

Original: English

**THIRD MEETING OF THE WORKING GROUP OF FISHERIES MANAGERS AND SCIENTISTS IN  
SUPPORT OF THE WESTERN BLUEFIN TUNA STOCK ASSESSMENT**

*(Bilbao, Spain, 25-26 June 2015)*

**1. Opening of the meeting**

The Chair of Panel 2, Mr. Masanori Miyahara (Japan) opened the meeting and welcomed all participants.

The Executive Secretary introduced the following CPCs to the meeting: Canada, European Union, Ghana, Japan, Mexico, Nigeria, Senegal, United States and Uruguay.

In addition, the following observers were present: Ecology Action Center (EAC), Pew Charitable Trusts and the Ocean Foundation.

The List of Participants is appended as **Appendix 2**.

**2. Election of Chair**

The United States nominated Mr. Masanori Miyahara (Japan) as the Chair of the Working Group.

**3. Adoption of agenda and meeting arrangements**

The Agenda was adopted without change and is appended as **Appendix 1**.

**4. Nomination of Rapporteur**

Ms. Carolyn Doherty (United States) served as rapporteur for the meeting.

**5. Review of the results of the Second Working Group of Fisheries Managers and Scientists in Support of the Western Atlantic Bluefin Tuna Stock Assessment**

The Chair recalled the report of the Second Working Group of Fisheries Managers and Scientists in Support of the Western Atlantic Bluefin Tuna Stock Assessment and reviewed the three recommendations agreed by the CPCs at that meeting, held in Prince Edward Island, Canada from 10 to 12 July 2014:

- 1) In the intersessional period, national scientists of the CPCs fishing for western bluefin tuna will work jointly to explore areas for collaboration, identify costs and develop their prioritization for the novel research proposals discussed at this meeting. The results of this work and the novel proposals will be presented to the SCRS in September 2014 for review and evaluation. At the same time, it was acknowledged that CPCs will proceed with work already underway (e.g., the expansion of existing surveys) and new projects for which funding has been secured.
- 2) The CPCs will collaborate in analyzing non-aggregated catch and effort data with the goal of improving the current stock abundance indices and developing a single index of abundance incorporating the data from various CPCs. Access to the data will be shared in a manner that does not violate data confidentiality concerns.
- 3) The CPCs will continue efforts to improve the quality and quantity of data collection and reporting, consistent with the recommendations of the SCRS. In particular, CPCs are encouraged to provide information about changes in fishing patterns and other variables that may influence the catch rate so that these factors can be incorporated into the standardization models.

Canada, Japan, and the United States provided updates on ongoing research activities relevant to these three recommendations.

Dr Gary D. Melvin (Canada) provided an overview of ongoing efforts in Canada entitled, “In situ acoustic observations of Atlantic bluefin tuna (*Thunnus thynnus*) with high resolution multi-beam sonar” (**Appendix 3**). His presentation described recent field studies to investigate the ability and adaptability of using high frequency multi-beam sonar to document, monitor, and quantify bluefin tuna. As Dr Melvin described, the preliminary results of this study clearly illustrate that bluefin tuna can be detected and tracked within the swath of the multi-beam sonar. The results of this study indicate that there is good potential for the utilization of multi-beam sonar to monitor and quantify bluefin tuna in a broad scale fishery independent survey.

Dr Melvin continued his discussion of ongoing efforts in Canada with a presentation entitled, “Bluefin tuna Bay Chaleur acoustic index of abundance” (**Appendix 4**). His discussion described the use of an ongoing acoustic survey for Atlantic herring in the Bay Chaleur area of the Gulf of St Lawrence to estimate abundance of bluefin tuna. Canada is re-analyzing these datasets for bluefin tuna going back to 1991 and has completed the analysis from 2007 to 2013. Preliminary analyses are positive and work will continue on these data and a fishery independent index of abundance for as many years as possible. This work will be presented to the data preparatory meeting in early 2016, following the protocols required for the introduction of a new index of abundance.

Dr Melvin finished his discussion of ongoing efforts in Canada with a presentation entitled, “DFO bluefin tuna science projects for 2015” (**Appendix 5**). Dr Melvin described that five industry-funded projects have been developed for 2015. Each of these projects will commence in August 2015 and will address specific issues identified to improve data input for the 2016 assessment. All data analysis will be completed in time to be present at the data preparatory meeting.

Mr. Haruo Tominaga (Japan) explained that without a Western Atlantic bluefin tuna quota set aside for research, no research efforts proposed last year have been conducted by Japan, nor can be completed for the next year.

Dr Craig Brown (United States) provided a “Progress report on selected USA research activities to improve the stock assessment of western Atlantic bluefin tuna” (**Appendix 6**). He described a pilot study to evaluate the feasibility of developing a WBFT young of the year (YOY) abundance index. In order to determine availability, distribution and potential sampling methods, a network of volunteer recreational fishermen and charter boat captains is being developed along the coast of the Florida Straits. Attempts to collect YOY bluefin tuna specimens will begin later this summer 2015.

Dr Brown continued his discussion with an overview of a pilot study designed to investigate the feasibility of conducting a close-kin analysis that could lead to direct estimates of WBFT spawning and stock biomass has also begun. Work has been initiated on three areas of research that may improve the existing WBFT larval index or lead to the development of new indices, including: (1) Incorporating age and mortality estimates for larvae collected in different regions within the Gulf of Mexico, which should improve the standardization of the current WBFT indices; (2) Development of a new index of larval prey, feeding success and growth, which could improve the standardization, for which work has been initiated on archived historical samples; and (3) Extending exploratory sampling efforts in the Caribbean Sea and western North Atlantic to determine the significance of alternative spawning grounds, for which sampling was conducted off Cuba and Mexico this year.

## **6. Review of the progress towards combining raw catch/effort data for individual fleets into a new index (or indices) of abundance for western Atlantic bluefin tuna**

The Chair convened a discussion on the progress of combining raw catch/effort data for individual fleets into a new index of WBFT abundance. The discussion began with an overview of the collaboration between Canada and the United States to combine data to generate a CPUE index that includes information from all longline fleets and protects data confidentiality as discussed in SCRS/2015/032. The United States and Canada are reviewing possible ways to blend their respective non-aggregated catch/effort data in order to create a combined index. This work will continue at a working meeting to be held in Canada this summer to which the United States, Japan and Mexico are invited to participate. It was agreed that this work will be advanced at a meeting of the parties on the margins of the upcoming SCRS species meeting in September 2015 with the goal of developing a single index of abundance incorporating the data from the CPCs prior to the 2016 data preparatory meeting.

There is also ongoing collaboration between the United States and Canada to generate the combined index for the rod and reel fishery.

Following on the previous exchange of information at the prior two meetings of the Working Group, there was additional discussion of data collection processes for the U.S. recreational rod and reel fishery. In response to Japan's query, the United States briefly explained its process for ensuring accurate catch and effort information from this fishery, including a requirement for direct reporting augmented by a scientifically valid statistical survey, and offered to provide more information to interested parties.

Japan and the United States will continue dialogue on this point and report back the results to Panel 2.

## **7. Consideration of future work**

The Chair recalled that at the last meeting of this Working Group, all participants recognized the value in discussing this particular stock together. The Chair reaffirmed the importance of this work and asked the CPCs to consider the next steps of the WBFT Working Group.

The CPCs agreed that this Working Group has been very constructive in advancing the collaborative research activities between the CPCs and that the efforts of this Group have been extremely positive. Noting this, all Parties agreed that a meeting of this Working Group would not be necessary for 2016 given the pending stock assessment and other ongoing work, though continuing the work of the group intersessionally was encouraged. In addition, all Parties agreed that the opportunity for the Working Group to reconvene at a later date should remain open. The Working Group, therefore, recommends that no intersessional meeting be held in 2016 and that Panel 2 would review the progress of research efforts at its 2015 meeting and consider holding the next Working Group meeting in 2017, if necessary.

The Parties also discussed the update of the AIC analysis performed by the SCRS in 2014 to investigate the high and low recruitment scenarios fit to the estimates of spawning stock biomass and recruitment. Canada suggested this work could be looked at further by the SCRS. The SCRS Chair confirmed that this should be possible at the September 2015 species group meeting.

## **8. Other matters**

No other matters were discussed.

## **9. Adoption of Report and adjournment**

The report was adopted and the Third Meeting of the Working Group of Fisheries Managers and Scientists in support of the Western Bluefin Tuna Stock Assessment was adjourned.

**AGENDA**

1. Opening of the meeting
2. Election of Chair
3. Adoption of agenda and meeting arrangements
4. Nomination of Rapporteur
5. Review of the results of 2nd Working Group of Fisheries Managers and Scientists in Support of the Western Atlantic Bluefin Tuna Stock
6. Review of the progress towards combining raw catch/effort data for individual fleets into a new index (or indices) of abundance for Western Atlantic bluefin tuna
7. Consideration of future work
8. Other matters
9. Adoption of Report and adjournment

## LIST OF PARTICIPANTS

**CONTRACTING PARTIES****CANADA****Scattolon, Faith\***

Regional Director-General, Bedford Institute of Oceanography, Department of Fisheries & Oceans 1 Challenger Drive, Polaris Building 4th Floor, P.O. Box 1006, Dartmouth Nova Scotia B2Y 4A2, Canada  
Tel: +1 902 426 7315, Fax: +1 902 426 5034, E-Mail: faith.scattolon@dfo-mpo.gc.ca

**Lavigne, Elise**

Assistant Director, International Fisheries Management Bureau, Ecosystems and Fisheries Management 200 Kent Street, Ottawa, Ontario K1A 0E6, Canada  
Tel: +1 613 990 5374, Fax: +1 613 993 5995, E-Mail: elise.lavigne@dfo-mpo.gc.ca

**Lester, Brian**

Manager, Fisheries Management Plans, 200 Kent Street, Station 135026, Ottawa, Ontario K1A 0E6, Canada  
Tel: +1 613 990 0090, Fax: +1 613 990 7051, E-Mail: brian.lester@dfo-mpo.gc.ca

**Melvin, Gary**

Biological Station - Fisheries and Oceans Canada, Department of Fisheries and Oceans, 531 Brandy Cove Road, St. Andrews, New Brunswick E5B 2L9, Canada  
Tel: +1 506 529 5874, Fax: +1 506 529 5862, E-Mail: gary.melvin@dfo-mpo.gc.ca

**EUROPEAN UNION****Daniel, Patrick\***

Commission européenne - DG Affaires Maritimes et Pêche, J-99 02/49, 1000 Brussels, Belgium  
Tel: +322 229 554 58, E-Mail: patrick.daniel@ec.europa.eu

**Nader, Gelare**

Dutch National Ministry of Economic Affairs, Agriculture and Innovation, Ministry of Economic Affairs, Directorate-General AgroBezuïdenhoudseweg, 73, 2594 AC Den Haag, The Netherlands  
Tel: +31 6 388 25305, E-Mail: g.nader@minez.nl

**Pilz, Christiane**

Management and Control of Sea Fisheries, IWC, Federal Ministry of Food and Agriculture, Wilhelmstrabe 54, 10117 Berlin, Germany  
Tel: +49 301 8529 3236, Fax: +49 228 99 529 4084, E-Mail: Christiane.Pilz@bmel.bund.de

**JAPAN****Miyahara, Masanori\***

Adviser to the Minister of Agriculture, Forestry and Fisheries, 1-2-1, Kasumigaseki, Tokyo Chiyoda-ku 100-8907, Japan  
Tel: +81 45 227 2601, Fax: +81 45 227 2701, E-Mail: masamiya@fra.affrc.go.jp

**Kimoto, Ai**

Researcher, Bluefin Tuna Resources Division, National Research Institute of Far Seas Fisheries, Fisheries Research Agency 5-7-1 Orido, Shizuoka Shimizu 424-8633, Japan  
Tel: +81 54 336 6000, E-Mail: aikimoto@affrc.go.jp

**Takeuchi, Yukio**

Associate Director, Bluefin Tuna Resources Division, National Research Institute of Far Seas Fisheries, Fisheries Research Agency, 5-7-1 Orido, Shizuoka Shimizu 424-8633, Japan  
Tel: +81 54 336 6039, Fax: +81 54 335 9642, E-Mail: yukiot@fra.affrc.go.jp

