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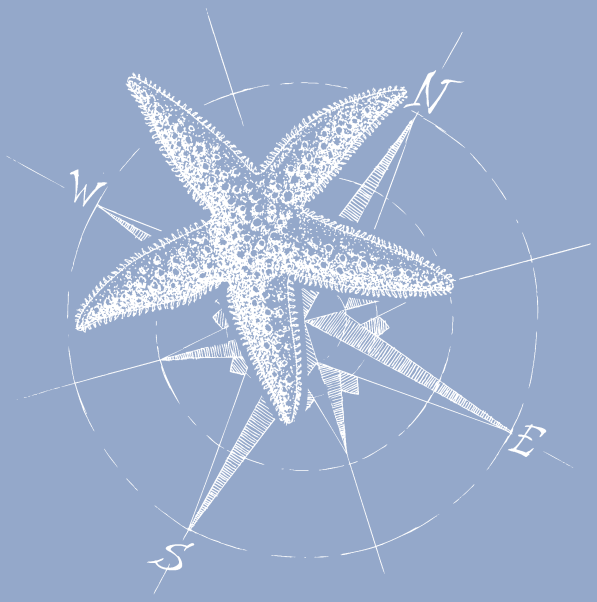
Making Research Count in Marine Governance - The Communication Challenge



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The context

No one can doubt that our fast-changing, deeply impacted seas require profound reforms in environmental policy and resource management. A global challenge made difficult by the huge deficit in communication between marine researchers, maritime stakeholders, civil society and reflected, in turn, by the lack of influence of up-to-date scientific knowledge on governance. To explore such complex issues in mid-March 2012 CIESM invited in Rome selected experts with complementary experience in marine research, media, maritime policy and industry (see list in Annex 1) to freely exchange their views over the course of one day. This article, written by the seminar moderator and peer-reviewed by the expert group, develops and synthezises the most challenging, promising threads stemming from the varied exchanges.

How to break major 'communication bottlenecks' ? Any possibility that scientists could make better use of new (and traditional) media, of innovative communication tools, to facilitate the transition towards responsible marine governance? An issue obviously too multi-dimensional to be resolved in these few pages and through a single set of tools. But one that will find here a number of pointers- some questioning the limits, objectivity, purposes of current communication practices; others offering innovative angles and perspectives for scientists to better inform civil society and ultimately assist the decision-making process. Along the way, a number of concrete recommendations are offered, together with diverse bibliographic references that will allow the interested reader to pursue specific lines of interest.

The separate worlds of scientists and decision makers

While recognizing the immense contribution of scientists to the war effort, Winston Churchill once famously remarked in a correspondence to his son Randolph[1]: 'Scientists should be on tap, but not on top'. He clearly had a point: scientists should advise, while policymakers - empowered by their electoral mandate - should decide. In any case, the governance of nations is not what researchers have been trained for, nor what the immense majority of them aspire to.

The real question is: how many scientists have the possibility to quickly inform the centers of decision, to directly present and defend science-based advice or options to top government circles? Indeed how many advisers doted with a solid scientific background do we find in the corridors of power, compared for example to the number of lawyers, economists, or even 'spin doctors' ? Sadly, politicians will often ignore or misrepresent science, because of their reliance on, and preference for, self-appointed experts who will back up their own expectations.

1 Quoted in Randolph S. Churchill, *Twenty-One Years* (1964), page 127.

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The clock is turning, fast. At a time when our global village faces environmental crises without precedent, when complex non-linear analyses are required, and when one is confronted with a variety of increasingly technical solutions to chose from, such anomalies do not appear tenable very much longer. Fortunately an increasing number of scientists now consider it not only their privilege but also their duty - individually and collectively - to inform Governments of their views that are shaped by the reality of scientific and technical facts.

Key points arising from the discussions

On meeting the demands of policy-makers for information

While there can be no doubt that Governments demand *useful* information, there is much evidence that the resulting official communication can be easily manipulated by powerful pressure groups that range all the way from big business and industry - the major players - to highly visible NGOs. The main objective of such lobbies is not so much 'accuracy' as getting their message and their definitions across, whether it is about enhancing their corporate visibility or bringing about societal changes. This is facilitated by the lack of any 'scientific accuracy filter' on the internet.

Modern media demand sharp, 2-minute maximum, high impact news. Most scientists are ill-prepared for such a context and will tend to shy away from it, so that scientific truth will be lost in the process. The vast majority of researchers has been indeed formatted to communicate differently, essentially to small peer groups of specialists by using long, solidly argued developments thru the respected system of peer-refereed journals. The fact that their professional reputation and chances of promotion mostly depend on their high citation scores within the restricted academic community does not do anything to bring them closer to the media. Most seminar participants considered that such a 'publish or perish' system, driven only by scientific impact and thus disconnected from society's needs, was archaic and should be abandoned, or at least balanced, in favour of a system providing fair professional recognition to researchers able to dedicate a significant part of their time for studies and for 'popular' communications responding to the demands of civil society at both local and national levels (see section on Science Shops later on).

A further difficulty, cultural this time, is that even researchers with a high social conscience will find it difficult to respond to the 'context-sensitive' demands of public communication, given their own insistence on cool objectivity shaped by their years of practice within the 'context-free' demands of science.

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A related, but distinct issue is the proper transfer of information by scientists to law makers in order to facilitate the drafting of legislation. While scientific reality is often complex, legal provisions need to be included in simplified logical schemes that cannot correspond to all the complexities of reality. And so scientists must be ready to propose to the legislator elements of language and clear definitions (for example on how to define the limits of the coastal zone) which, although not betraying the complexities of reality, will be capable of supporting the construction of an abstract and simplified model, as required in law making.

The suggestion to systematically create at national level an independent Office of Chief Scientific Advisor to the President, as is the case in countries like the USA or the UK, appears helpful. It met the unanimous support of the seminar participants, on the condition that the post would rotate every few years and have built-in mechanisms ensuring both its independence from political pressures and close connections to the heart of research excellence and innovation. A complementary proposal, to create a European Academy of Science founded on excellence and geared to societal needs, was also very welcome.

On the effective use of mass media

Researchers can influence the political agenda by mobilizing the public at large through effective, coherent communication on issues of societal importance. A problem is that scientists, 'trapped' by their rigorous formation, are rarely natural communicators. To reach beyond the classroom they must overcome both a language and a 'marketing' problem. They must not only learn to cut a long story short, but also introduce the ingredients of a 'good' story, one that will mix fun with provocative, sometimes inconvenient truths.

