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Scientific Diving in Europe: Integration, Representation and Promotion

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Abstract

In 2000, the European Union (EU) created the European Research Area with the intention of forming a unified area across Europe that would enable researchers to move and interact seamlessly based on a series of aligned working directives. The EU research network presently consists of 33 countries made up of the EU member states (27 countries) plus an additional 6 non-EU member countries that have associated status. The challenge for European scientific diving has been to integrate existing national programmes through a single organisational structure that supports the promotion of recognized diving standards within European science while advancing the wider acceptance of diving as a research tool. Since 2007, scientific diving in Europe has been overseen by the European Scientific Diving Committee that is based on the principle of promoting the European Scientific Diver and the Advanced European Scientific Diver competencies as the primary European scientific diving standards.

Keywords: diving standards, Europe, scientific diving

Introduction

Scientific diving is an indispensable research tool that supports a wide range of aquatic science disciplines including underwater archaeology and European water body management disciplines (Fischer P, personal communication, 2006; Sayer, 2007a) throughout most global environments (Lang and Sayer, 2007; Sayer, 2007a; Sayer et al., 2007a). In addition to surface supplied sampling from European research vessels, medium and deep water landers, and the application of remotely operated and autonomous underwater vehicles, scientific diving is an essential tool that supports cutting-edge science worldwide both in marine and freshwater environments (Fischer et al., 2007; Lang, 2007; Sayer, 2007a; Sayer, 2007b; Sayer et al., 2007a). Diver-supported aquatic research allows for high-quality, highly-selective, accurately-repeated and ecologically-compatible research (Bussmann et al., 2007; Keskinen and Arponen, 2007; Kuklinski, 2007; Sayer, 2007a; Schröder A and Krone R, personal communication, 2007). Today, scientific diving is often considered an essential tool for many research projects, predominantly in depth ranges of between 0 and 50 m water depth but with the technical capability of now going deeper and longer (Lang and Smith, 2006; Sayer, 2006). As such, diving is a research tool that is employed widely throughout Europe in support of a large number of high-quality research programmes (Sayer, 2007a).

Scientific diving throughout the world has an extremely good safety record (Carter et al., 2005; Lang, 2005; Sayer, 2005; Sayer and Barrington, 2005; Dardeau and McDonald, 2007; Sayer et al., 2007b). However, through its very nature, many national legislators view occupational scientific diving as

carrying a higher than normal risk (Sayer, 2004; Sayer and Forbes, 2007). Because of this, many countries insist on scientific divers having varying levels of training and qualifications in order to dive as part of their work. Although these qualifications have many commonalities between nations, it has been evident for some time that national considerations may impede the ability to use scientific diving easily between all nations that may partner pan-European research programmes. As well as imposing financial penalties on programmes wishing to engage in trans-national diving research programmes, different national approaches may now infringe European Union (EU) working directives (e.g., Directive 2005/36/EC that came into force in 2007).

As of the beginning of 2008, there are 33 countries that are eligible for European science funding with the potential for undertaking trans-national scientific diving projects. These are the present 27 EU member states (Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Republic of Cyprus, Romania, Slovakia, Slovenia, Sweden, Spain, United Kingdom) plus six member candidate or research-associated states (Iceland, Israel, Lichtenstein, Norway, Switzerland, Turkey). Scientific diving as a research tool and/or an 'at work' activity is approached differently in many of the 33 countries and may range from highly organised and co-ordinated activities integrated fully into that nation's health and safety legislation to an activity undertaken without any organisational framework. In addition, some nations may have specific diving at work legislation that fails to recognize certification and/or standards from other countries.

The need to develop an international and resilient research platform for scientific diving within the EU has become established because of the increasing need to address scientific issues on pan-European scales while advancing scientific excellence in diving-supported programmes within the EU-research framework. In addition, a more integrated approach will establish an organisation and organisational structure for scientific diving within the developing European Research Area (ERA). In all circumstances, it is essential to ensure that all advances in scientific endeavour and achievement are achieved within acceptable safety levels. For these reasons, leading scientists who employ diving techniques within eight European countries (UK, France, Sweden, Finland, Poland, Italy, Belgium and Germany) started an EU-wide initiative in 2007 to establish a pan-European platform to support scientific diving. As well as promoting and enhancing scientific excellence within the field of diving-supported aquatic research, the initiative also sought to establish harmonized rules and guidelines. Based on two international workshops in Berlin and Bremerhaven (Germany), the European Scientific Diving Committee (ESDC) was established and formally constituted in October 2007 in Bremerhaven.

This account outlines the structure and operational basis of the ESDC, the practical competency standards for scientific diving in Europe, and the proposed methodology for promoting scientific diving within the European research community.

Discussion

European Standards for Scientific Diving

The requirement to establish standard competencies throughout Europe was foreseen, and in the late 1980s scientists who used diving in their research sought to initiate the harmonization of the rules and procedures for scientific diving in Europe. In 2000, during the final meeting of that group in Banyuls-sur-Mer, France, this effort finally resulted in the development of two European scientific diving standards: that of European Scientific Diver (ESD), and of Advanced European Scientific Diver (AESD) (Table 1). The quality and widespread acceptance of these draft standards by much of the

European scientific community has resulted in them already becoming adopted within the health and safety legislation of some EU countries.

