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Abstract	Coastal zones are not only some of the most populous areas of the planet, but are also some of the most hazardous, facing a wide range of hazards alongside environmental degradation and increasing development pressures. The inter-connectivity of coastal systems, both human and physical, provides particular challenges to risk management, especially in the context of the complex governance regimes of such areas, where contrasting land and marine institutions and policies come together. After a brief overview of traditional approaches to coastal risk management, the chapter focuses on the role and potential of integrated planning and management in facilitating a more balanced and sustainable approach to coastal risk management. Within such discussions the value and potential of Integrated Coastal Zone Management (ICZM) alongside other integrated and spatial planning approaches is explored. ICZM has frequently been endorsed as a means of managing competing resources and 'wicked' (multi-dimensional) coastal problems, and so potentially has a valuable role to play. Drawing on a range of examples, particularly from European experiences, the chapter evaluates the extent to which ICZM contributes to coastal risk management. Whilst not a panacea, the chapter concludes that ICZM may be able to facilitate the development of more adaptable and palatable approaches for local communities, much needed in the context of coastal climate change impacts.	

Chapter 20
On the Edge: Coastal Governance and Risk

Rhoda Ballinger

20.1 Introduction. Coastal Risks and Needs

Coastal zones require special consideration. Loosely defined as those zones at the interface between marine and terrestrial systems, not only in terms of natural biological and physical processes, but also in terms of their governance, they pose unique and complex issues for natural risk management. Such zones are also some of the most populous areas of the planet (Mee 2010), where most megacities are located (Nicholls 1995; Grimmond 2011) and population densities average at least three times the global average (Small and Nicholls 2003). Many areas face multiple challenges, being susceptible to hazards such as storms, flooding, erosion and tsunamis as well as increasing environmental degradation and development pressures, including land subsidence, coastal habitat degradation, fisheries decline and pollution issues (Charlier 1989; Li 2003; Hadley 2009). Alongside this, the world's coast has lost much of its 'natural' coastal defence capacity, with 50 % of wetlands having disappeared over the last century due to human interference (Creel 2003). This has left high concentrations of people and assets at risk, particularly in deltas and other low lying coastal areas (McGranahan et al. 2007).

Such risks are also likely to rise as global population continues to grow and climate change exacerbates risks. Estimates for population growth vary, but some suggest the number of people living within 60 miles of coastlines will increase by about 35 % by 2025 compared with 1995 figures. Climate change, inducing a range of secondary impacts, including increased flooding, erosion, salinity changes and degradation of habitats, is likely to expose billions more worldwide to such risks (Creel 2003). Within South East Asia and the Pacific alone millions are likely to become sea level refugees by the end of the century (Wetzel et al. 2012). Whilst

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there remain huge uncertainties regarding climate change impacts and associated sea level rise predictions, such implications require a detailed, critical review of coastal governance and adaptability.

The chapter commences by reviewing traditional approaches to the management of coastal hazards before considering recent advances towards a more integrated approach to the management of coastal risks. The rest of the chapter focuses on the challenges which the coastal zone poses, including those associated with building and maintaining coastal resilience within the context of significant environmental including climate change. Within such discussions, the potential of Integrated Coastal Zone Management (ICZM) as a new governance approach is considered.

Throughout the chapter, there is focus on North West Europe where the author has considerable first-hand experience. Lessons from this region should be relevant elsewhere as much of the coast, particularly around the southern North Sea, is low lying, densely populated, and faces a range of coastal hazards. Also, whilst the level of centralisation and formality of arrangements associated with coastal protection varies from country to country (O'Connor et al. 2010), the region includes some of the most advanced coastal defence practice in the world. On top of this, public expenditure dedicated to coast protection has risen significantly in recent decades and is projected to escalate over the next half century (EUROSION 2004). This is fuelling debate over the future of hard defences and the need for consideration of other adaptation options and governance arrangements, including the role of ICZM.

20.2 Changing Approaches to Managing Coastal Risk

20.2.1 Traditional Approaches

Traditionally, coastal communities across North West Europe have battled 'against' nature, constructing hard coastal defences, including sea walls and even tidal barriers, along highly populated low-lying shores, particularly in the southern North Sea region. This almost unquestioning reliance on technological fixes (Mee 2010) was perpetuated after the 1953 North Sea storm event which resulted in a significant death toll, particularly in the Netherlands (Hillen et al. 2010).

Consequently, the Development – Defend cycle has been a feature of much decision-making until recently (Fig. 20.1) (Ballinger et al. 2002; Milligan and O'Riordan 2007). This has been perpetuated by local populations who have expected 'hold the line' solutions (Milligan and O'Riordan 2007), feeling safer living behind hard, clearly visible sea walls. Local politicians, frequently not well versed in coastal processes and engineering, have appeased their electorate, taking short-term decisions to sanction schemes. However, as Fig. 20.1 shows, such decisions have often provided impetus for further development on land behind defences, sometimes of inappropriate type and density. In turn, this has left populations and assets vulnerable, leading to further pressure for even higher levels of protection and sometimes even more defences.

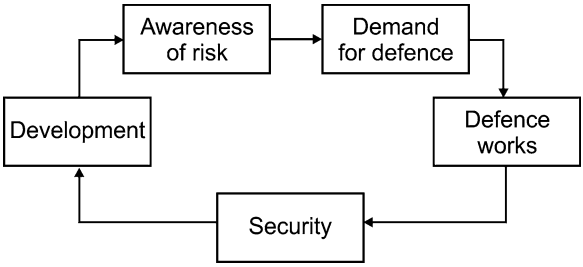

Fig. 20.1 The development–defend cycle

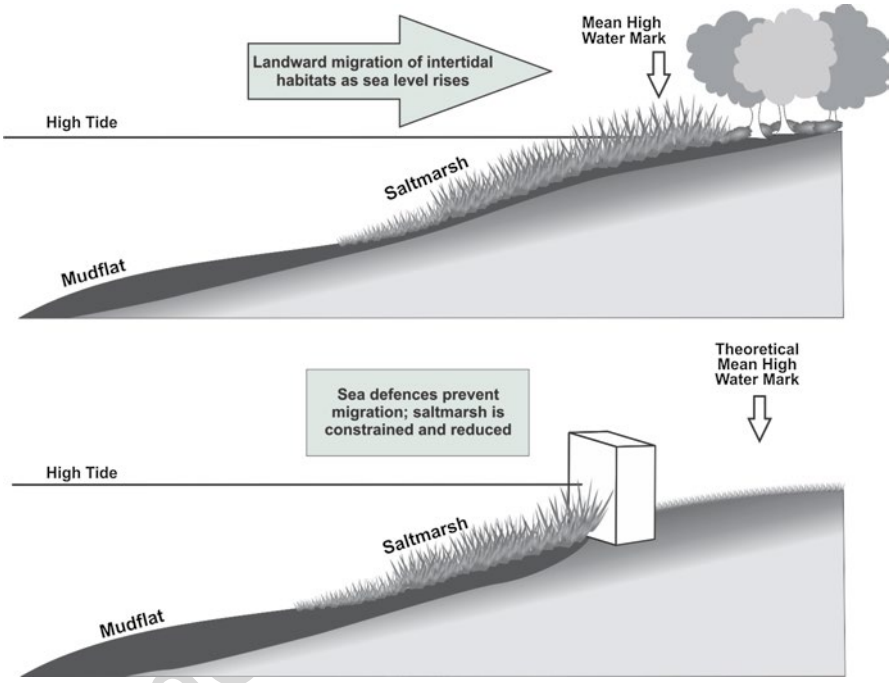

Fig. 20.2 Coastal squeeze

Driven by short-term, local needs, and based on the priorities of individual authorities, traditional hard engineering approaches have frequently been beset with problems. Parochialism has often exacerbated erosion issues down-drift of coastal protection schemes and other structures, as exemplified by the IJmuiden – Holland and Zeebrugge coasts (EUROSION 2004). There have also been issues associated with erosion of coastal intertidal habitats along low-lying coasts, particularly in estuarine areas where such habitats are frequently of high conservation value. As Fig. 20.2 shows, coastal squeeze occurs when intertidal habitats no longer can migrate landwards naturally and are 'squeezed' against fixed hard defences.

