A. NOAA Grant Number: NA10NMF4540471

B. Grantee: Coonamessett Farm Foundation, Inc

C. Project Title: Real-Time Electronic Bycatch Reporting Pilot Project

D. Amount of Grant $: $96,850.00 Actually Collected: $184,039.82

E. Award Start Date: 7/1/2010

F. Final Report (revised 8/12)

Executive Summary:

A real-time catch reporting tool has been designed in order to change the way fishery stakeholders collect fishery data, and interact with the resource in order to maximize catch and minimize by-catch while increasing productivity throughout the industry. The Coonamessett Farm Foundation Inc. has collaborated with the software development company Olrac SPS International to design and build the Olrac DDL fishery sampling and reporting software. The software allows easy data collection in the field including location, catch, environmental and additional user defined data entry fields. Initial testing both using proxy catch information on land, and in real-time on closed area fishing trips resulted in several modifications to both the software and hardware to optimize the system. This included reworking the method of catch input, redefining on deck sampling procedures and investigating a new method of ship-to-shore data transmission. As of early 2012 the software changes have been implemented and are in testing, the on-deck sampling procedures have been redesigned and will be tested in the upcoming months, and the ship-to-shore data system has been completely changed to a new provider. The modifications to the electronic monitoring system will be tested as soon as May 2012 and will be implemented on at least 10 vessels in the New Bedford limited access scallop fleet.

<u>Initial work designing the Olrac software interface:</u>

The first six months of this project focused on data modeling, in other words the "blueprinting" of the data elements to be incorporated into the Olrac software components. This was an iterative process, incorporating suggestions from Coonamessett Farm Foundation (CFF) staff, scallop industry representatives, the Olrac development team, and components from paper logbook forms. The Olrac software products were then customized accordingly and presented to CFF staff for review. The Ocean Land Resource Assessment Consultants (Olrac), developers of the Olfish software worked with the Coonamessett Farm Foundation and local Olfish agent, Olfish-AOLA, to develop a conceptual data model (Fig. 1).

Olrac SPS International (formally Olrac), developed two customized software elements for the Coonamessett Farm Foundation and the limited access scallop fleet, as follows:

Olrac–Dynamic Data Logger Scallop (Olrac DDL) – Vessel software used to record data and send reports to the Olrac-DDM.

Olrac–Dynamic Data Manager Scallop (Olrac DDM) – Web-based reports management database, used to aggregate and analyze reports sent from the Olrac DDL and transmit bycatch reports back to the fleet.

While the Olrac software has been designed and implemented into several fisheries around the world, it needed to be optimized to be used in the Limited Access scallop fishery. For example, the software is currently utilized in the offshore lobster fishery in the Northeastern US. While several of the data entry fields may be similar (latitude, longitude, depth, etc.) many of the fields had to be modified to accommodate the specific fishery needs and data collection differences between typical Olrac clients and the scallop fishery.

