



KRISTINEBERG MARINE STATION

5th International PhD-student course in DOCUMENTATION TECHNIQUES FOR SCIENTIFIC DIVERS 2019, (4-ECT)

Teachers that are involved and/or have contributed to the development of the course:

Maria Asplund is a researcher in marine ecology and the Diving activity coordinator at the Lovén Centre, University of Gothenburg. Her research primarily is focus on ecological processes, trophic interactions, functional ecosystem connectivity in relation to carbon sequestration and climate change. She uses scientific diving both in her own research, to support other research teams and she teaches scientific diving methods in international university courses. She represents Sweden in the European Scientific Diving Panel.

Eduardo Infantes a researcher in marine ecology mainly focusing on bio-physical interactions between seagrasses and hydrodynamics, and restauration of seagrass meadows. Scientific diving is extensively used within his research and he uses underwater documentation to illustrate and for his empirical analysis.

Lars-Ove Loo is a researcher in marine ecology and has worked with benthic-pelagic coupling in different ecosystems, mapping of different marine habitats and currently analyzing and processing historical marine biological data. He uses photography and filming as a tool in his research.

Anders Salesjö is a marine biology teacher and one of Scandinavia's topmost underwater photographers. He has won both the Nordic and Swedish championships in underwater photography and has represented Sweden at several world championships organized by CMAS (Confédération Mondiale des Activités Subaquatiques). He is an elected member of the Association of Nature Photographers. He is best known for his macrofauna photographs from Nordic waters but also from other part of the world.

Helén Nilsson Sköld is a researcher in marine zoology focusing on developmental biology like cell proliferation, reproduction and ageing but she also work on fish coloration in a behavioral or ecological framework.

Matz Berggren is a researcher in marine zoology specialized in crustacean taxonomy and ecology. He is using both diving and photographing as tools for collecting and illustrating taxa of interest in his research such as photography stacking. Working with habitat specialization by higher crustacean he illustrates this by building chosen habitats in aquarium and photographing the animals in it!

Martin Gullström is a researcher in marine ecology. His research interests focus on marine spatial ecology, landscape/seascape ecology, ecological connectivity, trophic interactions, fish/fisheries-related ecology; and sea grass ecology/ecophysiology related to carbon sequestration, ocean acidification and

climate change. Most of the research is linked to spatial resource management and nature conservation of the coastal marine environment. Scientific diving and underwater visual mapping methods are regularly used in Martin's research.

Leon Green Ekelin is a former-underwater-camera-technician-gone-research-student. With diving experience from under water film productions around the globe, he's now trying to find use of his skills when microscope filming and photographing eggs in the lab. His research studies focuses on environmental adaptation in fish mating systems. On a more personal level he is trying to get comfortable with rebreather diving.

Björn Källström is a researcher in marine biology. His research interests focus on tropical stony corals, seagrasses and rockpool ecosystems. He is an AESD and uses scientific diving for research and for constructing and maintaining underwater observatories for both research and out-reach. Björn works at the aquarium at the maritime Museum & Aquarium (Sjöfartsmuseet Akvariet) in Gothenburg, Sweden.

Jouni Leinikki is a marine researcher working as a private consultant through his company Alleco. He has specialized in scientific diving, and has conducted scientific research, assessments and scientific diver training since the beginning of 1980's. Jouni is also the chairperson of the Finnish Scientific Diving Steering Association and Finland's national representative in the European Scientific Diving Panel. During the past four years, Jouni has developed underwater electronic data collection methodology based on an underwater tablet computer and related software. The developed products also include a diver's buoy that allows to use GPS navigation underwater and to connect to the internet. Scientists can now collect georeferenced data directly into electronic format.

Staffan Von Arbin is a PhD student in underwater archaeology working with the project "Ripples on the Water: Seafaring Strategies in the Viken Area A.D. 1150–1550". He has a long experience working with marine archaeological cultural conservation and commissioning activities mainly at at Bohuslän's museum in Uddevalla. He is also a dive supervisor.

Lars Kirkegaard Lars is one of Scandinavia's very experienced photo/videographers with many years of working as both an active member of the Scandinavian Underwater Community, an underwater photographer, studio photographer, TV-videographer and as a Graphic Arts specialist. He has company Fotografit working with underwater imaging and light. In the course he will speak about underwater illumination.

Ursula Schwarz is our eminent staff, skipper and dive supervisor that have been previously previously involved in the courses.

Pia Engstrom and Diana Deyanova is our dive supervisors that have been involved in the courses.

Examiner for the 2019 years course: Prof. Peter Tiselius, University of Gothenburg.