This leads to their subsequent degradation and erosion (Doody 2004), a significant concern given the EC Birds (2009/147/EC) and Habitats (92/43/EEC) Directives. Whilst these require the conservation interest and integrity of Natura 2,000 coastal sites to be maintained, the European Commission and European Court of Justice have yet to decide definitively whether this applies in the context of climate change and accelerated sea level rise. Issues have been compounded by an existing legacy of coastal infrastructure, including ports and harbours, promenades and even military defences, which have influenced coastal sediment budgets and processes, and, consequently, vulnerability to coastal hazards. Indeed, the re-allocation of some existing infrastructure, notably promenades, and in the case of Jersey former World War II military defences, to coastal defence usage, has also been particularly problematic as these were not designed with a full knowledge and understanding of coastal processes.

Exacerbating these issues, decision-making structures associated with the control of coastal hazards have traditionally been overly complex as legislation has often evolved piecemeal, reacting to individual hazard events. With no generally accepted definition of the coastal zone, fragmented institutional frameworks for dealing with coastal hazards have often developed, sometimes even with separate streams of legislation developing for different hazards, notably flooding and erosion. This has been the case in England and Wales (Pettit 1999), where, until recently, there was little national overview of coastal hazards and their management. At local levels, such complexity and the lack of a national framework, has tended to perpetuate the dominance of local, 'reactive' hard engineering responses.

20.2.2 Move Towards Risk Management

Over the last few decades there has been a change in approach, fashioned by a gradual realisation that hard engineering solutions provide only one option and may only offer limited, short-term, recurring and expensive protection (Charlier 1989). Globally, focus has turned to a wider range of responses, particularly in the context of climate change, which can also help provide other benefits, particularly for recreation and conservation. The register of extreme flood events across Europe over the last 10 years has certainly forced many governments to reconsider their positions. Even in the Netherlands, where flood protection is essential to two-thirds of the country and nine million people (Transport and Water Management Inspectorate 2006), there is incipient concern and public debate about flood risks in the wake of a recent national report which suggests risks from flooding in some locations far exceed that from other human-induced hazards (Klijn et al. 2008). Whilst the Netherlands largely holds on to its existing protectionist stance, other countries in the region, notably UK and France, have embraced a risk-based paradigm and promoted this through relevant measures at a national level. Realising that

it is not possible to prevent all coastal flooding and erosion, a wide range of actions are suggested to manage risks and reduce impacts. Common elements of risk-based approaches include the need to:

- understand the nature of the risks, including their temporal and spatial extents
- communicate the risks appropriately with stakeholders including infrastructure providers
- take appropriate adaptive actions to reduce risks, damage and disruption

The National Flood and Coastal Erosion Risk Management Strategy for England (Environment Agency 2010) is typical, in which the onus on risk minimisation goes well beyond the province of the engineering community, forcing new shared, ways of decision-making, challenging existing working approaches and governance structures.

In terms of taking appropriate actions to reduce risk, Table 20.1 summarises the five generic shoreline policy options available to coastal managers and relates these to the three adaptation response strategies proposed by the Intergovernmental Panel on Climate Change's Coastal Zone Management experts (Gilbert and Vellinga 2005). These options are well recognised in Europe (see for example, MESSINA 2006 and EUROSION 2004) where they have been suggested as options for Coastal Sediment Management Plans, regional plans based on units defined by sediment cell boundaries (op. cit.). Similar options however, have been pioneered by and are already the cornerstone of the regional shoreline management plan process in England and Wales. Here, these non-statutory plans provide a strategic approach, supplying generic policies for the next hundred years for each management unit. As such, they direct local planning decisions and investments in coastal defence schemes. Whilst the realisation of these policies at local levels relies on appropriate funding, land availability and changing local priorities (Environment Agency 2012), these plans are becoming recognised as an important vehicle for the management of coastal risk, fostering engagement with a wider range of interests than merely the engineering community.

Table 20.1 also shows the extent to which the engineering and spatial planning communities need to be involved in decision-making related to each option. Clearly, spatial planning has a critical role as a gatekeeper of coastal change (Taussik 2000), preventing or restricting development in areas at potential risk. As indicated in the table, planning's input to ensure the sustainability of the 'no active' or 'limited intervention' options is essential. Its full involvement in retreat/managed realignment decisions, given the need to prevent development in areas at risk, is also vital. Whilst zonation of the coast in England and Wales has occurred within the shoreline management process and national planning guidance has been issued by the authorities on flood risk and coastal climate change adaptation, the non-statutory nature of the plans and indeed the guidance, threaten the sustainability and interpretation of the policies at local levels.

Indeed, at this level, where there are increasingly limited budgets and continued local development pressures and community concerns, some of the more unsavoury policies are already being challenged, sometimes unravelling deep-seated and protracted local coastal conflicts. Ballinger et al. (2002) and others (Greiving et al.

t1.1 **Table 20.1** Generic shoreline policy and adaptation options

t1.2 Strategic shoreline policy		IPPC response strategy involved	Sectoral involvement	
t1.3 Title	Description		Engineering	Planning
t1.4 Do nothing/no active intervention	No planned investment for flood or erosion defence	**Accommodation**: Continued occupancy and use of vulnerable areas	×	✓
t1.6	*This allows natural processes to 'take their course' (irrespective of whether or not an artificial defence previously existed)*	*Requires advanced planning and accepting loss of some coastal value*		
t1.9 Hold the line	To maintain the current shoreline position.	**Protection**: Defending vulnerable areas	✓	✓
t1.10	*This will involve maintaining or improving standards of protection. It could include a variety of approaches including improvements to existing artificial defences and undertaking works in front of existing defences.*	*Includes population centres, economic activities and natural resources*		
t1.16 Advance the line	New defences built seaward of current shoreline	**Protection**: as above	✓	✓
t1.18	*In practice the use of this is limited although there are opportunities associated with land reclamation, surfing and renewable energy generation.*			

t1.22 t1.23 t1.24	Managed realignment	Allowing natural shoreline movement, with some form of intervention, managing and directing the process in certain areas	**Retreat**: Abandonment of land and structures in vulnerable areas	✓	✓
t1.25 t1.26		*Provides opportunities for nature conservation*	*Involves resettlement of inhabitants*		
t1.27 t1.28	Limited intervention	Reducing risks by working with natural coastal processes and change.	**Accommodation/Protection**: as above	(✓)	(✓)
t1.29		*Includes measures attempting to:*			
t1.30 t1.31 t1.32		*Reduce rather than eliminate coastal erosion and cliff recession (e.g. nourishments)*			
t1.33 t1.34 t1.35		*Address public safety (e.g. flood warning systems, dune and forest maintenance, coastal building restrictions)*			

t1.36 Based on Environment Agency (2012), MESSINA (2004), and Gilbert and Vellinga (2005)