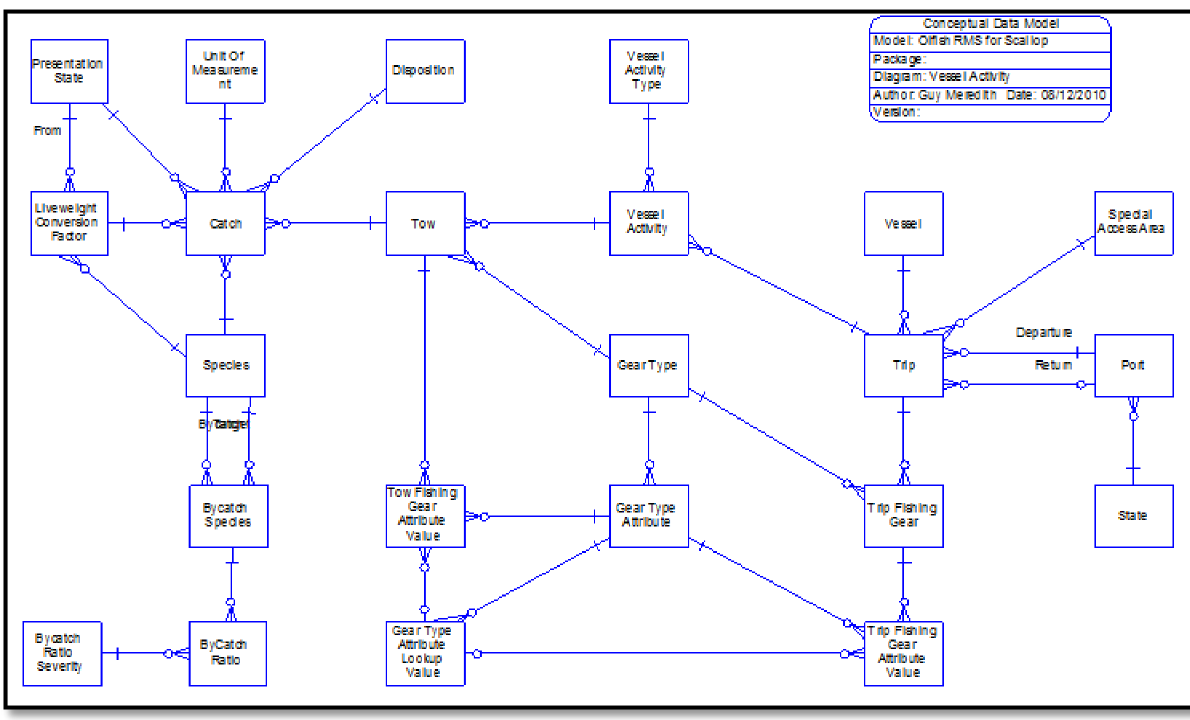


Figure 1. Blueprint of data elements collected by the Electronic Monitoring System.

After the data collection elements that were critical to the project were identified, work on the project then continued from "blueprinting" the necessary Olfish software components, to building a product that could be tested on vessels in the New Bedford scallop fleet. Initially the program delivered to the Coonamessett Farm Foundation in spring 2011 was comprised of key Olfish software components for use in the scallop fishery bycatch reporting solution. The software designed for the current project was based on the Olfish Vessel Dynamic Data Logger (Olfish-DDL) software, which was then specifically configured to suit the needs of the US scallop industry. This meant modifying the software to include fields in order to input scallop catch weights, discards of several commercially important species, dredge information, as well as weather and tow information. The screen shot from the program (Fig. 2) shows how catch information is logged for each tow, included species, weight, amount, as well as other critical information. After designing of the software was complete, in the spring of 2011 it was tested both on land using proxy catch and GPS simulations, as well as on the F/V Celtic in New Bedford.

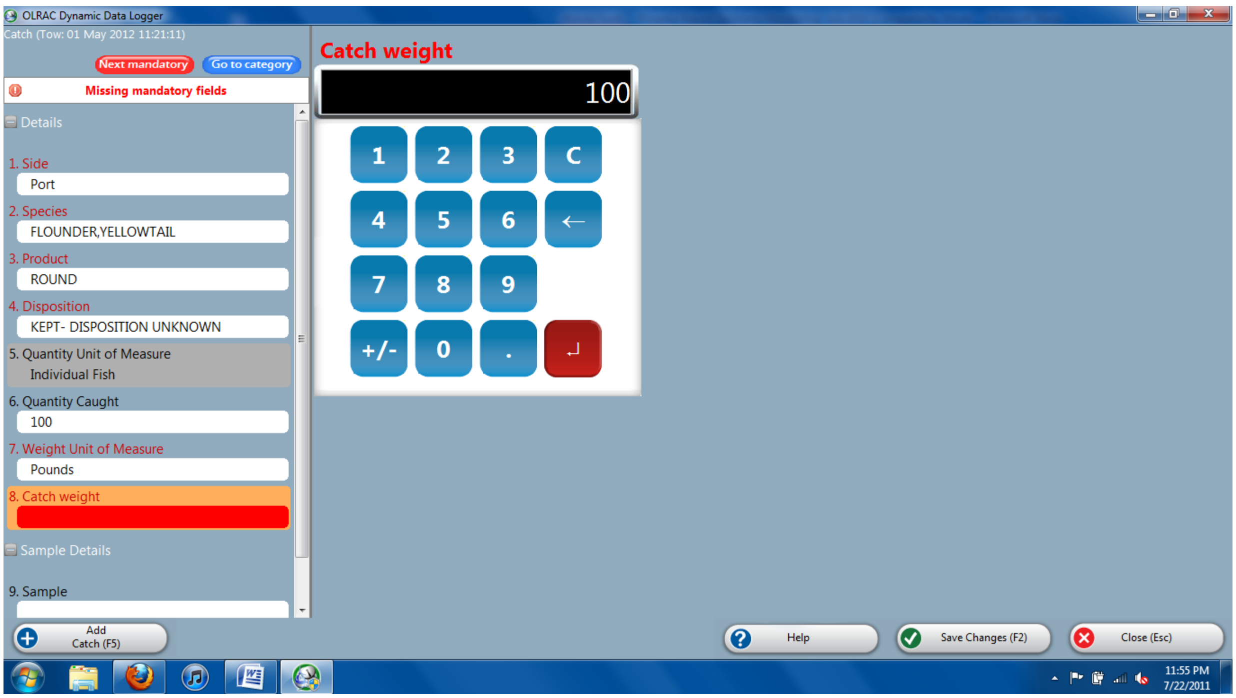


Figure 2. Screen shot of sample entry field on the Olrac DDL software

Is it not the intent of this project to facilitate incorporation of the biological sampling with the vessel's VTR. This computer, software, hardware and all data collected through the system to be entirely distinct from federally required catch reporting. However, the Succorfish company would like their unit to be NOAA approved as a VMS alternative to Boatracs or Skymate, and they are currently in negotiations over that possibility. Therefore, in the future it may be possible for vessel operators to utilize the Succorfish hardware to satisfy their eVTR requirements, however that is outside the objectives of the current project.

