



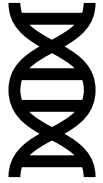
Dr. Markus Hoffmann, Technical Director - I-Tech AB

Quantifying the scale of the global barnacle fouling problem

Green Ship Technology

Copenhagen, Denmark– March 12, 2020

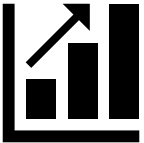
I-Tech AB Company Profile



- A global bio-tech company
- Inventor of the barnacle repelling active agent for marine coatings - Selektope®



- I-Tech supplies Selektope® to the global marine coating market.
- Included in 9 commercially available antifouling (AF) products



- Listed on the Nasdaq First North stock exchange since April 2018.



- I-Tech supplies Selektope® to global marine coating makers
- Included in 9 commercially available antifouling (AF) products



- Hundreds of vessels (400+) using the technology
- Almost all ship types are represented



- Extensive patent portfolio and regulatory approval scheme.

Focus on biofouling

Heavy barnacle fouling can increase vessel drag up to, and in excess of, 50% which equates to a significant increase in the fuel consumption and emissions.

AF systems reduce fuel bills & carbon dioxide (CO₂)

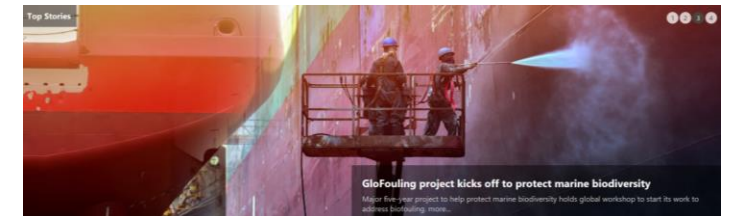
- Acknowledged fuel saving potential (10%) across the global fleet corresponding to around 10-15 billion USD.

AF systems reduce exhaust emissions

- >100 million tonnes of CO₂ emissions saving (10% fuel saving) + a lot of SO_x/NO_x/PM

AF system reduce spread of invasive species

- Hull biofouling identified as key IAS vector.



UN body adopts climate change strategy for shipping

Introduction to Selektope®

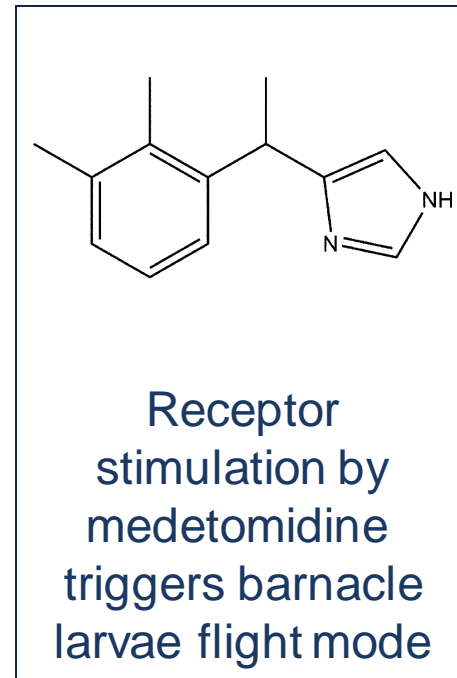
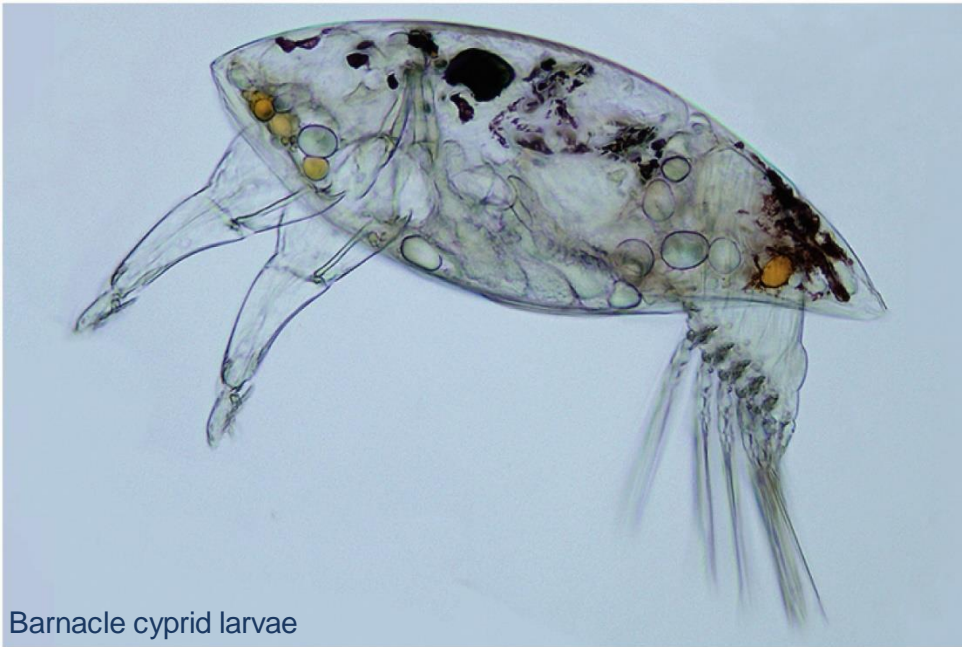


