

# 2006 Supplement to the Large Whale Gear Research Summary

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This collection of information represents select research projects conducted by the NOAA/Fisheries Northeast Regional Office (NERO), Protected Resources Division (PRD), Gear Research Group, unless otherwise noted. This is a supplement to the 3<sup>rd</sup> edition, April 2003. As new research becomes available, it will be included in a subsequent supplement. For updates, additional copies, questions, comments, etc., contact:

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Additional information can be found at the “**Atlantic Large Whale Take Reduction Plan**” website:

<http://www.nero.nmfs.gov/whaletrp/>

# Investigation of SAM Gillnet Gear

NMFS, NERO Gear Research Team  
December, 2003

## **Background**

Atlantic Large Whale Take Reduction Plan (ALWTRP) regulations require that gillnets set in Seasonal Area Management (SAM) locations be modified with additional net panel weak links. To meet the regulation, each 50 fathom net section needs to have five 1100 pound breaking strength weak links installed in it. Three of the weak links are in the floatline and one is installed in each of the up and down end lines that join the floatline to the leadline.

## **Methods**

In the spring of 2003 the National Marine Fisheries Service (NMFS) Northeast Regional (NER) Gear Research Team had 50 sink gillnets built which met the gear modification requirements of the SAM areas. The net sections were attached together to form strings of nets with each string having 10 to 20 net sections. This configuration of individual gillnets forming a string is consistent with traditional sink gillnet fishing practices. Each string of gillnets was anchored using two 25 pound Danforth style anchors, with one anchor attached to each end of the string, meeting the SAM anchoring requirements. Anchor groundline used was a section of 7/16ths sink line.

The nets were distributed to fishermen in Chatham, Massachusetts, Monhegan Island, and Stonington, Maine. The nets were fished in areas ranging from the Great South Channel to the offshore waters of the eastern Gulf of Maine. The SAM net strings were fished with conventionally hung nets having only one weak link in the center of each net's floatline. A member of the NMFS NER Gear Team made a three-day trip in May 2003 aboard a 44 foot offshore gillnet vessel fishing 20 SAM nets. The 20 SAM nets were configured in two 10 net strings with 25 pound Danforth anchors rigged at each end of the strings. The two 10 net SAM strings were set and hauled with four conventional net strings having 15 net sections per string and using a 50 pound steel dead weight to anchor the end of each string. The gear was fished off the northeast edge of Davis Swell in depths that ranged from 85 to 110 fathoms along the northeastern Gulf of Maine. Over the three day trip, the six gillnet strings were set and hauled three times for a total of 18 set and haul operations.

## **Results**

### Conventional gear

Two lead line failures occurred on day one. The parted line was repaired with a square knot and taped over with black electrical tape. These repairs held for the remainder of the trip. The failures occurred in net sections near the center of the string.

Three floatline failures occurred. One was at the point of the weak link rigging. The failures occurred in the last two nets of a string. These were repaired with a square knot and taped over with black electrical tape. The repairs held for the remainder of the trip.

The dead weight anchors rolled up four times in the end net panel.

### SAM Gear

No leadline failures occurred.

One floatline failed at the point of the weak link rigging. It was repaired with a square knot and taped over with black electrical tape. The repairs held for the remainder of the trip.

One 25 pound Danforth anchor was damaged when the shank was bent over the fluke at a 45-degree angle.

### **Discussion**

The NMFS supplied SAM nets were new and had not undergone any of the abrasions and wear which come from fishing operations. The conventional nets had approximately 70 set and haul cycles of wear on them. This probably contributed to the failures experienced by the used gear.

Comments on the performance of the weak links from participating fishermen in Chatham, Massachusetts, who fish the Great South Channel, and Monhegan Island, Maine fishermen, who fish the Gulf of Maine, were consistent with the performance documented in the three-day trip aboard the Stonington, Maine-based gillnetter.

