BOOK OF ABSTRACTS

OCEANS & LAKES 2017

Temporal assessment of the ammonia metabolism evolution in carp during fasting: a promising approach to optimize aquaculture practices involving fasting episode prior to fish transportation

BY Sarah Cannaerts

PROMOTER: Gudrun De Boeck (U Antwerpen)
CO-PROMOTER: Amit Kumar Sinha
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Fish and other aquatic organisms are being farmed for human consumption or other commercial gains and, for this purpose, transported across great distances. In aquaculture it is common practice to fast fish a couple of days before transport. This is done to lower their overall metabolism and thus reduce oxygen consumption and waste production. The idea behind this study was to look for an ideal fasting period for common carp (Cyprinus carpio L.), where its metabolism would become low enough to keep oxygen consumption and ammonia production minimal, while it would still be able to regulate ammonia-transport. This optimal fasting period might have been found around 6 days of food deprivation. After 8 days a further decline is seen in the ammonia metabolism, however, this seems to coincide with an increase in plasma ammonia levels, indicating possible toxic effects for the fish. Additionally, a mortality experiment was done to determine the sensitivity of common carp to high environmental ammonia after fasting. The results were inconclusive, but it seemed that feeding fish after exposure helped them cope with ammonia toxicity.

Renewed look at classification and GIS analysis of offshore tidal sands: geomorphology and properties. Case study of a northwestern area of the Belgian Part of the North Sea

BY Karolien Vanlerberghe

PROMOTER: Vera Van Lancker
CO-PROMOTERS: Nathan Terseleer, Giacomo Montereale Gavazzi

Research was conducted on most suitable methods and tools for the identification, characterization and classification of tidal bedforms, with a focus on the automatization of the process. A dataset was available from a study site located in the northwest of the Belgian Part of the North Sea (BPNS). A workflow was developed consisting fundamentally of two parts: morphometric analysis and classification. During morphometric analysis, terrain attributes are derived and 2D-profiles are extracted. The classification methods that are revised and implemented in the workflow are the Benthic Terrain Modeler (BTM), unsupervised clustering and object delineation, based on bathymetry and Bathymetric Position Index (BPI). The unsupervised classification and object delineation are combined to produce a final classified map of the study area. Following this methodology, assemblages of subaqueous dunes with different height and spacing could be revealed. Furthermore, hummocky terrains (likely representative of a gravelly seafloor) and flat terrains (likely composed of poorly sorted sediments) as well as the presence of peculiar circular depressions could be observed and extracted. The presence of these different bedforms indicates the variety in substrate, i.e. ranging from sand to gravel, and evidences the strong interaction with hydrodynamic forces which, ultimately with sediment availability, model and modulate the bedforms in the study area.

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Metal accumulation and effects of field-exposed zebra mussels; relationship with ecological quality

BY Aziz Hasan

PROMOTER: Lieven Bervoets (U Antwerpen)

The whole world is facing lack of reliable safe water sources. Increasing threat of metals contamination in inland water is of widespread concern for availability of safe water sources. Direct measurement of metals in biota is a good tool for assess the metal contamination in waterbodies. In this study, we exposed caged Dreissena polymorpha (zebra mussels) and Dreissena rostriformis bugensis (quagga mussels) in five different locations of the river Winterbeek for 7 weeks. Water quality monitoring and macroinvertebrates sampling were conducted in the same locations. Bioaccumulation levels of nine metals (Cd, Pb, Cr, Co, Cu, Ni, Zn, As, and Hg) in both mussel species and in Asellus sp. were analyzed and compared with sediment metals concentrations. We also investigated the relationship of ecological water quality and accumulated metals in biota. Further, we evaluated how metals accumulation in mussels affects in their physiological condition (respiration rate and issue condition indices).

