Oil Spill in the Kerch Strait

Ukraine Post-Disaster Needs Assessment

European Commission
United Nations Environment Programme

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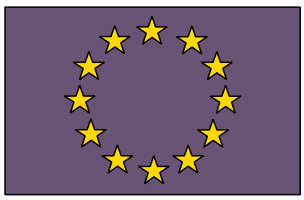

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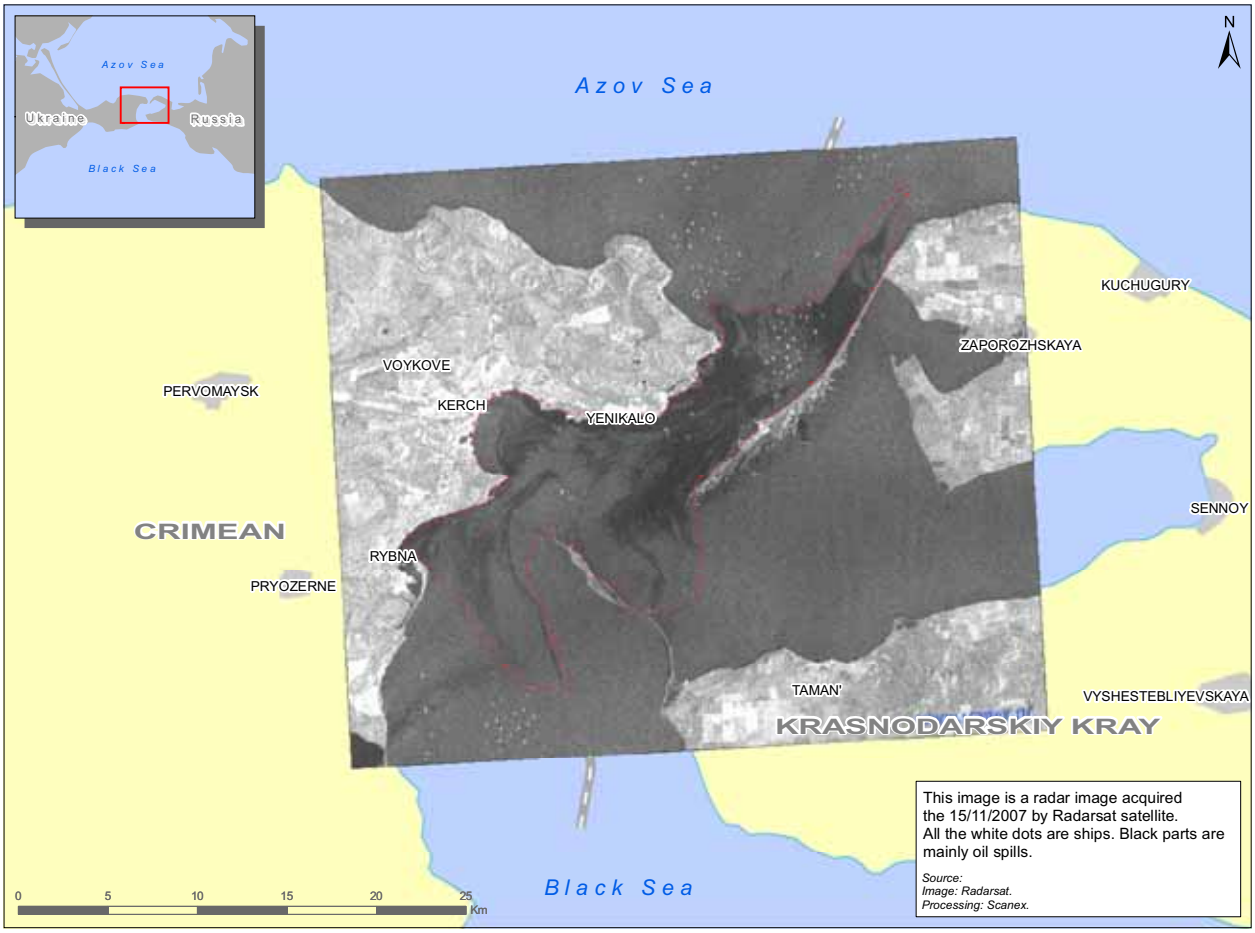
Introduction

On 11 November 2007, a strong storm in the Kerch Strait (which connects the Sea of Azov with the Black Sea and separates Ukraine from the Russian Federation) blew winds of up to 35 m/s and waves of up to five meters. The storm resulted in thirteen vessels being sunk, stranded, or damaged and the incident caused loss of life, of property, and environmental harm. The four vessels that sank were: motor tanker *Volgoneft-139* (Russian Flag), motor vessel *Volnogorsk*, motor vessel *Nahichevan* (Russian Flag), and motor vessel *Kovel* (Russian Flag).[1] Russian motor vessel *Volgoneft-139* initially leaked approximately 1,300 tonnes of fuel oil into the sea. Treacherous weather conditions at sea (18-20 m/s wind, 2.5 m waves), hampered any clean-up efforts in the sea during the initial 24 hours, resulting in oil being transported to the shorelines on both sides of the Kerch Strait.

By 21 November 2007 more than 500 people from the Ukrainian Ministry of Emergencies and civilian volunteers were involved in shoreline clean-up operations on Tuzla Island – situated north of the shipwreck in the middle of the Strait and one of the main affected areas. Seventeen technical units were engaged in clean-up efforts and fifteen ships performed oil spill contingency operations in the Kerch Strait. The European Commission (EC) immediately offered assistance for "preparing the environmental assessment as to the magnitude of the catastrophe as well as allocation of technical and financial resources to remediate its impact."

On 16 November 2007, the Government of Ukraine accepted the EC's offer of assistance. From 18-24 November 2007, the EC Monitoring and Information Centre (MIC)[2] deployed a mission. A team of five experts was deployed [to Ukraine] immediately; this team included a representative from the Joint UNEP/OCHA Environment Unit to "assist the Ukrainian authorities in assessing the environmental impact of the disaster; to observe the development of the pollution and to advise on immediate remediation needs." To undertake this rapid assessment mission, the MIC team conducted site visits to affected

Figure 1. Image acquired during monitoring of the oil slick in the Kerch Strait in November 2007



Industry in Kerch

areas and held numerous meetings with ministries at national and local levels. In the report of the MIC team, the situation observed on the field was described as follows:

The motor tanker "Volgoneft-139" with 3,463 tonnes of residual oil (heavy fuel oil type M-100 which corresponds to IFO 280-600) broke into two parts, leaving the front part anchored at 45° 13'01"N; 36° 31' 06" E. The back part drifted to the position 45° 15' 06" N; 36° 30' 07" E causing an oil spill of about 1,300 tonnes coming from its tanks. The motor vessel "Volnogorsk" sank at 45° 11' 05" N; 36° 31' 07" E. It is now at a depth of 10.6 m with 2,436 tonnes of sulphur on board. There is no observed leakage of bunker oil i.e. marine diesel fuel. The motor vessel "Nahichevan" sank at 45 ° 12' 00" N; 36° 33' 05" E. It is now at depth of 9.5 m with 2,365 tonnes of sulphur on board. The motor vessel "Kovel" sank almost in the middle of the channel and has drifted to near the Ukrainian shoreline at 45° 09' 02" N; 36° 26' 06" E. It is now at a depth of 9.3 m with about 2,100 tonnes of sulphur on board. Divers surveying the vessel observed a slight marine diesel fuel leak due to the destruction of the engine compartment.

According to the data provided by the Ukrainian Ministry of Transport, as of 20 November 2007, the total amount of the immediate spillage was 1,300 tonnes of heavy fuel oil, 2.3 tonnes of oil lubricants, 25 tonnes of marine diesel fuel oil and 5.5 tonnes of heating oil.[3]

At the launch of the MIC report, *Ukraine Oil Spill in Kerch Strait, Black Sea*, in December 2007, Commissioner Benita Ferrero Waldner, External Relations and European Neighbourhood Policy, and Commissioner Stavros Dimas, Environment and Civil Protection, EC, jointly stated: "Our cooperation with Ukraine is beneficial for both parties. The Black Sea is one which we both share and manage. It is in our mutual interest as well as that of other littoral countries to continuously strive not to unbalance its delicate ecosystem and the livelihood of all those that benefit from it."[4]

Following the MIC report and adoption of Resolution P6_TA, *On shipping disasters in the Kerch Strait in the Black Sea and subsequent oil pollution*, by the European Parliament on 13 December 2007[5], the EC, through its Directorate General for External Relations (RELEX), invited UNEP to coordinate a joint EC-UNEP comprehensive multi-sectoral Post-Disaster Needs Assessment (PDNA). In addition to the scientific assessment of the damages caused to the coastal and marine environment, the EC was keen to understand the institutional and economic

mid to long-term needs of Ukraine related to the oil spill incident, as well as to review existing data on costal sensitivity mapping for the region. Thus, the Ukraine PDNA was divided into the following four assessment categories: scientific, coastal sensitivity mapping, economic and institutional.

Thereafter, UNEP assembled a broad multi-disciplinary international team of experts to undertake the scientific, technical, and institutional assessments for the Ukraine PDNA. To assess the economic valuation of the environmental impacts of the oil spill UNEP initiated a partnership with a local Ukrainian university, Kyiv-Mohyla Academy.

The EC-UNEP PDNA team, supported by the Government of Ukraine (thereafter referred to as the PDNA team), was composed of the following four sub-teams:

- Coastal and Marine Assessment team
- Coastal Sensitivity Mapping team
- Institutional Assessment team
- Economic Assessment team.

The coastal and marine assessment team and the coastal sensitivity mapping team undertook the fieldwork component of a mission from 15-26 July 2008 in the Kerch Strait. Their aim was to identify the nature, extent, and location of remaining damages to the environment from the oil spill. From 1-17 July 2008, the institutional assessment mission was undertaken to review existing legal provisions and institutional mechanisms in Ukraine for oil spill emergency situations. The assessment objective was to ensure lessons learned from this incident would be incorporated into Ukrainian legislative and institutional systems, in order to facilitate a more effective emergency situation response in the future. The team engaged and consulted with a range of national, regional, and local stakeholders (see Appendix 4: List of Institutions consulted during the institutional assessment mission). The economic assessment team from Kyiv-Mohyla Academy conducted its field work in Kerch from 7-17 July 2008. Extensive secondary data gathering, field surveys, and interviews were conducted by the team during this period.

This report summarizes the findings of the PDNA team and provides a set of concrete recommendations for recovery and disaster risk reduction in Ukraine. It has been prepared by the EC-UNEP team with the participation of the Government of Ukraine.

UNEP experts collecting samples from contaminated materials found on the shoreline

Context

Bio-physical setting of the Kerch Strait and adjacent marine areas

The Kerch Strait is a shallow sound, 41 km long and 4.5-15 km wide, connecting the Black Sea with the Azov Sea. The depth of the Strait ranges between 5 to 13 meters and the seabed consists primarily of sand; occasionally it is covered with a layer of organic sediment and often is covered with sea grasses such as eelgrass (*Zostera maritima*). The direction of the currents in the Strait depends on the season and the weather. Frequently the surface currents go in one direction and the currents along the bottom in the opposite.

In the middle of the Kerch Strait is the island of Tuzla. It is a low and sandy island with littoral vegetation. There are no marine protected areas on the Ukrainian side of the Strait, with the exception of two smaller protected coastal areas, located on the coast facing the Azov Sea (see figure 10 on page 31).

The European anchovy (*Engraulis encrasicolus*) migrates on a seasonal basis between the Black Sea and the Azov Sea and is the main target for the fishing in the Strait. The anchovy population suffers from high fishing pressure both in the Azov Sea and in the Black Sea. In addition the invasive comb jellyfish (*Mnemiopsis leidyi*), originating from western Atlantic, preys on the eggs and juveniles of the anchovy. Since the oil spill incident the Government of Ukraine has prohibited fishing in the area (Order no. 320).[6]

The Azov Sea is a shallow marginal sea that connects to the Black Sea. The area of the sea is 37,600 km^2. The maximum depth is a mere thirteen meters and most of the Azov Sea is less than ten meters deep. The water of the Azov Sea is brackish with fluctuating salinity levels of 1-15 percent. The prevailing current is counter-clockwise. Formation of sea ice can occur temporarily at any time from late December to mid-March. The water mass of the Azov Sea is characterized by oxygenated surface water and anoxic bottom waters, with the anoxic waters forming a layer 0.5-4 meters above the seabed. The anoxic conditions are the result of heavy inflow of organic matter, nutrients, and sediments from nearby rivers such as the Don and Kuban. The average annual influx of fresh water into the Sea of Azov is 40.7 km^3, of which 28.5 km^3 comes from the Don River and 11 km^3 from the

Map of Kerch Strait

Kerch shore

Kuban River. The annual rainfall is 15.5 km^3 with evaporation losses of 31 km^3. The Sea of Azov loses 66.2 km^3 of water to the Black Sea and receives from it 41 km^3 on an annual basis.