European Scientific Diving Committee (ESDC)

Since the publication of the 2000 draft standards, there have been an increasing number of aquatic-aligned EU projects on worldwide relevant topics like global change and biodiversity, but also an increasing number of international relevant archaeological projects with respect to the UNESCO world heritage program. This increase in diving-supported research highlighted the need to develop an international and resilient research platform for scientific diving within the EU. Doing so would act to facilitate scientific excellence in diving-supported programmes within the EU research framework. In addition, it would establish a formal organisation and organisational structure within the developing ERA. In all circumstances, it was essential to ensure that all advances in scientific endeavour and achievement were achieved within acceptable safety levels.

For these reasons, in 2007, leading scientists who employ scientific diving techniques within eight European countries (UK, France, Sweden, Finland, Poland, Italy, Belgium, and Germany) started an EU-wide initiative to establish a pan-European platform to support scientific diving. As well as promoting and enhancing scientific excellence within the field of diving-supported aquatic research, the initiative also sought to establish harmonized rules and guidelines. Based on two international workshops in Berlin and Bremerhaven, Germany in 2007, the European Scientific Diving Committee was established and formally constituted in October 2007 in Bremerhaven. The main objectives of this newly founded ESDC are:

1. To advance underwater scientific excellence in Europe through:
   (a) the facilitation of conferences, workshops, courses and publications where scientific diving is promoted as a research tool;
   (b) the encouragement and support for European funded research networks that employ scientific diving;
   (c) the continual improvement and extension of the methodology of diver-supported research beyond the actual state-of-the-art methods and to seek out and validate new technologies which underpin future gains in knowledge of underwater science.

2. To promote safety in scientific diving across Europe through:
   (a) facilitating a pan-European framework that exists to promote industry best practice in scientific diving;
   (b) promotion and support for the establishment of national scientific diving committees where they don't exist;
   (c) the development and maintenance of a European database of scientific diving activities.

3. To encourage international mobility in the European scientific diving community through the implementation of a practical support framework by:
   (a) promoting the widespread recognition of the existing ESD and AESD as the minimum standards for scientific diving by assuring their acceptance as the primary qualifications for scientific diving in Europe;
   (b) becoming established as the recognised European body with responsibility to provide advice and guidance on the acceptance of existing standards within national and international legislative processes;
   (c) facilitating, promoting and maintaining communication with and between present national scientific diving organisations and the National Scientific Diving Committees.

The ESDC is working toward a format whereby the status of membership is indicative of the present structure that supports scientific diving at the national level. The three different levels of membership are: full members, associated members, and committed members.

1. Full members (FM): FM must have implemented the ESD and AESD qualifications as the primary standards for scientific diving in their country. FM must accept ESD/AESD certificates from other 'full member' states. FM must have in place a committee that represents their national scientific diving community and has a recognised status with a national authority that has responsibility for vocational scientific diving.

2. Associated members (AM): AM must have in place a committee that will represent their national scientific diving community, which formally represents the national scientific diving committee. AM must be supported by, or seeking support from, a relevant national authority and must demonstrate that there is an intention to implement the ESD and AESD qualifications as the primary standards for scientific diving in their country.

3. Committed members (CM): CM should demonstrate the support of their national scientific diving community, and the intention and mechanism to develop a national committee that will represent their scientific diving community. CM should furthermore demonstrate an implementation framework by which the ESD and AESD qualifications can become assured standards for scientific diving in their country and recognised by relevant national authorities.

The Development of the ESDC

A main goal of the ESDC for the near future is its recognition as the primary EU panel for scientific diving across Europe with the responsibility for promoting underwater science. An EU-wide coordination of diver supported research activities (presently mainly conducted at the national level) will provide the framework for significant synergistic opportunities with concomitant enhanced quality and quantity of aquatic research across Europe. In bringing together the national member organization for scientific diving, the ESDC wants to:

- Share information on scientific diving across Europe by initiating regular workshops;
- Identify national and international problems with respect to the application of this key method in aquatic science and to find appropriate solutions;
- Develop common strategies for synergistic diver-supported research across Europe;
- Develop strategies to facilitate improved access and efficient use of scientific diving infrastructure across Europe;
- Compile and publish position papers to give advice on strategic and scientific policy related to aquatic science and technology at the European level.

Besides the necessary conceptual work with respect to the development of EU harmonized guidelines for scientific diving (e.g., for conducting scientific dive missions from European research vessels, from land based European research stations, or in extreme environments, such as the polar regions), the ESDC shall, in particular, promote and initiate benchmark projects in the field of diver-supported aquatic science. To achieve this, the ESDC will become established as the recognised forum of European experts in scientific diving in order to provide a think tank based synergistic environment for prospective developments in the future of this research discipline.