Measured physicochemical characteristics (pH, temperature and O2 concentration) of the Winterbeek river were recorded within the environmental water quality standards for the Small River in Flanders, but the recorded conductivity exceeds the standard limit in all sites. Higher survival rates of zebra mussels were recorded with shorter exposure time at all the sites, that is because of they were tolerating lower pollutions and other environmental stressors during shorter exposure time. The respiration rates of both mussels exposed in four sites found higher compared to the respiration of their control mussels. Significant differences among sites were observed in accumulated Cd and As concentration in Zebra mussel after 5 weeks. Cu and Hg were significantly varied after 7 weeks of exposure in zebra mussels. In quagga mussels metals concentrations did not vary among sites except for Cr. Accumulated metals (except for Cu) in Asellus sp. were documented lower compared to metals concentration in both mussels. No significant relationship found between ecological water quality (MMIF) and metal accumulations in both mussels. In our best knowledge, this is the first time we are reporting biomonitoring of metals in the Winterbeek river, no other study previously reported this. This study will be very useful for compare the future studies in the Winterbeek river.

Modelling Soil Erosion Potential in The Transboundary Catchment of River Umba Using Remotely Sensed Data

BY Bonface Ngila Mutisya

PROMOTER: Nico Koedam (VUB)
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Soil erosion is one of the most important forms of soil degradation. Estimating soil erosion from field measurements is expensive, hence the extent of soil erosion in many tropical watersheds is unknown. The use of remotely sensed data and GIS to construct an empirical erosion model provides a quick first approximation method to estimate soil erosion by water over large areas even in data deficient areas. This study is a first step towards development of an erosion model for the transboundary catchment of the Umba river spanning 6500 km2 from Tanzania to Kenya. It is aimed at generating scientific information on sediment budget within the catchment in support of the Transboundary Conservation Area (TBCA) initiative between the two countries. The Revised Universal Soil Loss Equation (RUSLE) and open access remotely sensed data were used in a GIS environment to estimate soil erosion potential within the catchment.

Data for calculating the model factors was obtained from Landsat (land cover), TRMM (rainfall), SRTM (topography) and ISRIC (soil properties) archives. Rainfall erosivity and landcover factors were calculated from data averaged over 10 years (2007 – 2016). The mean rainfall erosivity is estimated at 3461 MJ mm ha-1 h-1 yr-1, while the soil erodibility ranged from 0.016 to 0.027 t h MJ-1 mm-1. The slope length and slope steepness factor ranged from 0 to 966 with high values only obtained for the steep Usambara mountains. The landcover factor derived from NDVI values ranged from 0.08 to 0.23. Multiplication of these factors into the RUSLE model indicates that the catchment has a mean soil erosion potential of 24 t ha-1 yr-1, some of which will be transported into the lowland areas thus impacting adjacent marine environment. The catchment has a median soil erosion of 4 t ha-1 yr-1 indicating that only a small portion of the catchment contributes to significant soil erosion. Our results were then validated through comparison with soil erosion estimates from other catchments in the region. Even though this method provides a quick and cost effective method to estimate the risk of soil erosion, calibration and validation of the key model factors through field measurements, and direct measurement of sediment transport by the river, would be crucial to improve reliability of the results.

Keywords: Soil erosion; RUSLE; Remote sensing; Transboundary; Critical habitats

Modelling of Suspended Particulate Material in The Scheldt Estuary:
Using a One-Dimensional Reactive Transport Model

BY Dogan Can Ayder

PROMOTER: Karline Soetaert

Suspended particulate matter (SPM) plays a vital role in estuary systems from a biological and social point of view. Hence, it is crucial to understand the SPM concentration and redistribution so as to be able to interpret anthropogenic impacts, and assess its effect on light required for biological production. Also, in the long-term, the SPM redistribution causes the variation of the morphology of estuaries. Since estuaries are highly dynamic ecosystems, SPM concentration and redistribution can help scientists to observe and foresee morphological and ecological changes in estuarine ecosystems.

