

ICCAT BLUEFIN TUNA AERIAL SURVEY 2010

Technical report

Aerial surveys explorations in the reproduction area of bluefin tuna

(Thunnus thynnus) in Balearics waters.

Prepared by



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Sub - area 1 - IBIZA

Introduction

The aerial survey campaigns in the breeding areas of bluefin tuna in the Mediterranean Sea are one of the scientific activities initiated by the ICCAT in the research program GBYP. The results of the exploration carried out in the reproduction area of the Balearic Islands in 2010 are presented in this report.

Material and methods

Sampling campaign

An aerial campaign was carried out during the period: 06.01.2010–07.02.2010, applying the work methodology planned by ICCAT. The working area has been divided into 10 straight transects oriented North to South forming a working survey. Once the survey was finished, the whole zone of work annotated by ICCAT in Balearic has been completed. In the Balearic Islands area, are planned five working surveys.

In order to maximize the flight schedule of transects 6, 7 and 8 established for ICCAT, these transects were divided in two (North part and South part) due to the geography of the zone as a lot of flight time it would have been lost for crossing the islands. Therefore, during a flight work has been done in the northern part of the island of Mallorca, while in other flights in the South. In addition, transects passing over land, the coast was turned so that the transect planned was regained. Using this methodology effective search effort was maximized.

In the campaign has been involved a team of three people: a scientist, Joan Miquel Sorell Baron; a marine expert in sightings and evaluation of schools, Lluís Navarro Martinez, and a pilot.

The materials resources used consisted of: a small plane equipped with a GARMIN GPS 430 GARMIN 128 GPS computer, with navigation and mapping software Oziexplorer, 7X50 binoculars: 113m/1000m, a Nikon camera (Nikkon AF-S 18-200mm. 1:3,5-5.6 G ED) and Samsun R55 laptop.

The working conditions planned by ICCAT were kept during the flights, with an altitude of 1000-1200 feet and an average speed of 120 knots. The duration did not exceed 4 hours, attending to the regulation proposed in the rule 16B in conformity with the JAR's regulations of the European Union. The surveys have been conducted only when weather conditions were good.

Methodology of work and operational protocol

The coordinates of the transects were transferred to the pilot which introduced them in the aircraft's GPS global positioning system (GARMIN 430) and executed the selected flight plan. During the flight, the sailor and scientist observed the presence of bluefin tuna schools. Once located the school, the pilot directed the plane in the specific area, circling in the sense of clockwise, which facilitated the scientist take pictures, as he was seated in the co-pilot right side of the plane.

Once confirmed the presence of bluefin tuna, the scientist proceeded to record all relevant information in the job template. Meanwhile, the marine expert estimated the average weight of individuals and total biomass.

Once the exploration air was finished, all the material was unload: graphic material, pictures, GPS'tracks. Computerization of data collected in the templates was also completed..

In order to register the paragraph track on the "Glare sector" and "Declination angle", the next methodology has been followed: the plane's direction considered was always to the North. Therefore, when we recorded the "Glare sector" and the "Declination angle" that came to starboard, has always been for us the East. Depending on the angle

of incidence is on file as: NNE, NE, E, SE, SSE all records observed to the right of the direction of the aircraft.

It was created a paragraph in the electronic templates, in part biological was introduced a note section to record the relevant biological information given for the study.

Results

During the aerial surveys in Baleares a total of 27 flights in 17 days were carried out. During 7 days only a flight was done, while the remaining 10 days 2 flights were carried out (Table 1). A total of 94.38 flight hours have been completed during the campaign. Of these, 55 hours were effective flying hours, that corresponds to the flight time used in each one of the different planned transects.

Total number of flight schedule	Total number of effective flight schedule	Number of days flown	Number of days without flying	Number of flights	Number of schools of bluefin tuna observed	Number of possible schools of bluefin tuna repeated
94,38	55	17	17	27	38	3

Table 1: Summary Table

Throughout the aerial campaign a total of 38 schools of bluefin tuna have been registered whose estimated amount ranges from 3,674.5 t and 3,724.5 t. Of all these, 370 t are estimated to be repeated. The amount of 3 schools, could not be determined due to the stabbed (tuna disappeared in the depths), or because the tuna were in depth and could not be estimate the actual amount of the school (Table 2). The 52 % of bluefin tuna registered corresponded to individuals with an estimated weight of 150 to 300 kg, while the 46 % corresponded to individuals from 25 to 150 kg. The amount of

individuals of tuna registered with a weighing less than 25 kg or a weighing more than 300 kg was very low with a percentage that does not exceed 2 % of total observed.

Bluefin Tuna School Components	Small		Medium		Large		Giant		Total	
	t	%	t	%	t	%	t	%	t	%
t (min)	38,5	1,05	1691,7	46,04	1942,5	52,86	1,8	0,05	3674,5	100
t (max)	38,5	1,03	1729,7	46,44	1954,5	52,48	1,8	0,05	3724,5	100
t (Repeated)	0,0	0,00	209,6	56,65	160,4	43,35	0,0	0,00	370,0	100

Table 2: Tons of tuna registered during the campaign by groups of sizes and the percentage that every group of sizes represents the total registered.

When observed for the first time, more than half of registered bluefin tuna schools were in quiet formation (ripples); in this kind of formation, bluefin tuna swam calmly on the surface. Next formation, so called splash, was observed with a frequency of 31,6 %; in this case, bluefin tuna were swimming and splashing the water making a white foam. Finally, with a smaller percentage, bluefin tuna were seen showing the ventral part of the body making a bright as sunlight (Table 3).

	Ripples	Shining	Splash	Total
Number	22	4	12	38
%	57,9	10,5	31,6	100%

Table 3: Number of schools of tuna and percentage of each one of the observed formations.

Most of the schools of bluefin tuna registered were observed in surveys 5 and 4 respectively (Figure 1). By contrast, in the survey 3 no bluefin tuna was found (Table 4).

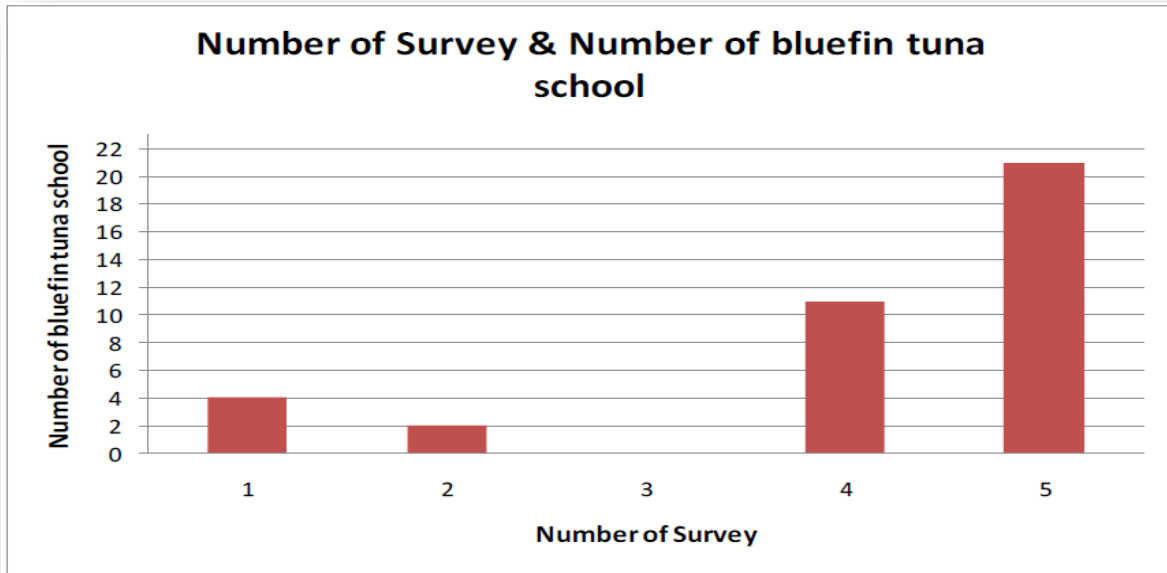


Figure 1: It represents the number of bushes observed in each of the 5 surveys realized.

It notes that in the transects 8 and 9 we found no kills of tuna (Figure 2). Transects 6, 2 and 4 respectively, the areas with a greater number of school of tuna (Table 4).

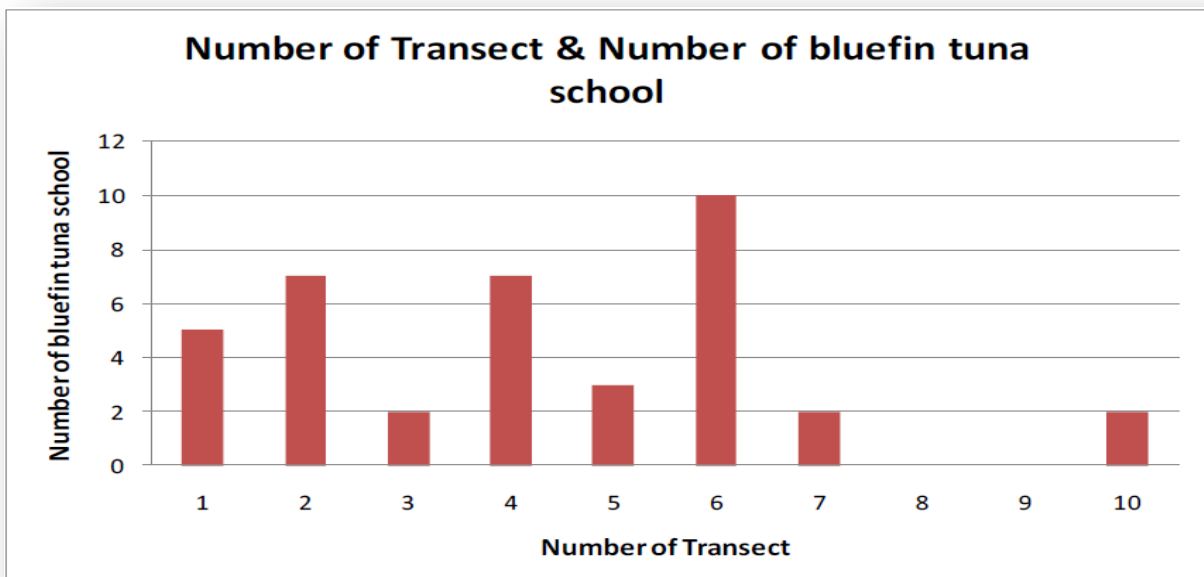


Figure 2: Bar graph showing the number of schools of bluefin tuna recorded in each of the transects.

Survey	Transec									
	1	2	3	4	5	6	7	8	9	10
1				4						
2				1		1				
3										
4	3	3				3	1			1
5	2	4	2	2	3	6	1			1

Table 4: Table summary of the number of school of tuna recorded in each of the surveys and transects

✚ Flights calendar realized during the campaign from 01.06.2010 to 02.07.2010

Sunday	Monday	Tuesday	Wednesday	Tuesday	Friday	Saturday
		1 1 Flight	2 1 Flight	3 2 Flight	4 1 Flight	5 2 Flight
6 2 Flight	7 1 Flight	8	9	10	11	12
13 1 Flight	14	15	16	17	18 2 Flight	19
20	21	22	23	24 1 Flight	25	26
27	28 2 Flight	29 2 Flight	30 2 Flight	1 July 2 Flight	2 July 2 Flight	



Sightings (*Thunnus thynnus*)

✚ Control of flight schedule

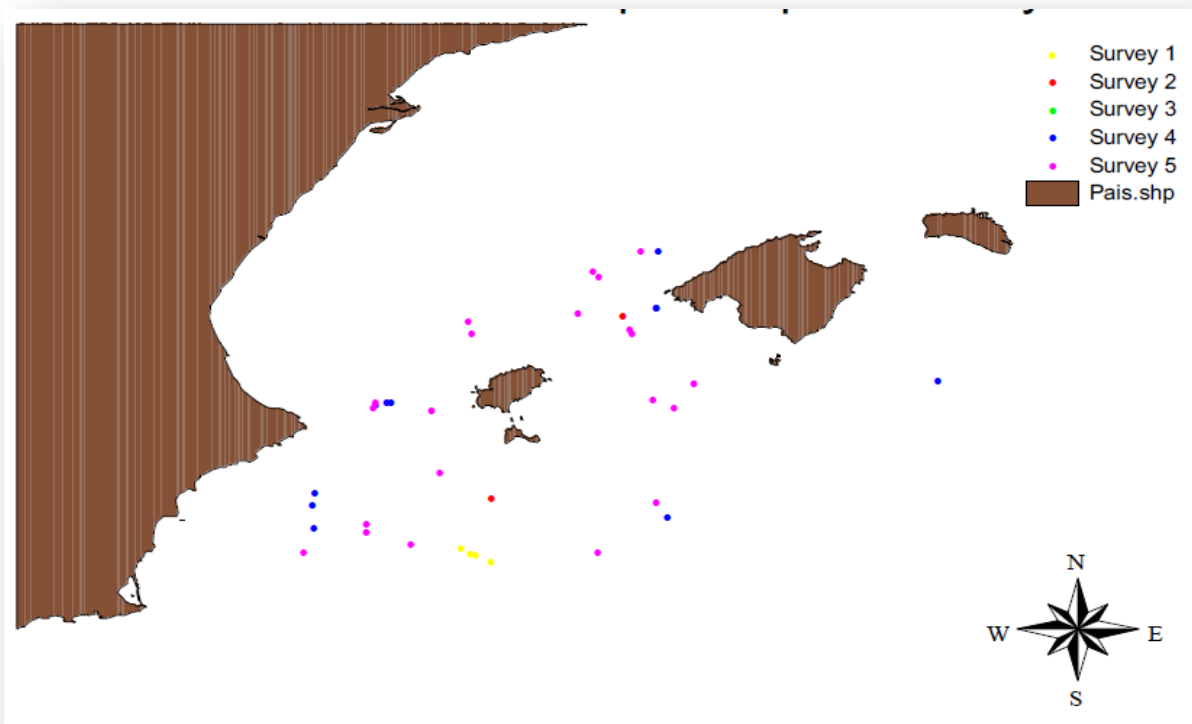
Day	Start eng	Stop eng	Hours	Sub area	Nº Survey	Transect	Start survey	Stop survey	Effective hours	notes
31/05/2010	15:30	17:30	2:00	1	0	0	0	0	0	Mobilization
06/01/2010	9:45	13:45	4:00	1	1	3,4,5	10:35	13:24	2:49	Job day
06/02/2010	13:00	16:15	3:15	1	1	1,2,3	13:20	15:34	2:14	Job day
06/03/2010	6:55	10:55	4:00	1	1	6,7,8,9,10	7:50	10:42	2:52	Job day
06/03/2010	12:45	16:15	3:30	1	1	9,7,10	13:19	15:26	2:07	Job day
06/04/2010	14:15	17:05	2:50	1	2	1,2	15:10	14:19	1:09	Job day
06/05/2010	6:45	10:45	4:00	1	2	10,9,8	7:55	10:17	2:22	Job day
06/05/2010	12:35	16:25	3:50	1	2	7,6,5	12:37	14:00	3:23	Job day
06/06/2010	6:50	10:50	4:00	1	2	8,7,6	8:16	10:22	2:06	Job day
06/06/2010	13:10	16:00	2:50	1	2	3,4	13:42	15:29	1:47	Job day
06/06/2010	13:05	16:15	3:10	1	2	3,4	13:30	15:52	2:22	Job day, repeated for bad weather
06/07/2010										No job bad weather
06/08/2010										No job bad weather
06/09/2010										No job bad weather
06/10/2010										No job bad weather
06/11/2010										No job bad weather
06/12/2010										No job bad weather
06/13/2010	13:05	16:15	3:10	1	2	3,4	13:30	15:52	2:22	Job day
06/14/2010										No job bad

										weather
06/15/2010										No job bad weather
06/16/2010										No job bad weather
06/17/2010										No job bad weather
06/18/2010	7:17	10:30	3:13	1	3	4,5,6	7:42	10:12	2:30	Job day
06/18/2010	13:00	17:00	4:00	1	3	6,7,8	13:46	15:44	1:58	Job day
06/19/2010										No job bad weather
06/20/2010										No job bad weather
06/21/2010										No job bad weather
06/22/2010	8:05	11:00	2:55	1	3	7,8	9:00	10:37	1:37	Job day
06/22/2010	12:50	15:50	3:00	1	3	9,10	13:35	14:15	0:40	Job day
06/23/2010	7:45	11:45	4:00	1	4	4,5,6	8:28	10:10	1:42	Job day
06/24/2010	11:30	15:30	4:00	1	4	6,7	12:20	14:41	2:21	Job day
06/25/2010										No job bad weather
06/26/2010										No job bad weather
06/27/2010										No job bad weather
06/28/2010	8:30	12:15	3:45	1	4	7,8,9	9:48	11:35	1:47	Job day
06/28/2010	13:40	16:15	2:35	1	4	10	13:59	14:45	0:46	Job day
06/29/2010	6:50	10:35	3:45	1	5	4,5	7:11	10:13	3:02	Job day
06/29/2010	12:40	16:40	4:00	1	4	4,3,2	12:54	15:54	3:00	Job day
06/30/2010	8:00	11:00	3:00	1	4	1	8:47	10:08	1:21	Job day
06/30/2010	13:00	16:25	3:25	1	4	4,5,6	13:18	15:37	2:19	Job day
07/01/2010	6:55	10:30	3:35	1	5	6,7	7:46	9:27	1:41	Job day
07/01/2010	13:05	17:05	4:00	1	5	3,2,1	13:32	15:57	2:25	Job day
07/02/2010	7:30	10:45	3:15	1	5	7,8,9	8:25	10:07	1:42	Job day
07/02/2010	13:00	15:30	2:30	1	5	10	13:40	13:50	0:10	Job day

