

# Tagging of bluefin tuna (*Thunnus thynnus*) with microchips for the purpose of individual growth estimation in cage culture

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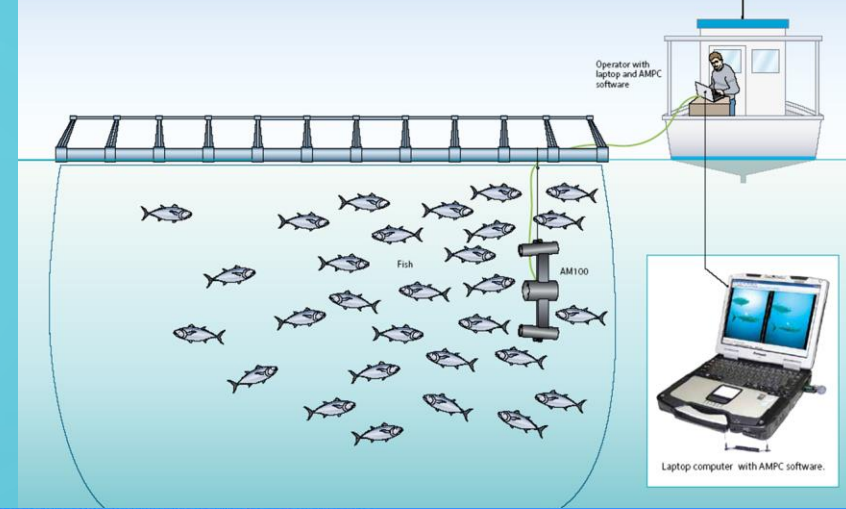
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Following intensive fattening operations in several Mediterranean countries in the late 1990s a very strong impact on BFT fisheries and its management was made.



With the purse seine captured fish being transferred to fish farms, apparently, catches were frequently under reported, and the size composition of fish entering fish farms remains a challenge. The appropriateness of a non-invasive stereoscopic video monitoring with respect to the size estimates over the time of farming/fattening continue to be discussed. In spite of some available data on bluefin tuna size structure at caging, the size information at harvesting or from markets do not always match predicted growth factors.



The screenshot shows the AM100 Analyzer software interface. The title bar reads "mjerenje duzina -tezina kavez 12 27052011.AQAM - AQ1 Systems AM100 Analyzer". The interface includes a menu bar (File, Edit, View, Project, Frame, Model, Help), a toolbar, and a main window with two stereoscopic video frames of fish in a cage. A table on the left lists "String Measurements" with columns for ID and Weight (kg). A "Summary" panel on the right displays statistics for the selected frame.

ID	Weight (kg)
2	8,613
3	8,684
4	8,250
5	8,362
6	12,338
7	4,545
8	11,469
9	8,243
10	8,180
11	8,563
12	8,226
13	6,753
14	7,610
15	9,786
16	8,431
17	8,515
18	8,230
19	8,301
20	7,504
21	7,508
22	8,999
23	7,429
24	9,595
25	8,542
26	8,886
27	9,137
28	3,757
29	8,903
30	9,543
31	10,237

Summary:

- Sizing
- Measurements: 30
- Mean weight: 8,44g
- Mean v.d.: 0,74m

Selected:

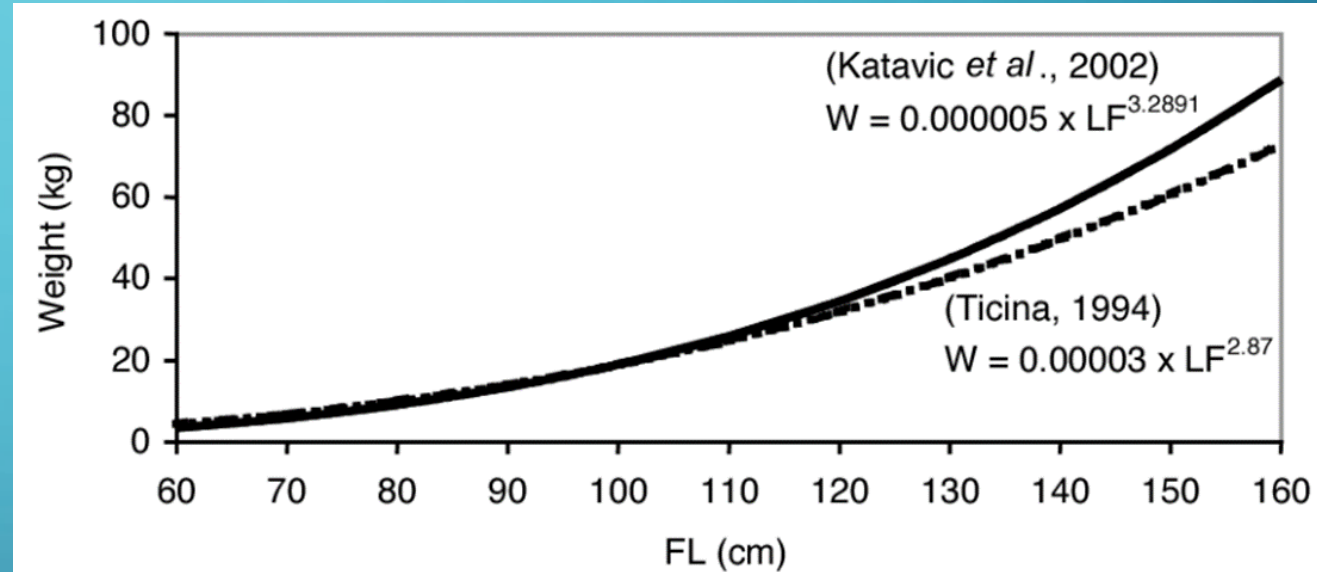
- ID: 18
- Weight: 8,23kg
- v.d.: 0,73m
- Range: 3,59m
- Frame: 17181
- Filename: 20110527\_130446\_00111CF018C5\_121 kavez 12\_27.05.2011\_Left.avi

