LoRa Mesh for Boating and Kayaking

LoRa Mesh Communications in the Marine Environment

The marine environment is simultaneously ideal for LoRa propagation and deeply hostile to electronics. Salt spray, humidity, UV exposure, and submersion risk demand careful hardware selection and installation practice. When properly deployed, Meshtastic mesh nodes on boats and kayaks deliver exceptional range and reliable communication for flotillas, cruising groups, and multi-vessel expeditions.

Propagation Advantages on Open Water

Open water is among the best environments for LoRa propagation. Without terrain obstacles, 915 MHz signals travel in an almost unobstructed line to the radio horizon. A node at deck level (1-2 m) achieves a radio horizon of roughly 5 km. A node at the masthead of a 12-metre sailboat (mast height ~15 m) extends the horizon to approximately 16 km (4.124 x √15) to sea level; because node-to-node range is the sum of both antennas' horizons, a masthead-to-masthead link between two such boats can be considerably longer. Practical ranges of **10-30 km** are achievable between vessels in calm conditions, but only when both antennas are elevated (masthead-mounted) and the path is clear; deck-level handheld nodes will see far less. Range degrades in heavy chop when wave crests periodically block the signal path, but multi-hop relay via intermediate vessels in the flotilla maintains fleet-wide coverage.

Marine Environment Hardware

Enclosures: All electronics should be housed in IP67-rated or better enclosures. Pelican cases, Hammond polycarbonate boxes with foam gaskets, or purpose-built marine electronics enclosures are appropriate. Apply conformal coating (e.g., MG Chemicals 422B) to all exposed PCBs. Use marine-grade stainless or anodised aluminium hardware for all external mounting.

Antenna selection: Stock PCB antennas on most Meshtastic hardware are inadequate for marine deployment. Options include:

- **Fiberglass marine whip (915 MHz):** 3 dBi gain, UV-stable fiberglass radome, stainless base. Mount on a rail bracket or backstay. Commercially available from vendors such as Taoglas and Linx Technologies.
- **Stainless rail bracket:** Many boaters mount both VHF and LoRa antennas on a stern rail bracket. LMR-200 is relatively lossy at 915 MHz (roughly 0.4-0.55 dB/m), so a very short (<1 m) run keeps losses acceptable; for anything longer, use a lower-loss coax such as LMR-240 or LMR-400.

Power: Connect to the 12V house bank via a fused spur with a DC-DC step-down converter. Peak draw is device-dependent but typically well under 500 mA for a single node (some ESP32 boards transmitting at full power with GPS/WiFi active can spike higher); a 1A fused circuit is sufficient for any single node. Check the specific board's datasheet.

AIS Relationship

AIS (Automatic Identification System) is a key position-reporting and situational-awareness aid for vessels in navigable waters; it supplements, but does not replace, the visual lookout and radar that are the primary means of collision avoidance under the COLREGs (the USCG states AIS should never be solely relied upon for collision avoidance). LoRa mesh does *not* replace AIS, marine VHF (Ch 16/DSC), or an EPIRB. The systems are complementary: AIS reports position to all nearby vessels and Vessel Traffic Services; LoRa provides private messaging and coordinated position sharing within a defined group. LoRa operates in the 915 MHz ISM band, entirely separate from the VHF marine band (156-174 MHz), with no regulatory conflict or interference risk.

Kayak Installations

A T-Echo or Heltec V3 in a small waterproof case can be mounted on the deck with RAM mount hardware or bungeed to deck rigging. A short external whip antenna epoxied into a cable gland on the case lid significantly improves range over a buried PCB antenna. For sea kayak expeditions, some paddlers integrate the node inside a transparent waterproof deck bag, allowing the E-Ink display to be read without opening the bag.

Recommended Marine Configuration

- **Modem preset:** choose based on traffic and range needs, not vessel count - use a faster preset (e.g. MediumFast/LongFast) when many nodes or frequent traffic risk channel congestion, and a slower preset (e.g. LongSlow) only when maximum range is needed and added delay is acceptable
- **GPS broadcast interval:** 2-5 minutes underway; 15 minutes at anchor

- **Role:** CLIENT on each vessel; ROUTER_CLIENT (deprecated; use ROUTER or REPEATER instead) on any vessel that is anchored and can serve as a relay
- **Channel:** Custom PSK shared with all vessels at the pre-departure check-in

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