

Oceans 21

GIS for Coastal Management and Coastal Education

A CO-OPERATIVE PROGRAMME

of the

Intergovernmental Oceanographic Commission (IOC)

and the

International Geographical Union (IGU)

in partnership with

Gerard J. Mangone Center for Marine Policy, Newark, Delaware, USA

CoastGIS International Executive Committee

International Centre for Ocean and Coastal Policy Studies (ICCOPS), Genova, Italy

GIS International Group (GISIG), Genova, Italy

<http://www.iccops.it/oceans21>, e-mail: oceans21@iccops.it

Framework Science Plan



Preface

This document describes the **Oceans 21 Framework Science Plan** based on a draft proposal for a modified/updated Science Plan for **Oceans 21**, transmitted to Prof. Anne Buttimer, (then) President of IGU, in July 2004. Prof. Buttimer accepted the general principles outlined in the draft and co-opted Mr. Bartlett, University College Cork, member of the IGU Commission on Coastal Systems, to act as advisor to the Working Group, while also requesting a regional focus on the Mediterranean for this iteration of **Oceans 21**. Prof. Adalberto Vallega, (current) President of IGU, provides liaison with the IGU Executive Committee for this programme. Mr. Julian Barbière of the Intergovernmental Oceanographic Commission (UNESCO) is the IOC co-ordinator for the initiative. The IGU Executive Committee accepted the principles of the revised Science Plan at their annual Congress in Glasgow, Scotland, in August 2004. The IOC provisionally accepted the principles set out in this Framework document at a joint working group meeting held at IOC in Paris on 24 November 2004.

The draft was produced by an **Ad Hoc Working Group** consisting of:

Prof. David R. Green - CoastGIS'05 Host & CoastGIS International Committee, Univ. of Aberdeen UK
(d.r.green@abdn.ac.uk)

Roger Longhorn, Director, Info-Dynamics Research Associates UK & CoastGIS International Committee;
City University, London, UK (ral@alum.mit.edu)

Dr. Emanuele Roccatagliata, GISIG-Geographical Information System International Group IT
(e.roccatagliata@gisig.it)

Darius Bartlett, CoastGIS International Committee and Department of Geography, University College Cork,
Cork IE (d.bartlett@ucc.ie)

The final draft Science Plan was presented at a joint working group meeting held at IOC in Paris on 24 November, 2004, attended by the above named individuals (apologies from Prof. Green), Prof. Adalberto Vallega (President, IGU) and Mr. Julian Barbière (nominated IOC co-ordinator) plus IOC staff Mr. Peter Pissierssens, Dr. Vladimir Vladmyrov, Mr. Thorkild Aarup and Mr. Erlich Desa. That meeting resulted in provisional acceptance of this document by the full working group as a **Framework Science Plan**, to be further elaborated operationally by Mr. Barbière, with assistance of the working group, in the form of an **Operational Plan: 2005 - 2008**. The Operational Plan sets out the focus for individual **Project** activities in support of the general **Themes** described in the **Framework Science Plan**. The **Operational Plan** may be modified from time to time as funding opportunities present themselves or if priorities change, with approval of the joint Steering Committee and their respective organisations.

Oceans 21
Co-ordinators

IOC

Mr. Julian Barbière
UNESCO
Intergovernmental Oceanographic Commission
Rue de Miollis
75732 Paris Cedex 15
Tel. ++33-1-45 68 40 45
Fax ++33-12-45 68 58 12
e-mail: j.barbiere@unesco.org
<http://ioc.unesco.org/iocweb/>

IGU

Dr. David Green
Centre for Marine and Coastal Zone Management
(CMCZM)
Department of Geography and Environment
School of Geosciences, University of Aberdeen
Elphinstone Road, Aberdeen
Scotland AB24 3UF, U.K.
Tel +44 (1224) 272324
Fax. +44 (1224) 272331
e-mail: d.r.green@abdn.ac.uk

General Secretariat

UNESCO
Intergovernmental Oceanographic Commission
Rue de Miollis
75732 Paris Cedex 15

Technical Secretariat

ICCOPS
International Centre for Coastal and Ocean Policy Studies
Via Piacenza 54, 16138 Genoa Italy
oceans21@iccops.it

Steering Committee

IOC

Prof. Biliana Cicin-Sain
Co-director
Center for the Study of
Marine Policy,
USA

Dr. Ulf Lie
IOC Consultant
Norway

IGU

Darius Bartlett
IGU Commission on Coastal Systems
Univ. College Cork, Ireland
e-mail: djb@ucc.ie

Roger Longhorn
IGU Commission on Coastal Systems
City University, London, UK
e-mail: ral@alum.mit.edu

Dr. Emanuele Roccatagliata
ICCOPS, Italy
e-mail: e.roccatagliata@gisig.it

MOTIVATION AND BACKGROUND

Oceans 21: At conception.

Oceans 21 was created in 1998 jointly by the Intergovernmental Oceanographic Commission (IOC) and the International Geographical Union (IGU) in the framework of the **1998 International Year of the Ocean**. According to the Memorandum of Understanding upon which the Programme design was based, co-operation of these two organisations focused on Integrated Coastal Management. The overall objective was identified as developing useful concepts, methods, and techniques in integrated coastal management for coastal managers and planners, with special consideration of the developing coastal environment and with education and training as cardinal operational arenas.

The programme was adopted by the two partner organisations during 1999-2000. Initial programme outcomes focused on issues of coastal urbanisation, a subject discussed at International Workshop “**Challenges on Growing Urbanisation of the World’s Coastal Areas**” (IOC 1999) held in Hangzhou, China, 27-30 September 1999, convened by the Intergovernmental Oceanographic Commission and SOA (State Oceanic Administration, China), with the collaboration of IOI (International Ocean Institute). The workshop focused on the rapid development of coastal mega-cities and the relating environmental problems. Relevant scientific materials may be found in the “Ocean and Coastal Management” journal [volume details]. To carry out collaboration in a regime with limited funds, the two organisations shared the opportunity to concentrate efforts in the preparation and circulation of dossiers, i.e. multi-lingual booklets addressed to coastal managers and planners, as well as to education and training institutions.

Oceans 21: From 2001 to 2004.

The 2001 to 2004 period was marked by global and sectoral specific events which refreshed the Programme and gave new impetus to collaboration.

First, the “**Global Conference Oceans and Coasts at Rio+10: Assessing Progress, Addressing Continuing and New Challenges**” (Paris, 3-7 December 2001), convened by IOC and sponsored also by the IGU, led to the adoption of a substantial final document which focused on the key issues of integrated coastal management and relevant implementation prospects, together with some essential operational guidelines. This document was addressed to the World Summit on Sustainable Development (WSSD 2002), where it gained unanimous consensus.

CoastGIS’03, the 5th international conference in the series that began in 1995 focusing on GIS and Computer Cartography for Coastal Zone Management, was a joint initiative of the International Geographical Union's Commission on Coastal Systems and of the International Cartographic Association's Commission on Marine Cartography. **CoastGIS’03**, held in Genoa, Italy, 16 - 18 October 2003, was convened by the Associations GISIG and ICCOPS under a commitment by the **CoastGIS** International Executive Committee and the sponsorship of the European Commission, supported by other important scientific organisations. **CoastGIS’03** hosted intense and extended discussions on the progress achieved in the use of GIS for sustainable development in coastal regions. Key subjects discussed at the conference were the appropriate conceptual background for further actions, the usefulness of considering case studies, and the prospects of implementing techniques and of meeting the special needs of planners and educators, particularly in developing countries.

The result of these discussions led to the conclusion that, because of parallel conceptual and technical improvements in the technology, and the emerging focus on geographic information infrastructures (also called spatial data infrastructures - SDI) at national, regional and global levels, geographic information (GI) and geographic information systems (GIS) have acquired increased relevance to help achieve the goals outlined in the December 2001 Rio+10 Global Conference mentioned earlier. Relevant papers from the **CoastGIS’03** conference “**Integrating Information in Coastal Zone Management**” are available in the Proceedings, published on CD-ROM, which can be ordered from GISIG. An edited collection of papers, many of them based on presentations made at CoastGIS ’01, is also published in book form (Bartlett and

Smith, 2004), which demonstrates the progression in thinking and focus relating to marine/coastal management integration via GIS technology.

The European Union funded project **ECO-IMAGINE**¹ started in 2004. This project, establishing a forum of scientists and researchers at the European level until 2007, comprises eight conferences and training courses. It can strongly help (i) the creation and maintenance of an actual context within which to help *Oceans 21* share and spread mutual knowledge and foster new discussion and (ii) the conception and design of new activities for *Oceans 21*, e.g. establishing an operational partnership for funding research and information dissemination.

