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ICZM as a framework for climate change adaptation action – Experience from Cork Harbour, Ireland

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ABSTRACT

Using the example of ICZM implementation in Cork Harbour – an intensive multi-use setting – the potential to inform and advance the implementation of climate adaptation is examined. National level policy for climate adaptation is reviewed with a local ICZM initiative with a focus on process, principles and people. Lessons learned and critical contributions are identified that can inform endeavours in similar coastal environments, and ensure that ICZM is optimised to support the implementation of climate adaptation and resilience enhancement. Evidence suggests that despite being implemented through different institutional and policy frameworks, the local partnership-based ICZM model can provide enabling mechanisms, facilitate capacity building and harness knowledge exchange and learning to support the local scale implementation of national climate policy.

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1. Introduction

The vulnerability of coastal environments to present-day and projected impacts of climate change has been widely acknowledged and comprehensively documented [46,64,8]. Carter [9] outlined the challenges facing Europe's cities and peri-urban areas in the context of climate change, while Hunt and Watkiss [35] review of climate change impacts revealed that cities and urbanised areas in coastal settings receive a significant amount of attention in the literature due to the fact that these locations are where important and significant impacts can be expected. In light of the challenge presented by the range of climate change impacts, and cognisant of the fact that mitigation alone will not fully off-set or immediately halt the full impacts of climate change [65], adaptation has thus become a more prominent element of policy responses to climate change [22,52], with many European nations producing National Adaptation Strategies over the last decade, e.g. Finland (2005), France (2006), Denmark, Germany, and United Kingdom (2008) and Belgium (2010) [7].

However, here the focus is on an in-situ ongoing ICZM process, representing one of a few contemporary national ICZM initiatives in Ireland [51], and the implementation of national policy on climate adaptation. Local scale ICZM effort, in this case the work undertaken in Cork Harbour, was examined to ascertain if it could meet and/or support the implementation requirements of nascent national policy on climate adaptation through action at the local-level. Emphasis was placed on the practice-based lessons to emerge that can inform the application of a similar partnership-based model in other coastal locales; and, what implications this may have for ICZM and climate adaptation in Ireland. Coastal management and climate adaptation policy in Ireland is outlined, followed by a description of Cork Harbour and ICZM and climate adaptation activity within the harbour. The national policy and local practice are then examined with particular attention is given to process, principles and people (stakeholders) and how the experiences drawn from these three categories provide lessons transferable to other coastal settings.

2. Coastal change and climate adaptation

Considering the socio-economic and ecological nature of climate change impact on coasts [10,31], it is logical to consider climate related impacts as a sub-set of issues or one (albeit critical) element driving coastal management intervention; i.e., another issue requiring the attention of coastal management practitioners

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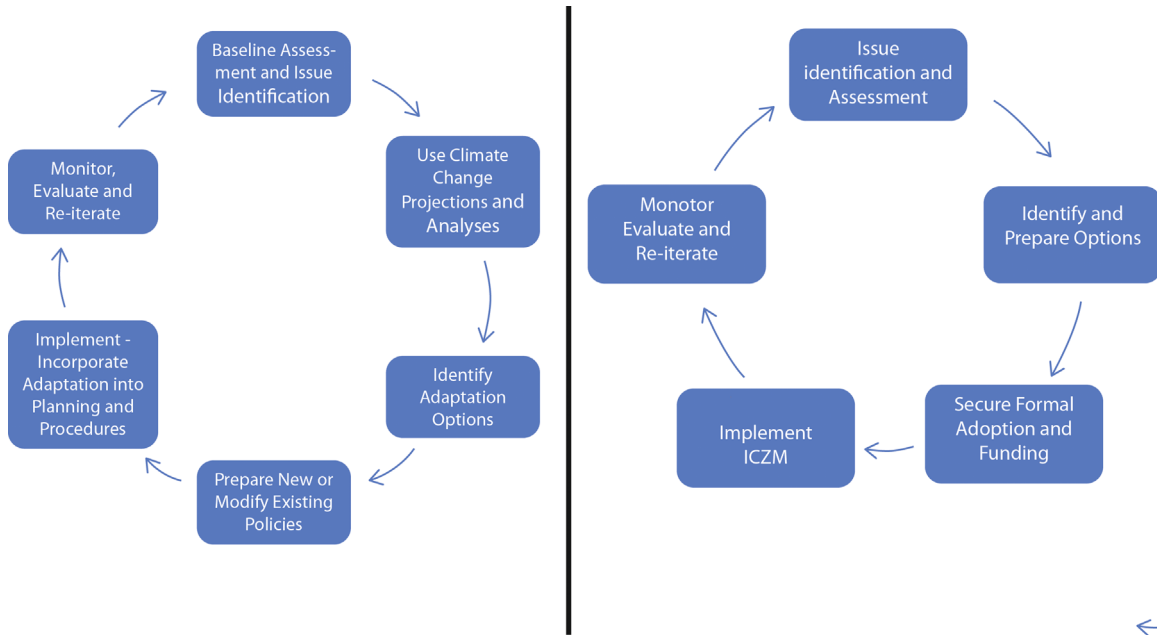


Fig. 1. The analogous processes of climate adaptation (modified from Gagnon-Lebrun and Agrawala [28] on left) and ICZM (modified from GESAMP [30] on right); both of which contain steps associated with assessment, planning and preparation, implementation and evaluation.

and stakeholders. ICZM represents a participative process which supports the sustainable use of coastal resources, and places emphasis on integrated approaches over sectoral-based practices ([51] and references therein). With sustainability underpinning ICZM, initiatives that represent sound coastal management practice should therefore be expected to implement climate change adaptation. Furthermore, in addition to an overlapping of issues, climate adaptation and coastal management can: involve the participation of similar constituents; rely upon analogous processes (see Fig. 1) as part of the approaches and methods used; and, work to similar principles.

Typical aspects of ICZM such as joined-up approaches to governance [60], impact assessment and data management [20,62], and implementation through spatial planning suggests a number of benefits can accrue with regard to climate adaptation. However, exploring the mutual benefits of the relationship between coastal management and climate adaptation, and putting the lessons to emerge into practice has not been a straight forward exercise (e.g. [9]).

Tobey et al. [64] analysed how the global stock of ICZM best practice over the last 20 or so years can inform practice related to coastal climate adaptation. Köpke and O'Mahony [70] looked at how certain marine and coastal sectors in Ireland were responding to climate change in the anticipation of the aforementioned national/government led policy response – this was conducted on the basis of the extent to which climate adaptation had featured in policy documentation guiding the future development and planned growth of individual sectors of activity. Falaleeva et al. [23] discussed how the anticipated statutory footing afforded to climate adaptation in Ireland offered opportunity to further develop and progress ICZM in the form of an enabler to adaptation. Gray et al. [32] detailed a locally-focused initiative involving coastal stakeholders from SW Ireland in a pilot type exercise to plan for adaptation, and revealed how certain methods presented both opportunities and challenges in assisting coastal stakeholders to identify appropriate adaptation responses (Gray et al., this issue). Other authors have examined the relationship between coastal management and climate change adaptation in terms of information needs for communities and managers, bringing together science and policy communities, models of partnership and

collaboration [56,59,66]. The concept of partnership which is central to ICZM (e.g. [44]) and climate adaptation (e.g. [1]), with collective action at different levels (e.g. community, administrative) and scales (e.g. local, regional) shown to yield positive results in countering socio-environmental issues.

Ireland as an island situated in the north-east Atlantic will experience climate impacts such as sea-level rise, and potentially higher intensity and changing storm and flood regimes [19,25,63], all of which will have implications for a country that has: its largest cities (Dublin, Cork, Limerick, and Galway) located on the coast, comprising approximately 34% of the Irish population [18,71]; one of the highest rates of coastal development in the European Union [38]; and, relies on its coast to support key infrastructure (e.g. ports, road and rail networks) and strategic industries.

