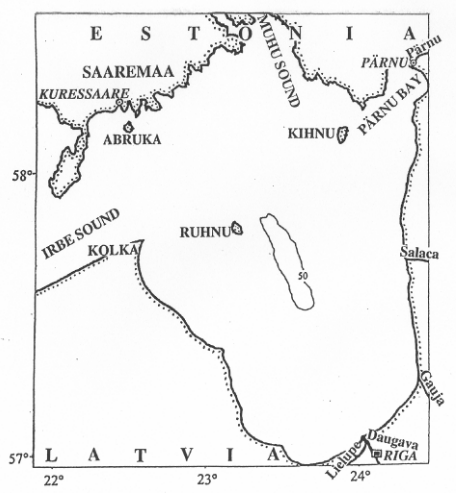
WT 7.1 GULF OF RIGA

1. Host Institution: Estonian Marine Institute of the University of Tartu
Contact: Evald Ojaveer evald.ojaveer@ut.ee

2. The Gulf of Riga is situated between the Estonian and Latvian mainland and Saaremaa Island.



3. Characteristics

Marine System	The surface area of the Gulf of Riga is 16 300 km², the volume is 424 km³. The salinity varies from 4 to 7 ppt (in near-coastal areas 0-2 ppt). It is connected with the open part of the Baltic Sea through the Irbe Strait and the Estonian Archipelago (Väinameri). The Gulf is an estuarine, land-dominated area. A separate ecological subsystem exists in the gulf. As there is no halocline in the gulf, the water in the bottom layers is rather cold and well aerated during the year. Therefore, a number of Ice Age relict species have found acceptable habitats there. Strong seasonal thermocline is an important factor for summer dynamics of the ecosystem. The gulf is a very productive area of the Baltic Sea. The dynamics of local populations of the gulf closely depends on periodic climate changes (mainly salinity, winter temperature and river runoff are important factors) and various anthropogenic impacts, and differ from other areas of the Baltic Sea. On the southern (Riga and its satellite towns) and eastern (Pärnu) coasts of the gulf important holiday resorts have existed long time. Nowadays the importance of tourism has enormously increased both on the mainland and especially on the islands. One of the most recent concerns is substantially increased maritime transportation (both cargo ships and leisure boats) that is an important vector for the introduction of non-indigenous species. The invasion of alien species has resulted in fundamental alterations in the structure and functioning of both the benthic and pelagic systems.
Watershed	The catchment area is rather flat and constitutes 134 000 km². Five relatively large rivers (Daugava, Lielupe, Gauja, Pärnu, Salaca) and a number of smaller rivers discharge into the gulf. The average annual freshwater inflow equals to 31 km³ (7.3 % of the volume of the gulf), 86 % of it falls into the southern part of the gulf. A number of dams have constructed on the rivers (incl. Daugava), some water reservoirs exist. The gulf is surrounded by densely populated areas as well as intensely used agricultural areas situated on the southern and eastern coasts.
Human Activities	Industrial wastes. The main industrial pollution sources are from Riga and other towns. Intense agriculture. Intensely used agricultural areas are situated on the southern and eastern coasts. Other: Overfishing of valuable species. Harmful algal blooms. Invasion of alien species.
Impact Responses	**Pollution and eutrophication**. The pollution with its side-effects has considerably affected the gulf ecosystem (impoverishment of species diversity, changes in the food web, increase in the frequency of harmful algae blooms, etc) and exerts additional impact to the natural stress factors of biota (limited salinity, low temperature in winter, etc). **Overfishing**. Fishing, fish processing and related professions are very important for coastal population. Mainly herring, perch, smelt, pike-perch etc are fished. The exploitation rates are high, some valuable species are overexploited. **Other**: habitat destruction; deterioration of the quality of coastal waters.

4. Policy

Policy issues	Eutrophication, harmful algal blooms and toxic pollution of the gulf; protection of the coasts, beaches and coastal waters including the areas of intense tourism; need for the ratification of the IMO ballast water regulations; recognition of the socio-economic and ethic value of marine resources (bottom vegetation, invertebrates, fish, birds, seals) and marine environment. The key questions: 1) What is the optimum exploitation regime to grant sustainable management of local fish stocks? 2) What is the acceptable management of coastal environment to support tourism and health resorts? 3) Can we foresee the changes in the unique ecosystem under heavy invasion of alien species? 4) What is the role of maritime transportation in degradation of ecosystems?
Policy changes	During the period covered by the time series indicated below, policy changes have been in the following: 1) enforcement of fishing rules; 2) protection of marine environment and ecosystems; 3) protection of resort areas.

5. Stakeholders and Institutional Governance

Major organisations	Ministry of the Environment; Ministry of Health, County and municipal administrations; fishermen's organisations, large ports – both in Estonia and Latvia; Baltic Marine Environment Protection Commission; International Council for the Exploration of the Sea.
Other leading organisations	Tourism organisations, Nature conservation organisations, holiday resorts.

6. Partner Collaboration

SPICOSA Partner Collaborations	Core Partner: Institute of Aquatic Ecology, University of Latvia (Dr. Maija Balode).

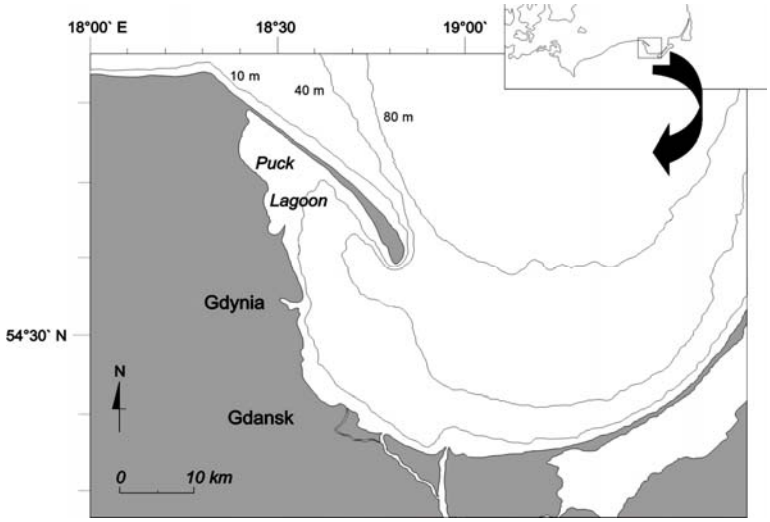
7. Systems Studies

Long time series	1) Hydro-meteorological data (temperature, winds, river discharge, cloudiness etc.) - since the 1940-50s; 2) Hydrochemical data – inorganic and total N, P, Si – since 70-80s. 3) Mesozooplankton: May-July – since 1957; April-November – since 1972. 4) Phytoplankton – since the 60ies. 5) Macrozoobenthos – since 70-80s. 6) Mysids – since 1974. 7) Spring spawning herring (year-class abundance, population numbers, population biomass, mean weight at age) – since 1957: 8) Smelt (year-class abundance, population numbers, population biomass, mean weight-at-age) - since 1960 9) Annual fish catches – since 1956. 10) Qualitative and quantitative data on feeding of herring, sprat, smelt, stickleback – since 1994. 11) Trace metals and organochlorine compounds in herring – since 1994. 12) Dioxins in herring – since 2002.
Research Projects *Socio-economic study*	Continuous state projects: 1) Investigations on dynamics and regularities of development of ecological subsystems in the North-eastern Baltic, Gulf of Finland and Gulf of Riga (2003-07). 2) The impact of spatial and temporal variation of coastal processes on the biological and functional diversity (2003-07). 3) State programmes on the monitoring of eutrophication (since 1994), on dangerous compounds (since 1994), of dioxin content in fish (since 2002), at the Estonian coasts. In 2002 an investigation on the catch effort of Estonian trawl fleet was carried out (MSc thesis).

WT 7.2 GULF OF GDANSK

1. Host Institution: **Maritime Institute in Gdańsk** **Contact:** **Juliusz Gajewski**

2. Gulf of Gdansk, Poland.



3. Characteristics

Marine System	The Gulf of Gdansk is a south-east part of the Baltic Sea enclosed by a large curve of the shores of Gdansk Pomerania in Poland (Rozewie Cape, Hel Peninsula), and Kaliningrad Oblast of Russia (Sambian Peninsula). Western part of the Gulf of Gdansk is the shallow waters of the Puck Bay and the south-east part is the Vistula Lagoon separated by the Vistula Spit and connected by the Strait of Baltiysk. Gulf of Gdańsk has different hydro-geomorpholo-gical regimes and consists of different units: lagoons, river mouths, sheltered and open coastal areas. This area is under strong anthropogenic pressure. Maximal depth is 120 meters, salinity: 7 PSU. Total surface area of the Gulf of Gdansk is 5134 km^2 and volume is 840,2 km^3. Major ports: Gdańsk, Gdynia, Kaliningrad, Hel, Puck (ca. 2 millions inhabitants).Sandy bottom biotopes are dominated by macrophyte vegetation only occur in the sheltered Puck Bay. Some small areas of stony bottom covered with macrophytes occur in the Gulf of Gdansk as well. The degree of naturalness and degradation of biotopes varies, with the greatest changes being observed below the halocline in the Gdansk Deep. Long-lasting periods of oxygen deficiency have caused the disappearance of almost all macroscopic life on the bottom and the impoverished plankton has limited fish reproduction.
Watershed	The Pomorskie region covers almost half of the Polish coastline (Eastern part), with two different types of settlements - westerly one being populated after II World War by immigrants from the Polish territories passed to Soviet Union and easterly one being populated by Kaszubian's – people living there already for hundreds years. Westerly part was dominated before 90-ties by intensive collective farming and industrial fishing. On the other hand the easterly part was mainly consisting of small private farms and small boat fisheries. The coastal zone of the study site is mostly low sand beaches – an excellent place for tourism development. Additionally Hel Peninsula being itself attractive creates a very good place for windsurfing in the Puck Bay.
Human Activities	Tourism, Agriculture, Fishing and Shipping
Impact Responses	Eutrophication, Trophic web changes, Diversity loss, Coastal erosion

4. Policy

Policy issues	Impact of changes in land use and agriculture in the coastal area and Vistula river catchment area on coastal water quality, consequences for coastal water management, Possibilities of environmentally-friendly reduction of unemployment and/or conversion from fishery/shipbuilding including reduction of "social exclusion" Harmonization of the management approaches of Natura 2000, EU-ICZM recommendations and the Water framework directive.

Policy changes	Changes in the settlement type after the II World War in Gdańsk area and west part of the region – immigration and nationalization of agriculture Evolution from environmentally negative (70's & 80's) to environmentally-friendly policies (concerning overexploitation of natural resources, including biological ones) Changes in urban and waste polices Changes in agriculture – bankruptcy of nationalized farms, economical and industrial crisis Changes in industry – bankruptcy of national industry and rebuilding under new regulations Changes in property ownership – privatization Demilitarization (e.g. free access to the beaches from 1989)

5. Stakeholders and Institutional Governance

Major organisations	Pomorskie Region Authorities Maritime Office in Gdynia Local Authorities around Gulf of Gdansk
Other leading organisations	Union of Coastal Cities Fishermen Association

6. Partner Collaboration

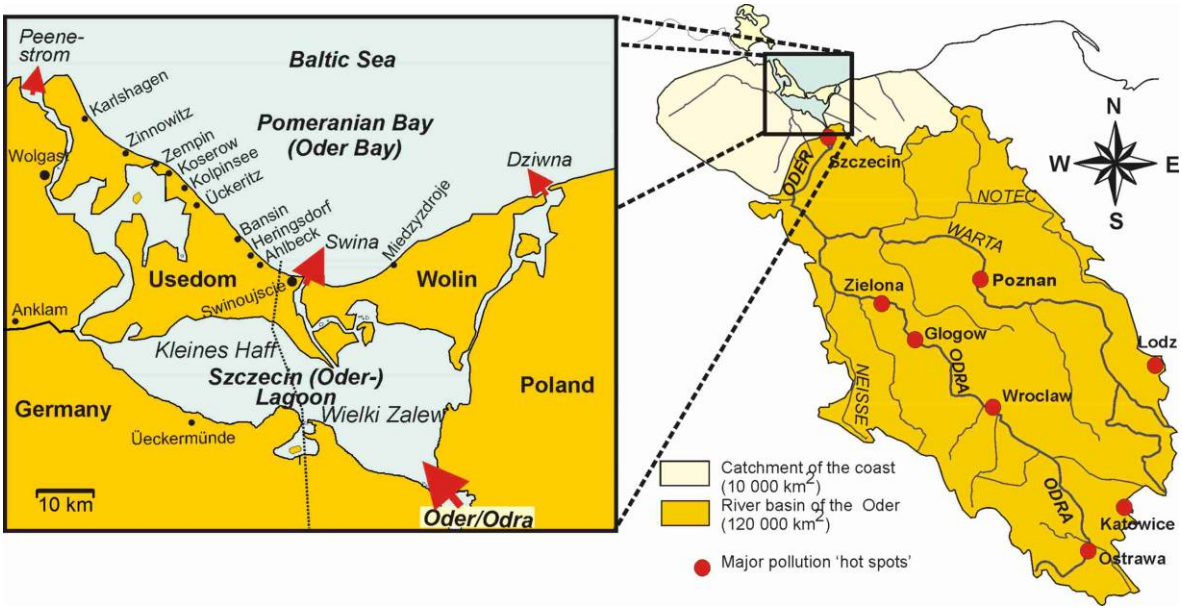
SPICOSA Partner Collaborations	SPICOSA Core Partner – Institute of Oceanography of University of Gdańsk

7. Systems Studies

Long time series	long-term (more than 20 years) data on: salinity, temperature, radiance, H_2S, oxygen, chlorophyll a, statistical data on economical, social and industrial issues (statistical information for 50 to 100 years), aerial photos of the coastal zone, various and large amounts of additional data e.g. meteorological, hydrodynamic, water quality, heavy metal, biological data
Research Projects *Socio-economic study*	A model of matter exchange and flow of energy in the Gulf of Gdańsk ecosystem, State Committee for Scientific Research, No 6PO4E 036 09 EUROCAT: European Catchments Changes and their Impact on the Coast Case Study VISCAT: The Vistula River Catchment and the Baltic Sea Coastal Zone**,** No. EVK1-CT-2000-00044 HIPOCAS, 40 Years Hindcast of the sea level, waves and circulation in the Baltic Sea, EU Project Nº.: EVK2-CT-1999-00038, 1-90 Maritime Institute in Gdańsk is preparing yearly assessment – "Maritime Economy – statistic review". DEDUCE: The Interreg III C project aiming on production of indicators of implementation of ICZM management.