The European Union funded project **MOTIIVE**², to run from February 2005 to February 2007, explores operational aspects of land-sea data harmonisation and integration across disciplines and national borders in Europe. **MOTIIVE** will exploit the work already completed in regard to marine metadata (MarineXML) and related marine/coastal ontology development and interoperability technology, producing tools and methodologies directly applicable to the target audience for *Oceans 21*.

Complementing the European coverage for the new *Oceans 21* Framework Science Plan that is ensured by **ECO-IMAGINE**, the link to *Oceans 21* provided by the Gerard J. Mangone Center for Marine Policy (Newark, Delaware, USA) and the international character of the **CoastGIS** conference series³, further guarantees a truly international focus and commitment to the programme's objectives beyond European borders.

Oceans 21: The Future (2005 - 2008).

The opportunity now exists to refresh and revitalise the *Oceans 21* programme by moving on from the subject areas identified in the original 1998 IGU-IOC Memorandum of Understanding, informed by the new orientations arising from the 2001 "Rio+10 Global Conference" in Paris, to a new outlook. This perspective proposes the optimised use of geospatial information and GIS for coastal management as implementing science, providing analytical, modelling and visualisation tools and techniques to achieve integrated coastal/marine spatial data infrastructures nationally, regionally and globally.

This **Framework Science Plan** spans a time frame of a decade or more. An operational plan for implementing specific actions, focused on specific framework themes, accompanies the plan, for the time frame 2005 to 2008. This ***Oceans 21 Operational Plan: 2005 - 2008*** details proposed objectives and meaningful outcomes that will support future extensions of the programme post-2008. Funding for many of the planned activities can be found from within European Union regional development and R&D initiatives, such as **ECO-IMAGINE** and **MOTIIVE**, as the Operational Plan for the next period foresees a significant European dimension. Additional non-European funding resources will also be investigated in order that the results can be translated to regions outside European coastal waters. During the four-year time frame of the **Operational Plan**, major international **CoastGIS** conferences will be held in the UK (2005), Australia (2006) and the Caribbean (2007), which will serve as key events at which *Oceans 21* results can be delivered, showcased and widely published.

Other international projects or programmes address some of the objectives in the original *Oceans 21* programme, for example **LOICZ** (Land-Ocean Interaction in the Coastal Zone) and IOC's **COOP** (Coastal Oceans Observation Panel). The revised ***Oceans 21 Framework Science Plan*** does not attempt to duplicate the excellent work in marine-coastal-land integration already evident in these well established initiatives, but

¹ European **C**onferences and forum for **I**ntegrated coastal **M**anagement and **G**eo-**I**nformation **r**esearch - funded under the Marie-Curie actions (MSCF-CT-2003-504444), see <http://www.gisig.it/eco-imagine/> for details.

² **M**arine **O**verlays on **T**opography for **A**nnex **I**I **V**aluation and **E**xploitation - an EU-funded special support action of the 6th RTD Framework Programme.

³ CoastGIS'05 is to be held in Aberdeen, UK; CoastGIS'06 will be held in Australia and CoastGIS'07 will be held in the Caribbean. Both CoastGIS'05 and '06 have already adopted themes focusing on research pertinent to the development and implementation of coastal/marine spatial data infrastructures, stressing the need to more fully integrate research and management activities for disciplines outside the traditional "coastal" zone with those who today work in the coastal arena.

rather will complement that work using the geographic information and GIS technology focus of *Oceans 21* to help planners and researchers to interpret the results of related programmes.

At global level, the SDI initiative of the **Global Spatial Data Infrastructure (GSDI) Association** offers considerable scope for engaging marine and coastal stakeholders in coastal and marine spatial data infrastructure development, especially the integration of thematic work within the SDI regimes of land-based planners and managers. Seven GSDI conferences have been held to date, in 1996 (Germany), 1997 (USA), 1998 (Australia), 2000 (South Africa), 2001 (Columbia), 2002 (Hungary) and 2004 (India), with the 2005 conference scheduled for Egypt. Papers highlighting the information needs of the marine and coastal communities have been presented at the last two conferences in 2002 and 2004 (Longhorn, 2002 and Bartlett et al, 2004). These conferences are characterised by the attendance of senior policy makers and managers from across the globe, including several UN and international development aid organisations. They provide a venue for highlighting the need for greater integration of coastal/marine science and management with disciplines not traditionally linked to coastal/marine environments, such as urban planning.

At a more regional level, Working Group III (Cadastre) of the UN-sponsored **Permanent Committee on GIS Infrastructure for Asia-Pacific (PGCIAP)** held an international workshop on “Administering the Marine Environment – The Spatial Dimension” in Kuala Lumpur, Malaysia, in May 2004. The meeting was attended by more than 100 delegates from 11 countries, and conclusions from this workshop were reported back, at Cabinet level, to the governments of a number of participant countries, notably those of Indonesia and of Malaysia. The need to encourage the development and take-up of marine and coastal-oriented spatial data infrastructures, with supporting GI technologies, was a strongly voiced conclusion from this workshop.

At European regional level, the pan-European SDI - **INSPIRE (Infrastructure for Spatial Information in Europe)** recognises the importance of coastal/marine community information needs. Also at European level is the joint European Space Agency and European Commission programme **GMES (Global Monitoring for Environment and Security)** within which one of the six primary themes is “Ocean and Marine Applications”. The **MOTIVE** project mentioned earlier specifically addresses the data harmonisation and information integration needs spanning the land-based **INSPIRE** initiative and the **GMES** ocean/marine theme.

Some of the more advanced national work targeted specifically on coastal SDI has been carried out in Canada (CCMC, 1999) and the USA (NRC, 2004). In both countries, the need to better coordinate and integrate data sources from land and sea have been officially recognized (NOAA 2004, US Commission on Ocean Policy 2004).

Across the globe, geospatial information is seen as the ‘glue’ that helps integrate information from numerous sources and disciplines into the unified analytical and monitoring systems needed to implement modern and efficient e-governance, thereby helping to improve quality of life for all citizens. Management of the social-economic aspects of individual coastal communities, within existing cultural contexts, is too often overlooked in favour of management of the natural or physical environment only. Helping to overcome this deficiency in current planning and monitoring activities in the coastal zone will be an important overall outcome of *Oceans 21*.

KEY FEATURES

The following subject areas, geographic focus, outcomes, products and communication tools are proposed for the ***Oceans 21 Framework Science Plan***. These contribute to the goal of increasing the level of interdisciplinary communications leading to greater integration of skills and knowledge in tackling difficult issues facing development and use of the coastal zone. These issues require closer cooperation between the traditional marine, coastal and land-based researcher and natural and manmade environment manager and those working in the socio-economic research community.

Subject areas.

Oceans 21 is concerned with:

- **trans-disciplinary scientific research** leading to a better understanding and implementation of management practices that will result in more sustainable coasts, focusing primarily on the local scale, informed by emerging national, regional and global spatial data infrastructures, and taking into account local coastal community culture;
- development and presentation of significant **interdisciplinary case studies** that proactively demonstrate how scientific and management disciplines need to work more closely together, across disciplines and from offshore to near-shore to coastal to inland geographic regions;
- **awareness and information dissemination** activities, introducing novel ways to carry the research message(s) to coastal managers, policy makers and programme funding organisations while also reaching a wider audience comprising all stakeholders, not only scientists or managers, thus ensuring wider public participation in key coastal community decision making;
- **education**, with special focus on distance learning methodologies and long-term sustainability of educational programmes in integrated coastal management at community level, building on an analysis of best practice found in existing national and regional programmes that use GI and GIS technology to educate stakeholders about coastal/marine issues;
- **training** for coastal managers and planners, with special consideration for the needs of developing nations.

Geographic focus.

The focus is on the needs of developing countries with respect to the subject areas outlined above. In order to further focus the planned work geographically, and thus ensure concrete deliverables, the Mediterranean region will play a central role in the first phase of the programme, elaborated in the **Operational Plan: 2005 - 2008**. The challenges of integrated coastal management are readily evident in the Mediterranean basin, where diverse natural and cultural heritage issues often conflict with economic development and the apparently unavoidable needs of daily life. The Mediterranean basin also presents a mix of countries spanning the highly developed to developing nations, with all that implies regarding resource availability to take up and implement *Oceans 21* outputs. The region comprises a wide variety of diverse cultures, religions, and management and governance practices, e.g. those of the Arab and non-Arab worlds. Disputed boundaries, both on-shore and off-shore also exist in this complex region, the main sea of which is fed by rivers in both Europe and Africa with implications for the European Union's Water Framework Directive and the Nile Basin Initiative.

Thus, the Mediterranean region provides a good proving ground for the objectives of *Oceans 21*, from both a scientific point of view and for the design and involvement of regional stakeholders in training partnerships and related actions with direct application at local community level. Once the tools, techniques, methodologies and programme materials developed in the Mediterranean region have been proven, they can be used as models for other trans-national coastal regions, such as the Baltic, Caribbean, Indian Ocean, or Western Africa, in future extensions to the programme.