Within Ireland, policy in relation to coastal management and climate change adaptation is being advanced in different ways [23]. The Government department principally responsible for action on climate change recently published the National Climate Change Adaptation Framework (NCCAF) [17]. Prior to this, adaptation was given a cursory mention within a limited number of spatial planning processes [40], and pursued through research activities ([32]; Gray et al., this issue), and some sectoral led responses (e.g. [72]); the publication of the NCCAF provided a mandate for adaptation to become a more urgent policy priority across the State. The publication in 2013 of the Heads of a Climate Action and Low-Carbon Development Bill provides a basis for legislation to address climate change in Ireland; priorities within the Bill include provision to develop climate change adaptation within the aforementioned NCCAF. The NCCAF provides a policy mandate for action to address climate change adaptation, requiring the integration of adaptation policies into decision-making at both national and local levels. The NCCAF mandates local authorities to integrate climate change adaptation within their spatial planning processes. Further, Government Departments and State Agencies are required to develop specific sectoral adaptation plans by mid-2014 in consultation with stakeholders [17,47].

While climate adaptation now has an identifiable policy framework (and is likely to gain a legal footing under the anticipated Climate Action and Low-Carbon Development Bill), ICZM in Ireland

has been advanced in a policy vacuum [49], attempts to progress implementation of ICZM are characterised by locally focused effort, conducted within time bound projects, see [50,48] for detailed reviews. Nevertheless, ICZM effort at the local level in Ireland is representative of good practice, recognised as a valued body of experience, and has established a community of practice across the island, and generated outputs of which have been positive in terms of capacity building [51]. The objectives of many ICZM efforts in Ireland resonate with the stated aims and intended actions of Ireland's climate policy, e.g. "...adopting [an] open, transparent, and inclusive approach to sectoral adaptation planning" and to "...consult and encourage partnership with stakeholders when addressing adaptation matters at a local level" [17], and a number of relevant lessons have emerged from ICZM experience with respect to policy implementation [23,24].

3. Site description – Cork Harbour

Cork Harbour is situated on the SW coast of Ireland, and extends approximately 20 km from a narrow channel entrance at Roches' Point to the docklands of Cork-Ireland's second city with a population of approximately 250,000 within the greater metropolitan area. Cork City has experienced a number of severe floods over the last decade, resulting in extensive damage to businesses and residences within the city centre environs [36], which in turn have begun to influence spatial planning and development control. Within the harbour, towns such as Passage West, Cobh, Crosshaven and Monkstown have populations between 1500 and 6500; smaller settlements along the Harbour's shores include Aghada, East Ferry and Ringaskiddy, all of which contain < 800 inhabitants (see Fig. 2).

The harbour is of national strategic importance in terms of trade and commerce, the harbour also contains sites of international ecological value (e.g. designations associated with the Ramsar Convention and Natura 2000 network), and accommodates multiple uses ranging from fisheries, tourism (e.g. watersports, angling and port of call for cruise liner traffic), shipping, defence (e.g. headquarters of the Irish Naval Service is located on Haulbowline Island in the harbour) and education to heritage, agriculture and food production, and bio-pharmaceutical industry [14,29]. The geological character of the harbour means much of the coastline is steep sided, resulting in steep linear coastal settlements and a concentration of transport, access, and land use in tightly defined low-lying areas close to the shoreline [15].

3.1. Coastal management and climate adaptation in Cork Harbour

As stated, many approaches focusing on the implementation of integrated coastal management in Ireland have taken place on a local scale within a project environment – one such example being the development of an ICZM strategy for Cork Harbour [14]. This work was initiated under the Coastal Research and Policy Integration (COREPOINT) project [14,49], which used an innovative model of partnership working termed the Expert Couplet Node (ECN), designed to bring the science and policy communities closer together to advance ICZM in practice. In the case of Cork Harbour, this involved researchers from third level education institutes working together with local authority planners (for further explanation of the ECN model and examples of its application within Europe see [13,53,49,16]).

Following the completion of the Cork Harbour Integrated Management Strategy, a group was formed – the Harbour Management Focus Group (HMFG) – to take forward the implementation of the



Fig. 2. Aerial photograph of Cork Harbour and its environs showing the distribution of settlements and mixed land-use composition. Copyright © Cork County Council 2005 – all rights reserved – Includes Ordnance Survey Ireland data reproduced under OSI – Licence number 2003/07CCMA/Cork County Council – Unauthorised reproduction infringes Ordnance Survey Ireland and Government of Ireland copyright – © Ordnance Survey Ireland, 2004.

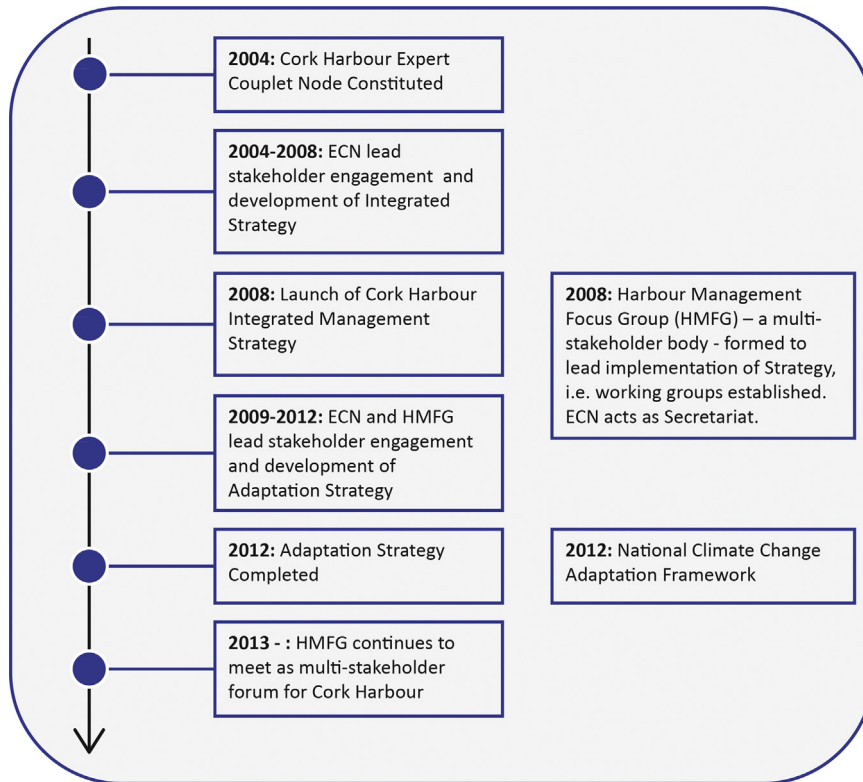


Fig. 3. Timeline of ICZM and climate adaptation activities in Cork Harbour involving the Expert Couplet Node (ECN) and Harbour Management Focus Group (HMFG).

strategy; this was a multi-stakeholder group which comprised as many representatives as possible of the various public bodies with a management role within Cork Harbour (e.g. spatial planning, tourism, environmental protection and assessment, rural development, shipping, commerce, and conservation); coupled with representatives from the private sector and any parties (e.g. environmental groups, development associations, and community heritage groups) with an interest in how the harbour is managed.