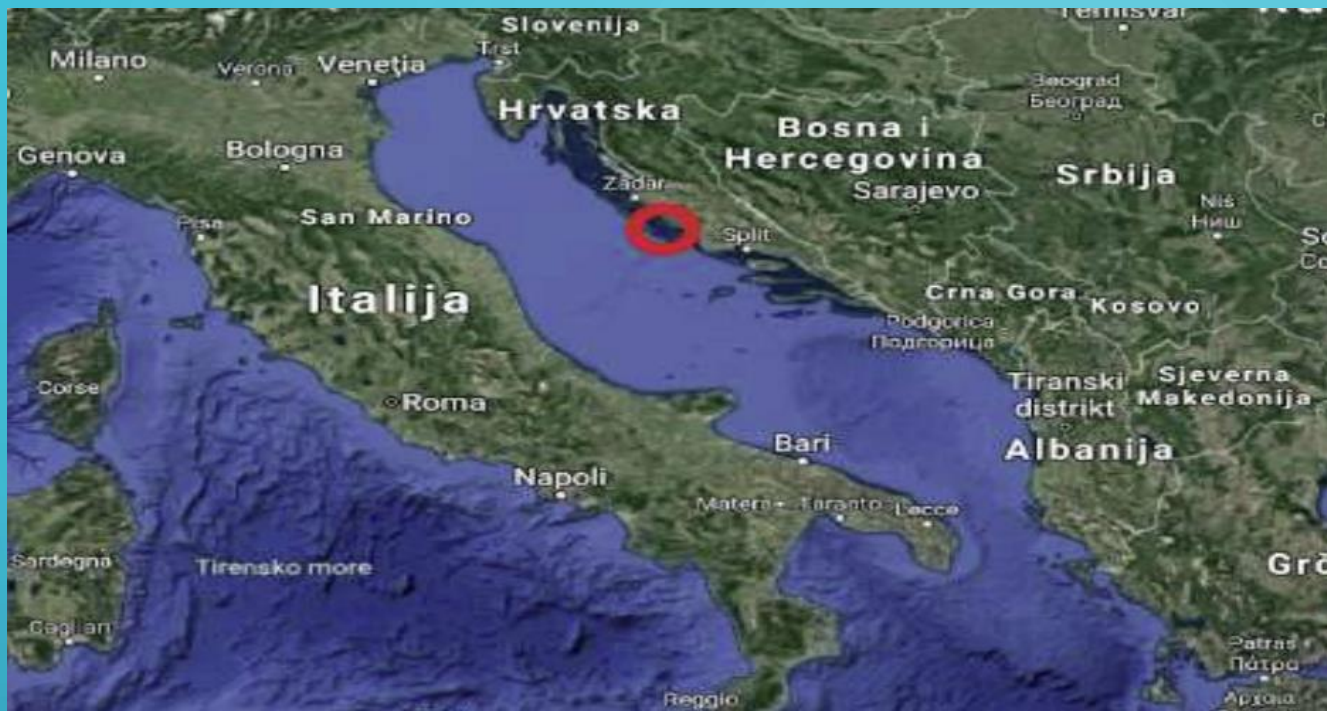
At the 21st Meeting of the Commission (ICCAT), the SCRS was requested to provide an update on the potential growth rates of bluefin tuna in farming/fattening facilities, with the aim of improving the consistency of the growth rates derived from eBCD s, as stipulated in paragraph 28 of Rec. 18-02. Namely, it is recognized that the growth rates derived from the eBCDs are not coherent with the SCRS tables and growth rates published in 2009 by the SCRS.



