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Enhancing resilience of food systems to promote food security
FAO Rome 2022

Food Safety: Emerging Risks in the One Health perspective

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Food System, Food Security, Sustainable Development and Food Safety: a multifaceted interface

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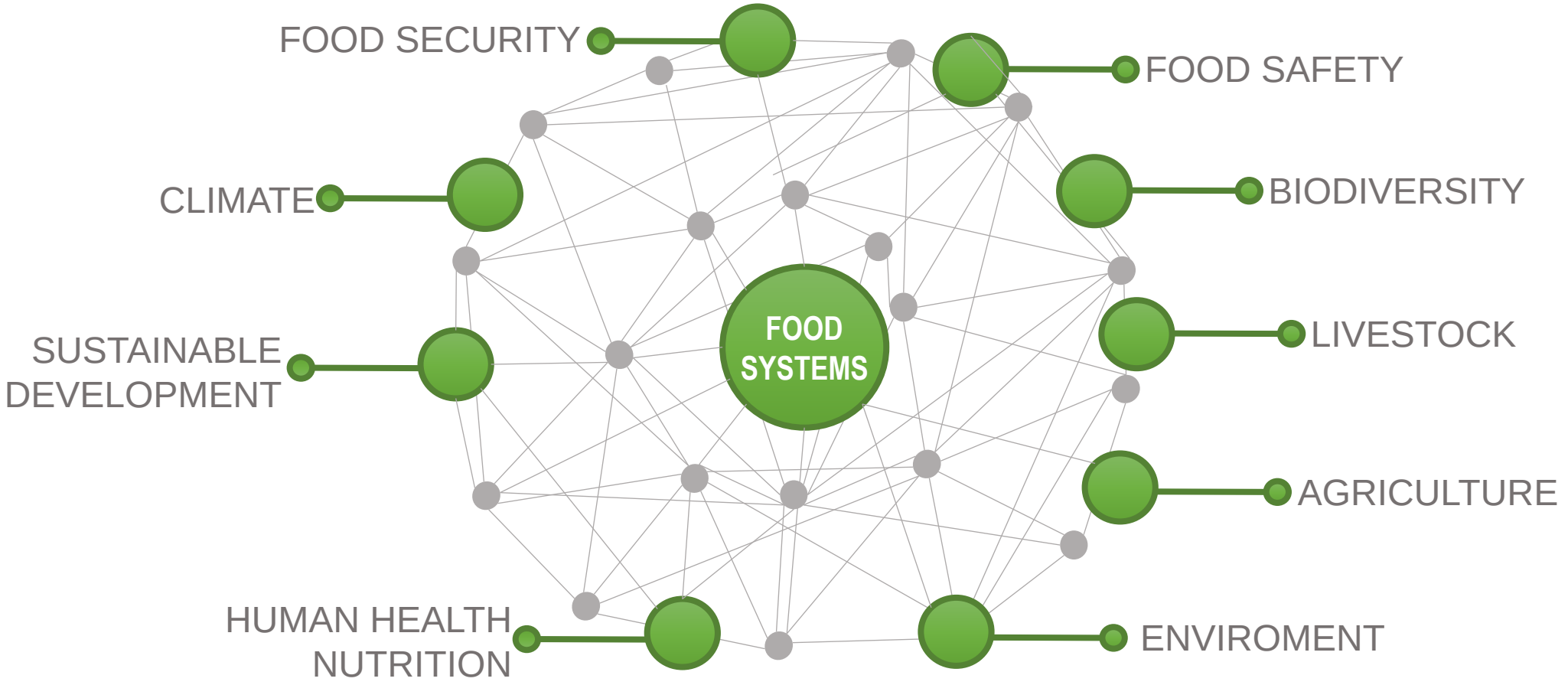

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One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent.

(OHHLEP One Health definition, 2021)

Food and Agriculture Organization of the United Nations

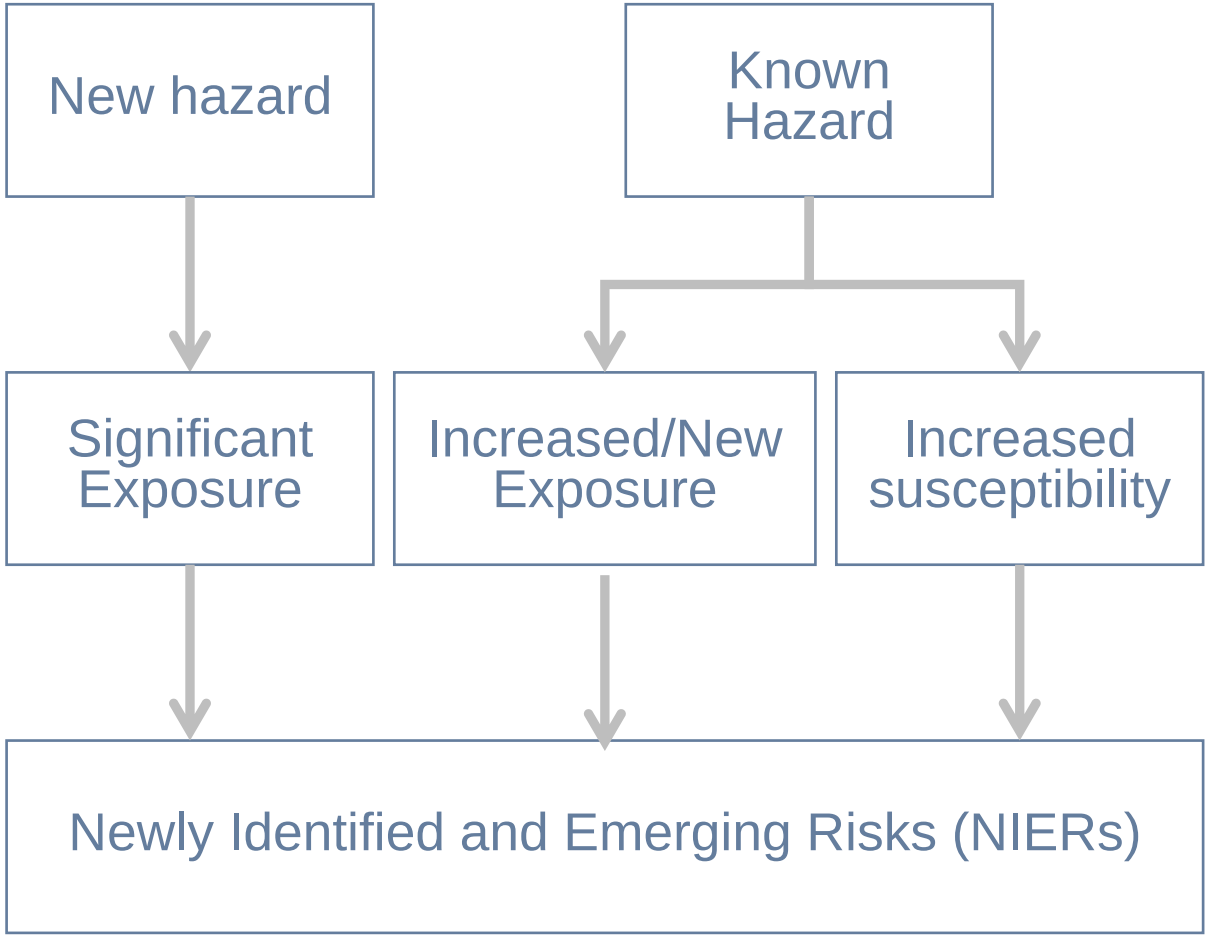
OIE WORLD ORGANISATION FOR ANIMAL HEALTH