Following the launch of the ICZM strategy, the ECN continued to provide a secretariat function for the HMFG (see Fig. 3 for an overview of the evolution of the ECN and HMFG in Cork Harbour), facilitating the organisation of meetings, circulating minutes and provision of materials linked to meeting agenda items, and progressing actions connected to the development of the strategy. The HMFG agreed a plan of action to implement as best as possible the actions contained within the integrated management strategy for the harbour, this entailed the formation of specific working groups (e.g. focusing on heritage, awareness raising and education, future planning), and quarterly meetings to update on progress, share information and progress areas of mutual interest – all conducted on a voluntary basis. The HMFG represents one of the few contemporary multi-stakeholder partnerships for coastal management in Ireland, the group continues to meet and collaborate in relation to the ICZM strategy.

As part of the Innovative Management for Europe's Changing Coastal Resource (IMCORE) project, members of the HMFG embarked on a process to develop a strategy for adaptation to climate change for Cork Harbour ([29]; Gray et al., this issue) which was informed by consultation with other stakeholders. Although legislation and policy for climate adaptation is at a more advanced stage than is the case for integrated coastal management, the development of an adaptation strategy in Cork Harbour represents one of the few early-stage responses to national policy, and its initiation pre-dated the publication of of Heads of the Climate Action and Low-Carbon Development Bill (2013) and the National

Climate Change Adaptation Framework [17].

To identify and exploit the value of ICZM good practice which can be transferred to climate adaptation, an appropriate approach entails examination of both concepts to see where synergies exist. Using case study experience to inform such an examination is particularly useful to practitioner audiences, as the lessons can be communicated in such a way as to allow replicable lessons and processes to be considered for implementation elsewhere. The situation in Ireland, and the example of Cork Harbour, provide a suitable case study in this regard, as Ireland: is a nation where the impacts of climate change on coastal environments and communities are evident; action on climate adaptation is becoming a political and scientific priority; and, the governance challenges Ireland faces mirror those of many other EU Member States in that both climate adaptation and coastal management are being advanced in very different ways. Considering the activity within Cork Harbour in relation to both climate change adaptation and coastal management, the site provides an ideal case study to examine how these processes influence and interact with each other, and how the initial ICZM-focused partnership was able to bring its capacity to bear on a process to address the challenges presented by climate change. Similarly there is value in analysing the work undertaken in Cork Harbour in terms of the potential opportunity this presents for other coastal sites in Ireland and elsewhere where local authorities and wider stakeholders have to contend with the multiple demands placed on coastal space, while also co-ordinating climate change adaptation responses.

4. Approach – review of local ICZM practice and national climate adaptation policy

In order to analyse the how ICZM can facilitate the implementation of climate adaptation, coastal management activity at the local level was reviewed in the context of national policy for

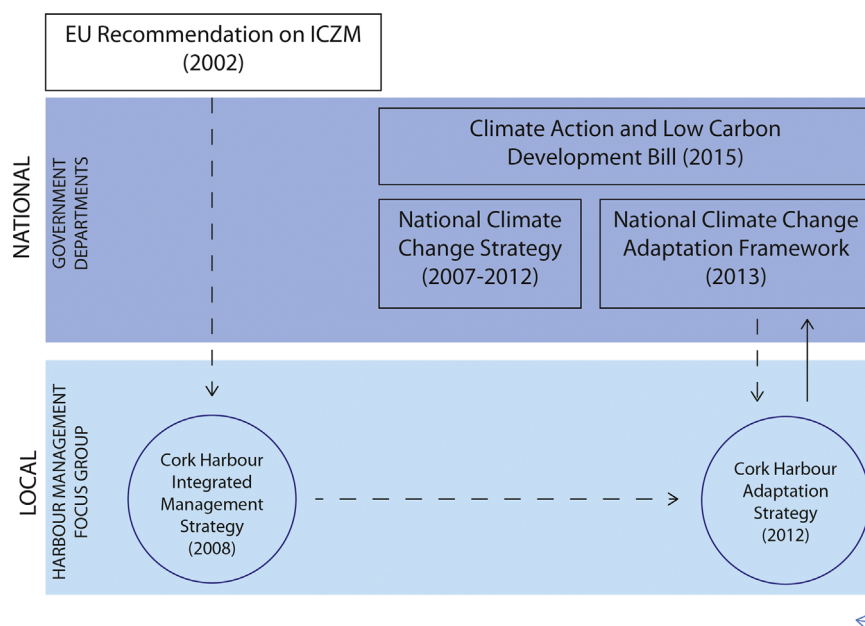


Fig. 4. Interplay between key legal and policy instruments for climate adaptation and coastal management at different levels in the context of activities within Cork Harbour.

climate adaptation. For climate adaptation, the basis for the review is the NCCAF which directs activity in Ireland at local and national levels and mandates action to be taken by competent authorities in relation to a number of key themes (pillars). With respect to ICZM, no comparable national level policy exists in Ireland. Accordingly, the principles contained in the EC's Recommendation on the implementation of ICZM in Europe (2002/413/EC) and their local application were considered as the comparable policy contribution for integrated coastal management (Fig. 4).

Local level activity in Cork Harbour relating to these two policy frameworks was analysed to assess how ICZM can contribute to implementation of national policy for climate adaptation (see Table 1). The ICZM initiative resulting in the Cork Harbour Integrated Management Strategy was progressed through planning meetings involving the HMFG and ECN, additional stakeholder correspondence outside these meetings, and interactions via public meetings – all of which were recorded using minutes, workshop reports and status updates – providing an objective record of the strategy development process. In particular, elements relating to the process, stakeholder interactions, and principles which led to the development of the Cork Harbour Integrated Management Strategy [14] were analysed with respect to the implementation requirements set out within the NCCAF; specifically those set out under the stated key pillars of the framework – knowledge base, governance structures, local planning, and engagement. Similarly, for each key pillar of the NCCAF – the related actions and suggested pathways to implementation were extracted and the language examined with a view to identifying key lessons and critical contributions (as detailed in Table 1) when set against the ICZM process completed in Cork Harbour. The subsequent findings from the analysis of local and national policies and practices in Ireland are then discussed against the wider literature on ICZM and climate adaptation to establish the wider applicability of the work undertaken in Cork Harbour.

5. Discussion

Climate adaptation can perhaps be considered synonymous with ICZM with regard to making a transition from a primarily theoretical focus towards a comprehensive body of good practice

emerging from shared experiences of actions undertaken. Steijn et al. [58] acknowledge that many of the earlier guidance and tools on ICZM were considered overly academic and unsuitable for the day-to-day needs of practitioners, and led to ICZM being labelled as an academic pursuit rather than a practice based approach to management. For climate adaptation, high-level policies have now been in place, for example, at the EU level (Adaptation White Paper; EC/COM/216), resulting in national level responses by many Member States [7]. Yet despite these supporting frameworks, and mounting evidence of the current and future risks climate change poses, there has been relatively little indication of action being taken to pre-emptively adapt to its impacts (Gray et al., this issue). The academic literature reflects a clear disjuncture in developed nations between the formulation of high-level climate policy and effective, 'on-the-ground' adaptation (e.g. [73]), prompting "concerns about the likelihood of effective adaptation given the speed of climate change and limited window of opportunity for action" [6]. In a survey of adaptation undertaken in the UK, Tompkins and colleagues report a similar trend; top-down policy has spurred efforts within some sectors and public sector administrations to begin a rudimentary assessment of the risks and possible impacts of climate change, but there is little evidence of these efforts being translated into pragmatic adaptation action at local authority level [74].

Nevertheless, a number of plans, projects and actions with direct or ancillary adaptation benefits have been identified in Europe, providing path-finding examples which others might follow [75]. However, examples of pre-emptive adaptation processes at the local scale meeting the standards of participation, long-term orientation, and appropriately anticipatory actions set by higher-level policies [12,17] are notable by their absence. This shortfall may result in socially unacceptable levels of risk being borne prior to adaptation measures becoming effective, and at a much higher economic cost. Therefore, there is now a clear imperative to advance climate adaptation action and to support such endeavours through existing processes, such as ICZM, and exploit such opportunities where they arise. Shared elements such as an iterative nature, potential for common constituents, mutual principles, and under-lying agenda of sustainability make a clear case for considering the potential for synergy between adaptation to climate change and ICZM. While the latter is arguably a more mature

Table 1
Benefits to implementation of national adaptation policy arising from ICZM at the local level, categorised according to process, people (stakeholders) and principles^a, and based on activities in Cork Harbour, Ireland.

