Slippery Ships activity sheet 39 Ways to Save the Planet

Royal Geographical Society

with IBG

Advancing geography and geographical learning

Ships

This is a resource linked to the BBC Radio 4 programme 39 Ways to Save the Planet. Listen to the episode Slippery Ships and complete the tasks below.

What is the problem?

If you put any object into ocean water, it is going to get fouled with 'a conditioning layer' consisting of diatoms and bacteria. In the shipping industry this leads to oysters, sponges, marine invertebrates, and barnacles attaching themselves to the hull of ships (shown in Figure 1 below). This describes how a bacterial layer leads to 'macro fouling' of larger organisms, known as biofouling.



Figure 1 Biofouling © Beth Macdonald

Biofouling

If this build-up is allowed to occur on the hull of a ship, it can lead to anything from a 12 to 55% energy efficiency loss over the duration of a ship's journey. This can create millions of pounds in extra costs on a single maritime journey due to increases in the amount of fuel and an approximately 20% loss in forward speed. This extra fuel releases extra greenhouse gas emissions and is a multibillion-dollar problem for major shipping companies such as APM-Mærsk, the Mediterranean Shipping Company and COSCO Shipping Lines.

Around half of all ships are affected by biofouling, resulting in around 10% of shipping emissions.

If left unchecked, biofouling can get to up to 30cm on the hull of ships. It is a longstanding problem for ships. To combat it, divers descend to scrap it off 'in-water', and toxic coatings are applied to the hull of the ships during dry-docking to reduce adhesion.

A Norwegian company Jotun has developed a revolutionary proactive cleaning solution, called HHS Hull Skating Solutions. It is a marine robot which can be deployed during the journey to clean the hull of the ship, reduce drag, improve energy efficient manoeuvres, and limit the need for extra fuel.

The Jotun marine robot removes the need to rely on scrapping and repainting. The robot has 4 magnetic wheels, each with a holding capacity of 300kg. It proactively cleans with 3 high-definition cameras and a purposely designed brush. The robot cleans and removes biofouling up to and including the onset of large slime, i.e., the early stages of build-up. It is estimated that full coverage of heavy slime creates a fuel penalty of approximately 18% for ships.

- 1. Plymouth Marine Laboratories research scientist Anna Yunnie discusses alternative fuel-saving technologies. Choose one of the following 3 high tech ideas and research it:
 - o A net of UV-LEDs lights, embedded into the hull
 - Ultrasound
 - Small scale electro chlorination

There are additional benefits in using the marine cleaning robots, namely by not scrapping paint off by hand toxic pollutants are not released into the surrounding water. Removing the build-up of biofouling limits the transfer of marine alien species around the world.

Acceleration

Globalisation is a longstanding process which has accelerated because of rapid developments in industries like shipping. The pre-emptive work against biofouling on the hulls of large ships is expected to further speed up global maritime trade. Creating slippery ships will further add to the phenomena of time-space compression — describing how relative distance between places is shrinking.

- Go to <u>Maritime Traffic</u> and open their Live Map for all ships at sea, in real time. In the banner
 on the left of the screen, select the Density Map option. On a printed world map annotate
 where the largest flows of maritime traffic are found (increase the opacity slider and
 specifically look at 1800K+ red category).
- 3. Using your annotated world map, describe the global pattern of shipping and sea lanes.
- 4. A choke point describes a narrow passage which holds strategic importance. They are typically canals, straits or channels. Using the Maritime Traffic Live Map circle on your map where you think these choke points are.
- 5. Why might the removal of biofouling help these congested waterways?

Further reading

- The Jotun marine robot <u>www.jotun.com/co/en/b2b/news/Jotun-announces-revolution-in-proactive-hull-cleaning-with-ground-breaking-Hull-Skating-Solutions.aspx</u>
- An incredible animated and interactive visualisation of global commercial shipping www.shipmap.org/
- Weaponisation of chokepoints <u>www.ecfr.eu/article/a-glimpse-of-the-future-the-ever-given-and-the-weaponisation-of-choke-points/</u>
- Time-space <u>www.sciencedirect.com/topics/psychology/time-space-compression</u>

 Shock of the Global: Post-War Britain and Globalisation <u>www.blog.geographydirections.com/2013/11/26/shock-of-the-global-post-war-britain-and-globalisation/</u>

 How China's Belt and Road Initiative is changing cities – and threatening communities <u>www.blog.geographydirections.com/2021/02/03/how-chinas-belt-and-road-initiative-is-changing-cities-and-threatening-communities/</u>

Suggested questions for Slippery Ships

- a. What percentage is lost in forward speed with a 12 to 55% loss in efficiency?
- b. When biofouling builds up, at what point does the Jotun marine robot become ineffective?
- c. How many ships will be involved in the sea trial of the Jotun marine robot this year?
- d. Why are the challenges (of climate change adaptation) 'immense' in the shipping industry?
- e. How much of total human GHG emissions is the shipping industry responsible for?

Answers to Acceleration section questions

- 3. 9 out of 10 of the world's busiest ports are in the Far East: Port of Busan (South Korea), Port of Hong Kong, Port of Shanghai (largest and busiest in the world), Port of Qingdao, Port of Singapore, Port of Shenzhen, Port of Ningbo-Zhoushan, Port of Tianjin and the Port of Guangzhou colloquially known as the 'Silk Road on the Sea'. This dominance is due to huge Chinese state investment in seaports and shows the country remains 'the workshop of the world' with a high number of ships in the western Pacific, Indian and Atlantic Oceans.
- 4. Well known choke points: the Suez Canal, the Panama Canal, Cape of Good Hope, Strait of Hormuz, the Strait of Malacca, the Strait of Gibraltar, the Turkish Straits, and Bab El-Mandeb which connects the Red Sea to the Gulf of Aden.
- 5. Biofouling removal will speed up the movement of ships thereby allowing faster transport and, in theory, less congestion and better routeing.

An RGS-IBG expert

Go to What our experts say to hear further analysis Society Fellow Professor Bharathram Ganapathisubramani from the University of Southampton.



