Technical Mission Report
Atlantic Bluefin Tuna
Aerial Survey
GBYP Research Program
(Area G – Phase 8)

Aegean Sea -Levantine Sea

14/06/2018

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I. Introduction

a) Background and objectives

The Atlantic bluefin tuna (*Thunnus thynnus*) is distributed throughout the Atlantic and the Mediterranean Sea. This makes it a shared fishery resource, with high market value and is exploited by more than twenty countries. The improving knowledge of the biological processes of bluefin tuna is essential to develop an international stock management policy for the sustainable exploitation of this resource (Lecomte, 2017)

The comprehensive ICCAT Atlantic Wide Research Program on Bluefin Tuna (GBYP) is required to improve basic data collection, the understanding of biological key and ecological processes, assessment models and management. An important element of this program is to carry out aerial surveys of the spawning population by transecting the Mediterranean Sea where and when shoals are traditionally sighted close to the sea surface to support the development of fishery independent index. Within this context a Mediterranean-wide extensive survey is carried out for a better understanding of the presence of spawners and their distribution.

This action plan was implemented for the first time in 2010 when four flight zones were defined. In 2011, new proposals on the area were set up and were taken again in 2013. Indeed, the actors of the GBYP program decided that it was better for the aerial prospecting area to take place in June. This period is interesting because it concerns the spawning time of bluefin tuna in the Mediterranean. At this time the spawning activity is optimal, but it can be disturbed by environmental conditions. ICCAT then decided to extend its survey area into seven areas to be observed. These 7 areas named from A to G were formed of parallel transects made from a statistical model. We can find Area A: Western Mediterranean/Balearic Sea, Area B: Western Mediterranean/Sardinian Sea, Sub-area C: Tyrrhenian Sea, Area D: Central- southern Adriatic Sea/Northern Ionian Sea, Area E: Strait of Sicily/Central-southern Mediterranean Sea, Area F: Ionian Sea/Eastern Mediterranean Sea/Aegean Sea, Area G: Aegean Sea/Levantine Sea. The aerial survey was also carried out in 2015 and 2017.

Regarding the 2018 prospection, the method used in 2017 is repeated, dividing the Mediterranean area into 4 areas overlapping with corresponding areas in previous survey (Area A: Western Mediterranean/Balearic Sea, Area C: Tyrrhenian Sea, Area, Area E: Strait

of Sicily/Central-southern Mediterranean Sea, Area G: Aegean Sea/Levantine Sea) as we can see below on the (fig.1). This choice is based on the previous aerial surveys data collection and fisheries data. (Cañadas, Vázquez, 2017)

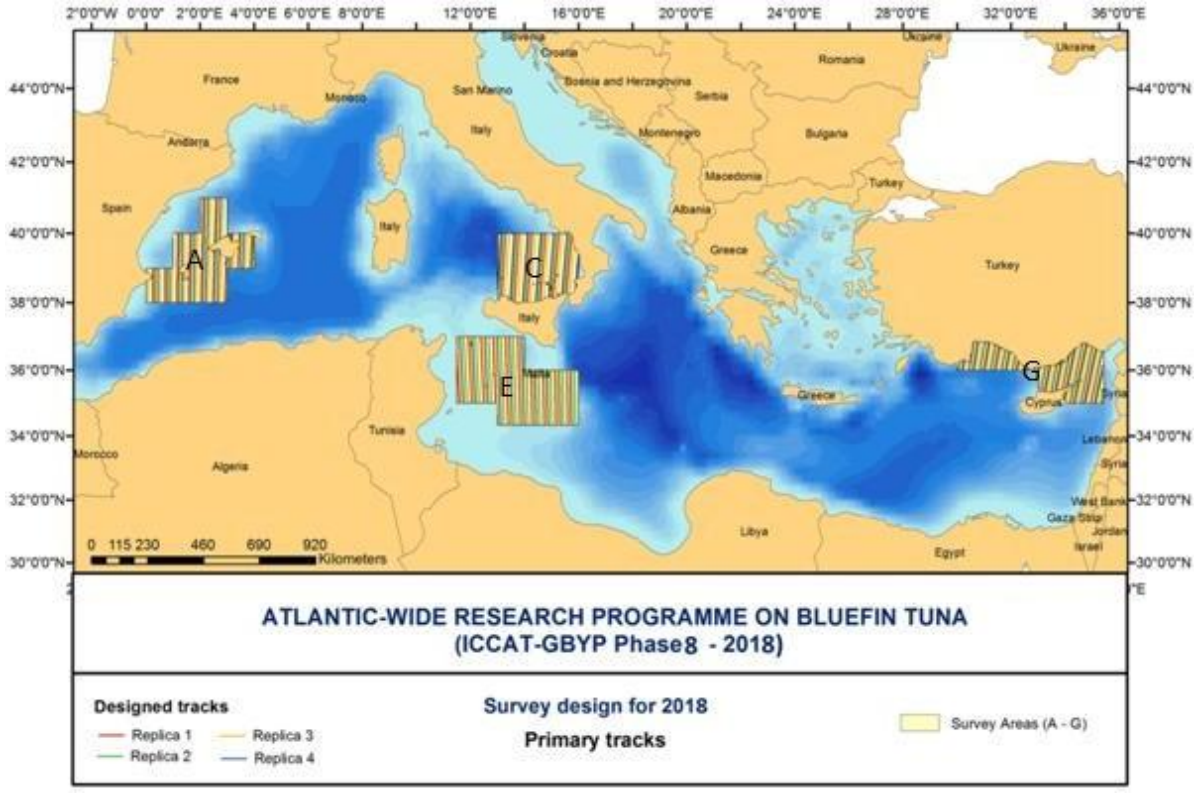

Fig. 1 : Survey ICCAT-GBYP Phase 8-2018

The 2018 Area G prospection was again entrusted to the Action Air Environnement French Company. This report will only process the information collected on the area G and will review the efficiency of the flights, our targeted species (Bluefin Tuna or BFT) and the secondary species sighted. All European staff involved in the surveys was called for a training session held at ICCAT headquarters in Madrid on May 16th, 2018, to explain the methodology, the operational standards and to share the previous field experiences.

II. Sampling protocol

The activities were carried out in accordance with ICCAT's call for tenders and the technical specifications attached to the contract. The behavior of the reproduction of bluefin tuna was detailed by Arena, P. (1978) in the Mediterranean; they explained that species tend to accumulate in schools from the end of April, with a maximum aggregation when the surface mixed layer above the thermocline exceeds 20 ° C.

This mission was conducted in June 2018. It began on May 30th ,2018 and ended on June 14th, 2018.

a) The aircraft and the team

The aircraft was a Cessna 337 code F-BVIT (fig.2) previously used for professional activities in support of bluefin tuna fishing. “Bubble windows” were applied to improve sightings as foreseen by ICCAT. Cessna 337 technical details are available in the 2010 report of Belleney and Ramonet (Bellenet *et al*, 2010).

As required by ICCAT, the aircraft had to maintain an approximate altitude of 1000 feets and a speed of 100 knots. The flying autonomy is about 5-6 hours.

Fig.2 : Cessna 337 Aircraft

The team was composed of four members (fig.3). An airline pilot FERON Patrick who already did the ICCAT aerial surveys; a professional spotter FONTANET Silvere seated in the front starboard. His role was to spot the fish and guide the pilot around it. He was able to determine the mass, the size and the behavior of the tuna shoals. The two scientists, ALLARD Rémi (France) and Cihan TOSLAK (mandated by Turkey) sat behind and they exchanged their places each new flight for a better uniformity of the data collection.

The scientific role on flight was also to determine the mass, the size and the behavior of the tuna, to take pictures as much as possible in case of spotting, and to identify other species such as marine mammals, turtles etc. While tuna schools or other species were observed on track waypoint, it was recorded on the GPS to retrieve the geographic coordinates and inclination angle.

Fig.3: Action air environment team 2018 for area G

b) Data collection equipment

The aircraft is equipped with a Garmin 795 GPS on the front of the aircraft for the pilot and a second GPSmap 527xs (fig.4) was installed in front of the professional spotter. This second GPS is used for data collection.

Fig.4: GPS equipment

For data collection, scientific observers used a SUUNTO PM 5 / 360PC inclinometer (fig.5) to measure the declination angle between the aircraft and the school of fish. This measurement shows how far away the school of fish is.

Fig.5: Suunto PM5 Inclinometer

During the flight, the observations are made along the transects, when the plane is on these lines the whole team is in searching effort; this event is called "ON EFFORT". Between the lines when the team is at rest, it's called "OFF EFFORT".

As required by ICCAT the scientist fills the Excel® files (see Appendix 1) which includes the time of observation, the GPS position, the altitude, the weather conditions and other details. He also had to fill the sighting Excel® files (see Appendix 2) in case of tuna school spotting, which includes the time of spotting, the position of the fish, the estimated mass (in tons), the size (small, medium, large), and also the behavior of the species.

c) ICCAT Tuna sighting protocol

The crew member who sees the animals first shall communicate it to the others. The SS on the opposite side from where the animals were detected shall fill out the number, date, hour, event (F) lat and long.