Typical outcomes.

The main outcomes proposed for *Oceans 21* include:

- conceptual open source⁴ tools and information systems (incorporating GIS technology) tailored to the differing needs of decision makers, planners, managers, and educators, informed by an analysis of past and present tools and systems, identifying those that represent best practice and existing gaps where more work is needed;
- specific reference documents (including best practice guides and case studies), tested methodologies and tools for improving and using coastal GIS in research and management of the coastal zone, particularly in regard to interoperability of disparate data sources from multiple disciplines;
- greater integration of researchers and managers from disciplines not traditionally linked to coastal zone research and development, within the framework of emerging national, regional and global spatial data infrastructures, achieved by creating new networks of practitioners that transcend traditional disciplinary boundaries;
- more highly visible participation in the regional (initially European) and global spatial data infrastructure initiatives that are key to increased ocean-land data harmonisation and information integration globally over the next two decades.

Typical products.

The following products are proposed as typical deliverables over the 4-year time frame for the first iteration of *Oceans 21*, as set out in the **Operational Plan: 2005-2008**:

- an *Oceans 21* programme website (www.iccops.it/oceans21/), closely linked to the relevant IOC website(s) (e.g. **IODE** and **ODIMEX/OceanTeacher**), and to the websites of those organisations or projects that have a role as participants in the programme, e.g. websites for IGU, **CoastGIS** conferences, **ECO-IMAGINE**, **MOTIIVE**, GSDI Association; INSPIRE, MarineXML, etc.;
- a portal to existing coastal/marine research and management oriented websites and information services with a spatial information or GIS component other than those of partner organisations mentioned above, yet highly relevant to the overall objectives of the programme, e.g. **EUCC - The Coastal Union - CoastalGuide** (www.coastalguide.org/index.html), **CoastBase** (Europe) (www.coastbase.org), **BalticGIS** (www.grida.no/prog/norbal/baltic/welcome.htm), **IOC GOOS Coastal Ocean Observations Panel** (COOP) (ioc.unesco.org/goos/coop.htm), **IOC MedGOOS MAMA** Project (Mediterranean network to Assess and upgrade the Monitoring and forecasting Activity in the region) (www.ifremer.fr/mama/), the **European Coastal Practice Network - CoPraNet** (www.coastalpractice.net/);
- demonstration software (“open source”) and examples concerned with coastal GIS as an aid to resolving coastal management problems, including tools that can be used by NGOs (non-governmental organisations) who may lack access to expert scientific help;
- GIS-based educational and training course material, “open source” and placed in the public domain⁵, available via web-based delivery mechanisms, including a website with pre-qualified and explanatory links to existing integrated coastal research and management education services and courses, for

⁴ “open source” is defined here as information content (educational material, software, methodologies, etc.) that are provided free of most copyright restrictions, thus permitting their use, re-use and modification by others who adhere to the same “open source” doctrine in the enhanced products or services that they may also create (www.gnu.org/philosophy).

⁵ “public domain” content is that which has no copyright of any sort attached to it, typically due to national legislation for certain types of information or by explicit statement of the original copyright holder that such rights are surrendered.

example EUCC's **CoastLearn**⁶, **ICZOMAT** (Integrated Coastal Zone Management and Training Project) (Le Tissier et al, 2003), the **BILKO** virtual global faculty for ocean and coastal remote sensing (UNESCO, 2004), UNESCO IIP Project GIS on-line training modules (UNESCO, 1999) and others;

- scientific events to discuss the subject areas and issues covered by the programme – initially within the framework of the existing and highly-successful **CoastGIS** conference series, plus other events as identified. The target should be at least one major international conference annually plus regional (Mediterranean, initially) conferences, seminars or workshops, as often as possible, annually as a minimum;
- dossiers, essentially consisting of handbooks, primers and guides, for the science and technical subjects areas of the programme;
- special issues of international journals and/or special issues in on-line web-based magazines such as *GeoCoast* (GeoCoast.co.uk) and *Journal of Coastal Conservation* - target should be one special issue annually;
- a bi-monthly (electronic) newsletter of activities relevant to programme objectives, published on the **Oceans 21** website, with links to similar and relevant periodical newsletters published by partner organisations or organisations with similar objectives.

Partnerships.

Implementation of **Oceans 21** will benefit from as wide a partnership as possible with organisations and institutions involved in its topical fields, or interested in its projects and able to contribute to success of the programme. The guiding principle in establishing partners will be complementarities with related initiatives, projects and programmes.

In its preparatory phase (1996-1998), **Oceans 21** benefited from the partnership of:

- Center for the Study of Marine Policy (CSMP), Newark, Delaware, USA;
- International Centre for Ocean and Coastal Policy Studies (ICCOPS), Genoa, Italy.

In line with the added focus on geographic information and GIS, plus spatial data infrastructure, the re-design of the programme will catalyse the partnership of:

- **International Geographical Union (IGU) - Commission on Coastal Systems (CCS)** - with special regard to CCS activities in GI and GIS;
- **UNESCO's Intergovernmental Oceanographic Commission (IOC)** - via the work of the Committee on International Oceanographic Data and Information Exchange (**IODE**), the **GOOS** (Global Ocean Observing System) **Coastal Oceans Observation Panel (COOP)**;
- the **CoastGIS International Committee** - that provides the experience of its established scientific panel offering sound expertise about all the **Oceans 21** topics from the coastal GIS viewpoint;
- **ICCOPS** - to ensure a continuity of the outcomes achieved during the late 90's by the two partner organisations (IOC and IGU), particularly in the framework of the 1998 Genoa Conference and also as international members of the MEDCOAST initiative/network, whose members include the UNEP Mediterranean Action Plan and IOC;
- the **Gerard J. Mangone Center for Marine Policy**, Newark, Delaware, USA - to ensure a really international and not only European outreach of the initiative;
- the **GIS International Group (GISIG)**, Genoa, Italy - for the issues concerning GIS international co-operation, education and outreach, with special regard to GIS users;
- **EUCC - The Coastal Union** - especially with regard to education on coastal issues in the Mediterranean and engagement of coastal zone practitioners in understanding the value of adopting emerging interoperability technologies and techniques;

⁶ on-line coastal management distance learning modules - www.coastlearn.org

- the **International Cartographic Association (ICA)** - Commission on Marine Cartography (supporters of the CoastGIS conference series);

Oceans 21 will seek support from the **GSDI Association** and the UN-recognised **Permanent Committee on GIS Infrastructures for Asia-Pacific (PCGIAP)**, in regard to coastal/marine spatial data infrastructure issues, especially via introduction of coastal/marine SDI theme in the GSDI annual conferences. The GSDI Association has been approached regarding creation of a formal Marine/Coastal Working Group within its current organisational framework. We expect a positive decision on this proposal before the end of 2004.

A similar “twinning” activity is proposed for the pan-European SDI initiative **INSPIRE (Infrastructure for Spatial Information in Europe)** that would focus specifically on coastal/marine SDI for the Mediterranean region, initially, with the ability in future to incorporate lessons learned and best practice to the Baltic and North Atlantic regions of Europe. INSPIRE makes provision for establishing Spatial Data Interest Communities (SDIC) and *Oceans 21* participants should consider forming or joining a Coastal/Marine SDIC in 2005. Valuable experience for integrating marine and coastal information across not only disciplinary but also national boundaries can be gained by participating in regional and global initiatives such as INSPIRE, GSDI and the joint EU-ESA Global Monitoring for Environment and Security (GMES) programme.

Infrastructure and Programme Linkages.

ICCOPS, in collaboration with GISIG, offers to provide a Technical Secretariat for *Oceans 21*, thus (i) ensuring effective linkages between the partner organisations and with other bodies co-operating with the programme, and (ii) convening co-operative projects benefiting from the expertise of the partners and co-operating organisations, aimed at securing funds for research and education-based projects.

Further than the Technical Secretariat hosted by ICCOPS and GISIG and to reinforce the operational capacity of *Oceans 21*, "The Home of Geography" (Villa Celimontana, Roma) will be able to host short courses and meetings."

In particular, ICCOPS and GISIG are able to take advantages of the existing **ECO-IMAGINE** project of the EC Marie Curie programme, which has already started a series of scientific events focusing on coastal management and the relevant use of GIS-based tools. Advantages exist in establishing a close link with these funded initiatives and the projects encapsulated in the *Oceans 21* programme, as indicated in the diagram in Figure 1. Similarly, the EU-funded RTD Framework project **MOTIIVE** is developing a suite of open source tools and methodologies to enable data harmonisation and integration of marine and terrestrial geospatial data for all coastal research and management disciplines. User and stakeholder engagement activities within **MOTIIVE** provide another avenue for increasing participation in *Oceans 21*.

