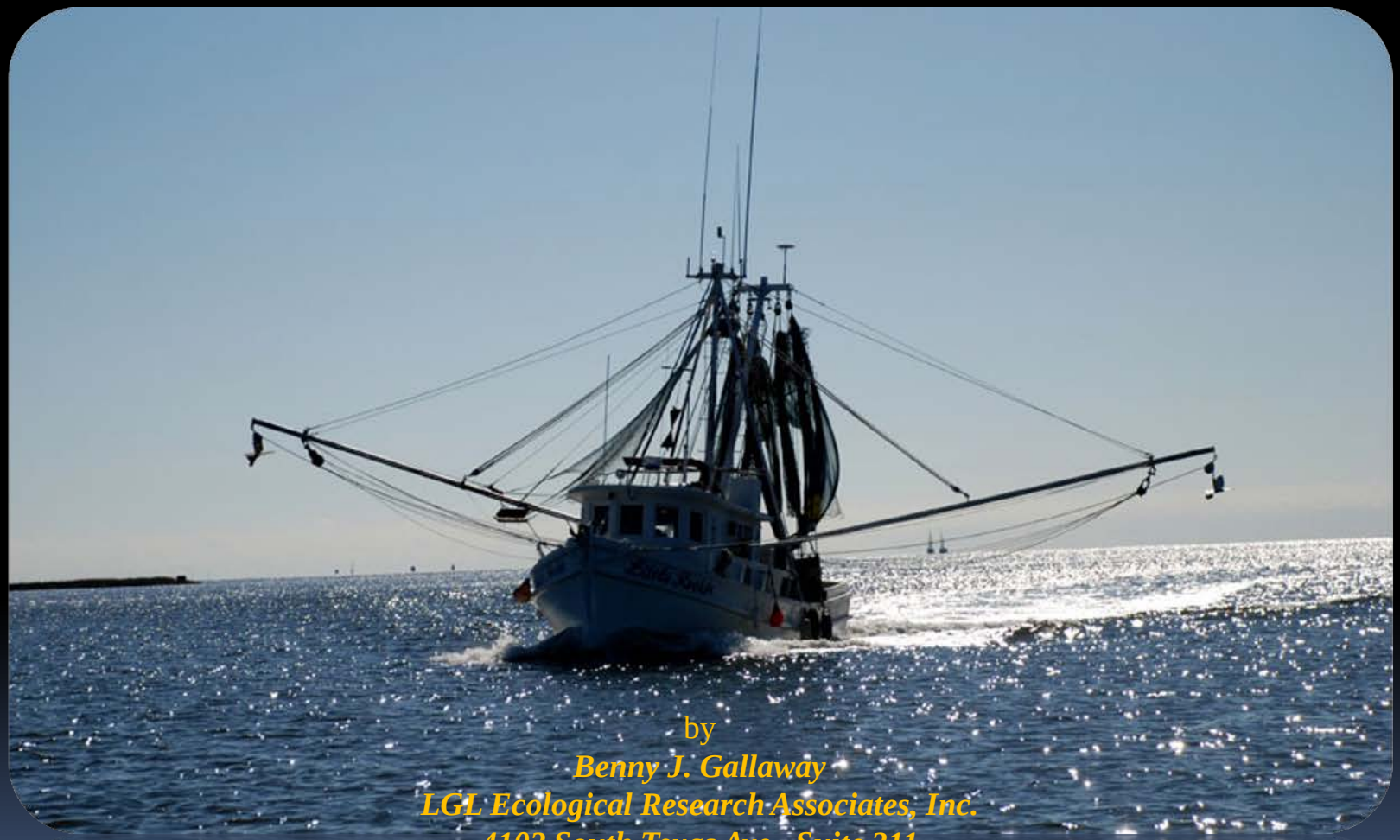
DEVELOPING A NEW METHOD FOR ESTIMATING SHRIMP FISHING EFFORT AS A REPLACEMENT FOR THE FAILING 3G cELB METHOD



by

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The Message

This presentation will describe a two-phased project to adapt the P-Sea WindPlot navigation software as necessary to acquire and transmit shrimp fishing effort data. The first phase will be to determine how many federally permitted vessels use P-Sea WindPlot, test the approach on one to several vessels, develop procedures to match landings and trip data and, ultimately, to develop a system for electronically transmitting the data to NMFS databases in a seamless fashion. The goal of the Second Phase will be to implement the new method in order to estimate shrimp fishing effort across the Gulf, beginning in the second quarter of next year (2021).