Summary of software progress to date:

The software has been developed according to specifications outlined by the Coonamessett Farm

Foundation, which includes numerous data fields which may be now, or in the future, important for vessel operators and owners in the scallop industry. It has been important not to limit the amount or type of information collected through the software, and therefore the decision has been made to leave the option open to collect many types of data which may or may not be utilized by every vessel. Information such as lunar phase, amount of wire out, depth of tow, and dredge size have been included, as well as catch amounts for all species found within the scallop industry. Since many fields have been included, once the software has been distributed to many more vessels within the limited-access scallop fishing fleet, the users may then determine which fields they deem most necessary, and turn off or omit those fields which may not be critical. The below screen shot (Fig. 3) shows what the program looks like when running during a tow.

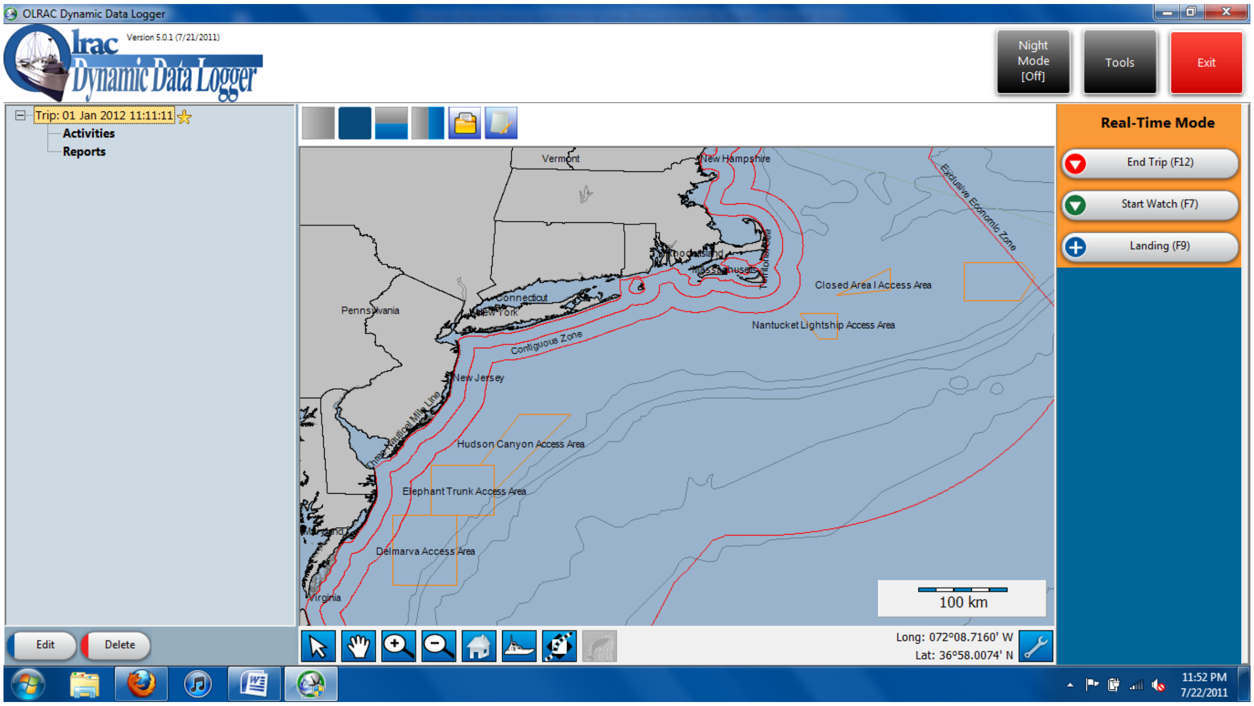
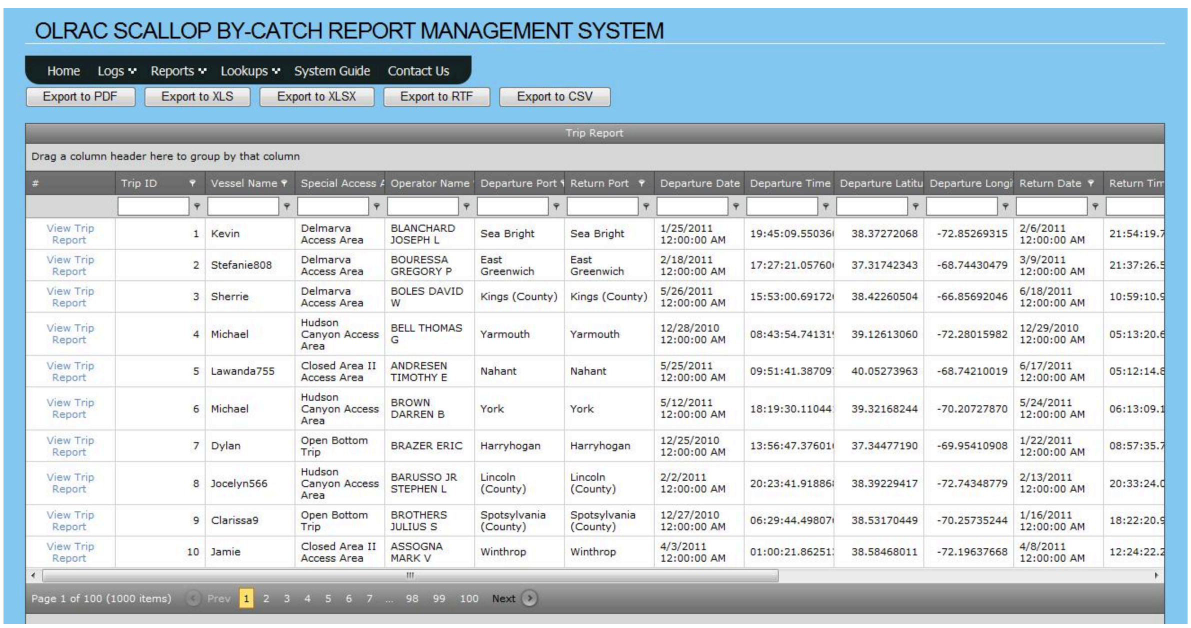


