

FILAMO Grant —Connecting field work and laboratory experiments to numerical modelling in a changing marine environment

Early-career scientist: Nerea Lezama-Ochoa

Report on my experience

I have spent the last two months working with Dr. Melanie Hutchinson at the Hawaii's Institute of Marine Biology (HIMB), located in the Coconut Island (Oahu, Hawaii). HIMB is home to over 100 researchers, postdocs, students and staff who develop new technologies to conserve marine and coastal biodiversity both in Hawai'i and globally. I worked in the Holland Lab, which uses tracking technologies to study the movements of sharks and fishes. Holland Lab is one of the most important research groups analyzing tagging data of pelagic species. My time working with Dr. Hutchinson and Dr. Holland has contributed significantly to my career making new contacts and collaborations that will benefit both, to AZTI and the HIMB. The marine lab has been a perfect place to work to fit for my knowledge gaps on analyzing tagging data that I was trying to learn since years ago. At personal level, the experience acquired as well as the knowledge learned during my stay in Hawaii funded by the FILAMO award will definitely help to put me on the map of major scientific research organizations who works for the conservation of pelagic marine species.

I will use what I learnt during my stay to help to analyze data of Bluefin tuna and mobulid ray species in the Tuna Research Division in AZTI-Tecnalia. At the same time, my plans are to collaborate with Dr. Hutchison and scientists from NOAA to create habitat distribution models using tagging data from hammerhead sharks to study the impact of climate change on the distribution of their populations around Hawaii. We plan to publish papers based on this work in collaboration between marine organizations.

My background

My doctoral research (AZTI, Spain) was focused on studying the biodiversity and habitat preferences of the bycatch communities from the tropical tuna purse-seine fishery in the Atlantic, Indian and Pacific Oceans using statistical models. For the last three years, I have been working at the Inter-American Tropical Tuna Commission (IATTC, San Diego), studying the spatial and temporal distribution of *Mobula mobular*, an important species in bycatch of the tuna purse-seine fisheries in the eastern Tropical Pacific.

I have applied different Species Distribution Models (GAMs, INLA, MaxEnt, etc) to study their habitats, searching for optimal approaches to reduce their bycatch with the minimum impact on the tuna fisheries. I have also included considerations of the possible effect of climate change on some of their distributions based on these habitat models. Our aim was to identify different bycatch hotspots of *M. mobular* as well as to understand the oceanographic processes that explain their distribution in the eastern Pacific and Atlantic Oceans. Some of the models I run so far were develop using tagging data to validate the presence of the species. However, learning analyze tagging data and create habitat distribution models using these data was one of the main goals I wanted to reach after finished my postdoc and during my stay in Hawaii.

What I learnt in Hawaii

I attended a workshop during two weeks to learn how to clean, prepare and analyze satellite and acoustic tagging data from sharks at HIMB taught by Dr. Baun and Dr. Scott. Both scientists are experts analyzing tagging data and work for the conservation of marine pelagic species around Hawaii. Specifically, I learnt (using R software):

- How to merge different sources and tagging data in a common database
- Clean, organize and prepare data before to analyze it
- Create the main exploratory plots to understand the time the species spend at surface and during night/day using the R package “RchivalTag” created by Dr. Baun
- Create maps with the movement of the animals by year and month
- Create depth-temperature profiles to understand their habitat patterns
- Overlap this information with oceanographic information to identify areas of reproduction, feeding, etc using the R package “oceanmap” created by Dr. Baun

During the workshop and the weeks after, a great interaction was created between scientists working at HIMB and NOAA. Numerous meetings were arranged for sharing ideas. Students participated in the workshop and showed us the labs and field work they are doing to understand the feeding patterns of vulnerable species of sharks that inhabit Oahu.

With the aim of build a network for future collaborations, I presented a seminar at NOAA Hawaii to explain my background, the use of species distribution models to understand the habitat of bycatch species and the main mitigation measures we are applying in the European Union to reduce the mortality of elasmobranch in tuna purse-seine vessels. The objective of the seminar was to introduce my work to start developing habitat distribution models using hammerhead tagging data (satellite and acoustic data for 15 years) from HIMB (project developed by Dr. Hutchinson) and oceanographic data from NOAA to understand their habitat use in Hawaii. Future projections under climate change scenarios are expected to be obtained. Random Forest or Generalized Additive models (GAMs) are expected to be used for this purpose.

At the same time, different projects were started in AZTI and were developed with the help of Dr. Hutchinson and Dr. Baun. The first one was to analyze the post-release survival of mobulid rays caught by tuna purse-seine fishery in the Atlantic Ocean. The scripts from the workshop were used for this project and tagging data from Wildlife Computers was analyzed. The second one was to help to analyze tagging data from Bluefin tuna species caught in the Bay of Biscay to study their migratory patterns in the Atlantic and Mediterranean Sea. Geolocation of the species and movement maps were created. Both projects, funded by the Basque Government and the European Union, will be developed deeper during 2020 in AZTI-Tecnalia.

Thank you for this opportunity. This grant not only gave me the opportunity to learn new statistical methods and meet recognized scientists from USA, but leaves me in a very good position to be able to develop my future work at AZTI during 2020. I would like to thank all the shark research team and particularly to Dr. Melanie Hutchinson for dedicating part of her time to teach me and introducing me to this new tagging world to me. And the last but not the less important for showing me the beauty of Hawaii.