This study aims to improve an SPM model embedded in the shallow water equation in 1D (Soetaert, sw1D: The shallow water equation in 1D. R package version 1.0, 2015). This model describes the flow of water which contains particles and dissolved substances by means of reactive-transport equations. A first improvement is achieved by implementing flocculation effects on settling velocity and SPM concentration.

In a second improvement, exchange of SPM with the sediment is assumed to take place in two layers, a fluff layer on top and a bottom compact layer. The former, top layer resuspends easily while the bottom layer has limited interaction with the water column.

A third improvement is to take into account differential distribution of currents and particles with water depth. The velocity profile along the depth of the estuary results in better predictions of the water column profile for velocity, SPM concentration and more importantly SPM transport.

It is found that the two-layered sediment property shifts the location of maximum SPM concentration towards the upper estuary. Lastly, SPM redistribution rate that does not include input from the North Sea, is predicted to be 5604 m3 sediment per year with the improved model.

The results obtained with the improved model are in better agreement with the observations compared to the original model.

Keywords: Suspended Particulate Materials, Scheldt Estuary, Reactive Transport Model, Flocculation, Two-Layered Sediment

RECENT CHANGES IN PHYTOPLANKTON COMMUNITY STRUCTURE IN RELATION TO LIMNOLOGICAL PARAMETERS IN LAKE KIVU

BY Edouard Rugema

PROMOTER: Elie Verleyen (UGent)
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Lake Kivu lies on the border of the Democratic Republic of Congo and Rwanda. The lake has a volcanic origin, is deep and meromictic and characterised by a very peculiar limnology and geochemistry. Here we combined limnological and biological data obtained during various long-term monitoring programs to provide an overview of the recent variability in the lake water column conditions and their effect on the phytoplankton community structure. The composition of the phytoplankton assemblage was homogeneous among the different lake basins studied. Seasonal changes in the phytoplankton community structure could be linked to changes in the mixed layer depth, which was confirmed by a Principal Component Analysis (PCA). However, the most striking finding is that the L. Kivu phytoplankton was essentially dominated by diatoms (dry season) and cyanobacteria (wet season) from 2002 to 2012, while this community was replaced by one dominated by diatoms (dry season) and chlorophytes (wet season) from 2012 onwards. This was again confirmed by the PCA which revealed that variation in phytoplankton community structure was first mainly related to long-term changes (i.e. before and after 2012) and secondly to seasonality with a clear separation between diatoms from other groups during the dry season. Moreover, the mean chlorophyll a concentration was 1.29 mg m−3 for the 2002–2012 period and 2.25 mg m−3 for the 2012–2014 period. Based on continuous temperature measurements using loggers installed in the lake between October 2012 and September 2014, we observed the sporadic breakdown of the water temperature gradient in parts of the mixolimnion at night as a result of an air temperature increase and a drop in relative humidity. This, in turn, resulted in a deeper mixing of the surface water column. We hypothesize that the 2012 shift in phytoplankton community regime could be explained partly by the occurrence of frequent diurnal mixing events (atelomixis) leading to a decrease in water column stability in the upper 60 m and hence a deeper mixing of the mixolimnion. In turn, this could result in more favourable conditions for the growth of chlorophytes which out-competed cyanobacteria.

Key words: phytoplankton composition, regime shift, physical factors

Ecology of the East Pacific green turtle at the Virrila estuary, northern coast off Peru: Implications for Conservation and Management strategies