Figure 3. Display showing the location of closed areas and limits the EEZ. Location will be updated on the screen in real-time as the vessel moves toward the fishing grounds.

Master data values are also able to be modified on the Olrac system, so as to allow for the various defined lists of values to be added to and amended, as necessary. For example, the software is pre-loaded with a defined list of species, gear types, ports, and units of measure and product types by species. A web-based interface is also provided as part of the Olrac software, which enables designated users (including the fishermen themselves) to view data sent to shore from the vessels. This interface allows for different user types with different associated access rights. Industry members will be able to see the trips and individual hauls carried out by their own vessel(s), and the catch taken and bycatch ratio (for all species) for each haul. They will also be able to view non-proprietary fleet-wide data. Everyday each vessel sends a catch report to the CFF server with their scallop and yellowtail catch for the previous day (and potentially other information as the project moves forward). This information is then processed by the CFF/Olrac server software, and is made anonymous through incorporation into a fleet-wide average of catch effort and bycatch rates in that particular area. Each vessel will then get a density map sent back to the vessel with a fleet-wide average of meat weights and bycatch rates. Through this processing technique there is no way for any vessel to receive information that is specific to any particular vessel, and has not been made anonymous through averaging and incorporation into a fleet-wide average.

In addition, a variety of queries are provided that should prove useful to scientists, fisheries managers and the fishermen themselves. The following are examples of the types of queries available: bycatch ratio by day, for a specific vessel, during a defined period; bycatch ratio by gear type over a defined period; and catch weight (both targeted and by-catch species) by gear type attribute (Fig. 4). Initially the data collected will have a minimal usefulness to managers and fishermen, as there are only 10 vessels reporting catch information. When the entire fleet incorporates this program in order to manage their bycatch as an entire fleet, the data will become much more valuable to those in a management role. Current management techniques rely on observer data. Which is costly to collect, and the quality has been called into question by managers and fishermen alike. Through fishermen accurately reporting their own catch information, this could turn into the most comprehensive data collection operation in the fishing industry. While initially this may seem as though a duplicitous effort of biological sampling, as the project moves forward it may become clear that this method is much more efficient at providing a much higher quality data set than current methods.