Barnacle fouling only occurs when a vessel is static, but it does not have to be static for long

Insurance that ships will stay barnacle-free

no-matter where they operate or how long they are idle is required = Selektope® inside

The bio-tech approach: Reversible receptor stimulation



- **Selektope®** is the brand name for **medetomidine** used as an active agent in marine antifouling coatings.
- This novel in its application by I-Tech:
 - Medetomidine is highly selective and links to the barnacle larvae's octopamine receptor transmitting signals.
 - Triggers temporary leg-kicking of barnacle cyprid larvae
 - EU/BPR Approved and similar approvals in all leading shipping markets.
 - No bioaccumulation in organisms

selektope®

Triggering flight mode

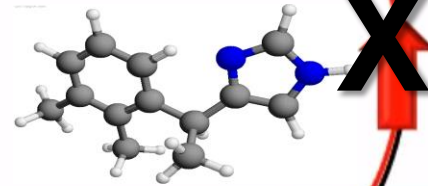
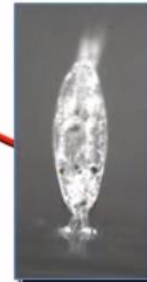
Life cycle analysis



Adult barnacle



Settling



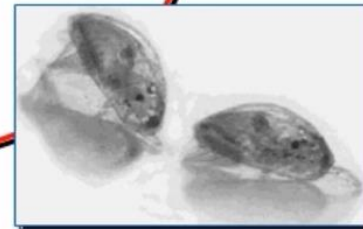
Adult barnacles produce larvae that eat and grow.

The larvae in the cyprid stage look for a suitable place to settle

The settled larvae metamorphose into juvenal adults.



Nauplii larvae

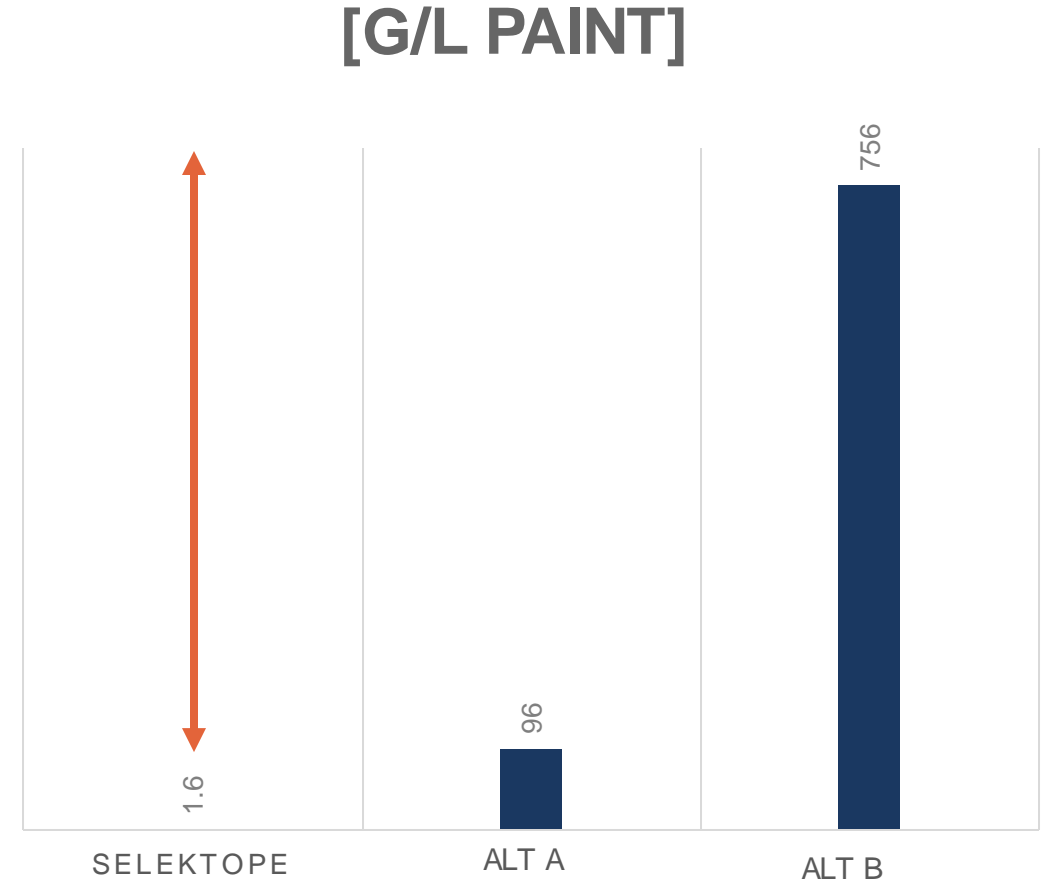


Cyprid larvae

- Exploratory surface behaviour necessary to settle is blocked.
- Kicking frequency is around 100/min
- Swim speed can be twice its length per second.

