

Environmental implications of the EUrosion project recommendations

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Abstract

Over the past decades, the number of inhabitants living in European coastal zones has more than doubled. A significant number of assets is threatened by coastal erosion, which affects each year important areas of coastal lands and undermines the defence against coastal flooding. The EUrosion project aim was to provide quantified evidence that coastal erosion in Europe is a problem of growing magnitude and that the current efforts undertaken by public authorities does not succeed in containing. The EUrosion project has resulted in several findings, and a number of proposals were formulated. Some of them can be related to environmental issues which will be analysed in this paper as well as the new Portuguese legislation regarding EIA, trying to give an idea as to how these recommendations could be being incorporated or considered. Despite these recent developments that ensure more restrict criteria be considered for EIA studies, there are still some drawbacks.

Keywords: Erosion, EUrosion project, environmental impacts.

1 Introduction

Over the past 50 years, the number of inhabitants living in European coastal municipalities has more than doubled, reaching 70 millions in 2001. A significant number of assets are threatened by coastal erosion, which each year affects 15 km² of coastal lands and undermines the defence against coastal flooding of thousands of square kilometres in land. Within the period 1999-2002, several houses had to be abandoned in Europe as a result of imminent coastal erosion risk and others saw their market value decrease by at least 10%. Other assets such as industrial facilities, agricultural lands, recreational areas and natural habitats are also at risk of coastal flooding.



Coastal erosion affects 19,729 km (nearly 20%) of the European coastline, among which 15,111 km are effectively retreating. Another 5,900 km have been “stabilised” by coastal protection (8,800 km if artificially protected areas that continue to retreat are included). By excluding the coastlines of Sweden and Finland, which both account for a large part of European coastal length and are not significantly affected by coastal erosion (with exception of Southern Sweden), the percentage affected by erosion reaches 27%.



Figure 1: Example of coastal erosion in the municipality of Happisburg, North Norfolk (UK), [1].

Coastal erosion and accretion has shaped European coastal landscapes, creating a wide variety of coastal types. Erosion of inland soils induced by rainfall and movement along riverbeds provides considerable amounts of sediments to the coast. These sediments together with those derived from coastal features (such as eroding cliffs and marine sand banks) provide essential material for the development of offshore reefs, mud flats, saltmarshes, sandy beaches, sand dunes, and marshes. In turn, these coastal habitats provide a wide range of outstanding benefits including locations for economic and recreational activities, protection from flooding in low lying areas, absorption of wave energy during storm surges, reduction of eutrophication of coastal waters, nesting and hatching of fauna species. Combating coastal erosion can create new problems elsewhere, depending on the type of measures taken.

The difficulty of reconciling the safety of asset investments along the coast with the benefits offered by natural coastal processes has been exacerbated in the past 15 years as a result of pressure from human activities and sea level rise. The comparison of the coastal erosion status of 1986 and 2001 reveals that, whilst the length of retreating coastline in Europe may have slightly decreased, the length of new engineered frontage – including notably new harbour areas and new hard coastal protection works – has increased by 934 km.



Figure 2: Example of coastal erosion in Vagueira (PT).

This suggests that previously eroding areas have been stabilized by coastal defence. Newly eroding areas – that is to say areas observed as eroding in 2001 but not in 1986 – are estimated to reach 875 km (where the comparison 1986-2001 is possible and of 1986 data is reliable). More interestingly, 63% of this newly eroding coastline segments are located less than 30 km from an existing engineered frontage – be it urban, industrial, or a coastal defence structure. As for 37% remaining newly eroding areas, they tend to have a higher density in areas where sea level has risen by more than 20 cm in the past 100 years.

The cost of mitigation actions are also increasing. In 2001, public expenditures dedicated to coastline protection against the risk of erosion and flooding have reached an estimated 3,200 M€ compared to 2,500 M€ in 1986 (an increase of 28%). However, these expenditures mainly reflect the needs to protect assets at imminent risk of coastal erosion, and do not reflect the hidden costs induced by human activities on the long term.

