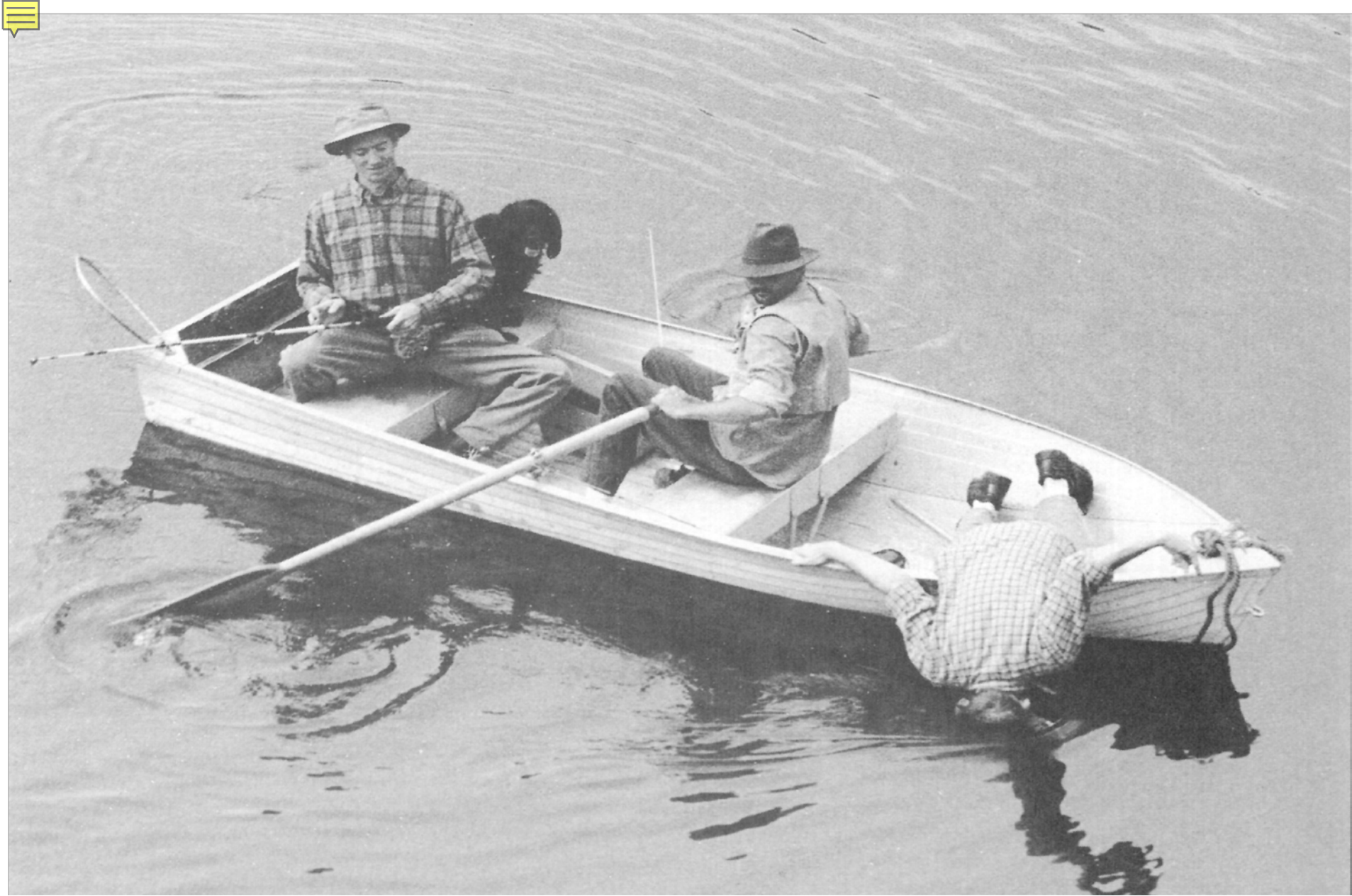




# Big Animals In an Ocean of Data

Randy Kochevar, *Senior Research Scientist*  
Oceans of Data Institute  
Education Development Center, Inc.

Presented at The Exploratorium  
From Data to Decisions: How Visualizations of Our Environment Inform Our Actions  
May 19, 2015

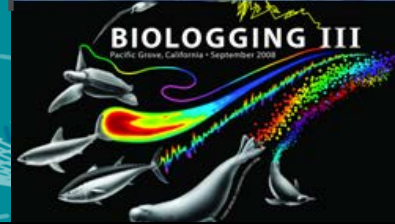
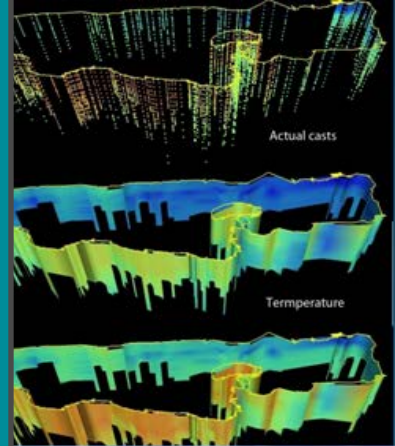
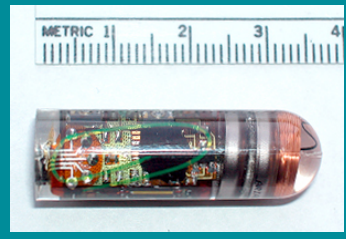




# TOPP Concept



# Electronic Tags



# What did we hope to accomplish?

Learn where animals go

Figure out better ways to follow them

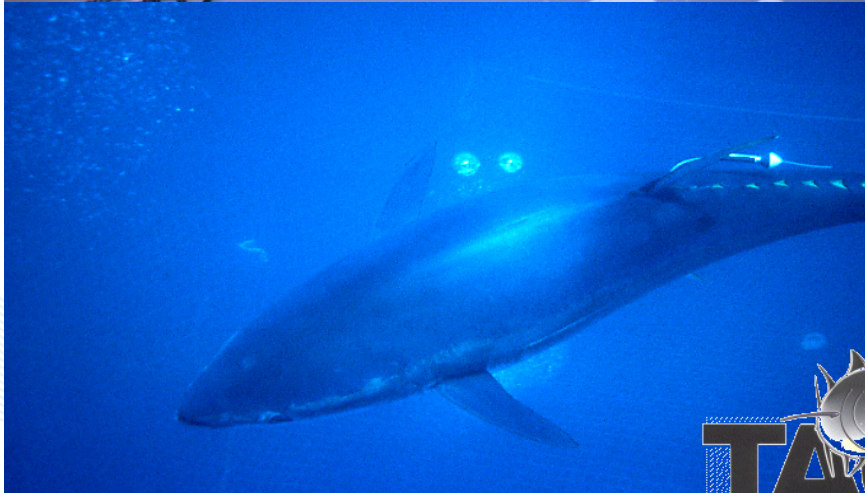
Learn how to predict where they'll go next