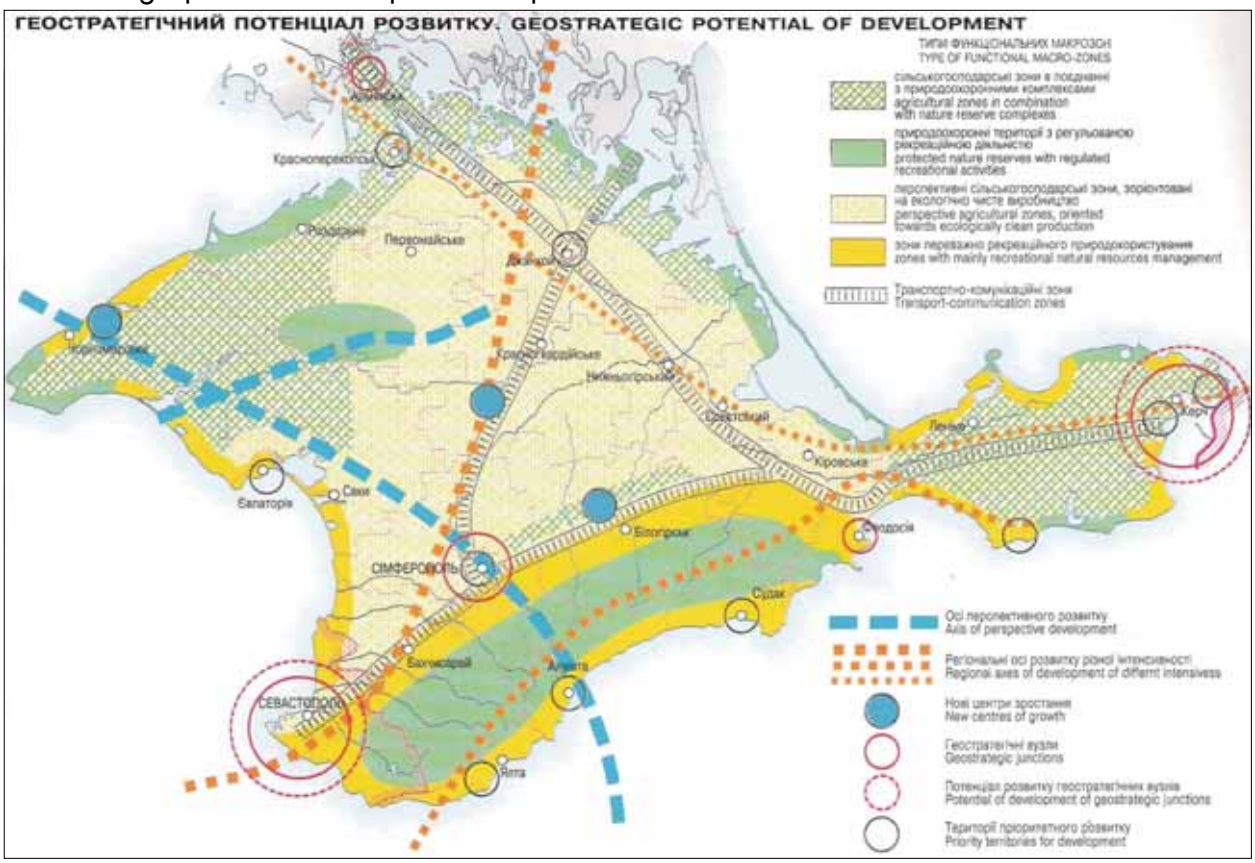
The productivity of the Azov Sea is very high (up to or above 100 $gC/m^2/y$). The diversity of macro-fauna species and fish, however, is relatively small (up to 350 species), though many species can be abundant. There are seventy-nine species of fish in the Sea of Azov, mostly Mediterranean, twenty-one percent of the fish are freshwater species. The fish with the greatest commercial value are Anchovies, Perch, Sturgeon, Bream, Whitefish, Herring, Plaice, Carp, Mackerel, and Mullet. The Azov Sea has historically been rich in marine life but over-fishing and pollution have reduced its biodiversity.

The average depth of the Black Sea is 1,200 meters and the maximum depth is 2,245 meters. The Black Sea is the world's largest meromictic basin, characterized by the strong stratification of the water mass with deep waters that very seldom mix with the upper layers.[7] As a result the water is anoxic below 120-200 m. The upper layers are fed by fluvial systems and are generally less dense with lower salinity than the deeper waters, with an average surface salinity around 18 percent. The temperature of the surface waters varies seasonally from 8 °C to 30 °C. The climatic variations in the Black Sea region are influenced by the North Atlantic Oscillation (NAO), a term used to describe the climatic mechanisms resulting from the interaction between the North Atlantic and mid-latitude air masses.

In the Black Sea there are several fish species originating from the Mediterranean. However, the diversity of fish species in the Black Sea is approximately one third of the diversity of the Mediterranean. The most common species of fish found in the Black Sea include: Anchovy, Sprat, Horse Mackerel, Whiting, Spiny Dogfish, Turbot, Sturgeons, Mullets, Atlantic Bonito, Bluefish, Twaite, Shad, and Rays. In addition, there are six main species of seagrass in the Black Sea: *Zostera marina, Z. noltii, Potamogeton pectinatus, Ruppia maritima, R. spiralis*, and *Zannichellia major*.

The coastal wetlands are migratory breeding grounds for numerous seabirds and waders. The most significant habitats are situated in the coastal area of Romania in the Danube Delta, along the Ukrainian coast, and the coastal areas in the Russian Federation from the Danube Delta to the Tamansky Peninsula in the Kerch Strait.

Geostrategic potential of transport development in Kerch[8]



Four species of marine mammals can be found in the Kerch Strait: three species of dolphins (the Bottlenose dolphin (*Tursiopstruncatus ponticus*), the Common dolphin (*Delphinus delphis ponticus*), and the Harbour porpoise (*Phocaena phocaena relicta*)), and near extinction, the Monk seal (*Monachus monachus*).

Trade significance of the Kerch Strait

As the connecting route between the Azov and Black Seas, and between Crimea and Russia, the trade importance of the Kerch Strait continues to grow for three primary reasons. First, Kerch owns major portal infrastructure including railway terminals, several ports, a small airport, and industrial complexes (metallurgy, shipbuilding). Secondly, Kerch hosts an important fishing fleet and processing centre for numerous fish products. Finally, the Kerch Strait is also a major energy route for transportation of oil products, minerals, grain, wood, and salt between Russia, Ukraine, and towards the south through the Black Sea. The Black and Azov Seas' seabeds, particularly in the south of the Kerch Strait, are reported to be rich in potential oil reserves.[9]

The role of the Black Sea Commission

Since 1992, the Commission on the Protection of the Black Sea against Pollution (the Black Sea Commission) acts on the mandate of member states bordering the Black Sea; namely, Bulgaria, Georgia, Romania, Russian Federation, Turkey, and Ukraine. The Black Sea Commission implements the provisions of both the Bucharest Convention (described in detail on page 38) and of the Black Sea Strategic Action Plan, which aims to combat pollution from land-based sources and maritime transport through monitoring of pollution, restoration, and conservation of marine resources.

UNEP activities in the region

UNEP supports the Black Sea Commission and its Member States through a series of activities within the framework of the Black Sea Strategic Action Plan. Activities have been related to marine litter, the protection of marine mammals, and the development of the Land-Based Sources of Pollution (LBS) Protocol. UNEP is also one of the founding partners of the Environment and Security Initiative (ENVSEC), which aims to reduce environment and security risks at a regional level. In 2006, ENVSEC

identified the Autonomous Republic of Crimea (ARC) as a priority area and implemented the project *Environmental assessment of development planning and environment-security monitoring in Crimea*. In the next four years UNEP GRID[10] and the UNEP centre for the management of environmental information will undertake a capacity-building project known as "EnviroGRIDS", to improve environmental monitoring and early warning systems for the Black Sea basin, along with 27 other partners.[11]

EU and EC engagements in the Black Sea region

Within the framework of its European Neighborhood Policy, the EU developed the *Black Sea Synergy* (BSS) programme. The primary objective of the BSS is to increase cooperation among and between the countries surrounding the Black Sea.[12] The EU-BSS programme primarily focuses on environment, maritime policies, and fisheries, and relies upon transboundary cooperation for implementation.

Council of Europe's recommendations for the region

The Council of Europe's report published in June 2008 entitled *The Fight against harm to the environment in the Black Sea*[13] explicitly stated that over-exploitation of the Black Sea's fisheries has led to the commercial extinction of 21 of the sea's 26 species of fish. Thereafter, in accordance with Recommendation 1837, dated June 2008, the Parliamentary Assembly of the Council of Europe requested its Committee of Ministers invite the relevant members of the Council of Europe to "actively promote the creation of a Black Sea Euroregion," on the model of the Adriatic Euroregion. Recommendation 1837 also called on these member-states[14] to "improve cooperation and integration in the field of maritime surveillance with a view to improving pollution control on the main maritime routes and to reinforce implementation of environmental agreements in the region."[15]

The vessel traffic in the Kerch Strait around the remaining part of the *Volgoneft-139* (site number 16)

Post-Disaster Needs Assessment

Objectives and scope

Post-disaster needs assessments (PDNA) seek to identify the needs to be addressed in disaster recovery processes. The environmental PDNA methodology, developed by UNEP, aims to support governments and local authorities in remediating environmental damages from disasters and in strengthening infrastructure to ensure a more efficient recovery response in the future. The environmental PDNA methodology as elaborated in this report seeks to provide an objective scientific assessment of the situation resulting from the Ukraine oil spill disaster, and proposes concrete recovery measures to rehabilitate the environment and to reduce risks and vulnerability to disasters.

The EC-UNEP Post-Disaster Needs Assessment, conducted with the support of the Government of Ukraine, covered the following four main areas with separate assessments for each:

1) **Coastal and marine assessment:** To obtain data on the impacts of the oil spill contamination on the coastal and marine environment of the Ukrainian side of the Kerch Strait, in order to establish an accurate assessment of needs for an adequate environmental recovery programme.

2) **Coastal sensitivity mapping assessment:** To assess the quality of existing coastal sensitivity maps and to gather information on the vulnerability of the environment. Through the information obtained, a set of measures were be proposed to improve coastal sensitivity maps and information management in emergency situations.

3) **Institutional assessment:** To review the existing legal framework and institutional mechanisms involved in responding to environmental emergencies, taking the oil spill of November 2007 as a demonstration of the ability of the current Ukrainian system to manage such emergencies.

4) **Economic assessment:** To examine the impact of the oil spill to the local and national economies, by evaluating the direct and indirect costs related to the oil spill response and its medium-term impacts on local businesses.

The geographic scope of the PDNA was restricted to Ukraine for this particular assessment, although the impacts of the November 2007 oil spill may be wider. The marine and coastal assessment team visited areas most impacted by the oil spill, in the Kerch Strait and on its extremities at the entrances to the Black and Azov Seas. The Coastal sensitivity mapping team conducted a *ground-truthing*[16] exercise, along the same area of the Ukrainian Coast covered by the marine and coastal assessment team. The Institutional assessment team conducted its mission on a national, regional, and local level, engaging with ministries in Kiev, ARC authorities in Simferopol, with scientific research centres in Odessa and Sebastopol, and more locally in Kerch itself. Finally, the economic assessment team undertook its field work in the city of Kerch and surrounding tourist areas.

Emergency phase monitoring and remote sensing analysis

In November 2007, during the emergency response phase, EC MIC and UNEP were engaged in a range of monitoring activities to examine the course of the response to the oil spill. Monitoring activities were accompanied by satellite data collection

A student from the Department of Environmental Studies of the National University Kyiv Mohyla Academy, sharing assessment findings

Assessing the shoreline North of the Kerch penninsula

to monitor the impact of the oil spill following the accident. The impacts were reported in numerous governmental statements and press sources. At the request of the Ukrainian Government, the MIC organized a preliminary rapid environmental assessment mission in November 2007 in which the Joint UNEP-OCHA Unit also participated. The findings from the MIC mission were later used as a basis for the preparation of the EC-UNEP PDNA mission.

Field work and reporting

In April 2008 UNEP conducted a scoping mission to Ukraine to meet the Ukrainian Government and the EC delegation in Kiev, in order to discuss and agree on the thematic and geographic scopes of the PDNA. All four assessment teams were in Ukraine and Kerch for several weeks in July 2008 where they formed independent teams in the field for each assessment component. After the completion of the fieldwork phase, all four assessment teams participated in a two-day meeting in Kerch to share mission findings and discuss reporting strategies. During this period, the institutional and economic assessment teams conducted meetings with local stakeholders and affected populations, while the coastal and marine assessment team and the coastal sensitivity mapping team visited the oil spill-impacted sites on land and at sea (10 zones were visited and 25 samples taken, see figure 9 on page 30). After the sampling took place, the EC delegation ensured the swift transfers of samples for analysis to an independent laboratory in the United Kingdom.

This report is a compilation of the findings from each of the four components undertaken in Ukraine for the EC-UNEP environmental PDNA. It aims to provide a comprehensive review of Ukraine's recovery needs following the Kerch Strait oil spill; it also identifies concrete recommendations to strengthen Ukraine's preparedness and response capacity to address environmental causes and consequences of disasters.

Coastal and Marine Assessment

Focus and method of assessment

The Post-disaster needs assessment (PDNA) team visited the Kerch Strait to conduct surveys of the Ukrainian coastline, the Kerch Strait sea floor, and Tuzla Island between 14 and 25 July 2008. The primary objective of the coastal and marine assessment was to obtain data on the environment following the oil spill incident, which could in turn provide the basis for further monitoring work and assist the government of Ukraine in formulating sound environmental management policies, and improve the capacity for disaster risk preparedness and emergency response coordination. Samples of degraded oil, contaminated shoreline material, and marine sediments were collected. This chapter sets out the findings with respect to specific sites investigated for oil contamination.

The accident

A storm with winds of up to 35 m/s and waves of up to 5 meters affected the northern Black Sea on 11 November 2007. As a result, motor tanker *Vologoneft-139* and motor vessels *Volnogorsk*, *Nahichevan*, and *Kovel*, anchored in the Kerch Strait, were virtually torn apart.

The *Volgoneft-139* broke into two parts and sank in the main ship channel in the Strait, initially leaking 1,300 tonnes of heavy fuel oil (reported to be oil type M-100 which corresponds to IFO 280-600). The stern was salvaged but the bow still rests on the sea floor at a depth of eight meters. As a result of the shallow water, it is clearly visible above the surface. Attempts to prevent oil from leaking from the wreck, through the use of booms, appeared to be unsuccessful due to the currents in the Strait. The other motor vessels, *Volnogorsk, Nahichevan,* and *Kovel* did not sink, but drifted towards the coast of Ukraine (south of Tuzla Island) – each carrying approximately 2,000 tonnes of granulated sulphur.[17] It was reported that the sulphur granulates leaked on to the sea floor from motor vessel *Kovel*. Due to the slow reaction of sulphur in water, it is unlikely that the sulphur granulates will lead to suspended colloidal sulphur in the short term.

The oil spill from the motor vessels drifted eastward in the direction of the wind, contaminating Tuzla Island and connecting Russian beaches. A week later saw the wind turning westward, further contaminating the beaches of Crimea with the remaining oil. Tuzla Island in particular suffered severe levels of contamination in comparison to connecting shorelines along the Kerch Strait. Although shorelines in the Kerch Strait were also affected by oil contamination, the actual extent of the contamination varied. Specific areas north of the Kerch Strait, on shorelines facing the Azov Sea, were also contaminated by small quantities of oil.