Allied Coastal, ICAM and Marine GIS Programmes and Initiatives.

Aside from the Spatial Data Infrastructure programmes already mentioned above, three related regional or global programmes or initiatives are of special interest to planners of the *Oceans 21* science plan re-drafting. The first is the **Coastal Oceans Observation Panel (COOP)** of partner organisation IOC's GOOS - Global Ocean Observing System. The strategic plan for **COOP**, while identifying the importance of data management and communications systems (UNESCO/IOC, 2003c pp. 89 - 104), does not attach any specific importance to GIS technology. The **COOP** plan overall is a science-oriented plan that is still more focused on near-shore oceanic science than the interdisciplinary and fully integrated GIS approach proposed for the *Oceans 21* Science Plan.

Numerous coastal zone management projects have been effected via the European Union's 4th, 5th and now 6th RTD Programmes, as well as major initiatives conducted by the European Commission's Directorate General Joint Research Centre (JRC), typically in cooperation with DG Environment, including the LaCoast initiative/project and the ICZM Demonstration Programme, which resulted in the ICZM Recommendations for Europe (EC 2000). Several of the EU-funded projects in the RTD Framework programme have involved development of GIS related technologies and methodologies, either as a main focus of the project or as

important ancillary activity. Also, non-RTD actions have been enacted by the European Commission, such as the major **EUROSION** programme and development of the **CoastBase** information database, service and portal for integrated coastal zone management. It is necessary in *Oceans 21* to continue to monitor such activities, especially at European level, so that appropriate linkages can be maintained between any such projects which can support the objectives of *Oceans 21*. Additional and new funding opportunities will also arise that could support *Oceans 21* activities via the remaining calls for proposal in the area of networks of excellence or concerted actions for the European Research Area under the EC's 6th RTD Framework programme and the 7th RTD Framework now being defined.

By far the most complementary international programme currently underway with parallel goals to *Oceans 21* is the **LOICZ - Land-Ocean Interaction in the Coastal Zone** programme of the **IGBP - International Geosphere Biosphere Programme**, which has just completed its first decade of work and launched a new science plan (IGBP 2004). This programme is sufficiently important, with respect to *Oceans 21*, that key targets and objectives are reproduced in Annex 1 to this proposal. Why should we proceed with the *Oceans 21* Science Plan re-drafting in light of LOICZ's plans? Mainly because LOICZ, like IOC's GOOS/COOP, is almost totally marine/ocean science based as opposed to investigating advanced GIS and allied technology contributions to **integrated** coastal zone management. Of course, it will be important that *Oceans 21* maintains an active interest in LOICZ activities as they unfold over the next few years. However, this also indicates how and why *Oceans 21* should distinguish itself from these similar but complementary programmes by focusing on the emerging and converging GI-related technologies as important tools to aid in ICM, as opposed to concentrating solely on the science as did much of the original science plan adopted in 1999.

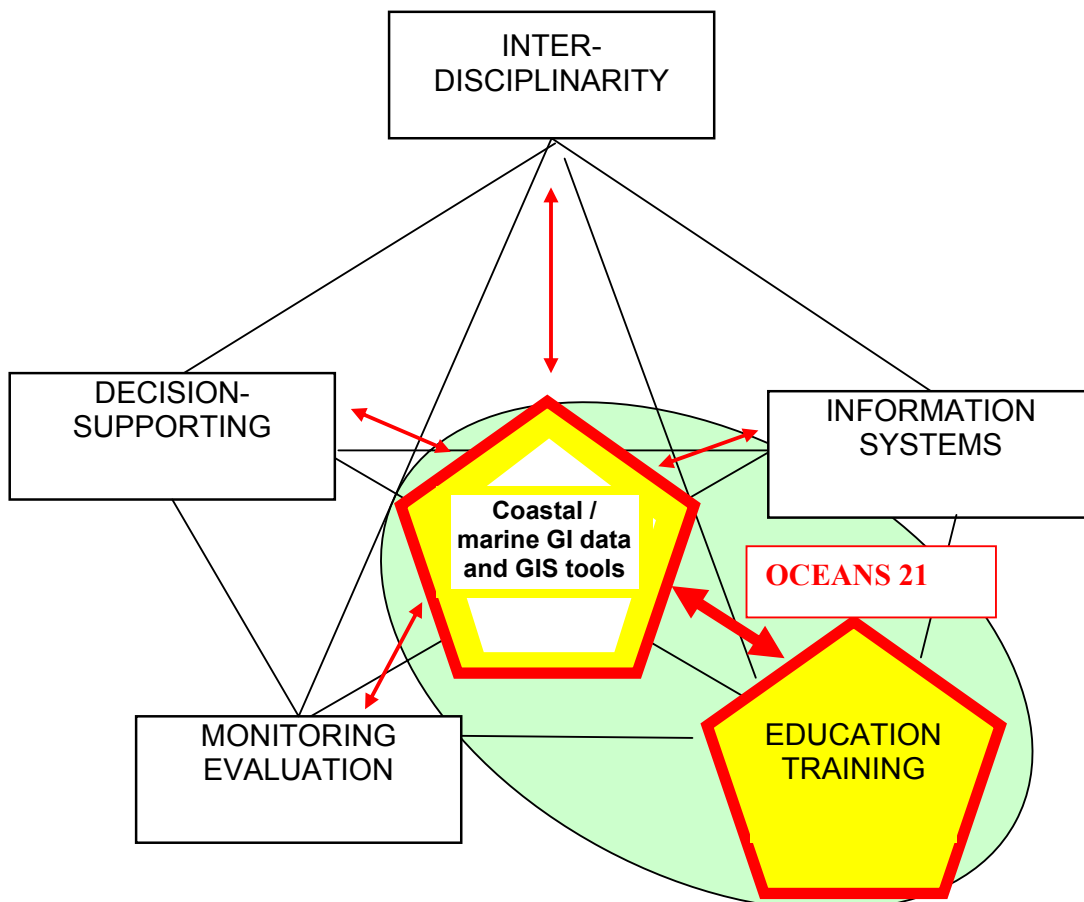


Figure 1. The setting of the *Oceans 21* programme.

OUTLINE OF THE *OCEANS 21* PROPOSED THEMES

Note

Specific activities relating to the **Themes** described here will be elaborated via **Operational Plans**, the first of which is in preparation for the time frame 2005 to 2008. The **Operational Plans** will be used in specifying individual **Projects** in support of the **Themes**. This is a divergence from the presentation of the original *Oceans 21* programme, which was based around Projects, but permits more flexibility in executing the overall programme into the future, as part of the longer term planning for *Oceans 21* as a continuing initiative.

Theme 1

Accumulating coastal knowledge for sustainable development: concepts and methods

linked to the ECO-IMAGINE project Working Group 1 -
 “**Building Coastal Knowledge and GI**”

Background.

The interdisciplinary concepts that applied to Project I of the initial *Oceans 21* programme will continue to apply to **Theme 1** in the new framework, with the focus now on coastal/marine spatial data infrastructure. The initial concepts were:

- identifying coastal systems as modular systems, resulting from the interaction between the coastal ecosystem (near ocean/land/atmosphere interfaces) and the human community resident geographically near to the coastal zone;
- understanding the coastal ecosystem as an evolving trophic web interacting with its abiotic niche;
- defining the coastal organisation exemplified as the changing set of interactions between the ecosystem and human communities, directed towards an objective;
- coastal use as a structured set of uses of coastal resources and the set of relationships between uses and stakeholders;
- describing coastal decision-making systems that include the decision-makers concerned with, and involved in, the organisation of the coastal system; and
- the coastal external environment as the set of natural and human elements and processes located outside the coastal system, with which the coastal system interacts, or expects to interact.

Objectives.

Theme 1 provides conceptual and logical backgrounds from which the other projects may benefit. In this sense, it should be regarded as the basis for the development of *Oceans 21* as a whole. It will contribute to the discussion about the expansion of ocean science and coastal knowledge, intended as an effective interdisciplinary approach to investigation of, and management of, the ocean/land interface that occurs in the coastal zone, regardless of how that geographic region is defined.

In particular, **Theme 1** aims to:

1. design and test experimental models for assessing, representing and simulating the interaction between the local coastal ecosystem and local communities, examining not only marine/coastal science but also socio-economic impacts, including those impacting on local or regional cultural heritage;

2. define methodologies and logical inputs for collecting and processing data relevant to coastal systems, focusing on the interaction between the ecosystems and human communities and decision-making systems relevant to those interactions;
3. explore the literature on the above subjects and periodically report on the state of the relevant key results;
4. identify or produce case studies covering the above subjects that focus on their utility for improving concepts and methods;
5. convene discussions on the above subjects involving scientists, management practitioners, planners and decision-makers (including politicians), ideally via on-going electronic means as well as at conferences and workshops.