The ability to use a personalized narrative, not devoid of affect and preferably with interactive storytelling, will make the message all the more effective. Scientists will facilitate public awareness by providing publicly accessible, user-friendly analyses, containing simple, workable concepts and operational definitions. Providing concrete examples of best practices or remedial action will be a plus, as well as illustrating the interdependence between economic wealth and environmental health. Instilling a sense of common societal interest, for example through the notion of shared marine resources and the threatened sustainability of our global 'commons', will help communicate a sense of lasting urgency, which can transform simple awareness into action.

Scientists should take more advantage of a variety of channels available to them, from traditional mass media to participatory science events, not to forget the more recent addition of blogs and social media (see further down), where opportunities exist for very different styles of scientific interventions.

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Hence 'career-scientists, 'citizen-scientists' and 'militant scientists' can each play a very useful role, as long as the information which they provide remains simple (not simplistic) and above all based on accurate, verifiable scientific evidence.

Box 1. Ten tips on what journalists want from scientists

- A readiness to be quoted (but possibility to check own's quotes should be agreed in advance);
- Knowledge of the issue, of the facts;
- A sharp answer to the five w's: Who? When? Where? Why? ... and above all 'so What ?'
- Colourful analogies, metaphors;
- if possible some compelling, even surprising elements;
- Responsiveness in returning their call (they have sharp deadlines);
- A willingness to guide them to other experts with different angles;
- Short press releases (no longer than one page), two weeks before the events

Avoid:

- Ideological arguments (most journalists have heard all this before);
- Long sentences

Building bridges between scientists and the press, so that they can at least share a common alphabet, seems a neglected, but necessary step. That task must not be under-estimated: as noted by the media experts present, the 'technicity' of the research sector will always make it easier to teach a scientist to become a journalist rather than the other way around. But the investment will prove worthwhile: an interesting idea, successfully tested at MIT[2], is to provide fellowships for the most promising science journalists to study the issues of marine science/conservation at a leading research institution in their country. At least hiring marine graduate students as interns to assist in connecting science and policy and in preparing press material will not hurt.

2 Knight Science Journalism Fellowships at MIT (9 months) http://web.mit.edu/knight-science/

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Reaching out to the youngsters

Our seminar also remarked that special efforts should be paid to reaching out to the younger audience - the users and policy makers of tomorrow – looking for ways to tap both their still intact curiosity for scientific discovery and their singular capacity to process digital information in unique ways. Traditional media should not be neglected either, as demonstrated by the large success of the NGS series 'youth radio investigates' in which young journalists collect and analyze original data with professional scientists, and then tell unexpected stories about what they discover[3]. More colleges and universities should invest in setting up and facilitating the production of a students' newspaper, often the first step in the policy arena for future leaders. The adaptiveness and receptivity of adolescents to the latest communication technologies, to Internet, their use of shortcuts that remain largely opaque to the adult world, all seem like promising paths.

On the decline of investigative journalism

The triangle involving scientists - journalists - decision makers has never been an easy one. But if one takes the 'European Knowledge Society' to heart[4], it should form an essential part of a sound communication strategy. Successfully moving the environmental debates to the public sphere, away from the narrow province of lobbyists and politicians, would accelerate the rate of reforms and promote better governance. The reality is starkly different. Major restructuring of the press sector, imposed in recent years[5] by large losses in advertising revenue and in subscriptions, have broken the subtle balance of power between journalists and their sources - once described as a 'tango' with either the journalist or the source in the lead[6] - in favour of communication 'spin doctors' who nowadays come mostly from the business and industry sectors[7].

While environmental news reports have a known history[8] of relying more on source-generated press releases and public relations efforts than on direct investigations, the current pattern is serious cause for concern. To begin with, shrinking budgets and shorter deadlines are forcing reporters to become 'desk-bound' and increasingly reliant on pre-packaged sources of news. Further, corporate business pressures now severely limit the scope of traditional media for investigative, criti-

3 http://www.youthradio.org/oldsite/nsf/index.shtml
4 see EC Report (2007) *Taking European Knowledge Society seriously* by U. Felt and B. Wynne.
5 Due to the emergence of new technologies, new media, concentration of media ownership, etc.
6 Herbert J. Gans (2004 [originally published 1979]). *Deciding what's news.* Northwestern University Press, New York.
7 J. Lewis, A. Williams and B. Franklin (2008). A compromised fourth estate? UK news journalism, public relations and news sources. Journalism Studies, 9, pp. 1-20.
8 see D. B. Sachsman (1976). Public relations influence on coverage of environment in the San Francisco area. *Journalism Quarterly*, 53, pp. 54-60.

cal reporting. Which calls for transparency and closer scrutiny of the ties between the press, governmental economic sensitivities, and private business interests. This raises overall fundamental questions about the role of modern journalism and the supposed democratisation of environmental information[9].

On science coverage in the mass media

The coverage of science in the mass media did take an alarming downturn in recent decades, as science reporters paid a heavy price to austerity measures, being often among the first to be laid off. And those left in place now dispose of much-reduced means for in-depth investigations of what are usually complex issues.

As a result, a number of newspapers and magazines have drastically reduced, if not entirely eliminated, their science pages. A thorough analysis of 250 American newspapers[10] documented that between 1990 and 2005 the number of US newspapers featuring a weekly science section had dropped from 95 to 34. And one cannot count on the enthusiasm of newsroom executives to reverse this trend as only 10% of them considered science and technology reporting 'very essential' to the quality of their products. Similar trends of reputed newspapers having to close or dilute their science coverage are found everywhere[11].

One hopeful note, from the Yale Forum on Climate Change and the Media[12], is that the coverage of *environmental* issues has been increasing in recent years, although with a new twist – 'hyperlocalism'. In other words, the story must have a local angle to interest a news editor. So priorities will differ from one part of the world to another, accounting for wide discrepancies not only in the choice of topics but also in the extent of newspaper coverage alloted to a given global issue. The graph below, based on a study of 50 newspapers in five continents by the Center for Science & Technology Policy Research, University of Boulder, Colorado[13], shows the monthly coverage of climate warming per newspaper to vary at least six-fold from the lowest (South Africa, Argentina) to the highest (Australia, New Zealand).

