

The Speed Dependence of Small Vessel Underwater Noise – Characteristics and Causes

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SUMMARY

Boating is an increasingly popular pastime in many countries. This raises concern about the underwater noise emitted by recreational vessels in sensitive coastal environments and its potential environmental impact.

We measured the underwater radiated noise (URN) of four small vessels at multiple speeds. A comparison to previous results on speed dependence shows inconsistencies.

It is clear that we need a deeper understanding of the mechanisms that cause underwater noise in small vessels.

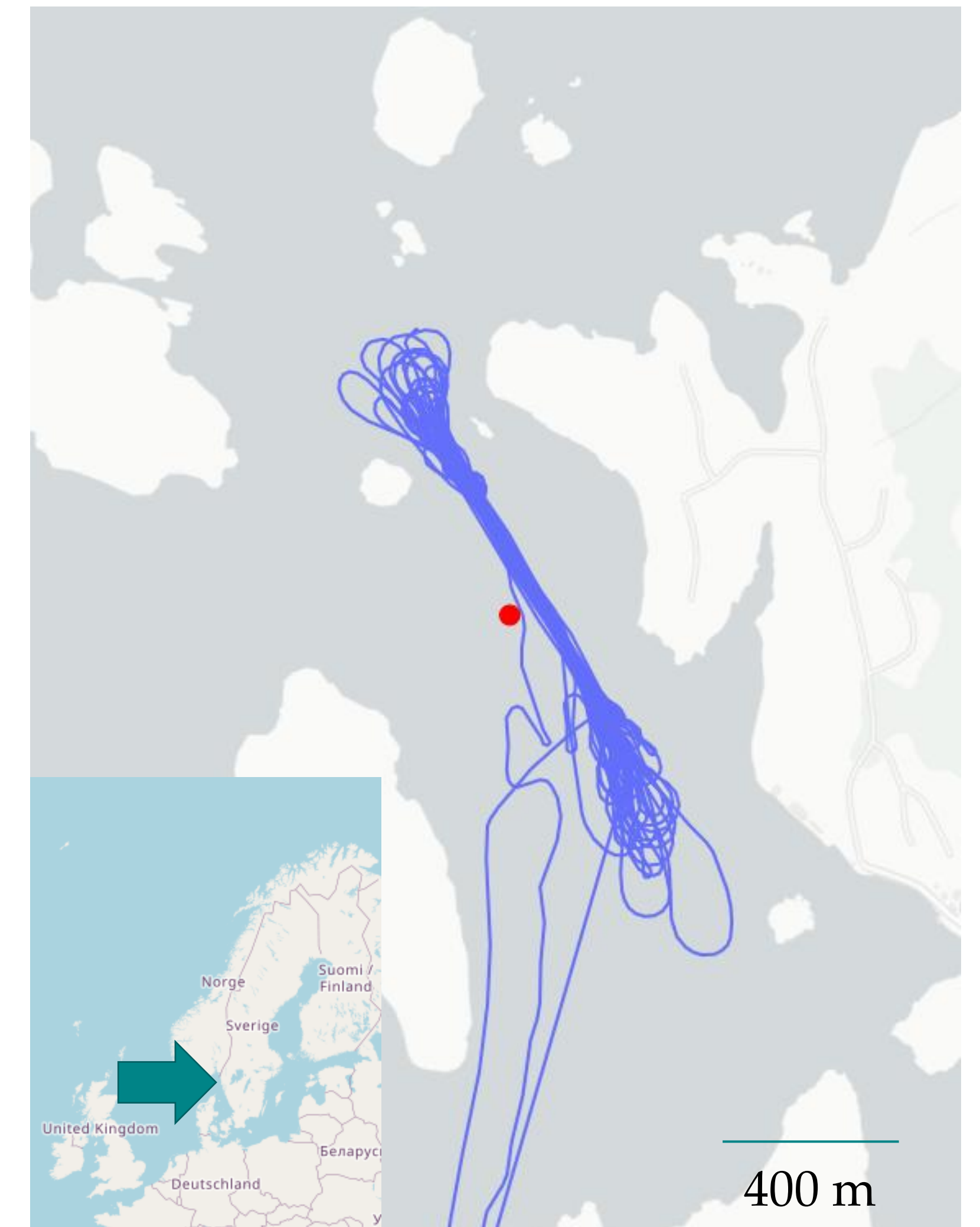


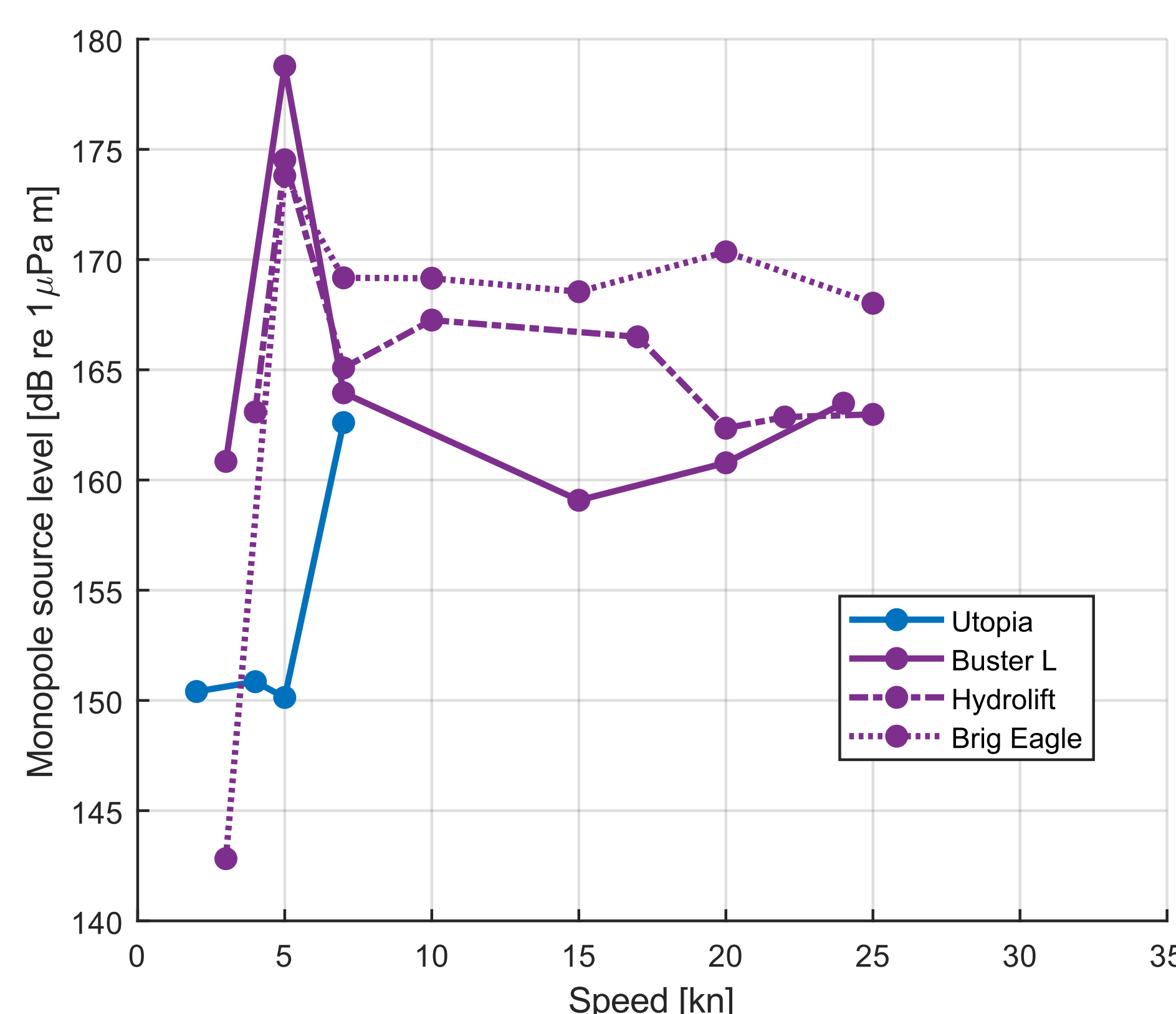
Photo and map of the measurement site, near Havstenssund on the Swedish west coast. Participating vessels carried a GPS receiver. The map shows GPS tracks (blue) and the hydrophone location (red dot).