2 Coastal erosion

With a few exceptions, coastal erosion can never be attributed to one single cause – be it natural (winds, storms, relative sea level rise, vertical land movement and slope processes) or human-driven (coastal protection, land claim, river basin regulation works, dredging, vegetation clearing, gas mining or water extraction) – but to a combination of factors, which together create the conditions for erosion to take place. These factors operate on different time and spatial scales and this can result in some of the effects being “hidden” before there are finally evoked and their impact quantified.

Coastal erosion figures depend on time and space scales of observation. The sedimentary coastline exists in an environment that is fluctuating over different timescales with periods relating to waves (seconds), tides (daily), seasons and longer timescales, as for example changes in sea level. Coastal erosion is defined

as the trend in coastline position after averaging over a period which is sufficiently long to eliminate fluctuations. Coastline fluctuations at time intervals smaller than a decade or at spatial scales smaller than a kilometre may exceed the trend figures and cause substantial damage.

The processes responsible for coastal erosion are different for different types of coasts. For cliff coasts erosion is an ongoing process, even in the absence of sea level rise, human interventions or changes in fluvial sediment supply. This is inherent to the fact that in many areas no accretional processes exist to counteract erosion. For sandy or muddy coasts the situation is different. Here accretional and erosional processes may balance each other and the coastline may appear stable whilst exhibiting an inherent dynamic. In practice this hardly ever occurs, because the balance between accretional and erosional processes is disturbed by sea level rise, uplift or subsidence of land, changes in fluvial sediment supply or by human interventions affecting wave and flow patterns in the coastal zone.

Table 1: Extent of coastal erosion per country, [1].

Country	Total length of the coastline (km)	Engineered frontage in 2001 ¹ (km)	Eroding coastline in 2001 ² km)	Eroding coastline in 1986 (km)
Belgium	98	52	25	25
Cyprus	334	70	124	--
Denmark	4605	577	607	607
Estonia	2506	27	51	--
Finland	14018	145	5	--
France	8245	1838	2055	1607*
Germany	3524	733	452	327*
Greece	13659	739	2320	523*
Ireland	4388	392	846	447
Italy	7468	1124	1704	1804
Latvia	534	22	175	--
Lithuania	263	31	64	--
Malta	173	12	7	--
Poland	634	152	349	--
Portugal	1187	123	338	295
Slovenia	46	22	14	--
Spain	6584	815	757	775
Sweden	13567	202	327	--
The Netherlands	1276	860	134	160
United Kingdom	17381	1488	3009	4115
TOTAL	100490	9425	13362	8228

¹ Including artificial coasts and hard coastal defence works

² Both protected and not protected



3 Findings from the EUrosion project

The aim of EUROSION project was precisely to provide quantified evidence that coastal erosion in Europe is a problem of growing magnitude and that the current efforts undertaken by public authorities does not succeed in containing. This study also aimed at formulating a set of proposals to better mainstream coastal erosion in the future at the European, national, regional and local levels. A review of both natural and human-induced factors responsible for coastal erosion has been undertaken in 60 case studies and 11 pilot sites, representative of European coastal diversity. The EUROSION project as resulted into several findings, [1]. However only some could have clear environmental implications, and only those will be referred here.

Finding 1 is related with the pressure on the coast and the loss of sediment. In fact urbanisation of the coast has turned coastal erosion from a natural phenomenon into a problem of growing intensity. The majority of coastal erosion problems is now induced by human activities and artificially stabilised seafronts are progressively encroaching on active sedimentary coastlines and cliffs. Dynamic ecosystems and their undeveloped coastal landscapes are gradually disappearing, due to a lack of sediment.

The combined effect of coastal erosion, infrastructure development and defences built to protect them have created, in many areas, a narrow coastal zone. This “coastal squeeze” process occurs especially in low-lying and intertidal areas, which would naturally adjust to the changes in sea level, storms and tides, but cannot anymore due to the construction of fixed barriers (roads, dikes), causing a direct loss of natural habitats. In areas where relative sea level is rising or where sediment availability is reduced, there is a further coastal squeeze resulting from a steepening beach profile and foreshortening of the seaward zones.