# Investigation of Gillnet Weak Links and Anchoring Systems

NMFS/NERO Gear Research Team  
April, 2005

## **Background**

Current Atlantic Large Whale Take Reduction Plan (ALWTRP) regulations require gillnets that are not returned to port with the vessel between December 1 and March 31<sup>st</sup> to be anchored with an anchor which has the holding power of a 22 pound Danforth. Some fishermen along the North Carolina coast set gillnet gear overnight within 300 yards of the beach and run them out perpendicular to the shore line. Vessels fishing in such close proximity to the surf line are unable to safely retrieve burying type anchors on the shore side end of net. Anchors in the 22 pound Danforth range used on the net's outside end (within 300 yards of beach) also present safety issues for these small vessels most of which are in the 20 foot range. The purpose of this investigation was to document fishing practices in this fishery and investigate several scaled down anchoring system and weak link combinations that would better meet the needs of the fishing industry while allowing an entangled whale to break free of the gear and avoid a serious entanglement.

## **Methods**

The NMFS NER Gear Team in conjunction with the Southeast Regional's (SER's) Fisheries Liaison and a commercial fisherman from North Carolina conducted an investigation of weak links and anchoring systems that would allow fishermen safe retrieval of gear while ensuring weak links placed in net panels would perform as designed. Several types of anchoring systems and weak link breaking strengths were examined during the investigation. Breaking loads were registered on the tow line and not at the weak link.

The nets used in this project were 100 fathoms long and each set used a single net. All nets were rigged with 5/16" twisted poly floatline and 65 pound leadline. Mesh size ranged from 3 inch to 3-1/4 inch. A tow line of approximately 15 fathoms was attached to the floatline near the center of the net and the other end was aboard the fishing vessel. A load cell was placed in line with the tow line to measure the load the vessel was exerting through the tow line to the gear. In all the sets except for *set # 3*, the vessel began to pull on the tow line at a speed of approximately 2 knots in a direction perpendicular to the net (Figure 1). The increasing load in the tow line was monitored with the load cell. The failure of a gear component (weak link, etc.) was accompanied by a sudden drop in the tow line load. This work was conducted from a 22 foot open vessel with a 225 Hp outboard.

Set # 1: The floatline was rigged with 600 pound weak links every 25 fathoms and 8 pound Danforth anchors were used at each end rigged with 18 inches of 1/4" chain and 8 feet of groundline. The gillnet was set perpendicular to the beach with the inshore anchor set in 8 feet of water and offshore anchor set in 15 feet of water. When a load of 350 pounds was reached a weak link parted and the test stopped.

Set # 2: The same gear and rigging arrangement as *set # 1* was used with the exception of the inshore anchor. For this test the 8 pound Danforth was replaced with a 31 pound dead

weight attached to the net by an 8 foot groundline. The floatline weak link parted when the tow line load reached 460 pounds.

Set # 3: Using the same gear and rigging as set # 2, the inshore anchor was set in 3 feet of water and the offshore anchor was set in 11 feet. The offshore anchor along with the end of the net was then brought aboard the vessel and the floatline was made fast to the vessel. The vessel attempted to tow the entire net away from the beach into deeper water. A typical fishing practice in the area is to pull the gear into deeper water to avoid swamping the vessel in the surf while retrieving the net, especially in foul weather conditions. The net was successfully pulled out of the surf line without breaking the 600 pound weak links.

Set # 4: Using a similar arrangement as set #1, the 600 pound weak links were replaced with 1100 pound weak links and the 8 pound Danforth anchors were replaced with 13 pound Danforth anchors. With an 811 pound load in the tow line the floatline parted at a splice.