2. The aircraft keeps its course until animals are abeam. In that precise moment the SS on the side of the sighting shall take the declination angle. The other SS shall once again fill out the hour, event (A), lat, long, angle, observer, cue, species, bank angle and fill with "Y" in "Abeam" column

3. It is mandatory in all BFT sightings to leave the transect to obtain a better estimate of the school weight and size, when the pilot gives the signal to leave, the SS shall note the time, the event (LE), the lat and long.

4. When starting the circles, the pilot shall notify the SS who will note again, the time, the event (C), the lat and long. This position shall correspond to the limit of the circle so the position of the sighting shall be calculated after the survey with GIS tools. The circles must always be clockwise; therefore, the PS has the best view of the school. ". **It is MANDATORY to always record both estimates by the PS and the SS independently .** In the case where the school has been detected by another crew member, SS shall note both separate estimates (from the pilot or the other SS plus the PS). The SS on the same side is in charge of taking photos when possible. The PS shall look at the school for improved estimates and the SS on the same side can take better photos.

5. After 1 or 3 circles (depending on the difficulty of the estimate), the aircraft shall return to the point where it left the transect. During this short period, the SS ensures that all data have been properly recorded.

6. The pilot shall manoeuvre as shown in Fig. 6 and shall notify the SS when the aircraft returns to the transect is reached. SS shall note hour, event (RE), lat and lon.

At the end of each flight, the GPS tracks are extracted, saved and transferred on Homeport® by Garmin and Google Earth® to control the data and produce maps for better readability of the results.

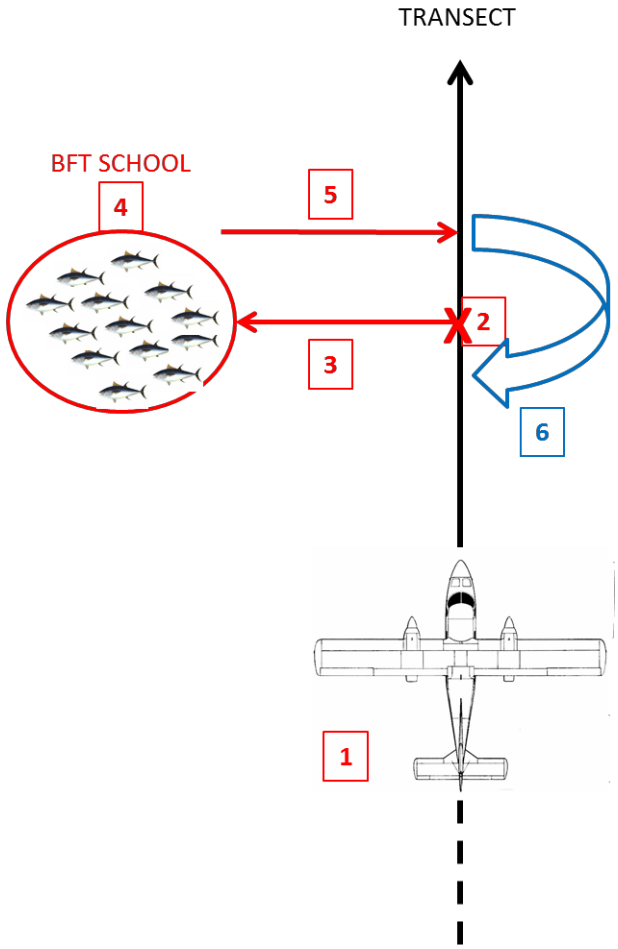

Fig.6: Typical Case. The school is close enough to obtain all data

During the flight we have a CANON EDS 70D camera with an 18-200 nm lens, a stabilizer and a polarizing filter, used to photograph schools of tuna and other species observed during the mission.

a) Weather conditions

Before each flight, the team consults the weather conditions quality of the day. If before leaving, or on the spot, the pilot and/or the cruise leader consider a lack of visibility for the bluefin tuna observation or the flight conditions are bad for their safety, they are entitled to decide not to fly or to return. The minimum visibility limit was set at 3.5km and observations cannot be made beyond 7.5km. For 'good' observational conditions, a sea state should be less than 2 or equal to 2 (Douglas scale) and a water turbidity less than 2 is required. The observation conditions are considered as " average " if there was too much fog and if the

professional spotter saw deep enough and there was not too many sea foam on the surface. On the other hand, poor conditions for observations relate to a rough sea with abundant clouds and thick fog. The spotter cannot perceive bluefin tuna school at a sufficient distance and depth. The collection of data under these conditions cannot be taken into account by ICCAT (Relot *et al 2015*)

b) Theoretical area G

The working area is located on the North-West of the Levantine Sea, between southern Turkey and the North and East of Cyprus (fig.7). The total transect length is 2777,4 nm and the distance and the details of the position are summarized below (fig.8). The area is divided into 14 or 15 transects and each transect is replicated 4 times (1-2-3-4).

Transect	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Replica 1 (nm)	75.7	100.5	110.3	90.4	56,6	46,9	5.3	4.6	18.6	25.7	32.4	49.9	51.2	14.8	
Replica 2 (nm)	56.7	98.3	104,8	98.1	55	48.6	19.3	2.3	13.8	33	41.1	49.5	50.9	17.3	
Replica 3 (nm)	27.5	95	104.8	108.6	59.9	51.6	45.9	1.8	8.4	29.3	38.4	47.9	51.2	12.8	4.8
Replica 4 (nm)	9.1	95.8	103.1	110.4	64,8	50.8	46.5	4.7	6.1	24.5	35.6	45.1	51.2	51.8	14.6
Total (nm)	168,8	389.6	426.4	407.5	236.3	197.9	117	13.4	46.9	112.5	147.8	192.4	204.5	96.7	19.4