**Tominaga, Haruo**

Assistant Director, International Affairs Division, Fisheries Agency, Ministry of Agriculture, Forestry and Fisheries, 1-2-1 Kasumigaseki, Chiyoda-ku, Tokyo 100-8907, Japan  
Tel: +81 3 3502 8460, Fax: +81 3 3504 2649, E-Mail: haruo\_tominaga@nm.maff.go.jp

**MEXICO****Ulloa Ramírez, Pedro A. \***

Director General Adjunto de Investigación Pesquera en el Atlántico, SAGARPA, Pitágoras No.1320, Col. Santa Cruz Atoyac, C.p. 03310 México, D.F., Mexico  
Tel: +52 5 3871 9500, E-Mail: pedro.ulloa@inapesca.gob.mx

**NIGERIA**

**Okpe**, Hyacinth Anebi\*

Chief Fisheries Officer, Fisheries Resources Monitoring, Control & Surveillance (MCS) Division, Federal Ministry of Agriculture and Rural Development, Department of Fisheries Lagos Victoria Island, Nigeria  
Tel: +234 70 6623 2156, Fax: +234 09 314 4665, E-Mail: hokpe@yahoo.com

**SENEGAL**

**Ndaw**, Sidi\*

Chef du Bureau des Statistiques à la Direction des Pêches, Ministère de la Pêche et de l'Economie Maritime, Direction des Pêches Maritimes 1, rue Joris, Place du Tirailleur, B.P. 289, Dakar, Senegal  
Tel: +221 33 823 0137; +221775594914, Fax: +221 33 821 4758, E-Mail: sidindaw@hotmail.com; dopm@orange.sn

**UNITED STATES**

**Smith**, Russell\*

Deputy Assistant Secretary for International Fisheries, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Room 61013 14th: Constitution, NW, Washington DC 20530, United States  
Tel: +1 202 482 5520, E-Mail: russell.smith@noaa.gov

**Blankenbeker**, Kimberly

Foreign Affairs Specialist, Office of International Affairs and Seafood Inspection (F/IA1), National Marine Fisheries Service 1315 East West Highway, Silver Spring Maryland 20910, United States  
Tel: +1 301 427 8357, Fax: +1 301 713 2313, E-Mail: kimberly.blankenbeker@noaa.gov

**Brown**, Craig A.

Chief, Highly Migratory Species Branch, Sustainable Fisheries Division, NOAA Fisheries Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami Florida 33149, United States  
Tel: +1 305 361 4590, Fax: +1 305 361 4562, E-Mail: craig.brown@noaa.gov

**Díaz**, Guillermo

NOAA-Fisheries, Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami Florida 33021, United States  
Tel: +1 305 898 4035, E-Mail: guillermo.diaz@noaa.gov

**Doherty**, Carolyn

Sea Grant Knauss Marine Policy Fellow, Office of Marine Conservation, U.S. Department of State 2201 C St NW, Room 2758 (HST), Washington DC 20520, United States  
Tel: + (202) 647-3464 (office), E-Mail: DohertyCE@state.gov

**Graves**, John E.

Professor of Marine Science, Virginia Institute of Marine Science - College of William and Mary, P. O. Box 1346, Gloucester Point, VA Virginia 23062, United States  
Tel: +1 804 684 7352, Fax: +1 804 684 7157, E-Mail: graves@vims.edu

**McLaughlin**, Sarah

Fishery Management Specialist, National Marine Fisheries Service, Highly Migratory Species Management Division 55 Great Republic Drive, Massachusetts Gloucester 01930, United States  
Tel: +978 281 9260, Fax: +978 281 0340, E-Mail: sarah.mclaughlin@noaa.gov

**O'Malley**, Rachel

Office of International Affairs and Seafood Inspection (F/IA1), National Marine Fisheries Service 1315 East-West Highway - Room 10653, Silver Spring, MD 20910, United States  
Tel: +1 301 427 8373, Fax: +1 301 713 2313, E-Mail: rachel.o'malley@noaa.gov

**Walline**, Megan J.

Attorney- Advisor, Office of the General Counsel for Fisheries, National Oceanic and Atmospheric Administration, U.S. Department of Commerce 1315 East-West Highway SSMC-III, Silver Spring Maryland 20910, United States  
Tel: +301 713 9695, Fax: +1 301 713 0658, E-Mail: megan.walline@noaa.gov

**Warner-Kramer**, Deirdre

Senior Foreign Affairs Officer, Office of Marine Conservation (OES/OMC), U.S. Department of State, Rm 2758, 2201 C Street, NW, Washington, D.C. 20520-7878, United States  
Tel: +1 202 647 2883, Fax: +1 202 736 7350, E-Mail: warner-kramerdm@state.gov

**URUGUAY**

**Esponda**, Cecilia\*

Dirección Nacional de Recursos Acuáticos, Constituyente 1497, 11200 Montevideo, Uruguay  
Tel: +5982 400 46 89, Fax: +5982 401 32 16, E-Mail: cesponda@dinara.gub.uy

***OBSERVERS FROM NON-GOVERNMENTAL ORGANISATIONS***

**ECOLOGY ACTION CENTRE - EAC**

**Schleit, Kathryn**

Ecology Action Centre - EAC, 2705 Fern Lane, Halifax B3K 4L3, Canada

Tel: +1 902 488 4078, E-Mail: kschleit@ecologyaction.ca

**PEW CHARITABLE TRUSTS - PEW**

**Hopkins, Rachel**

Pew Charitable Trusts, 609 Main Street, Harwich, MA 02645, United States

Tel: +1 215 713 5383, E-Mail: rhopkins@pewtrusts.org

**THE OCEAN FOUNDATION**

**Miller, Shana**

The Ocean Foundation, 1320 19th St., NW, 5th Floor, Washington, DC 20036, United States

Tel: +1 631 671 1530, E-Mail: smiller@oceanfdn.org

***SCRS CHAIRMAN***

**Die, David**

SCRS Chairman, Cooperative Institute of Marine and Atmospheric Studies, University of Miami, 4600 Rickenbacker Causeway, Miami Florida 33149, United States

Tel: +1 305 421 4607, Fax: +1 305 421 4221, E-Mail: ddie@rsmas.miami.edu

\*\*\*\*\*

**ICCAT SECRETARIAT**

C/ Corazón de María, 8 - 6 Planta, 28002 Madrid, Spain

Tel: + 34 91 416 5600, Fax: +34 91 415 2612, E-Mail: info@iccat.int

**Meski, Driss**

**Neves dos Santos, Miguel**

**De Bruyn, Paul**

**Kell, Laurence**

**Campoy, Rebecca**

**De Andrés, Marisa**

**Fiz, Jesús**

**García Rodríguez, Felicidad**

**Moreno, Juan Ángel**

**Peña, Esther**

**Peyre, Christine**

***ICCAT INTERPRETERS***

**Baena Jiménez, Eva J.**

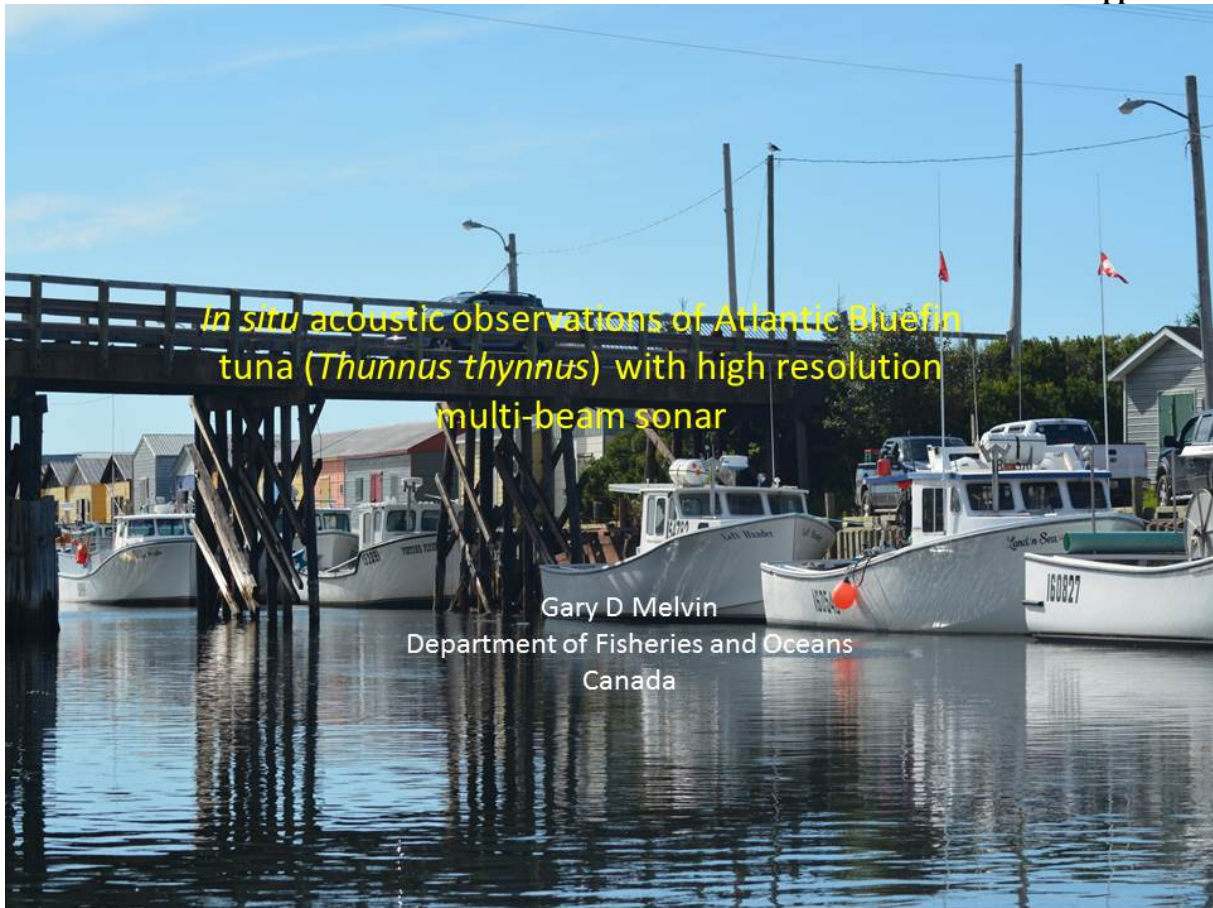
**Faillace, Linda**

**Liberas, Christine**

**Meunier, Isabelle**

**Sánchez del Villar, Lucia**

**Tedjini Roemmele, Claire**



## Background

- Most ICCAT Analytical Assessments are tuned with CPUE indices – bias and changing fishing patterns
- Recent concern about the representativeness of some CPUE indices of abundance for both eastern and western BFT stocks.
- Recommendation by SCRS for the development of Fishery Independent Indices.
- WG of Fisheries Managers and Scientists (July 2014) identified several proposals for new indices, and improvement of existing indices, by Canada, Japan, and the USA.
- One of Canada's 2 Proposals involved a full scale acoustic- trolling survey in the Gulf of St Lawrence.



