GEAR RESEARCH NEEDS and THE ATLANTIC LARGE WHALE TAKE REDUCTION PLAN

September 2015
WORKING DRAFT MATRIX
Provided to the Atlantic Large Whale Take Reduction Team

Background

Coordination between gear research and management is critical in order to help NOAA's National Marine Fisheries Service (NMFS) and the Atlantic Large Whale Take Reduction Team (ALWTRT) effectively reduce the serious injury and mortality of right, humpback and fin whales in commercial fisheries. This matrix is intended to identify and prioritize research needs related to reducing risks associated with vertical lines and groundlines.

Gear Research Needs

The gear questions and needs outlined in this matrix were taken from modifications presented and discussed at ALWTRT meetings and NMFS/Marine Mammal Commission workshops, amongst other sources. NMFS has incorporated suggestions made by the ALWTRT as appropriate. Also, NMFS intends to continue to modify and /or update the matrix yearly.

Although not included in the matrix, NMFS recognizes that gear marking may play an effective role in evaluating the gear modifications listed. NMFS therefore believes that gear marking is an important gear-related research need. Specifically, development of a technological device for gear marking purposes (e.g. bar code, electronic tagging) would provide additional information about the nature of the gear involved in an entanglement. Any research should focus on gear marking technology that handles the rigors of commercial fishing industry and can be easily affixed to the gear.

Select Gear Research Priorities

- Research related to reducing risk associated with vertical lines (including lipid soluble rope, thwartable bottom links, the time tension line cutter system, and other technologies)

- Development of a device for gear marking purposes (e.g. bar code, electronic tagging); should handle the rigors of commercial fishing and be easily affixed to the gear

For further information or questions, please contact John Kenney, NMFS Greater Atlantic Region, Gear Research Team (John.F.Kenney@noaa.gov or (401) 294-0443)

NOTE: Please see the companion "Whale Research Needs and the Atlantic Large Whale Take Reduction Plan" for identified and prioritized research needs regarding aspects of large whale behavior, including habitat usage, as well as foraging, migrating and breeding ecology.

Modification	Description	What it does	Is the technology currently available?	Gear Research Needs	Safety issues	How practical is it from an operational standpoint measure on a scale of 1 to 10? (10 is high)	How effective as a risk reduction measure on a scale of 1 to 10? (10 is high)	Comments, Recommendation, etc.	Research Priority	Status of Research
Surface System of the Buoy Line										
Reducing the separation between buoys in the surface system	Highflier and tide ball are held close to each other until it is time to haul the gear.	Reduces the horizontal line at the surface between the buoys of the surface system.	No	Develop techniques to reduce distance between surface system buoys while the gear is fishing and also provide the necessary slack between buoys required for hauling operations.	None anticipated	Unknown	8	Pursue efforts to develop potential methods with an emphasis on usability under expected at sea conditions.	High	Concept
Eliminate knots in the vicinity of a weak links.	Provide a simple means of connecting two ropes to each other without the bulk associated with a knot.	Increases the chance that a buoy weak link will have an opportunity to function by eliminating the need to use knots to attach ropes to each other.	No	Develop techniques that will lead toward knotless splicing methods.	None anticipated	Unknown	4	Pursue efforts to develop potential methods with an emphasis on usability under expected at sea conditions.	Low	Concept
Consider lowering weak link breaking strengths	Lower the maximum weak link breaking strengths from that currently allowed.	Lowers the force required to part the buoy away from the buoy line.	Yes	None at this time.	Yes	2	3	Maintain current requirements as NMFS believes they are currently as low as is practical. Additional reductions could jeopardize safety.	Low	None Initiated
Prohibit the use of floating line in surface system (SS).	Require that sinking rope be used in the SS.	Would lower the profile of the SS in the water column.	Yes	No research needs have been identified.	None	10	3	Low priority.	Low	Concept
Type of buoy	*Whale-Free Buoy,* developed by M.I.T Sea Grant.	Design of this device relies on a gradual transition from a limp buoy line to the stiff buoy in order to allow it to *flow* around an appendage if encountered by a whale.	No	Need to conduct field work to establish what fisheries and under what conditions the buoy will function satisfactorily from an operational standpoint. Investigate potential of incorporating a weak link into the device.	None anticipated	6	3	Not seen as a high priority in the absence of information supporting entanglement risk reduction.	Low	Developed by MIT with some support from the NEC.
Weak links	A device or technique used to reduce the breaking strength at a particular point in the gear to a predetermined maximum value, usually considerably lower than the strength of the line it is placed in.	Placement of weak links at buoys as well as other critical locations in gear allow a component of the gear to release in the event of an entanglement at a load considerably less than the strength of the line it is placed in.	Yes	None at this time.	None	9	3	Consider implications to new fisheries that might be brought into the plan.	Low	Complete