The pressures on the coast for development have not stopped. Despite the increasing number of effects of ‘coastal squeeze’ on the ability of the coast to sustain human use and the threat to natural resources building protective structures is still widely practised. This will result in further reduction in the space available at the coastal margin both for human activity, the protection afforded by naturally functioning coastal systems and the sustainable exploitation of the natural resource.

Finding 2 is related with environmental and economic assessment. Environmental Impact Assessment (EIA) procedures – directive 85/337/EEC – have been ineffective in addressing the impact of all human activities, such as development, on the wider coastal environment. Subsequently, the cost of attempting to reduce coastal erosion has increased considerably in relation to the assets requiring protection. Consequently it has resulted in a need to transfer the cost of coastal erosion mitigation measures to such activities.

In spite of clear evidence that human activities can increase coastal erosion, observations made in EUROSION case studies demonstrate that Environmental Impact Assessment (EIA) procedures have not been able to contain the extent of coastal erosion.



Data collected demonstrate that 63% of the 875 newly eroding kilometres of coastline (i.e. eroding in 2001 but not eroding in 1986) are located less than 30 km from an engineered frontage. The reasons for this are multiple:

- Considerable interventions affecting coastal erosion processes have taken place since the 1900's (1950's in the case of river damming), that is to say well before the existence of EIA regulations in Europe (in the 1980's). Many of these investments are still "active" in disturbing sediment transport processes. River basin regulation works, which disrupt the transport of coarse river sediments to the sea, cause an annual sediment deficit estimated at 100 millions tons;
- Coastal erosion originates in the cumulative impact of a wide range of natural and human-induced factors, none of which may be considered as the single cause for erosion. This is true for dams and for other projects related to industrial development, tourism (marinas, seafront rehabilitation), urbanisation, sand mining and dredging, and coastal protection itself. In case an EIA is required for such projects, experience has shown that their individual impact on coastal erosion will not be significant enough to justify the integration of coastal sediment transport in EIA;
- Large size projects, such as harbour extension, land reclamation for creating wind parks, or energy production plants do address coastal erosion processes with the framework of their EIA. However, it is quite common that the cost of mitigation measures exceed the willingness – or the capacity – of the project developer to pay for it;
- Current national legislations on EIA do not prescribe any clear rule for public hearings, i.e. for communicating to and cooperating with local stakeholders when establishing an Environment Impact Assessment. In a number of countries EIA reports are released for comments to the public at a very late stage of project developments and only for a short period. This was found to considerably hamper the integration of local "knowledge" on potential environmental damages – including damages due to coastal erosion – in projects' design;
- EIA procedures are not systematically required to small and medium size projects, though they contribute altogether to exacerbate coastal erosion.

The consequences of EIA limitations in addressing coastal erosion properly entail a significant increase of costs for society, in terms of habitat loss, loss of public facilities and invested capital and cost of mitigation measures.

Finding 4 refers the issue of the mitigation of coastal erosion. Lack of knowledge and understanding of coastal sediment transport processes have resulted over the past hundred years in inappropriate measures of coastal erosion mitigation. In a considerable number of cases, such measures may have solved coastal erosion locally but have exacerbated coastal erosion problems at other locations – up to tens of kilometres away – or have generated other environmental problems. As of 2001, about 8800 km benefit from coastal erosion mitigation schemes, and 80% of these schemes have been in place for more than 15 years.



Case studies reviewed by EUROSION project have provided a great deal of experiences over the cost-effectiveness and environmental friendliness of such protection schemes.