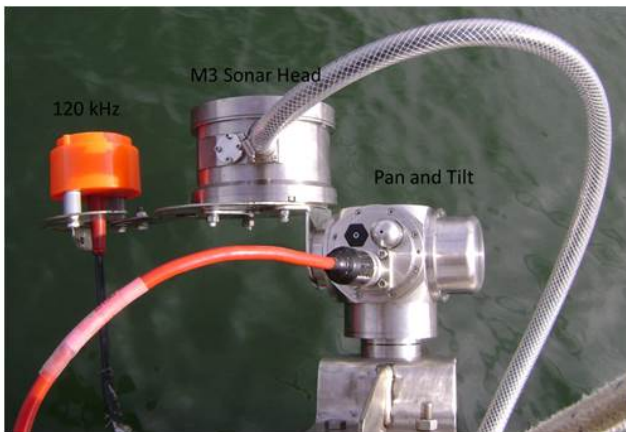
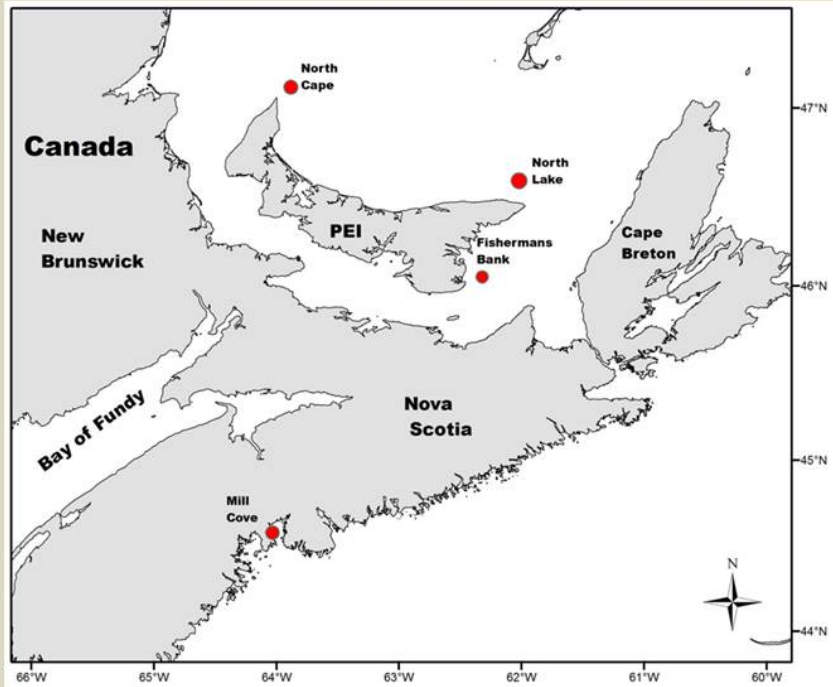
## Field Study Objectives

- Proof of Concept:
  - To evaluate the ability of acoustic technology to detect, observe, and quantify Bluefin tuna on the fishing grounds.
  - To investigate appropriate system configurations under different environmental and sea states (Tilt angle, vertical beam width, etc).
  - To investigate the operational limitations of the technology and approach to be considered in the final survey design.

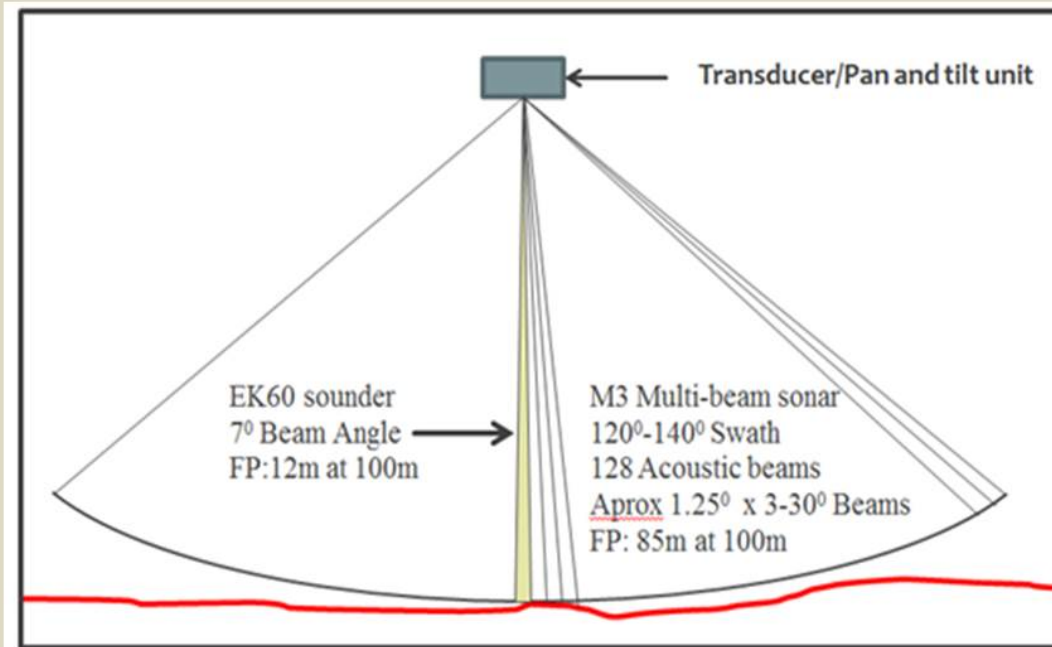
## Study area and Equipment

- Acoustic Recording undertaken at:
  - North Cape PEI - local and among herring fleet
  - East Point, PEI - local and among Rec fishing vessels.
  - Fishermans Bank, PEI, - local and among Rec fishing vessels.
  - A BFT Pen in St Margaret's Bay, Nova Scotia
- Equipment:
  - 24' Rossborough boat
  - Simrad EK 60 split beam (200kHz) scientific echosounder
    - 1 ping/sec
  - Simrad EK 60 split beam (120kHz) scientific echosounder
    - 1 ping/sec
  - Mesotech M3 multi-beam sonar (500kHz) 120° swath
    - ~ 5 pings/sec at 50m setting
- Survey Design
  - Ad hoc searches with a few transect in some areas.

# Location of Acoustic sampling sites in Eastern Canada



# Comparison of EK60 echosounder and M3 multibeam sonar beam patterns

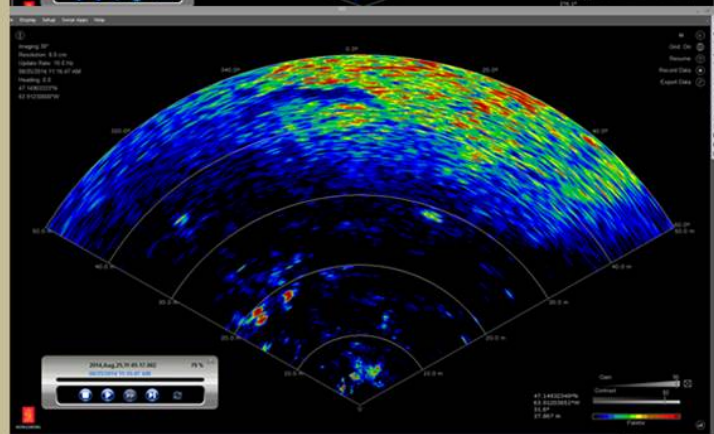


Observations in Shallow (<50) verse deeper water and rough and calm seas

M3 – Single ping  
>60m depth, and  
no wind/no swell

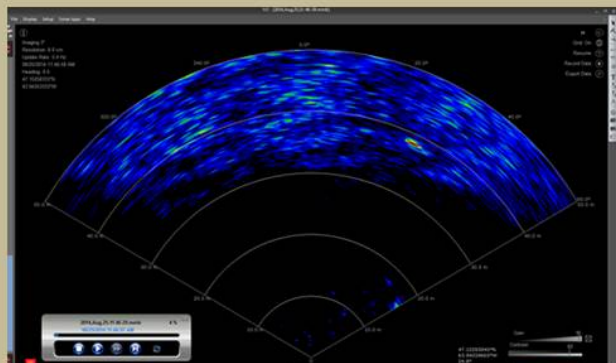


M3 – Single Ping, 20-25m depth, and 20 knot winds

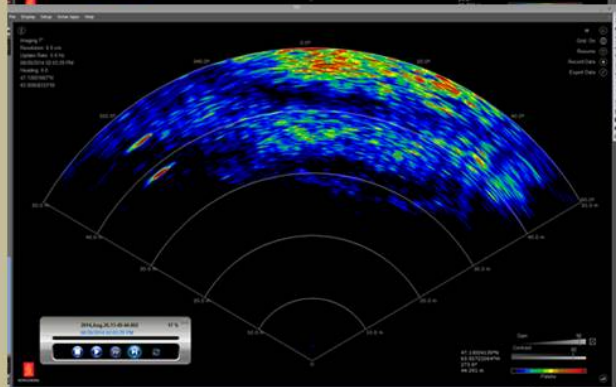


### Observations of 1 and 2 BFT

M3 – Single Ping,  
 - Range 50m  
 - Shallow water,  
 - One BFT

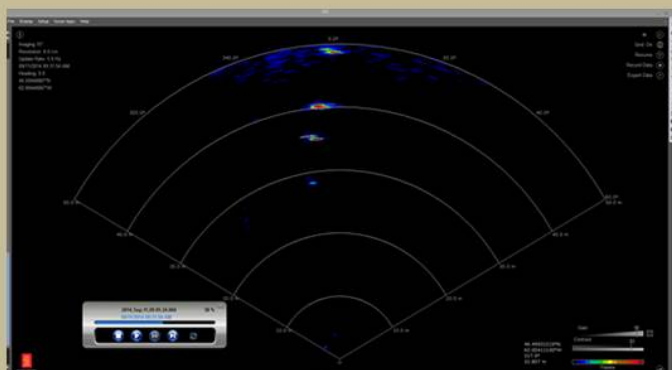


M3 – Single Ping,  
 - Range 50m  
 - Shallow water,  
 - Two BFT

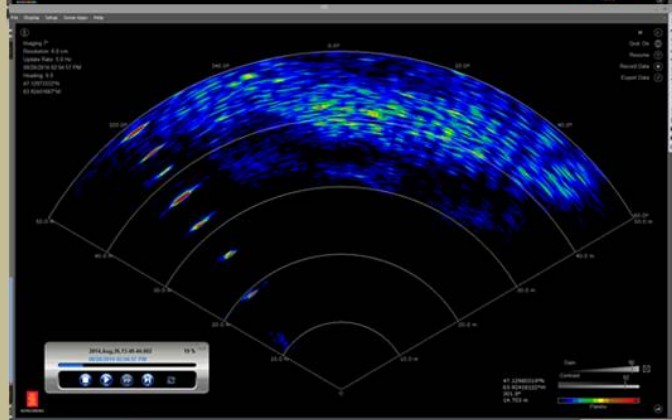


### Observations of Multiple BFT

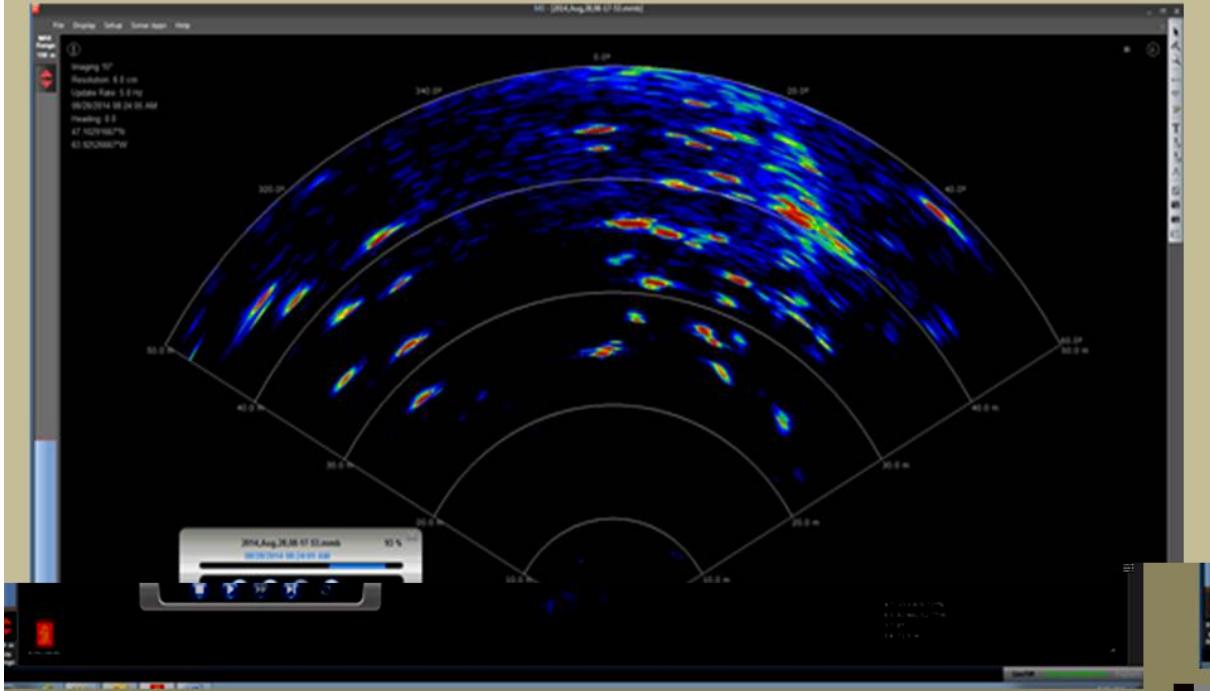
M3 – Single Ping,  
 - Range 50m  
 - Shallow water,  
 - 4 of 16 BFT



