



BFT aerial survey 2018
Area C and E

Aerial banners



Aerial banners

**AERIAL SURVEY FOR BLUEFIN SPAWNING AGGREGATION OF THE
ATLANTIC-WIDE RESEARCH PROGRAMME ON BLUEFIN TUNA
ICCAT-GBYP Phase 8
CALL FOR TENDERS ICCAT/GBYP 03/2018-b - Circular #0279/2018,
12.3.2018
AREAS C AND E**

Final Report

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Summary

Within the ICCAT GBYP program, aerial surveys were carried out with the aim of providing fishery-independent indices to improve the knowledge of Bluefin tuna populations in the Mediterranean, particularly for what is concerning the spawners aggregations. After the 2010 and 2011 surveys, which were carried out in four Mediterranean spawning areas, in 2013 the survey was extended to the whole Mediterranean Sea. The same choice was adopted for 2015 survey. In 2017, the surveys were limited to the 4 initial spawning areas and so has been done in 2018. In the 2018 campaign, Unimar was awarded to carry out the survey in the Area C (South Tyrrhenian Sea) and E (Sicily Channel) performing the 4 mandatory replicas in each area. The survey was carried out from May 28th to June 23th, 2018. N. 19 BFT sightings were performed in 28 total survey days (8 BFT sightings in the Area C and 11 in the Area E; 13 days in the Area C and 15 in the Area E).

Keywords

Abundance, Geographical distribution, Migrations, Spawning grounds, Tuna fisheries, Statistical sampling, Bluefin tuna, Thunnus thynnus, Mediterranean, Aerial survey



1. BACKGROUND AND OBJECTIVES

The improvement of the knowledge of the Atlantic bluefin tuna key biological and ecological processes is essential for developing management policy which can provide long term sustainable exploitation of this resource.

The comprehensive ICCAT Atlantic Wide Research Programme on Bluefin Tuna (GBYP) was initiated with the aim to improve basic data collection, the understanding of key biological and ecological processes, assessment models and management. Among the other activities, aerial surveys were planned to be performed for several years.

In 2010 and 2011, aerial surveys on spawning aggregations were carried on 4 areas in the Mediterranean Sea, which were, identified as spawning areas on the base of biological and traditional knowledge, as well as recent fishery data. In 2013 and 2015, following the GBYP Steering committee recommendation, the area of the survey was extended to the whole Mediterranean basin and therefore more sub-areas than in the previous years were identified.

In 2017, it was decided to restrict the survey to the 4 initial areas and so has been done in 2018:

- A - Balearic Islands
- C - South Tyrrhenian Sea
- E - Sicily Channel
- G - South Turkey, Cyprus.

This report describes the activities and the results related to the 2018 Unimar survey, covering the Areas C and E.

2. MEANS AND METHODS

The activities were carried out following the terms of reference of the ICCAT Call for Tenders and the Technical specifications annexed to the contract. The spawning behaviour of Bluefin tuna was reported in detail by Arena (Arena, P. 1979, 1982 a/b/c/d) for the South Tyrrhenian; the individuals tend to aggregate in bigger schools starting from late April, with maximum aggregation when water temperature exceed 20°C and while a thermocline forms and stabilises at a depth of 15 - 30 m, inducing Bluefin tuna schools to stay in the superficial layers.

Most of the personnel involved in the survey participated to the training course held in the ICCAT headquarters (Madrid, 16th May 2018), during which the details of the methodology and operative standards were explained and previous field experiences were shared.

2.1 Aircrafts and equipment

Two aircrafts were involved, both with upper wings, good forward visibility, bubble windows on both sides and capable of flying at a spotting altitude of 300 m and a speed of 100 nm, as



foreseen by ICCAT GBYP. Both the aircrafts were a "Partenavia P68" model, already used in the past campaigns.

In details, one model was a Partenavia P68 V (I-GNIT registration number), planned to work in the Area C. Stickers with "ICCAT 2" on the right side and under the left wing of the aircraft were attached. It has about 4-5 hours flight range.

- Brand: Partenavia
- Model: P68 V
- Code: I-GNIT

The second aircraft model was a Partenavia P68 C-TC (I-AGSD registration number). Stickers with "ICCAT 3" on the right side and under the left wing of the aircraft were attached. It has about 5-6 hours flight range.

- Brand: Partenavia
- Model: P68 C-TC
- Code: I-AGSD

The aircrafts and crews are shown in Figure 1.



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Figure 1 - Aircrafts ICCAT 2 (I-GNIT) and ICCAT 3 (I-AGSD) and the crews



The equipment used by the spotters was the following:

- 2 GPS: *Garmin*® GPSMap 62st and GPSMap 64s, with the statistical survey design uploaded (the same route files were provided to the pilot);
- 2 GPS external antennas, which were applied on the aircraft dashboard under the front window in order to enhance the satellite signal reception
- 2 digital *Nikon*® photo cameras: D3000 and D3200, with 6400 ISO maximum sensitivity, equipped with *Sigma*® 70-200 zoom lens f/2.8 OS and 62st, polarised filter (77mm gauge) and Nikon 55-200 zoom lens f/5.6 VR, polarised filter (52mm gauge): after some trial, the panning and multiple shot mode was chosen as the best one to have the higher possibilities to capture clear images
- *Silva Sight Master*® clinometers

Onboard the aircraft there were always a pilot, a professional tuna spotter and two scientific spotters. Effort and sightings were recorded on the specific forms and the GPS recording of all the flights and sighting positions were saved. During the flights, the GPS recorded (with a 3 seconds frequency) the exact position of the aircraft as well as all the waypoints entered by the spotters in order to mark the significant events to be transcribed to the forms. After every landing, the information was saved into the laptop and sent to the central office as soon as possible. The altimeter of the spotters GPS device and the aircraft one were daily calibrated with the known altitude of the airport. So the pilot followed the actual altitude that matched with the one measured by the spotters GPS device, that recorded the tracks.

The survey period started on May 28th and ended on June 23th, 2018.

According to the contract terms of reference, weather conditions were considered adverse when they could interfere with a reliable observation of tuna schools (winds over 3 Beaufort scale, clouds lower than 300 m, high or heavy rain).

Esri ArcMap® GIS software was used for data mapping. Garmin BaseCamp® and Garmin MapSource® were used for track designing, analysis, saving and editing.

2.2 The Survey design and the Survey areas

Aerial surveys were designed using the "DISTANCE" program and were provided by ICCAT GBYP. In each block, a series of transects were created, based on the dimensions of the area, in a manner to achieve the approximate statistical coverage. Surveys were designed as equal spaced parallel lines since it provides equal coverage probability (Hammond P. et al, 2010).

Area C is the Central Mediterranean area located North of Sicily and West of Calabria.

Area E is the Central Mediterranean area comprised between Sicily, Tunisia and Libya, included within the Rome and Malta FIR.

The importance of these areas for the Bluefin tuna spawning activities is well known (Arena, P. 1978, 1982): for this reason, constant activity of purse seine fishing has been carried out there since the early Seventies (Arena, 1990). A general map of 2018 survey areas is provided in Figure 2.