World Health Organization

UN environment programme

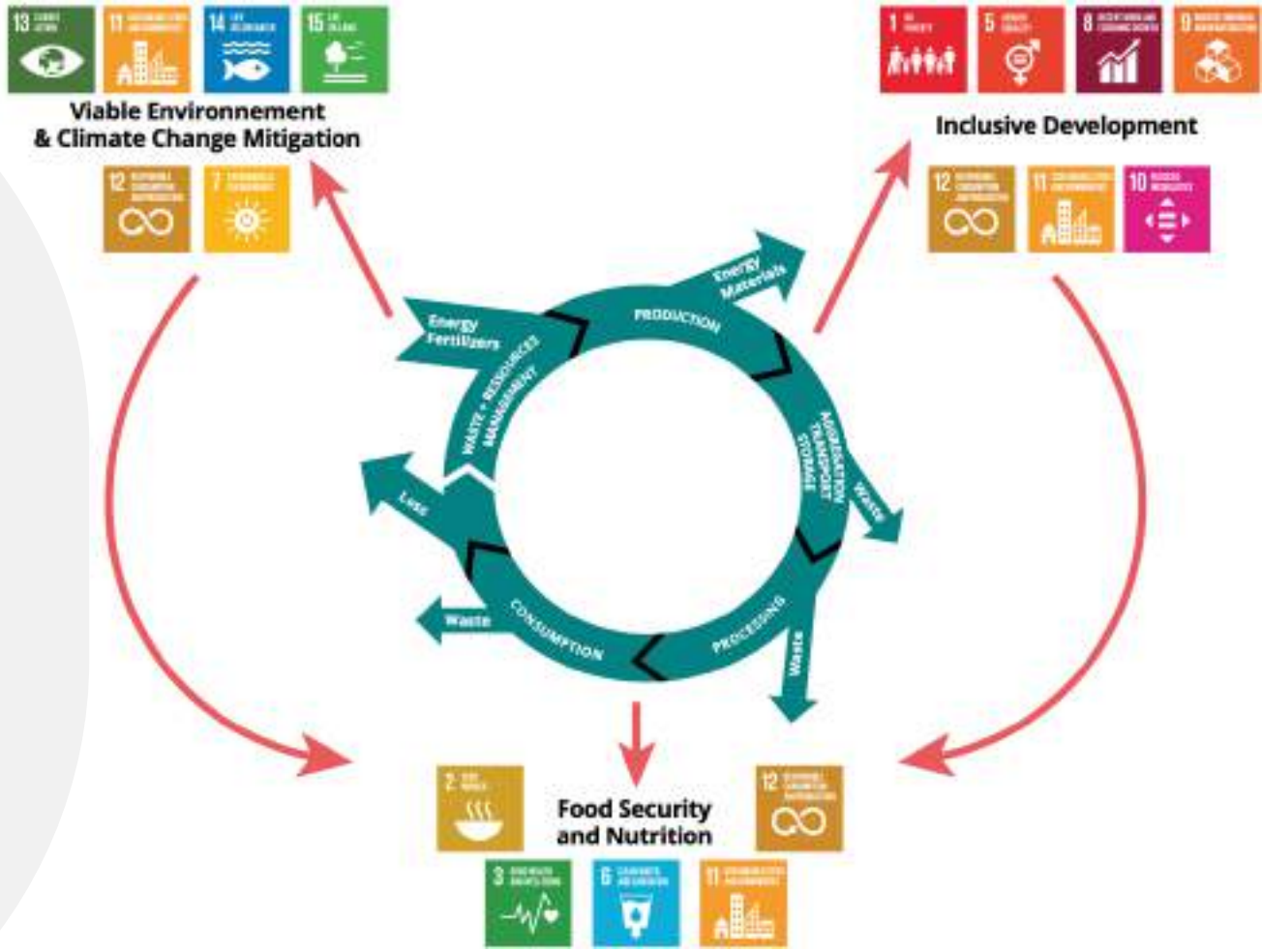
Emerging food risks:

a risk resulting from a newly identified hazard to which a significant exposure may occur, or from an unexpected new or increased significant exposure and/or susceptibility to a known hazard.



Emerging food risks

- Climate change and emergence of new food risks
- Changes in virulence of bacteria and viruses
- **Spread of antimicrobial resistances**
- New exposure to chemical contaminants including nanoplastics
- New food and agriculture technologies
- New organisms from NGT, Genome Editing and Synthetic Biology
- Dietary patterns changes
- ……



Dury, S., Bendjebbar, P., Hainzelin, E., Giordano, T. and Bricas, N., eds. 2019. *Food Systems at risk: new trends and challenges*. Rome, Montpellier, Brussels, FAO, CIRAD and European Commission.
DOI: 10.19182/agritrop/00080

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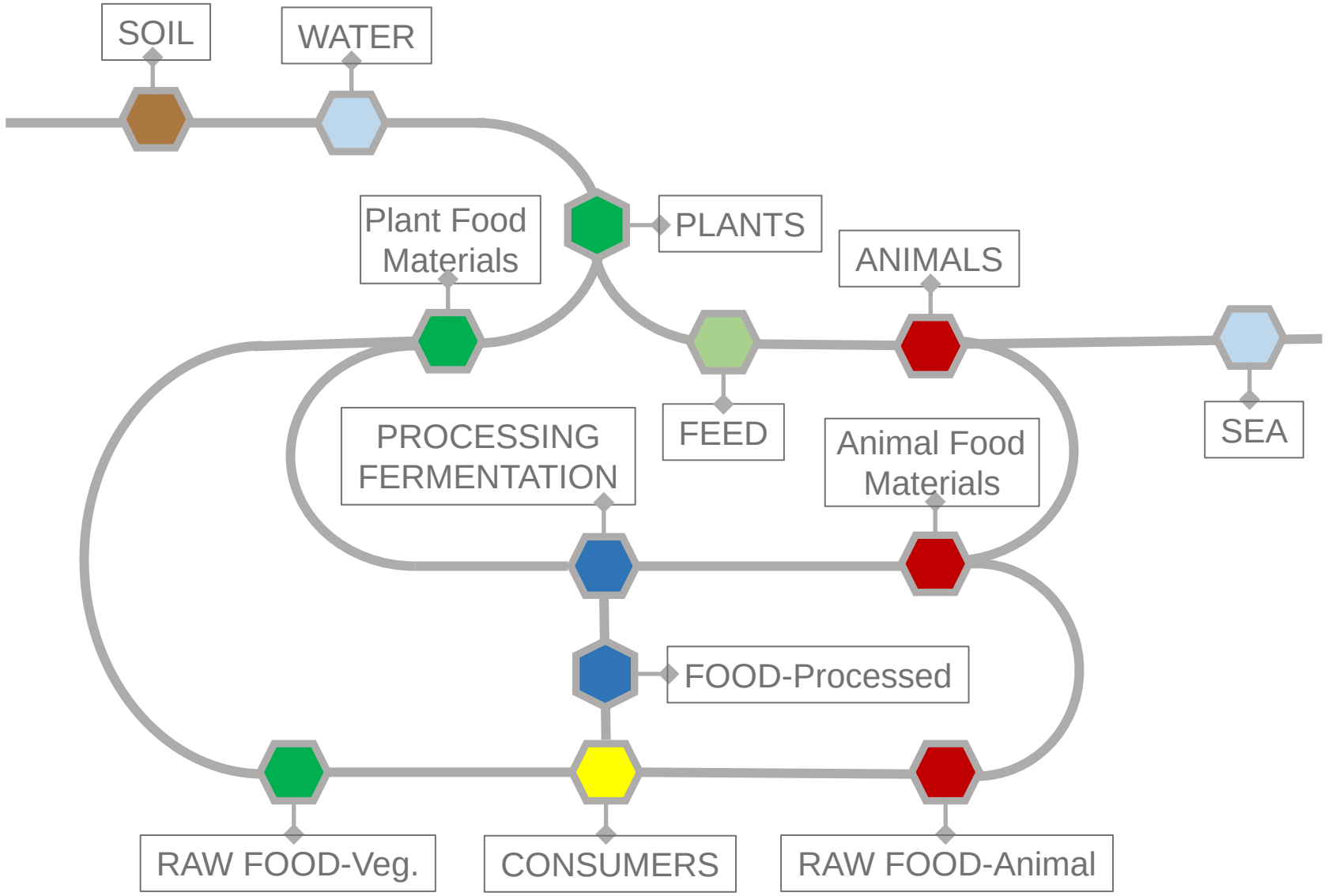
Food safety is the summation of all risk mitigation actions, from environment to consumption