Therefore the SCRS has asked CPCs to undertake studies as to consider the difference among geographic area (including Atlantic and Mediterranean), and the different farming/fattening strategies in providing an update on the potential growth rates of bluefin tuna.

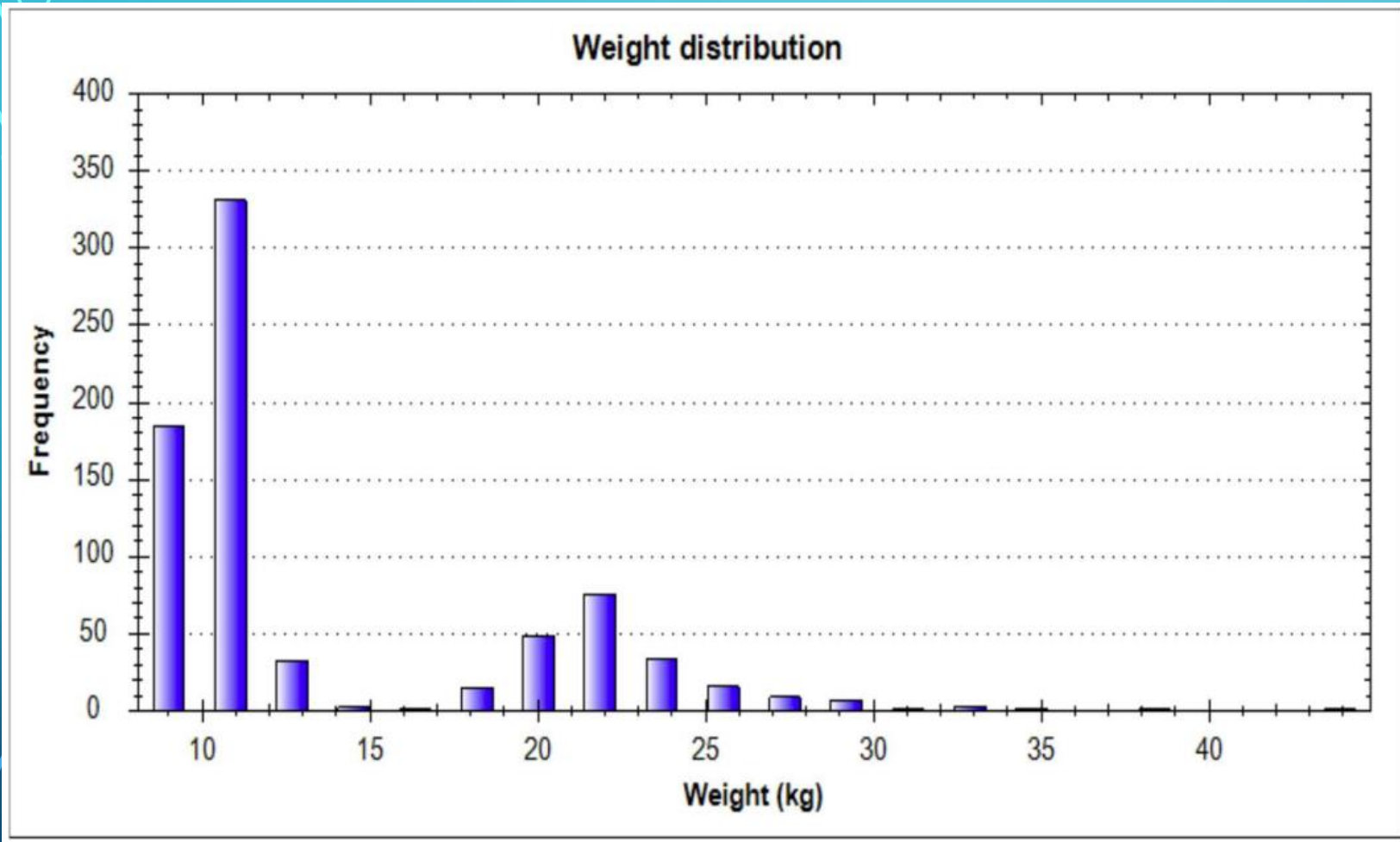
Consequently, the Atlantic-Wide Research Programme for Bluefin Tuna (GBYP) was committed to undertake scientific studies in selected farms to **identify growth rates including in weight and size gains of recognizable individual fish during the farming/fattening period** along the eastern Atlantic and Mediterranean.





