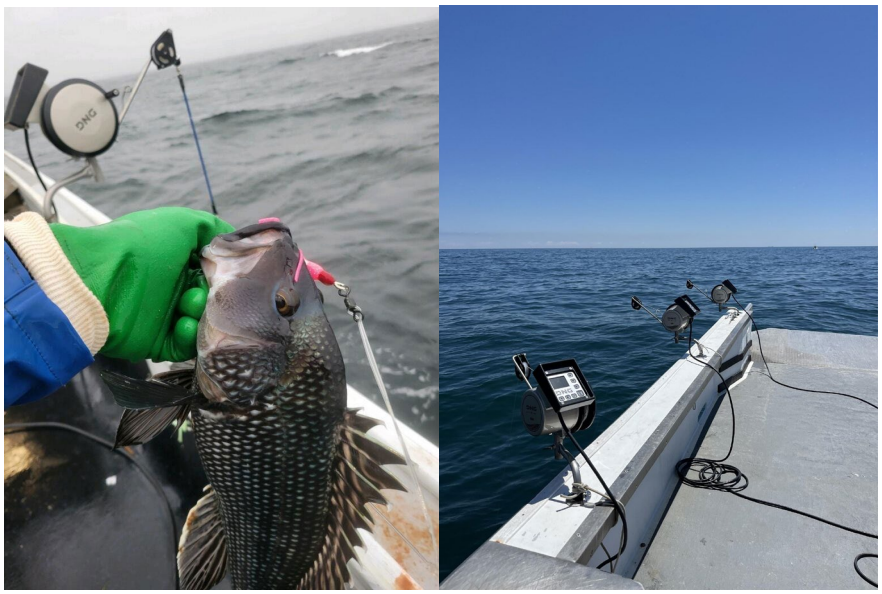
Year 1 Report: Exploring Mechanical Jigging for Benthic Fish Monitoring
SFW01 Fisheries Monitoring Plan
Reporting Period: October 1, 2023 to December 31st, 2024



Prepared for South Fork Wind

Submitted By: Matt Rodriguez and N. David Bethoney

Commercial Fisheries Research Foundation
Tel: 401-515-4662 Fax: 401-515-3537
Email: dbethoney@cfrfoundation.org

In collaboration with

Gregory Mataronas
Sakonnet Point Fisheries, LLC

Todd Sutton
Sutton Enterprises, Inc.

1.0 Summary

The South Fork Wind Farm (SFWF) benthic fish jigging survey was conducted to collect post-construction data on the feasibility of developing a benthic fish monitoring program using mechanical jigs within the SFWF area. Specifically, the survey seeks to see if jigging can replace a gillnet survey targeting monkfish, flatfish, and skates. Broadly, using jigs as an alternative to traditional trawling methods would allow for the continued sampling of benthic fish species in and around newly constructed offshore wind farms. The efforts undertaken in the fall of 2023 were preliminary to familiarize ourselves and the fishermen working with us in operating the automatic jigging machines and fishing techniques. Sampling in the spring and fall of 2024 was conducted utilizing the gear and methods refined during the fall.

During the fall of 2023, we successfully deployed and tested 2 different mechanical jigging machines of the Waterman and DNG brands. During this time, we emphasized developing an experimental design and fishing techniques. Each fishing vessel and crew partook in 6 field sampling days (12 total) between October and December 2023. Both crews had the opportunity to test the Waterman machines twice and the DNG machines twice. Once we had gotten a feel for the gear, we started testing alternative jig configurations, one of which works best for our overall project goals. Additionally, upon consulting the captains and crews, we decided to finish the fall sampling season (2 trips per vessel; 4 total) using only the DNG jig machines.

The spring sampling period of 2024 ran from April to June, with sampling occurring twice monthly. We employed 3 DNG machines aboard each vessel using the technique and gear configuration selected during the fall 2023 sampling period. Each vessel fished in the SFWF area and adjacent reference areas. In each area, we randomly selected 5 predetermined sampling sites

(15 total) for 20 minutes. During the 2024 sampling season, we also began deploying conductivity, temperature, and dissolved oxygen (CTD) readers. The CTD data loggers were deployed at every sampling event during this period.

