

Preventing Entanglements of North Atlantic Right Whales (*Eubalaena glacialis*) in Pot Fishing Gear

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Lethal and sub-lethal consequences from entanglement in commercial fishing gear are considered the principal threat to the critically endangered North Atlantic right whale (NARW) (*Eubalaena glacialis*), with a population currently estimated at fewer than 500 individuals. Fisheries management interventions, implemented primarily for pot and gillnet gear in US waters, have failed to reverse the incidence and severity of entanglements for the population as a whole. These measures have included fishing area closures, gear modifications, and disentanglement of animals carrying gear. We discuss these and other management measures, and present evidence to support those that will most likely lead to preventing entanglements while supporting the persistence of pot fishing in the eastern US and Canadian Maritimes. We focus in particular on the potential for using whale-release ropes, rope-less fishing, and at-call pop-up buoys that keep vertical lines at depth, and present the results of on-going trials evaluating the feasibility of these technologies in the northeastern US. Rope-less fishing and bottom-stowed vertical lines are the only techniques that for certain prevent entanglements, but their adoption requires that important fisheries management and operational concerns be addressed. These include an increase in gear conflicts in the absence of a substitute to surface buoys for identifying the presence of gear, concerns regarding enforcement, and regulatory changes to replace current buoy marking schemes. Although long considered an impractical option by many in the fishing industry and US Government, the challenges of rope-less fishing are less technological than economic, social, and managerial. As the only approach identified that can prevent entanglements with certainty, their evaluation should be a priority for the fishing industry in collaboration with engineers and fisheries managers, especially given the critical status of the NARW and the possibility that a lack of gear-based solutions might lead regulators to implement far more draconian measures affecting commercial pot and gillnet fishermen.

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*South Shore Lobster
Fishermen's Association*

PREVENTING ENTANGLEMENTS

What are the options?

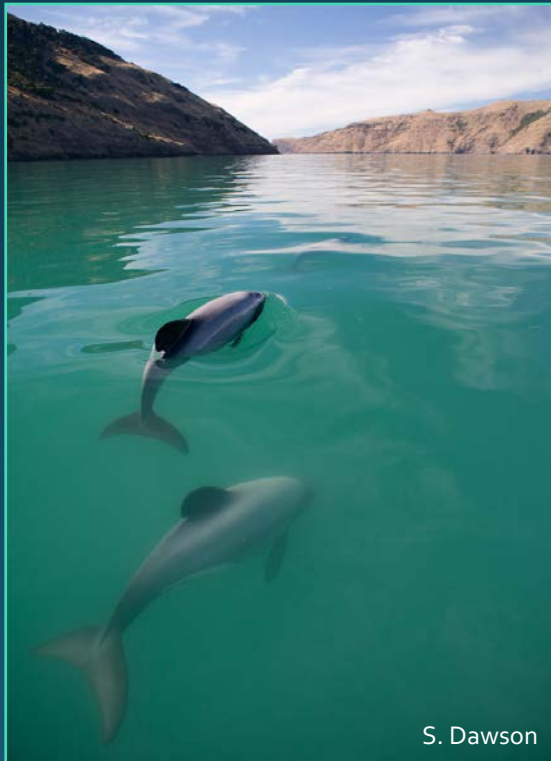
- 1. Close areas, close fisheries*
- 2. Reduce fishing effort*
- 3. Switch to catch shares*
- 4. Boycott/ban catches or certify "whale-safe" ones*
- 5. Modify gear or operational practices*
- 6. Focus on disentanglement, not prevention*

Which have evidence to support their efficacy?



1. AREA CLOSURES

To conserve or recover a **species** or **population**, they need to be large enough, located in the right areas, effectively managed, and avoid introducing new threats (see Gerrodette and Rojas-Bracho 2011; Gormley et al 2012; Slooten 2013)



Can protect animals within particular close areas

But need to consider population-level effect!

And need them to be established at the appropriate times

2. EFFORT REDUCTION



Western Australia – 235 vessels over 560nm (as the crow flies) (WA Fisheries, 2014); **Maine: 6000 licensed fishermen over 200nm (DMR, 2016)**

Lower density of gear may reduce probabilities of gear encounters (Kite-Powell et al., unpublished)

But remember, even with reduced effort:

"...any lines [sic] rising in to the water column has [sic] the potential to entangle a whale."

