

# Sub Sea Sonics/Guardian Popup Fishing System – Spring 2024 EFP Testing Results

Submitted To: California Department of Fish and Wildlife

Submission Date: 7/22/24

Submitted By: Bart Chadwick, Sub Sea Sonics



## Contents

1. Project Summary.....	5
2. Gear Description. ....	1
3. Trial Results.....	15
4. Gear Acceptability under the RAMP Criteria.....	26
5. Gear recovery plan in the event retrieval is unsuccessful.....	33
6. Gear enforcement considerations .....	34
7. Next Steps .....	35
Appendix 1. Alternative Gear Trial Results.....	36



## 1. Project Summary

This report summarizes the spring 2024 results of an Experimental Fishing Permit (EFPT2-001) to test Alternative Gear in the California Dungeness crab fishery. The EFP tested a fully integrated on-demand fishing system from Sub Sea Sonics and Guardian Ropeless consisting of the following components:

- Sub Sea Sonics AR4RT Acoustic Release
- Sub Sea Sonics ARI4RT Acoustic Deck Unit with Transducer
- Guardian Ropeless Line Handling System with required lines and floats
- Traps run in strings (trawls) with up to 10 traps per string
- Sub Sea Sonics Trap Timer Virtual Gear Marking App
- Sub Sea Sonics Ropeless Regulatory Portal

Additional key components of the EFP included:

- Vessel Tracking System
- Proficiency Training for Fishers and Enforcement Personnel

Extensive testing of the system was conducted during the spring of 2024 under EFPT2-001 in the California Dungeness crab fishery. Significant testing was also carried out under the same EFP during the spring of 2023. Previous testing was also carried out using single traps and the timed version of the release system (TR4RT) during 2021 in the California Dungeness crab fishery. In addition, significant testing of the system was conducted using single traps and the acoustic version of the release system in the California Spiny Lobster fishery and the Southeast US Black Sea Bass fishery during the winters of 2022-2023 and 2023-2024. Results from these testing programs are summarized below.

Results from AR4RT/Guardian system testing under EFPT2-001 during the spring of 2024 provide the most direct measure of the system performance for the gear that is targeted for authorization. Nineteen authorized agents and 19 vessels were approved to participate in the testing (Table 1). This included 5 vessels operating from San Francisco, 7 vessels operating from Bodega Bay, 4 vessels operating from Half Moon Bay, 1 vessel operating from Santa Cruz, and one vessel operating from Moss Landing. All of the vessels except the Areona in Santa Cruz were equipped with the AR4RT/Guardian Sleds with 15 strings of 10 traps each. The Areona was equipped with AR4RT/Guardian Retrofits with 16 strings of 8 traps each. Following training, the combined fleet of participants conducted a total of 2361 gear set during the period from 4/9/24 – 6/30/24. All testing was conducted under actual fishing conditions and allowed for retention and sale of catch. Each trial involved a string of 10 traps, with the exception of the Areona with 8 traps, so the total number of traps set during the trials was 23048. The trials were carried out over 277 individual trips.

Locations of the gear during the trials were focused on the fishing grounds offshore from Bodega Bay/San Francisco (Zone 3) and Santa Cruz/Monterey (Zone 4). Deployment depths ranged from 19 – 325 ft with an average of 162 ft. Wave heights ranged from 1.4 – 11.5 ft with an average of 5.5 ft. Wind speeds ranged from 0.0 – 27.2 kts with an average of 9.1 kts. Overall, the release system (AR4RT) was successful in 98.9% of the tests, the line handling (Guardian) was successful in 98.9% of the tests, and the overall success rate of the on-demand system was found to be 98.0%. When the on-demand system did not work, grappling was generally effective as a backup method. Loss rates for gear was about 1.6% although gear recovery efforts are still underway for those units so that number may go down. An

estimated total of 229470 pounds of Dungeness crab were landed by the participating vessels, indicating an average catch of about 12077 pounds for the 19 participating vessels. Note that this estimate is based on landings reported through the reporting app and may not reflect the complete totals submitted via E-Tix because use of the reporting app was not required, and some fishers may have submitted landings without using the app.

Totals	Number	Percent
Strings Set	2361	
String Haul	2357	99.8%
Traps Used	2678	
Traps Set	23048	
Traps Hauled	23004	99.8%
Traps Lost/Left1	44	1.6%
Release Success	2336	98.9%
Line Handle Success	2335	98.9%
Overall Popup Success	2314	98.0%
Grappled	36	1.5%

## 2. Gear Description.

This report summarizes the spring 2024 results of an Experimental Fishing Permit (EFPT2-001) to test Alternative Gear in the California Dungeness crab fishery. The EFP tested a fully integrated on-demand fishing system from Sub Sea Sonics and Guardian Ropeless consisting of the following components:

- Sub Sea Sonics AR4RT Acoustic Release
- Sub Sea Sonics ARI4RT Acoustic Deck Unit with Transducer
- Guardian Ropeless Line Handling System with required lines and floats
- Traps run in strings (trawls) with up to 10 traps per string
- Sub Sea Sonics Trap Timer Virtual Gear Marking App
- Sub Sea Sonics Ropeless Regulatory Portal

Additional key components of the EFP included:

- Vessel Tracking System
- Proficiency Training

The system was developed specifically for application to low-cost, on-demand trap fishing. The design of the system focused on addressing key inputs from the Dungeness crab fishing communities on the US west coast to provide a system that:

- Minimizes/eliminates exposure of whales and sea turtles to entanglement hazards in the water column.
- Has the potential to be capitalized and operated at costs that will not impose burden on fishers.
- Is simple enough to be easily integrated into the existing fishing process without undue impact to the time and effort required to deploy and retrieve the fishing gear.
- Is easily stowed within the footprint of the existing trap and allows stacking of traps.
- Is reliable and redundant to the degree that the amount of equipment loss is either the same or less when using the pop-up system compared to the traditional system.
- Provides comparable gear marking visibility on the surface to the traditional buoy system, and.
- Integrates a means to determine the location and identify the gear by fishers and enforcement agencies in the absence of surface buoys.

The overall concept of operation is shown in Figure 1. In preparation for setting the gear, the Trap Timer app is used to determine if the target area is clear of other gear (1). The buoy line and buoys are stored in the Guardian system and the release unit is armed. At the time of deployment, the Trap Timer app is used to mark the location of the first trap in the string (2). When the last trap in the string is set, the app is used to mark that as well (3). The pop-up system can be associated with the first, last or both first and last traps. When cell or wi-fi connectivity is available, the app will transmit the locations to a database that houses all of the regional trap locations and other meta-data (3). For pulling gear, the app is used to select the target trap which is triggered to release via a Bluetooth signal to the deck unit and the buoy line and buoy are released to the surface (4). The string is then recovered using normal handling gear (5). The AR4RT is then re-set, and the trap is re-deployed following the sequence described above (6). Details of the specific sub-systems are provided below.

### Sub Sea Sonics AR4RT Acoustic Release

The AR4RT is an underwater, on-demand, acoustic release for recovery of underwater equipment (Figure 2). The system was developed primarily for use with fishing traps but can be used in any suitable application. The system consists of an underwater housing, a rotating release cam, and a release line retainer. The system uses a simple, low-cost acoustic receiver to provide an on-demand release capability. Using the cam, the user arms the system and deploys the equipment. At the end of the deployment, the user sends the release command, and the cam rotates 180 degrees and activates the release. For most systems, this releases a coil of line and float that are secured to the trap, and the float comes to the surface and the equipment can then be retrieved. Each unit is generally programmed with a unique release code so that triggering of one unit does not trigger other nearby units. The release code is cross referenced to a serial number that is used to identify the unit so that the release code is not made public. Triggering of the system is performed using the Trap Timer app in conjunction with the ARI4RT deck box and transducer.

### Sub Sea Sonics ARI4RT Acoustic Deck Unit with Transducer

The ARI4RT with associated transducer is the acoustic deck unit that is used to trigger the underwater AR4RT release unit (Figure 3). The system consists of a ruggedized box with a small LCD screen, power switch, control switches, transmit indicator light, charging port, and transducer connector. The transducer comes with a cable that is sufficiently long to allow it to be hung over the side of the boat typically to a depth of about 10 ft while performing the release transmission. This spring we also tested a thru-hull mounted transducer, and some fishers also experimented with placing the transducer in a wet-well inside the vessel. The deck unit sends a signal to the underwater unit that includes its unique identifier, along with the release command. The deck unit itself is generally controlled by the Trap Timer app via a Bluetooth connection, and the only action performed on the deck unit is to power it up and toggle it into the menu system. After that the unit selection and release command transmission is all handled by the app. In the case of a failure of the app, the deck box can be used in manual mode by selection the unit ID, selection the release action, and then transmitting the release action.



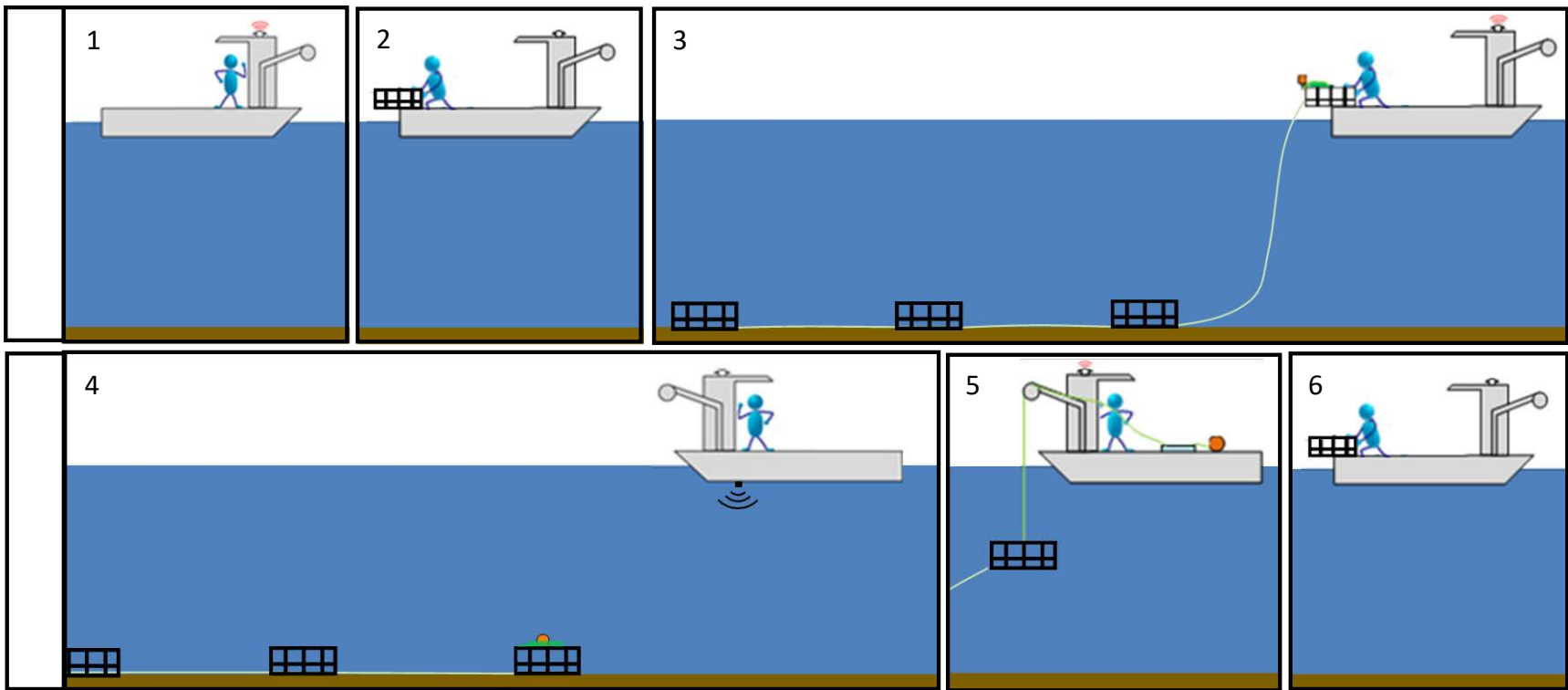


Figure 1. Concept of operations for the AR4RT/Guardian on-demand fishing system.