Juvenile Bluefin tuna were collected in 2019 from 6 individual purse seine catches during regular fishing season in the central Adriatic. The experimental trial was performed at the commercial tuna farm Balabra located in the central eastern Adriatic which capacity is 1.200 tonnes in 14 cages. At rearing site fish were distributed into two experimental cages, one of this containing 1506 fish and 1688 respectively.





Based on standardized age-length key for the East Atlantic and Mediterranean (Rodriguez Marin et al., 2016) majority of fish belong to age 2+, and far less to age 3+. Captured fish estimated in total quantity of 3.194 pcs and 40.806 kg, average weight 13 kg were kept alive, transferred to towing cages.

In total, 12 bluefin tuna juveniles were sampled from cage HRV011005, tagged with external clips combined with the cutting of the second dorsal fin. In the first week following tagging two fish died, both were examined and processed by the scientists involved. Unfortunately, the results were not promising. The markers fell from the anal or second dorsal fin.





PIT tags (Passive Integrated Transmitter), are tracking tags that do not require power. Instead, they have an internal microchip that is activated when it passes close to a special antenna. The antenna is connected to a computer that records the identity of the tag.

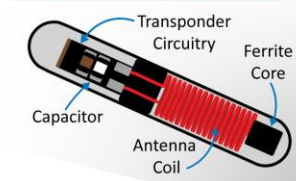
# How do PIT tags work?



Passive Integrated Transponder (PIT) tags are the most commonly used tags for identifying individual fish

## 1 Tags:

- Choice of different sizes depending on animal / fish size and desired read range
- Contain unique 10-15 digit alphanumeric ID code
- Are not battery operated and last "forever," or the entire lifetime of the fish



Tags are inactive outside an antenna's electromagnetic field and fish are not detected



Antenna's electromagnetic field activates tags

Detection range influenced by:

- Frequency
- Antenna power
- Tag orientation
- Interference

Detection range usually 3-18 inches

Computer records detection time and unique tag number

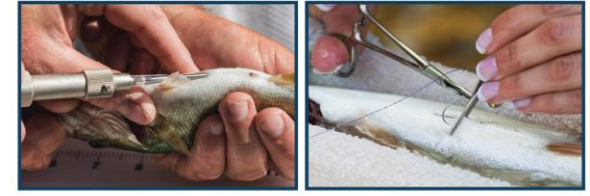


## 3 Antenna

Can come in many sizes and shapes such as rings, rectangles, handheld wands, and mobile antennas

## 2 Injection Methods

Tags can be injected with a needle (left) or surgically implanted (right)



Learn more about PIT tags at [FISHBIO.com](http://FISHBIO.com)



During five days, total of 206 bluefin tuna juveniles were hooked and marked by inserting PIT tag into a muscle on the top of the head. Age of tagged fish were estimated 2+ years (approx. 160 ind.) and 3+ years (>40 individuals).



- in order to prevent infection at the injection area, iodine based antiseptic cream (10% povidone iodine, propolis, cold-pressed herbal oils, lanolin and beeswax) was applied.
- creame properties: antimicrobial, anti-inflammatory and regenerative.
- oxytetraciline injectione during tagging applied to each tagged fish in a prescribed dose.