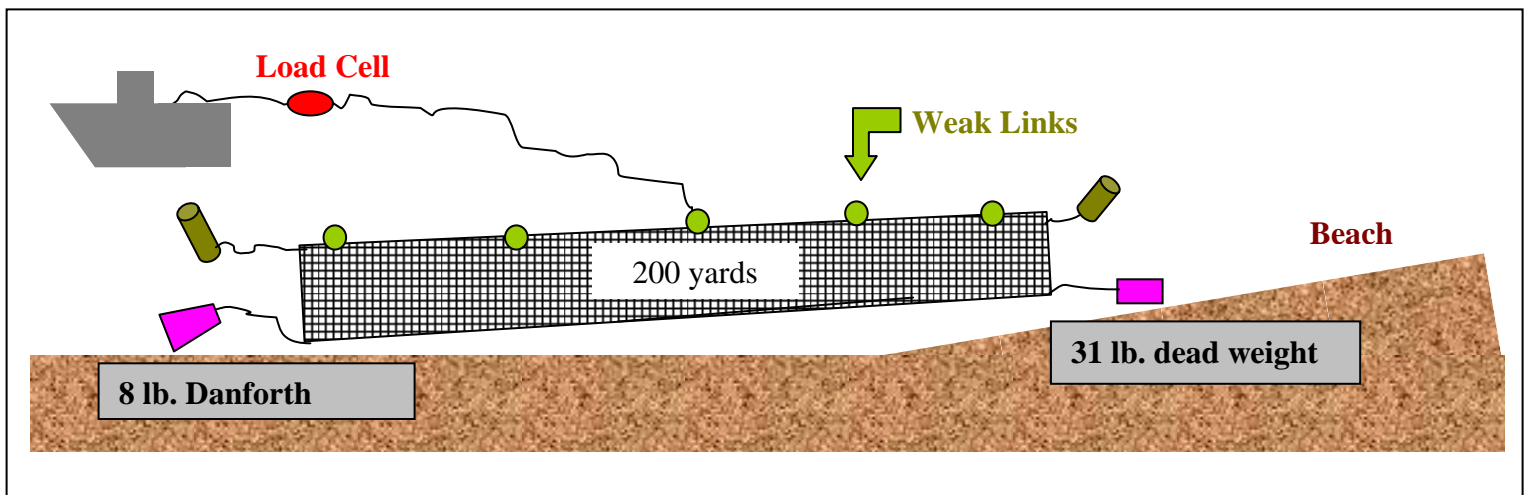
Set # 5: Same arrangement as used in set #4. The load in the tow line was increased to a point that caused failure of the up and down line joining the floatline to the leadline at the end of the net. The leadline also parted causing the loss of an anchor.

Set # 6: Same arrangement as used in set #4, with the exception of the inshore anchor. For this test the 13 pound Danforth was replaced with a 31 pound dead weight attached to the net by an 8 foot groundline. The first attempt to part the weak links resulted in parting the tow line at 860 pounds. Subsequent attempts to part the weak links were unsuccessful and resulted in dragging the anchors.

## Discussion

The test results above point out the importance of the relationship between the weak links and the holding power of the anchoring system. If the anchors cannot provide sufficient resistance then the weak links will not part. Set # 2 (Figure 1) rigged an 8 pound Danforth on the offshore end and a 31 pound dead weight on the inshore end showed that the 600 pound weak link parted with a 460 pound load on the tow rope, a load less than what would be required to part an 1100 pound weak link. This particular rigging arrangement also allows the gear to be fished in a manor which will not compromise safety practices currently utilized by this fishery.

**Figure 1.** Typical gear configuration for sets 1 through 6, set # 2 shown.



# Evaluation of Weak Link Performance in Offshore Gillnet Gear

NMFS/NERO Gear Research Team  
September, 2006

## **Background**

Net panel weak link requirements under the Atlantic Large Whale Take Reduction Plan (ALWTRP) for gillnet gear call for up to 5 weak links per net section in specific areas. The project described in this report investigated whether commercially fished gillnets equipped with 1100 pound net panel weak links as required in the ALWTRP, as well as other net panel weak link modifications, can be successfully fished at depths to 150 fathoms.