A UNEP expert sampling oil waste dumped south of the Arabat Spit (site number 6)

***Volgoneft-139* and the broken boom, from which oil still leaks**

The *Volgoneft-139*'s bow rests at a depth of eight meters at 45º13'01''N; 36º31'06''E. The *Volnogorsk* vessel rests at a depth of eleven meters at 45º11'05''N; 36º31'07''E, with a cargo of 2,436 tonnes of sulphur on board. The *Nahichevan* vessel rests at a depth of ten meters at 45º12'00''N; 36º33'05''E with a cargo of 2,365 tonnes of sulphur on board. The *Kovel* vessel rests at a depth of nine meters at 45º09'02''N; 36º26'06''E, with a cargo of 2,100 tonnes of sulphur on board. Earlier observations from the MIC rapid assessment report a leak of sulphur granulates and a slight marine diesel fuel leak from the damaged engine compartment.

A large number of seabirds were killed during the acute phase of the oil spill. Early reports on the Ukrainian side mentioned 150 killed birds,[18] whilst other estimations reported up to 30,000 seabirds being killed by the oil spill during November and December 2007.[19] In July 2008 during the coastal and marine assessment mission, it was reported that 7,140 tonnes of a mixture of oil, sand, sea-grass, driftwood, and jetsam had been collected.

The methodology of the assessment

The coastal and marine assessment sought to assess the state of the remaining oil in affected areas through a combination of visual observation and chemical analysis. The collection of field samples from sediments, surface water, and oil-polluted shoreline material will help to determine the likely long-term environmental impacts of the oil spill. The marine and coastal assessment was carried out using scuba diving gear, cameras, and oceanographic sampling equipment. All collected samples were placed in glass jars and frozen after a few days of refrigeration. The results of the sample analysis known as a "finger-print analysis"[20] helped establish the source of the oil. Samples taken to determine the type and residual levels of hydrocarbon compounds in sediment, surface water, and oil-polluted shoreline material were as follows:

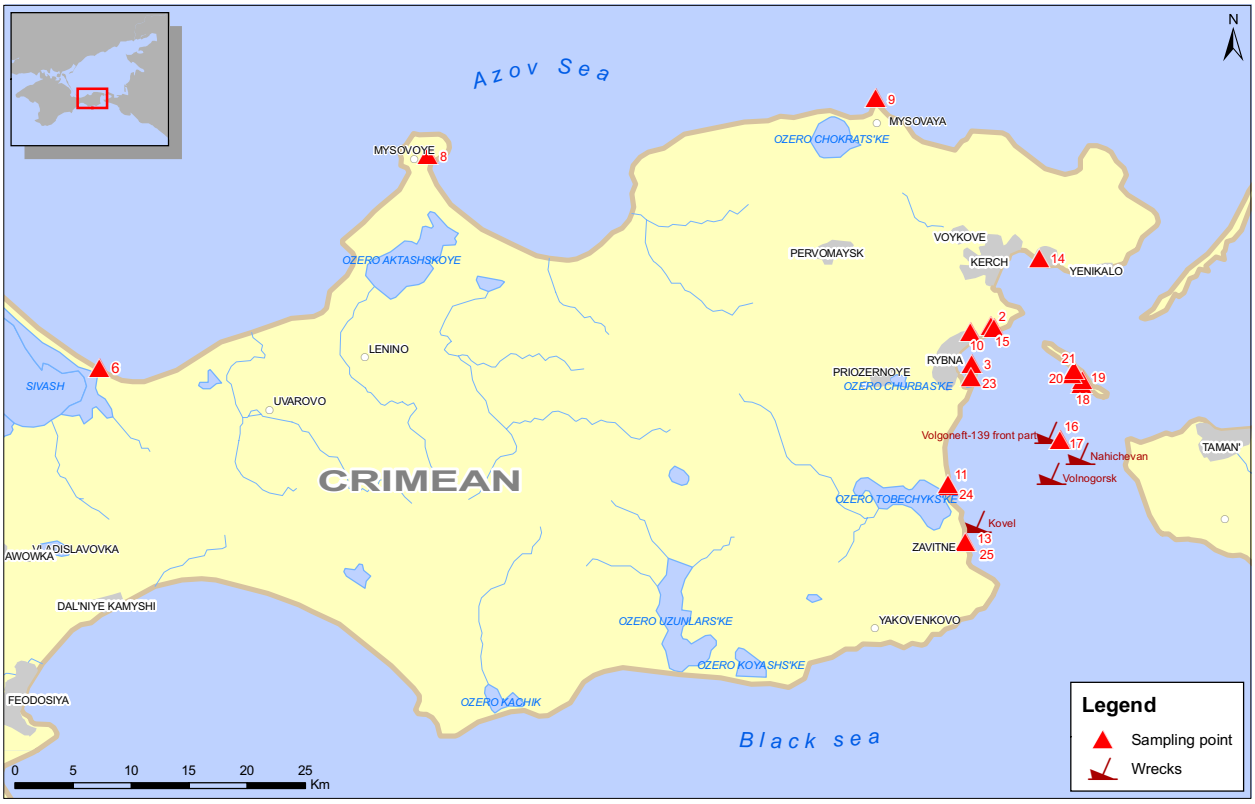
- Sediment samples were taken at depths ranging from two to eight meters. Care was taken not to disturb the fine surface flock during the sampling process. Approximately 100 grammes of sediment were taken at six sites by scuba diving or snorkeling.

- Samples of oil floating on the surface were collected near the front portion of motor tanker *Volgoneft-139*.

- Samples of oil and oil-polluted shoreline material such as contaminated seaweed and sand were taken at twelve sites along the Kerch Strait up to Arabat at the Azov Sea.

Sampling sites – taken through GPS (Global Positioning System) (see Appendix 5).

Figure 1. Map showing the location of the visited sites; red markings indicate where samples were collected



UNEP experts study sea charts in collaboration with the Marine Coordination Emergency and Rescue Center of Kerch

The analysis of the concentrations of petroleum hydrocarbons and polycyclic aromatic hydrocarbons (PAHs) in the samples of sediments, shoreline material, and surface water were conducted in an independent UK-based laboratory.

Petroleum hydrocarbons were analysed using Gas Chromatography with a Flame Ionization Detector.[21] PAHs were determined using a modified method based on US EPA 8100 which determines PAHs using Gas Chromatography and Mass Spectrometry.

Site descriptions

Site descriptions and observations from the fieldwork component of the assessment are provided in Table 1 (see below). The site numbers refer to the order in which the sites were visited. For more precise GPS coordinates of all visited sites see Appendix 5.

Table 1. Sampling sites, dates of sampling, depth, types of samples collected, and observations in connection with sampling. Zero (0) in "depth" column indicates a beach sample

Site n°	Date (July 2008)	Depth (m)	Description	Sample taken
1	16	0	Abrasive rock with eroded artificial construction. Plenty of old oil spots on the rocks.	None
2	16	0	Sandstone rocks. Exposed. Stains of oil on rocks. One pocket of oil.	Oil and Seagrass
3	16	0	Beach on and around the spit of Koca. Lots of sun bathers. Found one patch of degraded oil mixed with seagrass.	Oil and Seagrass
4	17	0	Fairly sheltered tourist beach. No oil but a lot of garbage.	None
5	17	0	Sandy beach. Lots of shells. No oil.	None
6	17	0	Garbage heap and dump site for bags with oil-polluted seagrass.	Oil and Seagrass
7	17	0	Rocky Shore. Small stains of oil on the rocks and lumps of seaweed and oil.	None
8	17	0	Rocky stony shore. Very few lumps of oil and seaweed and stains of oil. According to people living close to the site, no oil came here.	Oil and Seagrass
9	18	0	Sandy beach. Fairly sheltered. Some lumps of oil and seaweed. People living close by said no oil came here.	Oil and Seagrass
10	18	0	Narrow beach. Coastal wall behind. No oil on the beach. Dump site behind wall with bags of oil and seaweed. People who frequently bathe here say even now they often get oil stains after bathing.	Oil and Seagrass
11	18	0	Thin strip of land between lake and sea. Sand and rocks. People bathing. Some oil stains on rocks. Some lumps of oil and seaweed. People living close by say tankers often cause smaller oil spills. One bigger spill a month ago.	Oil and Seagrass
12	18	0	Sandy beach. The beach was cleaned on a regular basis by the owner of an orphanage. Still, small lumps of oil and seaweed were found.	None
13	18	0	Bay. Sandy Beach. Bathing people. Some lumps of oil and seaweed. Even more under a 5 cm layer of sand and shells.	Oil and Seagrass
14	21	3	Seagrass beds, dominated by *Zostera maritima*. Low visibility. Five cm layer of organic material. Sediment and bivalve sample taken.	Sediment
15	21	5	Visibility 1 m. No Seagrass.	Sediment
16	22	0	Water sample with oil. Oil film covering the surface, dotted with black droplets.	Surface water
17	22	8	Low visibility. No Seagrass.	Sediment
18	22	2	Depth 2 m. Visibility 7 m. Some seagrass.	Sediment
19	22	0	Clear black layer of "fresh" oil under 20 cm of sediment/shells in the waterfront (sample). Also big lumps of degraded oil above the maximum sea level - probably since the storm.	Oil and Seagrass
20	22	3	Visibility 7 m. Some seagrass.	Sediment
21	22	0	Big lumps of degraded oil above the maximum sea level – probably since the storm.	Oil and Seagrass
22	22	0	Lots of lumps of oil, some very big, above the maximum sea level and spread over the entire northern tip in a haphazardous way. The "cleaning" was obviously poorly done.	Oil and Seagrass
23	23	2	1-2 m depth sandy beach (bathers). No Seagrass. Snorkeled from beach.	Sediment
24	23	2	1-2 m depth sandy beach and some rocks (bathers). No Seagrass. Snorkeled from beach.	Sediment
25	23	2	1-2 m depth sandy beach (bathers and fishers). No Seagrass. Snorkeled from beach.	Sediment

The impact of the *Volgoneft-139* oil spill

The oil spill caused by the *Volgoneft-139* consisted of approximately 1,300 tonnes of heavy fuel oil of type M-100, which corresponds to IFO 280-600. The environmental conditions of the release of oil pollution determine to a great extent the impacts of the oil spill to the environment. In the context of marine environments, oil goes through a series of physical and chemical processes that degrade it. Such processes include the evaporation of hydrocarbons in the atmosphere, emulsification of the oil, dissolution of hydrocarbons to the water mass, dispersion of emulsified oil droplets into the water, oxidation, biodegradation, and sedimentation. The speed of these processes is dependent upon the type of oil and the respective environmental conditions. In the Kerch Strait oil spill, the heavy fuel oils leaked were found to be particularly resistant to the process of degradation. Furthermore, wind and wave conditions played a crucial role in the formation of emulsions and dispersions of oil in water. Evidently, a large amount of oil dispersed into the water will have an extensive biological effect on water-living organisms and will result in large quantities of oil remaining in the sea bed. In the Kerch Strait, gale force winds and heavy swells maximized the dispersion and emulsion process, which in turn forced a large portion of the oil into the water column. The oil in the water column then mixed with sediments released from the seabed by the strong turbulence of the storm, and most of this oil with the sediment mixture settled to the seabed. The low temperatures in the area during the six months following the oil spill also contributed to the conservation of the oil, as biodegradation and oxidation processes are slow and stop at temperatures close to zero degrees centigrade. Limited oxygen concentrations common in soft sediments have a similar effect on biodegradation and oxidation processes.

UNEP experts collecting sediment samples and recording the corresponding GPS coordinates

UNEP expert preparing for a dive around the *Volgoneft-139* wreckage (site number 17)

Petroleum oils are composed of aliphatic (Straight chains of hydrocarbons) and aromatic hydrocarbons. The aliphatic alkanes (paraffin) and cycloalkanes (naphtenes) are hydrogen saturated and comprise 80-90 percent of all fuel oils; aromatic hydrocarbons (e.g. benzene) and olefins (e.g. styrene and indene) compose 10-20 percent of all fuel oils. In contrast, crude oil can vary widely in the composition of hydrocarbons and in terms of physical properties. Refined products, particularly light-refined oils, tend to have defined properties irrespective of the crude oil from which they are derived. Fuel oils are categorized either as a distillate fuel or a residual fuel oil depending on the method of production. Residual oils and heavy fuels contain varying proportions of non-refined oils combined with refined lighter products may also vary considerably in their properties. From an environmental perspective, PAHs are important components of petroleum oils.[22] Many of the sixteen most common PAHs are toxic and mutagenic to organisms during prolonged exposure at relatively low levels.

The impacts of oil spills in a marine ecosystem are therefore highly dependent on the type of oil and the environmental conditions at the time of the spill. Light oil (such as diesel oil) contains significant proportions of acute toxic volatile short-chain aromatic hydrocarbons, most of which dissolve easily into the water. Thus, a small amount of diesel oil under stormy conditions may cause significant environmental impacts on the marine life. In contrast, a spill of heavy fuel oil may produce a lesser degree of toxicity to marine life under the surface, mainly because heavy fuel oil contains lower concentrations of acute toxic aromatic hydrocarbons. However, heavy fuel oils tend to be more resistant to degradation and can cause "physical" contamination, and remain in the environment for a prolonged period of time. In most cases where seabirds are affected by oil spill incidents, crude and heavy fuel oils are responsible for the extent of the physical contamination.

To accurately assess the distribution and extent of damage caused by the oil spill on the marine and coastal environment in the Kerch Strait and neighboring areas, the assessment team collected samples of sediments from the seabed in the Strait and neighboring littoral areas. The oil released from the *Volgoneft-139* was identified by the assessment team as a *heavy residual oil*. It was determined that this type of oil was unlikely to acutely affect the biology of the marine ecosystem due to its chemical properties. However, due to the physical properties of the oil, the assessment team predicted that seabirds and waders in the area are very likely to become contaminated with a possibility of an increased mortality rate.

It is thought that oil spills can, in some instances, account for a very significant input of PAHs into the environment. A single oil spill may result in the release of several tonnes of PAHs. Normally PAHs are measured as the individual and sum concentration of the sixteen priority PAHs. The acute toxicity of the majority of PAHs is generally low; however, several PAHs are potentially carcinogenic and mutagenic. The assessment ensured that samples taken of sediments and shoreline material also underwent an analysis for the sixteen priority PAHs.

Results of sample analysis and discussion

The results of the sample analysis are shown in Table 2.

The results of the analysis for petroleum hydrocarbons (C_{10} – C_{40}) show the following:

- Elevated concentrations of petroleum hydrocarbons in all seabed stations where samples had been extracted.