Figure 2. The AR4RT on-demand release unit.



Figure 3. The ARI4RT deck unit.

### Guardian Ropeless Line Handling System

The Guardian line handling system focuses on providing a simple reliable storage and retrieval system while utilizing existing gear and handling systems. The line used is generally the same diameter and type that is currently in use on the traps. Traditional foam buoys are replaced with a hard main float and an optional hard or Polyform trailer float.

Two Guardian configurations were used during the 2024 testing. The primary configuration was the Guardian installed in a small mesh cage that was dedicated to the purpose of housing the buoy line, float(s) and release unit (Guardian Inshore Sled; Figure 4). The sled was generally used as the last end of the string during gear sets and was connected to the end of the groundline via a gangion. In one case, a vessel used Guardian sleds at both ends of the string. The sled was the setup used on all but one vessel.

For the Guardian retrofit system, the line coil and floats are secured to the top of the trap using an open-topped mesh that is sewn or otherwise attached to the top of the trap. Around the top of the mesh, a drawstring is inserted that can be pulled tight to secure the line and buoy to the top of the trap. The loop formed by the drawstring is then run through a thimble on the trailer buoy, and through a guide to the release cam (Figure 5). The release itself is generally secured to a vertical member of the trap using pipe clamps. In operation, the line is either free spooled or coiled into a tub with the floats set to the side. The tub is then inverted, and the coiled line is placed into the mesh on the top of the trap. The release unit is armed, the drawstring pulled tight, and the loop is then secured onto the release cam.

### Traps Run in Groundline Strings

Testing and feedback from fishers indicated that the optimal configuration for the use of this on-demand gear is in conjunction with traps that are run in strings. In this configuration, the on-demand gear is installed at one end of the string, or for back-up or operational purposes could be installed at both ends of the string. The string configuration has two primary advantages when used with on-demand gear including (1) it reduces the capitalization costs because only one on-demand system is needed for several traps instead of being required for every trap, and (2) it provides a reliable and proven back-up method to retrieve the gear by grappling the groundline between the traps. Testing of the system with Dungeness crab traps was conducted with 5 traps in a string. This was based on the limitation in the EFP, and there is no reason that more traps could not be run in a string so long as the vessel and fishers are properly equipped and trained. In addition, there may be cases such as on smaller vessels where running fewer traps in a string would be advantageous or desirable from a safety perspective.

Figure 6 shows the typical trap string configuration used during the EFP testing program. Eight to ten traps were connected by a groundline, and the AR4RT/Guardian was installed on one of the terminal ends either as a sled or a retrofit. Trap spacing on the groundline was 250-300 ft to allow for sufficient separation of traps and for a single trap to be lifted by the hauler at a time. A short gangion was installed between the groundline and the trap to allow the trap to pass through the hauler. The groundline used was either 3/8" or 7/16" floating, neutral or sinking buoyancy rope.



Figure 4. Guardian Sled line handling system.

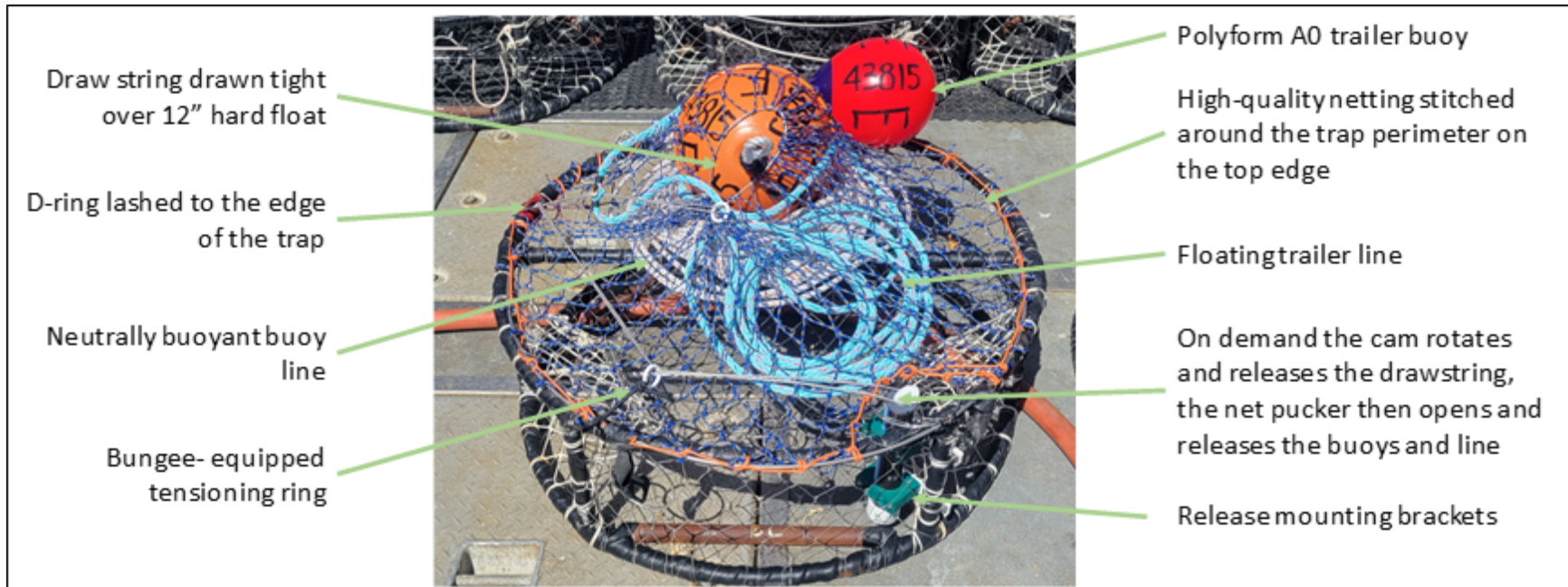


Figure 5. Guardian Retrofit line handling system.

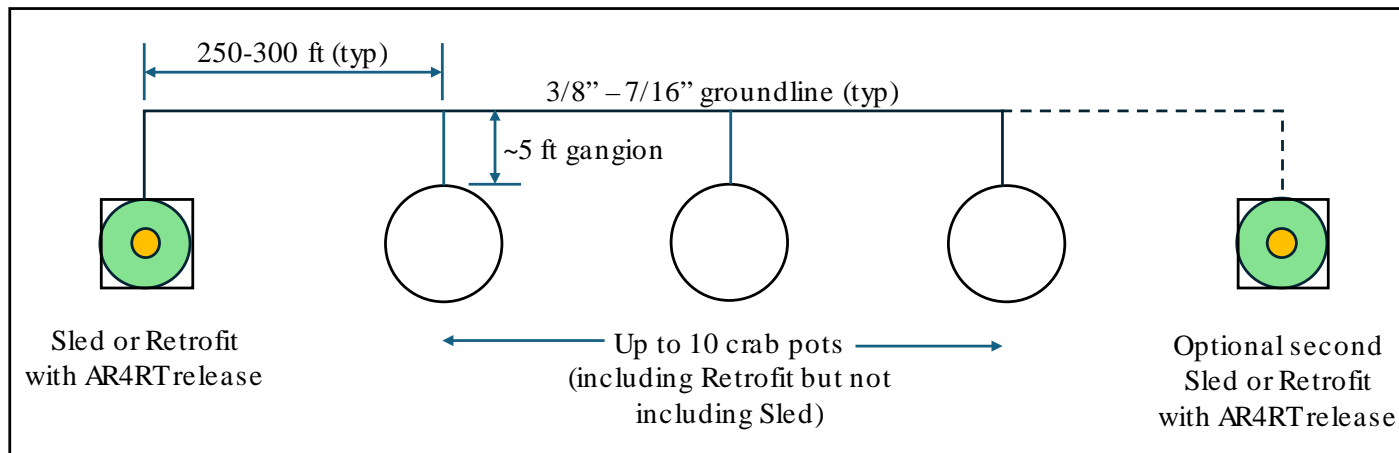


Figure 6. Photo (above), and general layout of the trap strings used during the EFP testing program (below).

