

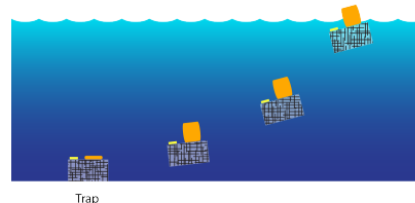
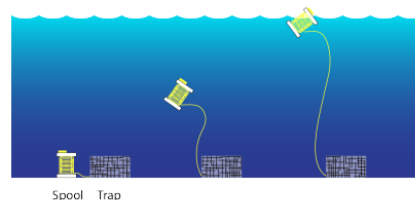
## Initial Trials Exploring Ropeless Fishing Technologies for the California Dungeness Crab Fishery

July 30, 2018 Update to the California Dungeness Crab Fishing Gear Working Group

Compiled by Geoff Shester, Oceana



**Introduction:** Ropeless fishing gear is a broad term describing new developing technologies that either partially or fully eliminate the vertical rope or line between fixed bottom fishing gear (i.e., pots, traps) and a surface buoy. In the context of whale entanglements, the thinking is that reducing the vertical lines in the ocean could reduce, or eventually fully eliminate the entanglements of marine wildlife with fixed fishing gear in the ocean. There are several types of ropeless gear: some use compressed air and inflatable bags, others use buoys and line that remain at the bottom with the trap until released. Release mechanisms include on-call acoustic triggers or timed triggers such as corrosive metals. On the US and Canadian East Coast there have been recent efforts to explore the use of various ropeless gears. This report summarizes recent trials conducted in the 2017-18 Dungeness crab fishing season, including testimonials written by each of the three participating fishermen in their own words, and summarizes outcomes of a recent meeting looking ahead at further exploration of ropeless fishing gear in the 2018-2019 season.



**Initial Trials:** On April 29-May 3, 2018, three California Dungeness crab fishermen conducted initial field trials with the gear. The goal of the initial trials was to introduce the fishermen to two ropeless systems, attach a single crab to each of the two systems, and conduct 1-2 deployments and retrievals of the trap using only the ropeless system.

**Study Sites:** We were able to test the Desert Star system in San Francisco Bay and Bodega Bay, and the Fiobuoy system in San Francisco Bay, Bodega Bay, and Monterey Bay. We obtained a research permit (MULTI-2018-003) from the Office of National Marine Sanctuaries to conduct the trials within National Marine Sanctuaries.



For the initial trials, we tested the first two of the following three systems:

**Desert Star:** The Desert Star system contains buoys and rope in a mesh bag with an acoustically triggered release mechanism attached to the side. The release mechanism is a small wire that disintegrates when an electrical signal is run through it, which is powered by internal batteries and a capacitor. The bag can be attached to the main line with a snap as shown in the picture. The buoys and line are stored in the bag and once released the buoys and line are separated from the bag. The gear can then be hauled as normal and once the pot is up you will unsnap the bag. The actual bag and buoy design is not integral to the device, therefore individual fishermen can develop different bag systems. For more information, see [www.desertstar.com](http://www.desertstar.com)



**Fiobuoy:** The Fiobuoy is a spool shaped buoy that uses an internal motorized jaw that keeps the spool from unraveling until released. The fishing line is coiled around the buoy itself. Upon receiving the acoustic release, the jaw opens and the buoy unspools and floats to the surface. The gear can then be hauled as normal. For more information, see [www.fiomarine.com](http://www.fiomarine.com)



**SMELTS Lift Bag:** Similar to other systems, the lift bag responds to an acoustic signal. Using compressed air in a tank similar to scuba, the acoustic signal inflates a salvage bag with sufficient volume and buoyancy to lift the gear in question, the size depends on the weight of the gear. We did not test this gear in the initial trials, but hope to test this system next season. For more information, see [www.smelts.org](http://www.smelts.org)



**April 30, 2018: John Mellor, San Francisco Bay:** We conducted a single deployment and retrieval of the Desert Star and Fiobuoy systems sequentially at approximately 65 feet depth near the Bay Bridge. Each system was left for approximately 5 minutes, and then we initiated retrieval. We conducted the test at slack tide to prevent the strong currents in San Francisco Bay from pulling the buoys underwater. Both releases occurred quickly and we were able to locate the gear within a few minutes. Before retrieval, we were able to locate both ropeless systems using the echosounder on the vessel, which appeared a few feet above the seafloor.



