JIMAR ANNUAL REPORT FOR FY 2012

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NOAA OFFICE *(Of the primary technical contact)*: PIFSC

NOAA SPONSOR NAME: Réka Domokos

PROJECT PROPOSAL TITLE: Assimilating *in situ* bioacoustic data in a mid-trophic level model and its impact on predicted albacore feeding habitat in the American Samoa waters

FUNDING AGENCY: NOAA

NOAA GOAL *(Check those that apply)*:

- ✠ To protect, restore, and manage the use of coastal and ocean resources through ecosystem-based management
- ☐ To understand climate variability and change to enhance society's ability to plan and respond
- ☐ To serve society's needs for weather and water information
- ☐ To support the nation's commerce with information for safe, efficient, and environmentally sound transportation.
- ☐ Mission Support

PURPOSE OF THE PROJECT *(One paragraph)*:

Pacific tuna stocks are facing increasing fishing pressure while they are also under the influence of natural variability and climate change. Nevertheless, the management of these species is still based on annual statistical stock assessment analyses ignoring environmental and climate variability. There is a need for new complementary approaches for management that relies on the development of ecosystem end-to-end models integrating both natural and anthropological effects. Such models, which describe the spatial population dynamics of tuna in relation to their bio-physical environment (e.g., SEAPODYM, a basin-scale ocean model), require key information and parameterization of the forage for tuna, the Mid-Trophic Level (MTL) micronekton, which is one of the less known components of the ocean ecosystem. To optimize the parameters of the basin-scale SEAPODYM MTL sub-model, *in situ* micronekton biomass should be incorporated at all representative regions within an ocean basin. Therefore, this project undertakes the task of incorporating *in situ* multi-frequency bioacoustic data from four different regions of the Pacific Ocean into SEAPODYM-MTL with a rigorous mathematical method of data assimilation. The incorporation of data from these first four regions is instrumental in the development of SEAPODYM and will lead to massive improvements of the model in the future. Further, the impact of this new parameterization will be tested on the prediction of the feeding

habitat and population dynamics of south Pacific albacore tuna in the Samoa region by comparison of model results to *in situ* data.

PROGRESS DURING FY 2012 *(One-two paragraphs)*:
Include a comparison of the actual accomplishments to the objectives established for the period, along with reasons for the slippage if established objectives were not met

After the development and validation phase of the data assimilation approach in the micronekton model conducted in 2011, the first optimization experiments with actual *in situ* acoustic data were conducted using North Central Pacific transects. However, the biomass in the surface layer was largely underestimated due to the position of the transducer below the hull. Thus, we decided to add 10% of biomass in the surface (e.g., Grandperrin 1975). Also the transects revealed to have a high noise to signal ratio that was filtered. Then, three optimizations experiments have been conducted. The first one used original Hawaii transects without any modification of the data before the processing, the second used the same data but the ratio of the epipelagic layer is increased by 10 percent of the biomass in the water column, and the last one used the same transects but after filtering to reduce the noise to signal ratio. There is a clear improvement in the fit to data between initial parameterization and those resulting from optimization. Still more encouraging, the new parameterization also improves the fit to independent acoustic transects recorded between Tasmania and New Zealand in August 2009 and June and August 2010. Since the parameterization strongly depends on the definition of vertical layers used to integrate the signal, we are now analyzing in more details the biophysical characteristics that can be used to define these layers. Then final optimization experiments will be conducted before the publication of results in a scientific article.

PLANS FOR THE NEXT FISCAL YEAR *(One paragraph)*:

We are in the final phase of the project that should include:

- Writing a scientific article on optimization of micronekton model with acoustic data.
- Writing a scientific article on the optimization approach of the MTL model.
- Update tuna (in particular albacore) application of SEAPODYM with the new micronekton and presentation of results at the scientific committee of the WCPFC. Wrinting a scientific article on south pacific albacore tuna application of SEAPODYM.

LIST OF PAPERS PUBLISHED IN REFERRED JOURNALS DURING FY 2011
OTHER PAPERS, TECHNICAL REPORTS, ETC.
PUBLICATION COUNT
*complete excel attachment (*JIMAR publications request*)

Lehodey, P., Senina, I., Calmettes, B., Royer, F., Gaspar, P., Abécassis, M., Polovina, J., Parker, D., Domokos, R., Hernandez, O., Dessert, M., Kloser, R., Young, J., Lutcavage, M., Handegard, N.O., Hampton, J. (2010). Towards Operational Management of Pelagic

Ecosystems. ICES CM Documents 2010, 20-24 Sep., Nantes, France. 13 pp. (*Best Conference Scientific Paper award*). ISBN 978-87-7482-085-7.