9 An in-depth treatment of this critical issue will be found in Anders Hansen (2010). *Environment, Media and Communication*. Routledge, London. 235 p.
10 C. Russell (2006). *Covering Controversial Science*. Working Paper Series n° 2006-4, Shorenstein Center on the Press, Kennedy School of Government, Cambridge, USA.
11 A. Hansen & R. Dickinson (2009). Science coverage in the British mass media. *Communications* 17, pp 365-378. C. van Rooyen (2004). Science & Technology Coverage in Sth African print media Sth Afr. Foundation for Education, Science & Technology.
12 http://www.yaleclimatemediaforum.org/2008/08/
13 http://sciencepolicy.colorado.edu/media_coverage/

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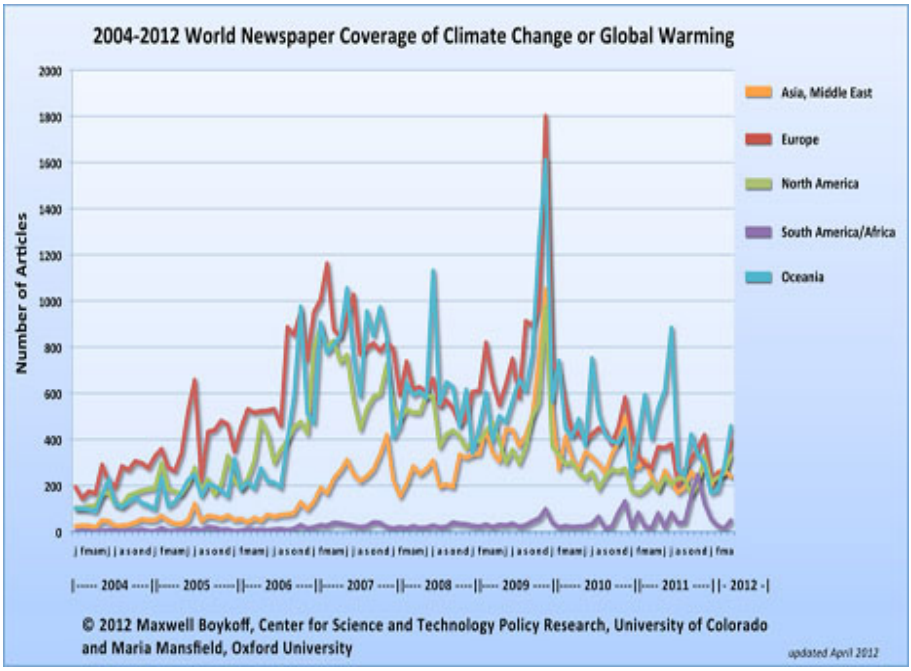

Press coverage of marine science has clearly expanded in the past 30 years, but marine research still regularly misses the top 10 in popular rankings[14] of 'hot' research fields, a sad reflection of the absence of a strong lobby, and of a single voice, for marine research .

All this raises a series of major questions that are treated thoroughly elsewhere[15]. How are science stories hierarchized by news editors? And, once selected, how will they be inflected and presented? How often will the search for sensationalism and for additional readers drive news editors to make space for unbalanced, unsubstantiated treatment? This likely accounts for the lack of rigour often observed in the journalistic treatment of issues regarding environmental risks[16], a pattern repeated in the coverage of marine environmental hazards.

From ignorance to misrepresentation of scientific evidence

While researchers were producing in-depth studies on the dangers of DDT, acid rain , persistent contaminants, global warming, etc, a small subset of the scientific community, with deep connections in politics and industry, led communication

14 Clive Cookson. Science's 10 hottest fields. *Financial Times* 24 June 2011.
15 for ex. in Stuart Allan (2005). *Journalism: Critical Issues*. Open University Press, London.
16 Stuart Allan (2002). *Media, Risk and Science*. Open Univ. Press, London

campaigns in vigorous denials of these dangers[17]. Relayed by complacent, undiscriminating journalists, these 'experts' have much contributed to a growing public distrust in science.

At the other hand of the spectrum, the press and the public can be easily abused by emotional challenges to scientific evidence when 'staged' and amplified by skilled militant conservation groups. This was illustrated by the Brent Spar controversy[18], which has become a 'textbook example'. Here Shell - the operator of this oil storage platform in the North Sea - was forced to abandon its plans to dump the platform in deep water once it became occupied by Greenpeace. This despite the favourable go-ahead given by 30 separate studies that had assessed the environmental implications and identified low toxic levels. Although science was this time on the side of Shell, as was confirmed *a posteriori* by the independent Expert Group on decommissioning off-shore structures, the oil company lost much credibility in this affair.

Examples of ignorance or deliberate distortion of science, at the service of corporate interests or ideologies, are found in many sectors, like:

- overfishing

At the heart of this issue, lies deep incomprehension and discord between fishermen and fishery scientists, a fathomless divide in outlooks over oceans and fish. To quote David Dobbs[19], "in a ideal world, these two views would merge into something richer. But they have not". Mistrust plus a basic incapacity to integrate the other's perspectives are such that the hardest scientific evidence has proved helpless to curb overfishing, a demonstration of major communication failure all across the board.

In 2003 groundbreaking research by Myers and Worm[20] documented a 90% decline in stocks from pre-industrial levels of large predatory fishes across the world ocean, further establishing that an 80% decline from pre-exploitation stocks levels typically occurred for any given species within 15 years of the onset of commercial fishing. Nearly ten years later, despite high visibility - front-page coverage in leading newspapers worldwide - of this real scientific breakthrough, fishing industry representatives and fishermen unions are still in denial and continue to oppose scientists over the root causes of the decline, citing causes largely outside of their control such as changes in ocean currents or natural cycles. In this particular case, an excellent press campaign was stifled by lack of follow-up political will, drawing

17 cf. Naomi Oreskes and Erik Conway (2010) *Merchants of Doubt*. Bloomsbury Publishing, NY
18 see R. Löfsted and O. Renn (1997). The Brent Spar controversy: an example of risk communication gone wrong. *Risk Analysis*, 17
19 David Dobbs, 2000. The Great Gulf - Fishermen, Scientists and the Struggle to Revive the World's Greatest Fishery. Island Press, Washington. 212 p.
20 Ransom A. Myers and Boris Worm. Rapid Worldwide Depletion of Predatory Fish Communities. *Nature*, May 15, 2003

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a terrible loss of credibility for European Fishery Ministers who failed to respond with proper adjustments in quota and fish stock management, contrary to their counterparts in New Zealand, the USA or Australia.