2006) have noted the rather disappointing and overestimated involvement of spatial planning in risk management across UK and many other countries of Europe, attributing this to a range of factors including the inadequate training and understanding of risk by planners, as well as the mere advisory nature of risk assessment and associated advice. However, there are some countries and regions where a stronger legal framework has provided a more effective approach. Article 8(2) of the ICZM Protocol to the Barcelona Convention states that contracting parties (i.e. Mediterranean countries) should establish a zone where no construction is allowed. This is not to be less than 100 m wide and should take account of climate change and natural risks. Similarly, the *Loi Littoral* in France demands a shoreline exclusion zone of 100 m (la bande littorale) where no construction is allowed (littorale non constructible) (EUROSION 2004). Over the last decade, this has been supplemented by Natural Risk Prevention Plans (Plan de Prévention des Risques) to control development within various risk zones, including coastal areas (Deboubt 2010). These plans are being prepared by county prefectures in consultation with local councils producing detailed spatial plans.

Whilst not specifically coastal, the Floods Directive (2007/60/EC) is promoting a risk-based rather than a flood management approach to both fluvial and coastal flooding. It is also encouraging a wider perspective and evaluation of human factors through a well prescribed statutory process, including mapping of potential flood extent, assets and humans at risk. It also requires adequate and coordinated measures to reduce areas at significant risk. Whilst some question the extent to which it will translate into the management of people, property and other human assets rather than flood control (Klijn et al. 2008), it certainly has been a significant catalyst for addressing coastal risk in some areas, such as Northern Ireland, where traditionally coastal flood and erosion have previously been low government concerns (Dodds et al. 2010). Whilst not explicitly related to coastal risk, the European Commission has recently devoted considerable effort into addressing and incorporating climate change into much of its legislation, particularly through it guidance on adaptation to climate change in water management and its subsequent 'A Blueprint to Safeguard Europe's Water Resources' (European Commission 2012). Similarly, the European Water Framework Directive (2000/60/EC) and the Marine Strategy Framework Directive (2008/56/EC), whilst not dedicated to risk management, provide opportunities for framing sustainable erosion and flood risk management practices within wider marine spatial and river basin planning systems.

20.3 Challenges for the Management of Coastal Risk

Despite moves towards a more risk-based management approach, a number of significant challenges hamper the management of coastal risks. These stem both from the unique characteristics of coasts and the distinctive institutional framework which has evolved to deal with coastal matters. The following paragraphs summarise those relevant to North West Europe.

The inter-connectivity of human, biological and physical coastal systems with associated complex feedback mechanisms provides particular challenges to risk management, especially in the context of the complex governance regimes of such areas, where contrasting land and marine institutions and policies come together. Indeed, as Moser et al. (2012) contend, coastal issues are often 'wicked' problems, resulting from this systemic complexity. They defy complete definition or understanding, which in turn negates against any simple solutions, given the limited time, discipline and spatial frames under which most coastal managers operate. Whilst many have called for a systems view to underpin coastal management (for example, van der Weide 1993) and associated modelling processes (Nicholls and Cazenave 2010), there is limited embedding of such systems into practice, albeit there have been some important pilots undertaken in Europe over the last few years to demonstrate the value of a 'systems approach' (Reis et al. in press).

There are challenges resulting from the complexity of physical systems in coastal areas for coastal risk management, particularly given land-sea and catchment sediment flows and the nature of these dynamic and long term processes (Pethick 2001). Aspects of scale are particularly complex, with much debate and emerging evidence linking global and local processes, particularly in the context of storm incidence. This is well exemplified by a recent analysis of the role of the global circulation, notably the North Atlantic Oscillation, on storm tracks and severity along the coasts of south Wales (Phillips and Crisp 2010).

However, management continues, hampered by the limited knowledge and understanding of such processes (McFadden 2007), often compounded by inadequate monitoring systems and associated data. Good monitoring practice is patchy across Europe. Whilst the MESSINA project found that, in some parts, such as in England, the Netherlands and German Landers, LIDAR and other advanced coastal monitoring systems are regularly, routinely and comprehensively employed, in other countries, such as Ireland and France, coastal monitoring is confined to specific locations or is linked to experimental research projects (MESSINA 2006). Limited knowledge and understanding, however, are much more prevalent across Europe. For example, a recent European report revealed the limited investigation of coastal erosion and processes within many EIAs for projects where such matters should have received more in depth study (National Institute for Coastal and Marine Management of the Netherlands 2004).

Issues associated with poor understanding, monitoring and science give rise to high levels of uncertainty. These, in turn, may make management decisions harder to justify to communities who may expect 'simple' answers and solutions. This may be particularly an issue when unsavoury adaptation options are under consideration, involving conflicts for space in already congested coastal space and/or high levels of expenditure within budgets that are already under strain. Clearly, uncertainties abound when climate change and its associated secondary impacts, including accelerated sea level rise and increased flooding, are considered. Communities not even currently living on the coast are likely to have to engage with such debate too as natural systems and associated habitats attempt to migrate landwards (Pethick 2001), calling into question approaches to risk communication and associated science translation (van Aalst et al. 2008).

There are also a multitude of challenges posed by the human system in coastal areas, which suggest that good governance and integrated policy making and implementation may be more difficult to achieve than elsewhere. This is particularly true given the complexity of property and other rights in the coastal zone as well as issues of changing access and distribution of resources, risk and social capital linked associated with coastal adaptation (Dolan and Walker 2006). Whilst some authors have highlighted the need to address economic issues (Cheong 2011) and called for holistic coastal resource assessment (Turner 2000), including economic and social aspects/consequences (O'Riordan et al. 2008) in relation to coastal risk, such matters are rarely adequately addressed. With the exception of the procedures in place in England, assessment of costs and benefits of coastal defence options at local, scheme and regional levels is rarely done systematically (MESSINA 2006). This is despite the considerable coastal defence expenditure in countries such as the Netherlands where between 30 and 40 millions Euros is annually devoted to beach and foreshore nourishment (op. cit.).

Of all the aspects of the human system, however, institutional and associated governance issues remain the most difficult challenge. There is no harmonisation of legislation on coastal erosion or flooding measures across the EU and so organisational structures vary from State to State. Generally, there are several tiers of administration involved, including local, regional and national bodies (Ballinger et al. 2008). Responsibilities are further frequently divided between bodies with off and onshore remits. Whilst the former tend to take a long term and more strategic, often national view, generally the latter have contrasting local and shorter-term priorities (O'Hagan and Ballinger 2010). In relation to the terrestrial environment, local government bodies dominate, taking key decisions relating to specific local coastal defence schemes and spatial planning. In contrast, Central Government oversees national offshore concerns such as shipping and renewable energy generation and, in the context of coastal defence, provides the steer for longer-term monitoring and some funding for local projects. The complexity of jurisdictions is particularly apparent in estuary areas, where boundaries between local administrations occur. This is the case in the Severn Estuary where recent devolutionary processes have led to a burgeoning of bodies with coastal interests, as government agencies and other bodies are duplicated on either side of the English-Welsh border (Fig. 20.3).