Use this information to help protect them

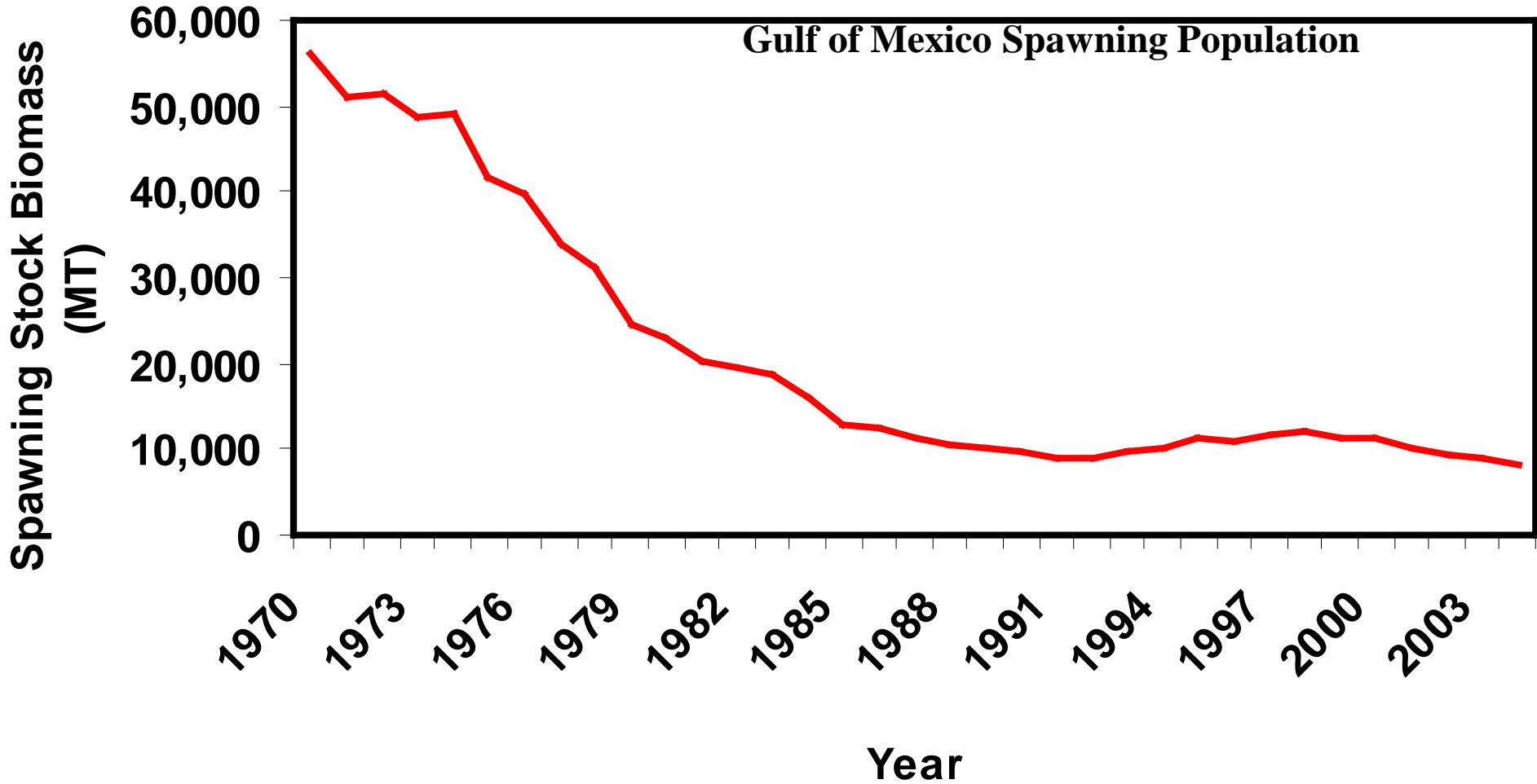


# TAG A GIANT CAMPAIGN 1996-2010

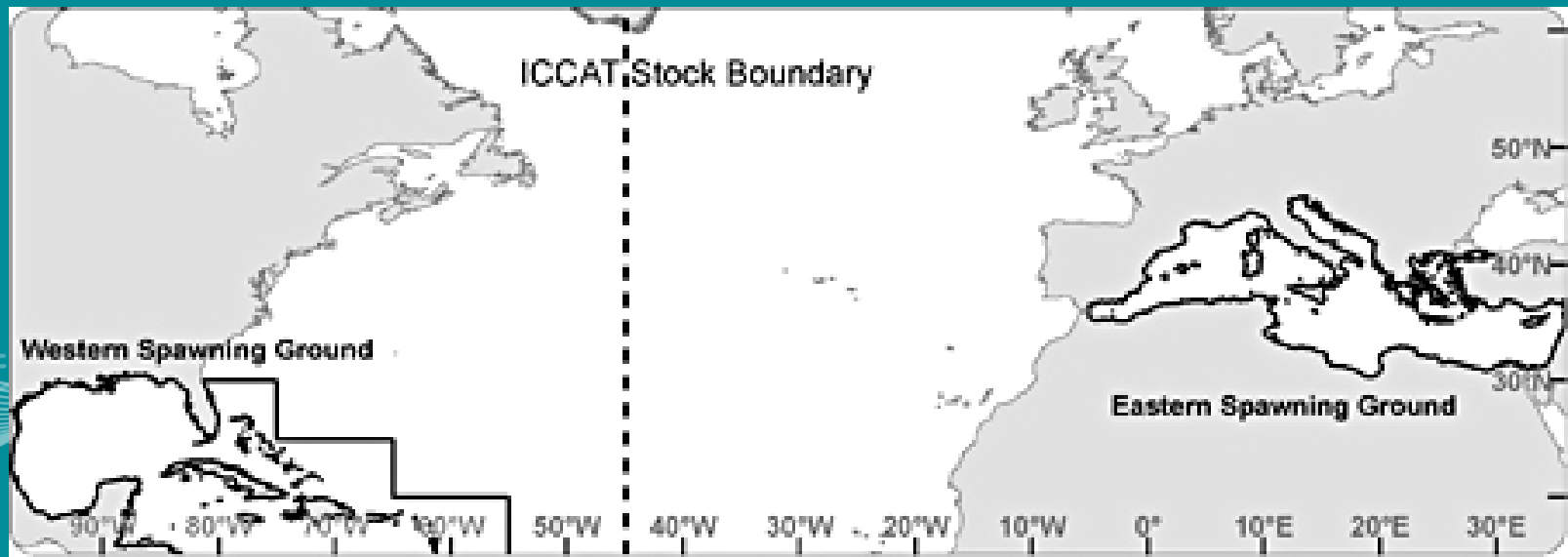
1050 Atlantic Giant Bluefin Tuna Tagged



# The Decline of West Atlantic Bluefin



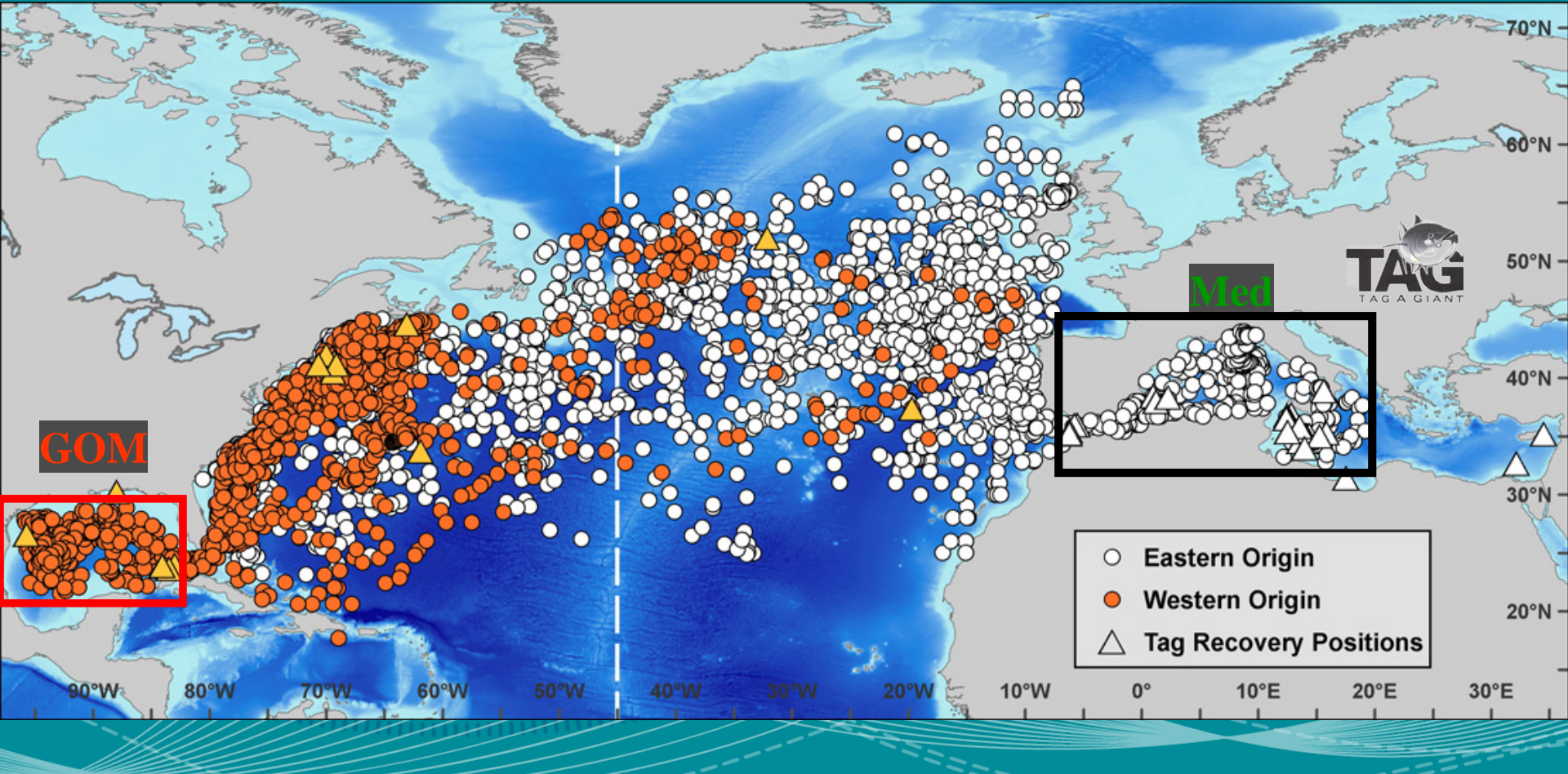
# ICCAT Atlantic Bluefin Tuna Management Boundary