WT 7.3 THE ODER (ODRA) ESTUARY

1. **Host Institution:** Baltic Sea Research Institute Warnemünde, Germany
   Contact: Gerald Schernewski gerald.schernewski@io-warnemuende.de



2. **The Oder estuary is the mouth of the Oder (Polish: Odra) river, one of the largest rivers in the Baltic region. It is located at the southern Baltic Sea (border between Germany and Poland).**

3. Characteristics

Marine System	**Oder Lagoon:** The coastal zone is dominated by the discharge of the river Oder (Odra) into the Szczecin (Oder) Lagoon. The large (687 km²) and shallow (average depth 3.8 m) Szczecin (Oder) Lagoon, is the key element of the Oder estuary region. The lagoon is subdivided into the "Kleines Haff", located mainly on the German territory, and the "Wielki Zalew" on the Polish territory. The Wielki Zalew covers about 60 % of the lagoon area and volume. **Pomeranian Bay:** The lagoon is connected to the Pomeranian Bay via three outlets. The bay is part of the Baltic Sea. Seaward boundaries are the Arkona Sea towards north-west and the Bornholm Sea in the north-east. The bay has an average depth of 13.2 m and covers an area of approx. 6.000 km². The bay is influenced by the Oder River water, but intensive wind-induced mixing and large-scale currents in the Baltic Sea dominate this system.
Watershed	**Oder River:** is one of the most important transboundary rivers in the Baltic region (854 km length). Its basin (118,000 km²) is shared between Poland (89 %), the Czech Republic (6 %) and Germany (5 %). Many larger cities and industries are located in the river basin (total population in the basin 15.4 millions). The basin is under intensive agricultural use. The average annual Oder discharge is 17 km³ (530 m³ s-1) and it contributes at least 94% to the lagoon's water budget. In the 1990's the riverine nutrient load was 94,000 t/a nitrogen (N) and 8,500 t/a phosphorus (P). Other major river basin – coastal area issues are flooding, shipping and technical measures as well as species migration.
Human Activities	Tourism, agriculture, fishing and shipping
Impact Responses	Eutrophication, nutrient loading, bio-chemical pollution, habitat destruction, biodiversity loss

4. Policy

Policy issues	➢ Impact of changes in land use and agriculture in the river basin on coastal water quality, consequences for coastal water management; ➢ Development of future land use scenarios, suggestion of concrete measures to reduce pollution and socioeconomic evaluation; ➢ Impact of climate changes on water discharge and nutrient load in the river basin, effect on coastal eutrophication, consequences for coastal water management and socioeconomic

	evaluation; ➢ Harmonization of the management approaches of Natura 2000, EU-ICZM recommendations and the Water Framework Directive;
Policy changes	➢ Drastic changes in agricultural intensity and practice in the Oder river basin after German reunification and political changes in Poland (from 1989 ongoing). Heavy impacts on nutrient loads and eutrophication were observed. ➢ Drastic changes in tourism and industry intensity after German reunification (1989) and political changes in Poland (from 1989 ongoing) as well as Poland's membership in EU (2004). ➢ Changing social, economical and environmental gradients between Germany and Poland and increasing economic problems. ➢ Changes in agriculture intensity and nutrient loads due to the Polish EU-memerbership.

5. Stakeholders and Institutional Governance

Major organisations	The following authorities are already involved in the ICZM-Oder initiative: ➢ Umweltministerium, Abt 4 - Integrierter Umweltschutz und Nachhaltige Entwicklung ➢ Amt für Raumordnung und Landesplanung Vorpommern ➢ Landesamt für Umwelt, Naturschutz und Geologie Mecklenburg-Vorpommern (LUNG) ➢ Landesamt für Forsten und Großschutzgebiete ➢ Staatliches Amt für Umwelt und Natur Ueckermünde and Rostock ➢ Institut für Fischerei der Landesforschungsanstalt ➢ Europaregion Pommerania ➢ Landkreis Ostvorpommmern and Landkreis Uecker-Randow ➢ Stowarzyszenia Polskich Euroregionu Pomerania ➢ West-Pommern Woiwodschaft Inspektorat Szczecin
Other leading organisations	The following groups are already involved in the ICZM-Oder initiative and have the aim to ensure a sustainable cross-border coastal development and to implement joint measures: ➢ Joint Polish/German Enviromnmental Commisssion ➢ Regional Agenda 21 "Oder lagoon" (joint German/Polish agreement and co-operation)

6. Partner Collaboration

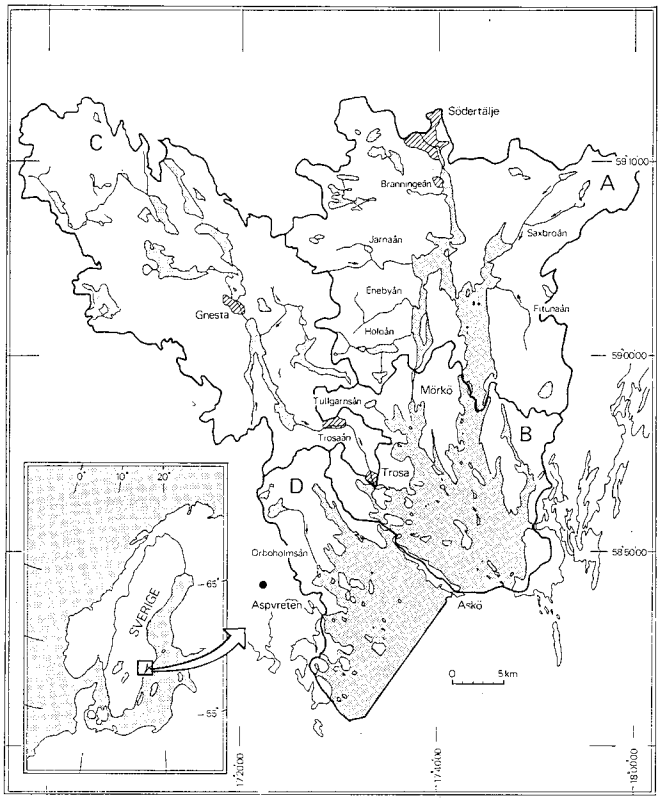
SPICOSA Partner Collaborations	**Core partners :IOW**: Baltic Sea Research Institute Warnemünde; **IOEW**: Institute for Ecological Ecomomic Research; **EUCC**: The Coastal Union, Netherlands, Germany and Poland & **KMG**: College for Management and Formation of Sustainable Development.

7. Systems Studies

Long time series	Hydrochemical, -physical and phytoplankton data, river discharge and nutrient loads of 30 years as well as weather and socio-economic data.
Research Projects *Social study*	**ICZM-Oder**: 11 partner institutes from different disciplines are involved in this national reference project on ICZM. The project is a reference project in UNEP-ICARM and LOICZ as well (budget: 2 Mio Euros, funded by BMBF, www.ikzm-oder.de). Aquatic systems, river basin –coast interactions, land use changes, tourism, indicators and global change effects on water quality are major topics. Further, investigations on spatial planning as well as legislative and socio-economic aspects are carried out. **ASTRA:** The Interreg project about practical consequences of climate change in the region. Data from many previous projects is available. Large inter-disciplinary and trans-national projects with many partners were e.g.: Oder Basin-Baltic Sea Interactions (**OBBSI**), Inter-disciplinary research on water quality, legislation & planning, lead by IOW. Transport and turnover in the Pomeranian Bay (**TRUMP**), lead by IOW. **GOAP**, inter-disciplinary project on ecological processes and functions in the Oder estuary. International Oder project (**IOP**), lead by University of Hamburg. Socio-economic studies are available with respect to tourism, agriculture, regional planning, cost-benefit anlysis, public perception and participation (Agenda 21).

WT 7.4 HIMMERFJÄRDEN

1. Host Institution: Stockholm University. **Contact:** Ragnar Elmgren
ragnar.elmgren@ecology.su.se



2. Himmerfjärden, Swedish Baltic coast with catchment (A+B+C) and reference area (D).

3. Characteristics

Marine System	A coastal bay system of 232 km2, mean about depth 17 m, atidal, Salinity 4-7, slightly lower than adjacent Baltic. Ice-covered most winters, summer water temperature ca. 20°C. Located 60 km S of Stockholm, Sweden.
Watershed	Area 1286 km2, with 8% lakes, 20% agricultural land, 65% forest, 3% built area. Mean water input 8 m^3s^{-1} from 9 brooks and streams, 7 m^3s^{-1} from Lake Mälaren through Södertälje, 2 m^3s^{-1} diffuse runoff, 1.5 m^3s^{-1} treated sewage ,4 m^3s^{-1} rain.
Human Activities	**Waste effluents**: Sewage from **Urban** area, emissions from **industrial** activity (e.g. lorry and pharmaceutical factories), run-off from agriculture. **Shipping:** to Södertälje and further through Lake Mälaren. **Recreation:** boating, swimming, fishing. **Fisheries:** Some commercial fishing. **Agriculture, Forestry.**
Impact Responses	**Nutrient loading:** has caused increased turbidity, loss of submerged aquatic vegetation, deep water oxygen deficiency, cyanobacterial blooms, biodiversity loss. **Baltic overfishing:** has caused trophic web change, biodiversity loss. **Industrial effluents:** Chemical stress on organisms suspected

4. Policy

Policy issues	1) Difference in interpretation of Urban Waste Water Directive between Sweden and EU, 2) Need for legislation that allows an Adaptive Management approach to minimize coastal eutrophication, 3) Implementation of advance nutrient reduction to minimize coastal and open sea eutrophication, 4) Implementation of the Water Framework Directive in the Swedish Coastal Zone.
Policy changes	1974 Greatly increased discharge of treated sewage, 1984 experimentally increased phosphorus load during one year, 1997 introduction of enhanced nitrogen removal

	(c.85%) in Sewage treatment plant, 1997-2005 temporary use of an Adaptive Management approach for running the sewage treatment plant, from 2004 implementation of the Water Framework Directive. Permanent permission for adaptive sewage management will be sought in 2008, when a long-term discharge permit for the Himmerfjärden sewage treatment plant will be decided.

5. Stakeholders and Institutional Governance

Major organisations	Southwestern Stockholm Region Water and Sewage Works, Inc., Himmerfjärden Nature Conservation Society, Svealand Coastal Water Conservation Association.
Other leading organisations	Södermanland and Stockholm County Administrative Boards, Swedish Northern Baltic Water District, Swedish Environment Protection Agency. **Industries:** Astra Zenca Inc., Scania

6. Partner Collaboration

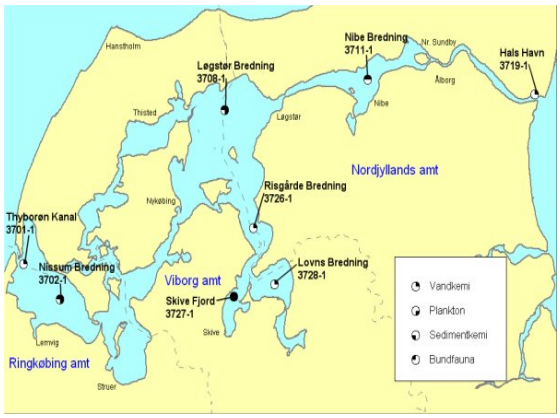
SPICOSA Partner Collaborations	Core partners: Enveco Environmental Economics Consultancy, Contact person Dr. Tore Söderqvist, tore@enveco.se (environmental economics) Gerald Moore, Plymouth Marine Laboratory, Prospect Place, Plymouth, PL1 3DH, UK, E-mail gfm@pml.ac.uk (marine remote sensing) Paul Tett, Napier Univ, Edinburgh, Midlothian EH10 5DT Scotland, p.tett@ichrachan.u-net.com (marine modelling)

7. Systems Studies

Long time series	From 1975 with sampling frequency 22-25/yr at 4-10, station, sampling every 5 m surface to bottom, variables: NH4, NO2/NO3, PO4, TP TN, Si, oxygen, salinity, temperature, chlorophyll a, phyto- and zooplankton (a few stations), phytoplankton primary production, yearly surveys of soft bottom macrofauna (1972-1997 every yr, thereafter every 3rd yr), water exchange estimates from a sophisticated oceanographic model. For remote sensing AVHRR archive from 1982. Use of VSF (volume scattering function data from sea-truthing in 2001/2002) to relate to AVHRR reflectance data. Meteorological data, land run-off and discharges from Lake Mälaren (water, nutrients) and local sewage treatment plants and industries, as well atmospheric deposition of nutrients available since 1975.
Research Projects	**Earlier:** A series of projects 1988-1996: Major project 1997-2003: SUCOZOMA (Sustainable Coastal Zone management) to develop methodologies to use adaptive management to minimize coastal eutrophication. 1997-2002: RESE (Remote sensing for the environment - Methods for detection of changes in aquatic ecosystems and monitoring of algal blooms). 2000-2003: OAERRE (Oceanographic Applications to Eutrophication in Regions of Restricted Exchange, EU Framework V project). **Ongoing:** Test of ecosystem responses to full scale nutrient load experiments using changes in the discharge from the sewage plant. Remote sensing project (2007-2010) funded by ESA to gather unique combined bio-optical and biogeochemical data on transects from coastal to open Baltic Sea waters (Himmerfjärden to Landsort Deep). **Future:** Full scale ecosystem experiments will continue at least to 2007 and likely beyond. Substantial funds are available from the STP and other sources to sustain additional research, e.g. the Swedish EPA and FORMAS presently support analysis of zooplankton samples to obtain long-term (from 1978) data series. A project to study enhancement of water quality through large-scale release of predatory fish (pikeperch) is being planned. Remote sensing: AUTOVAL (2007-2009): developing automated systems for sea-truthing of ocean colour data, FP6 proposal under IST5. Field campaigns to improve interpretation of satellite data of the Baltic coastal zone.

WT 7.5 LIMFJORDEN, DENMARK

1. Host Institution: Danish Institute for Fisheries Research**. Contact:** Josianne Støttrup jgs@dfu.min.dk



2. The Limfjord is situated in North Jutland, with western inlet to the North Sea and a narrow channel leading to the Kattegat.

3. Characteristics

Marine System	With a surface area of 1500 km3 and about 1000 km of coastline, the Limfjord is the largest fjord in Denmark. The fjord receives saltwater (32-34 ppt) from the North Sea in the west, and from Kattegat (19-25 ppt) in the east. Wind generated currents and tidal currents generate an average flow of 6.8 km3 from west to east through the fjord. The fjord consists of a system of shallow broads (5-8 m) linked by deeper sounds (18-22 m).The estuary is strongly impacted by an intensive blue mussel commercial fishery causing habitat changes and heavy eutrophication resulting in frequent oxygen depletion events. The fjord is used for ship transport from the North Sea to the Kattegat and viceversa and water-related recreational activity.
Watershed	The catchment area is relatively flat, expands over 51 counties covering an area of 7528 km2 and provides on average 2.7 km3 of freshwater runoff annually. The freshwater input is equivalent to about 1/3 of the total volume of the Limfjord. Nutrient loading is primarily from non-point sources. The primary land-use is agriculture covering about 62% of the area. About 15% is covered with forest and the remaining 22% is semi-urban and open nature. Suspended matter has a great influence on light penetration in this relatively shallow fjord and consists of phytoplankton and re-suspended matter, especially in the wind-exposed western part of the fjord.
Human Activities	Agriculture, Large catchment with intensive agriculture results in high annual nutrient input. Commercial fishing for shellfish. A large mussel fishing industry based on bottom dredging. Stones and shells removed are not returned to the estuary resulting in habitat degradation.
Impact Responses	**Eutrophication** has caused enhanced oxygen depletion occurrences and durations and changes in benthic-pelagic coupling **Impact of mussel dredging** from the commercial fishery has caused changes in musselstocks, in- and epifauna, sediment complexity and coupled effects on species interactions, sediment resuspension, seagrass and macroalgae and led to conservation measures as MPA **Other**: Over-fishing, Bio-chemical pollution - Trophic Web Change - Use Depreciation

4. Policy

Policy issues	**Fisheries policy**. Much effort has been put into devising a fisheries policy for the whole system, with participation from all the counties (management), research institutions and user groups. A fishery plan was published in 2000 and as a consequence of this several policy measures have been taken, such as; closing trawl fishery for eel and closing areas for all fishery with mobile gear. In 2004 a committee established by the Danish minister of fishery recommended on new regulation and initiatives towards a sustainable shellfish fishery and improved production of mussels by aquaculture. Danish authorities have to implement a number of these recommendations in the next years. A new tool is recently developed using GIS for the management mussel and oyster fishery and aquaculture and taking into consideration biological, political and user issues for the definition of potential sites/areas for fisheries or aquaculture within the whole Limfjord.

