

Report on the Activities of the Stanford University TAG A Giant Team for the Barcelona Zoo Conservation Grant

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Overview

In the North Atlantic and Mediterranean Sea, Stanford University Tag-A-Giant (TAG) research program researchers have electronically tagged ABT since 1996. To date, 1,368 electronic tags (internal archival, pop-up archival satellite (PAT), and acoustic tags) have been deployed on adolescent and mature fish primarily in the western Atlantic Ocean along the eastern seaboard of North America. Another 75 have been deployed in collaborations with scientists in the Mediterranean Sea. This electronic tagging effort has created a detailed time series for Atlantic bluefin tuna (ABFT) from 4 to 25 years of age, with over 45,000 tracking days from western Atlantic releases and tens of thousands of acoustic detections. Tracks from 1 to 4.5 years have been obtained with archival tags. Novel attachment protocols have enabled up to one year tracks with PAT satellite tags attached to giant bluefin tuna. These valuable data sets take rigorous efforts that require tag preparation, deployment, tag data collection upon tag recovery, processing and interpretation. It is often a multi-year process for a single data set from deployment date to the final archive date at ICCAT or NOAA databases. Population assignments of a proportion of the ABFT from the western Atlantic with track data have been possible using genetics of fin clips taken during tagging events. Assignments to a population are also possible when mature electronically tagged fish visit a known spawning site. Models incorporating these types of data have improved the capacity to predict spatial habitat use by population, maturity, natural and fisheries mortality, and to impact our capacity to project biomass trajectories.

We utilized funds from the Barcelona Zoo conservation program to tag Atlantic bluefin tuna in the eastern Mediterranean Sea an area that is very difficult to get data from.

Results

We put tags onto bluefin tuna and in the eastern Mediterranean Sea and recovered the data by collaborating with Israeli, US and Spanish scientists. Using the Barcelona Zoo funding we sent a team from Stanford to Israel and worked with sport fishermen to tag bluefin tuna (Figure 1 and Table 1). We were assisted in recovery of tags by Dr. Pablo Cermenó.



Figure 1. The release of bluefin tuna sponsored by the Barcelona Zoo by the TAG team led to two fish being tagged in the Mediterranean in 2017

Table 1. Information on the release and reporting of the two electronic tags.

Tagcode	ptt	Tagging Date	Deploy Longitude	Deploy Latitude	Measure Length cfl	prog_popdate	popdatse	poplon	poplat
PAM116P1986	166395	6/15/2017	34.40978	31.98052	135	2/10/2018	11/12/2017 13:32	14.519	32.838
PAM116P1962	152985	6/15/2017	34.28	32.04	125	12/12/2017	12/13/2017 2:53	12.659	41.278

Objective: Satellite Tagging of Atlantic Bluefin Tuna in the eastern Mediterranean Sea

For this experiment we purchased two mini-Pats from Wildlife Computers at a cost of \$4000 each. The tags take data every second and then compute positions based on light based longitude and sea surface and bathymetric latitude algorithms developed in our lab. We used our travel funds from the Zoo to go to the eastern Mediterranean Sea where we collaborated with scientists from Israel to conduct sport fishing operations about 25 nm from shore, that resulted in the release of two fish of approximately 40 kg. The two MiniPAT satellite tags placed on the bluefin tuna with a two point attachment technique, performed well, staying on the tagged fish for 5 months (tag 166295) and 6 months (Tag 152985) respectively. These tags recorded data on position, depth and temperature. Together these two tags have generated 330 days of data. Both fish remained in the Mediterranean Sea throughout the duration of the tracks. The tagged ABFT demonstrated a range of migratory patterns similar to what was reported in Cermenó et al. 2015.