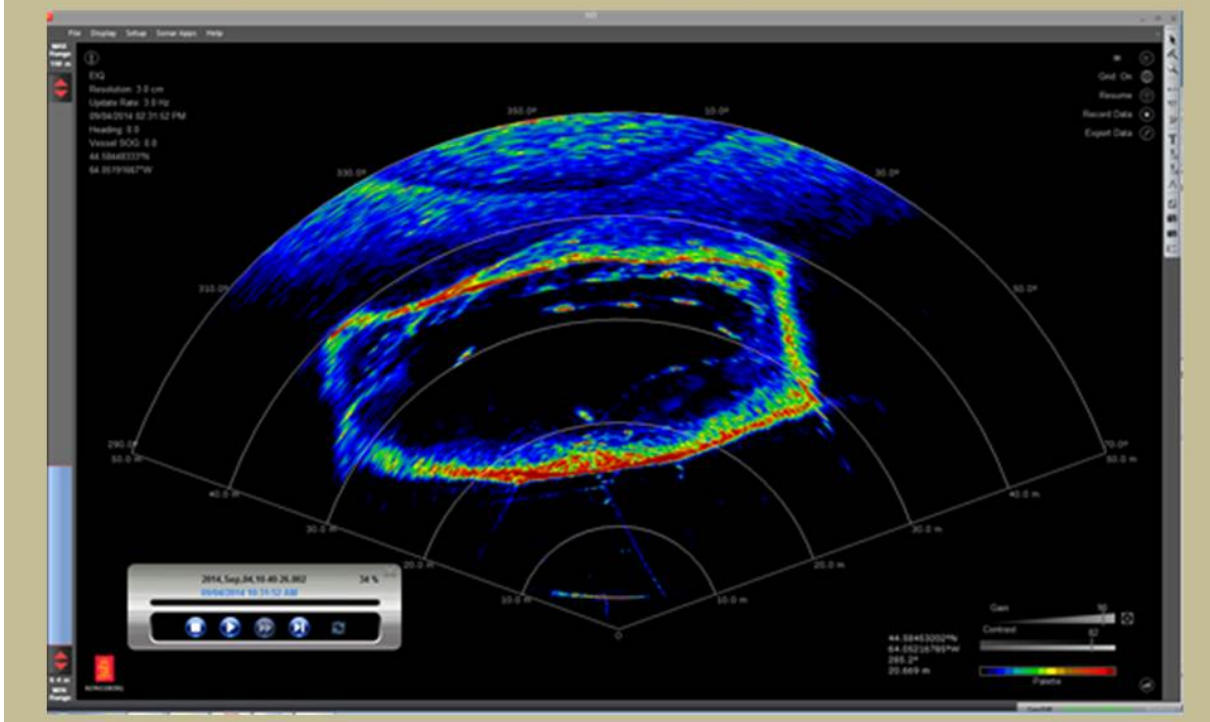
M3 – Single Ping,  
 - Range 50m  
 - Shallow water,  
 - 8 of 21 BFT



## Aggregation of bluefin tuna near a commercial herring gillnetter



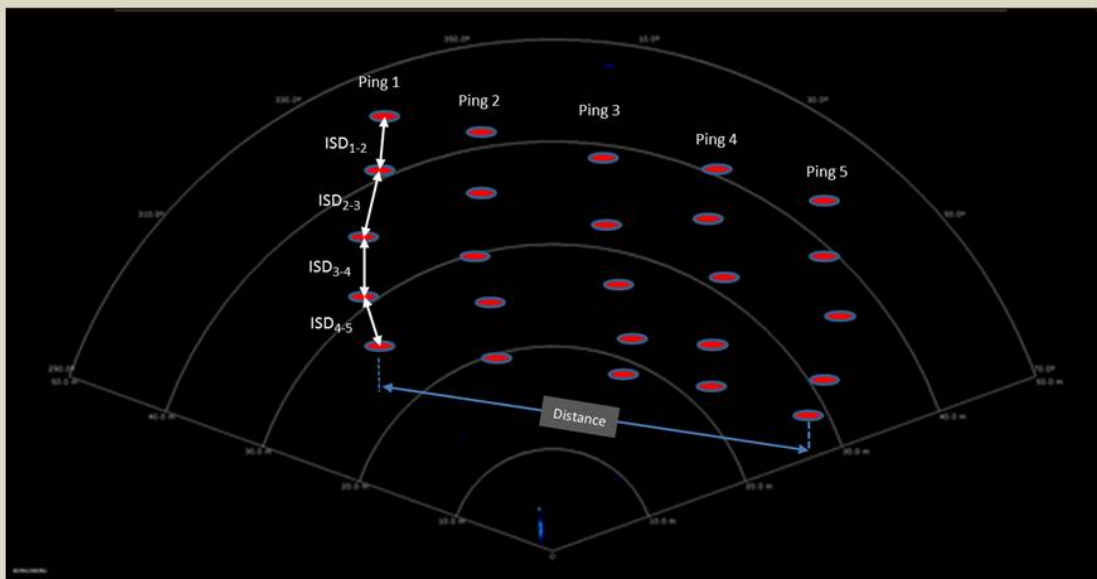
## Image of bluefin tuna in the Mill Cove pen in St Margarets Bay, Nova Scotia, September 4, 2014.



# Data Collection

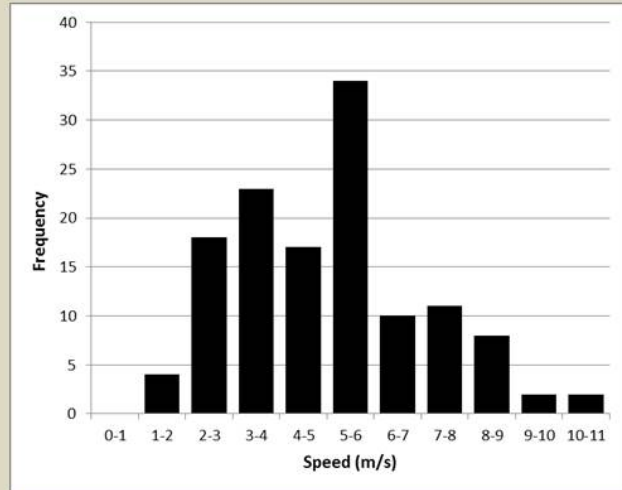
- Data Extractable for individual targets
  - Date, time, and vessel position
  - Position of individual targets in multi-beam swath.
    - Latitude and longitude
    - Angle and Range from sonar head
- Estimated Variables
  - Swimming speed within the sonar swath
  - Inter-spatial distance between adjacent BFT
  - Size of each target

Schematic of 5 ping overlay on a swath image illustrating the inter-spatial and swimming distance.



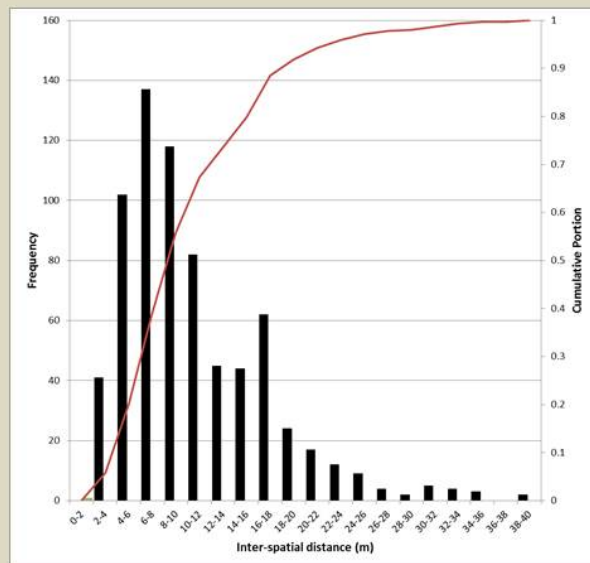
## Swimming Speed

	Individuals	Groups
Number	26	104
Mean (m/s)	3.65	4.14
Std Dev	2.22	2.07
Min	0.86	0.54
Max	8.87	10.98



## Inter-spatial Distance

Groups of Tuna	24
Observations	713
Mean (m)	8.94
Std	6.20
CV %	69.28
min	0.56
max	38.27



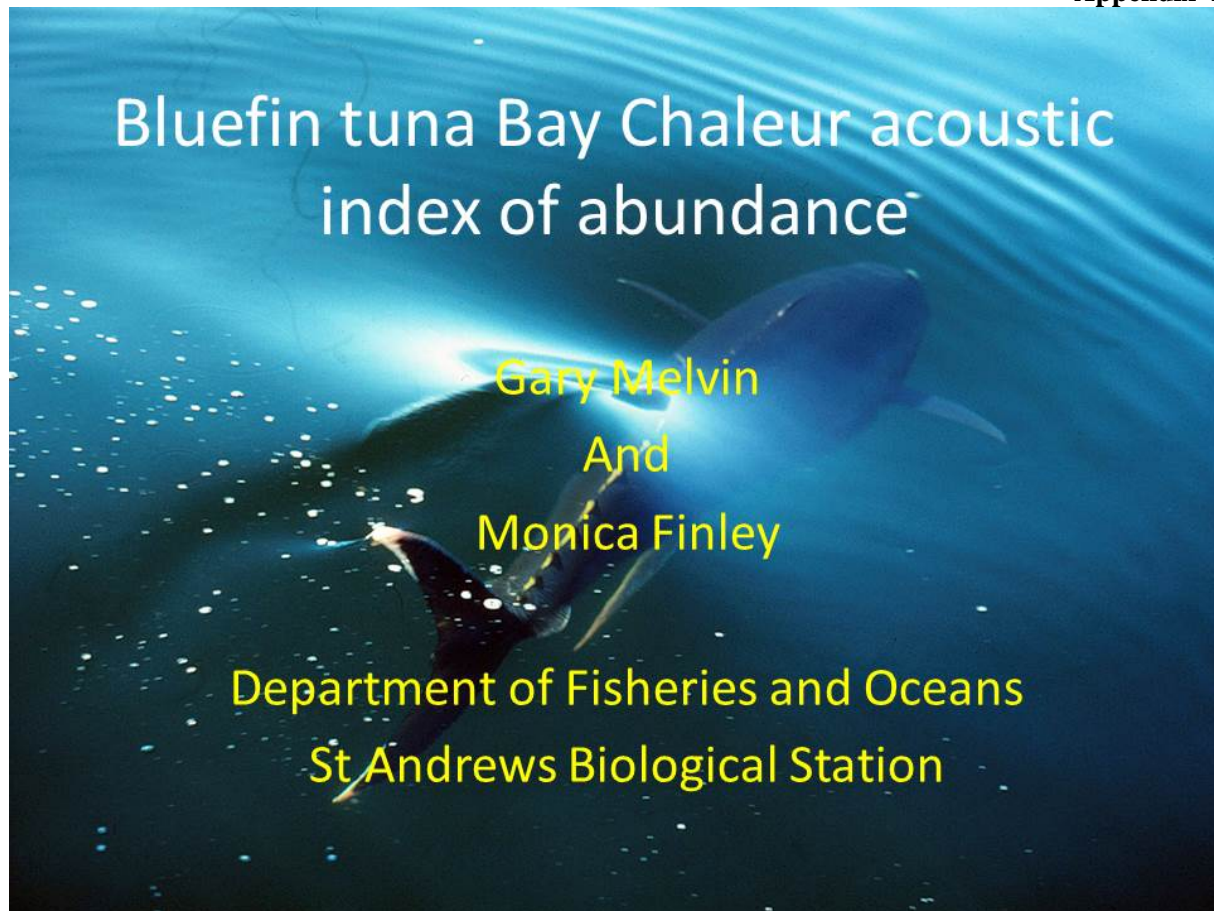
## Other Acoustic Observations

- Horizontal EK60 (200kHz) TS
- Vertical EK60 (120 kHz) TS (-34 to -14dB)
- Acoustic observations of:
  - Pilot Whales
  - Minke Whales
  - Sunfish (Mola mola)
  - Seals
  - Diving Birds
  - Gillnets with fish.
- BFT appear different from the above.