Major lessons learnt from these experiences are:

- Many hard engineered constructions had positive effects only in a short time and space perspective. Indeed, by disrupting long-shore drift of sediment, they have deprived beaches located further down-drift sediments and have therefore exacerbated coastal erosion in those locations. In addition they oppose a vertical resistance to the wave assaults which increases turbulence and sediment scouring, thus undermining their own foundations. The shift of coastal erosion problems down-drift urged further protection down-drift and resulted in a “domino” effect;
- Soft engineering techniques – especially beach nourishment – fulfil both safety functions and other functions such as recreational, economic, and ecological functions. However soft engineering techniques have also been subjected to major setbacks. Such setbacks have been caused by inappropriate design induced by poor understanding of the physical characteristics of the sediment cell, difficult access to sediment reservoirs which induces higher costs, or unexpected adverse effects on the natural system and principally the benthic fauna;
- Since the early 1990’s, a new approach to address coastal erosion has developed in Europe and consists in abandoning lands at risk and relocating the assets further inland (managed realignment). The reason is that cost benefit analysis has demonstrated that the cost of protection largely exceeds the value of assets to be protected on the long term (over the life expectancy of the assets). Furthermore the knowledge that coastal erosion is needed to provide sediments further down-drift and should therefore remain unimpeded if assets located have a considerable social, economical and ecological value. However the question of compensation is crucial to ensure acceptance of the solution, which can be quite unpopular with the local population. Failure to provide a fair basis for compensation – based for example on the “risk”-less market value instead of the actual market value “with risk” – may result in strong resistance from population and conflict with authorities, which delays the adoption of negotiated solutions and therefore increase the imminence of risk. Other practical questions related to compensation are the proportion and timing of advanced payments, inclusion of intangible costs in the compensation value, or appropriate compensation rules to avoid speculation.

These experiences demonstrate the limits of piecemeal responses to coastal erosion, and speak out for the adoption of proactive approach based on planning, monitoring and evaluation and ICZM principles. The same experiences also provide an overview of the key factors of success for such approach. Major among these factors are:

- A good understanding of coastal sediment transport processes within the “sediment cell”;



- A combination of engineering solutions are usually used. Most successful strategies have definitely tried to balance the urgency to immediately stop erosion in some places, the long term value of working with natural processes, and the acceptance that some lands will be inevitably lost;
- Research of multi-functional designs through a broad participation of all stakeholders. Seeking technical solutions which fulfil more than the function of safety is undeniably a major asset to make coastal erosion mitigation solutions more viable financially (by encouraging co-funding), but also socially more acceptable;
- A thorough assessment of costs and benefits. Cost benefit analysis provides the basis for making technical solutions viable financially and bankable. When rigorously conducted and adopting a broad time horizon (e.g. 50 years) and spatial scale (the sediment cell), such analysis also helps identify external environmental costs which in turn may provide further incentives to prefer managed realignment or simply “doing nothing” instead of erosion control measures.

4 Recommendations from the EUrosion project

4.1 Introduction

For the next 50 years, there are particular concerns about the following trends:

- Loss of sediment due to ongoing trends in river regulation works, coastal urbanisation, dredging, enclosure of tidal land, loss of vegetation, golf course development on dunes, sand mining and offshore sediment extraction;
- Loss of coastal space;
- Loss of dynamic coastlines and natural habitats. Sedimentary habitats are often used as sources of sediments to compensate chronic losses of sediments due to human interventions. The response of public policy and funding is mainly driven by property owners in trouble and by the empathy their situation generates in the public; with limited funding the erosion habitats will be lowest on the political list, as there will always be reference to ‘erosion as a natural process’. However, when a coastal zone is designated to provide the space for natural habitats or species, this function may be impacted if this zone is used as a long-term source of sediments, which may also be depleted in the end. EUROSION suggests that in general, natural habitats should not be the source of sediments to compensate chronic deficits of sediment due to human interventions, because this would undermine coastal resilience;
- Loss of resilience. The safety of people and the protection of economic assets and coastal biodiversity are likely to be more easily secured in coastal areas with a high degree of resilience. Unacceptable losses can be avoided by a timely incorporation of risks into planning and development, by making



shoreline management accountable and sustainable and by improving its information base;