- evolutionary science vs creationism

One would have thought that Darwin had definitely won the fight over creationists some 150 years ago, but in certain mass media the battle is still raging, dismissing the fact that creationism has no scientific basis and giving credence to the false notion that a scientific controversy is boiling over evolution[21]. Never afraid to demolish scientific evidence with statements relying purely on faith, creationists occasionally enlist 'experts' unaware of the findings of modern science to their cause. Such was the case in a recent controversy involving obsolete stratigraphic principles used to erroneously dismiss the dating of sedimentary layers provided by modern geo-science[22]. In the past twenty years, creationists have met with great success in the USA, where they have invested in a number of private television channels to relay their message to larger audiences in order to persuade school boards to give equal time to so-called 'scientific evidence against evolution'. This, despite the explicit statement send in October 2003 by Pope John Paul II to the Pontifical Academy of Science, that "fresh knowledge leads to recognition of the theory of evolution as more than just a hypothesis". More food for thought: surveys in a number of countries like Germany, Brazil and the UK indicate that between 20% and 30% of the population disbelieve in evolutionary theory and think that the world has been created within the last 10,000 years; the figure climbs above 50% in the USA[23], and beyond 75% in a number of Islamic countries like Turkey[24] where creationism has now become the government's official position on origins.

- climate change

So much is at stake, in terms of policy, geopolitics and local economies[25], that there have been many attempts to affect public perceptions[26] of the reality and impact of global warming. While much of the academic debate has been (legitimately) taken by the stark projections offered by the authoritative IPCC Panel on one side versus the optimistic mitigation prospects of economists on the other[27], some media have fallen victim of deliberate misrepresentations of scientific evidence[28] by other parties. One disturbing instance concerns the relentless bat-

21 Chris Mooney and Matthew C. Nisbet (2005). Undoing Darwin. *Columbia Journalism Review*, September/October issue

22 follow the exchange with his critics on www.theotokos.org.uk/pages/creation/berthaul/henke.html

23 JD Miller, EC Scott & S. Okamoto (2006). Science communication - public acceptance of evolution. *Science* 313: 765-766.

24 S Hameed (2008) Bracing for Islamic creationism. *Science* 322: 1637-1638.

25 Anthony Giddens (2009). *The Politics of Climate Change*.

26 R. Bord et al. (1998). Public perceptions of global warming. *Climate Research* 11.

27 See John Urry (2011). *Climate Change and Society*. Polity Press, Cambridge, UK. 218 p.

28 For example James Hoggan (2009). *Climate cover-up: the crusade to deny global warming.*

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tle of the Bush administration to undermine belief in global warming and to silence NASA climate scientists who showed otherwise[29]. A more recent example involved a French minister - a former geologist - who did not hesitate to falsify and truncate the results of the IPCC Panel in a book to buttress his own claim that global temperature elevations are not demonstratively correlated with CO2 increases. Due to his eminent political position, he was able to present his views unchallenged far too long in public media (television, radio) where his opponents were given at best 'equal time'. This dismissive treatment in various media of the scientific evidence gathered by hundreds of renowned climate paleo-climatologists allowed this pseudo-controversy to linger on for months, when the strong rebuttal of the French Academy of Science and a letter signed by 500 French researchers should have stopped it right away.

- contaminants and other public health issues

Distortion of scientific evidence, or delays in governmental communication, take on another dimension when touching on risks posed to human health. Illustrative cases include the handling of dioxin emissions at Seveso by Italian authorities in 1976[30], the tainted blood scandal in France in the 1980s[31], the global scare over 'mad cow diseases' in the early 1990s[32] and later over the risks of avian or swine flu pandemics[33], not forgetting the cover-up in the past decade of heavy metal contamination in cetacean meat by whaling countries[34]. Another revealing case involved the Chernobyl radioactive cloud that crossed most of southern and western Europe in the direct aftermath of the 1986 nuclear accident, entering the Swiss airspace to reappear in Spain ... while French health and nuclear safety authorities, relayed by compliant national media, maintained against all odds that their national territory was not affected.

Such major dysfunctions, whether linked to a collusion with strong interest groups, to a lack of institutional transparency, to excessive discretion from knowledgeable experts, to a lack of proper distance in the media coverage, or to a lack of proper consultation with scientists have all undermined public confidence in the competence of policy-makers, industrial company leaders, mass media and scientists.

Will these lessons be put to good use in our emerging Network Society? The answer is not known but the potential certainly exists, considering the broad set of communication tools now available, as will be seen next.

Greystone, Vancouver. 250 p.

29 Mark Bowen (2008) *Censoring Science: the Truth on Global Warming*. Penguin, NY. 324 p.

30 Brian Wynne [Ed.] (1987). *Risk Management and Hazardous Waste - the Dialectics of Credibility*. Springer Verlag.

31 R. Bayer and Eric Feldman [Eds.] (1999). *Blood Feuds - AIDS, Blood and the Politics of Medical Disaster*. Oxford University Press.

32 Scott Ratzan (1998). *The Mad Cow Crisis: Health and Public Good*. Routledge, London.

33 D. Butler (9 July 2008). Whatever happened to bird flu? *Nature News*. And Report accuse WHO of exagerating H1N1 threat, possible ties to drug makers. *Washington Post* (4 Jun 2010).

34 The Oscar-winning documentary *The Cove* (L. Psihoyos, 2009) is quite explicit over the official silence surrounding mercury contamination of dolphin meat sold on Japanese markets.

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Communicating science to a Digital Society

Social Networks

Growing public distrust in traditional mass media is counter-balanced by the recent irruption on the world scene, and immediate importance in the information sector, of digital social media (Twitter, blogs, etc). These have demonstrated a real capacity to spread and react to news with rapid, yet well informed messages, preciously helping to clarify and demystify controversial issues in near real time. Another celebrated attribute of social media is 'crowd-sourcing' - their capacity to mobilize, by a simple click, literally thousands of people.

By translating citizen awareness into rapid mass action, by allowing the public expression of popular democratic aspirations in a number of oppressed countries, social media have gained much international respect in recent months. Such powerful potential could be well exploited on the scientific front by interest groups – and one thinks here of a number of environmental issues. There again the responsibility of scientists in providing the best informed evidence, within faster and faster time frames, will be engaged.

***Box 2**. A basic Glossary (adapted from Willem De Moor)*

TWITTER?

Twitter is a microblogging system that allows for sending messages consisting of a maximum of 140 characters ("tweets") into the public domain. People read tweets of twitterers whom they are interested in by "following" them, and "retweet" them to his followers. In this way, messages can spread on the web very fast. Twitter is a platform that can be used in many different ways, from exchanging personal thoughts and reactions in real time, to spreading information about scientific, cultural or political events. Tweets may also contain links to other websites such as blog articles, wikis, and multimedia resources.

FACEBOOK?

Facebook is a social networking service and website launched in early 2004. At the time of this writing (May 2012), Facebook counted more than 901 million active users. Users must register prior to using the site; thereafter they may create a personal profile, add other users as friends, and exchange messages, including automatic notifications whenever they update their profile. Additionally, users may join common-interest user groups, organized by workplace, school or college, share pictures, videos, articles and play games.

