Theme Session B

The risk of failing in integrated coastal-zone management

ICES CM 2010/B:01

Monitoring and evaluation of spatially managed areas: A generic framework and its application

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The application of an ecosystem approach to management of the sea requires both integrated and strategic frameworks such as integrated coastal-zone management (ICZM) and the use of marine spatial planning (MSP) to minimize spatial use conflicts and environmental degradation. Such an integrated management promotes sustainable development based on achieving a balance of environmental, social, and economic objectives. Here we introduce a first draft of a generic framework developed in the EU FP7 project MESMA that gives guidance on how to assess the effectiveness of an existing management within a spatially defined area. More precisely, we define spatially managed areas as geographical entities where a marine planning framework is or will be used to manage multiple human activities in space and time while maintaining ecosystem integrity. The framework comprises practical guidance on the following steps: (i) selection of operational objectives and related criteria; (ii) collation and integration of information; (iii) performance assessment; and (iv) feedback processes. In the course of the MESMA project this generic framework will be applied and tested in a number of case studies. Here we highlight the processes and practical tasks involved in each of the framework steps, reflect on the first attempts to implement this framework and identify the requirements for practical tools such as standardized methods to map human activities and assess their cumulative impacts.

Keywords: management objectives, MSP, spatial management.

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ICES CM 2010/B:02

Socio-economic and cultural objective setting for supporting the effective use of indicators for integrated management of ecosystems

Amy Diedrich and J. Tintoré

The success of integrated management approaches such as marine spatial planning and integrated coastal-zonezone management (ICZM) in improving, conserving, and protecting ecosystems has been limited by the challenge associated with translating scientific information into management action. One of the reasons science can fail to provoke management responses is that research is often conducted without appropriate consideration of the socio-economic and cultural (SEC) and political contexts of the ecosystem that is being managed. Although science cannot make management decisions, which often result from a combination of objective information and value judgements, it can provide valuable data to inform and monitor the consequences of management actions. However, it is critical that this information be orientated towards addressing priority objectives from SEC and political perspectives, in addition to ecological objectives, if it is to be effective in generating appropriate actions at the governance level. Indicators have been receiving considerable attention in recent years as one potential solution to bridging the science–policy gap through the provision of viable, interpretable scientific information that responds to specific management objectives. The aim of this presentation is to emphasize the critical role of SEC objective setting and prioritization as a primary step towards the effective use of indicators for provoking management actions that support ecosystem management goals. The discussion will be contextualized using the case study of the Balearic Islands' ICZM indicators and LIMCosta

projects, which are being implemented through partnerships between the scientific community, government, civil society, and the Chamber of Commerce.

Keywords: cultural objectives, ICZM, indicators, socio-economic objectives.

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ICES CM 2010/B:03

Integrating coastal-zone dialogues: can initial networking of partners reduce conflicts in marine coastal areas?

Denis Lacroix

Integrated coastal-zone management (ICZM) is a link between three fields: environment, human activities, and economics. All three are under strong and contradictory pressures, entailing various types of development with numerous factors and limited up-to-date and consistent knowledge. Nevertheless, decision-makers must find methods and means to manage the sustainable development of the coastal area, a place where different and often conflicting uses are steadily increasing, notably in the Mediterranean. Numerous guidelines are available but in practice these are often far from usual and common sense recommendations. The actor-network theory (Callon and Latour) could be a useful tool to clarify and reduce the chronic problem of the conflict of uses in coastal areas. The usefulness and efficiency of this theory was demonstrated through the example of scallop fishery management in northern Brittany in the 1980s. After scaling up, this theory demonstrates its relevance and usefulness through two modern issues dealing with coastal management *lato sensu*: networking of actors involved in aquaculture development in order to train them to a new ecosystem approach (the IUCN initiative) and artificial reef project management (e.g. the Portuguese model of the Algarve). The advantage of this theory is the fact that it is a concrete and applied method that can be easily proposed to any set of stakeholders as soon as the challenge or project can be defined. This practical method can also be used as a simulation process incorporating foresight analysis.

Keywords: actor-network theory, ecosystem-based management, foresight analysis, ICZM.

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ICES CM 2010/B:04

Identifying cultural ecosystem services: the coastal futures approach

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Ecosystem services are variously employed to describe interactions between natural systems and human use. The research project "Coastal Futures" applied the concept to the specific case of offshore wind farm development in the German North Sea. Although the entire range of ecosystem services was assessed, our focus in this presentation is on cultural ecosystem services, an aspect often neglected because of the inherent difficulties of measuring non-market ecosystem values. Using the two districts of Dithmarschen and North Frisia on the North Sea coast of Schleswig-Holstein as a basis, we first describe the entire range of cultural ecosystem services found in the adjoining sea areas. Assuming strong development of offshore wind farming, we then describe the potential impacts of this development on the cultural ecosystem services identified. Because intangibles are difficult to quantify, we use a mixed quantitative and qualitative approach to rate these impacts both in spatial terms and in ecological terms. Some of the inherent difficulties of locating cultural ecosystems in space and time will be discussed. Although our results only represent a snapshot of the current situation, we believe that identifying and communicating non-market values can make an important contribution to integrated coastal-zonezone management (ICZM) and marine planning in that it allows values that are otherwise difficult to voice to be included in the debate.

Keywords: cultural impacts, ecosystem services, integrated coastal-zone management (ICZM), maritime spatial planning (MSP), offshore wind farms.

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ICES CM 2010/B:05

Marine Scotland Science: contribution of bathymetric surveys to marine planning for renewable energy developments

P. J. Hayes and I. M. Davies

Marine Scotland Science (MSS) has been asked to assist the emerging wave and tidal energy industries by providing regional datasets from selected areas around Scotland. One aspect of the work undertaken by MSS was to survey the bathymetry of the Pentland Firth, where tidal streams can attain 12 knots. Bathymetric data were collected using the FRV "Scotia" with a Reson Seabat 7125-B multibeam echosounder system. Transect lines were spaced ensuring 50–100% coverage for the majority of the survey area. In total, 235 km^2 were surveyed in the Pentland Firth from 18 July to 5 August 2009. The data were post-processed using industry standard software by Netsurvey Ltd. A quantitative approach was developed to make the best use of the bathymetric dataset. Within Arc GIS, the bathymetric data were used to create shape files with 10-m-depth intervals and 5-degree gradient intervals. A separate shapefile was created with buffer zones running parallel to the coastline, extending offshore at 1 km intervals. Each of the layers created was classified, clipped to the same size, and brought together into one shapefile in a geodatabase. This allows the data to be queried according to the seabed depth, seabed gradient, and distance offshore. Areas of the seabed suitable for demonstration through to full-scale commercial deployments can be calculated, based on developers' operating tolerances for depth, gradient, and distance offshore.