## **Objective**

The purpose of this project was to evaluate the operational performance of net panel weak link equipped gillnets fished in water over 130 fathoms deep. The tests included three variations of weak link configurations. The first, which is required under current Seasonal Area Management (SAM) regulations, has three weak links installed in the floatline of each 50 fathom net section. In addition, one weak link is in the up and down line at each end of the section. The up and down line attaches the float and lead lines.

The second configuration is a modification of the first, which is not currently required, but is being considered. This has one weak link in the center of the floatline and one in each up and down line. A fourth link is installed between the ends of the floatlines where adjacent sections are normally tied together to make up a string of nets.

The durability of these "SAM" nets was to be compared to the third configuration, the "non-SAM", standard ALWTRP nets, which have only one weak link in the net panel in the center of the floatline.

## **Methods**

In July 2005, twenty test nets were constructed (hung) by a Portland, Maine, fisherman. Ten were SAM nets with three weak links in the floatline, five in total per net. The other ten were modified SAM nets with one link in the floatline, and four in total per net. The weak links used were off the shelf, plastic, molded flat links with breaking strength of 1100 pounds.

The net builder then fished the test nets along with his existing non-SAM groundfish gillnets from his 50 foot gillnetter. The non-SAM nets complied with the ALWTRP weak link requirement by using a short piece of 1100 pound breaking strength rope inserted in the floatline as described in "Techniques for Making Weak Links and Marking Buoys" – April 2003. The test fishing took place in depths greater than 130 fathoms to test the net performance under the sea conditions and hauling loads found offshore. The vessel uses a Spencer Carter #5 gillnet hauler. The Spencer hauler is designed to handle the loads when hauling nets fished in waters over 100 fathoms. The condition of the nets and weak links was monitored for wear and failure by the captain and crew. If problems with the gear had occurred, a member of the NMFS NER Gear Team was to make a trip on the boat, but this was not needed.

## **Results**

Construction of the twenty test gillnets were completed and were loaded aboard the vessel in July 2005. The boat incorporated the test nets into the daily fishing operations, and fished them with the vessel's standard gillnets.

After four months the test nets were being fished to depths exceeding 130 fathoms and there were no reported weak link failures. This time frame represents 25 fishing days with hauls and sets of the gear. After inspection of the test nets, the captain and crew reported the performance of the nets and weak links had been very good. The captain contended that the off the shelf weak links were superior to weak links made of 1100 pound strength line spliced into the standard gillnet. The weak links in the modified SAM gillnet gear which were positioned between the net sections where the float ropes are usually tied together, were wearing and performing as well as the other links in the SAM and standard nets.

After nine months the vessel continued successfully fishing the test nets. All configurations of the weak links were performing well. It was estimated that the nets had been hauled and set 50 to 60 times during that time, and the captain stated that the test nets performed at least as well as the standard gear.

After more than a year, in September of 2006, the vessel continues fishing the weak link gillnets at depths reaching 150 fathom. As a result of his experience, the captain has made some alterations to the nets. He has replaced the up and down lines at the ends of each section with light twine having a breaking strength less than 1100 pounds. The use of light twine has eliminated the problem of having the flat plastic weak link get caught in the mesh and provides the end of each frame with a continuous weak link which attaches to the floatline and the lead line.

## **Conclusions**

The captain has stated he will be incorporating the 1100 pound flat weak links into the floatline all of his nets. He claimed the manufactured weak links have performed better than the rope weak links tied in the mid-section of the floatline in his standard nets. He says the tied in lines begin to chaff along the outer most fibers of the over hand knots which give the rope its 1100 pound breaking strength. Maintaining the rope weak links generates work for the crew, which will be eliminated by the plastic links. This project demonstrated that commercially fished gillnets equipped with 1100 pound net panel weak links, as required in the ALWTRP, as well as other net panel weak link configurations, can be successfully fished at depths to 150 fathoms.