Policy changes	**Fisheries Policy** in particular a policy for mussel and oyster fishery within the Limfjord has been established. A policy for increased production by mussel farming (aquaculture) has been established. A new **land-use policy** is currently being proposed to redistribute land use relative to watershed characteristics and potential run-off/nutrient leakage.

5. Stakeholders and Institutional Governance

Major organisations	County and Municipal administrations surrounding the fjord, Ministry of Fisheries, Ministry of Environment, Fishermen organisations, Agriculture Organisation, Aquaculture Organisation.
Other leading organisations	National Agency for the Environment, Coastal Authority Directorate, Tourist industry, Nature Conservation organisations such as Danish Nature.

6. Partner Collaboration

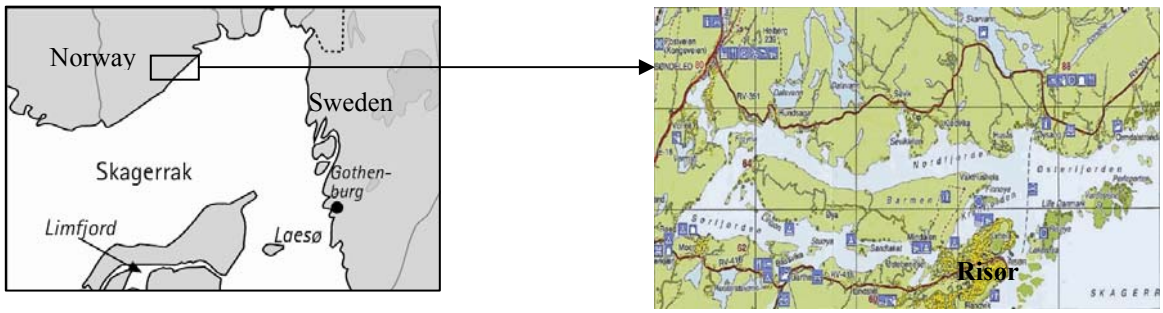
SPICOSA Partner Collaborations	Core Partner: **NERI** National Environmental Research Institute (Professor Stiig Markager); Systems Modelling. Linked Partners : University of Southern Denmark (Dr. Marianne Holmer). Marine Ecology and Socio-economic and IFM Institute for Fisheries Management & Coastal Community Development (Senior Researcher Sten Sverdrup-Jensen). Socio-economic

7. Systems Studies

Long time series	Hydrochemical, -physical and phytoplankton data, river discharge and nutrient loads of 30 years. Benthos, fish, birds and seals data over 10-20 years. Various and large amounts of additional data e.g. meteorological, hydrodynamic, sediment, heavy metal, biological data. A 3-page listing detailing all available time-series data has been collated.
Research Projects *Social study*	- A project "GIS-Limfjord" was initiated in 2004 introducing GIS data both on land and sea data as a tool in fisheries management within the Limfjord. It would be possible to access these data to integrate them. For summary see:**http://gis.dfu.min.dk/website/Limfjord/viewer.htm** - In 2002 a 3-year EU project EUROGEL was initiated with the aim to describe the distribution and temporal occurrence of jellyfish in the Limfjord and evaluating their grazing impact within the ecosystem. (2002-2004). Two EU projects (Essence and Mabene – 1999-2005) deal with the interactions between the benthic communities and the pelagic environment with particular emphasis on grazing aspects of mussel communities and on ecosystem modelling with focus on mussels. - A national project SUSTAINEX focus on impact of mussel dredging, recruitment processes of blue mussels, bentho-pelagic coupling all integrated in an ecosystem model. Several project deals with sustainable aquaculture of blue mussels and flat oyster coordinated by the Danish Shellfish Centre. One project deals with ecosystem models as tools for management. Funding is for 2007-2008. A close cooperation exists between research institutes, universities, and managers from the 3 counties bordering the fjord and stakeholders such as commercial and recreational fishermen's organisations. - In 1996 a social study on "The fight for the Limfjord – Lifestyles, environmental values and policies" was completed analysing the fishing community their use of the fjord, which is directly impacted by the declining fish stocks and future fishery policies. The report analyses the different usages in the fjord, the conflicts and possible consequences of different policies for the local communities.

WT 7.6 NORWAY SOUTH-EAST – THE SØNDELED FJORDSYSTEM

1. Host Institution: Institute of Marine Research. **Contact:** Lene Buhl-Mortensen lenebu@imr.no



2. The Søndeled fjord-system (Østerfjorden, Nordfjorden, Sørfjorden and Kranfjorden) is situated at the southern coast of Norway. It is separated from the open Skagerrak by islands and sounds.

3. Characteristics

Marine System	The Søndeled fjord-system is a typical threshold-fjord along the southern coast of Norway, separated from the open Skagerrak by islands and sounds with sills of 30m or less. Inside the sills are sheltered fjord basins with depth up to more than 180 m. Above the sill-level the fjord has an efficient water-exchange with the open Skagerrak. The deeper parts of the basins may suffer from low oxygen and some of the innermost basins are permanent anoxic. There are fisheries of cod in the fjord and shallow areas with eel-grass are important nursery grounds. Some mussel plants are located in the fjord-system. The fjord is considered moderately eutrophicated due to input of nitrogen from local sources as well as long-distance transport with currents from the European continent.
Watershed	The watershed constitutes both urban and rural settings and is about 516 km^2. A river with a mean flow of about 8 m^3/s enters the innermost basin. In addition about 2 m^3/s of freshwater enter the fjord-system via brooks and as diffuse run-off. The nutrient loading is primarily from diffuse sources. Only 3-4% of the watershed is agriculture fields, while about 70% is forest. The outer part is most urbanized with about 6000 inhabitants, and there is also somewhat industrialized. In the Kranfjorden there is chemical pollution of the sediments from earlier wood-processing industry. Shoreline development with constructions as houses, cottages, landing stages, piers/quays, cables and pipes frequently has lead to conflicting interests in the area.
Human Activities	The area is important for recreation and tourism. There are commercial fisheries and mussels plants in the fjord-system.
Impact Responses	**Eutrophication** has caused enhanced oxygen consumption and changes in epi- and hyperbenthos communities, possibly changes in primary production and in the phytoplankton community, including higher frequency of harmful species. Shifts in the food web may further have affected the pelagic – benthos interactions and recruitment of marine species. The wood-processing industry has lead to accumulation of mercury and copper in the sediments. **The fishery pressure** may cause over-fishing of important commercial species. The construction activities in the coastal zone may cause habitat destruction (e.g. *Zostra marina*), by dredging, dumping, fillings and artificial beaches, reduced value of fishing and trawling grounds because of cables, pipelines and marine installations. Mussel plants may hinder sailing and leisure fishing and enhance local biodiversity and production.

4 Policy

Policy issues	Reducing input of nutrients. Estimate the contribution from local sources versus long-distance sources. Evaluate possible effects of leakage of toxic substances accumulated in the sediments of the fjord. Discussions of costs/benefits by cleaning up. Fish and lobster stock assessment. Marine protected areas for European lobster. Establishing of artificial reefs for European lobster. Causes to, and effects of oxygen deficiency. Habitat mapping and development of GIS-tools for ICZM. Improvement of the coastal zone plans. Conflicts related to shoreline development. Benefits and drawbacks of mussel production.
Policy changes	Change in discharges of nutrients and toxic substances to the fjord due to national and international agreements, which led to construction of treatment plants. Increasing effort to include marine resource and user area in the coastal zone planning. Stricter enforcement and control regarding building activity in the coastal zone. Establishing of MPA.

Future Policy changes	Establishment of Marine protected areas. New national regulations for Environmental Impact Assessment (EIA), incorporating the EU directive on Strategic Environmental Assessment (SEA). EU directives (e.g. water framework, Habitat, Nature 2000)

5 Stakeholders and Institutional Governance

Major organizations	Municipality and County Administration, Ministry of Fisheries, Ministry of Environment, State Pollution Authorities, National Food Control Authorities, Fishermen organizations.
Other leading Organizations	Nature conservation organization "Naturvernforbundet Austagder" Aquaculture industry: " Skjelldyrker Forum" Sailboat owners organisation: "Risør Seilforening" Local fishermenns organisation: "Fiskarlaget Sør"

6 Partner Collaboration

SPICOSA Partner Collaborations	Core Partners: Univ. of Tromsø (Professor Ola Flaaten) and Univ. Bodø (Professor Audun Sandberg). Linked Partner: Norwegian Institute of Water Research. Watershed input, Social analysis (Dr. Jan Hennrik Sandberg og Dr. Jan Sørensen

7 Systems Data

Long time series	-Ocean climate/sea-temperature (80 years/55 years) -Oxygen in deep-water (since 1920) -Recruitment of cod and some other fish-species and biodiversity of littoral fish (since 1920) -Nutrients in coastal waters (Measurement of nutrients (N, P, Si) as well as salinity and temperature since ~1980 (25 years) -Phytoplankton monitoring, including harmful algal (High frequent sampling at a fixed station and along a transect since ~1980 (25 years) -Coastal-zone monitoring. (Hydrology, chemistry, plankton, hard-bottom and soft-bottom surveys since 1990 to date (14 years) -Stock assessments, fish, lobsters and shrimps (various periods of official statistics and own data collection) -Official register of Ground Properties, Addresses and Buildings - GAB (20 years)
Research Projects	-Project title: The Flødevigen Beach Seine Surveys (1919 to date) Objectives: 1. Study the recruitment of gadoid and other fish species at the Norwegian Skagerrak Coast. 2. Monitor the coastal fish community and its variation in time and space 3. Use variation in the biodiversity of the fish community as an indicator of the environmental situation. Principal Investigator: J. Gjøsæter, Institute of Marine Research, Flødevigen -Project title: Environmental condition in fjords along the Norwegian Skagerrak coast Objectives: Monitoring program on nutrient, chlorophyll and oxygen conditions in fjord along the Skagerrak coast. Principal Investigator: E.Dahl, Institute of Marine Research, Flødevigen -Project title: The response of hyperbenthos, infauna, and foraminifera to hypoxia in fjord-basins: Searching for indicator organisms and controlling environmental factors. Objectives: Increase the knowledge of the effects of eutrophication on the bottom-fauna of fjords and establish controlling environmental factors. Principal Investigator: L. Buhl-Mortensen, Institute of Marine Research, Bergen. -Project title: Population structure in cod from the Skagerrak Coast Principal Investigator: H. Knutsen, Institute of Marine Research, Flødevigen. Objectives: Describe the genetical structure of coastal cod stocks, and study the exchange between them and the influence of oceanic cod stocks (North Sea cod) -Project title: MPAs in coastal Skagerrak Principal Investigator: N. C. Stenseth, Institute of Marine Research, Flødevigen. Objectives: A model system for understanding lobster demography and successful introduction of MPAs in temperate waters.

WT 7.7 THE CLYDE SEA

1. Host Institution: Scottish Association for Marine Science**. Contact:** Kenny Black, Kenny.Black@sams.ac.uk

2. The Clyde Sea located on the Scottish westcoast.

3. Characteristics

Marine System	The Clyde Sea is Scotland's largest and deepest (190 m) fjordic system. It is marine dominated but separated from the Northern part of the Irish Sea by a shallow (50 m) sill. Deep water remains isolated from the surface during the summer months because of a strong seasonal density gradient. Vertical mixing is dominated by internal waves generated at the sill.
Watershed	It receives inputs from several smaller sea loch systems each with its own restrictive sill, and the Clyde River system, which passes directly through Scotland's major conurbation, Glasgow (pop. ~1 million). The Clyde river extends into the Southern Uplands with a catchment of 3900 km^2 above Greenock. The Clyde Lochs include Fyne, Gairloch, Goil, Holy Loch, Long and Stiven which penetrate the Highlands to the north, together having a catchment of 693 km^2 and runoff of 1.3x 10^9 m^3 yr^{-1}. The rural catchment is dominated livestock production. Higher ground is a mixture of moorland, intensive forestry and sheep farming. Until the 1990s, sewage sludge from the Glasgow area was dumped in the central Clyde Sea but is now processed through several large treatment works with long-sea outfalls. The Ayrshire coast has several industrial chemical manufacturing facilities discharging into the Clyde.
Human Activities	Shellfish and Finfish Fisheries and Aquaculture, Agriculture, Industrial and Urban Effluents, Forestry, Tourism, Shipping, Sailing
Impact Responses	Nutrient enhancement, Habitat Destruction, Biodiversity changes, Trophic Web Change, Pathogens/toxins

4. Policy

Policy issues	The carrying capacity for shellfish culture and the assimilative capacity for finfish culture. Consequences for fishing and aquaculture of increased recreational sailing activity in terms of space competition both at sea and in harbours. What is the sustainable harvest of wild shellfish and finfish. The role of Marine Protected Areas for enhancing fisheries and for conservation. The consequences for the ecosystem of reduced sewage inputs.
Policy changes	Aquaculture planning processes transferring from National to Local Authority. Implementation of the WFD and Catchment Management Planning Marine Spatial Planning proposals. Proposed UK Marine Act.

