Food safety of Sashimi in European Restaurants – A study case from Portugal



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Accelerating Scientific Discovery
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History



For over 2000 years Japan has begun to preserve fish in salt and rice - Nare-Sushi

In the year 700 A.D. born the funa-sushi



In the 17th century the haya-sushi arises



In 1824 comes the 1st nigiri with sliced raw fish on top.

At the same time borne SASHIMI.



Sashimi VS Sushi



Sashimi

Uramaki



Nigiri



Temaki



Maki



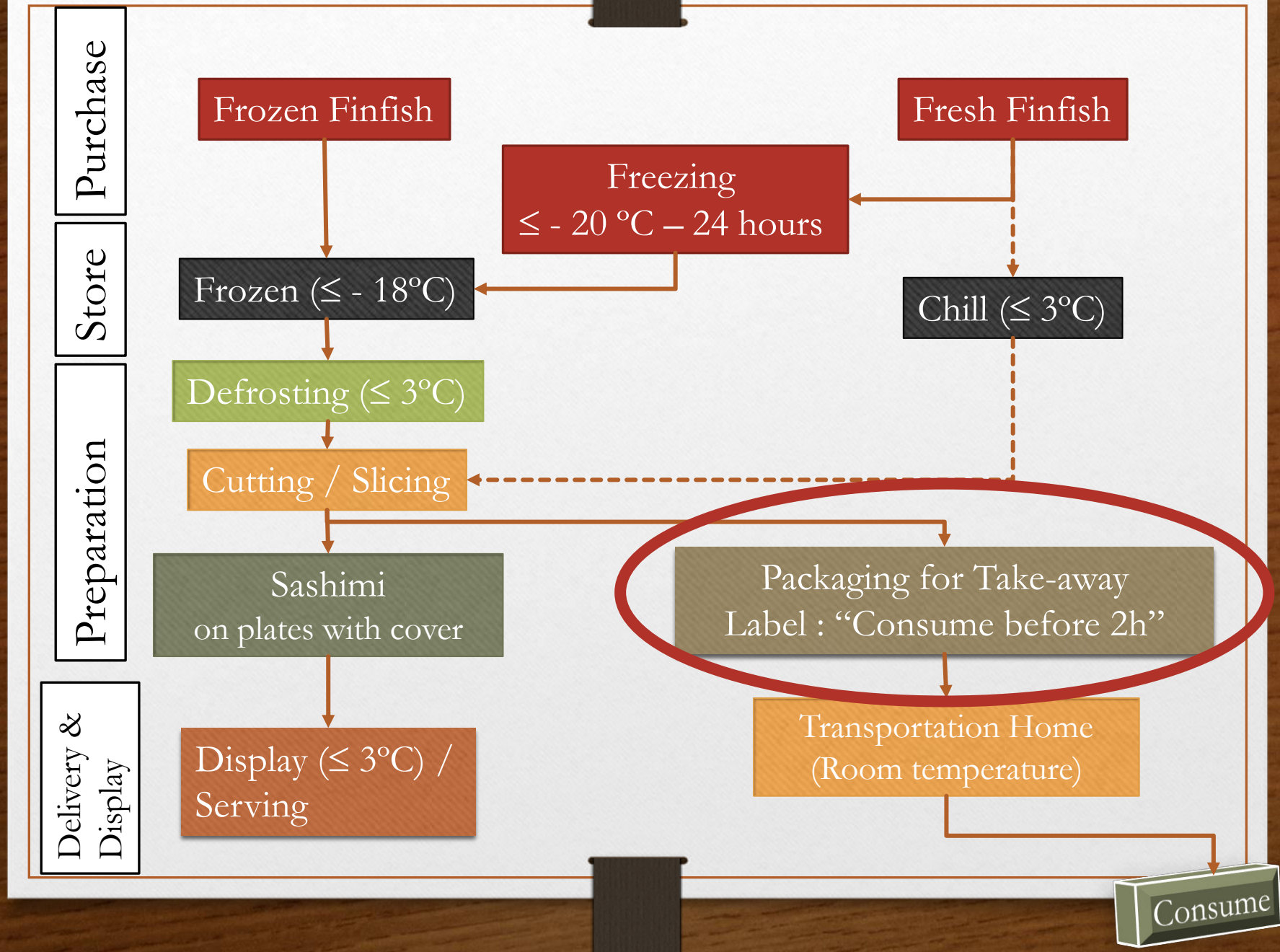
Chirashi



Regulation (CE) No 852/2004

Article 5

"Food business operators shall put in place, implement and maintain a permanent procedure or procedures based on HACCP principles"