# A Pilot Study to Investigate Possible Alternatives to Reducing Vertical Line Entanglements by Marine Mammals

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## Background

Vertical lines are utilized by a large number of fixed gear fisheries along the U.S. east coast and Gulf of Mexico (GOM). Marine mammals that encounter these vertical lines are known to sometimes become entangled. In particular, right whales (*Balaena glacialis*) that frequent the coastal waters have been documented with line in the baleen plates and wrapped around the caudal peduncle or leading edge of the tail fluke. Humpback whales (*Megaptera novaeangliae*) are also known to encounter and entangle lines around their long flippers and bottlenose dolphins (*Tursiops truncatus*) have wrapped line around their tail stock and fins. One approach to reducing possible interactions is to reduce the number of vertical lines in the water column or limit the amount of time they are present or suspended. From June 7-12, 2005 a pilot study was conducted in Panama City, Florida, to look at possible alternatives to current practices used to deploy and recover vertical lines in the pot and trap fishery. In collaboration with Northeast gear specialists, a team of gear specialists and biologists from the Harvesting Systems branch of NMFS, Pascagoula Laboratory, developed and evaluated several possible approaches to reducing vertical lines in the water column. NOAA divers collected underwater footage of mid-water buoy line interactions, acoustic releases, galvanic time releases and a number of line retention and deployment configurations used with the line release mechanisms.

## ➤ Acoustic Release



### Introduction:

The release we chose to test was a simple burn wire that erodes as an electrical charge is introduced. Although not new in concept, only recently has the technology developed and the cost reduced to the point that would allow their potential use in a commercial fishing application. Mechanical releases were also considered and readily available, but because of their increased cost and complexity they were not viewed as a viable option for the commercial fishing industry. The simple burn wire design was the only acoustic release tested.

### Objective:

Test the range and reliability of a non-mechanical, simple acoustic release that would possibly lend itself to commercial fishing applications.

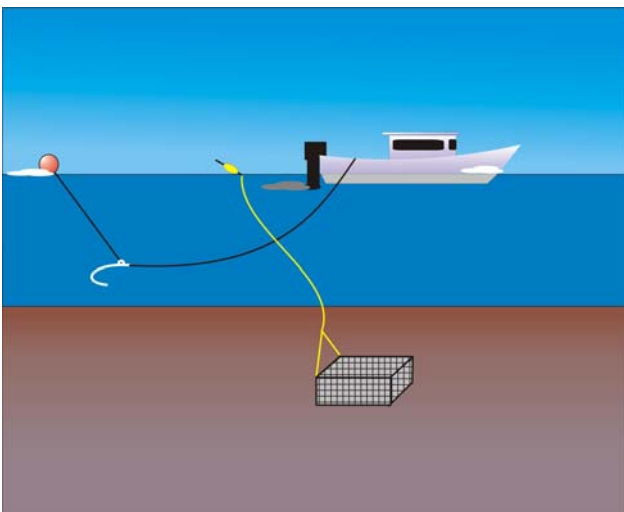
## Methods:

Tests were conducted using commercial lobster pots in an attempt to simulate actual fishing situations. The release was tested in depths that ranged between 12 -19 meters (40-60 feet). All tests were conducted on relatively flat, sand bottom and with an average water temperature of 23.5°C. In addition to lobster gear the release was attached to non-fishing devices in order to test the range and observe different deployment configurations. The acoustic release unit was mounted both horizontally and vertically to look at possible differences in range or reliability. The AR-50 acoustic release used for our work was manufactured by Sub Sea Sonics and is currently being used by crab fishermen on the Pacific coast of the U.S. The unit is rated to depths of 457 meters (1500 feet) and a range of 305-914 meters (1000-3000 feet). The LK-40 erosion links used for this trial are rated to 40 pounds. of resistance. The LK-80 link was not tested, but is available if a more substantial connection is required. Scuba divers documented the release and recorded the actual time from when a signal was received and the time the float was deployed. Different line containment and deployment approaches were tested and their success or failure noted and documented with underwater video.