LINKEDIN?

LinkedIn is a social network for professionals. Linkedin standardizes information entered by users into predefined "Profile Headline", "Summary", "Education", "Company", etc. categories. Users can connect with colleagues and professional contacts and join groups which collect people with the same interest or from a common industry - research discipline.

YOUTUBE?

YouTube is a video-sharing website, created in February 2005, on which users can upload, view and share videos. Most of the content on YouTube has been uploaded by individuals, although companies and organisations can offer some of their material via the site. YouTube offers users the ability to view videos on web pages outside the site. Each YouTube video is accompanied by a piece of HTML, which can be used to embed it in social networking pages and blogs. The interface of the YouTube website is available in 51 different language versions at the time of this writing.

Research institutions interested in developing their own pages on social media are advised to establish first a private account and then study the profiles and communication styles of similar organizations. NASA, CERN or NSF will provide a good start as they are often considered among the best examples of effective, dynamic scientific communication.

The choice of the most appropriate vector is critical, keeping in mind that **Facebook** is in general used for leisure, **Twitter** both for leisure and professional purposes, and **LinkedIn** mainly for professional purposes[35]. In addition very specific tools like **Slideshare** which one uses to share presentations online, may prove interesting.

Twitter is very suitable for policy-related information and updates. One will find a number of governmental organisations and elected officials already on Twitter, and so it is an excellent channel to get in contact with these organisations and officials, provide them with updates and information, or publicly debate ideas with them[36].

LinkedIn is most suitable to create groups of colleagues or people within a given discipline. These groups can be set up as forums where these individuals can discuss and comment on articles, updates, etc. In that context it can prove also suitable to promote events. Finally LinkedIn can be useful for recruiting scientific personnel.

35 L. Giuliano (2011). The CIESM Blog on marine bioprospecting – A case study of impacts of different promotional strategies. www.ciesm.org/LGiuliano11.pdf
36 as with the excellent Debating Europe http://twitter.com/#!/debatingeurope

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'Social media' implies social language and a tone more like a two-way conversation than an impersonal corporate presentation. Sounding human is very important, as illustrated by NASA in its successful tweet over Phoenix, the rover dedicated to Mars' surface exploration. Further applications of interest to broadcast the message of research institutions include tweetups that are informal meetings with the stakeholders (in this case the tweet followers) giving them firsthand information and look at the facilities; NASA Social[37] is a good case in point. Further media-friendly agencies include CERN and NSF which not only has a robust media outreach program but also has underwritten journalism through a system of grants to cover little or under-reported science. For example NSF funded a 180-part series of earth systems science stories produced on the web in collaboration with a radio program.

Other new, important developments for marine science communication involve the free Internet access to informed audio[38] or video podcasts, video-conferences[39], webinars, and to a number of excellent blogs, particularly in the sector of marine conservation.

Video-games

This sector is registering phenomenal growth. As documented in the previous *CIESM Marine Policy* Report[40] devoted entirely to the subject, videogames are not just a playground for youngsters but a growing hobby for millions of adults in responsible positions who find there anything from fast action to complex role games. Increasingly ambitious scenarios with elaborate graphic settings are being developed as a result, with a particular taste for societal or educational subjects. In the environmental sector alone, a number of challenging, exciting games focused on fighting climate change, biodiversity losses, or marine pollution are listed in the above-mentioned report.

The idea that games can help to engage and even solve important issues is not new. Recently gamers enabled researchers to decrypt the structure of a protein that helps viruses like HIV multiply[41]. And there is currently much activity supporting the development of 'serious' games like Games for Change[42] or collaborative simulations like living in a world without oil[43]. An example of how videogame scenarios - focused on real life characters and situations - can treat sustainable

37 http://www.nasa.gov/connect/social/index.html
38 e.g. *'Ocean voices'* by SeaWeb www.seaweb.com; *'Naked Oceans'* Project of Cambridge Univ.
39 e.g. ciesm visioconference on blue biotechnology www.ciesmseaforum.org
40 Briand F. and L. Giuliano. 2012. The potential uses for videogames in enhancing governance of marine resources. *CIESM Marine Policy Series* 2, 32 pp.
41 http://fold.it/portal/
42 www.gamesforchange.org/game_categories/environment/
43 www.worldwithoutoil.org/

fisheries management in a manner attractive to both youngsters and adults alike is to be found on a dedicated CIESM blog[44].

The development of participatory science

Science Festivals

The popularity and modernity of this concept is usually traced back to the launch of the first Edinburgh International Science Festival in April 1989. The success of an event featuring a great diversity of science and technology 'displays' - exhibitions, public debates, live experiments, interplay of science with culture, etc - with a flair and 'gusto' usually reserved for art festivals attracted so much attention that every year now sees about 80 distinct Science festivals in Europe alone. While festivals can vary greatly in size, it is estimated that last year alone these events attracted the attendance of 20 million people in Europe.

Within the last decade the concept has spread to the USA, where festivals are often prepared in collaboration with local universities or with learned societies like the American Association of the Advancement of Science or the American Physical Society.

Student Parliaments

In a Student Parliament, some 60-80 young people (aged 17 to 18) typically come together for two days to discuss current and controversial questions related to science and research. After a period of initial team building, the student delegates, altogether representing a number of colleges, work in four committees, hear experts from science and politics, and draft a resolution that is finally debated and voted on in their general assembly. Seventeen countries, working in concerted fashion, did organize such an event in 2011. In the end each Student Parliament selects two representatives who will attend the final event - a European Youth Parliament - where they will defend and promote their own resolution.

In the process the students gain first-hand experience of decision-making in a democracy, further their understanding of science-related issues of importance to society and consolidate their debating skills. In return the participants provide the perspectives and opinions of young people on the life science agenda to policy-makers and researchers. It is clear that such events have the potential to attract national media attention.

44 CIESM Blog on fisheries videogames at www.ciesmseaforum.org/category/fishery/

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Science Cafés

A science café is a place where, for the price of a cup of coffee or a glass of wine, anyone can come to explore the latest ideas in science and technology. Meetings take place in the comfort and relaxed atmosphere of a neighbourhood café, bar or pub, but always outside of a traditional context, allowing the invited scientist to present and debate 'current issues' face to face with the general audience.

Science Shops *(based on discussion with Henk Mulder)*

The 'science shop' concept did originate in the mid 1970s in various Dutch universities, in partial fulfilment of one of their essential missions - knowledge transfer. The concept greatly facilitated the selection of research topics better tuned to the local / regional needs of civil society.

