



Integrated Coastal Area and River Basin Management (ICARM): The Oder/Odra case study

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Kurzdarstellung

Integriertes Fluss-Küste Management: Die Oder Fallstudie. Flüsse beeinflussen ihre Mündungsgebiete und Küstenzonen maßgeblich. Daraus ergibt sich die Notwendigkeit eines integrierten Managements von Flusseinzugsgebieten und Küstenzonen. Diese Notwendigkeit schlägt sich auch in internationalen Programmen, wie UNEP-ICARM, nieder. Im Falle der Oder (polnisch: *Odra*) stellen Hochwässer und Meeresspiegelanstieg, Schifffahrt und technische Maßnahmen, Wasserqualität und Eutrophierung sowie die Wanderung von Fischen und eingeschleppten Arten entlang der Flussläufe, zentrale Themen dar, in denen sich die Wechselwirkung zwischen Fluss und Küste widerspiegelt. Vor dem Hintergrund der anhaltenden sozialen, ökonomischen und politischen Veränderungen in diesem Raum, der Bedrohung durch Klimaänderungen sowie durch konkrete Anforderungen, wie der EU-Wasserrahmenrichtlinie oder Natura 2000, ergibt sich erheblicher Handlungsbedarf und macht ein integriertes Fluss-Küste Management in der Oder erforderlich. Diese Notwendigkeit schlägt sich allerdings in den derzeitigen Abkommen, Aktivitäten und Strategien nicht nieder. Sowohl das Einzugsgebiet, als auch die Küste werden derzeit weitgehend separat voneinander betrachtet und die grenzübergreifende deutsch-polnische Kooperation steht im Vordergrund. Zudem besteht die Gefahr, dass in einem großen und komplexen Einzugsgebiet, wie dem der Oder, die Belange der relativ kleinen Küstenzone aus den Augen verloren wird. Aufgrund der ausgeprägten Wechselwirkungen zwischen Fluss und Küste sowie der Herausforderungen wurde die Oder als internationale Fallstudie des UNEP-ICARM Programms ausgewählt. In enger Zusammenarbeit mit dem Projekt „IKZM-Oder“ wird versucht, ein Bewusstsein für die Notwendigkeit eines integrierten Managements zu schaffen und den Dialog zwischen Küste und Einzugsgebiet zu fördern.

Streszczenie

Zintegrowane Zarządzanie Rzeką i Wybrzeżem: precedensowe badania Odry. Rzeki mają decydujący wpływ na swoje dorzecza i strefę wybrzeża. Z tego wynika potrzeba zintegrowanego zarządzania obszarami dorzecza rzek i strefami wybrzeża. Potrzeba ta znajduje także swoje odbicie w międzynarodowych programach, m.in. takich jak UNEP-ICARM. W przypadku Odry (po niemiecku: die Oder) głównymi zagadnieniami są powódzie i wzrost poziomu morza, żegluga i techniczne urządzenia, jakość wody i eutrofizacja, wędrówka ryb i gatunków zwierząt zabranych przez statki do rzek, jak również wzajemne oddziaływania jakie zachodzą pomiędzy rzeką i wybrzeżem. Z uwagi na zagrożenia, jakie niosą z sobą zmiany klimatyczne oraz konkretne wymagania prawne t.j. Ramowa Dyrektywa Wodna lub Natura 2000, istnieje zwiększona potrzeba działania oraz Zintegrowanego Zarządzania Obszarami Przybrzeżnymi rzeką i wybrzeżem w regionie Odry na płaszczyźnie społecznej, gospodarczej i politycznej. Niestety ta konieczność nie ma odzwierciedlenia w aktualnych umowach, działaniach i strategiach. Istniejąca współpraca transgraniczna nie uwzględnia ujednoczonego programu dla obszaru dopływu i wybrzeża. Poza tym istnieje niebezpieczeństwo, że w porównaniu z tak dużym i zróżnicowanym dorzeczem jakim jest dopływ Odry, pas wybrzeża straci na znaczeniu. W ramach programów UNEP-ICARM Odra została wybrana do przeprowadzenia badań precedensowych wzajemnych oddziaływań rzek i

obszarów wybrzeży oraz wyzwań przed którymi stoją tego rodzaju obszary. W bliskiej współpracy z projektem „ZZOP-Odra” podjęta zostanie próba uświadomienia potrzeby zintegrowanego zarządzania oraz wsparcia dialogu pomiędzy wybrzeżem i obszarami dorzecza.