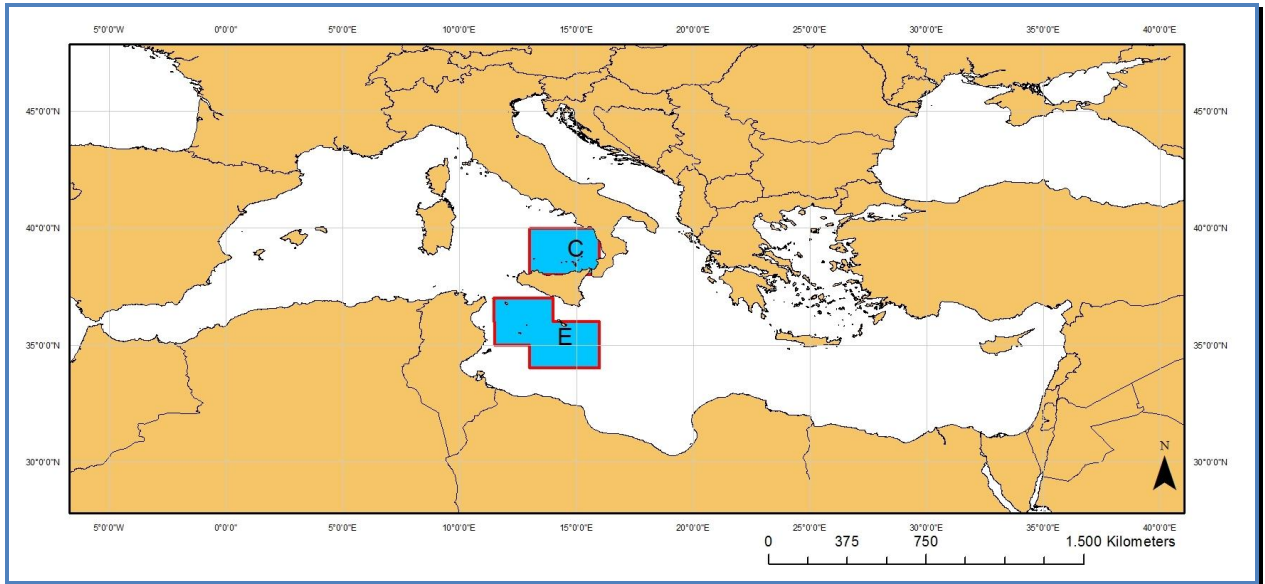


Figure 2 - 2018 Aerial Survey Areas (Unimar-Aerial Banners areas in blue)

The features of each survey area are described in Table 1.

The replicas to be performed in each area are shown in Figure 3 and Figure 4.



Table 1 - Features of Areas C and E

Area	C
Area (km ²)	53,868
Proport. of total area	20.3
Expected proportion. Length of Trackline on Effort	6,489
Expected proportion. Length of Trackline on Effort (minus 10% for circling)	5,841
% coverage	18.7
Line spacing per replica	42.5
On effort track Replica 1	1,270
On effort track Replica 2	1,273
On effort track Replica 3	1,228
On effort track Replica 4	1,332
Total on effort track	5,103
Leftover effort	21.4

Area	E
Area (km ²)	93,614
Proport. of total area	35.2
Expected proportion. Length of Trackline on Effort	11,278
Expected proportion. Length of Trackline on Effort (minus 10% for circling)	10,150
% coverage	19.3
Line spacing per replica	41.3
On effort track Replica 1	1,431
On effort track Replica 2	1,410
On effort track Replica 3	1,404
On effort track Replica 4	1,455
Total on effort track	5,700
Leftover effort	15.8

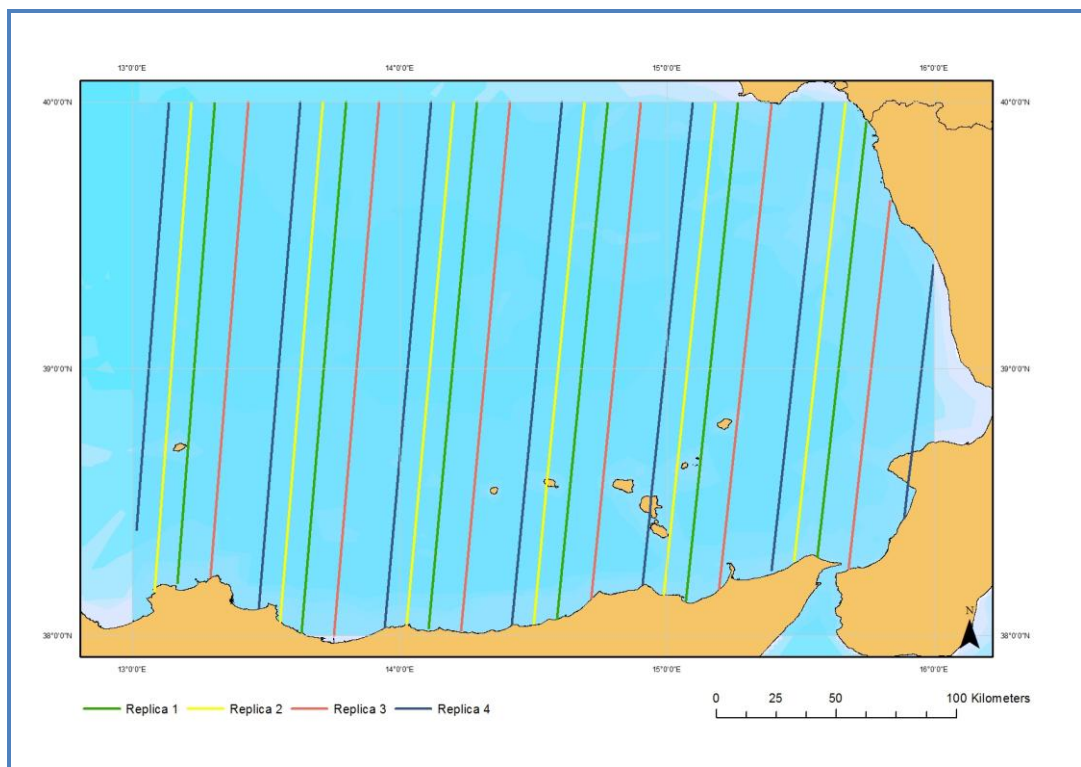


Figure 3 - Area C details and sampler routes (Transects-Legs)

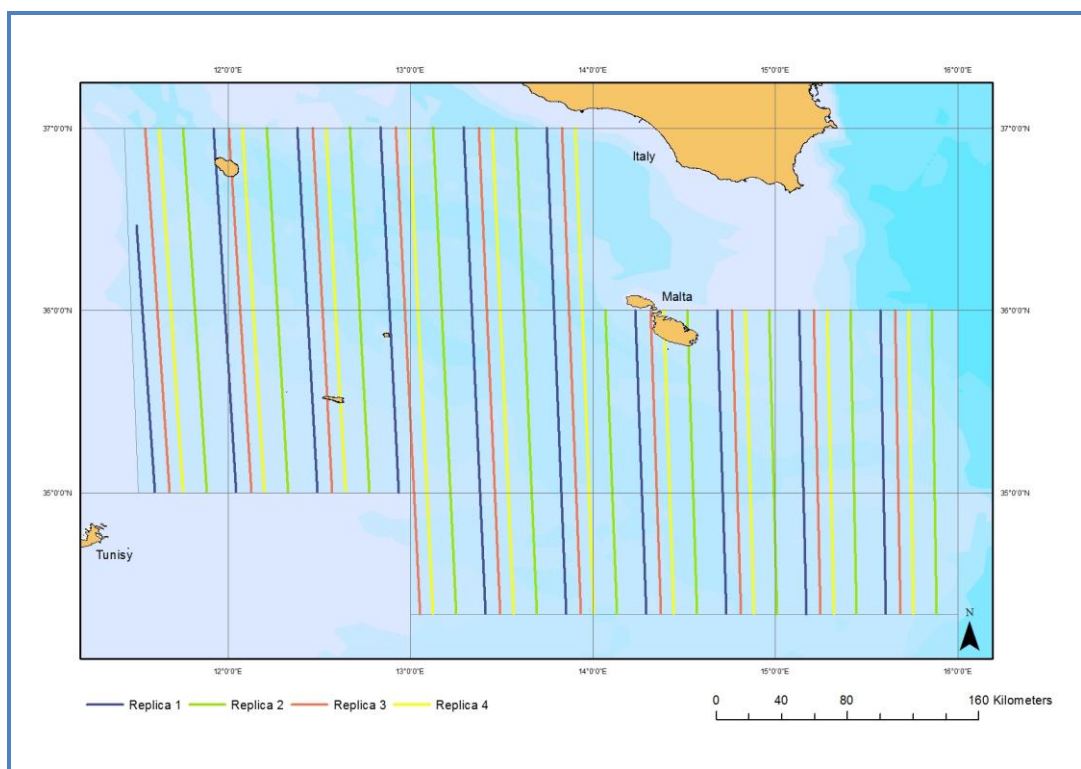


Figure 4 - Area E details and sampler routes (Transects-Legs)



3. RESULTS

3.1 Preparatory tasks

First of all, the team was set up. The Unimar coordination staff contacted the spotters and managed the preliminary activities with Aerial Banners, the partner company providing the aircrafts and the pilots. The spotters were chosen on the basis of the expertise requested for the aerial survey: years of experience in aerial tuna spotting for the professional spotters, years of experience in tuna fisheries and biology, aerial surveys and/or census of marine populations for the scientific spotters, past participation in aerial tuna spotting or aerial survey campaigns for the pilots. A data analyst with experience in data mapping was involved as well. All scientific observers were already involved in one or more campaigns in the previous years.