## Summary

- The M3 Sonar can detect, monitor, enumerate, and track BFT in open water, thus a candidate tool for development of a new fishery independent BFT index of abundance.
- Functional Range of M3 is dependent upon water depth and surface sea conditions.
  - Shallow water (20-30m) limited to 35-45 m.
  - Deep water >50m full operational range (>100m).
- During calm seas tilt angle of 0 can be attained, but must be increased with increasing sea state (max 20knots).
- 7 degree appears to good general tilt angle. Pan and tilt to finesse during surveying
- Vertical beam with of 7 and 15 degrees optimal in this study.
- Stability of transducer is vessel size dependent. A larger boat would improve acoustic detection.

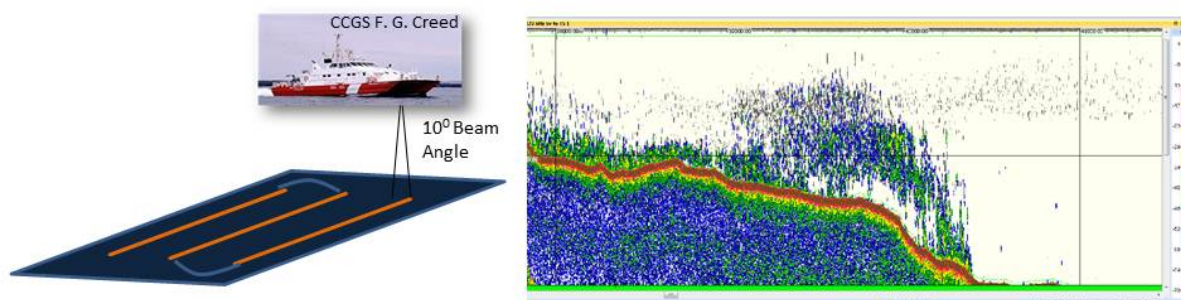




## Gulf Region Bluefin Tuna Abundance Index

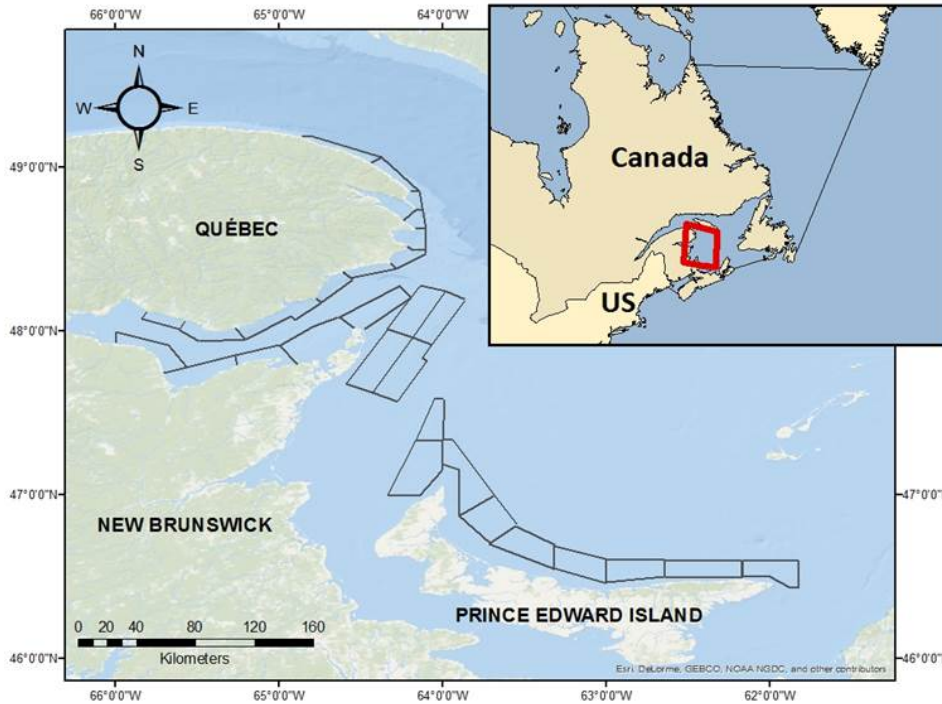
### Background

- The fall herring acoustic survey in the Southern Gulf has been conducted since 1991.
- The sampling design includes random (within strata) parallel transects with a hull-mounted single beam (120 KHz) transducer, using a Femto DE9320 digital echosounder. (LeBlanc *et al.* 2012)
- Survey has been conducted during the same period of time by the same vessel using the same equipment since it began.
- HDPS editing software uses a destructive approach and removes all backscatter not associated with the target species.
- Tuna were observed over the years but not available for quantification in the final analysis.



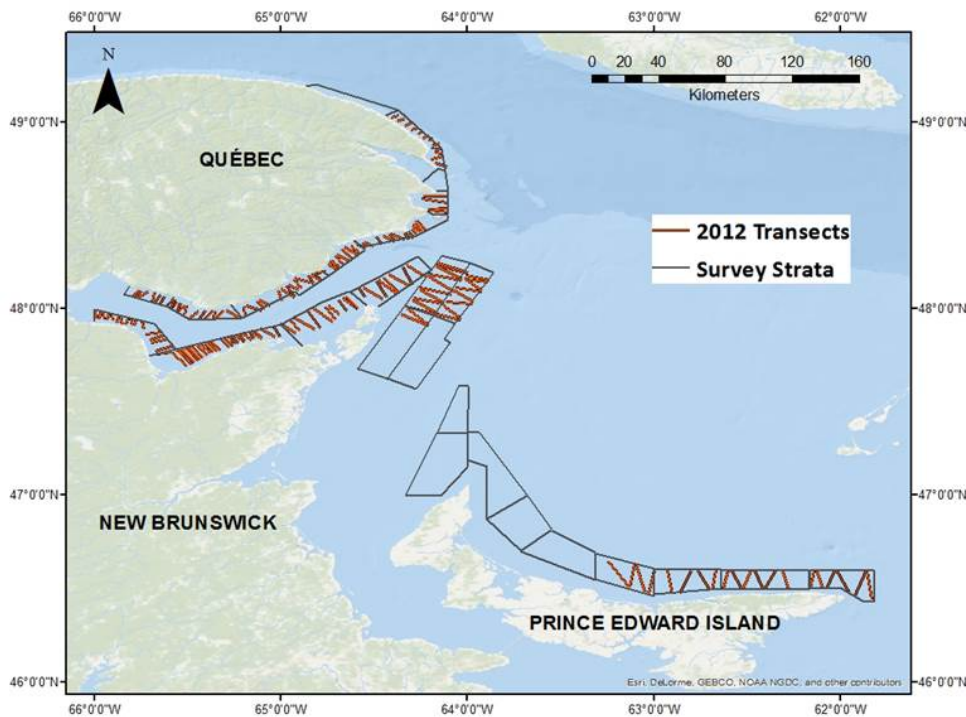
## NAFO Division 4T Acoustic Survey

A fall acoustic survey of herring concentrations in the Southern Gulf, Canada has been conducted since 1991.



The acoustic biomass index contributes to the stock assessment of 4T herring.

## Survey Transects 2012



Transect length ranges between ~2.5 and 18.4 km, average 7.7 km (2012).

In 2012 the total transect distance covered was 1,289 km.

## Available Data

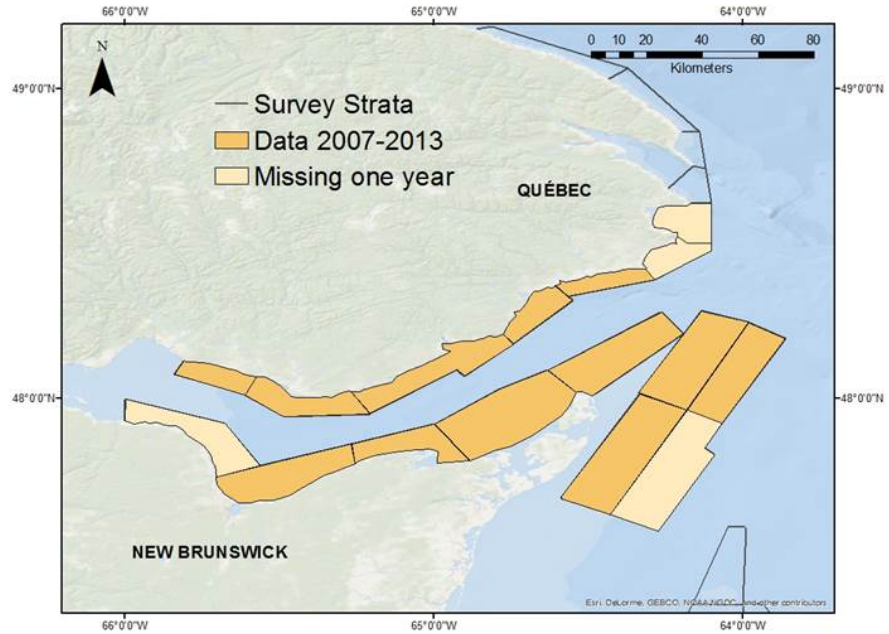
**24 years of acoustic survey data available.**

**PEI has been surveyed 17 of the 24 years.**

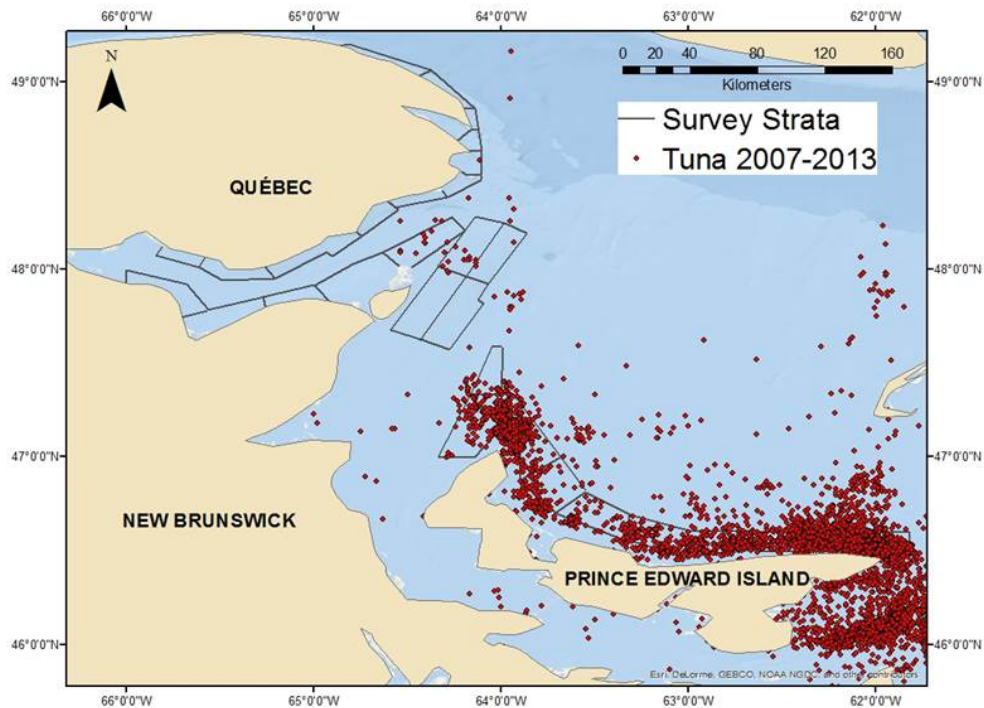
To date:

2007-2013 data have been re-edited and processed for BFT.

16 strata have been consistently sampled.