Based on the above goals, it is the intention that the ESDC will initiate and support national but EU open training programmes (basic and advanced skills) for students and scientists in addition to special training courses for benchmark techniques in research diving.

Discussion

Overseeing and working across Europe toward achieving high standards of scientific delivery using diving techniques will present a considerable challenge given the range of nationalities and national approaches to occupational scientific diving. However, EU working directives and the EU research funding frameworks present methods by which co-ordination and integration may be accommodated. It is hoped to build rapidly on the solid foundations of agreed scientific diving competencies to deliver a strong, productive and safe scientific diving community in Europe.

In October 2008, scientific diving in Europe was accepted to become an approved Panel of the Marine Board of the European Science Foundation. Scientifc diving in Europe will, therefore, from now on be overseen by the Marine Board - European Scientific Diving Panel (MB-ESDP)

Table 1. A summary of the main competency requirements for the European and Advanced European Scientific Diver standards. The main differences between the two standards are highlighted in bold italics.

EUROPEAN SCIENTIFIC DIVER (ESD)	**ADVANCED EUROPEAN SCIENTIFIC DIVER (AESD)**
An ESD is a diver capable of ***acting as a member of*** a scientific diving team. They may attain this level by either a course or by in-field training and experience under suitable supervision or by a combination of both these methods.	An AESD is a diver capable of ***organising*** a scientific diving team. They may attain this level by either a course or by in-field training and experience under suitable supervision or by a combination of both these methods.
- show proof of ***basic*** theoretical knowledge and a ***basic*** understanding of: 1. diving physics and physiology, the causes and effects of diving-related illnesses and disorders and their management; 2. the specific problems associated with diving to and beyond ***20 m***, calculations of air requirements, correct use of decompression tables; 3. equipment, including personal dive computers and guidelines as to their safe use; 4. emergency procedures and diving casualty management; 5. principles of dive planning; 6. legal aspects and responsibilities relevant to scientific diving in Europe and elsewhere.	- show proof of theoretical knowledge and a ***comprehensive*** understanding of: 1. diving physics and physiology, the causes and effects of diving-related illnesses and disorders and their management; 2. the specific problems associated with diving to and beyond ***30m***, calculations of air requirements, correct use of decompression tables; 3. equipment, including personal dive computers and guidelines as to their safe use; 4. emergency procedures and diving casualty management; 5. principles ***and practices*** of dive planning ***and the selection and assessment of divers***; 6. legal aspects and responsibilities relevant to scientific diving in Europe and elsewhere; 7. ***dive project planning.***
- be fully competent with/in: 1. diving first aid, including CPR and oxygen administration to diving casualties; 2. SCUBA rescue techniques and management of casualties; 3. the use and user maintenance of appropriate SCUBA diving equipment.	- be fully competent with/in: 1. diving first aid, including CPR and oxygen administration to diving casualties; 2. SCUBA rescue techniques and management of casualties; 3. the use and user maintenance of appropriate SCUBA diving equipment ***including dry suits and full-face masks;***

	4. ***basic small boat handling and electronic navigation;*** 5. ***supervision of diving operations***.
- be fully competent with: 1. search methods; 2. survey methods, both surface and sub-surface, capable of accurately locating and marking objects and sites; 3. the basic use of airbags and airlifts for controlled lifts, excavations and sampling; 4. basic rigging and rope work, including the construction and deployment of transects and search grids; 5. underwater navigation methods using suitable techniques; 6. recording techniques; 7. ***acting as surface tender for a roped-diver;*** 8. sampling techniques appropriate to the scientific discipline being pursued.	- be fully competent with: 1. search methods, ***such as those utilizing free-swimming and towed-divers together with remote methods suitable for a various range of surface and sub-surface situations;*** 2. survey methods, both surface and sub-surface, capable of accurately locating and marking objects and sites; 3. the basic use of airbags and airlifts for controlled lifts, excavations and sampling; 4. basic rigging and rope work, including the construction and deployment of transects and search grids; 5. underwater navigation methods using suitable techniques; 6. recording techniques; 7. ***roped/tethered diver techniques and various types of underwater communication systems such as those utilizing visual, aural, physical and electronic methods;*** 8. sampling techniques appropriate to the scientific discipline being pursued.
- show proof of having undertaken ***70*** open-water dives to include a minimum of: 1. ***20*** dives with a scientific task of work such as listed above; 2. 10 dives between ***15 and 24 m;*** 3. ***5*** dives ***greater than 25 m;*** 4. 12 dives in the last 12 months, including at least 6 with a scientific task of work.	- show proof of having undertaken ***100*** open-water dives to include a minimum of: 1. ***50*** dives with a scientific task of work such as listed above; 2. 10 dives between ***20 and 29 m;*** 3. ***10*** dives ***between 29 m and the national limit;*** 4. 12 dives in the last 12 months, including at least 6 with a scientific task of work. 5. ***20 dives in adverse conditions such as currents, cold or moving water.***

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