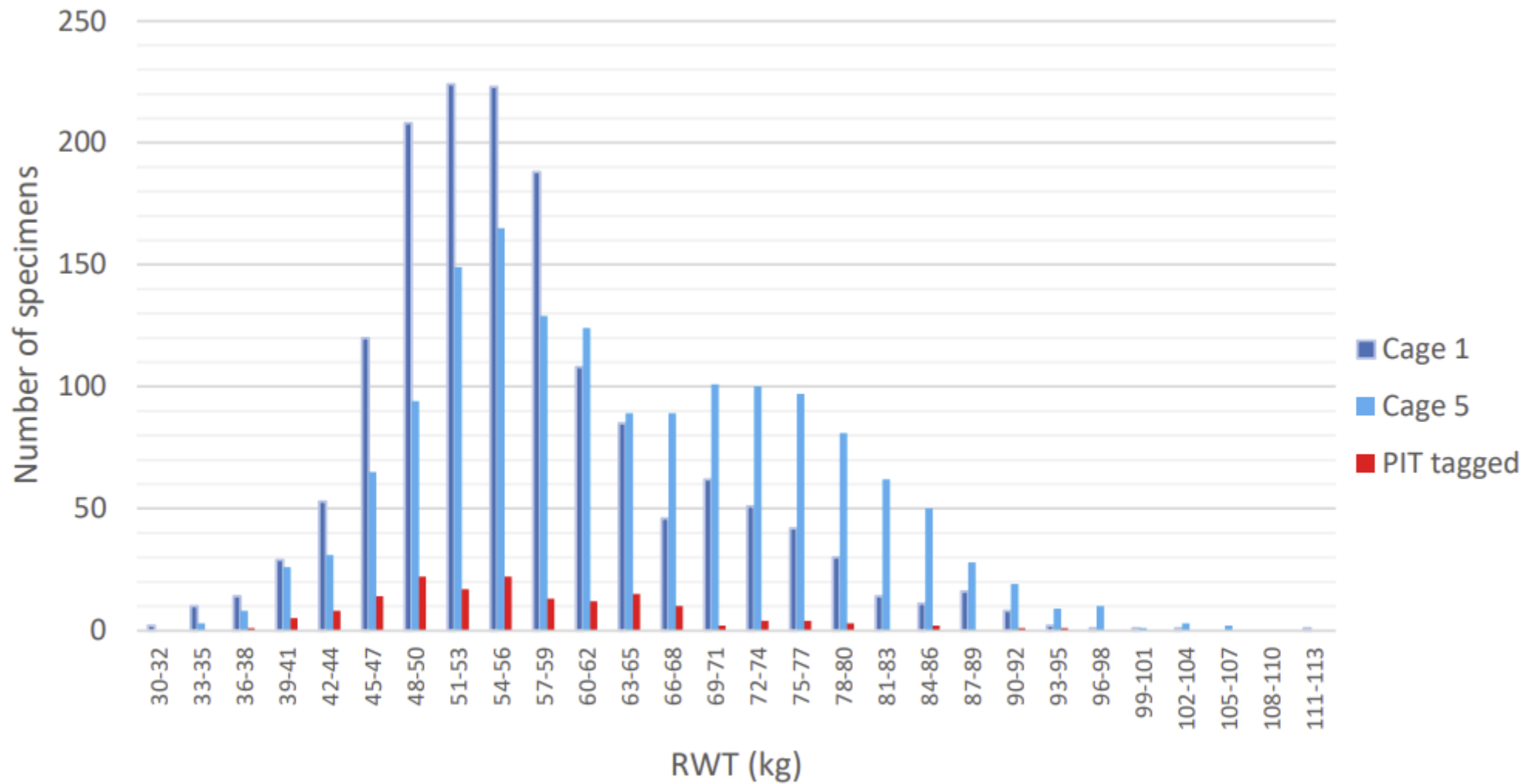




**AFTER 19 MONTHS  
OF FARMING**

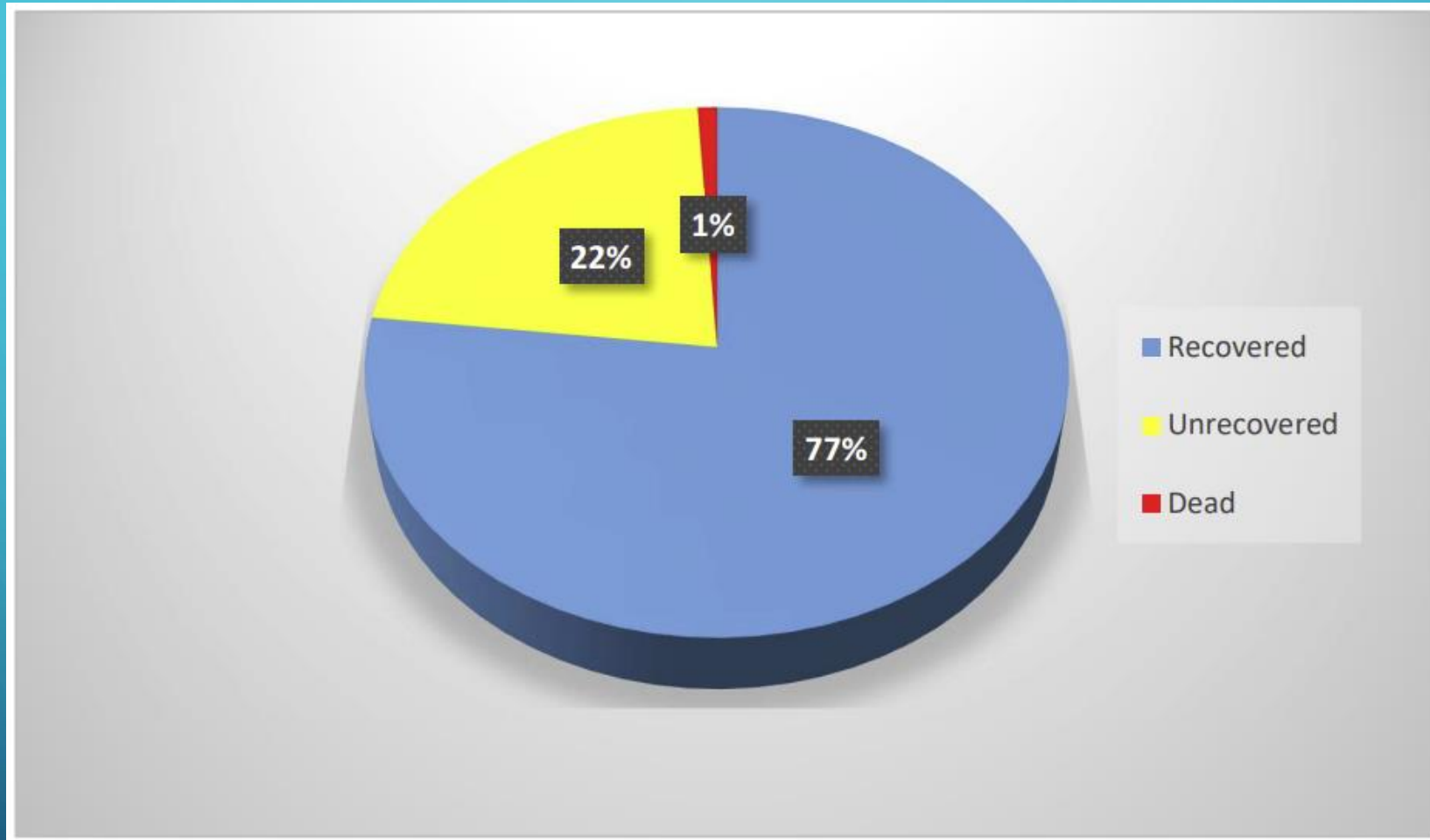
Fish were sampled at regular harvesting, killed and individually measured for SFL with measuring callipers (MC) and subsequently weighted ( $\pm 0.1$  kg)