In addition to the ICCAT course in Madrid, some meetings were held at Unimar headquarters in order to share the methodology among the scientific spotters and to organise the field activities. Other meetings with the pilots were organised before and during the surveys.

3.2 Field activity

Area C

According to ICCAT schedule and the meteorological conditions, the staff of Area C moved to the base airport on the first available day (May 27th, 2018) and started on May 28th. The survey in the Area C ended on June 16th, 2018. The diary report of the surveys carried out is provided in Table 2. The base airport for Area C was "Salerno - Costa d'Amalfi" airport, at Pontecagnano, south of Salerno. A flight per day was performed, as planned in the technical Offer.

The survey was carried out in 13 on-duty days. The aircraft used in all the campaign in the Area C was I-GNIT (ICCAT 2).

The I-GNIT team (ICCAT 2)

Pilots: Francesco Orrico, Francesco Ruggiero

Professional spotters: Vincenzo Severino, Mario Piscino

Scientific spotters: Adriano Mariani, Simone Serra, Andrea Fusari

The 2018 campaign was the sixth survey in the "C" area, already surveyed in 2010, 2011, 2013, 2015 and 2017. While in 2010 and 2011 about eleven transects per replica were followed, in 2013, 2015 and 2017 the transects number per replica was 6 or 7, so the distance between the lines was higher. In 2018, exactly the same design of 2017 was adopted.



Area E

According to ICCAT schedule and the meteorological conditions, on the first available day (May 30th, 2018) the spotters arrived to Pontecagnano and move to Malta onboard the I-AGSD aircraft. The survey in the Area E ended on June 23th, 2018. The diary report of the surveys carried out is provided in Table 2 and Table 3. The main base airport was Malta "Luqa" airport. Pantelleria and Lampedusa airports were used in some occasions for stop and/or refuelling when the western transects were performed, in order to optimize the flight hours and reduce the transfer time. Due to the adverse wind and sea forecasts, the flight plan was modified day by day in order to avoid any risk of exceeding the deadline set by the Protocol: in some case, when the weather conditions were good, more than one flight per day was performed.

The survey was carried out in 15 on-duty days. The main aircraft used in the campaign in the Area E was I-AGSD (ICCAT 3), performing 13 total days. Near the end of the survey, considering the bad weather forecasts, I-GNIT aircraft (ICCAT 2) moved to Malta in order to support the other aircraft and complete the survey within the deadline, performing the last two survey days together with I-AGSD.

The I-AGSD team (ICCAT 3)

Pilot: Daniele Mercurio

Professional spotter: Salvatore De Martino

Scientific spotters: Andrea Poggi, Sergio Lombardo

In both areas, the general visibility conditions were good during the whole survey, both the wind/sea state and haze/clouds. This allowed to have high sighting chances especially for scientific spotters, despite the professional spotters are able to detect schools also in medium conditions. When a lack of visibility was expected or observed, the survey was interrupted.



Table 2 - Daily report of the surveys - I-GNIT (ICCAT 2) aircraft

Flight #	Date	Mission start	Mission end	Area	Transects	Take off airport	Landing airport
1	28/5	7:53	11:13	C	R1L1-R2L2	Pontecagnano	Pontecagnano
2	29/5	7:58	11:26	C	R1L4-R1L3	Pontecagnano	Pontecagnano
3	30/5	8:49	12:42	C	R1L6-R1L5	Pontecagnano	Pontecagnano
4	31/5	7:47	11:22	C	R2L2-R2L1	Pontecagnano	Pontecagnano
5	1/6	7:51	11:19	C	R2L4-R2L3	Pontecagnano	Pontecagnano
6	2/6	7:40	11:30	C	R2L6-R2L5	Pontecagnano	Pontecagnano
7	3/6	7:29	11:00	C	R3L2-R3L1	Pontecagnano	Pontecagnano
standby	4/6						
standby	5/6						
8	6/6	7:55	11:20	C	R3L4-R3L3	Pontecagnano	Pontecagnano
9	11/6	8:05	12:01	C	R3L6-R3L5	Pontecagnano	Pontecagnano
10	12/6	7:46	11:08	C	R4L2-R4L1	Pontecagnano	Pontecagnano
11	13/6	7:45	11:09	C	R4L4-R4L3	Pontecagnano	Pontecagnano
standby	14/6						
12	15/6	9:54	13:27	C	R4L6-R4L5	Pontecagnano	Pontecagnano
13	16/6	7:44	11:06	C	R4L7	Pontecagnano	Pontecagnano
14	22/6	9:00	10:41	E	R4L5 (part)	Palermo	Malta
15	22/6	12:21	16:01	E	R4L1-R4L2	Malta	Malta
16	23/6	8:28	11:25	E	R4L3-R4L4	Malta	Malta
17	23/6	13:27	15:42	E	-	Malta	Pontecagnano



Table 3 - Daily report of the surveys - I-AGSD (ICCAT 3) aircraft

Flight #	Date	Mission start	Mission end	Area	Transects	Take off airport	Landing airport
transf.	30/5	14:05	17:05	E	-	Pontecagnano	Malta
1	31/5	8:08	13:27	E	R1L1 - R1L2 - R1L3 - R1L4	Malta	Malta
2	1/6	8:01	11:58	E	R1L4 - R1L5	Malta	Malta
3	2/6	6:29	10:07	E	R1L6	Malta	Malta
4	3/6	6:54	10:47	E	R1L10 - R1L9	Malta	Pantelleria
5	3/6	12:44	16:47	E	R1L8 - R1L7	Pantelleria	Malta
6	4/6	7:12	11:52	E	R2L1 - R2L2 - R2L3 (part)	Malta	Malta
7	5/6	7:35	11:01	E	R2L5 - R2L3 (part) - R2L4	Malta	Malta
stop	6-9/6			E			
8	10/6	6:23	10:34	E	R2L8 - R2L9	Malta	Malta
9	10/6	13:02	16:00	E	R2L10	Malta	Malta
10	11/6	6:48	10:05	E	R2L6 - R2L7	Malta	Malta
11	11/6	12:55	15:48	E	R2L6 - R2L7	Malta	Malta
12	12/6	6:39	9:28	E	R3L6 - R3L5	Malta	Malta
13	12/6	12:48	15:39	E	R3L4 - R3L3	Malta	Malta
14	13/6	8:08	11:25	E	R3L2 - R3L1	Malta	Malta
standby/transf.	14/6	4:01	5:30	E	-	Malta	Reggio Calabria
standby	15-18/6			E			
standby/transf	19/6	13:40	15:20	E	-	Reggio Calabria	Malta
15	20/6	7:01	11:31	E	R3L5-R3L6-R3L7	Malta	Malta
16	20/6	13:58	16:36	E	R3L7-R3L8	Malta	Lampedusa
17	21/6	7:33	8:59	E	R3L8	Lampedusa	Pantelleria
18	21/6	9:41	12:56	E	R3L10-R3L9	Pantelleria	Pantelleria
19	21/6	14:27	17:36	E	R4L10-R4L9	Pantelleria	Pantelleria
20	22/6	8:38	13:05	E	R4L7-R4L8	Pantelleria	Pantelleria
21	22/6	14:55	17:00	E	R4L6 (part)	Pantelleria	Malta
22	23/6	8:15	11:43	E	R4L6 (part)- R4L5 (part)	Malta	Malta



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transf.	23/6	12:45	15:30	E	-	Malta	Pontecagnano
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The times are in GMT and are calculated on the time the engines were switched on.

A first stop from 6/6 to 9/6 was decided because of the adverse weather forecast. The crew went back home.

On the 14/6, the weather forecasts were adverse and so it was decided to stop again the survey. The spotters decided in this case to wait in Malta for the good conditions monitoring the forecast day by day to be ready to start back the survey immediately and guarantee the respect of the deadline.

Although the flights were generally performed at the altitude and speed requested (300 m, 100 nm/h), occasional slight differences and fluctuations due to environmental and technical factors were observed.

