TAGGING PROGRAMME 2015 ATLANTIC-WIDE RESEARCH PROGRAMME ON BLUEFIN TUNA (ICCAT/GBYP/05/2015)

TASK C:
Electronic tagging of adult bluefin tunas in traps in the Mediterranean Sea, Sardinian waters

DRAFT FINAL REPORT

July 28, 2015

Com.Bio.Ma.

Consortium partners:

Com. Bio. Ma.
Centro di Competenza sulla Biodiversità Marina

Centro di Competenza sulla Biodiversità Marina Soc. Cons. a r.l. (COM.BIO.MA.)
Società Consortile a Responsabilità Limitata
Legal address: Via ing. Tommaso Fiorelli n.1, Cagliari (09126), Italy
Phone (39) 0706758050 - (39) 0706758051 – Fax (39) 0706758022

CARLOFORTE TONNARE P.I.A.M. – Srl

Carloforte Tonnare P.I.A.M. (Promozioni Industriali Agroturistiche mercantili) S.R.L.
Legal Address: Via Arezzo – 09126 Cagliari - Italy
VAT Number: 01929800926
Phone (39) 0781 855163 – Fax (39) 0781 850039

DRAFT FINAL REPORT

July 28, 2015

Summary

Contacts

Prof. Angelo Cau (Administrator) +39 070 675 8050
E-mail: cau@unica.it
Co.Bio.Ma. – Centro di Competenza sulla Biodiversità Marina
c/o Department of Life Science and Environment, University of
Cagliari Via Fiorelli 1, 09126 Cagliari, Italy
Tel. +39 070 675 8000 – Fax +39 070 675 8022 – Amm. +39 070 675 8040

TAGGING COORDINATOR

Dr. Piero Addis, Senior Researcher in Ecology - University of Cagliari
E-mail: addisp@unica.it
Via Fiorelli 1 - 09126 Cagliari, ITALY
Phone: (39) 070 675 8082, Fax: (39) 070 675 8022

TAGGING STAFF

Dr Marco Secci ma.secci7@studenti.unica.it	Scientist Com.Bio.Ma. – Tagging staff PhD Candidate – University of Cagliari
Dr Rita Cannas rcannas@unica.it	Scientist Com.Bio.Ma. – Tagging staff Senior researcher in Zoology– University of Cagliari
Dr Andrea Sabatini asabati@unica.it	Scientist Com.Bio.Ma. – Tagging data base Senior researcher in Ecology – University of Cagliari
Dr Francesco Palmas fpalmas@unica.it	Scientist Com.Bio.Ma. – Tagging staff PhD Candidate – University of Cagliari
Mrs Elisabetta Mereu combioma_scrl@legalmail.it	Administrative officer Com.Bio.Ma.

ICCAT/GBYP/05/2015
"TAGGING PROGRAMME 2015"

FOREWORD

The proposal for the "ICCAT-GBYP Tagging programme 2015 - TASK C: Electronic tagging of adult bluefin tunas in traps in the Mediterranean Sea, Sardinian waters" was submitted on May 5, 2015 by the consortium composed by the Centro di Competenza sulla Biodiversità Marina (Com.Bio.Ma.) and the Carloforte Tonnare PIAM (CTPIAM), which represents the company that manages the trap of Isola Piana.

The Com.Bio.Ma. is a scientific institution formally recognized by the Italian Ministry of University, Education and Research. Com.Bio.Ma. is a nonprofit consortium (limited liability consortium) aimed to the Research & Technological Development (RTD) in Sardinia. Com.Bio.Ma. has a documented multi-year experience in bluefin tuna and large pelagic species studies. In 2013, the institute has been involved both in the Biological Sampling and in the Conventional tagging programme by the ICCAT/GBYP, and in 2014 carried out a self-financed project for the complimentary conventional tagging of bluefin tuna in Sardinian traps. The current programme involved our institution in the electronic tagging on bluefin tuna in Sardinia, which provided to Com.Bio.Ma. and Carloforte Tonnare an opportunity to cooperate and contribute in the species conservation and management.

The tagging programme began on May 8, 2015, after the proposal was awarded by the ICCAT Secretariat.
The present report summarizes the activities carried out by July 15, 2015.

SARDINIAN TRAPS: general features

Currently in Sardinia are settled three traditional traps (tonnara): Isola Piana, Capo Altano and Porto Paglia. These traps are the last active traps remaining in the Mediterranean. The position of these traps has been the same since the 17th century, when high abundance of bluefin tuna contributed to sustain the coastal villages of Carloforte and Portoscuso (locally called "tuna district").

Unlike previous conventional tagging programmes (ICCAT/GBYP 2013 and 2014), the current programme involved only the trap of Isola Piana (located in the Island of San Pietro). The Isola Piana trap is deployed in the northern part of the island of San Pietro in the location known as "Tacche Bianche". It is the second oldest trap in Sardinia and nowadays the most productive one. It consists of a 1050 meters long tail and five chambers settled on a sandy bottom at 42 m depth. The trap of Isola Piana is manged by the Carloforte Tonnare PIAM srl. The trap crew includes 25 fishermen (tonnarotti).

ICCAT Number	Reporting Flag	Trap	Reg.Number	Owner	Address	Operator
ATEU2ITA00003	EU.Italy	Tonnara Isola Piana	ITA02/FIS/2010	Soc. Carloforte Tonnare P.I.A.M. s.r.l.	Via Arezzo n.2, 09125 Cagliari (CA)	Soc. Carloforte Tonnare P.I.A.M. s.r.l.

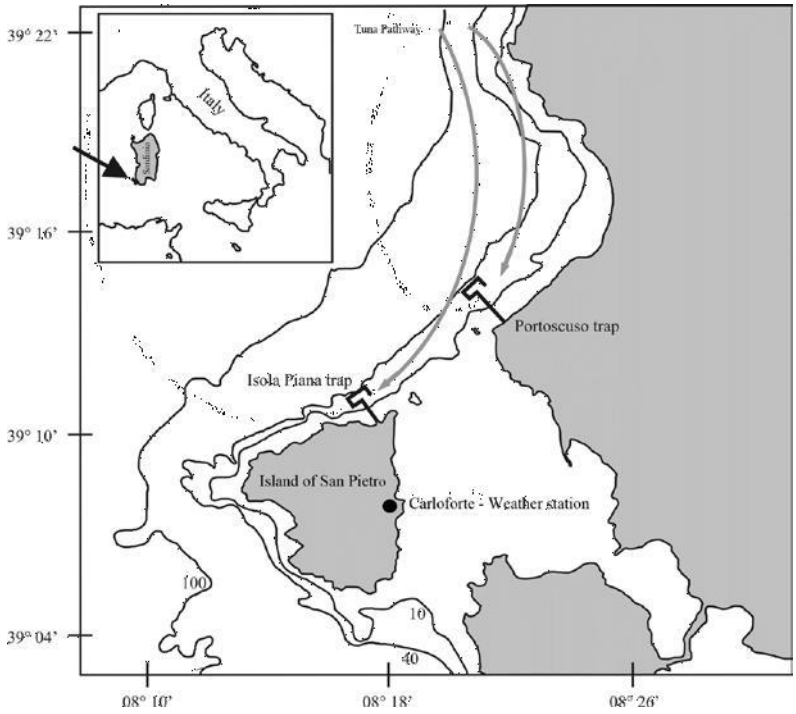


Fig. 1 - Location of the trap fishery in Sardinia

FISHING SEASON 2015

The preparation of the fishing season in 2015 in Sardinia started in early February. At that time all the equipment (system of nets, ropes, buoys and anchors) was submitted to the maintenance, before being deployed. The Isola Piana trap utilizes about 120 anchors (~200Kgs each), kilometres of steel cables and chains, hundreds buoys and kilometres of nets of different mesh size. This trap needs about 20 working days to be settled, providing favourable weather conditions.

Since mid-April 2015 the trap of Isola Piana has been fully operative and the first observation of entrapped bluefin occurred on late April.

It must be pointed out that since the 2011 the traditional system of harvesting by "mattanzas on-site" has been changed. After capture, most of the bluefin tuna is moved to a tuna farm in Malta (Mare Blu Tuna Farm - Ricardo Fuentes and Hijos company). For these purposes the transportation cage is positioned next to the death chamber in the western side of the trap. A dedicated tunnel connects the death chamber to the cage to facilitate the transfer of tunas. The tunnel also includes videocameras for counting bluefin tunas and assessing their weight against the available quota.