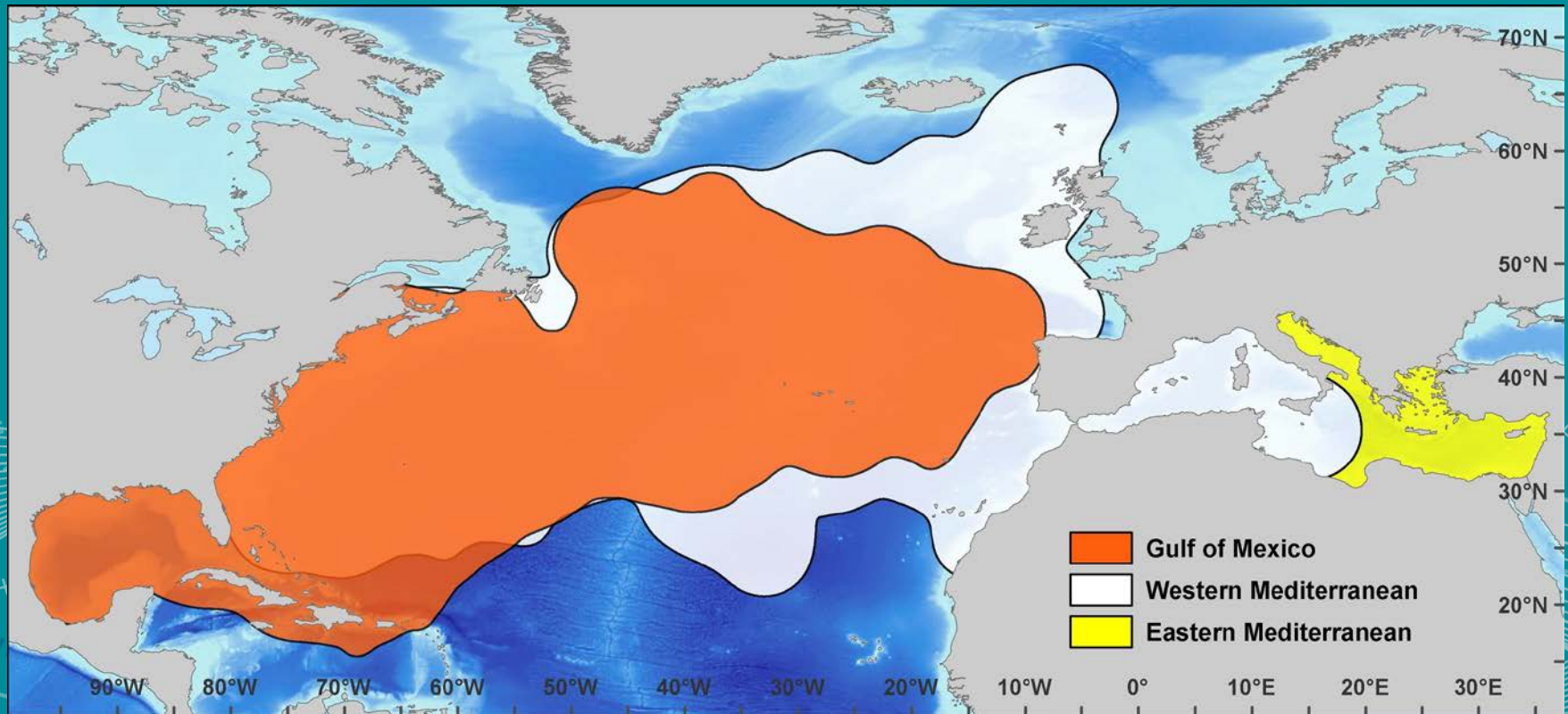


# Tagging Revealed Two Populations

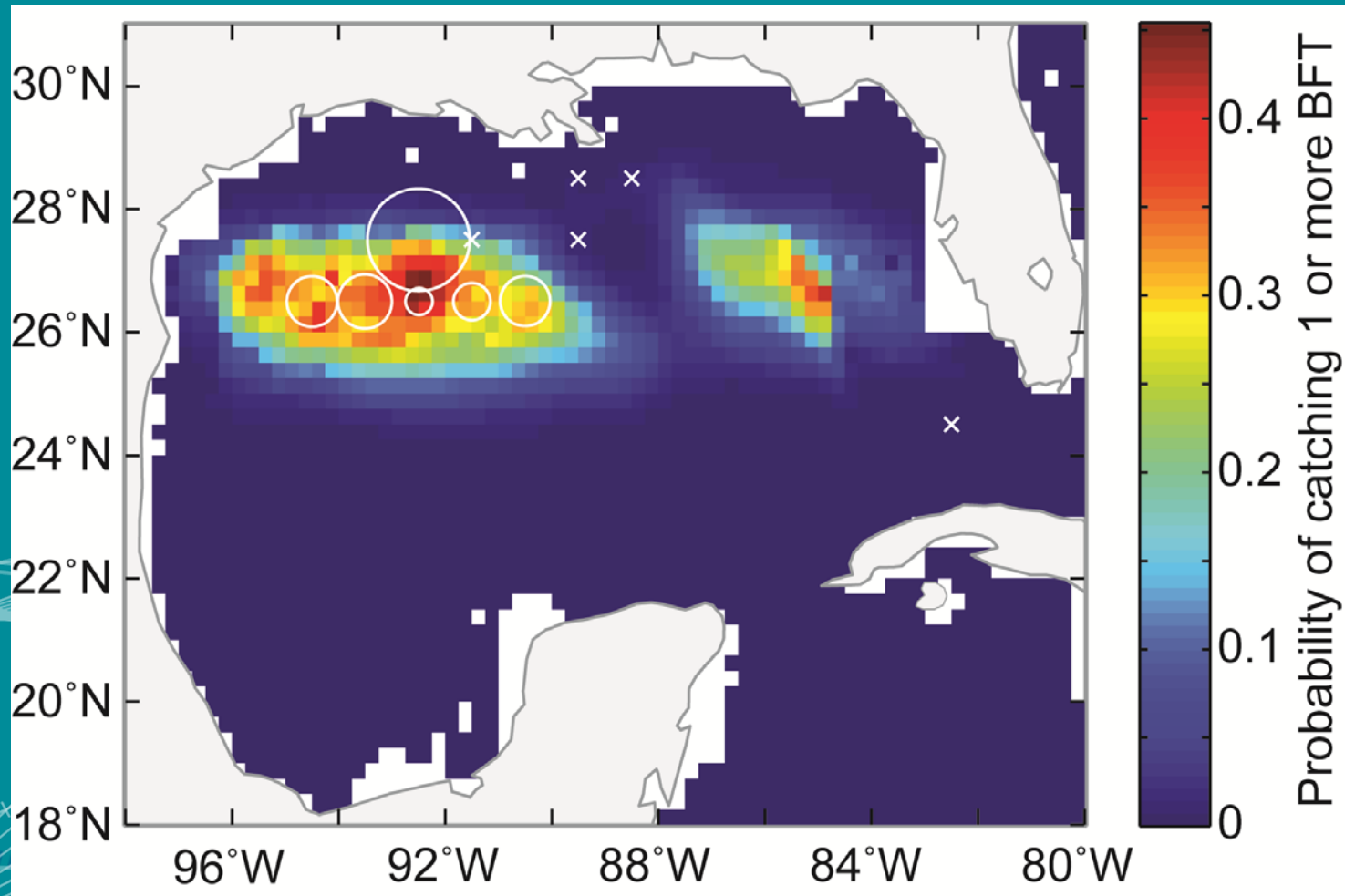
Only on Spawning Grounds Can you Find Single Stock