2.0 Introduction

Starting in the fall of 2023 and spring of 2024, the Commercial Fisheries Research Foundation, in partnership with local commercial fishermen, began a new project to investigate the viability of mechanical jigging machines to survey benthic fish species within offshore wind farms. This survey was necessitated by the current and planned construction of offshore wind farms in areas previously utilized by fishing methods such as trawling or gill nets. Specifically, the survey seeks to see if jigging can replace a gillnet survey targeting monkfish, flatfish, and skates. Such traditional methods may be difficult to conduct in these areas because of the limited maneuverability between the turbines. Jigging can be a much more targeted fishing method with several advantages, including reduced environmental impact, lower bycatch rates, reduced fuel consumption, and maneuverability within wind farm areas.

This study will be conducted for two years (2024-2025) twice a month in the spring (April-June) and the fall (October-December). The fall (October-December) of 2023 served as a testing and optimization period for the gear and a time for the captains and crew to become familiar with the new gear type. Starting in the spring of 2024, this survey was conducted in 3 different sampling areas: the impact area and two reference areas, predetermined for a previous gillnet survey that was canceled (Figure 1). These areas are shown in the figures below in Section 3. We chose not to sample these areas in the fall of 2023 because determining the best techniques was of greater importance at that time so sampling location was left to the captains' discretion and occurred closer to port.

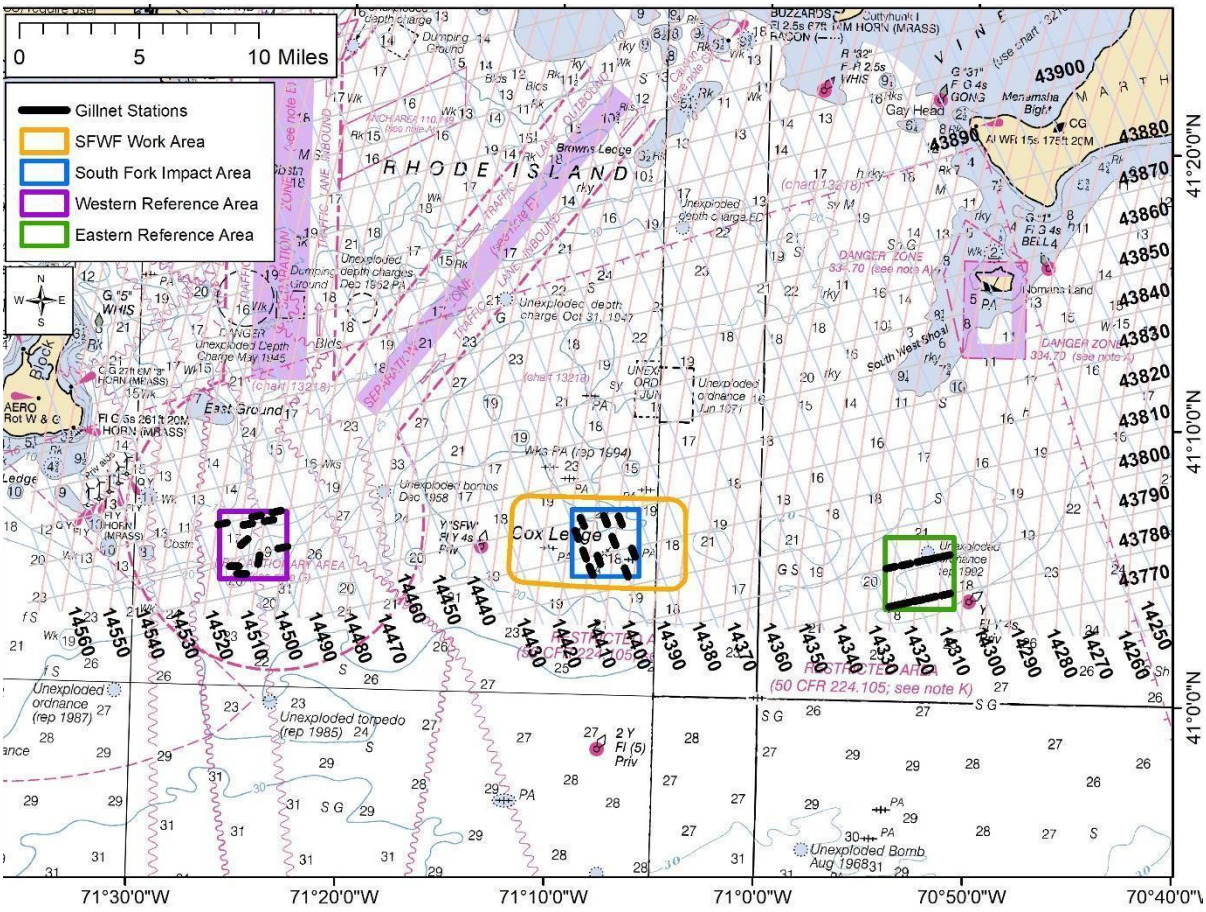


Figure 1. The South Fork Wind Farm jigging survey areas include the impact area and two reference areas. The stations within each area were developed for a gillnet survey and utilized by the jigging survey.

