Mid-term Research Programme 2006-2010 of the Institute for Limnology of the Austrian Academy of Sciences

(Translation of the version originally written in German in April 2005)

1. Main objective of the research programme of the Institute for Limnology

The study of ***"Ecophysiology and evolutionary ecology of aquatic organisms and communities"*** shall remain the primary research objective of the Institute for Limnology. We aim, however, at some modifications with regard to its content and structure. Based upon the focus of the Mid-term Research Programme (MRP) 2001-2005 and taking into consideration some structural changes in the course of the extension of the Institute and the replacement of four research positions within the next three years, we will modify the existing research programme within MRP 2006-2010. Two new research areas were developed within the previous programme ***"Formation and maintenance of diversity at the level of individuals, populations, species, and ecosystems":*** (1) A formerly unknown intraspecific diversity was demonstrated within microbial ecology and (2) climate-related algal and paleolimnological research revealed the importance of catchment area and long-range climatic effects for lake ecosystems. Within the MRP 2006-2010 we aim at a synthesis of these two subject areas by complementing the existing limnological research with investigations in terrestrial ecology and theoretical evolutionary biology. The perspective is a forward-looking research orientation under a changing socio-economic context, which requires increased public awareness of our research and demands for a more direct applicability of the results of basic research. These topical and structural changes may suggest a change of the Institute's name into 'Institute for Aquatic and Evolutionary Ecology'. A further goal of this change of name is the signalling effect with regard to the development of a new, interdisciplinary research area.

2. Catalogue of priorities

The former research focus is replaced by the modified objective, to investigate the ***"Extent, origin and ecological significance of intraspecific diversity of aquatic micro- and macroorganisms"***. This theme shall have the highest priority in all research fields of the Institute. The principle differences between prokaryotic and

eukaryotic organisms shall be illuminated. Genomes of microorganisms often differ considerably within one species, whereas such differences are smaller in higher organisms (e.g. vertebrates); however, intraspecific differentiation is also known for the latter (e.g. ecotypes). The obvious, fundamental differences between micro- and macroorganisms gained only minor importance in ecological research. The ecological significance of the intraspecific genetic diversity (microdiversity) shall be investigated in our laboratory for aquatic macroorganisms (e.g. coregonids in fish ecology) and microorganisms (heterotrophic bacteria, phototrophic cyanobacteria, fungi and protists). All the organisms shall be investigated by means of novel molecular and genetic methods; furthermore the effects of catchment area shall be investigated, specifically for microorganisms, because a global and ubiquitous distribution is currently assumed for the latter. The main challenge of such a research program is to link intraspecific molecular diversity with ecological aspects. With respect to biogeography this has already been investigated in microbial ecology within the MRP 2001-2005. Does high intraspecific genetic diversity correspond to a high ecological potential, i.e. a wide ecophysiological reaction norm? Or do, in contrast, only a few key genes determine the ecological amplitude? Different time scales, ranging from short-term, reversible acclimations to evolved and genetically fixed adaptations need to be considered for answering these key questions. Palaeolimnology offers the opportunity to analyse long-term variation, which is not accessible from evolutionary and ecological research with extant organisms.

The research programme outlined above is at the cutting edge within aquatic ecology, linking limnology with terrestrial and evolutionary ecology. The new research programme continues the scientific demand of the former, i.e. to recognise limnology as a sub-discipline of ecology and to give impulses for the higher research field. We will continue to use aquatic organisms and ecosystems to address general ecological and evolutionary issues. Even though these research issues are primarily related to basic research, there is a gradual transition to applied limnology, for instance with respect to the toxin production of cyanobacteria and the ecology of groundwater organisms. Groundwater resources will increasingly become important for maintenance of the human population in the 21st century, and microorganisms are responsible for element flow and detoxification of xenobiotics. Still, the genetic diversity and physiological capacity of groundwater organisms are largely unknown. The unity of basic and applied limnology is further demonstrated by the evaluation of

the ecological integrity of inland waters as demanded by the EU water framework directive. As a second priority, the Institute will try to keep a broad professional expertise to act as consultant for regional and federal agencies. In third priority, the Institute will continue its educational efforts. The International Postgraduate Programmes in Limnology (IPGL) has a leading role at the interface between research and education. The IPGL has an excellent national and international reputation regarding the transfer of knowledge to African and Asian (mainly China) countries. Several current and future research projects are based upon the long-term cooperation with former IPGL students. The qualified senior scientists will continue their lecturing at the universities of Salzburg, Vienna, and Innsbruck. Graduate and post-graduate students shall be integrated more closely into the institute's research activities than it is usual and feasible at most Austrian universities.