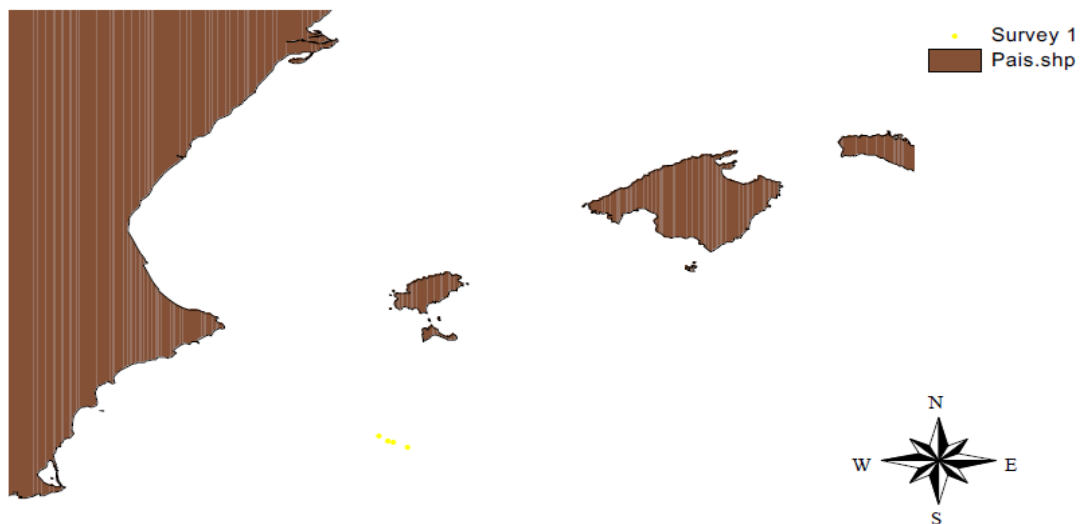
Spatial distribution of bluefin tuna schools registered

