

**PROJECT TO MODERNIZE POT FISHING FOR THE SOUTHEAST COMMERCIAL  
BLACK SEA BASS (BSB) POT PORTION OF THE SNAPPER-GROUPER FISHERY  
USING SUBSEA BUOY RETRIEVAL SYSTEMS**

***DATE OF APPLICATION:***

09/09/2025

***EXTENT OF TIME EFP REQUESTED:***

November 1, 2025 - April 30, 2028

***APPLICANT'S NAME, MAILING ADDRESS, TELEPHONE NUMBER, E-MAIL, AND  
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## Introduction

Substantial progress has been made under previous EFPs (2020–2025) to [evaluate a range of on-demand gear types, configurations, performance, and fisher preferences](#) for application of the gear to the Southeast commercial Black Sea Bass (BSB) pot fishery. Reliability testing during these projects demonstrated success rates greater than 99%, confirming the effectiveness of Subsea Buoy Retrieval Systems<sup>1</sup> (SBRS) when operated by trained fishers. However, issues related to entanglement risk, economic constraints, and delayed stock assessments continue to delay full-scale implementation.

Over the course of this work, [the Southeast BSB fishery](#) has served as a proving ground not only for gear but also for education and knowledge transfer. Since 2020, [more than ninety commercial fishers across multiple states have been directly trained through this project](#), with many receiving peer-to-peer instruction from those certified participants (Figure 1). The standardized “train-the-trainer” program developed here has become a model now applied in other regions and fisheries, (CA Box and King Crab, CA Dungeness crab), ensuring that operational lessons learned in the BSB fishery are exported to a wide audience.

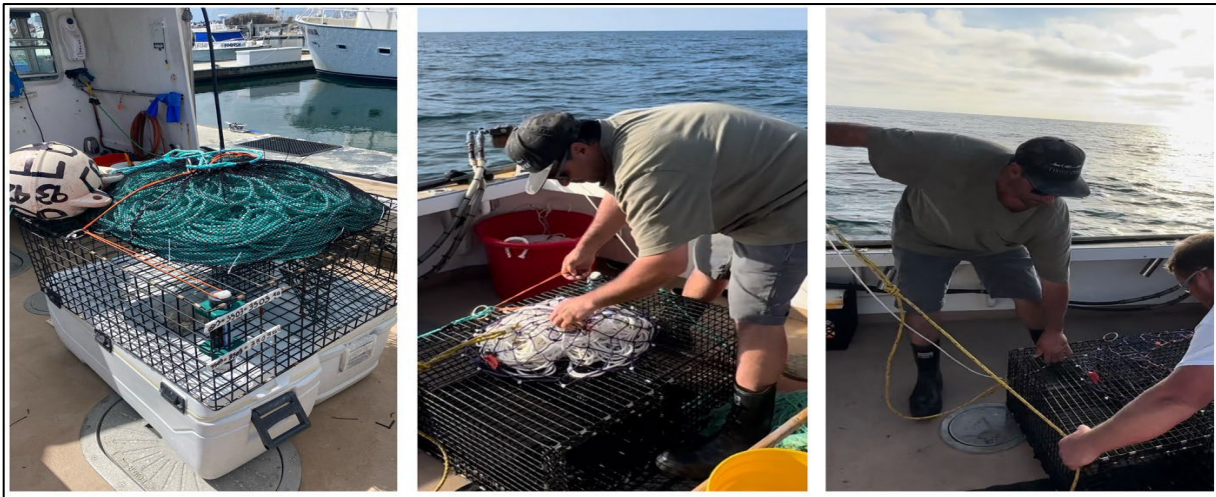


Figure 1 Black sea bass Captain M. Cowdrey conducting configuration testing and training with California Box Crab Captain J. Souza, 2024.



Figure 2 M. Cowdrey training California Fish and Wildlife Staff, 2024.

Equally important, state and federal law enforcement officers have received dockside and on-water training from BSB fishers as a result of this program (Figure 2), giving them firsthand experience with on-demand technologies and the associated virtual gear marking systems. These outreach and training efforts mean that the Southeast BSB fishery has not only advanced its own transition but has also built the knowledge base that other fisheries

<sup>1</sup> Subsea Buoy Retrieval Systems are also known as “ropeless”, “lineless”, “pop-up”, and “on-demand” fishing systems. For the purpose of the application, the all-inclusive term SBRS will be used for all devices, regardless of release type (Galvanic, Timed, Acoustic).

and enforcement bodies rely upon as they consider adopting whale-safe gear.

The purpose of this follow-on EFP is to maintain momentum and progress by continuing training and knowledge transfer, conducting focused refined gear testing, addressing shark interactions, expanding interoperability and enforcement systems, and assessing economic feasibility. Our updated power analysis and results through February of 2024 further validates the operational readiness of these systems:

- Mechanical reliability: 99.9% (95% CI: [0.9970, 0.9997])
- All-failure reliability: 99.1% (95% CI: [0.9864, 0.9935])
- Learning-phase operational error rate: 6.14%
- Operational-phase error rate: 0.84%

## Identification of Problem

Traditional pot fishing gear includes vertical end lines and buoys that stay in the water column for hours or days while the gear is deployed, presenting an entanglement risk to cetaceans and other protected species. Fishery closures meant to prevent interactions between vertical lines and endangered cetaceans have negative economic impacts on fishermen who are unable to access the resources on which they make their living. SBRS are innovative gear types that store buoys and their retrieval devices at depth, existing in the water column only when fishers are present. SBRS, or “ropeless”, systems have been utilized in fisheries and other marine applications worldwide for over twenty years and have been extremely reliable (>99%) in tests done internationally (Sawicki, 2021). Fishing grounds in the Black Sea Bass (BSB) pot portion of the Snapper-Grouper fishery off the coast of Georgia and Florida are currently closed in the winter when North Atlantic right whales (NARW) migrate to their seasonal calving grounds. Adaptation of on-demand systems for this style of pot fishing have removed nearly all risk to these whales and other marine animals that suffer entanglements, while still allowing fishermen to access the BSB fishery during time-area closures (SAFMC, 2025, Sawicki et al, 2024).

For fisheries management to determine if these devices could be relied upon in an area currently closed to pot fishing when NARW mothers and calves are present, a detailed performance analysis is required. This analysis is ongoing within this fishery and others where fishermen have been trained using the training model first developed here. The focus remains on the refinement and successful use of SBRS in real fishing conditions, alongside improvements in gear design and deployment reliability.

In addition, there is a continued need to train fishermen in this region, as has been done consistently since 2020, to ensure safe, effective, and responsible use of the technology. Our certified train-the-trainer model has also been applied globally, allowing knowledge and skills gained in this fishery to be transferred to others (Halonon, et al. 2024). These efforts are complemented by ongoing work to advance virtual gear marking applications and other innovations that support enforcement, management, and day-to-day operations. Together, these activities represent a comprehensive framework for assessing the reliability of these devices in sensitive habitats.

Our first fisher-funded pilot project conducted under a NMFS Exempted Fishing Permit (EFP) showed the eight types of on-demand gear we tested to be 100% reliable *when properly trained and experienced researchers and fishermen were operating the devices*. Our research highlights the importance of fisher input and expertise in making the gear more adaptable (and profitable) for those wishing to fish a SBRS. During our reliability testing in the initial pilot, researchers worked with ten fishermen on three vessels testing various gear configurations. To assess issues of safety, reliability of devices, efficiency, fishability and researcher and fisher learning curve, we collected trap interior and exterior recordings, active and passive deck and dockside operations recordings, and aerial video of retrievals and repacking/stowing activities on deck. At the conclusion of our first trial fishing season (fishing single pots), we demonstrated a 99.4% success rate of the devices (n=804 deployments).

In February 2022, our group was granted a second EFP, this time to perform fishing and testing activities during the time-area closure. In trials conducted from February and March 2022, our second fisher-funded project has shown all ropeless gear tested to be 100% reliable (n=144) when properly trained and experienced researchers and fishermen were operating the devices. Fishermen report < 1% occurrence of human error when setting control gear. These operational failures caused the line and buoys to be retained in their containment devices, so no gear was “accidentally released” or “unexpectedly” triggered at any time. Due to the positive experience of project participants, increased interest from other BSB pot endorsement holders were expressed and within a few months of the start of the second EFP, the EFP was modified to include additional fishers. To minimize the occurrence of human error while operating on-demand systems during the right whale calving season, the added fishers were trained during the regular BSB fishing season.