For all the performed flights, the tracks were registered by the observers' GPS (the .gpx files of the tracks and the Excel format tables of the same tracks are sent as Annexes).

The effort and sightings forms can be find in the Annexes, as well.

The photos can be identified according to the frame numbers. A complete set of the photos taken during the surveys can be find in the Annexes in .NEF (RAW) format.

In order to enhance the visibility of tunas and other species, we suggest to adjust contrast and light with a photo editing programs able to read .RAW (.NEF, in this case) format, such as Picasa.

The photos were taken following the methodologies tested in the previous campaigns, trying to improve the resolution, the exposure time and the focus system. In order to overcome the problems in photography, especially the ones linked to aircraft bouncing, high shutter speeds were used, but in many cases this wasn't enough for getting sharp photos. Despite all the precautions adopted, the presence of the windows unavoidably affected the sharpness of all the photos.

Maps of recorded GPS tracks

Figure 5 to Figure 12 show the GPS tracks recorded onboard the aircrafts during the survey. Each colour corresponds to a different day.

AREA C

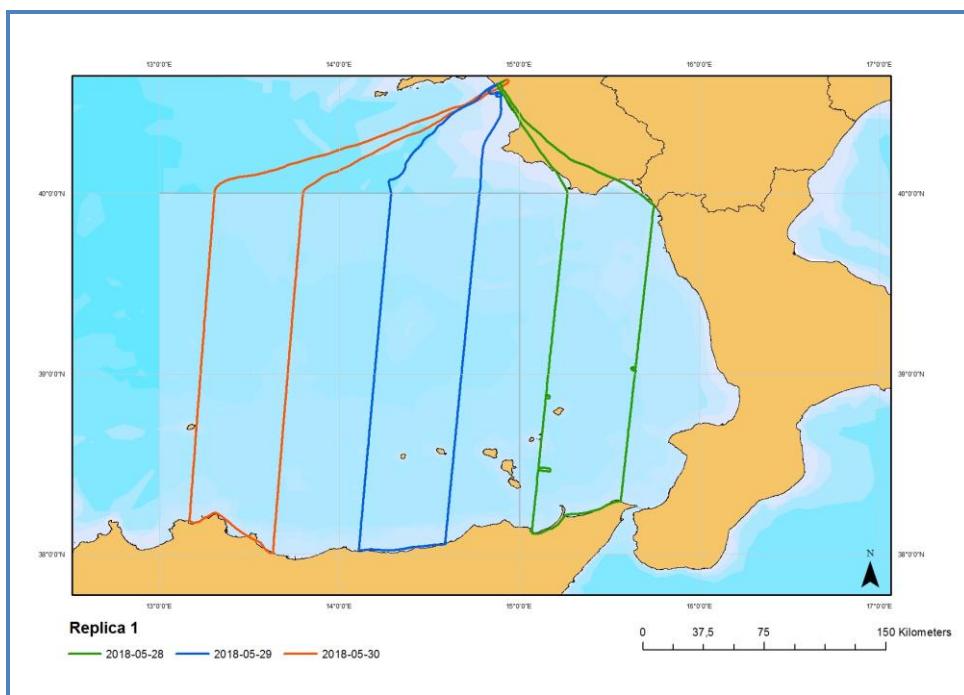


Figure 5 - Recorded GPS tracks: Area C, Replica 1

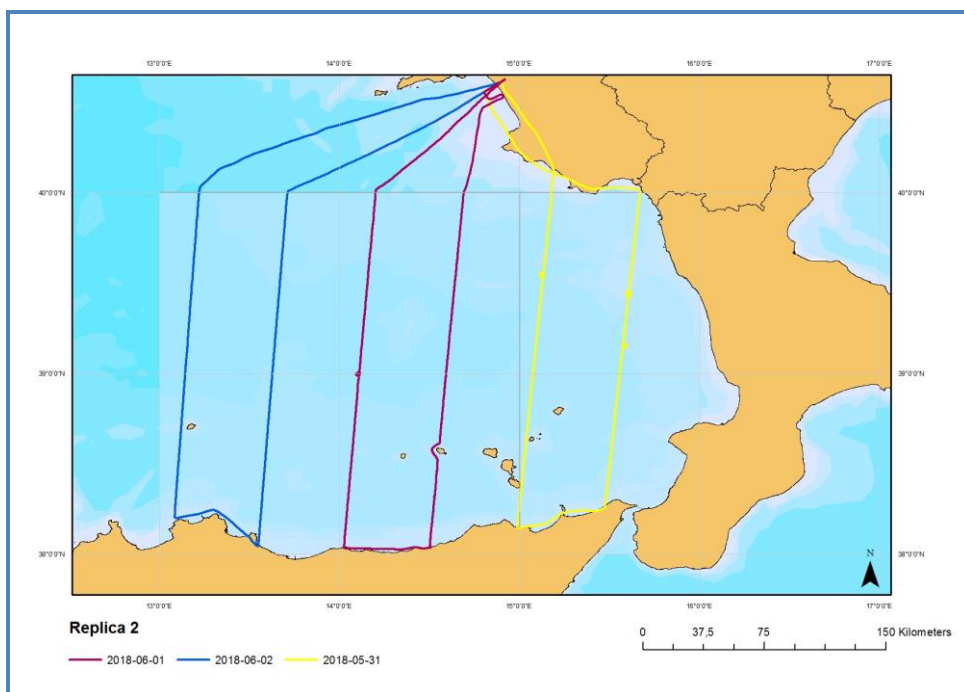


Figure 6 - Recorded GPS tracks: Area C, Replica 2

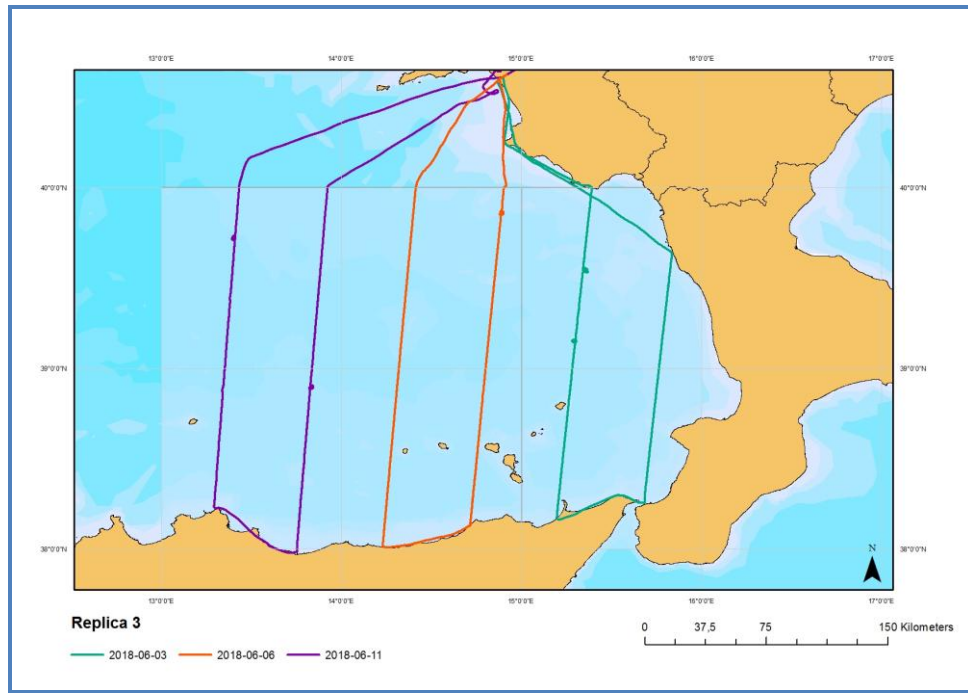


Figure 7 - Recorded GPS tracks: Area C, Replica 3

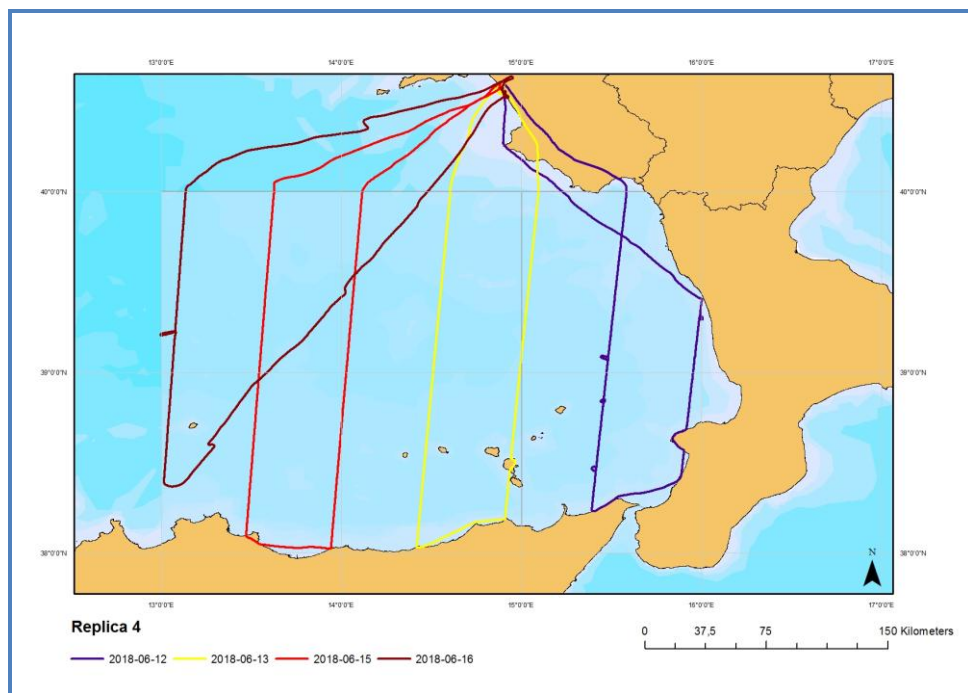


Figure 8 - Recorded GPS tracks: Area C, Replica 4

AREA E

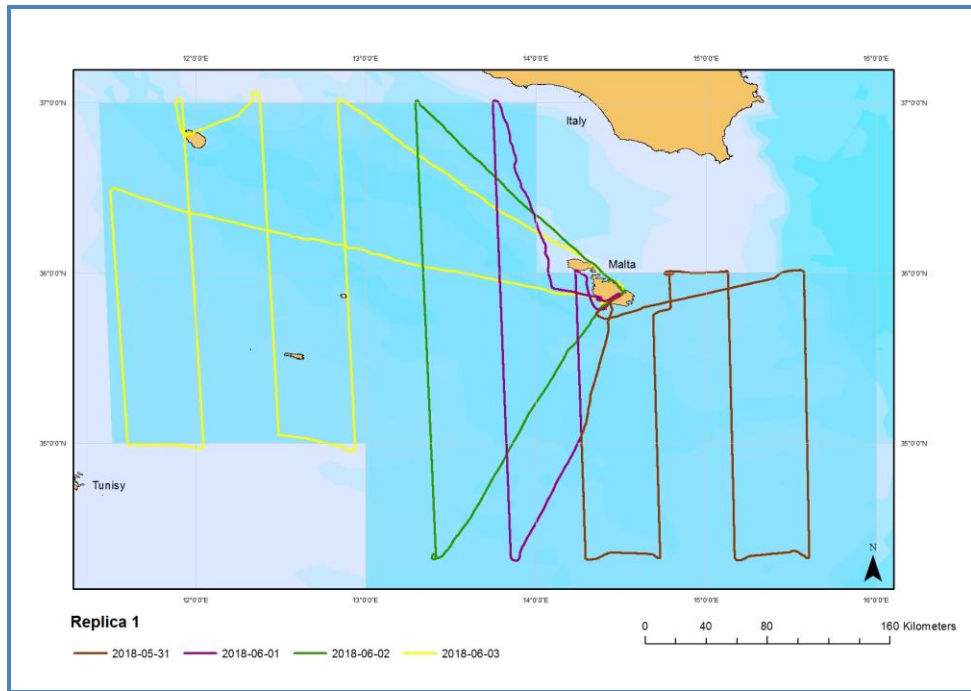


Figure 9 - Recorded GPS tracks: Area E, Replica 1

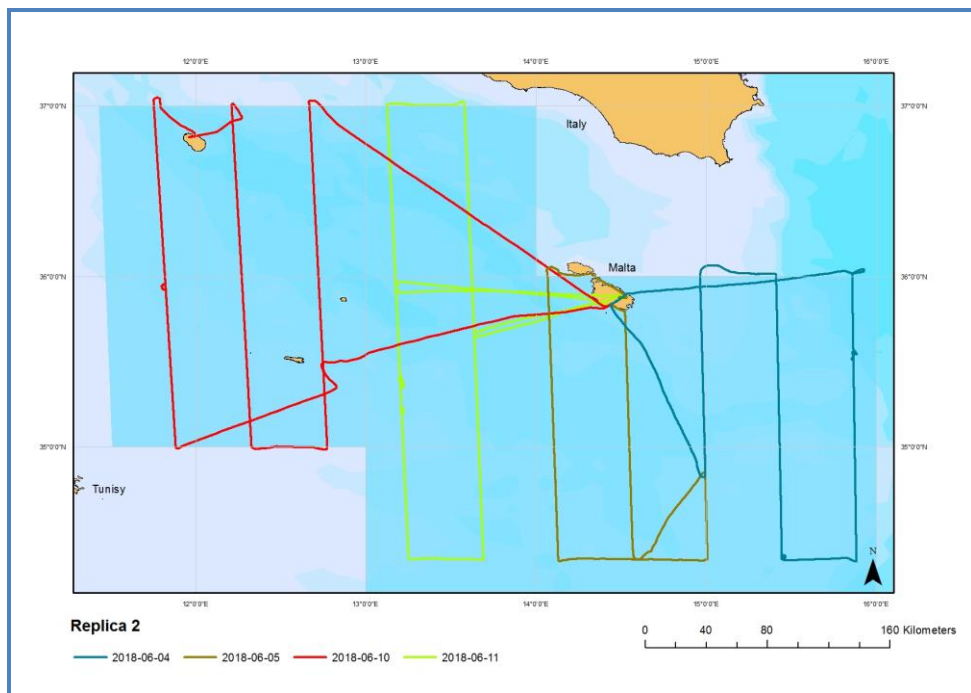


Figure 10 - Recorded GPS tracks: Area E, Replica 2

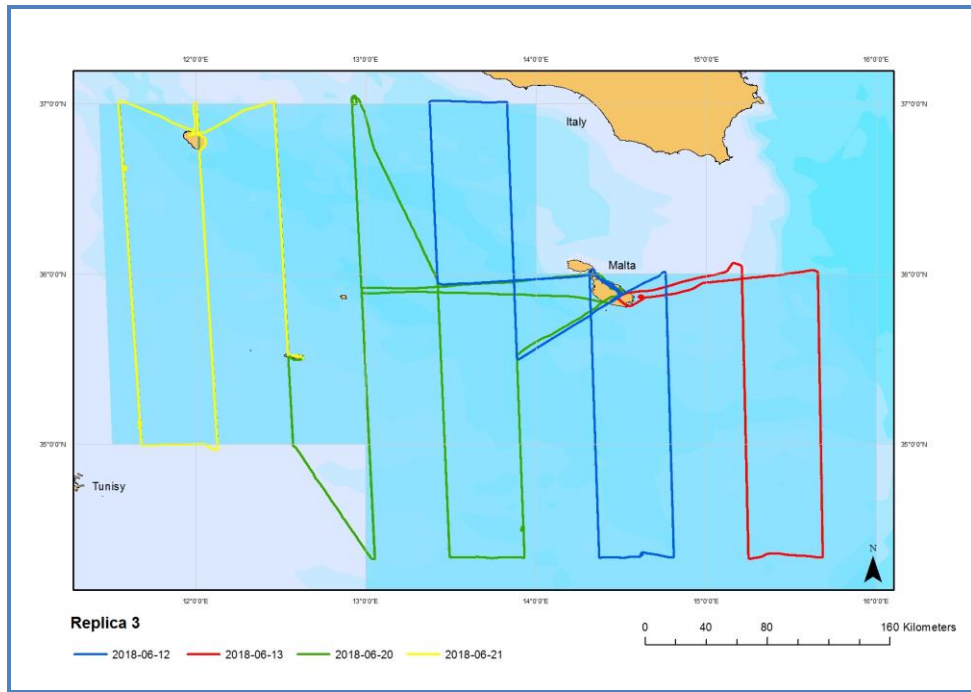


Figure 11 - Recorded GPS tracks: Area E, Replica 3

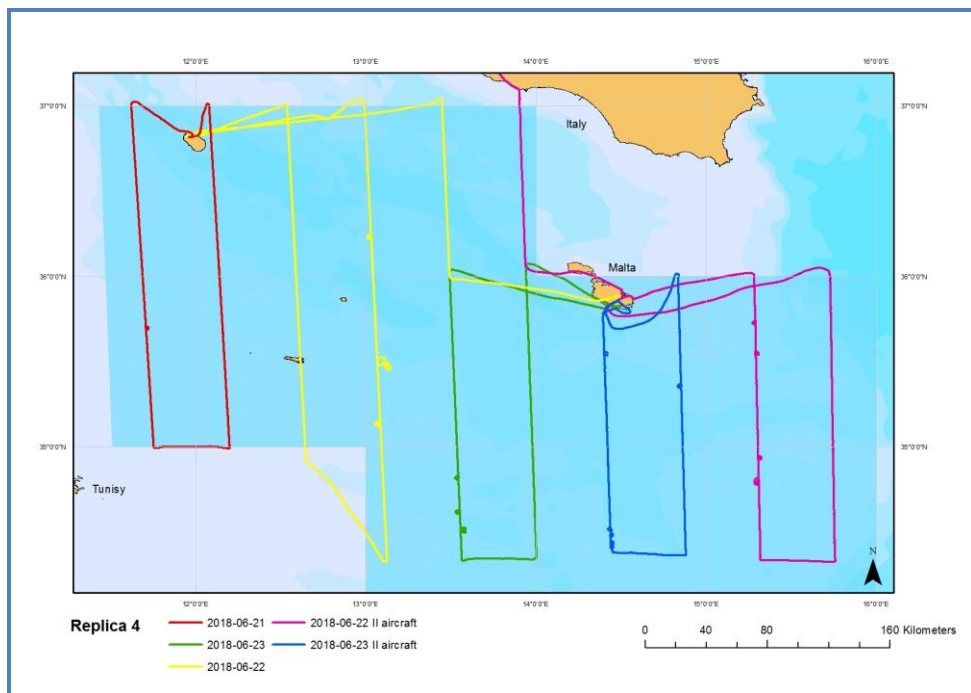


Figure 12 - Recorded GPS tracks: Area E, Replica 4



3.3 Sightings overview

Figure 13 and Figure 14 show the positions of the sightings of Bluefin tuna in Area C and E and the related values in terms of number of individuals and weight. All the details are available in Table 4 and in the annexed forms.

Figure 15 and Figure 16 show the distribution of the sightings of other species.