BY Evelyn Paredes Coral

PROMOTER: Marc Kochzius (VUB)
CO-PROMOTER: Javier Quiñones Dávila

The ecology of sea turtles has been assessed mostly at nesting sites, although sea turtles spend most of their lives at sea. The ecology of green turtles in the East Pacific has been taking more attention in the last decade. This is especially the case of Peru, where punctual information exists on feeding grounds. However, the link with environmental drivers as well as the quantification of anthropogenic impacts remain unclear. This study focuses on Virrila Estuary, a natural aggregation area for green turtles in the northern coast of Peru, located in a transitional zone influenced from upwelling and warm equatorial conditions. At Virrila Estuary, 13 surveys were carried out from 2012 - 2017 and one pilot study in 2011. Overall, 615 green turtles were captured during the in-water surveys and 838 individuals were registered as stranding records. Population structure was largely dominated by juvenile individuals (68.7 %; n = 765) and recapture rate was very low (4.9 %), indicative of a large population. Information obtained from recaptured individuals, indicates that green turtles probably spend a median of 219.5 days (0.6 yr) in the estuary with a maximum of 1054 days (2.9 yr). Somatic growth rate was one the highest in the East Pacific and together with the body condition index reflected values of healthy individuals and a population with a non-monotonic growth pattern with a peak in 81-90 cm curved carapace length. Based on information from stranding surveys, the main anthropogenic-derived threats were boat strikes (57.7 %; n = 45) followed by illegal capture (42.3 %; n = 33). We also discuss alternative ways to prevent and reduce anthropogenic-derived threats and the necessity of an active management intervention in Peru. Additionally, green turtle occurrence at Virrila Estuary showed to be linked with the environmental variability caused by El Niño events. This study indicates that Virrila Estuary is an important developmental habitat for juvenile East Pacific green turtles and we strongly exhort that management
efforts should focus on reducing anthropogenic-derived threats and law enforcement.

Keywords: Green turtles, Virrila Estuary, population ecology, anthropogenic impacts, conservation, El Niño

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Presence of metals and perfluorinated compounds in the aquatic food chains of two South African estuaries; the Umvoti and Matigulu

BY Georgina Collins

PROMOTER: Lieven Bervoets (UAntwerpen)
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Persistent pollutants threaten ecosystems and human health. Metal contamination from anthropogenic activities is causing metals to bioaccumulate, which may have toxic effects in aquatic organisms. Man-made per- and polyfluoroalkyl substances (PFASs) are now ubiquitous in the environment, and remain in largely unknown concentrations and with unknown effects on aquatic life. The Umvoti Estuary is known to be severely degraded and stressed by human activities, while the Matigulu Estuary is considered to be in a fair condition and less impacted. This study aimed to assess PFASs and metals present in different compartments of the Matigulu and Umvoti estuaries. Samples of water, sediment, fish tissues and invertebrates were collected in the estuary mouths and an upstream site in each estuary. This study was the first known study to assess PFASs in these South African estuaries and to assess metal concentrations in the Matigulu. A number of PFASs were found in water, sediment and biotic samples from both estuaries; with perfluorooctanoic acid (PFOA) present in every sample. Perfluorooctyl sulfonate (PFOS) was measured in all fish tissue samples and concentrations were significantly higher than other PFASs. Average PFOA concentrations from Umvoti water samples were higher than any other PFOA concentrations recorded in South African river water. PFOA and PFOS concentrations in fish tissues were higher in the Umvoti, compared to the Matigulu. Metals measured in water and sediment samples from both estuaries were found to be below the recommended levels. Secondary metal data, from sediments and fish muscle tissue, was used for comparison and showed that seasonality strongly influences the concentrations of metals in these estuarine systems. Metal concentrations differed significantly both spatially and temporally, supporting the need for repeated sampling over different seasons and within different zones of the estuary. PFOA and PFOS concentrations in fish from the Matigulu and Umvoti were below the Minimum Risk Levels (MRLs) for safe human consumption. However, some metal concentrations were present in concentrations higher than the MRLs and may pose a risk to human health. Further investigations are needed to make conclusive statements on the bioavailability, bioaccumulation and possible risk to human health from PFASs and metals in these estuarine systems.

Keywords: Umvoti; Matigulu; PFASs; metals; fish; water; sediment; invertebrates.