The preliminary analysis of the second EFP indicates that SBRS maintained a success rate of greater than 99% for deployment and retrieval (n=2,968 ) under operational fishing conditions. Failures were rare, occurring mostly during early training and attributable to fisher/researcher error, with no observed cases of accidental release or entanglement risk. Testing suggested the possibility of shark-related interactions with KD-40 buoys in one fisher-preferred configuration; however, direct evidence of such interactions was not observed. Sharks were occasionally noted in proximity to the gear on the



*Figure 3. Shark presence noted in videos near deployed gear*

seafloor (Figure 3), and in some instances sand tiger sharks were observed near the surface following buoy deployment, raising the possibility of opportunistic interactions. While the causal link remains unconfirmed, damage to buoys and buoy lines was sometimes documented in these cases, leading to compromised retrieval performance. To explore potential mitigation, we have experimented with alternative buoy colors and the use of ruggedized tethers designed to withstand incidental damage.

Addressing these hypothesized interactions through improved line packing, buoy colors, or ruggedization is therefore a necessary step toward broader implementation if utilizing that configuration. Overall, the devices performed reliably across a range of soak times, bottom types, and weather conditions, confirming their operational viability in the BSB fishery. Coupled with fisher-reported improvements in efficiency and ease of use following training, these results provide strong evidence that SBRS gear can support both conservation goals and continued fishery access (Sawicki et al.,2024).

## Research Objectives & Questions

This project builds upon four years of successful testing of Subsea Buoy Retrieval Systems (SBRS) in the Southeast BSB pot fishery. The fishery has proven to be an excellent environment to conduct gear research and development, given the relatively small scale of operations, well-defined closures, and active participation of endorsement holders. While SBRS have already demonstrated >99% reliability when operated by trained fishers, additional work is required to refine gear design, expand certified training, and document the economic and regulatory conditions under which widespread adoption would be feasible. This EFP is requested because it provides the regulatory exemptions and structured research framework necessary to continue to conduct testing during seasonal closures, trial modified configurations, and continue to build upon the regional knowledge exchanges that began in 2022 (Fluech and Baker, 2023, PBS, 2024).

In this project, we will evaluate updated, research-and-development (R&D)–enhanced variants of on-demand fishing systems produced by established manufacturers. Each device variant will undergo an independent, statistically powered reliability assessment, framed as a non-inferiority test against the established benchmark reliability of 0.984. Based on prior operational performance (99.9% mechanical reliability; 95% CI: 0.997–0.9997), the practical target sample size is ~300 hauls per variant, which provides adequate power to demonstrate significance even in the presence of a single mechanical failure. Where conditions are expected to be more challenging, or to support higher-confidence inference (~99% power), testing may be extended to ~400 hauls per variant.

At the program level, results from multiple improved devices will be pooled to provide a broader estimate of performance across the suite of technologies. These aggregated outcomes are expected to continue to demonstrate performance exceeding the benchmark standard, with narrow confidence intervals consistent with results obtained during the most recent operational phase of testing (2022–2024). This design ensures that the evaluation framework remains responsive to iterative improvements in device engineering, rather than functioning solely as a reassessment of legacy configurations.

It is our intent that this work will:

### Objective 1. Training & Knowledge Transfer

- Maintain fisher mastery through continued use and testing of SBRS.
- Refine the certified training program developed in 2022 into a standardized syllabus with written, digital, and video-based materials.
- Test the *train-the-trainer* model as a pathway to sustainable, peer-led education for new participants.
- Evaluate whether training reduces at-sea errors to statistically negligible levels.

### Objective 2. Focused Gear Testing

- Test fisher-selected, lower-cost SBRS systems under full operational conditions.
- Evaluate the performance of these preferred designs, incorporating fisher-led modifications identified in earlier projects.
- Address gear-specific refinements and quantify their effect on reliability, catchability, and efficiency.

### Objective 3. Shark Interactions

- Assess shark-related damage to buoys and lines observed in prior trials.

- Test different line packing methods, buoy colors, line materials, and ruggedization strategies to reduce interactions.
- Evaluate secondary or backup release systems for gear retrieval when sharks compromise the primary system.

#### **Objective 4. Virtual Gear Marking & Interoperability**

- Conduct broader testing of gear marking applications, virtual GPS tracking, and emerging interoperability systems.
- Potentially test the multi-manufacturer deck box and prototype enforcement portals.
- Determine whether virtual marking provides reliable, enforceable data access for managers and enforcement personnel.

#### **Objective 5. Economic Viability**

- Conduct fisher-centered analysis of costs and benefits for SBRS adoption.
- Evaluate whether operational use of SBRS is economically sustainable without external support.
- Document what cost reductions or financial supports would be necessary for wide-scale adoption.
- Compare traditional single-pot fishing with modified 2DF and 4BY configurations to assess potential cost savings.

By addressing these objectives, this EFP will provide not only the technical validation needed for SBRS adoption but also the regulatory, economic, and social framework for regional adaptation. This work will directly connect to the 2022 On-Demand Knowledge Exchange by testing its outputs in real-world conditions and building the foundation for future research, development, and cross-fishery implementation.

#### Collaboration

Collaborators include the University of Georgia Sea Grant, South Atlantic Fishery Management Council, NOAA, SERO, Marine Innovations Gear Alliance, Natural Resources Defense Council, and manufacturers. A standardized train-the-trainer course offering (initiated in 2022 and refined through 2024) will continue, with the goal of certification of fishers in on-demand gear operation. Fisher-led adaptations and knowledge exchanges remain core to this EFP.

#### **Project Timeline**

This project spans three years and is structured to progressively move from refresher training and scaled-up gear trials toward certification, refined economic analysis, and verification of readiness for implementation. Our first and second years will encompass intensive fisher training, gear-specific testing, shark interaction experiments, interoperability and marking system trials, and economic data collection. The third year will focus on validation of certification programs, evaluation of backup recovery systems, enforcement portal development, and a final economic viability assessment.

#### **Year 1 (November 1, 2025 – October 31, 2026)**

- **Training & Knowledge Transfer (RO1):** Conduct refresher training for participating fishers on selected gear configurations. Training will emphasize troubleshooting, use of updated manufacturer

apps, and application of the “Six Rights for Ropeless” learning framework. Data collected will help evaluate whether mastery can be maintained until authorization.

- **Focused Gear Testing (RO2):** Fisher-identified gear (e.g., Subsea Sonics AR4RT+, Longsoaker Guardian, Ashored MOBI, Fiobuoy) will be fished at full gear stack levels. Retained catch will be sold under wholesale partners, with detailed tracking of catch per unit effort (CPUE), soak time, and haul efficiency. This mirrors previous trials but with emphasis on lower-cost configurations.
- **Shark Interactions (RO3):** Test buoy packaging methods (netted containment, hard vs. soft buoys, color and size variants) and different line materials for resistance to damage. Footage will be collected to assess behavioral interactions.
- **Virtual Gear Marking (RO4):** Reliability of manufacturer-provided gear marking apps will be tested during live deployments, capturing data on positional accuracy, app-to-vessel chart plotter consistency, and enforcement review potential.
- **Economic Viability (RO5):** Structured surveys and fisher interviews will begin. Data will include real-time handling costs, soak/haul effort, fuel use, and fisher-reported profitability. Outcomes will feed into long-term cost modeling tools.