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Require surface system weak link for some offshore fisheries.	Place an additional weak link at the connection of the surface system and the buoy line.	Provides an increased measure of protection in the event of an entanglement while not compromising the weak link configuration currently required.	Yes	None at this time.	None	8	4	Do not pursue based on Atlantic Large Whale Take Reduction Team discussions.	Low	No research needed at this time
Buoy Line										
Thwartable Bottom Link	A device located at the bottom of a buoy line that will act as a weak link until the gear is ready to be hauled. At that time the device is switched from a weak link mode to a strong link mode, allowing the gear to be hauled.	In the "weak link mode" the device will release the buoy line from the bottom gear if a load exerted on the buoy line reaches a predetermined value. In order for the gear to be hauled the device must be told to change from "weak link mode" to "strong link mode."	No	Develop innovative techniques that utilize the thwartable link concept such as: acoustic, galvanic release, electric rope, timer, etc.	Unknown	Unknown	8	Pursue efforts to develop potential methods/techniques with an emphasis on cost and usability under expected at sea conditions.	Medium	Concept
Weak line with groundline extension	Vertical line with breaking strength of approximately 1000 pounds or less. Extend groundline between first & second pot so that vertical line is only hauling the weight of the first pot to the surface.	The weak line will allow a whale to break free from the bottom gear no matter where in the line the entanglement occurs.	Yes	Research has been conducted through the Fishing Gear Research Program to develop a weak rope product. The outcome of the Consortium's 'Biodynamics of Large Whale Entanglement' project may provide insight relative to the effectiveness of this type of modification.	Unknown	3	7	Re-evaluate this concept based on the outcome of the Consortium's 'Biodynamics of Large Whale Entanglement' project.	Medium	Concept
Visible rope	Rope that can be seen by whales.	A rope that is visible to a whale may allow the whale to avoid it.	No	Follow through with current Consortium for Wildlife Bycatch Reduction projects.	Unknown	Unknown	Unknown	Determine effectiveness of a visible rope relative to whales before pursuing additional development of visible rope.	Medium	The NEAq Consortium for Wildlife Bycatch Reduction is involved with projects to estimate the retinal visual pigment spectral sensitivities and evaluate avoidance behavior based on visual cues. The NEAq is furthering these efforts through a 2012 grant from NOAA's Bycatch Reduction Engineering Program.

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Slippery Rope	Develop a rope that is slippery to help reduce the entanglement risk to whales.	A slippery or low friction rope might pose less of a risk by allowing an entangled whale to shed gear more easily.	No	No short term research anticipated.	None	7	4	Determine if a slippery rope poses less of a risk to whales.	Low	Some preliminary work conducted by NMFS & WHOI.
Stiff rope	A rope that is stiff may be less susceptible to wrapping around a whale or appendage.	If buoy lines were too stiff to wrap around an appendage it is thought that they would pose less of an entanglement risk than pliable ropes currently used by industry.	No	Research is currently being conducted by NEAq/Consortium for Wildlife Bycatch Reduction to evaluate the potential of stiff rope in reducing entanglement risks.	Unknown	Unknown	4	Determine if stiff rope poses less of a risk to whales.	Low	Several types of stiff rope have been developed and evaluated. The NEAq Consortium for Wildlife Bycatch Reduction in conducting research on stiff or tensioned endlines.
Lipid Soluble rope	A rope that would quickly deteriorate if it came in contact with a whale.	A rope that would have characteristics suitable for use by the fishing industry that upon contact with a whale resulting from an entanglement would rapidly deteriorate	No	Conduct a feasibility study to determined efficacy of proceeding with development of this concept.	Unknown	Unknown	9	Conduct a feasibility study and if appropriate continue with development of product.	Low	Concept
Electric rope	A rope that conducts electrical signals or other type of information.	Having the ability to send information through the buoy line would allow communications with devices on the bottom such as a thwartable bottom link mentioned above.	No	Conduct a feasibility study to determined efficacy of proceeding with development of this concept.	Unknown	Unknown	Unknown	Conduct a feasibility study and if appropriate continue with development of product and system designs.	Low	Concept