#	Trip ID	Vessel Name	Special Access A	Operator Name	Departure Port	Return Port	Departure Date	Departure Time	Departure Latitu	Departure Longi	Return Date	Return Tim
View Trip Report	1	Kevin	Delmarva Access Area	BLANCHARD JOSEPH L	Sea Bright	Sea Bright	1/25/2011 12:00:00 AM	19:45:09.55036	38.37272068	-72.85269315	2/6/2011 12:00:00 AM	21:54:19.7
View Trip Report	2	Stefanie808	Delmarva Access Area	BOURESSA GREGORY P	East Greenwich	East Greenwich	2/18/2011 12:00:00 AM	17:27:21.05760	37.31742343	-68.74430479	3/9/2011 12:00:00 AM	21:37:26.5
View Trip Report	3	Sherrie	Delmarva Access Area	BOLES DAVID W	Kings (County)	Kings (County)	5/26/2011 12:00:00 AM	15:53:00.69172	38.42260504	-66.85692046	6/18/2011 12:00:00 AM	10:59:10.9
View Trip Report	4	Michael	Hudson Canyon Access Area	BELL THOMAS G	Yarmouth	Yarmouth	12/28/2010 12:00:00 AM	08:43:54.74131	39.12613060	-72.28015982	12/29/2010 12:00:00 AM	05:13:20.6
View Trip Report	5	Lawanda755	Closed Area II Access Area	ANDRESEN TIMOTHY E	Nahant	Nahant	5/25/2011 12:00:00 AM	09:51:41.38709	40.05273963	-68.74210019	6/17/2011 12:00:00 AM	05:12:14.8
View Trip Report	6	Michael	Hudson Canyon Access Area	BROWN DARREN B	York	York	5/12/2011 12:00:00 AM	18:19:30.11044	39.32168244	-70.20727870	5/24/2011 12:00:00 AM	06:13:09.1
View Trip Report	7	Dylan	Open Bottom Trip	BRAZER ERIC	Harryhogan	Harryhogan	12/25/2010 12:00:00 AM	13:56:47.37601	37.34477190	-69.95410908	1/22/2011 12:00:00 AM	08:57:35.7
View Trip Report	8	Jocelyn566	Hudson Canyon Access Area	BARUSSO JR STEPHEN L	Lincoln (County)	Lincoln (County)	2/2/2011 12:00:00 AM	20:23:41.91886	38.39229417	-72.74348779	2/13/2011 12:00:00 AM	20:33:24.0
View Trip Report	9	Clarissa9	Open Bottom Trip	BROTHERS JULIUS S	Spotsylvania (County)	Spotsylvania (County)	12/27/2010 12:00:00 AM	06:29:44.49807	38.53170449	-70.25735244	1/16/2011 12:00:00 AM	18:22:20.9
View Trip Report	10	Jamie	Closed Area II Access Area	ASSOGNA MARK V	Winthrop	Winthrop	4/3/2011 12:00:00 AM	01:00:21.86251	38.58468011	-72.19637668	4/8/2011 12:00:00 AM	12:24:22.2

Figure 4: Grids used to display information such as, vessel, departure port, and intended special access area for numerous trips.

The software was designed so that as much information as possible could be logged automatically, such as start tow, end tow, and all dredge information when the computer is connected to GPS. This would mean that fishermen would therefore only be required to manually input a minimal amount of catch information needed to determine discard rates, and total catch volume (see below for screen shot of catch data from one tow). It was found by both CFF researchers as well as fishermen aboard the F/V Celtic, that the original catch input procedure was too cumbersome to be considered a protocol that the scallop fleet would adopt. Several conversations with the Olrac team led to the decision to rework the current method of catch input, and redesign the method to be a grid-based system instead of the current text field-based input strategy. The new method has been designed by the Olrac software team, and is currently in still being tested.

The main problem with the software as it was originally delivered to CFF researchers was 2 fold; 1) it was too cumbersome to enter catch data as well as transmit the information to shore, therefore the fishermen (and the CFF researchers) could no figure out how to operate it as designed in an efficient manner, and 2) the data was transmitted over the current VMS system (Boatracs), which presented numerous technical (difficult to get the Boatracs system to communicate with the sampling software), financial (prohibitively expensive, and would not work past the pilot stage) and social (the fishermen did not trust the information transmitted was not routed through NOAA servers) constraints. Therefore, in the early fall of 2011, CFF researchers communicated their issues to Olrac software developers, and the programmers then began fixing the issues. The software developers were able to completely revamp the sampling input module by changing it from the overly cumbersome field-based method, to a much more intuitive grid-based method. The software was promised to the CFF researchers by January of 2012. That delivery date was not met, and the delivery date was guaranteed to be by May of 2012. That delivery date was not met either, and not the software has been promised by the end of August 2012, a full 8 months after when it was to be delivered. The slow software development timetable has been one of the most frustrating parts of this pilot project, and has stated debate among the researchers as to whether Olrac is sufficiently equipped to handle meeting the deliverable requirements in the future as the project moves from pilot stage to fleet-wide implementation.

Transmission of data from shore-to-ship

The ability to record data in real-time on the vessel and send reports on a regular basis to a central server is one of the most central objectives of the project. While the software will currently log all of the above information (Fig. 5), and will serve as a critical piece of equipment for a vessel tracking catch rates individually over time, it is the transmission to shore and the subsequent transmission of catch ratios per area back to the boat which will make the fleet more efficient. The software has been tested extensively by the Olrac software engineers, and by the Coonamessett Farm Foundation both on land and at sea to ensure the correct data can be sent and received reliably. At this point, the software is performing as designed as a data logging application; however data transmission still requires further development.