## Discussion:

Overall the AR50 performed well, the small size and durable construction of both the deck unit and the underwater release lend itself to small commercial applications. Divers were able to determine when the release mechanism received the signal from the command box and recorded the time of each release. We tested the range of the unit in ~250 meter increments and managed to deploy a surface float at 1852 meter (1 nautical mile) on at least one occasion. This was however, not repeatable with any confidence and not until the range was within 926 meters ( $\frac{1}{2}$  NM) did the repeatability return to 100%. One possible caveat in our test area may be the frequent use of military traffic, both vessel and numerous low flying aircraft. Although ambient noise was not measured, we speculate that background noise levels may reduce the effective range, although the unit was very reliable within the manufacturer's specifications. Bottom type and topography also play an important role in the effective range of the unit based on conversations with the maker of the unit. The orientation of the release did not appear to impact the range or release time. The AR50 release could easily be adapted for use in the commercial trap or pot fishery and may provide one possible option to reducing the time vertical lines are in the water column. The greater challenge will likely be to develop a reliable deployment system that can handle sufficient amounts of line and be quickly redeployed. Future work should focus on an efficient line containment device, one that could possibly be reloaded as the floatline is retrieved.

### ➤ Mid-Water Buoy Line interaction



### Introduction:

Buoy lines are found throughout the east coast and Gulf of Mexico and entanglements occur not only on large whales, but also smaller cetaceans and sea turtles. Breakaway gear is a concept that can be adapted by almost every pot fishery. The challenge is that in addition to the use of a buoy line, each fishery has a unique set of variables to be considered. After measuring parameters such as weight, buoyancy and line test of the pot gear on land, we looked at what influence the active fishing

environment had on an interaction. Barring animal behavior such as rolling or diving we tried to simply measure the force applied to the buoy line by an entity moving in a straight line at a fixed depth. With a team of divers and gear specialists, a device was assembled and a protocol for its application created. A hook was developed that could be towed fixed on its side, two fathoms deep and behind a vessel. The hook is attached directly to a tension meter by a towing cable. The hook (Figure above) was held at depth throughout the interaction until the breakaway device activates and the buoy is free from a knotless buoy line. With this type of test the terminal breaking point is scrutinized, as well as the friction factors of different line types, submerged buoy action, how loose scope responds to an interaction at depth.

**Objective:**

To compare breakaway buoy results conducted under a controlled laboratory environment, with that of actual fishing conditions. Attempt to simulate a realistic vertical line encounter at depth (2 fathoms) using a towed prototype hook.

**Methods:**

Two divers with cameras, two vessels and a data collector/surface camera man were used for this operation. The gear team at the Pascagoula laboratory designed and fabricated a breakaway buoy (see figs 1-4) that could be quickly rebuilt with the same breaking strength repeatedly. The team then put together a hook to catch the buoy line two fathoms down. The mid-water hook prototype performed as expected, although it could be improved for future tests. Slack in the scope snagging on the shackle and bights in the wire were the major sources of discrepancies. Minor modifications to the hook have been made to make the hook more predictable. During the first trial, divers could monitor the line and determine if it slipped through the bell of the hook, or was otherwise caught in a bight in a different place in order to make improvements to the device (Figures 5 and 6). The operation of the towing vessel was instrumental to the hook-ups so a number of approaches and speeds were tried and scrutinized for consistency.

Gear configurations to consider for each different pot buoy and break away type used:

- Hook weight and towing cable scope to maintain the interaction depth
- The surface floatation must hold up the weighted hook
- Depth of the hook is determined by the scope from the surface float

**Trial One; developing the protocol**

With divers in the water, observe how the hook device interacts with the buoy line without a diver's assistance. Film the action of the hook as it makes contact with the buoy line. A diver follows it, taking note of the action of the hook and the loose line. Points observed and filmed:

- Film the hook device in the water
- Film the layout of the gear on the bottom.
- How does the buoy line interact with the hook?
- Does the hook need modification to achieve a more acceptable action?
- Does the hook need modification to maintain an acceptable depth?
- How does the depth of the hook vary as it is drawn along the buoy line?
- Note the action of the buoy as the hook pulls on the buoy line.
- Note the action of the traps.
- Film the point when the buoy breaks away.