Fig.8 Table of theoritical transects

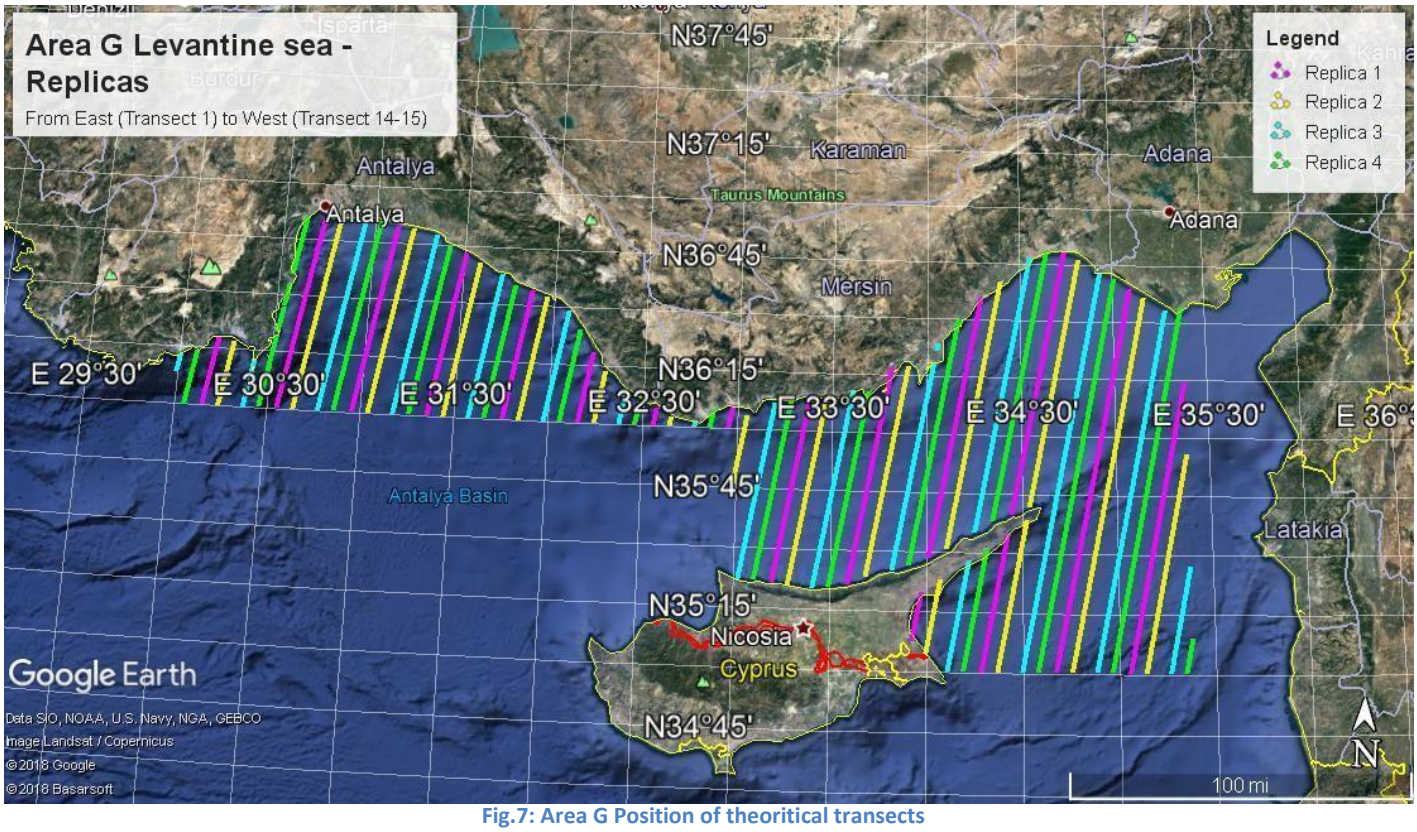

Fig.7: Area G Position of theoritical transects

c) Effective area G

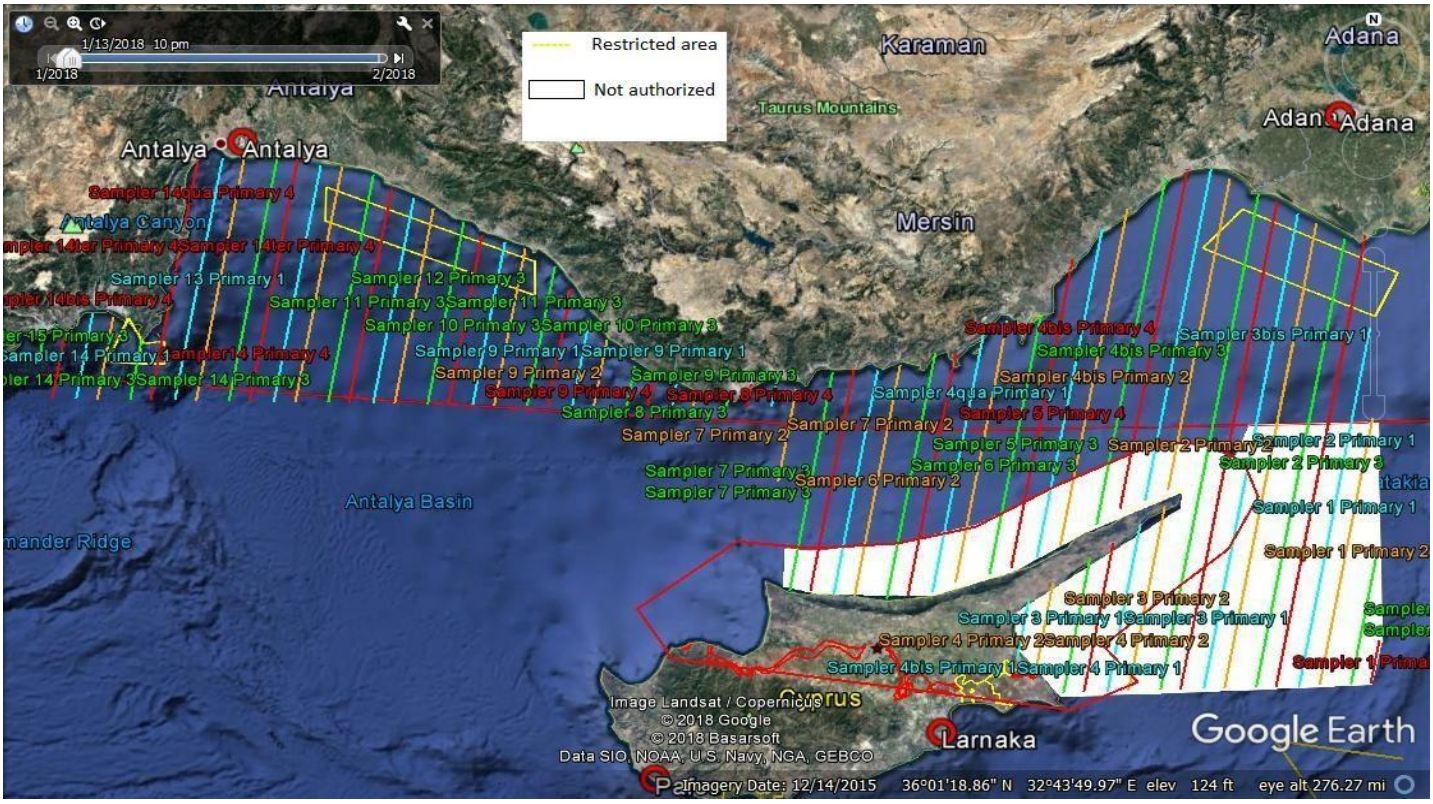

Fig.8: Area G Position of possible transects ordered by the authorities of Adana airport on 30 may 2018

Aerial surveys of bluefin tuna in Turkish and Cyprus airspace require complex procedures in order to obtain flight permits.

The international community, except Turkey, recognizes only southern Cyprus, considering northern Cyprus as an "occupied zone". Turkey recognizes the North as the "Turkish Republic of Northern Cyprus", and the South as the administration of Greek Cyprus; each having control over its own territory. Internationally, there is only one FIR (Flight Information Region), the one of Nicosia (South), covering all the airspace of Cyprus. The Turks consider that the northern part of this FIR is an "Ercan Advisory Airspace", Ercan being the airport of North Cyprus. Prior to each flight, the NOTAM issued to the crew by the operations of the departure airport stresses that Ercan is the only organization authorized for air traffic control, security, search and rescue in this area.

The Cyprus part of the work area programmed by ICCAT is entirely located in the northern part. Usually the Turkish authorities have made it clear to us that flights in this area should be the subject of a request to the authorities of Northern Cyprus.

This step was therefore taken, and an authorization was quickly obtained without restriction or limitation of duration. The authorization flight progress and various facts are detailed below. Fig.9

Dates		**Airports**		**Comments**
		Take off	**Landing**	
28-mai	Mond.	Cuers	Bastia	Remarks for below : Cyprus (South) only authorizes flights beyond the lines 12 nautical miles from shore line. Consequently some lines (transects) have to be cut in two : northern part of lines renamed with an "N" , southern part renamed with an "S".
28-mai		Bastia	Kerkira	
29-mai	Tuesd.	Kerkira	Dalaman	
29-mai		Dalaman	Antalya	
30-mai	Wednes.	Antalya	Adana	
31-mai	Thursd.			Flight plan with lines East of Cyprus (near Syria) refused by Adana operations
01-juin	Frid.	Adana	Adana	Clearance to enter East of Cyprus airspace refused. * : lines 1 and 2 : partial (only Turkish airspace)
02-juin	Saturd.	Adana	Antalya	
03-juin	Sund.	Antalya	Adana	
04-juin	Mond.	Adana	Adana	* : reminder of lines 1 & 2 réplica 1 East of Cyprus, that could not be flown on the 01 June. Dangerous area D13 penetrated.
05-juin	Tuesd.			
06-juin	Wednes.	Adana	Antalya	
07-juin	Thursd.	Antalya	Antalya	Dangerous area D8 penetrated.

08-juin	Frid.	Antalya	Adana	Very important military activity East of Cyprus, near Syria (war ship + helicopters) as warned by NOTAM. Line 1 not flown. Dangerous area D13 penetrated.	
09-juin	Saturd.	Adana	Adana	A few GPS signal interruptions and erratic altitude info, as warned by NOTAM	
10-juin	Sund.				
11-juin	Mond.				
12-juin	Tuesd.	Adana	Antalya	Dangerous area D8 penetrated.	
13-juin	Wednes.	Antalya	Adana	Russian Navy rocket firing in transects area (as warn by NOTAM)	
14-juin	Thursd.	Adana	Adana	Mission flown early, before beginning hour of Russian Navy rocket firing (07:00 UTC). Very important military activity East of Cyprus, near Syria (as warned by NOTAM). Line 1 not flown. On 2 occasions : order received from war ship on emergency frequency to move away, 3 miles south ot line 3 could not be flown. Dangerous area D13 penetrated.	

Fig.9 Authorization flight progress

Contrary to 2017 overflying within 12 nm of Cyprus was forbidden. On the 31st of May the Adana airport prevented us from flying into the Cypriot FIR because of very important military activity in this area in the East of Cyprus which is very close to Syria. The only explanation given from Adana airport operations is that the coordinates on the Turkish permit were on the FIR limit, which is normal since Turkish permit concerns Turkish airspace. They ignored the Northern Cyprus authorization; they even refused to contact the director of Northern Cyprus Aviation (Turkish Republic of Northern Cyprus, only recognized by Turkey).

This ban was finally lifted a few days later, allowing us to work and continue the transects but the ban persisted within the Cyprus's exclusive economic zone of 12 nm. Transect 1 of replica 3 and 4 could not be done because of the proximity to Syria.

III. Results

a) Log book and flight characteristics

The flights started on May 30th 2018 and ended the 14th of June 2018. 11 surveys, 61:06 hours of flights time were conducted with 50:50 hours for "survey flights time" and 10:16 hours for ferry times considering that starting off transect starts when aircraft's wheels leave the ground

and vice versa for landing. The total OFF effort and ON effort is 46:27 hours with 23:43 flighting ON effort and 22:44 hours OFF effort. The logbook details are summarized below (fig.10 and 11).