3.0 Methods

The sampling methods used during this reporting period were not uniform, as fall 2023 was an introductory sampling period for this project. As the season progressed, we refined the sampling methods and gear to maximize our sampling efficiency in the spring. From the fall trials and sharing information with those running the Northeast Fisheries Science Center's pilot hook-and-line survey, we developed protocols that were adopted into the spring 2024 survey. Final protocols are included as an appendix to this report, and a summary is provided below.

For the spring and fall 2024 sampling seasons, 5 sites were randomly selected from within the SFWF area and two adjacent reference areas previously used for the SFWF gillnet

survey. We deployed 3 automatic DNG brand machines using a modified fluke rig setup. The hook size and number were the same on all setups, as was the assortment of lures baited with squid or clams. We prevented the machines from jigging so that the lures dragged along the bottom as the vessel drifted, presenting the maximum number of lures to the maximum number of target species. Once the lines were deployed at the site, environmental data were collected. All lines were soaked for 20 minutes before being hauled, checked for any catch, bait replaced if necessary, and redeployed at the next station. Those captured specimens were speciated, tallied, measured to the nearest centimeter, and weighed before being returned to the sea.

4.0 Preliminary Results

A total of 285 jigging sets were conducted in the fall of 2023, and 270 jigging sets occurred in both the spring and fall of 2024 (Table 1). The main goal of sampling during the fall of 2023 was to identify a standard sampling approach and the optimal jigging setup to maximize our catch rate in the spring. During this period, we focused on learning to properly operate and develop survey protocols for these machines. Due to this, the data collected during this period are less detailed than that collected in 2024. For example, all individuals of a given, non-target species were weighed collectively with no length measurements. We will not be considering these data for future analyses.

As with all projects at their onset, we ran into problems during the early days, mostly involving familiarization with new gear. This project began with two different jigging machine systems. The lower-tech electric jigging machines we tested during fall 2023 were Waterman brand machines. We found that these machines were best for setting lines to the bottom and dragging them or suspending them vertically slightly above the bottom, as there was no jigging motion that could be reasonably achieved with them and no way to determine how deep they

were suspended. We could only tell if a fish was on the line by watching the machine's arm for exaggerated movement, which would sometimes be false if the window weight at the bottom of the rig bounced off the seafloor. Therefore, we began setting a time limit (20 minutes for one machine and 30 minutes for the other) and retrieving the lines to check once that limit had been reached. Another detriment to these machines was that the motors themselves are not waterproof. Additionally, the prongs protruding from the jigging motor to provide power were only covered by a removable aluminum cap with a large punch-out opening to connect power wires. This opening was easily large enough to allow spray to get to these connections under the right wind and wave conditions. After completing four total at-sea trials (2 days per vessel) and discussing with the captains, we discontinued using these machines as part of this survey. We felt that they were too clunky, had more potential points of failure, were less accessible to use, were a possible safety hazard due to more moving parts and electricity, and were overall less reliable than the DNG machines .

Another problem we identified was that the rig was more likely to become snagged along the bottom while we were dragging gear. The bottom in these sample areas had a sandy, mixed, or hard bottom and gravel. While not overly rocky, it's impossible to predict where there may be a larger or oddly shaped rock on which a hook may be snagged or under which a weight may be pinned. We never noticed that a line had been snagged until the 20-minute sampling timer was up, and we retrieved the line. All lost equipment was too small to locate on the ship's sonar; 14oz bullet weight, 12/0 hooks, ~10ft of line, and a 5lb window weight. In response to the lost equipment, a marine trash and debris notification was submitted. The incident report is included in the appendix below.