 **Survey 1**

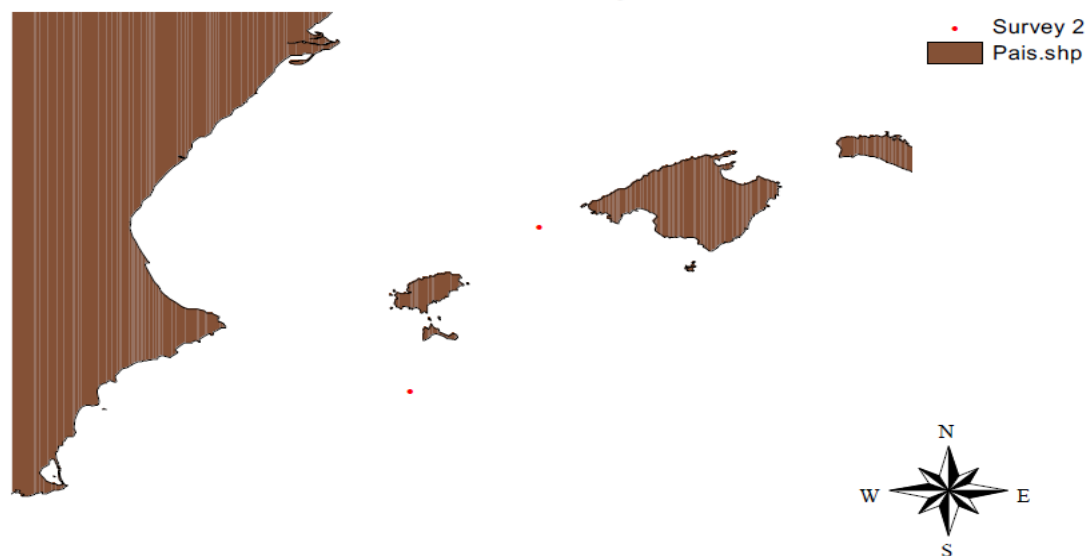
 **Partial distribution Survey**



Survey 1



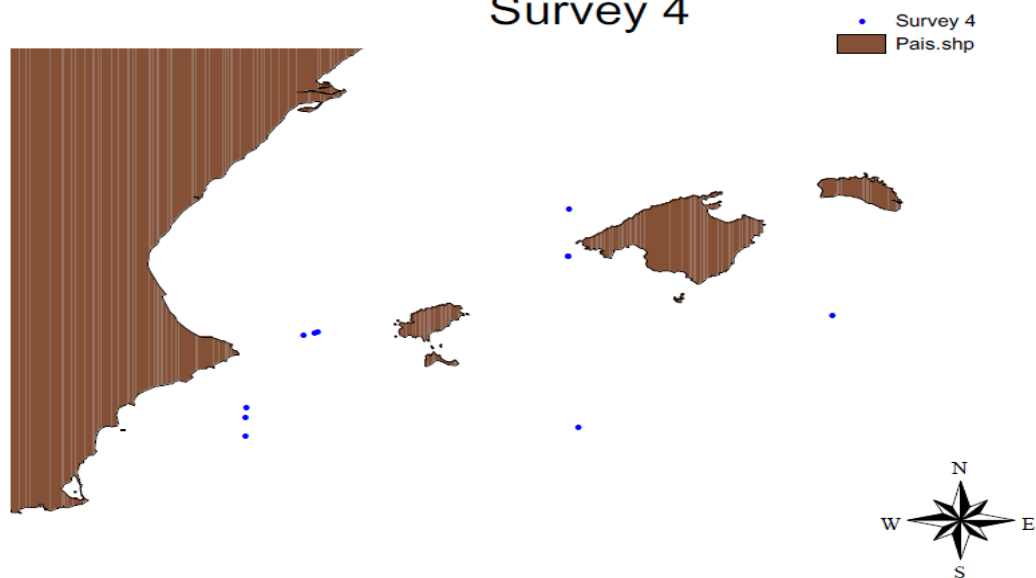
Survey 2

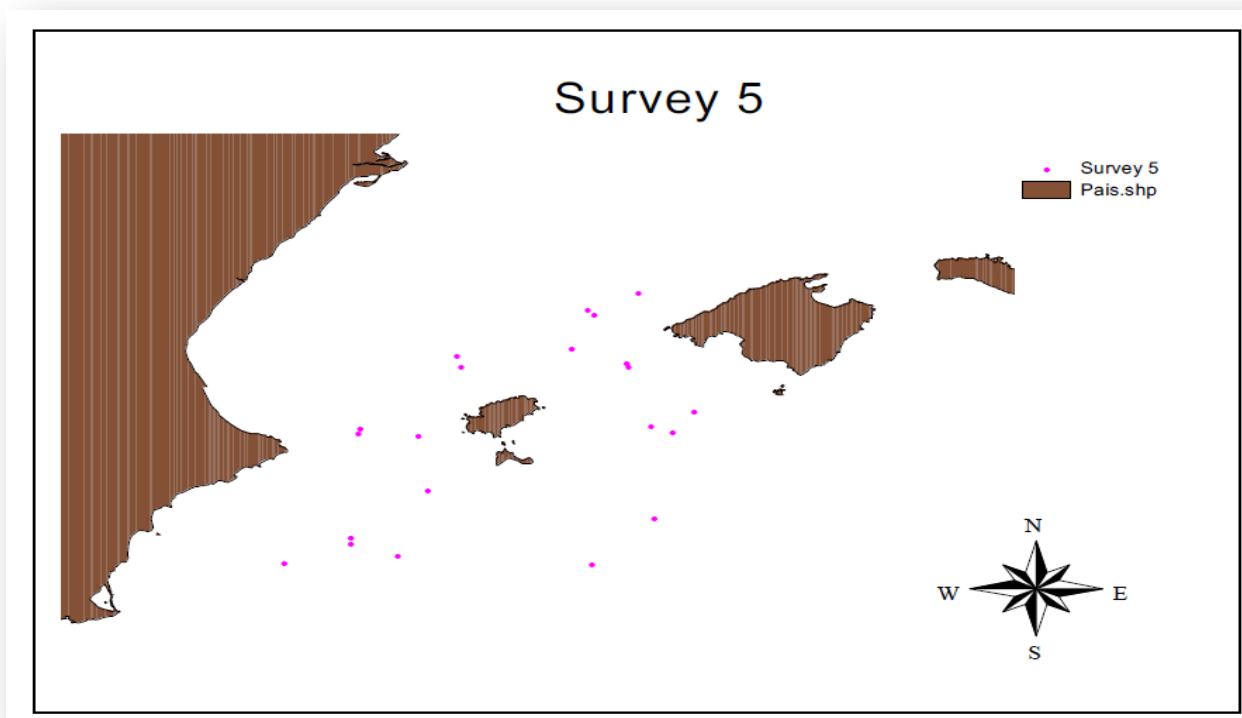


Survey 3



Survey 4





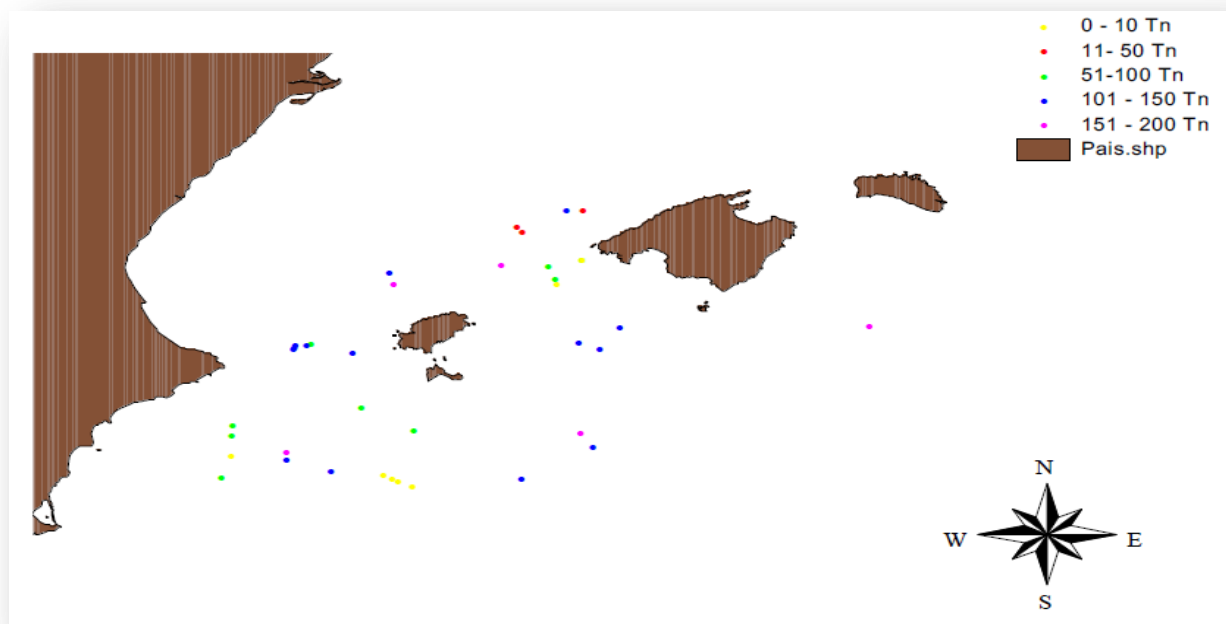
Date

Spatial distribution for weeks

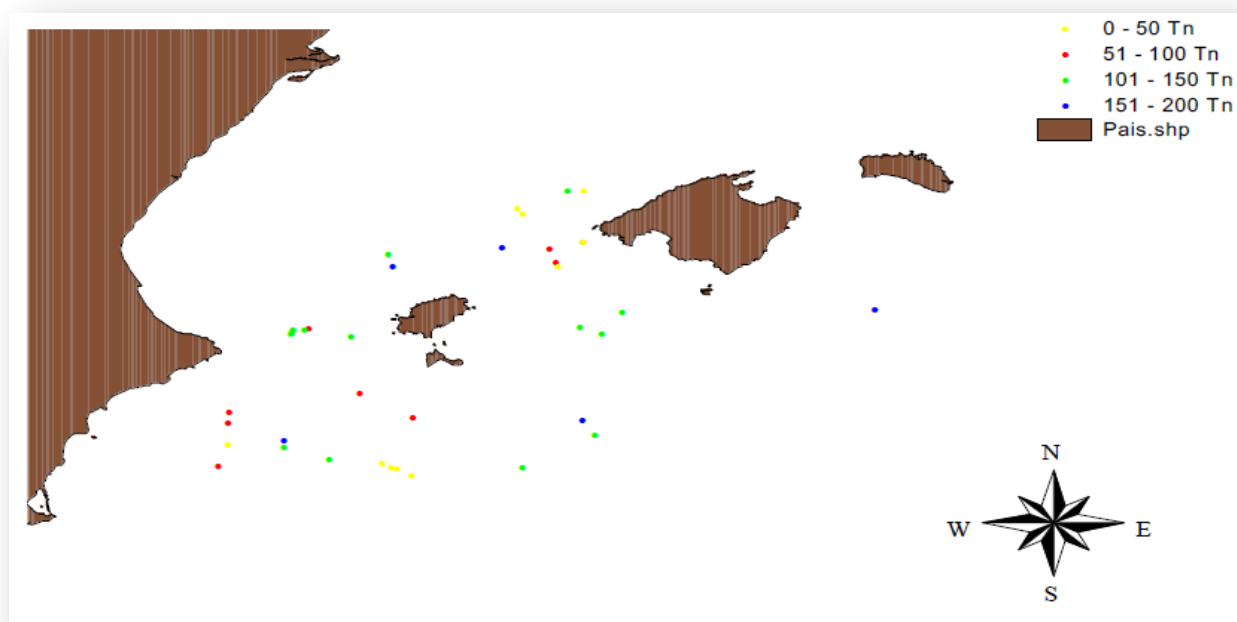


Minimal tons – 3

+ Minimum size of school Tn



+ Minimum size of school Tn

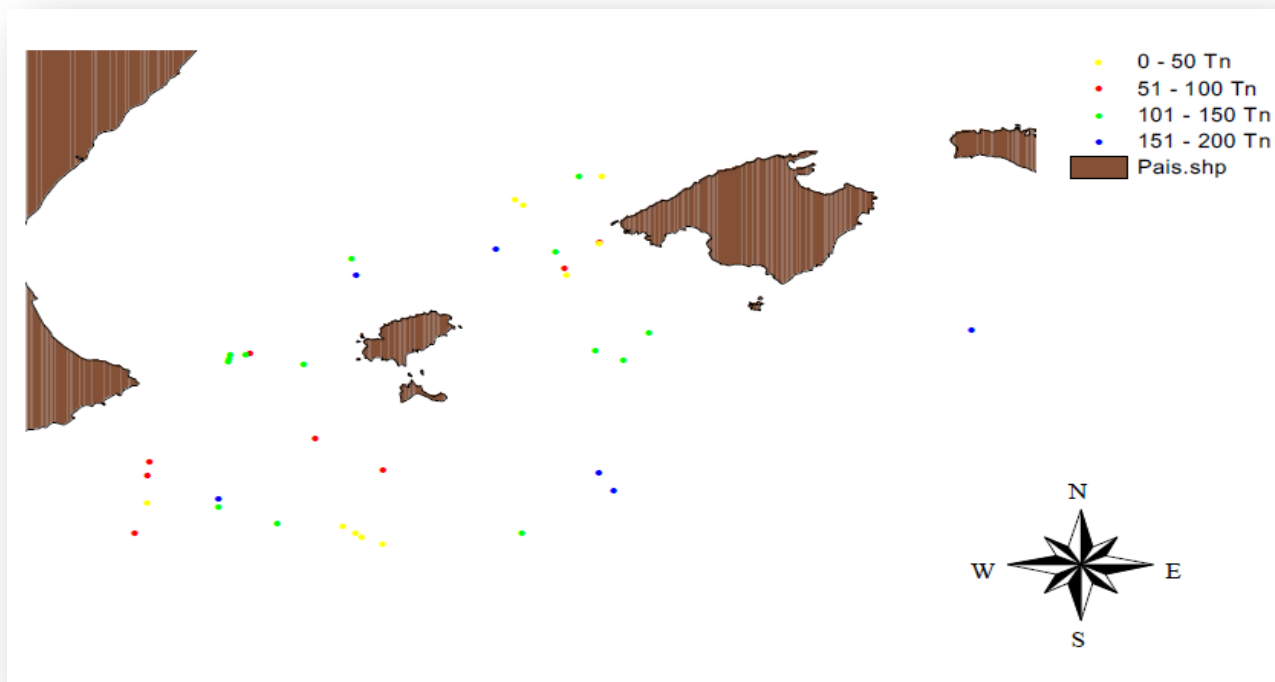


Maximal tons - 4

+ Maximum size of the school Tn



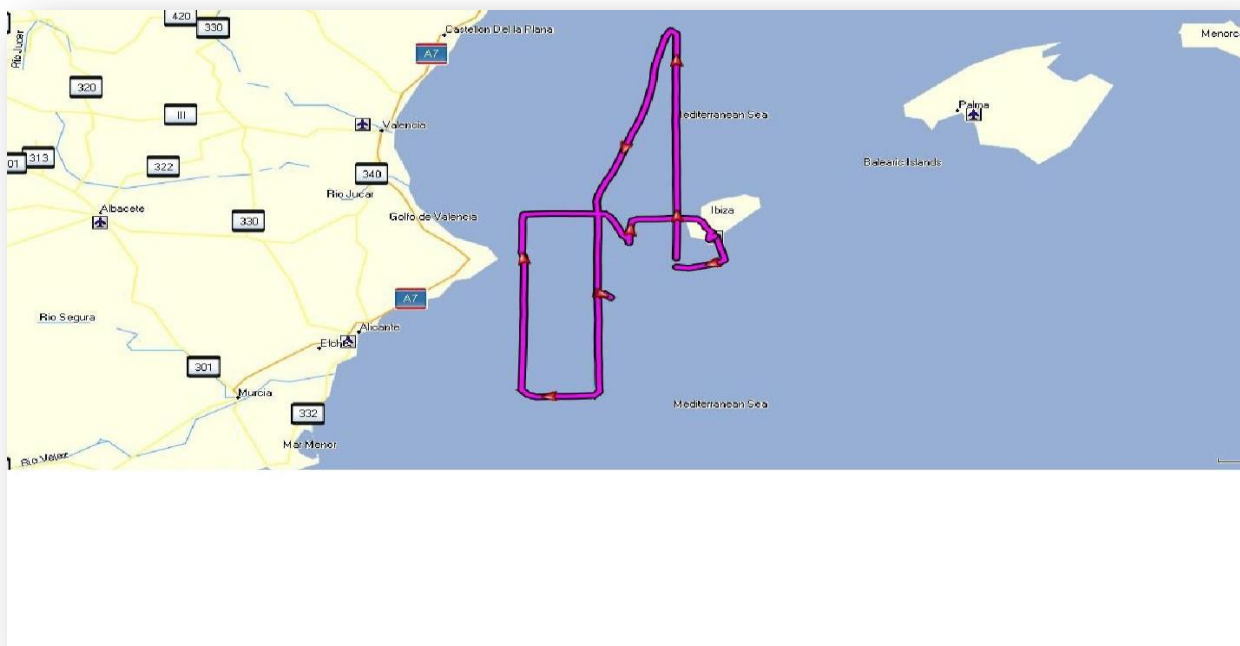
+ Maximum size of the school



IBIZA 01/06/2010



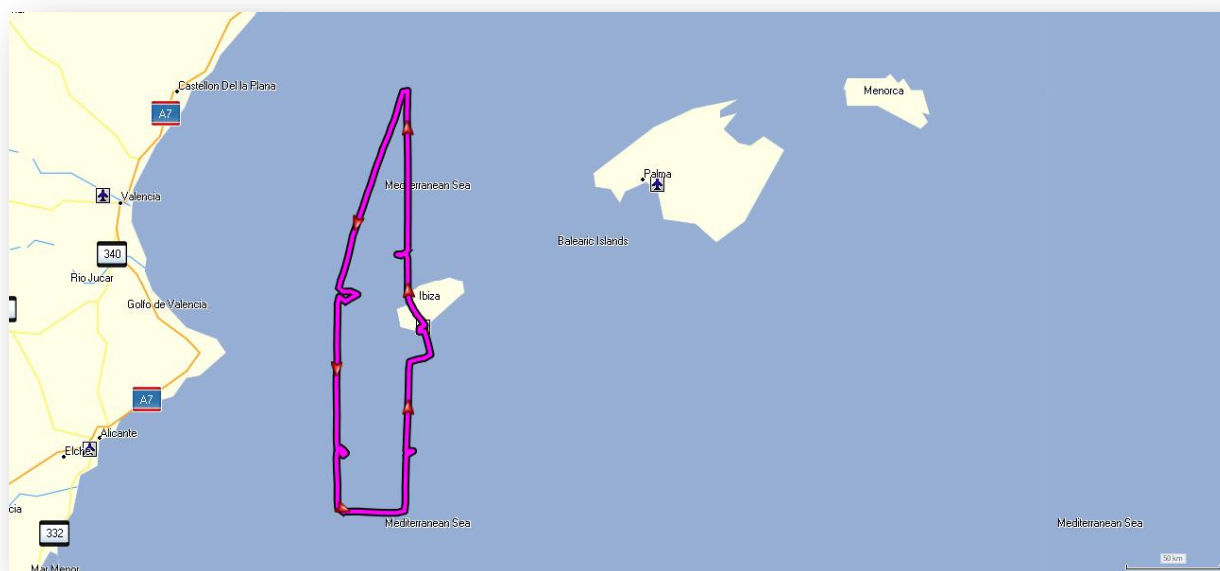
IBIZA 02/06/2010