Dates		Airports				Flight duration	Survey	Transect
		Take off	Landing	Depart.	Arrival			
28-mai	Mond.	Cuers	Bastia	11:14	12:39	1:25		Ferry
28-mai		Bastia	Kerkira	13:23	17:18	3:55		Ferry
29-mai	Tuesd.	Kerkira	Dalaman	09:00	12:43	3:43		Ferry
29-mai		Dalaman	Antalya	14:07	15:20	1:13		Ferry
30-mai	Wednes.	Antalya	Adana	09:28	14:13	4:45	1	R 1 lines 13-14-12-11-10-9-8-7
31-mai	Thursd.							
01-juin	Frid.	Adana	Adana	08:14	13:19	5:05	2	R1 lines 1*-2*-3N-4-5-6
02-juin	Saturd.	Adana	Antalya	07:58	13:05	5:07	3	R 2 lines 7-8-9-10-11-12-14-13
03-juin	Sund.	Antalya	Adana	08:15	12:25	4:10	4	R 2 lines 6-5-4-3N
04-juin	Mond.	Adana	Adana	07:51	12:47	4:56	5	R1 line 1*-2*-3S + R2 lines 1-2-3S
05-juin	Tuesd.							Day off
06-juin	Wednes.	Adana	Antalya	07:47	12:18	4:31	6	R3 lines 4-5-6-7-8-9
07-juin	Thursd.	Antalya	Antalya	08:23	11:59	3:36	7	R3 lines 14-15-16-12-11-10
08-juin	Frid.	Antalya	Adana	08:10	12:40	4:30	8	R3 lines 2-3
09-juin	Saturd.	Adana	Adana	08:08	11:57	3:49	9	R4 lines 4-5-6-7
10-juin	Sund.							
11-juin	Mond.							Aircraft maintenance
12-juin	Tuesd.	Adana	Antalya	05:59	11:20	5:21	10	R4 lines 8-9-10-11-12-13-15-14
13-juin	Wednes.	Antalya	Adana	07:02	09:12	2:10		*R4 lines 1-2-3 not flown*
14-juin	Thursd.	Adana	Adana	04:37	07:27	2:50	11	R4 lines 2-3

Fig 10 : Area G GBYP 2018 logbook

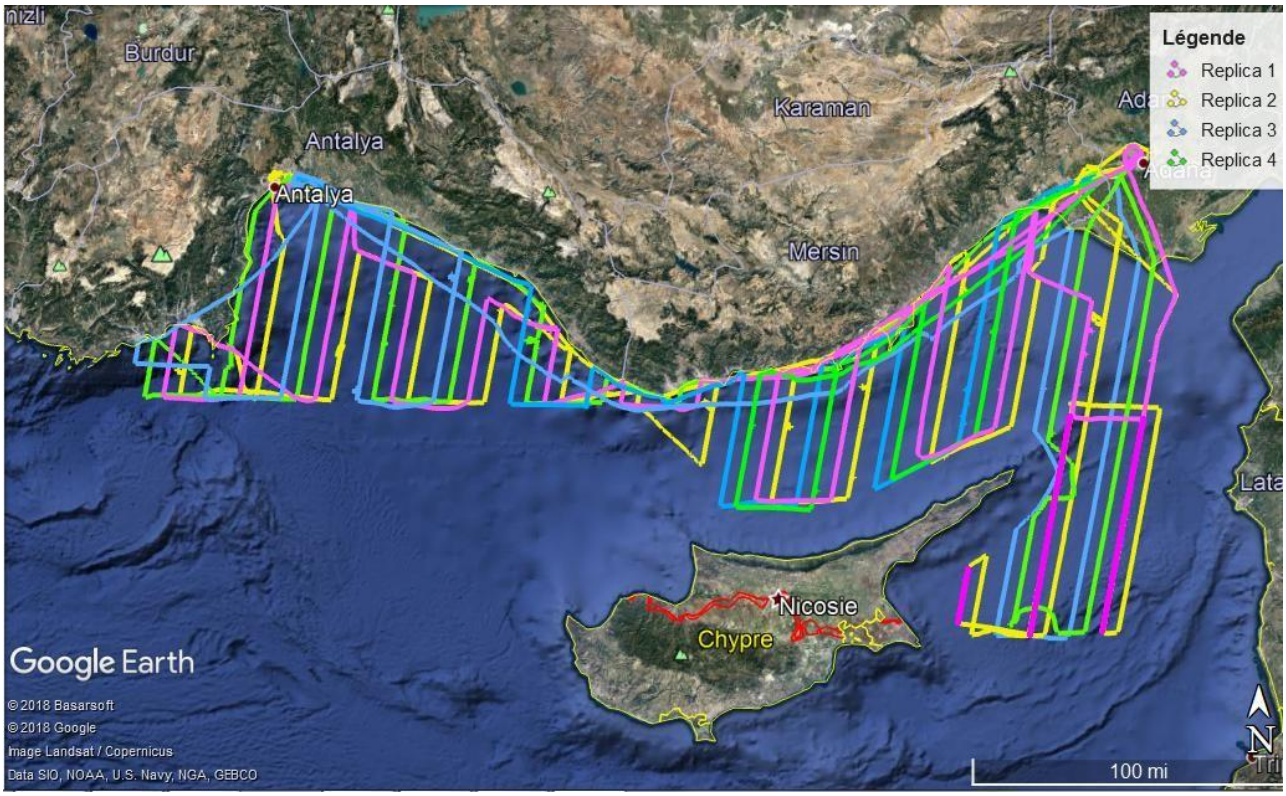

Fig. 11 : GBYP 2018 Map of Area G flighted for survey mission

b) Daily observation

For this part we consider the beginning of a flight or the take off as OFF EFFORT when the tires of the plane leave the ground and vice versa for the landing and we present the data by flight day (Survey 1 to 11 as fig12 to fig.22).

Only the estimates of medium weight and the quantity of the professional spotter are presented. For tunas we explained on the maps the individual number n and the medium weight. For cetaceans we mentioned only the number n but no number for turtles.

- 30th May, 2018

Survey	1
Date	30/05/2018
Departure	09 :44 :55
Landing time	14 :12 :55
Transect	14,13,12,11,10,9,8,7
Replicate	1
Total Time	4 :28
On effort Time	2 :00 :30
Off effort Time	2 :27 :30

Total Sightings	0

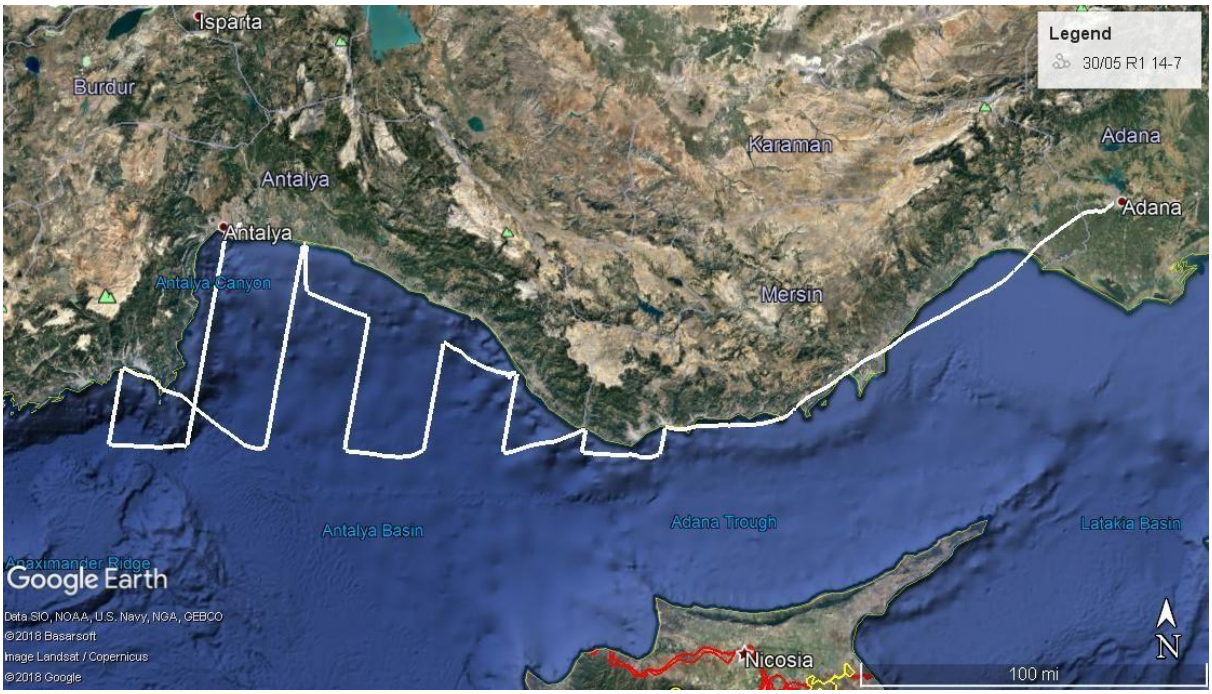

Fig.12 Survey 1 - Transects 14, 13, 12, 11, 10, 9, 8, 7 Réplica 1

- 1st June, 2018

Survey	2
Date	01/06/2018
Departure	08 :19
Landing time	13 :13
Transect	1*-2*-3N-4-5-6
Replicate	1
Total Time	04:53:29
On effort Time	02 :35 :47
Off effort Time	02 :17 :42