Film was taken of the protocol on deck, the action of the buoys on the surface the towed hook and the trap buoy. Footage was collected in the water and at the surface to record the operation and to help fine tune the process.

#### Footage on deck

- The tension measuring devices' configuration
- The buoy w/ hook being towed
- The hook interaction with the buoy line as the buoy is pulled under
- The gauged tension as the buoy breaks free

#### Footage in water

- How the hook looks towed through the water
- How the hook interacts with the buoy line
- What the hook/buoy line does as force increases
- The action of the scope during an interaction
- The strain on line and the action on the surface
- How the traps react

#### Force measurements

- The resistance of the device under tow before an interaction
- The tension produced as the line slides through the hook
- Force to sink pot buoy
- Force to lift trap(s), just before the buoy breaks free
- Force to break away buoy

### **Trial Two; Application**

Once the action in the water was acceptable we began work to assess the properties of various buoy line configurations. After Trial One, the hook action in the water was well documented. During Trial Two, the primary goal was to film the hook ups, break offs and the actions of the various line types. Divers were kept in the water during the trials to quickly retrieve the fallen buoy lines and realign any traps that had been moved by the previous test. Two versions of a breakaway buoy and different lines types and sizes were tested, measured and filmed.

### **Discussion:**

It was interesting to see how easy a 2:1 scope would wrap around the hook and snag in a slow (0.5-1 knot) current. Even 5/8 inch poly buoy line, which is relatively stiff, would bend around the hook inhibiting a clean hook up. The smaller diameter line, nylon in particular, was the most likely to snag resulting in greater forces to activate the breakaway buoy than would be expected. Clean hook-ups (buoy line sliding exclusively through the hook bell) resulted in the least amount of force required to break the buoy free. It was the influence of the scope that had the greatest impact on the amount of force needed to release the break away buoy. Future hook designs will cut back on areas that the line could possibly snag.

Most of the interactions at depth took little more force than it did on land to release the buoy. When the scope added resistance to the interaction, the force would get close to 3 times that found in the laboratory. The breakaway released at an average of 84 pounds in the laboratory using a 75 pound rated cable tie.

This protocol offered insight into the actions of the buoy line as it comes in contact with an entity a depth. Observations can now be made to find out which materials have the greatest

potential of minimizing entanglements by allowing breakaway devices to function, uninhibited by the interference of the scope. Now variables from the near surface down to 4 fathoms can easily be looked at and measured in more controlled conditions when working with buoy lines.

Fig 1. 14" buoy with PVC pipe dowel



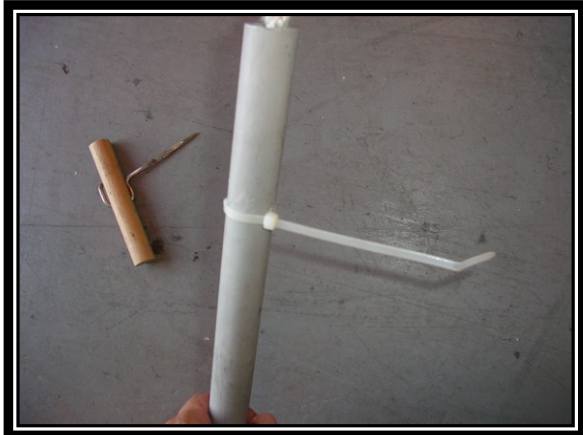
Fig 2. Awl through hole in pipe and line