159 sightings were performed: 19 of BFT (8 in area C and 11 in area E) and 140 (46 in area C and 94 in area E) of other species. Several photos of BFT sightings are provided, as well as of other species. According to the professional spotters' opinions, some of the BFT schools could be deeper and less visible, but professional spotters could estimate them according to their experience. Most of the schools were seen under the surface rather near to the aircraft.

The 2018 survey was performed about in the same period of the last two campaigns (2015 and 2017), but earlier than 2013 (started on June 18th). While in Area C the BFT sightings were distributed along the whole survey period, in the Area E they occurred only in the last 4 days. As usual, a certain number of loggerhead turtles and undefined dolphins were sighted. Some swordfishes were seen both in area C and E. Three pilot whales small groups and three sperm whales were detected in the area E. A shark was seen in area C. An albacore small school in Area E was seen, as well.

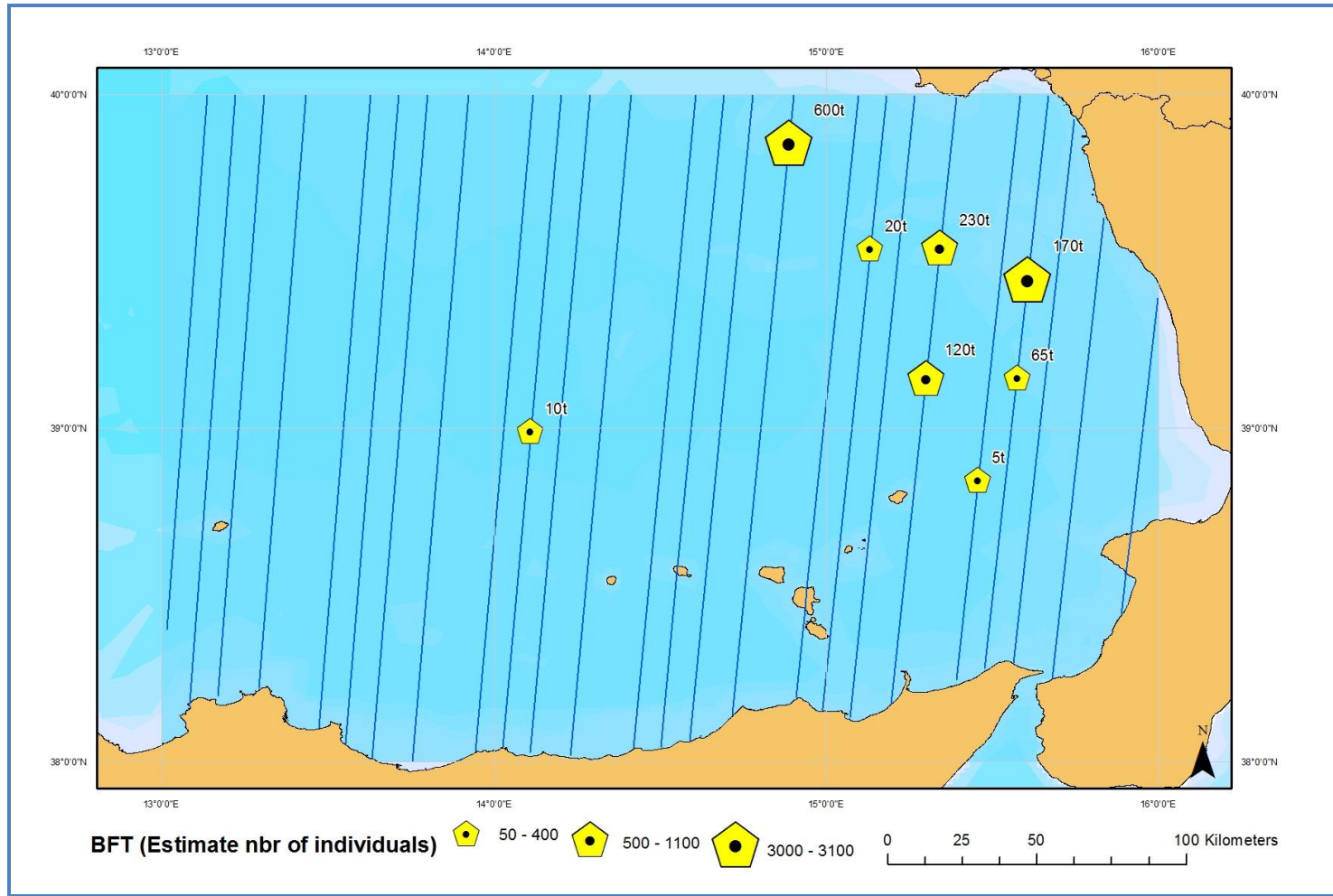


Figure 13 - AREA C, Map of the BFT sightings (number of individuals and weight)