Key Pillars – Adaptation Framework	ICZM in Cork Harbour		
	Process	People	Principles
<p>Knowledge Base</p> <p><i>“Building evidence base and tools to help adapt to climate change”</i></p> <p><i>“Link knowledge which already exists with policy and action”</i></p> <p><i>“Dialogue between the climate science community and policy makers will be encouraged”</i></p> <p><i>“Use adaptive and iterative processes”</i></p>	<ul style="list-style-type: none"> • Issue identification • Impact assessment • Site specific data • Locally scaled • Non-public datasets • Archival datasets • Organised approach to data collation • Information exchange 	<ul style="list-style-type: none"> • Capturing of tacit knowledge • Consolidating state-of-knowledge and input to inventory of existing data holdings • Support education and awareness • Identification of gaps – data and representation 	<ul style="list-style-type: none"> • Opportunity for adaptive management • Reflects local specificity • Broad holistic perspective • Adaptive management • Ability to work with natural processes
<p>Governance Structures</p> <p><i>“barriers for successful adaptation is the unclear definition and delineation of responsibilities of the different authorities and stakeholders”</i></p> <p><i>“fostering a shared approach to managing the impacts of climate change”</i></p> <p><i>“Enhancing linkages between scientific research and policy making”</i></p>	<ul style="list-style-type: none"> • Improved transparency • Increased buy-in to plan-making exercise • Accountability • Cost effectiveness • Enhancing linkages between science and policy 	<ul style="list-style-type: none"> • Common constituents • Access umbrella organisations • Linking of local action to national policy 	<ul style="list-style-type: none"> • Involvement of all relevant parties • Participatory planning
<p>Local Planning</p> <p><i>“Local authorities will continue to consult and encourage partnership with stakeholders when addressing adaptation matters at a local level”</i></p> <p><i>“fostering a shared approach to managing the impacts of climate change”</i></p> <p><i>“public bodies will engage directly with others that are influenced by their policy decisions”</i></p>	<ul style="list-style-type: none"> • Improved consultative process • Highlighted points of entry for adaptation • Issues identified • Opportunity to engage other planning authorities 	<ul style="list-style-type: none"> • Opportunity to engage all interested parties 	<ul style="list-style-type: none"> • Reflects local specificity • Taking a long(er) term perspective • Opportunity for adaptive management
<p>Engagement</p> <p><i>“engagement with key stakeholders to explore impacts and responses”</i></p> <p><i>“the involvement of key stakeholders at local level in the preparation of local adaptation plans is essential”</i></p> <p><i>“cross-sector engagement must often occur as part of the adaptation process”</i></p> <p><i>“stakeholders being given early and adequate opportunity to input to the process of preparing adaptation plans”</i></p>	<ul style="list-style-type: none"> • Opportunity to involve stakeholders • Inclusive • Communication of science • Dialogue and debate • Shared vision • Joint planning • Basis for stakeholder mapping • Use of different exploratory methods, e.g. scenarios, visualisation, GIS 	<ul style="list-style-type: none"> • Cross-sector engagement • Dialogue and debate • Allocation of resources • (Political) lobbying 	<ul style="list-style-type: none"> • Participatory planning • Reflects local specificity • Using a combination of instruments

^a The 2002 Recommendation on the implementation of ICZM in Europe set out eight principles on which to base implementation: A broad overall perspective; a long-term perspective; adaptive management; local specificity; working with natural processes; involving all parties concerned; support and involvement of relevant administrative bodies; and, use of a combination of instruments.

concept, certainly in the context of European action, the former is currently viewed as more of a priority, as evidenced by the proliferation of policy responses at both national and international levels [47].

5.1. Benefits of pre-existing process

In the case of Cork Harbour, efforts to implement ICZM were in place in advance of climate adaptation becoming a planning consideration for statutory (and non-statutory) organisations. The exposure of stakeholders within the harbour to a process that entailed issue identification and impact assessment (at a coarse level) ensured familiarity with a similar exercise undertaken as part of the adaptation process once it was initiated. In addition to familiarity with the process, a number of the stakeholders had developed a working relationship as part of the development and implementation work linked to the ICZM process that heretofore did not exist; these relationships provided a basis for future working with respect to climate adaptation. The formal and informal interactions between scientists, planners, and participants of different backgrounds and disciplines consolidated over a period of relationship building and mutual learning enabled closer alignment of scientific inquiry and practical application [66] and

the identification of agreed objectives from the outset. In the UK, Stojanovic et al. [59] reported similar benefits arising from ICZM (and partnership working – see below) in planning response to climate change impacts, while [33] found that the existence of an ICZM process within the Oder Estuary in Germany provided a basis for action related to climate adaptation planning and research. Muir et al. [45] argued a key benefit of ICZM in the context of climate adaptation for the Outer Hebrides islands of Scotland was the opportunity to bring greater levels of community representation into decision-making for hazard management in response to climate change.

5.1.1. Stakeholder mapping and impact assessment

An additional advantage arising from the ICZM process in Cork Harbour was the ability to build upon an existing network, and use this as the basis for comprehensive stakeholder mapping relating to climate adaptation in the harbour. Identifying how certain stakeholders or groups will be impacted by climate change, and to what extent they can contribute to a collaborative response is a critical undertaking in the climate adaptation process. This is reflected in the NCCAF which states in relation to the development of local adaptation strategies it is expected that “...full engagement of key stakeholders.” will take place, and “...opportunities are

provided for all interested individuals and organisations.”, thus, providing local authorities with a significant task in terms of stakeholder engagement for climate adaptation. Multi-disciplinary and cross-sectoral approaches that provide for integrated approaches involving stakeholders are viewed as being fundamental to sustainability [43,55]; such a function was provided by the HMFG in Cork Harbour, and augmented through additional cross-sectoral interaction by means of public workshops and meetings held during the development of the Cork Harbour Integrated Management Strategy. This cross-sectoral and multi-disciplinary approach ensured a better understanding of: (1) the potential synergies that existed between different sectors in the harbour; and, (2) how best to profile and map stakeholder representation within Cork Harbour. Use of an existing network also yielded benefits in terms of cost and time, e.g. a reduced lead in time and costs associated with preparatory stakeholder consultation-themed work relating to adaptation planning, which can often be under-estimated to the detriment of the process being undertaken [34,4,57]. Under the NCCAF, Cork County and City Councils will be expected to develop adaptation strategies for their entire administrative area. While Cork Harbour represents a discrete area of the overall jurisdictions of Cork County and City Councils, many members of the HMFG represent organisations whose administrative remit covers a much larger spatial area than the harbour, and their experience and involvement in the Cork Harbour process can be extended to stakeholder processes at the municipality level when needed.