Government responsibilities in most countries are generally fragmented and are sectorally or issue-based, creating potential issues for engendering a more holistic approach to the management of coastal risks. The piecemeal evolution of legislation over decades in reaction to specific concerns (Ballinger 1999), has resulted in the delivery of functions and services being divided amongst Government departments and agencies (op. cit.). This has led to the perpetuation of a silo mentality as sectors and associated administrations work in relative isolation (Ballinger et al. 2002). Given these narrow windows of decision making, there is a possibility that 'win – win' scenarios remain unrecognised and future adaptation options are overlooked, particularly planned retreat. This has been the case in Australia, where Abel et al. (2011) suggest that a legacy of former planning decisions, development pressures and liability laws has 'squeezed out' managed retreat in favour of development. In North

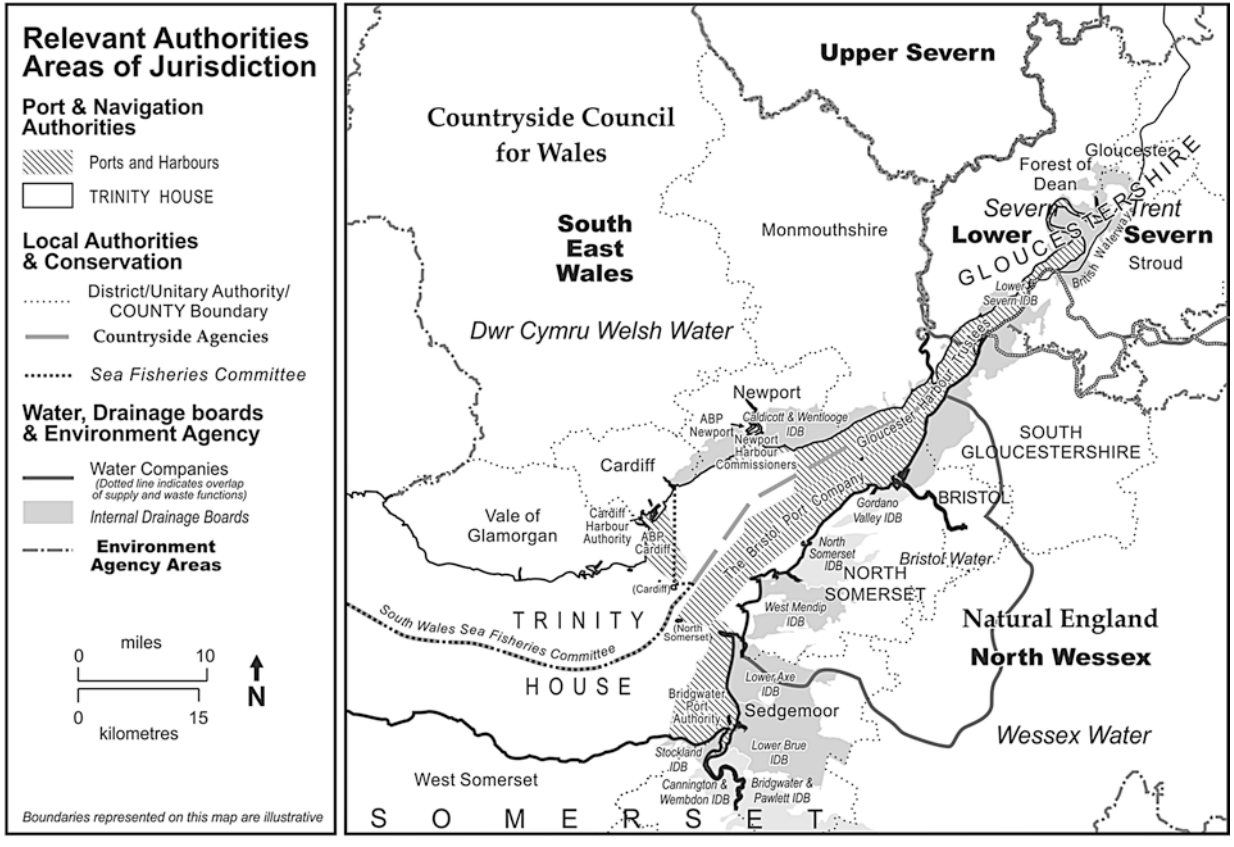

Fig. 20.3 Severn estuary bodies

West Europe, the plethora of laws, interests and sectors, alongside the lack of any overarching framework for resolving issues (Ballinger et al. 2008) inevitably results in conflicts between sectors and incompatibilities between coastal uses, as well as inefficiencies and short-term horizons. Coastal defence decisions and associated financing of coastal defence schemes 'compete' with those from other sectors. Indeed, the complexity of legislation and the lack of a clear hierarchy of coastal management objectives are frequent bugbears of practitioners. Whilst some recent European legislation, notably the Habitats Directive (92/43/EEC) and Water Framework Directive (2000/60/EC), does, however, demand a more coordinated implementation by competent authorities, there remains confusion related to the additional bureaucracies and plans brought about such legislation, superimposed on an already complex system (Ballinger and Stojanovic 2010).

In spite of some moves towards more integrated management approaches, through the shoreline management processes described above, the sectoral and somewhat artificial division of responsibilities between coast protection, sea defence and planning remains a significant impediment to fully integrated and sustainable coastal risk management (Ballinger et al. 2002). Problems associated with this are well documented by academics and policy makers for the UK (See for example: House of Commons Select Committee on Agriculture 1998; Pettit 1999) who point out that implications include inappropriate local government departmental structures and the associated, limited liaison between planners and engineers as well as a tendency to narrow, technocentric approaches (Ballinger et al. 2002). O'Hagan and Ballinger (2010) highlight a similar situation in the Republic of Ireland, illustrating this by reference to one of the councils in which the planning unit was, until recently, totally unaware of the council's committee on coastal erosion, even though both were housed in the same building. As O'Connor et al. (2010) note, with no national shoreline management policy, management tends to be reactive, responding to local demands, politics and economics. Given the sectoral fragmentation of responsibilities this becomes potentially even more problematic. Across Europe, the Floods Directive 2007/60/EC, referred to earlier, has potential to perpetuate a fragmented approach to coastal hazards, as coastal flood risk management rather than coastal flood and erosion risk management becomes targeted.

On top of these institutional issues, there are complex socio-economic considerations to address. As note above, climate change is forcing some difficult and sometimes unsavoury decisions (Lowry 2002) as some small coastal communities living in vulnerable locations may become untenable and may need to relocate. The economics of traditional coastal engineering approaches may be no longer valid in such cases forcing a new type of 'coastal squeeze' as coastal defence budgets tighten associated with the economic slow down and ever increasing competition between local government budget streams. The Wales Audit Office (2009) has stated that funding would need to increase threefold just to manage existing assets over the next 25 years. Such issues test coastal governance systems to their limit and pose questions of accountability, social justice, compensation and associated rights,

much debated in the academic literature (see for example, Tompkins et al 2008; Cooper and McKenna 2008). These include questions not only over how to balance private interests and the common good but also about how to balance national and local interests (Stallworthy 2006). Within such discussions, there is a gradual recognition that public financial responsibility for coastal risk should be limited and that there needs to be a less piecemeal and more accountable approach to public intervention (EUROSION 2004).