5. Stakeholders and Institutional Governance

Major organisations	Scottish Environmental Protection Agency Scottish Natural Heritage Scottish Executive

	DEFRA Fisheries Research Services
Other leading organisations	Scottish Coastal Forum Firth of Clyde Forum Argyll Fisheries Trust Scottish Quality Salmon Association of Scottish Shellfish Growers Clyde Fishermans Association

6. Partner Collaboration

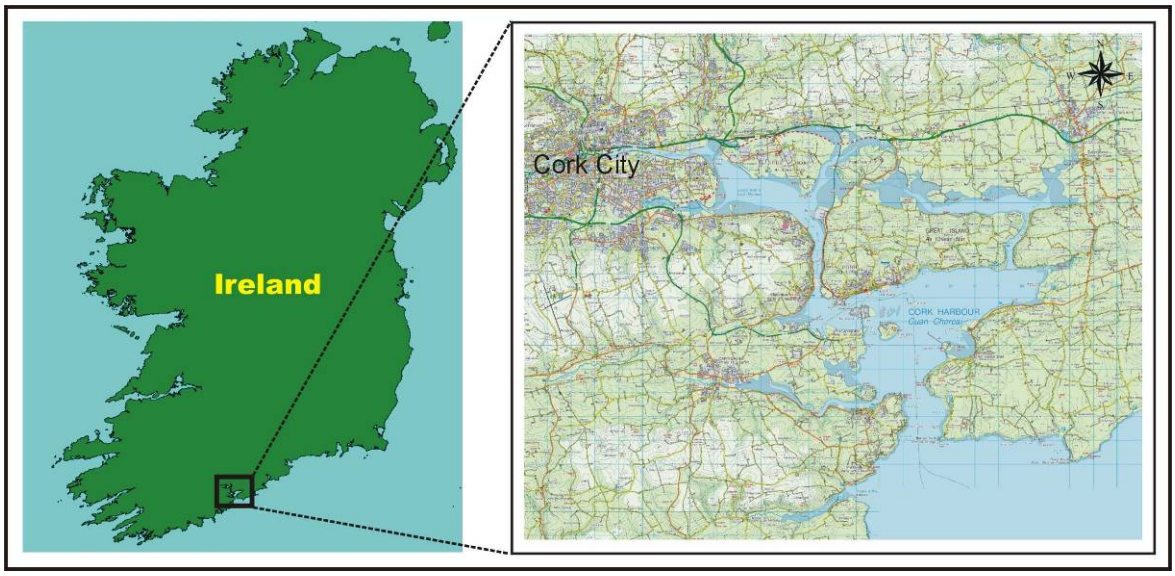
SPICOSA Partner Collaborations	Core Partner: Plymouth Marine Laboratory; University of Cardiff, Department of Earth Sciences ; University of Napier, School of Life Sciences. Linked partner: University of Portsmouth, Centre for Marine and Aquatic Resources Economics

7. Systems Studies

Long time series	Few long-time series for any parameter exist on the marine west-coast of Scotland but many research projects have made multiple year measurements of a wide range of parameters. Water quality measurements have been made in the Clyde River system for many years. There is a long time series (~40 years) of surface Temperature and Salinity at the Isle of Cumbrae withi8n the Clyde Sea and a much longer series from the Isle of Man to the South of the Clyde Sea. Several major European Projects such as PROVESS and OARRE have studied the Clyde as have many institutions from around the UK. SAMS has short time series (1-3 years) for a wide range of physical and chemical data taken over the past 100 years. Input data on weather can be obtained from several sources, river-borne nutrient data from can be obtained from SEPA together with some physical and nutrient data and details of all industrial discharges to the area; data from the former Clyde Sewage Sludge Dumping Ground is readily available.
Research Projects	**PROFILE: Processes in regions of freshwater influence** PROFILE, an EU MAST2 project, generating understanding of processes relating to hydrodynamics, sediments dynamics and microbiology, incorporated in a tested fully coupled model for regions of freshwater influence (ROFIs) was completed successfully in 1996. Studies of the discharge into an idealised Clyde Sea using the POL 3D-B model showed that the area of freshwater stratification near the river mouth, forming a bulge of a typical river plume in a low friction, low entrainment case, could readily form a persistent region of anticyclonic circulation. This can then affect the direction of subsequent discharges as the outflow varies in time. **OAERRE: Oceanographic Applications to Eutrophication in Regions of Restricted Exchange** **EU FP5 OAERRE**'s objectives were: 1. Observations of the physics of vertical and open boundary exchange in Restricted Exchange Environments (REEs), leading to improved parameterisation of these processes in research and simplified models. 2. Study of the phytoplankton and pelagic micro-heterotrophs responsible for production and decomposition of organic material, and of sedimentation, benthic processes and benthic-pelagic coupling, in REEs, with the results expressed as basin-scale parameters. 3. Construction of closed budgets and coupled physical-biological research models for nutrient (especially nitrogen) and organic carbon cycling in REEs, allowing tests of hypotheses about biogeochemistry, water quality and the balance of organisms. 4. Construction of simplified 'screening' models for the definition, assessment and prediction of eutrophication, involving collaboration with 'end-users', and the use of these models to analyse the costs and benefits of amelioration scenarios. OAERRE is a collaboration amongst physical, chemical and biological oceanographers, and coastal resource managers, with intensive studies relating to eutrophication at sites that exemplify a range of hydrographic and enrichment conditions.

WT 7.8 CORK HARBOUR, IRELAND

1. Host Institution: National University of Ireland Cork. **Contact:** Valerie Cummins v.cummins@ucc.ie



2. Cork Harbour, a large natural harbour of strategic importance, is situated on the south coast of Ireland.

3. Characteristics

Marine System	Cork Harbour, with a surface water body of 100km^2, extends from the tidal influence of the River Lee to the narrow Harbour mouth. Cork Harbour is a large, sheltered, naturally deep-water harbour. Strong estuarine influences dominate the upper reaches of the Harbour in particular. The coastline is mixed, consisting of built infrastructure, shallow cliffs, intertidal mudflats, reedbeds, shingle and rocky foreshores, which are exposed by the tide (tidal range 3-4m). The bathymetry of the Harbour reflects the morphology of the coastline, with gentle slopes dropping to a depth of 28m near the mouth of the Harbour (11m in the channel which is maintained at that depth for navigation).
Watershed	Riverine inputs originate from the Lee, the Owenacurra, the Glashboy and the Owenabue. Freshwater inputs from the Lee are controlled by the dam upstream at Iniscarra. Nutrient loading is primarily from non-point agricultural sources distributed throughout the catchment, but primarily in the upper reaches of the Lee estuary. Point source discharges have been reduced by the recent Cork main drainage scheme.
Human Activities	While contemporary use of large tracts of the Harbour is marked by concentrations of **urban** populations (most significantly, Cork City – population ~123,000) and widespread chemical and pharmaceutical **industries**, much of the coast remains unspoilt and characterised by rural **agricultural** land use or **protected habitats**. It's sheltered environment and deep-water channels make Cork Harbour an ideal location for **shipping** and **recreational boating** activities. The physical geography of the Harbour on the south coast of Ireland provides a strategic location for the Port of Cork situated in close proximity to the main shipping line to Northern Europe. **Tourism, marine heritage, fishing, and waste management** are other key human activities associated with the harbour.
Impact Responses	Eutrophication, water pollution, contaminated land, flooding and use conflict.

4. Policy

Policy issues	Dealing with remediation and redevelopment of contaminated **coastal brownfield sites**. Dealing with contamination from **heavy metals leaching** into the Harbour from the disused Irish Steel Plant and from the Irish Fertilisers Industry plant. Potential impacts of the Cork Main Drainage scheme on wading bird populations due to

	changing nutrient levels, recreational activities, and overall development of the Harbour. Issues of **coastal flooding and erosion** (especially flood impacts on Cork City). Identifying the **recreational carrying capacity** of the Harbour. The potential impact of the **Port of Cork** Strategic Development Plan which, aims to rationalise existing port activities and make provision for additional port activities that need land reservations.
Policy changes	The implementation of the Cork Main Drainage Scheme in response to the Urban Wastewater Treatment Directive. Cork County Development Plans – zonation of landuse for housing, industry, recreation, waste disposal (including incineration) and transport. IDA (Industrial Development Authority) development policy.

5. Stakeholders and Institutional Governance

Major organisations	**Local to National Authorities** Cork County Council, Cork City Council, Cobh Urban Council, Department of Communications, Marine and Natural Resources, National Parks and Wildlife Service, Irish Naval Service, Irish Coastguard, Department of Environment, The Marine Institute, Bord Iascaigh Mhara, Department of Community, Rural and Gaeltacht Affairs, Environmental Protection Agency. **Industrial/Economic users** Port of Cork Company, multi national pharmaceutical companies (e.g. Pfizers, ADM, Novartis), Whitegate oil refinery, Electricity Supply Board power generating station, cruise ship sector, fisheries sector (especially angling).
Other leading organisations	

6. Partner Collaboration

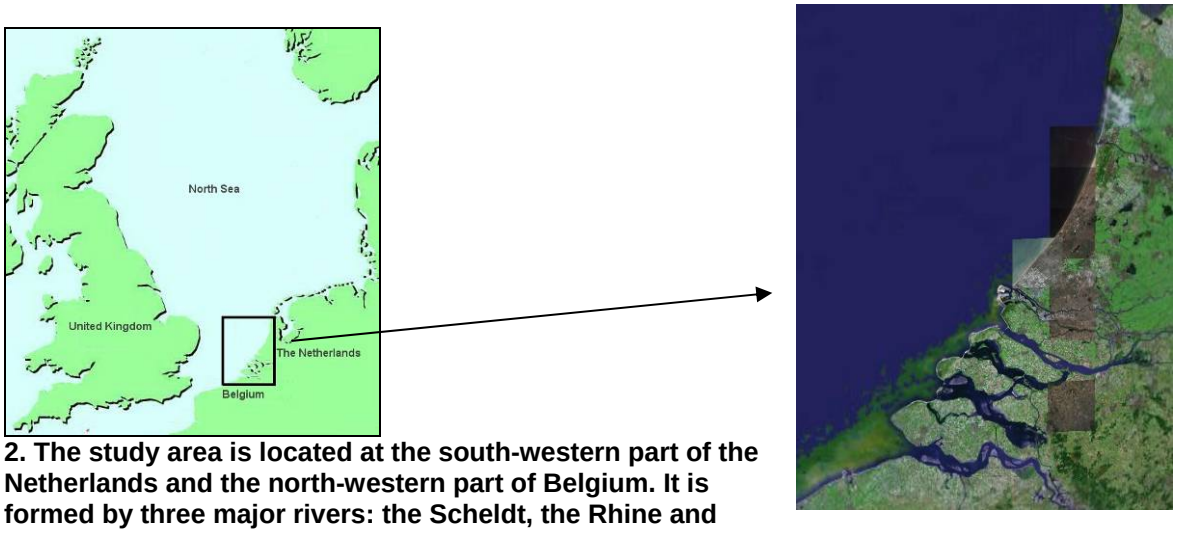
SPICOSA Partner Collaborations	Core partner: Marine and Coastal Environment Group, Cardiff University (Dr. Hance Smith) ENVISION, UK (Dr. Jeremy Hills)

7. Systems Studies

Long time series	Bathymetric data – initial admiralty charts go back over 100 years, with regular bathymetric survey data available over the past 30 years. Tidal records – over 25 years. Marine biotoxins and phytoplankton data- >20 years Geophysical data (sediment samples) - >30 years Water quality data >10 years
Research Projects	The COREPOINT (Coastal Research and Policy Integration), INTERREG IIIB, initiated in 2004, uses Cork Harbour as a strategic study site. Local policy issues are investigated through enhanced scientific understanding of natural processes within the harbour. These include reserach into physical coastal processes influencing vulnerability to flooding. Cork Harbour has also been mapped as part of the Irish National Seabed Suvey. The resulting data is used in a national project to advance the development of integrated coastal zone maps. The Blue City Project - use of Information Technology to study Cork City's water resources, (Higher Educational Authority funded), is also nearing completion.
Socio-economic study	Several socio-economic studies have been undertaken including: studies relating to Port of Cork Strategic Development, the Economic Impact of the Port of Cork's Cruise Traffic, the Economic Contribution of the Port of Cork to the Irish Economy and a case study on the Economic Significance of Ford Cork Week 1996 Sailing Regatta.

WT 7.9 RHINE-MEUSE-SCHELDT DELTA AND ADJACENT BELGIAN-DUTCH COAST

1. Host Institution: **Delft Hydraulics** **Contact:** **Marcel.Marchand@wldelft.nl**



2. The study area is located at the south-western part of the Netherlands and the north-western part of Belgium. It is formed by three major rivers: the Scheldt, the Rhine and Meuse.

3. Characteristics

Marine System	The delta coast has an overall length of about 100 km and consists of straight regular sandy beaches in the northern part between Hoek van Holland (NL) and The Hague (NL) and an irregular sandy delta coast in the southern part from Hoek van Holland (NL) to Oostende (B). The Delta has various closed tidal inlets and two open tidal inlets (Eastern and Western Scheldt). Formerly all water bodies were in open connection. The Western Scheldt is still functioning as estuary of the transboundary river Scheldt (Zeeschelde). At many locations the coast is backed by relatively strong and wide dunes. At some locations only one single relatively weak dune row exists and at other locations dune rows are absent and replaced by dikes. The large-scale mouth of the Scheldt estuary has relatively strong in- and outgoing tidal currents.
Watershed	The Delta area covers a wider area since it is connected through the transboundary catchments of Rhine, Meuse and Scheldt with major economic areas in Europe. The Rhine catchment size is 200,000 km^2 and has 58 million inhabitants; for the Meuse and Scheldt these figures are 34,000 km^2 / 9 million and 36,400 km / 12.8 million, respectively.
Human Activities	Two major European centres of naval transport and industry – Rotterdam and Antwerp – fringe a coastal countryside where recreation, agriculture and aquaculture are dominant economic activities. Main human activities in the delta area include coastal engineering/shore line protection against flooding in all water bodies, agriculture freshwater runoff and outlets, shipping at the harbour facilities, tourism, shellfish cultures and land reclamation for port development.
Impact Responses	Major research has been conducted in the following fields: Shoreline erosion and safety, eutrophication and nutrient loading, sediment dynamics, biodiversity and estuarine ecosystem functioning, delta water management.

