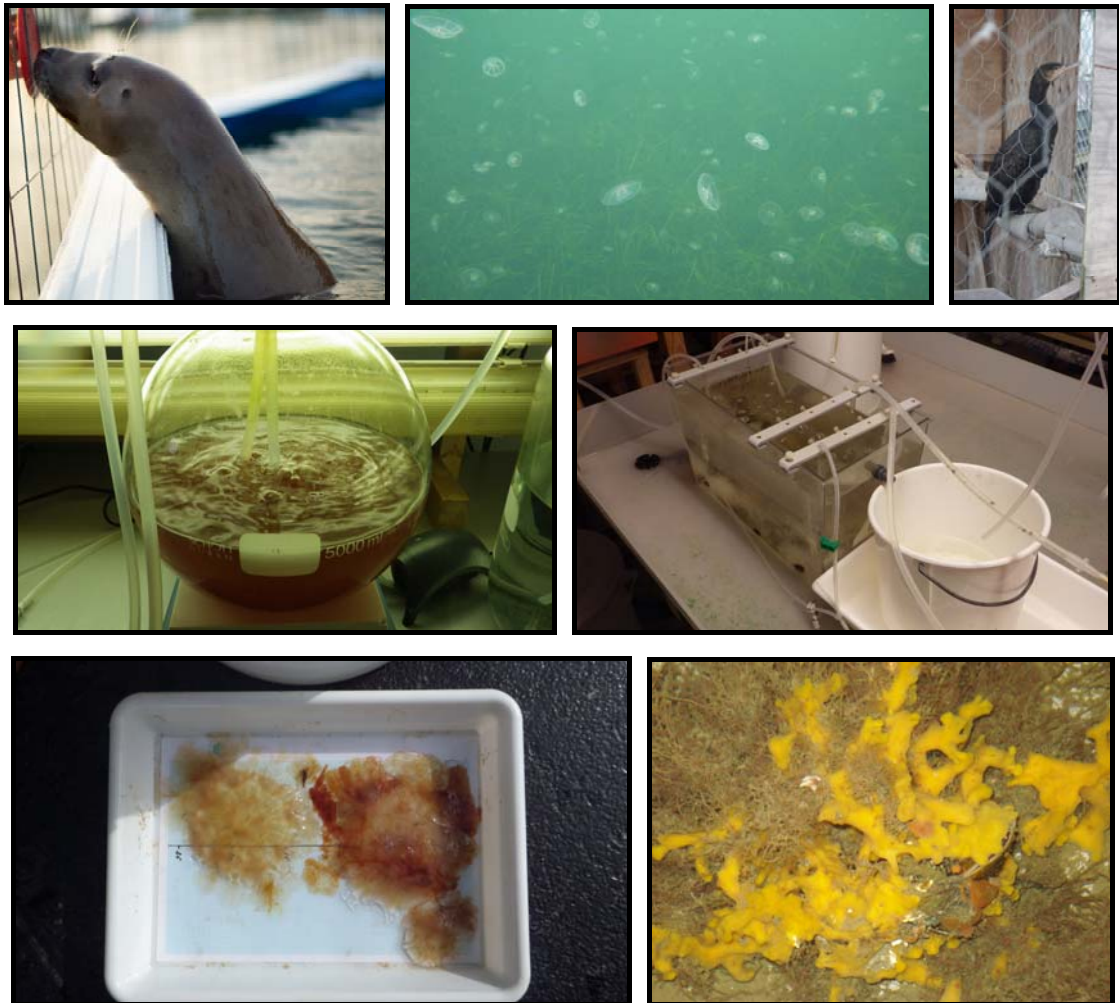




## Report on Activities in 2013

### Marine Biological Research Centre (SDU), Kerteminde



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## A short glimpse at finalized and new projects at the Marine Biological Research Centre (SDU) in Kerteminde

### MarBioShell

The MarBioShell was a 5-year project supported by the Strategic Research Council and coordinated by Professor Hans Ulrik Riisgård. The project is now finished and has assessed the potential for mussel farming in Great Belt. The project results are summarized at [MarBioShell home page](#), where there is also a [list of publications](#) related to the project.