### Sub Sea Sonics Trap Timer Virtual Gear Marking App

In order to enable the use of on-demand fishing traps, there is a concurrent requirement for maintaining the ability to regulate and enforce the use of traps while preventing gear conflicts. Additionally, detectability by other fishers is imperative to reduce and prevent gear conflict. The AR4RT system is supported by a tablet/cell-based app, a website, and a database to provide this capability. The app (Trap Timer) has versions that can be used onboard fishing boats, enforcement vessels and public vessels. The website is set up primarily for regulatory use. Access to the app is provided through an onboarding website that requires administrative approval by Sub Sea Sonics. Administrative approval includes verification of the user identity and role (fisher, enforcement, public). Once the user has been verified, the user is established in the database, and a private link to download the app from the app store is provided. For regulatory personnel, this process also provides access to the website. The app is free and available to the public. For the fisher, the app is setup and operated on a cell phone or tablet (Android or iOS) with the following features:

- Map: A map display showing the location of the deployed traps overlaid on a nautical chart. This is the default screen. A symbol indicates the location of the boat on the screen. The deployed traps are color coded to differentiate between the fisher's own gear and gear set by others. The map view displays all of the fisher's traps that are within the view window, along with other fishers' traps that are within the specified visibility radius (10 miles was used during the EFP).
- Table: A table display that shows the latitude and longitude of the fisher's deployed traps.
- Set: A button labeled "Set" that shows in both the Map and Table screens and activates a popup window that prompts the fisher for the AR4RT unit number and warns the fisher if there is another fisher's trap within a pre-specified radius of the location (Figure 7). There is also a "Release" button that executes the deployment of the trap, recording the position and then returning to either the Map or Table screen.
- Haul: A button labeled "Haul" that shows in both the Map and Table screens and activates a popup window that indicates that the trap has been retrieved and the retrieval time. By default, the closest trap to the boat is selected. Alternatively, the user can click on a specific trap in either the map or table mode and the option to haul it will come up in a popup window (Figure 8). The haul action also sends the release command to the deck unit to trigger the on-demand release of the AR4RT.
- Synchronize: There is a Sync button on the main screen that synchronizes the app with the shoreside database. Synchronization to the database can occur when the user is within Wi-Fi or cellular range. The system has settings options to select manual, Wi-Fi only, or Wi-Fi and cellular. When this function is executed, the system sends all user data since the last successful sync and retrieves others' data (interference data) since last successful sync for the area covered by map.
- Settings: An item from the upper left menu that allows the fisher to specify a name, password, boat name, interference radius, synchronization option, and selections for single traps and trawls.

The enforcement version of the app is the same as the fisher version except that traps for all fishers are displayed that are within a specified visibility radius of the enforcement vessel. From within the map or table view, they can access information about the trap including location, deployment time, popup time, range, bearing and associated permit number. The enforcement version also allows for activation of any acoustic unit withing the fishery. The public version of the app is the same as the enforcement version except that they cannot access any information about the fisher, only have visibility of any traps that are within a specified visibility radius and cannot activate acoustic units.

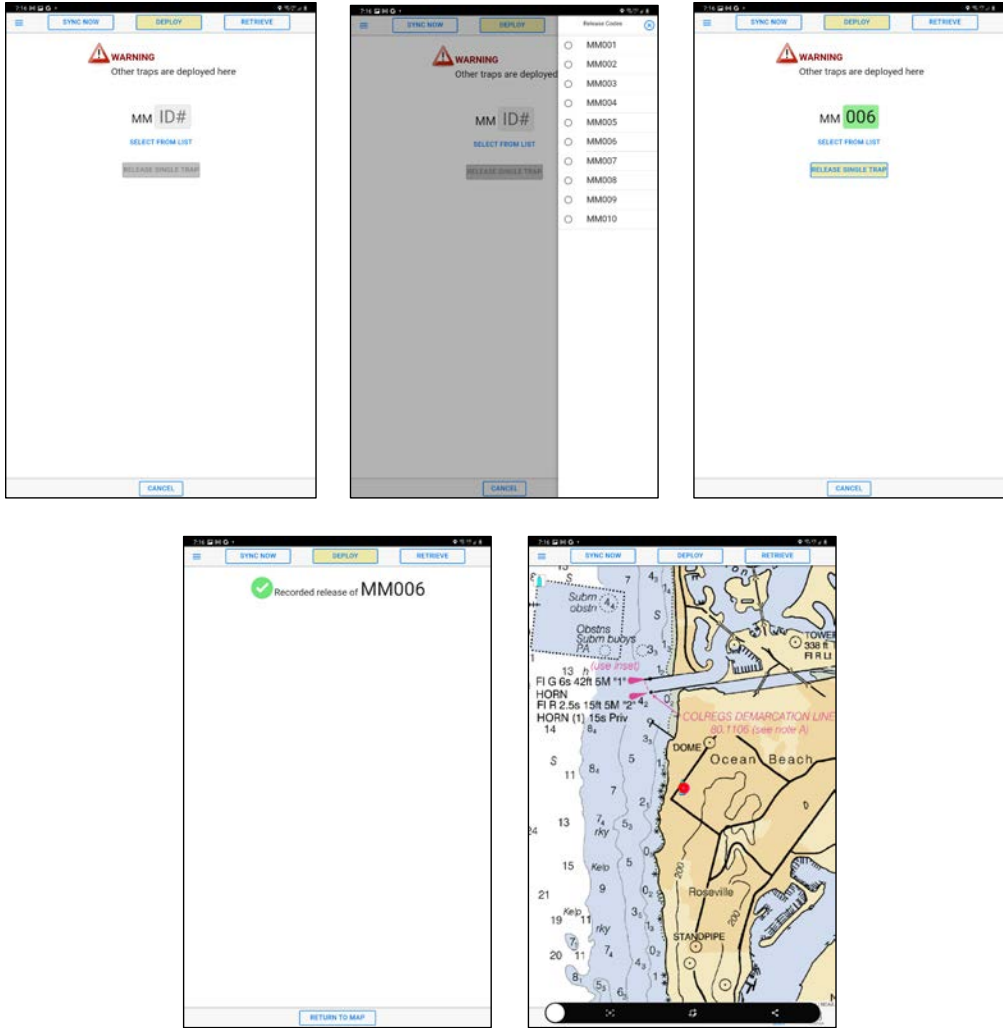


Figure 7. Trap deployment sequence for the AR4RT unit in Trap Timer.

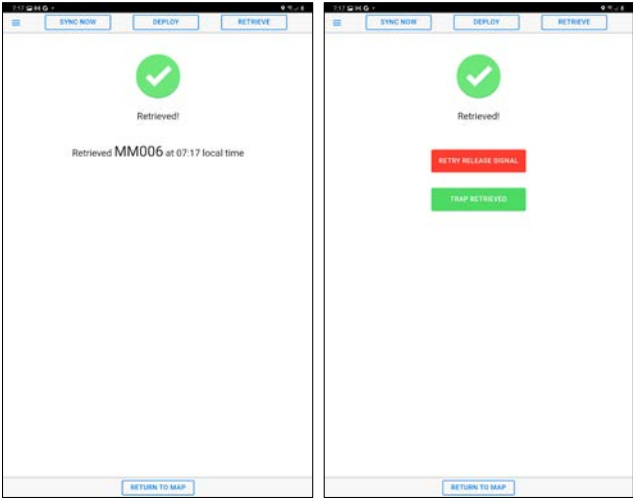


Figure 8. Trap retrieval sequence for the AR4RT unit in Trap Timer.



## Sub Sea Sonics Ropeless Regulatory Portal

The regulatory website (Ropeless Regulatory Portal) provides access to all data associated with users that are (or have been) actively fishing with Sub Sea Sonics on-demand gear. The website includes three main panels including a map view, a fisher table, and a data table (Figure 9). These views can all be filtered based on the data parameters of the database. In general, the data are first filtered in the fisher window by fishery, date, and then fishers within that fishery can be selected based on name, vessel name, or permit number. The filtered data are then display in the map view and the data view. The data view also provides multiple tabs to view general information, detailed information, and summary statistics associated with the filtered data.

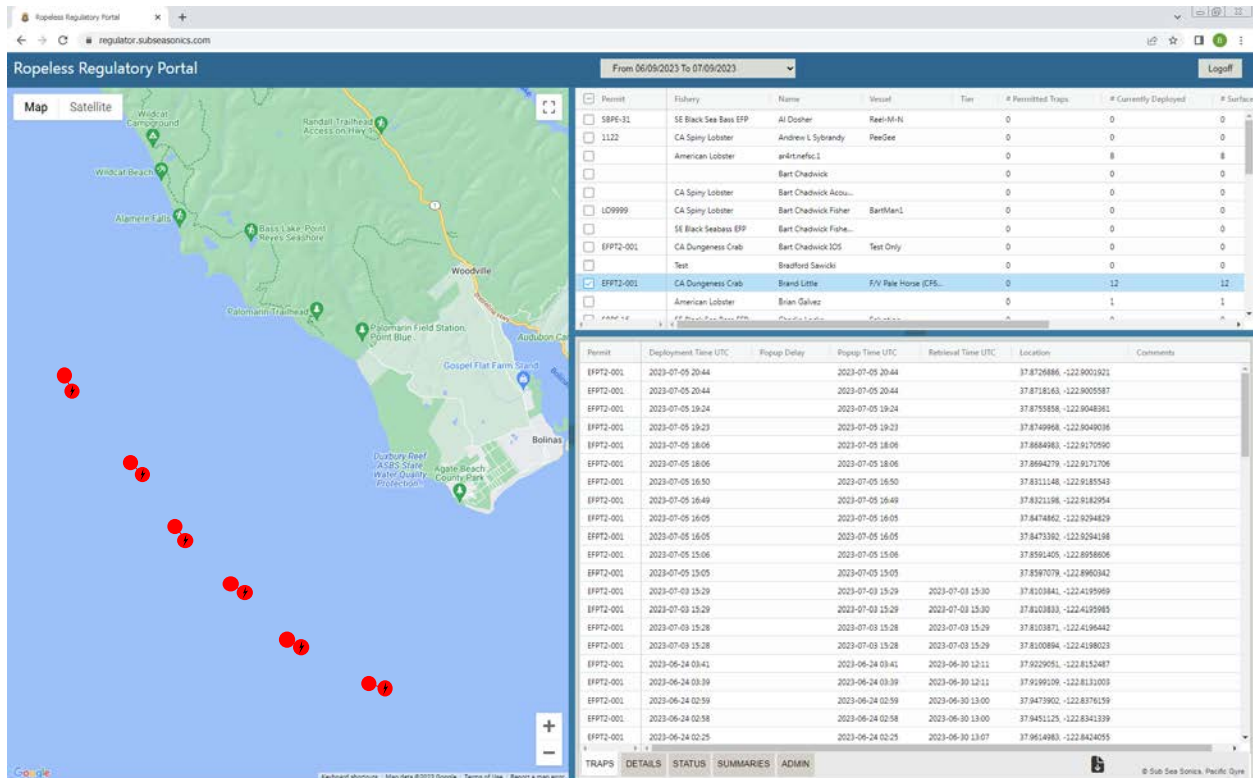


Figure 9. Screen shot from the Ropeless Regulatory Web Portal.

## Vessel Tracking System

The Vessel Tracking System (VTS) used during the EFP was either the Pelagic Data Systems Solar Logger (Figure 10 and Figure 11) or the Archipelago FishVue Lime. The Solar Logger is a solar powered, self-contained tracking device with built in cellular connectivity to a backend data storage and visualization dashboard. The unit is installed on an exposed upper area of the vessel, and automatically charges and activates when exposed to sunlight. Vessel location data are recorded at intervals of one minute. There are no maintenance or connection requirements for the installation. The FishVue LIME a data collection platform that allows fleet managers, fisheries managers and enforcement managers to monitor and access critical fisheries-related activity in real-time. FishVue LIME was designed to fit on a variety of vessels. Its minimal footprint makes it ideal for smaller boats without the space for a full-scale EM system, or in fisheries where the frequency or intensity of fishing is cost-prohibitive to full-scale Electronic Monitoring (e.g. few fishing trips per vessel, low catch rates etc.). The FishVue LIME unit is

enabled with GPS, global cellular connectivity, digital and analog sensor inputs. These systems provide compliance with vessel tracking requirements for the EFP and in combination with the Trap Timer app and the Ropeless Regulatory Portal, provides a complete system for enforcement of on-demand fishing gear.

