

## ATLANTIC BLUEFIN TUNA ELECTRONIC TAGGING DATA SUMMARY

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### SUMMARY

*A summary of currently available bluefin tuna electronic tagging data is provided to evaluate spatial coverage, sample sizes, and information gaps for the 2016 assessment. Data from 123 tagged bluefin tuna were compiled from databases submitted by four cooperating entities, including ICCAT GBYP, WWF Mediterranean, Canada Department of Fisheries and Oceans, and U.S. National Oceanic and Atmospheric Administration. Data are summarized by consecutive days at liberty per stock region per individual. Spatial coverage included 17 fish released in the Western Mediterranean Sea, 44 fish released near the Strait of Gibraltar, 17 fish released in the Bay of Biscay, 31 fish released in the Gulf of Mexico, nine fish released in the Gulf of St Lawrence, and five fish released in the West Atlantic. The available data represents a fraction of the electronic tags released on bluefin tuna in the Atlantic Ocean, and solicitation for additional collaboration is necessary to increase the temporal and spatial resolution of stock migration estimates.*

### RÉSUMÉ

*Un résumé des données de marquage électronique du thon rouge actuellement disponibles est fourni pour évaluer la couverture spatiale, la taille des échantillons et les lacunes en matière d'information pour l'évaluation de 2016. Les données provenant de 123 thons rouges marqués ont été compilées à partir de bases de données présentées par quatre entités coopérantes, y compris l'ICCAT-GBYP, WWF Méditerranée, le Ministère des Pêches et des Océans du Canada et la National Oceanic and Atmospheric Administration des États-Unis. Les données sont résumées par jours consécutifs en liberté par zone du stock et par spécimen. La couverture spatiale incluait 17 poissons remis à l'eau dans l'Ouest de la mer Méditerranée, 44 poissons remis à l'eau près du détroit de Gibraltar, 17 poissons remis à l'eau dans le golfe de Gascogne, 31 poissons remis à l'eau dans le golfe du Mexique, neuf poissons remis à l'eau dans le golfe du St-Laurent et cinq poissons remis à l'eau dans l'Atlantique Ouest. Les données disponibles représentent une fraction des marques électroniques déployées sur le thon rouge dans l'océan Atlantique, et il est nécessaire de solliciter une collaboration additionnelle afin d'augmenter la résolution spatiale et temporelle des estimations de la migration des stocks.*

### RESUMEN

*Se facilita un resumen de los datos de marcado electrónico de atún rojo actualmente disponibles para evaluar la cobertura espacial, los tamaños de muestra y las lagunas en la información para la evaluación de 2016. Se recopilaron los datos de 123 atunes rojos marcados de las bases de datos presentadas por cuatro entidades cooperantes, incluidas ICCAT GBYP, WWF Mediterráneo, Departamento de Pesca y Océanos de Canadá, y la Administración Nacional Oceánica y Atmosférica de Estados Unidos. Los datos se resumen por días consecutivos en libertad por región de stock y por ejemplar. La cobertura espacial incluía 17 peces liberados en el Mediterráneo occidental, 44 peces liberados cerca del estrecho de Gibraltar, 17 peces liberados en el golfo de Vizcaya, 31 peces liberados en el golfo de México, 9 peces liberados en el golfo de San Lorenzo y 5 peces liberados en el Atlántico occidental. Los datos disponibles representan una fracción de las marcas electrónicas colocadas en atunes rojos en el Atlántico y es necesario solicitar colaboración adicional para aumentar la resolución espacial y temporal de las estimaciones de la migración del stock.*

### KEYWORDS

*Atlantic bluefin tuna, satellite tags*

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## 1. Introduction

Information on stock mixing rates is essential for the development of a combined East-West stock assessment model for Atlantic bluefin tuna. Electronic tagging data provide detailed information on individual migration patterns and stock mixing rates. The bluefin tuna tagging workgroup (2015 Bluefin Data Preparatory Meeting) determined a minimum standard for submission of electronic tagging data from cooperating scientists, in preparation for the 2016 benchmark assessment. The minimum format requested was a summary of consecutive days at liberty per stock region per individual. To date, three cooperating entities have submitted data for the 2016 benchmark assessment, and include, ICCAT GBYP (GBYP), Canada Department of Fisheries and Oceans (DFO), and U.S. National Oceanic and Atmospheric Administration (NOAA). A summary of the submitted data is provided, along with the R script used to generate the data summaries from detailed track information on mean daily location in degree decimals latitude and longitude.

## 2. Materials and methods

A call for submission of bluefin tuna electronic tagging data was made during the 2015 data preparatory meeting. Three aforementioned entities submitted data. Stock region was assigned to each individual's daily location based on a mean latitude and longitude in decimal degrees. Eight stock regions were defined during the 2015 Bluefin Data Prep Meeting and modified to 11 regions during the Species Group Meeting, shown in **Figure 1**. The coordinates of each region's boundary are listed in **Table 1**. An R script was written (**Appendix A**) to assign the stock region and aggregate individual track data into consecutive days per stock region, which was the minimum data resolution requested by the SCRS, and was deemed an acceptable format for data sharing by each of the contributing scientists. The data were compiled into a single database. Additional summaries of tag releases per stock region, distribution of days at liberty, and size structure of tagged individuals in the West Atlantic are also provided to evaluate the spatial and temporal coverage of tagged bluefin tuna, and identify potential data gaps for the 2016 assessment.

## 3. Results and discussion

Electronic tag data for 123 bluefin tuna were compiled from three submitted databases (GBYP, DFO, and NOAA). The majority of fish were tagged and released in the Strait of Gibraltar (44 fish), Gulf of Mexico (31 fish), Western Mediterranean (17 fish) and Bay of Biscay (17 fish) (**Table 2**). The size of individuals ranged 190 to 240 cm straight fork length, with the majority of fish between 200 and 240 cm straight fork length at release (**Figure 2**). Tag duration ranged from 10 to 370 days; however, days at liberty greater than 150 days were uncommon (**Figure 3**). The compiled database (**Table 3**) provides all of the currently available electronic tagging data for the 2016 assessment, but represents a fraction of the electronic tags released on bluefin tuna in the Atlantic Ocean. Solicitation for additional collaboration is necessary to increase the temporal and spatial resolution of stock migration estimates, particularly between the East and West Atlantic regions.

**Table 1.** Atlantic bluefin tuna stock region boundary coordinates.

Gulf of Mexico																								
-80	-88	-95	-100	-100	-85	-80																		
20	20	17	20	35	35	25																		
Caribbean																								
-83	-75	-75	-65	-65	-55	-55	-70	-95	-88	-80	-80	-83												
30	30	25	25	20	20	0	0	17	20	20	25	30												
Gulf of St. Lawrence																								
-70	-70	-60	-55	-55																				
45	55	55	50	45																				
West Atlantic																								
-70	-55	-55	-65	-65	-75	-75	-83	-85	-70	-55	-55	-60	-70	-80	-100	-100	-45	-45	-30	-30	-25	-25	-70	
0	0	20	20	25	25	30	30	35	45	45	50	55	55	50	60	80	80	10	10	5	5	-50	-50	
North Central Atlantic																								
-30	-45	-45	-30																					
40	40	80	80																					
South Central Atlantic																								
-30	-45	-45	-30																					
10	10	40	40																					
North East Atlantic																								
-30	45	45	15	15	-15	-15	-30	-30																
80	80	50	50	60	60	50	50	80																
East Atlantic																								
-30	-30	-15	-15	15	15	5	-5																	
40	50	50	60	60	50	50	40																	
South East Atlantic																								
-30	-30	-5	-5	20	20	-25	-25	-30																
10	40	40	30	30	-50	-50	5	5																
West Mediterranean																								
-5	-5	5	23	23																				
30	40	50	50	30																				
East Mediterranean																								
23	45	45	23																					
50	50	30	30																					