- **Climate change.** Climate change scenarios predict an accelerated sea level rise, a more unpredictable storm regime and more extreme events. This can not be avoided for the next 50 years, because measures to counteract the greenhouse effect will only be effective on a longer term. However, the more measures are postponed, the more serious will be the risks to safety, economic assets and biodiversity. Therefore, it is still of fundamental importance to continue giving due attention to climate policies. Apart from hazards and risks that tend to be unpredictable, coastal erosion will result into an increasing cost to society, due to the increasing risk to lives and economic assets, the more habitat loss and the more mitigation costs;

In line with the findings and concerns, a number of proposals can be formulated, grouped into four recommendations, [1]. Only those directly or indirectly related with environmental issues will be briefly referred here.

4.2 Availability of sediments and space for coastal processes to operate

The sustainable development of coastal zones and the conservation of coastal biodiversity requires the long term availability of coastal sediments and space for coastal processes to operate. The availability of coastal sediments can be ensured by developing and implementing the concept of a 'favourable sediment status' as a basis for shoreline management and water catchment management, allowing the objective of supporting coastal resilience in general and of preserving dynamic coastlines in particular.

In order to restore favourable sediment status where losses have occurred, sediments may be introduced from the same catchment area and should be implemented through environmental planning mechanisms (ICZM, SEA, EIA). If insufficient measures are taken to ensure the availability of sediments and space for future coastal processes to operate, coastal resilience will decrease. In turn this will increase the risk of erosion and flooding events and the vulnerability of people and damage to economic assets and biodiversity.

The availability of space for coastal processes should be ensured through environmental assessment, spatial planning and Integrated Coastal Zone Management. These instruments should also be applied to make spatial allocations as to which areas should be reserved for temporary or permanent supply of sediments to allow coastal processes to operate.

4.3 Plan and invest at own risk

Public responsibility for coastal erosion risk should be limited and an appropriate part of the risk should be transferred to direct beneficiaries and investors, applying appropriate Environmental Assessment instruments.

Risks should be monitored and mapped, evaluated and incorporated into planning and investment policies. If insufficient measures are taken to internalise economic and environmental risks in planning and investment, society will be



faced with an increasing cost of shoreline management as well as cost due to damage to people, economic assets and private investments.

Finding 2 has highlighted the limitations of current EIA procedures in addressing coastal erosion driven by human activities. It is expected that a number of existing instruments could make it possible to overcome these limitations. These instruments include the European directive on Strategic Environmental Assessment (SEA), the Structural and Cohesion Funds, and the European Parliament and Council Recommendation on Integrated Coastal Zone Management (ICZM), national, regional and local planning and in investment policies. As a consequence, it is not proposed to create new instruments but instead to incorporate coastal erosion concerns (especially risks assessment) into the implementation of existing instruments at all level of administration. The three principle instruments are:

- The European directive on SEA has been adopted by the European Parliament and Council in 2002 and became effective at the level of EU member states in 2004. The SEA recognises the importance of taking a wide-ranging perspective when addressing the cumulative impact of piecemeal developments. This is particularly relevant to management within water catchment areas, coastal and nearshore coastal zones where knock-on effects, including exacerbation of erosion trends and risk of flooding as a result of reduced sediment availability may not be immediately apparent. The SEA is expected to raise coastal erosion concerns higher in the agenda in relation to tourism development plans and to define appropriate measures to be taken locally, regionally or nationally to minimize or compensate for coastal erosion induced by marinas or waterfronts development. In addressing human impact via SEA, it is recommended that coastal erosion becomes a mandatory topic to be assessed in relation to a wide variety of plans and programmes including planning, transport, tourist developments and offshore aggregate extraction, which affect the coast.
- Adopted in 2002 by the European Parliament and the European Council, the ICZM Recommendation promotes the implementation of 8 principles – holistic approach, long term perspective, adaptive management, local specificities, working with nature, participatory planning, involvement of all administrative bodies and combination of instruments. The ICZM Recommendation does not replace Environmental Assessment instruments but can be used in combination with them to identify mitigation solutions which are innovative, cost-effective, and socially acceptable.

