

LEVERHULME
TRUST



Managing the environmental impact of antifouling biocides in recreational marinas through stakeholder engagement

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Introductions

Jacob Cook:

- Locally-based University of Essex BSc Marine Biology undergraduate.
- Relevant experience from final year undergraduate research project, supervised by Nick Aldred.
- Now registered for PhD studentship under the Leverhulme Trust Sustainable Transitions Program within the School of Life Sciences and Department of Government.



Nick Aldred:

- Senior Lecturer in Marine Biotechnology, School of Life Sciences, University of Essex.
- 20 years of experience working in research and development of marine antifouling technologies
- Working with the marine paints industry (International Paint), governments (MOD, US Dept. Defense), charities and other stakeholders.



Antifouling History

- Use of antifoulants spans more than 2000 years of history, initially with the use of lead and copper sheets.

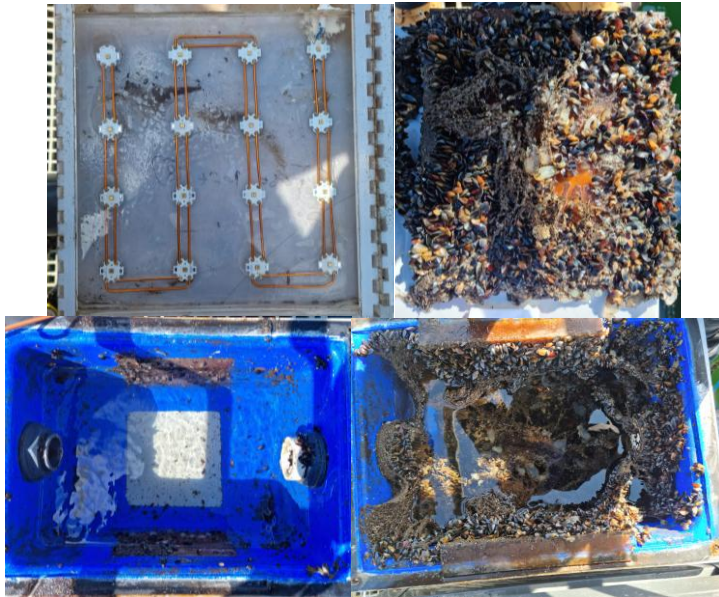


Genesis 6:14: “...make yourself an ark of gopher wood...and cover it inside and outside with pitch.”

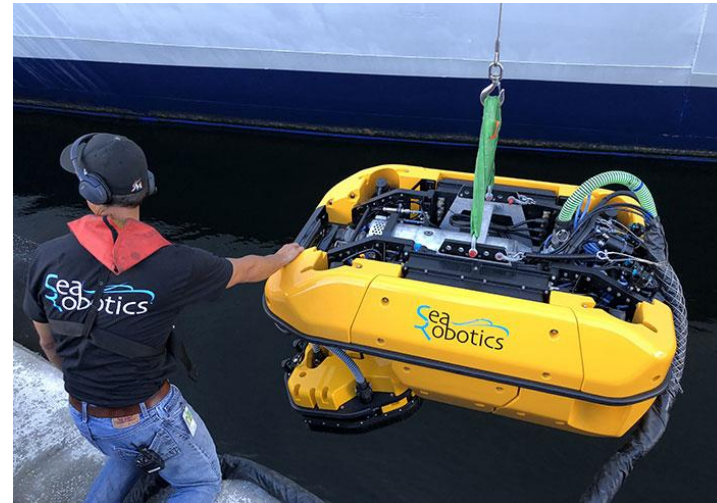
- The antifouling coating market is worth around \$4B USD per year.
- 42 million litres of paint in 2014.
- Shipping accounts for around 3% of GHG emissions.
- The 15 largest cargo ships emit more GHGs than all of the cars in the world combined.

Timeline	Major events
1500–300 BC	Use of lead and copper sheets on wooden vessels
1800–1900s	Heavy metals (copper, arsenic, mercury) incorporated into coatings
1800s–present	Continued use of copper in AF coatings
1960s	Development of TBT conventional coatings
1974	Oyster farmers report abnormal shell growth
1977	First foul release AF patent
1980s	Development of TBT SPC coatings allowed control of biocide release rates
1980s	TBT linked to shell abnormalities in oysters (<i>Crassostrea gigas</i>) and imposex in dogwhelks (<i>Nucella lapillus</i>)
1987–90	TBT coatings prohibited on vessels <25 m in France, UK, USA, Canada, Australia, EU, NZ and Japan
1990s–present	Copper release rate restrictions introduced in Denmark and considered elsewhere e.g. California, USA
2000s	Research into environmentally friendly AF alternatives increases
2001	International Maritime Organisation (IMO) adopts “AFS Convention” to eliminate TBT from AF coatings from vessels through:
	2003 – prohibition of further application of TBT
	2008 – prohibition of active TBT presence
2008	IMO “AFS Convention” entered-into-force

Modern Alternatives (but not for everyone!)