The impact of the economic crisis on the implementation of the EU Nature Directives in Greece

BY Charalampos Paliogiannis

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Established under the European Union (EU) Birds and Habitats Directives, the thirty-year trans-national Natura 2000 network is considered a fundamental biodiversity conservation framework worldwide. The global financial crisis has afflicted European economies since 2008 and has not only caused radical changes to the economic development, but has also resulted in major implications on nature conservation activities in one of the weakest EU member states, Greece. With a strong tradition in managing its high nature value in a centralized and questionable way, in the face of the economic crisis, implementation challenges of the Greek state concerning Natura 2000 have been enlarged. This research constitutes a broad-based assessment of the effects of the current economic crisis on the application of the EU Birds and Habitats Directives by the Greek state. By using an expert-based participatory approach (the Delphi technique) we attempt to address the impact of the crisis on the administrative levels, competent authorities and procedural frames of the national protected area system, as perceived by key stakeholders and experts. The Delphi approach allowed a systematic collection of experts' transdisciplinary judgements on the state of the Greek Natura 2000 network in terms of implementation, management, administration, monitoring and legislation. According to the substantial part of the Greek conservation community that participated in the survey, many enforcement obstacles are a product of either direct or indirect consequences of the economic crisis, while some are inherent to the lack of a national comprehensive conservation strategy. This study involved also an evaluation of the practices and obligations of the responsible management authorities of the Greek protected areas to get an insight of the "on the ground" financial consequences on their operation. Based on our findings we propose recommendations for improvements and measures that can substantially counteract the negative impacts of the economic austerity on the enforcement of nature conservation.

Key words: Natura 2000, EU Directives, conservation policy, protected area management, Greece, Delphi method, economic crisis

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The harbour porpoise (*Phocoena phocoena*): Consequences of anthropogenic underwater sound on their ecological value

BY Jill Debosschere

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Mainly due to anthropogenic activities, disturbance to the marine environment by underwater sound sources is an increasing problem in our seas and oceans. One of these activities, i.e. the construction of offshore wind farms, constitutes a relatively new and fast growing industry and potentially induces wide-ranging underwater sound disturbance. It is important to determine the effects on the marine environment and to manage negative impacts with proper mitigation measures, in order to achieve both a good environmental status and renewable energy development.

The response of harbour porpoise (Phocoena phocoena) to impulsive anthropogenic underwater sound is relatively well studied. This animal can thus be used as a highly relevant (due to their representative appearance and biological sensitivity) study object for studies on anthropogenic noise pollution (Wright, 2013).

This study focused on the differences in regulatory regimes with regards to offshore wind farm construction in various North Sea countries and how this impacts both harbour porpoise populations and installation costs. The direct and indirect operational consequences of the different regulatory regimes related to underwater sound mitigation with piling activities on the environmental impact of a population of harbour porpoises, in countries around the Southern North Sea was quantified using the interim Population Consequences of Disturbance model (Harwood & King, 2014a, 2014b)

The results of this study show that the impact on the harbour porpoise population differs when different time schedules are used, but this differences does not exist anymore when the noise mitigation measures big bubble curtain (BBC) and/or ICH noise mitigation screen are used. These results also show that building a wind farm every year affect the harbour porpoise population more than building two wind farms at the same time. Applying seasonal piling restrictions lowers the impact on the harbour porpoise population, but it is just a logical measure because the density of the population is three times lower in May then in March. There is also more research needed to know the reduction capacity of this rule when noise mitigation measures such as BBC and/or IHC noise mitigation screen are used. Seasonal piling restrictions in combination with an acoustic deterring device (ADD) is not enough to lower the impact on the porpoise population to acceptable values. Adding a BBC to the system reduces the impact on the harbour porpoise population a lot. When an IHC noise mitigation screen is also added to the piling event the reduction of the impact on the population is only noticeable for the time schedule where two wind farms are built without any overlap.

To save the harbour porpoise population in the Southern part of the North Sea regulatory regimes that make use of noise mitigation measures should be applied. All these conclusions are based on a small population from the BPNS because the scenarios only influence activities in the Belgian part of the North Sea (BPNS). It is important to confirm this conclusion with the use of other models.