The main way in which users view and access their data is typically through a secured web-based dashboard. The dashboard provides easy access to view or download current data as well as all historic data associated with the vessel. Once the vessel is being tracked, the home port location is automatically detected, and vessel movements are separated into “trips” that go from that location and return to that location. These trip records can then be visualized on the dashboard as vessel tracks with color coding associated with vessel speed.



*Figure 10. The Pelagic Data Systems Solar Logger installed on a Dungeness crab fishing boat.*

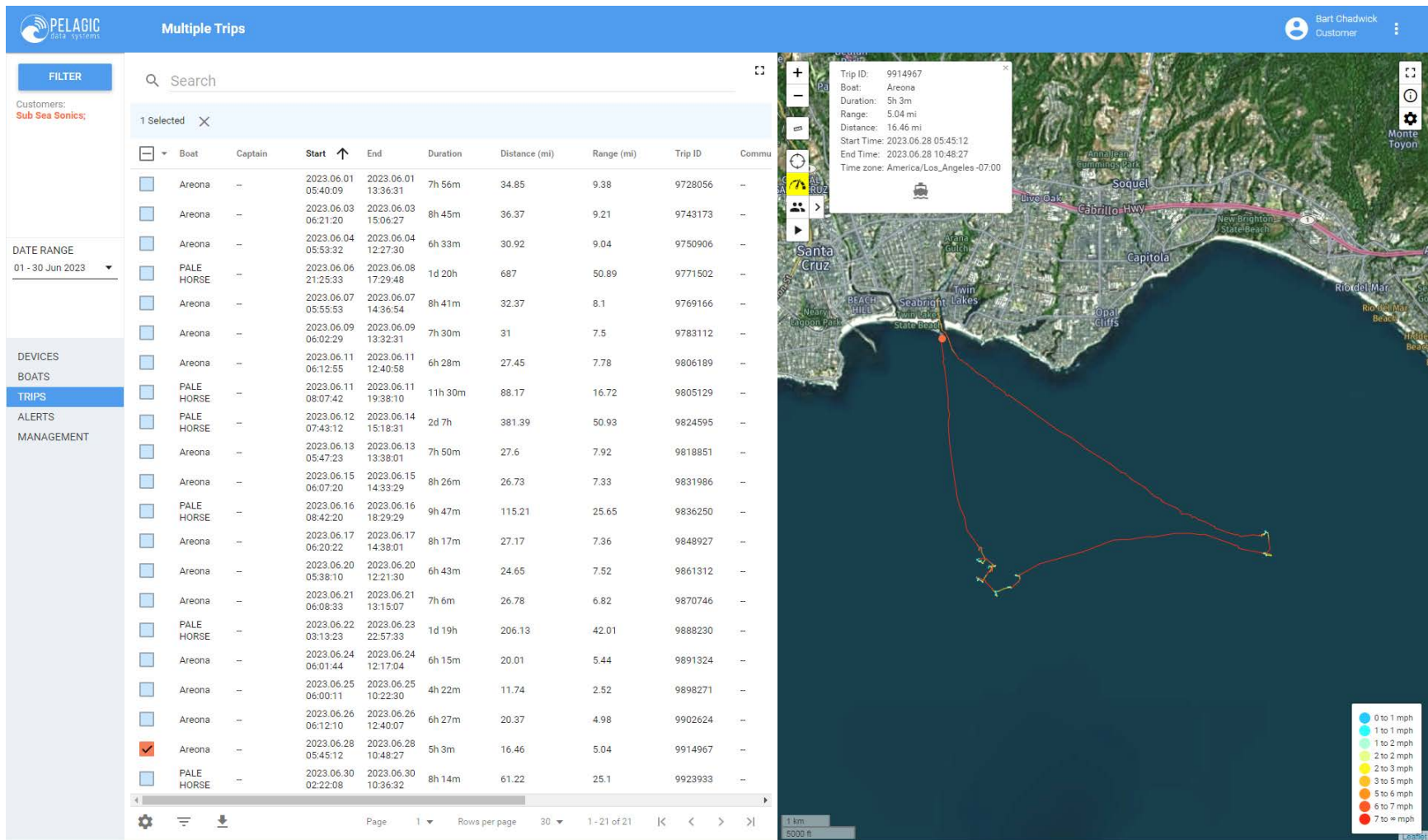


Figure 11. Typical VTS dashboard view of the trip list and trip track for a fishing day near Santa Cruz, CA.

## Proficiency Training

In order to assure readiness for use of the Alternative Gear, implementation of the system included a mandatory, standardized training program developed and administered by Sustainable Seas Technology. The training included dockside and at sea experience with all aspects of the system and required demonstration of proficiency to certified Trainers in order to allow for use of the gear. Only fishers who demonstrated proficiency were provided with access to the gear. Experience has shown that training and demonstration of proficiency are important to assure safe and effective use of the proposed Alternative Gear. Proficiency training for the spring of 2024 EFP effort was conducted in San Francisco during March of 2024. Training was provided for captains, crew, and enforcement personnel and included the following components:

- Terms and Conditions of the EFP: This covered the general and specific requirements of the EFP so that fishers are aware of their roles and responsibilities in the process. Each fisher is also provided with a printed copy of the EFP and terms and conditions and are required to carry these on their vessel during testing.
- Overview of the gear: This provided a walkthrough of each component of the gear and their function including the release, the line handling system, the deck box and transducer, and the gear marking app. Typical setup for longlining of the traps is also discussed in the context of the fishing vessel setup.
- Gear setup: This covered the steps to setup the release, line handling system, deck box and Trap Timer app. Setup of the traps for longlining is the responsibility of the fisher, but the setup can be reviewed at this step to make sure it is compatible with the EFP and the pop-up system.
- Dry run at dock: This covered the steps to operate the gear including deployment and retrieval of the pop-up gear and all aspects of the gear marking system.
- On-water operations: This provided on-water training with the Alternative Gear by running through a series of at least 10 gear sets and recoveries with trainers aboard to advise and make any adjustments that might be needed for the gear. The on-water training also includes the use of a grapple to recover the gear via the groundline in the event the pop-up system fails.

### 3. Trial Results

Extensive testing of the specific system described above was conducted during the spring of 2024 under EFPT2-001 in the California Dungeness crab fishery. Significant testing was also carried out under the same EFP during the spring of 2023. Previous testing was also carried out using single traps and the timed version of the release system (TR4RT) during 2021 in the California Dungeness crab fishery. In addition, significant testing of the system was conducted using single traps and the acoustic version of the release system in the California Spiny Lobster fishery and the Southeast US Black Sea Bass fishery during the winters of 2022-2023 and 2023-2024. Results from these testing programs are summarized below.

#### AR4RT/Guardian Testing under EFPT2-001- Spring 2024

Results from AR4RT/Guardian system testing under EFPT2-001 during the spring of 2024 provide the most direct measure of the system performance for the gear that is targeted for authorization. Nineteen authorized agents and 19 vessels were approved to participate in the testing (Table 1). This included 5 vessels operating from San Francisco, 7 vessels operating from Bodega Bay, 4 vessels operating from Half Moon Bay, 1 vessel operating from Santa Cruz, and one vessel operating from Moss Landing. All of the vessels except the Areona in Santa Cruz were equipped with the AR4RT/Guardian Sleds with 15 strings of 10 traps each. The Areona was equipped with AR4RT/Guardian Retrofits with 16 strings of 8 traps each. Traps were generally separated by 200-250 ft of groundline with 5 ft gangions. The Guardian line handling systems were initially set up with 300 ft of neutral buoy line with a 12 inch hard main float and an optional A0 Polyform trailer float or 5" hard float trailer. Each on-demand trap was equipped with an AR4RT unit programmed with a unique release code. All vessels were equipped with deck units and tablets to allow for virtual gear marking and acoustic triggering using the Trap Timer app. In addition, each vessel was equipped with a vessel tracking system that recorded the vessel position at a frequency of once per minute during all fishing operations. Following training, the combined fleet of participants conducted a total of 2361 gear set during the period from 4/9/24 – 6/30/24. All testing was conducted under actual fishing conditions and allowed for retention and sale of catch.

In accordance with the EFP, the following data were collected:

- The number of traps in the trawl, and the location of the first and last traps of the trawl.
- The name and vessel ID of the vessel the trap was deployed from.
- The experimental fishing permit number the trap was deployed under.
- The time and date of deployment.
- The time and date of recovery.
- The location the gear was recovered (if different from the deployment location).
- The distance between the location where the gear was deployed and recovered (if different).
- The location of any unrecovered traps.

The following performance-based data were also collected:

- Release unit success/failure/cause
- Line handling system success/failure/cause
- Overall on-demand system success/failure
- Backup grappling system success/failure

As part of the training program, fishers were instructed that gear performance reporting was required and they were provided with multiple means of reporting including a phone app, text message, phone call, or email. In addition, the EFP team checked in with fishers on a regular basis on their gear performance. While we believe that there was a high level of compliance with this reporting requirement, it was essentially an honor system and some gear issues may have been missed. At the same time, there were instances where a fisher identified an issue but wanted to try the gear again to verify the issue, and thus the same issue may have been replicated and counted again. For success/failure analysis, the following approach was adopted:

- If the gear could be recovered using the on-demand system the on-demand recovery was defined as successful
- If the gear could not be recovered using the on-demand system the on-demand recovery was defined as a failure
- Failures were subcategorized as best as possible into the following six cause codes based on the information reported by the fisher
  1. Release Malfunction
  2. Acoustic Coms
  3. Line Handling System
  4. User Error
  5. Environmental Conditions
  6. Unknown
- An on-demand recovery was counted as a failure if any of these items 1-5 were indicated
- Item 6 included a number of issues that were not necessarily related to on-demand gear performance (such as broken groundlines) and were treated on a case-by-case basis
- If the gear was successfully recovered by the backup method of grappling, the on-demand recovery was still counted as a failure, but the gear was not designated as lost
- If the gear could not be recovered with either the on-demand system or the backup grappling method then the gear was designated as lost

Based on the time and location that the gear was set; the following environmental data were also compiled:

- Water depth (from NOAA Coastal DEM)
- Wave Height (From nearest NOAA NDBC buoy)
- Wind Speed (From nearest NOAA NDBC buoy)

Also, in accordance with the EFP, participating fishers submitted landing data connected with EFP fishing activities using an electronic fish ticket using the web-based form submitted through the E-Tix application.