4. Policy

Policy issues	The overall policy issue in this densely populated Delta is how to achieve a truly sustainable development of the area. The aim is to achieve a balance between regional economic development, social well-being and restoration of ecological values. Important issues are how to **sustain regional economic growth**, to h**armonize port accessibility**, to match sustainable coastal and riverine tidal **defence systems**, with port accessibility, recreation demands and urban development, to c**ope with regional pressures**, to i**mprove the ecological integrity** and to e**nsure the freshwater supply** on the Delta islands.
Policy changes	Historic and recent protection measures along the Dutch and Belgian coasts have had major impacts on the coastal system. The Delta plan, finalized in 1986 was a major coastal engineering project to realize safety against flooding after the 1953 flooding disaster. Today negative environmental side effects ask for restoration of ecological functioning. Policy plans

	are being prepared and implemented for innovative solutions to restore estuarine dynamics as well as to upgrade the socio-economical structures of the whole southern Delta area. Future changes that will affect the Delta are the proposed reclamation and extension of the Port of Rotterdam (Maasvlakte 2) and the deepening of the transport channel in the Western Scheldt improving the accessibility of Antwerp Harbour. Longer term future (global) change will impose a complex of pressures on this Delta, such as: accelerated sea level rise, increased storminess, continued soil subsidence, increased international competition on the container freight market, reduction of the agricultural EU subsidies, etc

5. Stakeholders and Institutional Governance

Major organisations	Major end users of the project are: the **International Scheldt Commission**, responsible for the development of a management plan for the entire Scheldt River Basin District: the **Delta Council**, a collaboration of three provinces in the Delta region and the Dutch central government. **AWZ**, the Flanders Authority for Water and Marine Transport, and the **Rhine Scheldt Delta Organisation**, a unique collaboration of government authorities, harbour authorities and environmental organisations that aims at identifying and promotion of economic development, mobility, ecology, culture, tourism and recreation in the Delta.
Other leading organisations	Water management and coastal protection authorities, Port authorities, Regional and local governments

6. Partner Collaboration

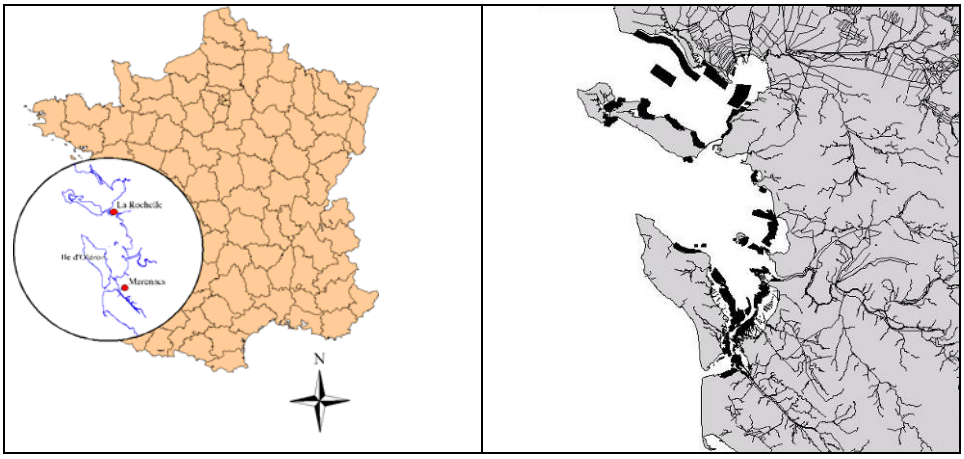
SPICOSA Partner Collaborations	Pilot coordination : WL | Delft Hydraulics (Drs. M.Marchand) National Institute for Coastal and Marine Management/RIKZ (H. Niesing) Institute for Environmental Studies (IVM) (Dr. Jan Vermaat) Flemish Institute for Technological Research (VITO) (Ir. G. Engelen) Linked partners : NIOO (Dr. P.Herman) (ecology); Univ. Gent (Prof. J. J. Jaap Bouma) (economics)

7. Systems Studies

Long time series	Monitoring data of water levels, river discharges, meteorology and morphology are available for over hundred years. Monitoring data on salinity, turbidity, concentrations of nutrients and chemicals are available from 1975. In the same period monitoring programmes have started on marine and estuarine biota, on vegetation and on species at higher trophic levels (fish, bird populations, marine mammals).
Research Projects	***SCALDIT***. http://www.scaldit.org/ (2003-2005), is conducted through the International Scheldt Commission with financial support of INTERREG IIIB NWE. The project is supporting WFD implementation. In the project all member states in the Scheldt river basin work together for the development of integrated water management in the Scheldt River basin District. ***ProSeS*** *;* *http://www.proses.nl/.* (2003-2004), a joint initiative of Flemish and Dutch governments, has produced a Development Outline (end 2004) to guarantee sustainable development in the Scheldt estuary. The Development Outline 2010 focuses on 1) safety against flooding, 2) accessibility of Flemish and Dutch Ports in the region and 3) maintenance and restoration of physical characteristics and ecosystem health.
Socio-economic study	Several socio-economic assessment studies have been performed on the process of decision-making related to the Delta works and on the failure of policies aiming at nature restoration in the Delta area through the return of reclaimed land into marine marshland.

WT 7.10 PERTUIS CHARENTAIS SITE - ATLANTIC- FRANCE

1. Host Institution: IFREMER LER/PC - 17390 LA TREMBLADE - FRANCE**. Contact:** Jean PROU jean.prou@ifremer.fr



2. The Marennes-Oleron and Charente system is located on the Atlantic French coast

3. Characteristics

Marine System	The Pertuis Charentais (40x80 km), located on the Atlantic coast is protected by two islands and is characterized by shallow waters (0-15 meters), intertidal mudflats, strong currents, extended wetlands and three main river discharges. Bird migration site, wetlands protection, sole nursery and benthic habitat are the main environment protection features. Integrated development schemes collapsed due to conflicts concerning environmental protection, space uses and freshwater sharing.
Watershed	The river Charente extends on a 10000 km2 watershed.
Human Activities	EU leader for extensive aquaculture production (mussels and oysters), the Pertuis are also characterized by important summer tourism activity involving urban and harbour coastal development. Hinterland, agriculture over-exploited freshwater resources for maize culture
Impact Responses	**Over-exploitation** of freshwater resource (both surface and groundwater). **Bio-chemical pollution** (bacterial contamination, agriculture wastes), Ground and surface water deterioration.

4. Policy

Policy issues	- socio-economic benefits to shellfish farming : trophic resources for oyster (phytoplankton production, organic matter, etc) depends on freshwater inputs (volumes, nutrients) - mutual socio-economic benefits to both tourism and shellfish farming : management of freshwater quality (bacteria, viruses) on recreational and shellfish growing areas - sustainability of marine and upstream activities especially for this site chosen as an EU intercalibration site in the frame of the Water Framework Directive.
Policy changes	▪ Failure of a coastal zone integrated management plan (SMVM) because of use conflicts (principally between environmental protection and socio-economic sectors). ▪ Agreement between actors (environmental protection, agriculture, shellfish culture, drinking water distribution) freshwater use on Charente river. Driven by politicians **Proposed:** Setting up of a "coastal waters management plan" (SMVM) equivalent to the "terrestrial" one and procedures of negotiation for freshwater management

5. Stakeholders and Institutional Governance

Major organisations	EPTB Charente - Institution Interdépartementale du Fleuve Charente, Agence de l'eau Adour-Garonne
Other leading organisations	GRAP Poitou Charentes - FREDON et Service régional de la protection des végétaux Stakeholder organisations? Any others?

6. Partner Collaboration

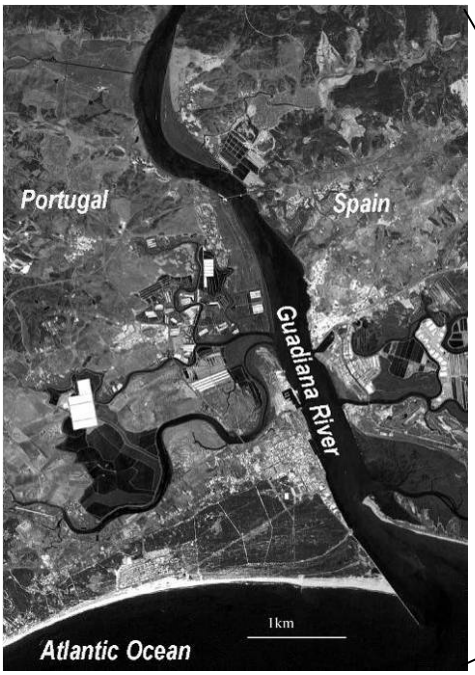
SPICOSA Partner Collaborations	Core Partners: IFREMER, CEMAGREF SOGREAH and University of Western Brittany Linked Partners : La Rochelle University, CREOCEAN

7. Systems Studies

Long time series	**Marine:** - temperature, salinity, nutrients, particulate matter, chlorophyll (since 1976 on 5 sampling sites) - chemical contaminants (since 1975) - microbiological contamination (since 1989) - harmful algal blooms (since 1986) - oyster stocks (century) - oyster growth and condition index (since 1978) - oyster mortality (since 1994) - oyster larvae abundance (since 1956) - mussel growth mortality (since 2000) **land:** - pesticides and nutrients on Charente river since 1992 - water fluxes at the outlet of Charente river since 2001, salinity since 1976 - land use, agriculture systems and practices, policies
Research Projects	- TROPHEE « Trophic capacity of European Ecosystems » (1990-1994, FAR): assessment of carrying capacity of cultivated shelffish areas – Coordinator: Ifremer - INTRMUD " Morphological development of Intertidal Mudflats " (1996-1999 – MAST3) : dynamics of intertidal mudflats – coordination : Plymouth - ESSENSE « Effects of Shellfish culture and options for Sustainable Exploitation » (1999-2001) : to improve knowledge for sustainable development of shellfish culture and exploitation – coordinator Netherlands Institute of Fisheries Research (Netherlands) - OPCOM « Operational Modelling for Coastal Zone Management » (MAST3, 1997-2000) : implementation of operational models in the coastal zone – coordinator : HYDROMOD (Allemagne), other partners : IFREMER-CREMA (France), IST (Portugal), Hidromod (Portugal), ERIV et EIA (Finland). - Monitoring networks : REMI, REPHY, RNO, REMORA - REPER is a observatory for research on environment in Pertuis Charentais : organization of monitoring networks, implementation of databases, permitting studies of interrelations in complex ecosystem impacted by anthropogenic activities - Programme Interface (historical project) From the watershed to the maritime area: water resource as object of an integrated and applied research. A case study : Charente watershed and Mer des Pertuis - Research on the Charente catchment area and the Marenne-Oléron's bay : continental part : 1994-1998 The aim of this work was to study the impact of the Charente's catchment area on the trophic system of the Marenne-Oléron bay and the consequences on its selfish farming. - On the large watershed scale, a scientific collaboration between WQRU and IFREMER is presently running (D. MUNARON thesis in relationship with CREMA L'Houmeau and La Tremblade Station) using MARS 2 D advection-dispersion model to simulate Charente pesticide runoff behaviour in sensitive littoral environment of Mer des Pertuis lagoon (French 1st oyster production site). - Programme Transpest 16 - MEDD pesticides (2005) – indicators (transfer of pesticides from agricultural areas to rivers) at the watershed level – sampling and monitoring of water quality at the same scale. - Programme MEDD 2006 – test of pesticides indicators at the plot and watershed scale. - Effects of Water Framework Directive on agriculture at the French national scale (CEMAGREF, French Ministry of Agriculture, DGFAR 2004-2005).
Social study	- Analyse du jeu des acteurs et des normes légales de la gestion des pêches et de la conchyliculture dans les pertuis charentais. Darbon D., Deglise C. Institut d'études politiques. Sciences Politiques Bordeaux.

WT 7.11 GUADIANA ESTUARY, PORTUGAL

1. Host Institution: CIMA – Centre of Marine and Environmental Research, Universidade do Algarve
Contact: Tomasz Boski



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2. Guadiana River Estuary is located in the southeast of Portugal and makes a border between Portugal and Spain. The geographical coordinates of the south most point on the Portuguese margin are 37º10' N and 7º24'E

3. Characteristics

Marine System	The Guadiana Estuary is a mesotidal, narrow funnel-shaped body, well mixed for low, summer (XX m3/sec) discharges, but vertically stratified in winter. The mixing zone is within the first 10 km from the mouth but brackish conditions may extend 40 km inland. Winter discharges delivers vital nutrients to the shelf sea. Since 2002, damming of the river reduced drastically this flux. Aquaculture and fisheries are important activities in this area. The wave regime is predominantly SW, associated mainly with swell from Atlantic Ocean. The strong long-shore current is west-to-east and transports ca 200 000m3/year of sand partially retained by groin. Domestic sewage discharge at present is important due to the legal halt of water treatment plant.
Watershed	Guadiana is the one of most important rivers on Iberian Peninsula whose total length is 730 km, of which the last 200 make a natural border between Portugal and Spain. Geologically the drainage basin of 67 000km2 is much diversified. More than 40 dams store water mostly for irrigation purposes (mostly in Spain) and decrease severely the water flow, causing eutrophication and sediment starvation along the coast. Forestry and agriculture are the principal activities in the Portuguese part of drainage basin. Industrial pollution is not important.
Human Activities	The Human activities on the two margins (East – Spanish, West – Portuguese) of the estuary are at present distributed in an asymmetric way. The most important activities are indicated together with impacts: Agriculture - eutrophication, Aquaculture - effluents, Tourism and recreation – habitat destruction, fisheries – border conflicts, salt production.
Impact Responses	**River discharge reduction** (recently-2002 closed Portuguese Alqueva dam) caused nutrient enhancement and contributes to the toxic algae blooms. Coastal erosion will become more severe. **Tourism development and urbanization** have invaded natural habitats and added untreated sewage discharge.

4. Policy

Policy issues	The damming of Guadiana River eliminated from coastal waters the turbid plumes, which support the plankton blooms and the planktivorous fish stocks. It aggravated the eutrophication impacts. The so called « minimal ecological discharge » is negotiated with water managing authorities in order to keep these issues controllable.
Policy changes	On the Portuguese side of the estuary, the Natura 2000 zone was declared and effectively stopped the urban/tourism development. However the adjacent zone is under strong pressure from tourism on coastal fringe and golf fields inland. The latter are menacing the Natural sanctuary area (Castro Marim salt marsh natural reserve of 2400ha, RAMSAR site). On the Spanish side, the construction of a tourist-urban development for ca 30,000 people under completion changed dramatically the land use policy, invaded the agriculture dominated land and salt marshes which were covered by imported earth and transformed into the golf fields.

5. Stakeholders and Institutional Governance

Major organisations	Ria Formoza Natural Park - Castro Marim Natural Reserve, Municipality of Castro Marim (Portugal), Municipality of Vila Real de Santo António, (Portugal) Municipality of Ayamonte (Spain), Regional Port Authority
Other leading organisations	The association of solar pond salt producers, Confederação Portuguesa das Associações de Defesa do Ambiente.

6. Partner Collaboration

SPICOSA Partner Collaborations	Linked partner: Portuguese Institute of Nature Conservation – Castro Marim Reserve – Dr. Anabela Resende. Fisheries Institute – IPIMAR, Tavira Station- Dr. Teresa Drago.

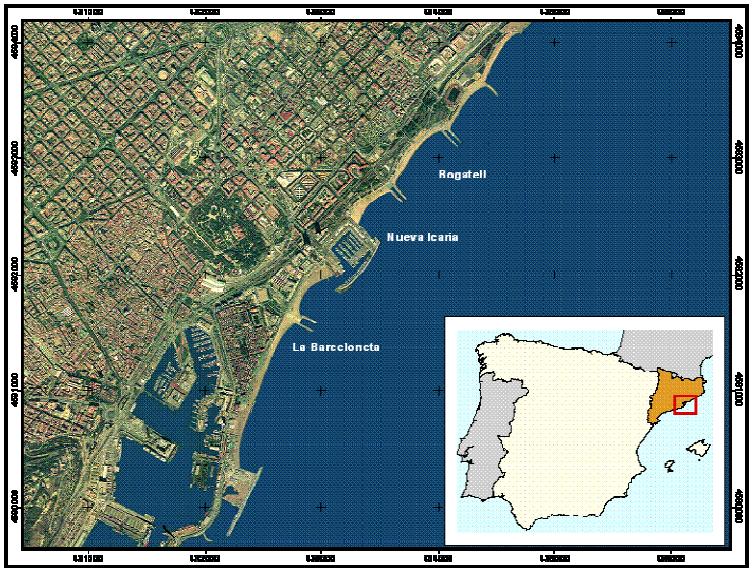
7. Systems Studies

Long time series	Sediment infilling of the estuary/postglacial sea level rise – last 10000 years. Tides – 5 years. Fish discharged (tone) in local port – 30 years. Fluvial discharge of Guadiana – 50 years. Rainfall data -120 years
Research Projects	Monitoring and environmental management of Guadiana Estuary – development of a tool - MEGASIG (2004 -2006), EU-INTERREG IIIA program. Objective: create a versatile management and educational tools for the stakeholders. Multidisciplinary study of Guadiana River Estuary: Estuarine Dynamics – Present Situation, Anthropogenic Influences and the Perspective for the future – EMERGE. (1999 -2002). EU-INTERREG II program. Objective: define the principal environmental forcing factors acting upon estuarine system.
Socio-economic study	To be undertaken within the framework of recently approved Asia Link “Coastal-Profs” project.

