Wild mussels (photo: Joana Dias)

ECOSUMMER – MARIE CURIE TRAINING SITE

ECOsystem approach to SUstainable Management of the Marine Environment and its living Resources

Newsletter - October 2007

The ECOSUMMER training site (project 020501-2, funded under the EU's FP6 Marie Curie programme is now in its 20th month and has so far funded 21 trainees for periods of research training lasting between 6 months and 3 years. In addition, the project has run two generic skills training course, in Vigo (June 2006) and Heraklion (May 2007). The project newsletter will present some of the project activities, in particular the work of the various trainees.

Contents for this issue:

Evolutionary genetics of the *Mytilus edulis* complex in Scotland

This is a 36 months research PhD project, established in joint collaboration by the University of Aberdeen, the Fisheries Research Services Marine Laboratory in Aberdeen, Scotland, and the Hellenic Centre of Marine Research in Greece. The project began in January 2007, and arose from the interest shown by the Scottish Shellfish Industry, Government and Science to clarify the status of *Mytilus* (Blue mussel) species present in the coastal waters of Scotland.

Joana Dias sampling mussels (left) and plankton (right)

Most recent classifications suggest the existence of four species of Blue mussels: *M. californianus* (which is found in the western USA and has very distinctive shell ridges), and the other rather more similar species *M. edulis*, *M. galloprovincialis* and *M. trossulus*, which are referred to as the *Mytilus edulis* species complex.

Shellfish farming is an important and growing industry in Scotland, dominated by the production of *M. edulis*, the endemic species. Other species, particularly, *M. galloprovincialis,* have been reported as present in Scotland, however these reports are a decade or more old, and used relatively old-fashioned identification methods. It is not clear that they reflect today's reality, or meet the standards available through modern genetic identification tools. Climate change is known to be influencing the

distribution of *Mytilus* species in other areas of the world, and so there is considerable uncertainty in the current distribution of *Mytilus* species in Scotland.

In the first year of this project we started by using molecular markers to identify the presence and distribution of *Mytilus* species from specific areas in Scotland where non-*edulis* species were suspected to be present. The survey is currently being extended to a national scale, through extensive sampling of mussels both from wild populations and cultivation units, and using newly developed molecular methods. Future work will involve the use of modern phylogenetic and evolutionary reconstructive methods.studies to characterise reproductive and developmental aspects of these species in Scottish coastal waters, and to investigate the origin of non-*edulis* species in Scotland. In view of the scientific and economic interest of this subject, the project is being carried out in collaboration with the aquaculture industry, which has provided extremely encouraging support and valuable advice.

Project dissemination

P. Joana Dias (2007). Evolutionary genetics of the *Mytilus edulis* complex in Scotland. FRS Young Scientists Seminar, Aberdeen, Scotland. ***Oral presentation.***

P. Joana Dias, Michael Bland, Stuart Piertney, Ian Davies, Michael Snow (2007). Evolutionary genetics of the *Mytilus edulis* complex in Scotland. Scottish Marine Group Meeting 2007, Edinburgh, Scotland. ***Prize received for best poster presentation.***

P. Joana Dias (2007). Blue mussels, ok, but which blue mussels? *The Grower*, Newsletter for the Association of Scottish Shellfish Growers, Issue June 2007. ***Newsletter Article.***

P. Joana Dias, Lauriane Sollelis, Stuart Piertney, Ian Davies, Michael Snow (2007). Identification of *Mytilus edulis* complex species using real-time PCR. 10th International Conference on Shellfish Restoration, Vlissingen, Netherlands. ***Submitted for poster presentation.***

Joana Dias, FRS Marine Laboratory, UK

Development of a GIS-based Tool for Interfacing and Manipulation of Time Series 4D (3D + time) Marine Datasets

The Hellenic Centre for Marine Research (HCMR), in Greece, possesses a large number of marine datasets from diverse sources – such as remote sensing, electronic sensors or data interpolation – that need to be stored so as to be readily accessible for queries by marine scientists. It should be possible to display the results of these queries using sophisticated techniques, such as 3D graphics and animations, and taking into account time (as the 4th dimension). Thus, there is a need for a powerful, yet simple to use, GIS-based tool that stores marine time-series datasets, performs analytical GIS functions and visualizes the results in 3D animations. Other analytical functions of such a tool could include characterization of relationships among different environmental variables, in space and time, as well as 3D mapping of certain ocean processes like upwelling, fronts or gyres.

We developed a GIS-based tool with the capability of interfacing and manipulation of time series 4D (3D + time) marine datasets. This system, based on the client/server paradigm (see fig. 1), is being implemented using several tools. Under a distributed and heterogeneous environment, Java is the natural choice of programming language, since it is simple, distributed, portable and multi-threaded and it is the ideal choice to implement the logical layer of this tool. Swing is used to develop the Graphical User Interface (GUI), *i.e.* the presentation layer. For the persistence layer, MySQL was chosen as the Relational Database Management System (RDBMS), because of its proven scalability, flexibility and high performance. The connection layer, between the client and the server, is assured by JDBC (Java Database

Connectivity), the industry standard for connectivity between the Java programming language and a wide range of databases.