Expected Outputs.

Outputs from **Theme I** will support the objectives of other Themes in the Framework Science Plan and will be delivered via the Internet, by CD and in hard copy, as appropriate to different target audiences. The low-speed Internet access available to many beneficiaries, especially in those countries with less-developed ICT infrastructures, may prevent them from depending on the Internet to deliver outputs that contain large volumes of data, as is often the case with spatially enabled data sets and their analysis. To overcome this, CD technology will be used in parallel with the Internet as an information delivery mechanism.

Typical outputs to be produced include:

1. Review or overview of extant literature via searches conducted in support of the Objectives listed above, such reviews to include analysis and explanation as to how the models, data sources, methodologies, GIS tools, etc. can be used to meet the listed Objectives. Such review(s) will identify key issues affecting local coastal communities around the target investigation area (initially the Mediterranean basin), especially with respect to socio-economic problems and cultural heritage considerations relating to the coastal zone.
2. Case studies and best practice guides relating to the issues identified in (1) above. These should be produced in such a manner as to permit their use as training materials in both distance learning and classroom (tutorial) based learning environments.
3. Models and GIS-aware/enabled tools, including those for data and metadata creation and for spatial analysis relating to socio-economic as well as scientific research, should be made available publicly on CD and for download via the Internet. Provision should be made for multi-lingual target audiences.
4. An on-line discussion forum where topical issues can be exposed and debated in a pro-active manner via e-mail or Web-based mail systems.
5. Seminars or workshops to disseminate the information above and provide face-to-face discussion and education forums for different stakeholder communities, e.g. research, planning/management, coastal community members. Conduct of seminars should be carried out by *Oceans 21* partners on a periodic and regionally focused basis, where appropriate, typically within the margins of existing conference and meeting plans of the partners.

Theme 2

GIS Implementation of Coastal Information Systems for ICM

linked to the ECO-IMAGINE project Working Group 2 -
 “Coastal Governance, Planning and Design and GI”

Background.

Geography is now considered as a key linking attribute for the majority of e-government initiatives around the world, which historically only included coastal areas incidentally. Yet, virtually all information collected for and needed by coastal zone researchers, planners, decision makers and monitors is geospatial in nature, i.e. it has an important location attribute. Landward geography, and seaward hydrography and bathymetry, are physically, legally, economically and socially interlinked in a complex web of information. The location attribute inherent in this vast range of thematic data provides the linking mechanism that permits interdisciplinary investigation of complex coastal issues, e.g. a multitude of different types of marine boundaries, scientific data on flora, fauna, geology, socio-economic impacts of coastal zone management policies and philosophies, etc.

Better understanding of geographic information (GI) and the technology to manipulate such data - geographic information systems (GIS) - is the linking mechanism required by, and used by, both researchers and planners/managers of the coastal zone, as well as by those scientific and planning disciplines removed from the coastal zone but whose work has direct impact on the coastal zone. GIS-enabled analysis and visualisation tools can also provide an important alternative to traditional information dissemination techniques for increasing the level of public participation in coastal zone decision making at community level.

Objectives.

Theme 2 focuses on investigating and proving GIS techniques that support ICM principles and deal with the issues that (i) are considered by literature review to be pivotal to optimise coastal management, and that (ii) are regarded by coastal managers as crucial for their daily work. In this respect, a set of technical contributions will be provided aimed at:

1. assessing the coastal system in terms fit to the needs to manage and monitor its sustainable development, e.g. information content, accepted data collection and analysis methodologies, information dissemination best practice;
2. defining relevant applications for Coastal GIS use within emerging Coastal/Marine Spatial Data Infrastructures that support wide dissemination of metadata (and data, where possible) created to international standards;
3. demonstrating the use of coastal GIS (tools, data, models) in selected case studies spanning as broad a range of issues as practical (informed by **Theme 1** outputs), e.g. coastal science research, socio-economic impact on coastal communities of current or projected coastal practices, assisting cultural heritage preservation;
4. designing and testing learning tools for GIS pertinent to coastal management issues, suitable for use in both distance learning and classroom based (tutorial) instruction - this to be done following desk research into the numerous GIS, coastal management, remote sensing for coastal management and related courses already known to exist (an expected output of **Theme 1** projects);
5. identify GIS-enhanced methods to increase public participation in making coastal planning and management decisions, at community level, including non-scientific stakeholders.

Expected Outputs.

Outputs from **Theme 2** will support the objectives of other Themes in the proposal, and will be guided to some extent by investigations conducted in **Theme 1**. All planned outputs will be delivered via the Internet, by CD and in hard copy, as appropriate to different target audiences. Typical outputs include:

1. Literature review of existing coastal information systems (CIS), including an analysis of such systems, examining information content requirements, accepted data collection practices (including quality control and metadata preparation), typical data analysis methodologies, information dissemination best practice, stakeholder involvement. The analysis should focus on how GIS technology is being used in the different CIS.
2. Case studies and/or a best practice guide demonstrating how relevant applications for GIS in coastal information systems are being used most effectively, based on the results in (1) above.
3. Best practice guides, based on existing or emerging international standards, for creating and disseminating metadata (information that describes other information) used to both discover and exploit data holdings of marine/coastal data custodians. This should take special note of the data publishing philosophies that underlie emerging e-governance initiatives at national and regional levels.
4. Web-based open source GIS tools that permit ready and rapid integration of spatial coastal data (near shore, shoreline, inland) into scientific and socio-economic analyses of coastal issues
5. Learning tools for coastal planners and management practitioners that demonstrate how GIS and spatial analysis can help address coastal management issues. Two versions should be created - one for traditional classroom instruction and another for interactive (Web-enabled or via CD-ROM) distance learning, including self-instruction
6. Best practice guidelines or specific case studies demonstrating how all stakeholders can be more comprehensively involved in coastal governance via participatory GIS techniques.

Theme 3

Coastal Urbanisation and Coastal Landscape

linked to the ECO-IMAGINE project Working Group 3 -
 “The Waterfront Management and GI”

Background.

The International Workshop “*Challenges of Growing Urbanisation of the World’s Coastal Areas*” held at Hangzhou, China, September 1999 (IOC, 1999), convened by the Intergovernmental Oceanographic Commission with the collaboration of the International Geographical Union, led participants to adopt a Final Declaration including these subject areas:

- Integrated Planning of Coastal Areas
- Education, Training and Public Awareness
- Establishing a network of large coastal cities

Due to their close linkage with the *Oceans 21* topics and approaches, the above subject areas were considered by IOC and IGU as components of the *Oceans 21* programme.

Since the design of the first *Oceans 21* Science Plan in 1998, the European Landscape Convention (Council of Europe, 2000) was adopted by the Council of Europe (see extract in Annex 2 to this document), representing 45 European states, in Florence in 2000. Various initiatives have been implemented by UNESCO concerned with cultural landscapes, including for example the Convention on Protection of Underwater Cultural Heritage, 2001 (UNESCO, 2001). This has triggered the need to focus on coastal landscapes with the aim of integrating the IOC guidelines on integrated coastal management created during the previous years of *Oceans 21* with the newly-adopted guidelines on the landscape, including the approach recommended by UNESCO for cultural landscapes. As a result, this subject area should also now be considered inherent to the background objective of *Oceans 21*, and as a theme operating across the projects mentioned above.

Theme 3 carries on the tradition of the former Project III theme “Methodology Development in Support of ICM”, but from the more focused viewpoint of evaluating decision support models, mechanisms and required data sources relating specifically to coastal urbanisation and landscape management. It is expected that this more selective approach will generate more concrete results and outcomes specific to an area identified as being of pressing urgency to coastal communities globally.

Objectives.

Objectives for **Theme 3** include the following, some carried forward from the prior Project III formulation:

1. identify the data and decision support systems (DSS) needs specific to investigating, planning and monitoring coastal urbanisation problems and proposed solutions from a holistic viewpoint (environment, economy, society, culture);
2. sponsor and encourage research into and development of the DSS tools identified above;
3. create new guidelines and best practice manuals specific to the need for managing coastal urbanisation, including not only scientific and technical guides, but also legal and related socio-economic guidelines;

Expected Outputs.

Outputs from **Theme 3** will support the objectives of other Themes in the proposal, and will be guided to some extent by projects conducted in **Themes 1** and **2**. All planned outputs will be delivered via the Internet, by CD and in hard copy, as appropriate to different target audiences.

