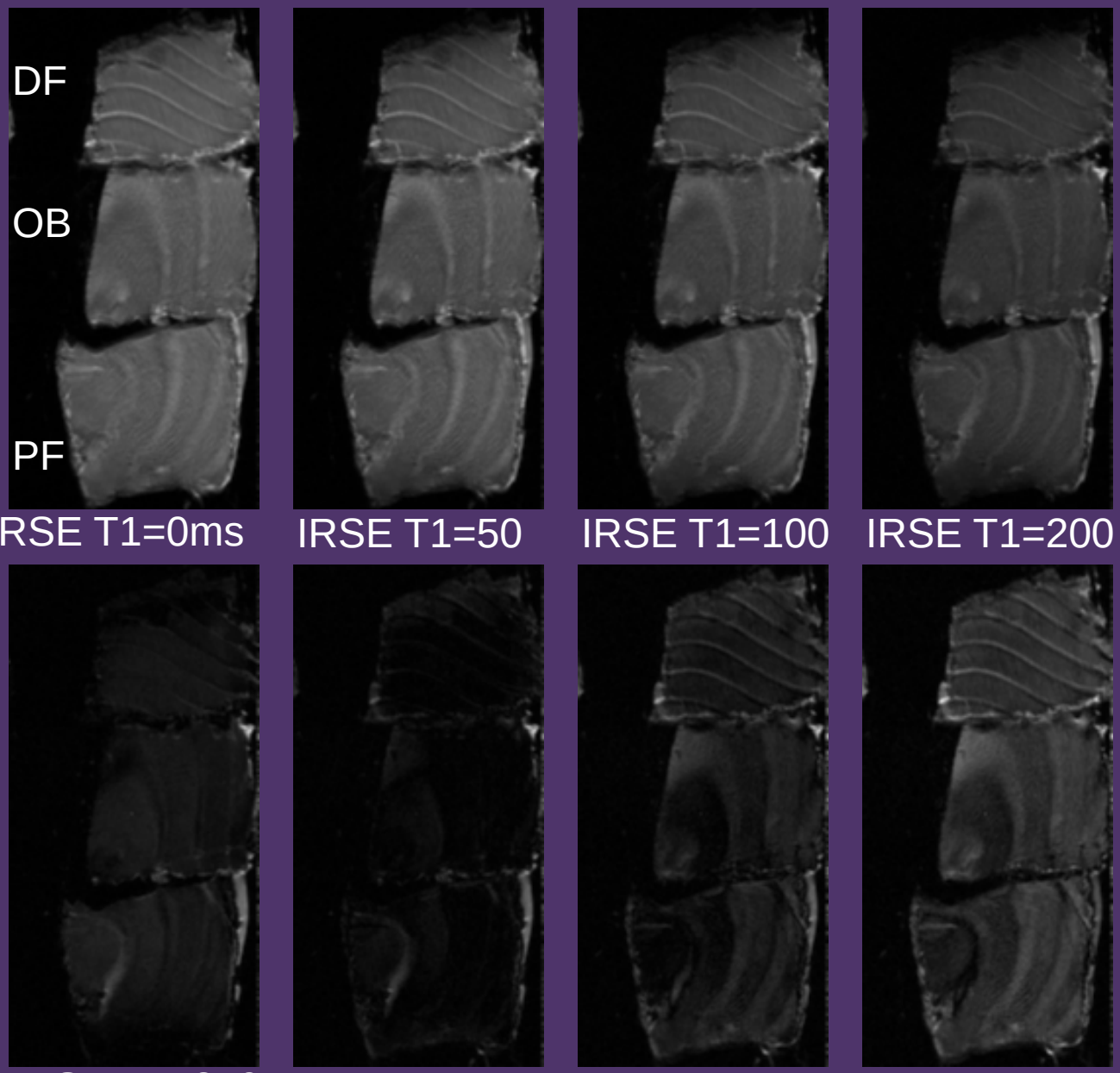
Possible large
cluster of
adipocytes

RW = Raw, OB = Oven Baked, MW = Microwaved