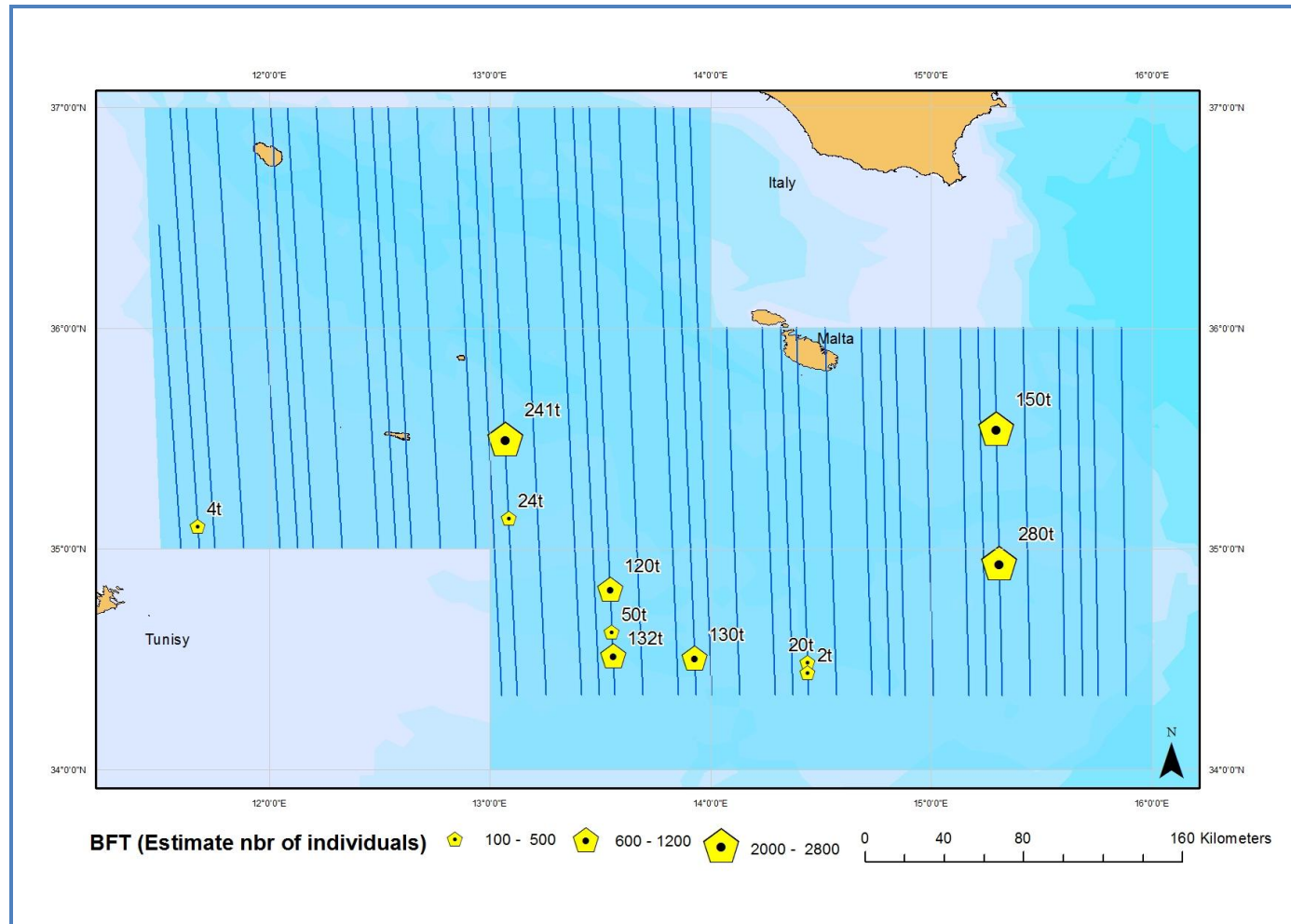


Figure 14 - AREA E, Map of the BFT sightings (number of individuals and weight)