Introduction

- LGL Ecological Research Associates, Inc. (LGL) is conducting a Phase I Pilot Program for the Southern Shrimp Alliance, Inc. (SSA) to develop an effort-measurement program to replace the failed cELB approach that has historically been used to measure effort.
- The Pilot Program began with discussions between NOAA Fisheries (Southeast Fisheries Science Center and Southeast Regional Office) and SSA regarding the looming failure of the current system at the end of this year.
- The agency had been evaluating options for replacing the cELB program and reached out to industry in August 2020 to find a cooperative solution.
- Mr. Steve Bosarge, President of SSA, brought forth the idea that an almost universal navigation system used by the Gulf Shrimp Fishery (P-Sea Windplot) has an internal logbook that perhaps could be modified to enable recording of the date/time/location data necessary to estimate effort.

Introduction (continued)

- His idea led to this (Phase I Pilot Program) to
  1. Evaluate the likelihood that P-Sea Windplot is used by a large fraction of the permitted shrimp fleet; and, if so,
  2. Modify and test the software to obtain and record the requisite information for estimating effort and how to most effectively pair effort and landings data at the trip level.
     - Testing will involve implementing the system on one or more actively fishing vessels with a cELB.
     - At the same time, 1) develop or confirm that the present stratified-random vessel selection process is appropriate, and 2) develop a comprehensive Procedures Manuel integrating the historical and new effort estimation procedures.

Introduction (continued)

- The last steps of the Phase I Pilot study will be to work with NMFS and randomly select a yet-to-be decided number of vessels to utilize P-Sea Windplot for monitoring effort in 2021; and, lastly

- Develop a plan to install and equip these vessels with the new P-Sea Windplot system and train Captains and Dealers in its use in the 1st Quarter of 2021.

- At present, we plan to obtain the data on "thumb-drives" along with the matched landings record, likely on paper. However, we will begin development of an electronic reporting system in the Pilot Study and finalize it during 2021.

- Before proceeding with results to date, we provide a background on the history of electronic monitoring of the shrimp fishery and how we got to the present situation.

Background

- Contention regarding Gulf of Mexico shrimp fishing effort and the associated bycatch estimates (especially those for Red Snapper) led the U.S. Congress in 1998 to allocate funding to the Gulf of Mexico shrimp fishery to develop methods for better estimating shrimp fishing effort.

- An efficient and accurate method using an electronic logbook (ELB) was developed, evaluated and refined (Gallaway et al. 2003 a, b and Cole et al 2006).

- The National Marine Fisheries Service (NMFS) which had participated in the ELB development studies, implemented a shrimp effort monitoring program using ELB's in June of 2004, and the program was continued through March 2013.

- Dr. James Nance and Rick Hart (both now retired) were the key NMFS participants; myself and John G. Cole (partially retired) were the key LGL players.

Background (continued)

- The initial effort monitoring program was conducted by LGL based on an initial sole-source contract award for 2004-2006, and then on a competitive procurement basis from 2006 through 2013.
- During the nearly 9 years that LGL conducted the ELB program, over 9,100 trips where trip landings were matched with trip effort were generated.
- The study collected data for 555,000 tows, including 54,869,394 total location points and 19,297,351 total intra-tow records.
- The program was featured in a symposium held during the 141st Annual Meeting of the American Fisheries Society in 2011.

Background (continued)

- NMFS ultimately replaced the ELB system with a cellular ELB (cELB) system beginning in 2014. At this point they took responsibility for all phases of the program--from data collection, to post collection, to processing and matching functions.

- The new cELB technology was developed over the period 2012 to 2013 in order to provide automated data transmission accomplished using cell phones connected to a U.S. government server.

- As the system did not require human intervention to retrieve memory chips, it was estimated to be able to save NMFS hundreds of thousands of dollars per year, while lowering the latency of the data. The change to cellular technology also enabled cost sharing by passing on yearly maintenance and data transmission costs to industry.

- The cELB program initiated in 2014 was and is being fully-run by NMFS. On the order of 475 vessels in the fleet had been equipped with a cELB by 2017.