### Year 2 (November 1, 2026 – October 31, 2027)

- **Training & Certification (RO1):** Formalize training developed in Year 1 into a standardized syllabus with written, video, and app-based materials. This will establish a framework for certification of SBRS operators in the BSB fishery.
- **Refined Gear Testing (RO2):** Conduct expanded trials with modified gear configurations (2DF and 4BY pots) to reduce the number of required SBRS devices per pot. These trials will test efficiency gains and cost reductions.
- **Shark Interactions (RO3):** Evaluate results of Year 1 trials and quantify effectiveness of countermeasures. Data will inform whether ruggedization strategies (reinforced lines, coated buoys) reduce retrieval failures.
- **Interoperability (RO4):** Test cross-manufacturer interoperability tools (EarthRanger, rmwHUB) and prototype multi-manufacturer deck box. Assess whether shared displays reduce gear conflicts and improve operational safety.
- **Economic Surveys (RO5):** Launch comprehensive survey effort with Snapper-Grouper permit holders to quantify decision-making schemes, historical fishing costs, and willingness to adopt SBRS. Begin Net Present Value (NPV) calculations for 1-, 5-, 10-, and 20-year adoption cycles.

### Year 3 (November 1, 2027 – April 30, 2028)

- **Train-the-Trainer Certification (RO1):** Test the standardized training syllabus through a train-the-trainer model, evaluating whether certified captains can successfully train new operators. Post-training operational performance will be tracked against baseline reliability rates (>99%).
- **Verification of Readiness (RO2):** Assess whether fisher-preferred gear systems, including 2DF and 4BY, meet the operational reliability threshold (99.1% with CI [0.986–0.993]) and are economically viable without subsidies.
- **Backup Recovery Systems (RO3):** If shark countermeasures remain insufficient, trial additional devices and assess their cost-benefit.
- **Enforcement Portal (RO4):** Develop or adapt an enforcement portal modeled on interoperability systems from other regions. Evaluate functionality for real-time enforcement access to deployment data.
- **Final Economic Analysis (RO5):** Compile fisher-reported costs, CPUE, and model outputs to provide management with a decision-support tool. Final analysis will include cost of expendables, gear replacement, and a scoring schema for non-monetary social benefits identified by fishers.

## Requested Exemptions

1. **50 CFR § 622.177 (a)(2) Associated buoys.** In the South Atlantic EEZ, buoys are not required to be used, but, if used, each buoy must display the official number and color code assigned by the RA so as to be easily distinguished, located, and identified.
  - *We require exemption from this rule because our SBRS gear (inclusive of buoys or lift bags) is borrowed gear and using the official color code and number prescribed by the RA would not be possible without permanently defacing the gear. Additionally, these buoys are submerged at depth. We will ensure that any buoys which are utilized during the regular season are marked appropriately.*
2. **50 CFR § 622.177 (a)(4) Unmarked sea bass pots or buoys.** An unmarked sea bass pot or a buoy deployed in the EEZ where such pot or buoy is required to be marked is illegal and may be disposed of in any appropriate manner by the Assistant Administrator or an authorized officer.
  - *We require exemption from this rule because our SBRS gear (inclusive of buoys or lift bags) is borrowed gear and using the official color code and number prescribed by the RA would not be possible without permanently defacing the gear. Additionally, these buoys are submerged at depth. We will ensure that any buoys which are utilized during the regular season are marked appropriately. We will use virtual gear marking to track our deployments, as well to avoid gear interactions with other participants.*
3. Operating under **50 CFR 622.183(a)(1)(ii)(E)** until such time that **50 CFR 622.183(a)(1)(ii)(F)** is effective.
  - a. **50 CFR 622.183(a)(1)(ii)(E)** A crustacean trap, golden crab trap, or sea bass pot cannot be baited. All buoys must be disconnected from the gear; however, buoys may remain on deck.
  - b. **50 CFR 622.183(a)(1)(ii)(F)** A sea bass pot cannot be baited. For a sea bass pot fished with a deployed vertical line or rope connected to a buoy, the buoy must be disconnected from the gear, although the buoy may remain on deck. For a sea bass pot fished without a deployed vertical line connected to a buoy, referred to as an on-demand or ropeless sea bass pot, the buoy may remain connected to the gear.
  - *We require exemption from 50 CFR 622.183(a)(1)(ii)(E) until such time that 50 CFR 622.183(a)(1)(ii)(F) is in effect because SBRS gear (inclusive of buoys or lift bags) may not always be easy or possible to disconnect from traps, particularly those that are fixed or spliced into the bridle system of singles or 4BYs. No pots will be baited during transit through MPAs.*
4. Operating under **50 CFR 622.183(a)(1)(vii)(E)** until such time that **50 CFR 622.183(a)(1)(vii)(F)** is effective.
  - a. **50 CFR 622.183(a)(2)(vii)(E)** A crustacean trap, golden crab trap, or sea bass pot cannot be baited. All buoys must be disconnected from the gear; however, buoys may remain on deck.
  - b. **50 CFR 622.183(a)(1)(vii)(F)** A sea bass pot cannot be baited. For a sea bass pot fished with a deployed vertical line or rope connected to a buoy, the buoy must be disconnected from the gear, although the buoy may remain on deck. For a sea bass pot fished without a deployed vertical line connected to a buoy, referred to as an on-demand or ropeless sea bass pot, the buoy may remain connected to the gear.
  - c. *We require exemption from 50 CFR 622.183(a)(1)(vii)(E) until such time that 50 CFR 622.183(a)(1)(vii)(F) is in effect because SBRS gear (inclusive of buoys or lift bags) may*

*not always be easy or possible to disconnect from traps, particularly those that are fixed or spliced into the bridle system of singles or 4BYs. No pots will be baited during transit through SMZs.*

5. **50 CFR 622.183(b)(6) Seasonal closure of the commercial black sea bass pot component of the snapper-grouper fishery.** The closed area is that area and time period described in paragraphs (b)(6)(i) and (b)(6)(ii) of this section, respectively. During the applicable closure, no person may harvest or possess black sea bass in or from the closed area within the South Atlantic EEZ either with sea bass pots or from a vessel with sea bass pots on board, except that a vessel with a valid commercial permit for snapper grouper with a sea bass pot endorsement that is in transit and with black sea bass pot gear appropriately stowed as described in paragraph (b)(6)(iii) of this section may possess black sea bass. In addition, sea bass pots must be removed from the water in the applicable closed area within the South Atlantic EEZ before the applicable time period and may not be on board a vessel in the closed area within the South Atlantic EEZ during the applicable closure, except for such sea bass pot gear appropriately stowed on board a vessel in transit through the closed area. See paragraph (b)(6)(iii) of this section for black sea bass pot transit and gear stowage requirements through the closed areas.
  
6. **50 CFR 622.183(b)(6)(i)** From November 1 through November 30 and from April 1 through April 30, no person may harvest or possess black sea bass in or from the closed area within the South Atlantic EEZ either with sea bass pots or from a vessel with sea bass pots on board in the South Atlantic EEZ inshore of the rhumb lines connecting, in order, the following points:

Point	North Latitude	West Longitude	Point	North Latitude	West Longitude	Point	North Latitude	West Longitude
1	35°15'	State/EEZ Boundary	13	33°44'	77°	25	32°34'	79°
2	35°15'	75°	14	33°25'	77°	26	32°25'	79°
3	35°06'	75°	15	33°22'	77°	27	32°23'	79°
4	35°06'	75°	16	33°28'	77°	28	31°53'	80°
5	35°01'	75°	17	33°32'	77°	29	31°31'	80°
6	34°54'	75°	18	33°22'	78°	30	30°43'	80°
7	34°52'	76°	19	33°06'	78°	31	30°30'	81°
8	34°33'	76°	20	33°05'	78°	32	29°45'	81°
9	34°23'	76°	21	33°01'	78°	33	29°31'	80°
10	34°21'	76°	22	32°56'	78°	34	29°13'	80°
11	34°25'	76°	23	32°44'	79°	35	29°13'	State/EEZ Boundary
12	34°09'	77°	24	32°42'	79°			

- *Our work requires exemption from this rule as it would not be possible to fish SBRS gear in any other area and return pertinent data on the economic viability of this gear for this fishery without access to the resource, which is in greatest abundance, is most valuable, and easiest to access in the winter closure area and closure period. We will take all available safety precautions necessary including turning off the permitted fishing vessels to look and listen for whales in the area for 15 minutes prior to triggering release of the devices. Further, before leaving the dock for all fishing activities, we will suggest that fishermen check the Whale Alert App or consult this sightings map: [WhaleMap](#) or all areas off NC and SC, we will advise our participant vessels to transit 10 knots or less within a 5 nautical mile radius of a right whale sighting for 3 days post the initial sighting. For areas off GA and FL, we will advise our participant vessels to transit 10 knots or less within a 5 nautical mile radius of a right whale sighting for 14 days post that sighting.*