NMFS, 2005

3. CATCH SHARES AND BYCATCH

Not much data on protected, endangered and threatened species

Complicated: maybe fewer discards, extended fishing seasons... many confounding factors

Whale quota trigger?
So low (1.4 PBR in US)
it would effectively close
the fishery almost
immediately



4. BAN/BOYCOTT PRODUCTS; PROMOTE "WHALE-SAFE" FISHERIES

Do boycott's work?

How do we know product came from a "safe fishery"?

Can enough fisheries be certified to influence others in time to avoid population declines?

Need domestic and international strategies - product origin, product destination; supply chain

Tuna-dolphin - unintended consequence of shift from setting on dolphins to using FADs, with increases in shark bycatch (among other species) and addition of a new whale entanglement risk from FADs

MMPA Import Rule – influential incentive for change?

5. MODIFY GEAR/PRACTICES (VERTICAL LINES)

~~Stiff rope~~

Weaker ropes

Colored/Illuminated rope

~~Tag lines~~

Rope-less fishing using
acoustic/trigger releases or
grappling

~~Time tension line cutter~~

~~Acoustic deterrents~~

~~Whale-free buoy~~

~~Buoy line trigger device~~

~~Lipid soluble rope~~

Main Focus: Vertical Lines



Modify gear/fishing practices

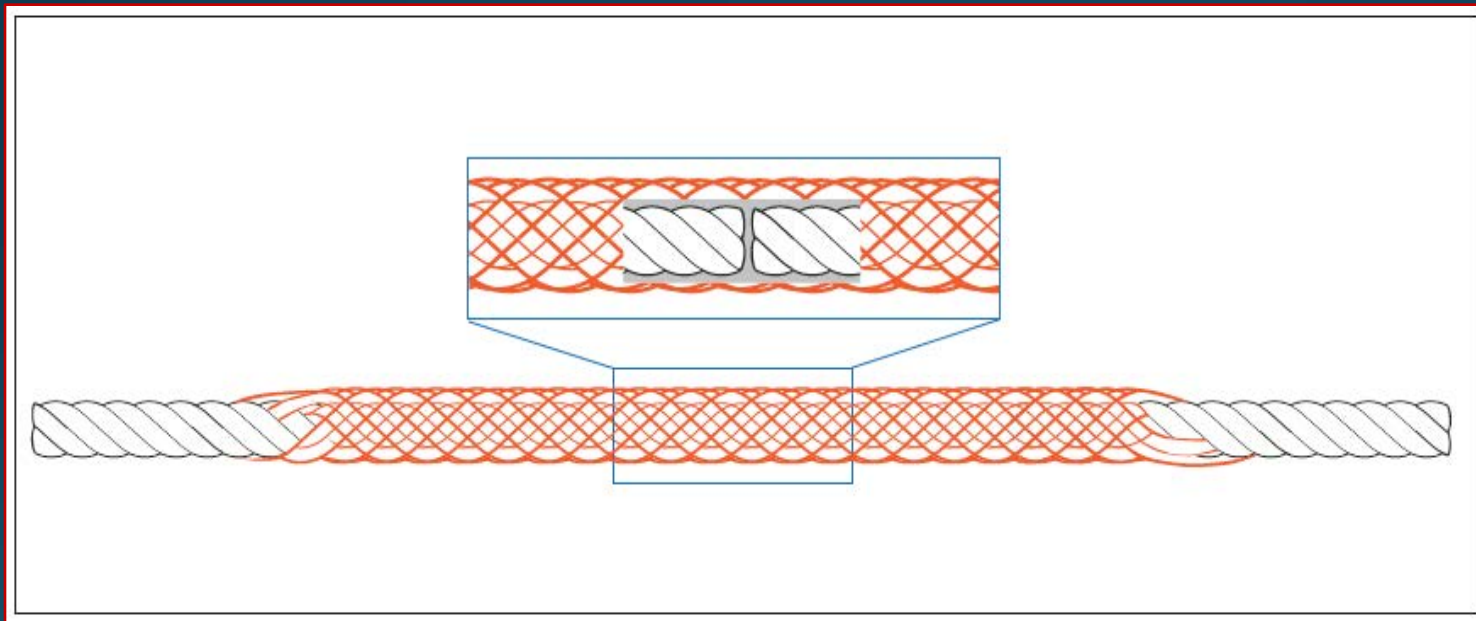
Color/illuminated rope: NARWs show a greater avoidance time with red/orange ropes vs other colors (Kraus and Hagbloom, 2012)