1 Background

Large rivers have a strong influence on the adjacent estuary and surrounding coastal area. During the last decade it became increasingly more obvious that coastal zones in the vicinity of large rivers cannot be managed independently from the rivers and their catchments. The Baltic Sea is an excellent example of how an entire regional sea is controlled by the catchment and river nutrient loads (Gren et al. 2000, Schernewski & Neumann 2002, 2005, Neumann & Schernewski 2005).

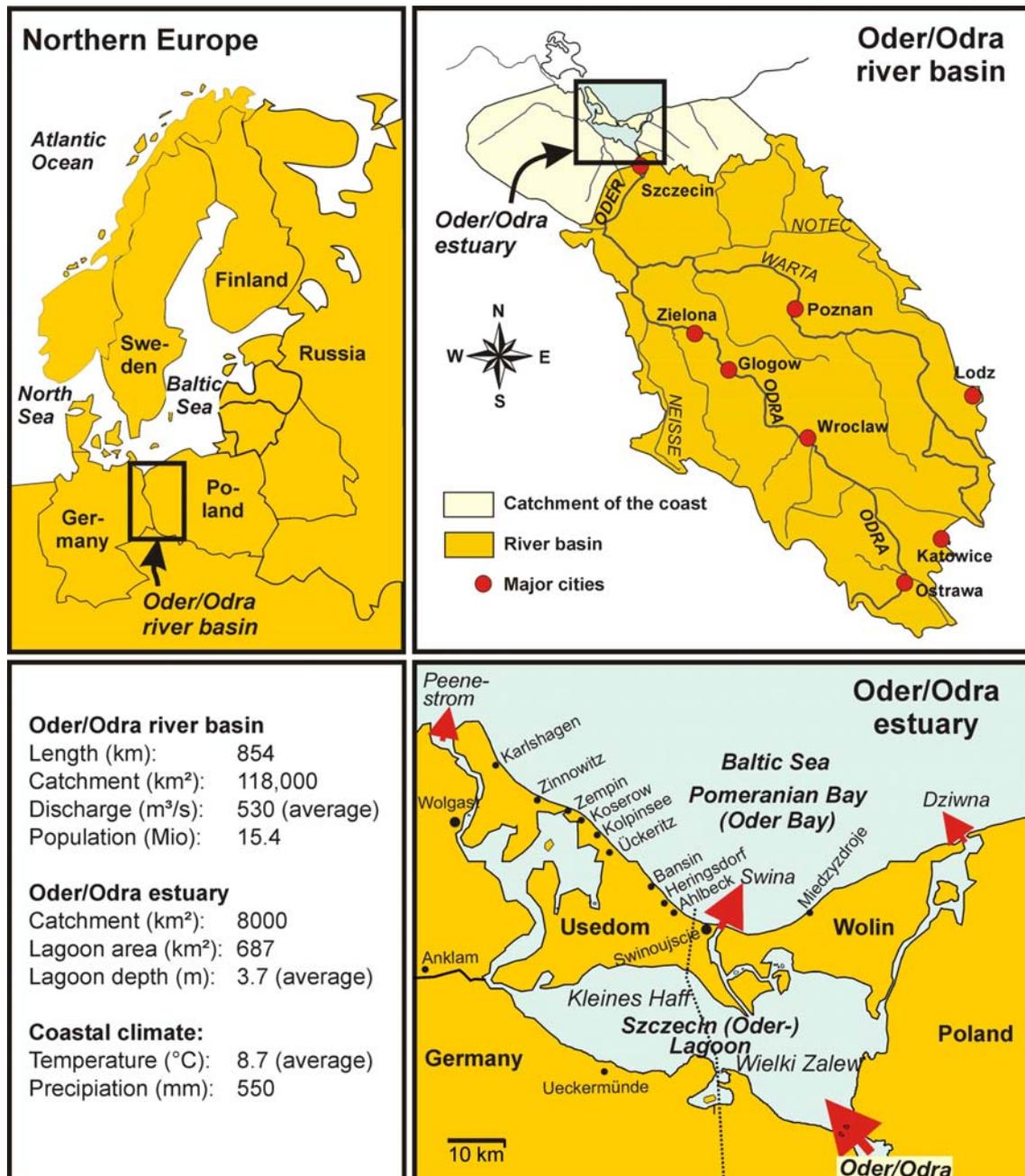


Figure 1: The Odra River basin and adjacent coastal area.