The concept has since expanded[45] to explicitly (a) orient research towards public concerns and (b) facilitate the participation of civil society in the co-creation of knowledge. It is found today in a number of countries under different names, such as Community Knowledge Exchange, Interchange, InterMediu, Echop a Sciences, Forskningstorg – so making the name meaningful in each local context (in Dutch, 'science' includes all academic disciplines, from humanities to engineering).

The fact that Science Shops provide independent, participatory research support in response to civil society's concerns is a key element that distinguishes them from other knowledge transfer mechanisms. Science Shops are gaining international importance in grant applications and academic scores, as in the UK's new Research Excellence Framework ('excellence with impact') and in various funding schemes of Regional Councils in France. Many universities now have a 'Science Shop' assigning supervision of students working on topics signaled by civil society organisations to professors who will integrate this as part of their regular teaching duties and be granted recognition for doing so. For the student the project is part of their curriculum, e.g. a Masters Thesis, and they get course credits. The organisation will differ between Shops: some are not part of a university and have a separate legal status. They must raise their own budget and work with various partners in different projects.

Media attention for Science Shop studies is usually high, as they are by definition relevant to the general public. Which means that such news will usually appear in the general - not in the scientific - pages of newspapers, thus reaching a larger audience.

45 International Science Shop Network http://www.livingknowledge.org/livingknowledge/science-shops

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Some key recommendations

• Scientists need to be trained in modern communication techniques, and learn in particular to adjust their message as a function of the media and targeted audience.

• Individual scientists and research institutions should be more pro-active and increasingly engage in the provision, packaging and management of news.

• Marine research institutes should integrate in their staff a dedicated 'science 'translator' - a specialist able to decrypt and dispatch the essence of their message - or at least an intern to assist in the preparation of press kits and press briefing.

• Provide fellowships for the most promising science journalists to study the issues of marine science/conservation at a leading research institution in their country

• An independent Chief Science Advisor Office, with frequent, trusted access to the highest Government level, should be created in every country.

• EU legislation should impose stronger obligations to base official environmental communication and decisions, at national and EU levels, on the best available science

• A European Academy of Science should be established with a mandate and a composition facilitating rapid, integrated responses to society's needs.

• Science journalists should adopt a chart of principles (a code of conduct) and avoid offering uncritical 'equal time' to unsubstantiated opinions versus evidenced-based expertise.

• Science Youth Parliaments should be promoted, to include a larger number of countries and continents, with the aim of holding a final meeting under the UN roof.

• Marine researchers should consider working with civil society organizations on issues that are important to local communities, using lessons from well-tested systems like Science Shops.

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Further reading

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Additional links

AAAS Kavli Science Journalism Awards http://www.kavlifoundation.org/aaas-kavli-science-journalism-awards

Scientific American Anthology of the best science writing on the web http://blogs.scientificamerican.com/network-central/2011/12/07/the-open-laboratory-2012-the-final-entries/

Society of Environmental Journalists www.sej.org

Knight Science journalism Tracker http://ksjtracker.mit.edu/1

International Science Writers Association http://internationalsciencewriters.org/

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Annex 1

Profiles of seminar's participants

Kathrine Angell-Hansen is the Director of the secretariat of the Joint Programming Initiative for Healthy and Productive Seas and Oceans (JPI Oceans). Prior to taking up this position two years ago, she was seconded as a national expert to DG MARE to coordinate the scientific file of this policy. Kathrine has been working as a Deputy Director in charge of budgets research and innovation in the Ministry of Fisheries and Coastal Affairs in Norway as well as in the Norwegian Research Council as a Director on strategic planning for innovation, international research and innovation, and with special responsibility for maritime, seafood and biotechnology. She worked for 10 years in industry as a marketing director and lobbyist in some of the major companies in Norway, and also as an expat in Europe (France and Denmark). Kathrine is educated at the University of Oslo with an extended master of science degree with emphasis on strategic planning

David Braun is Editor in Chief of National Geographic Digital Media's Daily News, Science, and Environment. He has been a news journalist for 36 years, working on newspapers, magazines, and websites in three countries (South Africa, the UK, and the U.S.A.). He has worked for National Geographic for 15 years, first in the Communications office as Public Affairs Editor, then on the Society's website, where he devised and launched Daily News (now read by 6 million visitors per month) and News Watch (a blog of 103 members of the wider National Geographic community, including scientists, explorers, students and aligned institutions).
Oceans form an important part of National Geographic's mission to focus on restoration and maintenance of sustainable fisheries and the creation of authentic and viable marine protected areas. Braun has folded these elements into his editorial focus, working with the Society's Mission Programs, National Geographic partners, and initiatives like the Census of Marine Life and the International League of Conservation Photographers. Braun is a generalist, drawing from experience covering business, politics (including a few years covering the U.S. Congress and the White House), city administration, science, technology and innovation to target environment content that resonates with a wide general audience. His academic qualifications are in Political Science, Economics, Journalism, and Business Administration.

Frédéric Briand *(seminar moderator)* studied economics and oceanography at the University of Paris, and marine ecology (Ph.D.) at the University of California. He spent his early professional career in Canada, investigating the dynamics of marine systems in the Pacific, Atlantic and Caribbean Sea. Co-discoverer of invariants in the architecture of global food webs - now a research sector on its own - he has authored numerous papers on the dynamics and conservation of complex ecological systems. Upon his return to Europe, Frederic managed sectors of multi-disciplinary research in various international Agencies (Unesco, IUCN), before taking on in 1992 the direction of the Mediterranean Science Commission (CIESM), an organisation which includes 22 Member States and federates over 4000 researchers.
Founder and editor of the well-known CIESM Monograph Series on Mediterranean Marine Sciences (now reaching 44 volumes), Frédéric is also the promoter of international 'marine peace parks' to facilitate co-governance of the marine commons, and a leading advocate of granting United Nations protection to all cetaceans on the high sea. Whaling Commissioner to the IWC, Adviser to various EU-Programs, he represents the Mediterranean region on various international Boards from the UN Committee on the Health of the Oceans (GESAMP) to the World Bank program WAVES.

Willem De Moor is working as an adviser at the secretariat of the Joint Programming Initiative for Healthy and Productive Seas and Oceans (JPI Oceans) where he mainly deals with the communication and outreach. Before joining the JPI Oceans secretariat Willem was a policy adviser at the Flemish Ministry for Economy, Science and Innovation where he was part of the EU presidency team. In this role he worked mainly on the organisation of the Strategic Energy Technology (SET)-plan 2010 conference and the EurOCEAN 2010 conference. Previously he worked as a policy adviser at the cabinet of the Flemish minister of Economy, Science and Innovation. Willem graduated with master in Modern History at the KULeuven. During an additional year in a master programme in Political Science – International relations at UCL he had his first work experience interning at the European Parliament.