Left: The growth and filtration rate of blue mussels from the Baltic Sea are compared to the ones from the Great Belt, Denmark, to understand what variables limit growth. Right: Professor Riisgård with a blue mussel (from: Fyens Stiftstidende, Business-Fyen).

### BIAS

[BIAS](#) is a 5-year EU Life project aiming at monitoring the acoustic noise levels of the Baltic Sea throughout a full year (2014). Magnus Wahlberg from the laboratory participated in deploying the loggers in the end of 2013 at various locations in Denmark. Magnus also participated in preparatory deployments of acoustic dataloggers around Kullaberg, Sweden, during the summer, 2013.



An acoustic data logger (the yellow tube in the cockpit to the left) prepared for deployment not far from Bornholm, on the 45 feet ketch *Roxy*, December, 2013.

### Harbour porpoises in Little Bælt

The Baltic porpoise is critically endangered. Key factors for protecting them is to understand their movement patterns and to find out which areas are used for basic behaviours critical for their survival (feeding, raising calves). Long term studies at key locations are needed to study the yearly variation in abundance of adults and calves and to pinpoint calving areas. Also, we need a better understanding of how the mothers and calves communicate. From July to November PhD student Lara Delgado studied the abundance and presence of calves in Little Bælt, as well as making acoustical recordings of mother and calves. The study was made on board the porpoise safari boat *Aventura* from Middelfart.



Lara Delgado looking for porpoises on *Aventura* in Little Bælt.

### Cormorant and grey seal hearing

The first measurements of the hearing abilities in air and underwater of cormorants were presented by MSc student Sasia Johansen at a conference in August, 2013. The hearing work at the laboratory was expanded by the arrival of a male and female grey seal in December, 2013. The preliminary enclosure will be enlarged during 2014, allowing for psychophysical trials of the seals' abilities to hear in air and under water.



PhD student Kirsten Andersen with her new arrivals, the grey seals Nino (left) and Luna (right).

### The birth of a porpoise calf at Fjord&Bælt

In early July, 2013, the female porpoise Sif gave birth to a male calf. The porpoises are housed in a net enclosure in the harbor at the outreach center Fjord&Bælt, next door to the marine laboratory. PhD student Lara Delgado was organizing the team of volunteers performing behavioral and acoustic observations of the mother and the calf. Among other interesting data, the hearing abilities of the calf could be measured. Sadly, the porpoise calf started to develop anomalous behaviours not long after birth for unknown reasons. Lactation never got started, and after a few days of futile efforts feeding the calf on milk from the mother as well as milk replacement, it was decided to euthanize the calf.



Chief trainer at Fjord&Bælt and Magnus Wahlberg measuring the hearing abilities of the new-born harbor porpoise.

### The construction of a sponge farm

To understand the population dynamics and aging of marine sponges, a 'sponge farm' was designed in the harbour net enclosure right outside the laboratory. The sponge farm consists of a triangular arrangement of wires, where small sponges have been attached on metal clips. The growth and vital rates (mortality, survival and reproduction) of the sponges will be monitored using a variety of techniques by Dan Levitis, Paul Dunn, Kim Lundgreen and PhD student Lars Kumala. Additional laboratory feeding and growth experiments will be conducted to determine potential age-related patterns in sponge performance.



Looking for eternal life? You may find it right underneath the docks at the laboratory! Left: sponges collected for cultivation. Right: Per Martensen from the SDU mechanical workshop is used to solving unusual problems at the laboratory – for example, installing an underwater sponge farm. Kim Lundgreen is assisting him.

### **Jelly fish cruises**

PhD student Josephine Goldstein collected jelly fish, both using the boat of the local Marine Home Guard for cruises in Great Belt and Limfjorden (through a research agreement between the Danish Marine Home Guard and SDU), and the small laboratory research vessel 'Mytilus' for sailing trips into the nearby Kerteminde Fjord/Kertinge Nor. The project aims at understanding the population dynamics and age patterns of bloom-forming jelly fish in the local waters of Denmark.