5.1.2. Access to data and knowledge

A further aspect of the ICZM process in Cork Harbour that benefitted the subsequent adaptation exercise was a prior stocktake of the datasets pertaining to the harbour, many of which are held by different organisations and not all publicly available, and are directly applicable to improving the knowledge base for climate adaptation planning (e.g. spatial land-use plans, inventories of coastal assets, at risk structures/sites, etc.). A key objective of the Cork Harbour Integrated Management Strategy was to identify and collate as much as possible all data holdings and research into a central repository. These data together with the locally specific knowledge of the individual HMFG members provide an enriched understanding of the socio-biophysical system that is Cork Harbour and represent what is a core component of adaptation planning at the local scale [32] while also being consistent with the NCCAF objectives of linking “...knowledge which already exists with policy and action”, and seeking to populate the information systems currently under-development to support climate adaptation in Ireland (e.g. Ireland's Climate Information Platform (ICIP); [47]). Sharing and updating of information became a common feature for meetings of the HMFG and this perpetuated into subsequent planning meetings focused upon the development of the climate adaptation strategy. During meetings of the HMFG it was clear that participants wanted to share actions being undertaken by their organisation (ongoing or intended) with respect to climate change, or sought to get information from other participants that would assist in the planning of their own actions. Therefore, cross-sectoral involvement within integrated approaches provides value and benefit in that participants are afforded the opportunity to build capacity and become more aware of adaptation needs and corresponding knowledge which can then be applied to their own sector specific adaptation exercise (as mandated by the NCCAF).

The engagement of the HMFG with an ICZM process indicated a willingness to advance sustainability and an acceptance to explore co-management and collaboration as a means of addressing societal challenges, which was subsequently applied to climate change adaptation. Being able to leverage this buy-in and direct focus towards adaptation was aided by the fact that the ICZM process in

Cork Harbour did reveal concerns held by stakeholders in relation to climate change impact, (e.g. flooding, implications for long-term planning) [14]. This information provided a basis for initiating discussions on how to formulate an adequate response, and how the HMFG could apply resources and direct its effort in this regard. While understanding and perceptions of climate change impact did vary across the group (an influential factor in the development of an adaptation strategy for the harbour, see Gray et al. (this issue)), within this transition period all members of the HMFG remained onboard and agreed to consider climate adaptation as an issue deserving attention and action. The ICZM process had demonstrated to all parties the capabilities of stakeholders that existed within the harbour, and the benefits of deploying collective resources to address contemporary challenges, e.g. the need to better promote the Harbour as a resource for amenity, and the requirement to inventory access points to the water in order to strategically plan investment in infrastructure [14].

5.2. Power of partnership

Partnership is an established component of ICZM and integrated approaches to coastal and marine planning [26,42,60], and is seen to provide for greater legitimacy and transparency in decision-making, delivery of plans of action through consensus and fuller agreement, and increased buy-in from all parties engaged with a particular management or planning issue. Stojanovic et al. [59] looked at how coastal partnerships can develop research strategies to better enable their contribution to coastal themed societal challenges, including climate change. Partnerships and the importance of their contribution has also entered the climate adaptation discourse and is being applied at different administrative and governance levels (e.g. [69,68,3,5]), with certain countries developing formal partnerships to contend with climate change (e.g. UK, see [37]).

The HMFG in Cork Harbour is analogous with many other multi-stakeholder partnerships in that it constitutes a diverse representation of interests, backgrounds, experience and opinions, which if utilised in a collaborative environment can be harnessed to address a range of social, economic and environmental issues, or challenges that comprise a combination of such issues (e.g. [21,27]). The value of such partnerships is increased when the wider network of the members are considered (e.g. an individual representing the port company may also have a position on the national bodies for port management, navigation and sea-trade), which provides an extensive constituency from which to draw in further information and expertise relevant to a local setting. Similarly, individual participants may represent large organisations (e.g. local authority) that contain a store of human capital and expertise. Having members within a partnership that can directly or indirectly connect and communicate with their sectoral contemporaries at regional and national levels provides an important avenue of influence for local initiatives, which can sometimes struggle to communicate to a national level the value of their actions at a local level [48]. Such avenues also increase the likelihood of local activity remaining consistent with national policy, support effective implementation, and contribute to the transfer of good practice between different municipalities or administrative units.

5.2.1. Platform for multi-stakeholder engagement

ICZM requires inclusive approaches and extensive stakeholder engagement [2,61]. Ensuring inclusivity and developing a partnership in order to progress ICZM within Cork Harbour had the added benefit in that such an approach ensured all the key stakeholders likely to be impacted by climate change were represented by statutory and/or non-statutory organisations (e.g. spatial planning, environmental protection, conservation, heritage,

tourism, fisheries, port and navigation, and rural development) and a partnership suited to the needs of climate adaptation planning was already in place at the outset and reflected the national level view that “*involvement of key stakeholders at local level in the preparation of local adaptation plans is essential*” [17]. Another benefit to arise from partnership was the opportunity to remove individuals from their established work environments and facilitate interaction with representatives of other sectors that they typically would not encounter as part of their operational activities. This breaking down of sector-focused silos [11] was already advanced when climate adaptation became the focus of the HMFG; thus, allowing for more open dialogue and a working environment conducive to knowledge exchange, and sharing of information which is critical to developing adaptation responses and ensuring in some way that “*public bodies engage directly with others that are influenced by their policy decisions.*” [17]. The NCCAF emphasises the importance of “*fostering a shared approach to managing the impacts of climate change*” to advance climate adaptation policy at local level [17], a concept that was very much facilitated by the HMFG and ECN in Cork Harbour, where as part of the development of the climate adaptation strategy, the partnership and other stakeholders (through public workshops) collaborated on identifying the key messages, objectives and actions. While local authorities in Ireland, such as Cork County and City Councils, will be statutorily obliged to deliver adaptation strategies, partnership focused processes such as that in Cork Harbour allow the local authority to gauge the contribution to be made by other statutory and non-statutory organisations and how to incorporate these contributions into their statutory development process.

5.2.2. Role of Expert Couplet Node (ECN)

The HMFG is distinct from the standard coastal partnership model through its relationship with the Expert Couplet Node (ECN). The partnership work of the HMFG in Cork Harbour was guided and supported by the ECN which fulfilled two key roles: as an accepted facilitator of the climate adaptation process; and, as a provider of information on the science and policy aspects associated with coastal climate adaptation which was communicated in different ways to the diverse members of the HMFG. Both of these functions were carried over from the initial ICZM process behind the development of the Cork Harbour Integrated Management Strategy where they were trialled and refined to establish a preferred way of effective working and communication acceptable to all parties (see Carlisle et al. (2008) and [67] for activities and working arrangements of all ECNs in Europe). The HMFG represents a near unique coastal management partnership within Ireland and is certainly untypical of many others in Ireland and elsewhere which are characterised by a lack of engagement by the private sector in particular [60]. For these reasons the facilitation role of the ECN was significant in that it was necessary to maintain a working environment that fostered the dialogue, cross-sectoral collaboration and information exchange required to successfully advance adaptation planning for Cork Harbour.

It is rational to consider the use of science to assist the implementation of policy through management decisions based on best available understanding and information. However, the flow of information and communication between science, policy and practitioner communities do not always best serve decision-making at the local level, which in many cases can actually illustrate the disconnect that exists between these groups [66]. The science policy communication role of the ECN provided important support to the functioning of the HMFG. ICZM, like climate adaptation, is a cross-cutting thematic area which has implications for many sectors and will require many sectors to take action in different ways but in a co-ordinated fashion to ensure interventions

achieve the desired societal outcomes. Similarly, both ICZM and climate adaptation have many direct and indirect policy linkages, resulting in a policy landscape that can be complex, and difficult for stakeholders to navigate and understand, and for stakeholders to locate their position in terms of response and action. In Ireland, responsibility for coastal management is diffuse and spread across numerous Government Departments and State agencies [50]. For some stakeholders, knowledge of how policy relating to coastal management, and latterly climate adaptation, would influence their livelihoods and long-term operations was not comprehensive. Having representation from the science and policy domains within the ECN meant that the HMFG had the opportunity to explore and scrutinise both aspects (e.g. science: what information should stakeholders be looking to obtain, what are the current projected impacts of climate change for the coastal location in question? – and policy: where to introduce/include adaptation within statutory planning, what sectors need to be engaged, what obligations exist for my organisation?). In this regard the HMFG and ECN can be considered a boundary mechanism between science, policy and practice (e.g. [66]) in that they provide convening, translation, collaboration and mediation functions, while also fulfilling the additional function of detailing the implications of policy at national level to local stakeholders, particularly from within sectors (e.g. business and industry – Chambers of Commerce) that would not typically be actively engaged by the competent/responsible Government Department.