Background (continued)

- From 2014 to 2020, the cELB has generally met NMFS expectations until recently when it was learned that the 3G system being used to transmit data will expire on 31 December 2020. Further, manufacturing delays occurred, and it took ~2 years to manufacture just 40 4G cELBs. In addition, funding is only enough to buy ~250 new 4G boxes.

- Also, 5G systems may become the requirement before all the 4G systems are acquired. Lastly, the ability to match landings data with trips has declined. On the order of 30-50% of the landings cannot be matched to the trips.

- The cELB system appears to be an non-option and the old ELB system is solid but requires extensive labor and there is a substantial delay between acquiring and transmitting the data.

Permitted Shrimp Fleet: August 2020

- Without consideration of whether a permitted vessel is actively fishing or simply holding a permit, there were 1,392 total permits on August 17, 2020 of which 1,283 were valid and another 109 were eligible to be renewed or transferred:

SUMMARY						
Coast Guard	State		Renew/Trans	Valid	Total Permits	SSA
101	14	AL	11	104	115	13
163	39	FL	21	181	202	22
11	0	GA	1	10	11	0
1	0	IL	0	1	1	0
297	53	LA	26	326	352	17
8	0	MA	1	7	8	0
1	0	MN	0	1	1	0
92	7	MS	8	91	99	7
30	10	NC	2	38	40	10
6	0	NJ	2	4	6	0
1	0	NY	0	1	1	0
2	0	OK	0	2	2	0
6	0	SC	1	5	6	2
523	12	TX	35	500	535	91
13	0	VA	1	12	13	1
1255	**135**		**109**	**1283**	**1392**	**163**

- The information was obtained through the Freedom of Information Act, note that the “State” is the address of the permit holder.

Active Vessels with a cELB History

- A switch to a new method of estimating fishing effort will require careful planning to ensure that any changes observed are “real” and not due to the change in method.
- Therefore, for the first year, selection emphasis will be placed on actively fishing vessels with a cELB history and known ports of landing.
- For the Pilot Study we also determined if the vessel owner was SSA member and if the vessel used P-Sea Windplot. The P-Sea Windplot survey focused on SSA members because we had up-to-date contact information for these vessels.

Evidence that P-Sea Windplot is Commonly or Even Universally-Used by the Gulf Fleet

- **NMFS** provided us a list of permitted vessels which had actively fished in the last few years, had carried a cELB, and had known ports of landing. **John Williams of SSA** provided us a current list of SSA members.

- There were 577 actively fishing vessels and, of these, 94 were SSA members:

Vessels	State-Port	SSA
97	AL	16
32	FL	7
81	LA	4
24	MS	1
343	TX	66
577		94

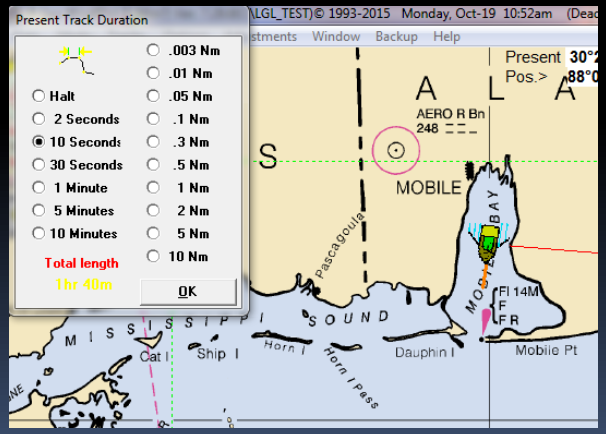
- 100% of the SSA component of the sample used P-Sea Windplot and informal discussions with shrimp fishers across the Gulf reinforces the idea that this software is dominant, it not even universally-used.

Setting up a Server

- We have programmed a stand-alone server, including the necessary software and several dozen custom scripts (e.g., in java, R) to run the ELB project.
  - Read trip data
  - Estimate effort
  - Match landing data
- Programs were tested and validated.
- As a starting point, our server is set-up to run the existing ELB program.

Research on P-Sea Windplot

- P-Sea WindPlot is a commercial fishing software program that is used for marine navigation.
- One of the functions is to record "tracks" which includes the latitude, longitude, and/or the time or speed of the vessel at a specified interval.
- Given that the current ELB program specifies effort based on this same basic information (i.e., locations at 10 min intervals) we investigated whether this software could be used in its present form to track shrimping effort.