Kim Lundgreen and Josephine Goldstein fishing for jelly fish from the Marine Home Guard boat.

### **Sticklebacks competing with jellyfish?**

Anastasia Yurtseva from St Petersburg started up a 9-month project in December, 2013, on interspecific competition between the common moon jellyfish and sticklebacks foraging on zooplankton in Kertinge Nor. Her visit is funded by a Danish Government Scholarship.



The laboratory containing the stickleback aquaria to the right.

### **Eelpout ecotoxicology**

In recent years malformations among eelpout fry living in North European coastal areas with high anthropogenic input have been observed. Unlike the majority of fish species the eelpout bears living

young, and maternal exposure to chemicals including endocrine disrupters might explain the observed fry malformations as similar effects have been observed by direct exposure of fish eggs. The Danish Environmental Protection Agency are via Centre on Endocrine Disrupters funding research on effects of endocrine disrupters in the Danish population and environment and Postdoc Jane Morthorst and Professor Poul Bjerregaard (both at SDU) perform these eelpout laboratory experiments to investigate the effects of various estrogenic compounds on gravid wild-caught eelpout and their fry.



Eelpout larvae are used a model species for investigating the effects of chemicals on the marine environment.

### **Life conditions 1 billion years ago**

To estimate the oxygen requirements of the first animals on earth, PhD student Daniel Mills explored the low-oxygen tolerance of the breadcrumb sponge.

It is widely thought that the oxygen requirements of animals were not met by the environment until relatively late in Earth's history, sometime 0.5-1 billion years ago). However, it is not known how much oxygen, exactly, these early animals required. The growth, respiration, feeding, and overall health of the sponges were unencumbered by oxygen levels met on Earth for nearly 2.3 billion years. Therefore there was likely enough oxygen in the environment to support animals well before their actual origination. Whatever delayed the evolution of animal life on Earth, it probably was not oxygen.



The two tinfoil-covered containers in the middle of the setup contain sea sponges grown under conditions mimicking the ocean environment billions of years ago.

### **Det Maritime Hus**

'The Maritime House' was launched in 2013 by SDU and Kerteminde Kommune to teach high school students about the marine environment, and to create interest among them for natural sciences. Rikke Svensson (SDU) is the main organiser of the project, and the high school classes spent 2-3 days in Kerteminde and on SDU campus to learn about marine production, diving physiology, and how to cook local seafood. The project continues at an even larger scale in 2014 through financial support from RegionSyddanmark.



Fish dissection for high school students (left) and student dive response measurements (right).

### **Teaching university classes**

University students from all over the world participated in several undergraduate and graduate university classes at the laboratory in 2013. The course topics ranged from marine and aquatic ecology, to bioacoustics and marine mammalogy.



Paul Dunn helping students to read a tagged star fish during a 1st-year university project.

## Staff, students, guests, and laboratory activities in 2013

### Staff

#### *Faculty*

Hans Ulrik Riisgård, Professor  
 Magnus Wahlberg, Associate Professor  
 Lee Miller, Associate Professor and Guest researcher  
 Dan Levitis, Assistant Professor  
 Kim Lundgreen, Academic Research Assistant

#### *Post Doc*

Paul Dunn  
 Anastasia Yurtseva (visiting from St Petersburg State University)

#### *PhD students*

Kirstin Anderson Hansen (2013-16). Hearing of marine mammals in air and under water  
 Lara Delgado (2012-15). Biosonar of toothed whales and behavioural implications  
 Josephine Goldstein (2013-16). Life-history stages of the moon jellyfish *Aurelia aurita* - towards a demographic understanding of jellyfish blooms  
 Lars Kumala (2013-16). Biodemography of aging in sponges (SDU and Max Planck Institute for Demographic Research)

#### *MSc projects*

Sasia Johansen (2013). Høretgærsklen I luft og vand hos mellanskarven (*Phalacrocorax carbo*)  
 Julie Madsen (2013). Et optimalt undervisningsforløb  
 Rasmus Sloth Pedersen (ongoing). Hearing in harbour porpoises  
 Tina Huulvej (ongoing). Response of the cormorants (*Phalacrocorax carbo*) to underwater sounds