Whale-release (≤ 1700 lbf) rope: NARWs and likely HWs more likely to break free from ropes at this breaking strength (Knowlton et al. 2016)

Pop-up buoys (and other “rope-less fishing techniques”):
No pot ropes in the water, no entanglement risk

Whale-release rope

The Braided Sleeve



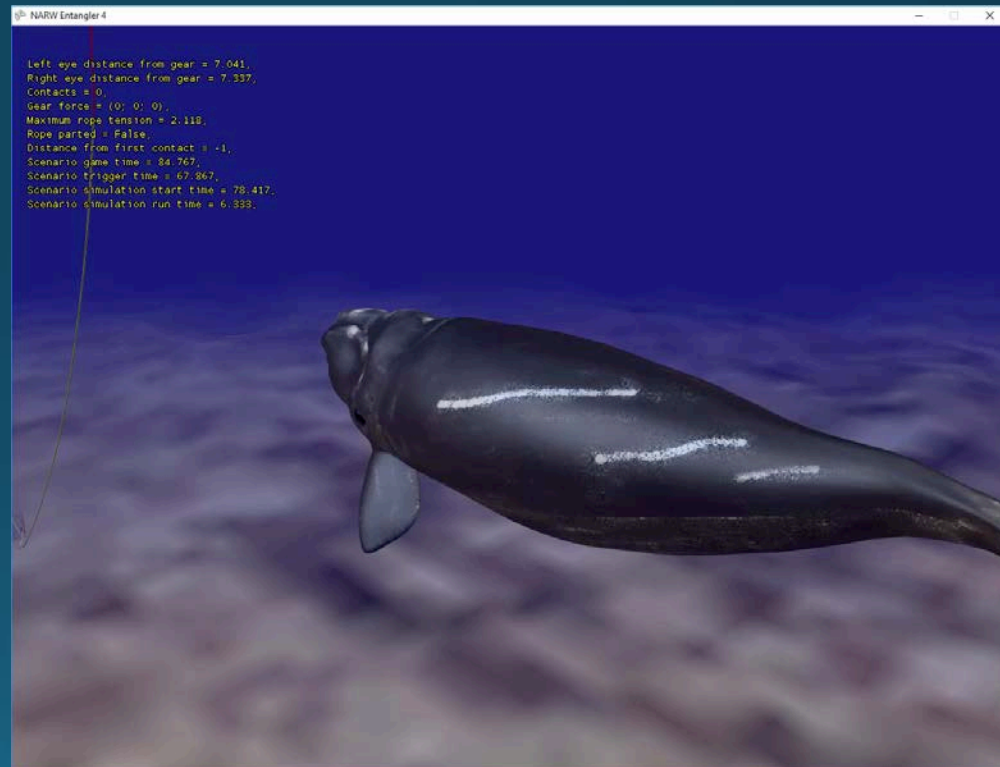
Field Trials: Whale-release rope



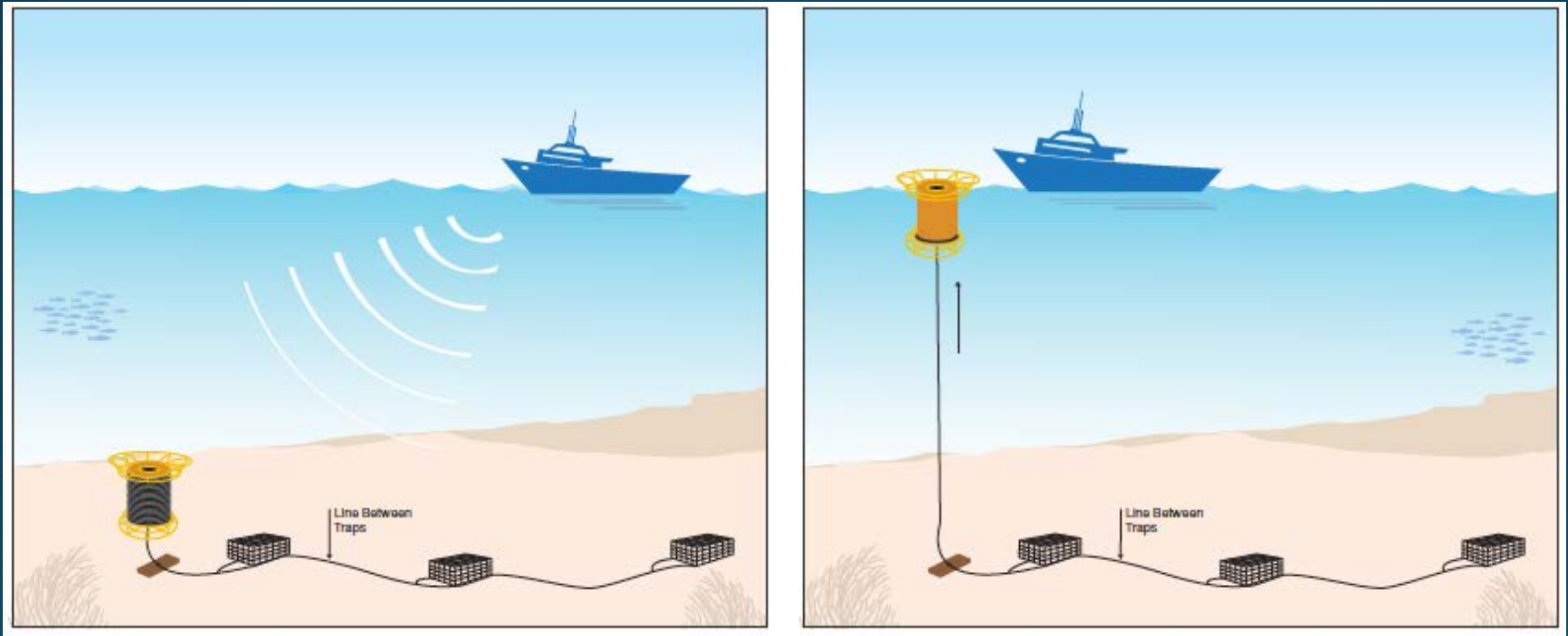
- Massachusetts, so far
- Braided sleeves inserted every 40' of vertical line (3/8" Everson Pro or Manline)