Keywords: bathymetry, geodatabase, marine spatial planning, renewable energy.

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Institutional and regulatory reform to contribute to the achievement of development objectives in the marine environment

J. C. McKie and I. M. Davies

Wave and tidal stream power generation is a high priority for the Scottish Government in meeting its target of 50% of the energy demand in Scotland to be met from renewable resources by 2020. Activities necessary to achieve this ambitious target include a spatial plan-led approach to development, and effective and efficient regulatory processes. A regulatory system review demonstrated that the consenting/licensing process has been complicated and multi-stranded, involving separate applications to several governmental regulators. Each regulator operated their own consultation processes, resulting in some consultees (statutory and other) receiving multiple approaches from regulators for comment on the same project. The Scottish Marine Act (2010) introduces a single Marine Licence to be issued by a single new body, Marine Scotland. The Marine Licence will incorporate the requirements under the various items of legislation which previously have been progressed independently. The regulatory processes therefore have been centralized within a single regulator who will establish a single point of contact ("one-stop-shop") for project developers. It will also allow an approach to regulation in which a case officer will take responsibility for the processing and progression of all elements of work leading to the granting or refusal of a Marine Licence. Further supporting activities include the preparation of a licensing and environmental impact assessment (EIA) guidance manual for developers and regulators, and environmental monitoring guidelines.

Keywords: guidance manual, institutional reform, marine licence, monitoring, regulatory reform, renewable energy, simplification.

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Risk-based frameworks in ICZM and MSP decision-making processes

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The coastal zone is considered to be the point of highest interaction between land-based activities and the local marine ecosystem. In addition, the coastal zone is a significant contributor to the socio-economic prosperity of local communities, supporting a broad base of economic and cultural sectors. As a result, it is also the zone where aquatic ecosystems can be particularly vulnerable to pressures caused by human activities and where management operates within a complex jurisdictional backdrop. An integrated management approach to both terrestrial and marine spatial planning aims at reducing conflicts while maintaining the productivity (in a broad sense) of aquatic ecosystems. Although fairly straightforward in the planning process, implementation and follow-up of such plans have proven to be challenging. Given the complexity of integrating ecosystem, social, cultural, and economic demands within a defined geographical area, decision-making approaches using classical risk analysis can provide structure that facilitates and informs the planning and implementation processes. Such an approach also assists fact-based priority setting while adhering to principles of inclusiveness and transparency. This paper presents lessons learned and best practices from integrated coastal-zone management projects and explores the use of such approaches in marine spatial planning.

Keywords: coastal zone, risk analysis, spatial planning.

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ICES ASC 2010/B:08

Policy fragmentation implications in ecosystem-based management in practice

Roland Cormier, Andreas Kannen, Ian Davies, Rafael Sarda, and Amy Diedrich

Integrated assessment processes are a practical outworking of ecosystem-based management principles. In its simplest form, most assessments involve the overlaying of geospatial components highlighting susceptible ecosystems in relation to a given project or sector activity. The end product aims to minimize environmental impacts through the implementation of mitigation measures. In general, this approach is ill-equipped to deal with cumulative effects resulting from multiple sector-based activities. Although integrated assessments may adequately ascertain the impacts, the implementation of resulting management plans is hampered by the complex, potentially conflicting, jurisdictional policy objectives of various levels and arms of government in a given geographical area. In the coastal zone, this complexity is amplified when land-based interactions located in the catchment area are considered. These are typically managed by policy objectives that may not align with marine ecosystem integrity. Such management plans can also have limited effectiveness without clear established formal accountabilities. In this paper, policy fragmentation is discussed as being a key impediment to effective ecosystem-based integrated management approaches. It also presents examples of successful projects highlighting institutional and policy integration initiatives.

Keywords: ecosystem-based management, policy fragmentation.

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ICES CM 2010/B:09

Integrated assessment for use in system-based management: ecosystem health and restoration through sustainable use of resources

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Developing human activities often conflict with nature preservation requirements and integrated assessments are necessary to build reliable scenarios for management. In a shallow estuary, the Limfjord in Denmark, reduction of nutrient loadings is necessary to fulfil criteria for European Union regulations, such as the Water Framework Directive (WFD). Cuts in nutrient loadings do not necessarily result in corresponding reductions in eutrophic impacts or in improvements in primary and higher trophic production, and the socio-economic consequences for mussel fisheries and aquaculture production are complex and hard to predict. An integrated analysis (ESE assessment) of interactions between nutrient loading and mussel production (fishery and aquaculture) was carried out, including ecological, social and economic aspects related to these issues. The model developed allows prediction of the effects of nutrient reduction on mussel growth and harvest yield from fisheries and aquaculture, and the socio-economic consequences. Furthermore, the model allows for feedback scenario prediction of production management of fishery (e.g. quota) and aquaculture (e.g. licences and labour), economic externalities (e.g. market demands and prices) and ecological externalities (e.g. oxygen-depleting events, harmful algal blooms). In the economic–social model components are embedded a "husbandry function" for aquaculture production and an "agent-based" production model for the mussel fishery, which are attractive features of high value and interest to the fisheries and mussel farming communities. The scenario results also include unanticipated potential wider benefits of ecosystem health by optimizing management in relation to other EU-driven regulations, such as the Natura 2000.

Keywords: ecosystem health, integrated assessment, system-based management.