**Table 2.** Electronic tag releases by stock region.

<i>Stock_Region</i>	<i>Bluefin tuna electronic tag releases</i>
Gulf of Mexico	31
Gulf of St Lawrence	9
West Atlantic	5
Central Atlantic	0
East Atlantic (Bay of Biscay)	17
Northeast Atlantic	0
East Atl/West Med (Strait of Gibraltar)	44
West Mediterranean	17
East Mediterranean	0

**Table 3.** Atlantic bluefin tuna electronic tagging summarized data submitted by cooperating scientists.

<i>Investigator</i>	<i>Tag_ID</i>	<i>Species</i>	<i>Length_cm</i>	<i>Weight_kg</i>	<i>Stock_Area</i>	<i>Start_Date</i>	<i>End_Date</i>	<i>Days/Area</i>
ICCAT_GBYP	120088	BFT	265	NA	SE_ATL	5/16/2012	6/20/2012	36
ICCAT_GBYP	120081	BFT	203	NA	SE_ATL	5/16/2012	5/19/2012	4
ICCAT_GBYP	120081	BFT	203	NA	W_MED	5/20/2012	6/20/2012	32
ICCAT_GBYP	120084	BFT	238	NA	SE_ATL	5/16/2012	6/24/2012	40
ICCAT_GBYP	120086	BFT	206	NA	SE_ATL	5/16/2012	5/18/2012	3
ICCAT_GBYP	120086	BFT	206	NA	W_MED	5/19/2012	6/21/2012	34
ICCAT_GBYP	120089	BFT	241	NA	SE_ATL	5/16/2012	6/1/2012	17
ICCAT_GBYP	120087	BFT	NA	260	SE_ATL	5/16/2012	5/18/2012	3
ICCAT_GBYP	120087	BFT	NA	260	W_MED	5/19/2012	6/1/2012	14
ICCAT_GBYP	120085	BFT	NA	190	SE_ATL	5/16/2012	5/19/2012	4
ICCAT_GBYP	120085	BFT	NA	190	W_MED	5/20/2012	5/29/2012	10
ICCAT_GBYP	120091	BFT	126	NA	SE_ATL	10/13/2012	10/13/2012	1
ICCAT_GBYP	120091	BFT	126	NA	W_MED	10/14/2012	11/11/2012	29
ICCAT_GBYP	120092	BFT	126	NA	SE_ATL	10/13/2012	10/13/2012	1
ICCAT_GBYP	120092	BFT	126	NA	W_MED	10/14/2012	12/10/2012	58
ICCAT_GBYP	120092	BFT	126	NA	SE_ATL	12/11/2012	3/9/2013	89
ICCAT_GBYP	120092	BFT	126	NA	W_MED	3/10/2013	3/15/2013	6
ICCAT_GBYP	120092	BFT	126	NA	SE_ATL	3/16/2013	3/17/2013	2
ICCAT_GBYP	120092	BFT	126	NA	W_MED	3/18/2013	3/22/2013	5
ICCAT_GBYP	120093	BFT	124	NA	SE_ATL	11/14/2012	11/14/2012	1
ICCAT_GBYP	120093	BFT	124	NA	W_MED	11/15/2012	8/16/2013	275
ICCAT_GBYP	120094	BFT	124	NA	SE_ATL	11/10/2012	11/11/2012	2
ICCAT_GBYP	120094	BFT	124	NA	W_MED	11/12/2012	11/16/2012	5
ICCAT_GBYP	120094	BFT	124	NA	SE_ATL	11/17/2012	2/6/2013	82
ICCAT_GBYP	120094	BFT	124	NA	W_MED	2/7/2013	4/17/2013	70
ICCAT_GBYP	120094	BFT	124	NA	SE_ATL	4/18/2013	4/20/2013	3
ICCAT_GBYP	120094	BFT	124	NA	W_MED	4/21/2013	6/26/2013	67
ICCAT_GBYP	120095	BFT	96	NA	W_MED	10/1/2012	1/30/2013	122
ICCAT_GBYP	120096	BFT	115	NA	SE_ATL	10/31/2012	11/15/2012	16
ICCAT_GBYP	120097	BFT	102	NA	W_MED	10/2/2012	5/28/2013	239
ICCAT_GBYP	120100	BFT	94	NA	SE_ATL	10/14/2012	10/14/2012	1

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<i>Investigator</i>	<i>Tag_ID</i>	<i>Species</i>	<i>Length_cm</i>	<i>Weight_kg</i>	<i>Stock_Area</i>	<i>Start_Date</i>	<i>End_Date</i>	<i>Days/Area</i>
ICCAT_GBYP	120100	BFT	94	NA	W_MED	10/15/2012	12/13/2012	60
ICCAT_GBYP	120103	BFT	129	NA	SE_ATL	10/20/2012	10/20/2012	1
ICCAT_GBYP	120103	BFT	129	NA	W_MED	10/21/2012	5/6/2013	198
ICCAT_GBYP	120105	BFT	124	NA	SE_ATL	10/13/2012	10/13/2012	1
ICCAT_GBYP	120105	BFT	124	NA	W_MED	10/14/2012	10/30/2012	17
ICCAT_GBYP	120105	BFT	124	NA	SE_ATL	10/31/2012	11/12/2012	13
ICCAT_GBYP	120105	BFT	124	NA	W_MED	11/13/2012	11/21/2012	9
ICCAT_GBYP	120107	BFT	99	NA	SE_ATL	11/9/2012	11/9/2012	1
ICCAT_GBYP	120107	BFT	99	NA	W_MED	11/10/2012	5/3/2013	175
ICCAT_GBYP	120108	BFT	115	NA	SE_ATL	10/21/2012	5/12/2013	204
ICCAT_GBYP	120108	BFT	115	NA	W_MED	5/13/2013	5/20/2013	8
ICCAT_GBYP	120109	BFT	107	NA	SE_ATL	10/12/2012	10/12/2012	1
ICCAT_GBYP	120109	BFT	107	NA	W_MED	10/13/2012	12/26/2012	75
ICCAT_GBYP	120109	BFT	107	NA	SE_ATL	12/27/2012	5/4/2013	129
ICCAT_GBYP	120109	BFT	107	NA	W_MED	5/5/2013	5/8/2013	4
ICCAT_GBYP	120110	BFT	105	NA	SE_ATL	10/14/2012	10/14/2012	1
ICCAT_GBYP	120110	BFT	105	NA	W_MED	10/15/2012	6/25/2013	254
ICCAT_GBYP	120111	BFT	113	NA	SE_ATL	10/12/2012	10/12/2012	1
ICCAT_GBYP	120111	BFT	113	NA	W_MED	10/13/2012	12/31/2012	80
ICCAT_GBYP	120112	BFT	99	NA	W_MED	10/2/2012	12/16/2012	76
ICCAT_GBYP	120113	BFT	94	NA	W_MED	10/8/2012	12/24/2012	78
ICCAT_GBYP	120114	BFT	108	NA	E_ATL	8/18/1912	9/19/2012	33
ICCAT_GBYP	120115	BFT	105	NA	E_ATL	8/18/2012	12/21/2012	126
ICCAT_GBYP	120116	BFT	105	NA	E_ATL	8/18/2012	11/11/2012	86
ICCAT_GBYP	120117	BFT	105	NA	E_ATL	8/7/2012	9/28/2012	53
ICCAT_GBYP	120118	BFT	105	NA	E_ATL	8/18/2012	9/24/2012	38
ICCAT_GBYP	120119	BFT	105	NA	E_ATL	8/18/2012	10/7/2012	51
ICCAT_GBYP	120119	BFT	105	NA	W_MED	10/8/2012	10/8/2012	1
ICCAT_GBYP	120119	BFT	105	NA	E_ATL	10/9/2012	10/11/2012	3
ICCAT_GBYP	120121	BFT	107	NA	E_ATL	8/7/2012	1/13/2013	160
ICCAT_GBYP	120121	BFT	107	NA	SE_ATL	1/14/2013	2/10/2013	28
ICCAT_GBYP	120121	BFT	107	NA	E_ATL	2/11/2013	7/4/2013	144
ICCAT_GBYP	120121	BFT	107	NA	SE_ATL	7/5/2013	7/22/2013	18
ICCAT_GBYP	120121	BFT	107	NA	E_ATL	7/23/2013	7/31/2013	9
ICCAT_GBYP	120121	BFT	107	NA	SE_ATL	8/1/2013	8/2/2013	2
ICCAT_GBYP	120123	BFT	105	NA	E_ATL	8/18/2012	10/1/2012	45
ICCAT_GBYP	120126	BFT	106	NA	E_ATL	8/18/2012	12/12/2012	117
ICCAT_GBYP	120125	BFT	107	NA	E_ATL	8/18/2012	10/19/2012	63
ICCAT_GBYP	120127	BFT	101	NA	SE_ATL	10/13/2012	10/13/2012	1
ICCAT_GBYP	120127	BFT	101	NA	W_MED	10/14/2012	11/15/2012	33
ICCAT_GBYP	120127	BFT	101	NA	SE_ATL	11/16/2012	3/19/2013	124
ICCAT_GBYP	120127	BFT	101	NA	W_MED	3/20/2013	6/10/2013	83
ICCAT_GBYP	120128	BFT	127	NA	SE_ATL	10/16/2012	10/16/2012	1
ICCAT_GBYP	120128	BFT	127	NA	W_MED	10/17/2012	12/3/2012	48

