

Tagging Programme 2013 (ICCAT-GBYP 01/2013 – Objective C
ATLANTIC-WIDE RESEARCH PROGRAMME ON BLUEFIN TUNA (GBYP Phase 4)

TAGAT
(Tagging of Adriatic Tuna)
- FINAL REPORT -

Participants in tagging programme:

Contractor: **Kali Tuna d.o.o. (KT)**
Administrative contact: Mr. Dino Vidov
Tagging Coordinator: Mr. Neven Cinoti

Subcontractor: **Institute of Oceanography and Fisheries (IZOR)**
Prof. Dr. Sc. Ivan Katavić
Dr. Sc. Leon Grubišić
Dr. Sc. Vjekoslav Tičina

Vessels involved in tagging activities:

Kali Tuna d.o.o.: **F/V NEPTUN I**, Croatia, AT000HRV00134
F/V OŠLJAK DVA, Croatia, AT000HRV00020

- Vessels (fishing / towing and tagging) that were used, or will be used in Tagging Programme 2013, are the property of Lubin Ribarstvo d.o.o., a sister company of Kali Tuna d.o.o. (according to Declaration issued by Kali Tuna d.o.o., on 06.06.2013).

FISHING ACTIVITIES:

Fishing vessel and fishing gear:

Purse seines for capturing BFT are operated by large, ad hoc vessels, known as purse seiners (F/V NEPTUN I, 39,9m in length). The purse seine gear of F/V „Neptun I“ is made up of a large net which encircles the tuna school and is closed at the bottom to entrap the fish. The net measures 1600 m in length, and 250 m in depth. The mesh size of purse seine is up to 200 mm in the body and the bottom part of the net, dropping to around 120 mm in the bunt. The top of the net is mounted on a floatline and the bottom on a steel chain (leadline) with steel rings, which allows the net to be “pursed”.

Fishing operation (as described in the Tagging Manual):

In order to minimize costs and improve our chances for fishing of large tuna schools, we decided to start fishing BFT for tagging activities just after BFT fishing season. All catches were done by F/V “Neptun I” (PS) (Table 1.) (marked blue in the GPS maps). For successful completion of tagging activities KT and IZOR were aiming to capture app. 2500 BFTs. However, since we were able to capture 2400 BFTs in only three fishing operations (two fishing days) it was decided not to proceed with further fishing, in order to reduce stress level in already captured fish. According to professional (KT) and scientific (IZOR) opinion already captured BFTs were considered to be satisfying for achievement of pre-set goals.

Transfers to the holding cage:

Captured BFTs were transferred from purse seine net of F/V “Neptun I”, to floating cage carried out by F/V “Ošljak Dva” (holding cage number 34; constructed of circular floating tube and net material with mesh size of 100 mm, suspended by weights, 30 m in diameter, 15 m in depth by side) (Table 2.). During each of the transfers, number and sizes (average weight) of BFTs, for each fishing operation have been estimated by skilled divers (Table 3.). All operations on sea have been done with outmost care in order to avoid injuries and reduce stress for the fish.

Table 1. BFT Fishing records

Date	Vessel (name, flag, ID number)	Captain	Gear	Location (latitude-longitude)
15.06.2013	NEPTUN I, Croatia, AT000HRV00134	SAŠA KURTIN	PS	φ43°03'; λ15°17'
15.06.2013	NEPTUN I, Croatia, AT000HRV00134	SAŠA KURTIN	PS	φ43°08'; λ15°14'
16.06.2013	NEPTUN I, Croatia, AT000HRV00134	SAŠA KURTIN	PS	φ43°08'; λ15°15'

Table 2. BFT Transferring records (from F/V NEPTUN I (PS) to F/V OŠLJAK DVA (floating cage))

Date	Vessel (name, flag, ID number)	Captain	Gear (internal KT cage number)	Location (latitude-longitude)
15.06.2013	OŠLJAK DVA, Croatia, AT000HRV00020	MARIN SANDALIĆ	Holding cage, number 34	φ43°03'; λ15°17'
15.06.2013	OŠLJAK DVA, Croatia, AT000HRV00020	MARIN SANDALIĆ	Holding cage, number 34	φ43°08'; λ15°14'
16.06.2013	OŠLJAK DVA, Croatia, AT000HRV00020	MARIN SANDALIĆ	Holding cage, number 34	φ43°08'; λ15°15'

Table 3. Catch per fishing operation (seine deployment) - divers estimation:

Date	Estimated number of BFTs	Estimated average weight per BFT (kg)	Mortality during fishing and transferring operations
15.06.2013	1100	20	none
15.06.2013	850	10	none
16.06.2013	450	10	none
TOTAL:	2400	14,58	none

TAGGING ACTIVITIES:

Equipment used for tagging activities:

Equipment for fishing, handling, tagging, sterilization and surgical equipment was prepared by scientific team.

➤ Fishing equipment:

- Fishing rod (PENN VS3080ARD56 line 30-80 lb), and reel (PENN 50VSW)

- Leaders: - Fluorocarbon leader Seaguar dia. 1,25 mm, 175 Lb
 - Fluorocarbon leader Seaguar dia. 1,05 mm, 125 Lb

- Circle hooks: - Owner Super Mutu circle hooks size 7/0, and 8/0
 - VMC Hook 763OR dynamic, size 13/0

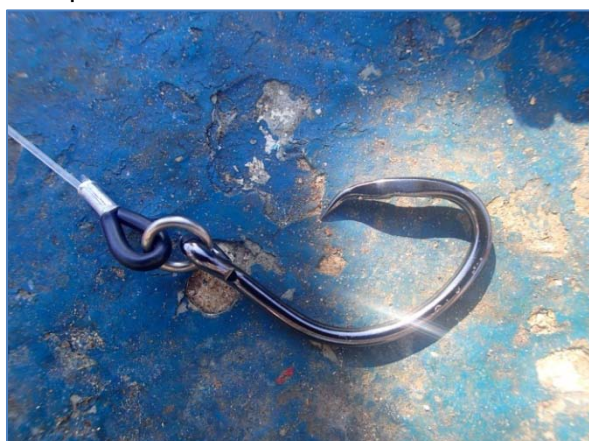
- Equipment for mounting of the hook on the leader: - Jinkai Leader crimp
 - Jinkai loop protector tubes

- Swivels: - Okuma RB Solid Ring no. 10
 - Jinkai Bullet Swivels SBS

- Non-stretching floating PE rope dia. 6mm

- Barbs were mechanically removed from all hooks that were used in the fishing operations, with aim to reduce injuries of the fish, and reduce time of hook removal.
- Leaders were 1,5m in length.
- Some of the Super Mutu circle hooks were ringed.
- Hooks were “crimped” to the leader using Jinkai Leader crimps and loop protector tubes.
- Leader was “crimped” to the swivel which was tied to the non-stretching floating rope with knots for easier handling.

Barbless ringed Owner Super Mutu “crimped” to the Seaguar leader; Owner Super Mutu “crimped” to the leader.



Fishing rod (PENN VS3080ARD56 line 30-80 lb), and reel (PENN 50VSW); completely mounted hand-line fishing gear.



➤ Handling and tagging equipment:

- Cradle (Aluminum constructed, rigid, cradle – like device for measuring small bluefin tunas (dimensions 125 x 57 cm). Cradle has etched measuring scale (on the aluminum frame) for the fork length measurement. It is coated with non-abrasive foil in order to prevent mechanical damages and mucus removal. Parts of the frame, which are in touch with tuna, are coated with sponge - like material. For surgical implementation of Internal Archival Tags two cushions coated with non-abrasive foil were prepared. They were used to keep the tuna in the belly up position. Also, cradle is equipped with rope handles for easier weighing operations.)

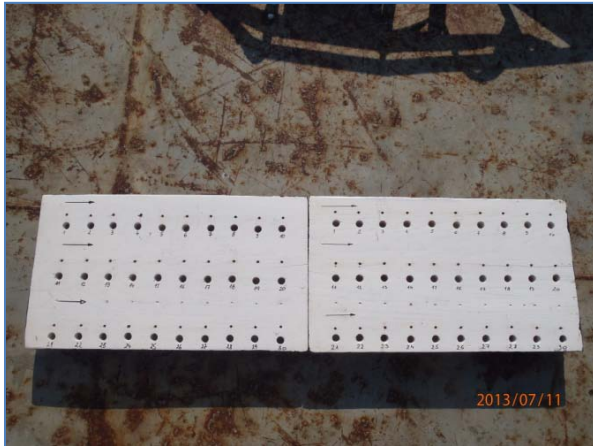
- Floating platform (Rigid platform made from stainless steel with handrail to prevent injuries, and falling over. On the front side of the platform is a slide for easier landing of the fish. Floating platform is placed and fixed inside of the cage frame.)