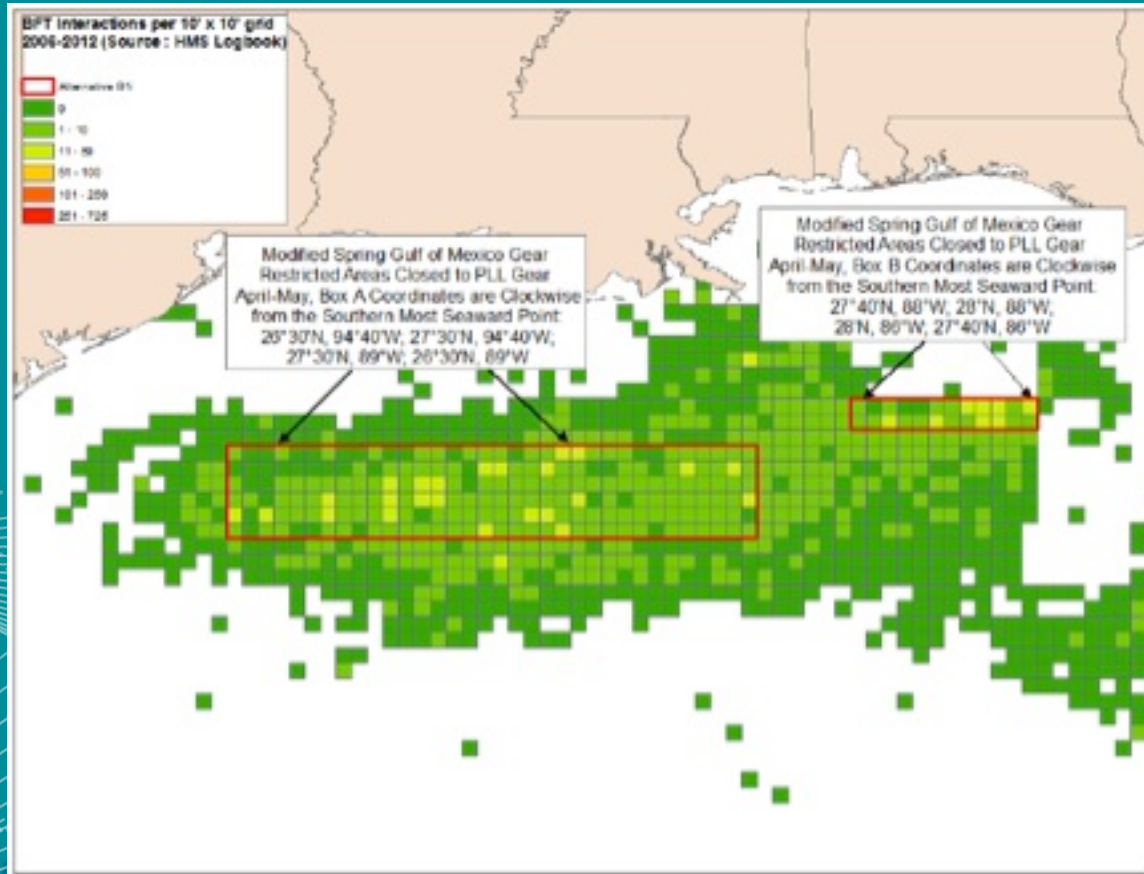
# Distribution of bluefin tuna in the Atlantic Ocean



