



*Mare Lac* — MASTERS SCIENCE DEGREE COURSE  
Advanced Studies in Marine and Lacustrine Sciences



*Mare Lac*

MASTERS SCIENCE DEGREE COURSE



GHENT UNIVERSITY

**Advanced Studies in Marine and Lacustrine Sciences**

**Thesis defense Marelac Monday 28<sup>th</sup> June 2004  
Room Valère Billiet (C wing – ground floor) S8  
Sterrecampus - Krijgslaan 281**

Time	Student	Title	Promoter	Exam commission	Exam commission
8.30 am	Frederic Vandepierre	Do bigger fish arrive and spawn at the spawning grounds before smaller fish: beach spawning capelin ( <i>Mallotus villosus</i> ) from coastal Newfoundland.	A. Vanreusel	Jan Mees (VLIZ)	David Methven (St John, Canada)
8.55 am	Jeroen Ingels	Free-living nematodes at both sides of the Scotia Arc, with special attention to the biodiversity of the genera <i>Desmodora</i> and <i>Desmodorella</i> (Fam. Desmodoridae).	S. Vanhove	A. Vanreusel	Rudy Herman (AWI)
9. 20 am	Wouter Willems	A GIS-approach to assess the impact of two pulpmills (Woodfibre and Port Mellon) on intertidal biodiversity in the Howe Sound Region (British Columbia, Canada).	A. Vanreusel	S. Degraer	Shannon Bard (Dalhousie, Canada)
9.45 am	Fien De Raedemaecker	A GIS-approach to compare intertidal diversity and contaminant loading in the marine receiving environment of two pulp mills in British Columbia, Canada.	A. Vanreusel	S. Degraer	Shannon Bard
10.10 am	Koen Reyntjens	The cost of transport of <i>Sepia apama</i> on the Whyalla breeding grounds.	A. Vanreusel	M. Vincx	Ron O' Dor (Dalhousie, Canada)
10.35 am	Coffee Break				
11.00 am	Isabelle Dufour	Physical characterization of the Sierra Ventana region in view of the rehabilitation of a dumping site of dredged material into a potential area for marine aggregates extraction.	V. Van Lancker	S. Deleu	Michael Fettweis (MUMM)
11.25 am	Ine Darras	A comparative analysis and validation of seafloor classification techniques.	V. Van Lancker	Geert Moerkerke (Magelas)	Marc Roche (Fund for Sand extraction)
11.50 am	Fabiane Gallucci	Can field distributions of estuarine intertidal nematodes be explained by sediment constraints on foraging success? The case of the predacious <i>Enoploides longispiculosus</i> .	T. Moens	M. Vincx	Carlo Heip (NIOO,NI)
12.15 pm	Lunch break				
2 pm	Ainhoa Blanco	Pilot study for the rearing of the blue mussel ( <i>Mytilus edulis</i> ) larvae in the laboratory.	M. Vincx	A. Verween	Marco Dubbeldam (Aquasense, NI)
2.25 pm	Leen Vandepitte	Spatial and temporal variability of the epi-, hyper- and endobenthos of nine sandy beaches along the Ecuadorian coast.	M. Vincx	S. Degraer	Jan Weslawski (PAS, Poland)
2.50 pm	Hannelore Maelfait	The effect of dense patches of tube-builders on the macrofaunal community.	S. Degraer	M. Vincx	André Catrijsse (VLIZ)
3.15 pm	Marijn Rabaut	System Analysis for Decision Support in the Allocation of Marine Protected Areas in the Belgian Part of the North Sea.	M. Vincx	J. Schrijvers	S. Degraer

**Do bigger fish arrive and spawn at the spawning grounds before smaller fish: beach spawning capelin (*Mallotus villosus*) from coastal Newfoundland.**