Complete data sets for the EFP testing during the spring of 2024 are included in Appendix 1. Performance results are summarized below based on the specified requirements in the EFP and the RAMP requirements for Alternative Gear authorization.

Vessel	Operating Port for EFP	Configuration	Number of Units	Number of Traps Per String	Total Number of Traps
Pale Horse	San Francisco	Sled	15	10	150
Cynthia	San Francisco	Sled	15	10	150
Sandy B	San Francisco	Sled	15	10	150
Plumeria	Half Moon Bay	Sled	15	10	150
Rosella/Helen Ruth*	Half Moon Bay	Sled	15	10	150
Miss Jessie	San Francisco	Sled	15	10	150
Genesis	Bodega Bay	Sled	15	10	150
Wild Winds	Bodega Bay	Sled	15	10	150
Ava Mae	Bodega Bay	Sled	15	10	150
Judy Kay	Bodega Bay	Sled	15	10	150
Sara Brent	Bodega Bay	Sled	15	10	150
Pamela Sue	Bodega Bay	Sled	15	10	150
Jacqueline L	Half Moon Bay	Sled	15	10	150
Eagle	Half Moon Bay	Sled	15	10	150
Carley Diane	Moss Landing	Sled	15	10	150
Imperial	San Francisco	Sled	15	10	150
Areona	Santa Cruz	Retrofit	16	8	128
Nanbellis Jo	Bodega Bay	Sled	15	10	150

\*Helen Ruth was an alternate vessel for the Rosella

*Table 1. Participating vessels and gear configurations.*

### **Number, Depth and Location of Trials**

The EFP requires annual reporting on the number of trips conducted by each vessel participating in the EFP, the total number of trap deployments, and the number of unsuccessful recoveries. The annual reporting for the EFP also requires a table containing deployment and recovery data for each trip conducted under the authority of this permit (see Appendix 1). The RAMP authorization requires that the number, depth, and location of trials be reported in the application. While there are no specific thresholds or requirements for these values, previous conversations with Department staff indicated an expectation for 100 deployment cycles over a range of ocean conditions.

During this phase of testing, a total of 2361 trials were conducted. Each trial involved a string of 10 traps, with the exception of the Areona with 8 traps, so the total number of traps set during the trials was 23048. The trials were carried out over 277 individual trips. Full details of the trials are included in Appendix 1.

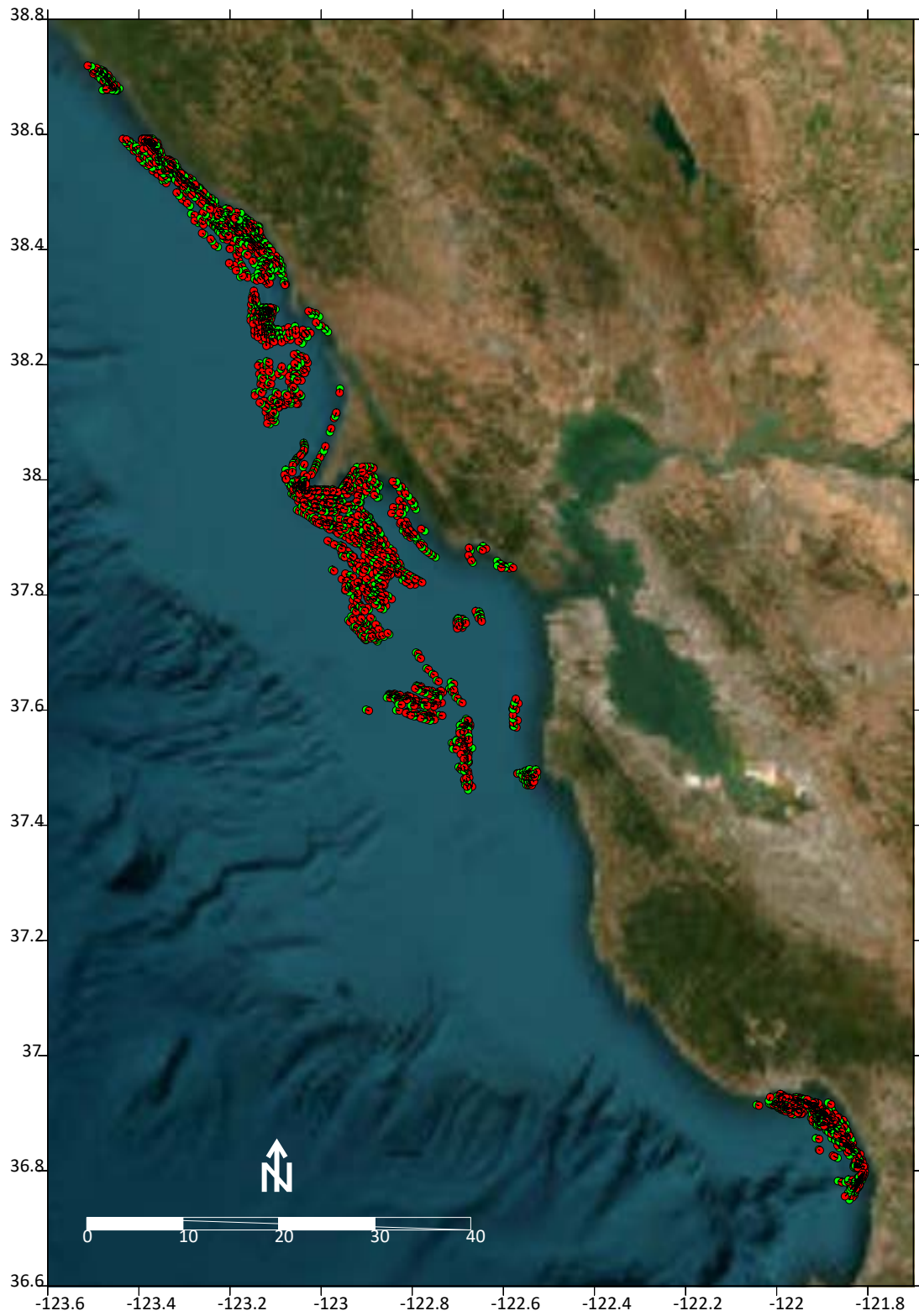
Depths of the gear during the trials were dictated by where the participating fishers wanted to fish the gear. No specific effort was made to test in depths other than those where the fishers would traditionally fish during the spring portion of the season. Depths ranged from 19 – 325 ft with an average of 162 ft. Statistics for the testing depths are shown in Table 1, and the complete data set for depths is included in Appendix 1.

Depth Statistic	Value
Depth Min (ft)	19
Depth Max (ft)	325
Depth Avg (ft)	162
Depth Std Dev (ft)	63

*Table 2. Water depth conditions during the EFP testing.*

Locations of the gear during the trials were focused on the fishing grounds offshore from Bodega Bay/San Francisco (Zone 3) and Santa Cruz/Monterey (Zone 4) (Figure 12). No specific effort was made to test in areas other than those where the fishers would traditionally fish during the spring portion of the season.





*Figure 12. Map of the testing locations. Red filled circles indicate the first end of the string, and green filled circles indicate the last end during the set.*

### ***Gear Performance and Loss Rates***

The only performance metric specified in the RAMP is that gear loss rates should not be more than 10%. Performance for the gear was characterized based on the success rate of the release units, the success rate of the line handling system, and the overall success rate of the on-demand system. In addition, we evaluated the success rate including the backup system (grapple) and the overall gear loss rate (Table 3).

### ***Overall Performance of the AR4RT Release System***

The AR4RT release system demonstrated a high success rate, achieving successful operation in 98.9% of the tests conducted. This performance is consistent with the results from the smaller-scale tests performed in the spring of 2023. Despite the high success rate, 23 release failures were documented. A thorough investigation into the causes of these failures is currently underway. Preliminary findings suggest various potential issues, including communication failures or possible binding problems, as some units functioned correctly on deck but were unable to be called underwater. Additionally, in several instances, internal microprocessor damage during production caused excessive current draw, leading to battery depletion. One instance involved the release cam not fully rotating, possibly due to debris obstruction. Other issues included a faulty deck box transmission and a loose battery. Some failures may be attributed to the rapid production scale-up, potentially impacting quality. Future efforts will focus on improvement in quality assurance checks during production, further enhancing the robustness of the releases to minimize these issues. Despite these challenges, the release units maintained a high success rate, with detailed accounting for each gear set provided in Appendix 1.

### ***Performance of the Guardian Line Handling System***

The Guardian line handling system also performed well, achieving a 98.9% success rate, slightly improving from the spring 2023 small-scale tests. During the testing, 24 failures were observed, primarily attributed to line tangles of the buoy line. Specific cases included the Guardian containment mesh tearing and tangling the buoy line and instances where it was suspected that the sled's incorrect landing position impeded buoy release. Some buoys were initially unlocated but surfaced later, likely due to currents or minor tangles resolving themselves. Poor line handling during sled packing contributed to some tangles. A comprehensive record of each gear set's performance is included in Appendix 1.

### ***Overall On-Demand System Success Rate***

Combining the individual success rates of the release and line handling systems, the overall success rate of the on-demand system was determined to be 98.0%, representing a slight improvement from the spring 2023 small-scale tests. In instances where the on-demand system failed, grappling techniques successfully retrieved the gear within an additional 10-30 minutes. All non-surfacing on-demand gear was recovered via grappling, except for a few noted cases.

### ***Lost Gear***

The EFP annual report requires a summary of efforts to recover lost gear and the outcomes. One sled was irretrievable after becoming unclipped at the c-link connection to the gangion. One buoy was lost due to a loose carabiner connection. A groundline break resulted in a single trap being lost, stuck on debris and irrecoverable despite grappling efforts. Two additional groundline breaks led to full recovery except for three intermediate traps. One gear string off San Francisco remained unfound despite multiple grappling attempts, suspected to have been displaced by a bottom trawler. Another string

could not be recovered in shallow water near Point Reyes, likely buried. Two strings near Bodega Bay are still unrecovered due to a vessel mechanical breakdown. An initial recovery attempt failed. For the four missing strings, CDFW has provided a waiver for additional recovery efforts, which are ongoing.