# Gulf of Mexico breeding sites



# 2014 Closure

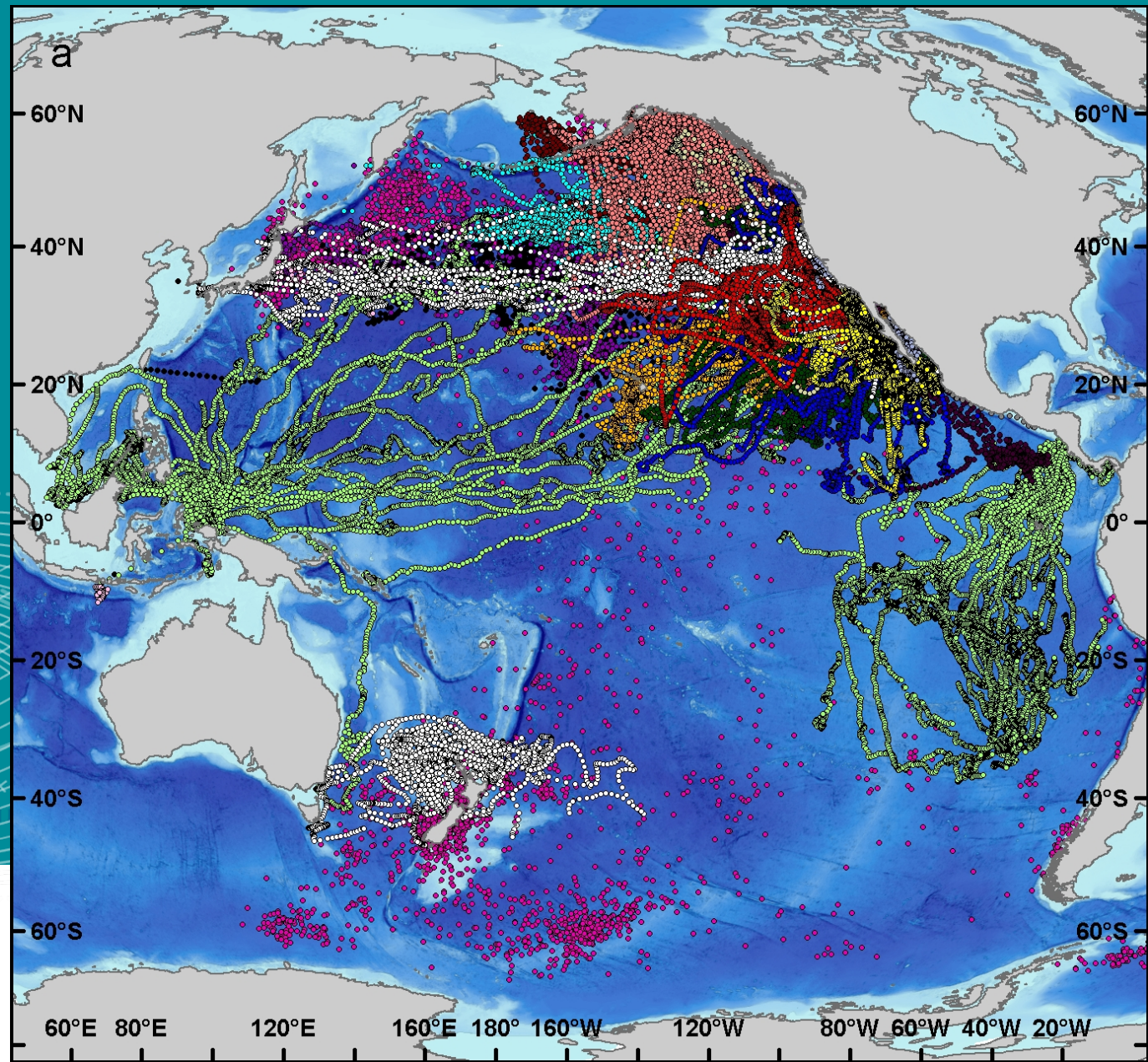


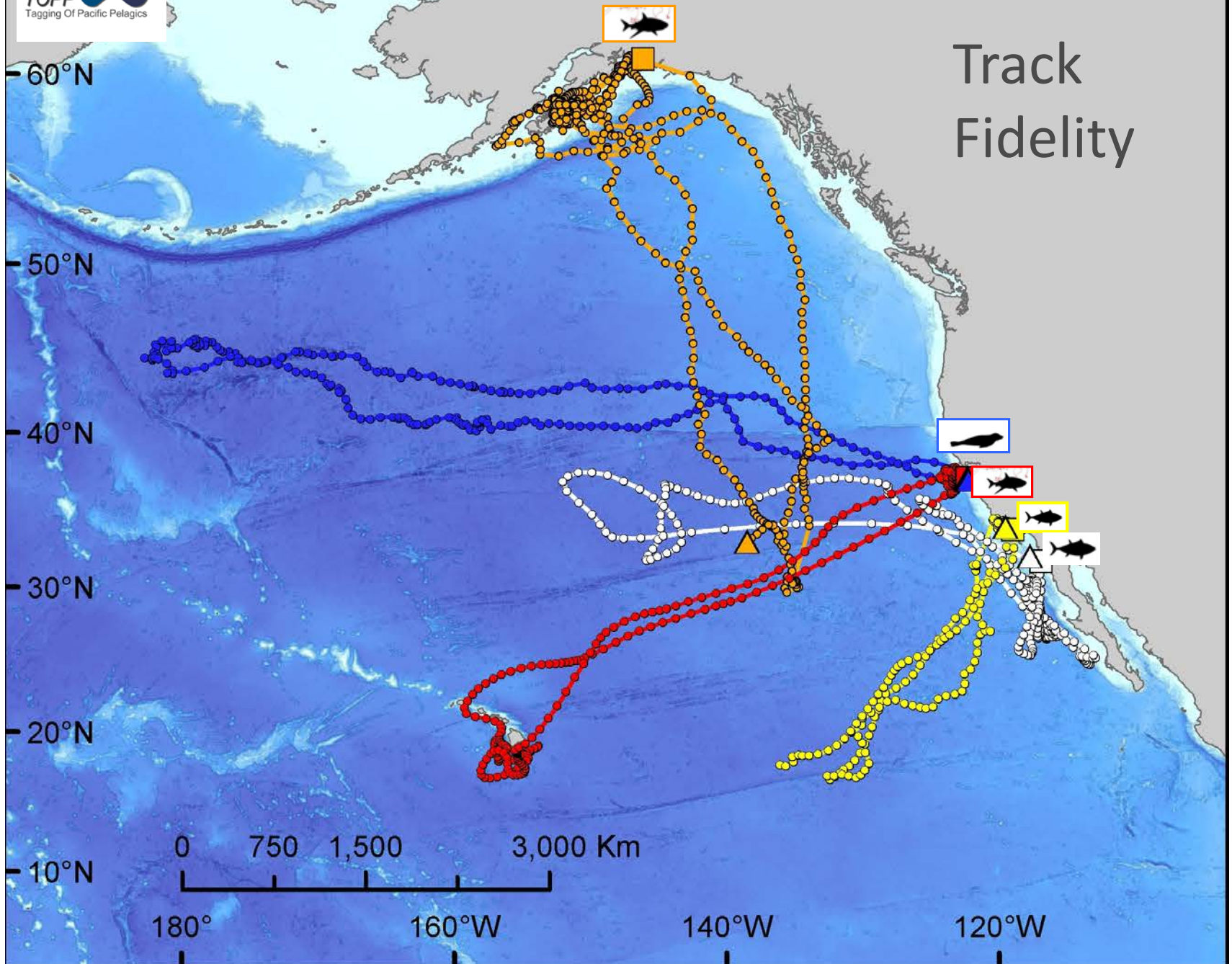
# A Decade of TOPP

23 species  
tagged

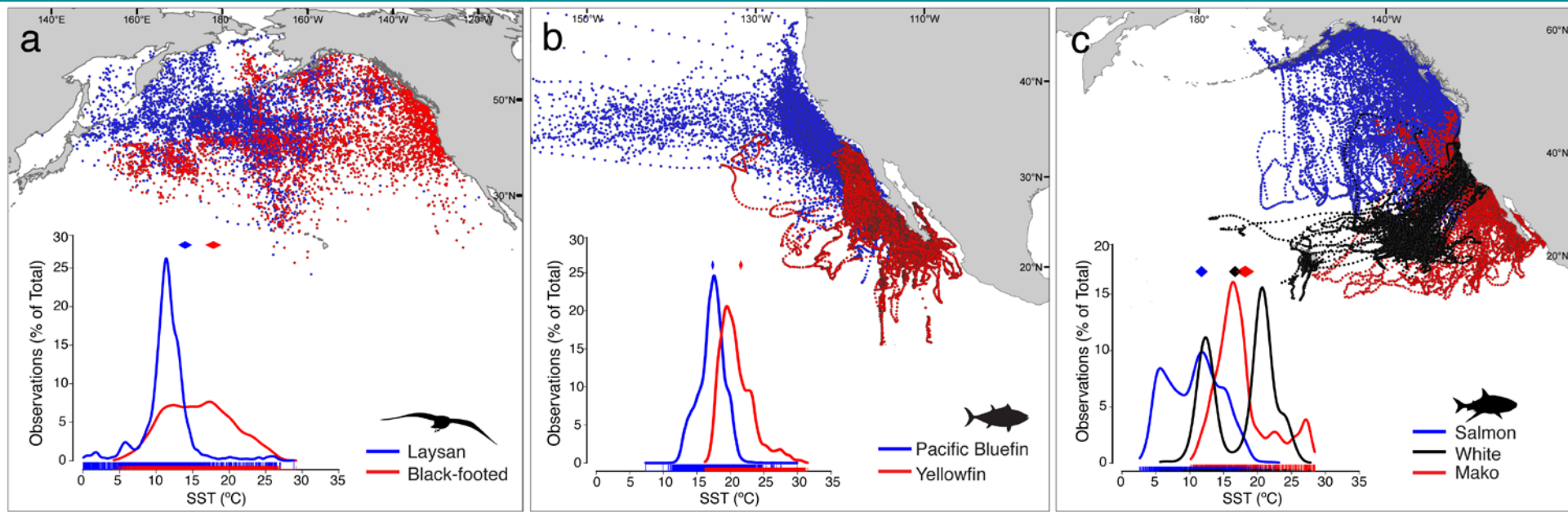
More than  
4,300 tags  
deployed

335,386  
track Days  
(and  
counting...)

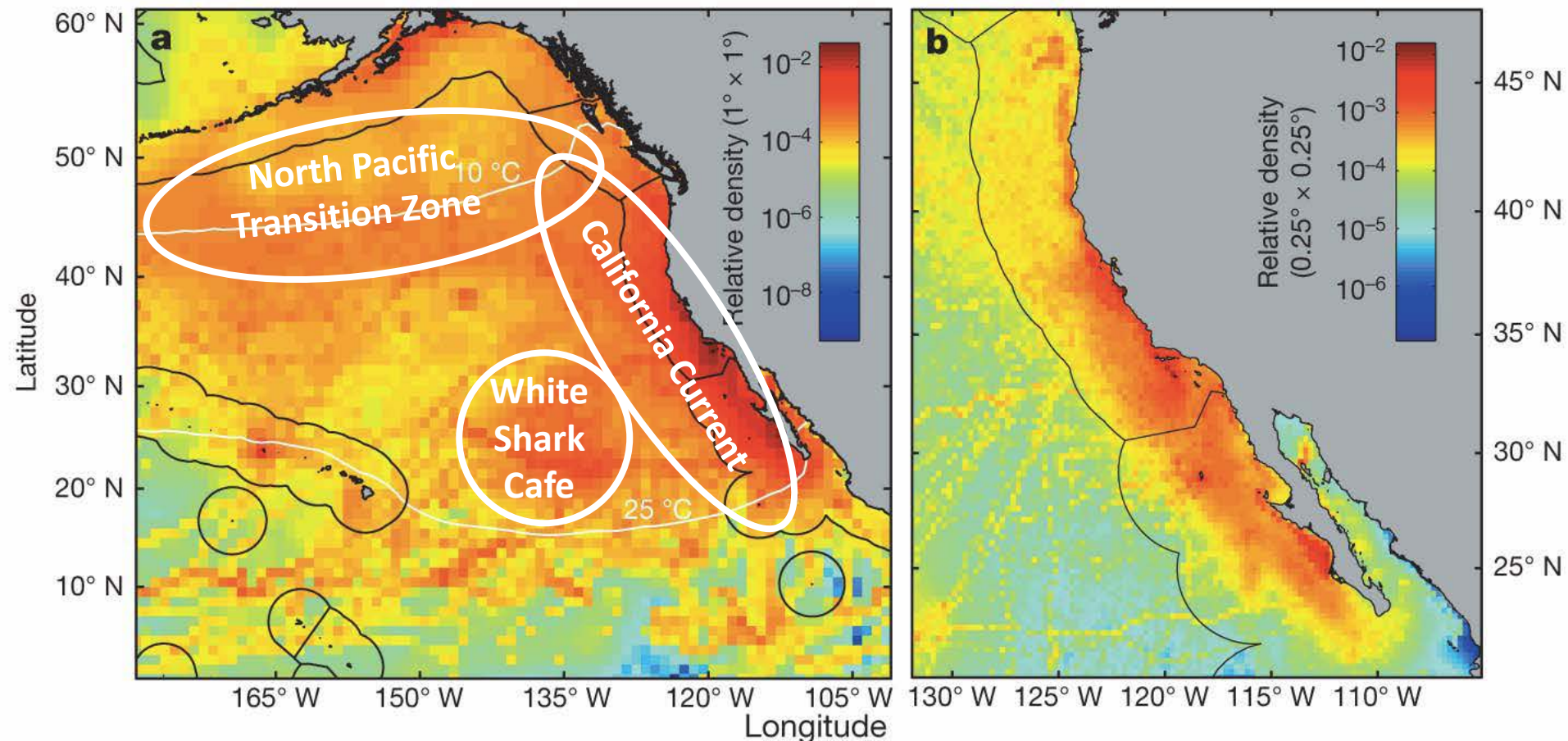




# We have begun to discern how closely related species use the ocean differently



# Biological Hot Spots of the Pacific Ocean



Where Predators (23 species)  
spend their time



# VR4 Global Active Detection of Acoustic Tags

From: vr4gservice@amirix.com  
To: bob.doiron@amirix.com, glen.robinson@amirix.com, bblock@stanford.edu,  
salvo@stanford.edu, tkchapple@ucdavis.edu, jjdale@stanford.edu,  
mrcastle@stanford.edu, alans@mola.stanford.edu,  
paulkanive@gmail.com, toleary@sonic.net, rhnixon@me.com  
Date: Thu, 03 Nov 2011 17:00:27 -0300  
Subject: VR4G-200056: Detected A69-1303-46111