Catch rates during the spring of 2024 were much lower than those of fall 2024. These may reflect normal differences in seasonal assemblages but may also reflect conditions specific to 2024. Multiple sources and survey CTD casts showed that colder-than-normal water temperatures on the bottom persisted into the beginning of the summer in 2024, which may be a factor as to why more fish were caught during the fall of 2024. These colder conditions on the bottom during the spring may have kept the expected seasonal fish assemblages away until later in the summer and negatively impacted our spring catch numbers, exemplified by the difference in spiny dogfish catch (Table 2). This was also the case with smooth dogfish, which may have been kept from inshore waters during the spring because of cold water temperatures, but moved inshore during the fall 4 as temperatures increased. Other species, such as the longhorn sculpin, spotted hake, and whiting, had high catch rate variability between seasons. The catch rates of these species were still very low and only one year of the survey has been conducted, so it is not possible to conclude with any certainty whether or not the difference in catch rates was due to water temperature or some other factor. Interestingly, the catch rate of red hake was the only species to have its catch rate decrease between the spring and fall. The species that made up the majority of our catch in both seasons was the spiny dogfish. The average size of the spiny dogfish also increased as the year progressed, with individuals caught in the spring being smaller than those caught in fall. The only target species we have successfully captured thus far has been the little skate. This species followed similar trends as the spiny dogfish and black sea bass, with fewer individuals captured in the spring than in the fall, and the average sizes of captured individuals being smaller earlier in the year (Table 2). The sample size for this species was still relatively low, making identifying any definite trends regarding species abundance or size distribution in the sampling areas through time difficult at best.

Table 1: Basic sampling metrics per season.

	Number of jigging events	Total time sampling (min)	Average Depth (ft)
Fall 2023	285	4749	106.92
Spring 2024	270	5400	119.16
Fall 2024	270	5400	118.82

Table 2: Total number of mean size and weight (+/- 1 standard deviation) by species for each season. Weights and lengths were not taken during the fall due to the exploratory nature of that survey.

Species	Total sampled 2023	Total sampled spring 2024	Total sampled fall 2024	Mean length spring 2024 (cm)	Mean length fall 2024 (cm)	Mean weight spring 2024 (kg)	Mean weight fall 2024 (kg)
Spiny dogfish	27	13	120	64.64 (7.19)	74.47 (8.47)	1.13 (0.5)	1.48 (0.57)
Smooth Dogfish	0	0	7	0	73.57 (8.12)	0	1.27 (0.52)
Black sea bass	113	0	12	0	35.41 (6.65)	0	0.48 (0.26)
Scup	1	0	0	0	0	0	0
Cod	1	0	0	0	0	0	0
Longhorn sculpin	3	0	1	0	33	0	0.17
Spotted hake	4	0	2	0	37	0	0.31
Little skate	0	3	8	25.5 (1.78)	51.5 (12.46)	0.48 (0.03)	0.64 (0.27)
Northern sea robin	0	0	2	0	40.5	0	0.43
Red hake	0	11	1	39.95 (7.39)	36	39.5	0.36
Weakfish	0	0	1	0	35	0.41 (0.23)	0.41
Whiting	0	1	2	33	33.5	0.2	0.18

Another deviation from the original sampling method added in the spring was the decision to take CTD casts after half (3) of the sampling days had already been completed in the spring. The CTD was also forgotten at the dock for one of the trips, reducing the days we

collected those data to 2. During the fall of 2024, the CTD was deployed successfully at each sampling location for every trip. The other slight deviation from the protocols involves sampling at site 218. One of the project captains familiar with that location reported that the bottom at this site was rougher than the others, and there was a high potential to lose gear. Thus, we decided to sample slightly to the north to avoid the rough bottom and will continue to do so every time the site is selected.

6.0 Outreach

This project idea and its preliminary results were presented as a poster at the 2024 ICES Annual Science Conference in Gateshead upon Tyne, U.K. The project was also featured in the April 2024 monthly CFRF newsletter. CFRF also maintains a project webpage that displays the survey's purpose and other information for the public.

7.0 Acknowledgements

Data collection for the SFWF Fish Jigging Survey was conducted by the Commercial Fisheries Research Foundation in collaboration with the commercial fishing industry. Thank you to all the staff that contributed. We want to thank captains Greg Mataronas and Todd Sutton of the F/V Cailyn and Maren and Sweet Misery respectively. We would also like to thank the crews aboard the respective vessels.