4.4 Make shoreline management accountable

Shoreline management should move away from piecemeal solutions to a planned approach based upon accountability principles, optimising investment costs against values, increasing social acceptability of actions and keeping options open for the future.

Finding 4 has highlighted the “reactive” approach to coastal erosion problems, which results into piecemeal solutions without clear objectives or long



term vision. It has also highlighted the potentially adverse effects of such an approach on coastal erosion processes themselves and more generally on environmental quality.

In response to these shortcomings, EUROSION project proposes a more proactive approach based on planning and accountability of achievements in the fields of shoreline management.

If insufficient measures are taken to make shoreline management accountable, costs to society will continue to increase and will become less sustainable; there is a risk that coastlines will become less resilient to erosion in the longer term. This will result into increasing cost to regional and national public budgets.

Member States should facilitate the implementation of financial compensation schemes in order to accommodate the realignment of coastal population at imminent risk of coastal erosion and flooding. Mechanisms should foster the transfer of the costs related to coastal erosion adverse consequences to parties responsible for coastal erosion (as established via SEA) and/or the owners of assets at risk. Plans should be established for 5 to 10 years, be subject to a SEA and be periodically revised. Such schemes should adopt the following principles:

- Working with nature;
- Combining different technical approaches, including hard, soft and retreat solutions;
- Searching for multi-functional designs involving the broad participation of all stakeholders;
- Conducting thorough cost-benefits analysis before making the decisions.

5 Environmental impacts of EUrosion recommendations

In line with the recommendations presented by the EUrosion project some environmental impacts can be addressed regarding the way these aspects are taken into account in the National legislation.

European Member States should ensure full incorporation of coastal erosion concerns in the implementation of the SEA and the EIA Directives. SEA should be promoted as an important new instrument for Environmental Assessment for coastal erosion management.

Local authorities should promote public information and awareness of coastal erosion risks, as a basis for coastal planning and management. This may be done through:

- Production and dissemination of risk maps at local scale (1:25,000);
- Promotion of public participation and stakeholder communication on Environmental Assessment and on socio-economic and financial risks.

In order to support these recommendations, EUrosion is producing guidelines on:

- Environmental assessment to improve integration of coastal erosion concerns into future investments. These guidelines should be made available



to a wide range of Environmental Assessment practitioners and translated into the EU official languages;

- Coastal erosion risk mapping for incorporation into land use planning and reporting.

Looking now at the Portuguese reality, it is interesting that, having the EUrosion project finished in May of 2004, a new legislation regarding EIA had come out in November 2005 (Decree-Law No. 197/2005, of 08/11, Ministry of Environment, Territorial Management and Regional Development), changing some of the basis of previous legislation, namely:

- Decree-Law No. 69/2000, of 03/05, approves the EIA juridic regime for the public and private projects, susceptible of producing significant environmental effects, as a key tool for a sustainable development policy.
- Clarification of the need of EIA for some public and private projects. This way it is assured the conformity of the national legislation with the purposes of the Directive No. 85/337/CEE, from the Council, of 27 June, related with the evaluation of the effects in the environment of some public and private projects, with the changes introduced by the Directive No. 97/11/CE, from the Council, of 3 March, giving so an answer raised by a report of the European Commission.
- Some changes were introduced guaranteeing the selection of some projects to be submitted to EIA as a function of its location, nature and dimension, the need to present by the promoter all the elements needed to its evaluation, and other aspects related to EIA process.
- The Directive No. 2003/35/CE, from the European Parliament and from the Council, of 26 May, related to the public participation in the setup of certain environmental plans and programs, according to the Directive No. 85/337/CEE, from the Council, of 27 June, changed by the Directive No. 97/11/CE, from the Council, of 3 March, is this way partially transposed.

These rules have as main goal to involve citizens in the decision-making process, guaranteeing the public participation, a wider information mechanism, as well as the access to the justice. The introduced changes facilitate and clarify the EIA process and allows an intervention more informed and active from the citizens.