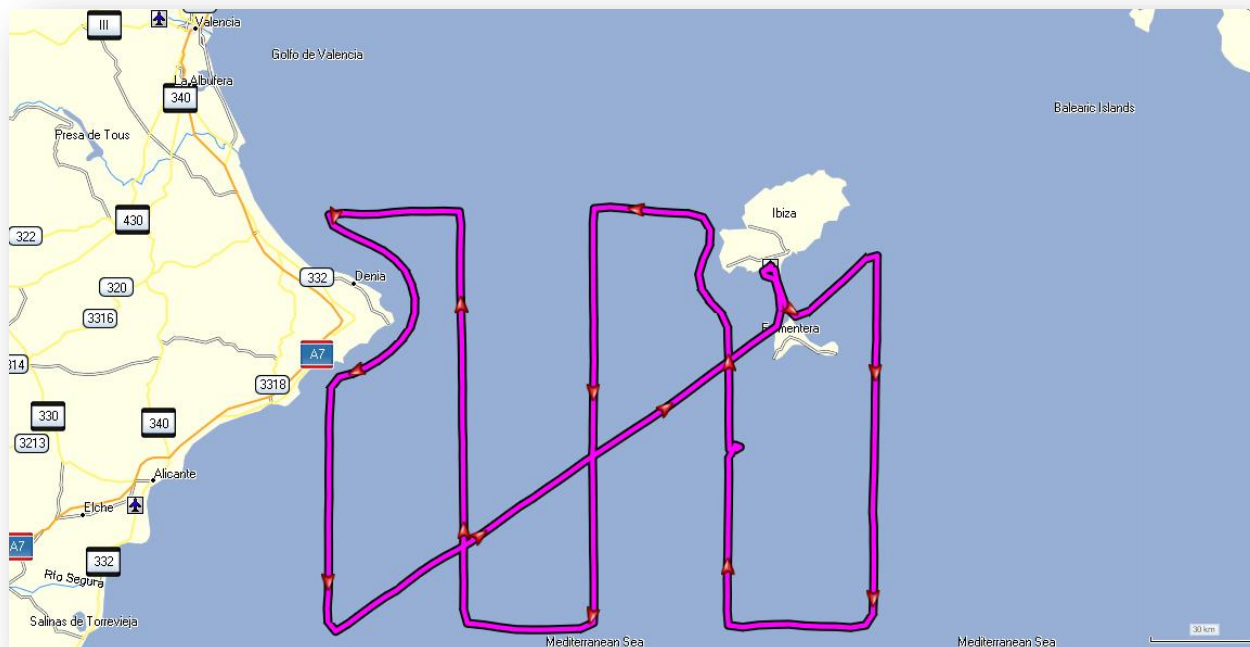
IBIZA 06/06/2010



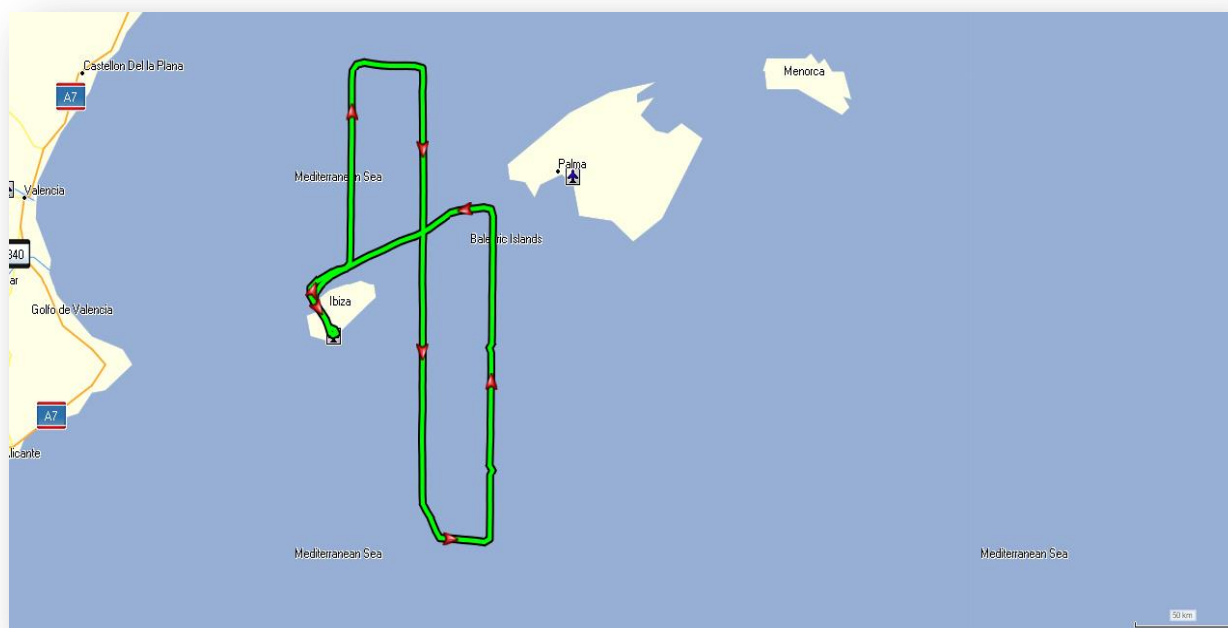
IBIZA 07/06/2010



IBIZA 13/06/2010



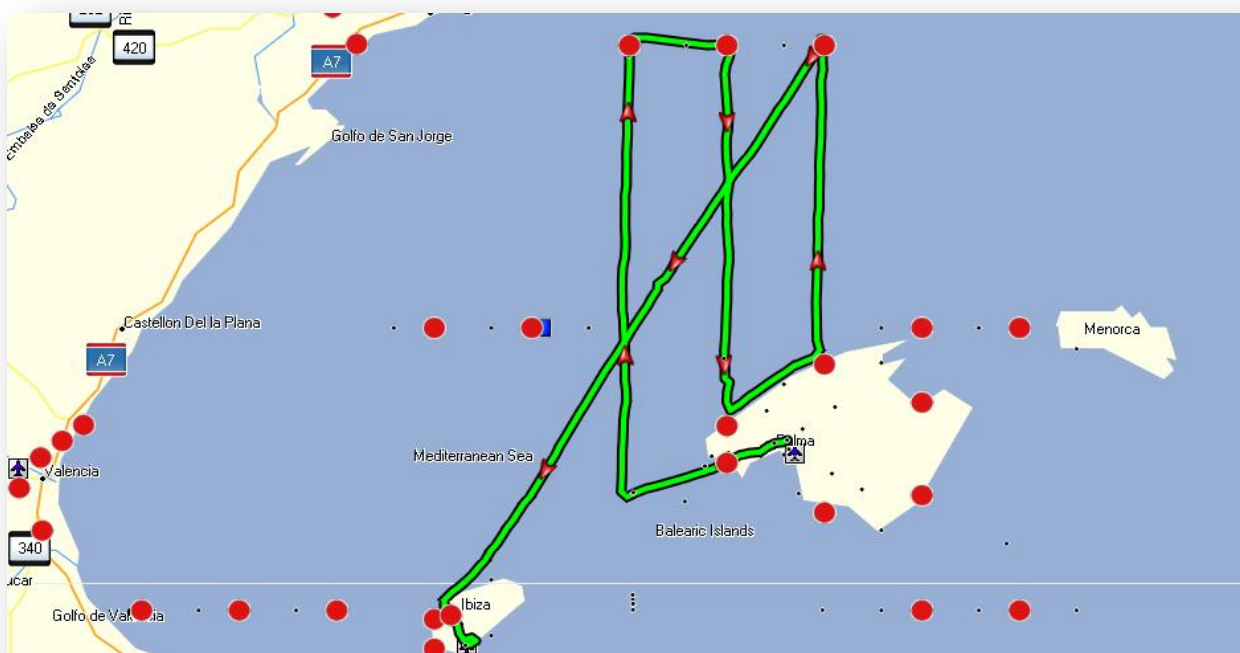
IBIZA 18/06/2010



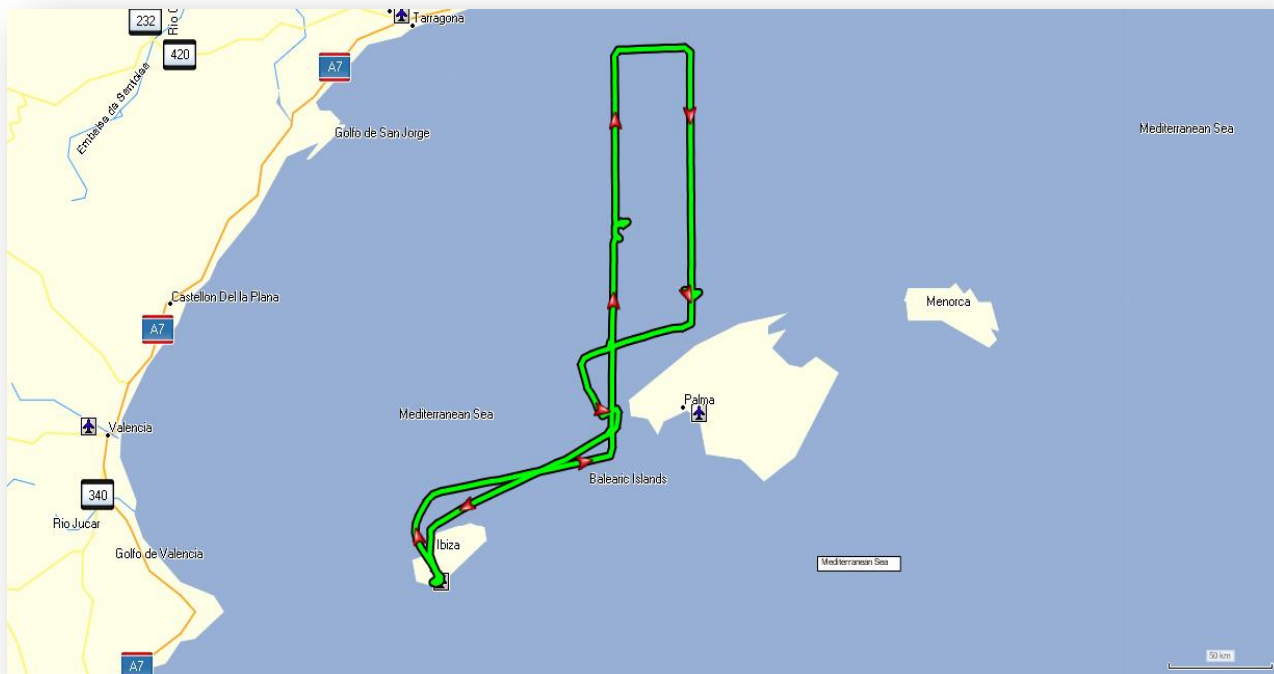
IBIZA 23/06/2010



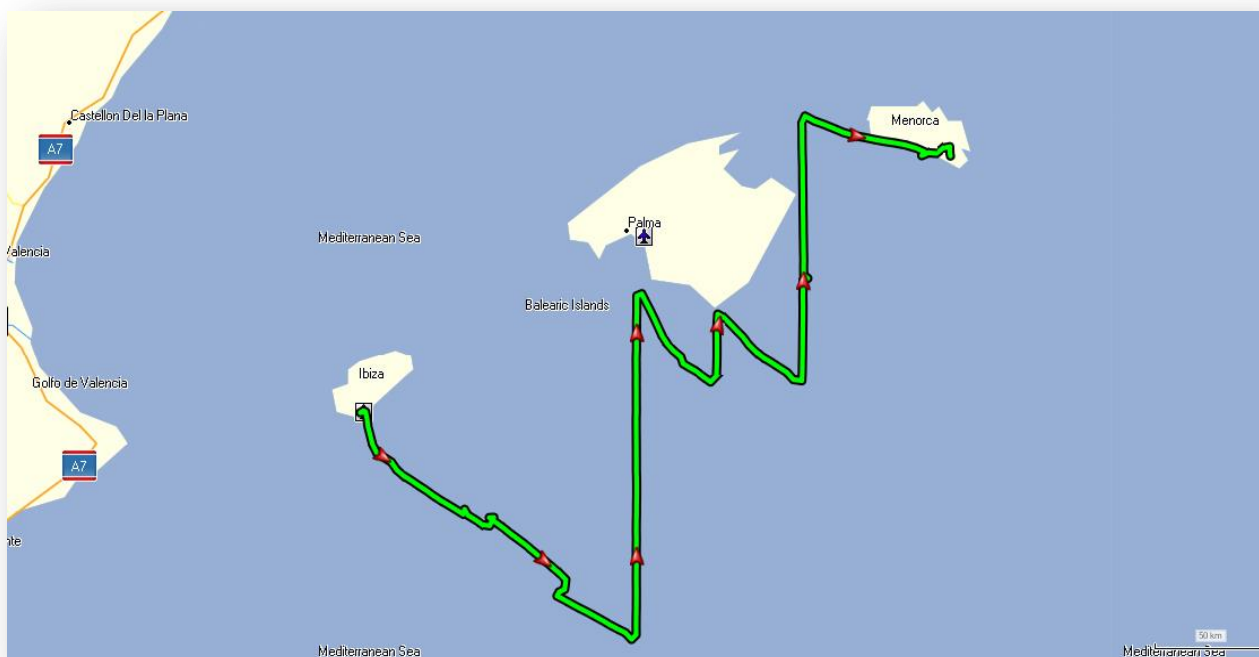
IBIZA 23/06/2010



IBIZA 24/06/2010



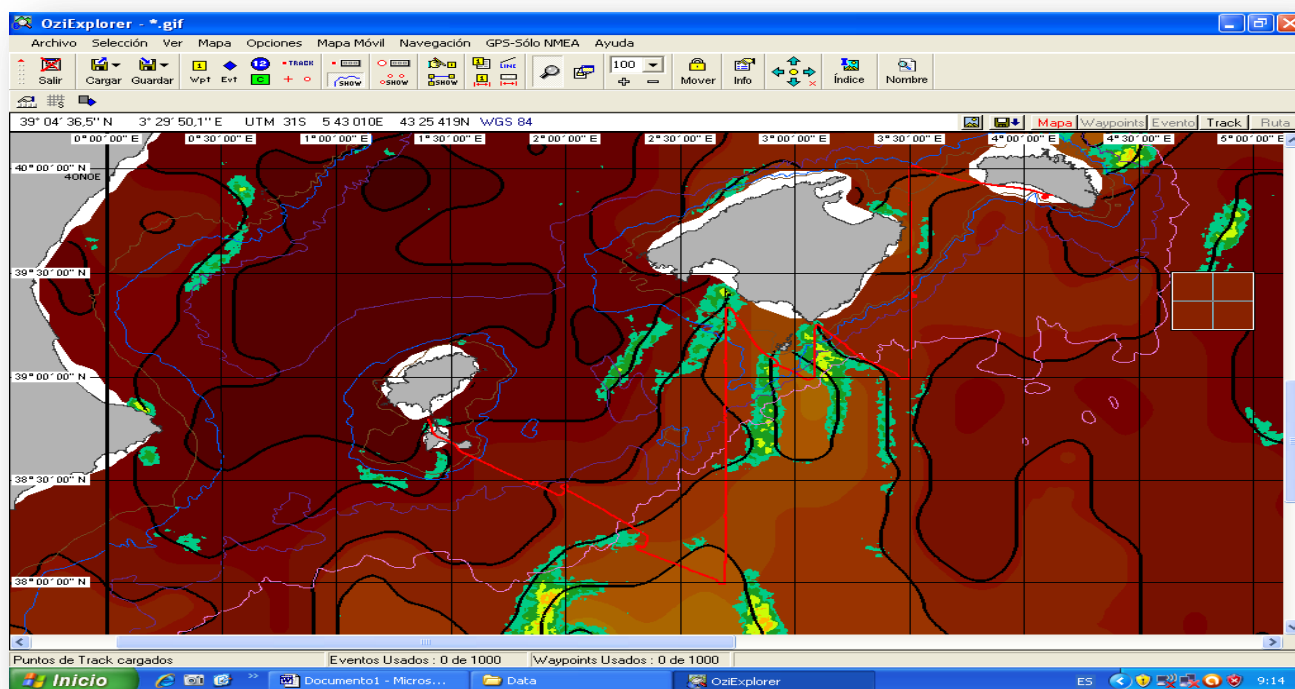
IBIZA 28/06/2010



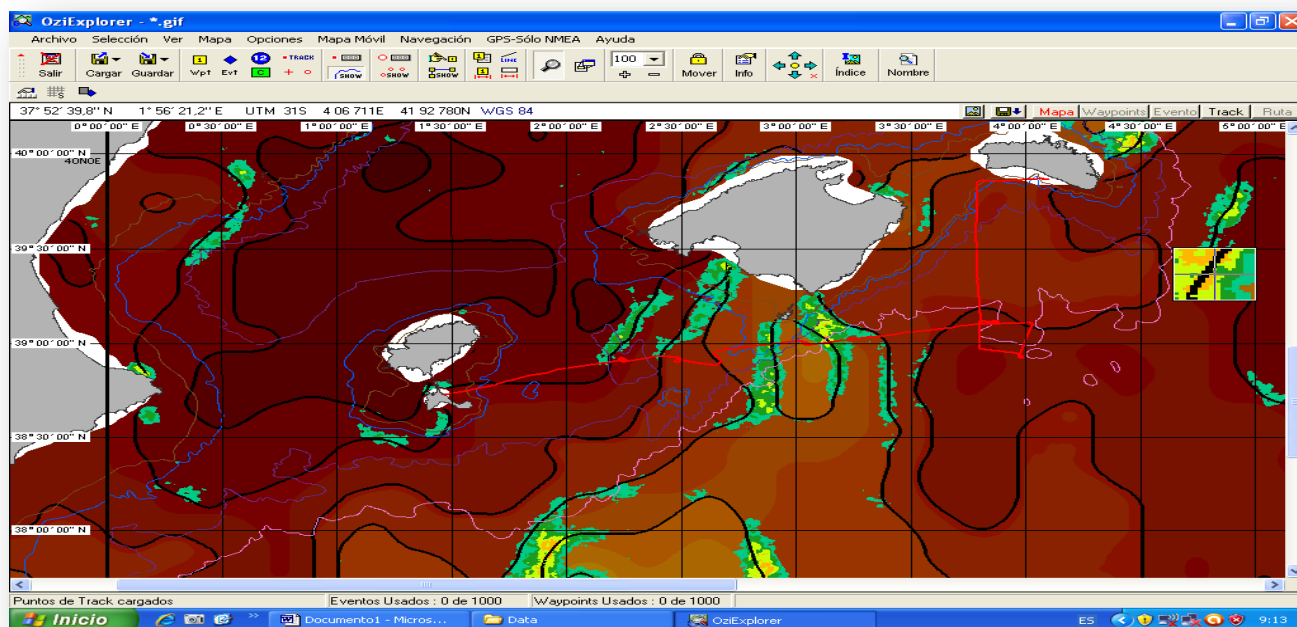
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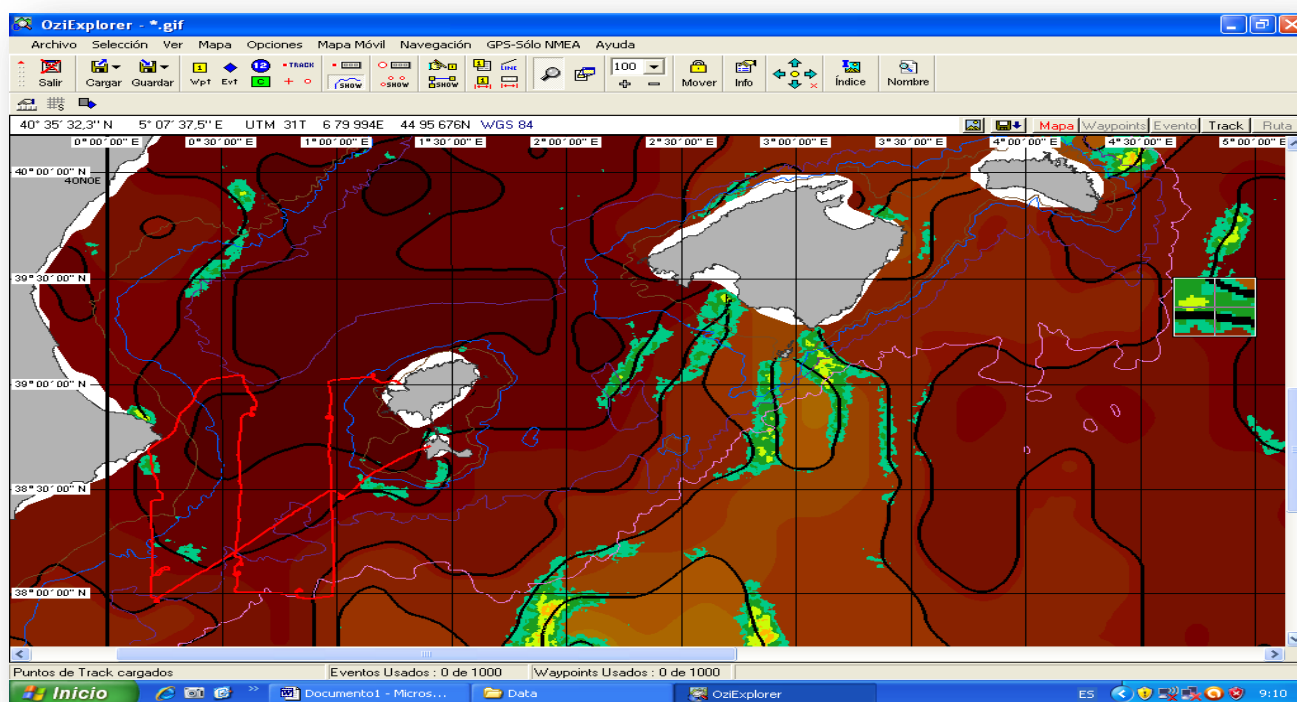
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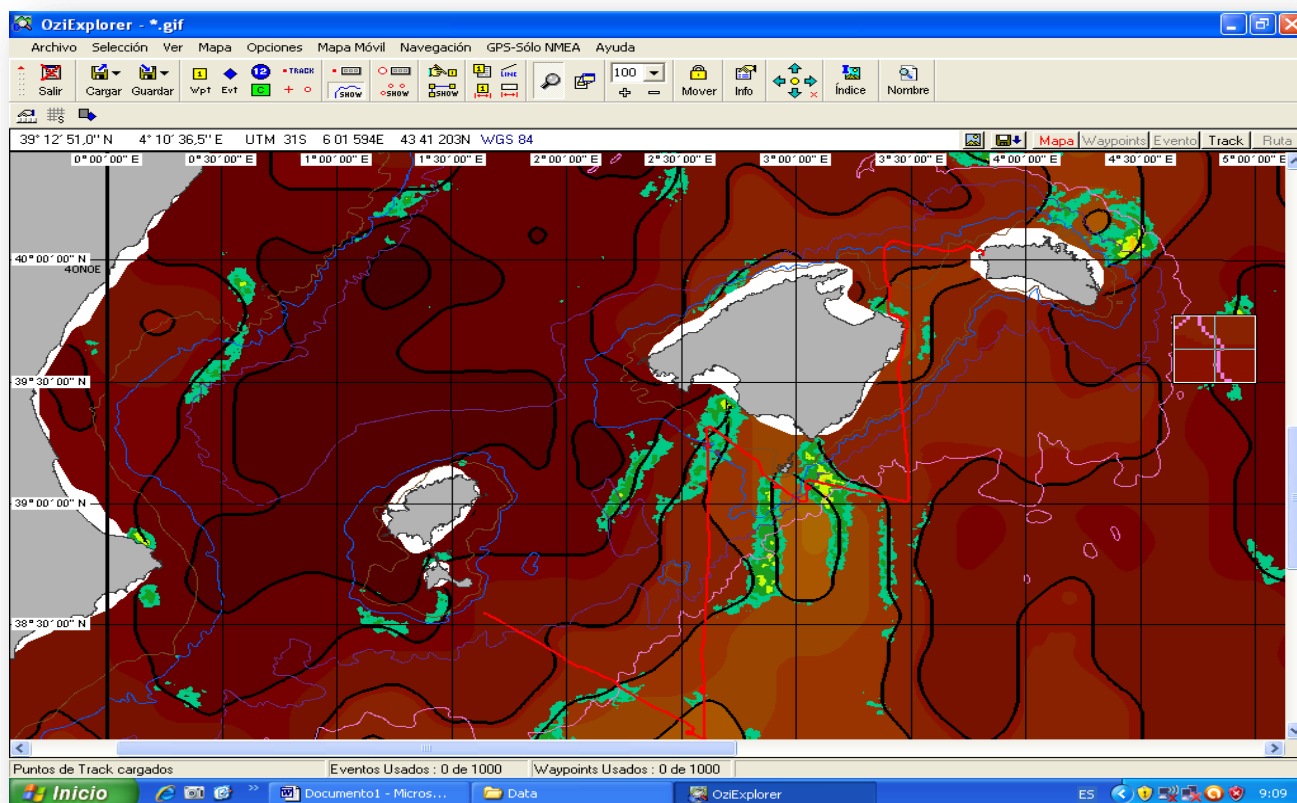
IBIZA 30/06/2010