The idea of integrated coastal area and river basin management (ICARM) is reflected in UNEP's ICARM approach, the European Water Framework Directive and partly in the Land-Ocean Interactions in the Coastal Zone (LOICZ) programme. All these programmes focus on water related topics. The spatial integration of river basin and coastal waters does not always reflect the interaction between terrestrial and aquatic systems well. Therefore, ICARM is not a replacement, but a supplement to traditional integrated coastal zone management (ICZM). The objectives are to raise awareness as well as to promote and ensure sustainable integrated coastal water and river management.

The Odra river (in German, *Oder*; in Polish and Czech, *Odra*) in the Baltic region is an outstanding example to illustrate the interrelations between river basin and coast and to demonstrate the dependency of coastal management on river basin management. Therefore, the Odra became the subject of an international case study for UNEP's ICARM programme and for LOICZ. These Odra-related activities are supported by the project, Integrated Coastal Zone Management in the Oder Estuary Region (ICZM Oder) (see <<http://www.ikzm-oder.de>>). This brief report is an outline of the Odra case study.

2 The Oder/Odra river basin and coastal area

2.1 The river and the river basin

The *Odra River* stretches from the Oderské Vrchy in the Czech Republic for 854 km across Poland and along the Polish-German border, emptying into the Szczecin Lagoon. It is one of the most important transboundary rivers in the Baltic region. The Odra Basin (118,000 km²) is shared between Poland (89%), the Czech Republic (6%) and Germany (5%). The Odra is essentially a lowland river with its source in the hilly Polish-Czech border region. Due to the warm-temperate climate with sufficiently rain in all seasons, the water discharge shows only a limited annual cycle with an average discharge of 530 m³/s. Floods are a rare phenomenon and are not necessarily linked to snow melting. The last extreme flood with a discharge up to 2,800 m³/s. took place during late summer 1997 and caused severe damage.

The Odra River has been canalised in parts and sluices allow intensive shipping between about 30 harbours and over 717 km of waterways. The largest harbours on the Odra, Kostrzyn and Schwedt, have a turnover of less than 500,000 tonnes per annum (t/a). Szczecin is the gate to the Odra river system and the most important trans-shipment centre. The Odra is linked to other river systems via canals; for example, two million tonnes of mainly sand, gravel and coal, are transported annually between Szczecin and Berlin over the Oder-Havel Canal. The Odra River basin contains altogether around 450 hydro-technical objects such as weirs, floodgates, hydroelectric power plants, polders, storage reservoirs and locks. Forty-six hydroelectric power plants contribute to the region's energy supply; the 48 storage reservoirs have a combined total volume of water amounting to 968 million m³. Large segments of the river are framed by floodplains and floodplain forests of outstanding ecological value. These are nature protected areas which host a large variety of birds, insect, amphibians, molluscs and fish.

Commercial fisheries is concentrated in the lower reaches of the river, but with a turnover of only about 100 t/a its economic role is insignificant. For public water supply, over one billion m³ of water are extracted annually from the river basin, but because the climate is humid, water shortages do not present a serious problem. River and ground water quality are, however, problematic because sewage and waste water discharged into the river are often not treated, or treated only insufficiently.

For centuries the Odra River basin has been subjected to strong human influence. Agricultural land covers 70% of the upper river basin and 58% of the middle basin. However the contribution of agriculture to the gross value added is only 3.9%. Several larger cities and many industries are located in the river basin which has a total population 15.4 million persons. According to Behrendt (personal communication) the nitrogen (N) and phosphorus (P) loads in the Odra River were already high in the early 1960's, with N totalling 50,000 t/a and P at 6,000 t/a. These increased further, reaching a

maximum during the 1980's, where N totalled 116,000 t/a and P 16,000 t/a. Subsequent economic changes, warmer and drier years and improved sewage treatment resulted in a significant decrease of nutrient loads by the late 1990's, with N falling to 94,000 t/a and P to 8,500 t/a. Compared to other rivers, heavy metal loads in the Odra are not outstanding, although sediments in some areas are polluted. The sediment load is about 400,000 to 500,000 t/a, with additional river bed sediment transport of 200,000 t/a.