#### *Finished BSc projects*

Ann-Sophie Delbanco. Stereotypic behavior of harbor porpoises in captivity  
 Kristine Jensen. Playback experiments on cormorants in air

#### *Trainees and international students (selection)*

Ruben van Beek (Van Hall Larenstein trainee placement from September 2013 to January 2014)  
 Ann-Sophie Delbanco, University of Copenhagen, Bachelor student, July 2013  
 David Domench (Leonardo da Vinci grant trainee, October 2013 to April 2014)  
 Ana Torrano Lozano (Leonardo da Vinci grant trainee from December 2012 to June 2013)  
 Magali Mulot (practical placement in engineering; May to July 2013)  
 Lucía Carlota Merino Gonzalez Pardo (Erasmus Placement traineeship; July to September 2013)  
 Belén García Ovide, Erasmus Placement traineeship, July to September 2013)

#### *Visiting scientists (selection)*

Poul Bjerregaard and Jane Mørthorst (SDU): Eelpout ecotoxicology study, fall 2013  
 Daniel Brady Mills (PhD student, SDU): Earth's evolution, spring 2013  
 Peter Madsen and Kristian Beedholm (Aarhus University): Toothed whale biosonar  
 Ursula Siebert (University of Veterinary Medicine, Hannover): Marine mammal hearing

### Conference presentations

Bergström, L., T. Malm, N. Å. Capetillo, H. Ohlsson, M. Wahlberg, R. Rosenberg, L. Kautsky 2013. Effects of off shore wind farms on marine wildlife – a risk assessment synthesis for Swedish waters. Conference on Wind power and Environmental Impacts, Stockholm February 2013  
 Delgado, L., Wahlberg, M., Blanchet, M-A. First description on behavioural development of a harbour porpoise (*Phocoena phocoena*) mother-calf pair. 10th Danish Marine Mammal Symposium: From species to management units, Copenhagen, Denmark. April 2013  
 Delgado, L., Wahlberg, M., Nørum, U. First description on social interactions in harbour porpoises (*Phocoena phocoena*). 10th Danish Marine Mammal Symposium: From species to management units, Copenhagen, Denmark. April 2013



- Dunn, P. H., D. A. Levitis (August 2013). Ontogenescence and the Barnacle: an experimental examination of early life mortality in the estuarine barnacle *Amphibalanus improvisus*. Paper presented at The Congress of the European Society for Evolutionary Biology, Lisbon, Portugal
- Dunn, P. H., D. A. Levitis. Ontogenescence in the Estuarine Barnacle *Amphibalanus improvisus*. Paper and poster presented at the Evolutionary Demography Society Meeting, Odense, Denmark, October 2013
- Goldstein, J., D., A. Levitis, H. U. Riisgård. Jellyfish in Kertinge Nor/Kerteminde Fjord (Denmark): size, growth and fertility. Paper presented at the Fourth International Jellyfish Bloom Symposium, Japan, June 2013
- Goldstein, J., D. A. Levitis, H. U. Riisgård. Jellyfish in Kertinge Nor/Kerteminde Fjord (Denmark): size, growth and fertility. Poster presented at the Evolutionary Demography Society Meeting, Odense, Denmark, October 2013
- Levitis, D. A., P. H. Dunn. A proxy-based hypothesis regarding the evolutionary history of metazoan senescence. Paper and poster presented at the Evolutionary Demography Society Meeting, Odense, Denmark, October 2013
- Kumala, L., P. H. Dunn, D. A. Levitis. Biodemography of aging in sponges: How can age be determined? Poster presented at the Evolutionary Demography Society Meeting, Odense, Denmark, October 2013
- Kumala, L. Investigations on abundance and activity of microbial sponge symbionts using quantitative real-time PCR. Oral presentation, 9<sup>th</sup> World Sponge Conference in Freemantle, Western Australia, November 2013
- Levitis, D., P. Dunn, J. Goldstein, L. Kumala. Oral presentation, The Evolutionary Demography Conference
- Miller, L.A., M. Wahlberg. Echolocation by the harbor porpoise: life in coastal waters. Dansk Havpattedyrsymposium, February 2013, Copenhagen
- Siebert, U., A. Ruser, K. Lucke, D. Houser, J. Teilmann, N. van Elk, J. Kristensen, M. Wahlberg, E. Everaats, M. Dähne. Investigations on hearing abilities of harbor porpoises (*Phocoena phocoena*) in human care and the wild. EAAM Nürnberg, March 2013
- Teilmann, J., R. Dietz, P. T. Madsen, D. Wisniewska, M. Johnson, L. A. Miller, U. Siebert. Acoustic Telemetry: Harbour porpoises and seals. 17. Danske havforsker møde, Roskilde Universitet, January 2013.
- Wahlberg, M. Hearing in the harbour porpoise. Office of Naval Research Program Meeting, San Diego, Sept. 2013