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<i>Investigator</i>	<i>Tag_ID</i>	<i>Species</i>	<i>Length_cm</i>	<i>Weight_kg</i>	<i>Stock_Area</i>	<i>Start_Date</i>	<i>End_Date</i>	<i>Days/Area</i>
ICCAT_GBYP	120128	BFT	127	NA	SE_ATL	12/4/2012	1/15/2013	43
ICCAT_GBYP	130543	BFT	245	NA	SE_ATL	5/20/2013	6/11/2013	23
ICCAT_GBYP	130543	BFT	245	NA	W_MED	6/12/2013	7/17/2013	36
ICCAT_GBYP	130543	BFT	245	NA	SE_ATL	7/18/2013	7/18/2013	1
ICCAT_GBYP	130545	BFT	232	NA	SE_ATL	5/20/2013	6/2/2013	14
ICCAT_GBYP	130546	BFT	240	NA	SE_ATL	5/20/2013	7/17/2013	59
ICCAT_GBYP	130546	BFT	240	NA	E_ATL	7/18/2013	7/26/2013	9
ICCAT_GBYP	130546	BFT	240	NA	NE_ATL	7/27/2013	7/29/2013	3
ICCAT_GBYP	130546	BFT	240	NA	E_ATL	7/30/2013	10/7/2013	70
ICCAT_GBYP	130547	BFT	235	NA	SE_ATL	5/20/2013	6/19/2013	31
ICCAT_GBYP	130547	BFT	235	NA	E_ATL	6/20/2013	7/6/2013	17
ICCAT_GBYP	130547	BFT	235	NA	NE_ATL	7/7/2013	7/24/2013	18
ICCAT_GBYP	130548	BFT	227	NA	SE_ATL	5/20/2013	6/2/2013	14
ICCAT_GBYP	130548	BFT	227	NA	W_MED	6/3/2013	6/13/2013	11
ICCAT_GBYP	130548	BFT	227	NA	SE_ATL	6/14/2013	7/1/2013	18
ICCAT_GBYP	130550	BFT	240	NA	SE_ATL	5/21/2013	5/21/2013	1
ICCAT_GBYP	130550	BFT	240	NA	W_MED	5/22/2013	7/3/2013	43
ICCAT_GBYP	130550	BFT	240	NA	SE_ATL	7/4/2013	7/19/2013	16
ICCAT_GBYP	130551	BFT	212	NA	SE_ATL	5/21/2013	5/22/2013	2
ICCAT_GBYP	130551	BFT	212	NA	W_MED	5/23/2013	9/6/2013	107
ICCAT_GBYP	130552	BFT	220	NA	SE_ATL	5/21/2013	5/27/2013	7
ICCAT_GBYP	130552	BFT	220	NA	W_MED	5/28/2013	6/1/2013	5
ICCAT_GBYP	130553	BFT	105	NA	W_MED	7/11/2013	11/2/2013	115
ICCAT_GBYP	130554	BFT	105	NA	W_MED	7/11/2013	9/25/2013	77
ICCAT_GBYP	130555	BFT	103	NA	W_MED	7/11/2013	9/1/2013	53
ICCAT_GBYP	130556	BFT	102	NA	W_MED	7/11/2013	1/3/2014	177
ICCAT_GBYP	130558	BFT	100	NA	W_MED	7/11/2013	9/14/2013	66
ICCAT_GBYP	130560	BFT	122	NA	SE_ATL	10/13/2013	10/14/2013	2
ICCAT_GBYP	130560	BFT	122	NA	W_MED	10/15/2013	12/19/2013	66
ICCAT_GBYP	130560	BFT	122	NA	SE_ATL	12/20/2013	12/20/2013	1
ICCAT_GBYP	130561	BFT	59	NA	E_ATL	7/26/2013	10/29/2013	96
ICCAT_GBYP	130562	BFT	60	NA	E_ATL	7/26/2013	9/6/2013	43
ICCAT_GBYP	130563	BFT	60	NA	E_ATL	7/26/2013	10/10/2013	77
ICCAT_GBYP	130564	BFT	56	NA	E_ATL	7/26/2013	9/4/2013	41
ICCAT_GBYP	130565	BFT	63	NA	E_ATL	7/26/2013	8/31/2013	37
ICCAT_GBYP	130566	BFT	100	NA	E_ATL	7/26/2013	9/10/2013	47
ICCAT_GBYP	130567	BFT	98	NA	E_ATL	7/26/2013	9/22/2013	59
ICCAT_GBYP	130569	BFT	118	NA	SE_ATL	9/30/2013	10/1/2013	2
ICCAT_GBYP	130569	BFT	118	NA	W_MED	10/2/2013	1/4/2014	95
ICCAT_GBYP	130568	BFT	114	NA	SE_ATL	9/24/2013	9/26/2013	3
ICCAT_GBYP	130568	BFT	114	NA	W_MED	9/27/2013	10/3/2013	7
ICCAT_GBYP	130568	BFT	114	NA	SE_ATL	10/4/2013	10/31/2013	28
ICCAT_GBYP	130568	BFT	114	NA	W_MED	11/1/2013	12/11/2013	41
ICCAT_GBYP	130568	BFT	114	NA	SE_ATL	12/12/2013	4/17/2014	127