Daniele Dessi graduated in aeronautical engineering in 1994 and obtained his Ph.D. in Aerospace Engineering from the University of Rome "La Sapienza" in 2000. In 2001 he joined as researcher the National Institute of Studies and Experiments for Naval Architecture (INSEAN), where he is now Senior Researcher. Since 2004 he is lecturer of Numerical Analysis at the University of Rome "La Sapienza". He is member of international scientific committees (ISSC, International Ship Structure Congress, HTA, Hydro-Testing Alliance) and has been also involved in the coordination of national and international scientific projects, as well as in industrial consulting activities in the maritime transport sector. His scientific in-

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terests involve fluid-structure interaction (aeroelasticity and hydroelasticity) and structural dynamics, with particular attention to nonlinear (asymptotic expansions) and inverse (updating and damage identification) problems.

Mario Dogliani was trained as a Naval Architect (degree 1983). He is now the Manager of Corporate R&D for the RINA Group of Companies. The main focus of his activities is related to promoting innovation within the marine and maritime industrial sector with special emphasis on environmental and safety aspects as well as on transfer of knowledge from scientific community to industrial operators such as, in view of example, blue biotechnologies and/or nanotechnologies applications in ship building. Mario is currently Vice President of the EU Waterborne Technology Platform and Coordinator of the Italian National Mare Platform (PTNM), and often acts as Italian Expert (on behalf of the Ministry of Research) for FP7 Transport R&D initatives.

Laura Giuliano was trained in marine microbiology, with a Ph.D. from the University of Marseille (France) and a post-doc at the Natl Centre for Biotechnology (GBF, Germany). She then joined the National Research Council (CNR) in Italy, where she directed a large research group at the IAMC-CNR Institute of Marine Research in Messina. Participated to national (EOCUMM, PNRA, CLUSTER-SAM, PON-SABIE) and international projects (BIODEEP, COMMODE, EUR-OCEANS), often with leading responsibilities. Member of different evaluation panels of research proposals to be funded by national (CNR-It, MIUR-It, PNEC-Fr) and intergovernmental Commissions (EU FP5, FP6). Author of scientific articles in international journals (over 40 peer-reviewed articles), she also engages in the promotion of science across a larger public (TV, press). Since 2004, Laura is scientific Advisor at CIESM Headquarters where she focuses on the harmonisation of major national marine initiatives and on influencing EU marine policy with a Mediterranean perspective. Her latest activities include international negotiations regarding access and benefit sharing over the development of blue biotechnology, and the promotion of marine science across a larger public via e-forums.

Anders Hansen is Senior Lecturer in the Department of Media and Communication, University of Leicester, UK. He is Associate Editor of *Environmental Communication: A Journal of Nature and Culture*, Chair of the IAMCR Group on Environment, Sciente and Risk Communication, and Executive Board Member and Secretary to the International Environmental Communication Association (IECA). His recent books include *Environment, Media and Communication* (2010) and *Mass Communication Research Methods* (edited four-volume set, 2009).
His main research interests are in environmental, science and health communica-

tion; media and the environment; news management and journalistic practices; media/new media activism; the roles of news and other media (including advertising) in representing and influencing political and social issues, with a particular emphasis on the discursive and rhetorical aspects of the media's roles in social, cultural and political change and development. He edited the first major publication in Britain to examine *The Mass Media and Environmental Issues* (1993) and much of his research has focused on environmental correspondents, environmental pressure groups and media coverage of environmental issues.

Eleftheria Lekakis received her doctorate in Media and Communications from Goldsmiths College, University of London, following a BSc in Political Science from the University of Crete, Greece, and MSc in Media and Communications from the London School of Economics. Her doctoral research was concerned with the communication of social change through the case of the fair trade movement in the United Kingdom, questioning the democratic potential of the internet for the communication of social change through alternative modes of trade. The focus on the internet as a platform for the launching of progressive forms of politics was interrogated in relation to the information-raising, organisation-building and mobilisation-allowing characteristics of the medium. Questions of linearity, speed, access and attention were addressed.
Her present research and activities address issues of politics and new media, primarily including corporate social responsibility and corporate citizenship, cultural citizenship, political communication and consumer politics. More specifically, at the moment her interests are vested in the exploration of the dynamic role of corporations behaving as potential agents for global social and environmental justice; the civic agency of individuals; the markets as an arena of the mediation of politics; the role of communication channels in these processes.

Gilles Lericolais, a marine geologist/geophysicist, has been working at Ifremer (France) since 1984. He graduated from ESEM in 1984 as a raw materials and energetic resources enginee and obtained a PhD in Marine Geology in 1997. During his career, Gilles joined more than 30 research cruises and was chief scientist for a number of them. From 1989 to 1991, he worked for Elf Aquitaine (now TOTAL) as an expert for site survey studies. From 1997 onward, he worked on the Black Sea sedimentary records and processes, and held key roles in EU Projects such as FP6 HERMES or FP7 HYPOX.
Closely involved since 2009 in the COST action TD902 (2009-2013): 'Submerged Prehistoric Archaeology and Landscapes of the Continental Shelf'. Responsible for the Ifremer project "Margins and Sedimentary systems" he was nominated Vice-Chair of the IODP Site Survey Panel in 2008 and Chair four years later. He was recently in charge of the GOLO research project - a collaborative effort be-

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tween TOTAL, EXXONMOBIL, FUGRO and Ifremer - before his appointment in 2011 as Director of European and International Affairs of Ifremer. Author of over 50 refereed publications.

Henk Mulder is in the Faculty of Sciences, University of Groningen, as Co-ordinator of the Science Shop since 1989. There, he facilitates research projects for civil society organisations, done by students and staff. Given his experience in this interactive form of science communication/public engagement, he also became Lecturer in Science Communication. He currently leads the EU funded project PERARES (Public Engagement with Research and Research Engagement with Society, with 25 partners in 16 countries. Its main objective is to strengthen co-operation between researchers and CSOs in setting research agendas.
Prior to PERARES, Henk Mulder was leader of the project 'Science Shops in Romania' in which he facilitated the construction of a national network of eight science shops at Romanian universities. He also was one of the main initiators for the international science shop network Living Knowledge and participated in various EU-funded projects. Henk Mulder holds an MSc in Chemistry and a PhD in Energy and Environmental Sciences. His current research involves the role of CSOs in upstream engagement with nanotechnology, funded by the Dutch National Research Program on Nano Sciences, NanoNed.