Matters are coming to a head as policies for local areas, taking on board economic issues and climate change, advocate the withdrawal or non-maintenance of sea defences and managed realignment. Whilst recent European reports have highlighted the requirement for expropriation or compensation measures to comply with EC competition regulations (Bucx 2010; EUROSION 2004), such mechanisms are not uniformly in place across Europe. Whilst French Law facilitates expropriation of assets threatened by coastal natural hazards under the *Loi Barnier* (op. cit.), the situation differs in the UK. The recent Flood and Water Management Act 2010 redefines coast protection to include anything undertaken to maintain or restore natural processes and 'passive inaction that allows sea defences to be breached naturally would seem to be legitimate, provided that the authorities act reasonably' (Gibson 2011a). However, as authorities only having statutory duties to pay 'compensation for loss or disturbance due to the exercise of their powers' if their conduct could be deemed as nuisance or negligence in common law in terms of coast protection (Gibson 2011b), there is no compensation mechanism (Defra 2009). With fundamental human rights incorporated into UK law and well-being powers provided to Local Government under the Local Government Act 2000, however, there still remains much confusion about public liability, compensation and ethical considerations.

Faced with uncertainty on compensation, community action has escalated (Milligan and O'Riordan 2007). This has been compounded by community disquiet about perceived inadequate consultation on shoreline management plans and concern that birds are fairing better than humans under the provisions of the European Habitats Directive in parts of the UK. Here, Central Government has made significant efforts to engage with all this, exploring and promoting new coastal adaptation and funding options for local communities through its recent £11 million Coastal Pathfinder Programme (Defra 2012), but, this has not, as yet, resulted in any major changes in Government policy or strategy.

20.4 ICZM: A New Governance Approach

Given the well recognised failings of existing institutional structures in coastal areas, it has been suggested that ICZM may be the answer. ICZM has been purported to be able to provide a framework for managing competing resources and tackle 'wicked,' multi-dimensional coastal problems including climate change adaptation (Vellinga and Klein 1993).

374 This section explores the role and potential of integrated planning and management
375 in facilitating a more balanced and sustainable approach to the management of
376 coastal risks, focusing on Integrated Coastal Zone Management (ICZM), defined as:

377 > a dynamic process in which a coordinated strategy is developed and updated for the allocation
378 > of environmental, social, cultural and institutional resources to achieve the conservation
379 > and sustainable multiple use of the coastal zone. (Sorensen 1993)

380 ### *20.4.1 ICZM Development*

381 Whilst early attempts at ICZM date back several decades to initiatives such as the
382 US 1972 Coastal Zone Management Act, it was the international prescriptions of
383 the subsequent decades, which brought ICZM centre-stage and resulted in its global
384 support by UN agencies, the World Bank and others (Cicin-Sain and Knecht 1998;
385 WWF 1998). All proposed ICZM as a means of delivering sustainable development
386 for coastal areas, helping facilitate multi-sectoral development and resolution of
387 coastal conflicts alongside attempts to protect coastal habitats and coastal system
388 integrity (Thia-Eng 1993). A range of tools were put forward, including many
389 directly relevant to the management of coastal risk, including environmental impact
390 assessment and information management. However, unlike coastal defence
391 management at the time, ICZM encouraged states to manage the coastal zone and
392 its watershed as an integral, single unit and to encompass all uses and users of the
393 coastal zone within an integrated framework.
394 As Cicin-Sain and Knecht (1998) argued, ICZM represented a 'new paradigm of
395 management for managers and a new way of thinking,' challenging existing man-
396 agement approaches, legal systems and administrative arrangements, particularly
397 those being sectoral, discipline or problem-based. Within this new approach 'inte-
398 gration' has been viewed as a central concept with various dimensions of integration
399 having been categorised (op. cit.). These include:

400 - intersectoral integration – amongst different coastal sectors;
401 - intergovernmental integration – amongst levels of government;,
402 - spatial integration – including land–ocean interaction;
403 - international integration – for transboundary issues; and
404 - science–management integration – between disciplines and between science and
405 management/policy.

406 Driven largely by environmental problems, including depletion of resources, pol-
407 lution and ecosystem damage, 380 ICZM efforts had been established by 2000
408 (Sorensen 2002). However, it was not until 2002, that the European Parliament and
409 the Council adopted a Recommendation on Integrated Coastal Zone Management
410 (ICZM) (European Parliament and Council 2002). Recognising that there was
411 already significant ICZM practice at local levels across already, the Recommendation,
412 a non-binding policy document, defined principles which together, it was suggested,

t2.1 **Table 20.2** The European
t2.2 ICM principles

Broad holistic approach	t2.3
Long-term perspective	t2.4
Local specificity	t2.5
Working with natural processes	t2.6
Adaptive management	t2.7
A combination of instruments	t2.8
Supportandinvolvementofallstakeholders-	t2.9
Participatory approach	t2.10

would help deliver better coastal governance (Table 20.2). It also sought to encourage rather than require European Member States to develop national strategies, based on the common principles and following national audits of coastal governance and associated institutional arrangements. Whilst there was little prescription in terms of the nature of the national strategies, the use of the principles has helped fashion some sort of European approach to ICZM (O'Hagan and Ballinger 2009). There have been calls for the principles to be clarified and prioritised (op. cit. and Ballinger et al. 2010). However, a preoccupation with developing a European Integrated Maritime Policy and associated Maritime Spatial Planning by DG MARE left ICZM policy development in Europe in limbo for some time. However, recently there has been a review of the ICZM Recommendation and an associated Impact Assessment has been conducted, investigating the economic, social and environmental consequences of a further initiative which is likely to include future actions on maritime spatial planning. There, has also been European funding support for numerous short-term ICZM projects, but these have tended to perpetuate the short term, project-based nature of ICZM efforts across the region (Shipman and Stojanovic 2007).

20.4.2 ICZM Performance and the Management of Coastal Risk

Whilst ICZM could be considered to be still in its early stages within Europe, there is considerable evidence which suggests that ICZM can make a considerable contribution to the management of coastal risk. Clearly the ICZM principles are relevant with some, notably 'working with natural processes,' 'adaptive management', and 'the long term perspective' closely aligned to the needs of coastal risk management. Encapsulated within the first of these, for example, is a need to work within the carrying capacities and limits of coastal ecosystems and natural physical systems: within the second, the principle suggests adjustment to management should occur with increased knowledge and understanding of problems, implying the need for sound scientific evidence to underpin coastal management decisions. Similarly, the long-term perspective principle, with its links to the precautionary principle, has clear ramifications for the management of coastal risk and

associated coastal defence decisions, although as Mee (2000) points out there are difficulties associated local ICZM projects making meaningful long-term priorities, given their limit remit and perspective.

