Appendix G. On-Demand Gear Project Summary

Informal Interim Report for the South Atlantic Fishery Management Council Regarding Black Sea Bass Subsea Buoy Retrieval Systems Testing (2020-2024)

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Executive Summary

During all phases of all projects, we have worked directly with over thirty different fishers and 14 units of nine different ropeless devices and completed thousands of gear deployments. 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.

Data were collected during four distinct testing cycles: May through July 2020, September and October 2020, and then February through March 2022. Cycle One was completed dockside to familiarize fishers and researchers with virtual gear marking software and SBRS gear using mock-up traps with obstructed entrances to avoid accidental catches. The second cycle began after receiving our initial EFP for the use of the selected styles of SBRS gear and pot configurations. The third cycle was a combination of activities from Cycles One and Two after the issuance of a second EFP. The fourth cycle began after a revision to our second EFP, which added extra time during the regular season for black sea bass pot gear and additional time to the expiration date of that EFP to complete a more robust set of testing. We selected several commercially available and prototype SBRS and Acoustic SBRS units to evaluate during dockside research deployments and operational fishing to evaluate how such a system might work within the operational fishing circumstances of the inshore BSB fishery.

As of the date of this report, our analysis still needs to be completed, but the available results now include 3522 deployments of releases and 3165 deployments of connected line management/lift bag/lift buoy systems. Of those deployments, we experienced 62 Operational failures (Fisher or researcher error) and three mechanical failures due to a non-functional deck box. Total gear loss was the equivalent of nine pots and four control pots in the allowable offshore area. Two of the five SBRS pots were lashed together on deck in a 2DF configuration and were lost during transit and not EFP fishing activities. Pots permanently lost due to fisher/researcher error or deck box malfunction and unable to be grappled are included here.

A manuscript is being completed that will return a more complete analysis of our results. It is anticipated that this process will be complete by September 2026, after the expiration of our funding and EFP. This summary is being submitted as a follow-up report of our findings to date.

We would also like to thank the SAMFC, NOAA, and SERO staff for their assistance in performing this research. We were fortunate beneficiaries of valuable insight, support, and guidance from all the fishers we worked with on the water, our industry collaborators, and funding from the National Sea Grant and the Saltonstall-Kennedy Competition.

EFP Finfish and Invertebrate Catch and Bycatch Report as of May 2021

All traps were fished in accordance with the Initial and Amended Exempted Fishing Permit in areas described within the permits. The table below shows the Finfish and invertebrate bycatch encountered during this study. The experimental (4BY) allowed for the entry of small fish (< 28cm) in numbers that approached levels recorded for the controls. However, we did not place these gears directly on the live bottom as they could not be tested until our last fishing trip, which lasted <12 hours. Additionally, all species observed in the traps (except pigfish) via trap cameras were not captured in the 4BYs but could exit the trap before haul.

The retention of sublegal BSB in the traps was much greater than expected, particularly with our use of 50.8 mm mesh. During daytime soaks, fish were observed to enter traps, feed on bait, and then remain within traps. Some BSBs did not feed, while others were observed swimming with bait held in their mouths for extended periods. It was observed that other small fish were also being retained but were not seen feeding on any of the bait offered. An unplanned overnight soak of 4BY gear allowed us to observe the trap used as a shelter by several undersized fish and other species (red snapper, American eel, pigfish grunt, Atlantic croaker). Five eels, two blue crabs, and the Atlantic croaker were also observed feeding on bait during that soak. When the 4BY gear was hauled ≈12 hours later, none of these species but the grunt remained in the trap. The capture of small fish that were seen to move freely in and out of the traps during soak periods was expected but not to the degree incurred. Further, due to periods (October) of juvenile fish residence on structures within our inshore fishing sites, the capture of these sub-legal fish was likely inflated.

Catch During Sea Trials- September 2020-October 2020.