- 80 experimental lines fished in same area as 80 normally configured endlines (control)
- Lobster, whelk, black sea bass
- 1-20 pot strings
- Depth: 80-310'
- July 2017 -

Lab Trials: Whale-release rope

- Pre- and post-fishing breaking strength
- Qualitative analysis of rope degradation
- Modeling rope tensions using load cells and *Orcaflex* software
- Modeling rope tensions using the Virtual Whale Entanglement Simulator



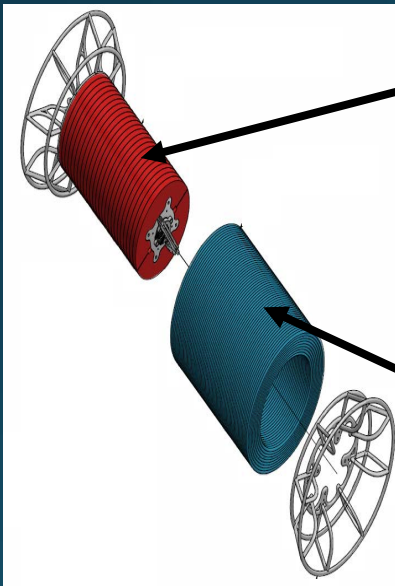
Pop-up Buoys/"rope-less fishing"