IBIZA 01/07/2010



IBIZA 02/07/2010



Sub - area 3 - MALTA

SURVEY SESSIONS

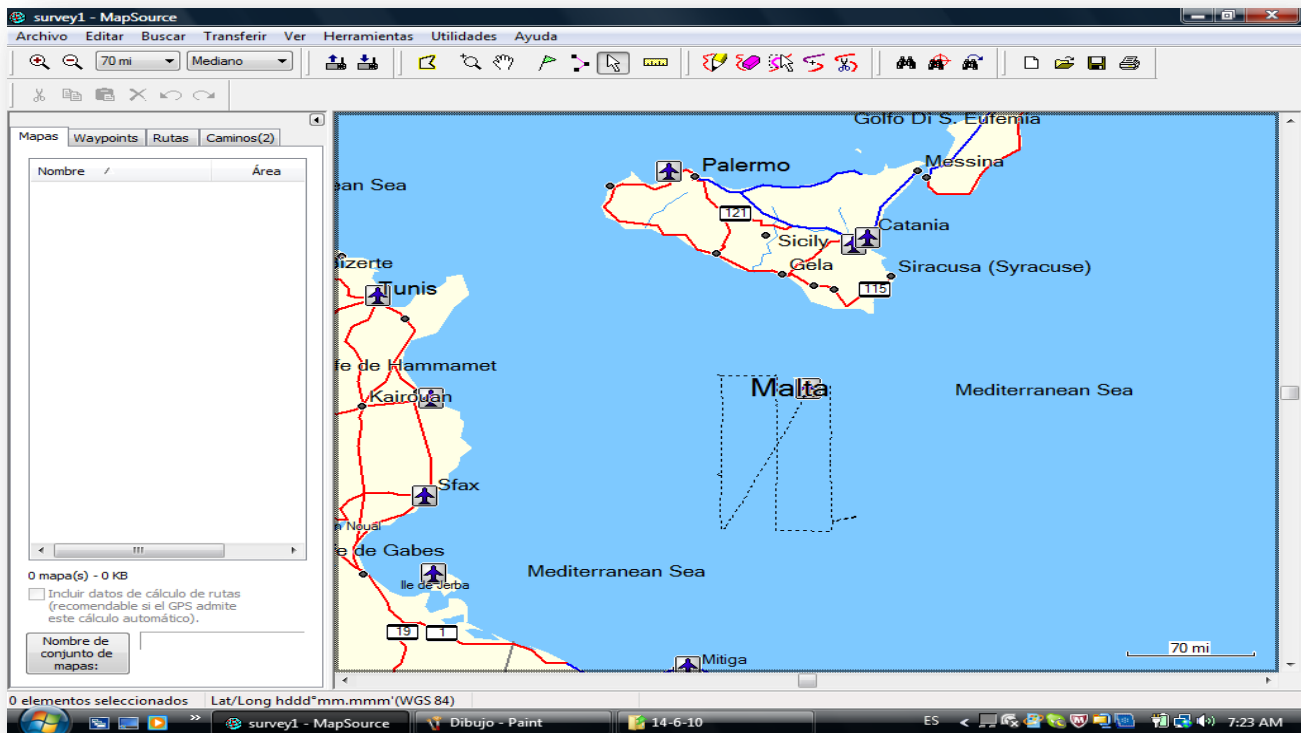
An outline of calendar events concerning the survey sessions follows.

MALTA 06/06/2010

First session of aerial surveys conducted. Details of the surveys are given in the table below.

Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	15:05	19:23	3

The weather conditions were good (Force 1-2 winds and a clear sky).



Surveys were carried out along the three line transects 5,6, and 7 of survey 1 (subarea 3), which were 47 minutes, 53 minutes, and 1 hour and 3 minutes long respectively. The aerial survey design speed and altitude were respected throughout all the three line transects.

No free swimming *T. thynnus* shoals were observed in any of the three surveys. Whilst conducting transect number 7, a tuna pen containing a school with an estimated weight of 80 tons was observed at Lat 34°30 07.7 Long 14°56 21.6 . The sighting was recorded through digital photography.

It is to be noted that seven tuna ships were observed whilst conducting the three aerial line transects.

MALTA 07/06/2010

Second session of aerial surveys conducted. Details of the surveys are given in the table below.

Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	11:10	15:05	2

The weather conditions were good (Force 1-2 winds and a clear sky).

Surveys were carried out along two line transects 3 and 4 and of survey 1 (subarea 3) and were 30 minutes and 49 minutes long respectively.

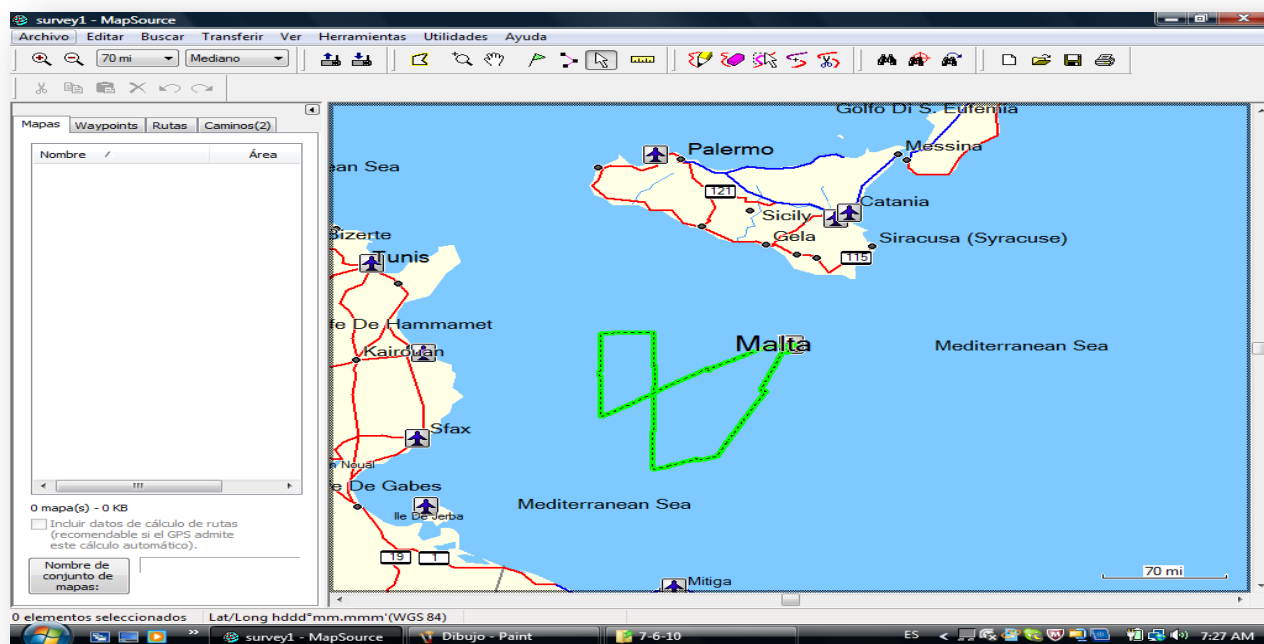
The following table outlines the details of the line transects followed.

Survey number	Transect number	Start position		End position		Duration (hh:mm)	Number of tuna shoals spotted
		Latitude	Longitude	Latitude	Longitude		
1	3	36°00 03.8	12°33 45.1	35°00 19.0	12°32 23.0	00: 30	0
1	4	34°20 43.6	13°05 24.6	35°59 35.4	13°04 42.8	00: 49	0

The aerial survey design speed and altitude were respected throughout the survey. No *T. thynnus* shoals were observed during any of the surveys conducted on this day.

One tuna fishing ship was sighted during transect 3.

Whilst conducting the line transect, the plane flew over Lampedusa (Approximate duration 1 min)



MALTA 08/06/2010 – 13/06/2010

No aerial surveys were conducted during this period due to adverse weather conditions (wind speed exceed 3 on the Beaufort scale). Pilot and spotters were on call during this period.

MALTA 14/06/2010

Third aerial survey conducted. Details of the survey are given in the table below.

Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	9:59	13:55	2

The weather conditions were good (Force 1-2 winds and a clear sky).

Line transects 1 (part of) and 2 of survey 1 (subarea 3) were conducted on the day. It is to be noted that the planned line transect 1 was not followed since this is located in Tunisian airspace.

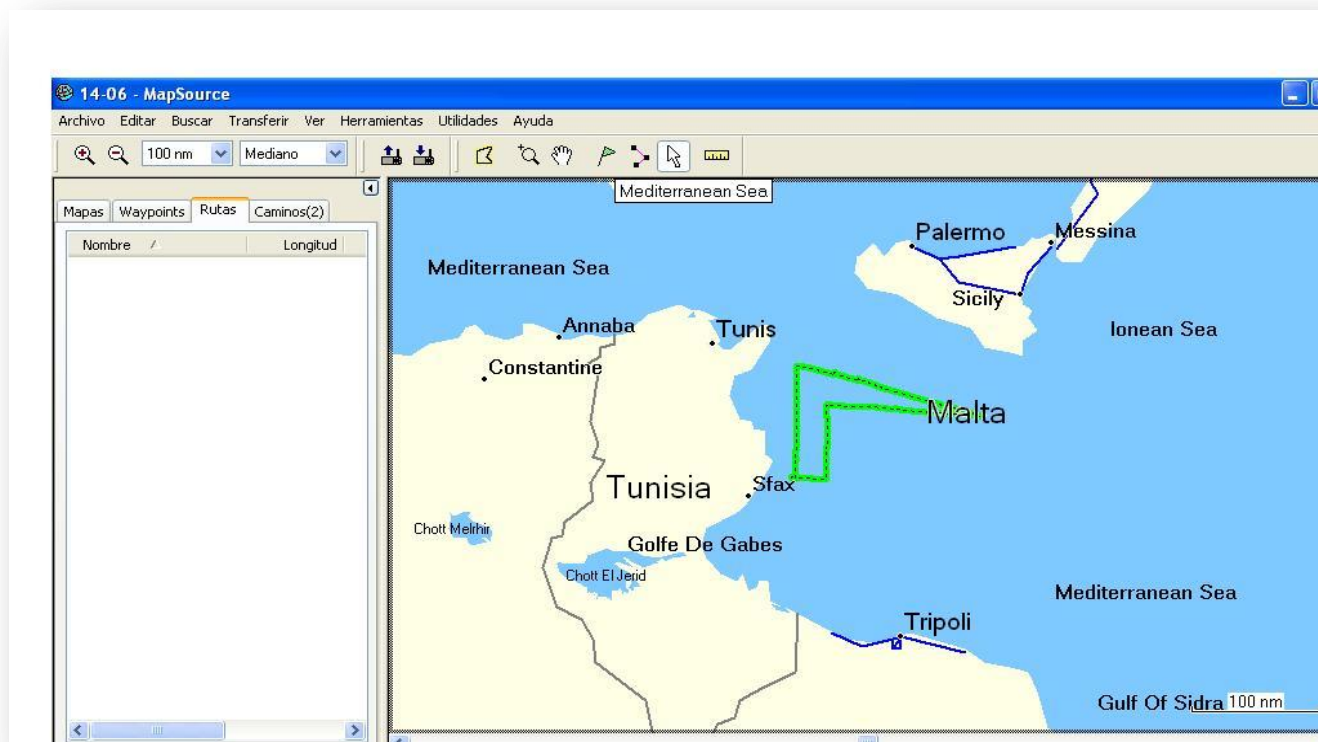
A parallel line transect was conducted approximately 2 miles from the planned transect. The duration of transects 1 and 2 were 41 minutes and 31 minutes respectively. The aerial survey design speed and altitude were respected throughout the survey.

The following table outlines the details of the line transects followed.

Survey number	Transect number	Start position		End position		Duration (hh:mm)	Number of tuna shoals spotted
		Latitude	Longitude	Latitude	Longitude		
1	1	35°01 39.6	11°30 15.9	36°30 45.8	11°31 51.7	00: 41	0
1	1	36°00 00.0	12°00 00.8	35°00 36.0	12°00 46.1	00: 31	0

No *T. thynnus* shoals were observed in any of the surveys conducted on the day.

In both transects, tuna fishing vessels were sighted.



MALTA 15/06/2010 – 16/06/2010

No aerial surveys were conducted during this period due to adverse weather conditions (wind speed exceeded Force 3 on Beaufort scale). Pilot and spotters were on call during this period.

MALTA 17/06/2010

Fourth aerial survey conducted. Details of the survey are given in the table below.

Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	9:40	13:40	2

The weather conditions were good (Force 0-1 winds and a clear sky).

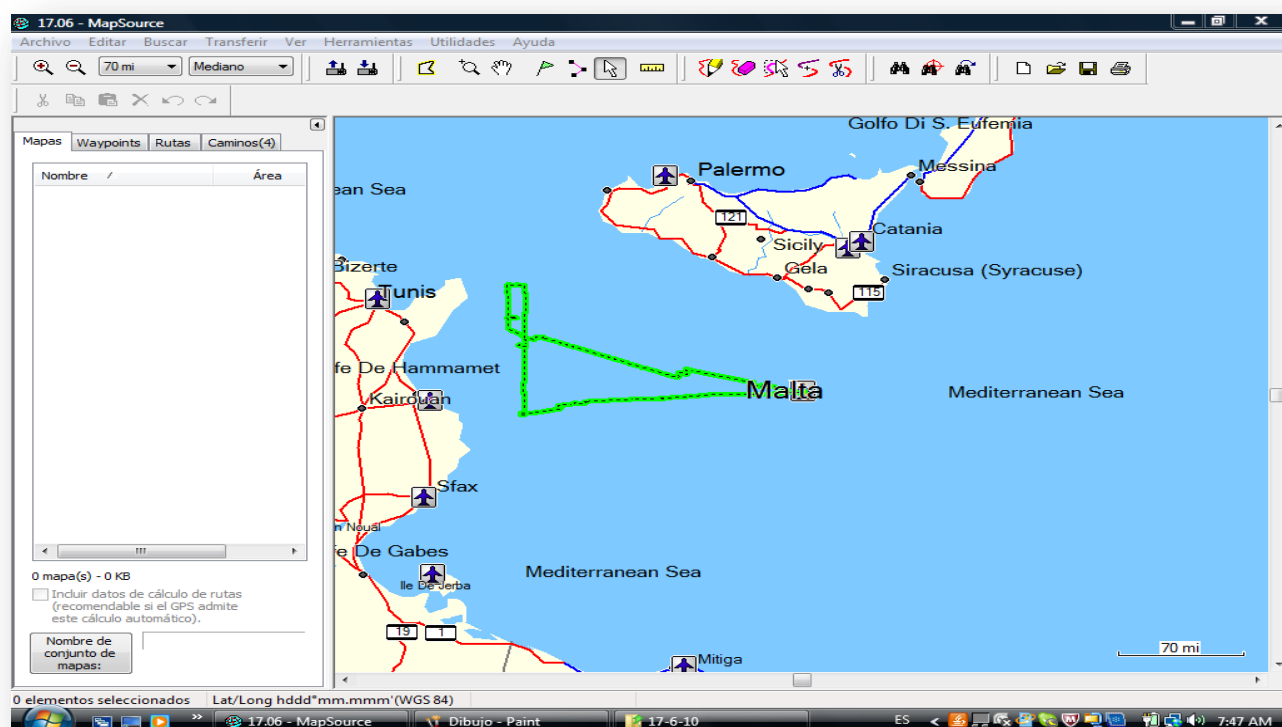
Line transects 1 (continuation from 14/06/2010) of survey 1 (subarea 3) and 2 of survey 2 (subarea 3) were conducted. The duration of transects 1 and 2 were 18 minutes and 50 minutes respectively. The aerial survey design speed and altitude were respected throughout the survey.

