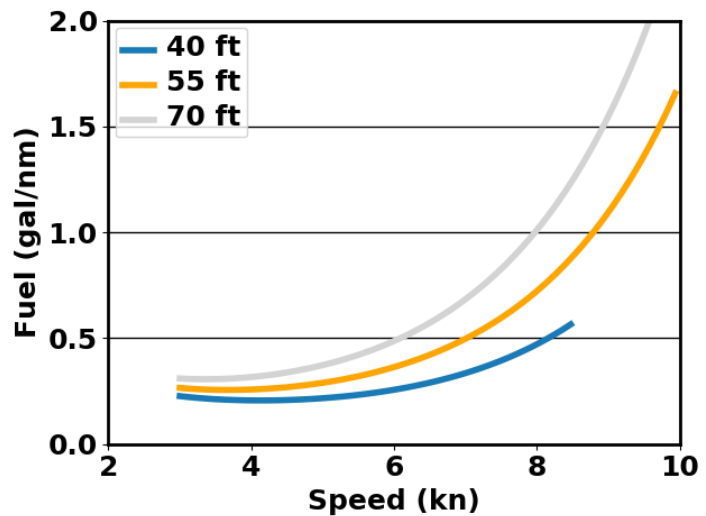


Propulsion Opportunities

It's common knowledge that slowing down or cleaning the hull can reduce fuel consumption. This document quantifies how much of an impact those measures can have, and presents results from some less established drag reduction methods like retrofitting a vessel with a bulbous bow.

The Value of Speed

The figure to the right shows how fuel consumption¹ typically changes as speed increases for displacement hulls ranging from 40 to 75 feet in length. The curves are terminated at the hull speed associated with each length. Two trends are consistent across all vessel classes:

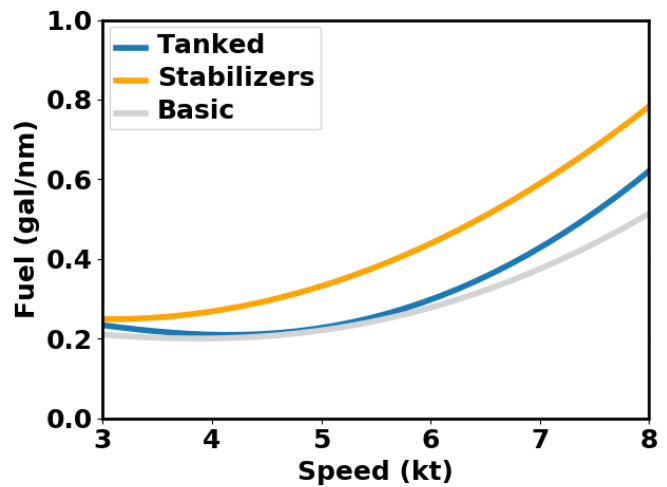


- Fuel consumption increases rapidly as the vessel approaches its hull speed
- Fuel consumption per nautical mile is nearly constant at low speeds, and can even increase as a vessel slows below 4 kt

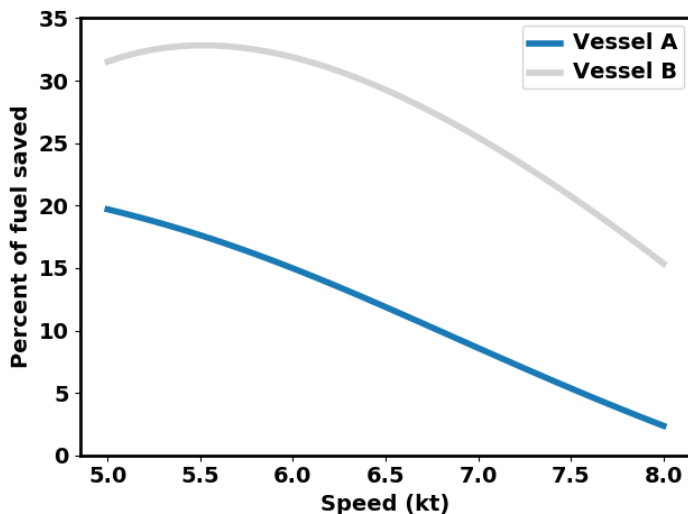
¹ Fuel consumption is presented in units of gallons per nautical mile (gal/nm). This is the inverse of how fuel efficiency is typically shown for a car, but allows total fuel consumption to be calculated by multiplying the fuel consumption rate by the total distance travel. For reference, a vessel that consumes 0.5 gal/nm travels 2.3 miles per gallon.

Stabilizers and Full Holds

The figure to the right shows fuel consumption curves measured on a 40' troll vessel under three distinct operating conditions. The exact effect of traveling with stabilizers deployed or a full hold of water ("tanked" as many fishermen say) depends on the specific hull configuration. However, measurements made under both configurations on several vessels suggest that operating "tanked" typically increases fuel consumption about 20% and deploying stabilizers increases fuel consumption by about 40% when operating near cruising speeds.



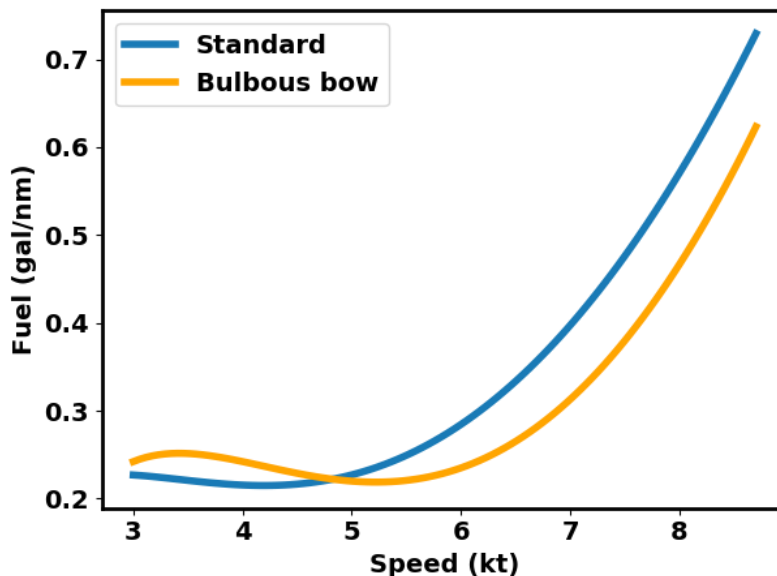
Hull condition



The Figure to the left shows how much fuel consumption can be reduced by cleaning the hull. The plot shows data from two sea trials performed before and after a hull cleaning. The data show a broad range in fuel consumption improvement depending on the vessel, but it appears that fuel consumption is typically reduced by around 15% at cruising speeds.

Hull shape

Various hull adaptations are made in the fleet to expand hold capacity, increase stability or otherwise improve the vessel. All of these adaptations have an effect on fuel consumption. One adaptation of increasing popularity is the bulbous bow. Bulbous bows affect the wave-making drag of vessels, and their impact on fuel consumption can depend on the precise shape and size of the bulb. However, when well designed a bulb can reduce vessel drag at cruising speed. The figure below shows results of a two sea trials on a 46 foot troll vessel before and after a bulbous bow was installed. The data show a reduction in fuel consumption of 18% at 8 kt, and an increase in fuel consumption at low speeds.



FVEEP also performed sea trials on two vessels that had the same original hull, but one had been extended by six feet to increase hold capacity. The original vessel length was 47 ft. The sea trials showed that the elongated vessel consumed 12% less power at 8 kt than the original hull, but it had more drag at low speeds.