Biomimicry in Ship Hulls To Reduce Noise Pollution and Harmful Wakes

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Noise pollution and ship-induced wakes not only harm wildlife and erode shores, but also cost the shipping industry billions of dollars in traffic disruptions. Aquatic insects and penguins travel swiftly through the water, using irregular surface texture to localize turbulence near the surface. Similarly, in sports, golf balls use dimples for smoother flight, while swimsuits developed by Nike use texture to slip through the water with less resistance. This project compared performance through a canal of a control model ship hull and designs implementing microscopic and macroscopic texture created by hydrophobic spray and 6mm-radius hemispheres on the hull's surface, with the goal of a 20% reduction in both noise and wake height without affecting speed or path of travel. Models were each driven by a 3-setting electric motor. Testing a total of four designs, modified models were found to have significantly reduced wake height, as well as maintain a straighter path and reach higher speeds, especially at higher motor settings. The joining of design elements yielded the best results. The final model combining micro and macroscopic texture with the hydrophobic spray and hemispheres used together provided a 72.5% reduction in wake height and a 7.6% increase in speed compared to the control for motor setting 3. None of the designs met the goal of 20% reduction in noise, but at higher speeds a 9.5% reduction in sound was achieved. This project supports the application of biomimetic designs to reduce ecological disruptions and improve stability and efficiency in watercraft.

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