Offshore Rope-Less Gear Prototype Design



32" diameter; 43" tall
130 lb empty (as hauled aboard)
340 lb w/ 900m 1/2" line

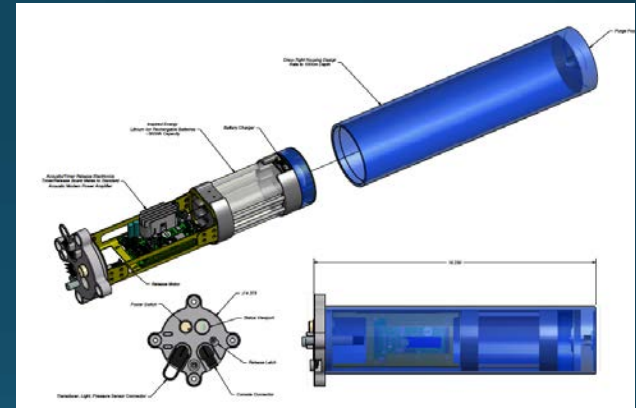


Low-Density Syntactic Foam (450m operational depth); >180lb buoyancy

To respool rapidly, remove "cheek cage", slide on pre-spooled line cartridge.

Spool + line weight ~ same as 180lb anchor

Acoustic Release fits inside spool core

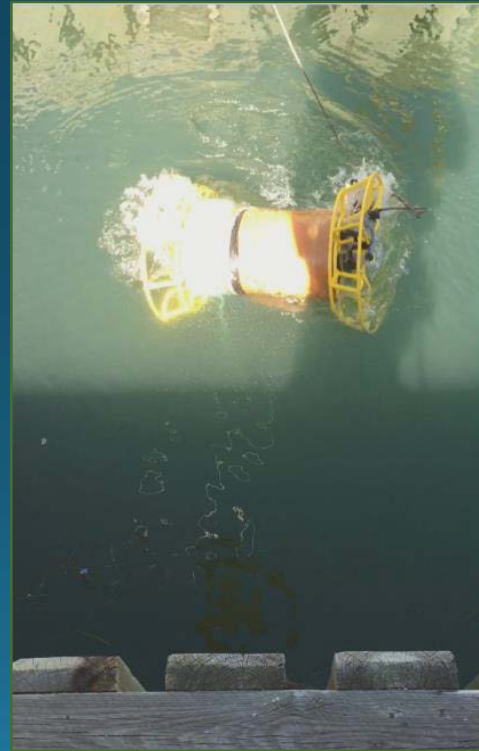


Acoustic tag readable by any vessel with deck unit; Unique signal for each owner/trawl

Modular design for application in multiple environments

Flotation spool/pop-up buoy evaluations

- WHOI Bench testing: 100% successful mechanical releases
- Four successful acoustically released line in dock testing



Flotation spool/pop-up buoy evaluations

Next Steps (2017-2018)

- Phase 1: Additional dock testing
- Phase 2: Evaluate on a research vessel
- Phase 3: Test with fishermen
- In tandem: Evaluate management and commercial considerations



POP-UP BUOYS IN USE!

Demonstrates commercial viability

Several US trials demonstrated functionality: DeAlteris 1999; Hopkins and Hoggard 2006; Allen and DeAlteris 2007

Advantages of “Rope-less” fishing

- No entanglements
- Fewer vessel conflicts
- Each release could incorporate GPS coordinates so that all vessels can detect the presence and orientation of bottom gear, and assist monitoring of the fishery
- Potential recouped losses from ability to relocate and retrieve derelict gear lost in storms or from vessel conflicts

Disentanglement versus prevention



OPTIONS SUMMARY

NO EVIDENCE REQUIRED

- Terminate pot fishing
- Fish without ropes

SOME SUPPORTING EVIDENCE

- Whale-release ropes
- Colored ropes

EVIDENCE NEEDED

- Impacts of permanent, seasonal, or dynamic area closures at the *population* level
- Reduced effort
- Catch shares
- Promoting “sustainable” fisheries; boycotts/bans of products from fisheries that entangle whales
- Other gear modifications

Our Working Strategy



Gear modifications need to be a centerpiece of whale entanglement prevention, even if area closures are enacted

Use whale-release rope in the short-term where feasible (such as with light duty gear) that may be visually enhanced

Study implications of using whale-release rope on entanglements using the Virtual Whale Entanglement Simulator

Increase scale of evaluations with fishermen of “rope-less” technologies

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