Selektope® - a differentiating agent

- Powerful enough to replace CuO and flexible enough to boost
- Repellent mode of action (flight mode)
- Used at around 0,1%w/w (a few grams per litre paint)
- Ultra-low leaching; >95% lower than corresponding amounts of CuO for similar barnacle fouling prevention effect.
- Biological degradation (consumed by microorganisms)
- Used only in self polishing AF systems to-date, no foul release incl. Selektope®, yet.



New barnacle fouling research insights

- I-Tech contracted Safinah Group for independent research into the scale of the barnacle fouling problem
- 249 vessel DD reports analysed, 263 Drydockings (DD) attended
- 572 observations of fouling condition
- Based on Safinah's historical Dry Dock (DD) attendance reports / inspections from 2015 – 2019

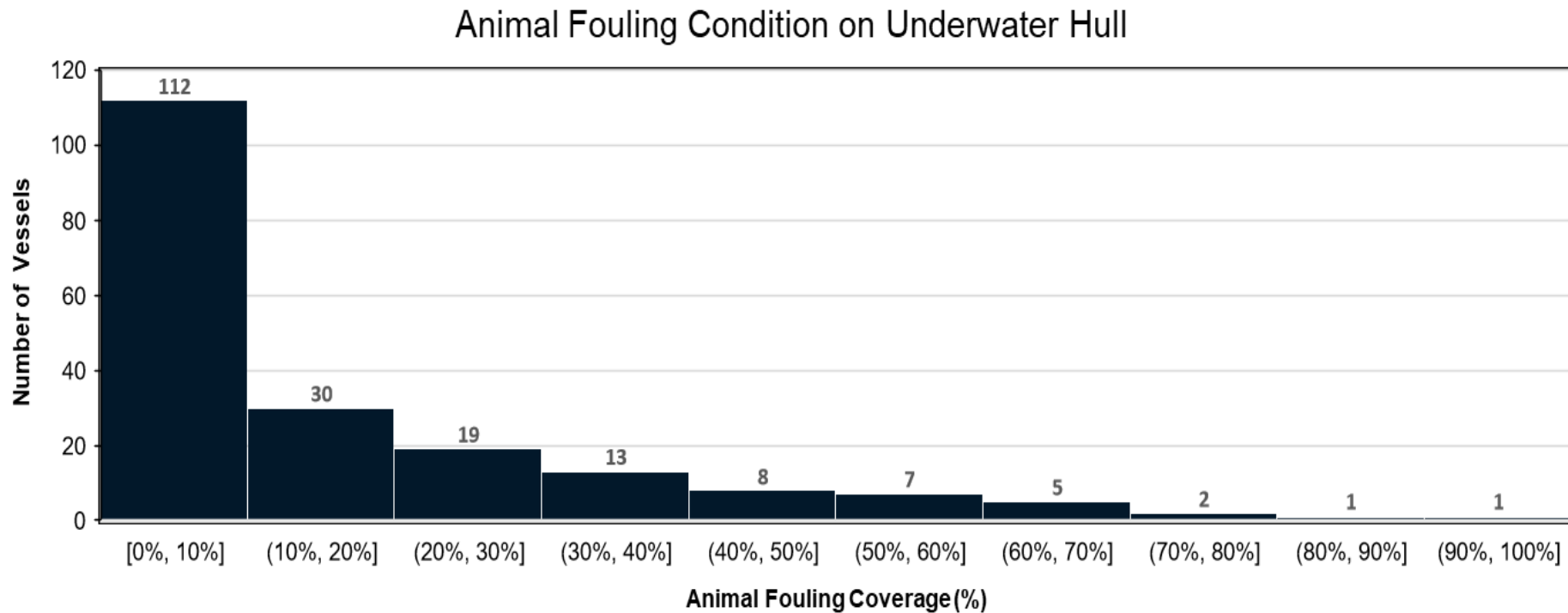


Safinah Group

360° Coating & Engineering Experts

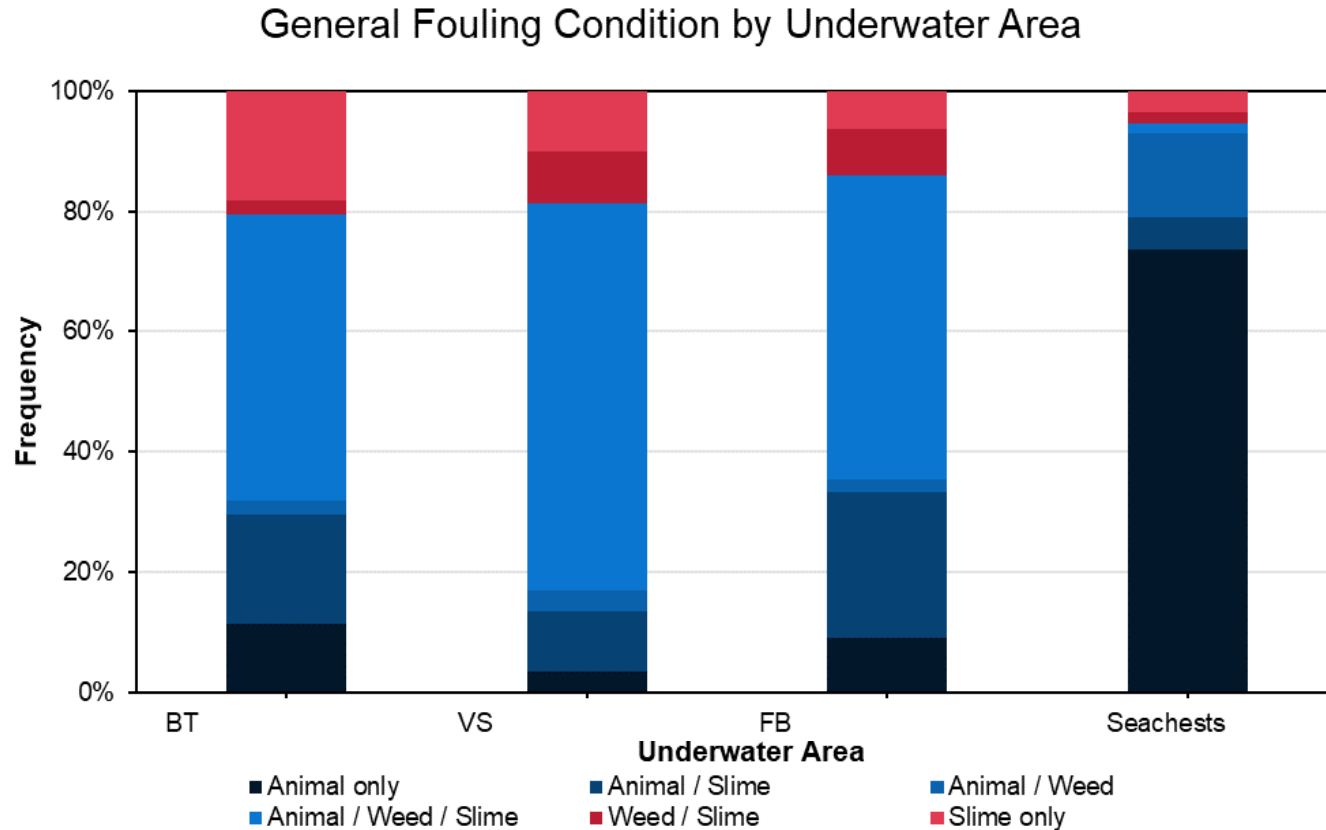
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Percentage of barnacle fouling



44 % of vessels surveyed had between more than 10 % barnacle fouling coverage on the hull.

Barnacle fouling by location

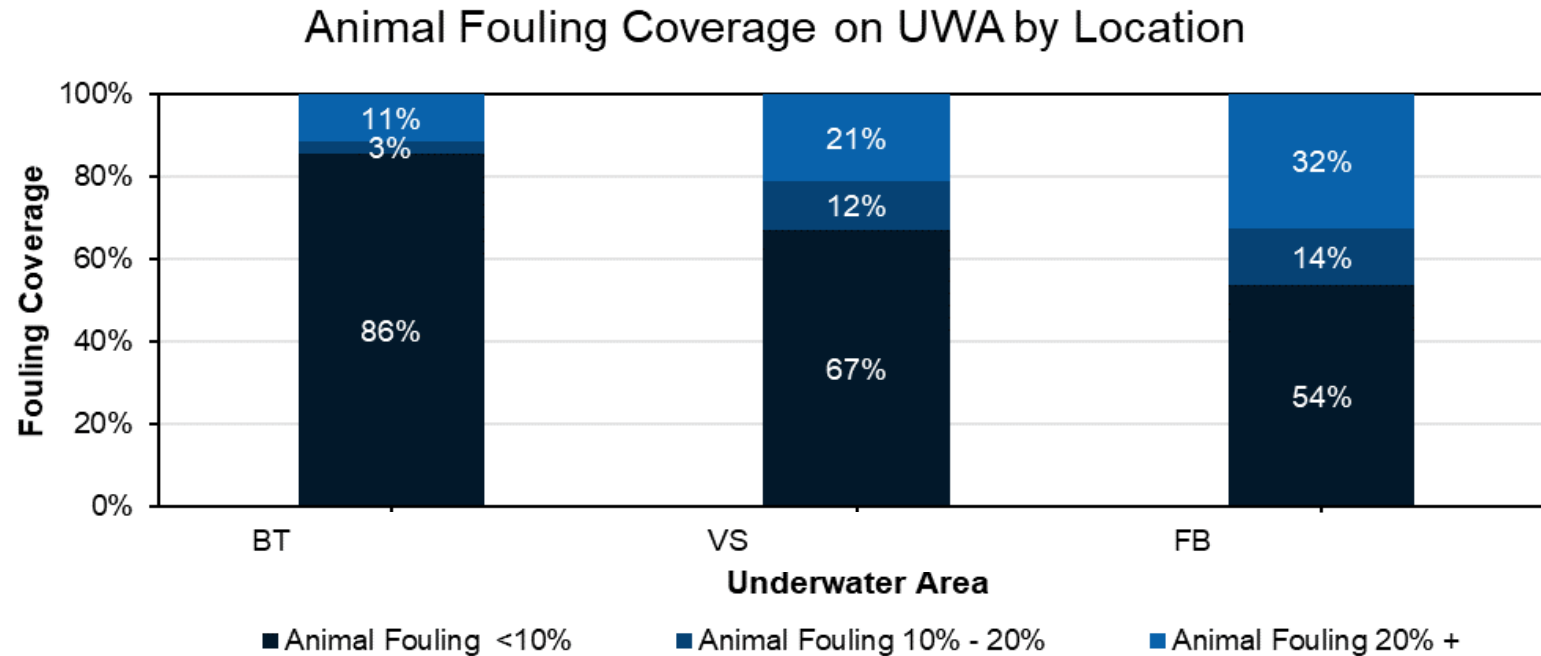


Barnacle fouling was present on the majority of the observations for all locations (Boottop, vertical sides, flat bottom and seachests).