Method

- Single hydrophone 1 m above seabed
- Range 90 m, water depth 20 m
- Monopole source levels
- Transmission loss calculated using seabed critical angle method¹
- Boats travelled along a 400 m track, carrying GPS receivers
- 97 passages at constant speed and heading were analyzed

RESULTS

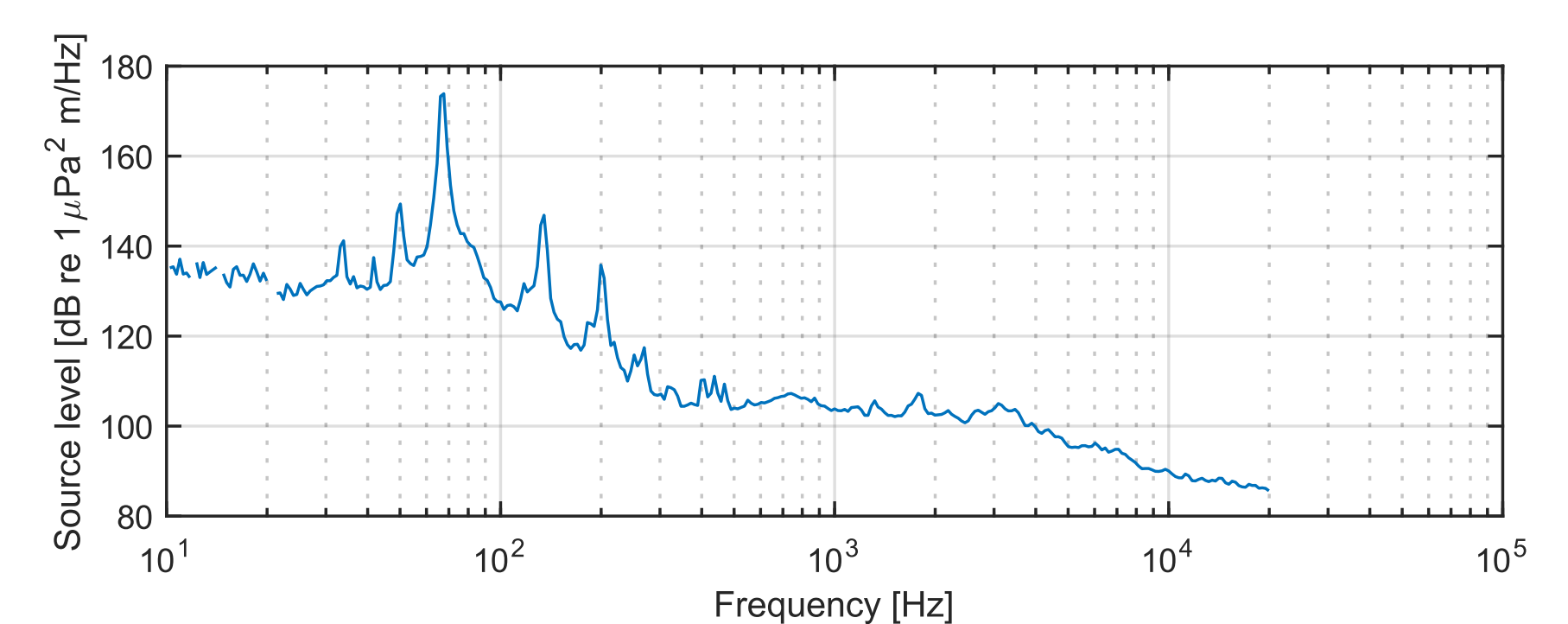
- Source level (SL) shows weak dependence with speed above 7 kn
- High SL peak at 5 kn for 3 of 4 vessels



Speed-averaged source levels of the participating vessels.

Discussion

- Our results show weak speed dependence at speeds above 7 kn
- The review by Parsons et al., 2021³, showed general dependency on speed
- Smith et al., 2024⁴, reported weak speed dependence in the underwater noise of a rigid inflatable boat (RIB)
- Without knowledge of the underlying mechanisms, it is difficult to explain the differences
- The 5 kn peak is tonal at 40-70 Hz with harmonics.



Narrowband source levels of Buster L at 5 kn.