While the use of partnership initiated within an ICZM framework has yielded benefit to climate adaptation in Cork Harbour, the voluntary nature of the partnership means it does not have the level of political and administrative support afforded to formalised institutional initiatives and is therefore susceptible to the shortfalls that such approaches can encounter [68] and which have been a recurrent theme within ICZM practice [41,48]. While the transition from ICZM to climate adaptation illustrates the flexibility and resolve of the HMFG to continue working within and outside the partnership, the initiative relies on the commitment of all parties to continue joint working, and even where this is secured the partnership has the potential to be undermined due to externalities (e.g. the current economic cutbacks being faced by local government in Ireland).

5.3. Application of ICZM principles to climate adaptation

The eight principles of ICZM as defined by the European Commission are viewed as the basis of effective coastal zone management [76]; despite debate centred on their interpretation and application, they remain a recognised framework for benchmarking progress in relation to ICZM within Europe. The ICZM process within Cork Harbour demonstrated mixed compliance with the ICZM principles [77], with all principles being adhered to, but certain principles being taken forward more than others (e.g. local specificity versus long-term perspective). Principles linked to participatory processes, adaptive management and local specificity were particularly apparent in the development of the Cork Harbour Integrated Management Strategy.

In terms of climate adaptation and implementation of the NCCAF, the principles that featured prominently in the Cork Harbour ICZM process offer immediate benefit with respect to the key pillars. Each of the NCCAF key pillars espouse working with stakeholders (Table 1) be it to garner data and information to improve the knowledge base, or developing partnerships to advance governance structures appropriate for effective adaptation. Similarly, local specificity features strongly within the NCCAF pillars, with a clear emphasis on the role of community and local government in adapting to climate change at the local scale. Thus, progress made with respect to these principles within an ICZM

process is directly transferable to processes geared towards the implementation of climate adaptation. Other principles such as those relating to the support and involvement of relevant administrative bodies were more evident through representation of government and state bodies at the local level but the extent to which this was maintained within their organisations at the national level was not explored, bearing in mind that no national level policy for ICZM exists in Ireland, and that the primary focus in Cork Harbour was to engage stakeholders (statutory and non-statutory) at the local level. In the case of Ireland, the fact that climate adaptation has an identifiable responsible authority would suggest that securing the support of administrative bodies at the local and national levels would be more achievable.

6. Conclusion

The premise that integrated approaches to coastal planning and management will yield benefit for climate adaptation efforts has been acknowledged [54,64,23,39], but when the varying approaches and institutional arrangements for implementation of ICZM within Europe and internationally are considered, the direct mapping of the ICZM process and practice onto adaptation implementation becomes less clear-cut. In Cork Harbour, an existing ICZM process was shown to benefit climate adaptation action through the provision of an established partnership approach to multi-stakeholder collaboration, support from science-policy entities, and presented a practitioner relevant “roadmap to coastal adaptation” as called for by Tobey et al. [64]. Legislative and policy requirements to implement climate adaptation at local scales are becoming more commonplace, such is the case in Ireland with the publication of the NCCAF and the Heads of the Climate Action and Low-Carbon Development Bill (2013), and while this is positive in terms of meeting the challenges posed by climate change and addressing the “adaptation deficit” (see Gray et al. (this issue), and references therein), it will in certain circumstances introduce a requirement for capacity building and guidance within local government and other sectors. In the case of Cork Harbour, much of the preparatory steps to implement climate adaptation have been initiated at the local level through ICZM effort (e.g. increased understanding of socio-ecological systems, knowledge exchange, and joined-up approach to planning) and provides a head start in terms of advancing climate adaptation.

The argument put forward here is not that ICZM is considered essential to the implementation of climate adaptation in coastal settings, but it does provide added value in terms of mobilising stakeholders to engage with climate issues and contributes to an improved knowledge base (cross sectors and levels of governance) to facilitate implementation of climate adaptation. The Cork Harbour experience demonstrated how non-ICZM partnerships, in this instance a non-statutory entity, can act as local nodes for climate adaptation using a process that is replicable and achievable at other coastal settings. Such local nodes, if operating within a co-ordinated environment such as that provided by national level policy, strategy or framework could cumulatively make significant contribution to achieving national goals and obligations.

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References

- [1] K.M. Allen, Community-based disaster preparedness and climate adaptation: local capacity-building in the Philippines, *Disasters* 30 (1) (2006) 81–101.
- [2] J. Areizaga, M. Sanò, R. Medina, J. Juanes, A methodological approach to evaluate progress and public participation in ICZM: the case of the Cantabria Region, Spain, *Ocean Coast. Manag.* 59 (2012) 63–76.
- [3] K. Backstrand, Accountability of networked climate governance: the rise of transnational climate partnerships, *Glob. Environ. Polit.* 8 (3) (2008) 74–102.
- [4] A. Berghöfer, H. Wittmer, F. Rauschmayer, Stakeholder participation in ecosystem-based approaches to fisheries management: a synthesis from European research projects, *Mar. Policy* 32 (2) (2008) 243–253.
- [5] F. Berkes, D. Jolly, Adapting to climate change: social-ecological resilience in a Canadian Western Arctic community, *Conserv. Ecol.* 5 (2) (2001) 18.
- [6] L. Berrang-Ford, J.D. Ford, J. Paterson, Are we adapting to climate change? *Glob. Environ. Change* 21 (1) (2011) 25–33.
- [7] G.R. Biesbroek, R.J. Swart, T.R. Carter, C. Cowan, T. Henrichs, H. Mela, M. D. Morecroft, D. Rey, Europe adapts to climate change: comparing national adaptation strategies, *Glob. Environ. Change* 20 (3) (2011) 440–450.
- [8] V.R. Burkett, R.J. Nicholls, L. Fernandez, C.D. Woodroffe, Climate Change Impacts on Coastal Biodiversity. Available at: <http://ro.uow.edu.au/scipapers/217>, 2008.
- [9] J.G. Carter, Climate change adaptation in European cities, *Curr. Opin. Environ. Sustain.* 3 (3) (2011) 193–198.
- [10] L. Celliers, S. Rosendo, I. Coetzee, G. Daniels, Pathways of integrated coastal management from national policy to local implementation: enabling climate change adaptation, *Mar. Policy* 39 (2013) 72–86.
- [11] A. Charles, People, oceans and scale: governance, livelihoods and climate change adaptation in marine social-ecological systems, *Curr. Opin. Environ. Sustain.* 4 (3) (2012) 351–357.
- [12] Commission of the European Communities, White Paper – Adapting to Climate Change: Towards a European Framework for Action (COM(2009) 147 final), Commission of the European Communities, Brussels, 2009.
- [13] J.A.G. Cooper, V. Cummins, Coastal research and policy integration in north-west Europe. The COREPOINT project, *Mar. Policy* 33 (6) (2009) 869–870.
- [14] COREPOINT (2008) (Eds.), V. Cummins, P. Griffin, J. Gault, C. O'Mahony, D. O'Suilleabhain, Cork Harbour Integrated Management Strategy: 2008, Corepoint: Coastal Research and Policy Integration, EU Interreg IIIB project, 35 pp.
- [15] Cork County Council, Cork Harbour Study – Public Consultation Draft, Cork County Council, 2011, 310 pp.
- [16] V. Cummins, J. McKenna, The potential role of sustainability science in coastal zone management, *Ocean. Coast. Manag.* 53 (12) (2010) 796–804.
- [17] Department of Environment, Community and Local Government, National Climate Change Adaptation Framework, Department of Environment, Community and Local Government, Dublin, Ireland, 2012, 73 pp.
- [18] R.J.N. Devoy, Coastal vulnerability and the implications of sea-level rise for Ireland, *J. Coast. Res.* 24 (2) (2008) 325–341.
- [19] S. Dunne, J. Hanafin, P. Lynch, R. McGrath, E. Nishimura, P. Nolan, J. Venkata Ratnam, T. Semmler, C. Sweeney, S. Varghese, S. Wang, Ireland in a Warmer World – Scientific Predictions of the Irish Climate in the Twenty-first Century. Report Prepared for Sustainable Energy Ireland and the Environmental Protection Agency by Met Éireann and University College Dublin under EPA STRIVE Programme 2007–2013, Ref: 2001-CD-C4-M2, 2009, 119 pp.
- [20] B. Dyer, K. Millard, A generic framework for value management of environment data in the context of integrated coastal zone management, *Ocean. Coast. Manag.* 45 (1) (2002) 59–75.
- [21] J.P. Ellsworth, L.P. Hildebrand, E.A. Glover, Canada's atlantic coastal action program: a community-based approach to collective governance, *Ocean. Coast. Manag.* 36 (1–3) (1997) 121–142.
- [22] N.L. Engle, Adaptive capacity and its assessment, *Glob. Environ. Change* 21 (2) (2011) 647–656.
- [23] M. Falaleeva, C. O'Mahony, S. Gray, M. Desmond, J. Gault, V. Cummins, Towards climate adaptation and coastal governance in Ireland: integrated architecture for effective management? *Mar. Policy* 35 (6) (2011) 784–793.
- [24] M. Falaleeva, S.R.J. Gray, C. O'Mahony, J. Gault, Coastal Climate Adaptation in Ireland: Assessing Current Conditions and Enhancing the Capacity for Climate Resilience in Local Coastal Management. Climate Change Research Programme (CCRP) 2007–2013: Report Series No. 28, Environmental Protection Agency, Wexford, Ireland, 2013, 98 pp.
- [25] G. Farrell, Impact on coastal areas, in: E.K. Beatty (Ed.), Ireland at Risk, The Irish Academy of Engineering, Dublin, Ireland, 2007.
- [26] S. Fletcher, Influences on stakeholder representation in participatory coastal management programmes, *Ocean. Coast. Manag.* 50 (5–6) (2007) 314–328.
- [27] S. Fletcher, Stakeholder representation and the democratic basis of coastal partnerships in the UK, *Mar. Policy* 27 (3) (2003) 229–240.
- [28] F. Gagnon-Lebrun, S. Agrawala, Progress on Adaptation in Climate Change in