One Health –Microbes

Flow of contaminants, cells and genes



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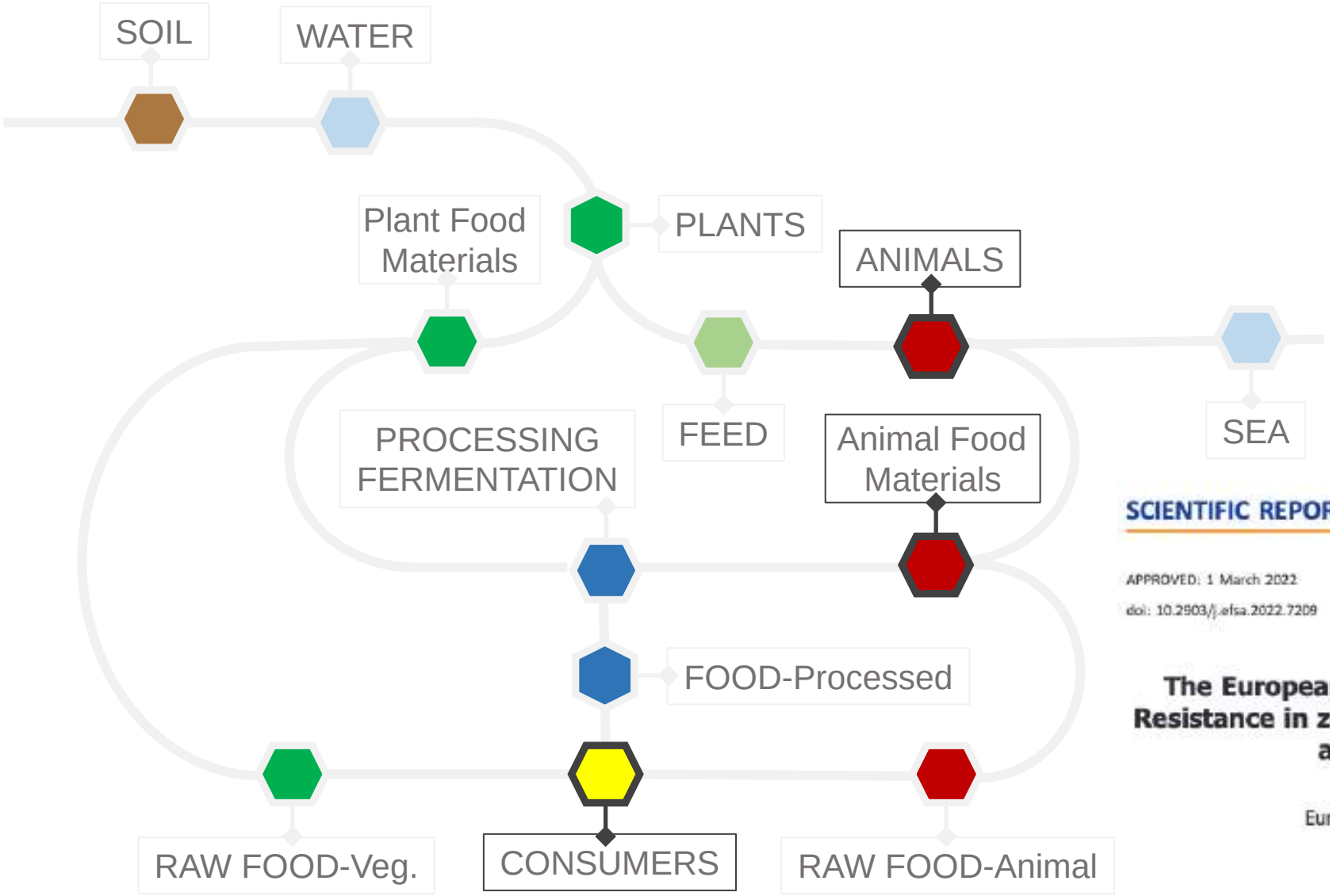
Data collection and elaboration form the basis for the evidence-based approaches

One-Health –AMR Bacteria

Data available for a limited number of countries



SCIENTIFIC REPORT

APPROVED: 1 March 2022

doi: 10.2903/j.efsa.2022.7209

The European Union Summary Report on Antimicrobial Resistance in zoonotic and indicator bacteria from humans, animals and food in 2019–2020

European Food Safety Authority and
European Centre for Disease Prevention and Control

SCIENTIFIC REPORT

APPROVED: 1 March 2022

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The European Union Summary Report on Antimicrobial Resistance in zoonotic and indicator bacteria from humans, animals and food in 2019–2020