- The concentrations ranged from 42 to 560 mg/kg (dw). The highest concentrations - 300 to 600 mg/kg – were found at stations 14-17. These were either stations at shallow depths, in close proximity to shorelines, which received large quantities of oil during the acute phase of the incident, or in the case of station 17, located close to the site of the *Volgoneft-139* shipwreck.

- Stations 18-25, where samples were collected in seabed areas near shorelines that received oil pollution, the levels of concentration ranged from 42 to 110 mg/kg. The concentrations highlighted by the analysis may represent the backdrop of the Kerch Strait, which is a heavily trafficked area where small oil spills are frequent. Concentrations of EPH above 100 mg/kg were found to be above the level that begins to affect many organisms. The analysis revealed it was likely that concentrations in the range found at stations 14-17 will cause long-term physiological damage to organisms living in the sediments (fauna) and seagrasses. The concentrations of PAHs showed elevated levels in most seabed stations. The concentrations found in stations 14, 15, 18, 20, 23, and 24 had the same level of concentration that is found in coastal sediments near industrial areas elsewhere in the world.

- Station 17 revealed particularly high levels of PAH concentrations, with as much as 58000 μg/kg PAHs. This level is equivalent to what PAH concentrations are in soils under extremely contaminated industrial sites.

Table 2. Result of sample analysis

Sample	**14**	**15**	**17**	**18**	**20**	**23**	**24**	**25**
Extractable Petroleum Hydrocarbons (EPH) C_{10}-C_{40} (mg/kg dry weight)	**500**	**560**	**360**	**64**	**44**	**79**	**110**	**42**
PAH by GCMS (µg/kg dry weight)								
Naphthalene	110	18	1700	<10	65	17	78	<10
Acenaphtylene	60	12	2000	7	46	20	110	<5
Acenaphtene	330	<14	480	20	49	41	56	<14
Fluorene	490	25	1900	69	240	78	180	<12
Phenantrene	980	90	10 000	200	580	240	810	<21
Anthracene	170	22	3500	16	120	33	180	<9
Fluoranthene	480	110	9800	70	270	140	660	<25
Pyrene	330	84	7500	46	190	110	510	<22
Benz(a) anthracene	220	83	4000	41	110	68	270	22
Chrysene	230	75	3700	21	92	53	250	<10
Benso(b) fluoranthene	250	91	3900	21	68	41	250	<16
Benso(k) fluoranthene	190	65	1700	<25	52	42	150	<25
Benso(a) pyrene	180	61	3200	17	63	40	210	<12
Indeno(1,2,3-cd) pyrene	120	47	1700	13	26	37	120	<11
Dibenso(a,h) anthracene	52	25	470	<8	10	9	28	<8
Benso(g,h,i) perylene	94	53	1700	<10	24	25	100	<10
Sum PAH	4300	860	58 000	540	2000	990	3900	<25

The Tuzla Island, one of the most contaminated sites, July 2008 (Site no. 19)

The chemical analysis of the oil using gas chromatography with a flame ionization detector, showed a heavy fuel oil. The heterocyclic resins and asphaltenes were also consistent with a heavy bunker fuel. The chromatogramme of the oil sample is illustrated in Figure 2. The presence of n-alkanes suggests that the oil had not biodegraded beyond a level three on the Volkman Scale.[23] The majority of oil (mixed with seagrass and shoreline material) collected by the assessment team on the Kerch beaches also showed limited biodegradation beyond level three. The probable explanation for the moderate degradation of the oil is due to low temperatures in the area, preserving its condition.

A fingerprint analysis of six samples (samples no. 2, 3, 6, 8, 13 and 19) was undertaken to accurately assess the origin of the oil found on the Ukrainian shorelines. Typical chromatograms of these samples are shown in Figure 3. Thin layer chromatography (SARA) and flame ionization detection allows the oil samples to be classified according to their composition. Certain fuel types can be identified by characteristic, reproducible chromatographic patterns. A fingerprint can be used to conclusively identify a mixture when a known sample of that mixture or samples of that mixture's source materials are available as references, such as sample 16.

Figure 2. The oil from *Volgoneft-139*. The chromatogram indicates a heavy fuel oil typical of a marine or bunker fuel oil. That carbon range is C9 -> C35 and the boiling point range 151 -> 491°C

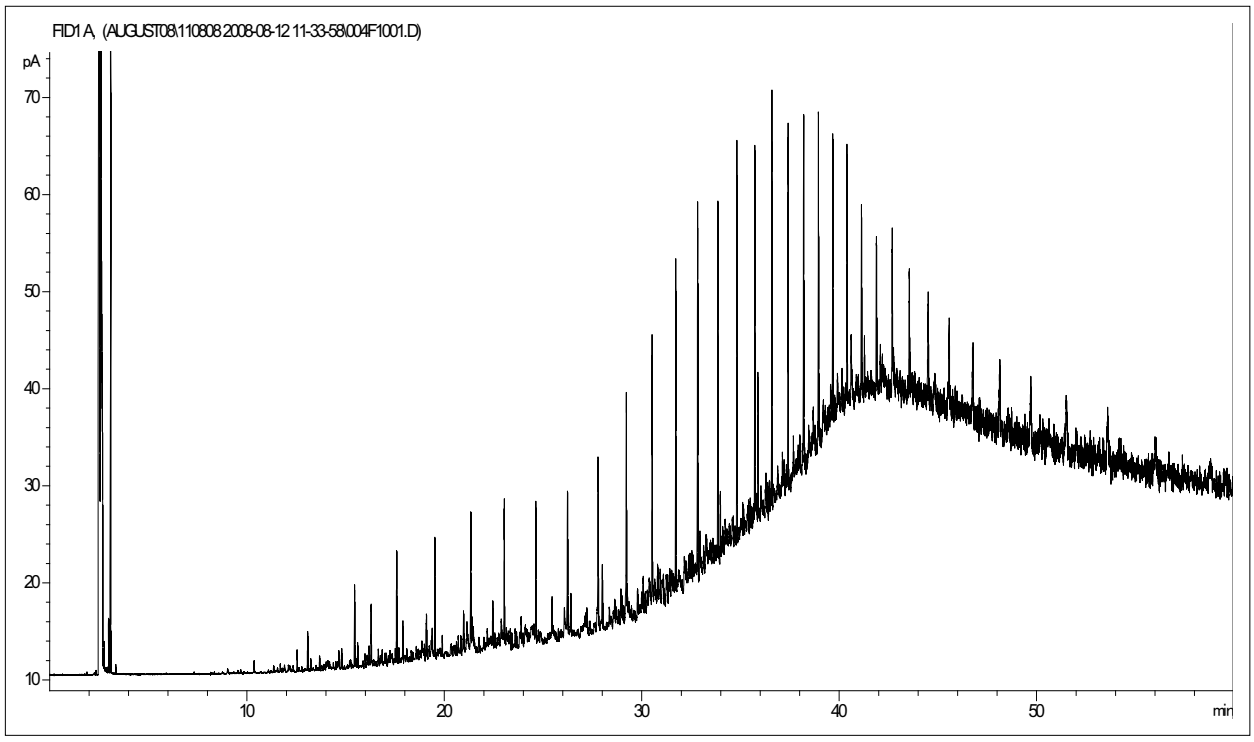


Figure 3. Chromatogram of oil sample collected at station 8

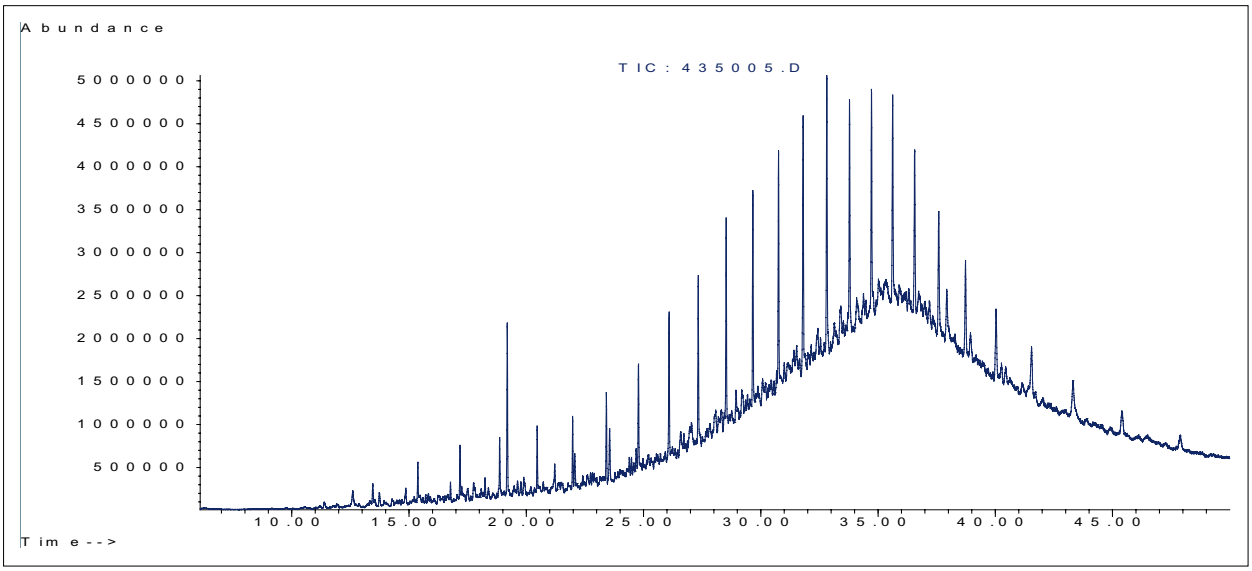


Figure 4. Typical fragmentograms of oil samples taken during the field inspections by the assessment team. The top fragmentogram shows the naphtalene alkylated series of sample 8, indicating the depletion of C0 naphthalene and the C1 naphthalene isomers relative to the C2 isomers. Below is a fragmentogram of sample 6 indicating the presence of the parent C0 phenanthrene and the four C1 phenanthrene isomers together with the C2 phenanthrene isomers. The general pattern indicates a petroleum product which has been subjected to thermal or high vacuum treatment characteristic of a heavy fuel oil

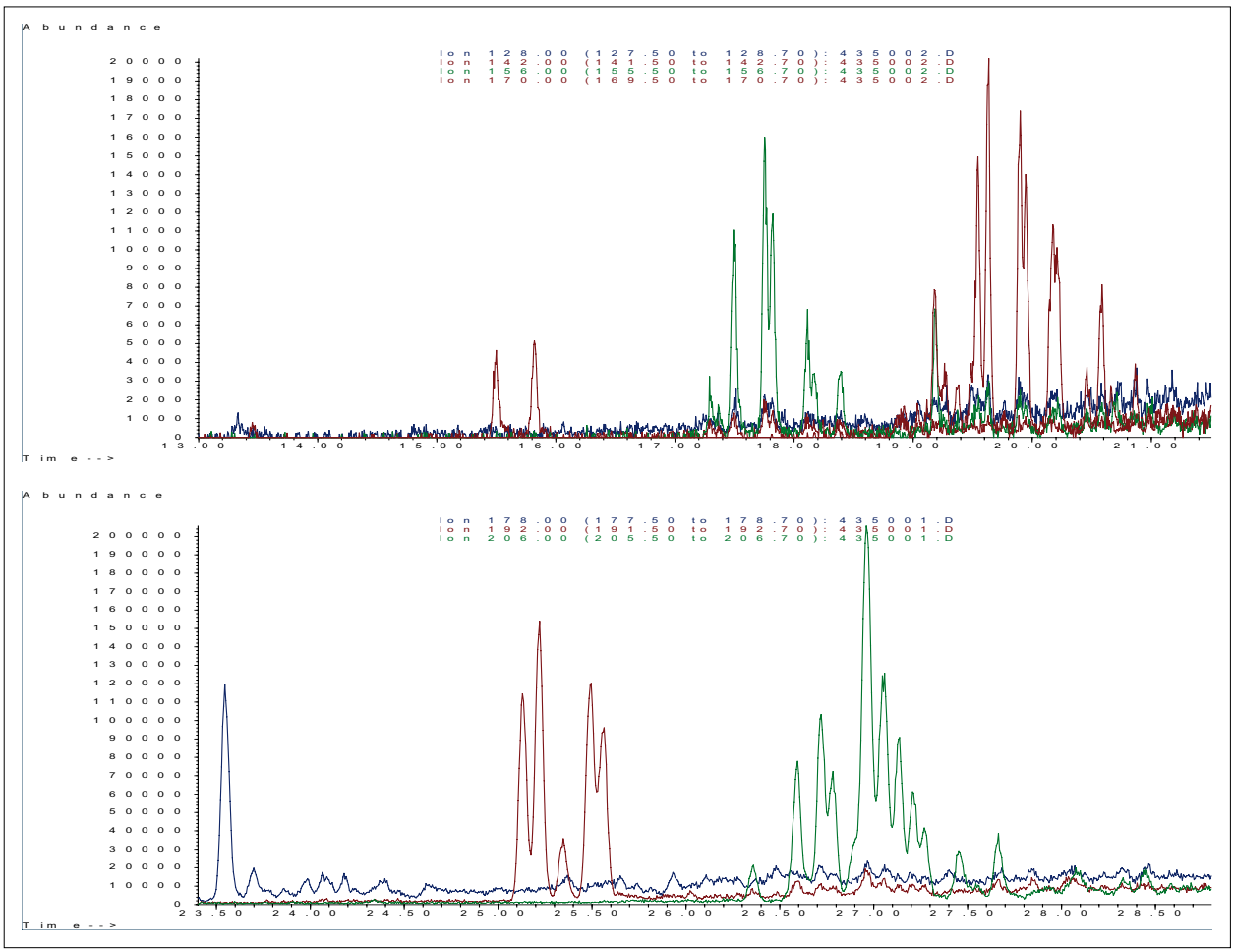
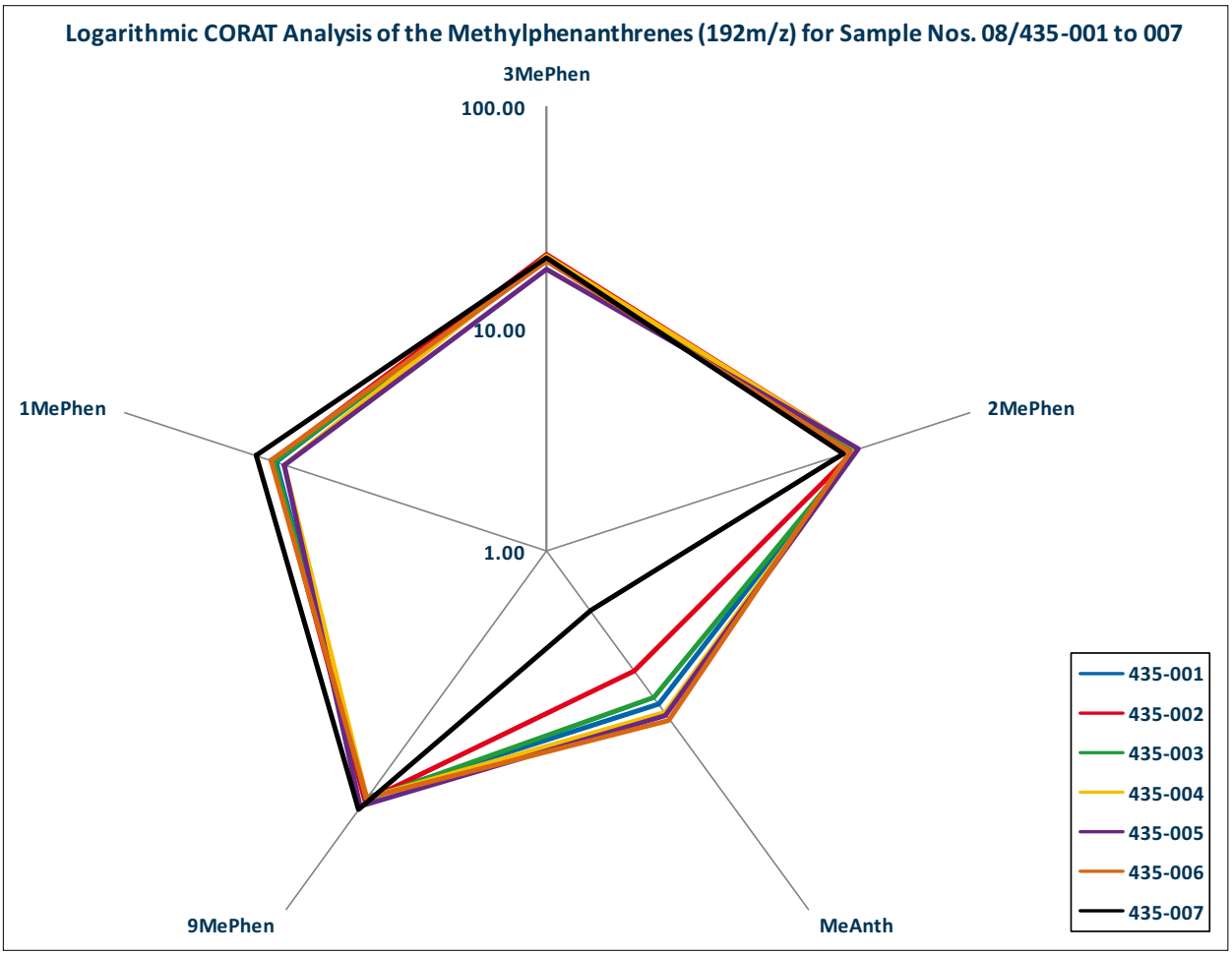