Appendix

Rig Creation Protocols

1. For the DNG systems, feed the tag end of the braided line through the guide hole on the inside of the spool and tie a double overhand loop to prevent the tag line from being pulled back through the guide hole.
2. Once the line has been secured, spool approximately 1000 yards onto the system.
3. Attach a snap swivel to the tag end of the newly spooled braided line.
4. Take approximately 20 ft of 130 lbs monofilament line and tie dropper loop knots every 22-24 inches so that there are 5 of these knots along the entire length of monofilament.
5. Attach one 12/0 hook to each lure (bucktail, fluorescent squid, worm, hair).
    a. One hook with each type leaving one hook bare. See below image.
    b. Some rigs may consist of 5 bare hooks without additional lures.
6. Attach one lure to each dropper loop.
7. Attach a snap swivel to one end of the monofilament, this will be the bottom.
8. Attach a regular swivel to the opposite end of the monofilament, this will be the top.
9. To store the completed rig, wrap it around an 8-inch length of foam (pool noodle) with the hooks embedded in the foam for security.
10. Set aside both the spooled machine and wrapped monofilament line. These two components are to be connected once on the boat.

Figure 5: Top to bottom lures are bare hook, hair, pink squid, and green worm.

On-vessel Set Up

1. Attach custom built jig machine mounts to gunnels of the vessel.
2. Insert gooseneck into the custom mount. Do not tighten completely. Rotate so that the gooseneck faces inwards.
3. Insert the post of the jigging machine into the gooseneck and tighten.
4. Rotate the gooseneck away from you so that it faces the water and tighten.
5. Attach a leash to the snap swivel at the end of the braided line. Attach the monofilament to the swivel at the other end of the leash.
6. Attach a 5 lb window weight to the snap swivel connecting the monofilament to the leash.
7. Attach a 14 oz bullet weight to the snap swivel at the end of the monofilament line.

Powering the Machines

1. Feed the power cables extending from the machines into the opening on the side of the battery box.
2. Attach red positive wires to the 12-amp circuit breakers and the black negative wires to the grounding busbar inside the battery box and tighten. Repeat for each individual power cable for each individual machine.
3. Connect positive and negative wires to their respective battery posts and tighten.
4. Once all respective wires have been connected, switch on the circuit breakers.

Pre-Trip Protocols

- Scheduling
    - These trips will be scheduled approximately a week in advance and weather permitting.
    - Prior to departing 5 primary locations will be randomly selected for each area (SFWF, Eastern and Western Reference Area).
    - Remain in communication with all captains regarding any change of plans.
    - Once a date is selected, fill out a float plan and save it to the HSE documents folder.
- Preparation
    - File the sail plan with the CFRF (Commercial Fisheries Research Foundation) office and notify CFRF staff of the sail date.
    - Complete all prerequisite forms for Ørsted.
    - All jigging machines need to be appropriately spooled prior to departure.
    - Rigs should be made before departure.

- Once the vessel has reached the sampling site all jigging machines will be outfitted to the F/Vs with appropriate mounts.
- Calibrate the Marel scale each day prior to using and again if needed.

Field Sampling Methods

Deploying Lines

1. Prime the machines by using the manual crank handle to turn the spool approximately a half turn.
2. Attach the swivel at the top of the leader to the snap swivel at the tag end of the line and uncoil the remainder of the leader from the foam.
3. Place lines horizontally along gunnels so that hooks will not get stepped on.
4. Bait hooks with pieces of cut squid or clam.
5. Making sure none of the hooks are caught on clothing or gear, carefully lower the lines into the water starting with the bullet weight at the end.
6. Lines should be sent all the way to the bottom with scope added so that the entire monofilament section drags on the bottom.
7. Add scope as needed based on sea state; an extra 15 feet by default.
8. While fishing the vessel is to be drifting to cover more ground thereby presenting the bait to more of the target species.
9. The icon in the upper right-hand corner of the machine's screen should say STOP. This indicates that the machine is not executing any jigging motions.

10. As the machines are not executing any jigging motion, it is more difficult for them to detect if a fish is on the line or not. All machines need to soak for 20 minutes before being retrieved and checked.

Line Retrieval

1. After the set soak time, each machine should be reeled up and checked for any catch.
2. To retrieve the rig in the safest way possible, using a gloved hand, grab the rig overhand and place retrieved hooks on gunnels until the entirety of the rig has been retrieved.
3. It is important to retrieve the rig overhand so that if there is an emergency you can drop the rig back into the water without accidentally being injured by a hook.
4. Remove captured species.
5. Re-bait hooks if necessary.
6. Re-deploy lines.