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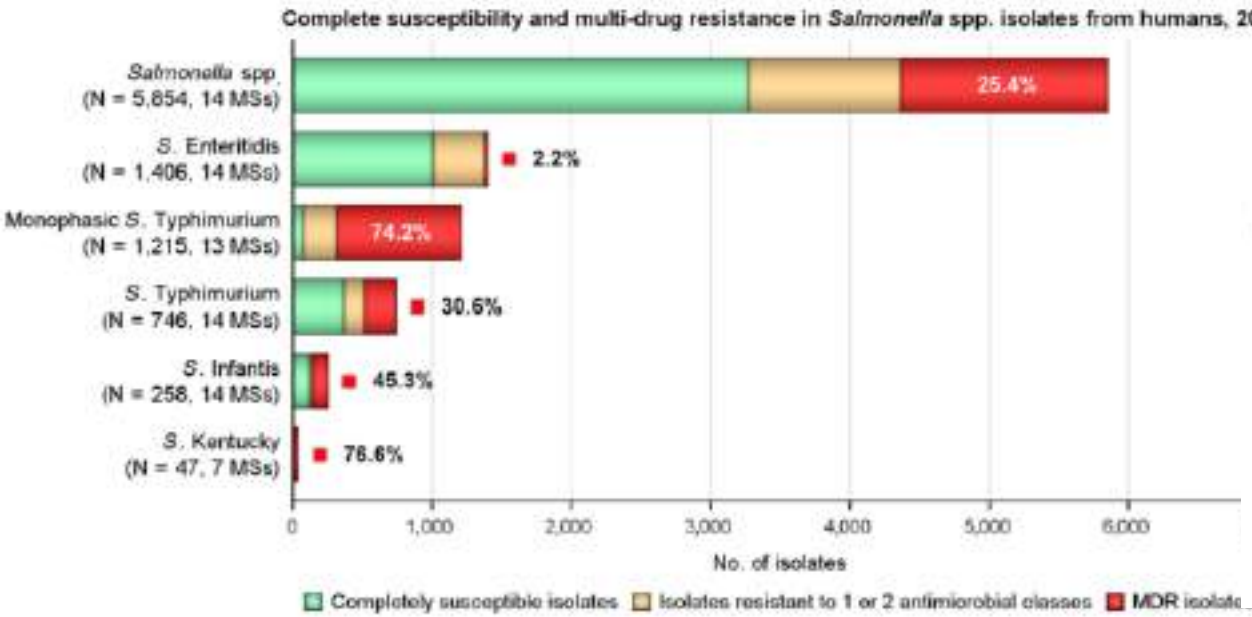
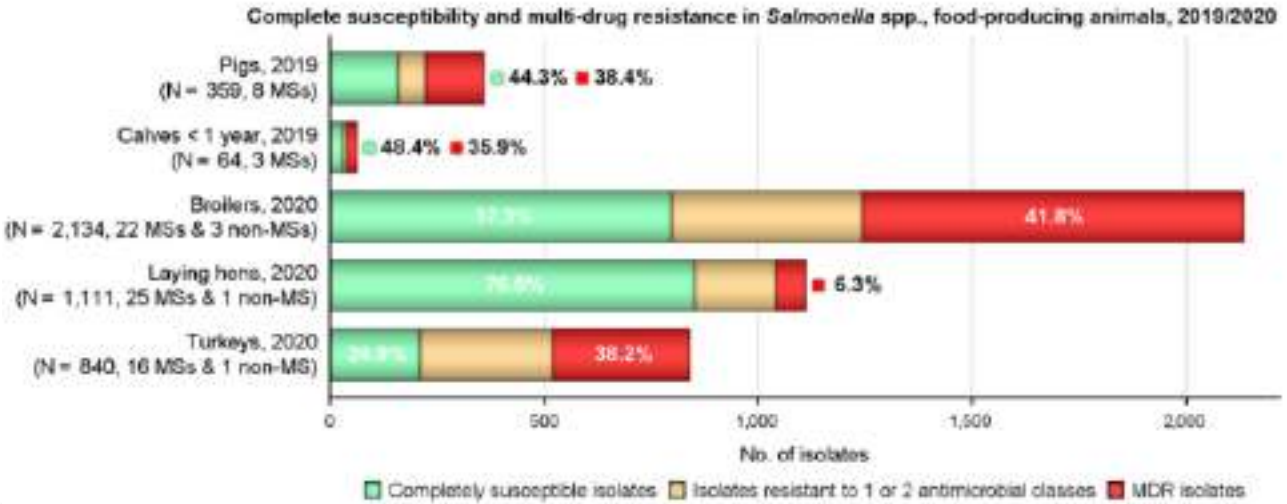
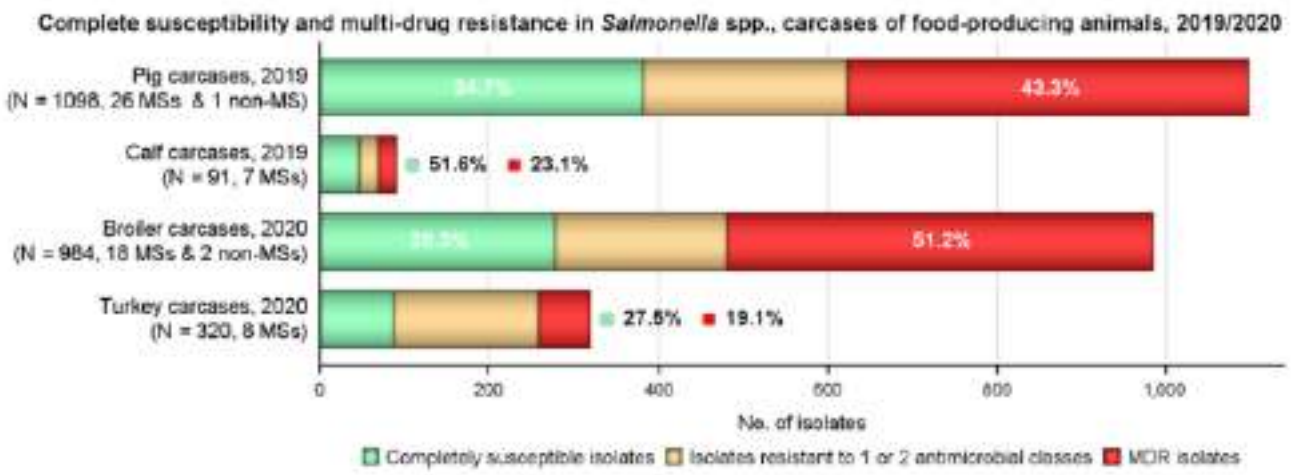
HUMANS



ANIMALS



MEAT-CARCASSES



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New scientific information is constantly being produced

molecules

MDPI

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Article

Structural Bases for the Fitness Cost of the Antibiotic-Resistance and Lethal Mutations at Position 1408 of 16S rRNA

Jiro Kondo * and Mai Koganei

Department of Materials and Life Sciences, Faculty of Science and Technology, Sophia University, 7-1 Kioi-cho, Chiyoda-ku, Tokyo 102-8554, Japan

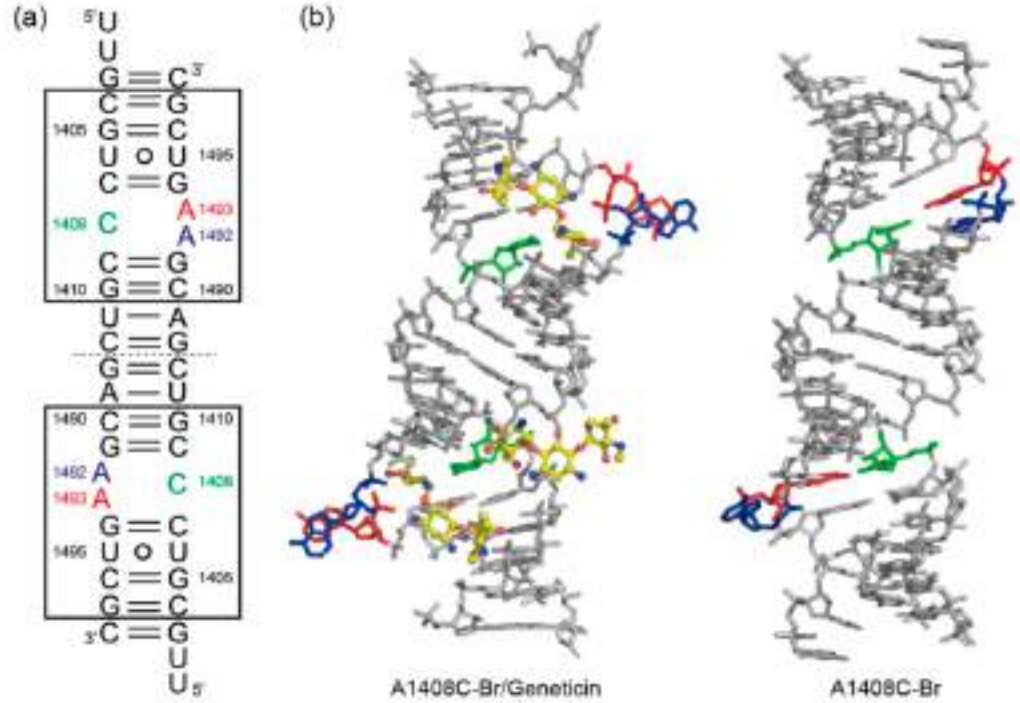

Figure 2. (**a**) Secondary structures of the RNA duplexes containing two A1408C mutant A-site molecular switches used in the crystallographic studies. (**b**) Tertiary structures of the RNA duplexes in the asymmetric unit of the A1408C-Br/geneticin and A1408C-Br crystals.