Typical outputs include:

1. Literature review of existing decision support systems (DSS) in use today for coastal zone management, including analysis of their capability to handle new coastal zone management issues in socio-economic development and cultural heritage protection for local coastal communities. The goal is to identify the main elements of a DSS for waterfront management, incorporating GIS technology, that can be used to help manage coastal urbanisation.
2. Open source DSS tools and methodologies delivering the DSS elements defined in (1) above.
3. Best practice guide demonstrating how the DSS tools defined in (1) and created in (2) above can best be used in a variety of analytical situations, especially for examining coastal urbanisation problems within societies at very different levels of development. This guide should also be structured for use in training activities.
4. Information dissemination package(s) to present the DSS tools to as wide an audience as possible via the Internet (e.g. the project Web site), CD-ROM and printed publications. Awareness of the tools and methodologies will be raised within different stakeholder communities (research, planning, management, local/national government, and citizens) via appropriate local, national and regional dissemination programmes conducted by the partners.

Theme 4

Science and Technology of Coastal Information Systems for ICM

linked to the ECO-IMAGINE project Working Group -
“Geo-spatial Technologies”

Background.

Investigations on key issues in this subject area have been carried out within the framework of the devised partnership, especially the previous focus of the *CoastGIS* conferences, which were highly GIS technology based. The issues previously identified may need to be re-oriented in order to tailor this Theme to the peculiar needs of the *Oceans 21* programme. The key goals for **Theme 4** remain as the implementation of Coastal Information Systems, with a special focus on their scientific and technical background, on best practice in the field, and on increased awareness of the present technological trend towards ever wider implementation of Web-based and mobile GIS solutions applicable to coastal management.

In the initial formulation of *Oceans 21* in 1999, Project IV covered coastal and deep-ocean monitoring systems. In the intervening 5 years, much of the work relating to collection and integration of data for such monitoring activities has been undertaken by the IOC’s committee on International Oceanographic Data and Information Exchange (**IODE**). The data exchange procedures, policies and facilities developed by IOC have already been likened to a full-fledged spatial data infrastructure (Longhorn, 2002). Not only have many of the initial problems been resolved, but a separate IOC activity focusing on coastal waters has now reached maturity - the IOC’s GOOS (Global Ocean Observing System) **Coastal Ocean Observation Panel (COOP)**. It would be foolish for *Oceans 21* to replicate this excellent work. Rather, a liaison function is foreseen that would integrate the results of such work more tightly with the mainstream coastal management community who may not be as fully aware as they should be of IOC activities in this area. Additionally, the application of GIS technology to the work of COOP and the **LOICZ** programme mentioned previously and outlined in Annex 1 would be advanced in **Theme 4**.

The information and knowledge derived from GIS-based (spatially enabled) data banks, together with lessons from the use of GIS for monitoring and evaluating coastal systems presented in the previous five *CoastGIS* conferences, may provide useful background to design, experiment and operate indicators for sustainable coastal management. Much work has been done with regard to identifying ICM indicators [see References for various indicators reports] and few of the recommendations can be implemented without resort to extensive use of GIS in both data collection and analysis, such as:

- the conceptualisation of indicators from the United Nations Commission on Sustainable Development (UNCSD),
- the contributions from a selected number of inter-governmental organisations, such as the Mediterranean Action Plan (UNEP),
- inputs from the indicators for landscape protection, which have been designed with reference to the Council of Europe’s “European Landscape Convention”, and
- monitoring coastal sustainability indicators adopted for the EU’s ICZM Recommendation.

In this respect, **Theme 4** will give special consideration to emerging subject areas, such as the need to protect, plan and manage the coastal landscape according to the newly-adopted European Landscape Convention. Development and wide dissemination of ocean and coastal data models and related open source information systems implementation technologies are also crucial for creating future Coastal/Marine Spatial Data Infrastructures that underpin any ICM Coastal Information System.

Objectives.

Proposed objectives for **Theme 4** include:

1. liaise with coastal monitoring programmes of partner organisations, such as IOC's COOP, LOICZ (Land Ocean Interaction in the Coastal Zone) and UNEP programmes such as the Mediterranean Action Plan;
2. investigate novel applications for mobile GIS solutions in both data collection and use, e.g. GPS-based, hand-held mapping and data collection, specifically for the coastal zone;
3. identify any specific mapping needs required to investigate and manage coastal urbanisation problems, especially as regards use of GIS tools during the investigative and problem-solving process;
4. identify any special coastal management indicators that can help assess the degree to which coastal urbanisation and coastal landscape are being affected by a range of factors, including socio-economic ones, relating these to existing coastal health indicators for the target region(s) under investigation and globally.

Expected Outputs.

Outputs from **Theme 4** projects will support the objectives of other Themes in the Framework Science Plan, and will be guided to some extent by investigations conducted in **Theme 3**. All planned outputs will be delivered via the Internet, by CD and in hard copy, as appropriate to different target audiences.

Typical outputs include:

1. Review or overview of coastal monitoring plans of the nations in the target region(s). Identification of additional indicators able to help identify potential problems in coastal health from urbanisation and/or cultural landscape points of view as opposed to purely physical environmental considerations.
2. Guidelines for mobile technology solutions incorporated in Coastal Information Systems, that can also be used as training materials in use of the technology.
3. Open source mapping tools (spatial data visualisation and more traditional map generation) to aid in analysis of coastal urbanisation and landscape management and presentation of results to stakeholders of differing ICT/GIS abilities, with an accompanying training guide and best practice guide in use of the tools.
4. Case studies on use of coastal health and sustainability indicators relating to coastal urbanisation and landscape management (as opposed to traditional environmental health indicators)
5. Seminars to disseminate the information gathered in **Theme 4** Projects and information packs to be used by partners in holding such seminars. These also to be made available via the project Web site and on CD-ROM.

Theme 5

Training, Education and Awareness on GIS-assisted ICM

Background.

While the primary goal of *Oceans 21* is the investigation and resolution of different types of problems relating to integrated coastal management, across disciplines, geographical and jurisdictional boundaries, results are of reduced value unless communicated to as wide a community of stakeholders as possible. Therefore, **Theme 5** concerns awareness for wide dissemination of information, production of educational materials and training initiatives. The latter would be conducted within the framework of the international conferences already mentioned, e.g. *ECO-IMAGINE* conferences, seminars and workshops and the **CoastGIS'05, '06 and '07** series of conferences. Additional exposure can be gained by promoting the *Oceans 21* programme activities proactively to organisations such as the EUCC - The Coastal Union - whose Mediterranean regional office is located in Barcelona, and via GSDI Association and INSPIRE (EC-backed) global and regional spatial data infrastructure conferences. Funded projects such as the EU's Coastal Practice Network (CoPraNet) and DEDUCE can also be used to disseminate information.

Objectives.

Specific awareness, education and training objectives for **Theme 5** include:

1. design, produce and disseminate manuals on best practice for both technological solutions and managerial guidance for key sectors and issues of integrated coastal management;
2. encourage and co-ordinate efforts to increase stakeholders' awareness of the use of GIS in the field for data collection and reporting and in the office for planning, monitoring and evaluation;
3. design and convene courses with the aim of optimising educational profiles and professional skills on a national and regional (multi-national) basis, focusing initially on the Mediterranean region, in close cooperation and liaison with existing programmes in the region;
4. encourage and promote the design and implementation of distance learning courses based primarily on the Web but supported by off-line materials (CD-ROM, DVD, printed course notes) where necessary;
5. monitor availability of formal coastal zone science and management course materials now becoming freely available from major universities around the world (although principally still in the USA today), such as the Massachusetts Institute of Technology (MIT) OpenCourseWare (OCW) Project (ocw.mit.edu).

Expected Outputs.

Outputs from **Theme 5** span and support the more specific training and information dissemination outputs already stated for the other four Themes in the Framework Science Plan. All outputs will be delivered via the Internet, by CD and in hard copy, as appropriate to different target audiences.

Typical outputs include:

1. creation and maintenance of the *Oceans 21* programme website (www.iccops.it/oceans21), that will be the focus or main portal for all awareness, education and training related actions;
2. demonstration software (open source) and examples concerned with coastal GIS as an aid to resolving coastal management problems, with the emphasis on coastal urbanisation and cultural landscape preservation, to be used in training courses and available on-line for free;
3. links to existing ICM education services and courses, such as EUCC's CoastLearn (on-line coastal management distance learning modules - www.coastlearn.org) and UNEP ICAM training sites;

4. scientific events to discuss the subject areas and issues covered by the programme - the target should be at least one major international conference annually plus regional (Mediterranean, initially) conferences, seminars or workshops, as often as possible, annually as a minimum;
5. dossiers, essentially consisting of handbooks, primers and guides, for the science and technical subjects areas of the programme;
6. special issues of international journals and/or special issues in on-line web-based magazines such as *GeoCoast* (GeoCoast.co.uk) and the *Journal of Coastal Conservation* - the target should be one special issue annually;
7. a bi-monthly electronic newsletter of activities relevant to programme objectives, published on the *Oceans 21* website, with links to similar and relevant periodical newsletters published by partner organisations or organisations with similar objectives.