*John Mellor Response: I felt that of the two, the spool [Fiobuoy] was the more mature with the smoothest operation, in terms of the release mechanism and apparent simplicity. I do like the bag aspect for the rope in Desert Star more than winding the spool. It's very difficult to imagine either one of them being used in the crab fishery as it now exists because of the high cost and technical difficulties currently they have.*

**May 1, 2018: Dick Ogg, Bodega Bay:** We conducted a simultaneous deployment of two traditionally crab pots with vertical lines, one trap attached to the Fiobuoy, and one trap attached to the Desert Star system. We first retrieved the two traditionally set pots. However, the Desert Star system did not pop up despite multiple attempts. The transducer was able to establish communications with the ARC-1X unit and confirm the trigger had been released, however, the buoys did not surface. Desert Star staff and fishermen Dick Ogg returned to the site multiple times in an attempt to better identify the precise location and recover the gear. Despite attempts to grapple the gear and retrieve the gear with scuba divers, the gear has not been recovered. As a result, we are unable to confirm the cause of the failure of this system. We were able to compensate fisherman Dick Ogg for his lost pot, however, Desert Star continues to search for the lost gear.



The Fiobuoy system did not surface on the first attempt, to initiate the acoustic trigger, but did surface on the second attempt. Once we spotted the gear, the crew was able to retrieve the buoy and bring it up with the hauler.

*Dick Ogg Response:*

*Here are my thoughts on the 2 ropeless buoys systems that I had the opportunity to test with you. First I would like to thank you Geoff for the time and energy you spent getting this opportunity together. It's not easy to coordinate fisherman at any time.*

*As you know, our test was done Tuesday, May 1st. The weather was perfect. It was clear with minimal wind. The current in the area we were setting was less than .5 knots. There was a slight roll to the ocean due to heavy wind on the outside but in the bay it was pleasant, to say the least. I thought that a good test would be to set a very short string as we would if we were fishing. So we set four pots, two of mine with a standard buoy set up (one main and a 2.5-fathom trailer) and following those the two ropeless systems. I wanted to show how we run the gear and set the pots. We ran my pots once then on the second pass began to try to deploy the ropeless systems.*

*I would like to give my idea of what I would expect from a successful test.*

- 1. Ease of deployment*
- 2. A consistent and reliable release of the buoy*
- 3. Ease of retrieving the pot and landing it on the boat*

*Now here is how I felt about the 2 systems we tested:*

*The Fiobuoy:*

*The system itself is fairly simple, consisting of a roller which doubled as the rope coiling device and the float. It was fairly bulky and would not fit in a pot to allow us to stack our gear when we need to move. That I feel is something that could be changed and would help to make the system more user-friendly. It*

released each time we tried it both in the outer bay and in a slip next to the boat when we came in. The underwater deployment was very slow. We began to ping for the buoys to release at 9:47 and we didn't spot it until 10:02. I also feel that the slow rate of rising was due to the large amount of rope on the spool. Given that you can deploy them from quite a distance that would not be too much of a problem. In addition, I believe you can ping a number of them and have them at the surface long before you get to the pot, an absolute necessity when your running gear at 4-5 knots.

There would have to be some improvement on the buoy's visibility. It would be very difficult to see in rough water. In addition, there is no trailer to allow us to put the buoy up without stress on the line. Another simple addition. Apparently, there is a coiler that goes with the system to aid in coiling the rope on the buoy. That would be the only way I could see this working effectively. I would be very concerned about tangles. Rope coiled tightly without a level winding device, has a tendency to overlap and not release. I've had it happen many times with new coils of rope on a spool. The other issue was picking up the buoy and getting it in the block. Because of the bulk, it was difficult to work around the block. This issue is something that could be changed in the design. I feel that this was a fairly successful test.

#### The Desert Star System:

This system was very complex. It consisted of a bag on the top of the pot with a deployment apparatus. The bag has the rope coiled inside and the float balls were held captive in the bag. It was designed to stay upright so the float balls could rise rapidly. The release mechanism is a wire that is dissolved electrically and then releases ropes that hold the bag closed.

I believe that given less rope and a smaller bag you could stuff everything in our pots so we could stack the gear but getting it out would be a whole other issue. Resetting the equipment is another problem. Because of the complexity, I don't see it being very practical at this point. There would need to be some design changes to even have my consideration. In addition to the fact, from what I understand, that the system deployed when we tested it but never surfaced. I spent over 3.5 hours and 2 days trying to recover my pot. Unfortunately, we never found it.