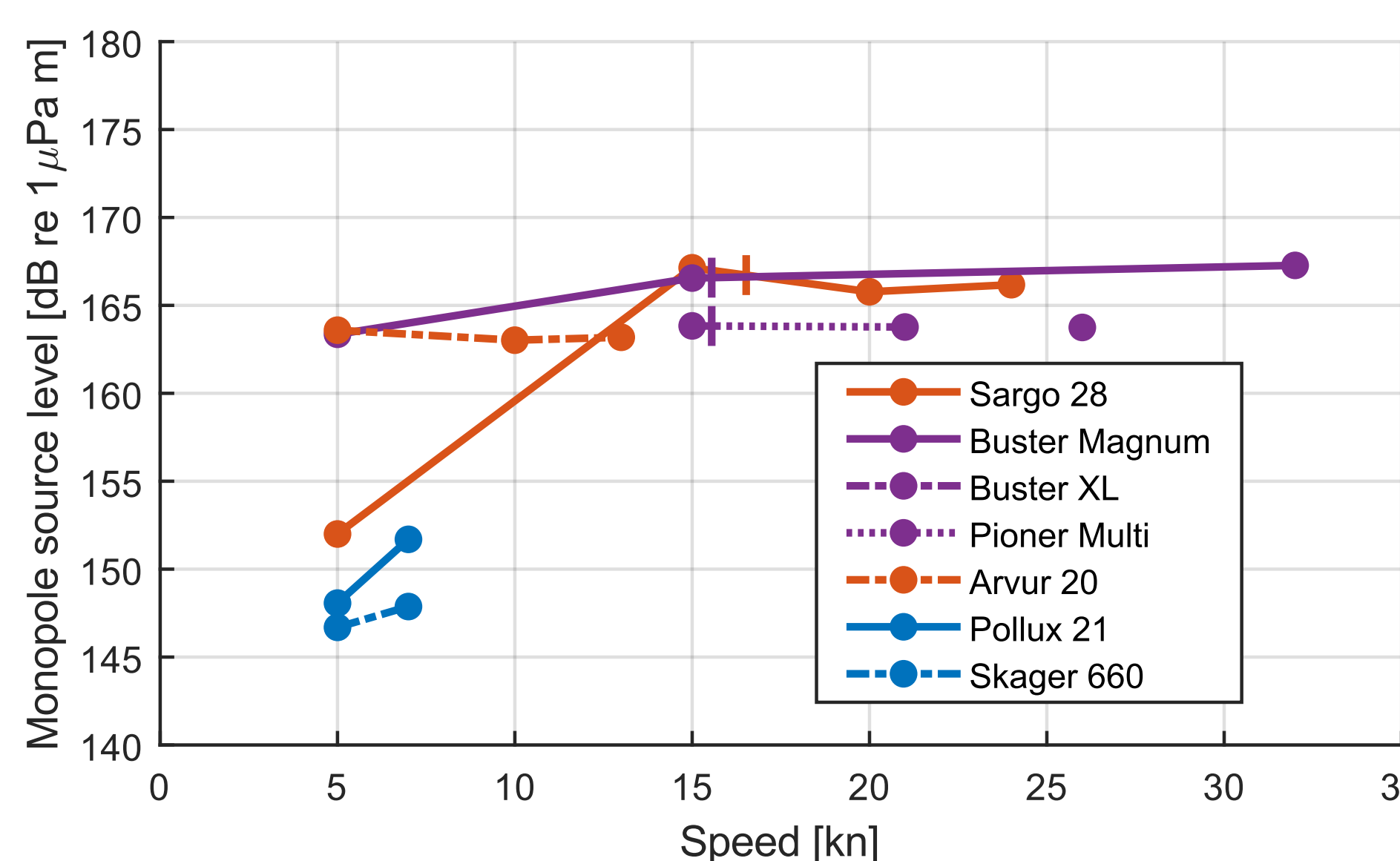
Previous results

Johansson et al., 2024² showed that

- Source level (SL) increases with speed until planing is reached
- When planing, SL dependence on speed is weak

Hull types

- Planing (purple line with circles)
- Semi-displacement (orange line with circles)
- Displacement (blue line with circles)



Speed-averaged source levels of the vessels studied by Johansson et al., 2024².

1. MacGillivray AO et al. (2023). Measuring vessel underwater radiated noise in shallow water. J Acoust Soc Am 153(3), 1506–1524.
2. Johansson AT et al. (2024). Speed dependence, sources, and directivity of small vessel underwater noise. J Acoust Soc Am 156(4), 2077–2087.
3. Parsons MJG et al. (2021). A Review and Meta-Analysis of Underwater Noise Radiated by Small (<25 m Length) Vessels. J Mar Sci Engrg 9(8), 827.
4. Smith TA et al. (2024). Underwater radiated noise from small craft in shallow water: Effects of speed and running attitude. Ocean Engineering, 306, 118040.