Contact information:

Maria Asplund maria.asplund@gu.se (Contact)

Eduardo Infantes eduardo.infantes@marine.gu.se (Course leader)

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Course description and entry requirements

Disciplinary domain: Marine Science and underwater science

Host: Kristineberg Station, Department of Marine Sciences, University of Gothenburg

Date and Location: The course will be conducted between 12-23 August (arrival 11th Aug) as a 13 day intensive course at the marine field station Kristineberg in Fiskebäckskil, Sweden (for more info: www.loven.gu.se).

Deadline for application: Apr 20th 2019

1. Number of participants

A total of 16 PhD students in underwater science disciplines (marine, biology, archaeology, geology, ecology, chemistry, arts and journalist). Master students, postdoc or early career scientists may also be accepted. Maximum of 12 scientific divers can participate in the course but we will also admit a maximum of 4 participants that use the same techniques while snorkeling if they do not have the required dive experience.

2. Course description

Photographic documentation techniques are used in science to map and measure distribution patterns, sizes, areas and volumes (Bryson et al. 2017). Further it can be used to record changes in the environment, in behaviors and to follow moving objects such as fish (Hammar et al. (2013). Underwater photography is also very important for science illustration and outreach. However, research in aquatic environments requires special techniques for documentation since the accessibility by humans are limited and most water conditions prevents observation of the underwater environment from the surface. Further, water creates challenging conditions compared to in air with changes in refraction, colours, light penetration and particles creates backscatter when supplying artificial light sources. The water movement also affects the stability of the cameras which have to be taken into consideration to get high enough quality to retrieve your data.

Scientific diving is an important tool for researchers to access the aquatic environment that they work in and to facilitate documentation techniques in the underwater environment. Scientific diving is used by marine researchers to visit, document and perform empirical studies in the environment that they work in and is used in multitude of disciplines from microbiology, ecology, geology, oceanography, chemistry, archeology to engineering sciences (Asplund et al. 2016).

Further, underwater documentation could also be of interest for journalists, communicators, and educators since these methods are used to create outreach material to authorities, legislators and the general public that cannot easily access the underwater environment. Many terrestrial sciences have a great advantage compared to marine sciences in that natural phenomena can be observed on first hand. This single handedly can create a greater understanding of the environment that they are studying. Underwater documentation by scientific divers are of great importance "to support professional research and education and for the protection, conservation and monitoring of the natural environment and cultural heritage" (European Scientific Diving Panel).

Aim: The aim of the course is to educate young scientists with tools for scientific underwater documentation techniques to illustrate scientific research and to conduct empirical studies in the marine environment. The course comprises introductory lectures but is mainly focus on practical hands-on sessions using underwater documentations techniques.

The goals of the course are:

- To run as a participatory oriented workshop including new upcoming and advancing techniques and knowledge is not only shared with the students but also among the participating teachers.
- To create international network platforms for underwater research and do joint science.
- To plan, conduct and carry out a joint small-scale research project with the ambition to be published after the course.
- To create scientific outreach material to the public for a better understanding of the submerged seascapes and cultural heritages.

3. Position in the educational system

Elective course; third cycle education.

- ### 4. Entry requirements
- (* if any of the requirements is not available at the deadline for application provide a plan how these requirements will be met before the course start).

The following should be provided in the application and sent to maria.asplund@gu.se deadline for application Apr 20th, 2019:

- Admitted to third cycle education, graduate students. Affiliations and insurance letter from a responsible person at their home university or research institute stating that they are students or employees.
- A short abstract (max 200 words) describing the applicants research and how the applicant can foresee the usage of scientific diving documentation techniques within their research (if applicable), should be sent in with the application to the course.

Additionally, for participants that will conduct scientific diving during the course:

- A dive certificate; either a professional European Scientific Diver, Swedish S30 or equivalent, according to IDSA level 1 standards or a recreational (sports-) dive certificate corresponding to at least CMAS** or PADI rescue diver.
- Documentation (log book) of at least 20 logged dives whereof at least 5 dives with a max depth of at least 18 m.
- Documentation of previous cold-water diving and experience of diving with dry-suit.
- A medical health examination for work diving according to Swedish Work Environment Authority's provisions AFS 2006:5 or corresponding foreign health examination less than 5 years ago (<40 years of age) and less than 2 years ago (>40 years of age at the time for the course).
- Documentation of conducted CPR (cardio pulmonary rescue training) within the last 3 years.

For participants using snorkeling during the course:

- Should feel comfortable to swim in deep water and have previous experience of snorkeling
- Should know how to wear dry- or wet suit and light weights for balance in the water.

Before the course start all participants should

- Prepare about 5 min presentation about their own research and how they foresee the use of underwater documentation techniques in their research and which techniques that are of special interests.