Common Name	Scientific Name	Number Caught
Black Sea Bass	*Centropristis Striata*	78

Finfish and invertebrate bycatch

Common Name	Scientific Name	Number Caught/Discarded
Sublegal Black Sea Bass	*Centropristis Striata*	84/84
Pigfish Grunt	*Orthopristis chrysoptera*	4/0
Red Snapper	*Lutjanus campechanus*	1/1
Gray Triggerfish	*Balistes capriscus*	1/1
Blue Crab	*Callinectes sapidus*	10/10
Leopard Toadfish	*Opsanus pardus*	2/2
Pinfish	*Lagodon rhomboides*	6/6
White Grunt	*Haemulon plumieri*	10/5
Sailor's Choice Grunt	Haemulon parra	10/4
Calico shame-faced Crab	Calappa flammea	7/7
Tomtate Grunt	*Haemulon aurolineatum*	5/5
Spottail Pinfish	*Diplodus holbrooki*	1/1

Observed in Traps-not caught (control and 4BY)

Common Name	Scientific Name	Number Caught
American Eel	*Anguilla rostrata*	5 Observed, not caught
Common Octopus	*Octopus vulgaris*	1 Observed, not caught
Vermillion Snapper	*Rhomboplites aurorubens*	1 Observed, not caught

EFP Finfish and Invertebrate Catch and Bycatch Report as of July 2024

Since 2020 fishing, the amount of sub-legal black sea bass in pots fished with SBRS gear has significantly declined to a rate far below what was initially experienced in the inshore trials. An analysis is incomplete at this time, but a significant portion of harvesting was completed in the presence of the PI in all seasons and areas. All traps utilized in the trials included in this report were constructed of 2" or larger mesh on all sides, allowing for the escape of most sub-legal fish. Handling time was minimized for all sub-legal fish remaining in traps and immediately returned to the water. Additionally, fishers experience decreased handling time.

Non-target retained species included common octopus, pigfish, ringtail grunts, oyster toads, gray triggerfish, conger eel, and white grunts.

Qualitative Review of Trap Camera footage highlights

An initial review of all trap camera footage in Georgia and Florida fishing areas revealed many red snappers far too large to access the traps. Additional footage from Outer Banks fishing areas showed many gray triggerfish, which were too large to access the traps. These fish spent much time interacting with the KD-40 buoys utilized for floatation. Footage combined from inside and outside the traps showed sub-legal black sea bass that would enter and exit the traps freely after feeding and then remain beside the traps, often resting on the live bottom within several feet of the deployed trap for a considerable time after feeding. This was witnessed during all times of the day. As observed during the 2020 testing, several non-endangered fish species were burrowing under or within traps during dusk and overnight but not in the traps at harvest time. Lastly, one gag grouper and one shark species, tiger shark (*Carcharias taurus*), were observed outside the traps circling the gear when black sea bass was within the trap feeding on bait. None entered the traps nor were observed interacting with the gear on the sea floor. However, several sharks were observed by the PI, fishers, and NOAA staff on four separate occasions at the water's surface just after the buoys' deployment.

Subsea Buoy Retrieval Systems Testing Summary

These results encompass work done between May 1, 2020- May 30, 2024, but still need to be completed. Because acoustic and timed releases can be reliably tested dockside, a percentage (<5) of these results include dockside trials during dockside training for volunteer staff and fishers.

We tested the various components for reliability as follows:
Acoustic or Time Date Release:

1. Did the release successfully release at the appropriate time (for time-date models)
2. Did the release and all components perform their intended task- i.e., burn wires burn, dissolving links dissolve, mechanical releases/cams rotate, mechanical jaws open, solenoid valves open to allow air release.)

Rope Management Methods:
For airlift systems:

1. Was the air dispensed sufficient to allow the device to rise to the surface with an attached pot?

For line containment systems:

1. Did the line successfully release from the containment system without snagging or fouling and enable retrieval at the surface?

If any of these components performed unsatisfactorily, several details and data points were gathered to determine the cause of the failure. We have completed a troubleshooting guide in our training designed to help alleviate many of these problems. This guide provides a template to help researchers examine failures and troubleshoot systems they are working with and has been successfully developed into a simplified learning tool for fishers. Additionally, a standardized approach to training (including a syllabus and testing process) for the end recipient was created in 2022 and has continued to be utilized through 2024 for certifying new fishers into the EFP process and for fishers in other regions. Finally, fishers from other states and countries participated in learning exchanges, received this standardized training, and successfully operated all gear types on the EFP under the guidance of our EFP fishers.

Definitions used for categorization of failures

Category	Definition
Mechanical	Failure of a machine component while the device is operating within its design constraints, preventing a successful retrieval.
Operational	Any operational practice flaw that, if corrected, could have prevented the failure from occurring or would have significantly mitigated its consequences.
Unknown	Not enough information to confidently determine why the retrieval failed.