Whilst there is much 'common sense' in the ICZM principles, it could be suggested that they are merely a repackaging of many of the principles of good environmental governance, commonly used in other spheres of environmental management. Their detailed interpretation at an operational level within an ICZM context has also been problematic and has led to much debated in the academic literature (for example, Cooper and McKenna 2008; McKenna and Cooper 2006; Ballinger et al. 2010). Even the widely accepted principle of 'working with natural processes, Cooper and McKenna (2008) note can be interpreted in various ways according to the time frame adopted. There are also problems of scale with a need for reconciliation between the need for 'local specificity' on the one hand and the need to take a 'broad approach' on the other (Ballinger et al. 2010). The participatory principle has also been criticised for its promotion of bottom-up' 'voluntary, powerless, under-funded and non-sustainable' approaches (McKenna and Cooper 2006) even though some evidence would suggest that some local coastal partnerships in the UK, whilst struggling with limited resources, have much to deliver (Stojanovic and Barker 2008).

In terms of other aspects of ICZM, Table 20.3 summarises the contribution of ICZM to addressing some of the key challenges currently facing the management of coastal risk, described in the previous section. Clearly, there is potential for ICZM to help alleviate some of these. ICZM can, for example, provide a neutral platform to bring together stakeholders from many backgrounds, disciplines and institutions to discuss coastal issues. This can build shared responsibility and understanding as well as fostering trust and respect. In turn this may and sometimes does lead to the 'win-win' situations, so much needed in the management of coastal risk. This is well demonstrated by the practical experiences of the Severn Estuary Partnership. This ICZM programme has provided multiple benefits over the last couple of decades (Ballinger and Stojanovic 2010), developing overarching estuary-wide policies to inform sectoral policy development. The Partnership has also provided a neutral platform for debate of coastal issues through regular multi-stakeholder engagement meetings including annual forums as well as providing significant assistance with the public consultation process on the recent shoreline management plan for the estuary. Whilst many ICZM efforts have been criticised for their limited linkage with their science base (McFadden 2007; Bille 2007; Mee 2010), the Partnership, through its close links with Cardiff University, has managed to address this. As well as science-based outputs, including a State of the Severn Estuary, associated report cards and education materials, have informed a range of audiences of the importance and characteristics of the estuary (Severn Estuary Partnership 2011), a science-policy forum has been established to address coastal adaptation matters for the whole estuary.

Whilst ICZM might appear like the panacea for coastal areas and indeed for the management of coastal risk, it frequently has not delivered as much as promised. However, there are some local success stories and achievements, particularly at

t3.1 **Table 20.3** The contribution of ICM to addressing key coastal risk management challenges

t3.2 Challenge	ICM's contribution	
t3.3 t3.4 t3.5 t3.6 Inter-connectivity of human, biological and physical coastal systems	Limited/minimal but with significant potential	ICM programmes and principles recognise this but ICM's contribution in practice is limited due to resource issues
t3.7 t3.8 Complexity of physical systems	Limited/minimal but with significant potential	As above
t3.9 t3.10 t3.11 Need for holistic resource assessment	Limited/minimal but with significant potential	Possible ICM programmes can promote this although rarely have resources to fully do so
t3.12 t3.13 t3.14 t3.15 Limited knowledge and understanding	Widespread and with further potential	Many ICM programmes play an important role in awareness raising and improving knowledge of stakeholders
t3.16 t3.17 t3.18 Inadequate monitoring and data	Moderate but with further potential	Some ICM programmes are involved in monitoring and data gathering programmes
t3.19 t3.20 Complex property and other rights	Limited/minimal but with potential	ICM programmes could be used to help explain these
t3.21 t3.22 t3.23 t3.24 Institutional issues	Limited/minimal but with potential	Whilst ICM cannot solve these, ICM programmes could help explain institutional arrangements and responsibilities
t3.25 t3.26 Administrative issues & split responsibilities	Moderate but with significant potential	ICM programmes can bring administrations together
t3.27 t3.28 Complex jurisdictions	Limited but with further potential	ICM programmes could be used to help explain these
t3.29 t3.30 t3.31 Silo mentalities	Moderate but with significant potential	The wide outlook of ICM programmes and multi-sectoral engagement can help reduce this
t3.32 t3.33 Competing priorities	Moderate but with significant potential	As above
t3.34 t3.35 Domination of narrow, technocentric approaches	Moderate but with significant potential	As above
t3.36 t3.37 t3.38 Local community engagement	Widespread and with further potential	A key feature of ICM programmes and project but questions over sustainability

local levels (Stojanovic and Barker 2008; Morris 2008) and sometimes in spite of a limited national supporting framework (O'Hagan and Ballinger 2010). Throughout much of Europe, apart from the Mediterranean where an ICZM Protocol to the Barcelona Convention was adopted in 2010, ICZM attains a limited status. Generally it is confined to a non-statutory, somewhat peripheral activity, with the longevity of even the most acclaimed ICZM programmes frequently questioned (Shipman and Stojanovic 2007).

This may reflect the perceived 'environmental' agenda of ICZM by many stakeholders which can make it difficult for industry to take it on board. Equally,

ICZM may seem overly complex, peripheral and challenging to traditional sectors of decision-making. As a result, as budgets tighten so 'coastal policy squeeze' occurs as it competes with other policy areas (op. cit., Christie 2005). Subsequent resource issues, associated with limited staffing, skills and funding, make it difficult for many local ICZM programmes to look beyond the short-term (Shipman and Stojanovic 2007) and to adequately address the real challenges of consensus-building (Poitras et al. 2003). Confined by their resource base and limited status, ICZM programmes often then have focused on soft, less challenging issues, such as recreation and education, rather than taking on fully fledged integrated planning and management *per se*. Increasingly too academics have questioned the wisdom of too much decentralisation of ICZM activity (Lowry 2002), fearing that this can lead to appropriate local agendas dominating as local power struggles come into play.

20.5 Conclusions

Traditional, technocentric approaches to coastal risk management are under strain as the coastal zone becomes under increasing pressure from population growth and development amid concerns over climate change predictions. Even the UK's Institution of Civil Engineers and a think tank of the Royal Institute of British Architects have recently suggested UK should establish it long-term position as to whether or not major coastal and estuarine cities, such as Portsmouth, should be defended and allowed to continue to expand or indeed, should retreat from the shore (Institution of Civil Engineers 2010). Whilst such monumental decisions may be some time away, governments are already having to face up to a wide range of adaptation options and contemplate abandonment of 'hold the line' in many locations where the cost benefit of improving or even maintaining current defences is not convincing. Many new approaches require involvement of multiple actors, challenging the engineering dominance of centuries. Given the complexities of potential impacts, the costs and benefits to a wide range of coastal interests and the ever increasing scrutiny of decisions, traditional governance structures are also being questioned.

In this context and drawing on a range of examples, particularly from North West European experiences, this chapter has evaluated the extent to which ICZM can contribute to the management of coastal risk. Whilst not a panacea, it concludes that ICZM may be able to facilitate the development of more adaptable and palatable approaches for local communities, much needed in the context of coastal climate change impacts. The ICZM principles are certainly of potential importance. However, there remain specific questions about the current underperformance of ICZM, particularly its floundering status within the European Union, where it is somewhat overshadowed by strategic debate on the future of marine planning and management. Indeed, it could be argued that such discussions may lead to further fragmentation rather than integration of governance.