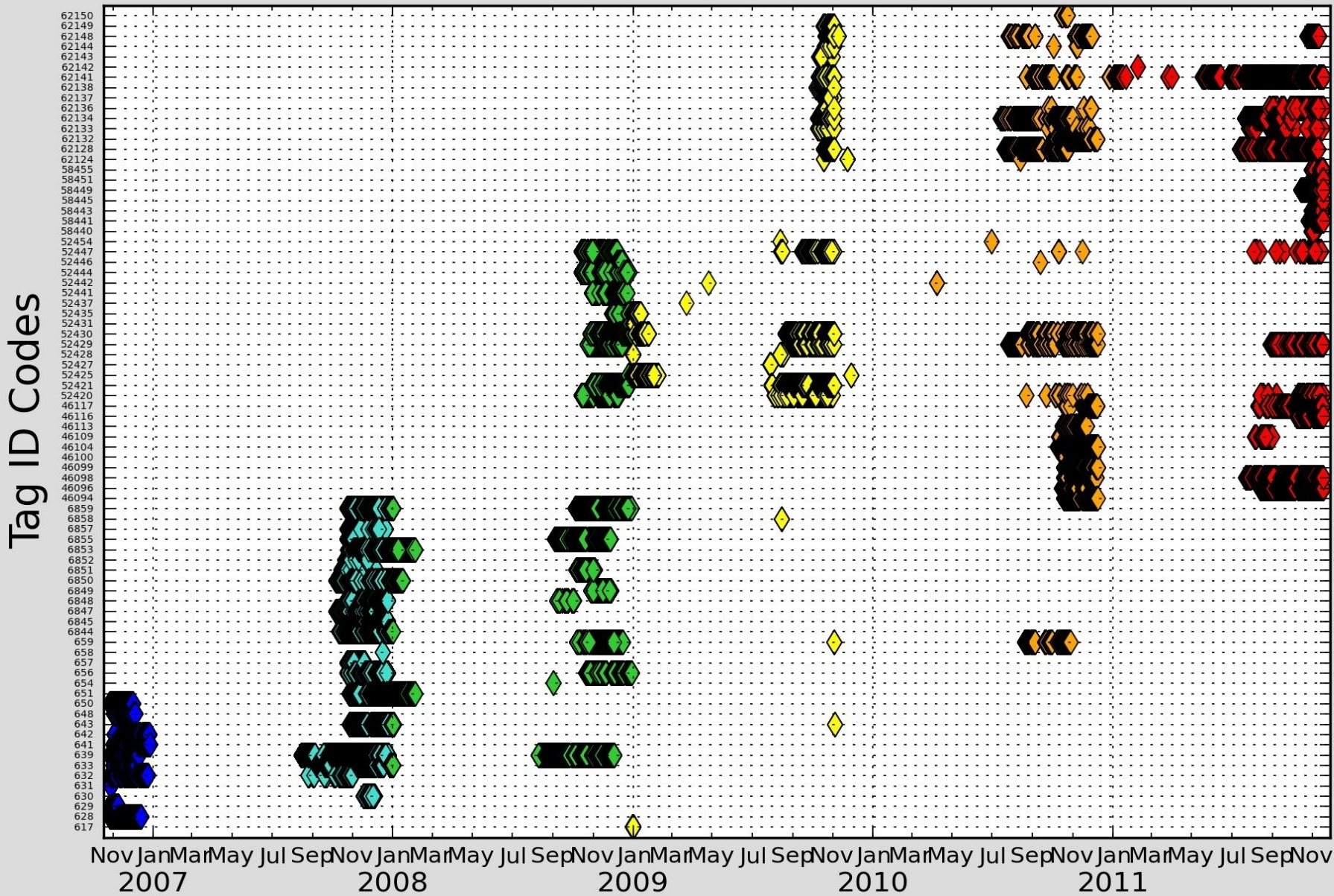
Tag ID: A69-1303-46111  
Time: 2011-11-03 19:59 +0000  
Notification ID: 849  
IMEI: 30-002501-021449-0

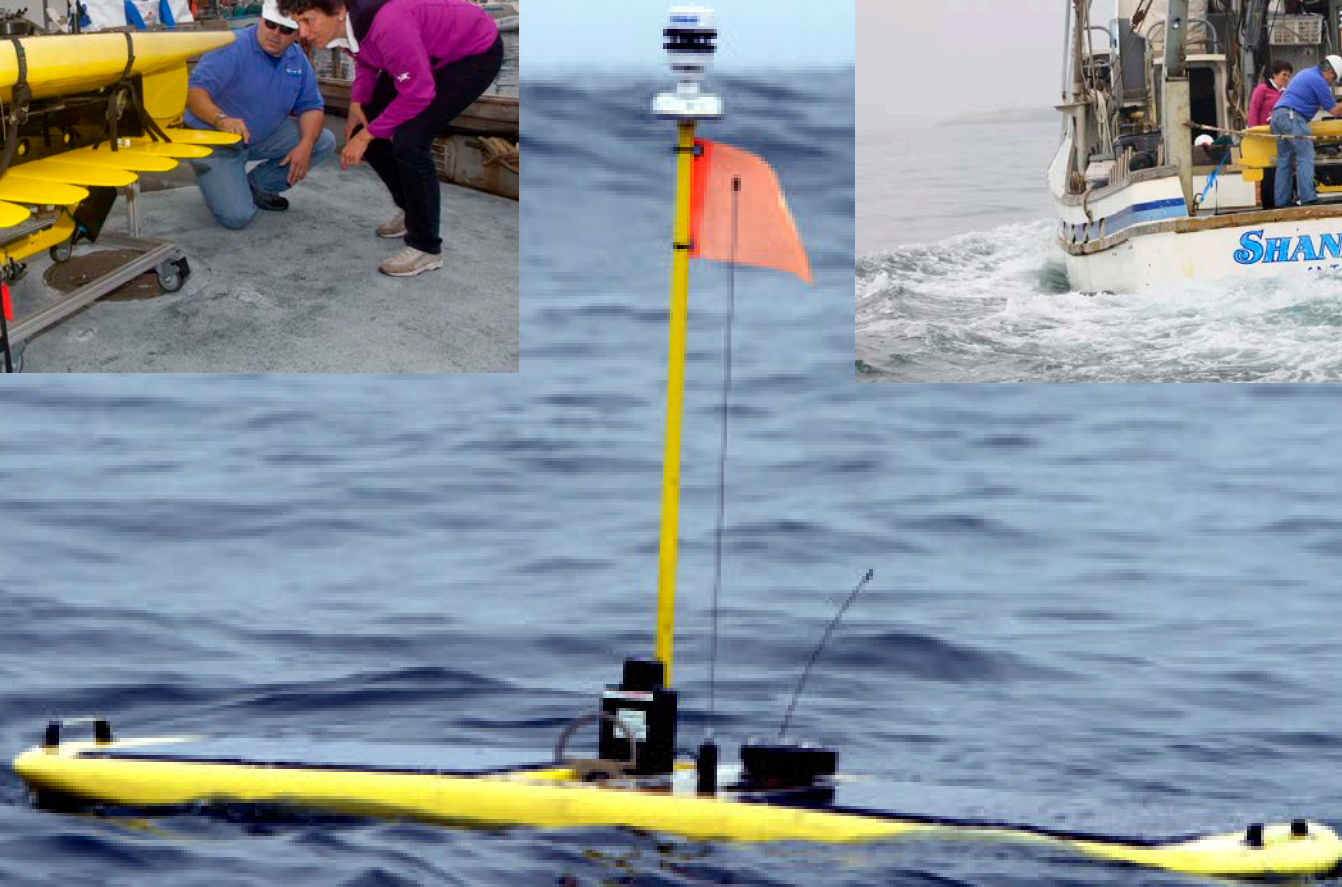
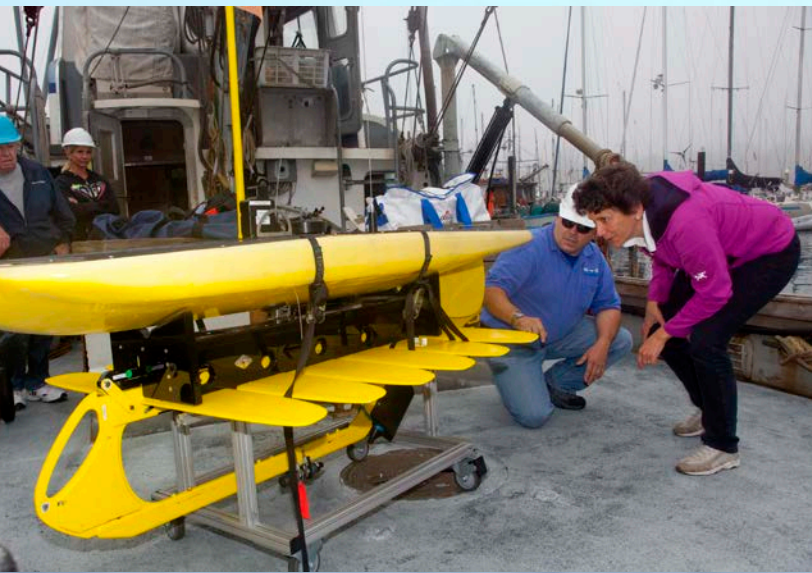


