18-month PostDoc: "Modeling tropical tuna movements and population dynamics in the Indian Ocean"

JOB DESCRIPTION

Title : Tropical tuna growth, movement and fishery analysis through the inclusion of tagging data into the population and ecosystem dynamics model APECOSM-E in the Indian Ocean

Location: University of Cape Town, MARE Institute, Department of Oceanography, Cape Town, South Africa

Team: International lab ICEMASA, UMR EME (Exploited Marine Ecosystems) Sète, France.

Type of contract: 18 months post-doctoral position funded by the French ANR

Compensation: Annual salary from 22 k€ to 31k€ depending on past experience; insurances included.

Start date: as soon as possible when position filled

Contacts: Olivier Maury (olivier.maury@ird.fr)

Dead-line for application: send CV and short letter of motivation before 1st November 2012.

PROJECT DESCRIPTION

This position is part of the French funded project MACROES (http://www.macroes.ird.fr/). The main objective of MACROES is to better understand and predict the end-to-end dynamics of global oceanic ecosystems in a context of intense fishing and planetary environmental changes (climate change, acidification, ...) by integrating the complex synergies and feedbacks (« top-down » and « bottom-up ») which propagate through the oceanic earth system. The project gives particular emphasis to tuna and the associated fisheries, as they represent the dominant exploited species in the global open ocean in terms of their volume, value and spatial coverage. MACROES is a contribution to the international CLIOTOP Program (http://www.imber.info/index.php/Science/Regional-Programmes/CLIOTOP).

The post-doctoral research fellow will be using the APECOSM-E model. APECOSM-E (Dueri et al., 2012a and b) is a deterministic model that represents the distribution and population dynamics of tropical tuna under the joint effect of environmental conditions and exploitation by fisheries. It is a simplified version of the top predator component of the APECOSM framework (Maury, 2010). The model is structured in 3D space and fish size and considers size dependent reproduction, growth, predation, natural and fishing mortality. Processes are time-, space- and size-dependent and linked to the environment through mechanistic DEB-based bio-energetic or behavioral parameterizations. The effect of fishing is explicitly considered.

A maximum likelihood approach (Faugeras and Maury, 2005) is used to estimate catchability parameters using the catch/effort and size data available in the project. The postdoctoral student will extend the approach by including a tag-recapture component in the likelihood function of the model so that conventional mark-recapture data can be integrated. This will be of critical importance to estimate the horizontal movement parameters of the model which are presently not well constrained in the simulations along with physiological and fishery parameters.

Tagging data from the IOTC Indian Ocean Tuna Tagging Program (IOTTP) will be used. During the IOTTP, more than 200 000 tuna were tagged and released from 2002 to 2009 in the western Indian Ocean. To date an excess of 31,500 tags (15.7%) have been recovered.

TASKS

The post-doctoral research fellow will be in charge of including tag-recapture data into the likelihood approach used to estimate the parameters of the APECOSM-E model. He/She will then run and analyze simulations over the historical period. He/She will be involved in the analysis of simulated 21st century scenarios in which anthropogenic climate change, ocean acidification and fishing will be considered simultaneously according to various fisheries management options. The successful candidate is expected to interact with several research groups in South Africa (Cape Town University) and in France (EME-Sète, LPO-Brest, LSCE-Paris).

REQUIREMENTS

Level: PhD in ecosystem modeling, fishery science, oceanography, applied mathematics or applied statistics.

Necessary skills: good skills in numerical modeling and scientific computing, fortran programming

Desired skills: oceanography, marine ecology, fishery science, statistics, high performance parallel computing, parameter estimation or data assimilation techniques

REFERENCES

Dueri S., B. Faugeras and O. Maury, 2012. Modelling the skipjack tuna dynamics in the Indian Ocean with APECOSM-E: Part 1. Model formulation. Ecological Modelling 245, 41-54.

Dueri S., B. Faugeras and O. Maury 2012. Modelling the skipjack tuna dynamics in the Indian Ocean with APECOSM-E. Part 2: Parameter estimation and sensitivity analysis. Ecological Modelling 245, 55-64.

Maury O., 2010. An overview of APECOSM, a Spatialized Mass Balanced “Apex Predators ECOSystem Model” to Study Physiologically Structured Tuna Population Dynamics in their Ecosystem. *In* Parameterisation of Trophic Interactions in Ecosystem Modelling, M. St John, P. Monfray (eds). Prog. Oceanogr. 2010. 84: 113-117.

Faugeras B. and O. Maury, 2005. An advection-diffusion-reaction size-structured fish population dynamics model combined with a statistical parameter estimation procedure: Application to the Indian Ocean skipjack tuna fishery. Math. Biosciences and Engineering, 2(4):719–741.