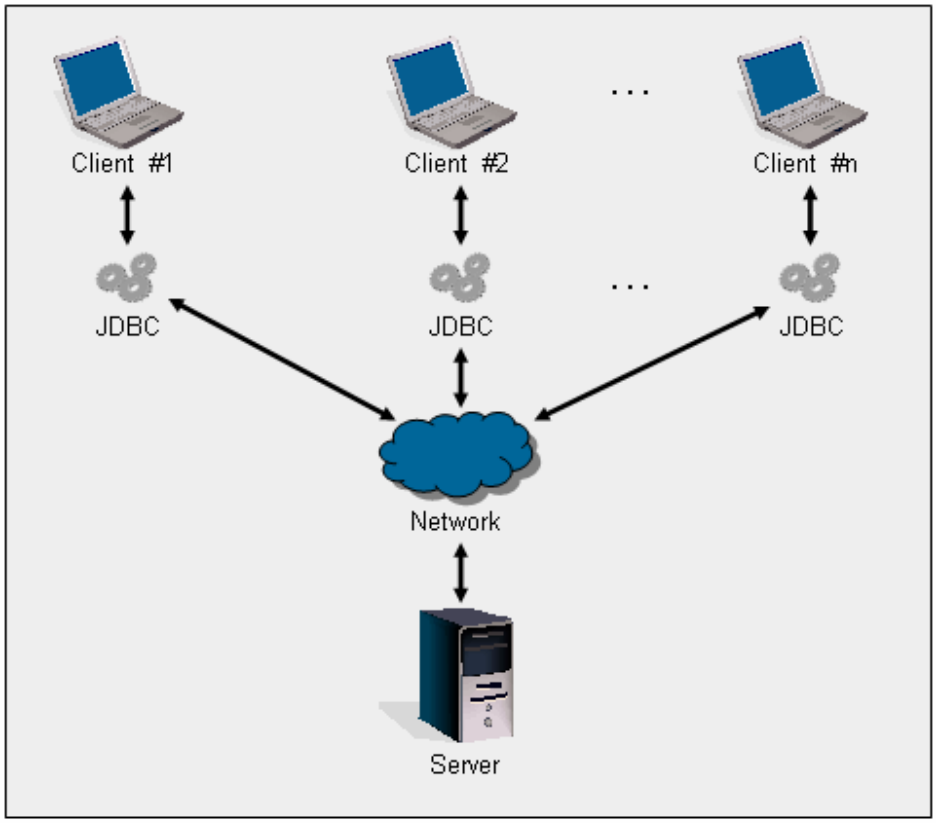

Fig. 1 – The system based on the client/server paradigm

This tool merges expertise from computer and marine science backgrounds (bioinformatics) in order to facilitate the understanding of the ever changing marine world through the manipulation of a wide variety of 4D marine datasets. It is expected to help scientists in their tasks by using a complete system capable of exploring and displaying (with 3D graphics) the required results in an easy and productive way. Ultimately, this will help us, humankind, to better understand some marine/ocean phenomena and also to discover previously unknown relationships between them.

Ricardo Fernandes, Institute of Marine Biological Resources, HCMR, Greece

Bottlenose dolphin, *Tursiops truncatus* (Montagu 1821), trophic ecology and population structure in Galicia, NW Spain

Bottlenose dolphins are widely distributed in inshore and offshore waters in temperate and tropical zones of all oceans and peripheral seas. Nevertheless the small size of the European populations and their coastal distribution bings them into regular contact with human activities. Conservation measures have been undertaken and the species is recorded in the Habitats Directive as a Species of Special Interest (Directive 92/43/CEE). In this project several techniques (stomach contents, stable isotopes and genetic analyses) are being used to test whether there are separate inshore and offshore populations or ecotypes, as has been described for bottlenose dolphins in other areas of the world, and whether there is spatial segregation by sex or age or the existence of two populations or ecotypes (one coastal resident group and one offshore). The data gathered in the study will help in the implementation of a successful conservation plan.

Bottlenose dolphins (photo: CEMMA)

At present, stable isotope analyses ($\delta^{13}C$ and $\delta^{15}N$) are being performed on skin and muscle samples from 40 bottlenose dolphins stranded or by-caught between 1998-2005, and the tissues of 12 known dolphin prey species. At a total length of 150 - 200

cm, dolphins show a marked change in trophic level, as seen when comparing $\delta^{15}N$ signatures of skin (short turnover time) and muscle (long turnover time). This change is probably due to the change in diet associated with weaning. Based on $\delta^{15}N$, the trophic level of the dolphins decreases with increasing body length and this trend is stronger in males, which could be an indicator of social segregation and movements within the population. Models relating isotopic composition of the predator and that of its prey are being developed. The results will be compared with existing data on diet from stomach content analyses.

During the Marie Curie funded training period, microsatellite markers will be analysed to determine whether there is genetic evidence for segregation into two populations.

Ruth Fernández, University of Aberdeen, UK

Water quality analysis to detect Harmful Algal Blooms on the Galician coast

The 1st of July 2007 was the official starting day of the project 'Water quality analysis methods aimed to study and detect Harmful Algal Blooms on the Galician coast' that is being hosted at the University of Vigo, Spain. During July there were two sampling cruises in the Galician Rias.

The first cruise took place in the Ría of Arousa on10th of July. The sampling team consisted of five people, all from the University of Vigo: Dr. Jesús Torres Penenzuela and Angela Mosquera Giménez from the laboratory of Remote Sensing and GIS, (Department of Applied Physics, Faculty of Marine Sciences), Vagelis Spyrakos and Daniel Pérez Estévez from the laboratory of Genetics and Immunology (Department of Biochemistry, Faculty of Biology) and Alberto Acuña Couñago from the laboratory of aquatic ecology (Department of Ecology and Animal Biology).

The second sampling destination was the Ria of Vigo, on 25th July. Luis González Vilas from the the laboratory of Remote sensing and GIS joined us, inceasing the number of the participants to six.

Left: Jesús and Vagelis are lowering a sensor that measures and calculates several physicochemical parameters. Middle: Daniel is collecting mussel larvae. Right: Alberto is ready to lower a phytoplankton net.

Left:. Everyone in action. Right: On the way to another sampling station, L-R: Luis, Daniel, Vagelis, Alberto, Angela.

Vagelis Spyrakos, University of Vigo, Spain

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