	A	B	C
1	Record ID	Date/Time	Correction
2	0601-2000	11/3/2011 15:12	
3	0601-2000	11/3/2011 15:47	
4	0601-2000	11/3/2011 16:34	
5	0601-2000	11/3/2011 16:50	
6	0601-2000	11/3/2011 16:56	
7	0601-2000	11/3/2011 17:05	
8	0601-2000	11/3/2011 17:07	
9	0601-2000	11/3/2011 17:14	
10	0601-2000	11/3/2011 17:22	
11	0601-2000	11/3/2011 17:22	
12	0601-2000	11/3/2011 17:27	
13	0601-2000	11/3/2011 17:33	
14	0601-2000	11/3/2011 17:33	
15	0601-2000	11/3/2011 17:34	
16	0601-2000	11/3/2011 17:36	
17	0601-2000	11/3/2011 17:52	
18	0601-2000	11/3/2011 17:55	
19	0601-2000	11/3/2011 17:58	
20	0601-2000	11/3/2011 18:15	
21	0601-2000	11/3/2011 18:16	
22	0601-2000	11/3/2011 18:17	
23	0601-2000	11/3/2011 18:20	
24	0601-2000	11/3/2011 18:54	
25	0601-2000	11/3/2011 18:56	
26	0601-2000	11/3/2011 18:58	
27	0601-2000	11/3/2011 19:00	
28	0601-2000	11/3/2011 19:01	
29	0601-2000	11/3/2011 19:04	
30	0601-2000	11/3/2011 19:07	
31	0601-2000	11/3/2011 19:11	
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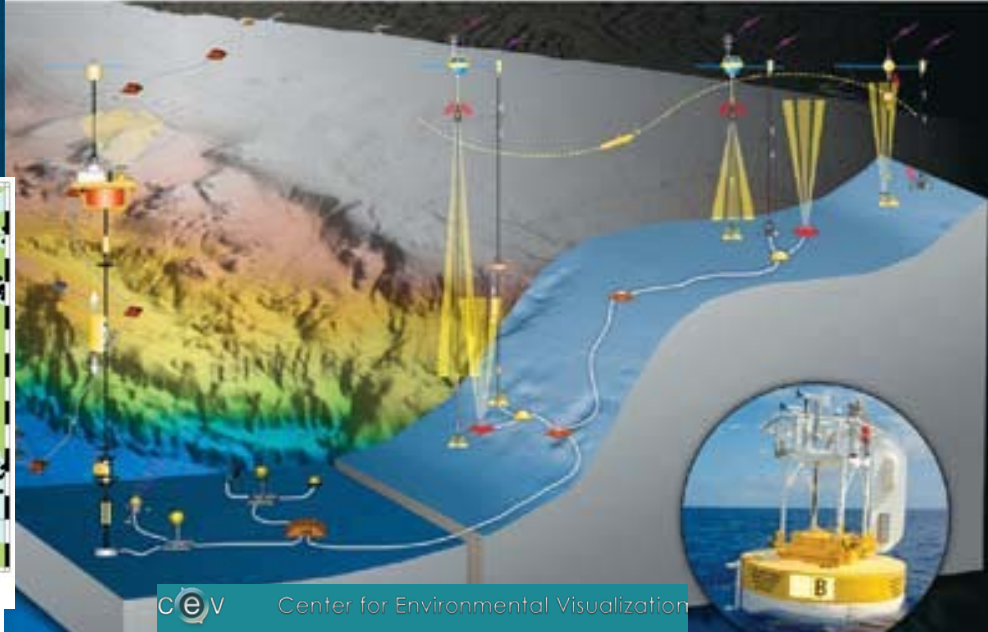
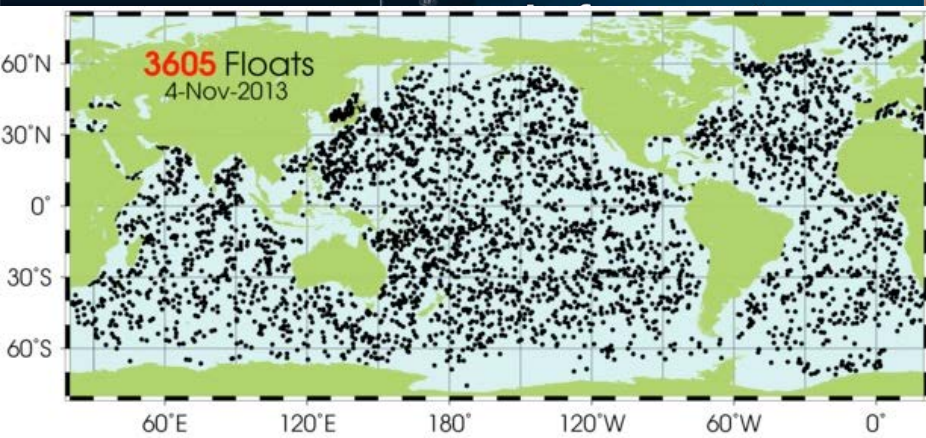
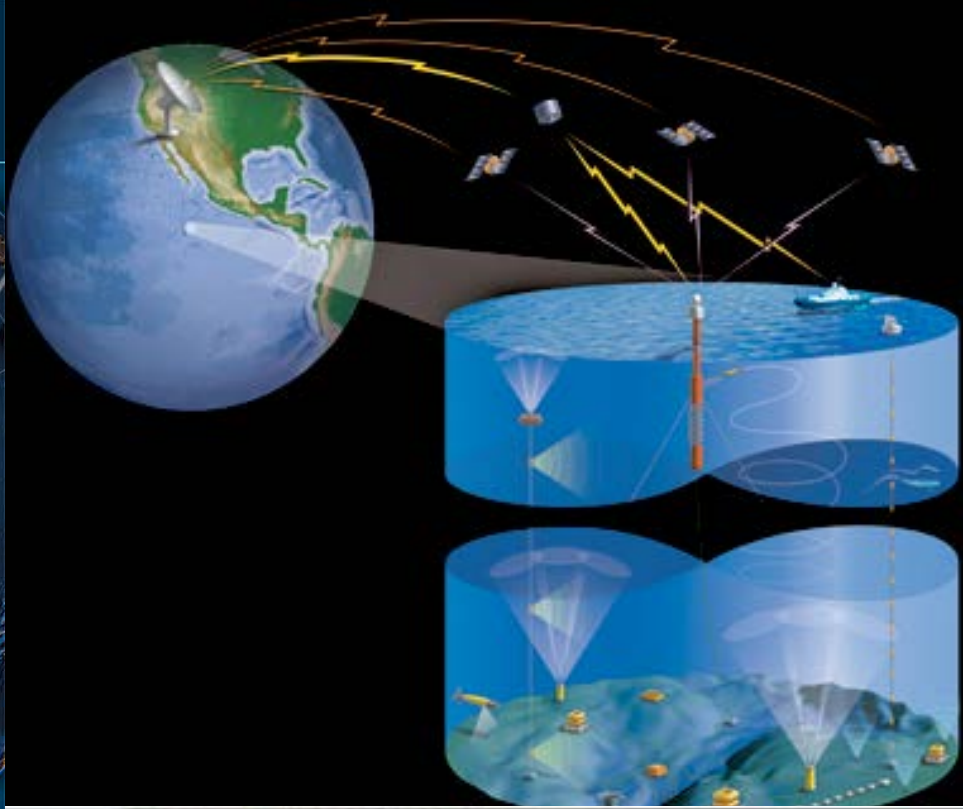
# Farallones Detections