WT 7.12. BARCELONA WATERFRONT, CATALUNYA, SPAIN

1. Host Institution: Institut Ciències del Mar, CSIC **Contact:** Dolors Blasco icmdir@icm.csic.es

2. Barcelona Waterfront, Northwestern Mediterranean, Catalunya, Spain



3. Characteristics

Marine System	30 Km of almost linear open Mediterranean coast broken by different coastal infrastructures such as harbours, protective barriers, etc. Tide generated currents are negligible and wave periods exceeding 7-8 s rare. The most persistent current direction is towards the SW, following the general circulation pattern of the peninsular shelf current of the North-western Mediterranean with an average velocity of 5 and 10 cm s^{-1}. The land is mostly beaches and urban construction. The bottom is mud or sand of various grain sizes up to gravel. The water is oligotrophic marine waters, naturally enriched in nutrients by the deep Mediterranean waters through winter mixing, and sporadically by the freshwater land runoff.
Watershed	The coast receives discharges from the Besòs River, and the Llobregat River with a mean water discharge of 5 and 20 m^3/s respectively. However the water discharge of both rivers is extremely variable (maximum values of more than 2000 m^3/s in strong flood events). Both rivers traverse urban, industrial and rural settings and the watershed size is 5000 km^2 for Llobregat and 1000 km^2 for Besòs. The watershed near the coast is all urban. During rain events, the coast receives the impact of urban drainage storm collectors, besides that from the rivers.
Human Activities	Barcelona and surrounding cities reach about 4 million habitants. Along the coast there are tourism activities, recreational and commercial harbours, some fisheries, waste effluents and two waste water treatment plants. Near the coast human activities are mainly urban activities with some industries. In the rivers watersheds there are heavy industries and agriculture
Impact Responses	**Urbanisation**. Changes on the dynamics and diversity of the marine ecosystem: Toxic algal bloom, jellyfish blooms, disappearance of key commercial species (e.g. anchovy, sole, hake, shrimp shellfish) **Coast line and morphodynamic modification** resulting in beach erosion, changes in sediments dispersion and sediment accumulation sites and in modifying the benthic community. Changes in bottom sediment and bathymetry by Harbour dredging and dumping activities, harbour expansion, and new structures (submerged barriers, and so on). Artificial plumes from urban collectors during rain events. **Toxic pollution** by waste discharged from rivers, and urban collectors. Accumulation of contaminated bottom sediment for decades. Organism, water and sediment contamination by urban and industrial waste.

4. Policy

Policy issues	1. Evaluation, monitoring and managing the effect of water and sediment runoff produced by sporadic rain and storms in seas like the Mediterranean, where those represent a major contribution of the land /ocean interaction: eutrophication, sediment transport and re-suspension, beach erosion, bacterial contamination, unexpected contaminants, beach water quality, etc. 2. Urban development/eutrophication/ biodiversity: Waste water treatment plant and emissary: 3. Exploring Possibilities (social, economical and ecological) of improving the highly degraded Barcelona littoral front for fisheries, and water sport activities. 4. How to comply with the new EU Water Quality Regulation Policies
Policy changes	1. 2002 Construction of two new Waste Disposal Plants: primary treatment, and new waste water emissary: 3 Km from the coast and at 50 meter depth, before was 600 m off and at 20 m depth 2006 Implementation to a secondary treatment. 2. Construction of a new recreational harbour, modernisation and amplification of the commercial harbour, construction of several protection dikes and underwater barriers. 4. Opening new beach sites, developing new beaches.

5. Stakeholders and Institutional Governance

Major organisations	Spanish Ministry of Environment. Conselleria de Medi Ambient of the Autonomous Catalan Government. Conselleria de Obras Publicas of the Autonomous Catalan Government. Barcelona City Hall
Other leading organisations	Agencia Catalana del Aigua. Autoritat Portuaria of Barcelona Harbour Fishermen organisations and recreational organisations. CLAPSA: Organization managing rain water discharge of Barcelona, through collectors.

6. Partner Collaboration

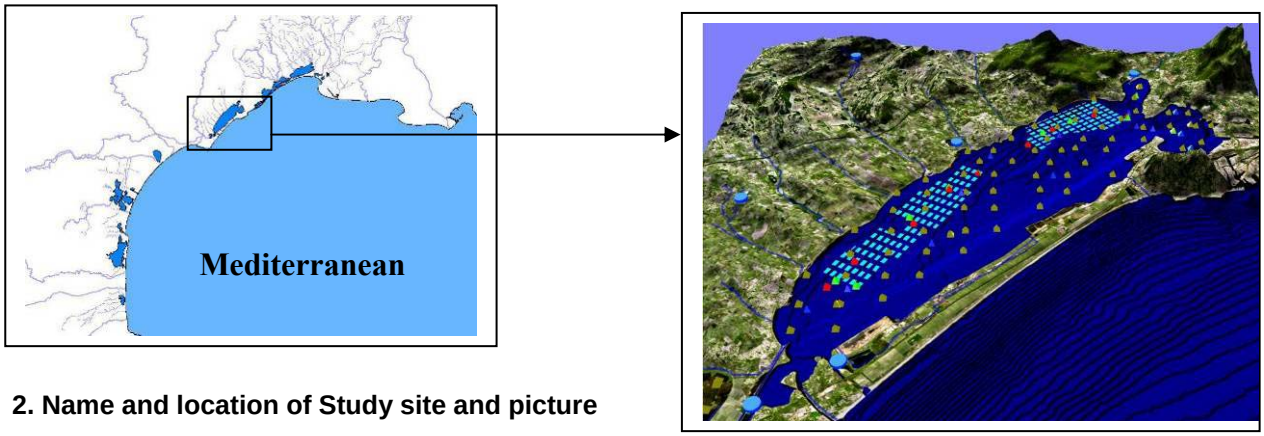
SPICOSA Partner Collaborations	Core Partner: Institut Ciències del Mar, CSIC. Link Partners: Centre d'Estudis Avançats de Blanes , CSIC.(R.Sardá), Instituto Mediterráneo de Estudios Avanzados (IMEDEA, CSIC). University of Girona.

7. Systems Studies

Long time series	Data of many variables (hydrographic, plankton and fish biomass, sediment and contaminants, bacteria counts etc) have been taken several times since 1965. Long time data: Meteorological data from a station right on the site, and sociological data. Since 1995 monitoring data on temperature and chlorophyll satellite information, Bacterial counts, nutrients, river outflow, phytoplankton biomass and species, Water colour, Beach erosion, meteorological data, Since 2003 real time data on temperature, currents, beach erosion and water turbidity and colour.
Research Projects	1. Morfodinámica de playas urbanizadas: integración de datos experimentales y modelos teóricos. Parte experimental 01/01/2004 - 01/12/2007, (PUDEM), Spanish Government. 2. Aproximación multiescala a la variabilidad de la turbulencia y su efecto sobre la estructura y la dinámica del ecosistema costero en el Mediterráneo noroccidental (VARITEC) 01/01/2003 - 01/12/2004. Spanish Government. 3. Pla de vigilància de fitoplàncton nociu i tòxic a la costa catalana. 2004-2007.Funding agency: Agència Catalana del Aigua (ACA), Catalan Government. 4. Programa de vigilància i control de la qualitat ambiental de les aigües litorals a Catalunya durant els anys 2003 a 2007. 2003-2007. Catalan Government
Socio-economic studies	1. Integrated program to study the effect of the mud submarine deposit of the area of the Besós prodelta on the Barcelona Coastal area. (SPIO): Corporación Metropolitana de Barcelona y Ministerio de Obras Públicas. 1987-1989 2. PORT (2002 -2004): Estimación de las obras del plan director sobre los recursos pesqueros que explota la flota pesquera de la cofradía de Barcelona. Autoritat Portuaria de Barcelona (APB).

WP 7. 13 THAU LAGOON

1. Host Institution: Ifremer **Contact: Lionel Loubersac lloubers@ifremer.fr**



2. Name and location of Study site and picture

The Thau lagoon is situated in the Languedoc Roussillon region (South East of France), along The Mediterranean border

3. Characteristics

Marine System	The Thau lagoon has a surface of 75 km2 and an average depth of 4,5m (max : 10m.). It is under strong marine influence. The lagoon is connected north to the sea by the canal of Sète (90% of exchanges) and South by the Grau de Pisse Saumes. The volume of the lagoon is 280.000.000 m3. During a year a third of this volume is exported to the sea. As tide is very weak (10cm.), the wind is the main factor of water masses transport. Wind is often strong, particularly when blowing from the NW with a mean of 118.5 days per year above Beaufort force 5. The climate imposes a wide range of water temperatures and salinities with minima of 5° in january and salinity near 27 and maxima of 29° in august and salinity reaching 40
Watershed	Watershed has a surface of 280 km2. Main hydrological regime of rivers is intermittent, only one, the Vene has a permanent output. Precipitation show large interannual variation (from 200 to 1.000 mm per year). The population on the watershed reaches 107.000 inhabitants (density of 380 inhab.km2) with a very strong growing rate (75% on the last ten years).
Human Activities	Shelfish farming (more than 10% of the whole french production), fisheries (clams and fishes), urbanism, recreational activities (bathing, nautism), health activities (thermalism, thalassotherapy; 2nd french site), agriculture (wineyards), marine industry (Sète harbour)
Impact Responses	Harmfull Algae bloom (PSP : Alexandrium and DSP : Dinophysis); bacteriological contaminations, anoxias, biodiversity changes, alien species (macroalgae), nutriment fluxes, trophic balance changes.

4. Policy

Policy issues	Much effort has been put into the setting up of a first integrated management programm (SMVM for Schema de Mise en Valeur de la Mer) which defines priorities of action about shelfish farming and offer a spatialised plan for the developpment of concurrential activities in the lagoon and on a part of the watershed. The main drawback of this SMVM (the first to be adopted in France) is its fixed frame which is difficult to make evoluting as decision for evolution/modification has to be taken at the summit of the French state (Conseil d'Etat) Other efforts have been put in works on the watershed (Two Contrats d'Etang) as to optimise waste water processing in relation with the occurrence of bacteriological contamination of lagoon waters and shellfish.
Policy changes	On the basis of the implementation of the WFD (particularly considering bathing waters and shellfish waters quality) policy changes have been implemented as to take the place of the SMVM policy issue. Those changes apply to : i/ a third Contrat d'Etang (Contrat Qualité) directly dedicated to the water quality of the lagoon and environmental management procedures (ISO 14001), ii/ a SCOT (Schema de COherence Territorial) and iii/ a SAGE (Schema d'Amenagement et de Gestion des Eaux) including an integrated territorial approach between the lagoon and the watershed.

5. Stakeholders and Institutional Governance

Major organisations	Syndicat Mixte du Bassin de Thau. (SMBT) This organisation has been set up recently (2005) and results from the fusion of two territorial communities corresponding to the southern and northern part of the lagoon and its watershed. The SMBT is nowadays the unique organisation in charge of the implementation of integrated management of the lagoon and its watershed and in charge of the implementation of the three management tools which are the Contrat Qualité, the SCOT and the SAGE.
Other leading organisations	- Cepralmar : an organisation depending from the Languedoc Roussillon regional council in charge of the relationships with the sea professionnals - Conseil Général de l'Herault who has responsabilities on the infrastructures development on the territory

6. Partner Collaboration

SPICOSA Partner Collaborations	- Core partners : JRC (Institute for Environment and Sustainability, Inland and Marine Waters Unit, Cemagref - Linked partners :University of Montpellier (UMR CNRS/UM2 Ecolag and LAMETA Socio-economy), Association Geyser (Mediation),

7. Systems Studies

Long time series	Hydrological, hydrochemical, microbiological, phytoplancton, macroflora and macrofauna, river discharges, nutriments loads, meteorology, hydrodynamism, sediments, heavy metals, organic contaminants but also land use dynamics, economical statistics, administrative limits and rules evolution. Some of the data series start from the end of the second War (1947)
Research Projects *and* *Socio-economic study*	- PNEC (Programme National en Ecologie Côtière) chantier lagunes méditerranéennes started in the year 80 (understanding of the ecological mecanisms, management tools development and integration of socio economic studies) - Institutional monitoring networks : RNO (1975), REMI (1984), REPHY(1992) and regional RSL (Réseau de Suivi Lagunaire started 2000; see http://rsl.cepralmar.com/), - Syscolag programme (see http://www.syscolag.org/) dedicated to the setting up of a shared knowledgee data base including metadata service, and GIS implementation - Dynamic atlas of Thau lagoon developped in the framework of Githau/Syscolag (ICZM of Thau lagoon) and RSL projects (see http://www.ifremer.fr/lerlr/bases_connaissance/mono_thau/thau/index.htm and http://www.ifremer.fr/lerlr/surveillance/atlas/thau.htm) - DITTY european project (development of a Decision Support System for the management of southern mediterranean lagoons; see http://www.dittyproject.org/) - Implementation of Sustainable and ICZM indicators programme (launched with the socio-economist team of Montpellier University).

WT 7.14 MAR PICCOLO

1. Institution: Istituto Marino Costiero, IAMC-CNR, Taranto (Italy)**. Contact:** Prof. Michele Aresta

2. The Mar Piccolo of Taranto is located North of the town of Taranto-Apulia-IT. The Mar Piccolo is connected with the Mar Grande basin through two channels, only one of which is important for water exchange.

3. Characteristics

Marine System	The Mar Piccolo of Taranto is located North of the town of Taranto and has a surface area of 20.72 km^2. It is an inner, semi-enclosed sea with estuarine features divided by two promontories of land into two smaller inlets, called First and Second Inlet which have a maximum depth of 13 and 10 m, respectively. Tidal range does not exceed 30-40 cm. The volume of water exchanged per hour through the two connecting canals is: Inlet : 500000 m^3 h^{-1}; 24 cm s^{-1}. Outlet: 380000 m^3 h^{-1}; 18 cm s^{-1}
Watershed	Besides Taranto (300 000 inhabitants), some small inland cities sum-up the residential population to over 500 000 inhabitants, with a rise of 20-30 % during summer. A navy base (the most important in Italy), a commercial port, mussel-culture and a fishing fleet directly or indirectly influence the water quality. The presence of 34 submarine freshwater springs (locally called "Citri") and the outfalls of small tributary rivers influence the salinity and carry agricultural chemicals (the latter). The scarce hydro-dynamism and the reduced water exchange with Mar Grande determine, mainly in summer, a high water-stratification.
Human Activities	Urbanization, Heavy industry, Aquaculture, Tourism, Transports and Agriculture are driving forces. Mussel-culture, Navy docks and the fishing fleet are internal pressures.
Unsustainable Forcings	Unresolved use conflicts; Urbanization and emissions; Heavy industry (stainless steel, cement, oil refinery) and relevant emission; Intensive Aquaculture; Intensive Agriculture and Drainage; Navy docks; Shipping.
Impact Responses	Bio-chemical Pollution; Diversity loss; Eutrophication (Algal blooms, microbial pollution); Habitat Destruction; Sediment and Turbidity (metals, IPA, PCB in marine sediments); City devitalisation; Social problems; Economy loss; Geomorphic changes.