Purchase
Store
Preparation
Delivery & Display
Frozen Finfish
Fresh Finfish
Freezing
≤ - 20 °C – 24 hours
Frozen (≤ - 18°C)
Chill (≤ 3°C)
Defrosting (≤ 3°C)
Cutting / Slicing
Sashimi
on plates with cover
Packaging for Take-away
Label : "Consume before 2h"
Transportation Home
(Room temperature)
Display (≤ 3°C) /
Serving
Consume

Food Safety Hazards

- Chemical – Heavy metals
- Biological –pathogenic and deteriorative bacteria
- Physical
- Radiological

Chemical Hazards

- Heavy metals
  - Hg, Cd, Pb

	Tuna mg/Kg w/w	Butterfish Mg/Kg w/w	Other Mg/Kg w/w
Mercury	1,00	1,00	0,50
Cadmium	0,10	0,05	0,05
Lead	0,30	0,30	0,30

Legal levels allowed for Hg, Cd and Pb

Material and Methods



- 23 Restaurants
- 57 samples of sashimi (takeaway)
- October 1, 2012 to October 15, 2013
- Sashimi Finfish samples:
  - 27 Salmon
  - 14 Tuna
  - 8 Sea Bass
  - 3 Butterfish
  - 2 Sea Bream
  - 1 Brill, 1 Great Scaloop and 1 turbot

Miguéis, S.[1*], Barros, A.[2], Coutinho, J.[3], Matos, C.[4], Saraiva, C.[1] & Esteves, A.[1]

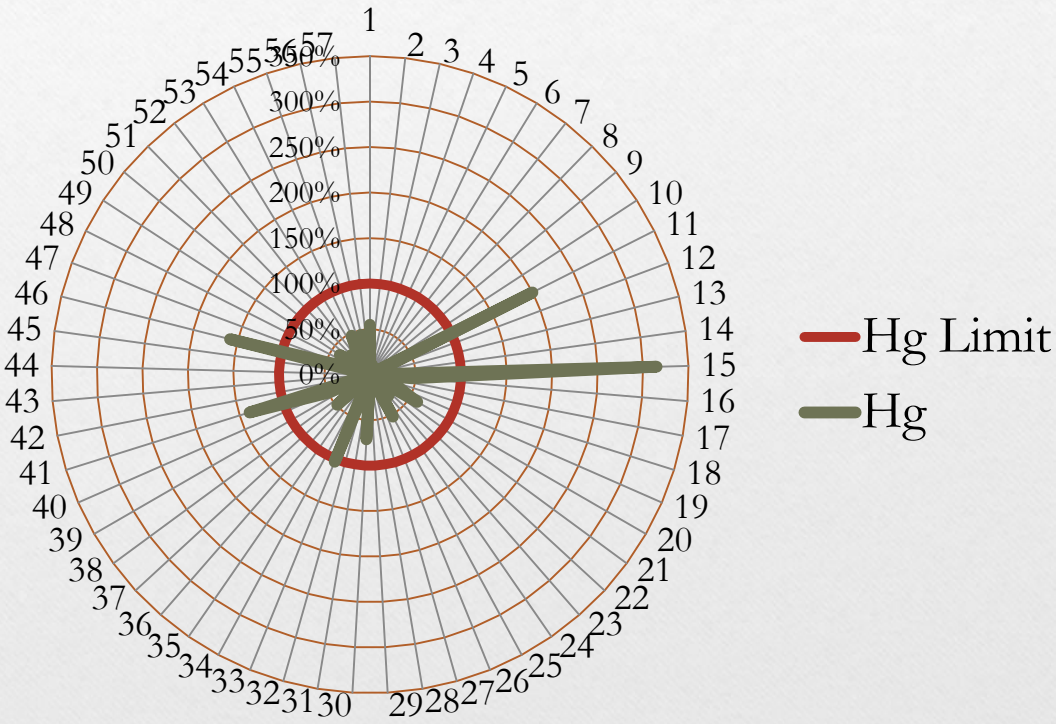
[1] *CECAV, School of Agrarian and Veterinary Sciences, DCV, University of Trás-os-Montes e Alto Douro, 5001-801 Vila Real, Portugal*

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[4] *Chemistry Department, University of Trás-os-Montes e Alto Douro, 5001-801 Vila Real, Portugal*

Hg (Mercury)