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ICES ASC 2010/B:10

Integrated coastal-zone management: bridging the land–water divide

Marc Ouellette

The coastal zone is an area of high ecological complexity and productivity given its intrinsic connectivity between habitats and processes of freshwater and marine aquatic ecosystems. It is also an area of complex anthropogenic interactions with variable social, economic, and cultural components. Furthermore, it is the zone where aquatic ecosystems are the most vulnerable to cumulative pressures caused by human activities of various types and intensity, where management lies within a complex jurisdictional backdrop. Thus, the coastal zone is a complex mosaic of variable zones of influences and ecosystem component vulnerabilities along the land–water interface. Canada is a maritime nation. It is bordered by the Pacific, Atlantic, and Arctic Oceans, it has the world's longest coastline (at ca. 244 000 km), and also borders interior freshwater "seas", the Great Lakes. Eight out of our ten provinces border oceans, as do our three Territories. Given this backdrop, integrated coastal management seems a formidable challenge, but it is possible and it is critical that we do it strategically and efficiently with the best available information at present. Under the Health of the Oceans Initiative, four Centres of Expertise have been established within the Oceans Sector of the Department of Fisheries and Oceans in order to better understand and address national integrated coastal and oceans management issues. An overview of the objectives of the CoE on Coastal Management is presented with a focused update on its efforts in the development of ecosystem-based approaches, in relation to cumulative effects, and risk analysis decision-making tools.

Keywords: adverse environmental effects, indicators characterization, integrated coastal-zone management, risk analysis.

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ICES CM 2010/B:11

From population modelling to management: integrating different risk factors affecting a seabird living in the Gulf of Finland, Baltic Sea

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The successful management of environmental risks requires that risks are considered simultaneously, rather than separately. It is also vital that uncertainty is taken into account in a coherent manner. The Gulf of Finland, the easternmost part of the Baltic Sea, is a brackish-water area facing many human-induced threats. In this paper we present a modelling approach that allows the integration of several risks and show how the results can be used to support management decisions. We use the common eider (*Somateria mollissima*) breeding in the Gulf of Finland as an example. The main threats to the species are assumed to be changes in salinity (through their main food items—blue mussels), oil spills, and hunting. First, a probabilistic age-structured Bayesian parameter simulation model describing the population dynamics is built, after which different risk factors are included in the model. Salinity changes are assumed to manifest in the survival of ducklings, whereas both hunting and oil spills remove a certain proportion of the total population. Of these risks, hunting can be estimated to some extent, but with the oil spills both the magnitude and the future frequencies of accidents are highly uncertain. Finally, the results are used as an input for an integrative decision model, a Bayesian network, in which different management strategies regarding oils spills and hunting can be tested. The method presented here will be applied later also to the Baltic herring (*Clupea harengus membras*) living in the Gulf of Finland.

Keywords: Bayesian modelling, common eider, Gulf of Finland, hunting, oil spills, uncertainty.

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ICES CM 2010/B:12

Probabilistic assessment tool for the Water Framework Directive: application to the Gulf of Finland

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Ecological status classification (ESC) of the Water Framework Directive (WFD) aims at the harmonized evaluation and management of inland and coastal watersheds in Europe. The target state, "good ecological status" by year 2015, provides a clear minimum to be reached. WFD ESC is based on a management-oriented view. If the state of a watershed is judged to be moderate or worse, there is a need to act and improve the state. So far it seems evident that the objectives of the WFD will not be attained before the deadline. We present a prototype of a modelling tool that can be used to assess the probability of reaching WFD aims in the Finnish coastal waters of the Gulf of Finland. The model is based on a relatively simple Bayesian network structure that integrates the results obtained by applying complicated load and ecosystem models and data analyses, given alternative nutrient abatement scenarios in Finland, Estonia, and Russia. Thus, the Bayesian network is used as a meta-model that integrates knowledge from several sources. The role of future climate change, as well as uncertainties arising from it and other sources can also be analysed. We suggest that this type of decision model could be useful in international cooperation when defining the objects, areal responsibilities, and optimal use of resources available for the abatement of nutrient loads. It would also be helpful when comparing divergent national implementation approaches of the WFD ESC or evaluating the magnitude of reference values and uncertainties related to them.

Keywords: Bayesian networks, decision analysis, ecological status classification, Water Framework Directive.

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ICES CM 2010/B:13

Use of reality models (architecture) for integrated coastal-zone management

Knut Torsethaugen

Challenge: How can actors involved in coastal development digest, accumulate, and use "state-of-art" knowledge from political, social, economic, and natural science in their daily work? How can we bridge the gap between advanced science and local coastal-zone management? Coastal areas are a limited resource with dynamic physical and biological properties and varying social and economic restraints and management. Cost-efficient and sustainable use of coastal areas is therefore a complex and interwoven issue. Making decisions within such complex systems can be more difficult the more information is available and simple solutions not based on a holistic, knowledge-based view can lead to disasters.

Solution: A reality model or architecture concept is introduced. Similar concepts are used in other sectors, such as enterprise, intermodal transport, and software development. The reality model is based on a vision and is a top–down holistic description of all of the elements and relations between elements that is part of the system. The overall aim is to establish a common framework for integrated coastal management based on accepted goals, experience, existing models, and cross-disciplinary knowledge. The model identifies conditions for how new scientific knowledge can be implemented in decision-making and is a guide for cost-efficient collection of information to fill knowledge gaps. The model includes functional and information architecture, which, combined with future ICT, can be the basis for developing decision support tools so that sustainable solutions can be found on different management levels as part of a holistic approach and thus reduce the risk of failure.

Keywords: architecture, coastal zone, reality model.

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The Gerrico project: when modelling helps the integrated management of the coastal area

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The Gerrico Project, managed jointly by Ifremer and the University of Nantes, is focused on the Bay of Bourgneuf. Located in the south of the Loire estuary on the French Atlantic coast, this bay is largely used by oyster farming (13 000 t yearly) and characterized by many interesting habitats, such as seagrass beds and honeycomb worms. In recent years the Bay of Bourgneuf has been faced with several problems affecting oyster growth, survival, and quality, the maintenance of water quality, biodiversity, and the sustainability of activities. The original feature of the Gerrico Project is the development of methods capable of taking into account the entire area from the watershed down to the marshes and the coastal sea, using a chain of coupled models to integrate the different activities by combining physical modelling (sedimentology, hydrodynamics), biological modelling (growth of the algal biomass, oyster growth), and economic modelling (management of oyster-rearing parcs on the scale of the production basin or shellfish-farming business). The common point driving this approach is water quality, on which depends the optimization of coastal activities. Some scenarios at different spatial and temporal scales (e.g. increasing nutrients; oyster growth variability between farming sites, impact of trophic competitors (slipper limpets, wild oysters), carrying capacity assessment) have been implemented in order to simulate the biological and socio-economic consequences of different types of management. The objective is to establish a dynamic tool that will provide a firm basis for integrated management of the coastal area.