- Dominant fouling combination for BT, VS and FB does include barnacle fouling with weed and slime.

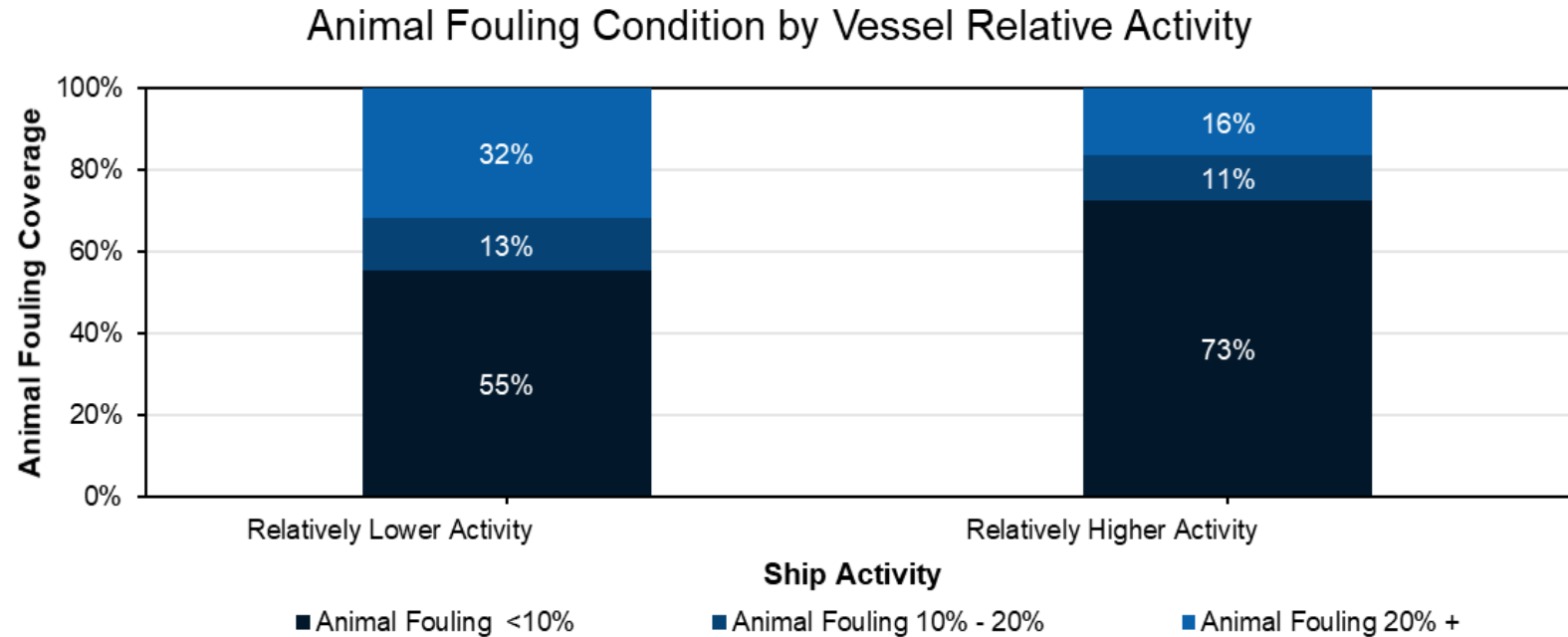
Approx. 74% of observations found barnacle fouling in seachests = niche areas are a huge problem area for barnacle fouling.

Barnacle fouling percentage coverage by location



Barnacle fouling coverage is significantly greater across the flat bottom compared to the vertical sides and boottop