- Tag holders (Two tag holders made from wooden block with double holes drilled into it (three rows, each row with double holes for double tagging, 10 holes in each row), allowing holder to be used for double tagging. The loaded applicators are placed into these holes in an upright position, with the sharp end facing up. The top was painted white and the holes were numbered sequentially.)

- Analogue weighing scale

- Spaghetti and billfish tags were divided in the groups of 25 sequenced tags in order to facilitate loading of the holders.
- Analogue weighing scale was attached to the vessel crane and placed above floating platform.

Tag holders; loaded spaghetti and billfish applicators.



Aluminum cradle; rigid stainless steel tagging platform fixed inside of the cage frame.



➤ Specific surgical and sterilization equipment:

- Betaiosodona Salbe (Mundi Pharma; active substance: Povidone iodine)
- Big Spray (Antiseptica; Rapid action alcoholic disinfectant with a very broad spectrum of efficacy and shortest contact times.)
- Oxygenon (Antiseptica; Disinfection of surfaces based on active oxygen with very broad spectrum of efficacy, no toxic residues, low impact on the environment.)
- Tyrosur (Salveo; active substance: Tyrothricinum; antibiotic for surface applications)
- Betadine (Alkaloid, skin disinfecting and cleansing solution; active agent contains povidone iodine (10% solution))

- Reverse cutting needle with violet monofilament CP (Ethicon, Polydioxanone monofilament synthetic absorbable suture, indicated for use in soft tissue approximation.)
- Taper point needle with violet braided monofilament MO-45 (Ethicon; absorbable suture)
- Surgical nitril and latex gloves
- Scalpel handles (Rudolf) with disposable scalpel blades (Braun)
- Disposable scalpels (Aesculap)
- Dark clothing (gray-brown) to cover the tuna's eye to calm it down.

- In order to sterilize clothing used for covering the eyes of tagged tuna, a bucket containing disinfectant was prepared. After each usage clothing was sterilized.

Tagging at sea from the purse seine:

For tagging purposes, at the end of pursing, the net was not fully drawn and was maintained at sea as it is described in the Tagging Manual. Captured BFTs were left to swim in enough room to avoid injuries and to reduce stress. Once the fish appeared calm we tried to feed them with bait (frozen small pelagic fish, dominantly sardine), without success. It seemed that the fish were under stress and were rejecting the feed. Also, it was observed that the fish preferred to be in the deeper water. Due to the possible weather deterioration (wind, waves, currents...), and taking into account safety of the crew and vessel, it was risky to leave the purse seiner with purse seine (not fully pursed) at the open sea. Also, since the initial plan was to capture 2500 BFTs we realised that we will need more than one fishing operation. Therefore, it was decided to transfer captured BFT to the holding cage 34.

Towing of the holding cage 34 to tagging location "island Žirje":

Immediately after the last transfer (16.06.2013), floating cage containing approximately 2400 BFTs, equipped with all necessary towing gear, was towed to the location of island Žirje (outer part of the island Žirje; approximately 31 Nm from the fishing grounds):

- $\phi 43^{\circ}39'$; $\lambda 15^{\circ}37'$ (marked red in GPS maps)

Duration of the towing operation was approximately 30 hours. The cage was towed to the designated location on 17.06.2013, and was anchored outside of the island Žirje, at the depth of approximately 60m. There were no mortalities during towing operation, although divers observed several BFTs with damaged skin (scratched). Once the cage was anchored, tunas appeared to be calm, although, all of them were in the deeper layers of water (10-15m; remark: thermocline was observed at 5m).

Tagging on the location island Žirje:

F/V "Ošljak Dva" was fully equipped with all necessary gear for tagging. Also, it was carrying couple tons of frozen small pelagic fish (sardine, anchovy, chub mackerel), which were loaded aboard to serve as bait. Once the holding cage 34 was settled, and stationed on side of the F/V "Ošljak Dva", feeding behavior of tunas was tested. First feeding was completely unsuccessful. We continued with feeding throughout the day with no change. Unfortunately, the same results (BFT did not eat) were observed on 18th, 19th, 20th and 21st of June (7 days after the capture).

The video from 21.06.2013., which was communicated to Mr. Di Natale (25.06.2013), is showing BFTs from holding cage 34 passing by bait (small pelagic fish) without eating it.

Table 4. Feeding records (Island Žirje)

Date	Feed*	Feeding	Feeding results	Sea state*	Mortality
17.06.2013	Small pelagic	3 times a day	Did not eat	2	None
18.06.2013	Small pelagic	3 times a day	Did not eat	2	None
19.06.2013	Small pelagic	3 times a day	Did not eat	2	None
20.06.2013	Small pelagic	3 times a day	Did not eat	3	None
21.06.2013	Small pelagic	3 times a day	Did not eat	3	1 (RMA13-003)

* Frozen small pelagic fish (*Sardina pilchardus*, *Engraulis encrasicolus*, *Scomber japonicus*)

* Douglas scale

F/V “Ošljak Dva” with the holding cage 34 anchored outside of the island Žirje



As fish were under stress, and did not accept bait, it was not possible to carry out neither biological and genetic sampling, nor tagging.

Towing of the holding cage 34 to tagging location “Lavdara Vela”:

Having feeding difficulties and since we were facing weather deterioration, on 21.06.2013, KT and IZOR jointly decided to tow the cage to more sheltered location. Our decision was to tow the cage to one of KT's empty concession, as it was announced to Mr. Di Natale on 11.06.2013. Name of the concession is “Otok Lavdara Vela”, located at “Srednji kanal”, Municipality “Sali”. Position of the concession is:

K1 ϕ 43°58' 08.97"; λ 15°13' 03.83";
 K2 ϕ 43°57' 44.91"; λ 15°14' 02.68";
 K3 ϕ 43°56' 14.41"; λ 15°13' 45.87";
 K4 ϕ 43°57' 18.45"; λ 15°12' 12.60".

Holding cage 34 was towed to the designated location on 23.06.2013, where it was anchored in existing grid system. Exact location of the cage was: ϕ 43°56'; λ 15°13' (marked red on GPS maps). Duration of the towing operation was approximately 24 hours (25 Nm from the previous location). No mortalities during towing were observed.

Table 5. Holding cage 34 - towing records

Date:	Fishing vessel (F/V name, flag, ID number)	Distance (Nm)	Duration (hrs)
16. - 17.06.2013	OŠLJAK DVA, Croatia, AT000HRV00020	31	30
21. - 23.06.2013	OŠLJAK DVA, Croatia, AT000HRV00020	24	25

Towing of the holding cage 34 to farm site Lavdara Vela; holding cage 34 anchored in grid system.



Tagging on the location Lavdara Vela:

Feeding activities were continued on 24 June 2013. Given that the fish were exposed to additional stress due to the towing, it was expected that it will take some time for them to start feeding. The fish was fed once a day, always at the same time (08-10:00 AM). On this way tuna is getting used to be fed always in the same period of the day, it becomes more active and it is easier to get it to eat. From our previous tagging experience it was known that in order to start catching / tagging the fish, we had to get them in the state when they feed frenzy, and when majority of the fish in the cage are feeding on the surface. Frozen or fresh small pelagic fish (mainly *Sardina pilchardus*), depending on the availability (fishing season – lunar phases), were used as a bait. Fish were fed “ad libitum”, using 300 to 500 kg of small pelagic fish per day (Table 6.). Although BFTs were not immediately begun to eat, we continued to feed in order to get them accustomed to the presence of small pelagic fish in the cage.

Seven days after the initial feeding, it was observed that some of the tunas were starting to eat, but they were still swimming in deeper layers of the water column. Shortly afterwards, some of the tunas started to eat on the surface exhibiting typical tuna feeding behavior.

15 days after the initial feeding, it was assessed that desired feeding behavior has been achieved, and that at least half of the tunas in the cage are eating frenzy. At that point it was estimated that the fish was acclimatized to the farming conditions, and was decided to start with the tagging activities.

Table 6. Feeding records (Farm site Lavdara Vela)

Date	Feed	Feeding	Feeding results	Daily quantities (kg)	Morts
24.06.2013	Small pelagic	1 time/day	Did not eat	300kg	none
25.06.2013	Small pelagic	1 time/day	Did not eat	300kg	none
26.06.2013	Small pelagic	1 time/day	Did not eat	300kg	none
27.06.2013	Small pelagic	1 time/day	Did not eat	300kg	none
28.06.2013	Small pelagic	1 time/day	Did not eat	300kg	none
29.06.2013	Small pelagic	1 time/day	Did not eat	300kg	none
30.06.2013	Small pelagic	1 time/day	Started to eat, 5-10kg	300kg	none
01.07.2013	Small pelagic	1 time/day	Approximately 20kg	300kg	none
02.07.2013	Small pelagic	1 time/day	Approximately 50kg	300kg	none
03.07.2013	Small pelagic	1 time/day	Approximately 100kg	300kg	none
04.07.2013	Small pelagic	1 time/day	Approximately 200kg	500kg	none
05.07.2013	Small pelagic	1 time/day	Approximately 250kg	500kg	none
06.07.2013	Small pelagic	1 time/day	Approximately 300kg	500kg	none
07.07.2013	We did not feed the fish.				
08.07.2013	Small pelagic	1 time/day	Approximately 500kg	500kg	none

Small pelagic fish used as bait; captured tunas feeding frenzy



Once arrived at the location Lavdara Vela holding cage 34 was guarded by the hired guard 24 hours a day, until tagging campaign finished, and the remaining tunas were released. Professional KT divers were checking the cage for the mortalities on the daily bases.