Genetic population structure and connectivity patterns of Giant Clams (*Tridacna* spp.) along the Western Indian Ocean

BY Kushlani Dissanayake

PROMOTER: Marc Kochzius

Knowledge on connectivity and population isolation of species offer an insight to make sound conservation and management decisions. Giant clams are the largest bivalves in the ocean, threatened by numerous natural and anthropogenic disturbances and therefore protected under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Few studies have been conducted so far to understand their gene flow in the Red Sea (RS) and Western Indian Ocean (WIO) and hence critical information gap is observed. The mitochondrial cytochrome oxidase subunit I gene (COI) was used as the molecular marker to identify the species and assess the population structure and gene flow in the RS (Jordan, Egypt and Saudi Arabia) and WIO (Kenya, Tanzania, Mozambique and Madagascar). A total of 267 T. maxima, 29 T. squamosa and 24 T. squamosina were identified with the aid of DNA barcoding. The Total number of haplotypes were 101 T. maxima, seven T. squamosa and nine T. squamosina. High haplotype and nucleotide diversity were observed in T. maxima (mean h = 0.868, mean π = 1.23 %), but was comparatively low in T. squamosa (mean h = 0.686, mean π = 0.04 %) and T. squamosina (mean h = 0.685, mean π = 0.42 %). Demographic history showed the signatures of population expansion in all species. The correlation between genetic distance (ϕST) and geographical distance was significant in T. maxima (R^2 = 0.524, p<0.01) between RS and WIO and within WIO (R^2 = 0.224, p<0.05), indicating isolation-by-distance. Published sequences were used to investigate the phylogeography of T. maxima and T. squamosa across Indo-West Pacific (IWP). Overall 230 haplotypes were yielded for T. maxima and 63 T. squamosa. A clear genetic break was discovered isolating the RS and also Madagascar in WIO. Additionally, limited migration was found between the RS and the WIO as indicated by F-statistics. No haplotypes were shared by populations from the Red Sea and the WIO with the Eastern Indian Ocean (EIO), Indo-Malay Archipelago (IMA), Western Pacific (WP) and Central Pacific (CP) indicating the speciation is peripheral areas. The haplotype network shows seven clades that are affiliated with the RS, WIO (2 clades), EIA, IMA, WP and CP which mainly explained by the ocean current pattern (ϕCT = 0.749, p < 0.0001). The hydrographic features, geographic distance, the short pelagic larval duration (PLD) and vicariant events are the possible driving forces shaping the local and regional genetic structure of giant clams.

Fossil pigments analysis in two lakes sediments cores reveals Holocene enviromental changes in the Larsemann Hills.

BY María Lucía Rivera Charún

PROMOTER: Elie Verleyen (UGent)

East Antarctic is one of the main regions in the world that offers information of the climatic changes throughout time, due to variations of environmental conditions and forcings, that can be evidenced with long-term paleo-reconstructions methods, such as the use of biological proxies. Here we analyzed the fossil pigment composition in sediment cores from two shallow East Antarctic lakes (Mochou and Discussion) in the Larsemann Hills to reconstruct past changes in the photo-autotrophic communities in response to environmental changes and variations in the light climate. The bottom age of the sediment core from Discussion lake is 1772 cal yr BP and of Mochou Lake 30000 cal yr BP, but we restricted to the first 50 cm (ca.9530 cal yr BP). Three different stratigraphic zones in each lake sediment core could be identified based on the fossil pigment composition. At Discussion lake, the presence of pigments between c. 1772 – 1516 cal yr BP was low, increasing in diversity c. 1516 – 288 cal yr BP, while c. 288 cal yr BP to the present there is a high concentration of carotenoids. Mochou lake c. 9530 - 6242 cal yr BP was characterized for a low concentration of pigments, from c. 6242 – 497 cal yr BP total chlorophyll and carotenoid constantly increased. The major quantity and pigment concentrations was found from c. 1895 – 497 cal yr BP. The differences in pigment composition between the lakes was confirmed by a principal component analysis (PCA) and could be tentatively linked to differences in the pigment composition of the lakes and their importance in each lake. In addition, changes in the past UVR and PAR penetration during the Middle - Late Holocene were inferred based on pigment ratios. In short, Discussion and Mochou might be influenced by environmental parameters and changes in the past climate, both lakes have a similar composition of pigments with differences in concentration, the ratios displaced periods of elevated high light penetration.We conclude that Discussion Lake presented a higher primary production and Mochou lake appear to have low productivity particularly at the early stages of the sediment core.