The following table outlines the details of the line transects followed.

Survey number	Transect number	Start position		End position		Duration (hh:mm)	Number of tuna shoals spotted
		Latitude	Longitude	Latitude	Longitude		
1	1	36°31 35.2	11°32 32.7	36°59 36.9	11°31 17.6	00: 18	0
2	2	36°59 40.2	11°41 18.3	35°37 21.2	11°42 10.0	00: 50	0

No *T. thynnus* shoals were observed in any of the surveys conducted on the day. Nevertheless, whilst cruising on the way back to Malta a 150 ton *T. thynnus* shoal was sighted at Lat 35°47'17.3 Long 13°03'16.8.

Tuna ships were only sighted along line transect 2.



MALTA 18/06/2010 – 23/06/2010

No aerial surveys were conducted during this period due to adverse weather conditions (wind speed exceeded Force 3 on the Beaufort scale). Pilot and spotters were on call during this period.

MALTA 24/06/2010

The fifth session of aerial surveys made. Details of the survey are given in the table below.

Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	11:28	15:13	2

The weather conditions were good (Force 0-1 winds and a clear sky).

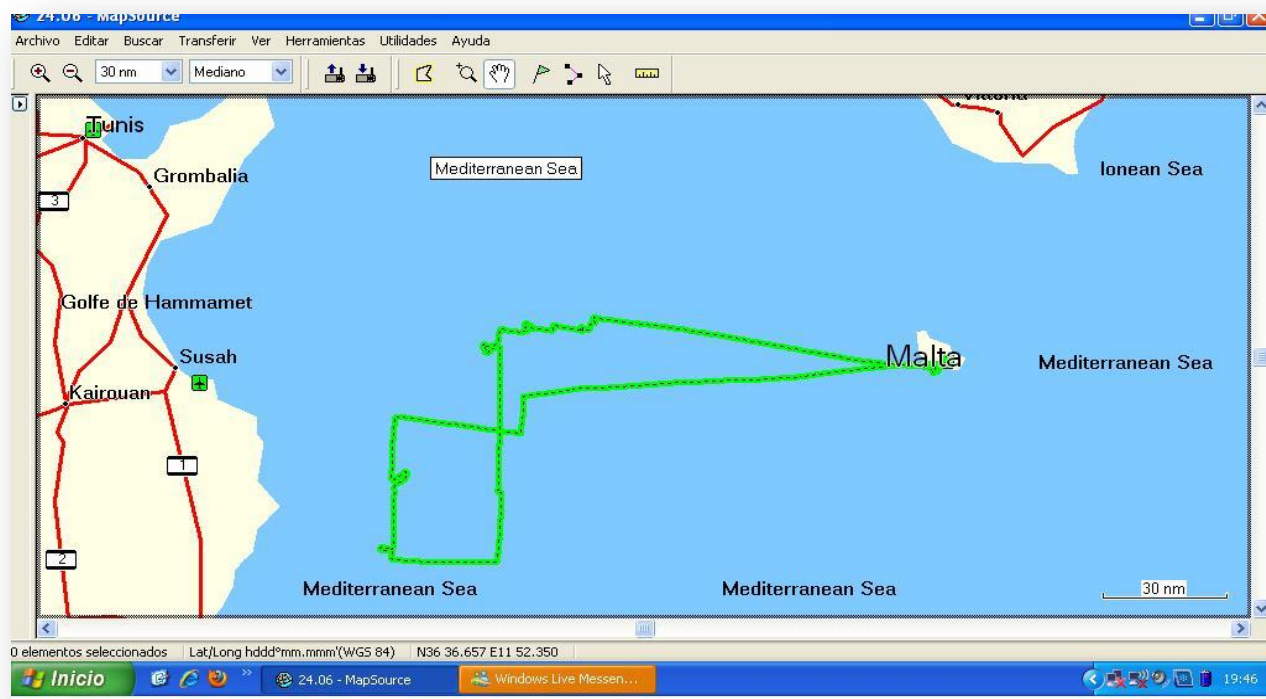
Line transects 2 (continuation from 17/06/2010) and transect 3 of survey 2 (subarea 3) were made on the day.

The following table outlines the details of the line transects followed.

Survey number	Transect number	Start position		End position		Duration (hh:mm)	Number of tuna shoals spotted
		Latitude	Longitude	Latitude	Longitude		
2	2	35°37 07.8	11°44 14.2	35°00 50.6	11°42 33.0	00: 25	0
2	3	34°59 58.2	12°14 03.9	35°59 26.5	12°14 56.5	00: 46	2

While conducting transect 3, two shoals of *T. thynnus* were spotted. The first school, which was sighted at Lat 35°54 46.8 Long 12°10 47.4, was estimated to be 35 Tons and made up of 2000 individuals of whom 75% were considered to be small and the rest were medium size according to the classification system used during this survey. The second *T. thynnus* shoal was smaller in size (approximately 25 Tons and 1400 individuals in total). Nevertheless the latter school had the same school composition as the first one.

In both transects, no tuna purse-seine vessels were sighted.



MALTA 25/06/2010

The sixth session of aerial surveys made. Details of the survey are given in the table below.

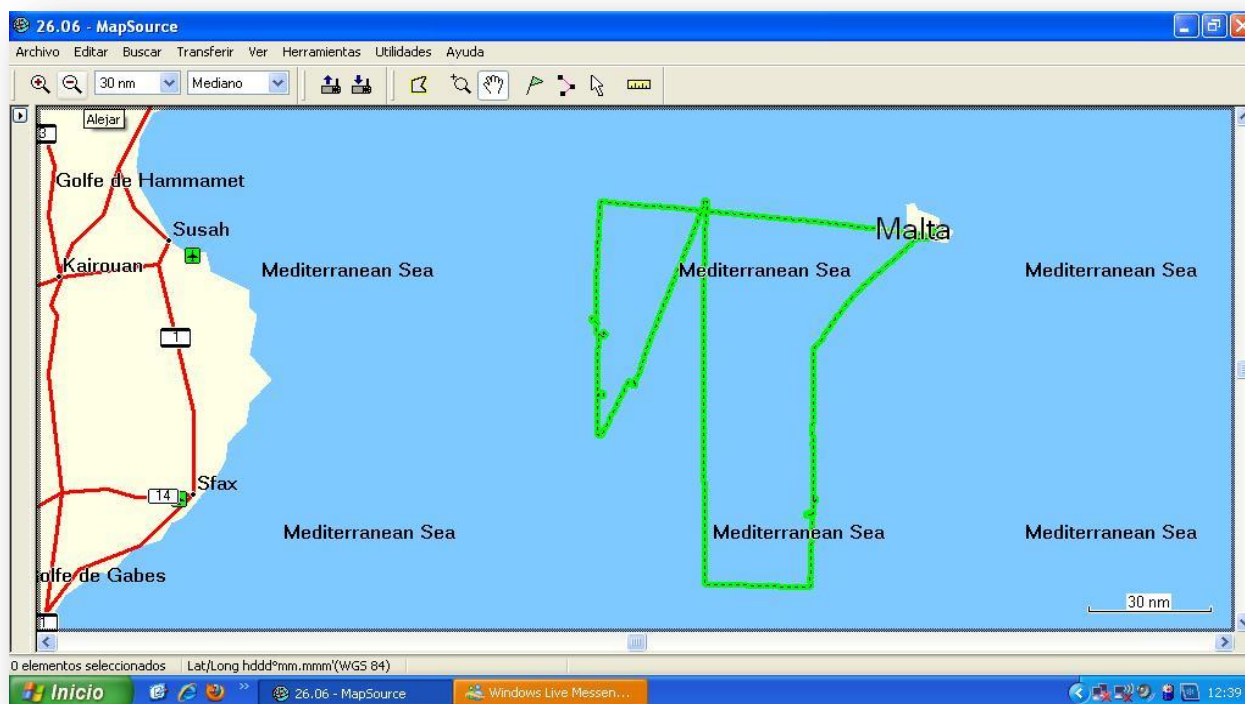
Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	8:38	12:30	3

The weather conditions were good (Force 0-1 winds and a clear sky). Surveys were carried out along the three line transects 4, 5, and 6 of survey 2 (subarea 3). The following table outlines the details of the line transects followed.

Survey number	Transect number	Start position		End position		Duration (hh:mm)	Number of tuna shoals spotted
		Latitude	Longitude	Latitude	Longitude		
2	4	35°59 09.7	12°47 35.6	35°00 36.5	12°46 57.1	00: 37	1
2	5	35°59 49.9	13°19 05.3	34°22 11.8	13°19 12.9	00: 47	0
2	6	34°20 29.7	13°50 08.3	35°21 26.9	13°52 01.5	00: 37	2

A 5-6 Ton school of *T. thynnus* was spotted at Lat 35°29 33.6 Long 12°44 56.6 while conducting transect 4. The school was composed of approximately 1500 small individuals. During transect 6, two shoals of bluefin tuna were spotted. The total weight of the schools were 0.5 and 0.4 Tons respectively. Both schools were made up of small individuals.

Tuna purse-seine ships were only sighted along line transect 4.



MALTA 26/06/2010

Seventh session of aerial surveys made. Two 4 hour flights were performed on the day. Details of the survey are given in the table below.

Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	8:20	12:12	3
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	14:30	18:28	3

Six aerial line transects were carried out on the day. Transects 3, 4 and 5 of survey 3 (subarea3) were made in the morning flight while transects 6, 7 and 8 of survey 2 (subarea 3) were carried out in the afternoon flights. Details of the individual line transects are given in the table below.

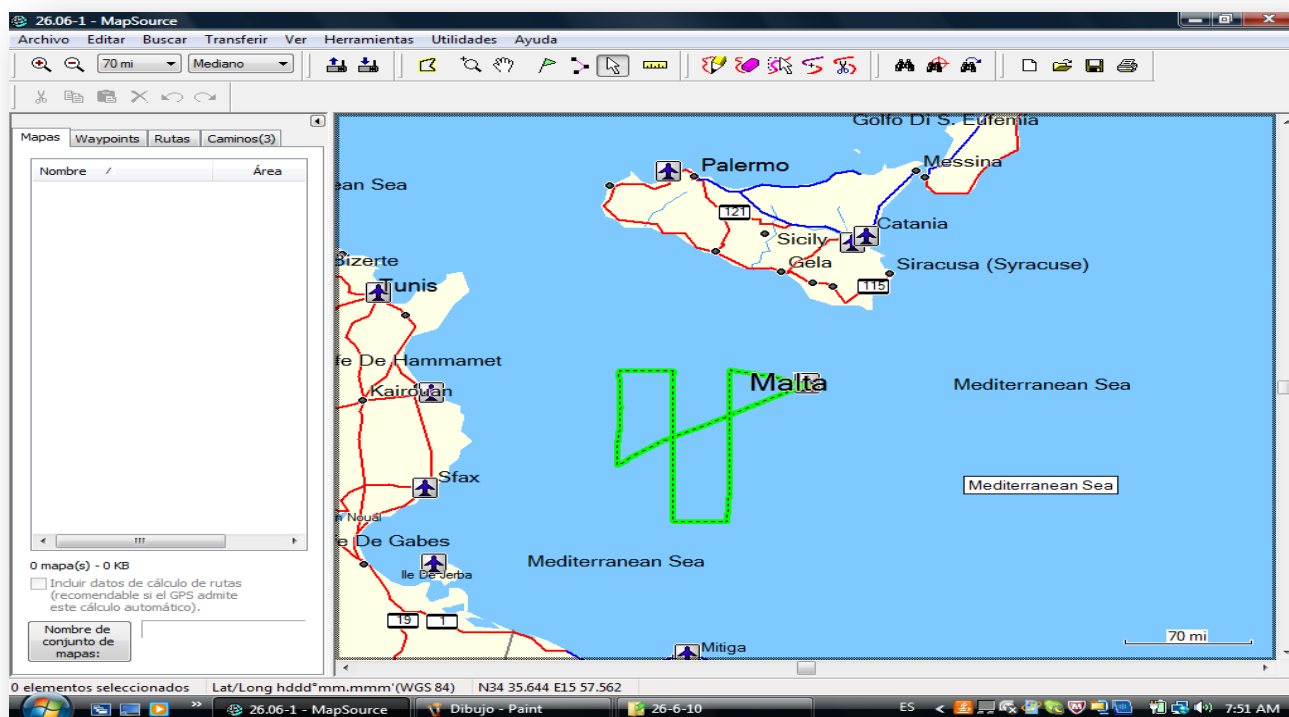
Survey number	Transect number	Start position		End position		Duration (hh:mm)	Number of tuna shoals spotted
		Latitude	Longitude	Latitude	Longitude		
3	3	34°58 10.0	12°35 47.3	35°59 24.9	12°36 46.0	00:29	1
3	4	35°59 41.0	13°08 30.8	34°21 58.9	13°08 35.1	00:50	0
3	5	34°20 55.6	13°39 56.5	35°59 13.4	13°41 41.9	00:45	0
2	6	35°59 50.7	13°53 09.7	35°23 20.8	13°51 38.1	00:19	0
2	7	35°48 02.8	14°24 18.7	34°21 44.8	14°23 02.6	00:52	0
2	8	34°20 54.7	14°55 58.5	35°58 30.9	14°56 46.6	01:38	6

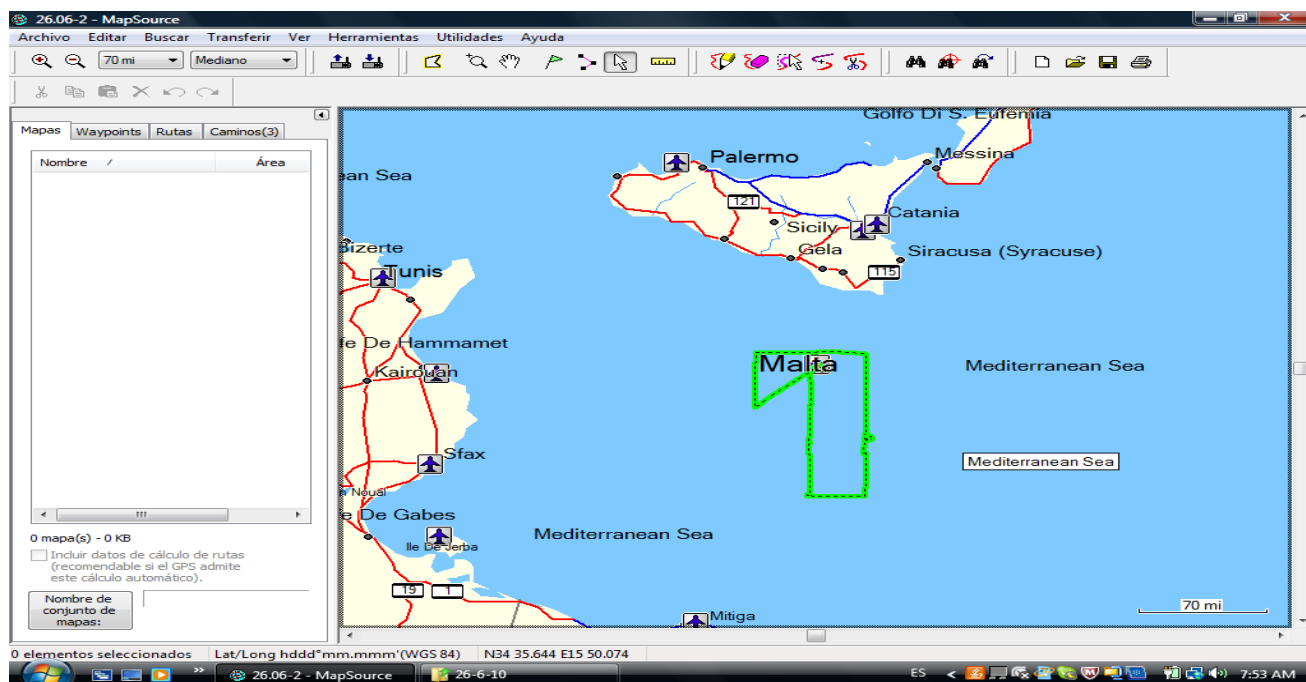
The surveys were made in force 0-1 wind conditions and clear to slightly hazy skies. The aerial survey design speed and altitude were respected throughout the six line transects carried out on the day. While conducting line transect 3, the plane flew over Lampedusa (Approximate duration 1 min).