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Light tag line to heavy hauling line	A light tag line runs from the surface buoy down to the gear. The bottom end of the tag line attaches to a hauling line. The hauling line is brought to the surface by the tag line and the gear can be retrieved.	Replaces traditional vertical line with a lower strength line that would have less impact on a whale should an entanglement occur.	No	None at this time.	minimal	3	3	Low priority.	Low	Concept
Two Buoy System	A buoy system that essentially reduces the scope of the buoy line during conditions requiring less than the total amount available.	The system consists of a typical surface buoy at one end of the buoy line and a smaller buoy at the other end. The buoy line passes through a pulley that is attached to the bottom gear. The buoyancy force of the smaller sub-surface buoy reduces the effective scope of the buoy line between the surface buoy and the bottom gear.	No	No short term research anticipated.	Unknown	Unknown	3	Low priority	Low	Some preliminary trials have been conducted by MADMF.
Time Tension Line Cutter bottom release	A device located at the bottom of a buoy line that will release the buoy line from the bottom gear after a predetermined load and time period have been exceeded.	The device cuts the buoy line away from the bottom gear if a load is exerted on the buoy line for a time longer than the device set to accommodate. E.g.: if normal fishing conditions require 5 minutes to haul the gear the device could be set to trigger the cut after a 10 minute time period. Thus, a whale entangled in the buoy line would be released from the bottom gear after pulling on the buoy line for 10 minutes.	Yes	Develop methods to safely handle the device as it comes aboard.	Yes Safety concerns result from difficulties associated with getting the device around the block and hauler (not an issue when employed with singles).	3	7	Continue field testing with a goal of developing practical handling methods to get the device around the block and hauler.	Low	The basic functionality of the device has been pretty well proven. However, there are issues getting the device around the block and the hauler.

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Weak link that breaks at a certain angle.	A device that attaches to a buoy line that will cut the line if the angle of the buoy line reached a certain angle.	When placed at the bottom of the buoy line this device will cut the buoy line away from the bottom gear due to the geometry of the gear resulting from an entanglement.	No	No short term research anticipated.	Unknown	Unknown	7	Recommend **not** pursuing development of this device at this time due to reasons discussed in "Working Draft of a Strategy to Reduce Large Whale Entanglement Risk Associated with Vertical Line"	Low	Concept
Buoy line Messenger System	A system that allows the gear to be set and marked with a low strength buoy line. Deployment of a messenger device with a hauling line allows the gear to be retrieved.	Gear is set with low strength endlines which mark the gear while it is fishing. To haul the gear a messenger device attached to a hauling line is sent down the low strength end line and attaches to the gear. This hauling line is then used for retrieving the gear.	No	Develop a system that addresses known operational problems, develop, test and evaluate prototypes.	Yes	2 (could increase if research is successful)	3	Recommend **not** pursuing development of this device at this time due to reasons discussed in "Working Draft of a Strategy to Reduce Large Whale Entanglement Risk Associated with Vertical Line"	Low	A proof-of-concept project, funded by NMFS, was conducted in the '90's.
Composition of the buoy line	Allow buoy lines to be comprised of sinking and floating line	Allowing floating rope to be used in the buoy line reduces the chance of the buoy line fouling and chafing on the bottom.	Yes	MADMF and NMFS tests showed that the composition of the buoy line, including 0%, 10% 33%, 67% and 100% floating line, had very little influence on its profile with a current greater than 0.5 knots. Independent, full-scale field-tests comparing buoy lines of different composition showed very similar results.	None	10	N/A	No further research necessary.	Low	Completed

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Reducing the Number of Vertical Lines										
Acoustic Release	Elimination of vertical line from the water column.	Holds the buoy and buoy line on the bottom until it is time to haul the gear.	No	Develop a robust low cost acoustic system. Research and design other components of the system, eg: buoy, endline, handling & packaging, deployment, etc. Need to address gear conflict issues - unmarked gear.	Yes	2 (could increase if research is successful)	10	Any future efforts should be aimed at developing a "low cost" acoustic device as the current cost is prohibitive. Need to address regulatory marking requirements. Further discussion is needed to address gear conflict issues arising from having un-marked gear.	Medium	The NEAq Consortium for Wildlife Bycatch Reduction is conducting additional research. No reliable system has been developed.
Increase the number of pots per trawl.	Increase the number of traps to reduce the number of buoy lines.	Reduces the number of vertical lines by increasing the number of traps per vertical line.	Yes	No research has been identified however, significant safety issues could be involved with any requirement to increase the number of traps per trawl.	Yes note A	note A	10	Coordinate with state and federal managers to make any regulatory changes.	Low	NMFS is undergoing rulemaking to require an increase in the number of traps per trawl based on area fished and miles from shore.
Elimination of one Vertical endline	Remove one of the two endlines marking a trawl or string of gear.	Has the potential to reduce the number of vertical lines.	Yes	No research has been identified however, there could be significant weather related safety issues due to losing the choice of which end to haul from relative to wind and sea conditions.	Yes Note B	3	10	Need to address regulatory marking requirements. Further discussion is needed to address gear conflict issues arising from having un-marked gear.	Low	No research needed at this time