7. **50 CFR 622.183(b)(6)(ii)** From December 1 through March 31, no person may harvest or possess black sea bass in or from the closed area within the South Atlantic EEZ either with sea bass pots or from a vessel with sea bass pots on board in the South Atlantic EEZ inshore of the rhumb lines connecting, in order, the following points:

Point	North Lat	West Long	Point	North Lat	West Long	Point	North Lat	West Long	Point	North Lat	West Long
1	35°15'	State/EEZ Boundary	8	34°12'	77°00'	15	33°01'	78°38'	22	30°58'	80°47'
2	35°15'	75°08'	9	33°43'	77°30'	16	32°40'	79°01'	23	30°13'	81°01'
3	34°58'	75°41'	10	33°21'	77°21'	17	32°36'	79°18'	24	29°32'	80°39'
4	34°49'	75°50'	11	33°18'	77°41'	18	32°19'	79°22'	25	29°22'	80°44'
5	34°47'	76°05'	12	33°22'	77°56'	19	32°16'	79°37'	26	28°50'	80°22'
6	34°31'	76°18'	13	33°12'	78°20'	20	32°03'	79°48'	27	28°21'	80°18'
7	34°20'	76°13'	14	33°05'	78°22'	21	31°39'	80°27'	28	28°21'	State/EEZ Boundary

- *Our work requires exemption from this rule as it would not be possible to fish SBRS gear in any other area and return pertinent data on the economic viability of this gear for this fishery without access to the resource, which is in greatest abundance, is most valuable, and easiest to access in the winter closure area and closure period. We will take all available safety precautions necessary including turning off the permitted fishing vessels to look and listen for whales in the area for 15 minutes prior to triggering release of the devices. Further, before leaving the dock for all fishing activities, we will suggest that fishermen check the Whale Alert App or consult this sightings map: [WhaleMap](#) or areas off NC and SC, we will advise our participant vessels to transit 10 knots or less within a 5 nautical mile radius of a right whale sighting for 3 days post the initial sighting. For areas off GA and FL, we will advise our participant vessels to transit 10 knots or less within a 5 nautical mile radius of a right whale sighting for 14 days post that sighting.*

8. **50 CFR 622.183(b)(6)(iii)** For the purpose of paragraph (b)(6) of this section, transit means non-stop progression through the area; fishing gear appropriately stowed means all black sea bass pot

gear must be out of the water and on board the deck of the vessel. All buoys must either be disconnected from the gear or stowed within the sea bass pot. Disconnected buoys may remain on deck.

- *We require exemption from this rule because SBRS gear (inclusive of buoys or lift bags) may not always be easy or possible to disconnect from traps, particularly those that are fixed or spliced into the bridle system of singles or 4BYs. No pots will be baited during transit.*
9. **50 CFR § 622.189(b) Configuration restriction.** In the South Atlantic EEZ, sea bass pots may not be used or possessed in multiple configurations, that is, two or more pots may not be attached one to another so that their overall dimensions exceed those allowed for an individual sea bass pot. This does not preclude connecting individual pots to a line, such as a “trawl” or trot line.
- *Our work requires exemption from this rule because it would not be possible to test our 4BY trap configurations with the fishers who elect to try them. These trap configurations would make transition to SBRS gear more affordable and is a critical element of our research.*
10. **50 CFR § 622.189(e)(1) Requirements for pot removal.** A sea bass pot must be removed from the water in the South Atlantic EEZ, and the vessel must be returned to a dock, berth, beach, seawall, or ramp at the conclusion of each trip. Sea bass pots may remain on the vessel at the conclusion of each trip.
- *Our work requires exemption from this rule because it would not be possible to test traditional soak times and approaches by some fishers who have historically used these methods. Combining SBRS, new trap configurations, and traditional soak times would make transition to SBRS gear more affordable for those wishing to use the pots as a passive fishing approach and is a critical element of our research.*
11. **50 CFR § 622.189 (g) Sea bass pot buoy line marking requirement.** In addition to the gear marking requirements specified in 50 CFR 229.32(b), from November 15 through April 15, each year, in the Southeast U.S. Restricted Area North as described in 50 CFR 229.32 (f) and from September 1 through May 31, each year in the Offshore Trap/Pot Waters Area and the Southern Nearshore Trap/Pot Waters Area, as described in 50 CFR 229.32(c)(6) and (9), respectively, the buoy line must be marked with a purple color band. The colored band must be clearly visible when the gear is hauled or removed from the water, including if the color of the rope is the same as, or similar, to the colored band. The purple band must be marked directly onto the line and adjacent to the buoy line markings specified in 50 CFR 229.32(b), that is, at the top, middle, and bottom of each buoy line deployed by, or on board, the vessel. Each of the three purple bands must be a 12-inch (30.5 cm) color mark. In marking or affixing the purple band, the line may be dyed, painted, or marked with thin colored whipping line, thin colored plastic, or heat shrink tubing, or other material.
- *Our work requires exemption from this rule and requests a different color (pink) for our line marking so that our experimental fishing is discernible from other fisheries and gear types.*

## Catch Information

1. The species expected to be harvested and/or discarded under the EFP.
  - a. Target Species: *Centropristis striata*, Black Sea Bass
  - b. Incidental Catch Species: Black Sea Bass, *Centropristis striata* (Sub-legal conspecifics), a small number of a variety marketable species including octopus.

2. The number or weight, by species, of such harvest and/or discard anticipated to occur during the exempted fishing, regardless of whether or not it is retained for sale.
  - a. We expect to harvest a total of approximately 10,000 pounds whole weight per year per fisher for a total of 40,000 pounds whole weight per year. Incidental species will be harvested if allowable by law and is expected to be less than 10% of total catch, or 1,000 pounds whole weight each year, per endorsement. For those non-permitted or non-exempted fish that show signs of barotrauma, we will use decompression techniques including descending gear devices and/or venting prior to being returned to the water.
3. The expected disposition of all regulated species harvested under the EFP
  - a. It will be sold.
4. Any anticipated impacts on fisheries, marine mammals, endangered species, or Essential Fish Habitat.
  - a. No detrimental impacts are anticipated.
5. Anticipated effort information for each vessel.
  - a. *Amount of gear to be used*: 35 total pots per vessel. See the ‘Black Sea Bass Pot Modifications’ sub-section in the ‘Effort Information’ section for more details on the configuration and types of on-demand systems being used.
  - b. *Average number of gear hauls*: < 3,000 per endorsement per year
  - c. *Average soak time*: 90 minutes for strike fishing, occasional overnight soaks.
  - d. *Sampling months/time of year*: January 1 - December 31, including November 15 - April 30 closed season.
  - e. *Sampling locations (including depth)*: Inshore, in waters between 20 and 65 meters. See the ‘Study Area’ and ‘Detailed Sampling Areas’ sub-sections in the ‘Effort Information’ section for more details.

## Effort Information

### Fishing Methods

**Table 1.** An overview of the gear type, working method, and development status of the gear to be tested during the requested EFP.

Manufacturer	Line Storage Method	Release Method	Field Tested?	Website
Desert Star Systems	Multi or Bag	Acoustic	Y	<a href="http://www.desertstar.com">http://www.desertstar.com</a>
Fiomarine	Spool	Acoustic/ Timer	Y	<a href="http://fiomarine.com">http://fiomarine.com</a>
Lift Labs (formerly Lobster Lift)	Air	Acoustic	Y	<a href="https://www.liftlabs.org">https://www.liftlabs.org</a>
Longsoaker	Mesh	GTR*	Y	<a href="http://longsoaker.com">http://longsoaker.com</a>
Ropeless Riser	Air	Acoustic	Y	<a href="https://www.ropeless.us">https://www.ropeless.us</a>

<b>Subsea Sonics</b>	Multi	Acoustic	Y	<a href="https://www.subseasonics.com">https://www.subseasonics.com</a>
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\*Retrieval device for catastrophic failure during configuration testing only.