In conclusion, I would like to thank you Geoff for giving me the chance to testing this technology. I feel very fortunate to have seen the products first hand and equally fortunate to be able to express my thoughts. Some design consideration that are obviously not new or earth-shattering by any means:

1. Simple equipment that didn't require huge alteration in our present practices. We realize that change is inevitable but it has to be practical.
2. Have less financial impact. The initial cost and the time it takes to operate are huge expenses most of us can't afford.
3. Doesn't contribute to gear loss
4. Gives us a means of identifying where the gear is

I also feel both systems could be used for ganging pots together but one deployment failure would have a substantial gear loss associated with it. Something definitely to consider.

**May 4, 2018: Calder Deylerle (Moss Landing):**

We conducted two tests of the Fiobuoy only, as the Desert Star system was not available. Weather conditions were calm and sunny on the first test, and then became windy (~15 knots) and foggy on the second test. We were able to locate the buoy and retrieve the buoy, however, it took about 5 minutes to locate the buoy on the second try. Calder's six year old son was able to gaff and retrieve the Fiobuoy.



*Calder Deyerle Response:*

*Thank you very much for organizing the opportunity to test out the Fiobuoy with the inventor of the buoy system, John Fiotakis. We tested the Fiobuoy AC100 acoustic release pop up buoy system in the Monterey Bay in the local crabbing grounds on May 4th, 2018. We deployed the system two separate times in 240 feet of water and had a successful test on both deployments. It was a great and very informative day on the water and overall I was very impressed by the simple design and advanced technology of the system. Some modifications to current fishing practices would be necessary to make the system work the way it is now, but with a well-designed re-coiler, I believe the technology is out there to make the system work in an efficient manner. I believe some modification to the product and more affordable availability of better technology is necessary before the system could be widely accepted. Simple improvements could include more buoyancy and better visibility, and on the more complicated side of things the electronics necessary to see where other fishermen's pots are and keep track of your own could be pricey and awkward at first until the kinks are worked out.*

*The Fiobuoy has great potential for being of beneficial use to the Dungeness Crab Fishery and trap fisheries around the world under many circumstances, including mitigation of whale entanglements. I believe more thorough testing of the technology should be the first step and am more than willing to continue to work with yourself, John and anyone else in the development and testing of this product or any other similar technology. I firmly believe that a breakthrough in gear modification is the solution to whale entanglements in fishing gear worldwide and will continue to rack my brain on the device that will outdo the Fiobuoy, but for now it's the best solution I know of for minimizing vertical lines in the water column.*



## Conclusions and Discussion of Initial Ropeless Gear Trial Results:

The three initial one-day trials of ropeless gear demonstrated that there is potential for some version of ropeless gear to be used in the Dungeness crab fishery. However, there remain several key questions and challenges that will require additional gear trials, experimentation, innovation, and communication among fishermen and fishery managers. The current gears are costly relative to the current costs of crab traps, however, with increases in number of units sold and potential changes to production, these costs could go down substantially.

One key question is how the location of gear can be identified by fishermen and enforcement agencies in the absence of surface buoys. Other fishermen need to know where the gear is to avoid setting on top of other gear, however, there are important confidentiality issues that should be considered. Enforcement needs to both know where gear is located but also be able to access the gear to check that it is tagged and configured properly, which implies they may need to have acoustic equipment to operate the gear.

It became clear that locating the gear after it has popped up is not trivial, as the buoy may not surface in the precise location it is dropped due to ocean currents. Making gear more visible is key, and there were several questions raised about whether the fishermen will be able to retrieve an entire string of gear.

Lastly, while system failures will inevitably occur in the innovation process and provide valuable lessons, the inability to locate the lost Desert Star system suggests that further gear testing include back-ups such as a traditional surface buoy and line in addition to the ropeless system. This will help retrieve gear in the event of a failure to better understand the causes of such failure, reduce the need for permits, and avoid creating marine debris. Once the kinks in the gear are worked out, the back-up line may no longer be necessary, and it is possible that widespread use of ropeless systems could eventually reduce overall rates of crab gear loss due to the absence of vertical lines while fishing.



F/V Karen Jeanne on Bodega Bay Ropeless Gear Trial

## July 19, 2018 Ropeless Fishing Gear Planning Meeting - Summary

**Background:** On May 31, 2018, four members of the California Dungeness Crab Fishing Gear Working Group (Kelly Sayce, Dan Lawson, Dick Ogg, and Geoff Shester) gave a panel presentation to the Marine Mammal Commission on our efforts and projects thus far, including the April/May 2018 initial trials and experience with ropeless fishing gear systems off Central California described above. As a result, the Commission is interested in supporting efforts to further explore these new technologies in the context of current west coast fishing operations. On July 19, Dr. Frances Gulland, one of the Commissioners, hosted an informal meeting with Commission and agency staff, gear manufacturers, and fishermen interested in trying out the gear.