2.2 The coastal zone

The *coastal zone* (where the waters of the Odra ultimately discharge into the lagoon and finally the Baltic Sea via the Dziwna, Swina and Peene) is a complex system of lagoons and islands shared between Germany and Poland. With a total of about 840,000 inhabitants (414,000 in Szczecin alone) this estuary region is sparsely populated. Ignoring Szczecin and Świnoujście, the population density for the rest of the region averages around 50 inhabitants per km². The Odra River flows through Szczecin and empties into the large but shallow *Szczecin/Oder Lagoon*. The river and its pollutant load are responsible for the poor water quality of the lagoon and its eutrophication. The lagoon acts as a storage pond for sediment, nutrients and heavy metals originating from the Odra; it thus protects the Baltic Sea from pollution. The flushing time is only 55 days, so that the lagoon's salinity of around 1.5 ‰ indicates that, conversely, it is only influenced to a minor degree by the Baltic Sea.

A waterway runs through the lagoon, linking the Baltic Sea to the City of Szczecin with its huge harbour and important ship-building industry. This waterway is constantly dredged to maintain a depth of more than 10 m. On the average, dredging has removed about 1.5 million m³/a of sediment over the last few decades. Most of the sediment deposited by the Odra as well as large amounts of nutrients are removed with this process and stored on land. Intensive denitrification removes about 15% of the deposited nitrogen load.

The landscape surrounding the Szczecin/Oder Lagoon is flat, dominated by agricultural land and forests. In some areas sand, gravel, oil and gas are exploited. Broad belts of reeds and artificial sandy beaches near the few small towns characterize the coastline. Owing to its outstanding ecological value and scenic beauty, most of the coastal area has become a nature protected zone. A detailed description of the lagoon's ecology is given in Radziejewska & Schernewski (in press).



Figure 2: The quiet and serene Odra Lagoon, despite its scenic appeal, suffers from severe eutrophication.

The lagoon water is discharged into the *Pomeranian (Oder) Bay* on the Baltic Sea via three outlets, the Dziwna, Swina and Peene. Seaward boundaries are the Arkona Sea towards the northwest and the Bornholm Sea in the northeast. The bay has an average depth of 13.2 m and covers an area of approximately 6,000 km². The bay is affected by the Odra River water, but intensive wind-induced mixing and large-scale currents maintain a generally good quality of water. The Odra (sand) Bank and shallow coastal waters, in particular, are ecologically highly valuable; they are either under nature protection or recommended for designation as Marine Protected Areas (MPAs). The Pomeranian Bay shoreline is characterized by coastal forests, cliffs and long sandy beaches; it is dotted with seaside resorts. Intensive sediment transport has led to sediment accumulation and continues to cause erosion in areas along the shoreline. In general erosion is a major problem, causing a coastline retreat of between 0.35 and 1.2 m per year.

Tourism, agriculture, fishing (3000 t/a in the lagoon) and shipping are important economic activities in the coastal zone. The large Polish harbours Świnoujście, Szczecin and Police have a combined annual turnover today totalling more than 22 million t (2002). The German harbours are of minor importance, eight harbours have a turnover of only 400,000 t/a each. More than one million persons arrive in these harbours annually. Along the coastline tourism is the exclusive economic factor and it is likely that altogether more than 10 million tourists visit the estuary region per year. Details about the river basin and the coast are given in Löser & Sekścińska (2005) and Behrendt & Dannowski (2005).

3 River basin and coastal issues

3.1 General regional issues

Many development plans and strategies, expert's reports, official documents and scientific papers exist for the Odra case. A systematic analysis and evaluation of these documents provided a detailed overview about the major concerns, issues and challenges in the region. The results are reported in detail in Löser & Sekścińska (2005). For the coastal area the following general issues are of major importance:

1. economic and infrastructural development of the City of Szczecin and the countryside, preservation of cultural heritage and a sustainable strategy to deal with a shrinking population;
2. improved cross-border cooperation in planning and administration, strengthening the identification with as well as the integration and advertisement of the region;
3. reduced and sustainable resource consumption as well as waste and sewage treatment;
4. sustainable tourism and agriculture against a background of fast-changing basic social and economic conditions;
5. flood management, coastal protection and shipping;
6. environmental quality (air, radiation, noise) with a focus on water quality;
7. preservation of biodiversity and nature, strengthening of cooperation in environmental protection as well as harmonization of multiple uses together with nature protection;
8. environmental education, improvement of educational systems and access to information.