The quota provided to the bluefin tuna trap fishery by the Italian Ministry for Agriculture, Food and Forestry Policies in 2015 is 194,06 tons (for three traps).

The quota for the Isola Piana trap has not been fully consumed, thus 2 tons were moved to the Capo Altano trap. On the basis of the plans agreed with the trap company, tagging started on July 01, 2015.

TAGGING PROTOCOL

The tagging protocol applied in this programme was similar to the one described in the document SCRS/2014/189, although some modifications were made in order to accomplish the tagging procedure by the diver, using pneumatic spearguns.

For the purpose of establishing a common protocol for size estimation, a coordinated work with Consorzio UNIMAR is planned before the ICCAT SCRS species working group meeting. Due to time constrains and the necessary time for carrying out the comparative analyses of this calibration, the results will be provided to GBYP under a separate and additional short report.

It must be pointed out that ICCAT GBYP Steering Committee requested additional tagging activities for deployment of 10 miniPATs in Sardinian traps in cooperation with the Consorzio UNIMAR (author of SCRS/2014/189, adopted as reference protocol in 2015). This activity was accomplished during tagging carried out by Com.Bio.Ma. and this join tagging activities allowed the two institution to coordinate and compare their methodologies. A common experiment using different systems was carried out with one dead bluefin tuna captured in the trap of Isola Piana.

TRAINING COURSE FOR DIVERS AND SCIENTIFIC TEAMS

Operational activities were properly prepared before the tagging phase, during a technical meeting held on June 17, 2015, at the trap company's headquarters (Carloforte). The tagging coordinator presented the tagging protocol, methodologies and equipment for electronic tagging and these were discussed at the meeting.

One testing day was also useful for testing the effectiveness of the equipment. The tagging team of Com.Bio.Ma. evaluated the effectiveness of pneumatic spearguns, the new laser pointer system and videocameras. Few modifications of the methodology have been introduced after the testing day.

Fig. 2 - The trap crew of Isola Piana preparing the death chamber for tagging.

TECHNICAL FEATURES OF THE TRAP OF ISOLA PIANA

The trap system used in Sardinia is classified as 'tonnara di corsa' (arrival or "incoming" trap) because bluefin tunas are captured along their pre-spawning migration route and with ripening gonads. According to the historical documentation, this location entrapped tuna from the north and north-west pathways.

The gear consists of nylon nets arranged in a tail and five chambers: the "Grande" (120 m x 45 m), the "Bordonaro" (45 m x 45 m), the "Bastardo" (45 m x 40 m), the "Camera di ponente" (45 m x 40 m) and the "Camera della morte" (the "death chamber") (45 m x 30 m). Only the death chamber has a moving mesh 'floor' (horizontal), used for pulling up the tuna and for carrying out the "mattanza". There are some differences in size of the tail and the chambers between the two traps due to the diverse features of the sea bottom and the trap orientation.

Following the technical meeting with the trap manager (Mr Giuliano Greco), the tagging coordinator (Dr Piero Addis), and the fishermen chief (*Rais* Luigi Biggio), it was decided to proceed as follows:

A) to start tagging operation after the tuna transfer into the transportation cage (for avoiding any interference between the death chamber and the cage);

B) to carry out electronic tagging inside the "death chamber", following positive experience from the last two years of conventional tagging.

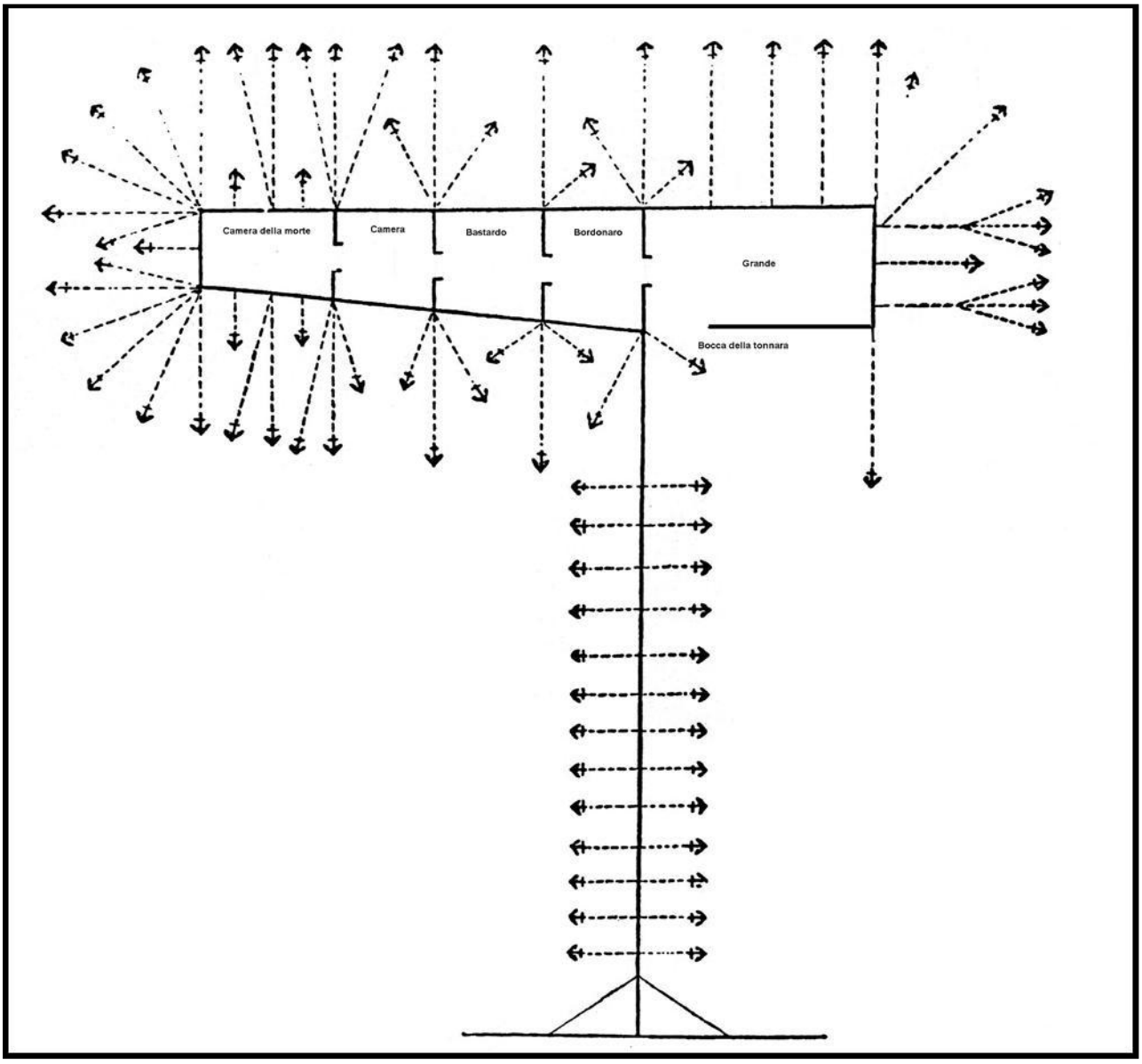


Fig. 3 - Scheme of the traditional trap of Isola Piana (Sardinia)

TAGGING EQUIPMENT

Tagging equipment used for the tagging by Com.Bio.Ma. and additional tagging carried out by UNIMAR.

Equipment	**Com.Bio.Ma.**	**Additional tagging UNIMAR**
Tag applicator	Customized (Fig.4)	Customized
Speargun	Oleo pneumatic MARES Cyrano 85-100 cm	OMER Cayman 95cm "Arbaletes single or coupled circular power band in Dynatex
Underwater camera	GoPro® HERO System	GoPro® HERO System
Software for image editing and analysis	TPSDig2; GoPro CineForm Studio	AQ1 AM100
Underwater Laser pointer	APINEX BALP-LG05-B150 - green	Not used
Anchor	Domeier L	Domeier L

APPLICATOR

Tag applicator have been provided by Com.Bio.Ma.