Cooperation with Croatian Fishery Authorities:

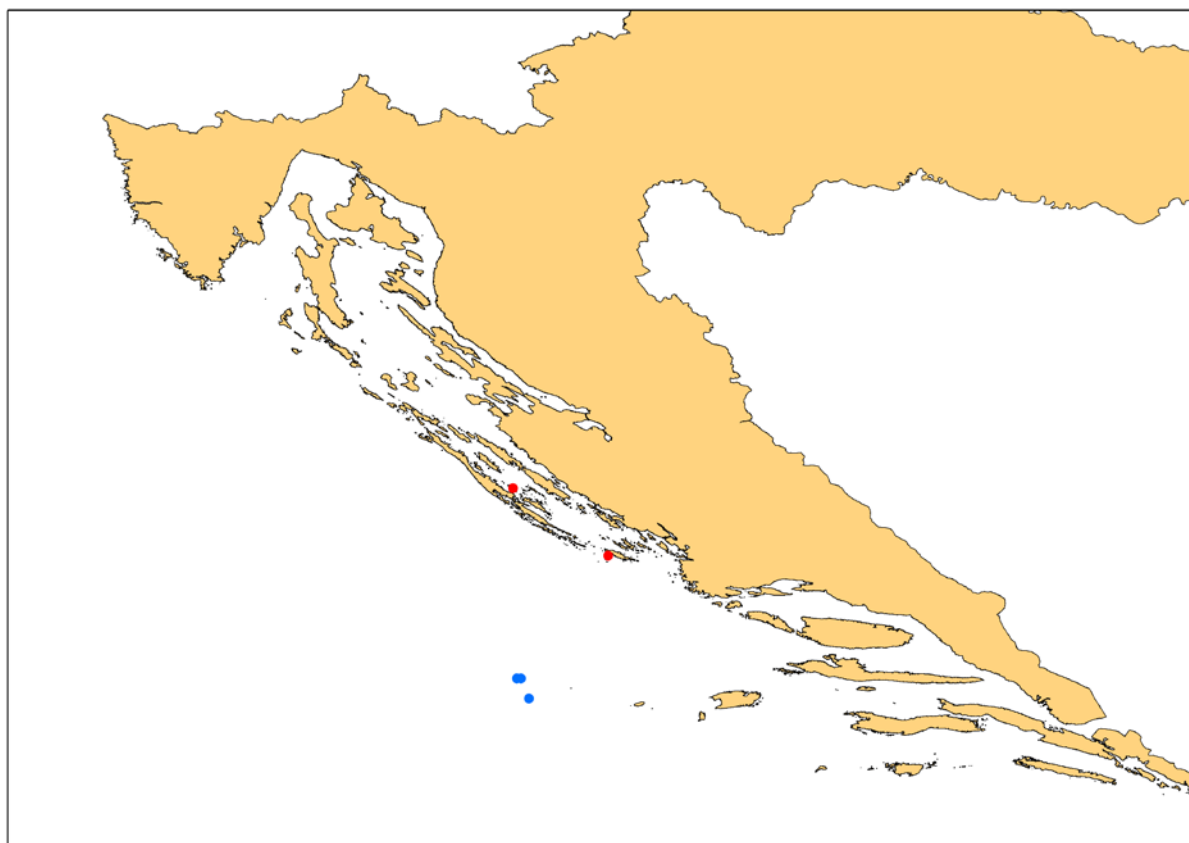
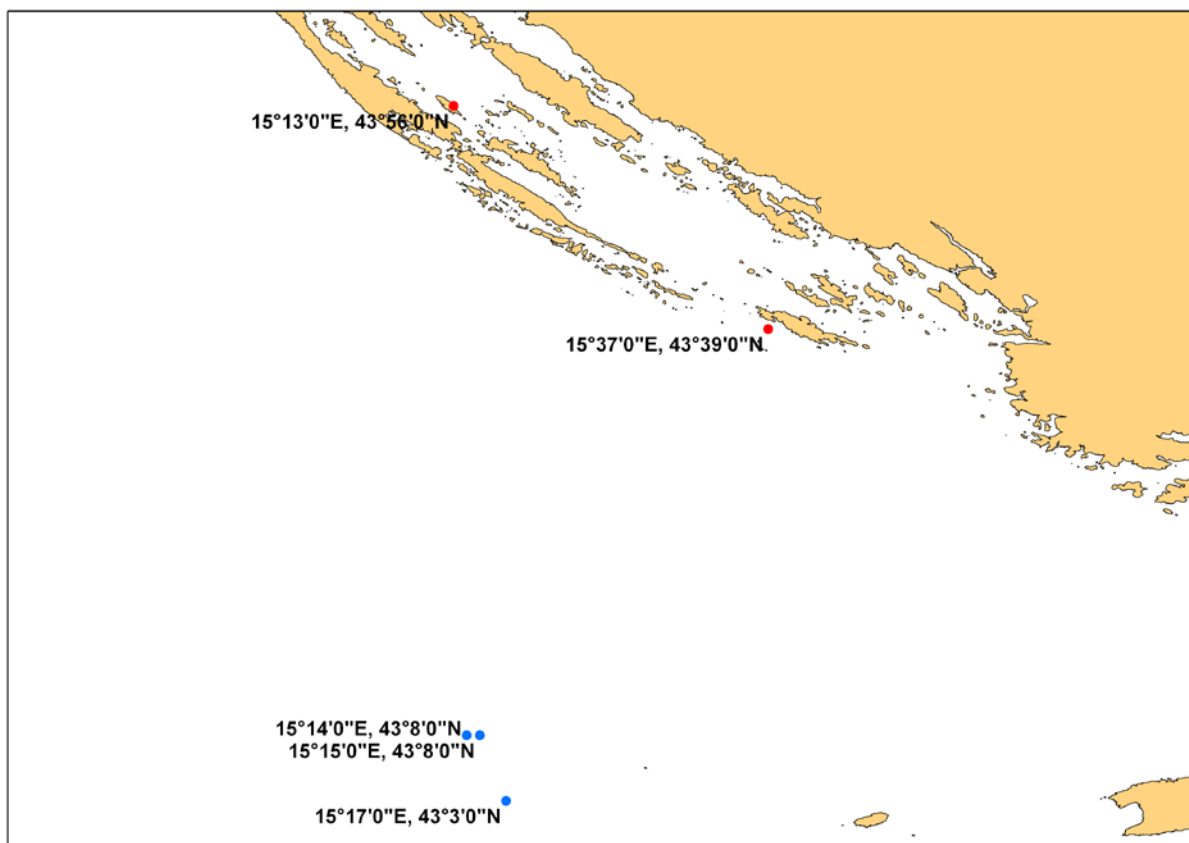
06.06.2013. - Croatian Authorities (Ministry of Agriculture, Fishery Inspectorate) were duly informed about all scientific tagging activities which will be performed by Kali Tuna and IZOR.

21.06.2013. - F/V “Ošljak Dva” together with the Cage 34 was inspected by the Fisheries inspector, Mr. Marko Pupiće Bakrač.

21.06.2013. - Fisheries Inspectorate was informed about our intention to tow the Cage to new location (Lavdara Vela)

24.06.2013. - Mr. Marko Pupiće Bakrač has issued Official Record about inspection; no irregularities were found.

GPS maps showing locations of capturing (marked with blue color), and locations of the tagging (island Žirje and farm site Lavdara Vela) (marked with red color).



Tagging started on 09.07.2013 and lasted for five tagging days. We tagged in average 233 fish per day.

Table 7. Details of the bluefin tunas tagged per day with various types of tags

Date	Spaghetti tags	Spaghetti and SBF tags	SBF tags	Spaghetti and LBF tags	Mini PAT and LBF tags	Internal and LBF tags	TOTAL:
09.07.	200						200
10.07.	299						299
11.07.	100	100			7	10	217
12.07.	1	149	1	99			250
15.07.	70			131		2	203
TOTAL:	670	249	1	230	7	12	1169

➤ **09.07.2013**

Tagging vessel: F/V „Ošljak Dva“

Total number of tagged fish on 09.07.2013: 200

*Remarks: 20 randomly selected single tagged fish (details available in the Table 8.) were released back in the holding cage 34, in order to monitor their behavior and mortality.