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Mechanical Time Release (MTR)	Holds the buoy and buoy line on the bottom for a predetermined length of time and then releases buoy allowing it to float to the surface with the buoy line.	The MTR is a small mechanical timer that can be set to release after a set period of time. It is used as a latch, holding the buoy and buoy line on the bottom until timer releases the buoy & line. Function is similar to the galvanic time release below.	No	Research and design of all components of the system, eg: buoy, endline, handling & packaging, deployment, etc. Need to address gear conflict issues - unmarked gear.	Yes	2 (could increase if research is successful)	8	As significant technical and regulatory obstacles will need to be overcome, careful consideration regarding R&D of this modification is necessary. Need to address regulatory marking requirements. Further discussion is needed to address gear conflict issues arising from having un-marked gear.	Low	Concept
Galvanic Time Release (GTR)	Holds the buoy and buoy line on the bottom for a predetermined length of time and then releases buoy allowing it to float to the surface with the buoy line.	Holds the buoy and buoy line on the bottom for a predetermined length of time. The GTR is a small device that when placed in seawater deteriorates at a predictable rate. It is used as a latch, holding the buoy and buoy line on the bottom until it has deteriorated and releases the buoy & line.	No	Research and design of all components of the system, eg: buoy, endline, handling & packaging, deployment, etc. Need to address gear conflict issues - unmarked gear.	Yes	2 (could increase if research is successful)	8	As significant technical and regulatory obstacles will need to be overcome, careful consideration regarding R&D of this modification is necessary. Need to address regulatory marking requirements. Further discussion is needed to address gear conflict issues arising from having un-marked gear.	Low	Some preliminary research has been conducted by the NMFS Gear Research Team

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Ground Line										
Conversion to wire rope	Replace existing ground lines with wire rope.	Removes the ground line from the water column by replacing it with sinking wire rope.	Yes	Research and design of all components of the system, eg: ondeck reels, connection techniques, etc.	Unknown	Unknown	7	Not seen as a high priority at this time as other more conventional methods exist (sink rope), however, it may address the longevity concerns associated with other products currently available.	Low	Concept
Zap Link	A device placed in the ground line that will release if a whale encounters the ground line and exerts a force in excess of 200 pounds.	The device is placed in the ground line between traps. The gear must be set and hauled from a particular end. When the device is tipped in one direction it can carry the rated load of the rope, however, when tipped in the opposite direction as would happen if a whale encountered the ground line the device would come apart releasing one end of the ground line.	Yes	Evaluate known operational problems and determine how practical the device is in different gear configurations.	Unknown	2	3	Recommend **not** pursuing development of this device at this time.	Low	Prototype completed
Type of rope	Replace floating ground lines with sinking rope.	Floating rope between traps in a trawl or between a gillnet and an anchor have been shown rise up to 25 feet or more above the bottom posing a risk to passing whales. Rope that sinks would tend to rest on the bottom posing little to no risk.	Yes	Develop more durable products to better withstand the riggers bottom contact.	No	7	8	Encourage rope manufacturers and industry to work together to continue the development of improved products.	Low	Rope manufacturers and idustry continue to work together to develop new and better products.
Reduced profile	A modification to existing floating ground line that would lower its profile in the water column and consequently reduce its threat to whales.	Still in somewhat of a conceptual stage, one possible scenario is to add weight at intervals along the floating ground line in order to make it sink.	Yes	None at this time.	Unknown	Unknown	Unknown	Do not pursue based on Atlantic Large Whale Take Reduction Team discussions.	Low	Completed
Note A. Customarily, the number of traps per trawl is dictated by a variety of factors such as vessel size, vessel set-up, local customs, fishing conditions, etc. Pushing the number of traps per trawl beyond the vessel's capability is a safety issue.										
Note B. The elimination of one vertical endline will often result in the gear having to be hauled with a vessel heading unfavorable to current weather conditions. With both endlines present, the most favorable hauling direction can be chosen.										