Keywords: coastal area, ecological modelling, economic modelling, marshes, oyster farming, physical modelling, watersheds.

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Participatory approach to identify governance indicators for integrated coastal-zone management: the case of Marine Protected Areas

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Marine Protected Areas (MPAs) are the laboratory of integrated coastal management. Driving the MPA system requires the implementation of a battery of indicators of governance. This governance must take into account both the internal dynamics of the system and the threats coming from the system environment. As part of a research project funded by the French Ministry of Ecology, (Liteau program), four coral reef MPAs were selected as pilot studies (St Martin in the Caribbean, Reunion and Mayotte in the Indian Ocean, the South Lagoon of New Caledonia in Oceania) to develop governance indicators jointly between scientists and managers of MPAs. The approach is definitely bottom–up. It is based on the co-construction of indicators. In that way, the views of the scientists who bring their knowledge of governance and ICZM were crossed with the views of the MPA managers who bring their field knowledge and specific requests relating to the management of their MPAs. The process was conducted in five steps which will be described. The main indicators will be presented and then discussed.

Keywords: French overseas territories, governance indicators, ICZM, marine protected areas, participatory approach.

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Some hints on the risk of failing in IZCM

G. David and A. Thomassin

The risk of failing in integrated coastal-zone management (ICZM)—is it only ascribable to increasing anthropogenic pressures in the coastal environment? Based on the example of Reunion Island and other French overseas region, the view expressed here is that the main risk results from the lack of structure in ICZM: (i) in the arena of public authorities acting on the coast; (ii) among private actors; and (iii) between public authorities and private actors. The integration between public actors is driven by coastal planning schemes but it does not work as hoped. Thus, the daily management of coastal activities remains sectoral. Local politicians are often wary of the concept of ICZM which they see as a top–down concept. The relationships between the authorities and local stakeholders dealing with coastal management are usually driven by rules. But often the enforcement is weak, owing to a poor acceptance of these rules by the local stakeholders. To improve the situation, the establishment of bodies for dialogue and consultation between the public authorities and local stakeholders is requested. In a more realistic way, collecting indicators devoted to social acceptability could be a first improvement. The establishment of a body dealing with information sharing, including indicators, among the public authorities could be a second step. Thus, integrated information management is a prerequisite to ICZM. Avoidance of this rule may risk major failure in ICZM.

Keywords: ICZM, information sharing, Reunion Island, risk of failing, social acceptability indicators.

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Using Bayesian network modelling to cope with the Marine Protected Area governance issue

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Bayesian networks are useful tools for modelling interactions and predictions in socio-ecological systems because they offer a robust theoretical framework towards risk and uncertainty management problems through the use of probabilities. Furthermore, this theory gives the possibility of combining expert knowledge and data. That is why they have been successfully used for helping resource-management decision-making process in numerous case studies. We propose application of this approach in order to deal with the Marine Protected Areas governance issue. A first model of Bayesian network has already been developed from a French Polynesia case study concerning fisheries response to regulations in Moorea Island. This step allowed us to think about a more comprehensive model, which would encompass the ecological, economic, and institutional components that underlie the understanding of the Marine Protected Areas governance issue. Therefore we derived a second model from six case studies: three in the Mediterranean and three in French overseas areas. The first objective was to draw through the structure of the Bayesian network a synthetic and comparative framework that represents the expert knowledge relative to the Marine Protected Areas implementations and their consequences on the different components of the socio-ecological system. The second objective is to simulate a governance scenario for a particular case study—as the impacts of different regulation measures on the resources and biodiversity conservation of the ecosystem or on the satisfaction of users such as fishers or tourists—once the parameters of the model have been set up by using both database and expert judgement.

Keywords: Bayesian networks, expert knowledge, fishery management and regulations, governance, indicators, integrated approach, Marine Protected Areas, probability, risk management, scenarios, simulation, social acceptability, tourism.

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ICES CM 2010/B:18

Constructing and validating indicators of Marine Protected Areas performance for decision support

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Marine Protected Areas (MPAs) are a key instrument for managing coastal ecosystems. Many international agendas foster the creation of MPA for achieving conservation of marine biodiversity, but also fishery management and more generally management of coastal uses. Scientific advice together with the provision of adequate tools is needed to assist managers in monitoring and assessing MPA performance. For this purpose, a sound collaboration between science and policy-makers is critical. A major objective of this collaboration is to define appropriate indicators in relation to detailed management objectives and actions. Indicators are intended to help in setting up appropriate conservation and regulation measures or adapting existing ones. This paper presents the approach developed in the PAMPA project for deciding, testing, and validating indicators of MPA performance. Formalizing objectives, constraints, and needs for managers is a first step in this process. The second step is to test and validate candidate indicators from real field data through application to various case studies. Indicators are related to biodiversity, resources, uses, and governance; they are obtained from several observation techniques and pertain to several case studies over the world, both in the Mediterranean and in French coral reef areas. The approach is illustrated through various examples from these case studies.

Keywords: decision-support system, indicators, Marine Protected Area, multidisciplinary, PAMPA project.

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ICES CM 2010/B:19

Economic assessment of the ecosystem services provided by freshwater in the coastal zone: an application to the Charente river catchment

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Integrated coastal-zone management is an emerging governance practice which aims at combining environmental preservation, economic development, and social concerns in the context of complex ecosystem dynamics and increasing anthropogenic pressures. Coastal managers need economic assessments in order to investigate the consequences of policy options which apply to different sectors simultaneously and pursue multiple objectives. The ecosystem services concept offers a framework for a better understanding of users' conflicts and management trade-offs regarding natural resources and the environment. This paper presents an economic assessment of the variations of the ecosystem services supplied by freshwater in the coastal zone, depending on various management options. This assessment has been carried out according to the "system approach framework" methodology developed by the European project SPICOSA (Science and Policy Integration for Coastal System Assessment). An integrated systemic model has been built following a participative approach in order to address the issue of freshwater allocation in the Pertuis Charentais region. The stakeholder forum agreed upon the assumption that freshwater scarcity affects mainly "provisioning services" used by households (drinking water) and agriculture (irrigation), "cultural services" used by recreational fishers, "support services" used by shellfish farming, and "regulation services" needed by wetlands. The economic assessment of these ecosystem services is based on two methods: remediation costs and productivity losses. The results contribute to the deliberative process engaged with local managers in order to explore new rules and institutional arrangements for water allocation, their consequences on ecosystem services, and their meanings in terms of conflict mitigation.