Figure 5. CORAT plots of the phenanthrene series of oil samples collected on the shorelines of the Kerch Strait have being compared with oil sample taken from the *Vologoneft-139* wreck. The diagnostic ratios obtained indicate a good correlation between the oil sample from *Vologoneft-139* and the oil found on the shorelines. However, sample 81 shows some dissimilarity and another source cannot be excluded



The diagnostic targeting indicated that there was some depletion, mainly naphthalene. The pattern and distribution of the phenanthrene series indicated that apart from sample three, all samples were closely related. The presence of these isomers indicates a high sulphur source.

Compounds such as hydrocarbons (found in oils, rocks extracts, sediments etc), can be used as biomarkers; an analysis of source characteristic and environmentally persistent biomarkers generates information useful to determine the source of the oil. This analysis revealed that hopane and triaromatic sterane biomarkers were present in all samples, indicating that oil residue found on the shoreline was heavy fuel oil. Typical fragmentograms from a biomarker analysis of some of the samples taken are shown in Figure 4. CORAT[24] plots derived from the diagnostic ratios obtained from the phenanthrene series, hopanes, and tri-aromatics indicated that the sample extracts provided a good correlation compared to the product sample 16 (see Figure 5), suggesting that the sampling was most likely of the same origin. Sample 3 from the Arshintsevo shoreline spit showed similar oil properties with minor differences, it was thought that this oil may have originated from a different source.

Summary of the main conclusions

The summary of findings from the coastal and marine assessment of the Kerch Strait, from Arabat Spit in the north to Naberezhne in the south, indicated the following:

- Significant amounts of oil, tar, and oil-contaminated materials were found in many of the affected areas, particularly on Tuzla Island.

The EC-UNEP PDNA Team consulting a map for the marine and coastal assessment

The oil will remain a source of contamination in the future unless removed. During the winter season the oil will degrade at a slow rate; in high temperatures the oil will heat up with the strong likelihood that leakage of fresh oil will occur, resulting in further contamination.

- Noticeable biological effects were not observed by the assessment team on the shorelines or the seabed in the Kerch Strait. It is likely that the toxicity of the oil will remain at a low level (as observed by the assessment team eight months after the incident). The physical effects from the oil contamination, such as the impaired movements in organisms and the effects on the insulating properties of plumage of birds, were the largest environmental impacts of the oil spill disaster.

- Based on studies of other oil spill incidents, during the initial acute phase the oil from the *Volgoneft-139* shipwreck probably had significant impacts on the littoral and sub-littoral fauna, and the flora of gastropods, crustaceans, algae, and seagrass.

- The chemical analysis of the samples of seabed sediments taken during the fieldwork assessment showed relatively high levels of petroleum hydrocarbons in several places, particularly near shorelines that had been hit by large quantities of oil. The levels of petroleum hydrocarbons found in certain areas of the Kerch Strait are high enough to cause physiological effects among sensitive organisms.

- The chemical analysis also indicated that oil found on most sites along the coast was likely to be of the same origin as the oil carried by the *Volgoneft-139*.

Coastal Sensitivity Mapping

Focus and method of assessment

Coastal sensitivity mapping is a methodology used to identify coastal areas most vulnerable to disasters. Sensitivity maps convey essential information to agencies and personnel responding to oil spill emergency situations through the identification of coastal resources sites and environmentally-sensitive areas. The creation of coastal sensitivity maps involves the compilation of information on resources and human activities in the studied area.

The Ukrainian Scientific Centre of Ecology of the Sea (UkrSCES), located in Odessa, which was initially consulted by the institutional assessment team, provided the team with an environmental sensitivity mapping atlas of the entire Ukrainian Black Sea coast up to the Kerch Strait.

This chapter describes the methodology followed by the coastal sensitivity mapping team to assess the quality of the environment sensitivity mapping atlas, particularly concerning the area of the Kerch Strait. Thereafter this chapter includes recommendations for improving coastal sensitivity mapping for the particularly high risk Kerch Strait, and more generally for the entire Ukrainian Black and Azov Seas' coastline.

Description of sensitivity mapping

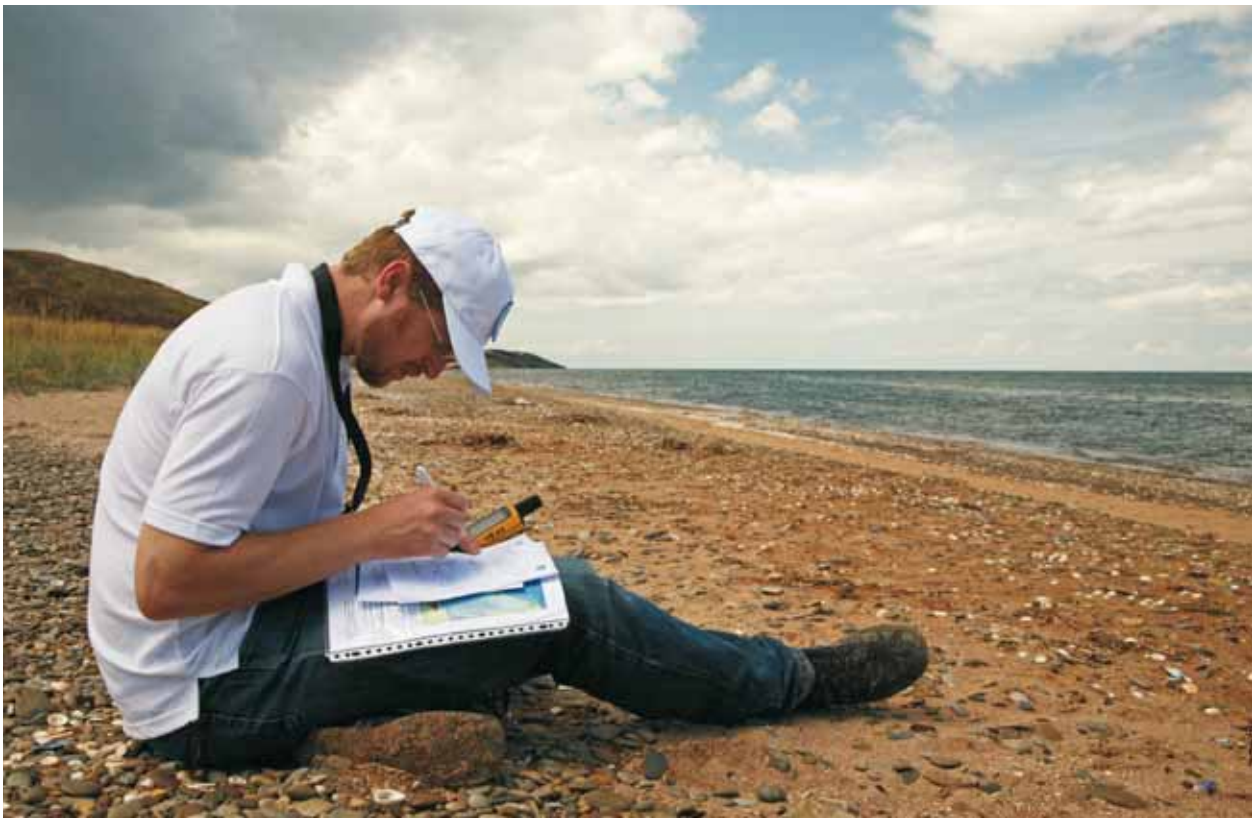
Environmental sensitivity maps are prepared by integrating data from a range of sources describing various aspects of the coastline. Such aspects may be of physical, economic, environmental, and social character. The typical data that should be present in sensitivity maps are:

Nature of the coast:

- coral reefs
- seagrass beds
- kelp beds
- mud flats
- beaches
- rocky outcrops
- estuaries.

Ecological significance:

- protected areas
- vulnerable wildlife.



UNEP expert identifying environmentally sensitive areas

Fisheries-related data:

- near-shore shallow water fishing areas, e.g. for fin fish, crabs, lobsters, shrimps or other species;
- seaweed gathering;
- shellfish beds in the intertidal zone or near-shore shallow water;
- fish and crustacean nursery areas;
- beaches with fishing activities, e.g. hauling in nets;
- permanent or semi-permanent fish traps and fishing platforms;
- aquaculture facilities for fish, molluscs, crustaceans, or seaweeds, in the intertidal or deeper areas; and
- fish and crustacean ponds on the seashore, and entrances of rivers important for migratory fish such as salmon.

Socio-economic features:

- boat facilities such as harbours, marinas, moorings, slipways and boat ramps;
- industrial facilities, for example water intakes for power stations and desalination plants, coastal mining, and salt evaporation lagoons;
- recreational resources such as amenity beaches, bathing enclosures, water sport and game-fishing areas; and
- sites of cultural, historical, or scenic significance, on or close to the shore.

Oil spill response features:

- ports;
- Oil Spill Response Centres;
- facilities (docks, launching sites, slipways) for deployment of oil spill response vessels; and
- waste collection and storage facilities.

Overview of the existing environmental information

In the framework of the *Black Sea Environment Sensitivity Mapping Atlas* project, led by the Black Sea Commission, UkrSCES is responsible for the production of all sensitivity maps for the coast of Ukraine. During the institutional assessment, the UkrSCES provided relevant GIS information to the PDNA team.