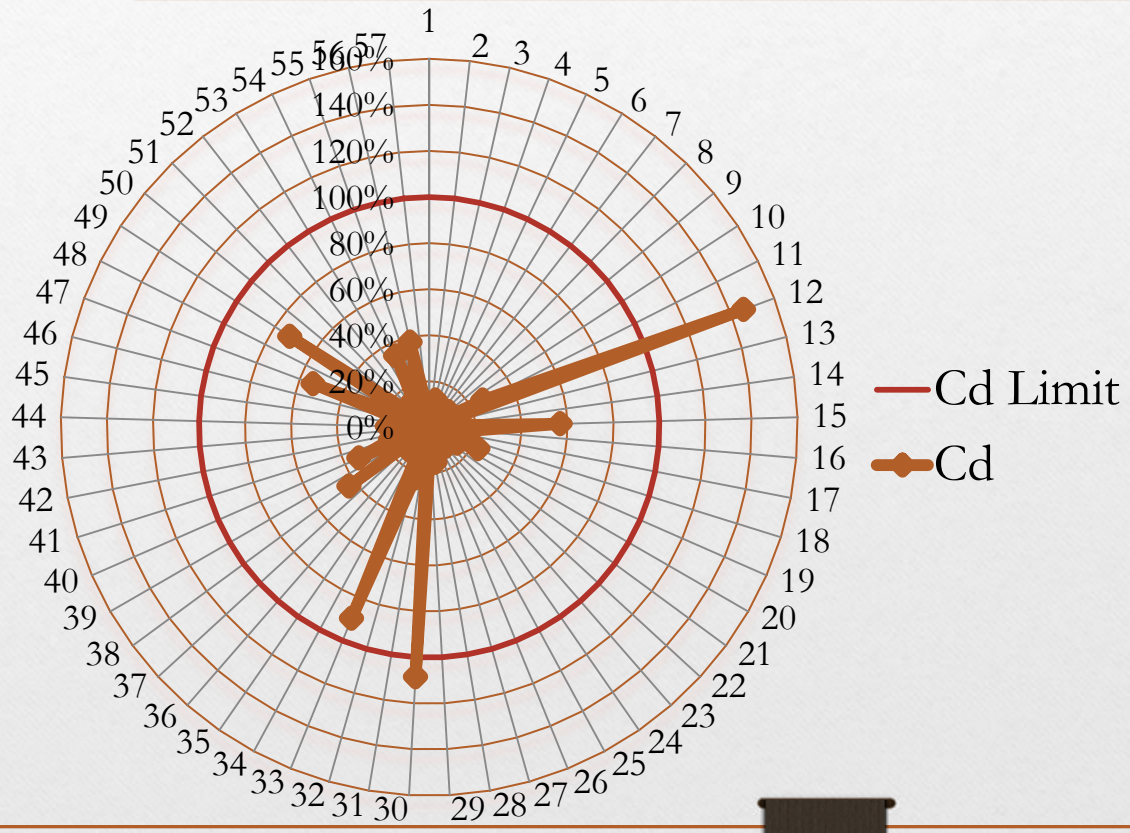
n= 57

8.77% above legal level

Morgano et al. (2013)
In tuna (n= 29)

7% above
1 mg Kg^{-1}

Cd (Cadmium)