Totals	Number	Percent
Strings Set	2361	
String Haul	2357	99.8%
Traps Used	2678	
Traps Set	23048	
Traps Hauled	23004	99.8%
Traps Lost/Left1	44	1.6%
Release Success	2336	98.9%
Line Handle Success	2335	98.9%
Overall Popup Success	2314	98.0%
Grappled	36	1.5%

*Table 3. Performance measurements for the AR4RT/Guardian on-demand system. Note that the percent of traps loss is based on the number of traps used, not the number of traps set.*

**Environmental Conditions During Trials**

The RAMP does not provide specific guidance on the requirement for ocean conditions during the trials, but only requires that the conditions during the trials be reported in the application. Based on the time and location data recorded in Trap Timer for each deployment, we compiled wave height and wind speed data from the nearest NOAA NDBC buoy (Table 4). Because these weather buoy station locations do not correspond precisely to the gear locations, there may be differences between the buoy conditions and the actual conditions that were present during the deployments. Wave heights ranged from 1.4 – 11.5 ft with an average of 5.5 ft. This significantly expanded the range of wave conditions as compared to the small scale testing during spring 2023. Statistics for the testing wave height are shown in Table 5, and the complete data set is included in Appendix 1. Wind speeds ranged from 0.0 – 27.2 kts with an average of 9.1 kts. This significantly expanded the range of wind conditions as compared to the small scale testing during spring 2023. Statistics for the testing wind speeds are shown in Table 6, and the complete data set for depths is included in Appendix 1.

Data Item	Source
Bodega Bay Wind	NDBC Station 46013
Bodega Bay Waves	NDBC Station 46013
San Francisco Wind	NDBC Station 46013
San Francisco Waves	NDBC Station 46026
Monterey Wind	NDBC Station 46092
Monterey Waves	NDBC Station 46279
Depth	NCEI DEM

*Table 4. Wind and wave condition sources for the EFP testing.*

Wave Data		
Wave Height Min	1.4	ft
Wave Height Max	11.5	ft
Wave Height Avg	5.5	ft
Wave Height Std Dev	2.1	ft

Table 5. Wave conditions during the EFP testing.

Wind Data		
Wind Speed Min	0.0	kts
Wind Sppeed Max	27.2	kts
Wind Speed Avg	9.1	kts
Wind Speed Std Dev	5.8	kts

Table 6. Wind conditions during the EFP testing.

### **Landings During the Trials**

The EFP annual reporting requires a summary of landing data for each crab species landed at each port by each vessel. In accordance with the EFP, participating fishers submitted landing data connected with EFP fishing activities using an electronic fish ticket using the web-based form submitted through the E-Tix application. A summary of the landings is shown in Table 7 below by landing port and for the total spring 2024 fishery. A total of 229470 pounds of Dungeness crab were landed by the participating vessels, indicating an average catch of about 12077 pounds for the 19 participating vessels. Note that this summary is based on landings reported through the Sustainable Seas Technology reporting app and may not reflect the complete totals submitted via E-Tix because use of the reporting app was not required, and some fishers may have submitted landings without using the app.

Landing Port	Landings (lb)
Half Moon Bay	24872
San Francisco	31062
Bodega Bay	151198
Santa Cruz	14481
Moss Landing	7858
Total	229470

Table 7. Summary of landings by landing port.

### **Previous System Testing and Testing in Other Fisheries**

The Alternative Gear described here (or aspects of that gear) has been subject to significant previous testing in the California Dungeness crab fishery as well as in other fisheries that are reasonably comparable to the California Dungeness crab spring fishery. These additional testing efforts are summarized below to provide additional information on the performance of the gear under a range of conditions.

### **2021 Testing in the California Dungeness Crab Fishery**

Previous testing was carried out using single traps and the timed version of the release system (TR4RT) during 2021 in the California Dungeness crab fishery. Testing for the TR4RT system with Dungeness crab traps was conducted out of Santa Cruz Harbor on F/V Grinder. An initial phase of testing was conducted

from September through October of 2021 in the commercial rock crab fishery but using Dungeness crab traps rather than rock crab traps. A second phase of testing was conducted in December 2021 in the commercial Dungeness crab fishery. For the trials, 5-10 traps were fitted with TR4RT release units and the PinPoint line handling systems (not the Guardian). During each deployment, the gear was marked on the surface with a backup line and float and was also marked virtually using the Trap Timer app.

A total of 130 trials were conducted during the two testing phases. Of these, 124 were considered to be successful for an overall success rate of 95%. Successful trials required that a complete deployment and recovery cycle of the on-demand system be achieved without any intervention using the backup float, grappling or any other means to assist in the gear recovery. Depths during the trials ranged from 55 – 195 feet. The trials were all conducted in Zone 4 which extends along the California coast from latitude 36° 0'N to 37° 11'N. Overall, the gear surfaced when expected and was found to release successfully. Over time, retrieval and redeployment efficiency was found to improve significantly. The Trap Timer virtual gear marking app was found to work consistently and enabled successful remote gear tracking. Of the six failures that occurred, two were related to a loose battery in one of the units that was subsequently corrected. Line tangles were the cause of three failures and this issue was also corrected by implementing a more consistent line coiling and securing procedure. The cause of one other failure was not documented. In general, the system was found to be highly reliable and issues that were identified during the trials have been addressed through corrective measures.

#### ***2022 Testing in the California Spiny Lobster Fishery***

Testing of the system was conducted using single traps and the acoustic version of the release system in the California Spiny Lobster fishery. Testing for the AR4RT system with the PinPoint line handling system was conducted out of San Diego Bay on the F/V Haywire. Twenty single traps were configured with the AR4RT/PinPoint system as the main retrieval system, and a second coiled line and float with galvanic timed release as the backup (note that the use of galvanic timed releases is allowed in this fishery so the backup system is what would normally be used as standard gear). Testing was conducted during the period extending from October – December of 2022.

A total of 122 trials were conducted with 117 successful, 4 requiring backup gear, and 1 unit lost under storm conditions. This translates to an overall 96% success rate for the system. Tests were carried out near the entrance to San Diego Bay and in the kelp beds to the west of Point Loma in water depths ranging from 6 – 55 ft. Of the six failures that occurred, two had release failures associated with the release cam jamming against the line coil, two were associated with line tangles, and one was displaced by a large storm and could not be located.

#### ***2022 Testing in the Southeast US Black Sea Bass Fishery (Sustainable Seas Technology)***

Testing of the system was conducted using single traps and both the timed and acoustic version of the release system in the Southeast US Black Sea Bass fishery during 2022 under a NMFS provided Experimental Fishing permit. Traps were outfitted with either the TR4RT or AR4RT/Guardian system. Traps were fished as singles with a limit of 35 traps per fisher. Backup recovery was by grapple. Testing was conducted during the period March 2022 – December 2022 (note that extensive additional testing has been conducted but these are the only results that have been compiled so far from one fisher).

A total of 593 trials were conducted with 586 successful, 7 requiring backup gear, and 0 units lost. This translates to an overall 98% success rate for the system. Tests were carried out offshore from Sneads

Ferry, North Carolina in water depths ranging from 2 – 96 ft. Of the 7 failures that occurred, four were related to human error and three had unknown causes.

### ***2023 Canadian Snow Crab Fishery (Canadian Wildlife Federation)***

Canadian Wildlife Federation (CWF) Guardian/Sub Sea Sonics trials took place in the Maritimes including Cribbons Point, Grand Étang, Bay Saint Lawrence (Nova Scotia), and Alberton (Prince Edward Island). CWF completed 52 deployments with the sled system and 26 deployments with the retrofit system. Deployments took place at depths varying from <10 fathoms up to 84.5 fathoms, wind speeds between 1 – 12 knots and swells reaching 2.5 meters.

Of the 52 deployments, 48 were successful, resulting in a success rate of 92% where success was defined by CWF staff as deploying the configuration, calling for it, and recovering the system along with the gear it is attached to. The 4 failures included one acoustic failure that occurred in a depth of 77 fathoms with 4 meter swells where the signal was never received by the unit even after repositioning the vessel and sending eight communication attempts. Another failure occurred where a snarl in the line prevented the buoys from surfacing. One failure was due to human error, where there was not enough line in the cage for the conditions and depth, and the final failure occurred in a depth of 80 fathoms during 3-meter swells, where it is unclear whether this was caused due to the conditions or if it was an acoustic failure.

### ***2023 Testing in the California Spiny Lobster Fishery***

Testing of the system was conducted using single traps and the acoustic version of the release system in the California Spiny Lobster fishery. Testing of the AR4RT system with the PinPoint line handling system was conducted out of San Diego Bay on the F/V Haywire. Twenty single traps were configured with the AR4RT/PinPoint system as the main retrieval system, and a backup release wire threaded through the release loop to bungee connection as a backup (note that the use of galvanic timed releases is allowed in this fishery so the backup system is what would normally be used as standard gear). Testing was conducted during the period extending from October – December of 2023.

A total of 244 trials were conducted with 243 successful, 1 requiring backup gear, and 0 units lost. This translates to an overall 99.6% success rate for the system. Tests were carried out near the entrance to San Diego Bay in water depths ranging from 21 – 40 ft. The single failure that occurred was attributed to the release unit because the unit later came up when the backup wire corroded. The cause of the release failure was unknown, and it seemed to be functioning properly when it was retrieved.

### ***2023 Testing in the California Dungeness Crab Fishery***

Previous testing was carried out under EFPT2-001 during the spring of 2023. Two vessels participated with 10 strings of 5 pots each with the terminal trap fitted with the AR4RT/Guardian Retrofit setup. During this phase of testing, 122 trials were conducted off San Francisco and 117 trials were conducted off Santa Cruz for an overall total of 239 trials. Each trial involved a string of 5 traps, so the total number of traps cycled during the trials was 1195. Overall, the release system (AR4RT) was successful in 99.6% of the tests. Only one failure was detected. In this case, after multiple triggers, the cam was found to only have partially rotated. The line handling (Guardian) was successful in 97.5% of the tests. Six failures were noted over the course of the testing. Based on the individual success rates for the release and the line handling system, the overall success rate of the on-demand system was found to be 97.1%. For those instances where the on-demand system failed, grappling was found to be highly successful in retrieving the gear within an additional 10-15 minutes. All of the on-demand gear that did not successfully surface

was subsequently successfully recovered by grappling. The only gear that was lost during the testing was a partial string of traps (4) that were displaced by a Halibut trawler that came through the fishing area.

***Summary of Other Testing***

Overall, the additional testing that has been conducted to date represents 1380 trials with a combined success rate of ~98%. The results from these other testing programs are comparable to what we found during the EFP testing for the California Dungeness crab fishery and support the conclusion that the gear is highly reliable. These other testing programs have also provided significant opportunities to continue to refine and improve the gear. Including this testing and the EFP testing, almost 3500 trials have now been performed with the gear.

#### 4. Gear Acceptability under the RAMP Criteria

A key goal of the EFP is to provide sufficient testing and evidence to determine if the gear is ready for Authorization under the RAMP criteria. A description of the Sub Sea Sonics/Guardian system capabilities with respect to the RAMP requirements for Alternative Gear is provided below for each of the current RAMP criterion.