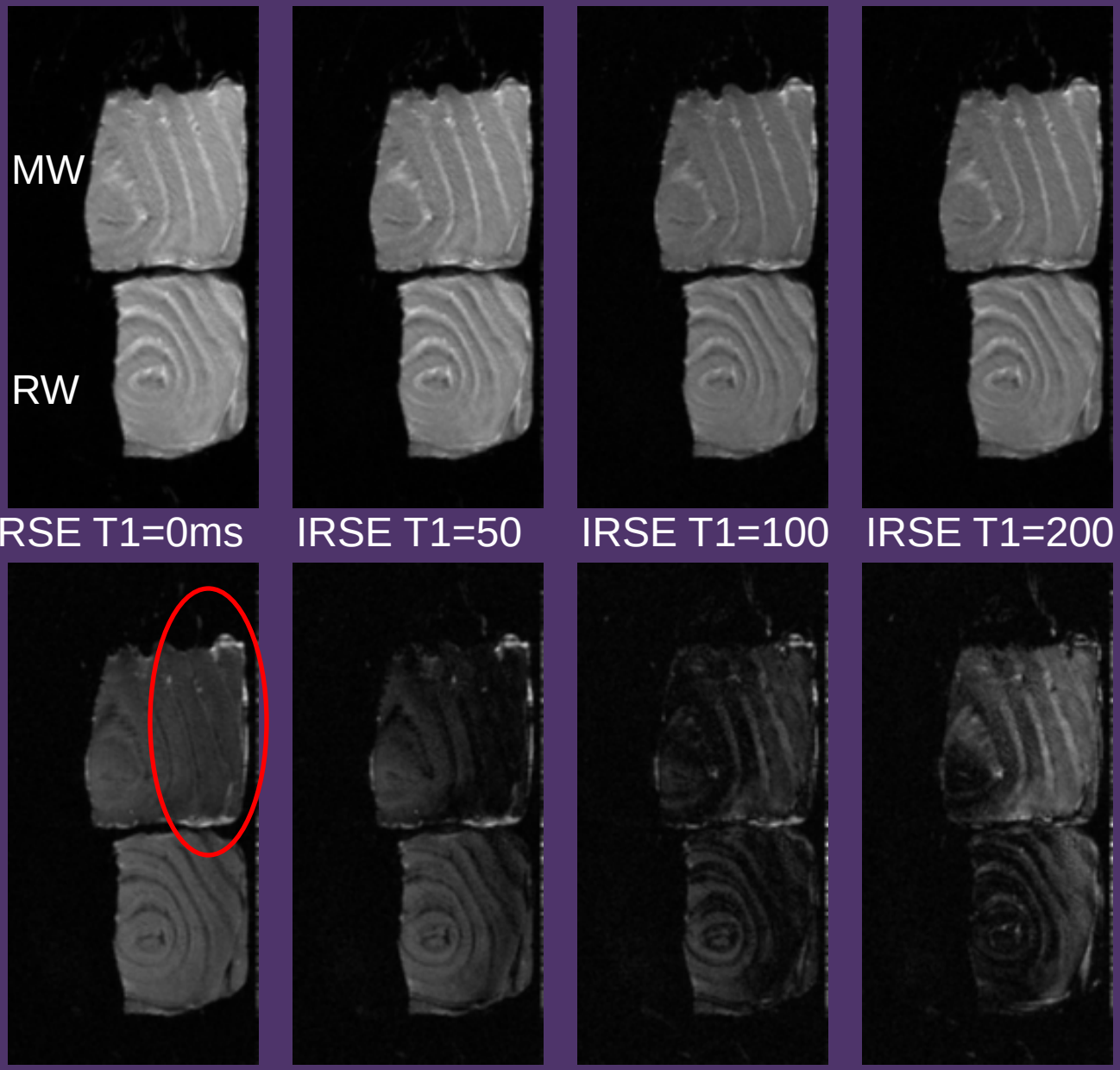
IRSE = Inversion Recovery Spin- Echo (T1)

ST = Steamed
PO = Poached
RW = Raw



IRSE = Inversion Recovery
Spin- Echo (T1)