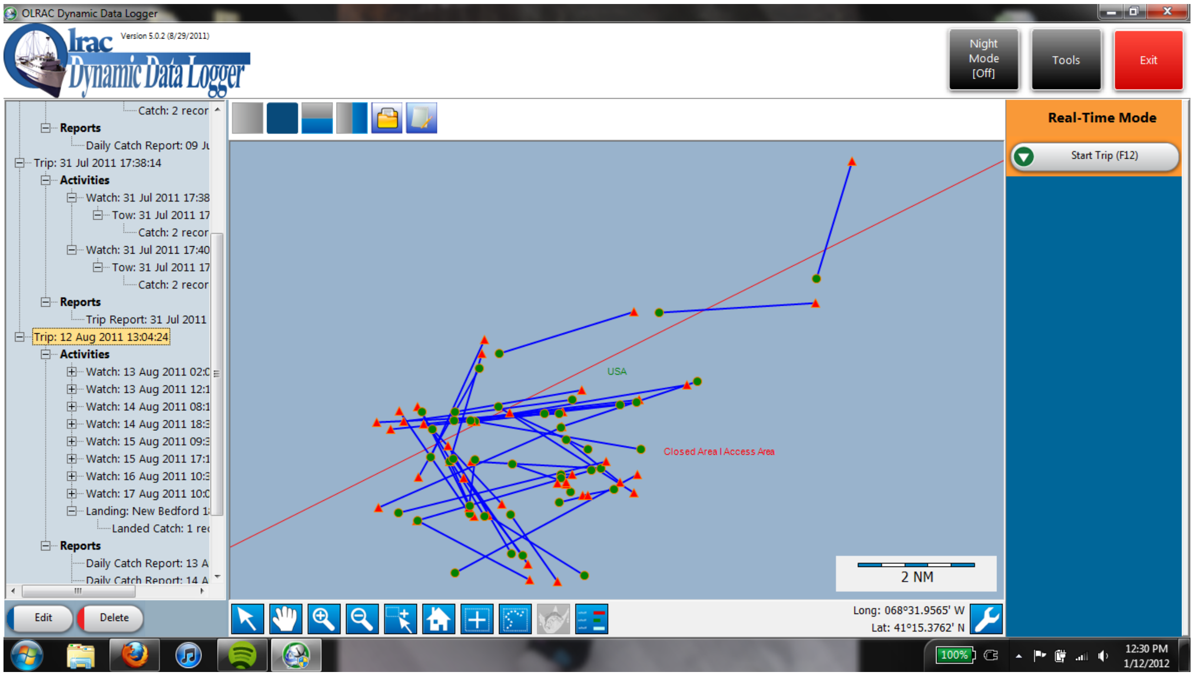


Figure 5. Tow locations and times logged by the Olrac software to be sent back to shore for processing.

Currently, the software is installed on the F/V Celtic, and data has been successfully sent back the Olfish RMS located at Coonamessett Farm. The feature of producing maps of catch ratios has also been integrated into the software platform, although the functionality of sending reports back to the vessels in real-time is still being tested and improved. Exact ratios of catch amounts to constitute “high”, “medium”, or “low”, discard levels are still being determined with direct input from the scallop fleet (Fig. 6). Once the correct ratios of discard to catch amounts have been determined, testing of returning reports back to the vessel of current aggregated catch levels will continue.