Whatever the shape of ICZM or indeed general governance structures for the management of coastal risk in future, there are several essential elements without which coastal risk decision-making will be destined to fail. These include mechanisms to ensure better scientific underpinning of decisions, improved public understanding and community engagement in decisions, and better understanding of how perceptions influence individual, community and government behaviour related to coastal risk. There, no doubt, will be challenges ahead for the management of coastal risk, but we need to ensure that communities can understand and make reasoned choices between difficult trade-offs (Tompkins et al. 2008; Alexander et al. 2012). Such decisions must also not preclude options or create public liability nightmares for future generations. With seemingly so many intractable and complex issues involved, it is, therefore, likely that coastal governance will remain 'on the edge' for some time to come.

References

Abel, N., R. Gorddard, B. Harman, A. Leitch, J. Langridge, A. Ryan, and S. Heyenga. 2011. Sea level rise, coastal development and planned retreat: Analytical framework, governance principles and an Australian case study. *Environmental Science & Policy* 14(3): 279–288.

Agency, Environment. 2010. *The national flood and coastal erosion risk management strategy for England*. London: Environment Agency.

Alexander, K.S., A. Ryan, and T.G. Measham. 2012. Managed retreat of coastal communities: Understanding responses to projected sea level rise. *Journal of Environmental Planning and Management* 55(4): 409–433.

Ballinger, R.C. 1999. The evolving organisational framework for Integrated Coastal Management in England and Wales. *Marine Policy* 23(4/5): 479–500.

Ballinger, R.C., and T.S. Stojanovic. 2010. Policy development and the estuary environment: A Severn Estuary case study. *Marine Pollution Bulletin* 61(1–3): 132–145.

Ballinger, R.C., J. Taussik, and J.S. Potts. 2002. Managing coastal risk: Making the shared coastal responsibility work. In *Proceedings of the 37th DEFRA, flood and coastal management conference,* Keele, September 2002.

Ballinger, R., V. Cummins, A.M. O'Hagan, and M. Phillips. 2008. *The point of COREPOINT: Improving capacity for Integrated Coastal Zone Management in North West Europe, COREPOINT report*. Available from: http://corepoint.ucc.ie/index.htm.

Ballinger, R., A. Pickaver, G. Lymbery, and M. Ferreira. 2010. An evaluation of the implementation of the European ICZM principles. *Ocean and Coastal Management* 53: 738–749.

Bille, R. 2007. A dual-level framework for evaluating integrated coastal management beyond labels. *Ocean and Coastal Management* 50(10): 796–807.

Bucx, T. 2010. *Assessment of European coastal erosion policies in relation to ICZM, Concepts and Science for Coastal Erosion Management (CONSCIENCE) project report*. Available from: http://www.conscience-eu.net/documents/deliverable11-assessment.pdf.

Charlier, R.H. 1989. Coastal zone: Occupance, management and economic competitiveness. *Ocean and Coastal Management* 12: 383–402.

Cheong, S.-M. 2011. Policy solutions in the U.S. special issue: Coastal adaptation. *Climatic Change* 106(1): 57–70.

Christie, P. 2005. Is integrated coastal management sustainable? *Ocean and Coastal Management* 48: 208–232.

Cicin-Sain, B., and R.W. Knecht. 1998. *Integrated coastal and ocean management. Concepts and practices*. Washington, DC: Island Press.

Cooper, J.A.G., and J. McKenna. 2008. Social justice in coastal erosion management: The temporal and spatial dimensions. *Geoforum* 39(1): 294–306.

Creel, L. 2003. *Ripple effects: Population and coastal regions*. Washington, DC: Population Reference Bureau. Available at: http://www.prb.org/pdf/RippleEffects_Eng.pdf.

Defra (Department for Environment, Food and Rural Affairs). 2009. *Appraisal of flood and coastal erosion risk management. A Defra policy statement*. London: Defra.

Defra (Department for Environment, Food and Rural Affairs). 2012. *Coastal change pathfinder review final report.* January 2012, PB 13720. London: Defra.

Dodds, W., J.A.G. Cooper, and J. McKenna. 2010. Flood and coastal erosion risk management policy evolution in Northern Ireland: "Incremental or leapfrogging?". *Ocean and Coastal Management* 53(12): 779–786.

Dolan, A.H., and I.J. Walker. 2006. Understanding vulnerability of coastal communities to climate change related risks. *Journal of Coastal Research*, Special Issue No. 39, Proceedings of the 8th International Coastal Symposium, 1316–1323.

Doody, J.P. 2004. 'Coastal squeeze' – An historical perspective. *Journal of Coastal Conservation* 10: 129–138.

Environment Agency. 2012. *Shoreline management plan policies: What do they mean?* Available from: http://www.environment-agency.gov.uk/homeandleisure/134834.aspx. Accessed Sept 2012.

European Commission. 2012. Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions – *A blueprint to safeguard Europe's water resources, Brussels*, 14.11.2012, COM(2012)673 final.

European Parliament and Council. 2002. *Recommendation of the European Parliament and of the Council of 30 May 2002 concerning the implementation of Integrated Coastal Zone Management in Europe,* 2002/413/EC. Available from: http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002. Accessed July 2012.

EUROSION. 2004. Living with coastal erosion in Europe: Sediment and space for sustainability, *PART I – Major findings and Policy Recommendations of the EUROSION project,* Service contract B4-3301/2001/329175/MAR/B3 "Coastal erosion – Evaluation of the need for action" Directorate General Environment, European Commission, 10 May 2004.

Gibson, J. 2011a. UK Coastal zone law notes, available from: http://www.coastlaw.uct.ac.za/iczm/notes/note4.htm#sect6. Last updated on: 1/3/11.

Gibson, J. 2011b. *Legal liabilities for coastal erosion and flooding in the United Kingdom due to climate change, Institute of marine and Environmental law*. Powerpoint presentation, available from: www.iucnael.org/en/documents/doc…/1011-gibson-john.html. Accessed July 2012.

Gilbert, J., and P. Vellinga. 2005. Coastal Zone Management. In *Climate change: The IPCC response strategies*, 133–159. Available from: http://www.ipcc.ch/ipccreports/far/wg_III/ipcc_far_wg_III_chapter_05.pdf. Accessed Aug 2012.

Greiving, S., M. Fleischhauer, and S. Wanczura. 2006. Management of natural hazards in Europe: The role of spatial planning in selected EU member states. *Journal of Environmental Planning and Management* 49(5): 739–757.

Grimmond, C.S.B. 2011. Urban climate in the coastal zone: Resilience to weather extremes. In Pelling, M. (ed.). *Megacities and the coast: Transformation for resilience,* A preliminary review of knowledge, practice and future Research, LOICZ, June 2011, 37–42. Abingdon: Routledge.

Hadley, D. 2009. Land use and the coastal zone. *Land Use Policy* 26(Supplement 1): S198–S203.

Hillen, M.M., S.N. Jonkman, W. Kanning, M. Kok, M.A. Geldenhuys, and J.F. Stive. 2010. *Coastal defence cost estimates case study of the Netherlands, New Orleans and Vietnam,* Delft University of Technology, in cooperation with Royal Haskoning, April 2010.