Setting Jigs and Data to be Recorded

- Make sure all machine settings are consistent for each machine.
- At each sapling location deploy all lines at the same time.
- Collect CTD data at each set location.
- Record set data as lines are set and haul data when lines are retrieved. Record:
    - Date
    - Vessel name
    - Machine number
    - Set number

- Station number
- Trip number
- Location at set and haul (lat/long)
- Set and haul time
- Set and haul bottom type
- Set and haul depth
- Sea state at haul
- Wind speed at haul
- Wind direction at haul
- Drifting speed
- Tidal stage at haul

Retrieving jigs and data to be recorded

- Biological data:
  - Date
  - Vessel
  - Machine number
  - Set number
  - Species
  - Total length or disk width (cm) of each individual
  - Total weight (kg) of all individuals by species
  - Number of each individual species caught
  - Which type of lure caught each individual or bare hook

- Check lines for any missing or damaged hooks and replace bait if needed.
- Redeploy lines.

South Fork Wind Marine Trash and Debris Overboard Report

(1) Date and time of incident:

5/22/2024 at 12:22pm.

(2) Lease number, OCS area and bloc (if applicable), and coordinates of the object's location (latitude and longitude in decimal degrees):

Lease area OCS-A 0517.
Lat/Long = 41.0725/-71.1090

(3) A detailed description of the dropped object, including dimensions (approximate length, width, height, and weight) and composition (e.g., plastic, aluminum, steel, wood, paper, hazardous substances, or defined pollutants):

5lb lead window weight 12 inches long. 3x 14oz lead bullet weights. 7x 12/0 steel Mustad brand fishing hooks. About 10ft of monofilament line.

(4) Pictures, data imagery, or a schematic/illustration of the object, if available:

(5) An indication of whether the lost item could be detected as a magnetic anomaly of greater than 50 nanotesla, seafloor target of greater than 0.5 meters, or a sub-bottom anomaly of greater than 0.5 meters when operating a magnetometer or gradiometer, side scan sonar, sub- bottom profiler in accordance with BOEM's most recent guidance:

Most of the lost gear was lead and not magnetic. The steel hooks would be magnetic but are too small to be detectable.

(6) An explanation of how the object was lost:

We were drifting and the rigs snagged on some rough bathymetry and they snapped.

(7) A description of immediate recovery efforts and results:

We drove back over the drift-track and looked at the sonar to see if we could find the gear on the bottom. It was too small to see on the sonar and we were unable to find or retrieve them.

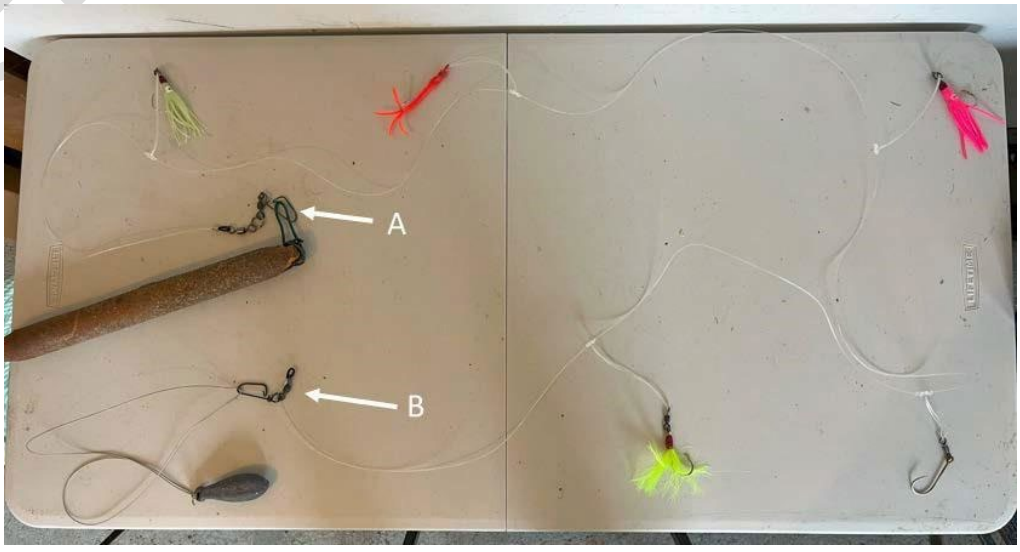


Image of rig used while sampling. Lost rig had no lures, only hooks. All weights in image are the same as others described in heading 3.