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► **To cite this version:**

Yen Vo-Hoang, Juliette Brendlé-Nicolas, Agnès Masnou, Sarah Guérois, Sylvain Pioch, et al.. Plastics and antimicrobial resistance of bacteria in coastal waters. International Symposium of LabEx DRIIHM 2024, Jun 2024, Montpellier, France. , 2024, 10.34972/driihm-a29016 . hal-04622232

HAL Id: hal-04622232

<https://hal.science/hal-04622232v1>

Submitted on 24 Jun 2024

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Plastics and antimicrobial resistance of bacteria in Mediterranean coastal waters



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Societal issues

600 tons of plastic waste are daily dumped into the Mediterranean Sea, 94% of these discharges being macroplastics (plastic particles > 5 mm). Among the consequences of this pollution, floating plastics constitute supports for the development of diverse microbial community leading to new ecosystems called **plastisphere**.

- ⇒ On plastics, antimicrobial resistance (AMR) is supported by BGN
- ⇒ Bacterial gender of ARBs depends on geographical site, but not on physical support
- ⇒ ARGs *bla_{NDM}* et *Int12* genes are specific of plastics

Microbiological analysis

Plastic pollution of coastal areas

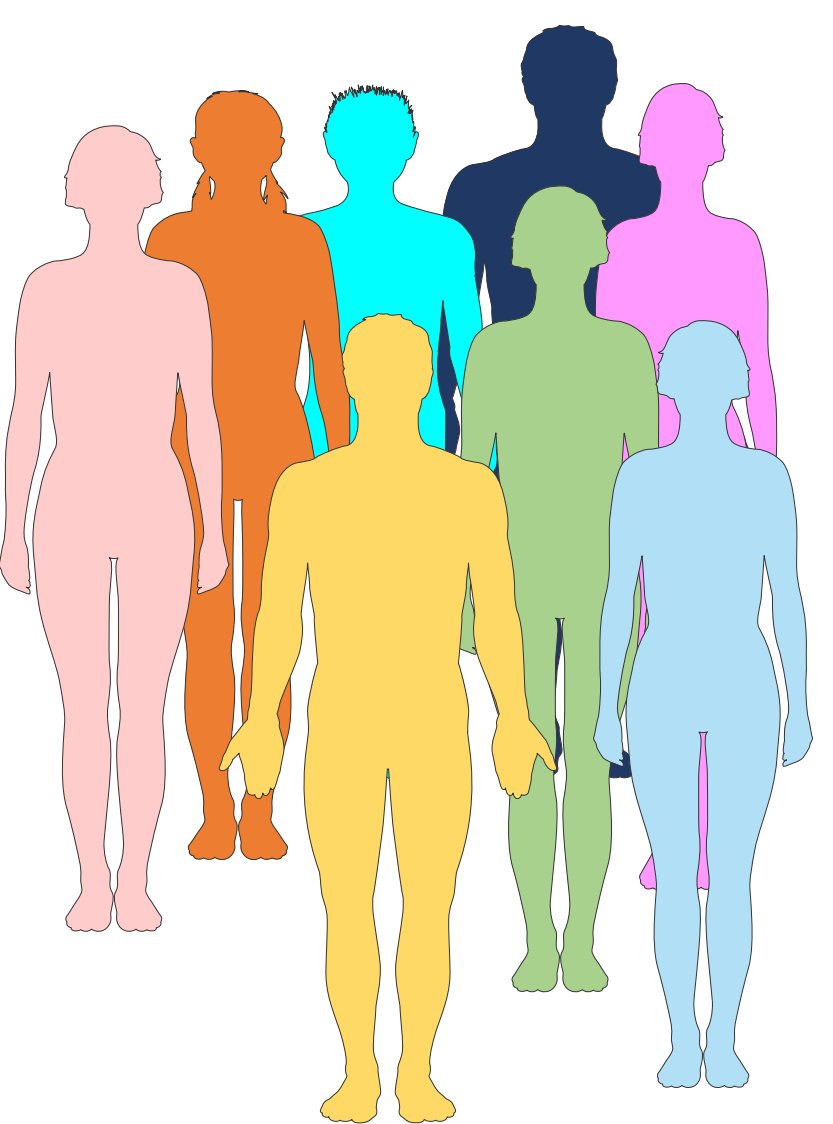
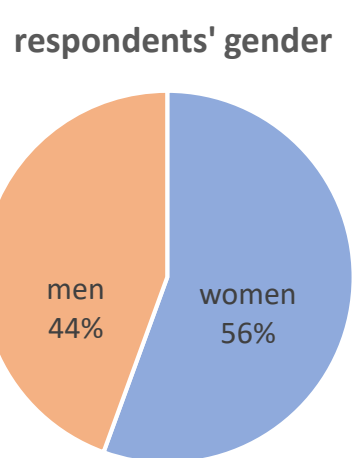
Plastic = support for antimicrobial resistance

Raising user awareness

Levers for action ?