Keywords: economic assessment, ecosystem services, integrated coastal-zone management, productivity losses, remediation costs, user conflicts.

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ICES CM 2010/B:20

Series of institutional and legal frames in the coastal-zone management: where are the risks of failing, where are urgencies in the field of law?

Florence Galletti

Since the mid-1980s, coastal-zone management has been affected by several tools in the law sector: protection through national or European Environmental Law, the Law of the Sea, and in particular legal constraints and permissiveness of the famous French Law called "law-coast", or one of its European counterparts. These constraints on coastal and maritime zones have been integrated with variable success in integrated coastal-zone management, although it is not a legal concept. Despite all measures of institutional and legal frameworks, coastal areas, which had been presented as dynamic zones, mainly in terms of economics and tourism, are facing many difficulties. They are linked to a complex set of factors: dependence on foreign markets, great wealth to be gained in a short time, development of the industrial sector as harbour activity, a mass of legal tools in the relations between state and private sector, legal insecurity, condemnations, trials, etc. Such difficulties have led the public policies sector to a critical situation, as exemplified in France. We discuss the risks of failing in legal coastal-zone management and its evolution. Is the collapse of this system of coastal-zone management predictable? Understanding the effects of French law of 3 January 1986, relative to the arrangement, protection, and development of the coast on public policies led by decentralized institutions. What are the contributions and limits of this law? Can we envisage other components for the coastal-zone management by the law?

Keywords: decentralization process, environmental law, French law called law-coast, law, law of the sea, legal coastal-zone management, marine and coastal public policies, Marine Protected Area, state.

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ICES CM 2010/B:21 Poster

Why and how integrated coastal-zone management should be put into the context of national maritime strategies

Yves Henocque

Over the last 30 years hundreds of integrated coastal-zonezone management (ICZM) initiatives have taken place all over the world but with very limited success for a number of reasons. For example, (i) local ICZM projects often become an end in themselves rather than a step towards a self-sustaining process, (ii) the perception of ICZM as an environmental management activity is stubbornly persistent, there is a need to embed ICZM into economic development, the very practice of environmental policy integration, and (iii) there is a lack of concrete articulation between local ICZM action and national policy. As regards the latter, things are now changing rapidly in many countries, including the European countries under the incentive of the new European maritime policy. Nowadays, ICZM initiatives are to be considered in the framework of national maritime policies and their underpinning principles, including the ecosystem-based approach.

Keywords: ecosystem-based approach, environmental policy integration, ICZM, maritime policies.

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ICES ASC 2010/B:22 Poster

Application of marine spatial planning tools to the minimization of risk to renewable energy developments

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Wave and tidal stream power generation is a high priority for the Scottish Government in meeting its target of 50% of the electricity demand in Scotland to be met from renewable resources by 2020. Renewable energy projects have the potential to interact with the environment (e.g. conservation aims) and with other uses of the sea (e.g. shipping routes, fishing areas). A significant risk in the regulatory process is that these interactions must be formally assessed (e.g. through EIA and Appropriate Assessment under the EU Birds and Habitats Directives) and reduced to acceptable levels. Marine Scotland collaborated with The Crown Estate (owners of the UK seabed) to identify areas of wave and tidal stream resource which avoided sensitive areas and limited impacts on existing marine uses. The identification of potentially suitable development areas was addressed through the application of marine spatial planning tools to develop an information framework covering the availability of exploitable resource and a wide range of information on constraints including incompatible current uses, environmental designations, shipping, commercial fishing, recreation, biodiversity, and fish spawning and nursery grounds. The output was a series of maps identifying the relative degree of constraint on wave and tidal development areas around the Scottish coast, from which decisions could be made on areas to consider for early leasing for wave and tidal power development.

Keywords: marine spatial planning tools, renewable energy, risk management, tidal stream, wave.

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Short-term chronological visualization of post-hurricane destruction in Puerto Rico using geographic information systems

Jacob Spuck

Much of what we know about hurricane destruction today is a result of many years of post-hurricane impact assessment by various professionals across the world. Although there have been many ways in which to study post-hurricane destruction, modern technology is today allowing for more detailed analysis of impact assessment. With the use of geographic information systems (GIS) as one application of technology, we are not only able to study long-term impacts of hurricane destruction, but also short-term impacts that occur chronologically up to 72 h after the hurricane has passed. Studies such as these are critical ways in which we can help to plan for evacuation and minimize casualties from post-hurricane impacts.

Keywords: coastal-zone management, natural diasasters, remote sensing/GIS.

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Spatiotemporal variability of fish functional assemblages along a marine estuarine–coastal gradient

Dorothée Kopp and Anik Brind'Amour

The coastal areas are highly dynamic ecosystems displaying great natural variability in temperature and salinity conditions. These factors, recognized as major drivers shaping coastal communities, are expected to change relative to global warming. Recent studies have highlighted temporal trends in the spatial distribution of warm water and marine fish species in different estuaries of the Bay of Biscay. Simulations recently realized with the model Mars3D indicated an increase in the mean bottom temperature (+1.5°C) and mean salinity (+2 psu) over the past 30 years in the Bay of Vilaine, an open shallow muddy estuarine area under the direct influence of freshwater inflows. This paper assesses the spatiotemporal patterns of marine migrant species that use the Bay of Vilaine as a coastal nursery ground. It uses a fish dataset from beam trawl nursery-dedicated surveys carried out from the end of August to the end of October between 1981 and 2009. Analyses were conducted using a functional description of the fish species categorized by species tolerance of temperature and salinity conditions. The present study is a contribution to the ecological understanding of temperature and salinity changes in coastal ecosystems.

Keywords: Bay of Vilaine, fish community, functional groups, nursery grounds, salinity, time-series.