Figure 1. Black Sea Environment Sensitivity Mapping Atlas (Geographic area covered: currently, information is available up to the North of Kerch Strait)

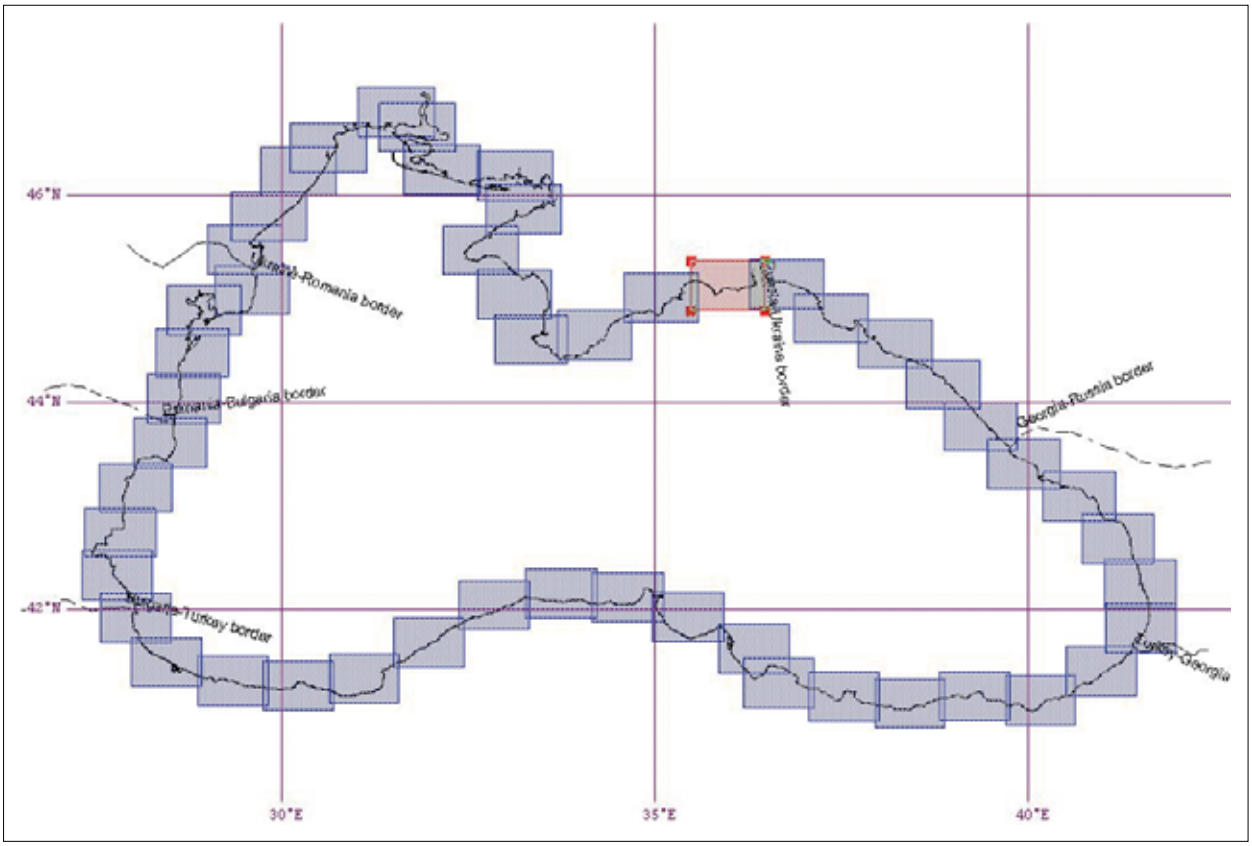


Figure 2. Existing sensitivity map of UkrSCES

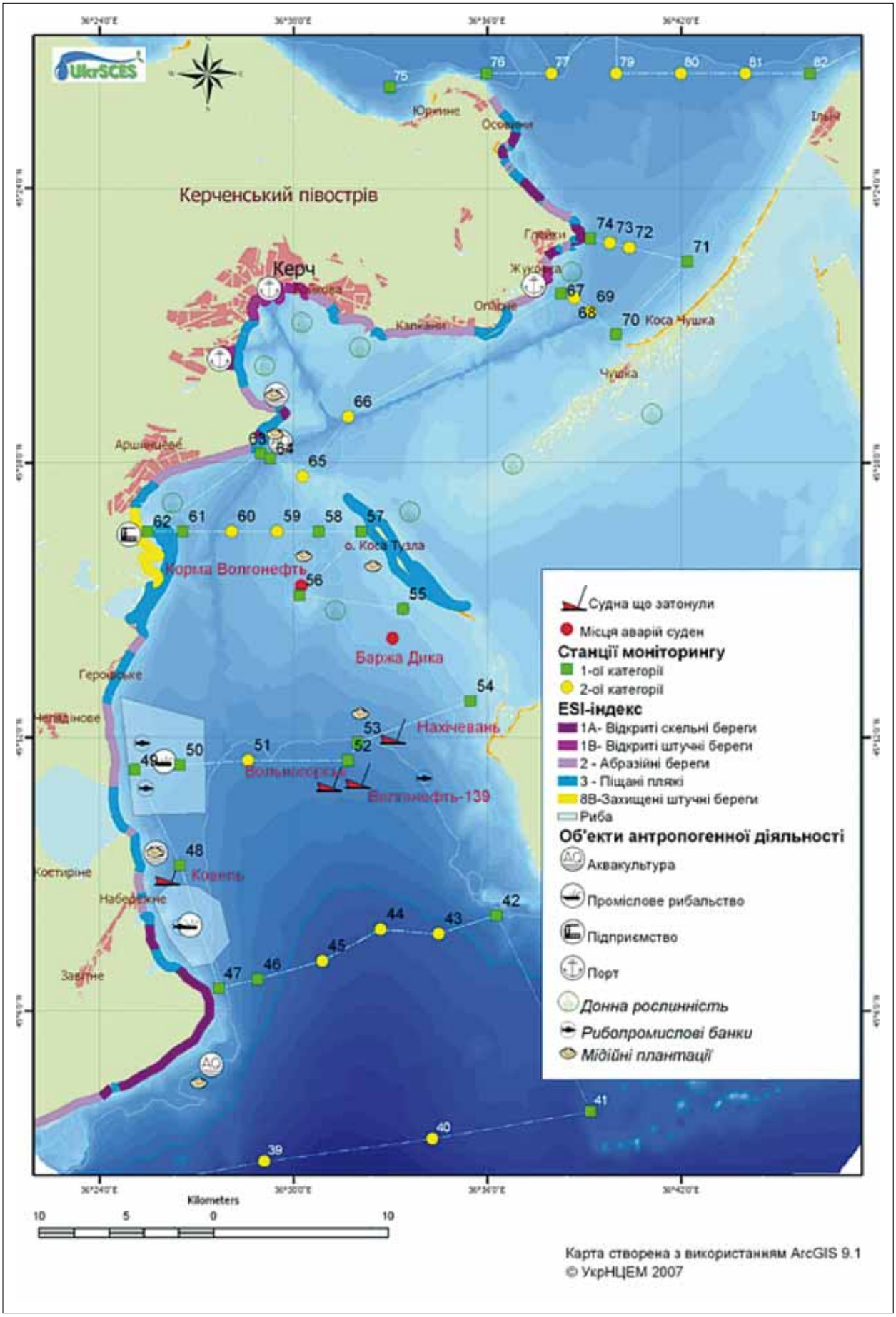
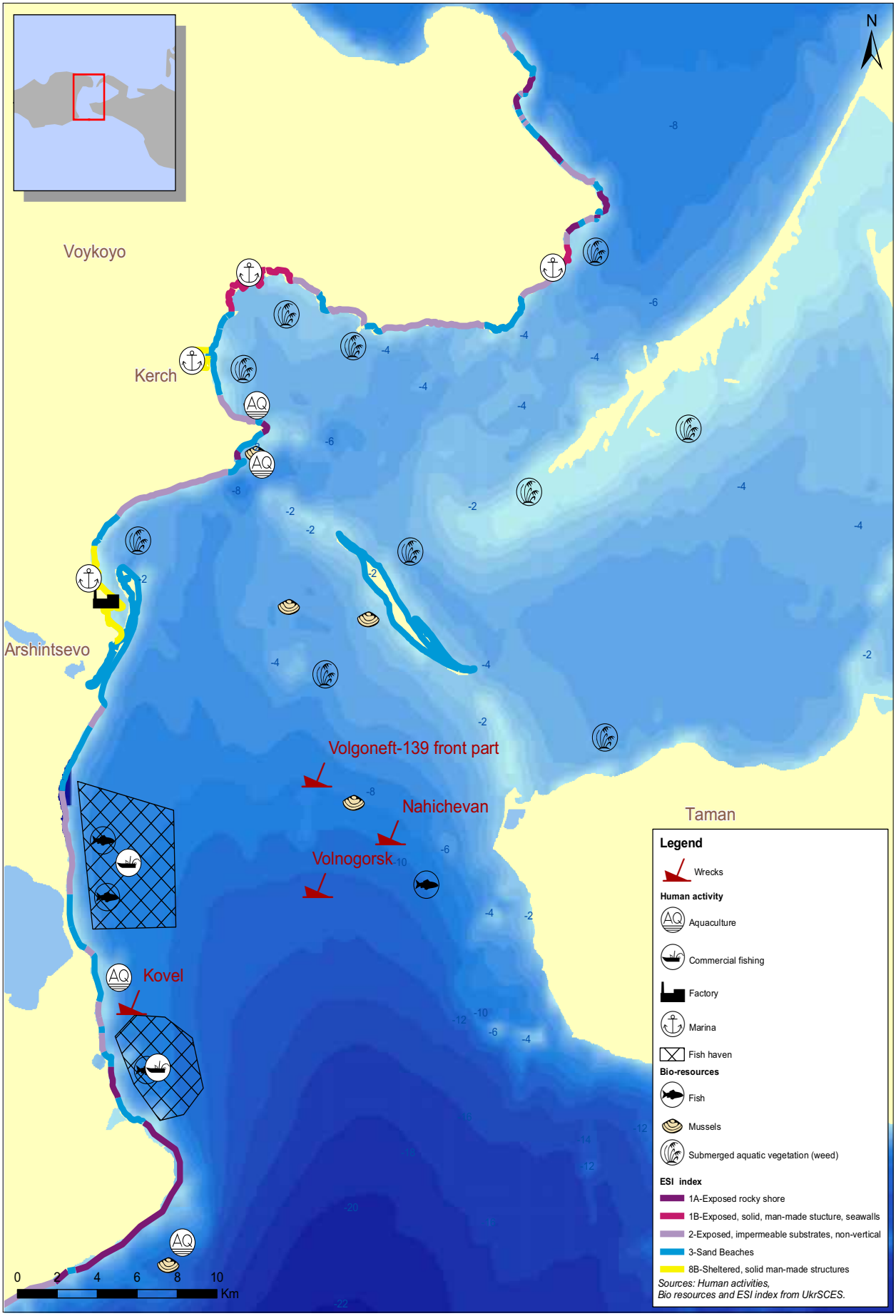


Figure 3. English version of the UkrSCES sensitivity map



The information currently available for the Kerch Strait was produced for the project *1:1.000.000 Environment Sensitivity Mapping Atlas of the Black Sea*, which is led by the Black Sea Commission. The map was created in accordance with the terms of reference for the classification and symbolization of Environmental Sensitivity Index (ESI) maps.

Map content:

- ESI characterization of the type of coastal zone: The indexation of the coastal strip was made on the basis of cartographic data of the navigation chart. ©State Hydrographic, Service of Ukraine, Kyiv and literature data on the Ukrainian marine and coastal environment. (Source: UkrSCES)
- Biological resources: Geographic distribution of mussels, fish, and submerged aquatic vegetation in the Kerch Strait. (Source: UkrSCES)
- Human activity: Type of object of anthropogenic activity. Information about the objects is taken from literature references. (Source: UkrSCES)
- Fish haven: Region of fish area. Data are taken from navigation chart. ©State Hydrographic Service of Ukraine, Kiev. (Source: UkrSCES)
- Kerch depths: Data from the navigation chart ©State Hydrographic Service of Ukraine. (Source: UkrSCES)

Assessment of the existing data – Remote sensing studies over Kerch Strait

The PDNA team used satellite images from 2006 and 2007 to assess the quality of the existing coastal sensitivity map. The following satellite coverage was obtained to verify the accuracy of the quality of the map:

- Landsat medium resolution data: Two Landsat images were necessary to cover the whole area of interest. The northern part was acquired on 23 May 2007; the southern part was acquired on 25 September 2006.[25] This imagery was used mainly to check the quality of the coastline classification and to provide general background information during the mission (Figure 5 on next page).
- Very high resolution imagery: around 50 percent of Crimea is covered with recent very high resolution imagery on Google Earth. Figures 7 and 8 on page 29 show all areas in the region depicted on very high resolution images. These images were acquired after 2005. Such high-resolution images provide detailed information about tourist resorts, ports, type of ships, aquaculture sites, and other points of interest in the area. These images were used to verify the accuracy of the UkrSCES sensitivity map in terms of specific sites.

Figure 4. Examples of information extracted using very high resolution imagery to assess the quality of the sensitivity map available


Sea stadium in Kerch


Kerch port

Figure 5. With a resolution of 30 meters/pixel, these Landsat images can be used up to a scale of 1/50,000

Figure 6. Recent Landsat imagery was used to control the quality of the shoreline mapping