Research on P-Sea Windplot

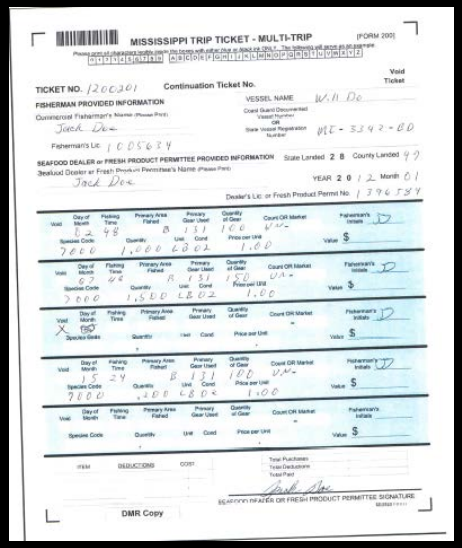
- We developed a program to read and plot P-Sea Windplot "track files" outside of the program and convert them to a format that could be input into the existing ELB software.
- While the track files contained much useful information regarding locations of tows, the tracking feature does not operate continuously and is designed to be easily turned turned on and off between fishing or for other reasons.
  - Position data between tows was rarely recorded and often did not have sufficient time stamp data to accurately determine the recording period between locations (thus hampering ability to infer vessel speed).
  - Given these gaps in data recorded, it would not be possible to ensure that all tow data were included for a trip
- Thus, we judged the data as currently recorded by P-Sea Windplot to be insufficient for use as an alternate ELB data program.
- In response, we reached out to the developer of P-Sea Windplot to discuss whether modifications to the program would be feasible.

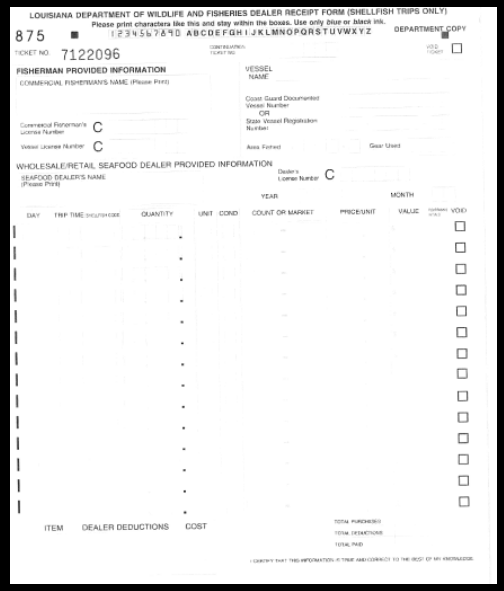
Progress with P-Sea Windplot

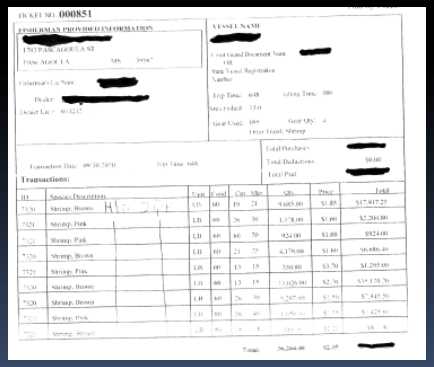
- We have contracted with P-Sea Windplot to modify their program to capture the latitude, longitude, date, and time every 10 minutes during the entire length of each trip.
- Upon P-Sea Windplot starting, the modified program will produce an ascii file on the computer's hard drive where the GPS generated NMEA GPRMC string will be recorded every 10 minutes.
  - This string provides location, time stamp data, and an indication whether the data are valid based on the number of satellites seen by the GPS at the moment of data capture.
  - The file will be named ELB-YYMMDDHHMM.dat to correspond to the date/time of initial creation.
- To retrieve these data, initially, the file will be copied to a USB flash drive.
  - When copied the original file will be automatically renamed with the extension ".old" to prevent subsequent trips being added to a file that has already been processed (while still allowing records be appended to the file prior to data collection even if there are power interruptions).