High activity versus low activity

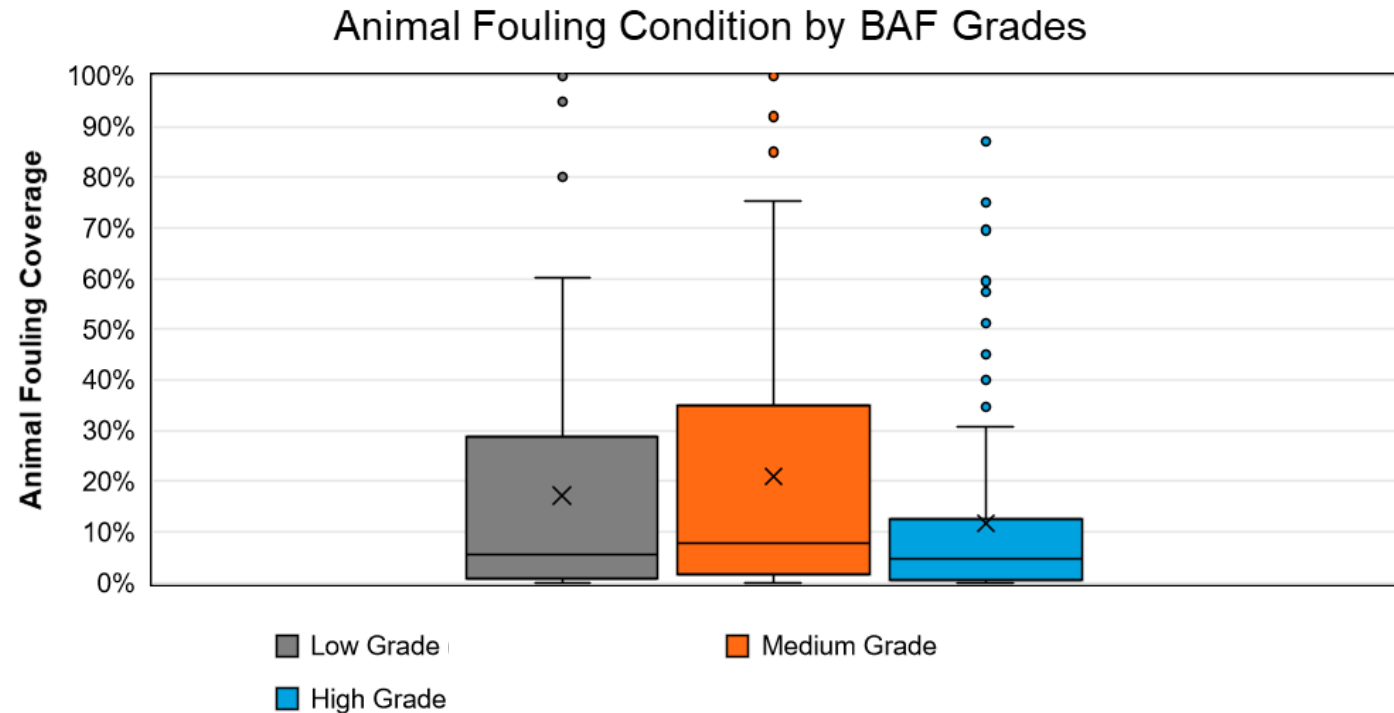


Animal fouling coverage increases for relatively lower activity vessels

- 45% of observations with animal fouling coverage > 10%
- compared to 27% for relatively higher activity vessels.

For all vessels, barnacle fouling is generally higher on the flat bottom and sea chest areas.

High grade versus low grade antifoulings



Barnacle coverage reduces with coating quality

- 37 % of observations with animal fouling coverage medium grade
 - compared to 12 % for high grade activity vessels.

Low grade, versus medium grade, versus high grade

Barnacle fouling can occur on any AF system

Risk of barnacle fouling is linked to:

- AF system type
- Biocides used
- Vessel activity
- Vessel trading patterns

Anti-barnacle insurance needed to protect hull at all time, regardless of variables listed above

Beware! Barnacle fouling pictures ahead!



Low grade AF



Photo 61: Vessel 14a – Flat bottom



Photo 62: Vessel 14a – Under bilge keel



Photo 63: Vessel 14a – Flat bottom



Photo 64: Vessel 14a – Vertical sides



Photo 65: Vessel 14a – Flat bottom



Photo 66: Vessel 14a – Flat bottom

Vessel Type: Bulker

In service period: 5 Years

UWH coatings: Low grade (Copper Oxide, Zineb)

Barnacle fouling:

- FB: 1,560m² (Total area 3,377m²)
- VS: 1,500m² (Total area 2,695m²)

Medium grade AF (Copper Oxide, CPT, Zineb)



Photo 34: Vessel 7a – Flat bottom



Photo 35: Vessel 7a – Flat bottom

Vessel Type: LNG

In service period: 5 Years

Barnacle fouling:

- FB: 2,950m² (Total area 7,705m²)
- VS: 3,000m² (Total area 8,169m²)

High grade AF (Copper Oxide, CPT)



Photo 46: Vessel 10a – Boottop



Photo 47: Vessel 10a – Vertical sides

Vessel Type: Oil Products Tanker

In service period: 5 Years

Barnacle fouling:

- BT: 1,770m² (Total area 3,450m²)
- VS: 1,770m² (Total area 3,450m²)

Foul release AF on vertical sides only



Photo 9: Vessel 4 – Vertical sides



Photo 10: Vessel 4 – Vertical sides

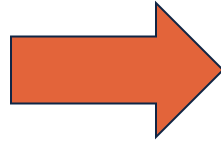
Vessel Type: Crude oil tanker

In service period: 5 Years

Barnacle fouling:

- FB: biocidal antifouling
- VS: 1,500m² (Total area 5,138m²)

Niche areas with Selektope® protection DD +16 months - barnacle free



Grating coated with high grade AF of SPC Cu_2O type for coastal LPG carrier (1200DWT) - 15 months

Grating coated with high grade AF of SPC Cu_2O + Selektope® for coastal LPG carrier (1200DWT) - 16 months