At the moment, German-Polish cross-border integration and cooperation receives much more attention than river basin and coastal cooperation and management. Only the issues of "flood management, coastal protection and shipping" (5 above), "environmental quality with a focus on water quality"(6 above) and, to a certain degree, "preservation of biodiversity and nature ..." (7 above) have a clear river basin - coastal dimension.



Figure 3: The Baltic Sea coast (Ahlbeck, Usedom). The photograph on the left shows a prime example of traditional architecture. The photograph on the right shows flourishing tourism on the beach.

3.2 Future threats and challenges

The Odra region faces dramatic political, social, economic and natural changes. These threats and challenges are only partly reflected in existing regional documents.

1. *Political and social changes:* The German part of the Odra region belonged to the former socialistic German Democratic Republic (GDR). With the German re-unification on 3 October 1990 important social, political and economic changes took place, which are still ongoing. Despite huge financial efforts the Odra region fell behind the development of other parts of Germany. Continuing economic problems cause an unemployment rate around 23%, the out-migration of the labour force and a declining local population. In 1989 Poland elected its first non-communist prime minister after 40 years of socialism. Like eastern Germany, Poland was subject to social changes and its transitional economy is still facing serious ongoing problems and changes. During the last decade the economic and social developments in Germany and Poland were largely independent and resulted in strong social and economic gradients. In the coastal area social problems are increasing and the gap between the flourishing seaside resorts and the hinterland is still deepening.
2. *EU membership and transformations:* With Poland's EU membership in 2004, the entire Odra region became part of the European Union. The new agricultural and industrial policy as well as the implementation of new standards will produce dramatic changes. Cross-border cooperation and competition will increase, resulting in social and economic transformations. This will have multiple effects on the Odra River basin, the river itself and the coastal area.
3. *Legal challenges:* Active European environmental policy has led to the Marine Strategy, recommendations on Integrated Coastal Zone Management, the Habitat Directive (Natura 2000) and the Water Framework Directive (WFD). The WFD and Natura 2000 are currently being implemented in Germany and Poland. Natura 2000 will create a large number of networked, protected areas in the Odra region, which will require effective management. Even more important is the WFD which has the aim to ensure good water quality in all EU member states. The WFD is a cross-border, river basin and coastal approach which requires, for example, that an integrated catchment and coastal management plan be developed during the next few years.
4. *Climate change:* Climate change scenarios predict an increased risk of extreme weather events. Ongoing sea-level rise and a sinking coast as well as changes in precipitation in the catchment, with subsequent changes in river discharge will increase the flooding risk in the river basin and along the coast. On the Baltic Sea coast, an increased risk of storms and storm surges will have immediate negative effects for coastal erosion, protection measures and tourism infrastructure (marinas, beaches, piers, promenades).

3.3 River basin and coastal area interaction and issues

The general regional issues were picked up, subdivided into more detailed issues, and analyzed according to their river basin and/or coastal area relevance. In a second step these issues were linked to future threats and challenges, to ensure that they will be given due consideration not only because of their current relevance, but because they are of growing concern for the future. The resulting issues were determined as follows.