4. Policy

Policy questions	The heavy industry and navy docks are two of the main employers in the area. The steel industry, not only through the emissions but also through the water-scooping machines, strongly influences the biodiversity and environmental quality of water and sediments. The presence of such industrial activities is also in conflict with other productive instalments such as the mussel farms and related activities. The drainage of agricultural soils and the sewage inputs are also important factors that influence the water and sediment quality. The Mar Piccolo is one of the Sites of National Interest for the high level of pollution and a special Programme has just been started in order to plan an intervention for cleaning sediments and reducing pollution. Regional Programmes also include interventions for the characterization and recovery of surrounding sites that may indirectly influence the quality of the basin.
Policy changes	The heavy industry (stainless-steel, oil refinery, cement manufacture) started to be establish in Taranto some fifty years ago (second half of the 1950s) completely changing the economy of the city and Province that were essentially based on agriculture, aquaculture, navy docks and handicrafts. Such change has caused a large increase of the population of Taranto grown to over 280 000 inhabitants from 150 000. Consequently, severe social problems exploded, especially when the steel industry, grown to hire over 22 000 employees, started to reduce the activity and to fire people (now there are less than 8 000 employed staff). These problems have strongly influenced the quality of life and safety in the city.

5. Stakeholders and Institutional Governance

Major organisations	All local and regional authorities (Province of Taranto, Municipality of Taranto), Ministry of the Environment, Ministry of Industry, Navy, Aquaculture enterprises, Recreational bodies and Tourism organizations
Participatory organisations SSA	Aquaculture and fishing enterprises; tourism enterprises.

6. Partner Collaboration

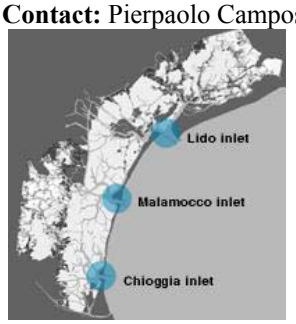
SPICOSA Partner Collaborations	Linked Partners : University of Bari, Others : Universities of Lecce and Ancona (Collaboration in environmental researches)

7. Systems Studies

Long time series	• Chemico-physical data for seawater and biochemical components of suspended matter: 1970 until today; • Floristic lists of macroalgal species: 1920-1925; 1987 until today. • Floristic lists of microalgal species: 1991-1994; 1996-1997; 2001-2003. • Metals (Hg, Pb, Cd, Cu, Zn, Ni and V) and HPAs and PCBs: 1986 until today • Quantitative data of fecal indicators : 1981 until today; Bacterial diversity: 1999 until today • Cystes in the sediments
Research Projects	• "Study of the ecosystem Mar Piccolo of Taranto: biocenoses with particular attention to phytocenoses"; • " Individuation and monitoring of non-indigenous species in the Taranto seas"; • "Chemico-physical and biochemical conditions in Mar Piccolo of Taranto"; • "Pilot study for the environment characterisation of marine areas subject to pollution "; • "Study for recovery and exploitation of shoreline in Mar Piccolo"; • "Preliminary study of ILVA water-scooping machine environmental impact the on Mar Piccolo ecosystem and on mussel-culture activities"; • "Monitoring and reclassification of costal zone for mussels production, stabulation, commercialisation and sale (D.L. 192/77 and D.L. 30/12/92, n. 530)" "Anthropogenic impact on the biodiversity of marine ecosystems"; • "Risk analysis and evaluation of the environmental quality index of coastal zones at high environmental impact: new classes of persistent pollutants"; • "Anthropogenic impact on biogeochemical cycles: ecological aspects"; • "Mussel culture: environmental studies at the production sites: bioaccumulation, epibionthic fauna and infauna on the harvesting collectors"; • "Innovative technologies including: Bioremediation, utilization of bacteria, and antibacterial activity of extracted products"; • "Technologies for CO_2 storage and reuse, including enhanced fixation in macroalgae for biofuel production"; • "Identification and monitoring of non-indigenous algal species in the Taranto seas"; • "Technological innovation and Polyculture activities for mussel culture"; • "Integrated procedures for the investigation of marine trophic processes and for the management of platforms for the continuous monitoring of the marine environment"; • "Characterization of waste water from the Taranto industrial area"; • "Study on the environmental impact of the water up-take plants from the ILVA factory on the Mar Piccolo ecosystems and mussel farming".

WT 7.15 VENICE LAGOON SYSTEM

Host Institution: CORILA - Consortium for the Management of Research on the Venice Lagoon System
Contact: Pierpaolo Campostrini campostrini@corila.it



2. The Lagoon of Venice is situated in North Adriatic, and it is connected to the Northern Adriatic Sea through three inlets

3. Characteristics

Marine System	Tidal lagoon of 550 km2, includes dunes, tidal channels, bare mudflats, seagrass beds and salt marshes, sea walls protection. Unique combination of hydro-geomorphologic features (defined by centuries of human interventions); natural features including endemic plant species and breeding ground and overwintering for bird species and other significant biodiversity as well as functional dynamics which support human activities in a city endowed with some of the worlds most important cultural heritage.
Watershed	Watershed of 1800 km2/1 million eq. inhabitants. Two main cities (Venezia, Chioggia) and a number of towns and villages (400,000 residents) are distributed around the lagoon perimeter and on some islands; 14 million tourist presences per year contrast with a resident population of 60,000 in the historical centre. Venice has one of the most important ports in Italy (30 million of tonnes of goods per year and 1 million cruise ship passengers), the third busiest Italian airport and the relics of the core of Italy's petrochemical and chemical industry (Marghera).
Human Activities	The Venice Lagoon is characterized by a high concentration of human activities and Catchment land use is historically a varying mixture of agricultural and industrial. Urban development and cultural heritage, tourism, recreational activities, commercial and traditional fishing, Industry, Agriculture, Aquaculture, Marine Heritage, Shipping
Impact Responses	Lagoon morphology erosion, geomorphic changes, bio-chemical pollution, eutrophication, sediment and turbidity, biodiversity loss and habitat destruction, trophic web change, use depreciation, city de-vitalization and cultural losses, social and economy weakness.

4. Policy

Policy issues	Maintaining the "lagoon status", between sediment inputs and erosion, and defending from sea storms, implies wide human interventions, which in Venice have continued since the XIV century. The presence of industrial and port activities, together with increased human pressures and intensive agriculture in the drainage basin, in the last century focused on the problem of eutrophication and pollution of water and sediment. Venice and its lagoon was declared "of national interest" by an Italian law in 1973 and a "World Heritage Site" by UNESCO in 1987. Huge economic resources have been spent by the Italian state for the safeguarding of the lagoon, the cultural heritage and for re-vitalizing the city. Cost–benefit ratio of these interventions is still an issue. Considering sea level rise, the physical defence of the city necessitates a mobile barrier system between the lagoon and the sea: after a 30 year-long debate, the political decision has finally been taken. Fishing of clams is a important economic activity (counting 60% of the national production), but its actual sustainability is uncertain: over-fishing, 'fishing down the food-web', sediment resuspension, damage to benthos and habitat destruction are recurrent problems. Granting access to the port, placed on the inner lagoon part, implies excavation of contaminated sediment from silted channels. Allowing fruition of some lagoon sites, for tourism and fishery, is necessary for the economic life of the residents, but creates easily non-sustainable conditions for the environment. Considering the sea in front of Venice, multi-regional and multi-national approaches are under consideration for an appropriate and effective management, starting with INTERREG initiatives.

Policy changes	Concerning the major policy changes made or proposed within the data life of the proposed Site, they includes: a. The exploitation of a Strategic Plan of the Municipality towards 2014, which include several policy action in the environment and sustainable development, b. The Lagoon Morphology Restoration Plan, which is going to be updated c. Plan for reduction of nutrient load from drainage basin (regional authority plan) d. Changing in the lagoon and sea fishery organisation The adoption of a new General Intervention Plan, considering the barrier system

5. Stakeholders and Institutional Governance

Major organisations	Comune di Venezia (municipality), Provincia di Venezia (district administration), Port Authority, Regione del Veneto (regional level), Magistrato alle Acque -local agency of the Ministry of Infrastructure and Transport, Ministry of Environment
Other leading organisations	Port enterprises , Tourism-related association of enterprises, Fishing-related association of enterprises, Chambre of Commerce

6. Partner Collaboration

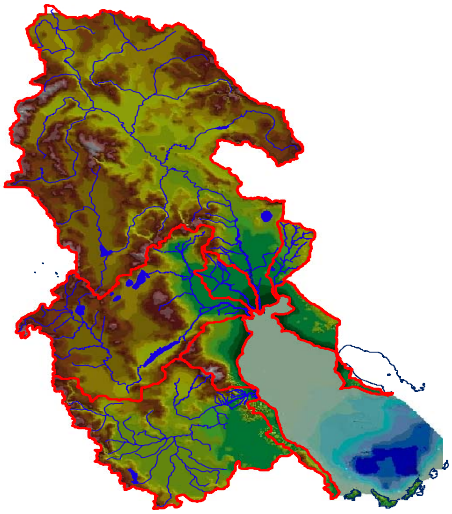
SPICOSA Partner Collaborations	*Core Partner: CORILA - Consortium for the Management of Research on the Venice Lagoon System, San Marco 2847, Venezia, Italy, Tel. +39 041 2402511* *Dipartimento di Scienze Economiche, DSE-UNIVE, Università Ca' Foscari* Cannaregio 873, 30121 Venezia, Italy Tel. +39 041 2349166 Fax +39 041 2711461 Contact person: CARRARO Carlo ccarraro@unive.it. economy *Istituto Nazionale di Oceanografia e Geofisica Sperimentale, OGS* Borgo Grotta Gigante 42/c, 34010 Trieste, Italy Tel. +39 040 2140315 Contact person: SOLIDORO Cosimo csolidoro@ogs.trieste.it. oceanography Dipartimento di Chimica Fisica, DCF-UNIVE, Università Ca' Foscari, Dorsoduro 2137, 30121 Venezia, Italy Tel. +39 041 2348674 Fax +39 041 2348586 Contact person: PASTRES Roberto pastres@unive.it. chemistry *Dipartimento di Scienze Ambientali, DSA-UNIVE, Università Ca' Foscari* Castello 2737/b, 30122 Venezia, Italy Tel. +39 041 2347742 Fax +39 041 5281494 Contact person: VOLPI GHIRARDINI Annamaria voghi@unive.it. Environmental science

7. Systems Studies

Long time series	Meteorological data and Relative Sea Water level data, Water quality monitoring – chemical, biological and ecotoxicological parameters, Biodiversity, Sediment pollution, Remote sensing, Economic and social data
Research Projects *Socio-economic study*	-MELa1 – monitoring water quality parameters and understanding their evolution 5 years long.. PI Pastres; Solidoro; Rismondo; Zirino. -DRAIN freshwater and nutrient load from drainage basin. PI Marcomini; Zonta -ORIZZONTE 2023 evaluation ecological status. -First Research Programme CORILA 2000-2003and Second Research Programme of CORILA 2004-2007, includes researches on: Cost-benefits analysis of land reclamation of brownfields in the Venice lagoon, Characteristics and conditions for a model of post-industrial sustainable development for Venice, Speciation and flow of pollutants, Ecological quality indices, biodiversity and environmental management for lagoon areas, Trophic chain and primary production in the lagoon metabolism, Meteo-oceanographic conditions and coastal zone water quality, Erosion and sedimentation processes in the Venice lagoon. -Many social or economic studies have been conducted relating to the coastal zone natural resources, by CORILA and others, e.g. a study concerning the incentives needed for a more "ecological" exploitation of fishing resources. CORILA participates in ENCORA EU concerned action, as Task Leader for Economy issues in ICZM

WT 7.16 THERMAIKOS GULF, GREECE

1. Host Institution: Institute of Oceanography HCMR**. Contact:** Christos Anagnostou chanag@ath.hcmr.gr



2. Thermaikos is a U-shaped gulf situated in NW Aegean Sea - Greece

3. Characteristics

Marine System	Thermaikos Gulf forms an extended shelf area, which has a significant influence from rivers. Most of the particulate inputs are trapped near the river-mouth. The suspended particulate matter concentrates in nepheloid layers, at the surface and near the bottom and most of them is deposited and berried on the shelf. The fresh/salt water interface zone plays a significant role in the increase of atmospheric N_2O and CH_4 concentrations coming from the bacteria production in this zone. The gulf shows eutrophication events caused by the high nutrient supply, derived from the river discharges.
Watershed	The total catchments basin of Thermaikos Gulf extends to an area of ~72.000 km^2, drained from four main rivers. The average discharge of the river system reaches values from 300-350 m^3s^{-1} and the annual discharge is estimated in 6-8 x 10^9 m^3y^{-1}. The solid annual discharge is rapidly reduced from 3-4 x 10^6Ty^{-1}, some decades ago, to 0,6-0,7 x 10^6Ty^{-1} in the recent years.
Human Activities	Urbanization [Thessaloniki a city of 1,5 million citizens], agriculture [Thessaloniki plain, Thessalia plain], industrial [Thessaloniki industry area], tourism [E and W site of the Gulf], fisheries, aquaculture mainly mussel farming.
Impact Responses	Intensive agriculture, intensive aquaculture, overfishing, urban/industrial wastes, water cycle intervention, transboundary pollution, massive tourism, second house settlements along the coasts, public ignorance of the value of the environment,

4. Policy

Policy issues	What measures should be undertaken to reduce nutrients? How Thessaloniki can have a clear water sea in its sea front? How a land planning for the aquaculture can be established? How fisheries can be regulated according to the carrying capacity of the system? How the summer tourist invasion can be managed?
Policy changes	Management plan and measures for the treatment of the domestic sewage Land planning of the mussel farms Measures to avoid over fishing

5. Stakeholders and Institutional Governance

Major organisations	Organisation for the Master Plan and Environmental Protection of Thessaloniki Thessaloniki Prefecture (Department of Agricultural Development, Department of Fishing, Department of Water Resources and Irrigation Works)
Other leading organisations	Thessaloniki Water Supply and Sewerage Company S.A. Thessaloniki

6. Partner Collaboration

SPICOSA Partner Collaborations	Core Partners : Institute of Oceanography of the Hellenic Center for Marine Research University of Thessaloniki, Aegean University Linked Partner : University of Pantheion (Pr. Tsaltas, Marine Law)

7. Systems Studies

Long time series	Hydrochemical, -physical and phytoplankton data, river discharge and nutrient loads. Benthos, fish data. Various and large amounts of additional data e.g. meteorological, hydrodynamic, sediment, heavy metal, biological data.
Research Projects *Socio-economic study*	**EUROCAT [An ELOISE EU-Project] :** *European catchments. Catchment changes and their impact on the coast* Long-term assessment of N & P loads and heavy metals of the Axios River and their impact on the coastal system of the Thermaikos Gulf. Formulation of management proposals aiming at the sustainable development of the river catchment and the coastal zone **INTERPOL [An EU Project] :** *Impact of natural and trawling events on resuspension, dispersion and fate of pollutants* Study of the effects of natural and anthropogenic (trawling) sediment resuspension on the biogeochemical cycles and transfer of pollutants, nutrients and key-elements in the continental shelf of the Thermaikos Gulf. **Metro-Med [An EU-MAST-III ELOISE-Project] ;** *Dynamics of Matter Transfer and Biogeochemical Cycles: Their modelling in Coastal Systems of the Mediterranean Sea* The target of Metro-Med project is to study and simulate the mechanisms of matter transfer and of the biogeochemical cycles in the coastal ecosystems (incl. Thermaikos Gulf).