Images provided by Chugoku Marine Paints

MR Tanker DD +49 months – still barnacle free

- Globally trading MR Tanker (*Team Calypso*) coated with Selektope®-powered, copper-free Seaflo Neo CF Premium AF system in 2015
- Average characteristics:
 - activity rate 60, average speed 12knots, Average temperature 25°C, Several long idling periods of 25 days+

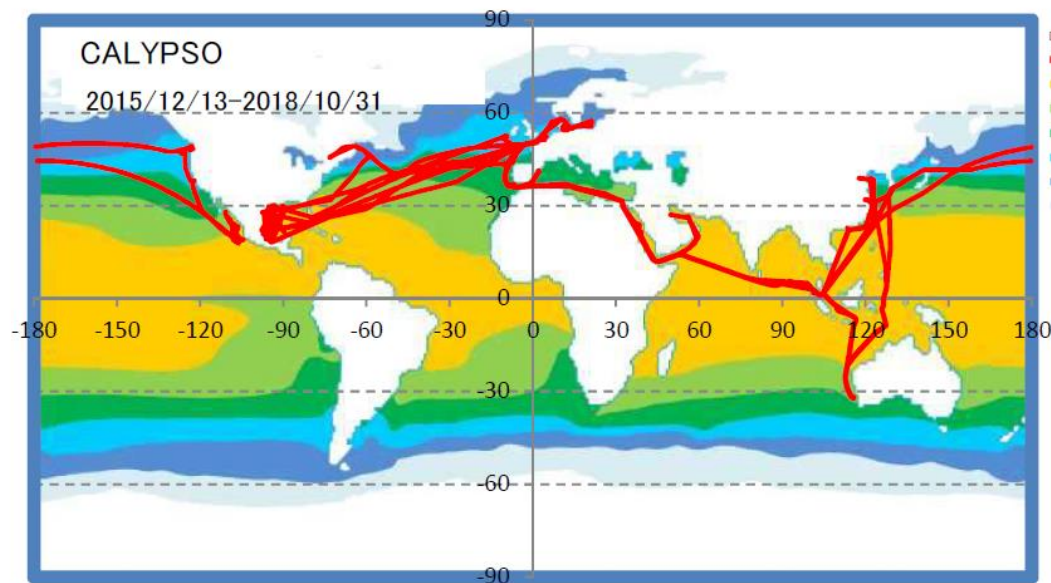


Fig.1 Operating Route

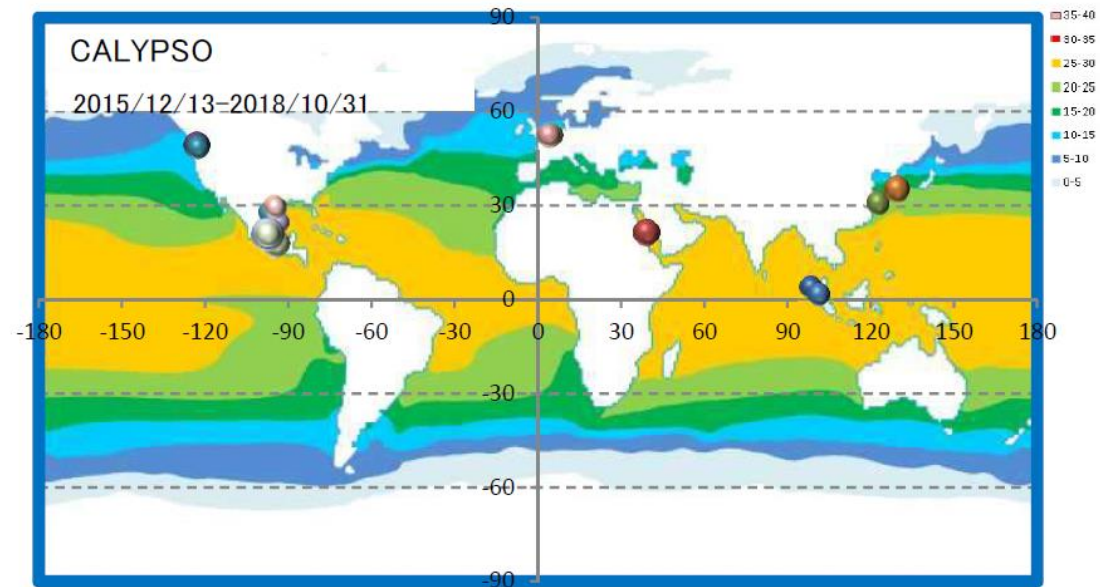
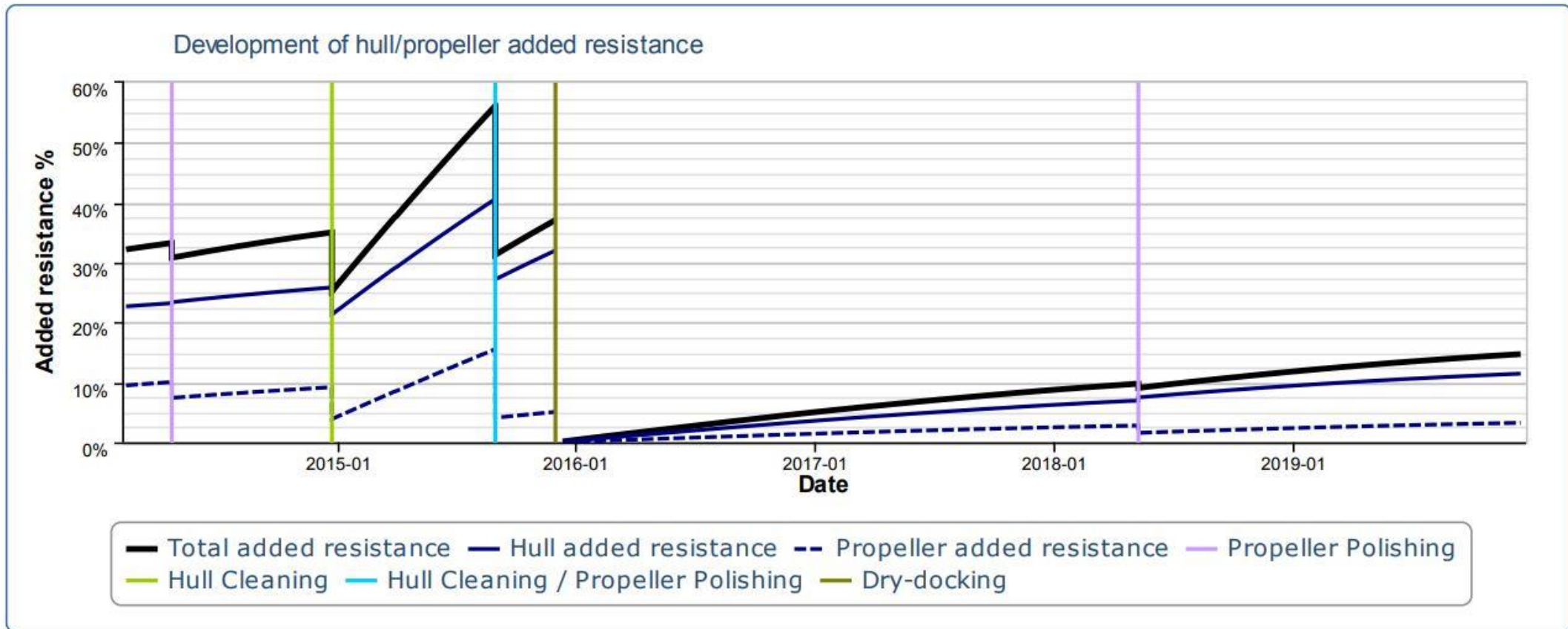