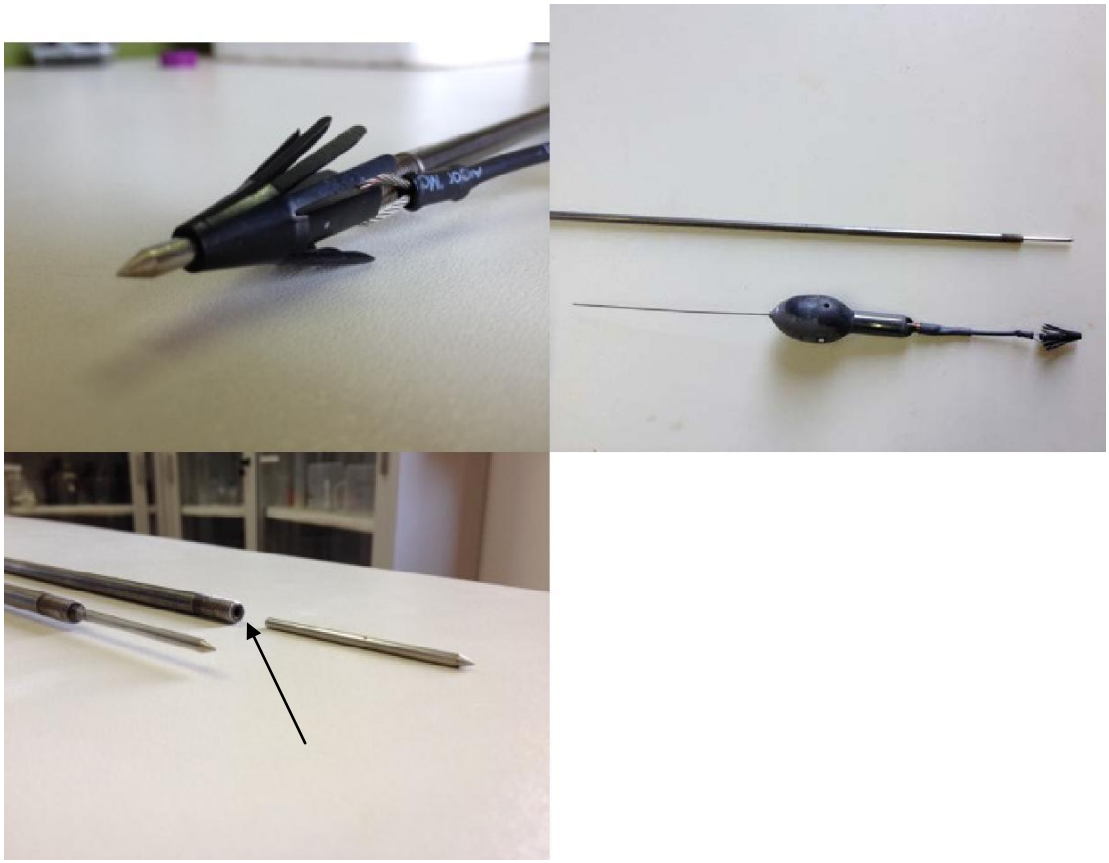


Fig. 4 – Details of the applicator for electronic tagging (shaft was drilled ø 3 mm)

SPEARGUN

We adopted the MARES mod. Cyrano speargun. This speargun combines the power characteristics of a pneumatic gun with manageability and extreme shaft speed. It is equipped by highly sensitive release mechanism, ergonomic handle with a soft insert and with power adjusting system. For tagging activities we used the 85, 97 and 110 cm sizes, which are equipped with a 7 mm Tahitian race shaft.

Fig. 5 - Set of spearguns, model Mares Cyrano, adopted for tagging: only one size (85 cm) was used for tagging

CAMERA TYPE

GoPro Hero3 black is a digital camera capable of capturing ultra-wide videos and 12MP photos at a rate of 30 photos per second. Optics are Ultra sharp *f*/2.8 6-element aspherical glass lens and Ultra wide angle / reduced distortion. It is powered by a 1050 mAh rechargeable lithium-ion battery chargeable via USB, with an estimated time duration ranging from 1:05 – 1:20 hours, depending on the resolution, frame rate and the usage of the LCD screen.

Fig. 6 - The GoPro Hero3 Black edition was successively adopted for tagging

Fig. 7 - Waterproof housing for the GoPro Hero3 Black edition

Fig. 8 - Removable LCD touch screen for the GoPro Hero3 Black edition

Key features

Video Resolution	NTSC fps	PAL fps	STD Mode	Protune Mode	Field of View (FOV)	Screen Resolution/ Aspect Ratio
1080p	60, 48, 30, 24 fps	50, 48, 25, 24 fps	YES	YES	Ultra Wide, Medium, Narrow	1920x1080 16:9
720p	120, 60 fps	100, 50 fps	YES	YES	Ultra Wide, Narrow*	1280x720 16:9
1440p	48, 30, 24 fps	48, 25, 24 fps	YES	YES	Ultra Wide	1920x1440 4:3
4K	15 fps	12.5 fps	NO	ONLY in Protune	Ultra Wide	3840x2160 16:9
4K Cin	12 fps	12 fps	NO	ONLY in Protune	Ultra Wide	4096x2160 17:9
2.7K	30 fps	25 fps	YES*	YES	Ultra Wide	2704x1524 16:9
2.7K Cin	24 fps	24 fps	YES*	YES	Ultra Wide	2704x1440 17:9
960p	100, 48 fps	100, 48 fps	YES	YES	Ultra Wide	1280x960 4:3
WVGA	240 fps	240 fps	YES	NO	Ultra Wide	848x480 16:9

LASER POINTERS

We adopted a waterproof green laser pointer by Apinex with features reported in the following table:

- Laser Class: IIIa
- Output Power: <5mW
- Wavelength: 532nm
- Batteries: 2 x AA (included)
- Body material: Aluminium
- Range : >3000 meters (outside the water)
- Dimensions: L:190mm x D:25mm
- Waterproof to: up to 300 feet

Fig. 9 - The single green-laser pointer used during electronic tagging

Fig. 10 - Coupled laser used on the speargun for scaling length of bluefin tuna

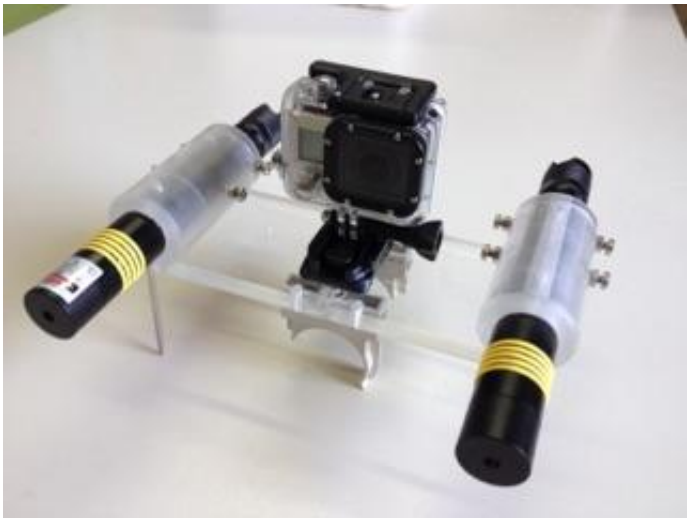


Fig. 11 - Detail of laser and adjustment screws

LENGTH ESTIMATION

Laser inter-distance validation

The inter-distance of the coupled lasers on each speargun was set on 17.8 cm, as a length reference. Before the tagging activities the inter-distance of each coupled lasers was tested at different distances (1 m; 3 m; 5 m), fixing lasers on a ruler. Possible laser deviations were corrected with the adjustment screws (Fig. 11).

Length estimation

Fork length (FL) was estimated by photo referencing technique. Photos were obtained from frames of the video recordings made by the GoPro camera. High resolution pictures have been analysed by the software Tpsdig2 (*Rohlf, F. J., 2009: TpsDig. Version 2.14*). The inter-distance lasers marks on the body of bluefin tuna (17.8 cm) were used as a length reference.

It must be pointed out that an exact angle between the tuna and the laser cannot be detected by the frame analyses. Nevertheless, the best frame with an angle closer to 90° was chosen for length calculation.

Exercise for size estimate

A dead specimens of 113 cm FL was considered for this trial. The estimated size of the specimens was accurately when the laser was perpendicular to the animal (Fig. 12a). As the shot angle decreases, the laser inter-distance increase (Figure 12b) and the estimated fork length is always underestimated.