Size distribution of tagged bluefin tuna in cage 1 and cage 5 at harvesting

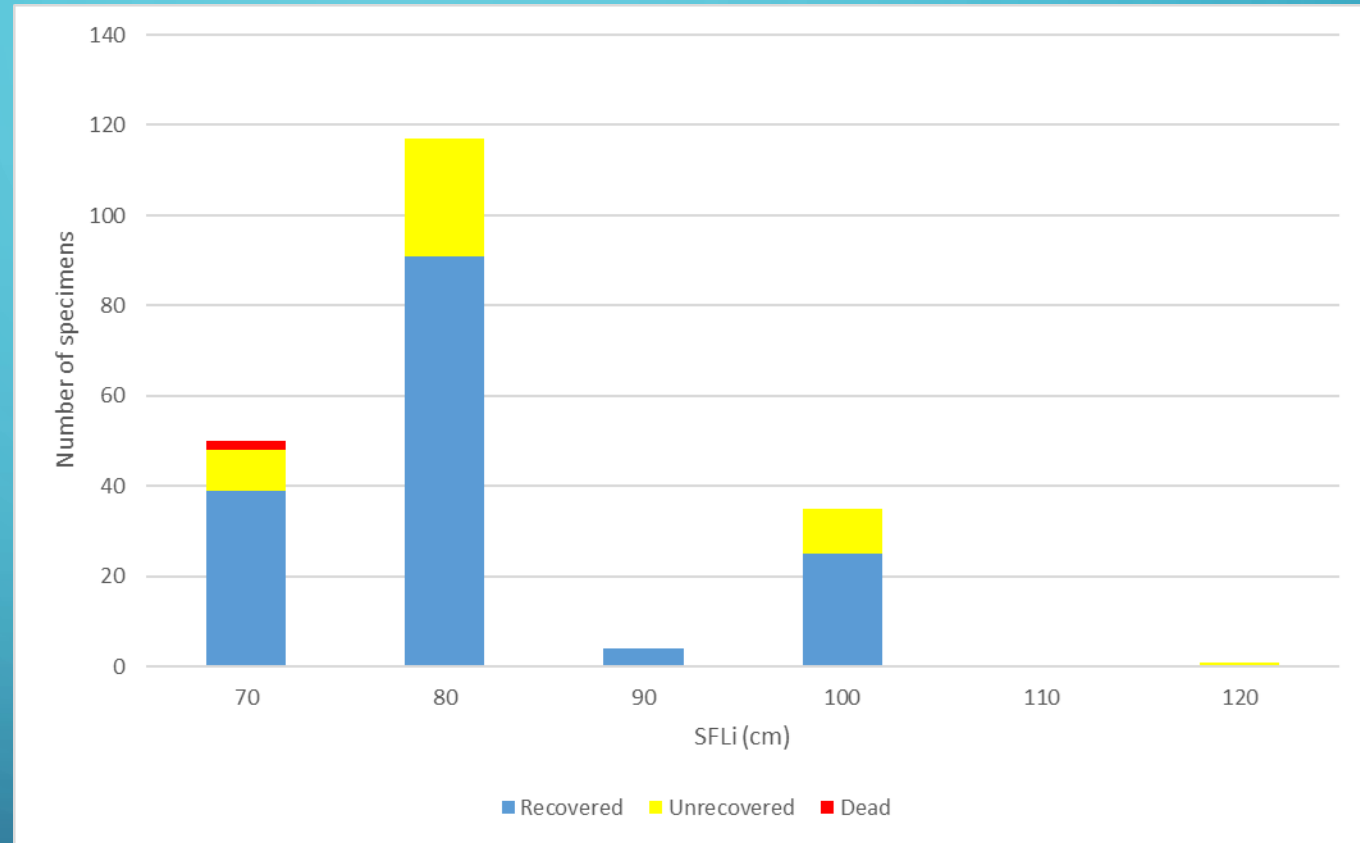
From the total tagged 206 fish, 158 were harvested, while 46 were not recovered. It is worthy to notice that only 2 fish died, both during tagging operation.