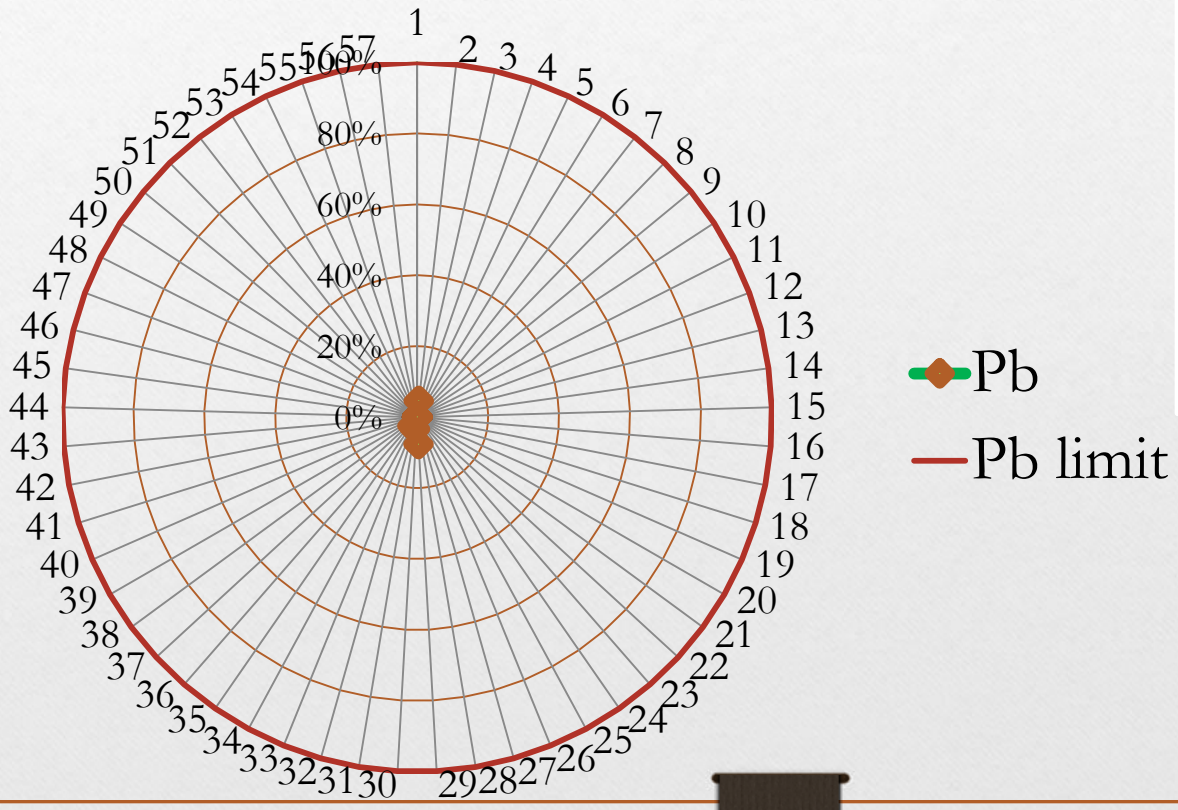
n= 57

3.5% above legal level

Octopus
n= 18

61% above 0.05mg/Kg (2013, Morgano)

Pb (Lead)



n= 57

0% above legal level

77% samples below the Limit of Quantification

Biological Hazards

- **Pathogenic and deteriorative Bacteria**
  - **Microbiological Quality levels**

Microbiological Quality Levels (Santos, et all. 2005 and Gilbert (2000))

Test	Satisfactory	Acceptable	Unsatisfactory	Unacceptable/ Potentially Hazardous
Indicators	Standard limits (log/g)			
Mesophilic	< 5 log	≥5 log <6 log	≥ 6 log	N/A
Enterobacteriaceae	< 2 log	≥2 log <4 log	≥ 4 log	N/A
E. coli	≤ 1 log	>1 log <2 log	≥2 log	N/A
Mould	< 2 log	≥2 log <3 log	≥ 3 log	-
Yeast	< 2 log	≥2 log <5 log	≥ 5 log	N/A
Pathogens				
S. aureus	< 1 log	≥1 log ≤3 log	>3 log <4 log	≥4 log
Listeria spp.	< 2 log	N/A	≥2 log	N/A
Listeria monocytogenes	Absent in 25g	≤ 2 log		≥2 log
Bacillus cereus	< 2 log	≥2 log ≤3 log	>3 log <5 log	≥5 log
Vibrio parahaemolyticus	Absent in 25g			Present in 25g
Clostridium perfringens	< 1 log	≥1 log ≤3 log	>3 log <4 log	≥ 4 log
Salmonella spp.	Absent in 25g			Present in 25g