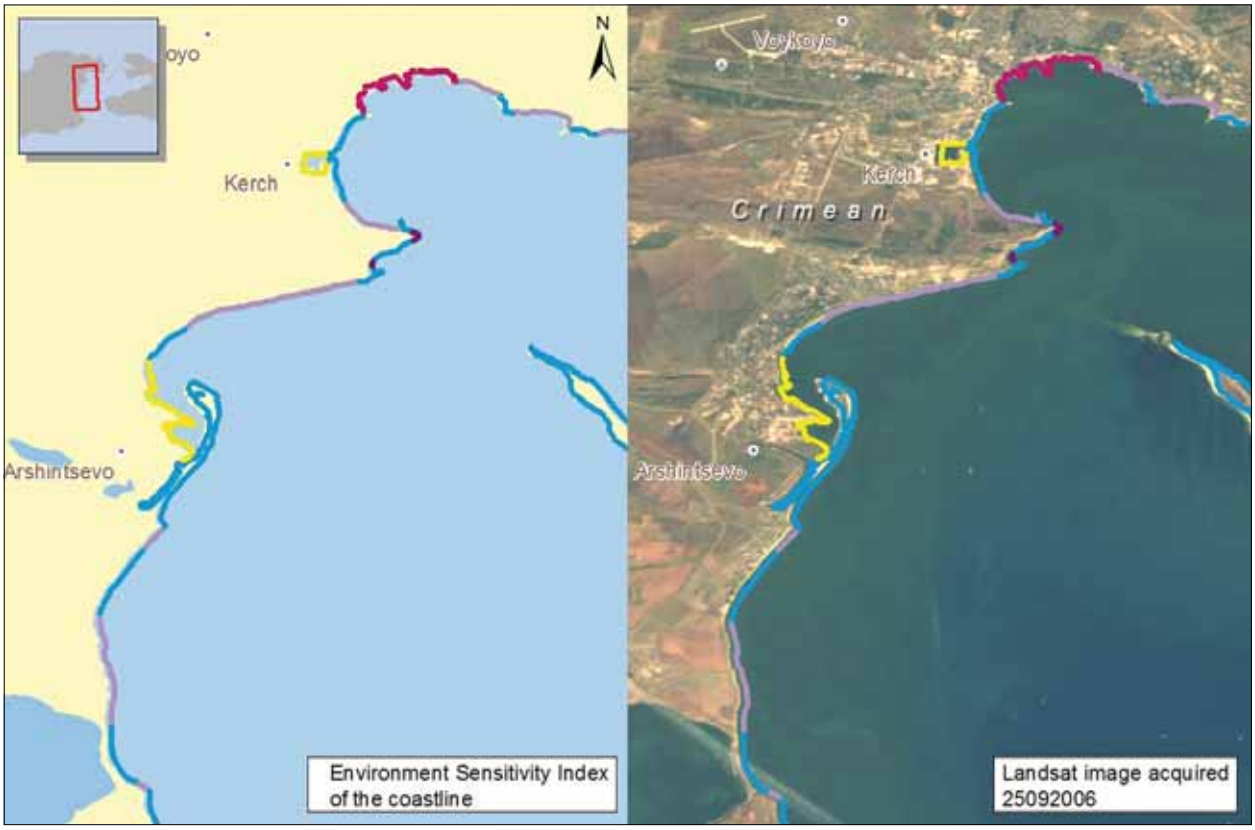


Figure 7. Google Earth coverage of Kerch strait

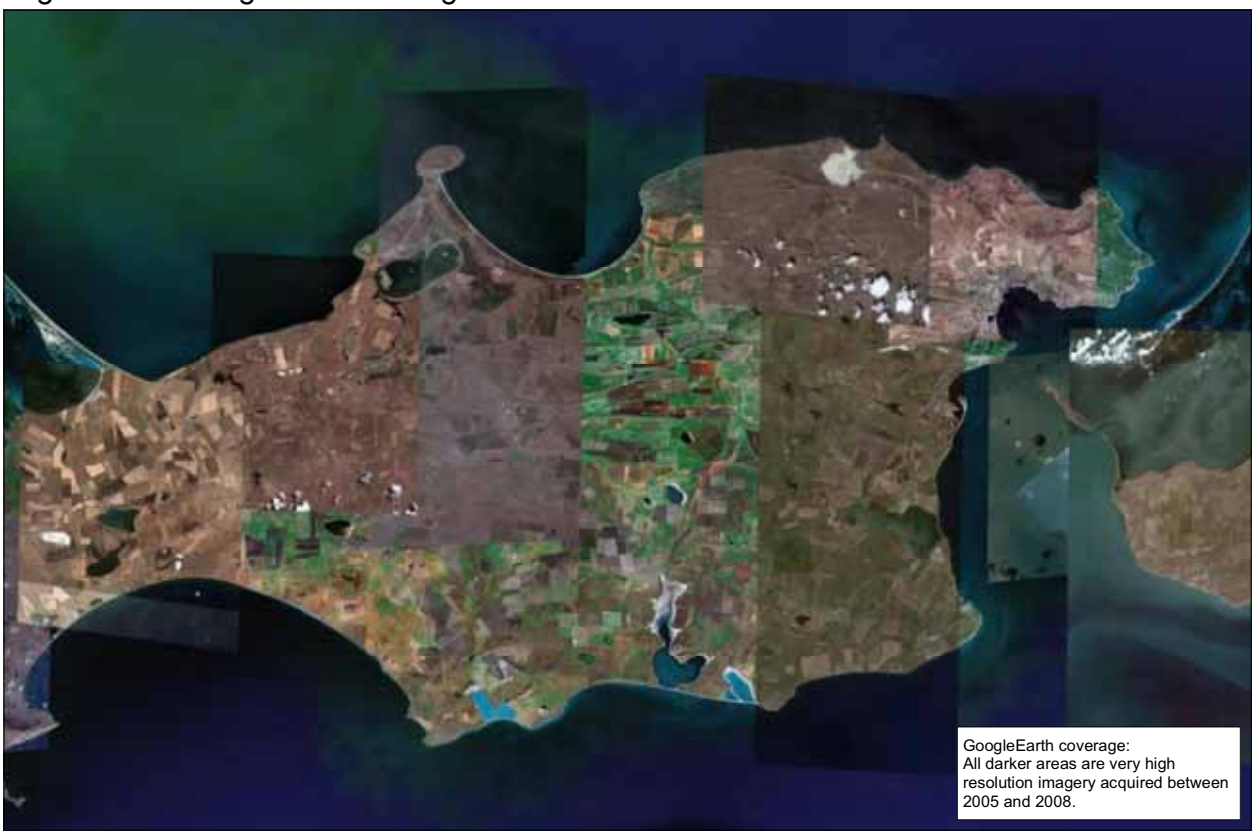


Figure 8. Difference between Quickbird (left) and Landsat (right) satellite imagery for information extraction

Assessment of the existing data – Ground-truthing over Kerch Strait

The assessment team was able to verify through field observation the accuracy, completeness, and usability of the information shown on the environmental sensitivity mapping atlas by UkrSCES. This assessment was made during a field mission in the Kerch Strait from 14 - 20 July 2008 where the team travelled by road and by sea to visit the sites.

In the field, the experts used a variety of different maps to navigate:

- Printed maps of recent satellite imagery
- UkrSCES sensitive map
- Ukrainian topographic maps
- World Database on Protected Areas maps.

The equipment used by the experts in the field included:

- GPS Garmin 60 to take precise coordinates of all observations and visited sites.
- Ricoh 500 SE camera with built-in GPS to take geo-referenced photos – all photographs taken during the mission were geo-referenced.
- Rugged laptop equipped with GPS allowing real-time tracking and collection of geo-referenced information.

The type of coastline is a highly significant factor governing the sensitivity of a coastline to oil spill situations. The assessment team took a large number of geo-referenced photos (Figure 11) when visiting sites. A comparison was later made to existing geo-referenced shoreline classifications, enabling the team to assess the quality of the existing map.

Equipment used by the coastal sensitivity mapping experts

Figure 9. Sites visited by the coastal and marine assessment and the coastal sensitivity mapping teams

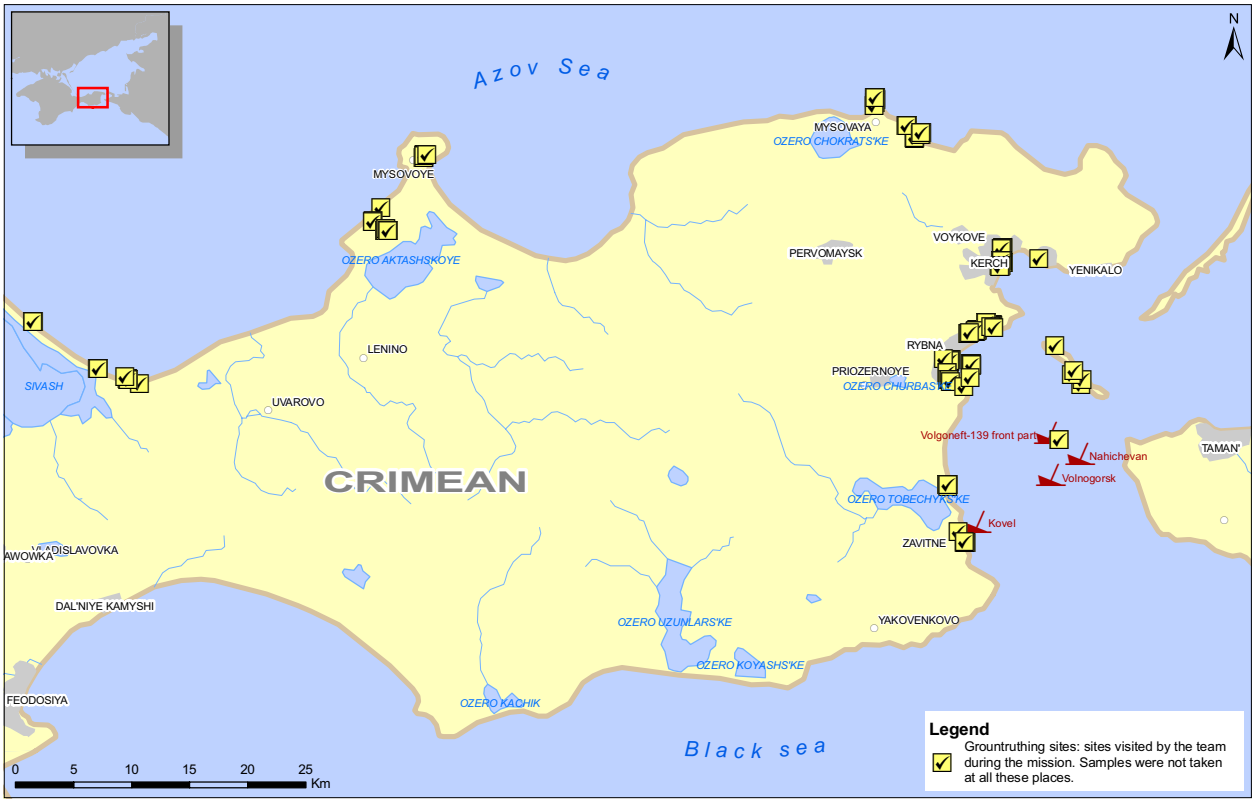
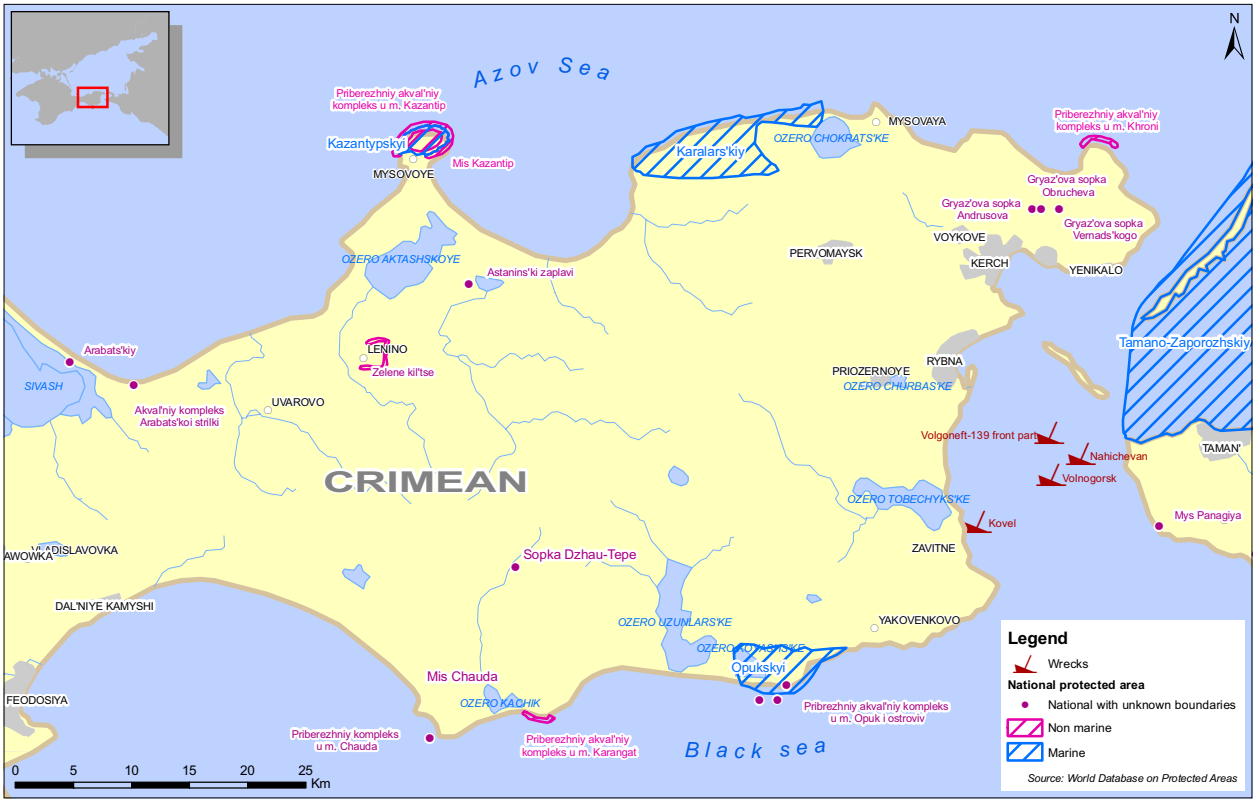


Figure 10. Protected areas of the Kerch Peninsula



Summary of findings

- The scale of the existing map is appropriate for a general overview of the Kerch Strait coastal sensitivity areas, and can be adapted in case of an oil spill emergency. Nevertheless, in accordance with IMO standards, an area at high risk of pollution, such as the Kerch Strait, requires the production of much more detailed environmental sensitivity maps (up to 1:5000 scale). It is therefore recommended to produce an environmental sensitivity atlas of the Kerch Strait with 1:25000 maps.

- Presently, the geographical extent of existing maps covers the area up to the north of the Kerch Strait. After the oil spill disaster in November 2007, oil was also discovered up to the Arabat spit, which was verified by this assessment mission. This discovery revealed that environmental damage was not limited to the Kerch Strait; surrounding areas including the Azov Sea coast were also at risk. Bearing this in mind, it is recommended that the coverage of the existing sensitivity map be extended in order to get a more comprehensive understanding of potential future disasters' effects on surrounding areas. During field work sensitive features were observed along the Azov Sea coast by the assessment team, such as protected areas, popular beaches, and aquaculture sites.

- Through a combination of satellite image data and field observation, it appeared that the content of the sensitivity maps and the shoreline classification presented on the sensitivity maps was both accurate and up-to-date.

- During the mission the assessment team observed bird colonies at various locations. However, the existing UkrSCES map did not reveal any sensitive wildlife in the Kerch Strait area. It is recommended that this report be followed up by a more detailed environmental study in the area. The findings of the recommended environmental study will help to highlight the seasonal trends of the wildlife in the Kerch Strait.

- To develop and coordinate an efficient oil spill emergency response, knowledge of the following would be valuable: where along the coast are the means for oil spill response located (facilities, equipment, etc); where

Figure 11. GEO-referenced photos of sites visited

Arshintsevo beach
Sandy beach
Environmental Sensititvity
Index: 3

Kerch city
Sheltered Artificial Structures
Environmental Sensititvity
Index: 8

Shrokhine
Exposed rocky shores
Environmental Sensitivity
Index: 1

dispersants can be used and where they should not be used; where booms can be deployed and the locations of any permanent boom moorings; which beaches of low sensitivity can, if necessary, have oil deflected onto them to save more sensitive zones; and the locations of access points. All of this information facilitates quick decision-making in the event of an emergency situation.

- During the field mission the assessment team found oil remnants in open bags on very sensitive sites, close to frequented recreational areas, which indicates a general lack of information on storage facilities locations. Furthermore, during the consultation process, "on-site" responders in Kerch stated that oil spill sensitivity maps did not reach marine response personnel during this event. It is therefore recommended that the communication and collaboration between key scientific institutions, such as the UkrSCES, and key decision makers involved in the emergency response processes, be improved to upgrade the efficiency of emergency response and preparedness.