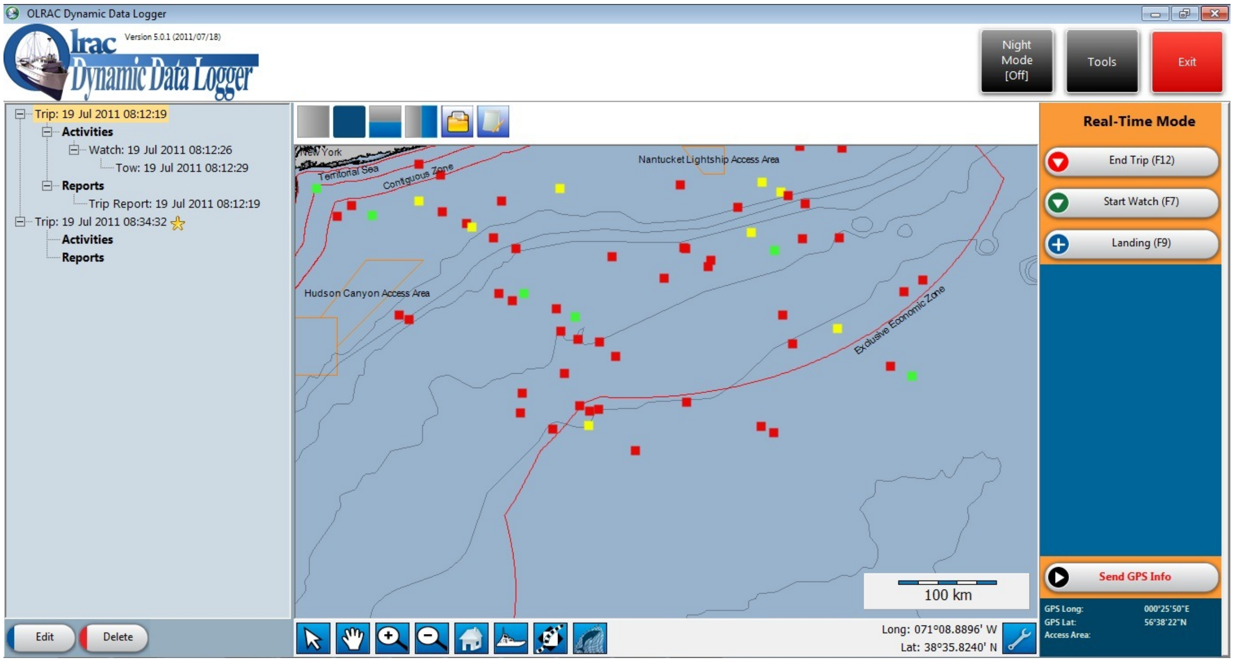


Figure 6: Main screen showing the Mapper, with the by-catch ratios shown as a series of coloured squares, where red indicates high by-catch, yellow medium by-catch and green low by-catch.

Satellite Transmission Hardware

The F/V Celtic has made several trips using the software, including a week-long sampling trip in August of 2011. The entire week-long sampling trip was recorded on the Olrac software, and daily trip reports were successfully sent to the RMS software via the Boatracs satellite data transmission system. Though the Boatracs interface can be cumbersome to use, and may prove to hamper wide spread integration of the data transmission system into the scallop fleet, the daily reports were transmitted quite well. Since using Boatracs to transmit the daily catch reports requires advanced computing skills, and quite a bit of guesswork and time to achieve successful transmission, the CFF researchers have determined that it is imperative for the success of the project to find a new method of data transmission. The Coonamessett Farm Foundation has investigated other hardware platforms which may transmit data at cheaper rates, and more consistently using the Iridium satellite network instead of the Boatracs system. Succorfish is a UK based industry leader in the design, development and manufacturer of bespoke marine tracking, asset management and control solutions. Succorfish has expressed great interest in collaborating with both the Coonamessett Farm Foundation Inc. and Olfish to distribute a satellite communication system that will work seamlessly with the Olrac software.

The Succorfish system works on a separate satellite network (Iridium) compared to the Boatracs network (Vodafone). The new system also has the capability to switch data transmission to cellular networks when near to shore, which significantly reduces cost. The new network should also improve signal strength, reducing “dead spots” while simultaneously improving transmission speeds and reducing transmission costs. The hardware is significantly less expensive on the new system as well, compared to several competitors running similar equipment. Succorfish has developed several pricing schemes which, due to the reduced costs of the network, allows for additional data transmission beyond strictly catch information for the same price as other networks. This should allow for email use, weather information, and other data use by fishermen at sea, potentially leading to further integration into fleet operations if the platform is not strictly used for scientific purposes.

Boatracs was prohibitively expensive, and presented an unforeseen social issue to the fishermen. While testing the software on ships in New Bedford, fishermen saw similarities between the current pilot project and a SMAST project looking to get fishermen to send in yellowtail flounder catch information through Boatracs. While SMAST was seeking to get the entire fleet to send in catch information, only several dozen ships were sending in data. When the fishermen were asked why this was the case, the overwhelming answer was lack of trust in sending information over the VMS system, and the belief that the data could be seen by people other than SMAST (ie. NOAA). Therefore, the fishermen believed the easiest way to avoid having their participation in a voluntary program come back to negatively effect them, was to simply not participate in the program. If this pilot project is to succeed throughout the entire fleet, perhaps the most important aspect is ensuring the trust of the fishermen is preserved, and that they sincerely believe there is no chance of them being negatively impacted by participating in the program. Therefore, the decision was made for both social and financial reasons to move away from Boatracs, and to the Succorfish satellite communication platform.

The Succorfish communication platform was promised to be delivered to the CFF researchers in September 2011, then January 2012, then April 2012. In April 2012, one unit was installed on the F/V Celtic, though not complete and without a working integration box to allow it to communicate with the computer. It was not until July 2012 that 10, fully complete communicating units were delivered to the CFF researchers. As of August 2012, nine of the 10 units have been installed on fishing vessels in New Bedford, and the last remaining unit is to be installed on a vessel in Barnegat Light, NJ in the fall. The units are all communicating with the satellites, and are ready to operate with the sampling software. However, now the project is still waiting on the Olrac software to be delivered.

On-deck sampling procedures

In order to be able to convince the fleet that the sampling is necessary, the on-deck biological sampling must be easily integrated into the current work environment. Therefore, during a week-long sampling trip in August 2011 aboard the F/V Celtic, a CFF researcher worked to optimize on-deck sampling strategies. The task of determining how to best integrate new sampling procedures with the fishing methods which differ from vessel to vessel throughout the fleet is not trivial. The on-deck sampling procedures must be easily transferrable to different vessels, through rigorous enough that quality biological sampling data can be gathered which will help the fleet function at a much more efficient level. Therefore decisions had to be made regarding weighing vs. counting of certain species, measuring of scallops vs. meat weight counts, as well as many other procedural judgment calls. The CFF researchers in conjunction with the fishermen working on the project have determined what they believe will work to gather quality data, without compromising safety or fishermen productivity. The on-deck sampling guidelines will be a work in progress as the project continues, in order to further refine which steps may be able to be omitted, or which protocols may be added in order to streamline the process.