Desire to reduce?

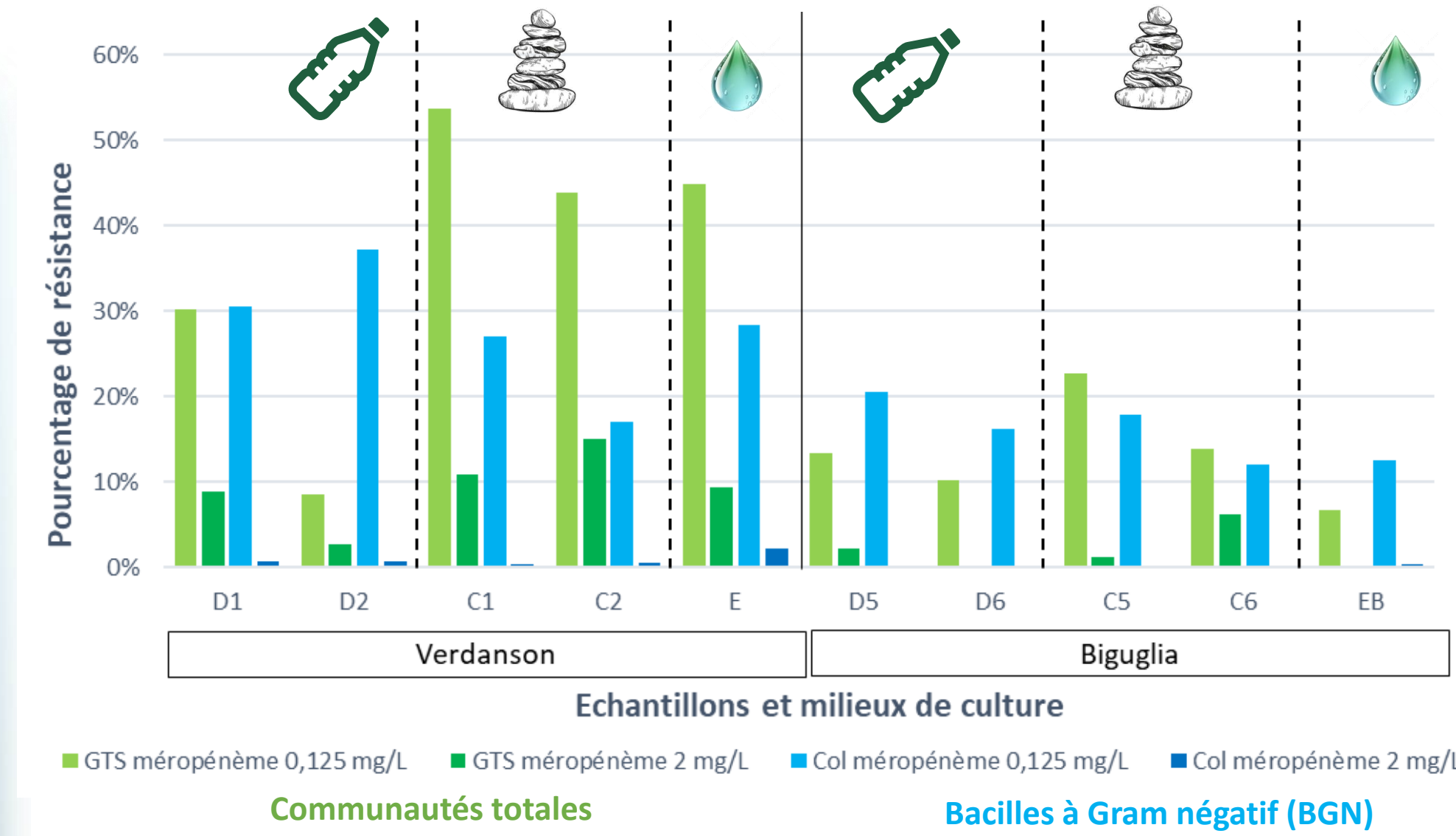
Plastic pollution Daily gestures



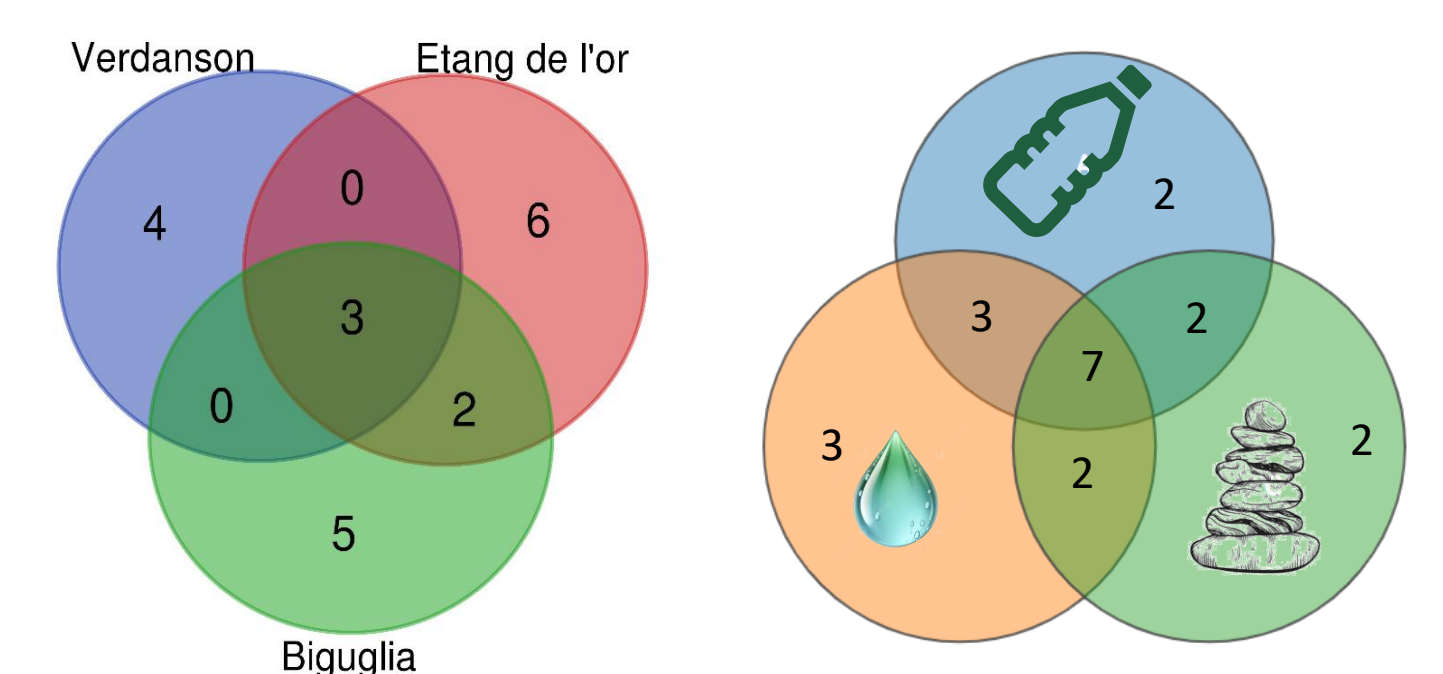
Survey respondents (volunteers) have good plastic waste reduction practices, 85% of whom set a goal of limiting their plastic production. Respondents have a good knowledge of microplastics, but are not informed about the microbiological risks associated with plastic pollution. Respondents mostly surprised by scientific data on plastic pollution. 63% of respondents have plans to improve their plastic waste reduction practices.

Scientific question

ARB communities in biofilms and water:



Comparison of bacterial communities (gender) on biofilms (and water):



Quantitation of ARGs on biofilms (and water):

		Emerging resistances			Gene transfert	
		<i>bla_{NDM}</i>	<i>bla_{OXA}</i>	<i>Int1</i>	<i>Int2</i>	<i>Int3</i>
Verdanson		Presence (>QL)	Presence (>QL)	Presence (>QL)	Presence (>QL)	Presence (>QL)
		Absence (<DL)	Absence (<DL)	Presence (>QL)	Presence (>QL)	Presence (>QL)
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Biguglia		Presence (>QL)	Presence (>QL)	Presence (>QL)	Presence (>QL)	Presence (>QL)
		Absence (<DL)	Absence (<DL)	Presence (>QL)	Presence (>QL)	Presence (>QL)
		Absence (<DL)	Absence (<DL)	Presence (>QL)	Presence (>QL)	Presence (>QL)

How can scientific data constitute good arguments for adopting righteous behavior ?

This study has been conducted at the interface between environmental ecology, chemistry and public health. Two aspects of the consequences of plastic pollution have been explored :

- **Microbial question :** This work has contributed to a better knowledge of antimicrobial resistance spreading conditions and a better understanding of the impacts of macroplastics on microbial ecology and public health. But the life cycle of the plastics collected is unknown. Thus a study of plastics "impregnation" (controlled life cycle) is planned as well as studies of macroplastics floating in salt water impacted by human activities (marina of Port Camargue).
- **Societal issues :** According to this work, interested users have been recruited for survey. They are sensitive to scientific data, they want to reduce plastic waste, and are willing to apply good practices. Interviews analysis is scheduled to address the question of information transfert, to investigate how scientific informations can be well received to encourage users to adopt virtuous behavior or to identify the **levers for action** to improve plastic pollution management.

Another question is also planned to be addressed: Could antimicrobial resistance evidenced on macroplastics be useful as sensitive markers of public health and constitute a supplementary argument:

- To persuade local public services and decision makers to improve the sites cleaning and the waste sorting and recycling;
- To convince national stakeholders to limit plastic production, to support the reuse of plastics (circular economy) and to incite the use of non-plastic materials;
- To inform the population on the risks of plastic pollution and to adopt an ethical behavior.