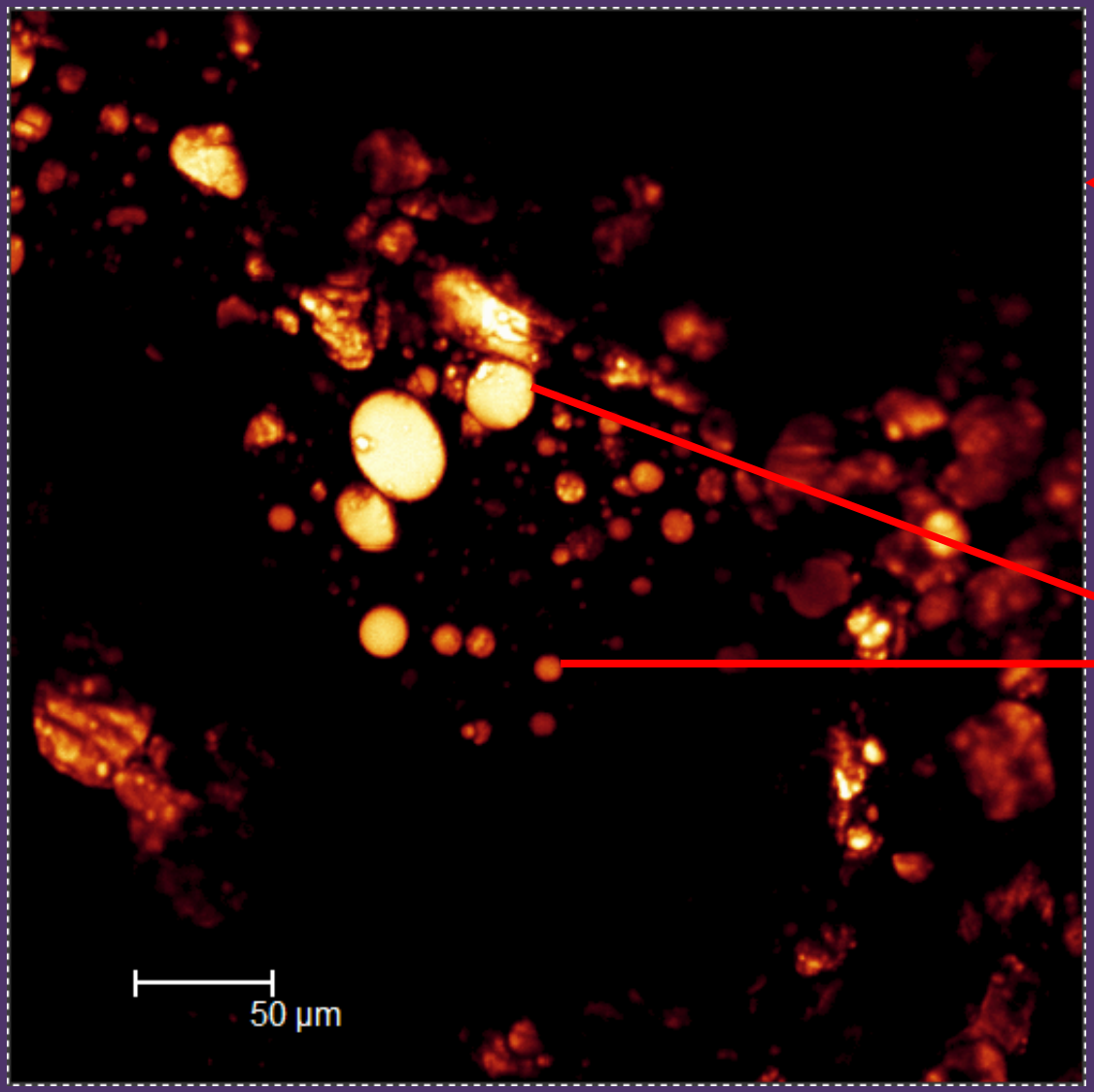
DF = Deep Fried
OB = Oven Baked
PF = Pan Fried

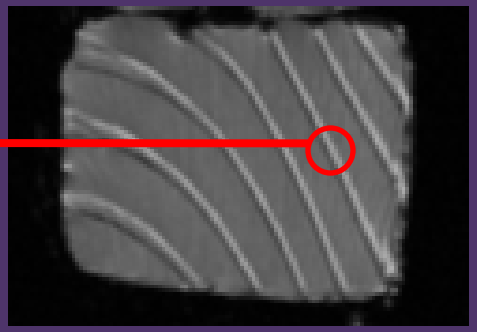


IRSE = Inversion Recovery Spin- Echo (T1)