Behavioural effects of Ocean Acidification in the Tropical Reef fish, *Amphiprion ocellaris*

BY Natacha Van Malder

PROMOTER: Gudrun De Boeck (UAntwerpen)
CO-PROMOTERS: Jyotsna Shrivastava, Kristien Van Camp

Rising concentrations of atmospheric carbon dioxide (CO_2), lead to a rise of CO_2 concentration in ocean water through a process called ocean acidification. In this study the effects of these higher concentrations were tested on behavioural changes, including coupling formation and olfactory sensing, in a tropical reef fish, Amphiprion ocellaris, for a period of 32 days. Behavioural changes in routine behaviour and boldness, were most apparent as CO_2 concentrations increased. Coupling formation seemed to be impaired at a pH of 7.4, though not yet at a pH of 7.8 which is predicted to occur by 2100. No clear differences were found in olfactory sensing between different CO_2 concentrations, giving no proof that ocean acidification might impair the olfactory mechanism.

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The connectivity of Kenya's Rift Valley salt lakes using the smooth flatsedge (*Cyperus laevigatus*)

BY Peter Mwaniki Kamindo

PROMOTER: Ludwig Triest (VUB)
CO-PROMOTER: Taita Terer

Understanding the distribution of genetic diversity of widespread dominant natural populations and how historical inter-basin connectivity has shaped that genetic distribution could provide broader insights into forces creating and maintaining biodiversity in isolated saltwater lakes. The overall objective was to assess the amounts and patterns of genetic diversity in C. laevigatus populations at a large geographical scale to understand the historical inter-basin connectivity between the saline alkaline lakes of the Rift Valley in Kenya. Using 13 microsatellite markers, the clonal diversity, genetic variation, genetic structure and fine-scaled spatial genetic structure were assessed on Cyperus laevigatus populations from 9 populations along the saline-alkaline lakes and a wetland of Kenya's Rift Valley. C. laevigatus populations maintained relatively high levels of clonal and genetic diversity at species level (clonal richness-R = 0.5 to 1; He = 0.65; Ho=0.55) comparable to other emergent clonal plants. Heterozygosity levels (FIS=0.16) indicated an overall within- population inbreeding. AMOVA revealed a moderate to high differentiation (FST=0.18; p<0.001) with most of the variation observed within individuals. A Mantel test showed a significant isolation-by-distance (r2=0.40; P=0.038) between the populations whereas a strong North–South differentiation gradient was revealed from a PCoA analysis. Bayesian clustering divided the populations into three or four gene pools with Lake Magadi population being separated from the rest. A fine-scaled spatial genetic structure generally revealed structure on sheltered populations indicating local dispersal over few metres. Historical inter-basin connectivity and the Rift Valley formation were proposed to be the major driving forces of the structuring of the populations.

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The truth behind glyphosate a harmless or toxic pesticide?