Fig 3. Tie pulled through line and pipe



Fig 4. Remove awl and lock down tie



**Midwater hook and bridle**

Fig 5. Hook and bridle dimensions

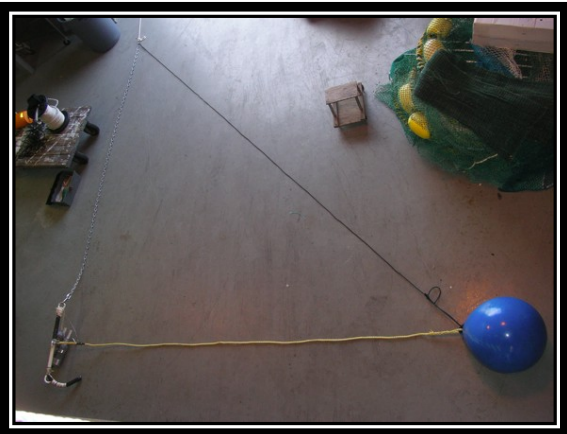


Fig. 6 Hook assembly





## ➤ Galvanic Timed Releases (GTR's)



### **Introduction:**

Galvanic timed releases (GTR's) have been commercially available for a number of years and are currently used in commercial fisheries throughout the world. Their use in the trap fishery in New Zealand and Australia is widespread. Although GTR's have been available for sometime, they are not commonly used by the commercial pot/trap fishery on the east coast or GOM. They offer an inexpensive alternative to mechanical or acoustic releases and

provide another approach to reducing vertical lines in the water column.

Metal anodes on the GTR erode, once introduced to sea water and eventually part to provide a release mechanism. The releases used for this test were developed by International Fishing Devices (IFD). Their accuracy is advertised as +/- 2.5% of the manufacturer's erosion time. Water temperature and salinity must be taken into account for release times and IFD provides a chart for adjusting release times for different water conditions. Standard load strengths are 10 pounds. but custom releases can be fabricated for loads up to 1500 pounds.

### **Objective:**

Re-evaluate the potential use of GTR's as a tool for reducing vertical end lines in the pot/trap fisheries. Look at the potential challenges of remotely deploying vertical floatlines in fisheries that utilize the deeper, offshore waters. Evaluate different deployment and line containment devices for reliability and ease of use.

### **Methods:**

GTR release times range from 1 hour to several weeks. For this study, custom made one hour GTR's were used with hook timers attached to each device to log actual deployment times. Commercially available lobster pots were used as well as other deployment devices to test the GTR's and different deployment methods. Divers recorded release times and evaluated the different line deployment devices. Underwater video was used to document each release and provide insight into potential problems. A number of the line containment devices failed and divers were able to note the problem and in some cases manually release or untangle the surface float so the gear could be recovered.

### **Discussion:**

Since comprehensive studies have already been conducted on actual erosion times and the impacts of water temperature and salinity, our primary focus was on the attachment and possible deployment techniques. Float type must be a consideration, especially if working in deeper water. The additional buoyancy created by the float and submerged line also must be taken into account. Extra weight in the trap was one way to overcome the additional buoyancy, but must be limited for the trap to be handled efficiently. Properly isolating the GTR from other metallic objects during attachment is also critical. Plastic ty-wraps or nylon line were used during these tests.

Divers re-entered the water ~10 minutes prior to the expected release and in each case the GTR deployed near the predicted time. Video was used to document the float and line

deployment and it quickly became clear that a number of the devices tested had little or no potential. Most tests were conducted in only 9-10 meters (30-35 feet) of water in order to allow maximum bottom time for divers. Even in this shallow depth it quickly became clear that a small amount of line resistance was critical for a clean (unknotted) deployment. Divers documented erosion times and whether the line and float cleanly deployed. Unfortunately, most of the data collected was lost after the Pascagoula Laboratory was destroyed from hurricane Katrina. All of the one hour GTR's tested during this study successfully released the surface float and deployment was always within ~10 minutes of the predicted time. In addition to salinity and water temperature, current may effect link erosion and the predicted release time. GTR's offer a cost effective and simple approach to deploying vertical buoy lines. As with the acoustic release, the deployment device and containment of line, especially in deeper water, will present the greatest challenge.

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