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ICCAT_GBYP	130568	BFT	114	NA	W_MED	4/18/2014	4/30/2014	13
ICCAT_GBYP	130570	BFT	121	NA	SE_ATL	9/24/2013	9/24/2013	1
ICCAT_GBYP	130570	BFT	121	NA	W_MED	9/25/2013	11/2/2013	39
ICCAT_GBYP	130570	BFT	121	NA	SE_ATL	11/3/2013	6/10/2014	220
ICCAT_GBYP	130570	BFT	121	NA	W_MED	6/11/2014	7/4/2014	24
ICCAT_GBYP	130570	BFT	121	NA	SE_ATL	7/5/2014	8/27/2014	54
ICCAT_GBYP	130572	BFT	124	NA	SE_ATL	10/4/2013	10/4/2013	1
ICCAT_GBYP	130572	BFT	124	NA	W_MED	10/5/2013	4/22/2014	200
WWF	97466	BFT	260	NA	SE_ATL	5/26/2011	7/19/2011	55
WWF	97462	BFT	210	NA	SE_ATL	5/27/2011	5/29/2011	3
WWF	97462	BFT	210	NA	W_MED	5/30/2011	7/22/2011	54
WWF	97462	BFT	210	NA	SE_ATL	7/23/2011	8/8/2011	17
WWF	97462	BFT	210	NA	E_ATL	8/9/2011	10/14/2011	67
WWF	97462	BFT	210	NA	NE_ATL	10/15/2011	10/25/2011	11
WWF	97462	BFT	210	NA	E_ATL	10/26/2011	11/18/2011	24
WWF	97462	BFT	210	NA	NE_ATL	11/19/2011	11/27/2011	9
WWF	97462	BFT	210	NA	E_ATL	11/28/2011	12/11/2011	14
WWF	97462	BFT	210	NA	NC_ATL	12/12/2011	1/2/2012	22
WWF	97462	BFT	210	NA	E_ATL	1/3/2012	1/10/2012	8
WWF	97462	BFT	210	NA	NE_ATL	1/11/2012	1/23/2012	13
WWF	97462	BFT	210	NA	E_ATL	1/24/2012	2/9/2012	17
WWF	97462	BFT	210	NA	SE_ATL	2/10/2012	2/10/2012	1
WWF	97462	BFT	210	NA	E_ATL	2/11/2012	2/11/2012	1
WWF	97462	BFT	210	NA	SE_ATL	2/12/2012	3/22/2012	40
WWF	86243	BFT	237	NA	SE_ATL	5/27/2011	7/18/2011	53
WWF	114009	BFT	254	NA	SE_ATL	5/16/2012	10/18/2012	156
WWF	114009	BFT	254	NA	E_ATL	10/19/2012	10/30/2012	12
WWF	114009	BFT	254	NA	SE_ATL	10/31/2012	11/9/2012	10
WWF	114009	BFT	254	NA	E_ATL	11/10/2012	11/10/2012	1
WWF	114009	BFT	254	NA	NC_ATL	11/11/2012	11/24/2012	14
WWF	114009	BFT	254	NA	SC_ATL	11/25/2012	12/30/2012	36
WWF	114009	BFT	254	NA	SE_ATL	12/31/2012	1/19/2013	20
WWF	114007	BFT	247	NA	SE_ATL	5/16/2012	5/16/2012	1
WWF	114007	BFT	247	NA	W_MED	5/17/2012	7/13/2012	58
WWF	114007	BFT	247	NA	SE_ATL	7/14/2012	9/2/2012	51
WWF	114007	BFT	247	NA	E_ATL	9/3/2012	9/17/2012	15
WWF	66694	BFT	251	NA	SE_ATL	5/14/2012	5/17/2012	4
WWF	66694	BFT	251	NA	W_MED	5/18/2012	6/5/2012	19
WWF	118756	BFT	243	NA	SE_ATL	5/16/2012	6/20/2012	36
WWF	118756	BFT	243	NA	E_ATL	6/21/2012	9/8/2012	80
WWF	118756	BFT	243	NA	NC_ATL	9/9/2012	9/13/2012	5
WWF	118756	BFT	243	NA	E_ATL	9/14/2012	9/14/2012	1
WWF	118756	BFT	243	NA	NC_ATL	9/15/2012	9/17/2012	3
WWF	118756	BFT	243	NA	SC_ATL	9/18/2012	10/4/2012	17

**Table 3.** Atlantic bluefin tuna electronic tagging summarized data submitted by cooperating scientists.

<i>Investigator</i>	<i>Tag_ID</i>	<i>Species</i>	<i>Length_cm</i>	<i>Weight_kg</i>	<i>Stock_Area</i>	<i>Start_Date</i>	<i>End_Date</i>	<i>Days/Area</i>
WWF	118756	BFT	243	NA	SE_ATL	10/5/2012	10/6/2012	2
WWF	118756	BFT	243	NA	E_ATL	10/7/2012	10/8/2012	2
WWF	118756	BFT	243	NA	NC_ATL	10/9/2012	10/13/2012	5
WWF	118756	BFT	243	NA	SC_ATL	10/14/2012	10/17/2012	4
WWF	118756	BFT	243	NA	NC_ATL	10/18/2012	10/22/2012	5
WWF	118756	BFT	243	NA	SC_ATL	10/23/2012	12/18/2012	57
WWF	118756	BFT	243	NA	NC_ATL	12/19/2012	12/21/2012	3
WWF	118756	BFT	243	NA	E_ATL	12/22/2012	1/19/2013	29
WWF	118758	BFT	246	NA	SE_ATL	5/14/2012	6/14/2012	32
WWF	86238E	BFT	NA	65	SE_ATL	5/14/2012	5/17/2012	4
WWF	86238E	BFT	NA	65	W_MED	5/18/2012	7/9/2012	53
WWF	86238E	BFT	NA	65	SE_ATL	7/10/2012	7/17/2012	8
WWF	86238E	BFT	NA	65	E_ATL	7/18/2012	8/10/2012	24
WWF	86238E	BFT	NA	65	NE_ATL	8/11/2012	8/16/2012	6
WWF	114008	BFT	NA	250	SE_ATL	5/15/2012	7/23/2012	70
WWF	114008	BFT	NA	250	SC_ATL	7/24/2012	7/31/2012	8
WWF	114006	BFT	NA	250	SE_ATL	5/14/2012	5/16/2012	3
WWF	114006	BFT	NA	250	W_MED	5/17/2012	7/13/2012	58
WWF	114006	BFT	NA	250	SE_ATL	7/14/2012	9/8/2012	57
WWF	114006	BFT	NA	250	E_ATL	9/9/2012	9/26/2012	18
WWF	86235C	BFT	NA	250	SE_ATL	5/14/2012	5/16/2012	3
WWF	86235C	BFT	NA	250	W_MED	5/17/2012	6/2/2012	17
WWF	118755	BFT	NA	250	SE_ATL	5/16/2012	5/17/2012	2
WWF	118755	BFT	NA	250	W_MED	5/18/2012	7/14/2012	58
WWF	118755	BFT	NA	250	SE_ATL	7/15/2012	7/21/2012	7
WWF	118755	BFT	NA	250	E_ATL	7/22/2012	10/15/2012	86
WWF	118755	BFT	NA	250	NE_ATL	10/16/2012	10/24/2012	9
WWF	118760	BFT	230	NA	SE_ATL	5/25/2013	5/25/2013	1
WWF	118760	BFT	230	NA	W_MED	5/26/2013	7/19/2013	55
WWF	118760	BFT	230	NA	SE_ATL	7/20/2013	7/26/2013	7
WWF	118760	BFT	230	NA	E_ATL	7/27/2013	8/10/2013	15
WWF	118760	BFT	230	NA	NE_ATL	8/11/2013	9/10/2013	31
WWF	118760	BFT	230	NA	NC_ATL	9/11/2013	10/8/2013	28
WWF	118760	BFT	230	NA	W_ATL	10/9/2013	10/14/2013	6
WWF	120447	BFT	242	NA	W_MED	5/21/2013	6/11/2013	22
WWF	118758B	BFT	246	NA	SE_ATL	5/21/2013	5/27/2013	7
WWF	118758B	BFT	246	NA	W_MED	5/28/2013	6/19/2013	23
WWF	118758B	BFT	246	NA	SE_ATL	6/20/2013	6/29/2013	10
WWF	120446	BFT	260	NA	SE_ATL	5/21/2013	5/21/2013	1
WWF	120446	BFT	260	NA	W_MED	5/22/2013	7/15/2013	55
WWF	120446	BFT	260	NA	SE_ATL	7/16/2013	7/23/2013	8
WWF	120446	BFT	260	NA	E_ATL	7/24/2013	9/6/2013	45
NOAA	GOM_2010_001	BFT	240	200	GOM	5/13/2010	6/7/2010	26
NOAA	GOM_2010_001	BFT	240	200	CAR	6/8/2010	6/14/2010	7