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ICES CM 2010/B:25 Poster

Assessing potential impacts of Marine Protected Areas on various Gulf of St Lawrence stocks and fisheries using ISIS-Fish

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Canadian demersal stocks have faced a strong decline in recent decades mostly as a result of overexploitation. In 2007, various initiatives started to protect fragile marine environments, counter pollution, and strengthen preventive measures. Those included the designation by the Department of Fisheries and Oceans (DFO) of six new Marine Protected Areas (MPAs), in agreement with Canada's international and national commitments. MPAs are one among other management tools that contribute to the improved health, integrity, and productivity of marine ecosystems. Two areas of interest (AoIs) have been proposed for designation as MPAs in the southern Gulf of St Lawrence, namely the American Bank and the Shediak Valley. These AoIs are recognized as key habitats for a number of fish and invertebrate species. ISIS-Fish is a spatially and seasonally explicit

simulation tool especially designed to explore management measure impacts. It is used here to evaluate possible outcomes of implementing MPAs on various stocks (Atlantic cod, snow crab, herring, and American plaice) in the southern Gulf of St Lawrence. The current low status of most stocks in the area has led to important quota reductions or moratoriums during recent years. Through ISIS-Fish we explore different management strategies applied to those AoIs such as a no-take option or partial regulation of exploitation. These simulations could help forecast potential benefits of proposed AoIs and provide the DFO with useful material for their MPAs designation process. This preliminary study permits the identification of key processes that should be described in depth to provide a more realistic estimate of impacts.

Keywords: Gulf of St Lawrence, ISIS-Fish, Marine Protected Areas, simulation.

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ICES CM 2010/B:26 Poster

Ecological and fisheries consequences of a mismatch between biological population structure and management units of Atlantic cod in US waters

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A mismatch between biological population structure of a species and spatial management units of the fishery can present problems, because the scale of management action should match the scale of biological processes. We hypothesized that recognition of fine-scale population structuring of Atlantic cod in US waters will redefine our perceptions of the productivity, stability, and sustainable yield of the regional population. The goal of our study was to use simulation modelling as a tool to examine the ecological and fisheries consequences of a mismatch between management unit and biological population structure, as defined by genetic analysis, of Atlantic cod. Two age-structured simulation models were compared to test our hypothesis: (i) the management unit model, wherein fish were grouped based on the current spatially defined US management areas (Gulf of Maine and Georges Bank), and (ii) the biological structure model, which consisted of three genetically defined population components (northern spring-spawning, southern winter/spring-spawning, and Georges Bank spring-spawning groups), with some mixing of early life stages. Productivity and yield of the biological structure model was lower than that of the management unit model because of consideration of the unique vital rates and dynamics of, and connectivity between, spawning groups. Stability of the system, however, was enhanced through these same attributes. Consideration of biological structure of cod changed our perception of the magnitude and distribution of productivity in the region, suggesting that expectations of productivity of Georges Bank cod should be reconsidered.

Keywords: management area, population structure, productivity, simulation model, stability, sustainability.

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ICES CM 2010/B:27 Poster

An indicators system to assess recreational fishery management goals linked to Marine Protected Areas: example of its implementation in three Mediterranean pilot sites

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In the French project "PAMPA" dealing with indicators of MPA performance, managers and researchers from eight French overseas and Mediterranean pilot sites are building an approach in order to assess the biodiversity conservation and the sustainability of uses in coastal marine areas regulated by a management plan. A standardized framework is developed from the identification of management objectives to the validation of an indicators dashboard for the decision-making

process linked to the MPAs. Several components of the coastal marine ecosystems and their uses are taken into account, with a focus on recreational activities because of their development related to the success of the MPAs and their impacts on the natural, social, and economic systems of the concerned areas. From three Mediterranean examples (Côte Bleue, Banyuls/Mer, and Cap Roux), we show different steps of the implementation of this framework for the purpose of underlying the statistical aspects linked to the definition of good indicators in order to answer management needs: collecting data with standardized surveys, exploratory data analysis using few metrics related to management measures, and selection of indicators on the basis of their statistical properties depending of the variability of the system analysed. Five categories of indicators (pressure, impact, fishing practice, social acceptance, and socio-economy) are defined to assess and to monitor recreational fisheries. They will be involved in an indicators set concerning the other uses (commercial fisheries and non-extractive uses), the species and habitats in and outside the protected coastal areas, and the governance of the MPA.

Keywords: Marine Protected Areas, metrics and indicators, recreational fisheries, standardized approach, statistical analysis, sustainable management, users' typology.

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ICES CM 2010/B:28 Poster

Recreational fishing around the Cap Roux MPA (northwestern Mediterranean Sea): evaluation, impacts, and consequences for the future of the marine reserve

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The Cap Roux Marine Reserve was created in 2003. It is situated close to the coastline of the department of Var, and covers an area of around 480 ha. All types of fishing are prohibited inside the MPA: professional or recreational fishing, spearfishing, and collecting. A monitoring of the leisure fishing was conducted inside and around the MPA from April 2009 to October 2009 in the "PAMPA" project. Based on initial results, a decreasing gradient of the fishing pressure was observed from the north to the south of the MPA. The easy access to the northern part of the MPA could explain the higher pressure in this area. In contrast, the southern part is more isolated and exposed to wind. Despite the mandated protection, several fishers were still observed inside the MPA, mainly as a consequence of lack of information and insufficient markers around the MPA. In these cases, the sizes of the fish caught were greater than those that were caught outside the MPA. Recreational fishing constitutes the most important pressure on fish assemblages in the Cap Roux MPA although its effect is not as extensive here as in other Mediterranean MPAs. For example, compared with the MPA of Cerbère-Banyuls (northeast French Mediterranean), the Cap Roux MPA appears to be less affected by fishing activities. It is thus important to include this activity in the future management plan of the Cap Roux MPA. Regular monitoring of recreational fishing is advised.

Keywords: leisure fishing, management plan, Mediterranean Sea, monitoring, MPA.