Total Sightings	9
ALBACORE	2
BFT	3
UNF	1
CAR	3

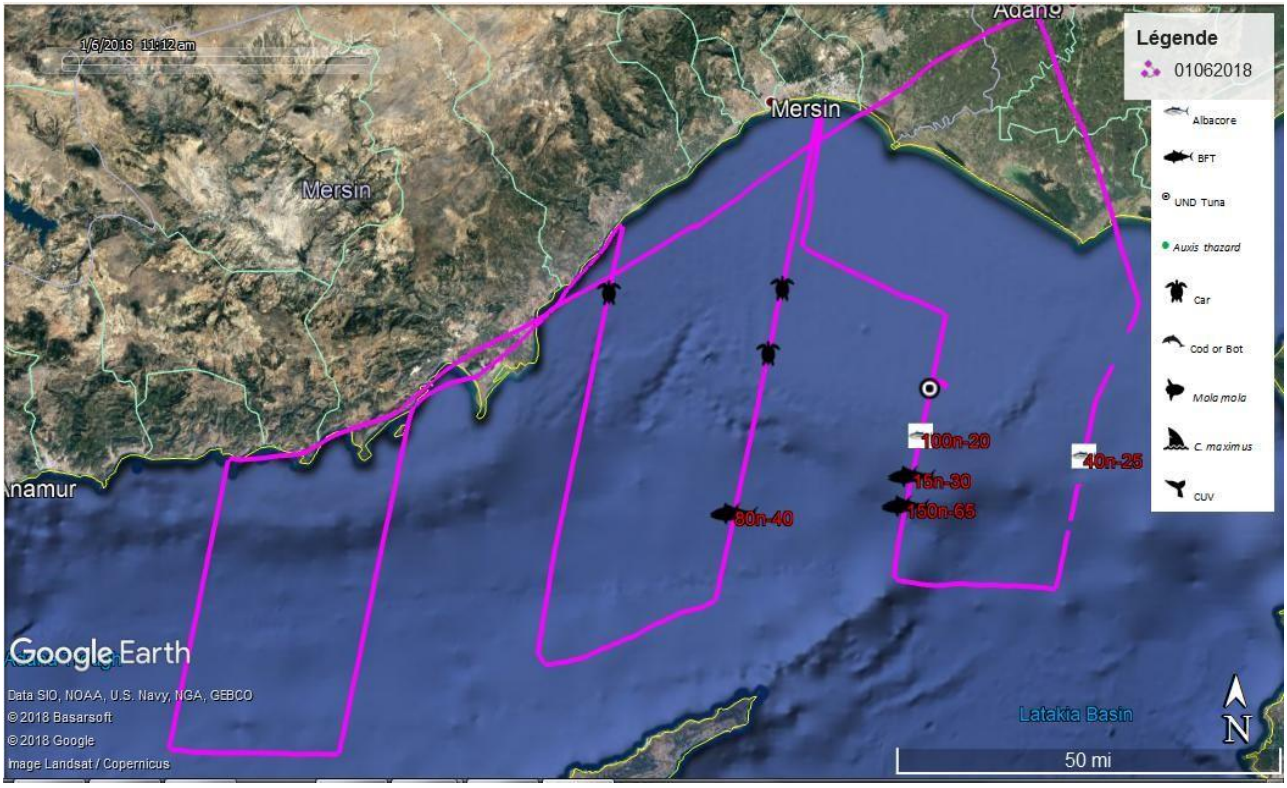

Fig.13 Survey 2 - Transects 1*-2*-3N-4-5-6 Réplica 1 (Xn=Individuals number - Y=Medium weight)

- 2nd June, 2018

Survey	3
Date	02/06/2018
Departure	08:05:00
Landing time	12:55:26
Transect	7-8-9-10-11-12-14-13
Replicate	2
Total Time	04 :50 :26
On effort Time	01 :59 :30
Off effort Time	02 :50 :56

Total Sightings	14
ALBACORE	2
BFT	2
UNF	2
CAR	7
COD	1

Fig.14 Survey 3 - Transects7-8-9-10-11-12-13-14 Réplica 2 (Xn=Individuals number - Y=Medium weight)

- 3rd June, 2018

Survey	4
Date	03/06/2018
Departure	08:24:30
Landing time	12:22:23
Transect	6-5-4-3N
Replicate	2
Total Time	03 :57 :53
On effort Time	01 :56 :47
Off effort Time	02 :01 :06

Total Sightings	7
BFT	4
UNF	1
COD	2

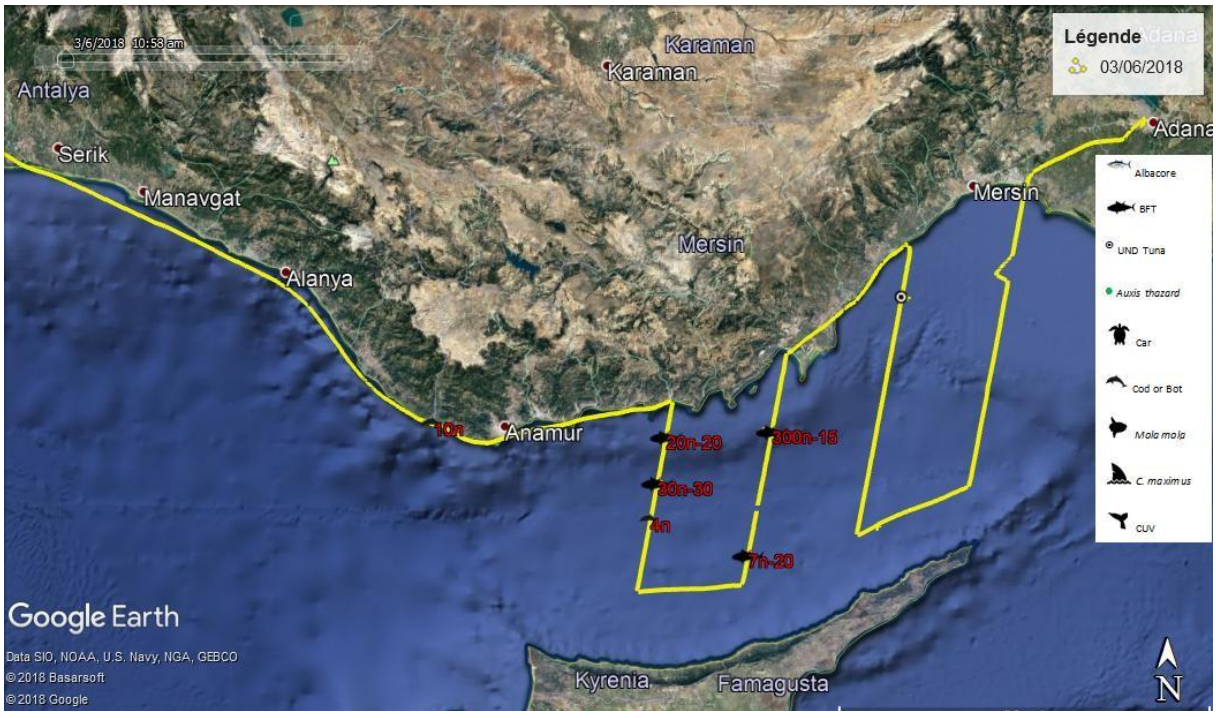

Fig.15 Survey 4 – Transects 6-5-4-3N Réplica 2 (Xn=Individuals number - Y=Medium weight)

- 4th June, 2018

Survey	5
Date	04/06/2018
Departure	07:52:27
Landing time	12:44:20
Transect	R1 line 1*-2*-3S + R2 lines 1-2-3S
Replicate	1-2
Total Time	04 :51 :53
On effort Time	03 :16 :49
Off effort Time	01 :35 :04

Total Sightings	0

Fig.16: Survey 5– R1 line 1*-2*-3S + R2 lines 1-2-3S (Xn=Individuals number - Y=Medium weight)

- 6th, June, 2018

Survey	6
Date	06/06/2018
Departure	07 :50
Landing time	12 :10 :00
Transect	4-5-6-7-8-9-10
Replicate	3
Total Time	04 :20
On effort Time	2 :18 :58
Off effort Time	02 :01 :02