foods

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Article

Occurrence and Multidrug Resistance of *Campylobacter* in Chicken Meat from Different Production Systems

Nânci Santos-Ferreira, Vânia Ferreira * and Paula Teixeira *

Wild Boars as an Indicator of Environmental Spread of ESβL-Producing *Escherichia coli*

Alessandra Mercato[1†], Claudia Cortimiglia[2†], Aseel Abualsha'ar[1], Aurora Piazza[1], Federica Marchesini[1], Giovanni Milani[2], Silvia Bonardi[3], Pier Sandro Cocconcelli[2] and Roberta Migliavacca[1]*

Frontiers in Microbiology | Volume 13 | Article 838383

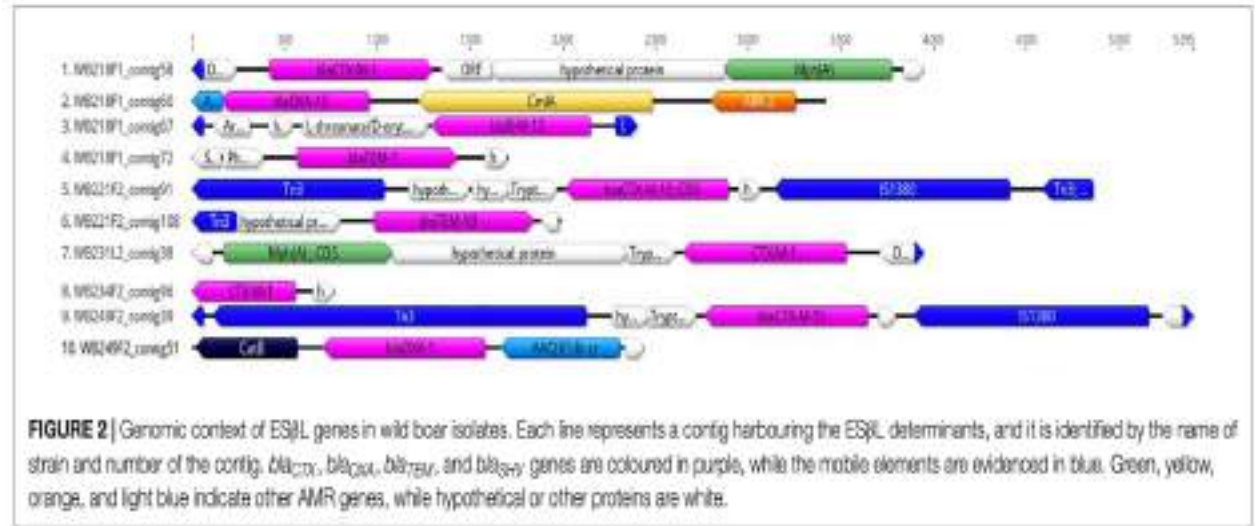

FIGURE 2 | Genomic context of ESβL genes in wild boar isolates. Each line represents a contig harbouring the ESβL determinants, and it is identified by the name of strain and number of the contig. bla_{CTX}, bla_{OXA}, bla_{TEM}, and bla_{SHV} genes are coloured in purple, while the mobile elements are evidenced in blue. Green, yellow, orange, and light blue indicate other AMR genes, while hypothetical or other proteins are white.

Biosensors and Bioelectronics 156 (2020) 112123

Contents lists available at ScienceDirect

Biosensors and Bioelectronics

journal homepage: http://www.elsevier.com/locate/bios

Dielectrophoresis assisted rapid, selective and single cell detection of antibiotic resistant bacteria with G-FETs

Narendra Kumar [a,1], Wenjian Wang [c,1], Juan C. Ortiz-Marquez [b,1], Matthew Catalano [a], Mason Gray [a], Nadia Biglari [a], Kitadai Hikari [d], Xi Ling [d,e,f], Jianmin Gao [c,**], Tim van Opijnen [b,***], Kenneth S. Burch [a,*]

antibiotics

MDPI

Article

Effective Photodynamic Inactivation of 26 *Escherichia coli* Strains with Different Antibiotic Susceptibility Profiles: a Planktonic and Biofilm Study

Òscar Gulías [1,*], Giselle McKenzie [1], Miquel Bayó [2], Montserrat Agut [1,*] and Santi Nonell [1,*]

Genomic Insights of *Enterococcus faecium* UC7251, a Multi-Drug Resistant Strain From Ready-to-Eat Food, Highlight the Risk of Antimicrobial Resistance in the Food Chain

frontiers | Frontiers in Microbiology

Front. Microbiol., 23 June 2022

*Mireya Viviana Belloso Daza, Giovanni Milani, Claudia Cortimiglia, Ester Pietta, Daniela Bassi and Pier Sandro Cocconcelli**

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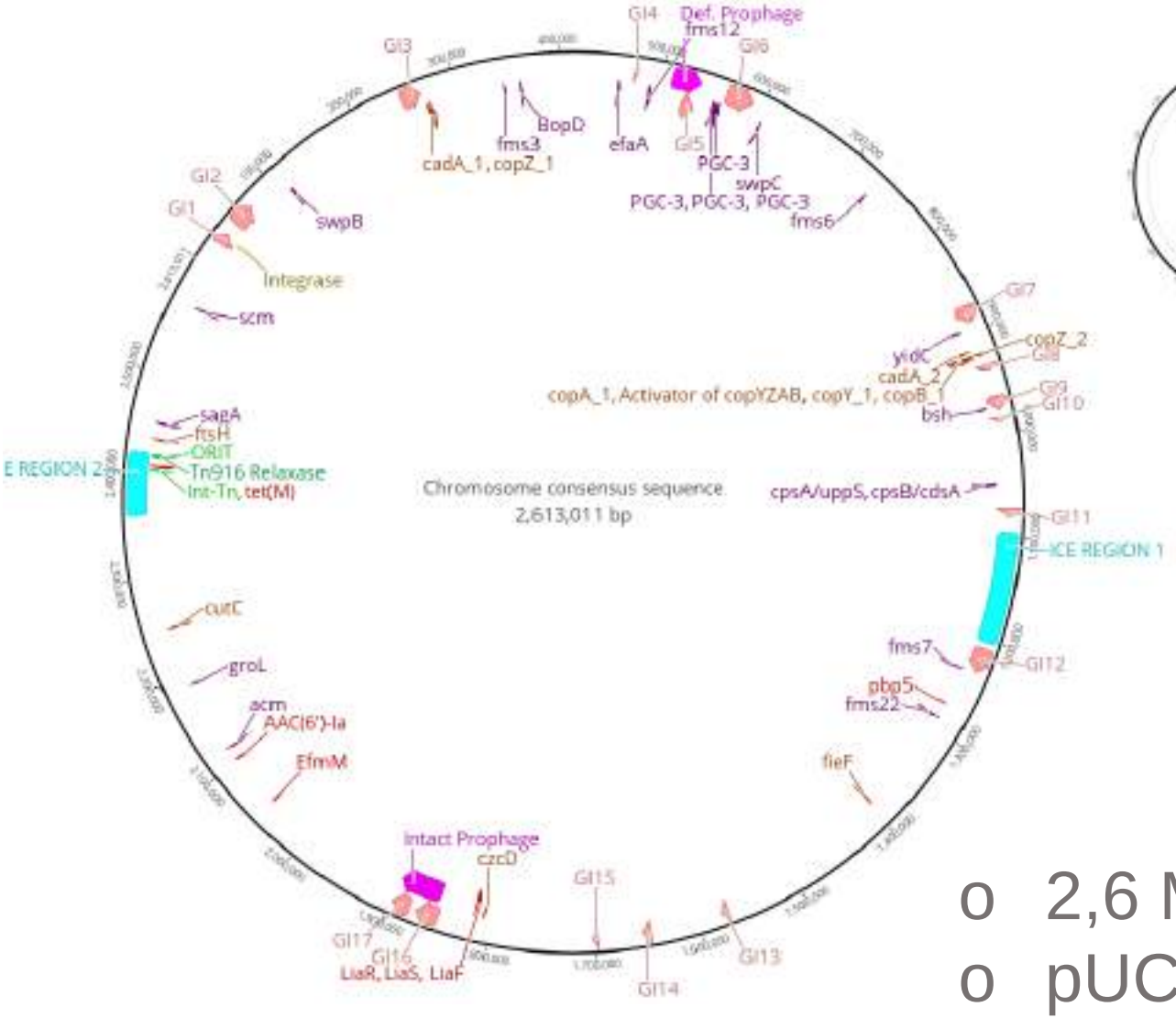
- UC7251 was isolated from fermented sausages
- it is phenotypically resistant to different classes of antimicrobials
- it is resistant to Copper, Cadium and Mercury
- ampicillin resistance was demonstrated to be linked to the presence of a hybrid-like PBP5 (PBP5-S1/R20).