Sumarized results related to recovered, unrecovered and dead bluefin tuna juveniles tagged at Pelagos Net Farm after 19 months of caging.

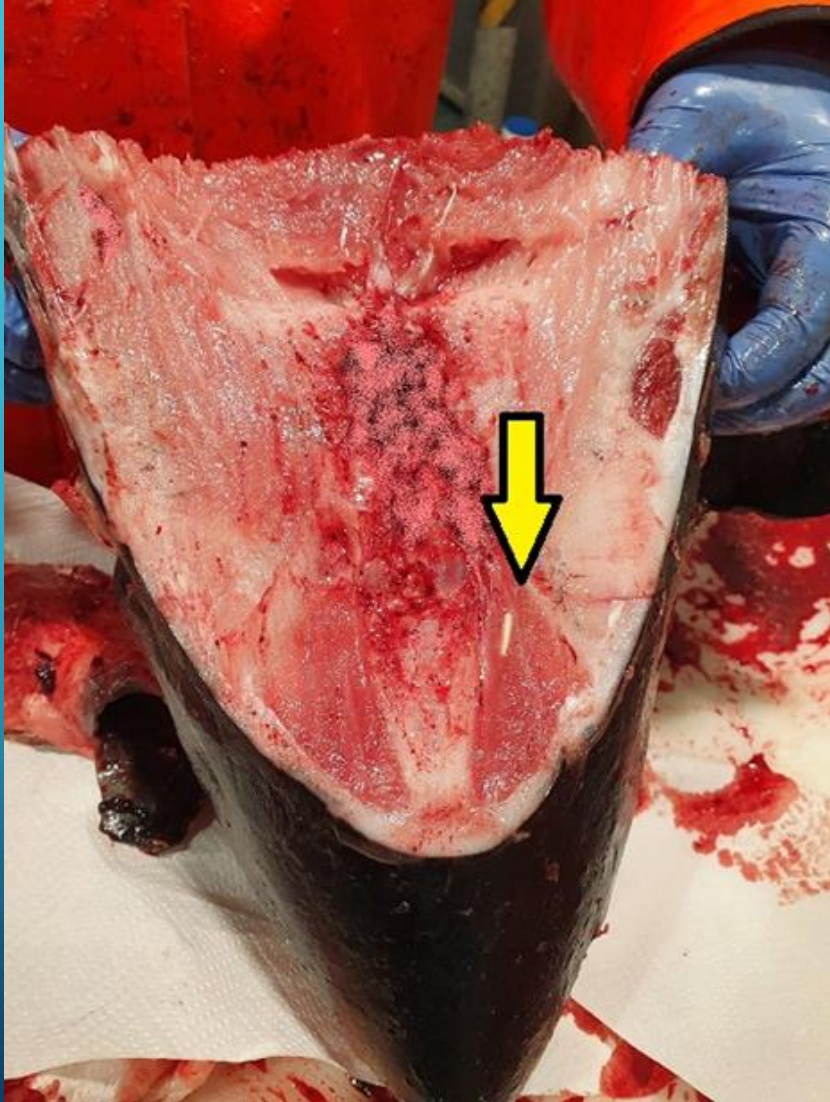


The proportion of the unrecovered fish could be result of a detector failure during harvesting operation as well as failure of readers being forced with harvesting routine procedures .  
Further factor, at least theoretically, could be loss of the tag.