Theme 6

Extending National, Regional and Global SDIs from Onshore to Offshore

Background.

Specification of national, regional and global spatial data infrastructures (SDI) has been underway for a decade. At trans-national level, investigations into regional SDI (RSDI) requirements began in 1995 in Europe (ESDI) and Asia-Pacific (PCGIAP) and in 2000 in the Americas (PC-IDEA), mainly in response to NSDI developments occurring in a few nations within these regions. Global SDI discussions started in 1996 with the first GSDI conference in Bonn, Germany and the Global Mapping Project, which began in 1997. Few attempts to create SDI at national level (NSDI) have reached maturity. Even now in 2004, many SDIs are still mainly “visions” and not legally mandated, physical components of an information infrastructure, comprising enforceable standards, mandatory spatial data metadata creation, and widely accepted information access policies. At regional level, even less has been achieved in creating viable spatial information infrastructure. Globally, the main focus has been on community building, consensus building, creating vision, and defining overall strategy and goals (see, for example, Williamson *et al.*, 2003). Yet SDI initiatives are progressing in all areas and the special needs of the marine/coastal communities can all too often be forgotten as these projects tend to be driven primarily by land-based topographic organisations, e.g. national mapping and cadastre agencies.

The visionaries and designers of SDI must accommodate the widely varying information needs of highly diverse disciplines and sectors of society, business and government. In the coastal zone, multiple disciplines and jurisdictions typically overlap, such as when a potential health epidemic is generated by toxic chemical concentration in marine fauna or flora that is later consumed by area residents. Then knowledge of distribution of the coastal zone flora and fauna, near shore and offshore hydrography and bathymetry, nearby land use practices by industry and agriculture, near-shore transport routes, fishing practices and zones all become intertwined. **Theme 6** looks specifically at some of the more important issues pertaining to integration of offshore, near shore, coastal and landward spatial information harmonisation and integration across domains and disciplines.

Objectives.

Proposed objectives for **Theme 6** include:

1. achieve informed and proactive liaison with the regional SDI initiatives, initially in Europe via INSPIRE (Infrastructure for Spatial Information in Europe) Spatial Data Interest Communities (SDIC) - but also in Asia-Pacific and the Americas, from the marine/coastal community point of view;
2. achieve informed and proactive liaison with the Global Spatial Data Infrastructure initiative to keep the needs of the marine/coastal research and management communities to the fore in further GSDI initiatives;
3. develop and promulgate greater awareness of data and metadata standards activities in the GIS interoperability community (the work of the Open GIS Consortium Inc.) and the international standards organisation ISO;
4. monitor, report on and where possible participate in projects in the Mediterranean basin that explore cross-disciplinary integration issues, such as terrestrial/marine cadastre, merging nautical charting and terrestrial mapping paradigms, integrating marine data inputs into traditional land-based socio-economic models for coastal urban development and monitoring.

Expected Outputs.

Typical outputs from **Theme 6** will include:

1. a Working Group will focus on coastal/marine SDI issues and infrastructure creation at global and European regional levels, ideally within the GSDI and INSPIRE frameworks, which welcome stakeholder participation;
2. the Working Group will report regularly via the Web and electronic newsletters on national, regional and global Coastal/Marine SDI developments, particularly as national SDIs become more mature;
3. maintain a watching brief in the relevant working groups of the Open GIS Consortium (OGC), the international body that develops industry-backed GIS interoperability standards and specifications, and report periodically on developments pertinent to the marine/coastal community;
4. participation in OGC Working Groups on environment, remote sensing and related GIS technologies, leading to reports on these developments as they apply specifically to the coastal/marine community;
5. guides and best practice case studies on using data harmonisation and integration tools and methodologies, derived from projects such as **MOTIVE** (mentioned earlier);

A joint approach is currently being prepared, in association with the PCGIAP, requesting that the GSDI Association include a dedicated session on marine and coastal spatial data infrastructures in their next and subsequent international conferences.

SUMMARY AND RECOMMENDATIONS.

To summarize, we propose that *Oceans 21* be refocused to concentrate more specifically on the role of spatial information (geographic information) and GIS technology as enablers for better management of coastal urbanisation problems identified more than five years ago at the IOC-SOA Hangzhou conference, reiterated at the Rio+1 global conference in Paris in 2000.

Much excellent work has already been completed in regard to the purely scientific research side of coastal management, both in the *Oceans 21* programme to date and in historical and on-going initiatives such as **LOICZ**. The *CoastGIS* series of international conferences, which began in 1995, developed the focus on GIS technology as an enabler for coastal research and management. This conference series has spawned similar national conferences (e.g. "Coastal GIS 2003", held in Woolongong, Australia, in July 2003 (Woodroffe and Furness, 2003)), as well as numerous national workshops and national and regional projects, which also now focus on similar issues.

Increasing participation of all stakeholders, not just the scientific or coastal management community, should be a priority that guides development of the individual Themes in the **Framework Science Plan**. GIS has been demonstrated to be a useful enabler in securing such participation due to its ability to present often complex relationships visually in a manner that lay persons (non-experts in ICT or GIS or coastal management) can understand.

Leaders or coordinators must be nominated for each of the proposed Themes. A **Technical Secretariat** has been offered by **ICCOPS** - International Centre for Coastal and Ocean Policy Studies in Genoa, Italy. This offer includes hosting the proposed programme Web site, which will be a key means of information dissemination and partner coordination.

Initial funding for many of the proposed activities is available from within the **ECO-IMAGINE** project and via annual international conferences in 2005, 2006 and 2007 in the *CoastGIS* conference series, plus coastal stakeholder engagement events of **MOTIVE**, all of which offer excellent venues to showcase the results of the *Oceans 21* programme.

References.

- Bartlett, D. and Smith, J. 2004. *GIS for Coastal Zone Management*. Boca Raton, Florida: CRC Press
- Bartlett, D., Longhorn, R. and Garriga, M.C. 2004. Marine and Coastal Data Infrastructures: a missing piece in the SDI puzzle? Proceedings of GSDI 7 Conference, GSDI Association, Bangalore, India, February 2004.
- CCMC, 1999, Draft Concept Outline Marine Geospatial Data Infrastructure (MGDI), Canadian Centre for Marine Communications. <http://cgdi.gc.ca/english/geospatial/MGDI/pdf/mgdi.pdf>
- Council of Europe. 2000. European Landscape Convention. CoE. <http://conventions.coe.int/Treaty/en/Treaties/Html/176.htm> (accessed 10 July 2004).
- Doherty, P. 2003. Ocean Zoning: Perspectives on a New Vision for the Scotian Shelf and Gulf of Maine. Marine Issues Committee Special Publication Number 12. Ecology Action Centre. Halifax, Canada.
- Doody, J P, Pamplin, C F, Gilbert, C and Bridge, L. 1998. Thematic Study F - Information required for Integrated Coastal Zone Management. European Union Demonstration Programme on Integrated Management in Coastal Zones. CEC.
- Douven, W J A M. 2002. Integrated Coastal Zone Indicators for Managing and Monitoring Tropical Marine Ecosystems. Teluk Banten Research Program Report Series No. 7. IHE, Delft, the Netherlands.
- EC. 2000. Communication from the Commission to the Council and European Parliament on Integrated Coastal Zone Management: A Strategy for Europe. European Commission.
- ETC/TE. 2003. Indicators to measure the progress of ICZM implementation and sustainable development of the coastal zone - second report of Expert Group. European Topic Centre on Terrestrial Environment, EEA.
- EUCC. 2004. CoastLearn - a multimedia distance training package on Integrated Coastal Zone Management. EUCC - The Coastal Union. (<http://www.netcoast.nl/coastlearn/website/index.htm>.)
- FAO. 1996. The Contribution of Science to Integrated Coastal Management. Reports and Studies No. 61. Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection - GESAMP. Rome, IT.
- Fisheries and Oceans Canada. 2000. Monitoring Marine Ecosystem Health - Canadian Perspective. Envirosphere Consultants Limited, Windsor, Nova Scotia, Canada.
- IGBP. 2004. Land-Oceans Interactions in the Coastal Zone (LOICA): Science Plan and Implementation Strategy & Structure; IGBP Report Series. International Geosphere Biosphere Programme, 30 January 2004.
- IOC. 1999. ISO-SAO International Workshop on Coastal Megacities: *Challenges of Growing Urbanisation of the World's Coastal Areas*. IOC Workshop Report No. 166. UNESCO, Paris, France.
- Le Tissier, M.D.A., Ireland, M., Hills, J.M., McGregor, J.A., Ramesh, R. and Hazra, S. (eds). 2003. A Trainers' Manual for Integrated Coastal Management Capacity Development. Integrated Coastal Zone Management and Training (ICZOMAT) Project. The University of Newcastle upon Tyne, Newcastle upon Tyne, U.K.
- Longhorn, R. et al. 2003. CoastGIS'03 Conference - Summary and Closing Remarks by CoastGIS'03 Scientific Committee. October 2003. Genoa, IT.
- Longhorn, R. 2002. Global Spatial Data Sharing Frameworks: the case of the Intergovernmental Oceanographic Commission (IOC) in Proceedings of GSDI Conference (GSDI-6), Budapest, Hungary.
- NOAA. 2004. Strategic Plan of the National Ocean Service: 2005 - 2010. US Dept. of Commerce, NOAA National Ocean Service. October 2004.
- NRC. 2004. A Geospatial Framework for the Coastal Zone: National Needs for Coastal Mapping and Charting. The National Academy Press: Washington, D.C.