**Table 3.** Atlantic bluefin tuna electronic tagging summarized data submitted by cooperating scientists.

<i>Investigator</i>	<i>Tag_ID</i>	<i>Species</i>	<i>Length_cm</i>	<i>Weight_kg</i>	<i>Stock_Area</i>	<i>Start_Date</i>	<i>End_Date</i>	<i>Days/Area</i>
NOAA	GOM_2010_001	BFT	240	200	W_ATL	6/15/2010	8/11/2010	58
NOAA	GOM_2010_002	BFT	260	360	GOM	5/22/2010	6/12/2010	22
NOAA	GOM_2010_002	BFT	260	360	CAR	6/13/2010	6/20/2010	8
NOAA	GOM_2010_002	BFT	260	360	W_ATL	6/21/2010	7/21/2010	31
NOAA	GOM_2010_002	BFT	260	360	GSL	7/22/2010	8/20/2010	30
NOAA	GOM_2010_004	BFT	250	340	GOM	5/22/2010	6/9/2010	19
NOAA	GOM_2010_004	BFT	250	340	CAR	6/10/2010	6/13/2010	4
NOAA	GOM_2010_004	BFT	250	340	W_ATL	6/14/2010	8/20/2010	68
NOAA	GOM_2010_005	BFT	260	360	GOM	5/22/2010	6/5/2010	15
NOAA	GOM_2010_005	BFT	260	360	CAR	6/6/2010	6/7/2010	2
NOAA	GOM_2010_005	BFT	260	360	W_ATL	6/8/2010	8/21/2010	75
NOAA	GOM_2012_02	BFT	240	225	GOM	3/2/2012	4/26/2012	56
NOAA	GOM_2012_04	BFT	240	225	GOM	5/25/2012	6/3/2012	10
NOAA	GOM_2012_04	BFT	240	225	CAR	6/4/2012	6/7/2012	4
NOAA	GOM_2012_04	BFT	240	225	W_ATL	6/8/2012	8/14/2012	68
NOAA	GOM_2012_06	BFT	195	NA	GOM	4/13/2012	5/19/2012	37
NOAA	GOM_2012_06	BFT	195	NA	CAR	5/20/2012	5/26/2012	7
NOAA	GOM_2012_06	BFT	195	NA	W_ATL	5/27/2012	6/4/2012	9
NOAA	GOM_2012_10	BFT	270	290	GOM	3/22/2012	5/24/2012	64
NOAA	GOM_2012_12	BFT	240	225	GOM	5/2/2012	5/10/2012	9
NOAA	GOM_2012_12	BFT	240	225	CAR	5/11/2012	5/16/2012	6
NOAA	GOM_2012_12	BFT	240	225	W_ATL	5/17/2012	6/29/2012	44
NOAA	GOM_2012_16	BFT	210	180	GOM	4/26/2012	5/9/2012	14
NOAA	GOM_2012_16	BFT	210	180	CAR	5/10/2012	5/31/2012	22
NOAA	GOM_2012_16	BFT	210	180	W_ATL	6/1/2012	6/28/2012	28
NOAA	GOM_2012_19	BFT	240	180	GOM	4/25/2012	5/27/2012	33
NOAA	GOM_2012_19	BFT	240	180	CAR	5/28/2012	6/11/2012	15
NOAA	GOM_2012_19	BFT	240	180	W_ATL	6/12/2012	7/23/2012	42
NOAA	GOM_2012_20	BFT	240	225	GOM	4/26/2012	5/21/2012	26
NOAA	GOM_2012_20	BFT	240	225	CAR	5/22/2012	5/29/2012	8
NOAA	GOM_2012_20	BFT	240	225	W_ATL	5/30/2012	6/1/2012	3
NOAA	GOM_2012_21	BFT	240	NA	GOM	4/10/2012	5/3/2012	24
NOAA	GOM_2012_22	BFT	210	NA	GOM	3/19/2012	6/22/2012	96
NOAA	GOM_2012_23	BFT	210	NA	GOM	3/28/2012	5/3/2012	37
NOAA	GOM_2012_23	BFT	210	NA	CAR	5/4/2012	5/7/2012	4
NOAA	GOM_2012_24	BFT	240	225	GOM	4/25/2012	5/28/2012	34
NOAA	GOM_2012_24	BFT	240	225	CAR	5/29/2012	6/3/2012	6
NOAA	GOM_2012_24	BFT	240	225	W_ATL	6/4/2012	6/5/2012	2
NOAA	GOM_2012_24	BFT	240	225	W_ATL	6/6/2012	6/15/2012	10
NOAA	GOM_2012_25	BFT	240	200	GOM	5/13/2012	6/14/2012	33
NOAA	GOM_2012_25	BFT	240	200	CAR	6/15/2012	6/18/2012	4
NOAA	GOM_2012_25	BFT	240	200	W_ATL	6/19/2012	7/2/2012	14
NOAA	GOM_2012_26	BFT	210	180	GOM	2/28/2012	6/14/2012	18
NOAA	GOM_2012_26	BFT	210	180	CAR	6/15/2012	6/19/2012	5