Year One (May 2020-Oct 2020)

Total Training, Trialing, Fishing, and Configuration Testing Research Days: 67
Supervised: 67
Unsupervised: 0
Trial Days:53
Fishing Days under EFP: 14
Different Releases Tested: 9
Different Types of Releases Tested: 4
1) Galvanic Timed Release, 2) Electronic Timed Release, 3) Acoustic Release, 4) Acoustic Release with Electronic Backup timer
Total deployments of SBRS systems (Release and Line Management System): 467
Total Releases Tested: 804
Line Management Methods Tested: 8
Operational Failures: 26
Mechanical Failures (Interruptions): 0
Gear Loss-4
SBRS lost: 0
SBRS rigged pots lost 0
Control pots lost: 4

Year Two (Feb 2022-Mar 2022)

Total Training, Trialing, Fishing, and Configuration Testing Research Days: 20
Supervised: 10
Unsupervised: 10
Fishing Days under EFP: 20
Different Releases Tested: 4
Different Types of Releases Tested: 3
1) Electronic Timed Release, 2) Acoustic Release, 3) Galvanic timed release as a backup only for tended gear on initial configuration days, not included in final results.
Total deployments of SBRS systems (Release and Line Management system): 87
Total Releases Tested: 87
Line Management Methods Tested: 3
Operational Failures: 8, 6 of which were related to Fisher not setting the timer properly and 2 due to researcher error with the line management method.
Mechanical Failures: 0
SBRS lost: 0
SBRS rigged pots lost: 0

Years Two, Three, and Four Combined: (Sept 2022-May 2024) *

Total Training, Trialing, Fishing, and Configuration Testing Research Days:
Supervised: 100
Unsupervised: incomplete results
Fishing Days under EFP: >100
Total number of hauls over the period analyzed: 2968
Different Releases Tested: 8
Different Types of Releases Tested: 3
1) Electronic Timed Release, 2) Acoustic Release, 3) Acoustic Release with Electronic Backup timer
Total Deployments of SBRS systems (Release and Line Management System): 2968
Total Releases Tested: (1341SK+1627GAC)
Different Line Management Methods Tested:7
Different Gear Marking Methods Utilized: 8- Trap Timer, Untethered, Ropeless Fisher, Ropeless Control, Ashored Atlas, Spot Trace, iSail, Blue Ocean Gear- Smart Buoy
Blue Ocean Gear
Line Management /Lift Bag/Buoy Testing: 2968
Mechanical Failures: 3, due to non-functional deck box on 04/03/2023
Operational (Fisher/Researcher) Failures: 25
Total Failures: 28

We experienced a 99.057% success rate for all deployments and retrievals. (Releases and Line Management /Lift Bag/Buoy combined.**

Gear Loss
SBRS lost: 9
SBRS rigged pots lost: 8
We experienced the loss of a 2DF pot from Capt. Lynn, which fell over the side of the boat during transit.
We experienced the loss of 1 single pot on 09/24/2022 during training due to fisher error.
We experienced the loss of 2 single pots on 10/06/2022, one due to fisher error (failure to rig buoy to line) and one due to fisher error in setting the timer.
We experienced the loss of 1 single pot on 03/04/2022 during training due to fisher error.
We experienced the loss of 3 single pots on 04/03/2023 due to a malfunctioning deckbox. Fishers could not retrieve the gear with a grapple due to the rocky bottom.

In total, we experienced 25 failures related to Fisher/researcher errors related to Line Management and timed releases not being set properly and 3 due to a non-operational deck box. This deck box was replaced and has functioned properly.

All systems (inclusive of release and Line Management /Lift Bag/Buoy) were and remain within 1% +/- reliability scoring (**99.057%)** of incomplete results, and all are >98.4% reliability per the EFP application.

**Partial results: The final analysis of winter periods and Saltonstall-Kennedy-funded work is incomplete but on par with reliability results and gear loss rates of prior years.*
***These results DO NOT include dockside testing/training*

Conclusion

The testing and evaluation of the Black Sea Bass Subsea Buoy Retrieval Systems (SBRS) from 2020 to 2024 have yielded promising results, indicating high reliability and efficiency in the deployment and retrieval processes. Throughout the project, extensive collaboration with fishers and the use of various SBRS technologies were crucial in understanding these systems' operational challenges and potential within the South Atlantic Fishery Management Council's jurisdiction.

Our findings demonstrate that the SBRS technologies have an overall success rate of over 99%, with minimal gear loss and failures attributed primarily to human error or equipment malfunction. The project has provided valuable data on the efficacy of these systems and offered essential training and standardized protocols for future use.