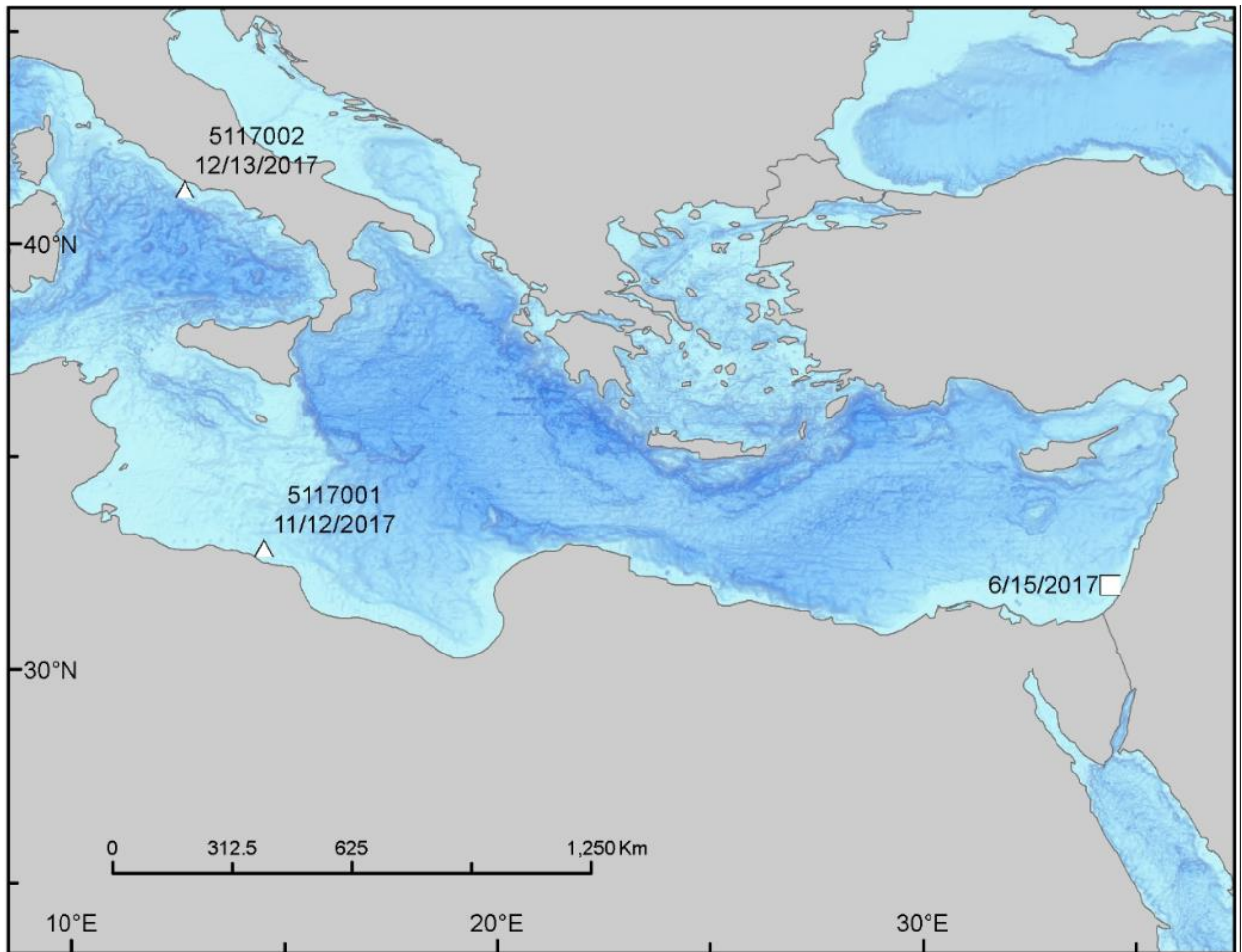


Figure 2. Tag location (square) and pop-up transmitting/and or release locations (triangle) of two bluefin tuna tagged in the Mediterranean.

The two bluefin tuna popped up under distinctly different circumstances. The first tag 16P1986 was tagged off Israel and had moved to an area upon premature release close to the northern coast of Africa. The fish had ranged from the eastern Mediterranean Sea into the central and western Mediterranean sea. The bluefin tuna visited a well known foraging and spawning areas in the western Mediterranean sea (the Balearics). The second fish has just popped up in the past week near the coasts of Italy and was recovered on December 17th. The tag has not been analyzed but by recovering the tag it will have an archival record of high value.