MW = Microwaved
RW = Raw

CONFOCAL MICROSCOPY

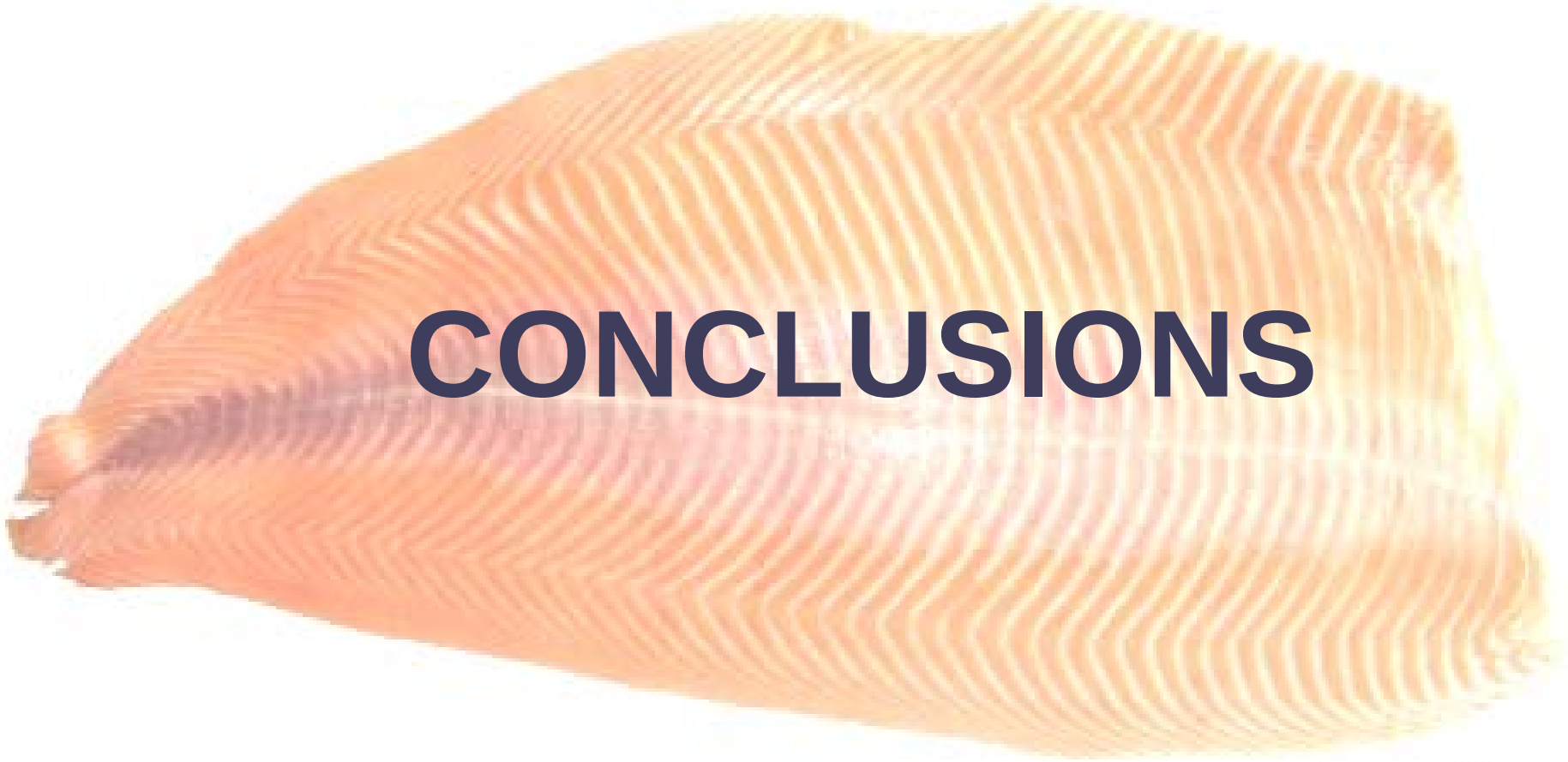




Many advantages over other microscopy methods

Lipid Droplets

Leica TCS SP2 confocal microscope, 561 laser
Raw Salmon, Stain: Nile Red



CONCLUSIONS

- Oven baked Salmon highest Omega-3 content
- Higher lipid concentration in dark muscle
- In white muscle most lipids present in Myosepta
- Lipid distribution changes occur between preparation methods

ACKNOWLEDGEMENTS

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