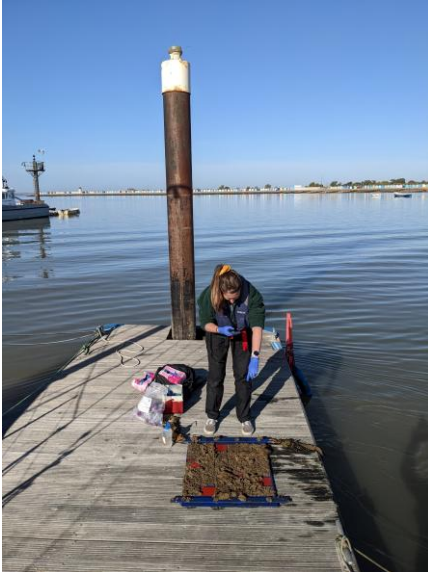


UV-C emitting LEDs

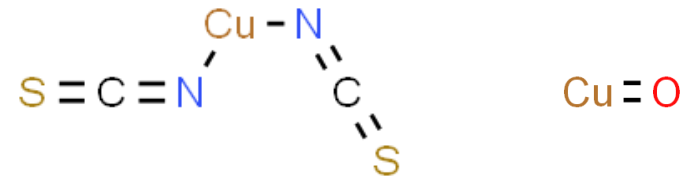


Hull grooming robots

Background

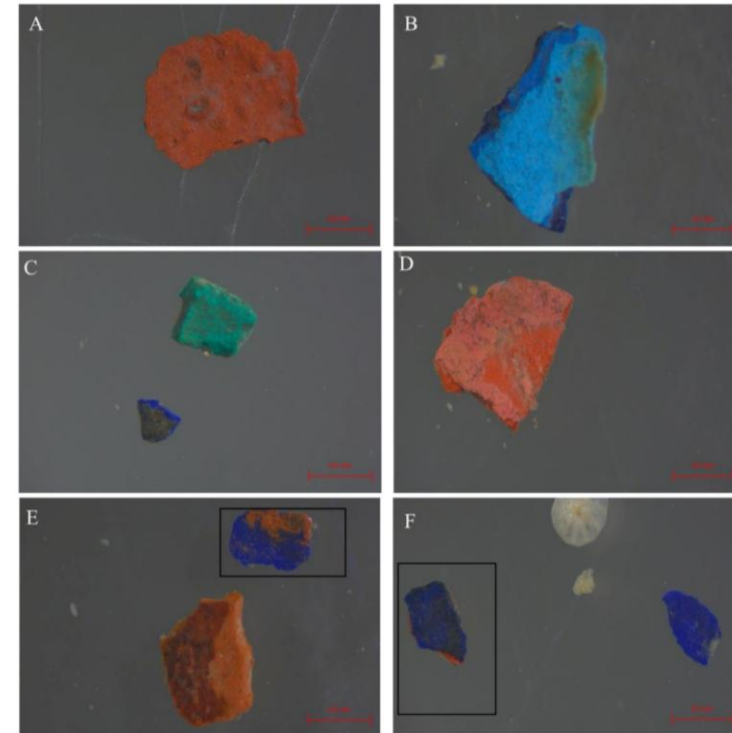


- September 2022: Initial tests of different paints performed in Brightlingsea:
 - *Epoxy primer control* (Hempel Light Primer)
 - *International Trilux 33* (Copper thiocyanate)
 - *International VC Offshore* (Copper oxide)
 - *Hempel Ecopower Cruise* (Non-biocidal)
 - *Coppercoat* (Metallic copper)
 - *Hempel Silic One* (non-biocidal FR)
- The aim was not to identify practical solutions, but may ultimately identify the best formulations for local use.



Environmental Concerns

- Antifouling coatings are toxic (mostly).
- Biocides released from coatings enter the environment during normal boating activity:
 - Less problematic with newer / more expensive formulations.
 - You get what you pay for in terms of (reduced) environmental impact.
- Paint particles (containing biocide) enter the environment during cleaning:
 - More persistent in particulate form.
 - May contain legacy coatings, unavailable today.
- Immediate effects may be local, but sediment moves.
- There is evidence that marine communities are affected.
- Paint particles are among the largest inputs of plastics into the ocean, and the only plastic designed to be toxic.





Boat moored to the posts

Study Design



- 3-Year project (immediate results unlikely....)
- **General aims:**
 - Identify the best / most effective products and best practice to improve outcomes for boat owners and also protect environmental health.
 - Build a scientific knowledge base about local impacts of antifouling practices from recreational boat use.
- **Approach:**
 - Collect samples from boat hulls and cleaning waste, from vessels with different operational cycles, maintenance practices and needs.
 - Environmental sampling in the local area. What is the current status?
 - Laboratory and field studies of paint effects. Should we be concerned?
 - Gather data from boat owners on opinions, priorities, costs and usage.
 - Engaging with boat owners to learn about challenges, opportunities and acceptable changes to routine practice.
- **First steps:**
 - We need your help!