**Frederic Vandeperre**

**David Methven (St John University New Brunswick Canada)**

**Ann Vanreusel (Marine Biology UGent, coordinator BIODAQUA EU-Canada)**

ABSTRACT – A relationship between body size and time of spawning has often been described for both pelagic and non-pelagic fish species that migrate for the purpose of spawning. The present study investigates this relationship for capelin, a pelagic smelt-like species that spawns on the beaches of Newfoundland. Simple linear regressions were carried out separately for three groups, ovid females, spent females and males, and for 3 successive years (1982-1984). Bigger fish arrived near the spawning grounds first, for all three groups and all three years and was most obvious for female capelin. Analyses of stomach contents of Atlantic cod (*Gadus morhua*), an important predator of capelin, showed a similar decrease in mean size of capelin throughout the capelin spawning season. Furthermore, t-tests strongly suggest that early in the spawning seasons, when capelin abundance was high, cod selected for bigger capelin, whereas towards the end of the spawning seasons, when capelin abundance was low, cod did not show any size preference.

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**Free-living nematodes at both sides of the Scotia Arc, with special attention to the biodiversity of the genera *Desmodora* and *Desmodorella* (family Desmodoridae).**

61842

**Jeroen Ingels**

**Ann Vanreusel, Sandra Vanhove (Marine Biology UGent, coordinator BIODAQUA EU-Canada)**

ABSTRACT – During the LAMPOS campaign (2002) on board of the RV “Polarstern” samples were taken along the Scotia Arc. In this study samples of two stations from the northern and southern part of the Scotia Arc (at a depths of 277 and 307 m) were analysed for meiofauna (especially nematodes). By identification of all species within two closely related subdominant nematode genera (*Desmodora* & *Desmodorella*) in the two Scotia Arc samples and available samples from adjacent areas (Maggellan Region, Drake Passage, Weddell Sea) it is concluded that: 1) Estimations of diversity are sample-size dependent and ask for standard sampling and processing methodology; 2) The Scotia Arc can be seen as a shallow bridge and a possible exchange route for meiofauna between the Antarctic and South America; 3) Nematode species are constraint by environmental conditions (bathymetry, sediment characteristics) rather than by geographical barriers; 4) Local nematode diversity does not necessarily reflect regional nematode diversity (i.e. restrictions in nematode species distributions result in high species turn-over between different stations, not always usable to predict larger scale diversity).

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**A GIS-approach to assess the impact of two pulp mills (Woodfibre and Port Mellon) on intertidal biodiversity in the Howe Sound region (British Columbia, Canada).**

**Wouter Willems**

**Shannon Bard (Dalhousie University, Halifax, Canada)**

**Ann Vanreusel (Marine Biology UGent, coordinator BIODAQUA EU-Canada)**

**ABSTRACT** – Intertidal biodiversity data collected by Bard (1998) in 1990-1993 at nine sites in Howe Sound, a British Columbian fjord, were the source data for this paper. Two pulp mills located in Woodfibre and Port Mellon, discharge their effluent in this fjord. Several process changes took place in both mills just before and during the intertidal sampling. The goal of this paper is to assess the impact of mill effluent on intertidal biota, by comparing trends in intertidal biodiversity with known mill impact, derived from tracers: dioxin/furan levels in the sediment and in crabs. Because intertidal and contaminant sampling sites were different, the use of traditional statistic tests was not possible. Therefore, contaminant and intertidal data were combined in a Geographical Information System (GIS), which allowed to observe correlations. Also included in this GIS were mill effluent dispersion patterns, surface currents and sediment data, which allowed the integrated interpretation of the data. Confounding factors in the interpretation of intertidal data, including local oceanographic conditions and non-pulp mill pollution sources, are identified in this paper. As such, this paper serves to help interpret and plan the sampling scheduled for the summer of 2004. The classification of animal species in feeding guilds and algae in taxonomic groups provided new insights in the data. The general trend at all sites seems an increase in species diversity. Discoloration and even die-off in the vicinity of the mills, was found to be correlated with sodium chlorate spills. As a conclusion, intertidal monitoring is a valuable addition to the current practice of taking grab samples of the sediment, but on its own is not a representative tool for the deeper environment.