#### Scientific papers (peer reviewed)

- Boström, M., C. Krog, L. K. Larsen, S.-G. Lunneryd, M. Wahlberg 2013. The acoustic activity of harbour porpoises (*Phocoena phocoena*) around gill nets. *Aquatic Mammals* 39(4): 389-396
- Dunn, P. H., C.M. Young 2013. Finding refuge: The estuarine distribution of the nemertean egg predator *Carcinonemertes errans* on the Dungeness crab, *Cancer magister*. *Estuarine, Coastal and Shelf Science* 135: 201-208
- Larsen, P.S., K. Lundgreen, H. U. Riisgård 2013. Bioenergetic model predictions of actual growth and allometric transitions during ontogeny of juvenile blue mussels *Mytilus edulis*. In: Nowak, J., Kozłowski, M. (eds.) *Mussels: ecology, life habits and control*. Nova Science, New York, pp. 101-122
- Linnenschmidt, M., J. Teilmann, T. Akamatsu, R. Dietz, and L.A. Miller. 2013. Biosonar, dive and foraging activity of satellite tracked harbour porpoises (*Phocoena phocoena*). *Marine Mammal Science* 29: E77-E97.
- Levitis, D., J. Goldstein 2013. The consistent, non-destructive measurement of small proteiform aquatic animals, with application to the size and growth of hydra. *Marine and Freshwater Research*. 64(4): 332–339
- Miller, L. A., M. Wahlberg 2013. Echolocation of the harbour porpoise: Life in coastal waters. *Frontiers in Neuroscience* 4:52. doi: 10.3389/fphys.2013.00052
- Nielsen, T. P., M. Wahlberg, T. Dabelsteen 2013. Assessment of long-distance detection of gillnets by porpoises: Reply to Dawson and Lusseau (2013). *Marine Ecology Progress Series* 478: 303-305
- Oliveira, C., M. Wahlberg, M. Johnson, P. Miller, P. T. Madsen 2013. The function of male sperm whale slow clicks off Northern Norway: Echolocation, feeding or navigation. *Journal of the Acoustical Society of America* 133(5): 3135-3144
- Pleissner, D., K. Lundgreen, F. Lüskow, H. U. Riisgård 2013. Fluorometer controlled apparatus designed for long-term algal-feeding experiments and environmental effect studies with mussels. *Journal of Marine Biology* 401961, 12 pp. doi:10.1155/2013/401961
- Rasmussen, M.H., T. Akamatsu, J. Teilmann, G.A. Vikingsson, and L.A. Miller. 2013. Biosonar, diving and movements of two tagged white-beaked dolphin in Icelandic waters. *Deep-Sea Research II* 88-89:97-105
- Riisgård, H.U., F. Lüskow, D. Pleissner, K. Lundgreen, M. A. P. López 2013. Effect of salinity on filtration rates of mussels *Mytilus edulis* with special emphasis on dwarfed mussels from the low-saline Central Baltic Sea. *Helgoland Marine Research* 67: 591-598
- Riisgård, H.U., D. Pleissner, K. Lundgreen, P. S. Larsen 2013. Growth of mussels *Mytilus edulis* at algal (*Rhodomonas salina*) concentrations below and above saturation levels for reduced filtration rate. *Marine Biology Research* 9(10): 1005-1017
- Riisgård, H.U., K. Lundgreen, P. S. Larsen 2013. Potential for production of 'mini-mussels' in Great Belt (Denmark) evaluated on basis of actual growth of young mussels *Mytilus edulis*. *Aquaculture International* (published online; doi:10.1007/s10499-013-9713-y)