- Developed Countries: an Analysis of Broad Trends, OECD, Paris, ENV/EPOC/GSP(2006)1/FINAL, 2006.
- [29] J. Gault, V. Cummins, S. Gray, C. O'Mahony, A.M. O'Hagan, Developing Local Coastal Adaptation Strategies to Climate Change across North West Europe: How IMCORE is addressing the Challenges, IMPRINT, vol. 2, 2011, pp. 37–44.
- [30] GESAMP (IMO/FAO/UNESCO-OOC/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection), The Contributions of Science to Integrated Coastal Management. GESAMP Reports and Studies No. 61, 1996.
- [31] M.T. Gibbs, Resilience: what is it and what does it mean for marine policy-makers? *Mar. Policy* 33 (2) (2009) 322–331.
- [32] S.R.J. Gray, A.S. Gagnon, S.A. Gray, B. O'Dwyer, C. O'Mahony, D. Muir, R.J. N. Devoy, M. Falaleeva, J. Gault, Are coastal managers detecting the problem? Assessing stakeholder perception of climate vulnerability using Fuzzy Cognitive Mapping, *Ocean. Coast. Manag.* 94 (2014) 74–89.
- [33] K. Hilpert, F. Mannke, P. Schmidt-Thome, Towards Climate Change Adaptation in the Baltic Sea Region, Geological Survey of Finland, Espoo, 2007, 55 pp.
- [34] B.A. Human, A. Davies, Stakeholder consultation during the planning phase of scientific programs, *Mar. Policy* 34 (3) (2010) 645–654.
- [35] A. Hunt, P. Watkiss, Climate change impacts and adaptation in cities: a review of the literature, *Clim. Change* 104 (1) (2011) 13–49.
- [36] J.M. Jeffers, The Cork city flood of november 2009: lessons for flood risk management and climate change adaptation at the urban scale, *Ir. Geogr.* 44 (1) (2011) 61–80.
- [37] E.C.H. Keskitalo, Climate change adaptation in the United Kingdom: England and South-East England, in: L. Brännlund (Ed.), *Developing Adaptation Policy and Practice in Europe: Multi-level Governance of Climate Change*, Springer, Netherlands, Dordrecht, 2010, p. 376.
- [38] L. McDuff, D. Peel, M.G. Lloyd, Informing a framework for coastal planning on the island of Ireland, *Town Plan. Rev.* 84 (4) (2013) 419–440.
- [39] M.V. McGinnis, C.E. McGinnis, Adapting to climate impacts in California: the importance of civic science in local coastal planning, *Coast. Manag.* 39 (2011) 225–241.
- [40] J.S. McGloughlin, J. Sweeney, Multi-level climate policies in Ireland, *Ir. Geogr.* 44 (1) (2011) 137–150.
- [41] J. McKenna, A. Cooper, Sacred cows in coastal management: the need for a 'cheap and transitory' model, *Area* 38 (4) (2006) 421–431.
- [42] A. Meiner, Integrated maritime policy for the European Union – consolidating coastal and marine information to support maritime spatial planning, *J. Coast. Conserv.* 14 (2010) 1–11.
- [43] A. Misselhorn, P. Aggarwal, P. Ericksen, P. Gregory, L. Horn-Phathanothai, J. Ingram, K. Wiebe, A vision for attaining food security, *Curr. Opin. Environ. Sustain.* 4 (1) (2012) 7–17.
- [44] R.K.A. Morris, English nature's estuaries initiative: a review of its contribution to ICZM, *Ocean. Coast. Manag.* 51 (1) (2008) 25–42.
- [45] D. Muir, A.G. Dawson, A.S. Gagnon, C. O'Mahony, Vulnerability and adaptation to extreme coastal flooding: an example from the South Ford area, Scottish outer hebrides, in: *Proceedings of Coasts, Marine Structures and Breakwaters: from Sea to Shore-Meeting the Challenges of the Sea*, ICE Publishing, 18–20 September, Edinburgh, London.
- [46] R.J. Nicholls, P.P. Wong, V. Burkett, J. Codignotto, J. Hay, R. McLean, S. Ragoonaden, C. Woodroffe, Coastal Systems and Low-lying Areas, in: M. L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden, C.E. Janson (Eds.), *Climate Change Impacts, Adaptations and Vulnerability*, Cambridge University Press, London, UK, 2007, pp. 316–356 (Intergovernmental Panel on Climate Change, Working Group 2, Fourth Assessment Report).
- [47] B. O'Dwyer, S. Gray, J. Gault, N. Dwyer, Enabling climate adaptation in Ireland – Ireland's climate information platform, in: E. Gleeson, R. McGrath, M. Treanor (Eds.), *Ireland's Climate: the Road Ahead*, Met Éireann, Dublin, 2013, pp. 95–99.
- [48] A.M. O'Hagan, R.C. Ballinger, Implementing integrated coastal zone management in a national policy vacuum: local case studies from Ireland, *Ocean. Coast. Manag.* 53 (12) (2010) 750–759.
- [49] C. O'Mahony, J. Gault, V. Cummins, K. Kopke, D. O'Suilleabhain, Assessment of recreation activity and its application to integrated management and spatial planning for Cork Harbour, Ireland, *Mar. Policy* 33 (6) (2009) 930–937.
- [50] C. O'Mahony, A.M. O'Hagan, E. Meaney, A review of beach bye-law usage in supporting coastal management in Ireland, *Coast. Manag.* 40 (5) (2012) 461–483.
- [51] C. O'Mahony, K. Kopke, S. Twomey, A.M. O'Hagan, J. Gault, E. Farrell, Integrated Coastal Zone Management in Ireland – Meeting Water Framework Directive and Marine Strategy Framework Directive Targets for Ireland's Transitional and Coastal Waters through Implementation of Integrated Coastal Zone Management. Report prepared under contract for Sustainable Water Network (SWAN), 2014.
- [52] R.A. Pielke, G. Prins, S. Rayner, D. Sarewitz, Lifting the taboo on adaptation, *Nature* 445 (2007) 597–598.
- [53] B. Queffelec, V. Cummins, D. Bailly, Integrated management of marine biodiversity in Europe: perspectives from ICZM and the evolving EU Maritime Policy framework, *Mar. Policy* 33 (6) (2009) 871–877.