BY Senne Aertbeliën

PROMOTER: Lieven Bervoets (UAntwerpen)
CO-PROMOTER: Lucia Vergauwen

Glyphosate and its commercial formulations are extensively used as herbicides in forestry, agriculture and domestic use. Significant concentrations of glyphosate and its primary metabolites have been observed in surface waters but research about its influence on the aquatic environment is needed. The toxicity of glyphosate and two of its commercial formulations Round-up® and Netosol® with active ingredient glyphosate were investigated with tests on Baetis sp., D. bugensis and D. rerio. In a concentration of 1 g/L of technical-grade glyphosate full mortality occurred for Baetis sp. and D. bugensis probably due to a decrease in pH. In Netosol® full mortality occurred at concentrations of 7.5 and higher for D. bugensis and 90 mg/L and higher for D. rerio. According LC10 and LC50 values of Netosol® for D. bugensis and D. rerio were determined from these tests. The LC50 value of D. bugensis and 96h LC50 value of D. rerio were respectively estimated as 6.1 mg/L and 47.9 mg/L. Non-lethal exposure effects including decreased swim bladder inflation and reduced growth were observed in D.rerio at a concentration of 30 mg/L of glyphosate in Netosol®. By combining large data sets from the Flemish Environmental Agency (FEA) and composing a species sensitivity distribution a currently non-existing critical environmental concentration for good ecological water quality was estimated. Using quantile regression on the large data sets of the FEA critical environmental concentrations of 2 µg/L and 10.3 µg/L for glyphosate and its primary metabolite AMPA were extracted. The estimated guideline values retrieved from the species sensitivity distribution to protect respectively 80, 90, 95 and 99% of species exposed to glyphosate or glyphosate-based herbicides were 371, 81, 18 and 0.6µg/L. This study proposes 2 µg/L as a threshold value which ensures good environmental health and does not show negative effects to any of the species tested in this research.

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The relationship between seagrasses and colonized sediments in Cau Hai lagoon, Hue, Vietnam

BY Thi Tuyet Pham

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CO-PROMOTER: Iris Stiers (VUB)
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Because of many benefits that coastal areas bring to residents, Cau Hai lagoon attracts more than half a million people base their lives on it. The lagoon possesses a high level of biodiversity, in which seagrasses are known to be very abundant in this area. However, climate change and economic activities have been causing harm to the coastal ecosystems. The area of seagrasses ecosystems has been reduced from about 2200 ha in 1999 - 2000 to 1000 ha in 2009 - 2010 [Cao, 2011]. The research and protection of seagrass ecosystems are then extremely urgent.

This study aims (i) to assess the effects of seagrass beds on sediment grain size as well as the relationship between seagrass species and other physio-chemical environmental parameters (Water temperature, pH, DO, Salinity, Turbidity, Water depth); (ii) to assess the spatial gradient $\delta15N$ and $\delta13C$ of seagrasses and sediment in the lagoon.

Seagrasses and sediments were collected in 31 sites at Cau Hai lagoon in which 21 sites with the presence of seagrass beds and 10 sites without. 7 seagrass species were observed, namely Halophila beccarii, Halodule pinifolia, Halodule uninervis, Najas indica, Halophila ovalis, Zostera japonica, Ruppia brevipedunculata. For sediment samples, impurities were removed and dissolved by chemicals, sediments were then sieved in to different classes of grain size. Mann-Whitney U test was applied to assess the differences between the grain size classification of sites with and without seagrasses. To study the carbon and nitrogen stable isotope, seagrasses and sediment were analyzed by EA-IRMS (Elemental analyser isotope ratio mass spectrometry).

Results show that the presence of seagrass beds can affect the sedimentation process in two trends depending on flow conditions: (i) Fine grain size (silt) increase in sediment according to the presence of seagrasses in tranquil water area (ii) In areas close to estuaries where currents are stronger, the presence of seagrass may decrease fine grain sediment (silt). Results from multivariate analysis show that among 7 species in the lagoon, Najas indica and Halophila beccarii reveal the most remarkable preference. Najas indica prefers fine sand, low salinity and can adapt to high turbidity while Halophila beccarii grows more in coarser sand and low salinity. In term of carbon and nitrogen stable isotopes, the data analysis showed that they are affected strongly by environment conditions: (i) $\delta13C$ has small fluctuation within a given species but wide variation among different species thus it can be used as one of factor to distinguish different seagrass species; (ii) $\delta15N$ has wide fluctuation for the same species in different places, thus the different signals are significant for tracing back the sediment sources.