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ICES CM 2010/B:29

Marine Protected Areas for coastal fishery management: confronting artisanal fishers' perceptions and fisheries data

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Marine Protected Areas (MPAs) are increasingly advocated for the sustainable management of coastal resources and associated fisheries. The Côte Bleue Marine Park (CBMP), on the French Mediterranean coast, was established in 1983 as a tool for fishery management. It comprises two

no-take reserves (NTAs; 290 ha) and ca. 5000 m^3 of artificial reefs. The aim of this study is to characterize the artisanal fishery in the CBMP and to develop indicators of the effects of the MPA on fishers' activity based on their attitudes and motivations. Surveys were conducted in 2009–2010 with the fishers (80%) willing to participate in this study to investigate the artisanal fishing activities. After landing, information was collected on gear, target species, and fishing areas, both for the present trip and for the past week. When possible, catches were weighed and identified to species level. Boat characteristics were obtained from administrative data. Independent individual interviews were also carried out to determine fishers' perceptions and motivations. These data were first analysed to come up with a synthetic description of the fishery that includes precise maps of the spatiotemporal distribution of fishing effort, especially around the NTAs and the artificial reefs. In a second step, we investigated the relationships between observed fishing activities and fishers' perceptions. If most fishers think that NTAs and artificial reefs have positive impacts on the artisanal fishery in general, perception of positive effects on the individual activity seems to depend of the métiers used and the distance of the fishing grounds to NTAs and artificial reefs.

Keywords: artisanal fishery, distribution, fishers' perception, fishing effort, MPA.

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Recreational fishing: a key issue for resources management in the southwest lagoon of New Caledonia

B. Preuss, D. Pelletier, and E. Gamp

Recreational fishing represents a large proportion of the total catch in many countries. This informal fishery is difficult to study and often overlooked, yet the characterization and estimation of catches of this activity is essential with regard to management plan building. Moreover, decision-makers need spatiotemporal information to implement adequate management tools, such as MPAs, TACs, or minimum size restrictions. The southwest lagoon of New Caledonia is a fragmented coral reef area facing the increasing population of Nouméa. It is a city of ca. 163 700 inhabitants, where recreational fishing is a widespread activity. This situation makes the management of informal fisheries a key issue for resources sustainability. An MPA network composed of seven reserves is the aim of the actual management plan, but recreational fishing effort and catches remain poorly known. In this study we address the question of recreational fishing management by a spatiotemporal modelling of fishing effort and catches. We used a roving survey, with attendance counts, and interviews with anglers. As expected, day types, weather conditions, and season, were the main factors explaining the attendance of recreational fishers. Furthermore, the lagoon could be divided in several areas corresponding to different types of fishing techniques and target species. Thus, in order to manage properly reef fish diversity, managers have to account for the spatiotemporal distribution of fishing effort, and for the life cycle and life-history traits of the most targeted species. In this respect, the applicability of a management plan to recreational fishing will be a key issue for the implementation of efficient resources management.

Keywords: fishery management, fishing effort distribution, MPA, recreational fishing, roving survey.

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Coastal fishing management complexities

Beatriz Morales-Nin, Miquel Palmer, and Antonio María Grau

Human activities are often concentrated in coastal regions, resulting in multiple uses of natural resources for human needs, with fisheries as a significant part. Fisheries are complex ecological and

social systems, evolving in time with a shift from a subsistence activity to commercial and towards recreational activity. The management policies have different jurisdictions at regional, national, and transnational level and must council the different management tools used to conserve the biodiversity and the social fabric in the coastal zone. We use as an example the Mediterranean coastal fisheries, which are basically traditional small-scale activities of low investment. The entire fleet comprises 42 000 small boats playing an important socioeconomic role in the European fishing industry, representing 42% of the employment in the EU catching sector and contributing 12% of EU catches, which, because of the narrow Mediterranean shelf, mostly correspond to coastal waters. Overlapping with the small-scale fishery in space and resource use, is a very important and increasingly popular recreational fishery, with over 2106 anglers and 3105 recreational fishing boats in the Mediterranean. The main management actions in the Mediterranean comprise limiting effort, gear selectivity, and closed areas and periods, as well as regulations for the commercialization and traceability of the fishing products. Our example provides evidence of the complexity of fishing rights and how they can be adapted into practical fishery management. combining fishing rights, open access recreational fishery, community-based management, and biodiversity conservation.

Keywords: coastal fishery, management.

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ICES CM 2010/B:32 Poster

Management plan as tool for sustainable use of marine resources: lessons from Latvia

Solvita Strake

Over last four years Latvia has put in considerable effort to implement the EU Birds and Habitats Directives and within the framework of the LIFE project "Marine Protected Areas in the eastern Baltic Sea" has established seven Marine Protected Areas (MPAs). At present there is only experience with terrestrial protected areas in Latvia. Therefore, the fears of different stakeholders about how MPAs will influence the economy and coastal development are understandable as together with designation of MPA two management plans for two territories have been elaborated. The management plan areas represent all most significant sea and coastal uses and socioeconomic interests. Especially diverse is the "Western Coast of the Gulf of Riga" with sea ports, shipping routes, fishery, tourism, and recreation. Near "Nida–Pērkone" there is potential interest in building wind farms and extracting oil. To support communication with stakeholders and to enhance acceptance of the management measures a full-scale socioeconomic analysis was carried out for the both sites, including explanation of the costs and benefits related to establishment of the MPAs. This work has been performed for the first time in Latvia and significantly contributed to the success of the stakeholder acceptance. In comparison with terrestrial areas, for marine sites there is very little opportunity to apply active management measures. Therefore, the proposed measures mainly concern regulation of economic use (e.g. fishery, tourism, port development and maintenance, extraction of mineral resources, offshore wind farm development, etc.), administrative measures, monitoring, scientific research, as well as rising of public awareness.

Keywords: management plan, Marine Protected Area, stakeholders, use of marine resources.

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ICES CM 2010/B:33 Poster

Marine Scotland Science: Contribution of seabed habitat surveys to marine planning for renewable energy developments.

M. R. Robertson and I. M. Davies

Sustainable development of marine renewable energy (wave and tidal stream power) in coastal waters requires that due account is taken of the biodiversity and conservation value of the seabed habitats in development areas. Areas of high tidal streams may contain reef habitat, an Annex 1 habitat in the EU Habitats and Species Directive. As part of Marine Scotland Science (MSS) assistance to the emerging wave and tidal energy industries, regional seabed survey datasets are being collected from selected areas around Scotland. Survey work in the Pentland Firth and Orkney waters, which have significant potential for both wave and tidal power, has included acoustic surveys using the FRV *Scotia* with a Reson Seabat 7125-B multibeam echosounder system. The backscatter data have been processed using QTC Multiview software to develop acoustic classifications of seabed sediment type. In addition, seabed video and still imagery has been used to develop biotope classifications (EUNIS assessment system) of the areas surveyed. The biotope classification has been used to ground-truth the acoustic data and to create biotope maps.