Fig.2 Long stay in port

Results proven by 3rd party data analysis

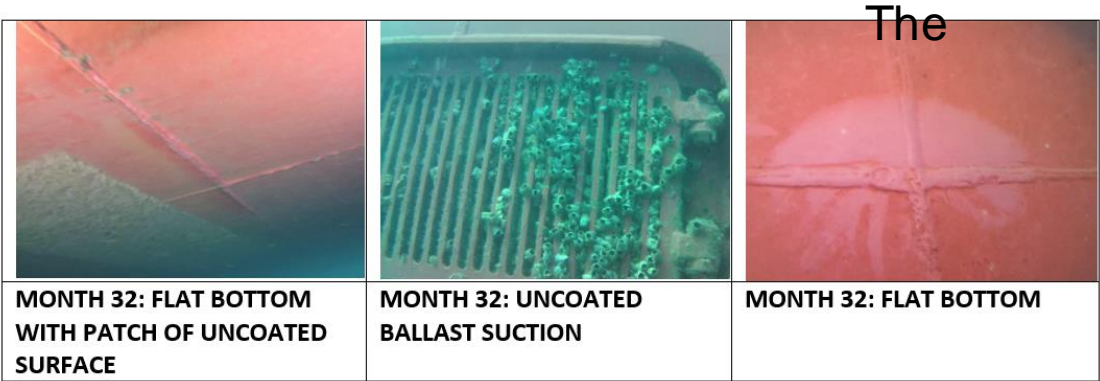


CAPSER Report. Propulsion Dynamics

Dive inspections show the power of Selektope®



- 27 months:
- Vertical sides clean
 - 6% added hull resistance



- 32 months
- Vertical sides clean
 - 8% added hull resistance

Month 49: only 15% added hull & propeller resistance



- 36 months
- Vertical sides clean
 - 8% added hull resistance

Summary

- Independent analysis of 249 vessels confirms animal (barnacle) fouling is clearly a problem.
- Approximately 30% of all vessels have barnacle coverage >20% of the total underwater hull area.
- Dominant fouling condition on BT, VS and FB includes barnacle fouling as a mixture of barnacle fouling, weed and slime.
- Flat bottom and sea chests is a problem area of barnacle fouling.
- Whilst the higher performance products show improved resistance to barnacle fouling there is still significant evidence of barnacle fouling on these products.
- DD data set clearly points to a need for further improvement of the current fouling control range in resisting animal fouling.
- Independent data showing antifouling coatings pigmented with Selektope® delivering improved and longer fouling protection during extended static periods would be a real benefit to ship operators.



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