Total Sightings	22
ALB	1
BFT	10
CAR	7
COD	2
BOT	2

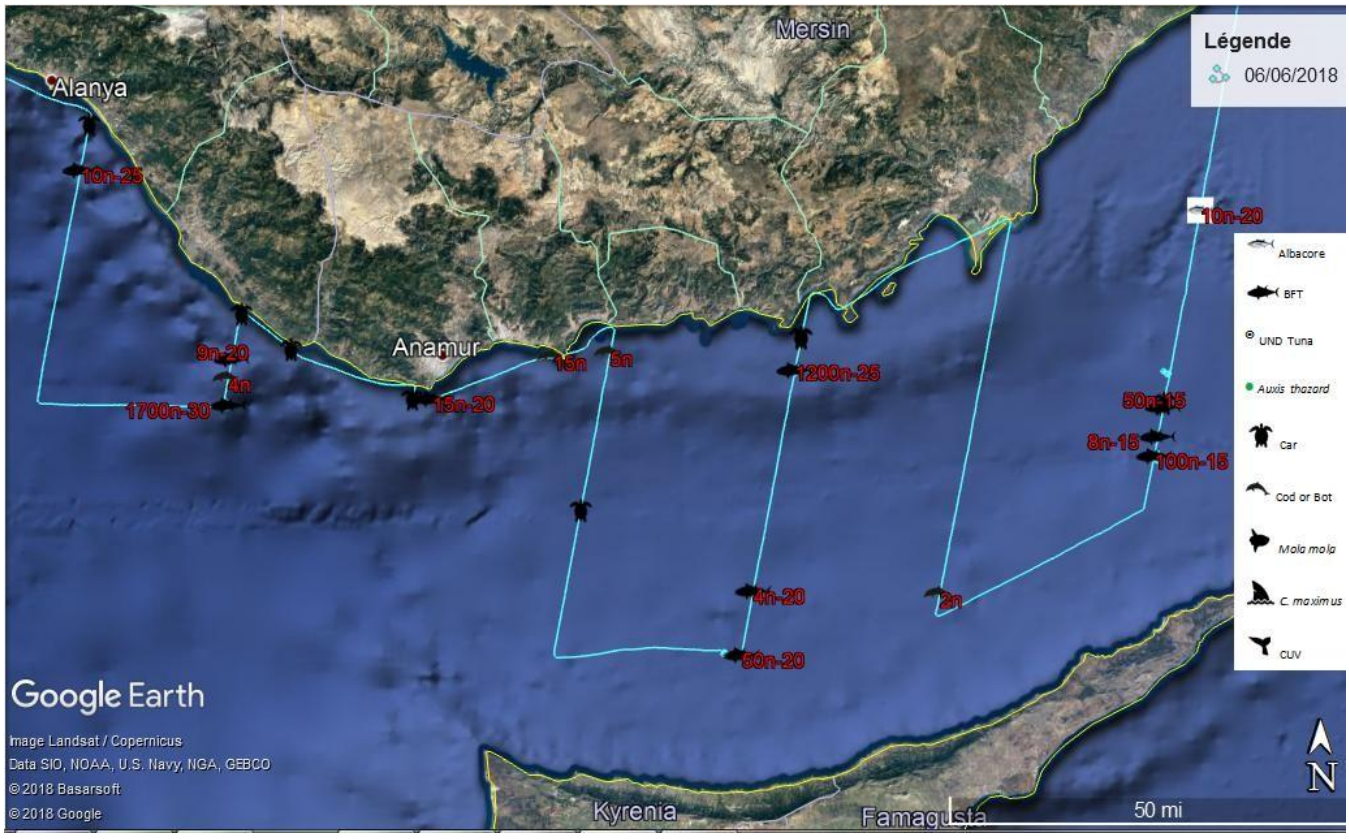

Fig. 17: Survey 6– R3 line 4-5-6-7-8-9-10 (Xn=Individuals number - Y=Medium weight)

- 7th June, 2018

Survey	7
Date	07/06/2018
Departure	08 :37 :35
Landing time	11 :54 :30
Transect	11- 12-13-14-15
Replicate	3
Total Time	3 :16 :55
On effort Time	1 :39 :04
Off effort Time	1 :37 :51

Total Sightings	4
BFT	2
COD	1
M.mola	1

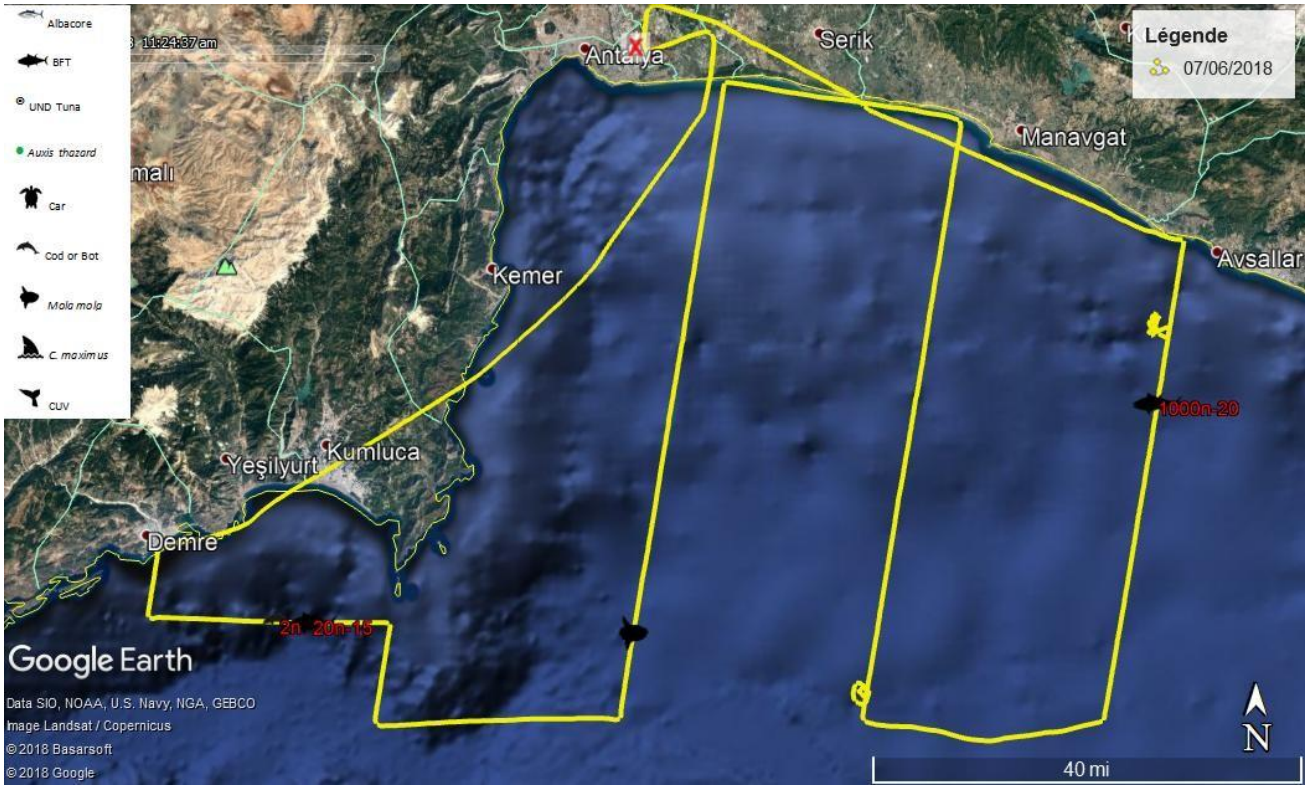

Fig. 18: Survey 7– R3 line 11-12-13-14-15 (Xn=Individuals number - Y=Medium weight)

- 8th June, 2018

Survey	8
Date	08/06/2018
Departure	08 :18
Landing time	12 :39
Transect	2-3
Replicate	3
Total Time	4 :21
On effort Time	1 :46 :34
Off effort Time	2 :34 :26

Total Sightings	12
BFT	7
CAR	3
C.maximus	1
BOT	1

Fig. 19: Survey 8– R3 line 2-3 (Xn=Individuals number - Y=Medium weight)

- 9th June, 2018

Survey	9
Date	09/06/2018
Departure	8 :12 :30
Landing time	11 :53 :50
Transect	4 -5-6- 7
Replicate	4
Total Time	3 :41
On effort Time	1 :57 :16
Off effort Time	1 :43 :44