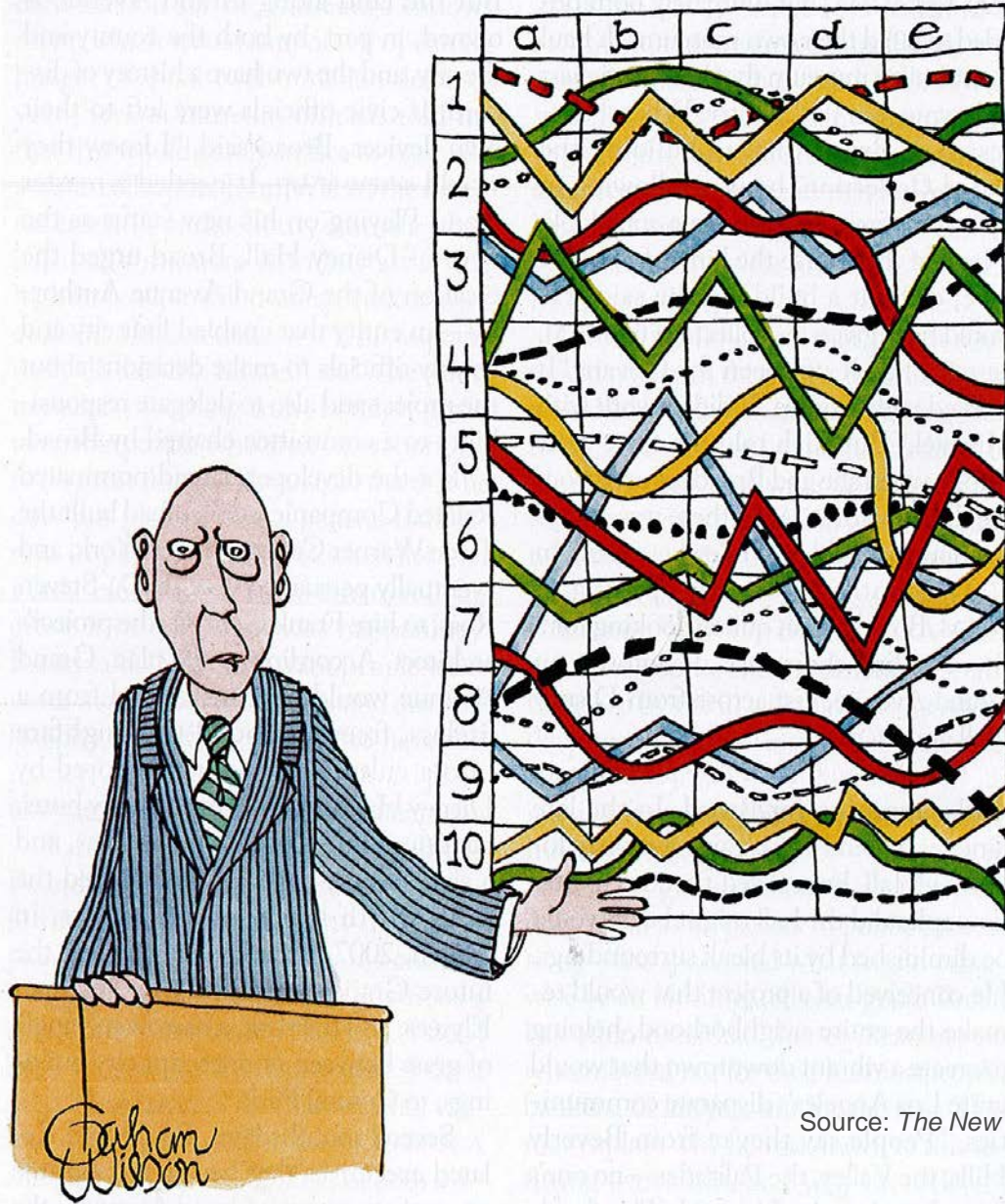




Liquid Robotics Wave Glider

# CYBER-INFRASTRUCTURE





Source: *The New Yorker*, December 6, 2010.

*"I'll pause for a moment so you can let this information sink in."*

*"I'll pause for a moment so you can let this information sink in."*

# Why the Oceans of Data Institute?

- Workforce imperative
- Educational imperative
- Social imperative



***“Decisions based on data and analytics will play an increasingly important role in business and society.”*** Davenport and Kim (Harvard Business School and KNDU Lab for Analytics Research), 2013

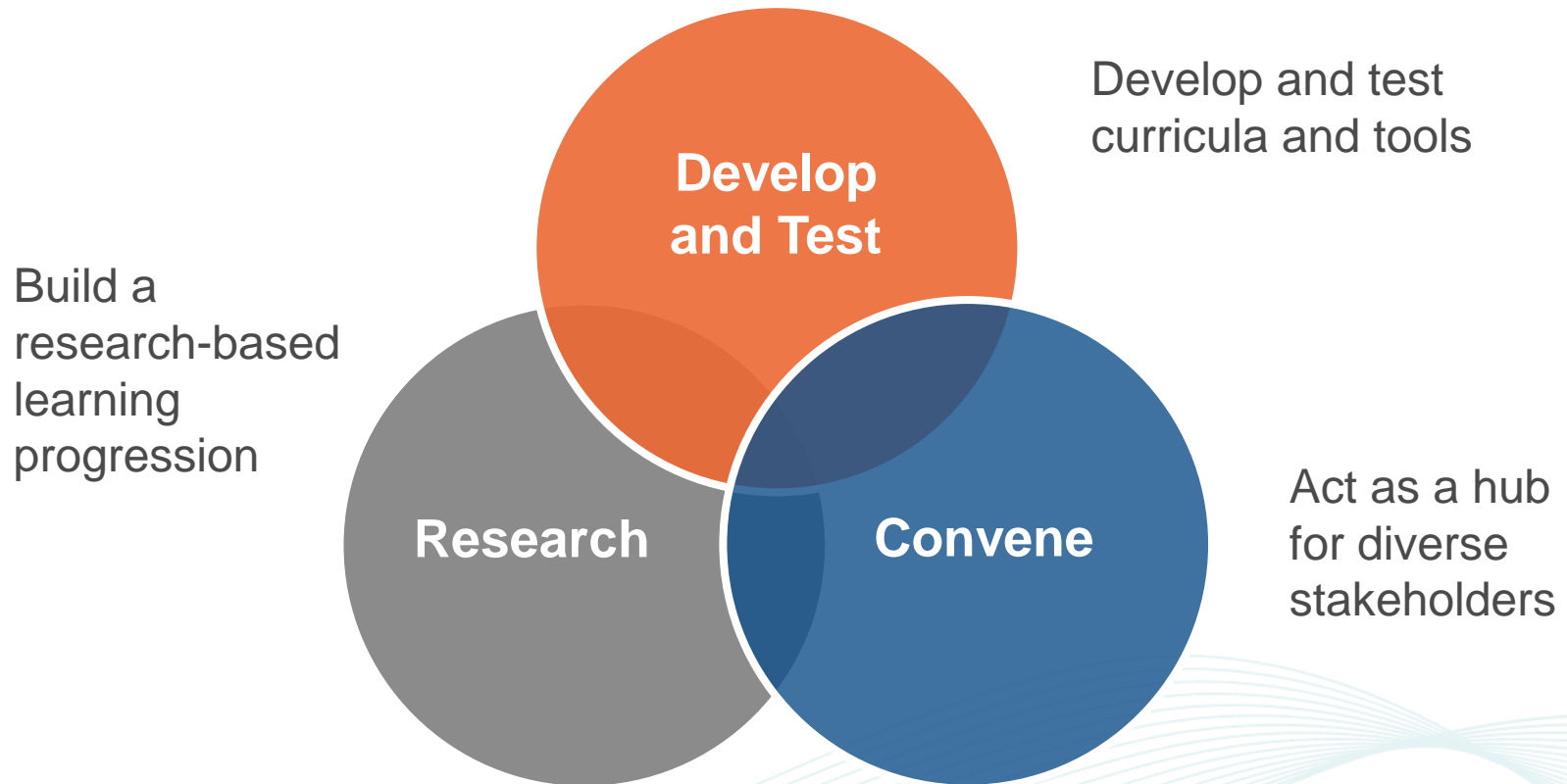
# Challenge: Most classroom experiences are with small, student-collected data sets.



Photo credit: *National Science Education Standards*



# Addressing the challenge: Oceans of Data Institute



Ocean Tracks x oceantracks.org

Tracks

Tools

My Maps

Library

Map data ©2013 Basarsoft, Google, MapLink, ORION-ME Imagery ©2013 NASA, TerraMetrics | Terms of Use

Plotted Value: Show Animal Movement: ▶

Depth **Speed** Curviness SST CHL

Active Track: **Elephant Seal 302**

6/11/2004 1/18/2005

Move Sliders to Set Plot Range Below

Speed(km/h)

Track Position Date

Average Value Over Plotted Range: **1.90km/h**

Add Measurements View Measurement Table

Map labels: Bering Sea, Gulf of Alaska, Canada, United States, Mexico, Gulf of California, North Pacific Ocean

- Get students quickly to the data
- Provide tools that allow students to interact with the data as scientists do

*Ocean Tracks: Investigating marine migrations in a changing ocean*

The *Oceans of Data Institute* aims to teach the next generation the art of discovering meaning in data, and to define and develop tools that engage students in data-intensive investigations.