- NSF. 2002. Workshop Report on Roles of Education in Sustaining ICM Processes - international workshop at Coastal Zone Asia Pacific Conference. National Science Foundation. USA.
- Rapport, D (principal investigator). 2001. International Inventory and Scientific Review of Indicators, Surrogate Measures and Other Parameters for Marine Environmental Quality. EcoHeath Consulting, Ontario.
- UNEP. 1999. Conceptual Framework and Planning Guidelines for Integrated Coastal Area and River Basin Management. Priority Actions Programme - Mediterranean Action Plan. PAP/RAC, Split, Croatia.
- UNEP. 1994. Guidelines for Integrated Coastal and Marine Areas. Priority Actions Programme - Mediterranean Action Plan. PAP/RAC, Split, Croatia.
- UNESCO. 2004. The UNESCO-Bilko Project - Virtual global faculty for ocean and coastal remote sensing. UNESCO. <http://www.ncl.ac.uk/tcmweb/bilko/>. (accessed 10 July 2004).
- UNESCO. 2001. The Convention on the Protection of the Underwater Cultural Heritage. <http://www.unesco.org/culture/legalprotection/water/images/engconv.doc> (accessed 10 July 2004).
- UNESCO. 1999. UNESCO IIP GIS Project: Training Module on the Applications of Geographic Information Systems (GIS) for On-line Governance and Accessing Public Domain Information. <http://gea.zvne.fer.hr/index.html> (accessed 10 July 2004).
- UNESCO/IOC. 2003a. Indicators for GOOS. Report of the inter-sessional group. 20 May 2003. UNESCO.
- UNESCO/IOC. 2003b. Reference Guide on the Use of Indicators for Integrated Coastal Management - ICAM Dossier No. 1 - Manuals and Guides no. 45. UNESCO.
- UNESCO/IOC. 2003c. The Integrated, Strategic Design Plan for the Coastal Ocean Observations Module of the GOOS. UNESCO.
- UNESCO/IOC. 2002a. International Workshop on the Role of Indicators in Integrated Coastal Management: Background Paper, 29 April - 1 May, 2002, Ottawa, Canada.
- UNESCO/IOC. 2002b. International Workshop on the Role of Indicators in Integrated Coastal Management: Workshop Report, 29 April - 1 May, 2002, Ottawa, Canada.
- US Commission on Ocean Policy. 2002. Mid-term report on Developing a National Ocean Policy. September 2002.
- US Commission on Ocean Policy. 2004. An Ocean Blueprint for the 21st Century: Final Report of the U.S. Commission on Ocean Policy - Pre-publication Copy, Washington, D.C. September 2004. <http://www.oceancommission.gov>
- Williamson, I., Rajabifard, A. and Feeney, M-E. 2003. *Developing Spatial Data Infrastructures. From Concept to Reality*. London: Taylor and Francis. 316pp.
- Woodroffe, C.D. and Furness, R. A. 2003. *Coastal GIS 2003 - an integrated approach to Australian coastal issues*. University of Wollongong, Australia.
- WSSD. 2002.

ANNEX 1. LOICZ SCIENCE PLAN 2004+

(extracted verbatim from “Land-Oceans Interactions in the Coastal Zone (LOICZ) - Science Plan and Implementation Strategy Structure - January 2004”)

“Therefore the primary goal of the “New” LOICZ will be to:

“to provide a framework for integrated analysis and dissemination of existing information and to act as a means to focus on key issues concerning human activity and resource use in the coastal zone by applying the full water-continuum scale including the river catchments and the EEZ as spatial scales of major human interventions”

...

It has become clear that irrespective of our improved understanding of coastal system metabolism and to some extent its drivers and pressures, there remain major interrelated challenges of confronting and managing the consequences of global environmental change whilst addressing and securing a sustainable future. At a limited scale, tools have been developed to translate this understanding to management and policy. However, there is still a lack of both understanding and tools for the derivation, differentiation and quantification of anthropogenic drivers and global environmental pressures. This distinction is essential for appropriate management of anthropogenic land-ocean interactions in the coastal zone.

2003+; consequently, the “New” LOICZ aims to overcome traditional disciplinary fragmentation in particular between natural and human dimension sciences. The primary goal of the LOICZ new framework for integrated analysis of existing information is to focus on key issues concerning human activities in the coastal zone (including applying the full catchment scale as part of the water-continuum). Closely related goals will be to identify and promote ways to transfer information to the stakeholders about what is being learned from the science, and to identify what needs to be answered by science. An underlying principle of the new LOICZ framework is to continuously engage in a “science–policy–public“ dialogue addressing scientific information needs as well as human development and implementation issues. The “New” LOICZ will address the primary issues of sustainable human use of coastal systems in respect to vulnerability of coasts and risks for human uses through the pursuing the following objective:

“to assess, model and predict the change in adaptive capacity of the global coastal zone as an integral part of the Earth System under multiple forcing, including the contribution of, and consequences for, human activity”

Science Themes

The “New” LOICZ strategy is designed to provide improved integrative and policy relevant scientific understanding of the coupled biogeochemical, physical and human dimensions of coastal change that contributes to the goals and objectives of IGBP-II. It will address questions posed in the IGBP-GAIM program through 5 themes that form the backbone of the scientific activities, namely:

Theme 1: Vulnerability of coastal systems and hazards to human societies sets the stage for the subsequent themes that address special parts of the wider coastal domain. It is integrative in nature and deals with coupled human and ecological system change, carrying capacities and vulnerability issues including the risk of degrading sustainability of coastal goods and services delivery under different scenarios of future change.

Theme 2: Implications of global change and land and sea use on coastal development focuses on increasingly contentious spatial, temporal, and organisational issues of coastal change, and land and sea use, and how they influence natural resources availability and natural systems sustainability.

Theme 3: Anthropogenic influences on the river catchment and coastal zone interaction address river catchment-based drivers/pressures that influence and change the coastal domain. The whole water cascade (source to sea) is considered as a single system. Transport processes across the ocean boundary and anthropogenic influences through activities in the EEZ are included in particular through links with theme 2 and 4.

Theme 4: Fate and transformation of materials in coastal and shelf waters by drawing on the results of themes 2 and 3, focuses on the cycling of carbon, nutrients and sediments in the coastal and shelf waters and their exchange with the ocean. This recognises that the coastal waters are the principal locality for vital benthic effects influencing the shelf ecosystems (and their use) and global chemical cycles, and that processes here are changing.

Theme 5: Towards coastal system sustainability by managing land-ocean interactions provides an overarching integration cutting across the four other themes. It is expected to serve as a platform addressing the development of the coastal zone and management of its resources, thus the people using them, in the context of strong and weak sustainability options. It should consequently not be considered as a freestanding disconnected research field.

ANNEX 2. COUNCIL OF EUROPE - "EUROPEAN LANDSCAPE CONVENTION" - 2000

(extract)

Article 1 – Definitions

For the purposes of the Convention:

- a) "Landscape" means an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors;
- b) "Landscape policy" means an expression by the competent public authorities of general principles, strategies and guidelines that permit the taking of specific measures aimed at the protection, management and planning of landscapes;
- c) "Landscape quality objective" means, for a specific landscape, the formulation by the competent public authorities of the aspirations of the public with regard to the landscape features of their surroundings;
- d) "Landscape protection" means actions to conserve and maintain the significant or characteristic features of a landscape, justified by its heritage value derived from its natural configuration and/or from human activity;
- e) "Landscape management" means action, from a perspective of sustainable development, to ensure the regular upkeep of a landscape, so as to guide and harmonise changes which are brought about by social, economic and environmental processes;
- f) "Landscape planning" means strong forward-looking action to enhance, restore or create landscapes.

Article 2 – Scope

Subject to the provisions contained in Article 15, this Convention applies to the entire territory of the Parties and covers natural, rural, urban and peri-urban areas. It **includes land, inland water and marine areas**. It concerns landscapes that might be considered outstanding as well as everyday or degraded landscapes.

Article 3 – Aims

The aims of this Convention are to **promote landscape protection, management and planning**, and to organise European co-operation on landscape issues.