WT 7.17 IZMIT BAY

1. Host Institution: TUBITAK, Marmara Research Center (MRC). **Contact:** Leyla Tolun
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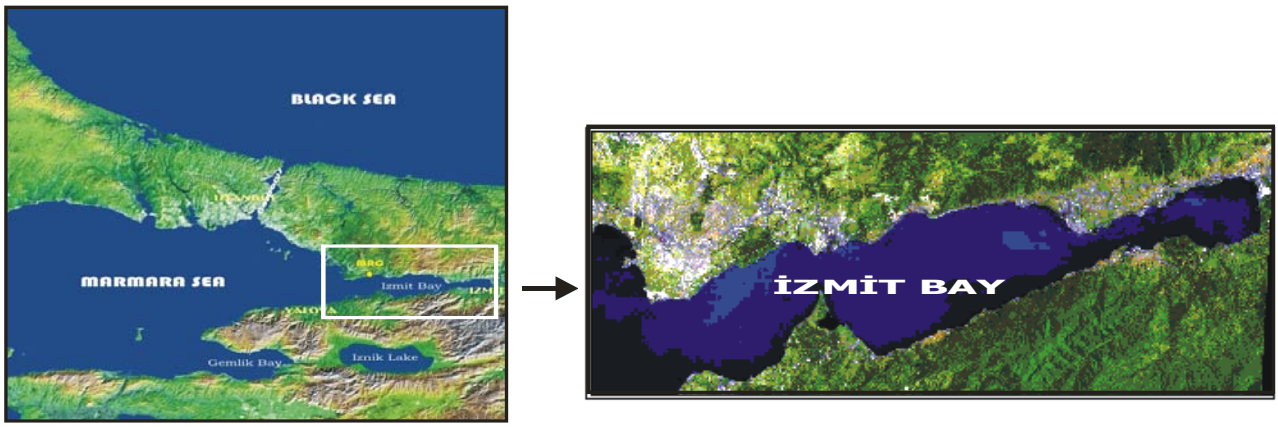
2. Izmit Bay



3. Characteristics

Marine System	Izmit Bay, located in the southeastern part of the Marmara Sea has an area of 279 km^2. The bay consists of three parts, connected to each other by narrow openings. The bay has a two- layer water stratification and flow system with a halocline / thermocline which separates the lower water layer of Mediterranean origin (35-38 ‰) from the upper layer of Black Sea origin (22-28 ‰). The thicknesses of the layers change seasonally depending upon the current systems in the area. The major discharges are from the northern part of the Bay.
Watershed	Izmit watershed is a part of Marmara watershed. Although Dilderesi river and Eastern Channel are the main freshwater inputs to the Bay, both of them carry polluted waters from surrounding industries, settlements and agricultural area. Dilderesi is 12 km long and carries $70x10^6$ m^3/year.
Human Activities	Urban wastes, industrial wastes (toxic) and, heavy ship traffic, atmospheric pollution, restricted water circulation, natural phenomenon like earthquake, pollution transport from the adjacent seas
Impact Responses	Oxygen deficiency in bottom waters, biochemical pollution, eutrophication, accumulation of pollutants in sediments and biota, sediment toxicity, habitat destruction, toxic algal blooms, bio-diversity loss.

4. Policy

Policy issues	**Water quality**. Development of water quality models, identification of limiting nutrient and self-purification capacity, nutrient discharge regulations and control, setting up toxicity threshold levels **Integrated waste management**. Legal constraints, development of regional criteria for discharges and water quality, capacity building towards the public health and environmental welfare, risk assessment and minimization for hazardous and toxic wastes (accidents), development of contingency plans. Unification of the SMEs for pollution abatement and conservation of resources Promoting **decentralized approach** for the source control, reuse/recycle of the wastes, enhancement of public awareness, involvement of stakeholders in the decision making process. Rational integration of institutional bodies, cost control from a central budget allocation body and optimization of the efforts by cost-benefit analysis, improvement of existing NGOs in the region as well as promoting international well known NGOs to focus on the problems Land use options, changes, foreseen impacts and prioritization

Policy changes	**Land use policy** has been drastically changed in favour of industrial establishments. The proximity of Izmit Bay to the metropolitan city of Istanbul enhanced this development. **Environmental policies**. The large volumes of wastes from domestic and industrial sources were mostly discharged to the environment without any treatment and until 1980's, it was assumed that this activity was not deleterious. As a direct consequence of pollution the insufficient environmental policies towards resource management and abatement of pollution was affected and needed to be upgraded. Environmental laws and regulations was set up associated with water pollution control, solid waste control air pollution control etc. However, the levels of nutrient and organic matter in the Bay waters have increased despite the regulations and eutrophication problems persist in the bay. In recent years periodic red tide events have been observed and the Secchi depth has decreased. Furthermore, hazardous wastes and toxic substances in the industrial and complex wastewaters are still out of control.

5. Stakeholders and Institutional Governance

Major organisations	Ministry of Environment and Forestry, Kocaeli Metropolitan Municipality, Kocaeli Province Directorate of Environment and Forestry
Other leading organisations	Kocaeli University, Gebze High Technology Institute, Kocaeli Chamber of Industry, NGOs

6. Partner Collaboration

SPICOSA Partner Collaborations	Core Partner: University of Haifa (IL) (Dror Angel, sedimentary processes, organic pollutants) Link Partners: Middle East Technical University –Marine Science Institute (Suleyman Tugrul Ecological Dimension of SAF and Temel Oguz, modelling support), Istanbul Technical University (Oya Okay, Ecological Dimension of SAF and Sedat Kaptasli modelling support)

7. Systems Studies

Long time series	Physical parameters: water column depth, sechi disk depth, temperature, salinity, conductivity, current (before earthquake), light penetration, total suspended solids (for years 1985, 1990, 1995, 2000). Meteorological data (daily since 1985). Chemical parameters: Dissolved Oxygen, pH, nutrients (total nitrogen, nitrate and nitrite nitrogen, total phosphorus, ortho-phosphate phosphorus, reactive silicate), total and dissolved organic carbon, total polycyclic aromatic hydrocarbons (years between 1999-2003), PCBs (years between 1999-2000)in different matrices (sediment and biota). Biological parameters: Chlorophyll-a, phytoplankton, (number and species), primary production, biomarkers. Remote Sensing and Geographical Information Systems (since 1998). NOAA and Landsat images. Digital data integrated GIS. Point sources: Domestic and industrial wastewater discharges (from nine main discharges of north-eastern region), pollutant loads (total nitrogen, total phosphorus, silicate, total organic carbon, biological oxygen demand), toxicity measurements on the sources. Atmospheric PAH deposition (four seasons in year 2002).
Research Projects	* Wastewater Treatment and Disposal Studies. 1988-1989. NATO TU-WATERS * The effects of industrial developments on the coastal waters and semi enclosed areas - Izmit Bay case study (two projects):1994 –1996, 1999-200. Focus was on eutrophication, water quality, pollution sources and marine biodiversity. In the second project water quality monitoring studies and toxicity of the wastewaters was investigated. * Determination of the Adverse Effects of the Industrial Wastewaters to the Coastal Water Quality of Yalova. 1997 -1998. * Determination Of The Pollution Level In Izmit Bay After The Earthquake. 2001-2002 * Effects of the Natural Phenomenon and Land Based Sources to the Coastal Waters: Case Study of Izmit Bay and Dilderesi River (2001 -2002). The aim was to determine the industrial and domestic pollutants arising from heavily industrialized northern part of Izmit Bay and their effects to the coastal waters of the Bay. * Carcinogenic Polycyclic Aromatic Hydrocarbons (PAHs) Entering Izmit Bay: Determination of Sources and Concentration Levels (2002-2003).

WT 7.18 DANUBE DELTA

1. Host Institution: EC Joint Research Centre, Institute for Environment & Sustainability. **Contact:** Wolfram Schrimpf**,** wolfram.schrimpf@jrc.it

2. Danube Delta-Romanian-Bulgarian Coastal Zone. The Black Sea lies between Southeastern Europe and Asia Minor. The Danube Delta is located around the area where the Danube River flows into the Black Sea- in Dobrogea, Romania and a small part in Odes'ka oblast', Ukraine.

3. Characteristics

Marine System	The Black Sea has an area of 422,000 km² and a maximum depth of 2210 m. The basin is ranked among the most ecologically threatened water bodies of the world, it has unique natural features -presence of H_2S at a depth below 150m (13 % of the total Black Sea domain supports life), drainage area exceeding 5 times the surface area of the basin, very low water exchange rate, low salinity and is under great anthropogenic pressure due to the substantial fresh water input (especially in the North-Western part of the basin), that determine the extremely high sensitivity of the Black Sea ecosystem to external forcing. The Danube basin, Delta and Black Sea represent a continuum of closely related ecosystems. The Romanian Black Sea coast is the most subjected to freshwater flow area, the Danube river loads (Danube delta) contributing substantially to the coastal ecosystem degradation. Due to its geographic position and the pattern of the main Black Sea currents the Bulgarian Black Sea shelf is under the strong influence of the major freshwater inflow from the North-West.
Watershed	The Black Sea is the only basin with a drainage area five times larger than the sea. The inflow of freshwater from the surrounding areas, especially central and middle-Eastern Europe amounts to 320 km³ per year. The most important river entering the Black Sea is the Danube, receiving runoffs from substantial parts of seventeen European countries including major industrial and agricultural areas. The watershed of Danube is 817,000 km². The Danube Delta is the largest and best preserved of European deltas, with an area of 3446 km². Romanian irrigated land is 31,020 km^2, the arable land- 41 %, permanent pastures-21 %, while the permanent crops are 3 %. In Bulgaria 40.02% of the total land is arable land, whilst permanent crops are 1.92%.
Human Activities	Agriculture, industrial and urban effluents, fisheries and shipping, tourism
Impact Responses	**Nutrient enrichment, biodiversity changes, invasive species, habitat destruction, food-web shifts** **Eutrophication** has caused severe ecosystem impacts such as phytoplankton blooms, anoxia, and hypoxia and together with **overfishing**, **invasive species** and trawling have been considered the key ecological issues especially in the North-Western Black Sea coastal waters. Nutrient over-enrichment has lead to dramatic alteration in the structure of marine fauna and flora, resulting in undesirable food web shifts during the last decades and constitutes a continuous threat to biodiversity and ecosystem functioning. Overfishing and invasive species introductions acting in parallel add further to the cascade of ecosystem alterations.

4. Policy

Policy issues	Water Framework Directive (2000/60/EC); NATURA 2000, Council Directive 91/271/EEC concerning urban waste-water treatment; Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources; Marine Monitoring and Assessment (eutrophication, biodiversity, hazardous substances) in the context of implementation of the future Marine Strategy; Trans-boundary Integrated Coastal Zone Management

Policy changes	Implementation of the European policies by the pre-accession countries.

5. Stakeholders and Institutional Governance

Major organisations	Black Sea Commission, National and Local Environmental Protection Agencies, Romania, National Company "Romanian Waters", National Institute for Danube Delta –Tulcea, Romania, Ministry of Environment and Water, Bulgaria, Black Sea Directorate, Bulgaria
Other leading organisations	Ministry of Development and infrastructure (Bulgaria), Ministry of Transport (shipping camara), Bulgaria; Ministry of Tourism, Bulgaria; National Agency of fishing and aquaculture, Bulgaria

6. Partner Collaboration

SPICOSA Partner Collaborations	**Core partners**: JRC, Institute for Environment and Sustainability, EU; National Institute for Marine Research and Development "Grigore Antipa", Constanta Romania; Institute of Oceanology, Bulgarian Academy of Sciences, Varna, Bulgaria; Norwegian College of Fishery Science, University of Tromsø, Norway; Linked partners : Marine Brunch of Ukrainian Hydrometeorological Institute, Sevastopol, Ukraine; Water Global Partnership, WP Bulgaria

7. Systems Studies

Long time series	Black Sea inter-disciplinary (physical, chemical and biological data) multivariable historical database was created in the framework of the NATO TU-Black Sea Project; Existing Data base for the Study site belonging to the various institutions in the region
Research Projects	-Danube Delta Project, financed by GEF (1994-1998) aimed at effective protection, enhancement and management of protected areas of the Ukrainian and Romanian part of Danube delta - European River Ocean System (EROS) 2000 and EROS-21 EU Project (1994-1998) developed an integrated approach to the eutrophication, contaminant problem, particle transfer, sedimentation and biogas production of the north-western Black Sea through the establishment of fine resolution coupled hydrodynamical-biogeochemical models of the river and marine systems in order to describe and predict the response of the coastal ecosystem to natural variability and anthropogenic factors such as changes in land use and hydraulic management; - Black Sea Ecosystem Process and Forecasting/Operational Database Management System, NATO SfP (1998-2001) developed further the NATO Black Sea Data Base and Management System for management oriented operational marine forecasting and research; -EUROCAT (European Catchments). Catchment changes and their impact on the coast. EC (2002-2003). An integrated network aiming to determine limiting concentrations of pollutants and nutrients for sustainable development on the basis of ecological and socio-economic indicators; - Sea-Search: a Pan European Network for Ocean & Marine Data and Information Management, EU (2002-2005), a Pan European Network for Ocean and Marine Data and Information Management (oceanographic and biological data). This activity will continue at more detailed level (data of interdisciplinary parameters) within the 6FP Project SeaDataNet, starting in 2006;
Socio-economic study	-CESUM-BS, 5FP-EU (2000-2003)-the objective of the project was sustainable development of the Black Sea region in the context of environmental, economic and social problems for harmonisation with the EC standards through increased regional and international co-operation and networking. The environment-socio-economic aspects included selection of indicators for ecosystem health assessment and identification of priority socio-economic drivers for sustainable management of the Black Sea ecosystem and balanced economic development at regional level; THRESHOLDS, 6FP-EU, (2005-2008) – identification of thresholds for ecosystem performance to provide management options for rehabilitation; GEF/UNDP "Black Sea Recovery Project" – collection of new data for assessment of the recent Black Sea state and provide options for management