Future research directions

Once the updated Olfish catch screen module has been sufficiently tested and shipped to the CFF researchers, it will be subsequently installed on the F/V Celtic. The captain and crew have been very accommodating in testing the different software and hardware configurations, and will assist in beta testing the new catch input method. Late spring of 2012 the new hardware setup from Succorfish should be operational as well, and will also be tested on the F/V Celtic. Once the catch input method has been streamlined, and the hardware integrated with the Olrac system, the fishermen will continue to send catch data to shore. The data in the reports will be then be aggregated and analyzed by the Explorer utility, and then report will be produced, demonstrating, for example, Yellowtail Flounder to Scallop by-catch ratios (or any other by-catch ratios desired). The software is designed to send back to all the vessels via email, as a list of coordinates, which can then be viewed via the Olfish DDL mapper, so as to enable the skipper to direct his fishing to the most appropriate area.

CFF was recently awarded 2012 RSA funding to continue the electronic monitoring work. The primary focus moving forward will be to shift from small scale testing to a broader pilot implementation, to include installation of the Olrac DDL and Succorfish SC2 on 10-12 vessels. To further enhance the value to the fishing industry of this solution the future proposed work includes incorporating a number of added value features to the software as listed below. The satellite transmission hardware company, Succorfish SC2, is in negotiations with the NOAA VMS certification unit, and they believe they will receive NOAA certification for their proprietary SC2 unit to function as an approved VMS device as well in 2012. Succorfish will also release a standalone email client and a man over board alert, all of which could provide added value to industry.

Additional species may be added to the on-vessel bycatch reporting module. This would allow different ratios to be recorded for each target and bycatch species, and for these ratios to be differentiated from others in the vessel’s chart by creating them as separate layers (with different colors, if desired, for the high, medium and low ratios to those used for other bycatch species). The skipper can then select which layers to view, as is currently the case. The captain/owner will be able to select bycatch reports for desired species while at sea, and to select which species to view via the RMS's website portal. This feature will have the ability to include turtle and marine mammal avoidance, in addition to bycatch avoidance.

Electronic VTR capacity. Olrac has developed a pilot eVTR based on specifications released by NOAA’s Northeast Fisheries Service Regional Office. This eVTR functionality, updated with recent NOAA standards, can be added to the Scallop product. Currently, only groundfish vessels are permitted to submit VTRs electronically, but it is expected that other Northeast fisheries will be permitted by NOAA in future years.

Quick Grid. Olrac will soon release a new Olrac Vessel DDL module, which utilizes tabular data entry to simplify and increase the speed at which larger data sets, such as catch information and gear configurations, can be recorded. The Olrac DDL Scallop customization will be updated with this information.

Researcher Data Set. A data set will be added to the vessel software, Olrac DDL, to be used by researchers when onboard. This screen would allow researchers to record data about turtles and experimental gear, for example.

Email Alerts. A feature will be added to the Olrac RMS (shore software) to allow the administrator to send email alerts to the vessels, such as weather alerts, NOAA announcements, news on software version updates and on updates to master data. A history of all emails can be kept on both the RMS and on the vessel DDL.

In summation, all the software has been developed and tested. We are awaiting hardware that should solve the issues related to data entry and transmission. We expect to place these systems on 12 vessels initially and follow up with additional vessels if successful. Most of the crews on the vessels that have been chosen have participated on bycatch research trips and have been trained in data collection (measuring scallop shell height, fish length, and collection of shell height/meat weight samples.

While the grant period has ended, and this report is termed the “final report”, the project is ongoing, and will continue until all of the objectives stated in the original work plan are completed. Since the official end of the grant period last year, there has been considerable progress achieved in meeting the objectives stated in the original work plan. The main obstacle at this point is out of the control of the CFF researchers, as the subcontractors of the hardware and software design have been delayed in submitting the agreed upon deliverables to the researchers.

As with any pilot project, when initiating a entirely new software sampling and satellite communication platform, there are bound to be delays and issues that come up as part of the process. While the goals that were outlined as part of the initial work plan have not all been met, progress is being made on all of them, and all of the objectives will most definitely be completed. The 10 vessels that have been chosen to work on this project were all selected due to their relatively late fishing schedule (mostly fall and winter to complete DAS and closed area trips) in order to facilitate more data collection once the software is delivered. The captains of these vessels have all expressed how much they are invested in seeing the project succeed, and are all looking forward to getting the system running.