Seven shoals of tuna were spotted on the day. The shoal dynamics data on the particular schools is summarized in the table below.

Survey number	Transect number	Position		School size (number of individuals)	Estimated weight (Tons)	Size components (%)			
		Latitude	Longitude			S	M	L	G
3	3	35°37 02.2	12°37 14.4	20	0.08	100	0	0	0
2	8	35°01 17.7	14°58 02.2	2300	50	50	5	0	0
2	8	35°00 40.1	14°58 23.2	1600	80	0	100	0	0
2	8	35°01 33.4	14°59 06.6	800	100	0	100	0	0
2	8	35°01 10.7	14°58 48.6	2000	50	50	50	0	0
2	8	35°01 59.8	14°58 06.1	700	40-50	0	100	0	0
2	8	34°59 55.3	14°57 34.4	1200	150	0	100	0	0

Tuna fishing vessels were sighted while conducting transects 7 and 8.





MALTA 27/06/2010

Eight session of aerial surveys were made. Four aerial line transects were carried out during one flight in the morning and another in the afternoon. The following table illustrates a summary of the survey details.

Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	8:34	12:45	2
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	16:00	18:35	2

Transects 1, 2 of survey 3 (subarea 3) were made during the morning flight, while transects 6, 7 of survey 3 (part of) (subarea 3) were carried out during the afternoon flights.

Details of the individual line transects are given in the table below.

Survey number	Transect number	Start position		End position		Duration (hh:mm)	Number of tuna shoals spotted
		Latitude	Longitude	Latitude	Longitude		
3	1	34°59 24.6	11°33 49.8	37°00 00.5	11°31 49.0	01: 06	0
3	2	36°00 12.5	12°05 50.5	35°01 08.8	12°03 55.5	00: 28	0
3	6	36°00 00.9	14°14 39.2	34°23 09.6	14°13 09.1	01: 09	2
3	7	34°22 04.6	14°44 50.3	34°55 07.0	14°49 08.6	00: 31	1

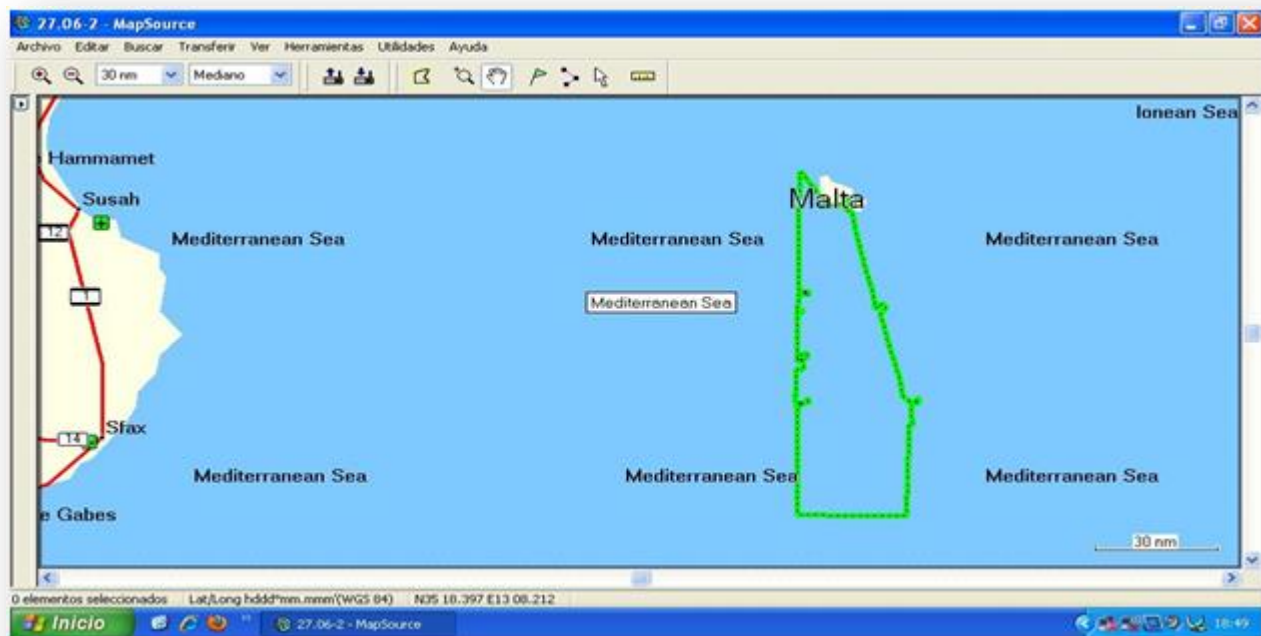
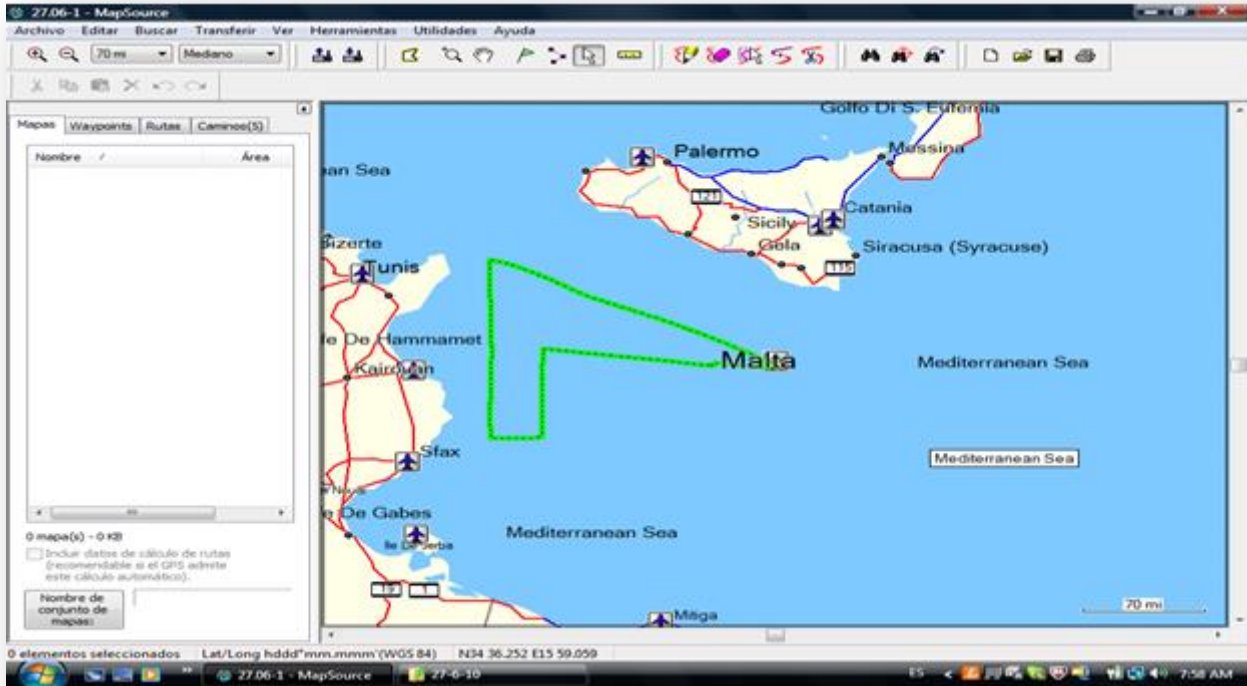
The weather conditions were good (Force 0-1 winds and a clear sky).

The aerial survey design speed and altitude were respected throughout the four line transects carried out on the day. Four shoals of tuna were spotted on the day.

Details of the recorded shoals are given in the table below.

Survey number	Transect number	Position		School size (number of individuals)	Estimated weight (Tons)	Size components (%)			
		Latitude	Longitude			S	M	L	G
3	6	35°12 58.0	14°13 04.3	3	0.012	100	0	0	0
3	6	34°54 34.8	14°16 00.9	7	0.100	100	0	0	0
3	7	34°54 30.6	14°49 09.2	2400	40	100	0	0	0
Sighted while cruising back to Malta		35°22 15.6	14°36 23.3	20	0.040	100	0	0	0

Tuna purse-seine ships were only sighted along line transect 6.



MALTA 28/06/2010

The ninth session of aerial surveys was made. Five aerial line transects were carried out during a morning and afternoon flights.

The following table illustrates details of the survey.

Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	8:23	12:15	3
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	15:20	18:31	2

Transects 2 (part of), 3 and 5 (part of) of survey 4 (subarea 3) were made during the morning flight, while transects 6 and 8 of survey 4 (subarea 3) were carried out during the afternoon flights. Line transects made during the morning were, at times, carried out in slightly hazy to medium hazy skies.. On the other hand, the sky was clear during the afternoon flights. On the day, winds of force 0-1 on the Beaufort scale were recorded.

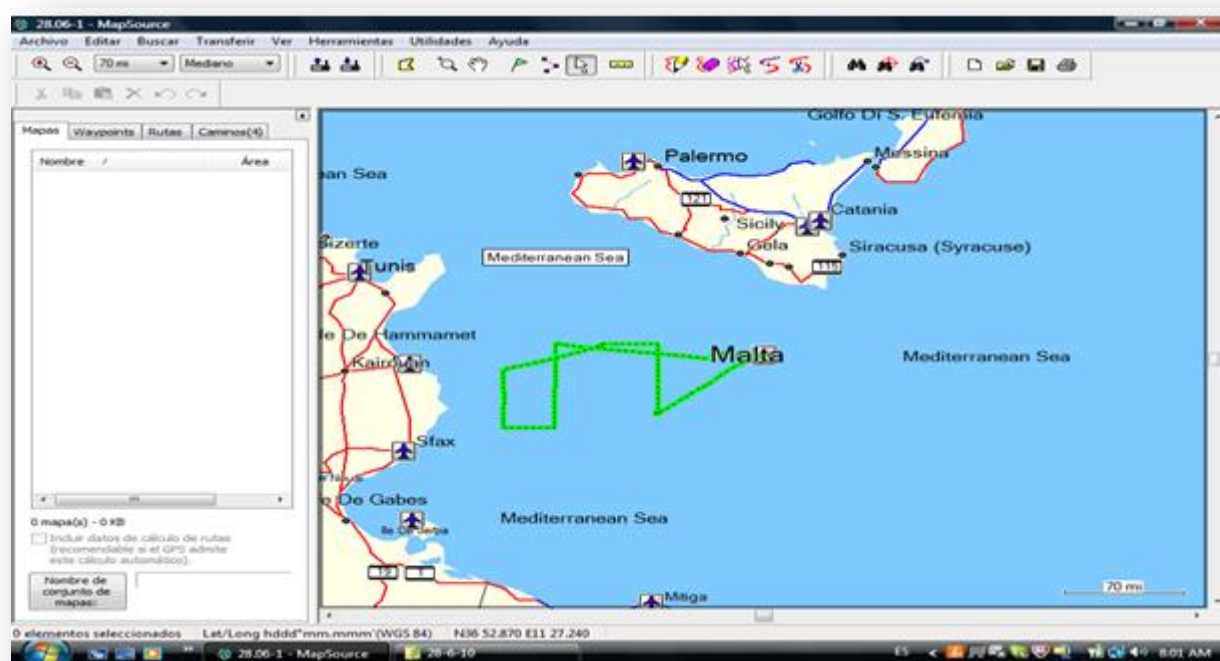
The table below summarizes the details of the individual aerial line transects.

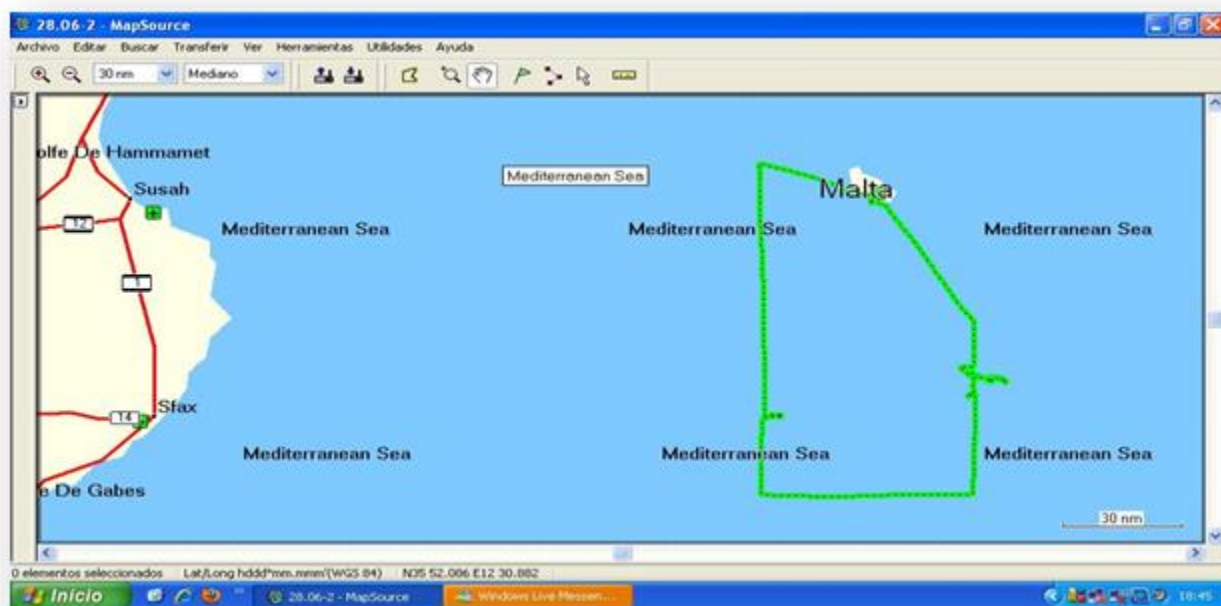
Survey number	Transect number	Start position		End position		Duration (hh:mm)	Number of tuna shoals spotted
		Latitude	Longitude	Latitude	Longitude		
4	2	35°00 06.2	11°45 03.5	35°23 43.7	11°43 44.9	00: 12	0
4	3	36°00 08.0	12°17 12.7	35°00 57.3	12°15 49.8	00:27	0
4	5	36°00 17.2	13°19 25.2	35°11 16.5	13°22 27.1	00:32	1
4	6	36°00 10.0	13°52 52.8	34°21 56.1	13°52 07.3	00:56	1
4	8	34°21 08.5	14°56 43.8	35°11 11.9	14°57 52.4	01:02	5

A summary of assessment of the observed shoals of tuna are summarized in the following table.

Survey number	Transect number	Position		School size (number of individuals)	Estimated weight (Tons)	Size components (%)			
		Latitude	Longitude			S	M	L	G
4	5	35°10 05.0	13°20 44.0	15	0.045	100	0	0	0
4	6	34°44 42.5	13°58 34.5	7-8	0.060	100	0	0	0
4	8	34°50 10.7	14°58 12.5	4	0.015	100	0	0	0
4	8	34°51 02.5	14°56 09.5	15	0.008	100	0	0	0
4	8	35°57 42.2	14°56 44.6	1600	40	100	0	0	0
4	8	34°57 16.8	14°56 50.3	1400	50	0	80	20	0
4	8	34°56 49.0	14°58 19.2	500	80-100	0	50	50	0

On the day no tuna purse-seine fishing vessels were seen in the area of study.