**Keywords: pulp mill pollution, intertidal biodiversity, GIS, Howe Sound, environmental monitoring**

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## **A GIS-approach to compare intertidal diversity and contaminant loading in the marine receiving environment of two pulp mills in British Columbia, Canada.**

**Fien De Raedemaeker**

**Shannon Bard (Dalhousie University, Halifax, Canada)**

**Ann Vanreusel (Marine Biology UGent, coordinator BIODAQUA EU-Canada)**

**ABSTRACT** – Intertidal monitoring during 1992 and 1993 at mid to low intertidal rocky-shore beaches surrounding two marine-discharging pulp mills in British Columbia revealed a decline of biodiversity as the sites were closer located near the mill outlet. The present study reports spatial changes in species richness, trophic composition and algal composition of intertidal benthos over a gradient of effluent exposure. Those spatial trends are related to dioxin/furan loads in sediment, Dungeness crab (*Cancer magister*) hepatopancreas and Pacific oyster (*Crassostrea gigas*) muscle, sampled in the same area but at slightly different locations. Local oceanographic conditions and non-pulp mill pollution sources in the vicinity of the two pulp mills are considered as confounding factors in assessing pulp mill effluent. Statistical analyses were used to assess trends in intertidal biodiversity. A GIS-approach, incorporating the most important known oceanographic features, is a very helpful additional tool to visualise the major relationships between intertidal biodiversity and contaminant loadings.

This study has discovered that in some regions cumulative contamination may exert a large and long-lasting effect on intertidal diversity and community structure even when current pollution has decreased. Feeding guilds deemed very useful tools to reflect shifts in the functioning of a given area. Deposit feeders were highly abundant on isolated patches close to the mill with abundant sources of organic material. Green algae deemed tolerant to pulp mill effluent whereas red algae were the most sensitive to bleached kraft pulp mill effluent. This study suggests that environmental impact is not always proportional to the volume of pulp and paper production and waste loading but highly depends on local oceanographic conditions and historic depositions.

There is a strong need for long-term monitoring to complete the accurate assessment or potential sublethal and ecosystem effects, and to understand the bioaccumulation dynamics of effluents on a site-specific basis. In the summer of 2004, intertidal monitoring will be repeated at the same sites, which aims to detect long-term changes in biodiversity and to evaluate the impact of historic contaminated sediment depositions. This paper serves as a preliminary study to propose a sampling regime and recommend appropriate analysis for interpreting the results.

**Keywords: marine pulp mills, intertidal monitoring, TEQ, British Columbia, GIS**

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**The cost of locomotion of *Sepia apama* on the Whyalla mating grounds.****Koen R.A. Reyntjens****Ron O'Dor, Alison J. King (Dalhousie University, Halifax, Canada)****Ann Vanreusel (Marine Biology UGent, coordinator BIODAQUA EU-Canada)**

ABSTRACT – The giant Australian cuttlefish, *Sepia apama* are like other cephalopods uniquely suited for field energetic studies. Their hollow mantles that pump water for respiration and jetting can also accommodate differential transducer-transmitters. These transmitters indicate pressure-flow output, which can be calibrated against oxygen consumption by swim-tunnel respirometry. Radio-acoustic positioning telemetry (RAPT) recorded pressure-flow power and cuttlefish movement with a meter accuracy during their annual spawning aggregation near Whyalla, South Australia. Combined with behavioural video-material on these mating grounds speed-pressure flow relationships were determined for both cuttlefish jetting and fin-undulation separately. The cost for jetting and finning was calculated and compared with the cost of transport of other cephalopods. An activity spectrum was created and mating behaviour was investigated.

**Keywords:** cuttlefish, *Sepia apama*, RAPT, filter, finning, jetting, mating, Whyalla

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**Physical characterization of the Sierra Ventana region in view of the rehabilitation of a dumping site of dredged material into a potential area for marine aggregates extraction.**

**Isabelle Dufour**

**Vera Van Lancker, Samuel Deleu, Els Verfaillie, Valérie Bellec (Renard Centre Marine Geology, UGent)**

**ABSTRACT** – This study focuses on the impact of dumping of dredged material on the morphology and surficial sedimentology of the dumping site S1 (Sierra Ventana, Belgian continental shelf), on the recovery after the disposal has ceased and on the possibility to rehabilitate the dumping site S1 into an area for the extraction of marine aggregates (MA) (zone 3).