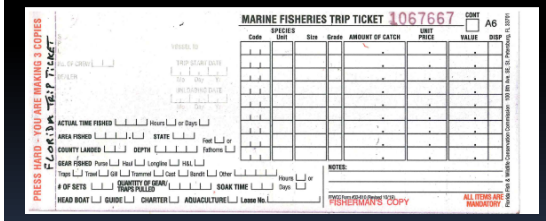
Matching Effort with Landings

- To match shrimping effort with landings, initially, we will manually pair trip tickets with the data recorded by P Sea Windplot.
- We have example trip tickets from FL, MS, LA, and TX that we are using to develop a system whereby we scan hard copy tickets, convert to spreadsheet data, and then a custom script reformats the data so that it is compatible with NMFS landings data.



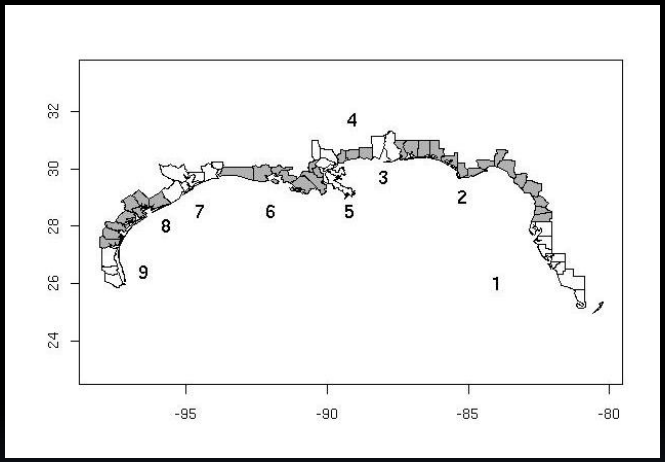






Random Selections for 2021

- Actively fishing permitted vessels with a cELB history will provide the universe for the random selections for 2021. We will stratify these vessels by port , organized into the nine (9) geographical regions.



- A description of the regions is provided: 1= Key West to Tampa, FL; 2= Florida north of Tampa; 3= Alabama; 4= Mississippi; 5= Louisiana east of River; 6 Louisiana west of River; 7= Upper Texas; 8= Central Texas and 9= South Texas.

Random Selections for 2021 (continued)

- Working with NMFS, ports will be stratified by total landings and vessels within port will also be stratified by landings weighted by the degree of their participation in cELB program. The number of selections for each strata will be proportional to weight of each of the respective strata.

- Once selected the vessels will be contacted that they have been selected and it will be confirmed that the vessel uses P-Sea Windplot. If not , an alternate selection will be made.

- The selection procedure will be conducted in cooperation with NMFS. Our intent is to transfer our historical knowledge to the new cadre of NMFS scientists leading the shrimp effort studies.

Summary of Path Forward

- Modifications to P-Sea Windplot will be ready for initial testing in mid-November
  - Partner with Bosarge and/or Wallace to complete field validation
- Make a random selection of shrimp boats to measure effort for 2021
  - Stratify by ~9 port areas and then by landings
- Jan.- April 2021: visit boats, help captains install software and make arrangements to meet and retrieve data
  - Expand efforts after April so that the fleet will not miss an entire year of effort (2021)
- Run program for another two years (2022 and 2023) beyond the completion of the 2021 study, and then pass off to NMFS in 2024.

Program Cost Estimates

Phase	Amount	Funded By
Phase I (September-December 2020)	$327,000	SSA
Phase IIa (January-April 2021)	$327,000	NMFS/SSA
Phase IIb (May-December 2021)	$685,152	?
Phase III (January-December 2022)	$1,027,728	?
Phase IV (January-December 2023)	$1,027,728	?

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Literature Cited

- **Gallaway, B.J**., J.G. Cole, L.R. Martin, J.M. Nance, and M. Longnecker. 2003a. Description of a simple electronic logbook designed to measure effort in the Gulf of Mexico shrimp fishery. North American Journal of Fisheries Management 23:581-589.

- **Gallaway, B.J**., J.G. Cole, L.R. Martin, J.M. Nance, and M. Longnecker. 2003b. An evaluation of an electronic logbook (ELB) as a more accurate method of estimating spatial patterns of trawling effort and bycatch in the Gulf of Mexico shrimp fishery. North American Journal of Fisheries Management 23:787-809.

- Cole, J.G, **B.J. Gallaway**, L.R. Martin, J.M. Nance, and M. Longnecker. 2006. Spatial allocation of shrimp catch based upon fishing effort: adjusting for the effects of the Texas opening. North American Journal of Fisheries Management 26:789-792.