## Commercial Landing Locations of BFT



PEI Coverage:

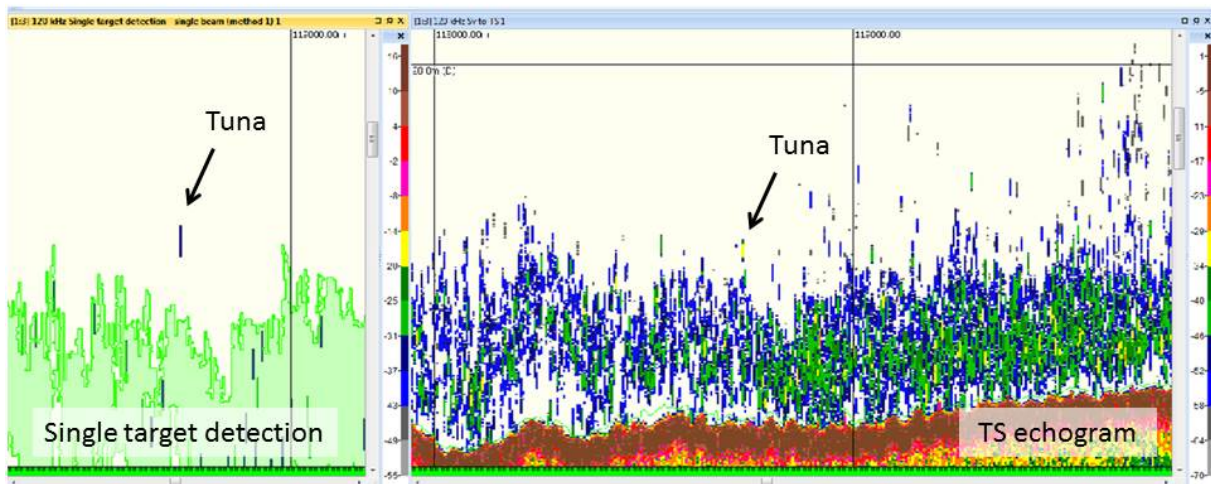
- 24 year of Surveying
- 17 years some PEI Strata
- Many years of incomplete coverage
- Final analysis will look at PEI coverage

Year	PEI Survey	Year	PEI Survey	Year	PEI Survey
1991	n/a	1999	Y	2007	Y
1992	n/a	2000	Y	2008	Y
1993	Y	2001	Y	2009	Y
1994	n/a	2002	Y	2010	Y
1995	Y	2003	Y	2011	n/a
1996	Y	2004	Y	2012	Y
1997	Y	2005	Y	2013	n/a
1998	n/a	2006	Y	2014	n/a

## Acoustic Estimation of Gulf Region Bluefin Tuna Abundance

Did we find tuna in the Raw? Yes

- ❖ 377 identified single targets in 2012 and 279 in 2013 (preliminary, note- PEI was not surveyed in 2013)



**To do:**

Analyze multiple years and compare acoustic abundance estimate (# tuna/km<sup>2</sup>) to the current CPUE index.

## Steps

- Quality Control
- Identify TS range of observed bluefin from previous acoustic work.
- Finesse single target detection algorithm
- Identify BFT from all transects
- Enumerate the number observed per transect
- Stratum area weighted estimates to account for inter-year variability.

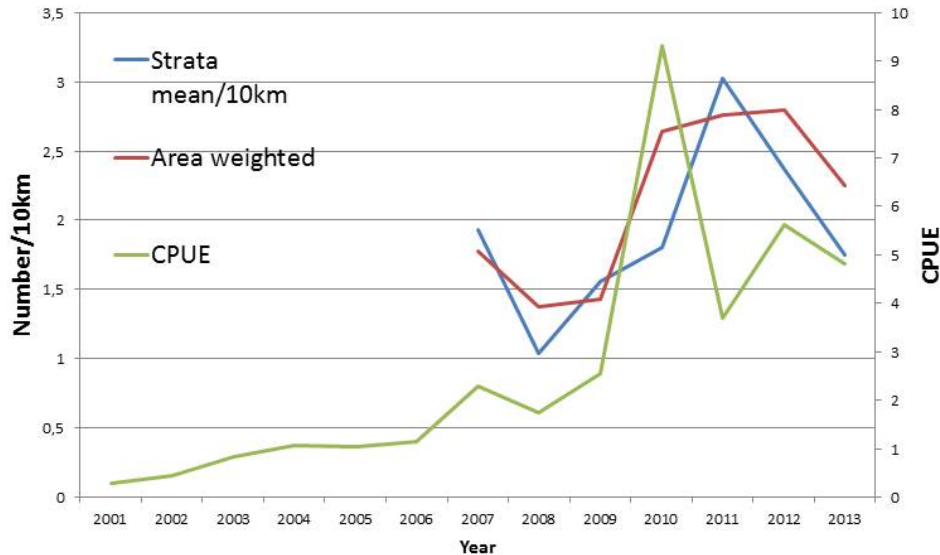
### Tuna like Single Target Identification

Table: Parameters for single target detection

Parameter	Value selected
Minimum TS value	-35 dB
Maximum TS value	-16 dB
Pulse length determination level	6 dB
Minimum normalized pulse length	0.50
Maximum normalized pulse length	1.80

- A school detection algorithm was used to detect and remove targets within schools.
- Single targets above 2.5 meters from the surface and below 1 m from the bottom (best bottom candidate in Echoview) were removed.
- Remaining single targets that meet the above criteria were individually assessed.

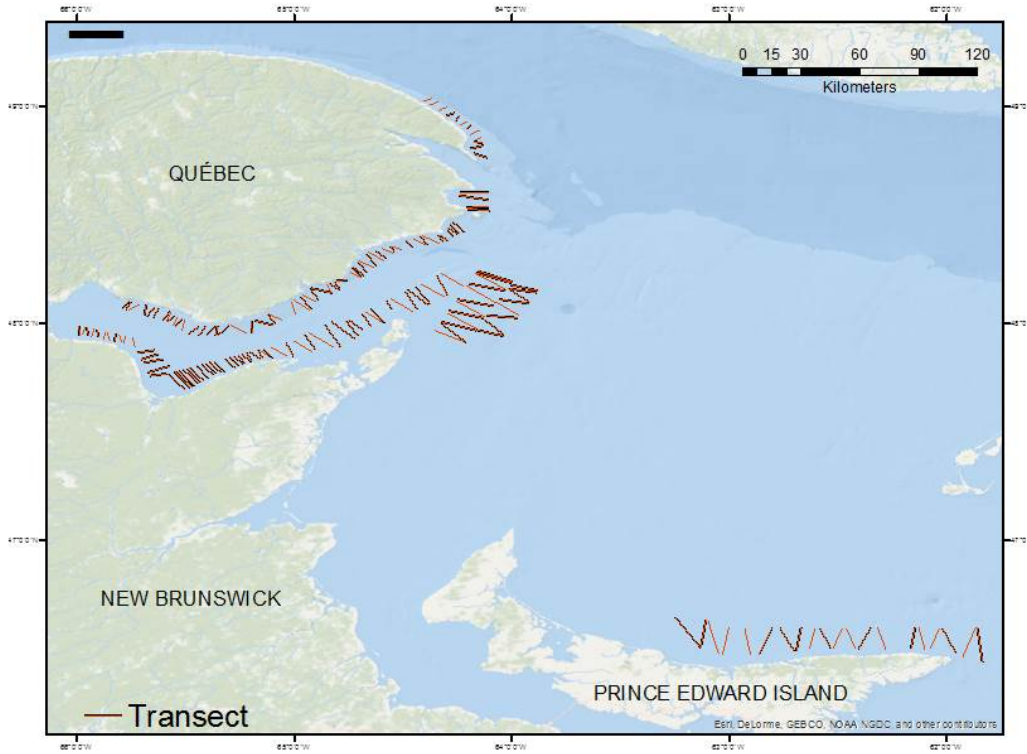
## Preliminary Results



## Summary

- BFT #/10km appears to follow a similar trajectory as the CPUE, without the extreme inter-annual variation.
- There is a significant increase, but not unrealistic, in the index in 2010 that remains high until 2013 when it decreases some.
- Anticipated data analysis (including variance) from 2001 to 2014 to be presented at the 2015 SCRS meeting.

## Acoustic Survey 2012



## DFO Bluefin Tuna Science Projects for 2015

### 2015 New BFT Projects

- For 2015, five projects have been developed that address specific issues identified to improve data input for the 2016 assessment.
- Projects are industry funded.
- Project are schedules to commence around August 1, 2015.
- All projects are to be completed before the 2016 data prep meeting

#### 1) Review and revise the SW Nova Bluefin tuna index of abundance.

- Uncertainty related to effort actually directed at bluefin tuna during a fishing trip for some vessels.
- Effort and by-catch of Big Eye tuna has been increasing since the early 2000's.
- The project will define a series of criteria to identify the proportion of a standard trip devoted to Bluefin tuna.
  - through consultations with the industry and a review of individual log books.
- Work has already commenced.



## Project 1 – SWNS BFT Index

Objectives are to:

- Determine protocols for identifying from vessel log books those trips which may not reflect the effort devoted to Bluefin tuna;
- Examine and adjust fishing effort of affected trips, and
- Revise the Bluefin tuna index of abundance for southwest Nova Scotia fleet.

Expected Completion:

- December 31, 2015 or earlier

## 2) Sampling Program Support

- Continuation and expansion of field sampling program
- collections throughout the Atlantic Provinces during the fishing season
- Technical support for processing and cataloguing

## Project 2 – Field Sampling Support

Objectives are to:

- Coordinate the collection of bluefin tuna heads and biological data associated with landed fish.
- Provide training in the removal of otoliths and collection of a tissue sample for genetic studies.
- Collect and process the otoliths and tissue samples from fishing ports throughout the Atlantic Provinces and Quebec required for a variety of studies.
- Preserve and catalogue all material collected.

Completion Date:

- Annual - December 31, 2015

### 3) Review of Gulf of St. Lawrence Bluefin tuna index of abundance

- Gulf of St Lawrence Bluefin tuna index is one of the key indices of abundance used in the 2014 stock assessment and has a strong influence on the stock status.
- Concerns were expressed regarding the representativeness of the index due to management and fishing pattern changes.
- suggestions to split the index into two time periods to try and account for the abrupt increase in 2010.
- Investigate if these changes can be accounted for through standardization and consultations with industry

### Project 3 - GoSL Index

#### Objectives:

- Determine protocols for identifying from vessel log books those trips which may not reflect the effort devoted to bluefin tuna;
- Examine and adjust fishing effort of affected trips, and
- Revise the bluefin tuna index of abundance for the Gulf of St Lawrence.

#### Completion Date:

- March 31, 2016

### Project 4 - PSAT Tagging study

- PSAT studies have been initiated to investigate the movement, distribution and origin of Atlantic Bluefin tuna.
- Project currently underway to report all Canadian tags in a format consistent with the SCRS requests.
- BFT expanding range (i.e., Newfoundland, Bay Chaleur). With apparent increase in abundance it is important to have a good understanding on how these fish are moving.
- Propose to release 20 new PSAT focusing on release locations not previously targeted.

## Project 4 - PSAT Tagging study

- Objectives:
  - Coordinate with the fishing industry the locations from which tagging will be conducted.
  - To tag 20 Bluefin tuna throughout the Atlantic Provinces and possibly Quebec based on availability.
  - Monitor and report on the movement of BFT as the tags are released and data transmitted.
  - Prepare a final report on the distribution and movement of tagged fish.
- Completion Date:
  - March 31, 2016

## Project 5- ICCAT Tagging Program

- GBYP program has established a voluntary tagging program with the fishing industry to tag and release bluefin tuna.
- ICCAT provides the conventional tags and reporting forms to the industry.
- Industry tag the bluefin tuna – fleets throughout Atlantic Canada engaged to undertake tuna

## Project 5- ICCAT Tagging Program

- Objectives
  - Collaborate with the industry to mark bluefin tuna released alive with conventional tags.
  - Promote the tagging of released bluefin tuna with conventional tags provided by ICCAT and in support of GBYP.
- Completion Date:
  - March 21, 2016, but subject to renewal annually

# Progress Report on selected USA Research Activities to Improve the Stock Assessment of western Atlantic Bluefin Tuna



United States of America Scientific Delegation to ICCAT SCRS  
Meeting of the Working Group of Fisheries Managers and Scientists  
in support of the Western Bluefin Stock Assessment  
June 25, 2015