During the configuration process, we ensure that modified systems are capable of operating at the highest level of reliability. Initial test traps will be deployed no fewer than ten times consecutively with safety lines, with lines and buoys stored at depth and timers and/or GTRs in place as backup releases. These configurations have already been proven effective in other U.S. regions, as well as in the United Kingdom and Canada. Video documentation of fish, traps, SBRS units, and participant behavior will be used to confirm the safety of target catch, sub-legal species, nearby marine life, and crew.

BSB pots will be fished as singles, 2DFs, or [4BYs](#) in inshore areas during closure periods to allow comparison with control pots. Where appropriate, additional data will also be collected from traditional gear equipped with vertical lines and surface buoys, but only during the open fishing season when the use of such gear is legally authorized. Data will include the time required to retrieve and rebait both traditional and experimental traps, as well as comparisons of handling effort. These experimental gears and configurations will be fished on live bottom with SBRS systems, without persistent vertical lines, and recorded using virtual GPS gear marking applications. Virtual gear marking—via chartplotters, GPS, and manufacturer software—will be evaluated for accuracy, with interoperability results shared with fishery managers.

Figures 4 –13 (On-Demand System Information Section) illustrate the SBRS gear and pot configurations selected for this project. Backup releases will be employed to prevent gear loss in the event of catastrophic SBRS failure during configuration testing only. Any modifications to rigging will be developed in consultation with regional and federal agencies and in collaboration with fishers and industry partners. Participating fishers are expected to use grant support and/or self-funding. To ensure compliance with the Marine Mammal Protection Act through the Marine Mammal Authorization Program, all legal catch will be landed and sold to qualify as commercial fishing. NOAA Fisheries will be consulted to confirm that study design and fishing activities align with existing North Atlantic right whale conservation measures.



Figure 4 Subsea Sonics AR4RT/TR4RT configurations. Left to right: A) Cowdrey, 2022 (Longsoaker Guardian and SSS hybrid), B) [Phillips, 2020](#) (VIDEO), and C) [Hull, 2022](#) (VIDEO).

## Black Sea Bass Pot Modifications

BSB pot fishers are currently limited to 35 traps per endorsement, and they must return to the dock at the end of each fishing trip. While many pot fisheries utilize trawls (traps connected by a ground line) to improve efficiency and reduce the number of vertical buoy lines, trawls are not allowed in this region during parts of the season. To address this, we collaborated with endorsement holders to conceive a method that connected four regulation-sized pots for our pilot project. This configuration, referred to as the 4BY, was built using wire connecting clips (hog rings) and required only one SBRS gear device to retrieve the four pots. Our experimental design ensured that all sides of the pots and configurations of pots used a mesh size of greater than 2.00" to allow maximum opportunity for the release of unintended species and sub-legal conspecifics (Rudershausen et al., 2016). This modification also reduced the total entrances from eight to four (Figures 5 and 6). By reducing the number of entrances and consolidating pots, the configuration decreased the time required for setting and resetting gear and offered a potential method to improve return on investment for fishers, since fewer SBRS devices were needed to fish the same number of pots.

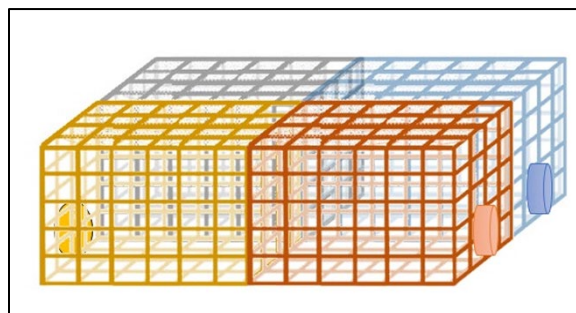


Figure 5. 4BY Configuration

We trialed this gear with multiple fishers. Some participants responded positively, finding the 4BY (Figure 5) efficient and well-suited to their operations, while others did not prefer it due to servicing and handling challenges. Despite these mixed responses, the gear demonstrated clear potential, and we intend to continue testing it to assess whether broader adoption could reduce costs and improve winter fishing efficiency. For example, fishing 32 pots traditionally required 32 individual deployments, whereas the 4BY reduced that effort to a minimum of eight deployments. Importantly, the interior dimensions of all configurations remained compliant with regulatory requirements.

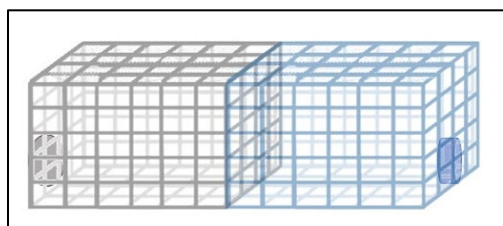


Figure 6. 2DF Configuration

In addition to the 4BY, we also tested a simplified version in which only two traps were connected, allowing for both standard entrances and 50% trap entrances. This “2DF” configuration (Figure 6) was conceived by Captain Cowdrey, who often fishes without crew and found the 4BY difficult to service singlehanded. In 2023, we discovered archival material documenting that this same two-pot configuration had been profiled decades earlier by William MacDonald in *National Fisherman* (MacDonald, 1974). These findings

suggest that both the 4BY and 2DF warrant continued investigation as options to reduce procurement and implementation costs for SBRS while maintaining—or potentially improving—catch efficiency.

## Study Area

Fishing will take place inshore, in waters between 20 and 65 meters per the map below (Figure 7). Fishermen participating in the work will advise PI if any changes to arrangements with opportunity regions are needed during the project period. PI will consult with NMFS to ensure that changes are compliant with the EFP.

We will not fish in Special Management Zones (SMZs) or those areas listed in CRF 50 §622.182 Gear-restricted areas (a)(1)(i) through (ii).

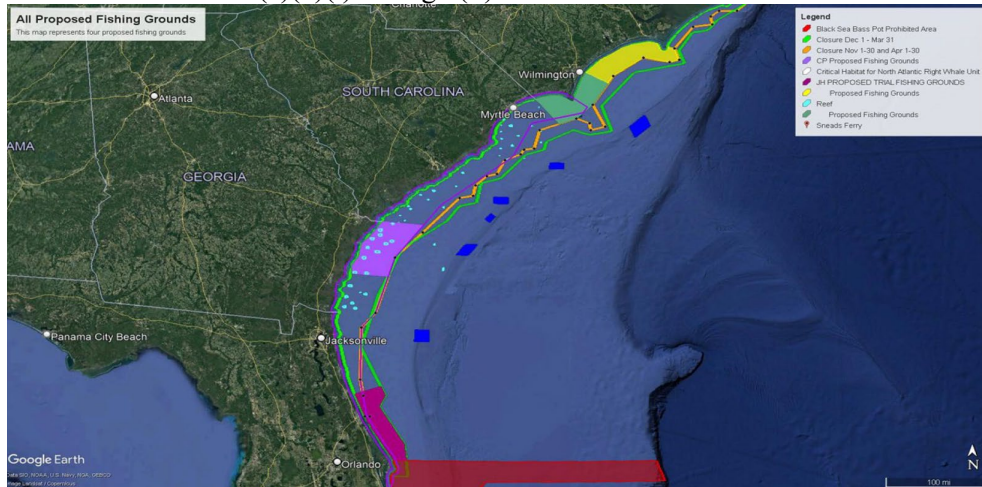


Figure 7. The proposed fishing areas for the SA BSB pot fishery 2025-2028.