5. Preliminary Schedule

Day 0. Arrival (11-Aug, 2019)

Day 1. Introduction, safety regulation and practical dive safety for scientific divers

- Introduction to the course and examples of scientific diving in science
- Lecture on Swedish Diving legislations, Gothenburg University dive rules, Routines for Scientific diving at Kristineberg.
- Handing out equipment, soft wares and paper work
- Group work with dive planning and risk assessments for scientific diving.
- Refreshment dives, dive planning, risk assessment of safe practice scientific diving techniques and rescue scenario training
- Welcome mixer and student short presentations

Days 2-5. Illustrating marine research using underwater digital photography

- Hands-on handling of photographic equipment for underwater documentation
- Lecture on the difference of photography on land and in water, optimization of lighting and position of strobes during underwater photography, macro- and wide-angle photography, composition of picture
- Practical sessions with underwater photography both macro- and wide angle while diving
- Practical use of macro and wide-angle photography in science, examples from for instance seagrass ecology, coloration and color change of organisms, following short-term and long-term changes, revisiting of localities used in previous scientific projects etc.
- Hands on Imaging in Lightroom and Photoshop (Adobe) and Image J
- Stacking photography

Days 6-7. Digital photography for empirical studies and scientific outreach

- Hands on practice with in-field practice and image analysis of underwater stereo photography and time-lapse techniques to quantify changes in the environment
- Hands on practice with in-field practice and image analysis of underwater photography to study distribution, morphology, coverage, volumes, coloration and behavior.
- Underwater video streaming to documentation and outreach. Example of Kristineberg Underwater Observatory video system
- Practical in video filming and editing in scientific outreach.

Days 8-9. Photogrammetry: 2D and 3D techniques for quantitative analysis

- Use of stereo-video system techniques and hands on analysis of the films, measuring of distance, mobility and behavior, size of marine organisms
- Building up 3-D models of objects using 3D photogrammetry and measuring volume

Days 10-11. Underwater mapping

- Underwater mapping and GPS positioning using an underwater tablet.
- Introductory lecture on coastal mapping using drones.
- Alternative techniques, such as MOV (underwater sledges), drop-video techniques for observation and quantification in the marine environment.

Day 12. Examination

- Presentation of scientific diving documentation produced during the course and how they plan to apply these techniques within their research and projects conducted during the course.
- Presentation of the scientific outreach video.
- Cleaning, returning of equipment and leaving.

6. Outcomes

1. Knowledge and understanding

After completion of the course the Ph.D. student is expected to have received tools needed to use underwater documentation techniques for:

- To illustrate their underwater research and produce outreach material.
- To be able to conduct empirical studies in the marine environment using underwater documentation techniques.

2. Skills and abilities

Use of scientific underwater documentation techniques are required skills in the European Scientific Diver (ESD) certification, which is a mobility certificate within Europe. Therefore, documented proof of experience from the course can further be used if students intend to apply for the ESD certificate.

3. Judgement and approach

We need to provide the new generation of researchers of tools so that they can make use of underwater documentation into their marine research. Further, the candidates will learn how to adapt to the new legislations and practice safe scientific diving.

6. Required reading

Reading material will be provided after acceptance in the course and will include:

- Scientific papers describing underwater documentation techniques that will be used during the course.
- Diving work The Swedish Work Environment Authority's Provisions on Diving Work and General Recommendations on the implementation of the Provisions 2010:16.
- Dive rules for Gothenburg University (STYRDOKUMENT Dnr V 2013/511).

7. Assessment

Required steps in order for a student to pass the course:

1. Oral presentation on arrival.
2. Oral presentations of the documentation produced during the course and how the PhD students aim to apply the scientific documentation techniques in their research.
3. Showed proof that they practice safe diving (or snorkeling) and field practices and make correct risk assessment Active participation during the course.

4. All scheduled activities during the course are mandatory.

8. Grading scale

The grading scale comprises Fail, (U), Pass (G)

9. Course Evaluation

The course evaluation is carried out together with the Ph.D. students at the end of the course, and is followed by an individual, anonymous survey. The results and possible changes in the course will be shared with the students who participated in the evaluation and to those who are beginning the course.

10. Language of instruction

The language of instruction is English. A high English level in writing, reading and speaking is required to participate in the course.

11. Course fee

- The course is funded by The Royal Swedish Academy of Sciences and covers accommodation, food (breakfast, lunch, dinner at the station restaurant), all diving material and boating facilities.
- Travel to Kristineberg is not covered for by the course.
- To cover some external expenses for the course, a **course fee of 150 Euros** is required.

References

Asplund et al. (2016), The European Scientific Diving network's 2nd Conference on Scientific Diving: a collective view from the organising committee. *Underwater technology* 34: 1-2

Bryson et al. (2017) Characterization of measurement errors using structure-from-motion and photogrammetry to measure marine habitat structural complexity. *Ecology and Evolution*, DOI:10.1002/ece3.3127

European Scientific Diving Panel, www.scientific-diving.eu/

Hammar et al. (2013) Hydrokinetic Turbine Effects on Fish Swimming Behaviour. *PLOS One* 8(12):e84141. doi:10.1371/journal.pone.0084141