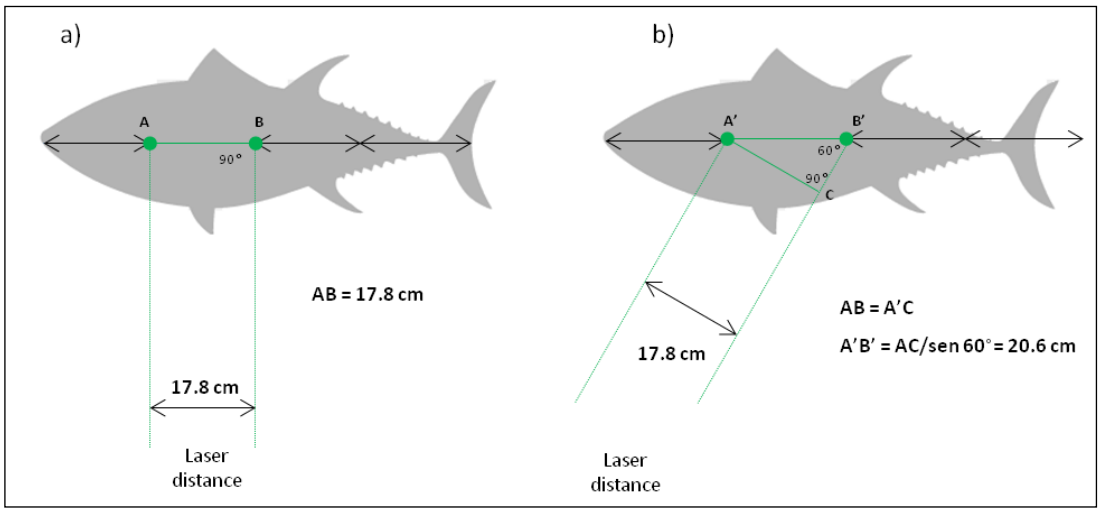


Fig. 12. Scheme of the exercise for size estimates **a)** Laser landmarks with 90° angle; **b)** Laser landmarks with 60° angle (laser inter-distance on the specimens corresponds the hypotenuse of a right triangle whose cathetus is the known distance of 17.8 cm).

In the table below are reported data from the validation exercise carried out on a dead specimens of 113 cm FL. The table reports the minimum and maximum sizes estimated for different angles of shot where the max size = min + 30%.

Laser point distance	Shot angle °	Real FL (cm)	Speargun Distance m	Calculated laser point distance (cm)	Calculated FL (cm)	Error %	Estimated FL (cm)	Error %	Estimated FL Min	Max
17,8	90°	113	1	17,8	111,3	1,5	111,3	1,5	111,3	144,7
17,8	90°	113	2	17,8	114,5	-1,4	114,5	-1,4	114,5	148,9
17,8	90°	113	3	17,8	111,3	1,5	111,3	1,5	111,3	144,7
17,8	80°	113	1	18,1	109,6	3,0	107,9	4,5	107,9	140,3
17,8	60°	113	1	20,6	112,2	0,7	97,2	14,0	97,2	126,3
17,8	45° *	113	1	25,2	119,5	-5,8	84,5	25,2	84,5	109,9
17,8	30° **	113	1	35,6	124,5	-10,2	62,3	44,9	62,3	80,9

* maximum evaluable angle
** not evaluable angle

The following table provides the length estimates made by photo referencing, for all bluefin tunas tagged by Com.Bio.Ma.

ID	S/N tag	PTT	Days	Date	Time	Tag	min FL (cm)	Weight (kg)	note
1	14P0192	150404	250	01/07/2015	13:04	Y	103,8	21,3	Photo referencing
2	14P0338	150405	250	01/07/2015	13:00	Y	110	25,0	Photo referencing
3	14P0374	150406	365	01/07/2015	14:08	Y	138,6	47,8	Photo referencing
4	14P0376	150407	365	01/07/2015	12:55	Y	191,9	118,9	Photo referencing
5	14P0377	150408	365	01/07/2015	13:47	Y	119,8	31,8	Photo referencing
6	14P0383	150409	250	01/07/2015	12:57	Y	93,3	15,8	Photo referencing
7	14P0384	150410	250	01/07/2015	13:22	Y	111,3	25,9	Photo referencing
8	14P0388	150411	250	01/07/2015	13:15	Y	163,2	75,6	Photo referencing
9	14P0404	150412	250	01/07/2015	13:37	y	130±5	40±5	Visual estimation
10	14P0435	150413	250	01/07/2015	13:12	Y	123,0	34,2	Photo referencing
11	14P0436	150414	365	01/07/2015	13:46	Y	120±5	35±5	Visual estimation
12	14P0437	150415	365	01/07/2015	13:26	Y	127,2	37,6	Photo referencing
13	14P0465	150416	250	01/07/2015	13:29	Y	164,3	77,0	Photo referencing
14	14P0498	150419	365	01/07/2015	13:55	Y	103,9	21,3	Photo referencing
15	14P0500	150420	250	01/07/2015	13:18	y	130±5	40±5	Visual estimation
16	14P0524	150417	365	01/07/2015	13:31	y	135,7	45,1	Photo referencing
17	14P0526	150421	365	01/07/2015	13:42	Y	133,6	43,2	Photo referencing
18	14P0529	150422	250	01/07/2015	13:07	Y	155,8	66,4	Photo referencing
19	14P0531	150423	365	01/07/2015	12:50	Y	146,3	55,6	Photo referencing

Weight estimation

Weight of each bluefin tuna was calculated on the base of length, assuming fixed length/weight rate. Length/weight rate calculated for bluefin tuna captured in Sardinian traps in previous years (n = 12800; period 1994-2007) was:

$$W = FL^{2.8171} * 0.000044300$$

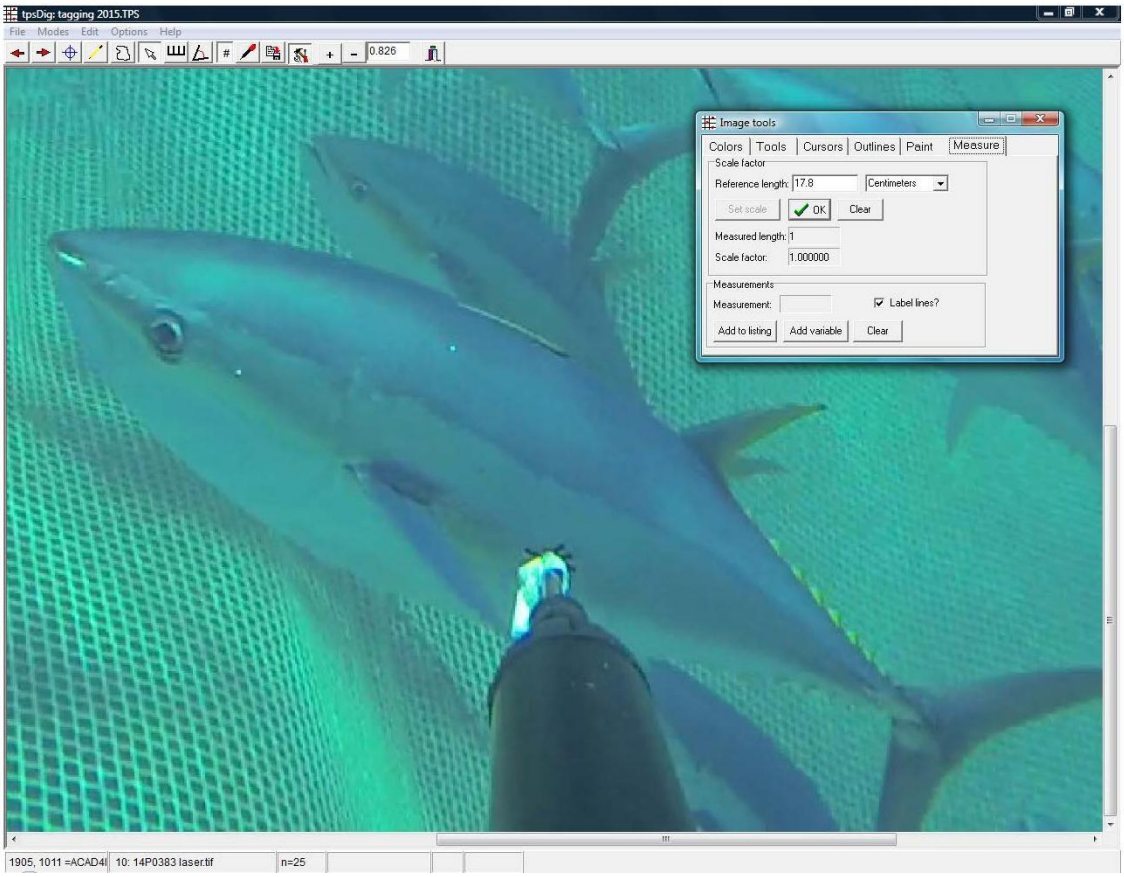


Fig. 13 - Example of picture used in the photo referencing (green landmarks by laser are detectable on bft)

