# THE ATLANTIC-WIDE RESEARCH PROGRAMME FOR BLUEFIN TUNA (GBYP Phase 14)

## GBYP e-tagging program PHASE 14.

## NORTH-WEST MEDITERRANEAN.

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## Introduction.

Effective management of Atlantic bluefin tuna (ABFT) depends on a clear understanding of key life-history traits—such as growth, maturity, survivorship, movements, and population structure—which in recent years has been strengthened by new biological data from electronic tagging, genetics, and otolith microchemistry. These complementary datasets are increasingly valuable for refining estimates of stock composition, population mixing, and basin-scale biomass dynamics. While the Mediterranean spawning grounds represent a major focal point for the purse-seine and farming industry and therefore for obtaining information on individuals directly subjected to harvesting pressure and understand changes in the spawning behaviour and areas.

Sustainable management of Atlantic bluefin tuna requires robust modelling of life-history traits (growth and maturity), survivorship, movements, and population structure. In recent years, biological data from electronic tagging, genetics, and otolith microchemistry have increased and now provide vital inputs to models of stock composition, mixing, and biomass assessment. One region of particular interest is the Northwest Mediterranean (e.g., Balearic–Gulf of Lion area), which is a key zone for foraging and transit and lies adjacent to known spawning habitats of the eastern stock. Our team proposes to continue and expand electronic tagging efforts in the Northwest Mediterranean to improve empirical understanding of movement dynamics, connectivity with other Mediterranean sub-basins, and exchanges with the Atlantic via the Strait of Gibraltar.

Tagging studies across both spawning and non-spawning regions have shown that large ABFT tend to undertake long-distance movements linking Mediterranean reproductive areas with the Atlantic, whereas smaller individuals generally remain more resident (Aranda et al., 2013; Cermeño *et al.*, 2015); subsequent analyses have refined this size-dependent transition threshold and confirmed that fish begin to exhibit Mediterranean–Atlantic exchanges once they reach a certain body length (Rouyer *et al.*, 2022). Moreover, although recent tagging work has improved our understanding of basin-scale movements, the patterns of connectivity within the Mediterranean itself remain insufficiently documented. Movements between the western basin, the Adriatic Sea, and the Levantine Sea are still poorly resolved (Fig 1), even though several electronically tagged individuals have demonstrated the capacity to traverse these sub-basins (Cermeño *et al*, 215; Block personal communication). These preliminary observations suggest that intra-Mediterranean connectivity may be more complex and extensive than previously assumed, underscoring the need for broader spatial coverage and longer time-series to fully characterize exchanges between the eastern and western Mediterranean.

To achieve these objectives, we proposed electronic tags (satellite, archival, and acoustic) under the ICCAT e-tagging programme (Phase 14) as powerful tools to reduce uncertainties in spatial and temporal distribution patterns and to inform fisheries management.

The main objective of this tender was to extend our electronic tagging efforts on large ABT in the Northwest Mediterranean during the spring quarter of 2025. We planned to deploy ICCAT-provided tags and to collect associated biological samples (genetics, morphometrics) to strengthen assessments of stock composition and movement ecology relevant to MSE operational modelling.