- [54] R.F.M. Sales, Vulnerability and adaptation of coastal communities to climate variability and sea-level rise: their implications for integrated coastal management in Cavite City, Philippines, *Ocean. Coast. Manag.* 52 (7) (2009) 395–404.
- [55] S. Serrao-Neumann, F. Crick, B. Harman, M. Sano, O. Sahin, R. van Staden, G. Schuch, S. Baum, D. Low Choy, Improving cross-sectoral climate change adaptation for coastal settlements: insights from South East Queensland, Australia, *Reg. Environ. Change* 14 (2) (2013) 489–500.
- [56] J. Shaw, C. Danese, L. Stocker, Spanning the boundary between climate science and coastal communities: opportunities and challenges, *Ocean. Coast. Manag.* 86 (2012) 80–87.
- [57] S. Stead, A comparative analysis of two forms of stakeholder participation in European aquaculture governance: self-regulation and integrated coastal zone management, in: T.S. Gray (Ed.), *Participation in Fisheries Governance*, Springer, Dordrecht, 2005, pp. 179–192.
- [58] R. Steijn, P. Czerniak, A. Volckaert, M. Ferreira, E. Devilee, T. Huizer, R. ter Hofstede, Integrated Coastal Zone Management: OURCOAST outcomes and lessons learned, Publications Office of the European Union, Luxembourg, 2012, 36 pp.
- [59] T.A. Stojanovic, I. Ball, R.C. Ballinger, G. Lymbery, W. Dodds, The role of research networks for science-policy collaboration in coastal areas, *Mar. Policy* 33 (6) (2009) 901–911.
- [60] T.A. Stojanovic, N. Barker, Improving governance through local Coastal Partnerships in the UK, *Geogr. J.* 174 (4) (2008) 344–360.
- [61] T.A. Stojanovic, R.C. Ballinger, C.S. Lalwani, Successful integrated coastal management: measuring it with research and contributing to wise practice, *Ocean. Coast. Manag.* 47 (5–6) (2004) 273–298.
- [62] T.A. Stojanovic, D.R. Green, G. Lymbery, Approaches to knowledge sharing and capacity building: the role of local information systems in marine and coastal management, *Ocean. Coast. Manag.* 53 (12) (2010) 805–815.
- [63] J. Sweeney, F. Albanito, A. Brereton, A. Caffarra, R. Charlton, A. Donnelly, R. Fealy, J. Fitzgerald, N. Holden, M. Jones, C. Murphy, Climate Change – Refining the Impacts for Ireland, STRIVE Report (2001-CD-C3-M1) ISBN: 978-1-84095-297-1, Technical Report, Environmental Protection Agency, Wexford, Ireland.
- [64] J. Tobey, P. Rubinoff, D. Robadue Jr., G. Ricci, R. Volk, J. Furlow, J. Anderson, Practicing Coastal adaptation to climate change: lessons from integrated coastal management, *Coast. Manag.* 38 (3) (2010) 317–335.
- [65] R.S.J. Tol, Adaptation and mitigation: trade-offs in substance and methods, *Environ. Sci. Policy* 8 (6) (2005) 572–578.
- [66] J. Tribbia, S.C. Moser, More than information: what coastal managers need to plan for climate change, *Environ. Sci. Policy* 11 (4) (2008) 315–328.
- [67] J.M. Veiga, The Collaboration Process Between Scientists and Authorities – Indicators and Guidelines to Support a Developing Working Relationship, Report Prepared as part of Innovative Management for Europe's Changing Coastal Resource (IMCORE), EU Interreg IVB project, 2011.
- [68] C. Vogel, S.C. Moser, R.E. Kasperson, G.D. Dabelko, Linking vulnerability, adaptation, and resilience science to practice: pathways, players, and partnerships, *Glob. Environ. Change* 17 (2007) 349–364.
- [69] E. Wilson, Adapting to climate change at the local level: the spatial planning response, *Local Environ.* 11 (6) (2006) 609–625.
- [70] K. Kopke, C. O'Mahony, Preparedness of key coastal and marine sectors in Ireland to adapt to climate change, *Marine Policy* 35 (6) (2011) 800–809.
- [71] R. Devoy, Implications of Accelerated Sea-Level Rise (ASLR) for Ireland, SURVAS Expert Workshop on European Vulnerability and Adaptation to impacts of Accelerated Sea-Level Rise (ASLR), SURVAS, Hamburg, Germany, 2000, p. 15.
- [72] B. Kelly and M. Stack (2009) Climate Change, Heritage and Tourism: Implications for Ireland's Coast and Inland Waterways. The Heritage Council of Ireland Series. An Chomhairle Oidhreachta/ the Heritage Council. ISBN 978-1-906304-06-5, 2009.
- [73] Z. Tang, S.D. Brody, C.E. Quinn, L. Chang, Wei T., Moving from agenda to action: evaluating local climate change action plans, *Journal of Environmental Planning and Management* 53 (1) (2010) 41–62.
- [74] E.L. Tompkins, E. Boyd, S. Nicholson-Cole, W.N. Adger, K. Weatherhead, N. W. Arnell, Observed adaptation to climate change: UK evidence of transition to a well-adapting society? *Global Environmental Change* 20 (2010) 627–635, <http://dx.doi.org/10.1016/j.gloenvcha.2010.05.001>.
- [75] CIRCLE2 (2013) Adaptation Inspiration Book- 22 Implemented cases of local climate change adaptation to European citizens. 2013. Climate Impact Research and Response Coordination for a Larger Europe (CIRCLE 2). Edited by Pijnappels, M and Dietl, P. Carlisle, M.A., Green, D.G. and W. Ritchie (2008) COREPOINT Expert Couplets and Case Studies: Descriptions of physical, ecological and socio-economic context and of area-specific COREPOINT activities. University of Aberdeen and COREPOINT, 92pp.
- [76] J. McKenna, A. Cooper, A.M. O'Hagan, Managing by principle: A critical analysis of the European principles of Integrated Coastal Zone Management (ICZM)@ 32 (2008) 941–955.
- [77] R. Ballinger, V. Cummins, A.M. O'Hagan, M. Philippe, The Point of COREPOINT: Improving Capacity for Integrated Coastal Zone Management in North West Europe, Corepoint, Cork, 2008, p. 81.