Keywords: Renewable energy, marine spatial planning, seabed habitat, acoustic survey, biotope classification, Pentland Firth, Orkney

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Interaction in coastal waters: a roadmap to sustainable integration of aquaculture and fisheries — the COEXIST project

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Coastal areas are subject to an increase in competing activities and protection and are a source of potential conflict for space allocation. The maintenance and/or development of small-scale coastal fisheries and aquaculture are highly dependent on the availability and accessibility of appropriate sites. Activities include not only fisheries and aquaculture, but also tourism, wind farms, Marine Protected Areas, etc. There is good reason to believe that the competition for such sites will increase, emphasizing the need for improved management tools supporting policies for space allocation along the entire European coastline. COEXIST is a broad, multidisciplinary approach with 13 European partners to evaluate these interactions with the ultimate goal of providing a roadmap to better integration, sustainability, and synergies among different activities in the coastal zone. The project will study the interactions between capture fisheries and aquaculture and evaluate mutual benefits and possible bottlenecks for concomitant development of these activities in the coastal zone within the context of the ecosystem approach to management. It will propose, develop, and evaluate the efficiency of spatial management tools (zoning, closed areas, etc.) to promote different forms of coastal aquaculture and fisheries at different scales (e.g. local, regional) and it will exploit mutual opportunities (e.g. artificial reefs, protected areas, wind farms, tourism etc.) within a context of competition for space by multiple users. The project will address differences in acceptance of activities (fisheries, aquaculture, and other use of the coastal zone) by the public.

Keywords: aquaculture, coastal zone, fisheries, interaction, legislation, marine spatial planning.

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ICES ASC 2010/B:35 Poster

The development of a novel regulatory and planning tool to guide the sustainable development of oyster aquaculture in New Brunswick, Canada

Sophie Bastien-Daigle and Matthew Hardy

Conservation and protection of fish habitat in coastal zones is proving to be inherently challenging because of the myriad regulators and stakeholders interacting there in a complex web of legitimate uses and conflicts. Innovative management regimes are required in that zone in order to protect fish habitat and other ecological resources while allowing for its sustainable development. Emergence of the aquaculture industry in the coastal zone has sparked calls at the global level for integrated regulatory frameworks to guide its development. The federal and provincial governments of Canada agreed, in 2002, to develop a comprehensive framework covering environmental review and management, site selection, design criteria, and operating conditions to guide oyster culture. The main objective of this framework was to streamline and bring a greater measure of predictability, consistency, and timeliness to the environmental review process of oyster aquaculture projects within the context of sustainable development. Key elements: This class screening relied on geospatial analysis to reduce spatio-temporal interactions between the activity and valued ecosystem components such as locations of bird colonies, species at risk, waterfowl and fish habitat, wetlands, dunes, and saltmarshes. In addition to these safeguards, possible use scenarios with various management options were evaluated. Zones were subsequently defined where shellfish leases could be best located to protect the environment, to reduce conflict with other users and to meet regulatory requirements. The Replacement Class Screening Report will continue to be updated via an Adaptive Management Process that will provide continuous feedback as to its effectiveness.

Keywords: aquaculture, environmental assessment, oyster, regulatory framework.

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ICES ASC 2010/B:36 Poster

Environmental vulnerability profiles: characterization of pressures in the southern Gulf of St Lawrence, Canada

Matthew Hardy, Marc Ouellette, and Roland Cormier

The worldwide realignment of research and management objectives in recent years to respond to implementation of the "ecosystem approach" represents a departure from past practices where emphasis was mainly on a single-species fisheries or single-activity basis. Although there is a broad consensus on the purpose of this realignment, its practical application continues to be a significant challenge given the complexities of attempting to develop multispecies/activity integrated management plans, frameworks, and approaches for all factors affecting the aquatic environment. The management of human activities, both aquatic and land-based, that contribute to adverse environmental impacts on aquatic ecosystems is one of the major challenges associated with integrated coastal and ocean management. There is recognition that effective integrated management will require new pragmatic approaches, in addition to current practices. It is also particularly important to develop approaches that build greater credibility with the public with regard to integrated planning initiatives and that are based on clear, factual, and interpretable information. The Gulf of St Lawrence Regional Vulnerability profile is being developed by the Department of Fisheries and Oceans Canada with contributions from a number of federal and provincial departments. The purpose of this atlas is to identify and scope the environmental pressures associated with a number of human activities from a geospatial perspective and to illustrate their respective and relative intensity. This is not an assessment, but may serve to identify research or assessment needs. It can also be the basis for engaging relevant federal and provincial partners as well as for communicating with the public in a structured and factual manner.

Keywords: atlas, coastal management, geospatial, vulnerability.

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The adaptation of a risk-based approach for integrated coastal management

Matthew Hardy and Ray MacIsaac

In Canada, the development of risk-based approaches to support decision-making continues to be a priority for integrated coastal-zone management. The development of a conceptual framework for risk-based integrated management is considered as a means to more effectively use existing information and ensure the efficient deployment of resources as well as renewing the focus on priority setting. Strengthening the initial phases of this process is key to building a credible and pragmatic management process that has the potential to be successful at achieving realistic goals within a well-defined scope and scale of issues. The retooling of the best available information is being considered with regard to the development of environmental vulnerability profiles in order to incorporate: (i) ecologically significant areas, (ii) social-cultural and economically significant areas, (iii) human use activities and their zone of influence, and (iv) characterizing the potential conflicts and compatibilities. The intent is to provide the context to frame preliminary decisions with regard to the appropriate approach and level of response required to lead to more focused assessments relating to ecology, sociocultural and economic, and governance issues. The elements being considered are founded on the recognition of jurisdictional authorities and their respective accountabilities for the management of issues that cannot be resolved unilaterally by any organization or entity alone. Moreover, a risk-based framework is being examined as a means to provide an objective, rigorous, and iterative approach that may serve to validate facts and perceptions around public concerns while enhancing communication and engagement.

Keywords: coastal, integrated management, risk analysis, vulnerability.

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