##### Detectability

RAMP Requirements: The RAMP requires gear “detectability by the department, fishermen and public, including description how location of Alternative Gear is available visually or virtually, equipment specifications including costs, and any required specialized equipment or training to deploy, operate, or detect the gear. If “ropeless,” the gear must be used with software that enables department law enforcement and other fishing vessels within the specified visibility radius of the gear to identify the location of the gear at all times when it is deployed.”

The Trap Timer app provides detectability of the gear for fishers, enforcement and public users. When the gear is underwater, the app shows the location of the gear on a tablet or cell phone that synchronizes with a shoreside database. When the gear is at the surface, both the app and floats provide visibility. The equipment required to detect the gear includes a tablet or cell phone with cellular and Wi-Fi capability (typical cost \$0-300) with the Trap Timer app (currently free) installed. As described previously, the app provides virtual visibility to the fisher of all of their gear and provides visibility to enforcement and public users. Training in the use of the app is available from Sub Sea Sonics at no charge. The app is available for Android and iOS via the respective app stores once the user has signed up via the onboarding website ([www.onboarding.subseasonics.com](http://www.onboarding.subseasonics.com)).

##### Retrievability

RAMP Requirements: The RAMP requires a “means of retrieval, including description of release mechanism, equipment and any specialized training needed to deploy and/or retrieve Alternative Gear, description of safeguards and procedures to minimize gear loss and ghost gear, with gear loss rates of no more than 10%. Gear must include a back-up release capability so it will surface in the event of an equipment failure and must include a gear recovery plan if the gear does not rise to the surface.”

Because the AR4RT system uses an acoustic trigger, there is a requirement for a deck unit and transducer to activate the release. For fishers, the gear is deployed and retrieved as described in the previous sections of this document that describe the gear. While the pop-up gear itself can be handled with traditional deck gear, the configuration of the traps in strings may require adjustments to the vessel and gear handling techniques in order to accommodate the strings. Because the Dungeness crab fishery in California currently only uses singles, most vessels that adopt this gear would need to make the required changes to allow for handling of strings. Based on the test vessels that we evaluated, this is generally feasible for a range of existing vessels but the length of the strings that can be handled safely and effectively may be a function of the size and configuration of the vessel as well as the size of the crew. However, with a minimum string length of two, generally any vessel in the fleet could be adapted to use the gear.

For enforcement, two potential approaches could be considered for retrieving the gear. If the Department desires the capability of directly handling the gear, then enforcement vessels would need to



be outfitted with the same essential gear as the fishing vessels with respect to both the pop-up gear and the trap strings. This would include the deck unit and transducer, and a tablet with the app installed. The Department vessel would need appropriate gear handling systems, deck space, configuration and crew to handle strings up to the maximum length approved. Alternatively, the Department could utilize the wealth of digital data available from the Trap Timer App, the Regulatory Portal, and the VTS to arrange for observing and inspecting when fishers are hauling the gear. Given that the Department will generally know where all the gear is set, and where all the fishing vessels are, this seems like a much more favorable approach that would allow full enforcement capabilities while minimizing gear, vessel and crew requirements. This would also reduce the potential risk and liability associated with resetting the gear improperly. In either case, Sub Sea Sonics and Guardian can provide the necessary training associated with the on-demand gear, but enforcement would be required to work with fishers or others to develop the required skills for handling trap strings.

The primary mechanism proposed to prevent gear loss is via grappling for the groundline. As described in previous sections, this backup method has proved highly reliable, and is a commonly used practice among fishers in many different fisheries and situations. To make this backup as reliable as possible, the correct type of grappling gear should be specified and training with the gear should be included as part of the training for the system. With the high reliability of the on-demand system, combined with the tried and true backup of grappling and adequate training, gear recovery rates approaching 100% have been demonstrated and can be expected in the future.

#### Ability to Identify

RAMP Requirements: The RAMP requires a “means of Alternative Gear identification, including the method or description of the mechanism required for the department to identify Alternative Gear to permit holder both remotely when submerged, and at the surface.”

The AR4RT/Guardian system provides the ability for enforcement personnel to identify the Alternative Gear both when submerged and at the surface. When the gear is submerged, the regulatory version of the Trap Timer App provides the ability to identify the permit number associated with any trap that is within the specified visibility radius of the vessel. These traps are visible in the map and table views of the app and clicking on the trap brings up the required information including position, deployment time, popup time, range, bearing and associated permit number. When the gear is at the surface, the app can still be used in the same way, or the gear can be identified based on the traditional float markings. The visibility radius is adjustable but should be at least  $\frac{1}{4}$  nautical mile based on the recommendation in the RAMP. In addition, the Ropeless Regulatory Portal provides full visibility of all of the gear across the fishery.

#### Benefit

RAMP Requirements: The RAMP requires “evidence Alternative Gear reduces risk or severity of entanglement.”

The benefit of the AR4RT/Guardian system in reducing entanglement risk is based on removal of the vertical line during the time between deployment and popup. The degree of risk reduction is a function of the percentage of time the system is in ropeless mode, which is determined by the return time of the fisher relative to the popup time. In general, these times can be very close and risk reduction for entanglement should be on the order of 99% or greater. This parameter is calculated as:

$$\% \text{ Risk Reduction} = \frac{\text{Deployment Time} - \text{Popup Time}}{\text{Deployment Time} - \text{Retrieval Time}} \times 100$$

Typical soak times (Deployment Time – Retrieval Time) for the gear during the spring are 2-10 days, while the time for the fisher to recover the vertical line following on-demand popup is generally less than 5 minutes. Thus the % Risk Reduction is typically on the order of >99.9% compared to traditional gear.

Along with the potential benefit to reduce entanglement risk, the primary benefit that the gear provides is the potential for fishers to have access to the fishery when it would otherwise be closed due to the presence of whales. Southern fishing zones of the California Dungeness crab fishery are consistently closed during the spring now because of either the high presence or the expected high presence of whales in the area. During the spring of 2023, this closure was limited to Zones 3-6 while fishing was allowed to continue in Zones 1-2 through mid-July. This trend is likely to continue and creates uneven access to the fishery that could be relieved by the approval of Alternative Gear.

### Enforceability

RAMP Requirements: The RAMP requires “including means by which department law enforcement can find and retrieve the Alternative Gear at sea and costs of any necessary equipment and/or training. Department law enforcement must be able to retrieve and redeploy the gear.” In addition, to assure that fishers are not using the gear in areas or during times that are not allowed, the RAMP requires “all vessels must have an operational electronic monitoring system affixed to their vessel and must be recording location while engaged in any fishing activity for commercial Dungeness crab. Electronic monitoring systems must be capable of tracking and recording vessel location using GPS coordinates at a frequency of no less than once a minute during fishing operations. Electronic monitoring data shall be made available to the department or authorized agent upon request for the duration of the fishing period and 60 days thereafter.”

The ability of the Department to perform enforcement would be highly enhanced by the use of the integrated AR4RT/Guardian system described here. This is because the system provides vastly more information regarding the location and status of both the gear and the vessels than is currently available. Information on the gear location and status is available through both the Trap Timer app and the Ropeless Regulatory Portal, and vessel tracking information is available through the VTS dashboard. All of these systems were made available to the Department for trial and testing during the EFP testing period. The functionality of each of these systems are summarized below from an enforcement standpoint. During the EFP enforcement personnel were trained on both the popup gear and the longlining techniques for hauling the gear. They demonstrated that they could successfully retrieve and redeploy the gear from an enforcement vessel.

### **Trap Timer App**

The enforcement version of the Trap Timer app provides enforcement access to all of the permitted traps within the fishery. In the map and table views, these traps show up as icons or list items, respectively. During underway operations, the app can be used to locate and identify gear. In conjunction with the deck unit and transducer, the app can be used to trigger the release and retrieve the gear for inspection purposes. The app automates this process so that the enforcement personnel only have to select which trap to retrieve, and the app will automatically cross reference the release ID.

The app can also be used to re-mark the gear if it is set after inspection. The Trap Timer app is free and available through app stores following onboarding through Sub Sea Sonics. Free training for the app is also available from Sub Sea Sonics.

### ***Ropeless Regulatory Portal***

The Ropeless Regulatory Portal provides a web-based link to the Sub Sea Sonics trap database. The portal provides access to all current and historical trap locations, information on deployment and retrieval times, along with fisher, permit and vessel information (Figure 9). This information is only accessible to enforcement personnel on a fishery basis. The data there can be filtered and downloaded based on any desired parameters. This system provides enforcement the ability to review the locations, timing and effectiveness of the gear from the office. It can also provide the ability to plan enforcement missions based on near real-time information on trap locations and status. Access to the Ropeless Regulatory Portal is free for enforcement personnel. Sub Sea Sonics can provide free training for enforcement personnel on the use of the portal.

### ***Vessel Tracking System***

The Pelagic Data Systems VTS provides dashboard access to all current and historical vessel location information on a per trip basis (Figure 11). Other VTS systems contemplated for use by the Department provide similar capabilities. The VTS system provides visibility into the movements and operations of the fishing vessels through map visualizations of position and speed. These maps provide a clear picture of where and how the vessels have been operating. From an enforcement perspective, the VTS dashboard provides a powerful tool to determine if fishers are operating in the proper areas and the proper times, if fishers reported gear locations correspond to their vessel tracks (Figure 13), and to further investigate any operations that may be considered to be unlawful with respect to fishing regulations. Access to the VTS dashboard is currently being provided by gear manufacturers. The costs are associated with the purchase of the gear and the subscriptions that support gear access. Future costs and cost responsibilities are not known at this time, but the Department is moving toward VTS requirements for all vessels in the Dungeness crab fleet. Training on the use of the VTS can be provided by the VTS provider or their dealer representatives.

### ***Recommended Enforcement Approach***

Based on the capabilities described above, the proposed Alternative Gear provides significant advantages for enforceability compared to traditional gear. The recommended enforcement approach for the Alternative Gear is to take advantage of these systems to assure that the gear is used properly within the fishery. This can be approached on a multi-tier basis including:

- Off-Water Enforcement Approaches
  - Evaluation of trap locations, deployment times and retrieval times in the Ropeless Regulatory Portal
  - Evaluation of vessel locations and speeds in the VTS dashboard
  - Comparison of trap locations with vessel locations with associated discrepancy analysis based on fishing-like operations in the absence of deployed gear
- On-Water Enforcement Approaches
  - Identify vessels and/or gear of interest based on off-water analysis
  - Contact vessel operator to inspect vessel or pull and inspect gear

Importantly, all of the off-water approaches provide a means to conduct enforcement in a much safer and cost effective way that does not depend on weather conditions or enforcement vessel availability. On-water approaches can take advantage of the off-water information to be much more targeted and effective as well.