**Table 3.** Atlantic bluefin tuna electronic tagging summarized data submitted by cooperating scientists.

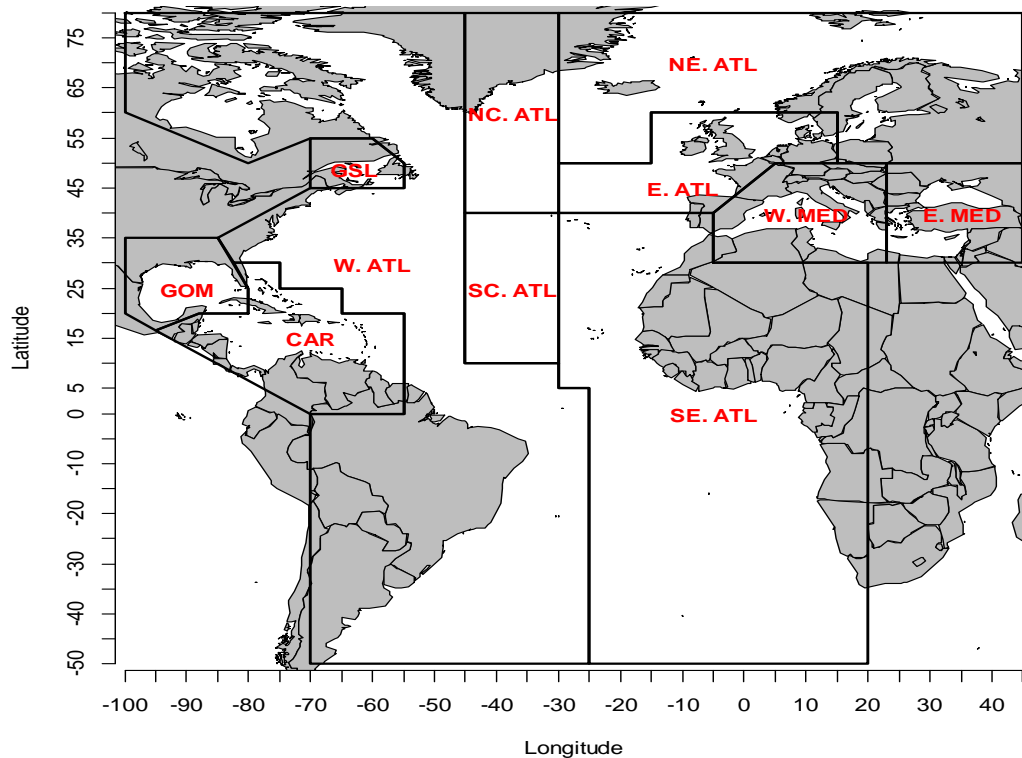
<i>Investigator</i>	<i>Tag_ID</i>	<i>Species</i>	<i>Length_cm</i>	<i>Weight_kg</i>	<i>Stock_Area</i>	<i>Start_Date</i>	<i>End_Date</i>	<i>Days/Area</i>
NOAA	GOM_2012_26	BFT	210	180	W_ATL	6/20/2012	7/29/2012	40
NOAA	GOM_2012_26	BFT	210	180	GSL	7/30/2012	9/18/2012	51
NOAA	GOM_2012_27	BFT	240	225	GOM	5/14/2012	6/14/2012	32
NOAA	GOM_2012_27	BFT	240	225	CAR	6/15/2012	6/24/2012	10
NOAA	GOM_2012_27	BFT	240	225	W_ATL	6/25/2012	7/11/2012	17
NOAA	GOM_2012_28	BFT	240	200	GOM	5/17/2012	6/14/2012	29
NOAA	GOM_2012_28	BFT	240	200	CAR	6/15/2012	6/16/2012	2
NOAA	GOM_2012_28	BFT	240	200	W_ATL	6/17/2012	7/10/2012	24
NOAA	GOM_2012_30	BFT	240	225	GOM	5/28/2012	6/30/2012	34
NOAA	GOM_2012_30	BFT	240	225	CAR	7/1/2012	7/3/2012	3
NOAA	GOM_2012_30	BFT	240	225	W_ATL	7/4/2012	9/21/2012	80
NOAA	GOM_2012_31	BFT	240	200	GOM	5/25/2012	5/31/2012	7
NOAA	GOM_2012_31	BFT	240	200	CAR	6/1/2012	6/6/2012	6
NOAA	GOM_2012_31	BFT	240	200	W_ATL	6/7/2012	6/29/2012	23
NOAA	GOM_2012_31	BFT	240	200	GSL	6/30/2012	8/16/2012	48
NOAA	GOM_2012_32	BFT	195	NA	GOM	5/11/2012	5/19/2012	9
NOAA	GOM_2012_32	BFT	195	NA	CAR	5/20/2012	5/29/2012	10
NOAA	GOM_2012_37	BFT	210	170	GOM	5/23/2012	6/3/2012	12
NOAA	GOM_2012_37	BFT	210	170	CAR	6/4/2012	6/13/2012	10
NOAA	GOM_2012_37	BFT	210	170	W_ATL	6/14/2012	7/5/2012	22
NOAA	GOM_2012_41	BFT	240	200	GOM	4/9/2012	5/22/2012	44
NOAA	GOM_2012_41	BFT	240	200	CAR	5/23/2012	5/25/2012	3
NOAA	GOM_2012_41	BFT	240	200	W_ATL	5/26/2012	6/20/2012	26
NOAA	GOM_2012_44	BFT	225	NA	GOM	5/20/2012	6/1/2012	13
NOAA	GOM_2012_44	BFT	225	NA	CAR	6/2/2012	6/8/2012	7
NOAA	GOM_2012_44	BFT	225	NA	W_ATL	6/9/2012	7/11/2012	33
NOAA	GOM_2012_44	BFT	225	NA	GSL	7/12/2012	7/12/2012	1
NOAA	GOM_2012_44	BFT	225	NA	W_ATL	7/13/2012	7/17/2012	5
NOAA	GOM_2012_44	BFT	225	NA	GSL	7/18/2012	7/18/2012	1
NOAA	GOM_2012_44	BFT	225	NA	W_ATL	7/19/2012	7/20/2012	2
NOAA	GOM_2012_44	BFT	225	NA	GSL	7/21/2012	8/5/2012	16
NOAA	GOM_2012_44	BFT	225	NA	W_ATL	8/6/2012	8/7/2012	2
NOAA	GOM_2012_44	BFT	225	NA	GSL	8/8/2012	8/9/2012	2
NOAA	GOM_2012_46	BFT	210	NA	GOM	5/20/2012	5/29/2012	10
NOAA	GOM_2012_46	BFT	210	NA	CAR	5/30/2012	6/5/2012	7
NOAA	GOM_2012_46	BFT	210	NA	W_ATL	6/6/2012	7/2/2012	27
NOAA	GOM_2013_008	BFT	210	NA	GOM	4/12/2013	5/25/2013	44
NOAA	GOM_2013_018	BFT	225	NA	GOM	3/28/2013	5/30/2013	64
NOAA	GOM_2013_018	BFT	225	NA	CAR	5/31/2013	6/5/2013	6
NOAA	GOM_2013_018	BFT	225	NA	W_ATL	6/6/2013	6/7/2013	2
NOAA	GOM_2013_034	BFT	190	155	GOM	5/12/2013	5/19/2013	8
NOAA	GOM_2013_034	BFT	190	155	CAR	5/20/2013	5/22/2013	3
NOAA	GOM_2013_034	BFT	190	155	W_ATL	5/23/2013	6/28/2013	37
NOAA	GOM_2013_034	BFT	190	155	GSL	6/29/2013	8/9/2013	42