- Type of tagging: SINGLE TAGGING
- Applied tags: CONVENTIONAL SPAGHETTI TAGS
- Tags number: from BYP021851 to BYP022050
- Total number of tagged fish with spaghetti tags (09.07.2013): 200

➤ **10.07.2013**

Tagging vessel: F/V „Ošljak Dva“

Total number of tagged fish on 10.07.2013: 299

*Remarks: One damaged spaghetti tag (no. BYP022099). Tag was retrieved but due to the damage was not applied to the fish.
20 randomly selected single tagged fish (details available in the Table 8.) were released back in the holding cage 34, in order to monitor their behavior and mortality.

- Type of tagging: SINGLE TAGGING
- Applied tags: CONVENTIONAL SPAGHETTI TAGS
- Tags number: from BYP022051 to BYP022350
- Total number of tagged fish with spaghetti tags (10.07.2103): 299

➤ **11.07.2013**

Tagging vessel: F/V „Ošljak Dva“

Total number of tagged fish on 11.07.2013: 217

*Remarks: All tunas tagged with Internal Archival Electronic Tags (12 BFTs) were released back into the holding cage 34 in order to monitor their behavior, and intervene in case of mortality (Eventually two mortalities were discovered in the holding cage 34, tags were retrieved and reused. Therefore it is stated

that on 11. July, 10 BFTs were double tagged with internal archival tags. Details available in the Table 8. and Table 9.).

21 randomly selected double tagged fish (spaghetti and small billfish tags; details available in the Table 8.) were released back into the holding cage 34, in order to monitor their behavior and eventual mortality.

- Type of tagging: SINGLE TAGGING
- Applied tags: CONVENTIONAL SPAGHETTI TAGS
- Tags number: from BYP022351 to BYP022450
- Total number of tagged fish with spaghetti tags (11.07.2103): 100

- Type of tagging: DOUBLE TAGGING
- Applied tags: CONVENTIONAL SPAGHETTI TAGS and SMALL BILLFISH (SBF)
- Spaghetti tags number: from BYP022451 to BYP022550
- SBF tags number: from BYP059026 to BYP059125
- Total number of double tagged fish with spaghetti and SBF tags (11.07.2013): 100

- Type of tagging: DOUBLE TAGGING
- Applied tags: ELECTRONIC MINI PAT and LARGE BILLFISH (LBF)
- Electronic mini PAT tags number: 12P0150 (Argos ID 130559), 12P0147 (Argos ID 130557), 12P0149 (Argos ID 130558), 12P0099 (Argos ID 130554), 12P0145 (Argos ID 130555), 12P0146 (Argos ID 130556), 12P0142 (Argos ID 130553)
- LBF tags number: from BYP071913 to BYP071919
- Total number of double tagged fish with mini PATs and LBF tags (11.07.2013): 7

- Type of tagging: DOUBLE TAGGING
- Applied tags: INTERNAL ARCHIVAL ELECTRONIC TAGS (MK9-SN) and LARGE BILLFISH (LBF)
- Internal archival electronic tags (MK9-SN) number: 1290527, 1290531, 1290532, 1290533, 1290535, 1290536, 1290539, 1290541, 1290542, 1290543
- LBF tags number: BYP071901, BYP071903, BYP071904, BYP071905, BYP071906, BYP071907, BYP071909, BYP071910, BYP071911, BYP071912
- Total number of double tagged fish with internal and LBF tags (11.07.2013): 10

➤ **12.07.2013**

Tagging vessel: F/V „Ošljak Dva“

Total number of tagged fish on 12.07.2013: 250

*Remarks: LBF tag no. BYP071993 fell off, and has not been recovered.
 Spaghetti tag no. BYP022705 fell off, has been retrieved later on. Due to this, one tuna is tagged solely with SBF tag.
 21 randomly selected double tagged fish (spaghetti and small billfish tags; details available in the Table 8.) were released back into the holding cage 34, in order to monitor their behavior and mortality.

- Type of tagging: SINGLE TAGGING
- Applied tags: CONVENTIONAL SPAGHETTI TAGS
- Tags number: BYP022793
- Total number of tagged fish with spaghetti tags (12.07.2103): 1

- Type of tagging: DOUBLE TAGGING
- Applied tags: CONVENTIONAL SPAGHETTI TAGS and SMALL BILLFISH (SBF)
- Spaghetti tags number: from BYP022576 to BYP022704 and from BYP022706 to BYP022725
- SBF tags number: from BYP059126 to BYP059254, and from BYP059256 to BYP059275
- Total number of double tagged fish with spaghetti and SBF tags (12.07.2013): 149
- Type of tagging: DOUBLE TAGGING
- Applied tags: CONVENTIONAL SPAGHETTI TAGS and LARGE BILLFISH (LBF)
- Spaghetti tags number: from BYP022726 to BYP022825
- LBF tags number: from BYP071926 to BYP072025
- Total number of double tagged fish with spaghetti and LBF tags (12.07.2013): 99
- Type of tagging: SINGLE TAGGING
- Applied tags: SMALL BILLFISH TAGS (SBF)
- Tags number: BYP059255
- Total number of tagged fish with spaghetti tags (12.07.2103): 1

➤ **15.07.2013**

Tagging vessel: F/V „Ošljak Dva“

Total number of tagged fish on 15.07.2013: 201

*Remarks: Divers checking the cage on the 13th and 14th of July, discovered two dead fish that were double tagged with Internal Archival Electronic MK9 – SN and LBF tags. Tags were recovered, sterilized and reused on 15.07.2013. Tunas tagged with reused tags, were released back into the holding cage, and were released together with the rest of the school on 16.07.2013. (Details available in the Table 8. and Table 9.).

- Type of tagging: SINGLE TAGGING
- Applied tags: CONVENTIONAL SPAGHETTI TAGS
- Tags number: from 022 557 to 022 575, from 022 951 to 023 000, and 022 705
- Total number of tagged fish with spaghetti tags (15.07.2103): 70
- Applied tags: CONVENTIONAL SPAGHETTI TAGS and LARGE BILLFISH (LBF)
- Spaghetti tags number: from 022 826 to 022 950, and from 022 551 to 022 556
- LBF tags number: from 072 026 to 072 150, and from 071 920 to 071925
- Total number of double tagged fish with spaghetti and LBF tags (12.07.2013): 131

Total number of tagged fish conventional spaghetti tags: 670

Total number of double tagged fish with conventional spaghetti and SBF tags: 250 (*one fish tagged with SBF only)

Total number of double tagged fish with conventional spaghetti and LBF tags: 230

Total number of double tagged fish with mini PAT and LBF tag: 7

Total number of double tagged fish with archival MK9-SN and LBF tag: 12

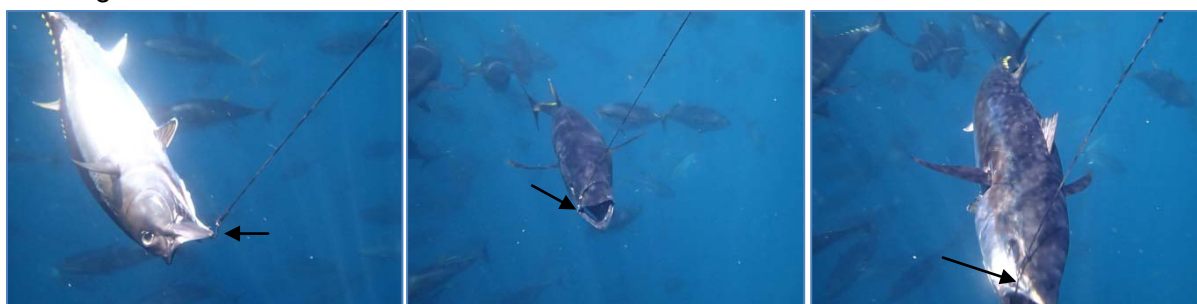
TOTAL NUMBER OF TAGGED FISH: 1169

PROTOCOLS:

Tagging protocol:

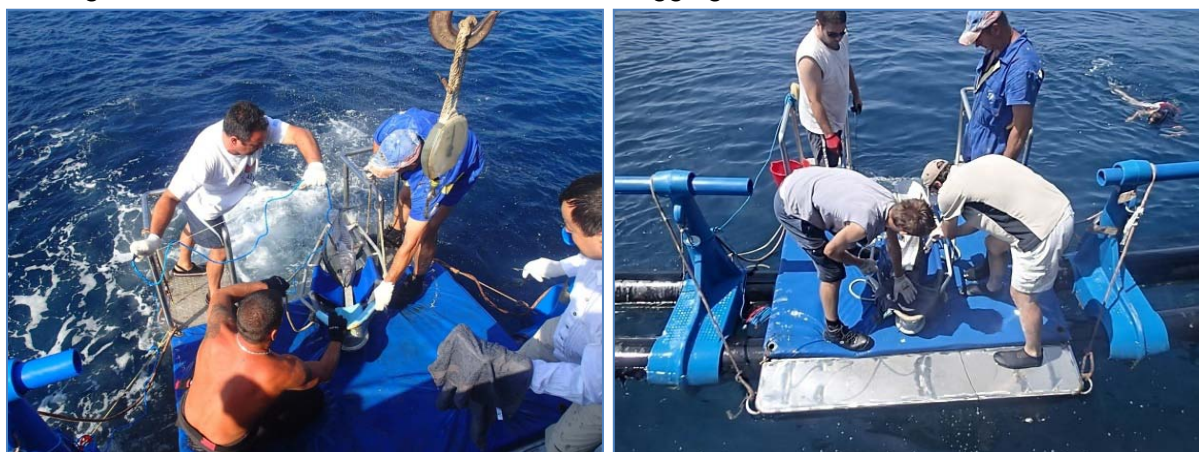
- Tagging platform was placed and fixed inside of the cage frame, with aim to facilitate hand-line fishing, measuring and tagging activities.
- Front side of the platform was faced towards cage, and the back side towards tagging vessel.
- Floating platform had a “slide” in the middle of the front side, for easier manipulation with cradle and fish.
- After hooking, fish were pulled out from the sea on the cradle, which had integrated measuring scale. Platform “slide” was used solely to facilitate manipulating with hooked fish and cradle, and not to land the fish. In order to measure fork length, head of the tuna is placed as close as possible to the limiting frame, which is coated with sponge like material (marking 0 cm). This is simple but very efficient method to measure accurately fork length. Also, usage of the cradle facilitates manipulation with fish (fishing, releasing, tagging) without touching it. The main issue is to avoid massive stress and sampling related mortality of the fish, since young bluefin tuna are very fragile and handling can result in high mortality. Using this method our catch procedure was rapid and almost harmless for the fish; moreover, it allowed us to catch and tag large quantities of fish.
- All injured tuna (mechanical injuries of the jaws, skin, fins, eyes or operculum bleeding) with seemingly lower probabilities of survival once put back into the sea, were rejected, and were designated for biological and genetic sampling. Rejected tunas were placed in ice and transported via speed boat to the laboratory of IZOR, Split.
- Special attention was paid to the hooking location. It was observed that when barbless circle hooks were used, majority of the tunas were hooked externally (mouth or jaw). There were no records of tunas hooked internally (throat, oesophagus, or gut). Also, because of its design (point is turned perpendicular to the shank to form a circular shape), and due to the fact that the barb was mechanically removed, unhooking time was significantly reduced (in most cases after the line was loose the hook would fall off by itself).
- Once the fish is placed in the cradle the eyes of the tuna are covered with sterilized dark clothing. For that purpose a bucket with the disinfectant was prepared.
- When needed, tunas were handled using both hands, one holding the caudal peduncle and the other sustaining the body. The tunas are always placed on the same side of their body when on the cradle, depending on the tagger’s position and needs.

Hooking location



- Conventional tags (spaghetti and bill fish tags) were divided in the groups of 25 sequenced tags in order to facilitate loading of the holders. Each group of tags was kept in the labeled plastic wrapper. Before being used, inspected and sharpened applicators were sterilized with antiseptic. Once they were loaded to the tag holder, tags were attached to the designated applicators. Loaded applicators with tags were sprinkled with disinfectant. On the top of each tag a povidone iodine was applied (Betaisodona). If applicators were used twice a day, they were washed carefully with washing detergent and then rinsed thoroughly in several changes of fresh water. Also, before second usage applicators were sterilized with antiseptic. Before each tagging trip, the tag applicators were sharpened, thoroughly cleaned and sterilized. The tag was implanted a couple of centimeters below the insertion of the second dorsal fin, so that its head, after perforating the skin and muscle, crosses the fish's sagittal plane through the second dorsal fin pterygiophores and its barb becomes firmly anchored through them. The direction of tag implantation is from the back, at an angle with the body of less than 45° , in order both to minimize the drag due to water resistance during swimming, and to ensure that the barb gets firmly anchored in the pterygiophores. Tag insertion was carried out with an appropriate applicator. The tagger was holding the tag-loaded applicator firmly in his hand and was inserting it into the fish body with a brisk and calibrated movement of the hand. Soon afterwards, the tagger was retrieving the applicator with a gentle and continual backward movement of the hand. Tagger was checking whether the tag is correctly placed and ensuring that the fish has not been badly damaged. When handling the fish, tagging team had to wear surgical nitril or latex gloves, also, cradle, fish handler's and tagger's gloves, and any other equipment that was in the contact with the fish body were kept wet permanently. The whole procedure of conventional tagging lasted 20 seconds in average (time outside the sea). Since most important issue related to tuna tagging is the fish survival rate, tagging operation has to be as fast as possible, in order to reduce stress, and cause the least possible detriment to fish health.

Placing hooked tuna in the cradle; conventional tagging.



- Internal Archival Electronic Tags (Wildlife Computers, MK9-SN, 12 pieces) were prepared in front by the scientific team. Tag was activated by a scientific team member just before implementation. The weights of tunas selected for the archival tagging were ≥ 20 kg (average 21,9 kg, average fork length 104,2 cm), preferably with no damages from fishing and handling.

Once the fish was hauled onboard and placed in the tagging cradle, fish eyes were covered, it was measured, unhooked, and conventional tag was applied (large bill fish tag; according to the conventional tagging protocol (see above)). After conventional tag was applied fish was turned, facing belly up and two supporting cushions were inserted (in order to keep the fish in the designated position). An incision of about 2 cm long was made with a sterile surgical scalpel blade in the abdominal wall about 1/3 the distance from the anus toward the base of the pelvic fins, and about 2 cm to the left of the centerline of the fish. Special care was taken to cut through the dermis only and partially through the muscle, but not into the peritoneal cavity. A sterile gloved finger was inserted into the incision and forced through the muscle into the peritoneal cavity (as described in the Tagging Manual). Next, a small amount of Tyrosur (active substance: Tyrothricinum; antibiotic for surface applications) was applied into the wound. Archival tag was previously sterilized in 10% povidone-iodine solution (internal part of the tag was covered with Betaisodona), and was inserted through the incision into the peritoneal cavity, with the stalk protruding outside. The incision was closed with two surgeon's knots using a sterile needle and suture material (triangular reverse cutting needle with violet absorbable suture monofilament Ethicon CP). After incision was closed, 10% solution of povidone - iodine was applied. During whole operation, which lasted 90 – 120 seconds in average (time outside the sea), operculum (gills) of the fish was sprayed with the sea water.

All surgical equipment used for tagging operation was disposable.

Implementation of the archival tags.



- Electronic miniPat tags (Wildlife Computers, 7 pieces) were prepared in front by the scientific team. Pop-up tag was activated by a scientific team member just before implementation. The weights of the tunas selected for the pop up tagging were ≥ 20 kg, since smaller specimens would suffer because of the comparatively high drag caused by the tag (average 21,1 kg, average fork length 102,7 cm). Selected fish had no visible damages from fishing and handling, and was estimated to have best surviving chances.

Physical condition of the fish to be tagged was carefully checked before tagging. Pop-up tag was inserted using the designated applicator at the base of the second dorsal fin, so that it becomes anchored in the pterygiophores. Before insertion applicator and tag were sterilized, and 10% povidone-iodine (Betaisodona) was applied on the tip of the tag. In addition to the pop-up tag, a conventional tag (large bill fish tag according to the conventional tagging protocol (see above)) was also inserted into the fish. After tagging has been carried out, fish condition was inspected. In the case when the tagged fish, according to tagger estimation, was somehow injured or too stressed, the pop-up tag was retrieved (as described in the Tagging Manual).

The whole procedure of conventional tagging lasted 20 seconds in average (time outside the sea).

Preparing pop-up tag for the implementation; miniPAT tag.



Preparing pop-up tags for implementation.



- All parts of the equipment that were in touch with the tuna, including gloves of the tagging team members, were disinfected after each tagging operation.
- After each tagging operation, cradle together with the tuna was lifted and attached to the analogue weighing scale, in order to measure weight of the tagged fish.
- Immediately afterwards cradle together with the tagged tuna was gently placed in the open sea. The fish is put back into the water with its head pointing in the same direction as the boat.

Released double tagged tuna



Releasing of the captured bluefin tuna from the holding cage 34:

On the 16th of July captured BFTs from holding cage 34 were released to the open sea (location Lavdara Vela, $\phi 43^{\circ}56'$; $\lambda 15^{\circ}13'$). Releasing of the fish was filmed with stereoscopic AQ1 camera and digital under - water camera.

Under - water label of fish releasing for AQ1 stereoscopic camera; releasing of the captured bluefin tuna



Fishing protocol:

- Different techniques of fishing from the holding cage were tested during tagging operation. Generally, fresh sardine was used as bait.