MALTA 29/06/2010

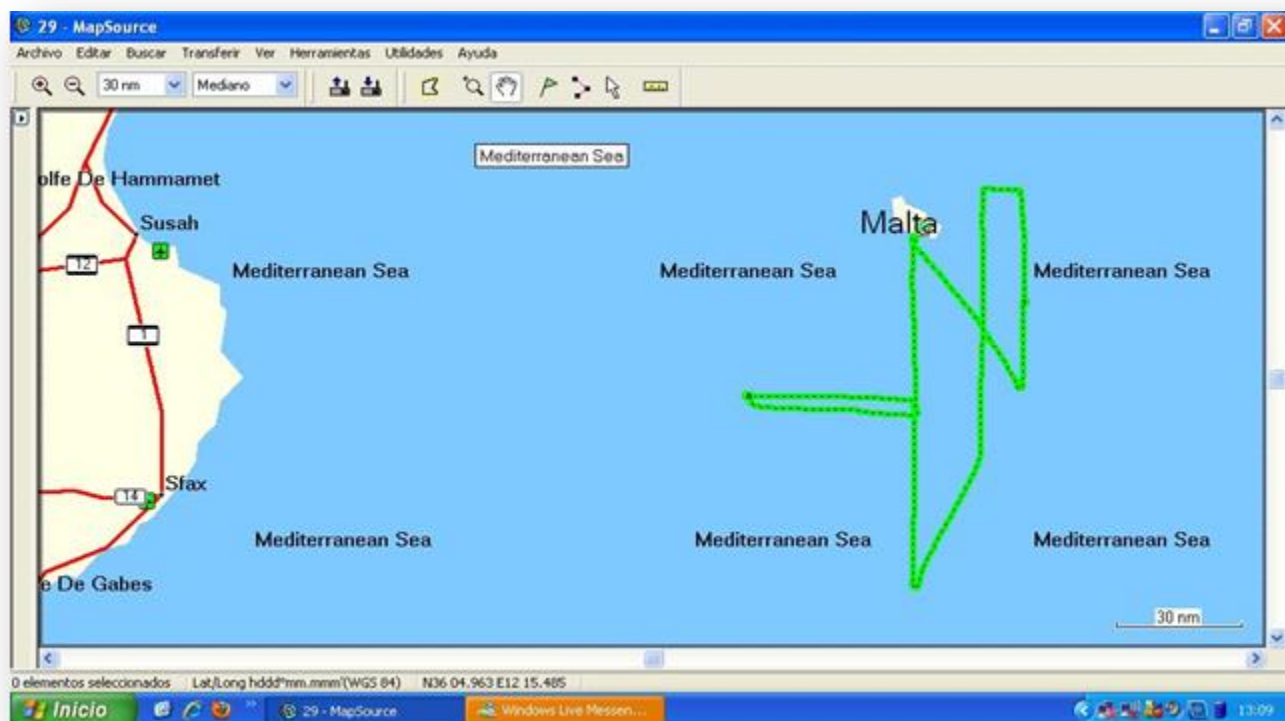
The tenth session of aerial surveys made. The following table illustrates details of the survey.

Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	9:15	12:50	3

Surveys were carried out along line transect 7 (continuation from 27/06/2010) of survey 3(subarea 3) and transects 7 and 8 of survey 4 (subarea 3). It is to be noted that transect 7 (survey 4) was interrupted and hence was considered as two separate line transects. This was done to take into account the 'no effort' time. The table below shows a summary of details of the transects made on the day.

Survey number	Transect number	Start position		End position		Duration (hh:mm)	Number of tuna shoals spotted
		Latitude	Longitude	Latitude	Longitude		
3	7	36°00 37.7	14°46 08.2	34°55 13.6	14°45 30.2	00: 25	0
4	7	34°21 27.2	14°26 13.5	35°07 24.2	14°25 47.4	00: 33	0
4	7	35°07 33.8	14°26 18.5	35°47 25.7	14°25 44.7	00: 23	0
4	8	35°12 02.3	14°57 42.4	36°00 46.9	14°57 07.5	00: 22	0

The surveys were made during Force 0-1 winds. All line transects, except for transects 7 (Survey 3) and 7 (Survey 4), were made in clear sky conditions. No tuna shoals were observed in any of the surveys made on the day. Nevertheless, while cruising between transects a 150 ton *T. thynnus* shoal was sighted at Lat 35°09 45.6 Long 13°36 55.5. No tuna purse-seine vessels were sighted on any of the line transects made.



MALTA 30/06/2010

No aerial surveys were made since the aircraft was being serviced.

MALTA 01/07/2010

The eleventh session of aerial surveys was made. Two flights were performed on the day.

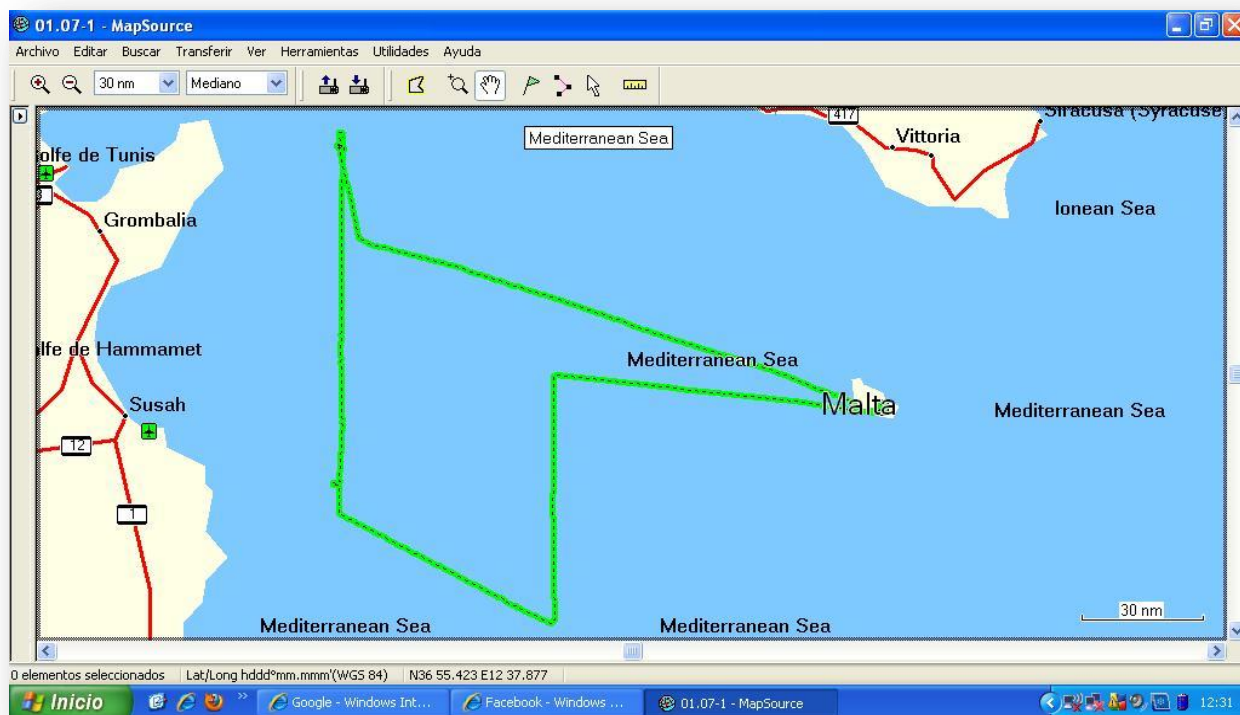
Details of the survey are given in the table below.

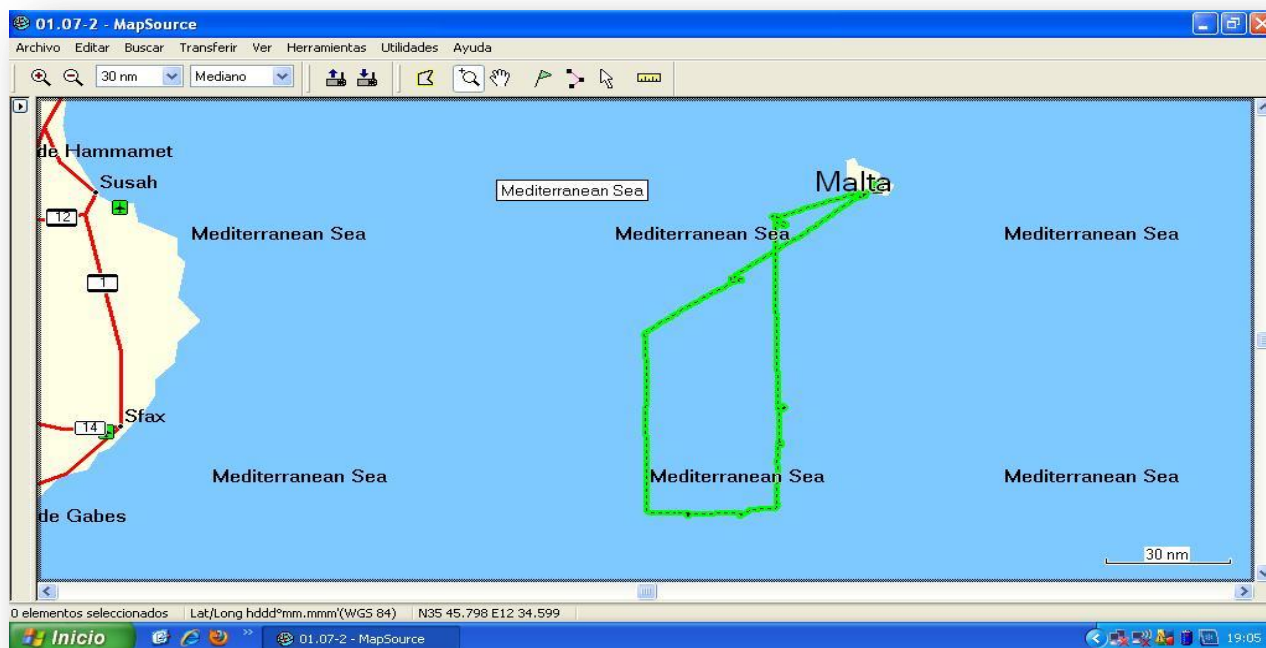
Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	8:19	12:18	2
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	15:56	18:34	2

Four aerial line transects were made on the day. Transects 2 (continuation from 28/6/2010) and 4 of survey 4 (subarea 3) were made in the morning flight while transect 5 (continuation from 28/6/2010) of survey 4 (subarea 3) and transect 6 of survey 5 (subarea 3) were carried out in the afternoon flights. Details of the individual line transects are given in the table below.

Survey number	Transect number	Start position		End position		Duration (hh:mm)	Number of tuna shoals spotted
		Latitude	Longitude	Latitude	Longitude		
4	2	35°24 29.0	11°43 54.6	36°59 48.8	11°44 13.0	00: 27	0
4	4	35°59 58.1	12°49 32.4	34°58 46.4	12°48 52.9	00: 55	0
4	5	35°10 45.6	13°20 39.2	34°21 30.9	13°20 43.7	00: 23	0
5	6	34°21 39.6	13°58 30.9	35°41 52.3	13°59 20.2	00: 51	0

A 0.6 Ton shoal of *T. thynnus* was seen while cruising between transects. While conducting transect 4 (survey 4) a tuna fishing fleet consisting of 6 vessels was spotted.





MALTA 02/07/2010

Twelfth and final session of aerial surveys made. Five aerial line transects were carried out during one flight in the morning and another in the afternoon. The following table illustrates details of the survey.

Plane type & Registration number	Crew	Departure from Luqa	Arrival at Luqa	Number of Line transects conducted
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	8:35	12:25	3
Partenavia (P-68) EC - IOD	Roberto Corral Carlos Dos Santos Edwin Zammit	15:36	17:28	2

Transects 3, 4 and 5 of survey 5 (subarea 3) were made in the morning flight while transect 7 of survey 5 (subarea 3) and transect 7 of survey 6 (subarea 3) were carried out in the afternoon flights. The aerial line transects were, at times, carried out in slightly hazy to medium hazy skies. On the day, winds of force 0 -1 on the Beaufort scale were recorded.

The table below summarizes the details of the individual aerial line transects.

Survey number	Transect number	Start position		End position		Duration (hh:mm)	Number of tuna shoals spotted
		Latitude	Longitude	Latitude	Longitude		
5	3	36°00 17.6	12°22 50.8	35°38 55.2	12°21 42.1	00:10	0
5	4	35°00 11.9	12°52 51.9	35°48 30.6	12°54 12.2	00:26	0
5	5	35°50 15.3	13°25 32.3	34°24 26.8	13°25 13.5	00:15	1
5	7	35°22 52.6	14°30 49.7	34°21 55.9	14°31 10.1	00:41	0
6	7	34°20 54.5	14°42 56.6	35°20 00.6	14°43 24.9	00:39	1

Assessment of the observed shoals of *T. thynnus* is summarized in the following table.

Survey number	Transect number	Position		School size (number of individuals)	Estimated weight (Tons)	Size components (%)			
		Latitude	Longitude			S	M	L	G
5	5	34°53 56.7	13°26 05.3	7-8	0.05	100	0	0	0
6	7	34°56 54.2	14°43 21.3	1750	200	0	50	50	0



REPORT SUMMARY

Total number of hours flying	Number of operative days (during which surveys were made) between 04/06/10 to 22/06/10	Number of days on standby during the period 04/06/10 to 22/06/10	Number of shoals recorded
16 hours 9 minutes	4	13	2

Control of flight schedule

Day	Start eng	Stop eng	Hours	Subarea	Nº Survey	Lines	Start Survey	Stop Survey	Effective Hours	Notes
06/04/2010	6:50	12:05	5:15	0	0	0	0	0	0	movilization
06/05/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
06/06/2010	12:55	16:55	4:00	3	1	5,6,7	15:14	18:29	3:15	1º job day
06/07/2010	9:00	13:00	4:00	3	1	4,3	12:28	14:00	1:32	2º job day
06/08/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
06/09/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
06/10/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
06/11/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
06/12/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
13/6/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather

14/6/2010	7:55	11:55	4:00	3	1	2,1	11:05	12:33	1:28	3º job day
15/6/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
16/6/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
17/6/2010	7:25	11:25	4:00	3	2	2	11:01	12:14	1:13	4º job day
18/6/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
19/6/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
20/6/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
21/6/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
22/6/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
23/6/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
24/6/2010	9:10	13:10	4:00	3	2	2,3	12:43	14:07	1:24	5º job day
25/6/2010	6:20	10:20	4:00	3	2	4,5,6	9:16	12:07	2:51	6º job day
26/6/2010	6:05	10:05	4:00	3	3	3,4,5	9:14	11:46	2:32	7º job day
26/6/2010	12:20	16:40	4:00	3	2	6,7,8	14:33	18:04	3:31	7º job day
27/6/2010	6:25	10:25	4:00	3	3	1,2	9:36	11:22	1:46	8º job day
27/6/2010	13:50	17:00	3:10	3	3	6,7	16:11	18:05	1:54	8º job day
28/6/2010	6:10	10:10	4:00	3	4	2,3,5	9:22	11:39	2:17	9º job day
28/6/2010	13:10	16:30	3:20	3	4	6,8	15:40	18:05	2:25	9º job day
29/6/2010	7:00	10:45	3:45	3	3,4	7(nºs.3),7,8	9:41	12:44	3:03	10º job day
30/6/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
31/6/2010	0:00	0:00	0:00	0	0	0	0	0	0	no job bad weather
07/01/2010	6:05	10:05	4:00	3	4	4,2	9:01	10:55	1:54	10º job day
07/01/2010	13:40	16:30	2:50	3	4,5	5,6(nºs.5)	16:36	18:12	1:36	10º job day
07/02/2010	6:20	10:20	4:00	3	5	3,4,5	9:28	11:32	2:04	11º job day
07/02/2010	13:20	15:25	2:05	3	5,6	7,7(nºs.6)	15:40	17:05	1:25	11º job day
07/03/2010	7:25	12:45	5:20	0	0	0	0	0	0	movilization
			73:45:00						36:10:00	