NOAA FISHERIES

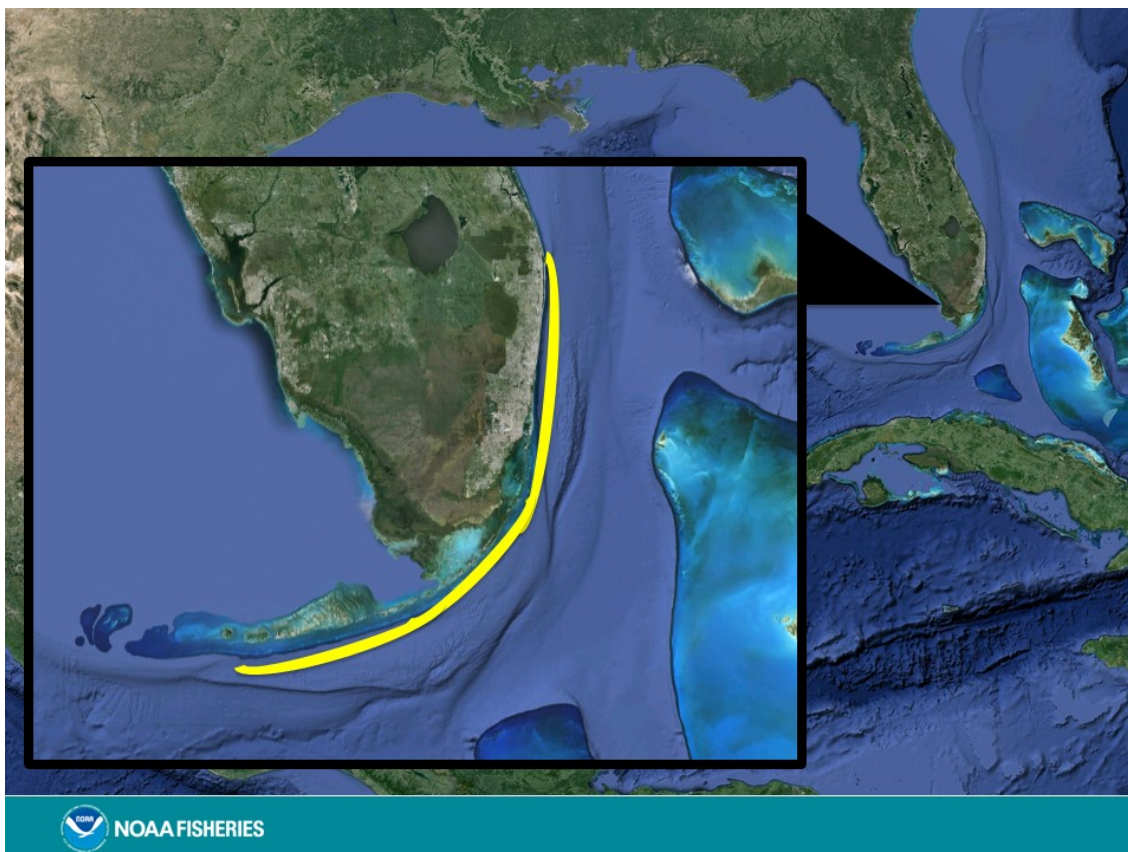
U.S. Department of Commerce | National Oceanic and Atmospheric Administration | NOAA Fisheries | Page 1



NOAA  
FISHERIES

## A feasibility study on the development of annual relative abundance indices for young-of-the-year Bluefin tuna (*Thunnus thynnus*) in the Straits of Florida





NOAA scientists have been meeting with recreational fishermen and charter boat captains to explain the study, and provide training in how to identify young-of-the-year bluefin tuna. A number of these fishermen have agreed to participate in the voluntary network of samplers along the Florida Straits.



Blackfin 19-25 gillrakers

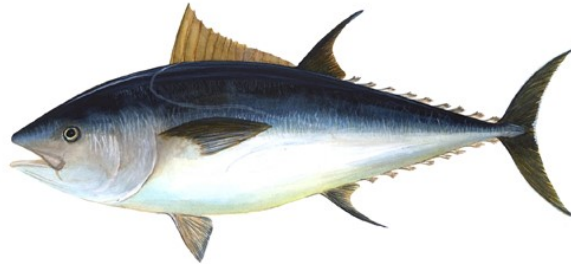


Bluefin 34-43 gillrakers

NOAA scientists have also conducted some initial field testing of the gear provided by Japanese scientists.



## Developing a genomic approach Bluefin tuna assessment



### Background

Human genome project has changed the game for molecular DNA technology and analysis

Newly-developed, next-generation DNA techniques have dramatically increased power of genetic methods

New economy of human genome project has vastly decreased analytical costs, now comparable to or cheaper than many traditional sampling methods

1000s of DNA markers can be sequenced rapidly and cheaply to identify individuals.

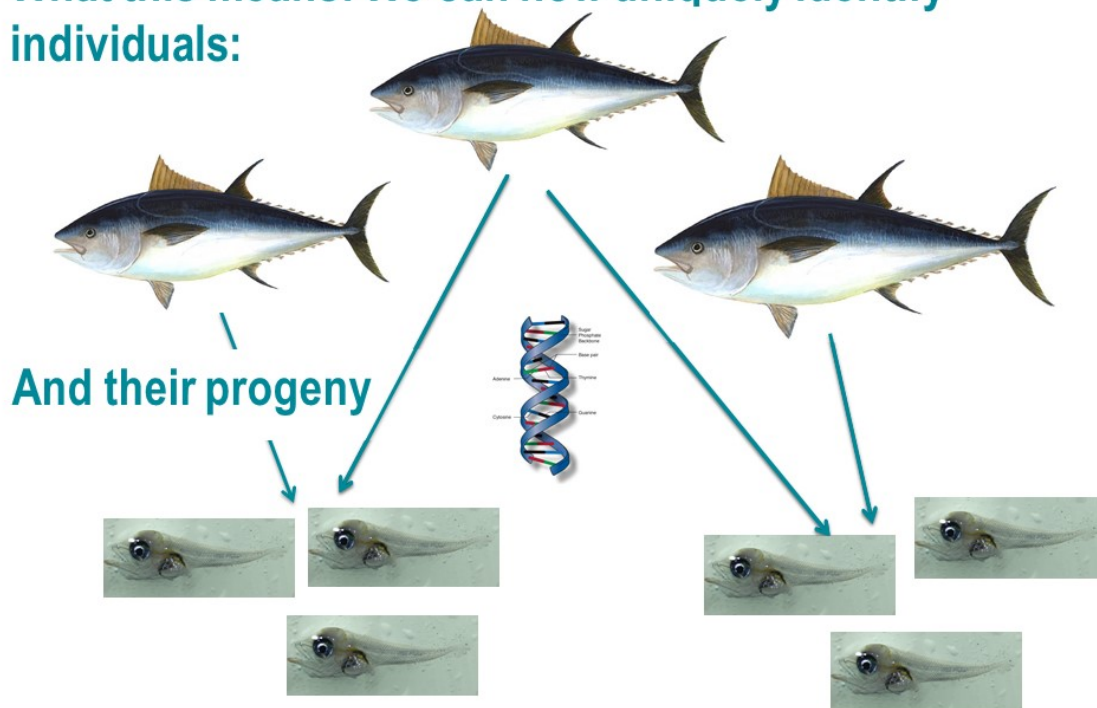
It is time to apply these methods to fisheries problems



Courtesy: National Human Genome Research Institute and Smithsonian National Museum of Natural History



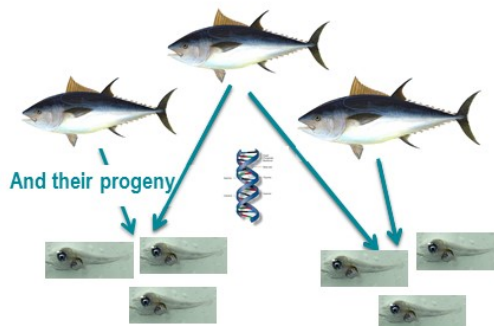
## What this means: We can now uniquely identify individuals:



Larval pictures from Katherine Dale, NMFS

## Close-Kin Analysis

By counting number of parent-offspring pairs, we can estimate number of parents



Similar to a mark-recapture experiment

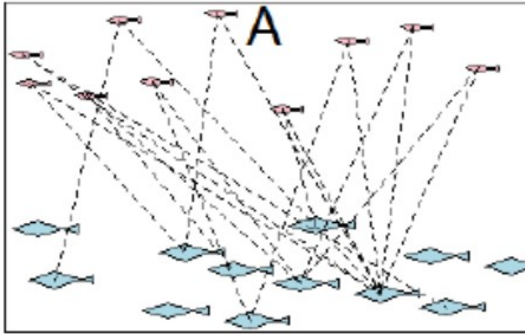
Successfully applied to

- Minke whales
- Southern Bluefin tuna



---

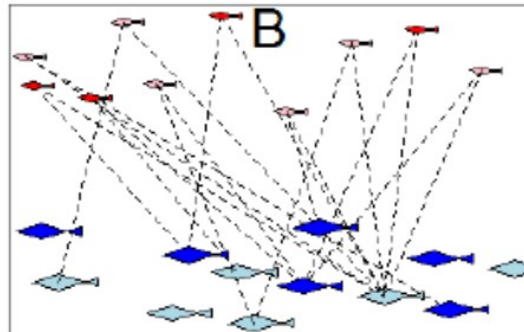
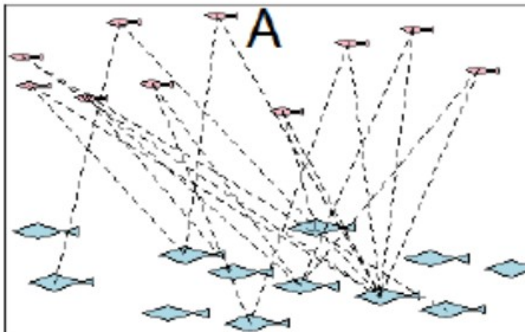
## Close-Kin Analysis (Bravington et al. 2013)



A. Each juvenile 'tags' its parent's DNA marker

---

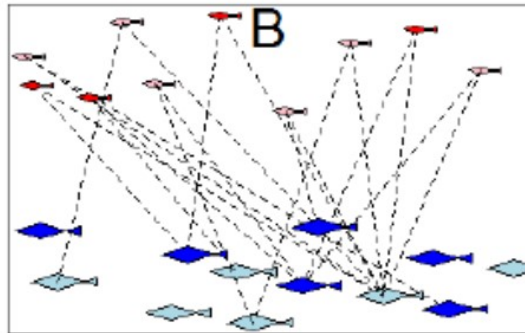
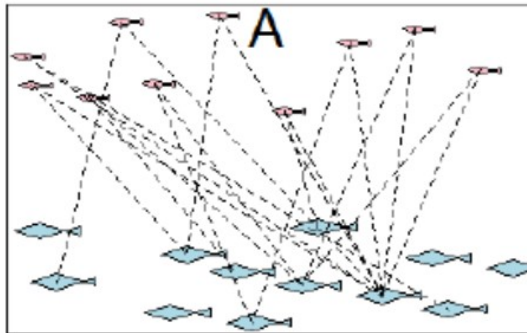
## Close-Kin Analysis (Bravington et al. 2013)



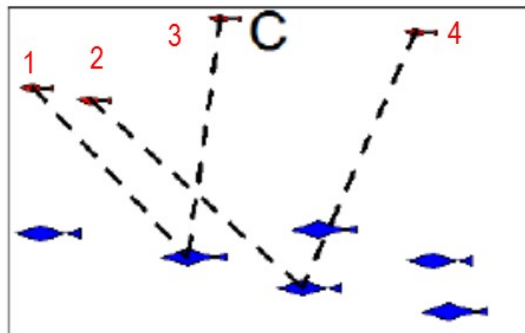
B. Sample some fraction of adults and juveniles, obtain genotypes



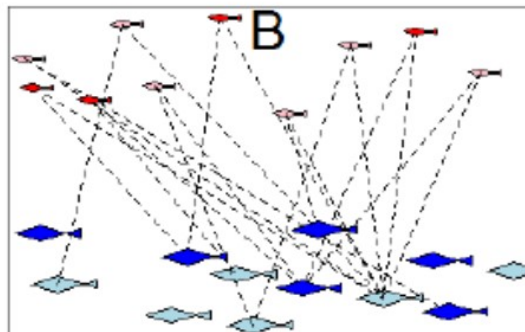
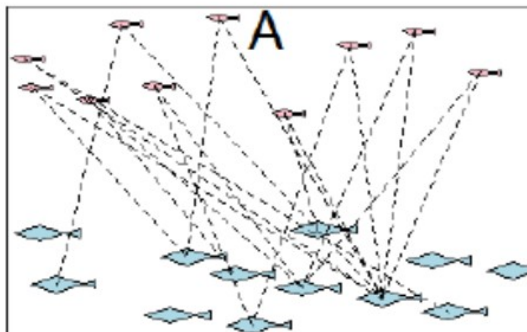
## Close-Kin Analysis (Bravington et al. 2013)