**Meeting Participants:** Marine Mammal Commission staff (Commissioner Frances Gulland, Peter Thomas, Dennis Heinemann, Brady O'Donnell); Dungeness Crab Fishing Gear Working Group Members (Jim Anderson, John Mellor, Dick Ogg, Geoff Shester); Pacific Coast Federation of Fishermen's Associations (Noah Oppenheim); Gear Manufacturers (SMELTS Inflatable Bag System: Richard Riels; Desert Star: Christian Aparecio, Marco Flagg, Jake Wolf; Fiomarine: John Fiotakis); CDFW (Bob Puccinelli, Joanna Grebel); Ocean Protection Council (Paige Berube); New England Aquarium (Tim Werner); Woods Hole Oceanographic Institution (Mark Baumgartner).



**Meeting Goals:** The goals of the meeting were to share information on three currently available ropeless systems, discuss fishermen perspectives, and develop a plan to have several fishermen test a few of the current ropeless systems in the coming fishing 2018-19 season, including to identify the costs, permits, and funding necessary. We were also able to have an initial conversation on management and enforcement needs and considerations, which provided useful information to gear manufacturers for further innovation.

**Key Outcomes:** There was general agreement that there is promise and value in further exploring ropeless fishing gear in the West Coast Dungeness crab fishery, as part of a broader strategy to reduce whale entanglements. The key objectives for the coming fishing season are to provide multiple fishermen an opportunity to experiment with different systems and boat configurations, and further demonstrate whether the ropeless concept can actually work for the Dungeness crab fishery. Gear manufacturers offered to provide test units to fishermen next season, and fishermen voiced their willingness to participate in trials, with the goal of initiating the next round of trials in April 2019-June 2019. We hope to solicit additional fishing participants in the 2019 trials through the California Dungeness Crab Fishing Gear Working Group.

Regarding permitting, there is no need to acquire any additional research permits for testing ropeless gear provided each trap is equipped with a traditional line and buoy in addition to the ropeless system, and gear is fished legally within the Dungeness crab season. However, an experimental gear permit and/or Sanctuary research permit would be required to conduct trials with multiple traps attached to a single buoy, outside the Dungeness crab season, or without a buoy to mark the gear location. Given the interest in examining multiple traps per system, particularly for larger crab vessels, it may be necessary to initiate the process of requesting experimental gear permits from the California Fish and Game Commission.

Members of the East Coast “Ropeless Consortium” from Woods Hole Oceanographic Institution and the New England Aquarium participated remotely to provide feedback and advice from their experiences testing and developing ropeless fishing systems in East Coast lobster and crab fisheries. Continued communication and collaboration with these efforts will be important as we move forward.

We discussed the following general outline of the goals for the 2019 testing including:

- Work with 5-10 fishermen that fish at a variety of depths, locations, conditions, and vessel types
- Test 3 types of existing ropeless systems, using readily available prototypes to keep costs down
- Deploy up to 10 units of gear of each system
- Attempt single and multiple traps per unit
- Allow fishermen to work with each system for several weeks to try different techniques, configurations, and adjustments.
- Gather feedback from fishermen, foster interaction with gear developers.
- Compensate fishermen and gear developers for time, travel, shipping costs, and other costs associated with gear trials.
- Explore potential funding through Marine Mammal Commission, Ocean Protection Council, and other sources.

**Acknowledgments:** Thank you to the fishermen Dick Ogg, Jim Anderson, Calder Deyerle, and John Mellor who voluntarily took time off from fishing without pay to participate in the gear trials, provide your experiences in writing, and/or attend the planning meeting. Your dedication to solving the whale entanglement issue is recognized and sincerely appreciated. Thank you to Commissioner Frances Gulland and the Marine Mammal Commission staff for hosting and organizing the July 19 meeting and for inviting us to present at the May 31 annual meeting. Thank you to Monterey Bay National Marine Sanctuary Staff Karen Grimmer and Sophie Debeukelaer for helping obtain necessary permits for the initial trials. Thank you to gear manufacturers at Desert Star, Fiomarine, and SMELTS for traveling to attend the meeting and gear trials and for lending your equipment and expertise. Thank you to Bob Puccinelli from CDFW for providing a helpful overview of enforcement needs and providing constructive feedback as we explore this new gear. Thank you to Fran Recht and Robert Morgan (WDFW) for your helpful insights and feedback during the Bodega Bay gear trials.