Rod and reel as specified in fishing equipment section was used with limited success. It was very difficult to handle the rod on the platform, especially once the fish was hooked. In order to manipulate and bring the hooked fish to the cradle, member of the tagging team / fisherman, had to catch the line with the hands and steer caught tuna. Although it was easy to handle the fish at first, bringing the fish to the cradle resulted in prolonged duration of the fishing operation.

Hand-line fishing as specified in fishing equipment section was used throughout the fishing operation with excellent results. Although, during tagging operation some modifications of the original design were made, since smaller deficiencies were observed:

- Fluorocarbon leader regardless of the diameter was breaking a lot, especially once 20kg or bigger tuna was caught. It seems that fluorocarbon as leader is not suitable once the fishing has been done from hand, without rod and reel. Therefore, we used 3,5mm rope as a leader (3,5mm, black sinking PP rope). It seems that once the fish is feeding frenzy, simple gear without fluorocarbon is suggested to be used.
- Owner Super Mutu barbless hooks showed excellent durability and performance. Although, significantly better results were observed when ringed hooks were used. Hooks without a ring (crimped directly to the leader) were breaking more often, and were in general attached deeper in the mouth cavity.
- VMC barbless hooks showed great performance but limited durability. It was observed that the hooks are bending and losing form, especially once the bigger tunas were hooked.

Modified hand-line fishing gear with 3,5 mm rope; Banded VMC hook



Broken fluorocarbon leader; Broken Owner Mutu hook



Tagging team

A tagging team was made up of seven people:

- Fisherman: hooks and steers the fish towards cradle, lifts the cradle with fish in order to be measured on the analogue weighing scale.
- First fish handler: holds the cradle in order to receive hooked fish, ensuring that it reaches the right measuring position, measures it (length) and calls out the measurement for the recorder (see below), if necessary holds the fish down while the tagger inserts the tag, lifts the cradle with fish in order to be measured on the weighing scale, cleans and sterilizes the cradle.
- Second fish handler: holds the cradle in order to receive hooked fish, covers the eyes of the tuna with sterilized dark clothing, un-hooks the fish, puts it back into the sea as soon as tagging operations have been completed.
- First tagger: inserts the tag into the fish, receives and after usage returns applicators to the Coordinator (see below) on board of the tagging vessel, estimates condition of the fish according to the instructions and call out the estimation to the recorder.
- Tagger assistant: assists once Internal archival tags are applied; once Internal Archival Tags are applied places the cushions on each side of the cradle so that the tuna can be placed belly up.
- Coordinator on board of the tagging vessel: coordinates tagging operation, prepares tags, places the tags in tag holder, prepares surgical equipment, prepares electronic tags, sterilizes equipment and tags, measures tuna weight and calls out the measurement for the recorder (see below).
- Recorder: records length and weight measurements, records fish condition estimations.

Tagging team



Survival rates of the tagged fish:

In order to assess survival rate of the tagged fish (single and double tagged with conventional and electronic Internal archival tags) it was decided to retrieve back to the holding cage 34, approximately twenty randomly selected tagged fish from each tagging day (except 15.07.2013), and all twelve fish tagged with internal MK9-SN tags. It was noticed that implantation (insertion) of the internal tag requires more handling (tagging times compared to conventional tags were more than doubled), it is more stressful for the fish, and can cause more detriment to fish health. Therefore, we were expecting that potentially there would be mortalities.

All together 94 tagged fish were returned back to the holding cage 34, and were released together with the rest of the school on 16.07.2013.

Table 8. Details of the tagged Bluefin tunas returned back into the holding cage 34.

09.07.2013		
20 fish tagged with conventional spaghetti tags from tag BYP021928 to tag BYP021947 were returned back into the holding cage for further monitoring, and were released together with the rest of the school on 16.07.2013.		
10.07.2013		
20 fish tagged with conventional spaghetti tags from tag BYP022151 to tag BYP022170 were returned back into the holding cage for further monitoring, and were released together with the rest of the school on 16.07.2013.		
11.07.2013 - following tagged fish were returned back into the holding cage for further monitoring, and were released together with the rest of the school on 16.07.2013.		
Count:	Spaghetti tags	SBF
1.	BYP022451	BYP059026
2.	BYP022454	BYP059029
3.	BYP022455	BYP059030
4.	BYP022458	BYP059033
5.	BYP022461	BYP059036
6.	BYP022462	BYP059037
7.	BYP022472	BYP059047
8.	BYP022482	BYP059057
9.	BYP022484	BYP059059
10.	BYP022486	BYP059061
11.	BYP022489	BYP059064
12.	BYP022514	BYP059089
13.	BYP022520	BYP059095
14.	BYP022521	BYP059096
15.	BYP022526	BYP059101
16.	BYP022527	BYP059102
17.	BYP022529	BYP059104
18.	BYP022532	BYP059107
19.	BYP022536	BYP059111
20.	BYP022540	BYP059115
21.	BYP022544	BYP059119
	LBF	Internal Archival Tags
1.	BYP071901	MK9-1290527
2.	BYP071903	MK9-1290531
3.	BYP071904	MK9-1290532
4.	BYP071905	MK9-1290533
5.	BYP071906	MK9-1290535
6.	BYP071907	MK9-1290536
7.	BYP071909	MK9-1290539
8.	BYP071910	MK9-1290541

9.	BYP071911	MK9-1290542
10.	BYP071912	MK9-1290543
12.07.2013 - following tagged fish were returned back into the holding cage for further monitoring, and were released together with the rest of the school on 16.07.2013.		
Count:	Spaghetti tags	SBF
1.	BYP022577	BYP059127
2.	BYP022578	BYP059128
3.	BYP022579	BYP059129
4.	BYP022581	BYP059131
5.	BYP022582	BYP059132
6.	BYP022583	BYP059133
7.	BYP022585	BYP059135
8.	BYP022587	BYP059137
9.	BYP022588	BYP059138
10.	BYP022589	BYP059139
11.	BYP022590	BYP059140
12.	BYP022592	BYP059142
13.	BYP022593	BYP059143
14.	BYP022594	BYP059144
15.	BYP022596	BYP059146
16.	BYP022697	BYP059147
17.	BYP022598	BYP059148
18.	BYP022599	BYP059149
19.	BYP022601	BYP059151
20.	BYP022602	BYP059152
21.	BYP022604	BYP059154
15.07.2013 (Divers checking the cage on the 13th and 14th of July discovered two dead BFTs that were double tagged with Internal Archival Electronic MK9 – SN and LBF tags. Tags were recovered, sterilized and reused on 15.07.2013. Tunas tagged with reused tags, were released back into the holding cage, and were released together with the rest of the school on 16.07.2013.)		
Count:	LBF	Internal Archival Tags
1.	BYP071902	MK9-1290530
2.	BYP071908	MK9-1290538

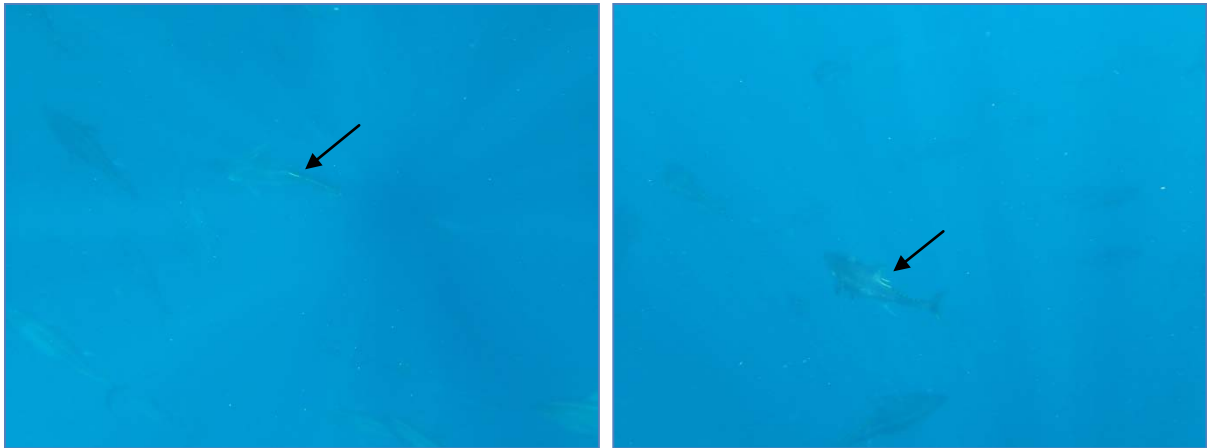
Tags from mortalities were extracted by cutting the fish's flesh around the dart, rather than by pulling it with force, so that it can be used with another fish. Archival tags were sterilized and reused, without resetting.