- Riisgård, H.U., P. S. Larsen, D. Pleissner 2013. Allometric equations for maximum filtration rate in blue mussels *Mytilus edulis* and importance of condition index. Helgoland Marine Research (in press)
- Riisgård, H.U. 2013. Filter-feeding mechanisms in crustaceans (Chapter 15, 79 pp.) In: Thiel, M., Watling, L. (Eds.) *Life styles and feeding biology*, in the book series on *The Natural History of Crustaceans*, Oxford University Press (in press)
- Riisgård, H.U., M. Mulot, L. Merino, D. Pleissner 2013. Effect of salinity-changing rates on filtration activity of mussels from two sites within the Baltic *Mytilus* hybrid zone: the brackish Great Belt (Denmark) and the low saline Central Baltic Sea. Open Journal of Marine Science (accepted)
- Shiganova, T., H. U. Riisgård, S. Ghabooli, O. S. Tendal 2013. First report on *Beroe ovata* in an unusual mixture of ctenophores in Great Belt (Denmark). Aquatic Invasions (in press)
- Wilson, M., A. Surlykke, M. Wahlberg, P. Madsen 2013. Ultrasonic predator-prey interactions in water – convergent evolution with insects and bats in air? *Frontiers in Neuroscience* 4:137:1-12

#### Scientific seminars

- International symposium on echolocation in toothed whales and bats, May 2013

#### Popular science

- Wahlberg, M. (2013). Nyd dine ører! Oceaner af Lyde exhibit booklet, Naturama, Svendborg

#### Teaching

##### University

- 1<sup>st</sup> year projects (NAT501): Hearing in porpoises, dive physiology of porpoises, starfish telemetry
- Zoology course visit
- Aquatic biology
- Fresh water biology
- Biology of Marine Mammals (University of Southern Denmark and Aarhus University; 2 classes)
- Acoustic communication (international PhD class)

##### High school teaching

- Det Maritime hus: 2-3 day educational visits of high school classes, in all more than 10 classes in 2013
- Haahr high school, Svendborg, 1-day visit, May
- Akademiet for talentfulde unge, 1-day visit, May

#### Scientific outreach (selection)

- Fiskens dag, September, mussel soup arrangement for tourists
- Fjordens dag, September, mussel soup arrangement for tourists
- Open house, Forskningens Døgn, April
- Science festival, September (lectures in public schools for more than 1000 students)
- 'Foodtech Bazar', Roskilde, October, 2013 (poster about mini mussels)

#### Media (selection)

- Bornholm TV2: Acoustic noise in the Baltic sea, December
- DR radio about the grey seal project, December
- Fyens Stiftstidende about porpoise research cruises in Little Bælt, August
- Fyens Stiftstidende about the grey seal projet, December
- Home guard's home page: Havforskersejlads: Dræbergopler i Limfjorden Septemner
- Ingeniøren and Skive Folkeblad about Hans Ulrik Riisgård and killer jellyfish; May-December (5 articles)
- Business-Fyn (Fyens Stiftstidende) about Hans Ulrik Riisgård and mussel cultivation, June
- Nordjyske Stiftstidende about Hans Ulrik Riisgård and jelly fish, September and December
- Politiken about Hans Ulrik Riisgård about jelly fish, August, 2013

#### Funding (selection)

- Carlsbergfondet: particle counter (Riisgård) and sound-proof booth (Wahlberg)
- Danish National Research Council: Large framework 2012-14 (Madsen, Surlykke, Wahlberg)
- EU Life: BIAS (monitoring Baltic Sea noise levels; Sigray, Tougaard, Wahlberg)
- European Fisheries Fund: Echo measurements of fishing gear (Larsen, Wahlberg)
- University of Southern Denmark Research fund: Porpoise studies in Little Bælt (Delgado)