Institution of Civil Engineers. 2010. *Facing up to sea level risk: Retreat? Defend? Attack? The Future of our Coastal and Estuarine Cities*. Institution of Civil Engineers.

Klijn, F., P. Samuels, and A. van Os. 2008. Towards flood risk management in the EU: State of affairs with examples from various European countries. *International Journal of River Basin Management* 6(4): 307–321.

Li, H. 2003. Management of coastal mega-cities—A new challenge in the 21st century. *Marine Policy* 27: 333–337.

Lowry, K. 2002. Decentralized coastal management. *International Newsletter of Coastal Management* 42: 1–42.

McFadden, L. 2007. Governing coastal spaces: The case of disappearing science in integrated coastal zone management. *Coastal Management* 35(4): 429–443.

McGranahan, G., D. Balk, and B. Anderson. 2007. The rising risks of climate change: Urban population distribution and characteristics in low elevation coastal zones. *Environment and Urbanization* 19: 17–37.

McKenna, J., and J.A. Cooper. 2006. Sacred cows in coastal management: the need for a 'cheap and transitory' model. *Area* 38(4): 421–431.

Mee, L. 2010. Between the devil and the deep blue sea: The coastal zone in an era of globalisation. *Estuarine, Coastal and Shelf Science* 96: 1–8.

MESSINA. 2006. *Integrating the shoreline into spatial policies, Practical Guide*. Project part-financed by the European Union, (European Regional Development Fund) within the INTERREG IIIC Programme. Available from: http://www.interreg-messina.org/documents/CoastalToolkit/MESSINA%20-%20Practical%20Guide%20-%20Integrating%20the%20Shoreline.pdf.

Milligan, J., and T. O'Riordan. 2007. Governance for sustainable coastal futures. *Coastal Management* 35(4): 499–509.

Morris, R.K.A. 2008. English nature's estuaries initiative: A review of its contribution to ICZM. *Ocean and Coastal Management* 51: 25–42.

Moser, S.C., J. Williams, and D.F. Boesch. 2012. Wicked challenges at land's end: Managing coastal vulnerability under climate change. *Annual Review of Environmental Resources* 37. Available from: http://www.susannemoser.com/publications.adaptation.php.

National Institute for Coastal and Marine Management of the Netherlands. 2004. *A guide to coastal zone erosion practices in Europe: Lessons learnt*. Report to Directorate General Environment European Commission as part of the EUROSION project. Available from: http://www.eurosion.org/shoreline/lessons_learned.pdf.

Nicholls, R. 1995. Coastal megacities and climate change. *GeoJournal* 37(3): 369–379.

Nicholls, R.J., and A. Cazenave. 2010. Sea-level rise and its impact on coastal zones. *Science* 328(5985): 1517–1520.

O'Connor, M.C., J.A.G. Cooper, J. McKenna, and D.W.T. Jackson. 2010. Shoreline management in a policy vacuum: A local authority perspective. *Ocean and Coastal Management* 53(12): 769–778.

O'Hagan, A.M., and R.C. Ballinger. 2009. Coastal governance in NW Europe: An assessment of approaches to the European Stocktake. *Marine Policy* 33(60): 912–922.

O'Hagan, A.M., and R. Ballinger. 2010. Implementing Integrated Coastal Zone Management in a national policy vacuum: Local case studies from Ireland. *Ocean and Coastal Management* 53: 750–759.

O'Riordan, T., S.A. Nicholson-Cole, and J. Milligan. 2008. Designing sustainable coastal futures. *Twenty-First Century Society: Journal of the Academy of Social Sciences* 3(2): 145–157.

Pethick, J. 2001. Coastal management and sea-level rise. *Catena* 42: 307–322.

Pettit, S.J. 1999. The statutory approach to coastal defence in England and Wales. *Marine Policy* 23(4/5): 465–477.

Phillips, M.R., and S. Crisp. 2010. Sea level trends and NAO influences: The Bristol Channel/Severn Estuary. *Global and Planetary Change* 73(3–4): 211–218.

Poitras, J., R. Bowen, and J. Wiggin. 2003. Challenges to the use of consensus building in integrated coastal management. *Ocean and Coastal Management* 46: 391–405.

[AU3] Reis, J., T.S. Stojanovic, and H.D. Smith. in press. Relevance of systems approaches for implementing integrated coastal zone management principles in Europe. Submitted to *Marine Policy*.

Severn Estuary Partnership. 2011. *State of the Severn Estuary Report.* Available from: http://viewer.zmags.com/publication/ad5b93bd#/ad5b93bd/1.

Shipman, B., and T. Stojanovic. 2007. Facts, fictions and failures of Integrated Coastal Zone Management in Europe. *Coastal Management* 35: 375–398.

Small, C., and R.J. Nicholls. 2003. A global analysis of human settlement in coastal zones. *Journal of Coastal Research* 19(3): 584–599.

Stallworthy, M. 2006. Sustainability, coastal erosion and climate change: An environmental justice analysis. *Journal of Environmental Law* 18(3): 357–373.

Stojanovic, T., and N. Barker. 2008. Improving governance through local coastal partnerships in the UK. *Geographical Journal* 174: 344–360.

Taussik, J. 2000. The role of town and country planning in implementing shoreline management strategies. In *Proceedings of 35th MAFF conference of river and coastal engineers.* Keele University, 5–7 July 2000. London: Ministry of Agriculture, Fisheries and Food.

Tompkins, E.L., R. Few, and K. Brown. 2008. Scenario-based stakeholder engagement: Incorporating stakeholders preferences into coastal planning for climate change. *Journal of Environmental Management* 88(4): 1580–1592.

Transport and Water Management Inspectorate. 2006. *Assessment of primary flood defences in The Netherlands,* National Report on 2006. Available from: http://www.safecoast.nl/editor/data-bank/File/Assessment%20primary%20flood%20defences%20in%20NL.pdf.

Turner, R.K. 2000. Integrating natural and socio-economic science in coastal management. *Journal of Marine Systems* 25(3–4): 447–460.

van Aalst, M.K., T. Cannon, and I. Burton. 2008. Community level adaptation to climate change: The potential role of participatory community risk assessment. *Global Environmental Change* 18(1): 165–179.

van der Weide, J. 1993. A systems view of ICM. *Ocean and Coastal Management* 21: 129–148.

Vellinga, P., and R.J.T. Klein. 1993. Climate change, sea level rise and integrated coastal zone management: An IPCC approach. *Ocean and Coastal Management* 21(1–3): 245–268.

[AU6] Wales Audit Office. 2009. *Report on coastal erosion and tidal flooding risks in Wales*. Wales Audit Office.

Wetzel, F.T., W.D. Kissling, H. Beissmann, and D.J. Penn. 2012. Future climate change driven sea-level rise: Secondary consequences from human displacement for island biodiversity. *Global Change Biology* 18(9): 2707–2719.

WWF and IUCN. 1998. *Creating a sea change: The WWF/IUCN Marine Policy*. Available from: http://www.iucn.org/about/work/programmes/marine/marine_resources/?1605/Creating-a-Sea-Change-The-WWF-IUCN-Marine-Policy.

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Author Queries

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