1. *Flooding*: The Odra is a lowland river with only a low hydraulic gradient. The tides in the Pomeranian Bay are in the range of only one decimetre. Strong northerly wind can cause storm sea levels on the Baltic Sea coast of one meter and more above normal. During these situations backwater in the Odra and a temporary intrusion of Baltic Sea water with a salinity of 6 ‰ into the lagoon can occur. Climate change and a sinking coast have resulted in a relative increase in sea level throughout the region, of about 1 mm/a over the last century. An accelerated increase is assumed to be the case for this century. Storm surges will also cause the water level in the Odra to rise; backwater will penetrate even further into the river basin and create a hazard. Climate change will affect not only the coast but also the river basin itself. Recent calculations do not suggest a significant increase in precipitation in the Odra basin, but the likelihood of extreme events and floods (like 1997) might become greater. The region thus faces danger from two sides, due to sea-level rise and increased flooding. An integrated coastal and flood protection scheme is therefore what is required.
2. *Shipping and technical measures*: Shipping plays an important role in the coastal area and on the Odra River. To increase transportation, allow larger ships to enter the harbour of Szczecin and augment the importance of Szczecin as the gateway to Berlin and the other cities in the Odra River basin, the canal through the lagoon will be deepened from 10.5 to 14.5 m. The waterway in the Peene Straight, close to the lagoon, will be deepened to 7.5 m, for the purpose of fostering maritime tourism; this task should be carried out by 2006. According to the Odra 2006 programme the water level and flow in the middle and lower Odra will be regulated to allow the passage of class-three ships. Further, new polders and storage reservoirs and a new barrage near Brzeg Dolny are planned. The flood protection systems and dams near major cities in the upper reaches of the river will be modernized, as well. All of these measures could alter the course and velocity of the Odra, endangering ecologically valuable ecosystems and bayous, and might increase the risk of flooding. An integrated concept for nature protection, and for the prevention of and protection from flooding, which take shipping and technical measures into account, is what is required.
3. *Eutrophication and water quality*: Intensive agriculture, industries and cities produce loads of heavy metals, organic pollutants and particularly large loads of the nutrients, nitrogen and phosphorus. The Odra River water quality suffers from these pollutant loads, but the major consequences are most visible in the coastal area. The Szczecin/Oder Lagoon can be regarded as a hypertrophic, degraded ecosystem. It lacks, for the most part aquatic vegetation, suffers from severe (partially toxic) algae blooms and the water transparency in summer often measures a visibility of less than 50 cm. On sunny, breezeless days, anoxic conditions can arise temporarily, causing die-off and damage to the benthos and a release of phosphorus from the sediment (internal eutrophication). Untreated sewage water from the City of Szczecin is a source of human pathogenic viruses, which can negatively impact hygienic (bathing) water quality in the lagoon, close to the city. Regular dredging of the canal and denitrification processes have meant that the lagoon still serves as a retention pond for nutrients and protects the Baltic Sea to a certain degree from pollution, but the poor water quality hampers bathing tourism and nature conservation. Water quality will gain in importance because most parts of the coastal zone have been designated Natura 2000 sites and the EU Water Framework Directive (WFD) demands good water quality for all surface waters. The WFD further requires a joint river basin and coastal water management plan.
4. *Species migration*: Linked river-coastal systems provide a convenient path for the spreading and migration of species. Intensive shipping resulted in the intrusion of many alien species into the Odra system, which have already partially replaced the original fauna. So far over 20 macrobenthos species are spreading in the coastal waters and the river. Many more alien species are expected and these would pose a serious threat to the present ecosystems. Several fish species like eel, salmon and trout migrate within the Odra water system or enter it to spawn.

The degradation of the ecosystems in the river and the coast is a serious threat and altered the fauna already. The huge number of technical obstacles in the river hampers the fish migration seriously. The suggested large number of Natura 2000 sites in the Odra system calls for an integrated river-coast nature protection management.

4 Present regional cooperation

Regional cooperation currently focuses on three main areas or tasks, namely, coastal zone management between Germany and Poland in the area of the Pomeranian Bay and Szczecin/Oder Lagoon, river basin management between Germany, Poland and the Czech Republic of the Odra River catchment area, and the comprehensive ICARM programme in accordance with WFD specifications.

1. *Coastal area management:* In the coastal zone, several mutual agreements concerning cross-border cooperation between Germany and Poland exist. Results are e.g. the joint Euroregion Pomerania, the regional Agenda 21 “Szczecin Lagoon” and the joint Environmental Commission. The two programmes and the commission form the basis for Polish-German cooperation on concrete projects. Spatial planning and the development of ICZM plans, however, are carried out independently. In 1996 the first Polish ICZM plan was provided by the HELCOM PITF MLW Odra Lagoon Area Task Team. In 2004, a draft ICZM plan for the German side was prepared. Neither plan is legally binding and neither has so far been integrated into regional spatial planning proposals.
2. *River basin management:* Several agreements between Germany, Poland and the Czech Republic ensure close cooperation in the Odra River basin. The International Commission on the Protection of the Odra against Pollution (ICPO) has the task to protect rivers, lakes and the sea. In May 2002 the ICPO received the mandate to coordinate the implementation of the EU Water Framework Directive within the international Odra River basin. Another ICPO task is protection from flooding, which is the main issue in the Polish “Program Odra 2006”. Thus far, however, a river basin management plan has not been developed or implemented.
3. *River basin and coastal area cooperation:* The WFD requires that a joint river basin and coastal area management plan be prepared over the next few years. This plan, however, focuses only on water quality and is spatially restricted to the immediate coastal waters (i.e. not further than one nautical mile from the shoreline). At present there is no systematic cooperation on Odra River basin and proximate coastal issues ; a comprehensive ICARM programme is still lacking.