## Vessel Information

**F/V Lady Kay (SBPE-9) VID: 587674**

Sneads Ferry, North Carolina

Vessel Owner Information:

Michael Cowdrey

PO Box 598

Sneads Ferry, NC 28460 - 0598

(910) 340-9801

[michaelcowdrey@gmail.com](mailto:michaelcowdrey@gmail.com)

Vessel Captain Information and Primary Project Participants:

Captain Michael Cowdrey and designated crew

*Researchers:* Kim Sawicki, Bryan Fluech

**F/V Captain Lynn (SBPE-20) VID: 542775**

**F/V Scrappy Dog (SBPE-18) VID: 693421**

**F/V Running Rabbits (SBPE-26) VID: GA5457SR**

Townsend, Georgia

Vessel Owner Information:

Charles Phillips

1418 Sapelo Avenue NE

Townsend, GA 31331

(912) 832-4423

[GA\\_Capt@yahoo.com](mailto:GA_Capt@yahoo.com)

Vessel Captain Information and Primary Project Participants:

Captain Charlie Phillips and designated crew

*Researchers:* Kim Sawicki, Bryan Fluech

**F/V Work-a-Hull-ic (SBPE-7) VID: 1094408**

Ormond Beach, FL

Vessel Owner Information:  
Jimmy Hull  
Southport Angler Inc  
111 W Granada Blvd  
Ormond Beach, FL 32174-6303  
(386) 547-1254  
[hullsseasfood@aol.com](mailto:hullsseasfood@aol.com)

Vessel Captain Information and Primary Project Participants:  
Captain Jimmy Hull and designated crew  
*Researchers:* Kim Sawicki, Bryan Fluech

### On-Demand System Information

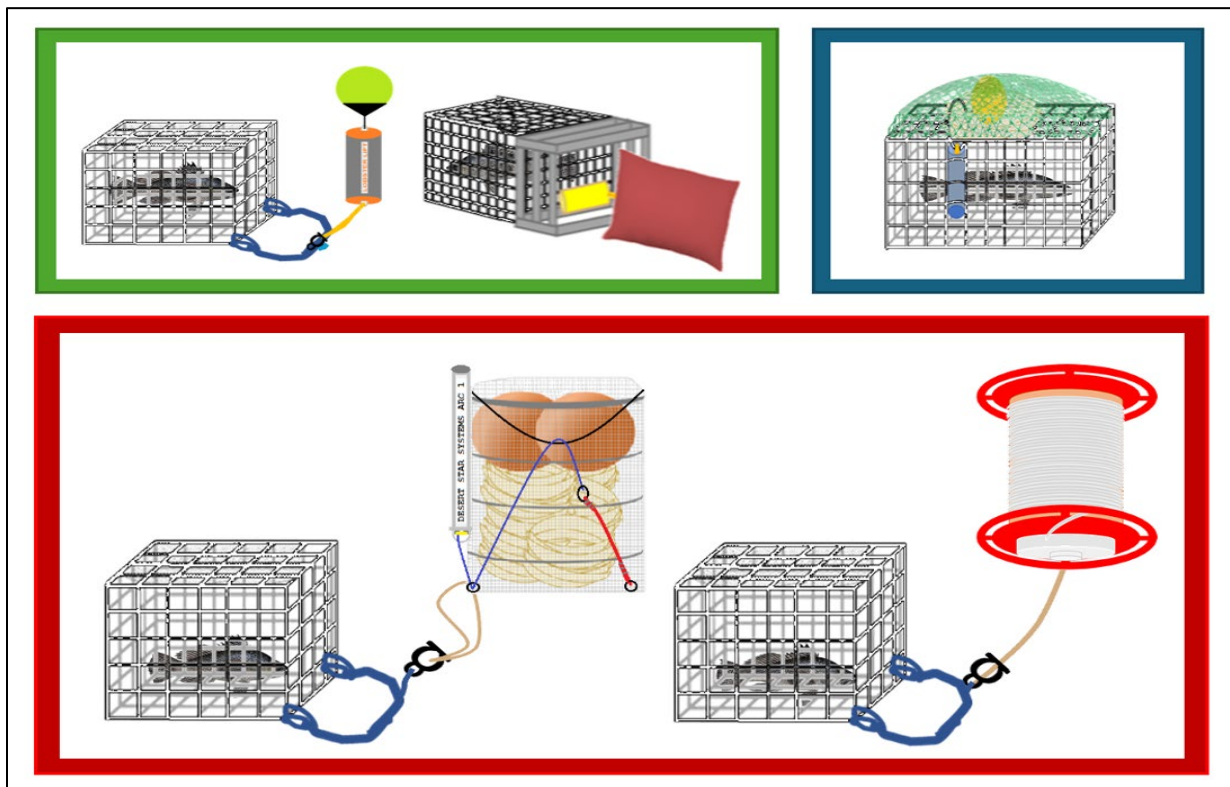


Figure 8. On Demand (SBRS) systems being tested in this project. From left to right, top to bottom: Lift Labs, Ropeless Systems RISER-AT, Longsoaker-Guardian and similar retrofit kits & Subsea Sonics - TR4RT, Desert Star Systems ARC-1XD, Fiomarine-FioBuoy, Sawicki & Toth, 2021

### Desert Star Systems

**Product Name:** Desert Star ARC-1XD  
**Manufacturer:** Desert Star Systems  
**Release Type:** Acoustic Release  
**Line Management Style:** Rope Release Bag/Interior of Trap with Guardian Retrofit  
**Field Tested:** Yes  
**Available for Purchase:** Yes  
**Website:** <http://www.desertstar.com>  
**Video Demonstration:** [Desert Star Systems](#)

The Desert Star ARC-1 is a modular acoustic release system produced by Desert Star Systems that can be paired with any rope management systems (Figure 9). As seen in Figure 6, the rope is contained in a mesh bag (Guardian Retrofit) and the buoy is left external to the bag, with an acoustically triggered release mechanism attached inside the trap. The release mechanism is a small magnesium wire that disintegrates when it receives an acoustic command. Once released, the buoy pulls the line out of the bag and ascends for retrieval at the surface. The gear is then hauled as normal, and the line is repacked for another deployment. The rope storage method can and has been customized to fishermen's needs according to their geographic regions. This release system has existed and been in use by fishermen in New South Wales (Australia) for many years and is available for purchase on Desert Star Systems' website. This device will require weight to be added to the trap to fully submerge the buoy.

This system has been successfully tested and used by fishers in Australia, New South Wales, South Africa, New Zealand, Scotland, Canada, California, Maine, Massachusetts, Georgia, and North Carolina for use in fishing applications and had a reliability of >99% during our second EFP.



Figure 9. Desert Star Systems ARC1-XD

### Fiomarine

**Product Name:** Fiobuoy® AC100  
**Manufacturer:** Fiomarine  
**Release Type:** Acoustic Release  
**Line Management Style:** Spool Design  
**Field Tested:** Yes  
**Available for Purchase:** Yes  
**Website:** <http://fiomarine.com>  
**Video Demonstration:** [Spool design](#)



Figure 10. Fiomarine Fiobouy

The Fiobuoy® is an integrated smart buoy system comprised of a spool of rope, acoustic modem, floatation, and release mechanism affixed to a subsea object (Figure 10). Each unit has a unique identification code to allow security to the fleet and provide an integrated system management capability for enhanced fisheries operations and oversight. The code management capability can be configured to allow only the buoy to operate in areas open for fishing. If there were an attempt to launch the system within a closed zone, the release jaws would not close on the

surface. This system capability prevents the deployment of the system when configured for this functionality. The Fiobuoy mechanical release is activated upon receiving an acoustic command from the surface vessel, a master code for enforcement personnel is also designed into the system. There are also two failsafe release backups in the Fiobuoy: a time/date trigger and a low battery trigger. Once the mechanical jaws are released, the Fiobuoy floats to the surface as the line unspools. Recovery operations remain the same as traditionally marked surface float fixed gear traps. This configuration removes the surface float and the vertical line in the water column until a release is triggered. This device will not require weight to be added to the trap unless fast moving currents are present.

This system has been successfully tested by fishers in Australia, New Zealand, Scotland, California, Maine, Massachusetts, Georgia, and North Carolina for use in fishing applications and had a reliability of >99% during our second EFP.