**Table 3.** Atlantic bluefin tuna electronic tagging summarized data submitted by cooperating scientists.

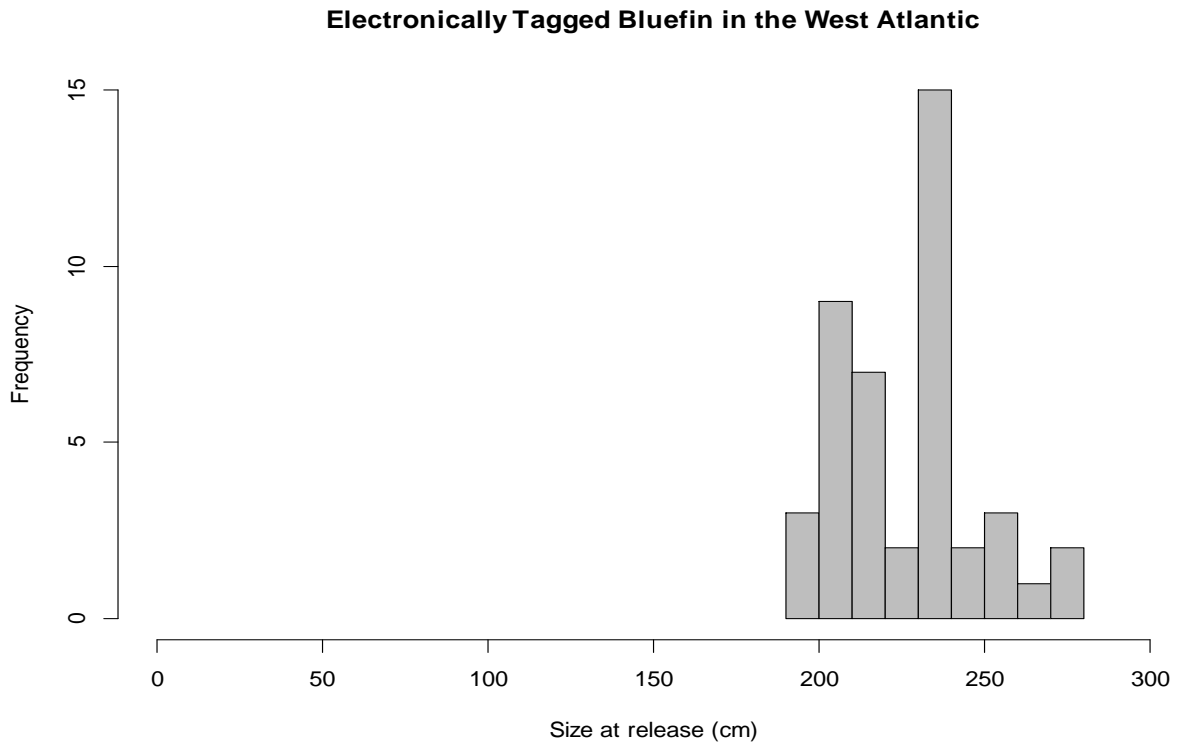
<i>Investigator</i>	<i>Tag_ID</i>	<i>Species</i>	<i>Length_cm</i>	<i>Weight_kg</i>	<i>Stock_Area</i>	<i>Start_Date</i>	<i>End_Date</i>	<i>Days/Area</i>
NOAA	GOM_2013_036	BFT	210	200	GOM	5/14/2013	6/25/2013	43
NOAA	GOM_2013_036	BFT	210	200	CAR	6/26/2013	7/6/2013	11
NOAA	GOM_2013_036	BFT	210	200	W_ATL	7/7/2013	8/24/2013	49
CAN_DFO	132813	BFT	216	181	GSL	10/30/2013	10/31/2013	9
CAN_DFO	132813	BFT	216	181	W_ATL	11/2/2013	11/8/2013	10
CAN_DFO	132813	BFT	216	181	GSL	11/10/2013	12/2/2013	11
CAN_DFO	132813	BFT	216	181	W_ATL	12/4/2013	12/4/2013	12
CAN_DFO	132813	BFT	216	181	GSL	12/6/2013	12/12/2013	13
CAN_DFO	132813	BFT	216	181	W_ATL	12/12/2013	1/6/2014	14
CAN_DFO	132813	BFT	216	181	C_ATL	1/6/2014	1/19/2014	15
CAN_DFO	132813	BFT	216	181	E_ATL	1/21/2014	2/13/2014	16
CAN_DFO	132813	BFT	216	181	C_ATL	2/15/2014	3/15/2014	17
CAN_DFO	132813	BFT	216	181	E_ATL	3/17/2014	3/26/2014	18
CAN_DFO	132813	BFT	216	181	C_ATL	3/29/2014	4/1/2014	19
CAN_DFO	132813	BFT	216	181	E_ATL	4/1/2014	4/1/2014	20
CAN_DFO	132814	BFT	213	272	GSL	10/31/2013	11/3/2013	21
CAN_DFO	132814	BFT	213	272	W_ATL	11/5/2013	2/27/2014	22
CAN_DFO	132815	BFT	216	238	GSL	10/31/2013	11/3/2013	23
CAN_DFO	132815	BFT	216	238	W_ATL	11/5/2013	6/24/2014	24
CAN_DFO	132817	BFT	216	227	GSL	11/2/2013	11/3/2013	25
CAN_DFO	132817	BFT	216	227	W_ATL	11/5/2013	11/5/2013	26
CAN_DFO	132817	BFT	216	227	GSL	11/5/2013	11/5/2013	27
CAN_DFO	132817	BFT	216	227	W_ATL	11/5/2013	1/10/2014	28
CAN_DFO	132817	BFT	216	227	C_ATL	1/10/2014	1/23/2014	29
CAN_DFO	132817	BFT	216	227	E_ATL	1/23/2014	1/29/2014	30
CAN_DFO	132817	BFT	216	227	C_ATL	1/29/2014	2/16/2014	31
CAN_DFO	140225	BFT	216	249	GSL	9/16/2014	9/27/2014	32
CAN_DFO	140225	BFT	216	249	W_ATL	9/27/2014	9/28/2014	33
CAN_DFO	140225	BFT	216	249	GSL	9/28/2014	10/1/2014	34
CAN_DFO	140225	BFT	216	249	W_ATL	10/2/2014	10/14/2014	35
CAN_DFO	140225	BFT	216	249	GSL	10/14/2014	10/17/2014	36
CAN_DFO	140225	BFT	216	249	W_ATL	10/17/2014	10/18/2014	37
CAN_DFO	140225	BFT	216	249	GSL	10/18/2014	10/30/2014	38
CAN_DFO	140225	BFT	216	249	W_ATL	10/30/2014	1/14/2015	39
CAN_DFO	140225	BFT	216	249	GSL	1/15/2015	1/16/2015	40
CAN_DFO	140225	BFT	216	249	W_ATL	1/17/2015	1/17/2015	41
CAN_DFO	140225	BFT	216	249	GSL	1/18/2015	1/18/2015	42
CAN_DFO	140225	BFT	216	249	W_ATL	1/18/2015	2/1/2015	43
CAN_DFO	140227	BFT	203	204	GSL	9/17/2014	11/11/2014	44
CAN_DFO	140227	BFT	203	204	W_ATL	11/11/2014	11/16/2014	45
CAN_DFO	140227	BFT	203	204	GSL	11/16/2014	11/16/2014	46
CAN_DFO	140227	BFT	203	204	W_ATL	11/17/2014	12/10/2014	47
CAN_DFO	140228	BFT	216	227	GSL	9/17/2014	9/26/2014	48
CAN_DFO	140228	BFT	216	227	W_ATL	9/26/2014	10/15/2014	49

**Table 3.** Atlantic bluefin tuna electronic tagging summarized data submitted by cooperating scientists.

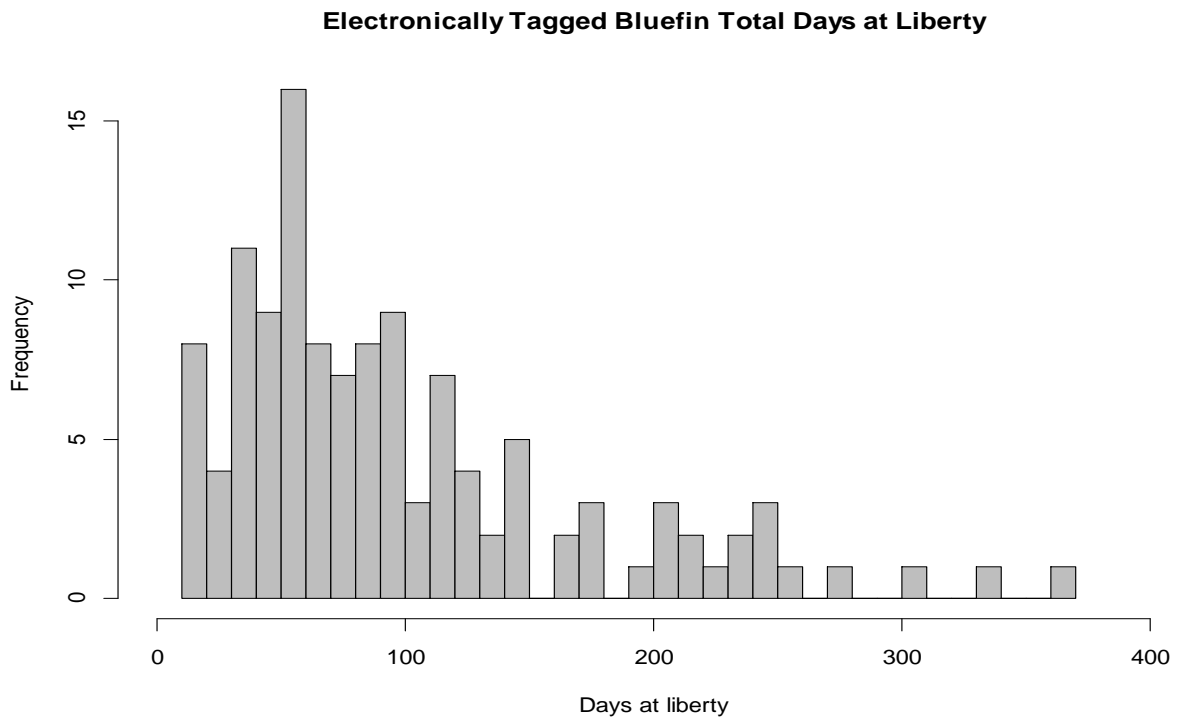
<i>Investigator</i>	<i>Tag_ID</i>	<i>Species</i>	<i>Length_cm</i>	<i>Weight_kg</i>	<i>Stock_Area</i>	<i>Start_Date</i>	<i>End_Date</i>	<i>Days/Area</i>
CAN_DFO	140228	BFT	216	227	GSL	10/15/2014	10/24/2014	50
CAN_DFO	140228	BFT	216	227	W_ATL	10/24/2014	1/19/2015	51
CAN_DFO	140230	BFT	216	249	GSL	9/16/2014	10/18/2014	52
CAN_DFO	140230	BFT	216	249	W_ATL	10/18/2014	2/1/2015	53
CAN_DFO	140234	BFT	279	363	GSL	9/17/2014	10/1/2014	54
CAN_DFO	140234	BFT	279	363	W_ATL	10/1/2014	11/8/2014	55
CAN_DFO	140234	BFT	279	363	GSL	11/9/2014	11/16/2014	56
CAN_DFO	140234	BFT	279	363	W_ATL	11/17/2014	2/6/2015	57
CAN_DFO	91284	BFT	NA	181	W_ATL	8/19/2009	10/17/2009	1
CAN_DFO	93550	BFT	NA	45	W_ATL	9/11/2009	3/7/2010	2
CAN_DFO	93557	BFT	259	227	W_ATL	8/12/2009	12/1/2009	3
CAN_DFO	93558	BFT	244	45	W_ATL	8/16/2009	10/17/2009	4
CAN_DFO	95418	BFT	274	295	W_ATL	8/8/2009	8/27/2009	5
CAN_DFO	95418	BFT	274	295	C_ATL	8/30/2009	9/25/2009	6
CAN_DFO	95418	BFT	274	295	W_ATL	9/25/2009	9/25/2009	7
CAN_DFO	95418	BFT	274	295	C_ATL	9/28/2009	11/29/2009	8



