

## What determines spawning phenology in Bluefin tuna?

Bluefin tuna migrates all over the Atlantic to feed – but at some point it migrates to the Mediterranean to spawn. It spawns around the Balearic Islands when the temperature is above 20 degrees, and leaves back to the Atlantic to forage for another year. But what is it that determines the timing of spawning in this species? What are the fitness of eggs spawned at different times of the year in the Mediterranean?

*Bluefin tuna were harvested along the Norwegian coast in the 50ies-70ies. Here is a picture of a landed catch in Telavåg, Sotra around 1972.*



Understanding the value of offspring spawned over the seasons is a valuable first step to predict how environmental factors and climate change may affect the phenology and recruitment of fish species.

**Method:** The Master project involve bioenergetics and ecological modelling the foraging process, metabolism and growth of Bluefin tuna. We have developed a model for Bluefin tuna already, which can be applied and further developed in the project ([Reglero & al 2011](#)). Environmental data from the Balearic Sea can be used as forcing, in collaboration with colleagues in Palma, Mallorca. The modelling is not very demanding, but an interest in computing and quantitative analysis is needed.

**Research environment:** The master student will be a member of the Theoretical Ecology Group <http://bio.uib.no/te/> and also collaborate with researchers in Mallorca with expertise in Bluefin tuna larval ecology (Patricia Reglero).

**Supervisor:** [Øyvind Fiksen](#)

**Literature** (Druon et al., 2016, Reglero et al., 2015, Reglero et al., 2014b, Reglero et al., 2014a, Muhling et al., 2013, Reglero et al., 2012, Torres et al.,

2011, Reglero et al., 2011, Catalan et al., 2011, Varpe, 2012, McNamara and Houston, 2008)

- CATALAN, I. A., TEJEDOR, A., ALEMANY, F. & REGLERO, P. 2011. Trophic ecology of Atlantic bluefin tuna *Thunnus thynnus* larvae. *Journal of Fish Biology*, 78, 1545-1560.
- DRUON, J. N., FROMENTIN, J. M., HANKE, A. R., ARRIZABALAGA, H., DAMALAS, D., TICINA, V., QUILEZ-BADIA, G., RAMIREZ, K., ARREGUI, I., TSERPES, G., REGLERO, P., DEFLORIO, M., ORAY, I., KARAKULAK, F. S., MEGALBFONOU, P., CEYHAN, T., GRUBISIC, L., MACKENZIE, B. R., LAMKIN, J., AFONSO, P. & ADDIS, P. 2016. Habitat suitability of the Atlantic bluefin tuna by size class: An ecological niche approach. *Progress in Oceanography*, 142, 30-46.
- MCNAMARA, J. M. & HOUSTON, A. I. 2008. Optimal annual routines: behaviour in the context of physiology and ecology. *Philosophical Transactions of the Royal Society B-Biological Sciences*, 363, 301-319.
- MUHLING, B. A., REGLERO, P., CIANNELLI, L., ALVAREZ-BERASTEGUI, D., ALEMANY, F., LAMKIN, J. T. & ROFFER, M. A. 2013. Comparison between environmental characteristics of larval bluefin tuna *Thunnus thynnus* habitat in the Gulf of Mexico and western Mediterranean Sea. *Marine Ecology Progress Series*, 486, 257-276.
- REGLERO, P., BLANCO, E., ORTEGA, A., FIKSEN, O., DE LA GANDARA, F., SEOKA, M., VIGURI, F. J. & FOLKVORD, A. 2015. Prey selectivity in piscivorous bluefin tuna larvae reared in the laboratory. *Journal of Plankton Research*, 37, 2-5.
- REGLERO, P., CIANNELLI, L., ALVAREZ-BERASTEGUI, D., BALBIN, R., LOPEZ-JURADO, J. L. & ALEMANY, F. 2012. Geographically and environmentally driven spawning distributions of tuna species in the western Mediterranean Sea. *Marine Ecology Progress Series*, 463, 273-+.
- REGLERO, P., ORTEGA, A., BLANCO, E., FIKSEN, O., VIGURI, F. J., DE LA GANDARA, F., SEOKA, M. & FOLKVORD, A. 2014a. Size-related differences in growth and survival in piscivorous fish larvae fed different prey types. *Aquaculture*, 433, 94-101.
- REGLERO, P., TITTENSOR, D. P., ALVAREZ-BERASTEGUI, D., APARICIO-GONZALEZ, A. & WORM, B. 2014b. Worldwide distributions of tuna larvae: revisiting hypotheses on environmental requirements for spawning habitats. *Marine Ecology Progress Series*, 501, 207-224.
- REGLERO, P., URTIZBEREA, A., TORRES, A. P., ALEMANY, F. & FIKSEN, O. 2011. Cannibalism among size classes of larvae may be a substantial mortality component in tuna. *Marine Ecology Progress Series*, 433, 205-219.
- TORRES, A. P., REGLERO, P., BALBIN, R., URTIZBEREA, A. & ALEMANY, F. 2011. Coexistence of larvae of tuna species and other fish in the surface mixed layer in the NW Mediterranean. *Journal of Plankton Research*, 33, 1793-1812.
- VARPE, O. 2012. Fitness and phenology: annual routines and zooplankton adaptations to seasonal cycles. *Journal of Plankton Research*, 34, 267-276.