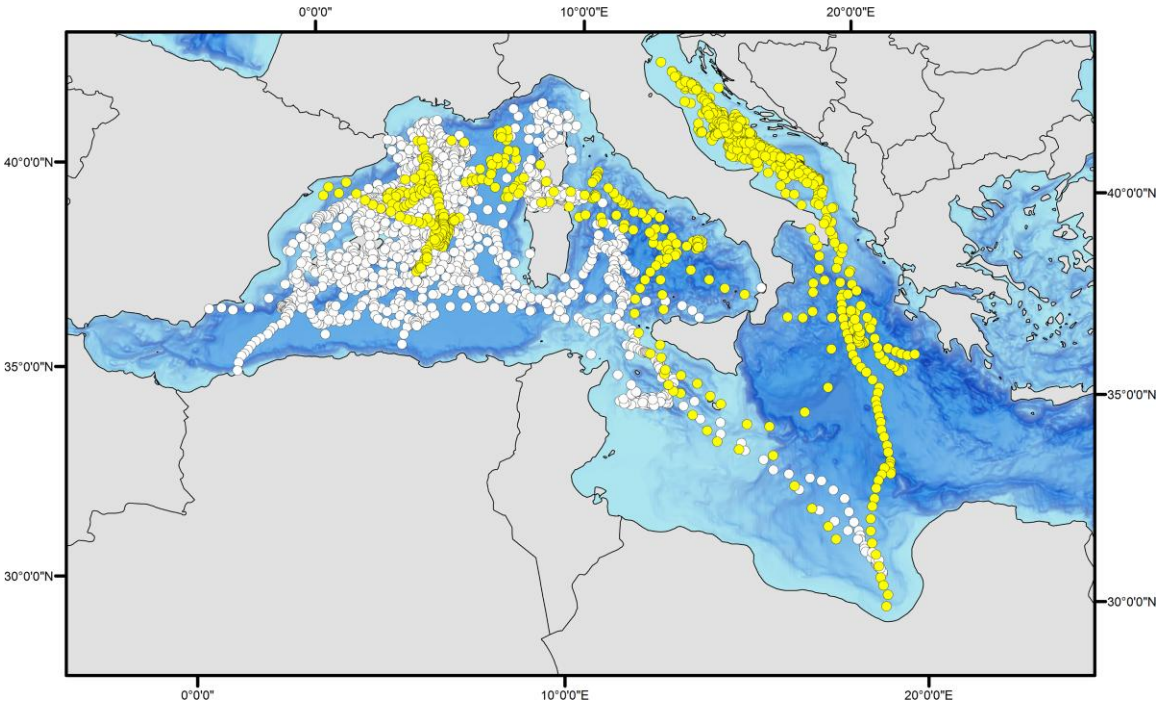


Figure 1: Electronic tagging efforts across Wester Mediterranean and Adriatic regions illustrates connections. White circles represent the positions of the tuna tagged in the western Mediterranean basin (n = 28 pop-up tags + 1 internal tag), while yellow circles represent the positions of the tuna tagged in the Adriatic (n = 9 pop-up tags). Extracted from Cermeño et al, 2015).

The tagging expeditions were made possible thanks to the collaboration of the "Associació Catalana per la Pesca Responsable" (ACPR), an organization that brings together recreational fishers committed to promoting sustainable and responsible fishing practices.

## Methodology Description

Under the Memorandum of Understanding, this call received a total allocation of three pop-up satellite tags (Lotek), along with eight external acoustic tags and four internal acoustic tags, all intended for deployment in the northwestern Mediterranean.

Satellite tags will be deployed using established techniques (Block´s Laboratory protocols) with looped tethers and titanium darts. Pop-up satellite tags were expected to provide up to ~1 year of continuous tracking; acoustic tags can enable survivorship monitoring over 6–10 years where receivers are present. Archival tags will be prioritized for smaller fish.

PSAT and acoustic tags are inserted a few centimetres below the second dorsal fin, with the dart passing through the skin and muscle until it anchors between the supporting fin bones. The tag is applied at an angle under 45° to reduce drag while ensuring proper fixation. The tagger delivers a firm insertion, removes the applicator carefully, and checks that the tag is secure and the tuna has not been injured.

For internal archival tagging, the tuna is brought on board and stabilized following the same procedure used for PSAT deployments (eyes covered and gills irrigated). A small 3–4 cm incision is made with a scalpel in the abdominal region just behind the pectoral fins, and a steel trocar is then used to create an access channel into the peritoneal cavity. The disinfected archival tag is inserted through this opening, after which the incision is closed with absorbable monofilament sutures. A conventional external tag is also placed dorsally to indicate that the fish carries an internal archival device.

Genetic samples (two fin clips) will be collected along with length measurements. Necessary permits were obtained through the relevant Spanish authorities.

All electronic tag datasets will be processed with the standard track models, GPE3 and state-space models (SSM).

## Results

Tagging operations were conducted in two key areas of the northwestern Mediterranean: the Cap de Creus region and, further south, the Blanes Canyon, both of which offered suitable conditions for locating and tagging bluefin tuna (Figure 2).


Figure 2: Locations of the tagged bluefin tuna. Red dots are PSAT tags while green represents the acoustic.

Across these sites, the full set of three PSAT tags—L330-4918, L330-4920, and L330-4919—were successfully deployed, along with two external acoustic tags (1613471 and 1613468). The fish tagged ranged from 111 cm to 149 cm CFL (average size of 130 cm), and all captures were handled correctly, allowing the tuna to be released in good condition. Unfortunately, two of the PSAT tags detached prematurely, and the causes of these early releases are currently under evaluation (Table 1).

| | | Position | | | | | | | Position | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Hour | Lattitude | Longitude | Tag code | e-tag | Size CFL (cm) | Pop-off day | Days@liberty | Lattitude | Longitude | Recovered |
| 10/04/2025 | 15:46 | 42,2408 | 3,1966 | L330-4918 | POP-UP | 111 | 10/07/2025 | 91 | 39,2836 | 2,78265 | No |
| 10/04/2025 | 19:13 | 42,2362 | 3,2028 | L330-4920 | POP-UP | 120 | - | - | - | - | |
| 07/06/2025 | 9:00 | 41,6221 | 2,9065 | L330-4919 | POP-UP | 144 | 15/10/2025 | 130 | 39,2836 | 2,78265 | Yes |
| 07/06/2025 | 9:30 | 41,6221 | 2,9065 | 1613471 | EXT-SONI | 134 | - | - | - | - | |
| 10/08/2025 | 10:13 | 41,6205 | 2,9240 | 1613468 | EXT-SONI | 149 | - | - | - | - | |

Table 1. Data of the bluefin tuna individuals tagged during the expeditions.