The disposal of dredged material at the old dumping site has produced, except for the northeast, sand piles on the edges and a depression in the centre. The dumping also caused a clear depth reduction and a grain-size decrease towards the northeast, consequently influencing a larger area.

After the closure of the old dumping site S1 in 1999, small and large dunes were formed. Due to intense hydraulic sorting processes, there is a clear correlation between the morphology and the textural differentiation of the surficial sediments of the old dumping site. The sediments of the old dumping site are clearly coarser than the sediments of the new dumpingsite. No sound correlation was found between the acoustical seabed classes based on multibeam measurements and the sedimentological nature of the seafloor. It seems that there was a correlation with the bathymetry, but it is not clear whether this is due to a depth-dependency of the seabed classification or to a natural grain-size differentiation due to changing bathymetry.

The medium to fine sand of the investigated part of the centre of zone 3 tends to have a good combination of silt-clay fraction and shell fragments for the use as fill- and replenishment sand. The sediments of the south and eastern part of zone 3 seem to be less suited for fill- and replenishment sand, due to their lower silt-clay fraction. The western, northern and southern regions of zone 3 are not yet investigated. The concentrations of PAH's, mineral oil, PCB's and heavy metals in the 7 analysed samples, are lower than the standards for the re-use of waste as a construction material and as soil for all types of terrains, except for natural area.

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## **A comparative analysis and validation of seafloor classification techniques.**

**Ine Darras**

**Vera Van Lancker, Samuel Deleu, Els Verfaillie, Valérie Bellec (Renard Centre Marine Geology UGent)**

**ABSTRACT** – This paper focuses on the classification of the seabed by means of different techniques. Three acoustic techniques were used, multibeam echosounder, sidescan sonar and RoxAnn™ based on single-beam echosounder, to identify and map sedimentology of the Sierra Ventana. Those techniques were compared with the radiometric technique Medusa. Ground truthing for different parameters was based on 16 boxcores.

Multibeam data were post-processed with Kongsberg Simrad software (Triton). The generated map showed a strong correlation between sedimentology and bathymetry. This is partly caused by an inaccurate correction for the bathymetry. The manual classification of sidescan sonar data, based on a standardized classification table, showed a good agreement with the sediment samples. Classification of RoxAnn™ data was done in two different ways, based on scatterplots and based on histograms. The use of scatterplots seemed efficient. The classification based on histograms could only be used to compare roughness and hardness values relatively to each other. Moreover, a big variety in between surveys was observed. The radiometric technique, Medusa, proved to be an accurate technique for the measurement of mud fractions but only rough differences between grainsizes were detected.

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**Can field distributions of estuarine intertidal nematodes be explained by sediment constraints on foraging success? The case of the predacious *Enoploides longispiculosus*.**

**Fabiane Gallucci**

**Tom Moens, Magda Vincx (Marine Biology, UGent)**

ABSTRACT – *Enoploides longispiculosus* is a prominent predacious nematode in sandy sediments of the North Sea and adjacent estuaries. Recent laboratory experimental work highlights their potential importance as structuring forces for prey meiobenthic and ciliate community abundance and composition. The present study addressed the question of whether field distributions of *E. longispiculosus* can be explained by sediment constraints on its foraging success. The spatial distribution of *E. longispiculosus* in an intertidal flat with gradually shifting sediment composition and its relation to other nematode abundances ('potential prey') and sediment characteristics were investigated. The results showed strong variability in predator densities even between sites which differed only slightly in sediment composition. *E. longispiculosus* abundances were positively correlated with mean grain size and fine sand fraction and with the sediment exposure time within a tidal cycle and negatively with total nematode densities, very fine sand and silt content. Experiments were then performed in which two bacterivorous nematode species were offered as prey to *E. longispiculosus* in microcosms containing sediments of different silt content, grain size and water content. We quantified predation rates over a 24-h incubation and assessed whether prey selectivity was modulated by changing sediment characteristics. The three sediment characteristics tested strongly affected predation efficiency but not prey selectivity. *E. longispiculosus* preferred one of the prey species independently of sediment characteristics. Increases in the silt fraction and decreases in mean grain size and water content strongly reduced or even totally impeded predation rates by *E. longispiculosus*. Those effects compared remarkably well with the natural range of silt and grain size in which *E. longispiculosus* was abundant on the Paulina tidal flat. We suggest that field distributions of predacious nematodes may be governed by sedimentary effects on their foraging efficiency, rather than by food availability *per se*. The potential impact of differential predation efficiency of *E. longispiculosus* on prey populations is discussed.