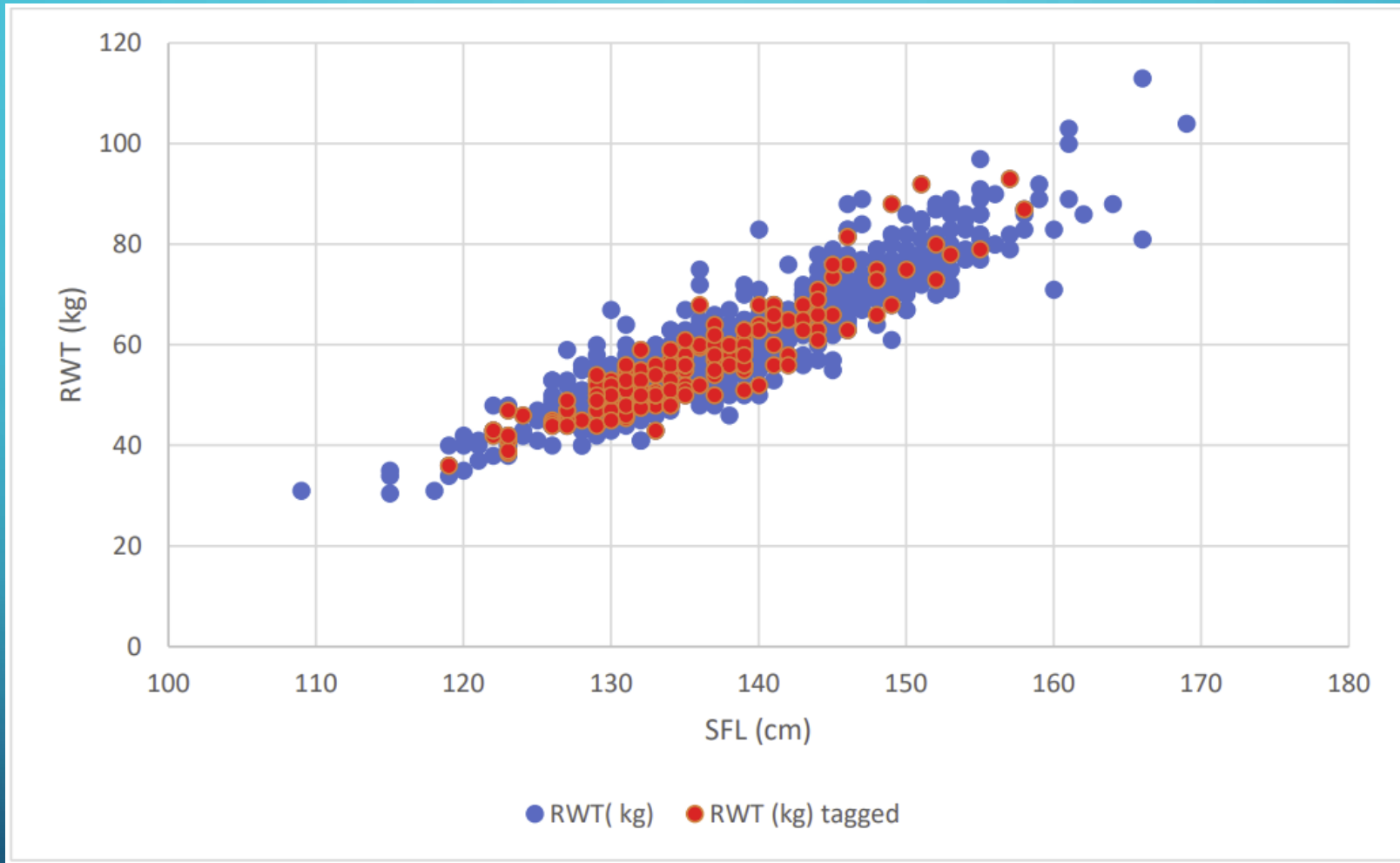
Following surgical examination, we have concluded that after a year and half in the host the tag was not encapsulated with surrounding tissue. Because of complete healing of wound site, and no visible signs of inflammation or rejection, it suggests that an encapsulated tag appears to be biologically inert and/or BFT did not recognize it as foreign body.







The presence of the tag did not appear to adversely affect the growth or condition (L-W relationship) of the tagged fish



LW distribution of tagged (n=156) and non tagged (n=938) bluefin tuna from experimental cages #1 and #5.

# Dream team for tuna tagging.