The L330-4918 tag popped off between Sardinia and Sicily, approximately 80 nautical miles from the nearest coast, making its physical recovery impossible (Figure 3). In contrast, the L330-4919 tag detached south of Mallorca, and its subsequent drift brought it toward the coastline, where it was successfully retrieved. The recovered device was delivered to ICCAT, and the forthcoming data download will provide a more detailed understanding of the behavior and movement patterns of that individual bluefin tuna.

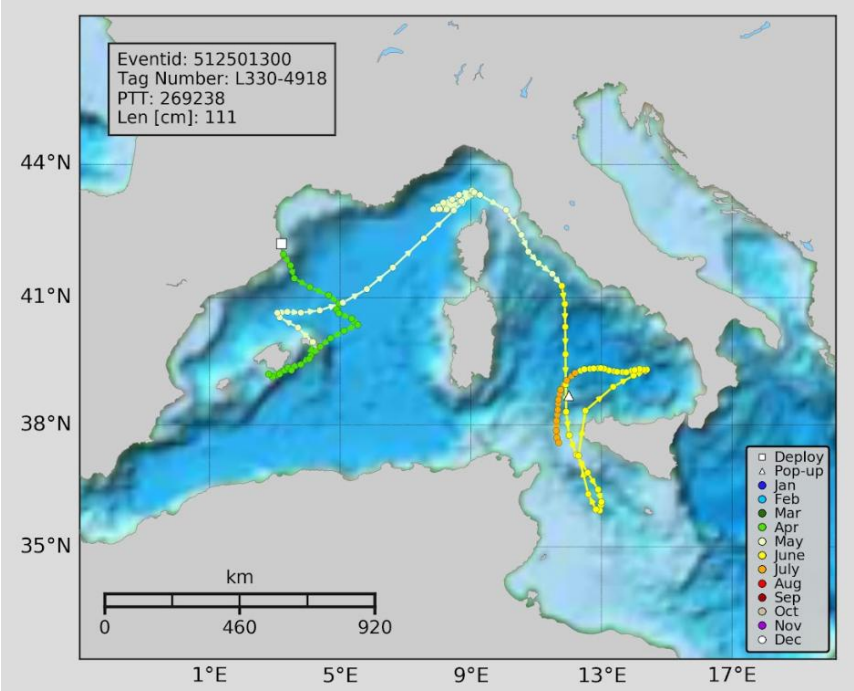


Figure 3: Preliminary track from tag L330-4918 (11 cm CFL).

## Conclusion and recommendations

Once again, sea conditions strongly influenced the field campaigns, delaying several planned outings with recreational fishers and resulting in a mismatch between the peak presence of tuna and the selected survey windows. Nevertheless, five bluefin tuna were successfully tagged, including three equipped with PSAT devices which, despite experiencing premature detachment—possibly linked to the relatively small size of the individuals—are still expected to provide valuable insights into their movements and potential reproductive behaviour.

The physical recovery of one of the tags will make it possible to examine the tuna's movements in far greater detail, providing high-resolution data that offer unique insights into its behaviour and underlying biology. This information will allow us to reconstruct fine-scale activity patterns, improve our understanding of habitat use, and deepen our knowledge of how individuals navigate and utilize the northwestern Mediterranean.

Phase 14 has enabled Stanford, TAG program, in collaboration with the Barcelona Zoo to return the effort to the WN Mediterranean area. Spawning and movement between the different basins are key to understand the bluefin tuna biology. Understanding the behaviour and movements of small- and medium-sized bluefin tuna is essential for accurately describing how these individuals use spawning areas and different basins within the Mediterranean Sea.

**Acknowledgments**

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**References.**

Aranda, G., Abascal, F. J., Varela, J. L., & Medina, A. (2013). *Spawning behaviour and post-spawning migration patterns of Atlantic bluefin tuna (Thunnus thynnus) ascertained from satellite archival tags. PLOS ONE, 8(10), e76445.*

Cermeño, P., Quílez-Badia, G., Ospina-Alvarez, A., Sainz-Trápaga, S., Boustany, A. M., Seitz, A. C., Tudela, S., & Block, B. A. (2015). *Electronic tagging of Atlantic Bluefin Tuna (Thunnus thynnus, L.) reveals habitat use and behaviors in the Mediterranean Sea*. *PLOS ONE, 10(2*), e0116638.

Rouyer, T., Bernard, S., Kerzerho, V., Giordano, N., Giordano, F., Ellul, S., Ellul, G., Derridj, O., Canet, R., Deguara, S., Wendling, B., & Bonhommeau, S. (2022). *Electronic tagging of Bluefin Tunas from the Maltese spawning ground suggests size-dependent migration dynamics*. *Environmental Biology of Fishes, 105*(5), 635–644.