Material and Methods



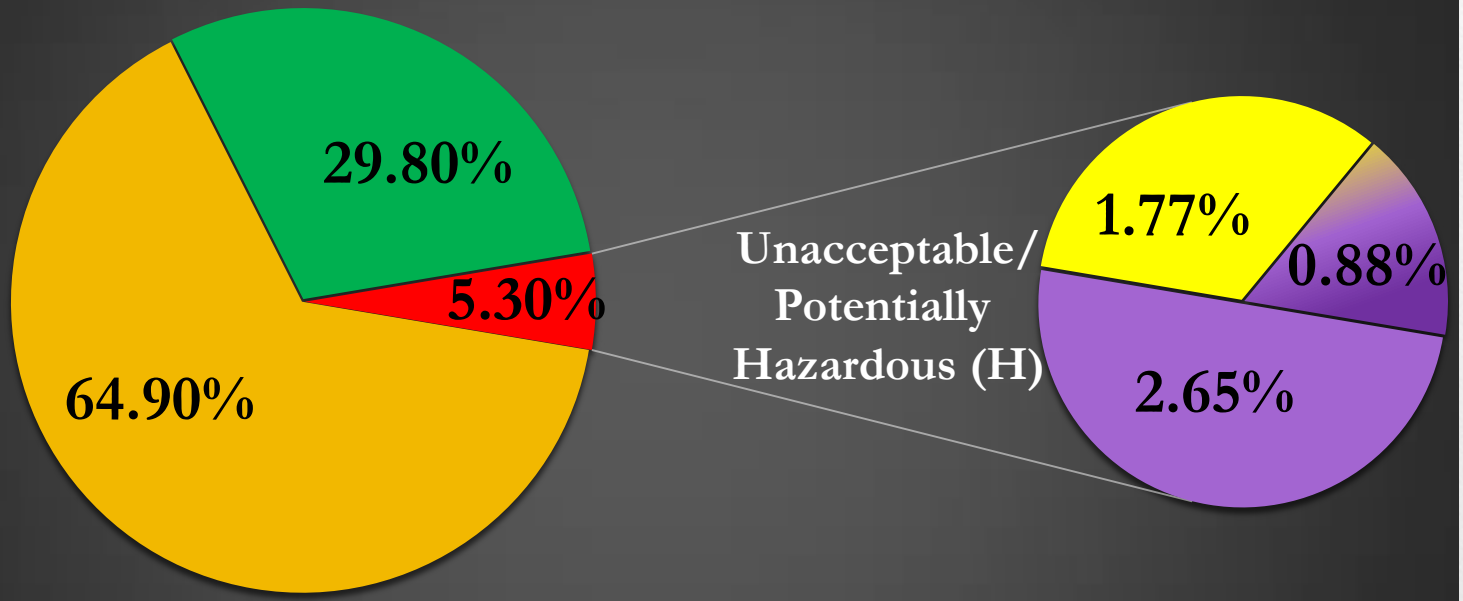
- 23 Restaurants
- 114 samples of sashimi (takeaway)
- October 1, 2012 to October 1, 2013
- Restaurant variable:
  - Typical Restaurants: 63 samples
  - Non-Typical Restaurants: 51 samples
- Season variable:
  - Winter Samples: 54 samples
  - Summer Samples: 60 samples

Microbiological parameters:

- **Indicators:**
  - Mesophilic
  - Psichrophilic
  - LAB
  - Enterobacteriaceae
  - Mold e Yeast
  - *E. coli*
  - *Pseudomonas* spp.
  - Clostridium spp.
  - H_2S positive bacteria
- **Pathogenic:**
  - *Staphylococcus aureus*
  - *Clostridium perfringens*
  - *Bacilllus cereus*
  - *Listeria monocytogenes*
  - *Vibrio parahaemolyticus*
  - *Salmonella* spp.

MIGUÉIS, S., MOURA, T., SANTOS, C., SARAIVA, C. & ESTEVES, A.
CECAV, Escola de Ciências Agrárias e Veterinárias, DCV, Universidade de Trás-os-Montes e Alto Douro, 5001-801 Vila Real, Portugal

Microbiological quality level of sashimi



- Unsatisfatory (U)
- Satisfatory (S)
- H - S. aureus(SA)
- Acceptable (A)
- H - L. monocytogenes(LM)
- H - LM and SA

n=114

Pathogenic Bacteria

- *Staphylococcus aureus* – **PRESENT** in **35%:**
  - Unacceptable or potentially Hazardous 2.6%
  - Unsatisfactory: 8.8%
  - Acceptable: 23.7%
  - Satisfactory: 64.9%

Pathogenic Bacteria

- *Listeria monocytogenes* – **PRESENT** in **20.2%**
  - Unacceptable or potentially Hazardous : 3.5%
  - Acceptable: 16.7%
  - Satisfactory: 79.8%

Pathogenic Bacteria

- *Bacilllus cereus* – **PRESENT** in **12.2%**;
  - Unacceptable or potentially Hazardous: 0.0%
  - Unsatisfactory: 3.5%
  - Acceptable: 4.4%
  - Satisfactory: 87.7%