Fig. 14 - Frame showing the tagging action with laser landmarks visible on the individual

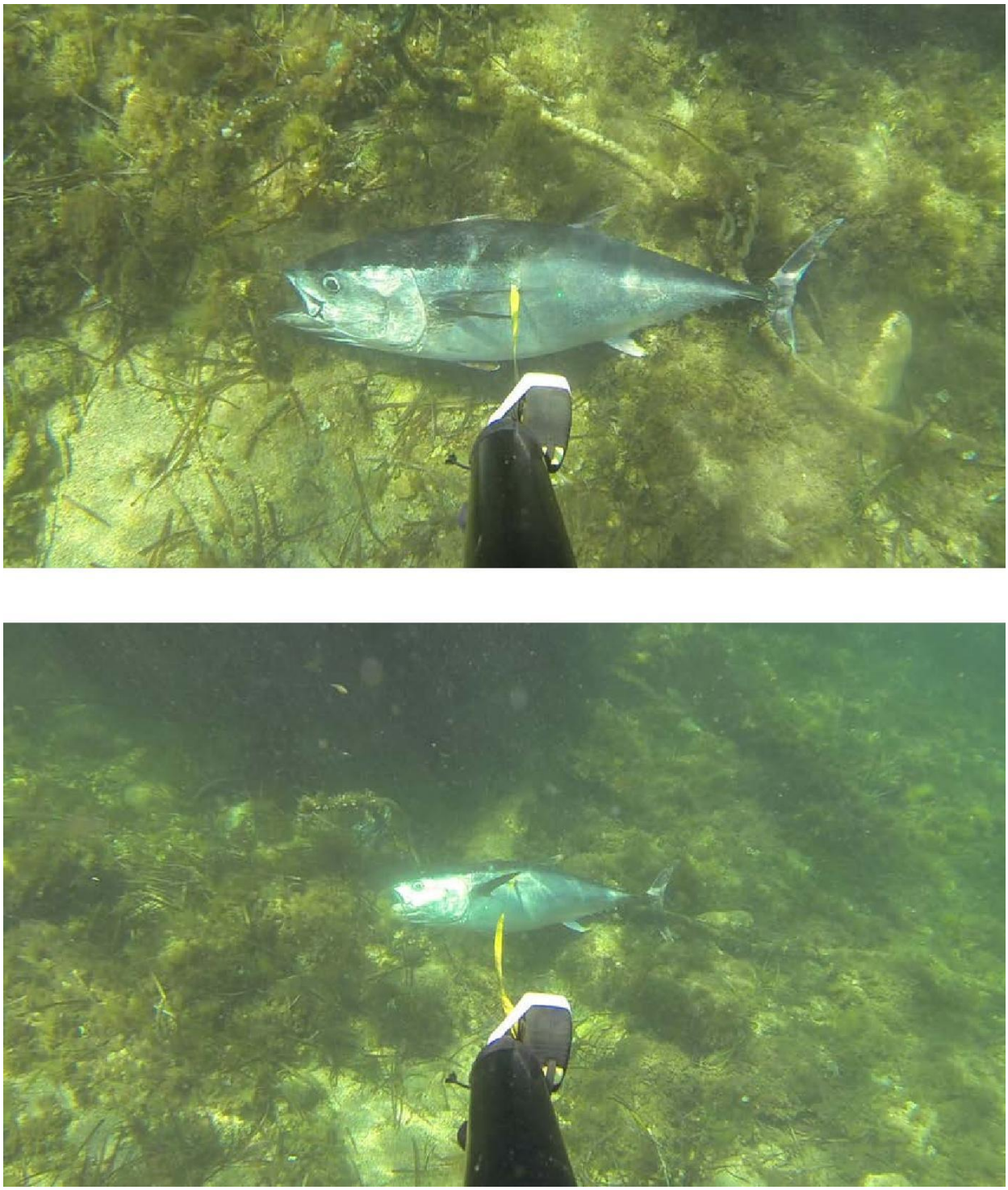
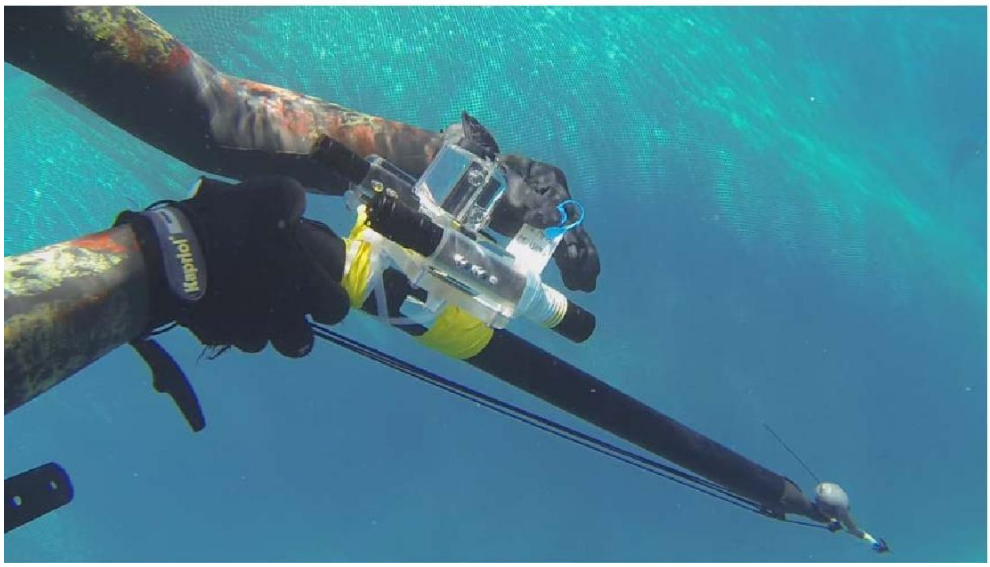
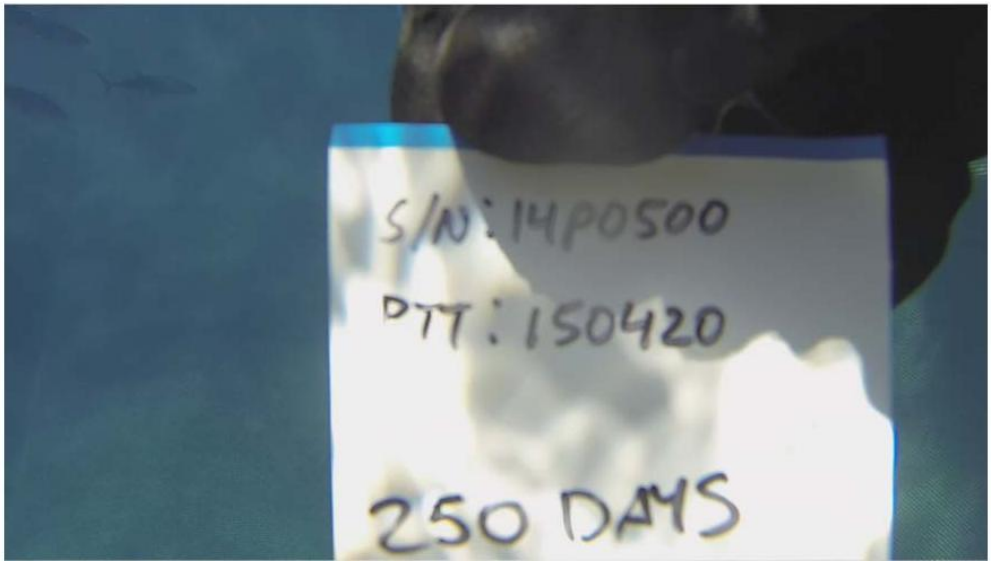


Fig. 15 - Frames showing the trial for validation of length in a 30 kg bluefin at 1 m distance (above) and 2.5 m (below)

LABELING PROCEDURE AND CODES

The serial number of each electronic tag was registered by videocamera by the scientist or a diver before each tagging action.