Löser & Sekścińska (2005) give more details about agreements, cooperation, organisations and responsibilities.

5 Constraints, needs, and lessons learned

Constraints for ICARM

The severe problems in the Odra region clearly reflect a growing need for joint coastal area and river basin cooperation and management, but this issue still receives only minor attention. The trans-national Odra region reflects the cultural, economic and social differences especially between Germany and Poland. Therefore, the focus of recent efforts has been to improve cross-border cooperation between Germany and Poland, and to encourage joint regional development. In general, the lack of a common language has contributed to the less than optimal efficiency of cross-border activities.

A survey among authorities and regional stakeholders was carried out, and a media analysis was done to gain an impression of the public perception of river basin and coastal problems and issues. Regional authorities, especially, are well aware of the major problems and clearly see the links between catchment and coast, but they fail to take action. Public awareness of water-related problems and the consequences of not having efficient, integrated management is only poor. Future threats like climate change and sea-level rise and their potential consequences are not well perceived. Problems

and issues in the neighbouring countries are not sufficiently reflected in domestic media. In the Odra case, an awareness and information deficit clearly exists.

The coast suffers mainly as a result of activities in the river basin; but, at the same time, the coastal area is small compared to the large catchment. Experiences concerning the implementation of the WFD in other river basins revealed that small coastal communities are often “outnumbered” and must compete for attention against many representatives from the river catchment area. Thus, coastal communities are less able to attract attention to their specific issues and problems.

Needs

There is a general need to raise common awareness about river-related problems, to improve cross-border communication and information, and to promote the integrated management of the Odra River and coastal zone. Cross-border coastal dialogues are required (and have already been initiated) to bring together the coastal communities and help them to develop a common identity. In a subsequent step, coast-river dialogues addressing a concrete topics like the EU WFD should be initiated to support joint river basin and coastal zone planning. The coastal perspective needs to be included in priority actions and the ICPO should be buttressed in developing implementation programmes.

Evaluation and lessons learned

Big river systems like the Odra, with a large regional population, many authorities and organisations, as well as complex political and legal structures require high ranking political commitments, clear objectives and structures as well as a suitable body to form the basis for cooperation and management. In this respect, the ICPO is just such a body, although its coastal perspective is currently not well developed. Recent EU directives have accelerated cross-border cooperation; because of a fixed schedule for implementation of various measures, for the directives require concrete plans to be drawn up and specific actions taken by specified deadlines. The EU Water Framework Directive is today the major impetus for cooperation in the river basin area and, hopefully, it will enhance basin-coast activities as well.

An organisation like UNEP adds an international dimension to the basin-coast problematique and allows an exchange of experiences vis-à-vis river-coast case studies from other parts of the world. UNEP can assist, support, and complement existing structures and bodies. The project IKZM-Oder (ZZOP-Odra), which is backed by UNEP, successfully contributed supporting activities in this respect. These include the following:

- provision of background reports concerning major issues and uses (tourism, fisheries), legislation, planning, division of authority in the region, identification of stakeholders, and the regional implementation of the WFD. An initial German coastal management plan has already been published. All reports serve as a basis for the dialogue meetings and management policies.
- a coastal regional Agenda 21, which is a political commitment and forms the basis for cross-border cooperation. The size and population of the Odra system precludes full public participation and stakeholder involvement in a basin-coast dialogue, but the regional Agenda 21 supports coastal public participation and education.
- organisation and documentation of the first cross-border stakeholder dialogue with 90 participants. The dialogues are accompanied by dissemination of information and other awareness-raising activities. A strategy to set up a basin-coast dialogue is already being developed.
- provision of an internet-based regional information and GIS planning system. The system contains different types of compiled and prepared information (maps, reports, pictures etc.) and gives stakeholders direct access to relevant ICARM information. An initial evaluation of how this system was utilized was very positive.
- provision of diagnostic analysis e.g. on the impact of future climate change and land-use changes on pollution in the catchment and eutrophication of the coastal waters and the Baltic Sea. Recommendations for adaptive management will be made.

- compilation and application of a set of indicators and criteria for evaluating the effectiveness of sustainable development of the Odra river and coastal area.

References

The following list of references represents only a small selection of the entire bibliography. A more comprehensive overview is given by Löser & Sekścińska (2005) or can be found under <<http://www.ikzm-oder.de/>> and <<http://www.eucc-d.de/ikzmdokumente.php>>.

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