**Figure 1.** Atlantic bluefin tuna stock regions.



**Figure 2.** Size at release (straight fork length in cm) of electronically tagged bluefin tuna in the West Atlantic, Gulf of Mexico, and Gulf of St. Lawrence.



**Figure 3.** Days at liberty of electronically tagged bluefin tuna in the Atlantic Ocean, Mediterranean Sea, Gulf of Mexico, and Gulf of St. Lawrence.

R script to generate electronic tag data summaries from detailed track mean daily locations.

```
#IMPORT DATA
setwd('Bluefin/Bluefin_etags')
data=read.csv('Bluefin_etag_data.csv')
head(data)

#REQUIRED R PACKAGES
library(sp)
library(maps)
library(mapdata)

#DEFINED STOCK AREA X (LON) AND Y (LAT) BOUNDARIES
BFT1=list(x=c(-80,-88,-95,-100,-100,-85,-80), y=c(20,20,16.5,20,35,35,25))
BFT2=list(x=c(-82.5,-75,-75,-65,-65,-55,-55,-70,-95,-88,-80,-82.5),
          y=c(30,30,25,25,20,20,0,0,16.5,20,20,25,30))
BFT3=list(x=c(-70,-70,-60,-55,-55), y=c(45,55,55,50,45))
BFT4=list(x=c(-70,-55,-55,-65,-65,-75,-75,-82.5,-85,-70,-55,-55,-60,-70,-80,-100,-100,-45,-45,-30,-30,-25,-25,-70),
          y=c(0,0,20,20,25,25,30,30,35,45,45,50,55,55,50,60,80,80,10,10,5.5,-50,-50))
BFT5=list(x=c(-30,-45,-45,-30), y=c(40,40,80,80))
BFT6=list(x=c(-30,-45,-45,-30), y=c(10,10,40,40))
BFT7=list(x=c(-30,45,45,15,15,-15,-15,-30,-30), y=c(80,80,50,50,60,60,50,50,80))
BFT8=list(x=c(-30,-30,-15,-15,15,15,5,-5), y=c(40,50,50,60,60,50,50,40))
BFT9=list(x=c(-30,-30,-5,-5,20,20,-25,-25,-30), y=c(10,40,40,30,30,-50,-50,5,5))
BFT10=list(x=c(-5,-5,5,23,23), y=c(30,40,50,50,30))
BFT11=list(x=c(23,45,45,23), y=c(50,50,30,30))

#STOCK AREAS PLOTTED ON MAP
map('worldHires',col=c('gray'),fill=T,xlim=c(-100,45),ylim=c(-50,80))
axis(1,at=seq(-100,45,5))
axis(2,at=seq(-50,80,5))
mtext('Longitude',1,line=3)
mtext('Latitude',2,line=3)
polygon(BFT1,border=1,lwd=2)
text("GOM",x=-90,y=25,font=2,col=2)
polygon(BFT2,border=1,lwd=2)
text("CAR",x=-70,y=15,font=2,col=2)
polygon(BFT3,border=1,lwd=2)
text("GSL",x=-63,y=49,font=2,col=2)
polygon(BFT4,border=1,lwd=2)
text("W. ATL",x=-60,y=30,font=2,col=2)
polygon(BFT5,border=1,lwd=2)
text("NC. ATL",x=-37.5,y=60,font=2,col=2)
polygon(BFT6,border=1,lwd=2)
text("SC. ATL",x=-37.5,y=25,font=2,col=2)
polygon(BFT7,border=1,lwd=2)
text("NE. ATL",x=-5,y=70,font=2,col=2)
polygon(BFT8,border=1,lwd=2)
text("E. ATL",x=-10,y=45,font=2,col=2)
polygon(BFT9,border=1,lwd=2)
text("SE. ATL",x=-5,y=0,font=2,col=2)
polygon(BFT10,border=1,lwd=2)
text("W. MED",x=10,y=40,font=2,col=2)
polygon(BFT11,border=1,lwd=2)
text("E. MED",x=35,y=40,font=2,col=2)

#STOCK AREA ASSIGNMENT BASED ON BFT LOCATION IN DECIMAL DEGREE LAT AND LON
BFT_area=c("GOM", "CAR", "GSL", "W_ATL", "NC_ATL", "SC_ATL", "NE_ATL", "E_ATL", "SE_ATL", "W_MED", "E_MED")
lat=data$Lat_Estimated
lon=data$Lon_Estimated
data$STOCK_AREA=as.character(sapply(1:length(data[,1]),function(i){BFT_area[which(c(
  point.in.polygon(lon[i],lat[i],BFT1$x,BFT1$y),
  point.in.polygon(lon[i],lat[i],BFT2$x,BFT2$y),
  point.in.polygon(lon[i],lat[i],BFT3$x,BFT3$y),
  point.in.polygon(lon[i],lat[i],BFT4$x,BFT4$y),
  point.in.polygon(lon[i],lat[i],BFT5$x,BFT5$y),
  point.in.polygon(lon[i],lat[i],BFT6$x,BFT6$y),
  point.in.polygon(lon[i],lat[i],BFT7$x,BFT7$y),
  point.in.polygon(lon[i],lat[i],BFT8$x,BFT8$y),
  point.in.polygon(lon[i],lat[i],BFT9$x,BFT9$y),
  point.in.polygon(lon[i],lat[i],BFT10$x,BFT10$y),
  point.in.polygon(lon[i],lat[i],BFT11$x,BFT11$y))=1)])})

#DATA AGGREGATION: DAYS PER STOCK AREA BY TAG_ID
data$REGION_ENTRY=1
for(i in 2:length(data[,1]))
{
  data$REGION_ENTRY[i]=ifelse(data$Reference_ID[i]==data$Reference_ID[i-1]&data$STOCK_AREA[i]==data$STOCK_AREA[i-1],data$REGION_ENTRY[i-1],data$REGION_ENTRY[i-1]+1)
}
summary=aggregate(data$Date,by=list(data$Reference_ID,data$STOCK_AREA,data$REGION_ENTRY),length)
colnames(summary)=c('Tag_ID','Stock_Area','Entry','Days')
summary$Start_Date=as.Date(sapply(1:length(summary[,1]),function(i){data$Date[data$Reference_ID==summary$Tag_ID[i]&
  data$STOCK_AREA==summary$Stock_Area[i]&data$REGION_ENTRY==summary$Entry[i]][1]}))
summary$End_Date=as.Date(sapply(1:length(summary[,1]),function(i){rev(data$Date[data$Reference_ID==summary$Tag_ID[i]&
  data$STOCK_AREA==summary$Stock_Area[i]&data$REGION_ENTRY==summary$Entry[i]][1]}))
summary
write.csv(summary,'Bluefin_etag_data_summary.csv')
```