S/N: 14P0500
PTT: 150420
250 DAYS

AUTHORIZATION

An official communication on tagging activities was delivered by email to the Coast Guard of Portoscuso and Carloforte on May 29, 2015. The local authorities were informed on the tagging operation one day before. The Coast Guard of Carloforte monitored the whole tagging process in the Isola Piana trap, until the release of the tagged tunas.

TAG AWARENESS CAMPAIGN ACTIVITIES

A contribution to ICCAT GBYP Tag Awareness Campaign was made, by informing the public on the tagging programme and activities. Poster "Trova la marca" with info on tags recovery and reward has been distributed in the following localities:

- Stintino, Coast Guard
- Alghero, Coast Guard
- Porto Torres, Coast Guard, Club Marina Cormorano
- Santa Maria Navarrese
- Arbatax
- Portoscuso
- Carloforte
- Teulada
- Buggerru
- Oristano
- Sant'Antioco
- Calasetta
- Cagliari
- Villasimius

TAGGING ACCOMPLISHED

A total of 19 bluefin tuna were tagged on July 01, 2015. One residual tag (PTT 150418) wasn't utilized due to technical problem in the trap chamber. According to ICCAT GBYP Steering Committee's decision, this tag was provided to another team carrying out complimentary tagging activities.

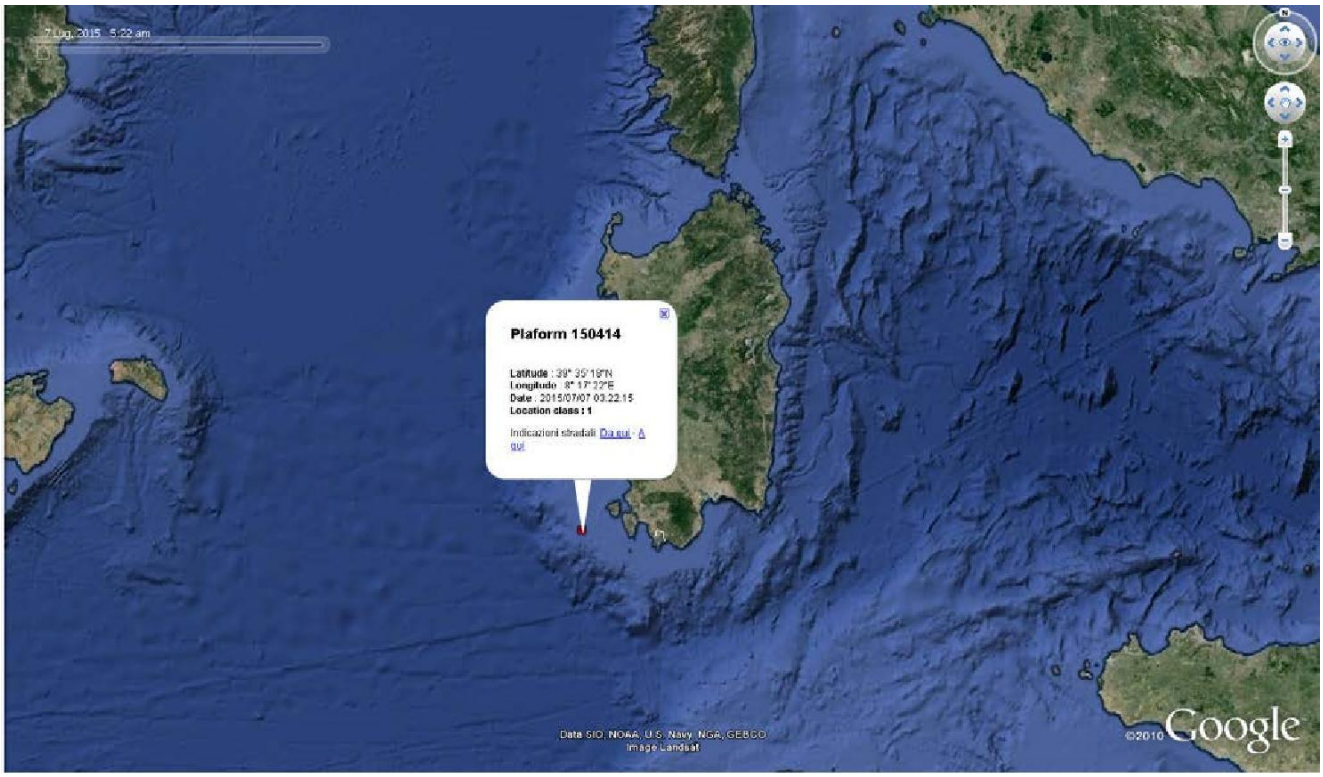
Information on bluefin tuna tagged in Sardinian trap were properly recorded on the form provided by ICCAT and attached at the present report.

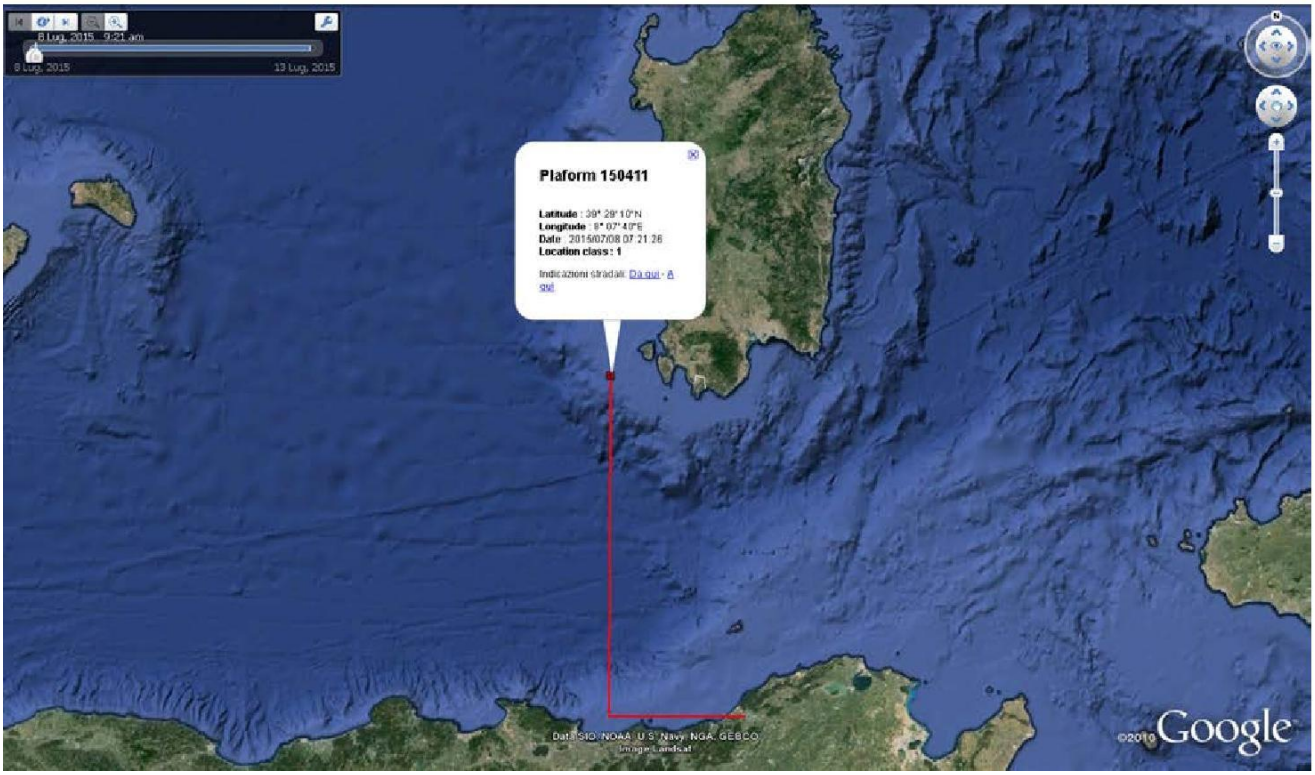
Tag/Animal identification		Tag Deployment date			Deployment (Decimal)		Expected Tag Detachment Date			Date Pop off	Lat/Long
Argos ID	Species code	Year	Month	day	Lon	Lat	Year	Month	Day		
150404	BFT	2015	7	1	8,29	39,19	2016	3	6	17/07/2015	39° 32' 58"N 6° 13' 10"E
150405	BFT	2015	7	1	8,29	39,19	2016	3	6		
150409	BFT	2015	7	1	8,29	39,19	2016	3	6		
150410	BFT	2015	7	1	8,29	39,19	2016	3	6		
150411	BFT	2015	7	1	8,29	39,19	2016	3	6	08/07/2015	39° 29' 10"N 8° 07' 40"E
150412	BFT	2015	7	1	8,29	39,19	2016	3	6		
150413	BFT	2015	7	1	8,29	39,19	2016	3	6	09/07/2015	39° 28' 39"N 7° 40' 52"E
150416	BFT	2015	7	1	8,29	39,19	2016	3	6		
150420	BFT	2015	7	1	8,29	39,19	2016	3	6		
150422	BFT	2015	7	1	8,29	39,19	2016	3	6		
150406	BFT	2015	7	1	8,29	39,19	2016	6	29	14/07/2015	39° 43' 16"N 4° 59' 25"E
150407	BFT	2015	7	1	8,29	39,19	2016	6	29	09/07/2015	36° 31' 04"N 12° 34' 59"E
150408	BFT	2015	7	1	8,29	39,19	2016	6	29		
150414	BFT	2015	7	1	8,29	39,19	2016	6	29	07/07/2015	39° 35' 18"N 8° 17' 22"E
150415	BFT	2015	7	1	8,29	39,19	2016	6	29		
150417	BFT	2015	7	1	8,29	39,19	2016	6	29		
150419	BFT	2015	7	1	8,29	39,19	2016	6	29		
150421	BFT	2015	7	1	8,29	39,19	2016	6	29	13/07/2015	38° 15' 42"N 8° 23' 08"E
150423	BFT	2015	7	1	8,29	39,19	2016	6	29		