Despite these recent developments that ensure the promotion of public participation and stakeholder communication on Environmental Assessment it is interesting to look at the coastal or related projects, and see which are the obligations in terms of EIA. The obligations are referred to the general case or to sensitive areas, which are considered as being the following:

- Protected areas, classified according to the Decree-law No. 19/93, of 23 January, with changings introduced by the Decree-law No. 227/98, of 17 July;
- Natura 2000 sites, special zones of conservation and special zones of protection, classified according to the Decree-law No. 140/99, of 24 April and EU Directives No. 79/409/CEE and 92/43/CEE.



- Protection areas of national heritage and buildings of public interest defined in the law No. 13/85, of 6 July.

The coastal or related projects included in the nº3.b) and 4 of article 1, of the Portuguese Decree-Law No. 197/2005, of 08/11, are the following:

- Land reclamation to the sea. General case: ≥ 100 ha; Sensitive areas: all;
- Port facilities, including fishing ones. General case: boats ≥ 1500 GT; Sensitive areas – all;
- Navigation channels and regulation of rivers. General case: ≥ 5 ha or ≥ 2 km, drainage basins ≥ 25 km² or ≥ 5 km; Sensitive areas – all;
- Dams or other facilities to retain water. General case: height ≥ 15 m or volume ≥ 0.5 hm³ or water plan ≥ 5 ha or crown wall ≥ 500 m, earth dams ≥ 15 m or volume ≥ 1 hm³ or water plan ≥ 5 ha or crown wall ≥ 500 m; Sensitive areas: height ≥ 8 m or volume ≥ 0.1 hm³ or water plan ≥ 3 ha or crown wall ≥ 250 m, earth dams ≥ 8 m or volume ≥ 0.5 hm³ or water plan ≥ 3 ha or crown wall ≥ 250 m
- Coastal defences against erosion (diques, groins, adherent works and others), when not predicted in coastal zone management plans, excluding its maintenance and rebuilding or emergency works; Sensitive areas: all.
- Dredging in river entrances between diques and on beaches, excluding those of navigation conditions maintenance that do not exceed depths previously achieved. General case: $\geq 100\,000$ m³/ano; Sensitive areas – all.
- Marinas, ports and docs. General case: on the coast ≥ 300 berthing places for boats longer than 12 m (7% of berthing places with higher length); Sensitive areas – all.
- Golf courses. General case: >18 holes or 45 ha; Sensitive areas – all.

These recent developments ensure more restrict criteria to be considered for EIA studies. However there are still some lacks, related to projects that could have an important influence in the erosion phenomena. In fact there are still some cases (dams, coastal defences, marinas) where EIA could not be done, and no reference is made to the impact on the coast in terms of sediment control.

6 Final remarks

Over the past 50 years, the number of inhabitants living in European coastal municipalities has more than doubled. A significant number of assets is threatened by coastal erosion, which affects each year important areas of coastal lands and undermines the defence against coastal flooding. Several houses had to be abandoned in Europe as a result of imminent coastal erosion risk and others saw their market value decrease. Other assets as industrial facilities, agricultural lands, recreational areas and natural habitats are also at risk of coastal flooding.

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the future at the European, national, regional and local levels. A review of both natural and human-induced factors responsible for coastal erosion has been undertaken in 60 case studies and 11 pilot sites, representative of European coastal diversity.

The EUROSION project as resulted into several findings and a number of proposals were formulated, and grouped into four recommendations. Some are directly or indirectly related with environmental issues, which have been analysed in this paper. The new Portuguese legislation regarding EIA has been analyzed.

Despite these recent developments that ensure more restrict criteria to be considered for EIA studies, there are still some lacks, related to projects that could have an important influence in the erosion phenomena. In fact there is still some cases (dams, costal defences, marinas) where EIA analysis could not be done, and no reference is made to the special impact on the coast in terms of sediment control.

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