**Keywords: intertidal flat, nematodes, sediment, experiment, top-down control, predation, *Enoploides longispiculosus***

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**Pilot study for the rearing of the blue mussel (*Mytilus edulis*) larvae in the laboratory.**

**Ainhoa Blanco**

**Marco Dubbeldam (Aquasense, Nederland)**

**Magda Vincx (Marine Biology UGent)**

ABSTRACT – Spawning and settlement of *Mytilus edulis* are very important from an ecological and economical point of view. Cultivation and exploitation of mussels are limited by settlement and recruitment to the natural stocks. The demand of mussel seed is limited by the fact that natural settlement of these seed takes place only in spring. The objective of this pilot study was: the design in the laboratory of a system for conditioning mussels to maturity, rearing the larvae and facilitate the appropriate substrate for the larvae to settle. The use of two different algae diets, consisting on a single algae species (*Isochrysis galbana*) and a mixture diet (*Isochrysis galbana* and *Pavlova lutheri*) showed higher growth rates for the mixture diet. Rearing tanks with the lowest larvae concentration showed also the highest growth rate. Petticoat gauze proved to be a good substrate for the settlement of mussel larvae. These results may prove the viability of the rearing of mussel larvae in the laboratory.

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## **Spatial and temporal variability of the epi-, hyper- and endobenthos of nine sandy beaches along the Ecuadorian coast.**

**Vandepitte Leen**

**Magda Vincx, Thomas Vanagt, Nancy Fockedeey (Marine Biology, UGent)**

**ABSTRACT** – Nine sandy beaches along the Ecuadorian coast were sampled for epi-, hyper- and endobenthos on four occasions (August 1999, November 1999, February 2000 and May 2000). Spatial and temporal patterns within and in between these three benthic groups were investigated, as well as abiotic factors possibly structuring the communities. Within the endo- and hyperbenthos, five geographically distinct communities could be observed, which were different for both groups. Endobenthic communities were primarily distinguished based on differences in abiotic factors such as gravel content, chlorophyll *a*, salinity and beach morphology. Within the defined communities, temporal patterns could subsequently be distinguished. Hyperbenthic communities on the other hand, mainly seemed to be structured by seasonal trends. Abiotic factors were not as a decisive factor as for the endobenthos. Within the epibenthos, there could only be made a clear distinction between anthropogenically and non-anthropogenically influenced beaches, based on total densities and species richness.

A comparison of the endo-, hyper- and epibenthos, shows that the endobenthos is characterised by the highest total densities (on average 745 ind./m<sup>2</sup> per sample), whereas the hyperbenthos showed the highest species richness (on average 15 higher taxonomic groups or 43 morphospecies per sample). The epibenthos was characterised by the lowest total densities (on average 0.04 ind./m<sup>2</sup> per sample) and an average species richness equal to that of the endobenthos (5 species per sample). The extremely low total densities of the epibenthos require some caution when interpreting the data. Dominant taxa varied considerably per beach and per sampling period. Combining the three benthic groups into "macrobenthos" gave a total 111 observed taxa, with an average of 28 taxa per beach. The only pattern found within the macrobenthos was the grouping of two beaches that are under anthropogenic influences of tourism and waste water dumping, thereby concluding that human disturbance cannot be ignored when investigating the benthos of Ecuadorian sandy beaches.