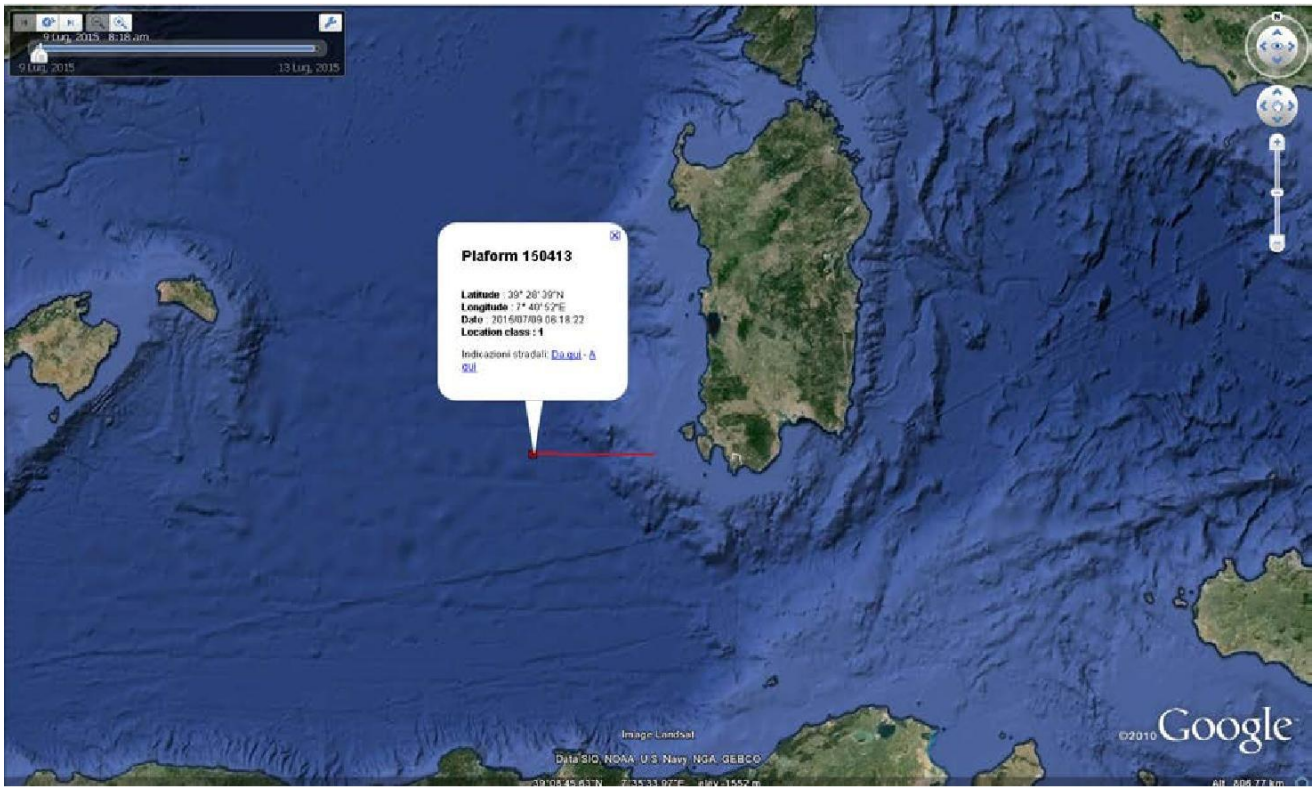
BIOLOGICAL SAMPLINGS

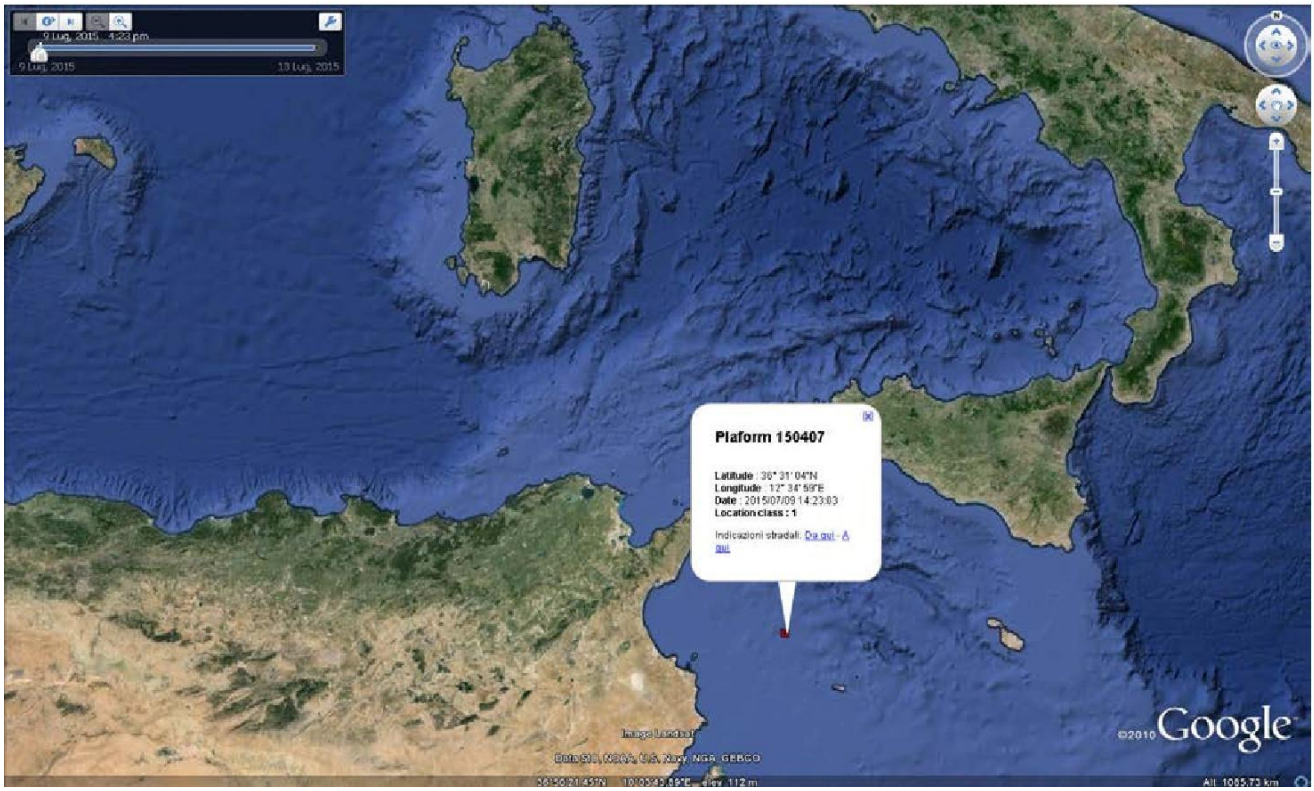
A total of 50 samples (muscle, spines and otholits) were collected in the trap of Isola Piana. Samples were collected from specimens during a mattanza carried out on May 30, 2015. The ICCAT GBYP protocol for sampling, labeling and storing samples of genetic tissue, otoliths, spines was duly followed and the samples will be provided to the Consortium in charge of the GBYP Biological studies in 2015.