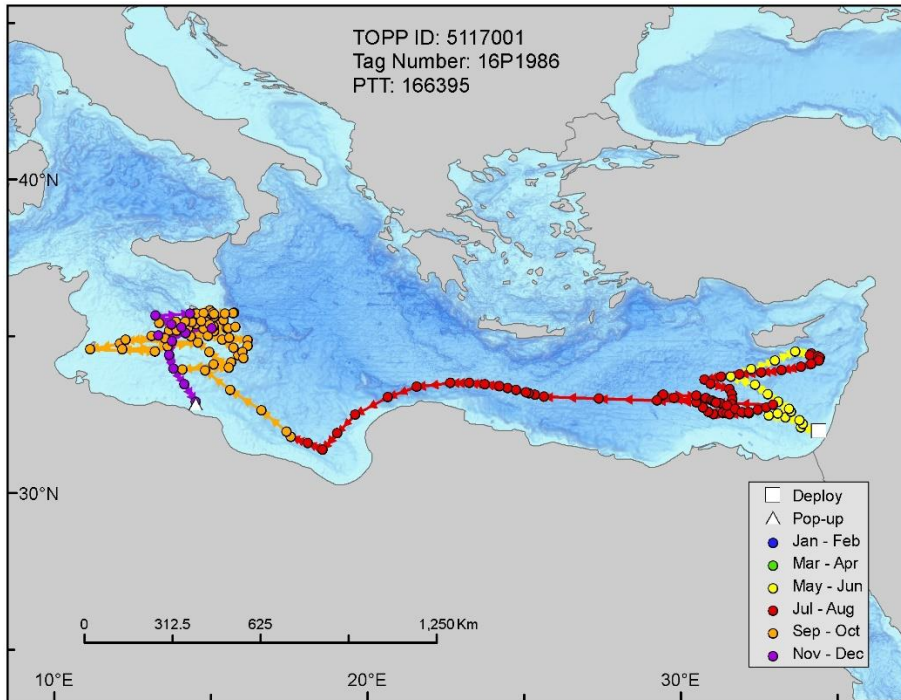
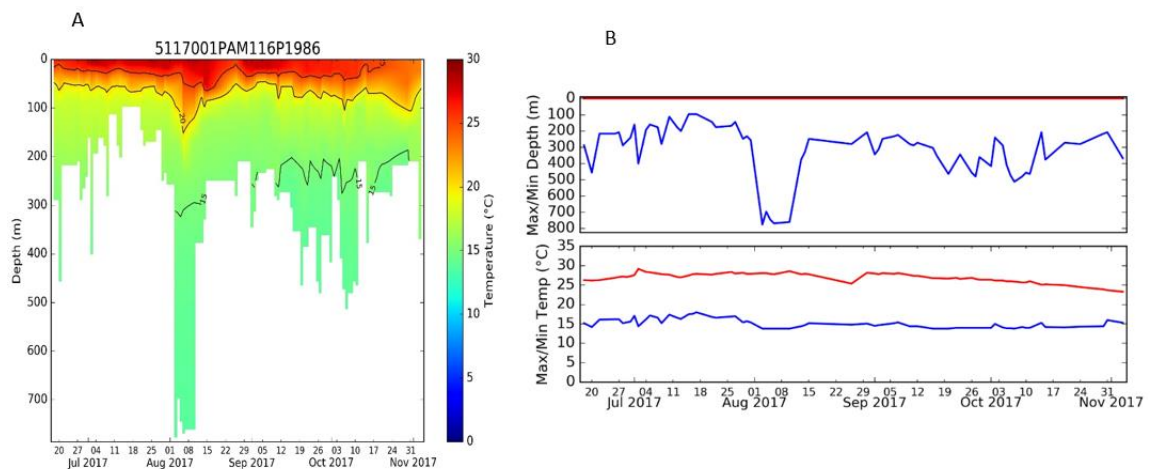


Figure 3. The track of the Atlantic bluefin tuna after release in the eastern Mediterranean. This fish swam to the region south of the Balearics in the western Mediterranean and the tag popped up prematurely in November.

The depth distribution (Figure 4) of this bluefin tuna was revealed by the time at depth transmissions and the minimum and maximum depth excursions. This data showed that the bluefin tuna (116P1986) remained in relatively warm waters the entire duration during the track with surface temperatures well above 25°C. The fish ranged in maximal depths to dives over 750m and entered into waters at depth of 10°C. The maximum depth and



The second tag was PAM116 P1962, popped up on schedule 6 months post release. This tag was south of Rome, about 7 nautical miles out (Figure 2). The tag has been retrieved and the data will be recovered from an archive on the tag. The data will be valuable to discern if the fish spawned at any time during the time it was tracked and if so, where this occurred.

Conclusions

The Stanford University TAG team has successfully demonstrated it can tag Atlantic bluefin in the eastern Mediterranean and leave tags on for over six months in duration. We are pleased with the early results and the preliminary work supported by the Zoo will hopefully enable a more sophisticated grant for the team involved in the research.