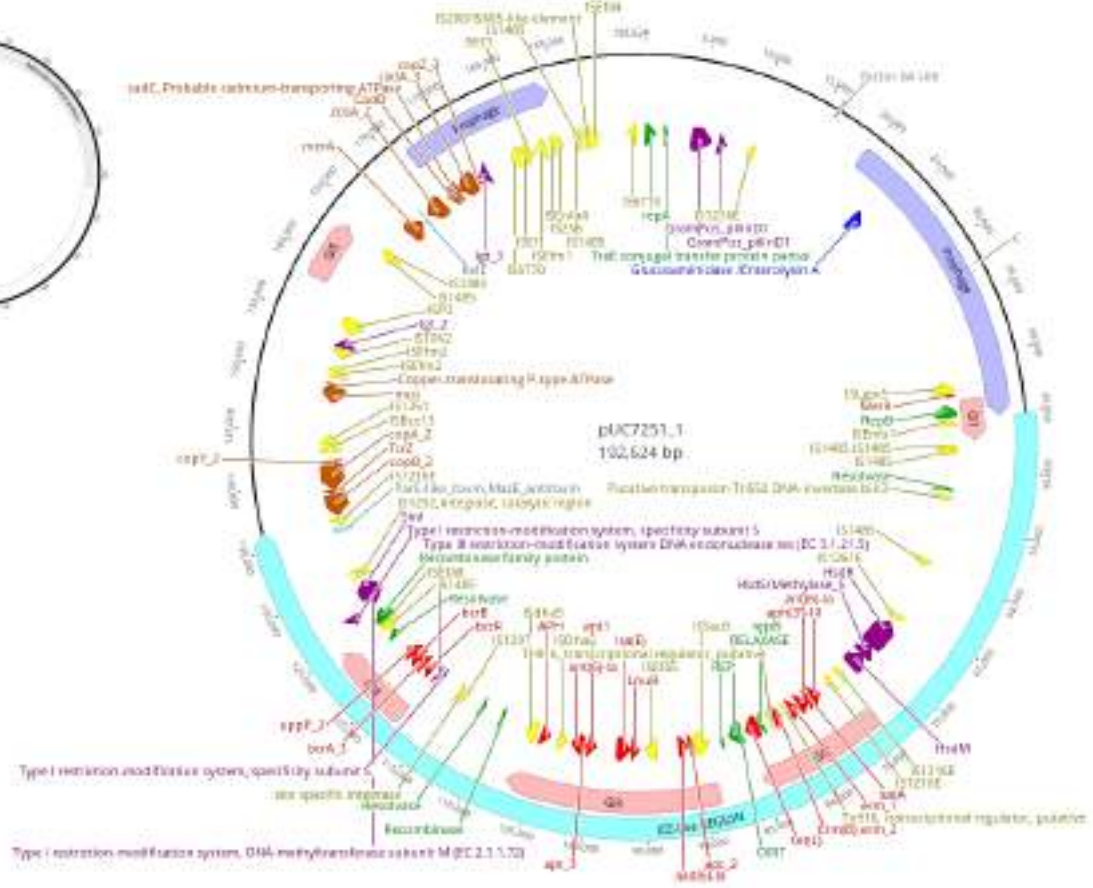
AAC(6')-Ia	Chromosome	Aminoglycoside N(6')-acetyltransferase (EC 2.3.1.82)
EfmM	Chromosome	rRNA) methyltransferase
pbp5	Chromosome	Penicillin binding protein 5
tet(M)	Chromosome	Tetracycline resistance
ant(6)-Ia	pUC7251_1	Aminoglycoside 6-adenylyltransferase
ant1	pUC7251_1	Streptomycin 3''-adenylyltransferase
ant(6)-Ia	pUC7251_1	Aminoglycoside 6-nucleotidyltransferase
aph	pUC7251_1	Aminoglycoside phosphotransferase family protein
Lnu(B)	pUC7251_1	Lincosamide nucleotidyltransferase
lsa(E)	pUC7251_1	ABC-F type ribosomal protection protein Lsa(E) EryR
tet(L)	pUC7251_1	Tetracycline efflux MFS transporter Tet(L)
satA	pUC7251_1	Streptothricin acetyltransferase A
erm_1	pUC7251_1	Erythromycin resistance
erm_2	pUC7251_1	Erythromycin resistance
aad(6)-Ia	pUC7251_1	Aminoglycoside 6-adenylyltransferase