### Lift Labs

**Product Name:** Lift Labs-All Models

**Manufacturer:** Lift Labs

**Release Type:** Acoustic Release

**Line Management Style:** Lift Buoy

**Field Tested:** Yes

**Available for Purchase:** No – solid prototype

**Website:** <https://www.liftlabs.org/the-gear>

**Video Demonstration:** [Lift Labs](#)

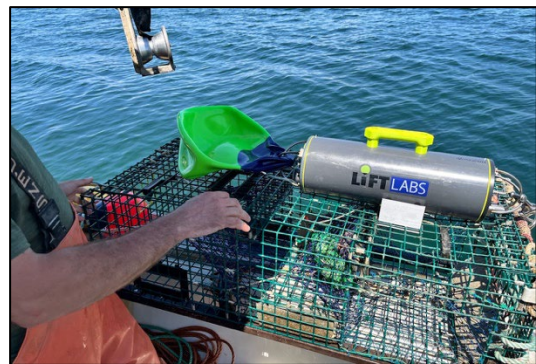


Figure 11. Lift Labs

Lift Labs is a lineless, self-surfacing modular lobster trap retrieval system. Traps utilizing Lift Labs technology sit on the seafloor and are raised when needed through acoustic signal (Figure 11). To retrieve a trawl, a fisherman sends an acoustic signal from the boat to a module attached to the trawl. The buoy increases in size until it can float the trap to just below the surface (4-8 ft. below the waterline). The buoy is then hauled, the traps are retrieved, removed from their catch, and re-baited. This method uses no vertical endline but does use rope between traps. This device will not require weight to be added to the trap.

This prototype has been successfully tested by fishers in Maine, Massachusetts, Georgia, and North Carolina for use in fishing applications and had a reliability >98.5% during our second EFP.

## Longsoaker Fishing Systems

**Product Name:** Guardian Retrofit/Fisher designed alternative  
**Manufacturer:** Longsoaker Fishing Systems  
**Release Type:** Line management and/or GTR Release  
**Line Management Style:** Net  
**Field Tested:** Yes  
**Available for Purchase:** Yes  
**Website:** <https://longsoaker.com/>  
**Video Demonstration:** [Longsoaker Guardian](#)

The Longsoaker Guardian is a fishing trap retrieval system. Traps utilizing the Guardian technology sit on the seafloor and are raised when paired with a release. The Guardian Retrofit generally consists of net stitched or zip-tied to the top of the trap which allows the release of a coiled line and/or buoy from the top of a standard pot or trap. A standard HDPE buoy is used (KD40) and is submerged for most of the soak time (Figure 12). It is not visible on the surface until the selected release is deployed and releases the buoy and line. The buoy is then hauled, the traps are retrieved, removed of their catch, and re-baited.

Retrieval time is the same as with regular gear, most fishermen will be able to use their existing buoy lines and deck gear. This gear can be easily modified to meet specific fishing requirements for different locations and regulations. When not in use, the retrofit is out of the way and does not require de-rigging, removal, or storage.

This system has been successfully tested by SST staff and fishers in the BSB pot fishery extensively and had a >99% during our second EFP.

**Product Name:** Galvanic Timed Release  
**Manufacturer:** Longsoaker Fishing Systems  
Longsoaker Fishing Systems  
**Gear Type:** GTR  
**Field Tested:** Yes  
**Available for Purchase:** Yes  
**Website:** <https://longsoaker.com/>  
**Product Page:** [GTRs](#)



*Figure 12. Guardian Ropeless style (fisher-designed) line management paired with the Subsea Sonics AR4RT release unit.*



*Figure 13. Longsoaker GTR system installed on Terhune Bag*

Galvanic Timed-Releases (GTR) are a low-cost option in widespread use in the marine industry and in multiple pot fisheries globally. (Figure 13) (Salvador et al., 2006). A GTR device uses two dissimilar metals that corrode at a predictable rate. The corrosion releases the link, which then allows a float and line to rise to the surface for recovery. GTR's must be used in saltwater. Their corrosion rate depends on the water's salinity and temperature at the depth being used.

GTR releases offer approximate release timing, which varies with water temperature, salinity, current speed, and fouling. Thus, GTR-equipped ropeless systems will still leave the rope in the water column some percentage of the time.

***The primary purpose of these releases in this trial is to ensure a “back-up” method of retrieval for the SBRS systems in case of catastrophic failure of the acoustic systems or timers during configuration testing only.*** We are utilizing this back up system occasionally in other fishing projects during configuration testing as well.

### Subsea Sonics

**Product Name:** AR4RT

**Manufacturer:** Subsea Sonics

**Release Type:** Acoustic Release

**Line Management Style:** Multi

**Field Tested:** Yes

**Available for Purchase:** Yes

**Website:** [www.subseasonics.com](http://www.subseasonics.com)

The Subsea Sonics AR4RT is a modular acoustic release system produced by Subsea Sonics that can be paired with any rope management system. As seen in Figure 12, the rope is contained in a mesh bag with an acoustically triggered release mechanism attached to the side. This release unit is deployed underwater and contains the receiver plus a microcomputer and batteries and has a motorized cam that rotates when actuated by the onboard transducer and deckbox. It turns on automatically when it is placed in the ocean by means of water contact to the link and the coil contacts. It has a unique 4-5 digit identification number that has been assigned to it by the factory. This identification number is entered into the topside acoustic release deckbox when a command is sent. This can be done by the fisher manually, or the Trap Timer Application from a tablet onboard. When the release command is received the unit rotates a mechanical cam, affecting the release.

Once released, the buoys and line ascend out of the bag and are available for retrieval at the surface. The gear is then hauled as normal, and the line is repacked for another deployment. The rope storage method can and has been customized to fishermen's needs according to their geographic regions. This release system has existed since the 1990's and has been successfully tested by NOAA for use in fishing applications. This system has been successfully tested by SST staff and fishers in the BSB pot fishery extensively and had a >99% during our second EFP. This device will require weight to be added to the trap to fully submerge the bag.

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## Appendix 1. Power Analysis of SBRS Reliability: Retrospective Results (2020–2024) and Prospective Testing Framework

### Methods & Power

#### Phases and data

We aggregated testing into two phases based on training status and procedures:

- Learning phase (May–Oct 2020 and Feb–Mar 2022): 554 deployments, 0 mechanical failures, 34 operational errors.
- Operational phase (Sept 2022–May 2024): 2,968 deployments, 3 mechanical failures, 25 operational errors.

Primary endpoint (forward-looking): device/mechanical reliability.

Rationale: the fishery has standardized training (syllabus, testing, troubleshooting guide), and future reliability metrics for authorization should reflect device performance rather than operator learning artifacts.

- Operational phase mechanical reliability:  $2,965/2,968 = 99.899\%$ 
  - 95% Wilson CI: 99.703% – 99.966%
- Learning phase mechanical reliability: 100% (0/554 mechanical failures).

#### *Hypothesis test and achieved power (retrospective)*

One-sided test against the EFP benchmark:

- **H<sub>0</sub>:  $p \leq 0.984$**  (device reliability does not exceed the benchmark)
- **H<sub>1</sub>:  $p > 0.984$  ( $\alpha=0.05$ )** (device reliability exceeds the benchmark)

With  $n = 2,968$  and observed  $\hat{p} = 0.999$ , the achieved power to exceed 0.984 is effectively  $\sim 100\%$ . This decisively clears the benchmark on device reliability.

Context (not used in future reliability analysis): all-mode reliability

- $2,940/2,968 = 99.057\%$
- 95% exact CI: 98.640% – 99.346% (achieved one-sided power vs 0.984  $\approx 94\%$ ).

Learning-curve documentation (operational errors)

- Learning phase: 6.14% (34/554)
- Operational phase: 0.842% (25/2,968)
- Relative reduction  $\approx 86\%$ .

A simple exponential fit implies an operational-error “half-life” of  $\sim 1,000$  deployments under standardized procedures.

Statistical details

- Confidence intervals: Wilson for mechanical reliability; exact binomial for all-mode checks.
- Power: one-sided z-approximation at  $\alpha=0.05$  using observed  $\hat{p}$  and  $n$ .

- Dataset scope: excludes dockside drills; includes at-sea deployments.

### Proposed Future Testing

Primary endpoint: mechanical reliability (successful release and surface presentation).