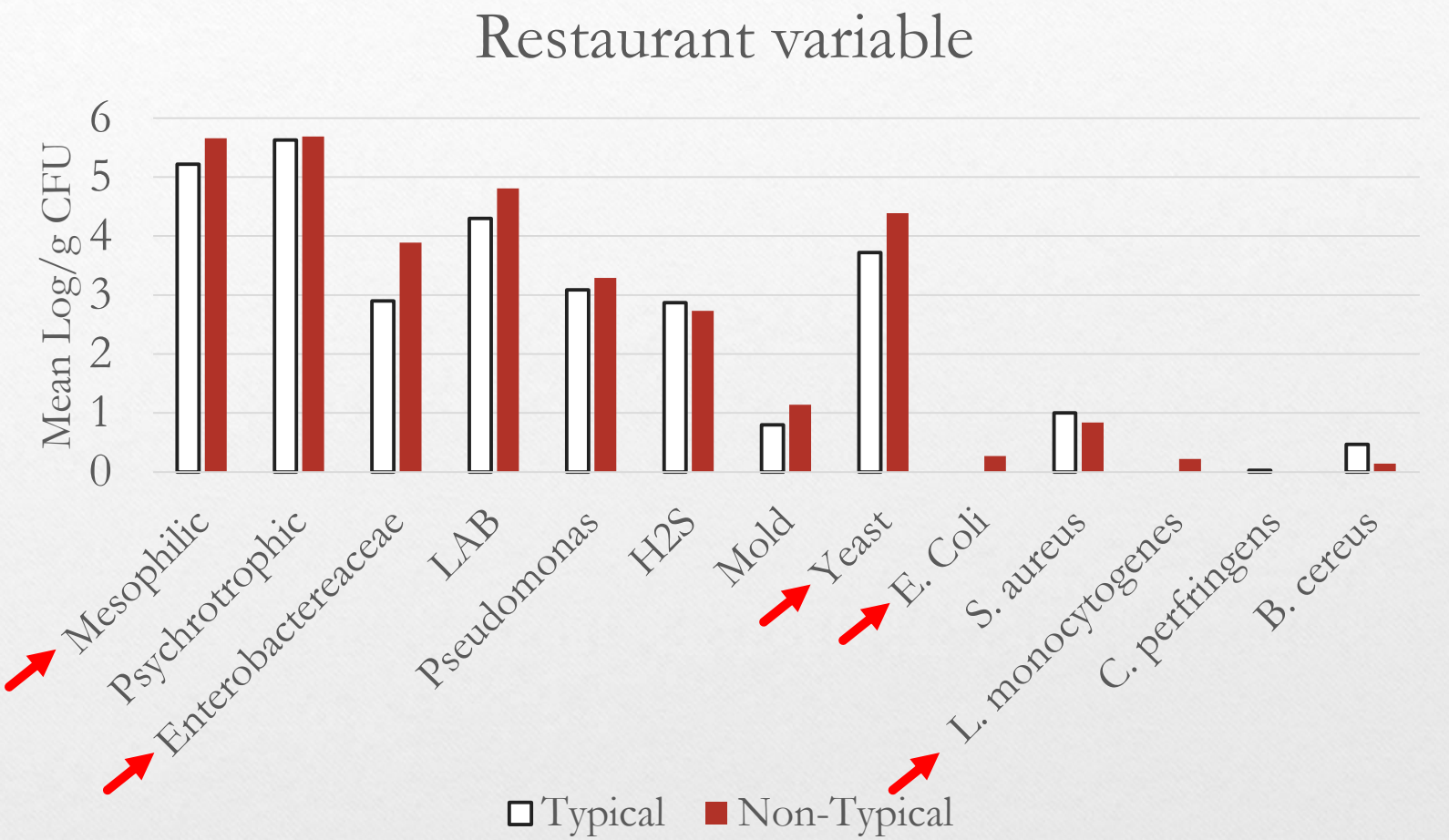
Pathogenic bacteria

- *Clostridium perfringens* – **ABSENT**;
- *Vibrio parahaemoliticus.* – **ABSENT**;
- *Salmonella* spp. – **ABSENT**;