Table 9. Testing the survival rate of the single and double tagged fish

Date	Retrieved tagged fish	Mortality	Observations
09.07.2013	20 (single tagged)	None	Divers were not able to spot tagged fish in the school of bluefin tunas.
10.07.2013	20 (single tagged)	None	Couple single tagged tunas were observed swimming with the rest of the school.
11.07.2013	21 (double tagged; SBF + spaghetti tag) and 12 (double tagged with internal archival and LBF tags)	None	More single and double tagged tunas were observed swimming with the rest of the school. They were not feeding.
12.07.2013	21 (double tagged; SBF + spaghetti tags)	None	Single and double tagged fish were observed swimming with the school. They were not feeding.
13.07.2013		1 (double tagged with internal archival)	

		and LBF tag)	
14.07.2013		1 (double tagged with internal archival and LBF tag)	
15.07.2013	2 (tagged with internal archival tags (retrieved from mortality))	None	Two dead double tagged tunas (internal archival and LBF tag) were discovered. Tags were retrieved and reused. Tagged fish was spotted coming near the surface and feeding on the bait fish.
16.07.2013		None	It was observed that couple dozen tagged tunas are swimming and feeding with the rest of the school. Tagged fish showed no signs of stress. No visible changes in skin coloration, or damages of the skin were observed.

Single and double tagged tuna in the holding cage swimming with the school.



Tagged fish inside the holding cage feeding with the rest of the school



Biological and genetic sampling and analysis

Biological and genetic sampling within the BFT Tagging program in Croatia were performed by subcontractor, IZOR, Split.

Tunas taken for genetic sampling were sent with speed boat to the IZOR laboratory in Split. Majority of sampled tunas were selected from specimens having small surviving chances, due to the injuries, or bleeding.

All sampling, labeling, storing and shipping of samples, of genetic tissue, otoliths and spines, were conducted according to the protocols adopted by the Contractor and the GBYP 01/2012B manual. For genetic analysis fin clips from pectoral fin were collected and preserved in non-denatured ethanol. Samples were described, labeled and preserved, and sent to the AZTI laboratory via courier service.

The rest of the sampled tunas were donated to charity, or were consumed by crew.

Table 10. Research Mortality Allowance

Date:	No. of pieces	Total weight (kg)	Final destination
21.06.	1	10,75	Crews personal consumption
09.07.	3	37	Crews personal consumption
10.07.	4	47	Crews personal consumption
11.07.	6	71	Crews personal consumption
12.07.	10	135	Scientific purposes (GBYP BIOLOGICAL AND GENETIC SAMPLING - Transferred with speed boat to Laboratory of IZOR, Split)
15.07.	8	128,5	Scientific purposes (GBYP BIOLOGICAL AND GENETIC SAMPLING - Transferred with speed boat to Laboratory of IZOR, Split)
16.07.	30	470,1	Scientific purposes (GBYP BIOLOGICAL AND GENETIC SAMPLING - Transferred with speed boat to Laboratory of IZOR, Split)
Total:	62	899,35	

Extraction of sagittal otoliths from the tuna head; transfer of tunas for biological and genetic sampling to the laboratory of IZOR, Split

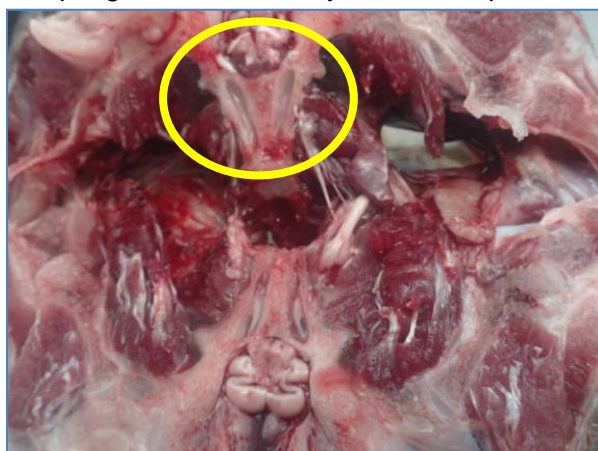


Table 11. GBYP Sampling data table

INDIVIDUAL FISH CODE					TISSUE COLLECTED		
PARTNER CODE	AREA	FISHING GEAR	INDIVIDUAL ID NUMBER	SIZE CLASS CODE	TISSUE CODE1	TISSUE CODE2	TISSUE CODE3
IZOR	AS	PS	1	J	O	S	F
IZOR	AS	PS	2	J	O	S	F
IZOR	AS	PS	3	J	O	S	F
IZOR	AS	PS	4	J	O	S	F
IZOR	AS	PS	5	J	O	S	F
IZOR	AS	PS	6	J	O	S	F
IZOR	AS	PS	7	J	O	S	F
IZOR	AS	PS	8	J	O	S	F
IZOR	AS	PS	9	J	O	S	F
IZOR	AS	PS	10	J	O	S	F
IZOR	AS	PS	11	J	O	S	F
IZOR	AS	PS	12	J	O	S	F
IZOR	AS	PS	13	J	O	S	F
IZOR	AS	PS	14	J	O	S	F
IZOR	AS	PS	15	J	O	S	F
IZOR	AS	PS	16	J	O	S	F
IZOR	AS	PS	17	J	O	S	F
IZOR	AS	PS	18	J	O	S	F
IZOR	AS	PS	19	J	O	S	F
IZOR	AS	PS	20	J	O	S	F
IZOR	AS	PS	21	J	O	S	F
IZOR	AS	PS	22	J	O	S	F
IZOR	AS	PS	23	J	O	S	F
IZOR	AS	PS	24	J	O	S	F
IZOR	AS	PS	25	J	O	S	F
IZOR	AS	PS	26	J	O	S	F
IZOR	AS	PS	27	J	O	S	F
IZOR	AS	PS	28	J	O	S	F
IZOR	AS	PS	29	J	O	S	F
IZOR	AS	PS	30	J	O	S	F
IZOR	AS	PS	31	J	O	S	F
IZOR	AS	PS	32	J	O	S	F
IZOR	AS	PS	33	J	O	S	F
IZOR	AS	PS	34	J	O	S	F
IZOR	AS	PS	35	J	O	S	F
IZOR	AS	PS	36	J	O	S	F
IZOR	AS	PS	37	J	O	S	F
IZOR	AS	PS	38	J	O	S	F
IZOR	AS	PS	39	J	O	S	F
IZOR	AS	PS	40	J	O	S	F

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IZOR	AS	PS	41	J	O	S	F
IZOR	AS	PS	42	J	O	S	F
IZOR	AS	PS	43	J	O	S	F
IZOR	AS	PS	44	J	O	S	F
IZOR	AS	PS	45	J	O	S	F
IZOR	AS	PS	46	J	O	S	F
IZOR	AS	PS	47	J	O	S	F
IZOR	AS	PS	48	J	O	S	F
IZOR	AS	PS	49	J	O	S	F
IZOR	AS	PS	50	J	O	S	F
IZOR	AS	PS	51	J	O	S	F
IZOR	AS	PS	52	J	O	S	F
IZOR	AS	PS	53	J	O	S	F
IZOR	AS	PS	54	J	O	S	F
IZOR	AS	PS	55	J	O	S	F
IZOR	AS	PS	56	J	O	S	F
IZOR	AS	PS	57	J	O	S	F
IZOR	AS	PS	58	J	O	S	F
IZOR	AS	PS	59	J	O	S	F
IZOR	AS	PS	60	J	O	S	F

Table 12. Description of fish selected for biological sampling.