WGS hybrid WGS sequencing

Illumina-PacBio

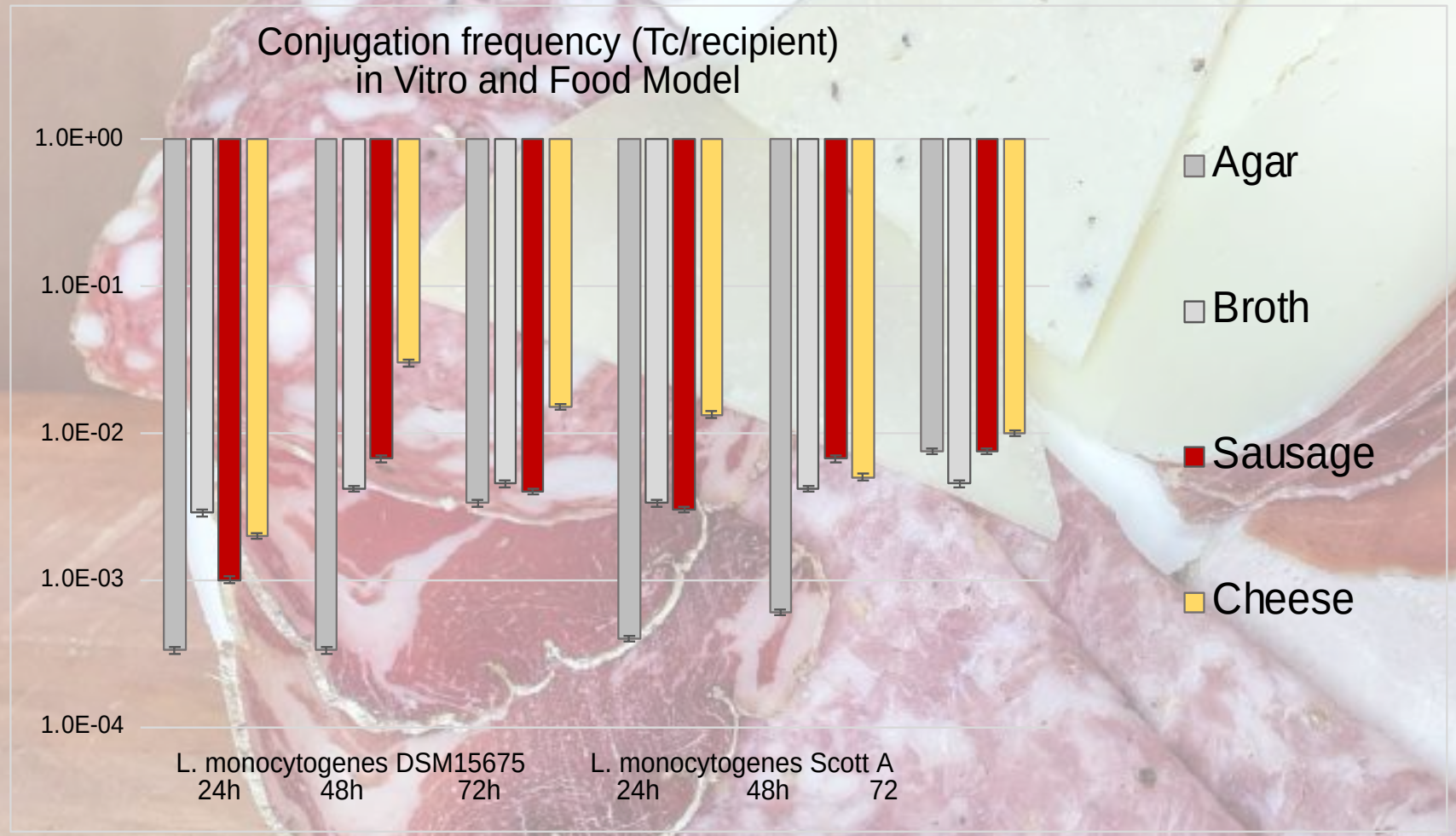
ICE
IS-Tn
AMR





- 2,6 Mb chromosome
- pUC7251_1 (192 kb)
- pUC7251_2 (1,9 kb)

The spread of AMR in food microbiota occurs at high rates through mobile genetic elements



Selection for chromosomal and plasmid markers

- tetR
- eryR

confirmation by PCR

- Tn916 spread at high frequency

Microplastics and horizontal gene transfer of AMR genes

Journal of Hazardous Materials 411 (2021) 126079

Contents lists available at ScienceDirect

Journal of Hazardous Materials

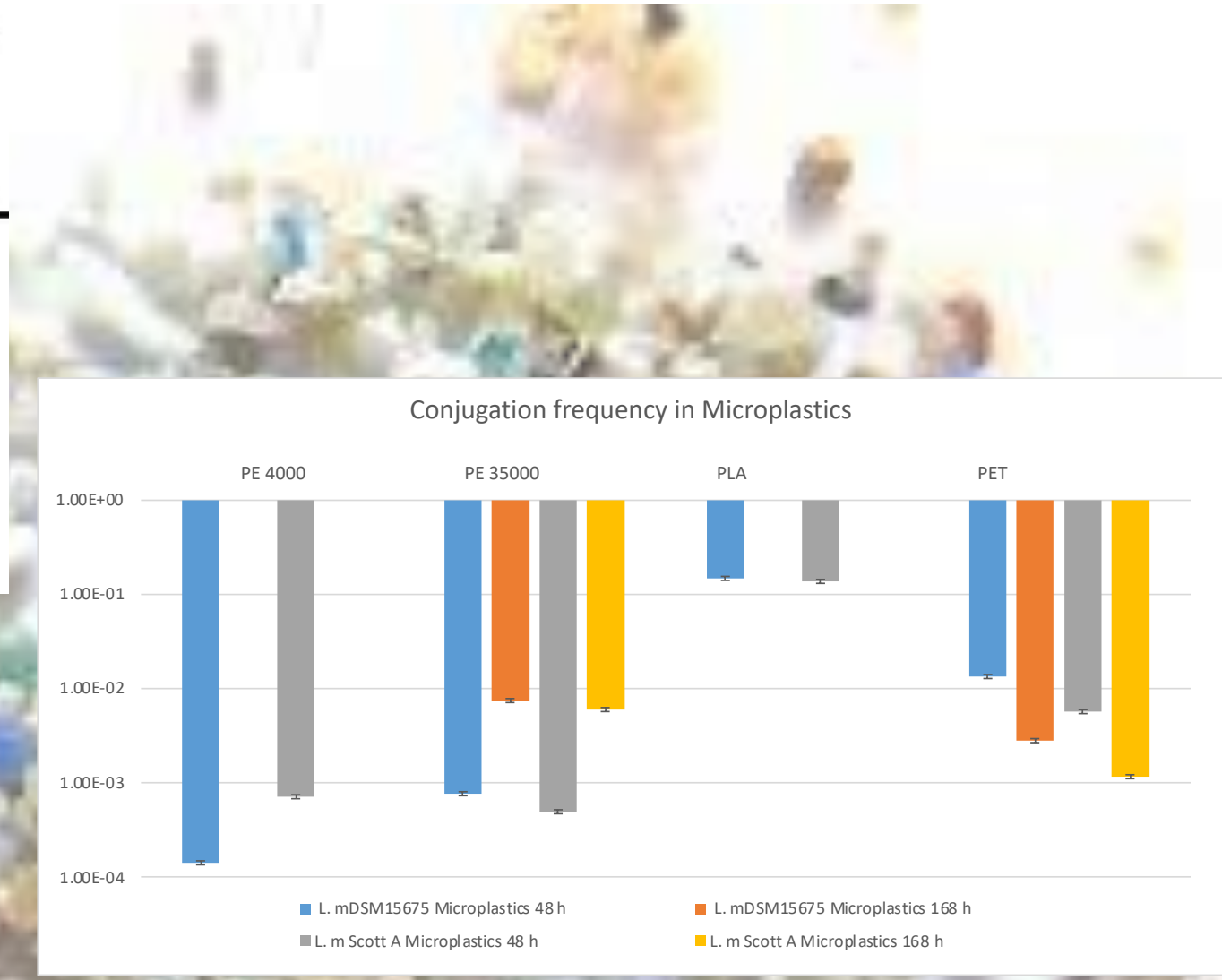
journal homepage: www.elsevier.com/locate/jhazmat

Research Paper

Bacterial community profiling of floating plastics from South Mediterranean sites: First evidence of effects on mussels as possible vehicles of transmission

Francesca Bandini [a], Ilef Hchaichi [b], Nesrin Zitouni [b], Oumayma Missawi [b], Pier Sandro Cocconcelli [a], Edoardo Puglisi [a,*], Mohamed Banni [b,c]

[a] Dipartimento di Scienze e Tecnologie Alimentari per la sostenibilità della filiera agro-alimentare, Facoltà di Scienze Agrarie Alimentari ed Ambientali, Università Cattolica del Sacro Cuore, Via Emilia Parmense 84, 29122 Piacenza, Italy
[b] Laboratory of Biochemistry and Environmental Toxicology, ISA Chott-Mariem, Sousse University, Sousse, Tunisia
[c] Higher Institute of Biotechnology, Monastir University, Monastir, Tunisia



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Limits exist in the transfer of scientific achievements into best practices for food system