Season and Restaurant variables

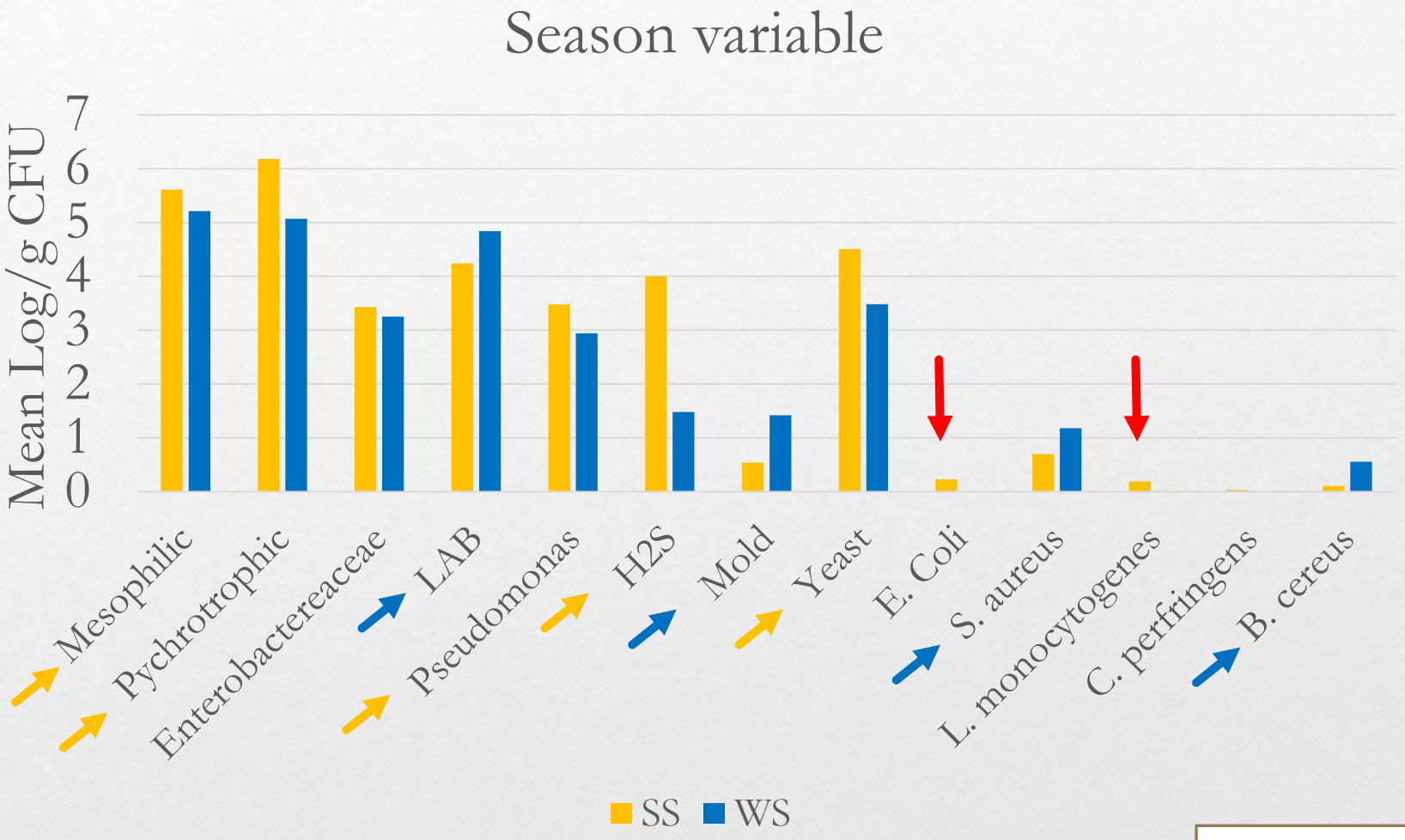
MQ level	SS	WS		Typical	Non-Typical
Satisfactory (0/114)	0.00%	0.00%		0.00%	0.00%
Acceptable (34/114)	47.06%	52.94%		64.71%	35.29%
Unsatisfactory (74/114)	51.35%	48.65%		54.05%	45.95%
Unacceptable/Potentially Hazardous (6/114)	100.00%	0.00%		16.67%	83.33%