Peter Rebernik is currently head of "PHAROS International, Bureau for Cultural & Scientific Projects", based in Vienna, Austria. He also serves as Executive Director for EUSEA, the European Science Events Association, www.sciencefestivals.eu, which assembles about 90 institutions organising "science engagement activities" like science festivals or science weeks. He also is general secretary of the "Austrian Society for the Advance of Science".
He studied electronics at the Technical University Vienna, and served as its assistant professor. Thereafter, he worked for Philips, building telephone exchange computers, started his own company marketing personal computers. A change came with his appointment as director of the Technical Museum Vienna, and as director of the KunstHausWien. Since then, he works as advisor for museums, exhibitions, as coordinator for four EU funded projects and many other cultural and scientific projects

Tullio Scovazzi is professor of International Law at the University of Milano-Bicocca, Milan, Italy. His main fields of interest are international law of the sea and the environment, cultural properties, and human rights. He occasionally participates, as legal expert of Italy - or of the international institutions involved - in meetings

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and negotiations on various subjects, including the Barcelona Convention on the protection of the Mediterranean Sea and its Protocols, the United Nations Working Group on biodiversity beyond national jurisdiction, marine mammals, fisheries in the Mediterranean, the underwater cultural heritage.

Vilhelm Skjaerpe has been working with interactive media since 1989, developing concepts for e-learning, pedagogic games, role-play games and exhibitions. Prior to that, he was educated at The School of Communication Arts in 84/85 and at the University of London in 89/90. In 1996 Vilhelm founded Mediafarm AS, based in Stavenger (Norway). The company is involved in four sectors: e-learning, interactive games and simulations, corporate video and role-play games. All areas are targeted towards training or learning applications. Clients have been, among others, the Norwegian Parliament, the Norwegian Foreign Office, the European Parliament, ExxonMobil, Statoil, several science centres and other visitor's centres and museums in Norway. Through its development of role-play games, Media Farm has had a particular influence on the media industry.

Mario Sprovieri received a Ph.D. in Geochemistry (1997) from the University of Palermo. Currently Professor of Oceanography at the University of Palermo and Professor of Chemical Oceanograpy at the University "Parthenope" of Naples. He is also head of the Geochemistry Laboratory at the IAMC-CNR of Naples and head of its Detached Unit of Capo Granitola, Sicily. His research is mainly focused on the paleoceanography of the Mediterranean basin, and on pathways of inorganic and organic contaminants in highly anthropised worldwide distributed marine coastal zones. Principal Investigator in the GTSnext and Earthtime EU programs (astrochronology from the present to the base of the Neogene and the Lower Cretaceous), he is also PI in the EUROCEANS and SESAME EU, TARA Ocean, JERICO and Perseus (FP7) programs for application of stable isotope to the definition of nitrogen and carbon cycles in the Mediterranean oceanography system. Co-author of several international science plans, author of more than 90 peer-reviewed papers in paleoceanography, stratigraphy and environmental science, he is currently head of the CNR National program "Biogeochemistry of the marine environment".

Konstantinos I. Stergiou holds degrees in biology from Aristotle University of Thessaloniki 'AUTh' (BSc, PhD), and in oceanography from McGill University, Canada. Since 2006 professor at the School of Biology, AUTh, he teaches courses on Ichthyology, Fisheries Biology, Fisheries Resources, Management and Time-Series Analysis. Director of the Laboratory of Ichthyology. His research interests

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cover fish life-history, population dynamics, fisheries ecology, modeling and forecasting, ecosystem management, and bibliometrics. Co-Chair in 2001-2007 of the CIESM Committee on Marine Ecosystems and Living Resources. Since 2004 participates in the FishBase Consortium. He serves in the Editorial Board of the journals Fisheries Research, Ethics in Science and Environmental Politics, and Journal of Biological Research. He is contributing editor of the journal Marine Ecology Progress Series and Associate Editor for the FishBase Section in the journal Acta Ichthyologica et Piscatoria and Academic Editor of Plos-One. He has contributed 120 papers in peer-reviewed journals, 20 book chapters, and some 200 others (technical reports and popular magazines).

Joaquín Tintoré holds a Ph.D in physics and is professor of physical oceanography from CSIC (Spanish Council for Scientific Research) at IMEDEA (CSIC-UIB) where he leads the Department of Marine Technologies, Operational Oceanography and Sustainability. Since December 2008, he is also Director of a Spanish Large Scale Marine Infrastructure, SOCIB (Balearic Islands Coastal Ocean Observing and Forecasting System), a new multi-platform facility of facilities that responds to scientific, technological and strategic society priorities related to the role of the oceans in climate change. Throughout his career, Joaquin has studied the physical processes and mechanisms that can explain the dynamics of the coastal ocean and its multidisciplinary interactions (from the nearshore to the open ocean). He has always combined a threefold approach: (a) searching for new and non-repetitive scientific ideas, (b) maintaining high quality science linked to technology development and (c) developing new tools for decision support and by this increasing the transfer of knowledge to society and contributing to science-based integrated coastal and ocean management. His present interest includes the implementation of new monitoring devices such as autonomous underwater gliders (more than 10.000 profiles since 2006) on a multi-platform distributed observing systems framework to study the coastal ocean spatial and temporal variability and related ecosystem response. He has published 120 papers in international refereed journals, has been principal investigator in 42 peer reviewed research projects and has also coordinated two EU funded international projects. In 2003 he obtained the Spanish National Research Award.

Fabio Trincardi studied marine geophysics at the University of Bologna and University of Trieste, followed by a NATO post-doc Fellowship at the US Geological Survey Menlo Park, California. Currently Director of the Institute of Marine Sciences (ISMAR-CNR), he leads RITMARE, the largest Italian program on marine and maritime research. His scientific interests focus on the evolution of continental margins, integrating geophysical, sedimentological and geo-chronological meth-

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ods, past climate regimes and their impacts on coastal systems and deep-water settings. Co-ordinator of large projects (EURODELTA; the Geological-Mapping Project of the Italian Seas; risk-assessment projects related to slope stability and pipeline routing), contractor in ten other EU projects on continental margins and deep-sea ecosystems. He participated, often as Chief Scientist, to more than 35 scientific cruises (Mediterranean, Pacific Ocean, Antarctica). Guest Editor for special issues of the journals Geochemistry, Geophysics, Geosystems, Marine Geology, and Oceanography. He contributed to over 180 peer-reviewed papers, refereed books, and other publications.

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