SAMPLING DATA											
Catch Date [dd/mm/yyyy]	Sampling Date [dd/mm/yyyy]	Latitude	Longitude	Length [cm]	Length Type	Weight [Kg]	Weight Type	Sex	Reproductive Stage	Collector	Notes
15.06.2013.	21.06.2013.	43°08	15° 14	83,50	FL	10,75	T	F	I	L.Grubisic	
15.06.2013.	09.07.2013.	43°08	15° 14	82,00	FL	10,00	T	M	I	L.Grubisic	
15.06.2013.	09.07.2013.	43°08	15° 14	91,00	FL	15,00	T	F	I	L.Grubisic	
15.06.2013.	09.07.2013.	43°08	15° 14	86,00	FL	12,00	T	F	I	L.Grubisic	
15.06.2013.	10.07.2013.	43°08	15° 14	79,00	FL	10,00	T	M	I	L.Grubisic	
15.06.2013.	10.07.2013.	43°08	15° 14	80,00	FL	10,50	T	M	I	L.Grubisic	
15.06.2013.	10.07.2013.	43°08	15° 14	84,00	FL	13,00	T	F	I	L.Grubisic	
15.06.2013.	10.07.2013.	43°08	15° 14	85,00	FL	13,50	T	F	I	L.Grubisic	
15.06.2013.	11.07.2013.	43°08	15° 14	79,00	FL	8,50	T	F	I	L.Grubisic	
15.06.2013.	11.07.2013.	43°08	15° 14	81,00	FL	10,00	T	F	I	L.Grubisic	
15.06.2013.	11.07.2013.	43°08	15° 14	84,00	FL	11,00	T	F	I	L.Grubisic	
15.06.2013.	11.07.2013.	43°08	15° 14	86,00	FL	10,00	T	F	I	L.Grubisic	
15.06.2013.	11.07.2013.	43°08	15° 14	89,00	FL	13,00	T	M	I	L.Grubisic	
15.06.2013.	11.07.2013.	43°03	15° 17	102,00	FL	18,50	T	M	I	L.Grubisic	
15.06.2013.	12.07.2013.	43°08	15° 14	83,00	FL	10,00	T	F	I	L.Grubisic	
15.06.2013.	12.07.2013.	43°08	15° 14	82,00	FL	10,00	T	F	I	L.Grubisic	
15.06.2013.	12.07.2013.	43°08	15° 14	84,00	FL	10,50	T	F	I	L.Grubisic	
15.06.2013.	12.07.2013.	43°08	15° 14	84,00	FL	10,50	T	F	I	L.Grubisic	
15.06.2013.	12.07.2013.	43°08	15° 14	86,00	FL	10,00	T	M	I	L.Grubisic	
15.06.2013.	12.07.2013.	43°08	15° 14	90,00	FL	13,50	T	F	I	L.Grubisic	
15.06.2013.	12.07.2013.	43°03	15° 17	101,00	FL	17,50	T	M	I	L.Grubisic	
15.06.2013.	12.07.2013.	43°03	15° 17	103,00	FL	17,50	T	M	I	L.Grubisic	
15.06.2013.	12.07.2013.	43°03	15° 17	104,00	FL	17,50	T	M	I	L.Grubisic	
15.06.2013.	12.07.2013.	43°03	15° 17	106,00	FL	18,00	T	M	I	L.Grubisic	
15.06.2013.	15.07.2013.	43°08	15° 14	91,00	FL	12,50	T	M	I	L.Grubisic	
15.06.2013.	15.07.2013.	43°08	15° 14	95,00	FL	13,50	T	M	I	L.Grubisic	
15.06.2013.	15.07.2013.	43°08	15° 14	97,00	FL	14,00	T	M	I	L.Grubisic	
15.06.2013.	15.07.2013.	43°08	15° 14	100,00	FL	15,50	T	M	I	L.Grubisic	
15.06.2013.	15.07.2013.	43°08	15° 14	103,00	FL	15,00	T	M	I	L.Grubisic	
15.06.2013.	15.07.2013.	43°03	15° 17	103,00	FL	18,00	T	M	I	L.Grubisic	

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15.06.2013.	15.07.2013.	43°03	15° 17	105,00	FL	17,00	T	M	I	L.Grubisic	
15.06.2013.	15.07.2013.	43°03	15° 17	110,00	FL	23,00	T	M	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°08	15° 14	81,00	FL	8,50	T	F	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°08	15° 14	82,00	FL	10,00	T	F	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°08	15° 14	83,00	FL	10,00	T	M	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°08	15° 14	83,00	FL	10,20	T	F	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°08	15° 14	84,00	FL	9,20	T	F	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°08	15° 14	85,00	FL	10,00	T	M	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°08	15° 14	86,00	FL	10,80	T	M	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°08	15° 14	86,00	FL	10,80	T	F	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°08	15° 14	86,00	FL	10,50	T	M	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°08	15° 14	87,00	FL	11,00	T	F	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°08	15° 14	90,00	FL	12,40	T	M	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°08	15° 14	101,00	FL	15,20	T	M	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°08	15° 14	101,00	FL	16,00	T	F	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°08	15° 14	101,00	FL	17,00	T	F	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°08	15° 14	102,00	FL	17,00	T	F	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°08	15° 14	102,00	FL	17,40	T	F	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°08	15° 14	102,00	FL	16,50	T	M	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°08	15° 14	103,00	FL	17,20	T	M	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°08	15° 14	103,00	FL	18,00	T	M	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°08	15° 14	103,00	FL	18,00	T	M	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°08	15° 14	104,00	FL	19,00	T	M	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°08	15° 14	104,00	FL	18,80	T	M	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°03	15° 17	105,00	FL	19,00	T	F	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°03	15° 17	106,00	FL	19,50	T	M	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°03	15° 17	105,00	FL	19,20	T	F	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°03	15° 17	106,00	FL	20,00	T	M	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°03	15° 17	110,00	FL	21,00	T	F	I	L.Grubisic	
15.06.2013.	16.07.2013.	43°03	15° 17	110,00	FL	24,00	T	F	I	L.Grubisic	

Correspondence on retrieval of electronic tags

In order to contribute on retrieval of electronic tags, Kali Tuna and IZOR are in tight communication with Mr. Di Natale.

Electronic miniPAT tags										
Data requested on:	Argos ID	miniPAT	LBF tag	Tagging date	Release time	Latitude	Longitude	FL (cm)	Weight (kg)	Days at sea:
4.9.2013	130555	12P0145	BYP071917	11.7.2013	10:39	φ43°56′	λ15°13′	103	21,5	52
4.9.2013	130557	12P0147	BYP071914	11.7.2013	9:52	φ43°56′	λ15°13′	102	21	12
15.10 2013	130554	12P0099	BYP071916	11.7.2013	10:15	φ43°56′	λ15°13′	105	22	76
15.10 2013	130558	12P0149	BYP071915	11.7.2013	10:10	φ43°56′	λ15°13′	100	20	65
4.11.2013	130553	12P0142	BYP071919	11.7.2013	10:44	φ43°56′	λ15°13′	105	23	
	130559	12P0150	BYP071913	11.7.2013	9:45	φ43°56′	λ15°13′	102	19,5	
	130556	12P0146	BYP071918	11.7.2013	10:41	φ43°56′	λ15°13′	102	20,5	

RECOMMENDATIONS:

- To avoid heavy mortalities of fish caught by purse seine for tagging purposes, it is highly recommended to place fish from the seine net to floating cage for recovery, as to enable fishing by hook instead of taking fish on board by the scoop net. Tagging is recommended to start at the moment when at least 50% of the captured fish is eagerly taking bait. Therefore, feeding behavior should be monitored and reported before tagging team is gathered.
- Contrary to the ABFT Tagging Manual, recovery of the captured fish took days instead hours (seven to ten days to start feeding). Therefore it is recommended for further tagging operations to plan far longer period of adaptation.
- Considering small size of the tagged juvenile fish ages 1 and 2, it seems that smaller conventional tags are more appropriate than large ones such as large billfish and pop-up tags.
- Since tagging procedure is stressful for the fish, and can result with late mortality, it would be recommended to place tagged fish into a floating cage, to monitor survival and fish behavior for few days, prior releasing them into the open sea. This is of particular importance in the cases when an expensive electronic tags are used.
- Since it is noticed that during first days of tagging, average weight of the tagged fish was smaller in relation to the last tagging days, it would be recommended to use more „brutal“ tags at the end of the tagging activities.
- As to facilitate smooth tagging procedure, there is a need to capture at least double quantity in relation to the number of fish intended to be tagged. Otherwise, limited number of the fish in the holding cage may influence feeding behavior and fish motivation to take a bait.
- Hand-line fishing may be significantly improved if fluorocarbon leader is replaced with adequate PP rope. It is noticed that a ringed circle hooks are less harmful for fish, as it minimizes injuries of the mouth cavity.
- Aluminum non abrasive cradle, has shown to be an optimal and easy solution to perform a quick handling, measuring and tagging procedure.
- When inserting internal electronic tag, in order to keep the fish calm and in the belly up position, it is highly recommended to use two supporting cushions on both sides of the cradle, as to reduce the skin injuries.
- As for number of persons involved in the tagging procedure it was found that 4 persons are needed for hand-line fishing, measuring and conventional tagging procedure. There is a need also for two additional persons on board of the tagging vessel, one to take recordings and pass tags to the tagger, and other one to deliver

the bite into the holding cage. However, when tagging with internal archival tags, there is a temporary need for additional assistant for surgery.

- It is recommended to perform biological and genetic sampling in parallel with tagging activities, by selecting heavily injured specimens with little chances for survival.

EXECUTIVE SUMMARY:

Conventional and electronic tagging of juvenile bluefin tunas captured by a purse-seine in the Adriatic Sea were performed during 2013 in the framework of the ICCAT-GBYP intensive scientific tagging programme. Tagging activities were done in close collaboration of Croatian tuna industry (Kali Tuna d.o.o.) and research institution (IZOR, Split). About 2,400 BFT juveniles were caught in the central Adriatic following BFT fishing season. Fish were transferred from purse seine into a holding floating cage, then towed from open sea to a protected coastal zone for further acclimatization. Adaptation to captive conditions and initiation of the feeding took few weeks, after which the tagging activities were performed. In total 1169 BFT juveniles were tagged, among which 480 were double tagged, 12 were tagged with internal electronic archival tags and 7 miniPATs. Biological and genetic sampling were carried out during the tagging activities by using injured fish having little or no chance to survive. The samples were shipped to the AZTI laboratory.