n=114

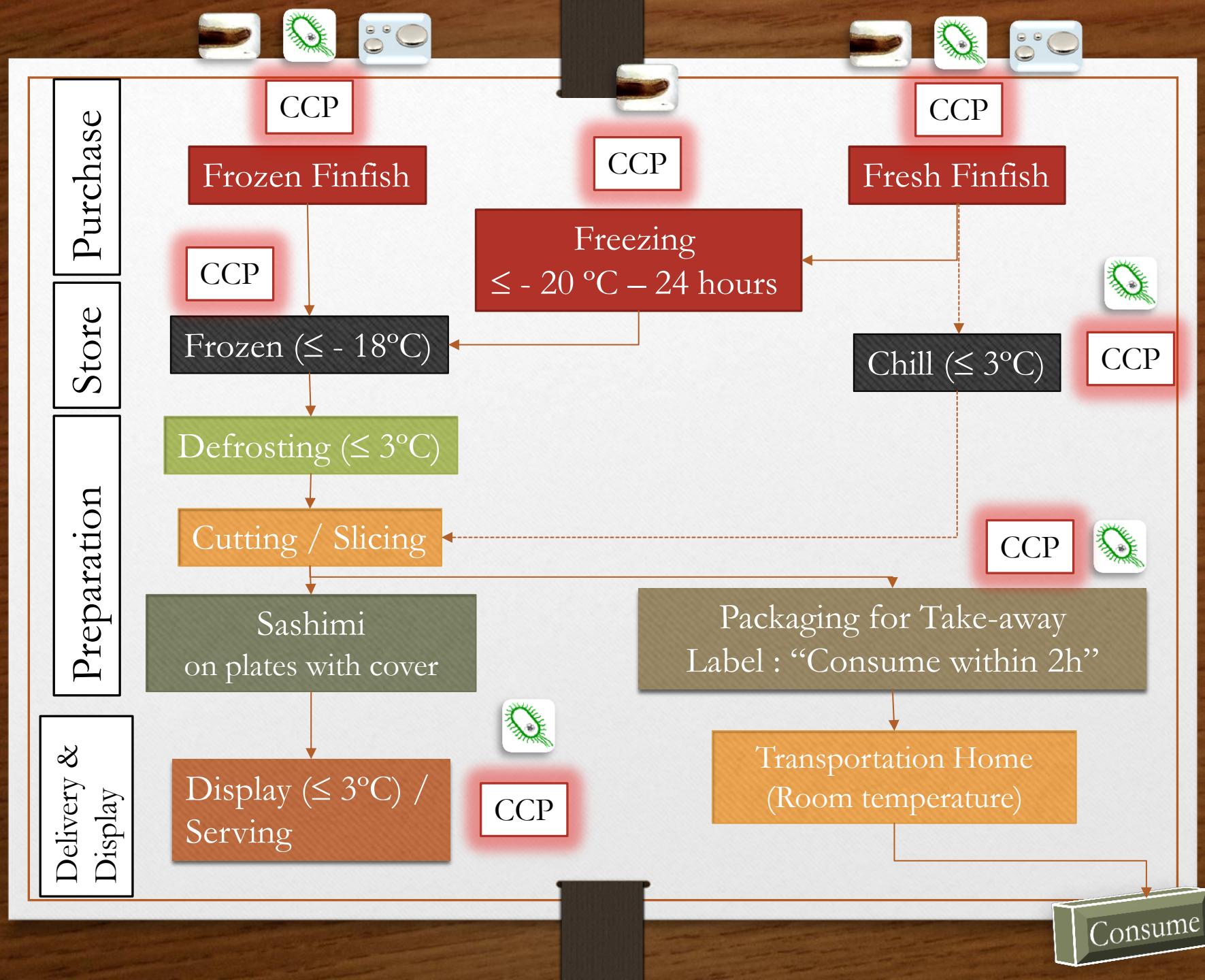

Restaurant variable
Mean Log/g CFU
0
1
2
3
4
5
6
Mesophilic
Psychrotrophic
Enterobactereaceae
LAB
Pseudomonas
H2S
Mold
Yeast
E. Coli
S. aureus
L. monocytogenes
C. perfringens
B. cereus
Typical
Non-Typical

p<0.05

n=114


Season variable
Mean Log/g CFU
0
1
2
3
4
5
6
7
Mesophilic
Pychrotrophic
Enterobactereaceae
LAB
Pseudomonas
H2S
Mold
Yeast
E. Coli
S. aureus
L. monocytogenes
C. perfringens
B. cereus
SS
WS

p<0.05


Purchase
Store
Preparation
Delivery & Display
CCP
Frozen Finfish
CCP
Freezing
≤ - 20 °C – 24 hours
CCP
Fresh Finfish
CCP
Frozen (≤ - 18°C)
Chill (≤ 3°C)
CCP
Defrosting (≤ 3°C)
Cutting / Slicing
CCP
Sashimi
on plates with cover
Packaging for Take-away
Label : "Consume within 2h"
Transportation Home
(Room temperature)
Display (≤ 3°C) /
Serving
CCP
Consume

As increase sashimi food safety?

- Develop a Good Manufacturing Practices guide
- Select aquaculture finfish or choose suppliers that can ensure low levels of heavy metals
- Select suppliers that ensure Listeria free finfish.
- Improve hygienic plans in facilities to ensure the elimination of *Listeria monocytogenes*.

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- MS Cátia Santos
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- Mr. Carlos Matos (Lab. Technician)

Thank you for your attention …