Suntsov, A. and Domokos, R. Vertically migrating micronekton and macrozooplankton communities around Guam and the Northern Mariana Islands. Submitted to Deep-Sea Research I; accepted with moderate revisions

GRADUATES:
Names of students graduating with MS or PhD degrees during FY 2011; Titles of their Thesis or Dissertation
none

AWARDS:
Name of JIMAR employees or project receiving award during the period, and Name of award

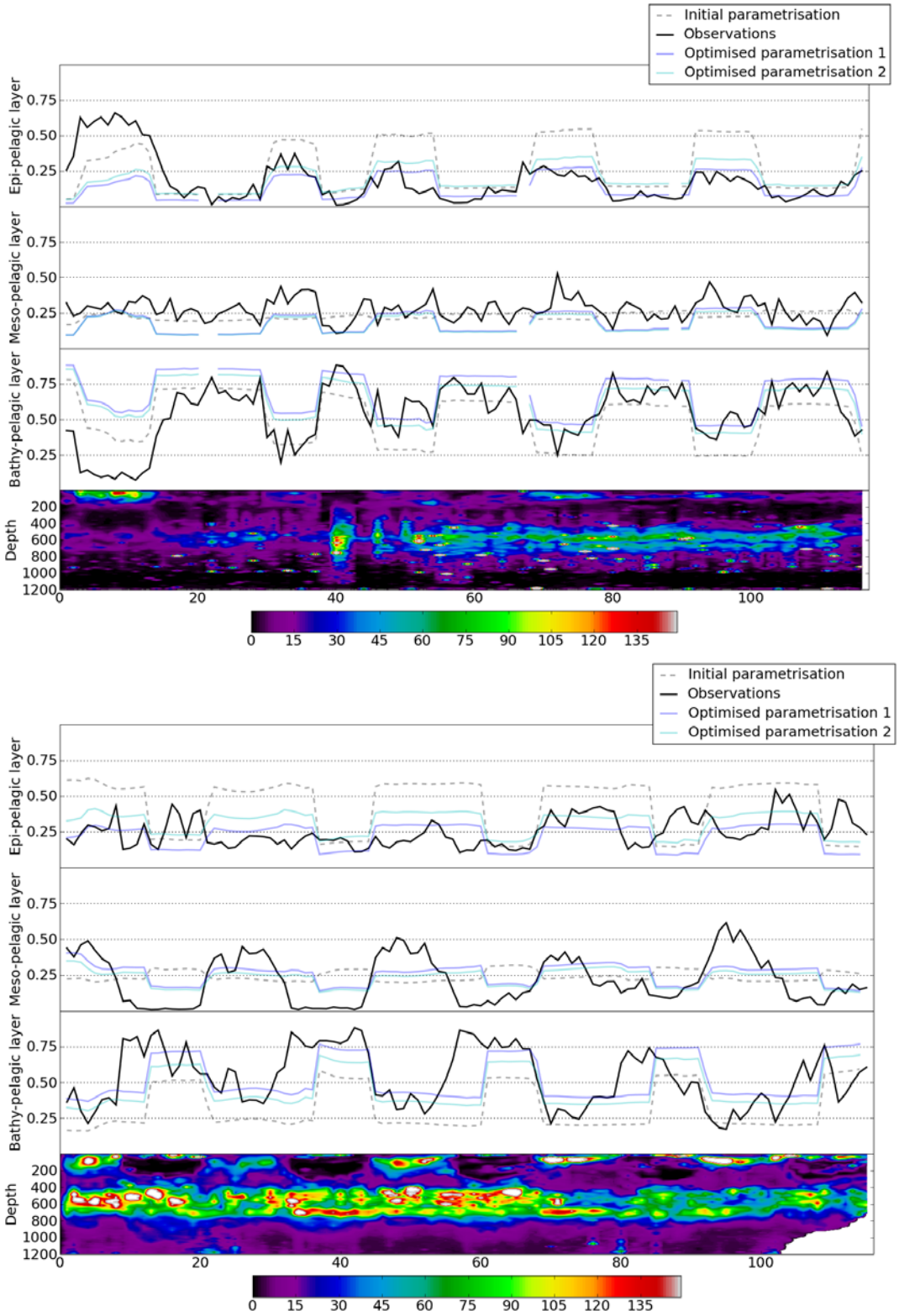
Best Conference Scientific Paper award: Towards Operational Management of Pelagic Ecosystems

PERSONNEL *(on Subcontracts)*:
For projects that awarded subcontracts in the fiscal year, please provide the number of supported postdocs and students from each subgrantee.

None

ACRONYMS:
Please provide the complete descriptions for any acronyms used in any areas of the report. For example: UH (University of Hawaii)

SEAPODYM: Spatial Ecosystem And Populations Dynamics Model
MTL: Mid-Trophic Level
NASC: Nautical Area Scattering Coefficient



Caption 1: Observed (signal) and predicted (biomass) relative values over the three vertical biological layers of the micronecton model for (top) the north Pacific transect used for optimization experiments and (bottom) the Tasman Sea transect used for validation