Hypothesis framework (per device variant):

- **H<sub>0</sub>:  $p \leq 0.984$**  (device reliability does not exceed the benchmark)
- **H<sub>1</sub>:  $p > 0.984$  ( $\alpha=0.05$ )** (device reliability exceeds the benchmark)

Design:

Each R&D-improved variant from established manufacturers will undergo an independent, statistically powered non-inferiority test against the reliability benchmark of 0.984. Based on prior operational-phase results (observed  $\hat{p} = 0.998989$ ; 95% CI: [0.9970, 0.9997]), a target of ~300 hauls per variant provides  $\geq 95\%$  power while tolerating one mechanical failure and still achieving significance. To accommodate more challenging fishing conditions, or to achieve  $\geq 99\%$  power, testing may be extended to ~400 hauls per variant, which allows up to two mechanical failures without loss of statistical significance.

Failure-tolerance thresholds (exact one-sided binomial test,  $\alpha=0.05$ , H<sub>0</sub>:  $p \leq 0.984$ ):

Failures observed (k)	Minimum hauls (n) required for significance
0 failures	$n \geq 186$
1 failure	$n \geq 295$
2 failures	$n \geq 392$
3 failures	$n \geq 483$

Program-level analysis:

In addition to variant-level assessments, pooled results across the suite of improved devices will be reported. Aggregated outcomes are expected to continue to demonstrate reliability well above the benchmark, with narrow confidence intervals consistent with the most recent operational-phase testing ( $>99\%$  overall reliability).

Interpretation:

This framework ensures that statistical conclusions capture the iterative engineering improvements in device design and performance, rather than functioning as a reassessment of legacy systems.

## Appendix 2. Testing of Ropeless Fishing Gear

Testing of Ropeless Fishing Gear: Since 1998, more than 30 research projects have tested ropeless concepts and ropeless retrieval systems, with more planned and ongoing.

In 1998, the U.S. National Marine Fisheries Service (NMFS) issued a federally funded contract to "design, develop, and evaluate ... a cost-effective prototype acoustic release system for the buoy endline of offshore lobster trap gear." Since this first initiative, a considerable amount of testing of ropeless retrieval systems has taken place. A comprehensive overview of all the research to date indicates a total of 32 ropeless technology projects. Overall, this testing has served to drive the evolution from a technical concept to a working prototype to an operational system and finally to an established product with commercial viability.

### Testing of Ropeless Concepts

Since 1998, at least 11 research projects that funded conceptualization of ropeless gear were developed in the U.S. Six of these were based on acoustic release technology, the innovation at the heart of many ropeless retrieval systems. Table 3 outlines the full scope of conceptual research since 1998 in the U.S., which led to the creation of fully operational ropeless systems. The table describes the gear style, sample size (when available), location, funding source, and type of project. The types of projects are very diverse, including the creation of a ropeless prototype, lab testing of ropeless gear, demonstrations of gear, and using gear for fishing (Table 3).

### Testing and Use of Ropeless Systems

Results and ideas generated from the conceptual projects detailed above led to the development of full-blown operational systems available for further testing and daily use. These tests have produced iterative improvements to gear and brought several systems to commercial viability. Equally important, testing has generated helpful data on how well ropeless systems work.

Table 3 gives an overview of 21 testing projects (or demonstrated use) of ropeless retrieval systems, several in "at-sea" conditions. For these tests, testers deployed the gear, virtually marked its location, virtually relocated it, and then retrieved it. It describes gear style, sample size, type of testing, and location of testing for each project. Tests of ropeless gear have been conducted all around the world, including in Australia, Canada, New South Wales, Scotland, and Massachusetts.

**Table 2.** Research on ropeless concepts in the United States since 1998.

<b>Year</b>	<b>Project Author and Citation</b>	<b>Type of Project</b>	<b>Location</b>	<b>Sample Size (n)</b>	<b>Gear Style and Name</b>	<b>Funding Source</b>
1999	DeAlteris, 1999	Prototype and Testing	RI	10	Acoustic releases (Benthos 875, Edge Tech AMD)	NOAA

1999	Turner et al., 1999	Concept, Built, and Lab Tested	NH	N/A	Acoustic release Buoy less Lobster Trap	NH Sea Grant
2013	Partan and Ball, 2016	Research and Concept	MA	N/A	ORE (Edge Tech) line canister, Desert Star, Fiobuoy, WHOI concept	NOAA
2007	Allen and DeAlteris, 2007	Prototype and Test	RI	129	Acoustic	NFWF
Before 2007	NOTUS (ALWTRT, 2010)	Built	NJ	N/A	Notus Acoustic Release	NMFS
2012	PFC, 2012	Tested and Used for Fishing	ME	386	GPS and Grapple (not recommended)	NMFS
2012	Gwinn Grapple	Tested and Used for Fishing	MD	30	GPS and Grapple (not recommended)	NMFS
2014	Hopkins et al., 2015	Concept, Built, and Lab Tested	NH	Unk	Acoustic Release	NH Sea Grant
2015	Basque et al., 2015	Concept, Built, and Lab Tested	NH	N/A	Acoustic Release Buoy less Trap	NH Sea Grant
2018	Biedron, 2018	Trial	MA	N/A	Desert Star	IFAW
2018	Shester, 2018	Demonstration	CA	8	Fiobuoy, Desert Star	Oceana

**Table 3.** Testing of ropeless gear systems from 1996 - September 2025.

<b>Year</b>	<b>Project Author and Citation</b>	<b>Type of Testing</b>	<b>Location</b>	<b>Sample Size (n)</b>	<b>Gear Style and Name</b>
1996 - 2019	Fiobuoy, Fiomarine (pers comm)	Internal Test	AUS	206	Fiobuoy
2000 - 2019	Multiple Customers (pers comm); Ridd et al., multiple dates; McCrindell	Active Use	AUS	N/A	Fiobuoy Line Spool, Timer or Acoustic Release
1999	DeAlteris, 1999	Prototype Test	RI	50	Acoustic Release
2005	Hopkins and Hoggard, 2005	Prototype Test	MS	N/A	Subsea Sonics AR50
2007	Allen and DeAlteris, 2007	Prototype Test	RI	129	Acoustic
2011	FDRC; Liggins, 2012	Test Used for Fishing	NSW AUS	>100	Acoustic Release Line Storage Bag
2018	CWLA; Terhune et al., 2018	Used for Fishing	CAN	94	Desert Star ARC-1
2018	Acadian Crabbers Assn. (DFO, 2018; Gies, 2018)	Used for Fishing	CAN	Unk	Desert Star ARC-1
2019	CWLA, 2019	Tested	CAN	Ongoing	Ashored MOBI
2011	Porter, 2018 for MLA	Used for Fishing	NSW	Active Use	Desert Star
2018	SMELTS and NOAA (Milliken, 2018; Riels, 2018)	Test	MA	50	SMELTS
2018	WHOI/NOAA (Milliken, 2018; Ball et al., 2018)	Test	MA	50	WHOI Spool
2019	Acadian Crabbers Assn. (DFO, 2018)	Used for Fishing	CAN	Ongoing	Ashored MOBI Edge Tech 5112 SMELTS
2019	Lobster Lift (C. McCarthy pers comm)	Internal Test	MA	>50	Lobster Lift Prototype
2019	SMELTS/NOAA (pers comm)	Used for Fishing	MA	>12	SMELTS Lobster Raft
2016 - 2019	Patan and Ball, 2016, 2018; Ball et al., 2018	Test	NE AL	42 proposed	Line Spool, Acoustic Release

2017 - 2019	SMELTS; Riels, 2018	Internal Test	PNW, NE AL	608	SMELTS
2018 - 2019	Ashored (M. Poole, pers comm. 0029)	Internal Test	CAN	>100	Ashored MOBI
2019 - 2021	Flagg & Sawicki, ongoing	Test, Used for Fishing	Scotland, UK	>100	Desert Star ARC- 1 Fiobuoy
2020 - 2025	RMW & Sawicki, ongoing	Test, Used for Fishing	USA	> 6,000	All listed in this application
2020- 2025	Chadwick, Halonen, Mullins, Sawicki	Test, Used for Fishing	USA	>4000	Subsea Sonics/Guardian Ropeless