As the analysis continues, further refinement and optimization of these systems are anticipated, aiming for even higher reliability and broader adoption among fishermen.

Acknowledgments
We thank all collaborators, including fishers, industry partners, and regulatory bodies, for their invaluable contributions. The outcomes of this project will hopefully pave the way for continued innovation to benefit species in need. The final results and comprehensive analysis will be available by September 2026, contributing to the broader scientific and fishing communities' understanding of ropeless fishing technologies.

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Appendix

Examples of data recorded by various electronic gear marking and research applications (Untethered App, Conserve.iO)

Raw Metrics collected from all applications:	
VESSEL NAME, CAPTAIN ID	RAIN
# OF POTS	RANGE_MS
APP USED TO RECORD LOCATION	RECOVERED TIME
APP USED TO RECORD TESTING DATA	RELEASE_LOCATION_LAT_DEG
SBRS GEAR	RELEASE_LOCATION_LON_DEG
SBRS TECHNICIAN	RETRIEVE SBRS 1 AR/TD SUCCESS?
BEARING TRUE NORTH	RETRIEVE SBRS 1 ROPE SUCCESS?
BEGIN_LOCATION_LAT_DEG	ROPELESS TRAP ID
BEGIN_LOCATION_LON_DEG	SEA LEV
CATCH_QUANTITY	SINGLE_TRAP POINT/TRAWL
CLOUD COVER	SOAK TIME (MIN)
CURRENT SPEED (KTS)	TEACH/LEARN/MASTERY
DATA ENTRY TECHNICIAN	TEST _ID
DEPLOY SBRS 1 AR/TD SUCCESS?	TEST TYPE? GEAR/TRACK/BOTH
DEPLOY SBRS 1 ROPE SUCCESS?	TRAP COUNT
DEPLOYED TIME	TRAP TAG ID
GEAR STYLE	TRAWL_END_LOCATION_LAT_DEG
HUMAN ERROR?	TRAWL_END_LOCATION_LON_DEG
IMAGES	TRIP_ID
NOTES/COMMENTS	WATER DEPTH (M)
PROJECT_ID/TRIAL	WATER TEMP (C)

Examples of comments provided by researchers on failures

Note entered by fisher or researcher after interruption
• Unit flooded, used incorrect air line, which caused the line to rip out of the device and fill with water.
• Release twine snagged; splice protruding from line
• Discovered dead battery
• Failed to release message on app; told it to retry and it worked all in the same deployment
• Failure to release notification, tried again, then successful. Think they did not wait req 60 sec.
• Moved to deeper side of dock. Took longer, weed whacker running? Once it turned off, we were fine.
• Bag snag due to splicing error... frayed rope
• Staff did not plug in deck box
• Screws were not tightened by researcher, so wire could not burn
• Pulled up after 17 min, unit still had not released. Checked time set in unit and it was set for 28 days not 15 minutes
• The buoys were jammed in too tightly for them to pop out.
• The wire did burn but the clip did not open far enough for the rope to move, need additional buoy
• The buoys need to be resting against the wire to pop out.
• Unsuccessful retrieval because staff used the SSS transducer instead of the DS transducer
• Released but safety line and Fiobuoy line wrapped together
• Line was wrapped through handle of unit and clipped to trap-pin released but line could not release
• Acoustic release deployed but only one buoy was inside; needed two
• Released but fouled in bag because of rigging by technicians.
• Leak in valve caused by researcher changing valve
• Leak in valve caused by researcher changing valve prior to test

The 6 Rights for Ropeless Research: Using a Ropeless System Right (TRRAPT system)

Right Transducer?

Did you select the correct transducer for the unit you are trying to release?

Right Route?

Send Sound:

Not through a hull,

Not against the current,

Not Near Noisy things

Right Rigging? (Review, Release, Retrieval)

Review Pics to confirm:

Release Rigged Right? (wire, release line, links, O-rings in place, pins)

Retrieval Method Rigged Right? (air, e.g., valve turned on or line system line: flaked or spooled, line secured to rope containment device)

Right Application?

Did you select the correct device application and deck box for the release?

Right Power?

Does your unit have ENOUGH battery power?

Does your deck box have power?

Does your deck box have ENOUGH power?

Does your vessel have an inexpensive inverter into which your deck box is plugged?

Right Time?

Did you let the unit go into "sleep" mode before trying to wake up?

Did you set the timer for the correct time/date?

Did you select the properly sized GTR for current oceanic conditions?