When studying Ecuadorian surf zone systems more in detail, for example within the framework of the effect of climate changes on the benthos, one should bear in mind that (1) different benthic groups show different spatial and temporal patterns, (2) temporal patterns are not the same between beaches and (3) the structuring function of environmental variables and the impact of human disturbance can differ considerably between the benthic subgroups.

**Keywords: epibenthos – hyperbenthos – endobenthos – macrobenthos – sandy-beach - surf zone – Ecuador**

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## The effect of dense patches of tube-builders on the macrofaunal community.

**Hannelore Maelfait**

**Steven Degraer, Magda Vincx (Marine Biology, UGent)**

ABSTRACT – Dense patches of the tube-building polychaete *Polydora ciliata* and the amphipods *Jassa* and *Corophium* occur on artificial structures along the Belgian coast. Because the mud layers, formed by these tube-builders, are considered as a threat to the ecological balance on the one hand or as advantageous to the macrofaunal diversity on the other hand, the *in situ* effect of high densities of tube-builders on macrofaunal community structures was studied, hereby distinguishing between the effect on the mobile and the sessile species assemblages. Therefore, data on tube-builder densities in relation to density and diversity of other macrofauna from four groynes during two consecutive springs (April/May 2001-May 2002) were analysed. Tube-builders were found to have both positive and negative effects on the macrofaunal community. Although the two communities have a higher species richness with higher tube-builders densities, this trend is much stronger for the mobile community. There is a positive effect on most annelids because many predatory annelids can take profit from the predation on the tube-builders. The high numbers of tubes lead to sediment stabilisation and this has a positive effect on percentage cover of *Obelia dichotoma* because this sessile species is sensible for the possibility of siltation and smothering. The sediment stabilisation has also a negative effect on sessile species such as *Balanus crenatus* because smothering prevents feeding and causes death. We conclude that an increase in densities of tube builders leads to a more diverse mobile community and within the sessile community, high densities of tube beds are responsible for an increase in the percentage cover of some sessile species and a decrease for others.

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## **System Analysis for Decision Support in the Allocation of Marine Protected Areas in the Belgian Part of the North Sea.**

**Marijn A. Rabaut<sup>a,1</sup>, Magda Vincx<sup>a</sup>, Jan Schrijvers<sup>b</sup>, Steven J. Degraer<sup>a</sup>**

**ABSTRACT** – *Marine Protected Areas* (MPAs) have been recognised as a viable tool for marine conservation by conservationists, resource managers, scientists and coastal planners. They are however often implemented without a firm understanding of the economic, social and ecological consequences. This literature review merges many of the thoughts with respect to MPAs. The construction of conceptual qualitative flow charts allows developing transparent *system analysis*. This is a *mental mapping* exercise that visualises links between and within user groups. It acts as a *Decision Support System*, and as a tool for easy public information and participation. The different levels of system thinking and their linkages are visualised in a general flow chart. Departing from public support and clear policy objectives, the core message is quantifying the parameters. Specific flow charts are established to define different economic impacts (fisheries, sand and gravel extraction, tourism, wind mill farms). It became clear that fisheries and tourism can benefit most from an MPA establishment. Ecological impacts are important in nature conservation and drive most socio-economic impacts. Ecological interactions are therefore described in depth and visualised in a specific flow chart. The social impacts cannot be underestimated and are visualised in the general flow chart. The flow charts are designed to show the existing links between user groups of a temperate marine area. During the establishment of this conceptual model the Belgian situation was emphasised. The high activity level and data availability make it possible to discriminate the MPA effects from the noise which is highly controversial until now. The challenge is now to quantify this qualitative model.

**Key words:** marine protected area, conceptual flow chart, system analysis, decision support system, belgian continental shelf, impacts, ecology

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## **To be expected thesis defense by**

**Nijs Kim J.J.**

**Population estimation and growth rate of Nautilus at Osprey Reef,  
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**17<sup>th</sup> September 2004 at 2 pm (to be confirmed)  
at Sterrecampus S8**