Total Sightings	12
ALB	3
BFT	4
CUV	1
A.thazard	2
CAR	2

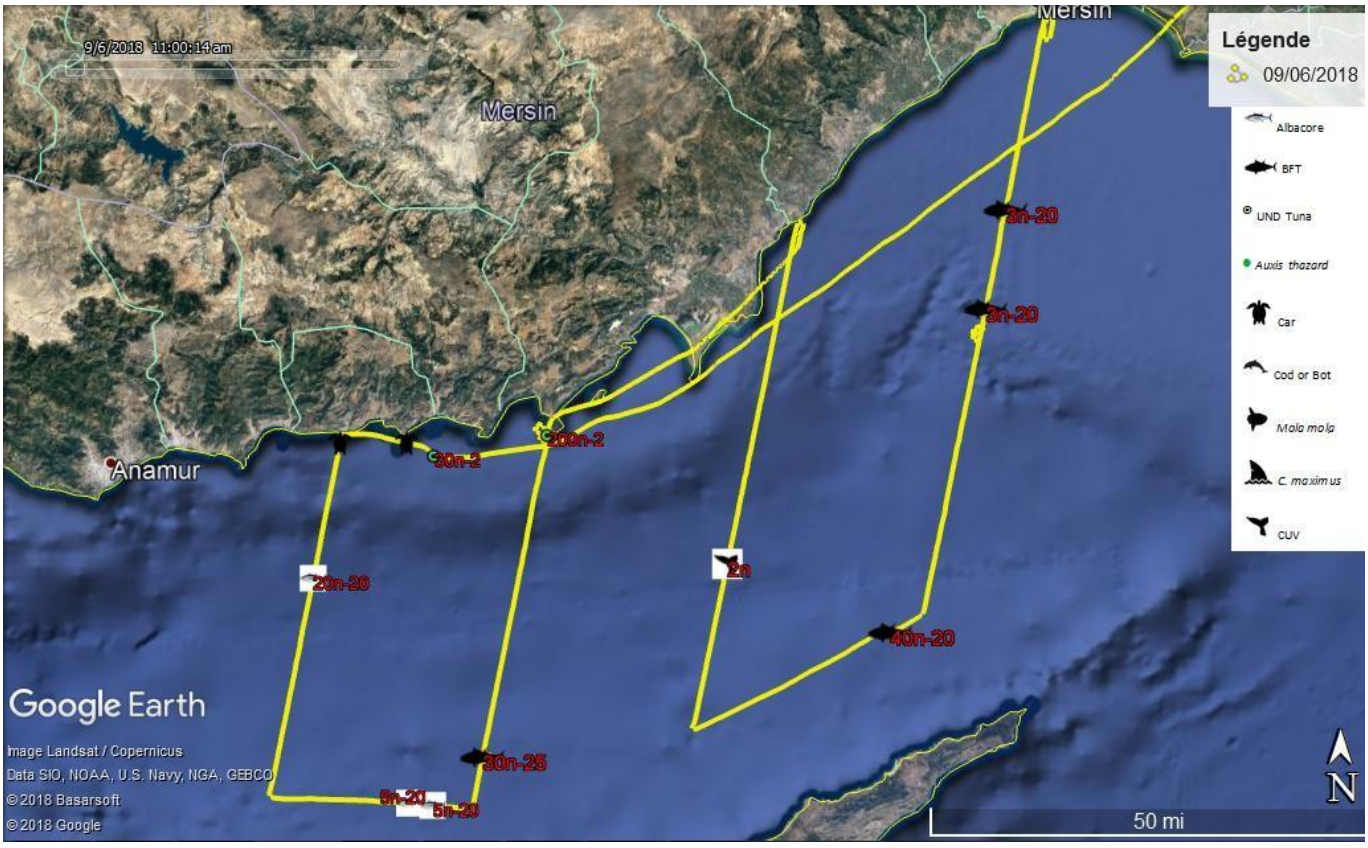

Fig. 20: Survey 9– R4 line 4-5-6-7 (Xn=Individuals number - Y=Medium weight)

- 12th May, 2018

Survey	10
Date	12/06/2018
Departure	06:07:15
Landing time	11:14:10
Transect	8-9-10-11-12-13-14-15
Replicate	4
Total Time	05:06:55
On effort Time	02:33:39
Off effort Time	02:33:16

Total Sightings	13
BFT	6
ALB	1
CAR	5
UNF	1

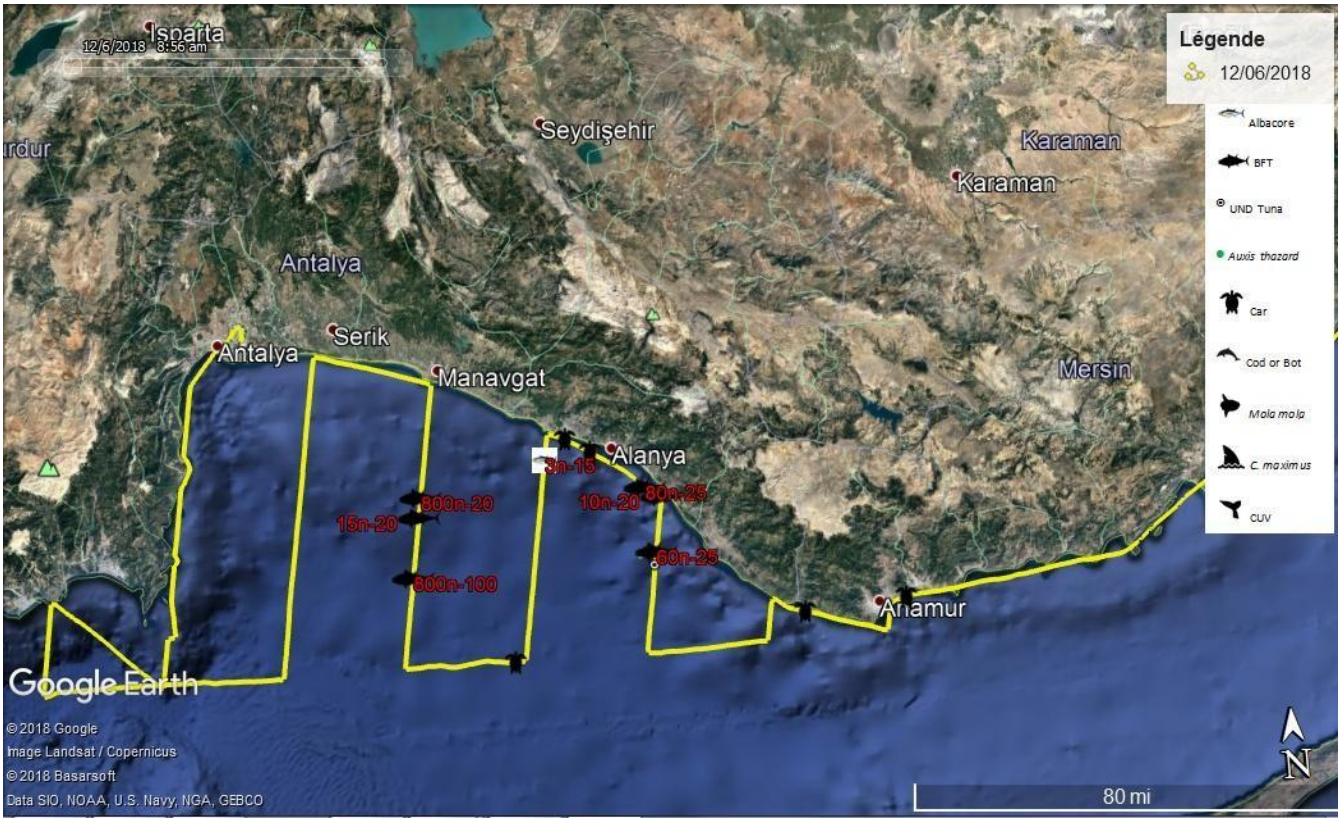

Fig. 21: Survey 10– R4 line 8-9-10-11-12-13-14-15 (Xn=Individuals number - Y=Medium weight)

- 14th June, 2018

Survey	11
Date	14/06/18
Departure	04:43:37
Landing time	07:24:00
Transect	2-3
Replicate	4
Total Time	2 :40 :23
On effort Time	1 :44 :56
Off effort Time	00 :55 :27

Total Sightings	0
UNF	1

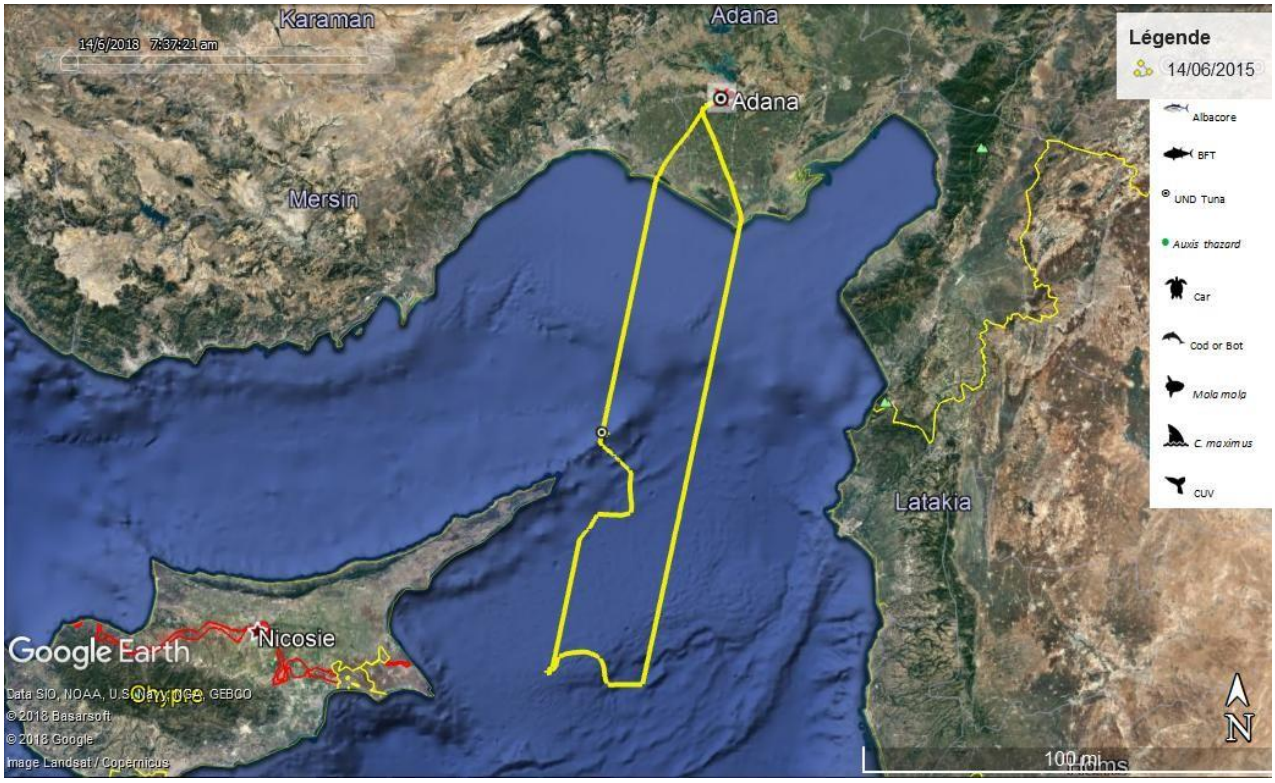

Fig.22 Survey 11– R4 2-3 (Xn=Individuals number - Y=Medium weight)