Preliminary data on the popped-off tags from the trap of Sardinia

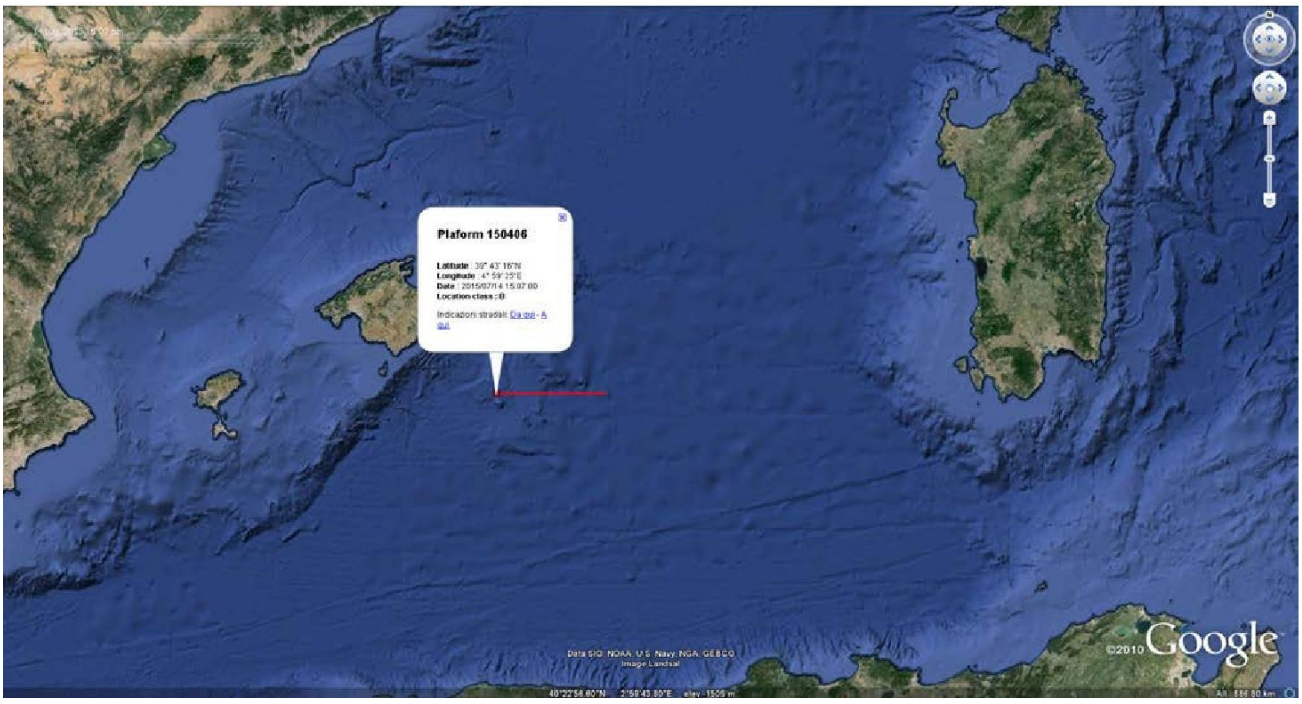


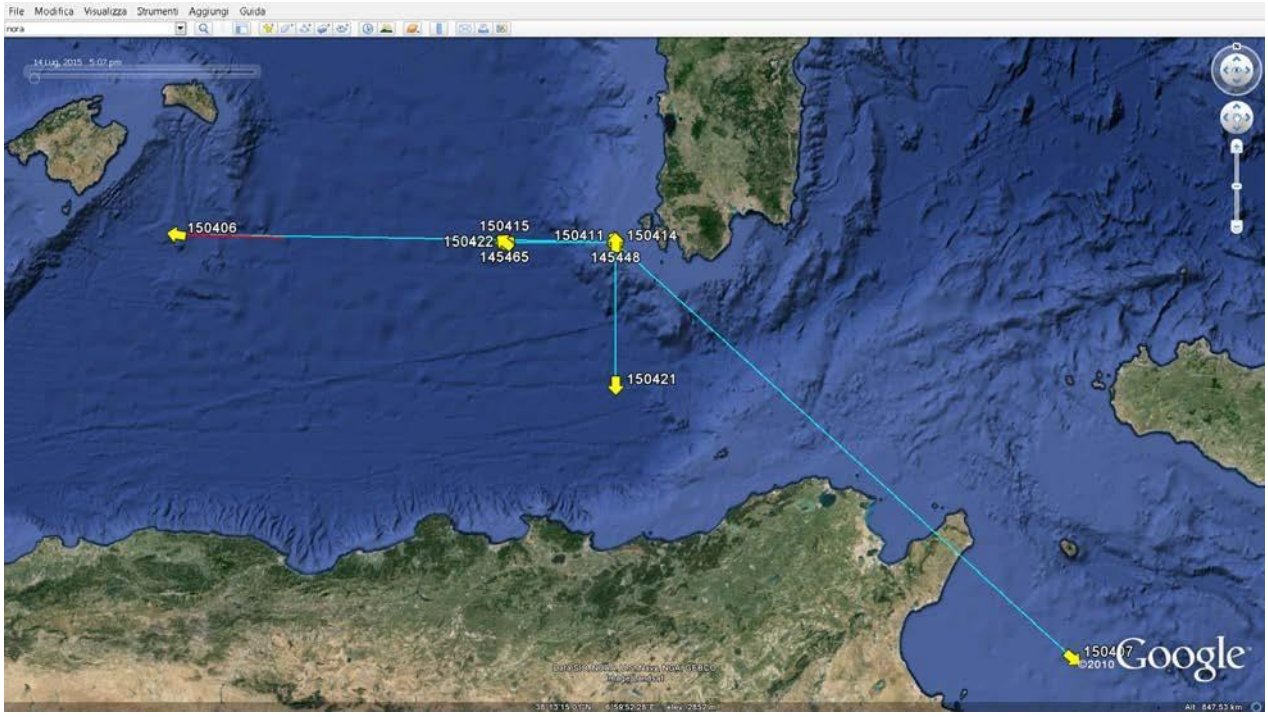



9 Lug, 2015 8:18 am
9 Lug, 2015
13 Lug, 2015
Piaform 150413
Latitude : 39° 28' 39"N
Longitude : 7° 40' 5"E
Date : 2015/07/09 06:18:22
Location class : 1
Indicazioni stradali: Da qui - A qui
Image Landsat
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
©2010 Google


9 Lug, 2015 4:23 pm
9 Lug, 2015
13 Lug, 2015
Piaform 150407
Latitude : 38° 31' 04"N
Longitude : 12° 34' 59"E
Date : 2015/07/09 14:23:03
Location class : 1
Indicazioni stradali: Da qui - A qui
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
©2010 Google


Plaform 150421
Latitude : 38° 15' 47"N
Longitude : 8° 23' 06"E
Date : 2015/07/13 05:18:30
Location class : 1
Indicazioni stradali: Da qui - A qui
©2010 Google


Plaform 150406
©2010 Google


File Modifica Visualizza Strumenti Aggiungi Guida
150406
150415
150422
145465
150411
150414
145448
150421
150407
2010
Google