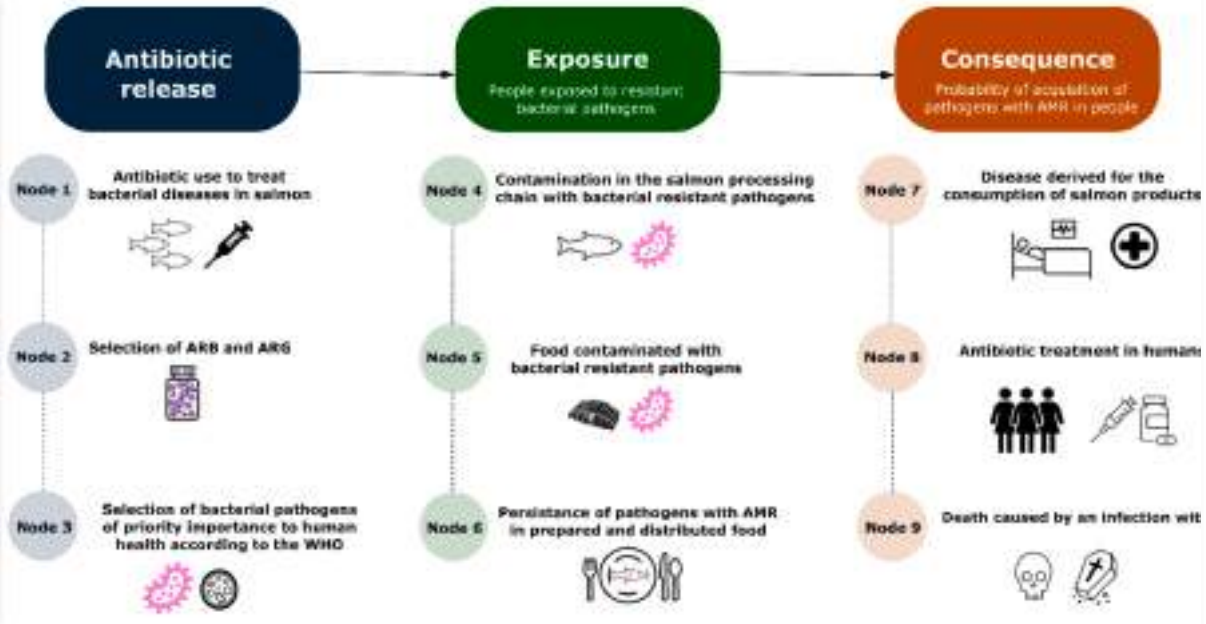
antibiotics

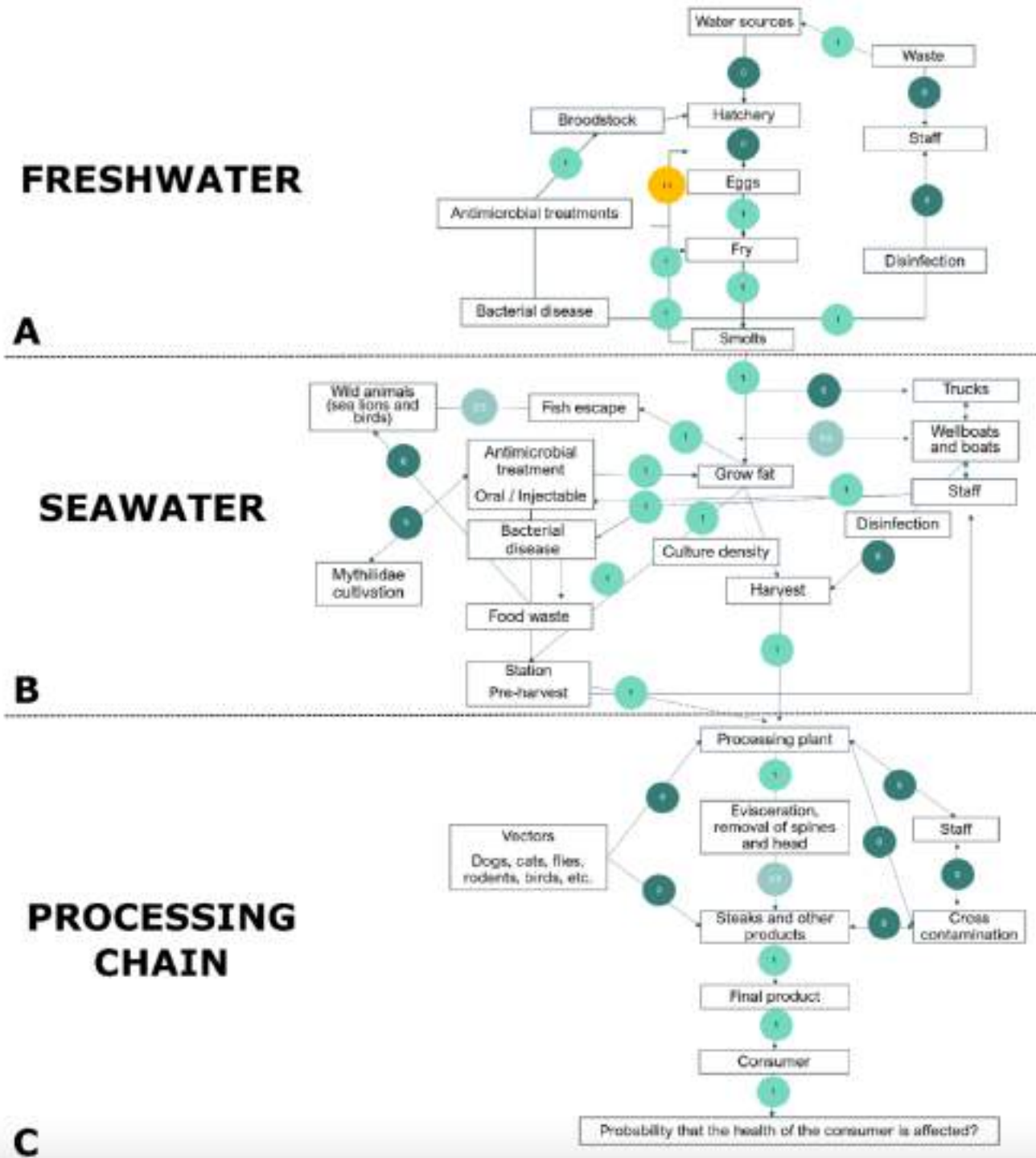
MDPI

Article

Qualitative Risk Assessment for Antimicrobial Resistance among Humans from Salmon Fillet Consumption Due to the High Use of Antibiotics against Bacterial Infections in Farmed Salmon

Marília Salgado-Caxito [1,2], Natalia Zimin-Veselkoff [1], Aiko D. Adell [2,3], Jorge Olivares-Pacheco [2,4,*] and Fernando O. Mardones [1,5,*]





Emerging Risks and One Health
What is needed to meet the challenges ahead?

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- Can One Health and Food Safety issues be addressed without scientific research and technological innovation?
- What is the role of Higher Education and Universities in cutting-edge research and technology transfer?
- Can a research with an effective societal impact be made?
- How can a global university alliance contribute?

Strategic Alliance of Catholic Research Universities

Australian Catholic University
www.acu.edu.au

Boston College
www.bc.edu

Pontificia Universidad Católica de Chile
www.uc.cl

Pontifícia Universidade Católica do Rio de Janeiro
www.puc-rio.br

Sophia University
www.sophia.ac.jp

Universidade Católica Portuguesa
www.ucp.pt

Università Cattolica del Sacro Cuore
www.unicatt.it

Universitat Ramon Llull
www.url.edu/en

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Emerging Risks and One Health
What is needed to meet the challenges ahead?

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- increased scientific knowledge
- multi and transdisciplinary approach
- open science
- global scale view
- competence building
- test evidence-based solutions – best practices
- knowledge and technology transfer
- societal impact

FAO – SACRU Letter of Intent

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