IV. Discussion-Conclusion

a) Scombridae sightings

A total of 94 observations were made on the G area including 54 scombridae observations. For these 54 sightings, there are 38 observations of *Thunnus thynnus* BFT, 9 sightings of *Thunnus alalunga* (ALB), 2 observations of *Auxis rochei* and 5 observations of Scombridae still indeterminate.

On the whole mission, 10614 species of *T.thynnus* were identified for a total weight of 334.620 tons, 25 observations concern what we called small schools (<25kg) and 12 observations concerned medium-sized fish between 25 and 150 kg.

Concerning *Thunnus alalunga* (ALB) we found 10614 species for a total weight of 12.070 tons.

b) Other species

In this study approximately 86 specimens were reported belonging to six identified species (3 sightings of *3 Tursiops truncatus BOT,* one sighting of *Mola mola,* one sighting of *Cetorhinus maximus, 6* sightings of *37 Delphinus delphis (COD)* and one sighting of 2 *Ziphius cavirostris (CUV).* The most commonly species seen was the *Caretta caretta (CAR)* with 27 sightings for 31 species.

c) Comparison

The objective of this mission was to collect as many biological and meteorological data as possible during the observation of *Thunnus thynnus*, in order to establish mathematical models on spawning population migration, and the presence of young tunas etc. Today it is generally accepted that bluefin spawning can start at 19,5-20° C with a peak around hot weather (23-24 ° C) in specific and restricted areas (around the Balearic Islands, Sicily, Malta, Cyprus and in some areas of the Gulf of Mexico),

Given the results from previous years, the observed quantity of bluefin tuna is lower compared to 2017 in the same area with 44065 specimens for 901.57 tons but is still normal or better compared to the low quantity observed in 2015 (2534 specimens for 38 tons).
The area in question is still frequented by small fish on the surface. According to the professional spotter the big fish seems more difficult to meet in this area where the big fish is probably in depth.

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VI. Table of appendixes

a) Appendix 1

EFFORT FORMS

SURVEY DETAILS								TEAM				SURVEY CONDITIONS					GLARE				
Date	Time	Event	LAT	LON	Subarea	Survey	Transect	Pilot	Front Spotter	Left rear Spotter	Right rear Spotter	Altitude	Sea State	Haze	Turbidity	Clouds	Side	Sector	Intensity	Subjective P	Subjective S
09-juin	08:12:30	OFF	N36.98867	E35.29139	G-I	9		16	32	68	62	45									
09-juin	08:26:50	OFF	N36.80936	E34.71951	G-I	9		16	32	68	62	323	1	4	2	0	P	180-270	1	M	M
09-juin	08:28:50	ON	N36.78243	E34.64124	G-I	9	4-4	16	32	68	62	322	1	2	2	0	P	210-300	1	M	G
09-juin	08:31:46	ON	N36.77761	E34.64255	G-I	9	4-4	16	32	68	62	339	1	2	1	0	P	210-300	1	M	G
09-juin	08:48:51	ON	N36.30270	E34.51696	G-I	9	4-4	16	32	68	62	335	1	2	1	4	P	210-300	1	M	M
09-juin	08:49:40	LE	N36.28040	E34.51118	G-I	9	4-4	16	32	68	62	335	1	2	1	4	P	210-300	1	M	M
09-juin	08:52:24	RE	N36.28809	E34.51277	G-I	9	4-4	16	32	68	62	320	2	2,5	1	2	p	210-300	1	M	M
09-juin	08:56:10	ON	N36.18160	E34.48520	G-I	9	4-4	16	32	68	62	330	2	2,5	1	0	P	210-300	1	M	M
09-juin	09:02:50	ON	N35.99813	E34.43897	G-I	9	4-4	16	32	68	62	327	1	2,5	0	0	P	210-300	1	M	M
09-juin	09:06:18	ON	N35.90623	E34.41458	G-I	9	4-4	16	32	68	62	332	1	2,5	0	2	P	210-300	1	M	M
09-juin	09:07:10	ON	N35.88228	E34.40869	G-I	9	4-4	16	32	68	62	300	1	2	0	0	P	210-300	1	M	M
09-juin	09:08:20	OFF	N35.84969	E34.39878	G-I	9		16	32	68	62	300	1	2	0	0	P	210-300	1	M	M
09-juin	09:19:49	ON	N35.67550	E33.95761	G-I	9	4-5	16	32	68	62	327	1	2	0	1	P/S	120-240	1	M	M
09-juin	09:47:38	OFF	N36.45495	E34.15733	G-I	9	4-5	16	32	68	62	330	1	2	0	1	P	270-300	1	G	G
09-juin	09:55:28	OFF	N36.26228	E33.95968	G-I	9		16	32	68	62	450	0	2	2	1	P	300-360	1	G	G
09-juin	10:02:19	ON	N36.14829	E33.68289	G-I	9	4-6	16	32	68	62	286	0	2	2	1	P	360-120	1	G	G
09-juin	10:03:05	LE	N36.12401	E33.67651	G-I	9	4-6	16	32	68	62	286	0	2	2	1	P	360-120	1	G	G
09-juin	10:07:15	RE	N36.12269	E33.67740	G-I	9	4-6	16	32	68	62	302	0	1	0	0	S	0-120	1	G	G
09-juin	10:24:30	LE	N35.62016	E33.55511	G-I	9	4-6	16	32	68	62	326	0	1	0	0	S	0-120	1	G	G
09-juin	10:27:13	RE	N35.61907	E33.55499	G-I	9	4-6	16	32	68	62	313	0	1	0	0	S	0-120	1	G	G
09-juin	10:29:42	OFF	N35.54857	E33.53772	G-I	9	4-6	16	32	68	62	293	0	1	0	0	S	0-120	1	G	G

b) Appendix 2

SIGHTINGS FORMS

POSITIONING DATA										SIGHTING DATA									SCHOOL COMPONETS				
Num	Date	Event	Time FS/ ABEAM/Circle	LAT FS/ ABEAM/Circle	LON FS/ ABEAM/Circle	ABEAM?	Angle ABEAM	Bank angle	Altitude	Observer	Cue	Species	Size PS	Weight PS	Size P/SS	WeightP/SS	Leave ?	Photos?	Numbers	% small	% medium	% large	% giant	Cetaceans?
		F																						
		A	08:48:00	N36.3253	E34.5224																			
69	09-juin	C				Y	30	0	330	62	SP	BFT	3	60	3	60	N	N		100,00				N
		F	08:49:00	N36.2988	E34.5158																			
		A	08:42:27	N36.4799	E34.5620																			
70	09-juin	C	08:50:17	N36.2854	E34.4983	Y	20	0	340	32	SP	BFT	3	60	3	60	Y	Y	7914	100,00				N
		F																						
		A	09:10:20	N35.8213	E34.3375																			
71	09-juin	C				Y	25	0	330	32	SP	BFT	40	800	40	800	N	Y	7978	100,00				N
		F																						
		A	09:29:00	N35.9282	E34.0240																			
72	09-juin	C				Y	20	2,5	327	62		CUV	2				N	N						N
		F	10:02:50	N36.1317	E33.6781														7987-					
		A	10:02:56	N36.1285	E33.6774														7988-					
73	09-juin	C	10:03:49	N36.1268	E33.6650	Y	23	0	320	62	SP	OTH	200	600	200	600	Y	Y	7996	100,00				N
		F	10:24:14	N35.6276	E33.5562																			
		A	10:24:20	N35.6249	E33.5556														8008-					
74	09-juin	C	10:25:00	N35.6264	E33.5678	Y	22	0	316	68	SP	BFT	30	750	30	750	Y	Y	8011		#####			N
		F																						
		A	10:31:40	N35.5485	E33.4608																			
75	09-juin	C				Y	40	2,5	300	32	SP	ALB	5	100	10	100	N	N		100,00				N