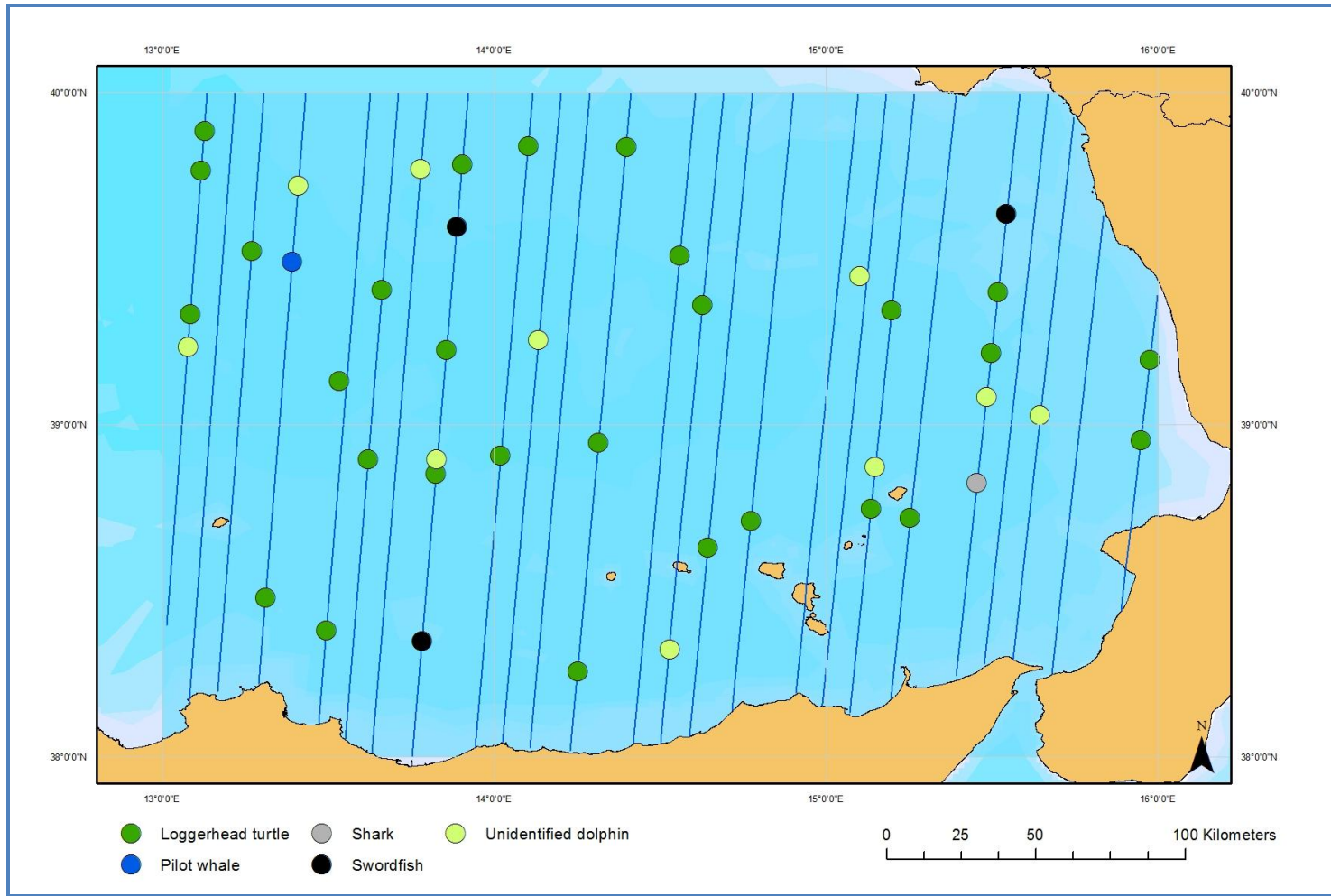


Figure 15 - AREA C, Map of the other species sightings

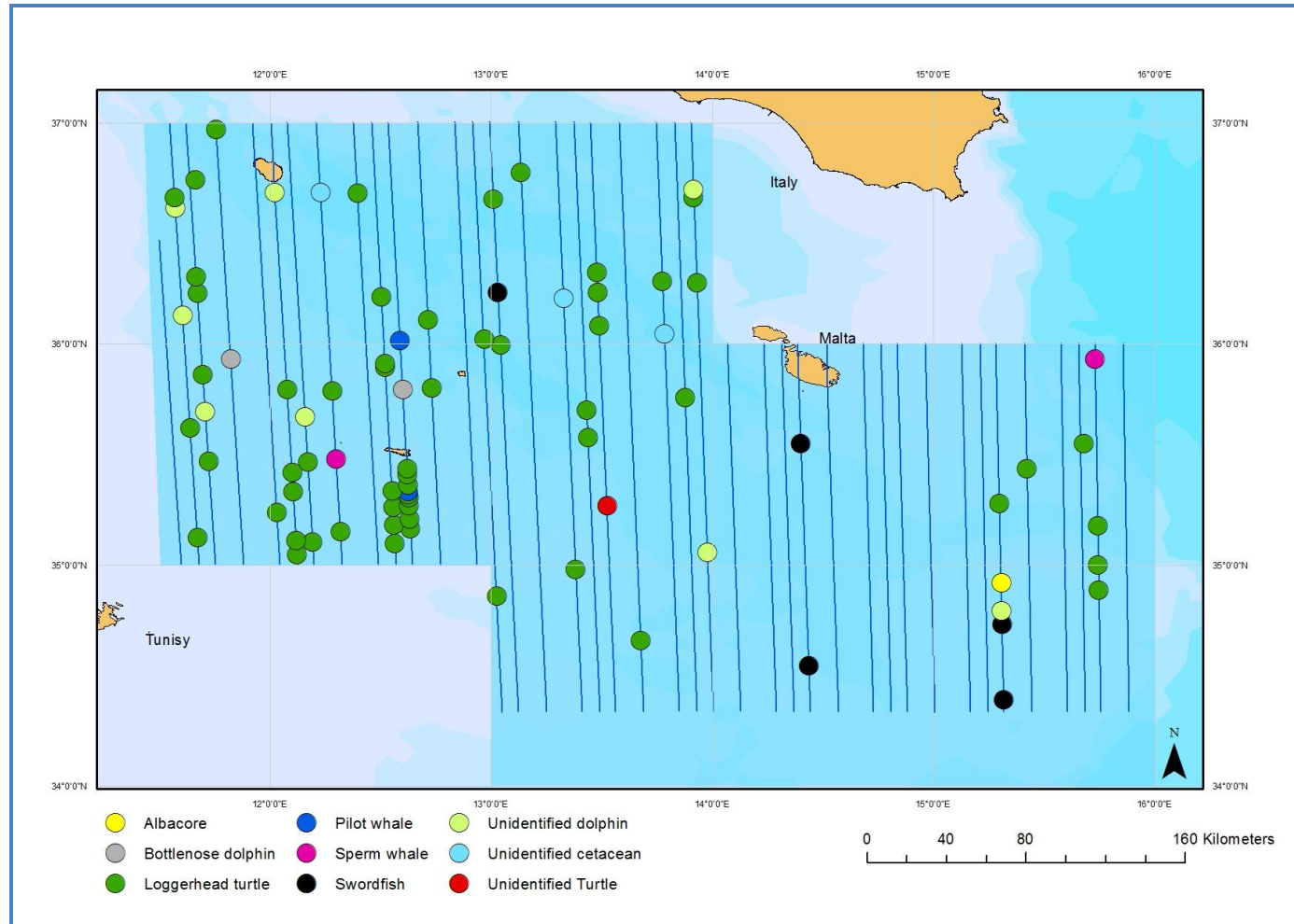


Figure 16 - AREA E, Map of the other species sightings



Table 4 - Overview of the BFT sightings - I-GNIT (ICCAT 2) aircraft

AREA	ID	Date	Time abeam	Lat first sighting	Lon first sighting	Abeam?	Angle abeam	Altitude	Spotter	Cue	School size PS	Weight PS (t)	% small	% med	% large
C	9	31/5	10:32:45	39,53628	15,13123	Y	30	303	75	TR	100	20000			100
C	10	31/5	12:08:03	39,15066	15,57429	Y	32	301	75	TR	400	65000		25	75
C	11	31/5	10:23:08	39,44553	15,60636	Y	35	300	38	SH	3100	170000		97	3
C	13	1/6	8:57:54	38,98999	14,10896	N	29	309	34	TR	50	10000			100
C	18	3/6	08:17:22	39,54023	15,34212	Y	21	303	37	SU	1100	230000		25	75
C	19	3/6	08:38:36	39,15069	15,29926	Y	23	309	34	SU	500	120000			100
C	25	6/6	10:49:45	39,85423	14,88815	Y	45	300	38	SH	3000	600000			100
C	40	12/6	9:02:57	38,84314	15,45607	Y	28	313	38	RI	100	5000		100	
E	66	22/6	14:43:35	34,93633	15,30558	Y	48	291	34	SP	2800	280000		70	30
E	69	22/6	15:09:13	35,54583	15,29247	Y	43	301	34	SP	2000	150000		100	
E	73	23/6	10:13:56	34,43600	14,43956	Y	26	333	34	SP	100	2000	100		
E	74	23/6	10:17:04	34,48295	14,43815	Y	44	310	34	SP	500	20000		100	

Table 5 - Overview of the BFT sightings - I-AGSD (ICCAT 3) aircraft

AREA	ID	Date	Time abeam	Lat first sighting	Lon first sighting	Abeam?	Angle abeam	Altitude	Spotter	Cue	School size PS	Weight PS (t)	% small	% med	% large
E	23	20/6	08:06:14	34,50241	13,92561	Y	57	307	65	SH	1000	130000		70	30
E	42	21/6	11:15:07	35,09879	11,67422	Y	32	300	39	JU	200	4000	100		
E	60	22/6	10:12:31	35,49940	13,06747	Y	6	317	31	SP	2600	241000		80	20
E	61	22/6	10:38:26	35,13610	13,08508	Y	11	306	39	SP	300	24000		100	
E	77	23/6	09:33:11	34,81495	13,54363	Y	24	299	31	SP	1200	120000		100	
E	78	23/6	09:45:41	34,61945	13,55193	Y	15	314	39	SP	500	50000		100	
E	79	23/6	09:53:02	34,51326	13,55639	Y	20	303	65	SP	1100	132000		30	70



3.4 Methodological remarks and discussion

Regarding the methodological aspects of the sightings, no significant difference from the past campaigns is worthy of notice.

The campaign was carried out without special problems in the Area C: only two short stops were decided, for weather reasons.

Regarding the Area E, many difficulties were related to weather conditions, while other difficulties (logistics and administrative) were avoided with a careful planning. Bad sea and wind forecasts forced the crew to continuously modify the flight plans in order to avoid strong wind areas, as well as to speed up the surveys performing more than one flight per day. In two moments, the survey was stopped. The worst difficulty was linked to the high variability of the forecasts from a day to another: for this reason, during the second stop the crew didn't move from Malta ready to perform the flights on the first good day, rather than go back home and waste time, especially because the survey deadline was approaching.

It is confirmed that the bubble windows are very useful for vertical and near spotting, but at the same time they create some disturbance for taking photographs because of the strong light reflection and light distortion. Even if the camera was set with the highest shutter speeds, sometimes the photographs were "blurry" or distorted: this seems to be the result of the window interference.

As in the past campaigns, an external antenna was installed and connected to the GPS. We suggest to fix it over the aircraft instrument panel or on the upper part of the front window in order to overcome some GPS signal reception problem, already noticed in the former campaigns, especially during circling.

As for the sightings of other species, particularly turtles, since during the survey it was stressed to register them in a systematic way, and it happened to have long periods with only a few sightings followed by strong concentrations of sightings, we suggest to modify the way of registration. It could be much more practical to register them in a separate sheet, where only the position and time of the sighting is requested (it is enough to mark a point in the gps). Since these species are not the main focus of the survey, it is probably not important to have information about abeam or not, declination angle and type of cue or to have two different (F and A) waypoints (they are sighted almost always under the aircraft, with the animal swimming at the surface): this modality would permit to sign them without affecting the main target of the survey even in the cases when all of the sudden a big number of sightings occur.

Regarding the BFT spotting results, the importance of southern Tyrrhenian Sea and of Sicily Channel as bluefin tuna spawning areas is confirmed. Among the 19 BFT schools observed (8 in the Area C and 11 in the Area E), most of them were detected lower under the surface. Only in very few cases they were clearly seen on the surface.

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Weather forecast websites

Passageweather	www.passageweather.com
Windy	www.windy.com (and smartphone app)
Windfinder	http://it.windfinder.com
Mediterranean Wave Forecast	http://isramar.ocean.org.il
Aeronautica Militare Italiana	http://www.meteoam.it
Consorzio Lamma	http://www.lamma.rete.toscana.it



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5. ANNEXES

1. Complete Effort and Sighting forms
2. GPS tracks and tables
3. Photos
4. Power Point presentation