### ***Independent Gear Retrieval***

In the event that the Department requires to independently retrieve the Alternative Gear without the assistance of the fisher, this capability is fully supported by the system. The enforcement version of Trap Timer provides access to the location, permit, vessel, and popup ID for every deployed system. In order to retrieve the gear, the enforcement vessel approaches to within acoustic range, puts the transducer in the water, activates the deck box, and then uses the app to select the target unit. The app sends the release command to the deck unit and the deck unit transmits this acoustically to the underwater release. The gear is then retrieved for inspection using traditional hauling gear. When complete, the gear is re-set using traditional methods, and the app is used to re-mark the gear using the associated popup ID. Through the app, the Department has access to all of the release codes associated with the popup IDs in their fishery.

### **Interoperability**

Although not specifically called for under the RAMP Alternative Gear requirements, interoperability is an important aspect of the Alternative Gear. In particular, interoperability with respect to mobile fisher and other ocean users that may interact with fixed fishing gear, and interoperability with fishers within the same fishery using other types of Alternative Gear.

### ***Interoperability with Mobile Fishers***

Interoperability with mobile fishers is important to consider because they may be operating in the same areas and without surface buoys, they will be unaware of the fixed gear. To address this, the public version of the Trap Timer app provides these fishers with visibility of the fixed gear. This works in the same way that the app works for fishers and enforcement, however it does not allow for any operation of the gear. The public version of the app will display all of the Alternative Gear within the specified visibility radius. The visibility radius is generally established on a fishery-wide basis. Consideration should be given to a requirement for the use of a public version of the app for other mobile and fixed gear fisheries that have the potential for gear conflicts when popup gear is being used in the Dungeness crab fishery.

### ***Interoperability with Other Alternative Gear***

Interoperability with other alternative gear will be important if gear from other manufacturers is authorized within the same fishery. The Sub Sea Sonics/Guardian system has already implemented this interoperability through a system called the rmwHUB, an interoperability capability developed and supported by the Ropeless Manufacturers Workgroup. This system is currently implemented or in the process of being implemented by all of the major on-demand fishing gear manufacturers with the exception of EdgeTech. Through the rmwHub, gear from other manufacturers is visible to the fisher via the Trap Timer app. This allows for the fisher to avoid interferences that might result from the overlay of trap strings in the same area. The system does not provide any detailed information on the gear, but just displays the location. Ongoing work to integrate the rmwHUB with the Earth Ranger hub will allow for

inclusion of EdgeTech gear and potentially other gear types and capabilities that are available through that system.

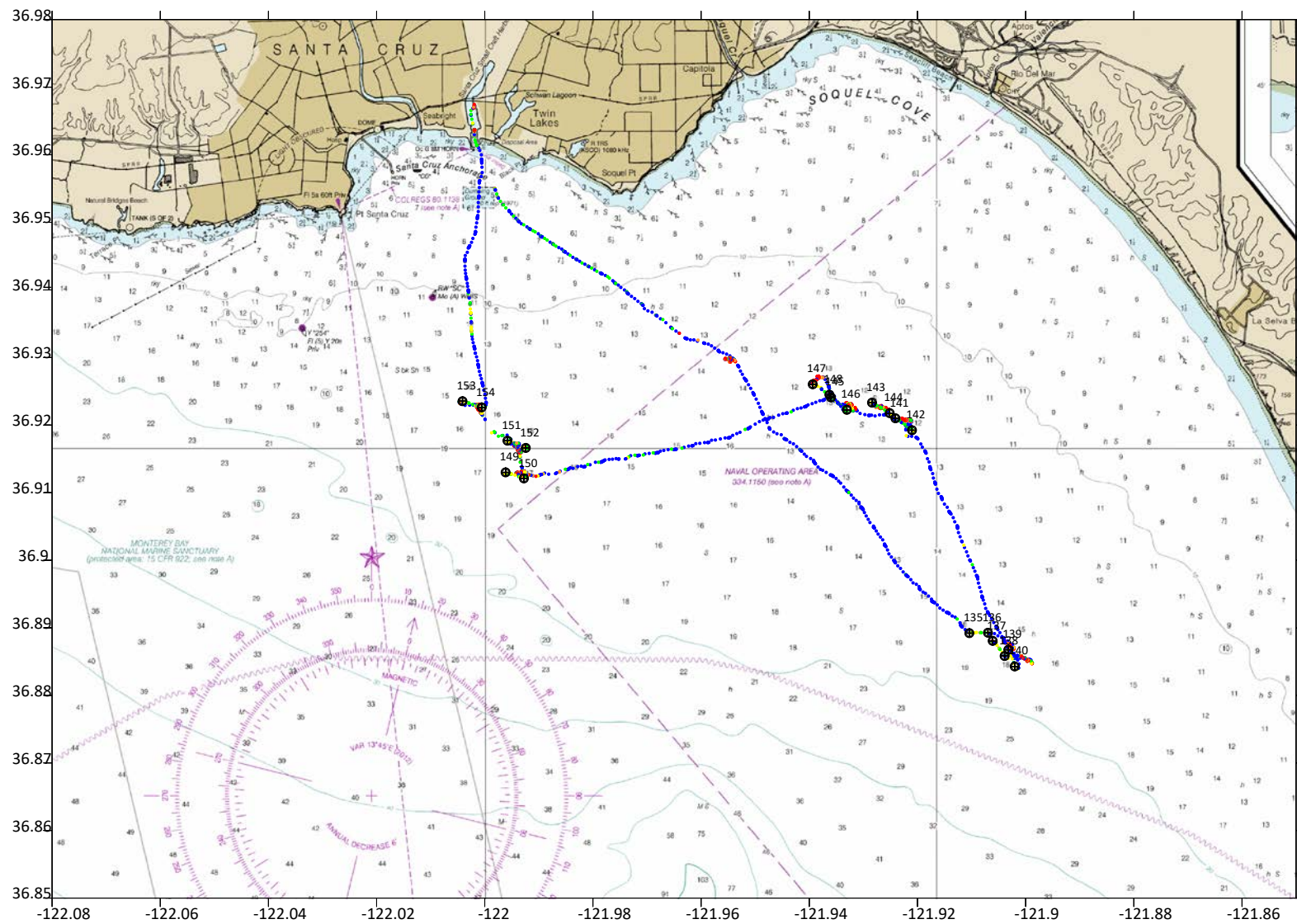


Figure 13. Map showing the overlay of trip data from the Pelagic Data Systems VTS and trap locations from the Ropeless Regulatory Portal. The combination of these data sets provides a powerful tool for enforcing the proper use of the proposed Alternative Gear.

## 5. Gear recovery plan in the event retrieval is unsuccessful

The Alternative Gear recovery plan for the AR4RT/Guardian system incorporates three key aspects. First, the AR4RT/Guardian system is a proven, highly reliable on-demand solution that reduces the number of failures to a very small number. Second, an accurate gear marking and documentation system for lost gear built into the Trap Timer app. Lastly, a highly reliable alternate method is in place to recover gear that does not popup. The underlying system has been shown to have a reliability of >97% under spring fishing conditions in the California Dungeness crab fishery. For the small percentage of gear that does not come up on demand, the grappling backup was also shown to be highly effective and required only 10-30 minutes of additional time to recover. In the event that both the release and the backup fail, the gear remains accurately marked using the Trap Timer app, and the lost status is flagged in the database. This will provide a reliable search location for any subsequent gear recovery efforts under the Departments Lost or Abandoned Dungeness Crab Trap Gear Retrieval Program. Given the documented reliability of the main and backup systems, it is demonstrated and expected that loss rates will comply with RAMP requirements. The Ropeless Regulatory Web Portal can also be used to track statistics of gear loss associated with the Alternative Gear so that any issues or trends can be identified and addressed.

## 6. Gear enforcement considerations

As described above, the Alternative Gear proposed here provides a range of methods to support enforcement. Because the gear is deployed in strings, the ideal approach for the Department to retrieve and deploy the gear is by having the fisher do it. This has multiple advantages in that the enforcement vessel does not have to be modified to allow for handling strings, the fishers will be highly adept at handling the gear because they do it all the time, and the Department will not be responsible for any issues that might occur during hauling or setting the gear. In this case, the Department would be required to have access to the Trap Timer app, the Ropeless Regulatory Portal, and the VTS dashboard in order to plan and execute enforcement actions. The use of Trap Timer in the field requires a tablet with wi-fi and cellular connection that generally costs in the range of \$200-300 unless an existing tablet or phone can be used. There would be no other costs to operate enforcement in this mode. An enhancement to this would be to make sure that the enforcement vessel has continuous connectivity through a satellite link so that Trap Timer could be synchronized outside of cell range, and if desired the portal and dashboard could be used on a laptop on the vessel.

Alternatively, if the Department desires to haul and set gear themselves, the primary requirements beyond what is described above would be to also have a deck unit and transducer, and outfit the enforcement vessel to handle strings. The cost of the deck unit and transducer is ~\$1320. The cost to outfit the enforcement vessel to haul strings would be vessel specific. Because the Department is already managing other fisheries that utilize strings of traps, it is expected that this will not be a major variation from current operations. As described previously, in the event that the Department requires to independently retrieve the Alternative Gear without the assistance of the fisher, this capability is fully supported by the system. During the 2024 spring season CDFW enforcement personnel were provided with both training and equipment free of charge for use during the active EFP fishing period. This included supervised on the water use of the app, in-water gear, longlines of traps, deck unit and web portal.



## 7. Next Steps

Following the spring gear trials in 2023, we compiled and submitted an alternative gear authorization request to CDFW. The Department declined to authorize this request because they believed the gear did not meet the RAMP criteria for Enforceability including the following issues:

- The trap marking software requires fishers to manually input the gear set location which could allow for fishers to set traps in closed fishing areas without detection by Department law enforcement staff; and
- The proposed gear doesn't provide a means for the Department to verify the manually entered gear set location.

To address these concerns, the Department recommended expanded testing along with the implementation of a robust electronic monitoring program and the utilization of conditional authorization limits that will be established in the upcoming RAMP 2.0 regulations.

***“The Department believes that expanded testing along with the implementation of a robust electronic monitoring program (currently scheduled for the 2024-25 season) and the additional conditional authorization limits that will be established in the upcoming RAMP 2.0 regulations will address these issues.”***

Sub Sea Sonics/Guardian have followed through with the largest full-scale testing of on demand gear ever conducted. The results show that the gear is reliable and effective and there is significant demand from the fleet to use the gear for access to the spring Dungeness crab fishery. Robust electronic monitoring will be in place for the 2024-2025 season and the new RAMP 2.0 regulations are also scheduled to be in place. On this basis, we believe that the clear next step is for the gear to be authorized under RAMP 2.0.

## Appendix 1. Alternative Gear Trial Results

(See attached spreadsheet)