C. Genetically identify matches, i.e. number of parent/offspring pairs; here there are 4



## Close-Kin Analysis (Bravington et al. 2013)



D. Estimate number of spawners:

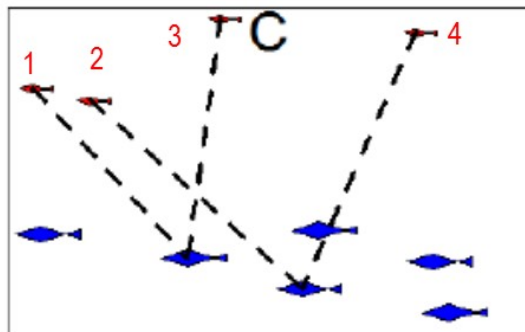
$$\hat{N} = 2 * J * A / POP$$

4 Juveniles sampled

6 adults sampled

4 POPs

$$\hat{N} = 2 * 4 * 6 / 4 = 12 \text{ spawners}$$



## Close-Kin Analysis: Study Design Overview

- **Spawner Marking:** Gulf of Mexico (GOM) Larval Sampling Program
  - Existing long-term monitoring survey since 1977
  - Stratified random sampling
  - Coverage across the northern Gulf of Mexico spawning grounds
- **Spawner Recapture:** Sampling of U.S., Canada, Japan, and Mexico Fisheries (and other international fisheries)
  - Marked individuals (GOM spawners) assumed to mix with unmarked population
  - Marked spawners recaptured in fisheries after the spawning period, outside of the GOM (does this represent a random sample of adults?)
  - Short duration between mark and recapture events, potentially negligible natural mortality



## Pilot Study underway – Objectives:

- Identify unique individuals using next-generation genomic sequencing following methods developed for Southern BFT
- Evaluate the feasibility of using GOM larvae to mark WBFT spawners
  - 500-1,500 individual larvae encountered yearly
  - Very clustered: few samples capture many larvae
  - Can we extract sufficient quality DNA from larval samples?
  - Unknown kinship (spawner genetic diversity) in larval samples
    - Does one plankton tow represent multiple spawner genomes or a single pair?
    - Has sufficient larval mixing occurred such that individual larvae represent a sample unit, i.e. unique spawner pairs?
- Feasibility of sampling fisheries for recaptures of genetically marked spawners
  - Can we identify stock origin of harvested fish? (i.e. East versus West Atlantic and remove positive N bias of recapturing mixed stocks)
  - Can we obtain representative samples from fisheries and meet the assumption of homogeneity in probability of recapture? (essential to obtain unbiased estimates of spawner absolute abundance using CKA)



## Potential Benefits

### Pilot:

- 1) Application of next-generation genetic techniques for spawning stock abundance estimation – a different and more valuable result than just stock origin
- 2) Estimation of East vs West stock origin by genetic methods – useful as a stand-alone product for allocating catch compositions

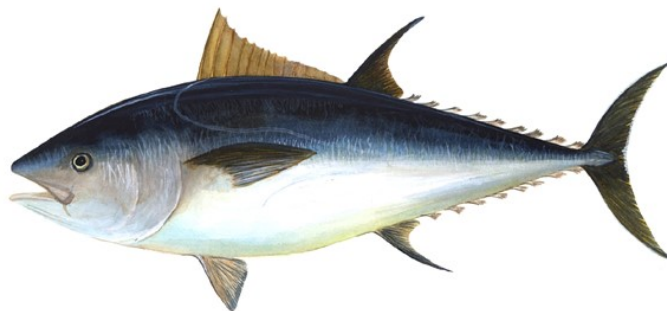
### Operational (Provided that pilot succeeds):

- a full close-kin analysis may provide an estimate of absolute number of spawners
- This could greatly reduce assessment uncertainty
- Or provide new basis for deriving quotas as a fraction of the spawning stock



**NOAA  
FISHERIES**

## Developing new/improved fishery independent indices for western Atlantic Bluefin Tuna using larval collections



## Potential improvements to existing indices

- Incorporate an adaptive sampling scheme based upon habitat models
- Expand depth-stratified sampling to define the vertical distribution of larvae
- Incorporating age and mortality estimates for larvae collected in different regions within the Gulf of Mexico

## Potential new indices that might be developed:

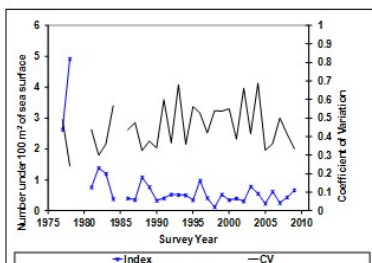
- Develop an index of larval prey, feeding success and growth
- Initiate sampling for bluefin tuna eggs, to index of spawning stock biomass
- Extend exploratory sampling efforts in the Caribbean Sea and western North Atlantic to determine the significance of alternative spawning grounds



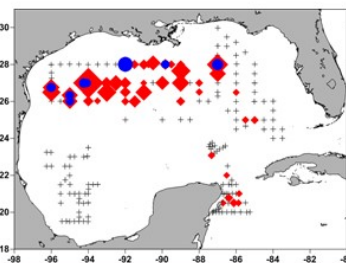
## Past improvements to existing larval index: catch efficiencies

- *Issues:*
  - The larval index was zero-inflated, and didn't account for environmental conditions. This resulted in a high degree of uncertainty around index values
- *Solutions:*
  - We developed an environmentally-driven habitat model to predict conditions and locations where larvae would be expected
  - This model suggested that catchability of larvae was likely sub-optimal, so we introduced a new plankton sampling gear in 2010, which is much more efficient

Larval bluefin index (blue), and coefficient of variation (black)



Larval bluefin catches from bongo net (blue) and S-10 net (red) tows, 2010



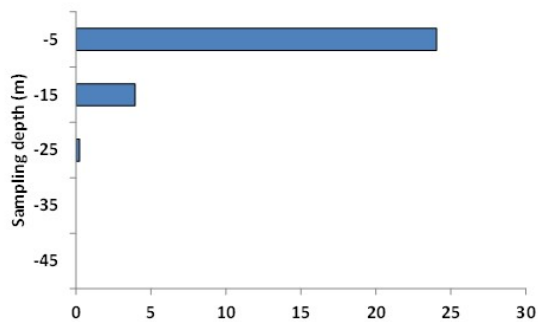
## Potential future improvements to existing larval index: depth distributions

- *Issues:*
  - We have limited information on distributions of larvae by depth, and so catch efficiencies are still not well known
  - This contributes another potential source of error to the larval index
- *Solutions:*
  - We propose to increase use of depth-stratified opening/closing nets on annual cruises, in order to quantify the sampling efficiencies of all gears used
- *What we need:*
  - More ship time during the peak spawning season

A MOCNESS opening and closing plankton sampling net

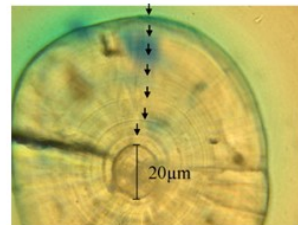


Preliminary data on larval depth distributions



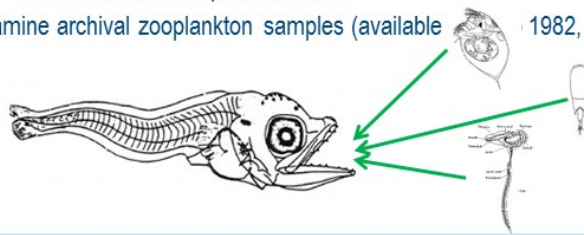
## Potential future improvements to existing larval index: larval aging

- *Issues:*
  - Estimates of age-at-length are required to standardize larval catches for the larval index
  - The current age-length curve was developed from larvae sampled off Miami more than 30 years ago
- *Solutions:*
  - New age curve was developed from samples taken in 2012. Curve will be updated using the 2013 and 2014 specimens.
  - We have begun to age larval bluefin from several cruises in the Gulf of Mexico in recent years
  - When sufficient samples have been processed, we will develop predictive models to define how environmental conditions affect growth, and how this varies among years
- *What we need:*
  - Resources for lab work, to dissect and age larvae



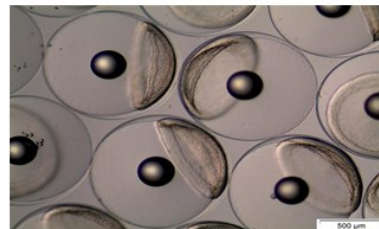
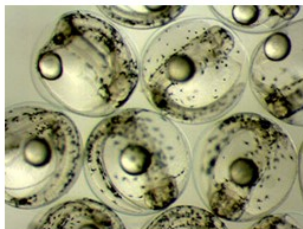
## Potential development of new indices: feeding success and recruitment

- *Issues:*
  - Survival of larvae at very early life stages may exert a strong influence on recruitment variability
  - Planktonic feeding conditions are likely important, but little is known about larval bluefin feeding ecology
- *Solutions:*
  - We have begun to look at gut contents and feeding preferences of larvae from the Gulf of Mexico, in collaboration with WHOI, and this year we will examine archival plankton samples from past years to determine the abundance of these prey items.
  - Larval feeding success and prey fields will be compared among years with good vs. poor recruitment
  - When combined with estimates of larval growth rates, we can investigate how environmental conditions drive larval survival and recruitment, and how these might have varied in the past several decades
- *What we need:*
  - Resources for lab work, to dissect and process larvae
  - Resources to examine archival zooplankton samples (available 1982, possibly earlier)



## Potential development of new indices: egg production

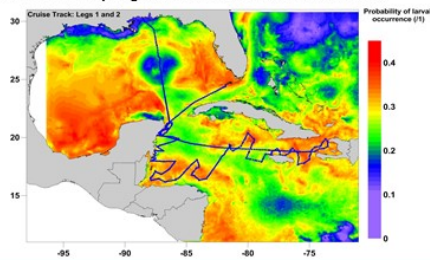
- *Issues:*
  - Larval growth and mortality contributes to variability in larval abundances, which adds error to estimates of spawning stock biomass from the larval survey
- *Solutions:*
  - A daily egg production model (DEPM) provides a much more direct estimate of spawning biomass
  - This could be developed for bluefin tuna using genetic techniques to identify eggs
- *What we need:*
  - Resources for genetic analyses to identify eggs, which are already collected during annual surveys



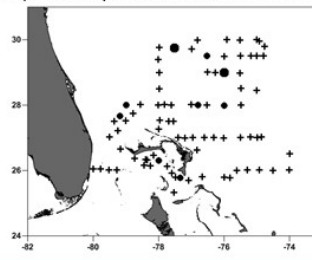
## Potential development of new indices: alternate spawning grounds

- *Issues:*
  - Sampling for larval bluefin tuna has traditionally been concentrated in the northern Gulf of Mexico
  - Limited sampling in the southwest Gulf, western Caribbean, and north of the Bahamas has collected small numbers of larvae
  - However, the importance of this spawning activity to the western stock is not known
- *Solutions:*
  - Additional sampling efforts in potential spawning grounds with greater spatiotemporal coverage
  - Genetic analyses to compare relationships between larvae from inside vs. outside the Gulf of Mexico
  - Backtracking and development of individual Based Models (IBMs) using hydrodynamic models estimate spawning locations of larvae caught
- *What we need:*
  - More ship time in the southwestern Gulf of Mexico, western Caribbean and western central Atlantic
  - Resources to sort collected samples, and to analyze collected larvae genetically
  - Resources to complete IBM and larval backtracking analyses

Cruise track and sampling stations: Bluefin tuna cruise 2011



Larval bluefin tuna (black dots) collected north of the Bahamas, 2013



## Areas where progress has been made since 2014 meeting of this Working Group:

Potential improvements to existing indices currently underway:

- Incorporating age and mortality estimates for larvae collected in different regions within the Gulf of Mexico

**This work is underway**

Potential new indices that might be developed:

- Develop an index of larval prey, feeding success and growth

**Study initiated on archived historical samples**

- Extend exploratory sampling efforts in the Caribbean Sea and western North Atlantic to determine the significance of alternative spawning grounds

**Sampled off Cuba and Mexico this year. Funding has not yet been identified for expansion into the Atlantic. There is likely a need for a larger NOAA ship with increased endurance for this work.**