Institutional Assessment

Focus and method of assessment

This chapter is an assessment of the institutional capacity of the Government of Ukraine to deal with marine oil spills. The event of the oil spill in the Kerch Strait will be used as a demonstration of Ukraine's current capacity to deal with such an emergency. The assessment recognizes that planning for oil spill emergencies can present a range of challenges through each of the stages involved: preparedness, response, clean-up, assessment, storage and disposal of waste, and monitoring.

The main objectives for the institutional assessment component of the PDNA were as follows:

- To map out the institutional infrastructure for disasters from oil spills.
- To examine the command and control structures currently in place in national and sub-national authorities, with the view to strengthen planning and response for environmental emergencies related to oil spills.
- To review regional and international agreements that currently assist Ukrainian authorities in contingency planning and response for environmental emergencies related to oil spills.

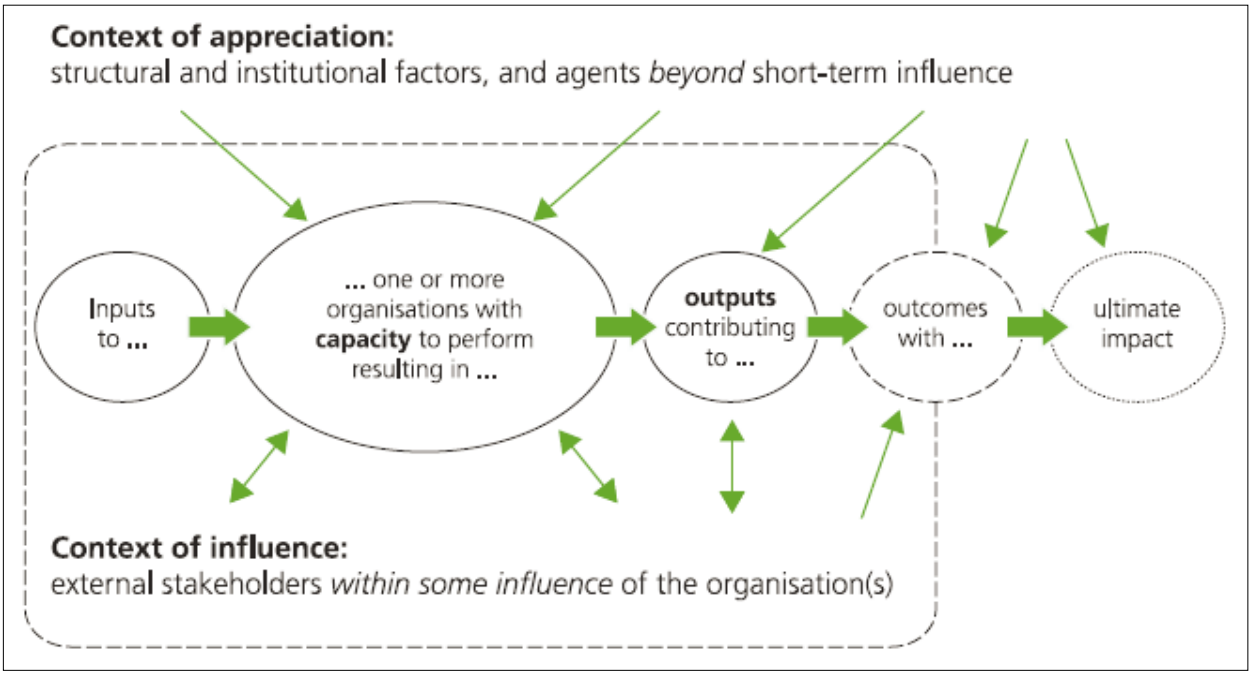
This assessment used the methodology mapped out in the European Commission report, *Institutional Assessment and Capacity Development, Why, what and how*, 2005. This assessment uses an approach that views institutions as open systems subject to short and long-term influences on their capacity to achieve specific outputs and impacts (see Figure 1).

Institutional assessments tend to follow a specific set of activities to determine the ultimate impact of institutions. The methodology employed for this institutional assessment was adapted to accommodate the context and circumstances surrounding the Kerch Strait oil spill, and the institutional factors that surround the actions of the relevant Ukrainian ministries that played a significant role. The approach was adapted to include the following:

Step 1: The Context – Includes an assessment of the national, regional, and international legal and policy context, in relation to the implementing role of each Ukrainian institution. The assessment reviews and takes into account both structural and institutional factors. Structural factors include issues such as institutional mandates, autonomy, and legitimacy in the bureaucratic government structure. Institutional factors include issues such as legislative provisions and procedural norms.

Step 2: The Outputs – Examines the roles of the various national and sub-national Ukrainian institutions

Figure 1. Analytical framework, organizations as open systems[26]



involved in emergency response and clean-up operations after the oil spill in the Kerch Strait.

Step 3: Inputs and Resources – Provides an overview assessment of resources available to deal with emergency response situations, collaboration, monitoring, and assessment. It has not been the role of this study to examine the broader institutional inputs and resources.

Step 4: Synthesis of Information – Examines the capacity of institutions to respond to the various aspects of dealing with oil spills and provides a recommendation for strengthening institutional capacity based on accepted best international practices.

Data Collection

Data collection for the institutional component of the PDNA consisted of the following sources of information:

1. Publicly available laws, regulations, and policies of the Government of Ukraine concerning emergency situations;
2. Various reports prepared by external organizations (eg. academic organizations) on the role of institutions and interactions between the Government, executive level, and administration in Ukraine;
3. Official documents provided to the PDNA assessment team during the mission from 1-17 July 2008 in meetings conducted with Government officials; and
4. Oral information provided from meetings held with Government officials from 1-17 July, 2008.

For a complete list of institutions consulted for the institutional component of the PDNA see Appendix 4.

Legal and Policy Context, Institutional Roles

Legal Frameworks and Institutional Mandates

This section examines Ukrainian ministries and institutions responsible for the coordination of emergency responses, with reference to specific laws and regulations. Through compiling information on specific laws, the institutional assessment team was able to gain an understanding of the relationship between the executive arm of the Government of Ukraine and the administration, which in turn provided a basis for understanding the coordination of oil spill emergency responses in Ukraine. Specific laws and decrees applicable to emergency situations are listed below:

1. **Law No 1908-III** – Regulates relations arising during implementation of emergency measures, aimed at protection of life and health of people and the normalization of an ecological situation in the emergency ecological situation zone. The emergency ecological situation zone is a separate territory of Ukraine, upon which the emergency ecological situation occurred.[27]

2. **Law No 1809-III** – Defines organizational and legal grounds for protection of the citizens of Ukraine, foreigners, and stateless persons who stay on the territory of Ukraine, and, protection of production of social objects, and the environment from man-caused and natural emergencies.[28]

3. Under **Decree 843** – The Cabinet of Ministers were given the authority to appoint a coordination body for the elimination of emergencies[39] (known as the "Special Commission"). This *Special Commission*[30] has a number of functions defined within *Decree 843* and includes *inter alia*, the:
   a. Determination of the level of emergency: national, regional, local, or site.
   b. Appointment of the Emergency Elimination Commander.
   c. Coordination of the activities of central and local authorities.
   d. Submission to Cabinet of Ministers for allocation of additional funds.
   e. Arrangements for monitoring of the environment.

4. Depending on the level of emergency **Decree 843** provides guidance on the membership of the Special Commission. In relation to national level emergencies the membership should be comprised mostly of relevant ministerial figures.

5. In accordance with **Decree 1567**, regional authorities provide the initial response (Part IV) to any emergency under the relevant commission of the state administration where the emergency occurs. This is only up until the appointment of an Emergency Situation (ES) Elimination Commander after which time the Commander takes control of resources.[31]

6. Under **Decree 1201**, the establishment of a headquarters for elimination is provided for the role of the Emergency Commander, and for the ability of the Emergency Commander to coordinate with the Special Commission over the organization, coordination, and direction of the emergency response.[32]

7. **Decree 1567** defines national level emergencies and identifies the relevant emergency situation ES code.[33] For the purpose of the institutional assessment the following mandates for ministries under ES code 20300 – Hydrological ES (occurring in the sea) – were used.

From a legal perspective, the institutional assessment team observed that a sufficient level of guidance for emergency response situations is available in Ukraine. The laws described above define the mandates that are required at a national-level (including those that involve oil spills) that may affect the marine and coastal areas of Ukraine. Additionally, the provisions of the laws define the role of regional-level authorities in an emergency response situation.

While there are clear mandates for specific ministries, in some instances institutional mandates play a pivotal role in emergency situations. That is, while legal provisions did not define a specific mandate, some ministries, such as the Ukrainian Ministry of Environmental Protection, have lent support to emergency response situations. This assessment chapter will later describe the roles played by key Ukrainian institutions in the Kerch Strait oil spill incident.

Table 1. Ministry and mandate in the case of an emergency situation

Ministry	Standard function distribution according to Decree 1567
Ministry of Internal Affairs	Ensuring the maintenance of public order, traffic safety, and preservation of material and cultural values in case of emergency.
Ministry of Environmental Protection	In the above decrees it is mentioned that MEP conducts standard monitoring in this case (i.e. oil concentration in sea water in comparison with maximum allowable concentrations (MAC) and soil contamination by oil in comparison with ambient concentrations).
Ministry of Economy	Coordination of activities for economic entities based on the requirements of technogenic safety. Forecasting and assessment of ES social and economic consequences, creation of financial reserves and material resources.
Ministry of Foreign Affairs	Maintaining international contacts in relation to emergencies. Organization of interaction for emergency prevention and response, provision of humanitarian aid to affected population. Functioning as a permanent system control body.
Ministry of Emergencies	Coordination of activities of the central executive authorities and other parties implementing planned activities for the ES prevention and response; responsibility for their timely and comprehensive implementation. Functioning as a permanent system control body.
Ministry of Defence	Ensuring the resolutions of the President of Ukraine are followed, including the involvement of: military transport aviation in shipment of manpower and resources of emergency (search) rescue services, material resources to the areas of ES consequences, military units of radiation, chemical and biological protection, engineering troops, emergency search and rescue diving navy units, and special aircraft in the ES response activities.
Ministry of Transport	No specific mandate cited in Decree 1567 but identified as having a role to play.
Ministry of Finance	Provision of funds for ES prevention and consequences' mitigation, provision of aid to affected population. Creation of insurance and reserve funds.
State Commission for Communication	Ensuring stable operation of centralized warning and communication system, including urgent repair or replacement of damaged lines and communication means.
State Commission for Information	Provision of timely and comprehensive information to population about threat or onset of an ES and its consequences. Emergency broadcasting of messages about an ES.
State Border Guard Service	No specific mandate cited in Decree 1567 but identified as having a role to play.
Security Service of Ukraine	Taking measures, within its powers, to ensure security during an ES.

Organizational Structures and Policy Implementation

Institutions are developed on the basis of having inherent structures responsible for implementing a set of norms that exert authority over a specific issue at the national or sub-national level of influence.[34] Formalized rules are generally developed based on regulatory processes, ministerial decrees, policy documents, and directions from senior managers. The main Central Executive authorities engaged in the Kerch Strait emergency response operations liaised with the PDNA team and included the Ministry of Emergencies, the Ministry of Transport and Communications, and the Ministry of Environmental Protection in Ukraine.

The Ukrainian Ministry of Transport and Communications operates in accordance with the Constitution of Ukraine, Decrees of the President of Ukraine, and provisions and orders of the Cabinet of Ministers.[35] The Ministry of Transport and Communications' Department of Navigation Safety is responsible for marine oil spills, and has developed oil spill contingency plans for each Ukrainian port and retains relevant equipment at ports such as booms, sorbents, and dispersants for emergency situations.[36] Additionally, regular operational response exercises are conducted in conjunction with other Black Sea ports through the Black Sea Economic Cooperation. At present the scope of the Black Sea Economic Cooperation is limited to dealing with oil spills in port areas within the marine areas of Ukrainian territory, shipping outside of Ukrainian territory, and rescue of ships in distress within Ukrainian marine areas. The Ministry's role is somewhat limited in accordance with relevant legal provisions for emergency response situations. The institutional assessment team understood that the Black Sea Economic Cooperation operates under its own mandate and responded to the Kerch Strait oil spill by provision of resources and assistance within this mandate.

The Ministry of Emergencies is regulated by decisions of the Constitutional Court of Ukraine, Presidential Decrees, Orders of the President of Ukraine, provisions of the Verkhovna Rada of Ukraine, memorandums, Ukrainian laws, resolutions, provisions and instructions of the Cabinet of Ministers of Ukraine, and orders of relevant government bodies. As mentioned previously, the Ministry of Emergencies is the primary response agency in Ukraine in the event of an oil spill, and depending on the scale of the emergency, appropriate resources are mobilized from the Ministry of Emergencies for response operations.

The Cabinet of Ministers determines the scale of an emergency situation and issues instruction accordingly; they determine response requirements from the Ukrainian Central Executive Ministry. In addition to emergency situations, the Central Executive Ministry coordinates the activities of other ministries, the Council of Ministers of the Autonomous Republic of Crimea, local state administrations, enterprises, institutions, and organizations mandated to deal with population and territory protection issues in the event of emergency response situations. It became clear during the consultations that a national plan does not exist to deal with oil spill emergencies in Ukraine. However, representatives from the Ukrainian Ministry of Emergencies postulated that contingency plans to deal with hazardous chemical substances were used in the event of oil spill incidents.

The activity of the Ministry of Environmental Protection (MEP) is regulated by the Constitution of Ukraine, the Law of Ukraine *On population and territory protection against extraordinary situations of man-caused and natural character*, codes and provisions of the Cabinet of Ministers of Ukraine, memorandums, Ukrainian Laws, Resolutions, provisions and instructions of the Cabinet of Ministers of Ukraine, and orders of the government bodies.

While the role of the MEP itself is clear, its mandate for oil spill response and management is vague. The institutional assessment was unable to find specific guidance documents for emergency situations from the MEP. In the Kerch Strait incident, the main responses of the Ministry appeared to be directed by the Cabinet of Ministers and by the Special Commission (see Table 2).

Table 2. Responsibilities of national and sub-national Authorities of the Ministry of Environmental Protection in Relation to Oil Spills[37]

National level	Ministry of Environmental Protection (National Executive Authority)	– Coordinates the activities of central and local authorities; – Approves or coordinates environmental rules, requirements standards, limits and quotas and controls compliance with them; and – Participates in international cooperation.
	State Ecological Inspectorate	– Exercises state control over compliance with environmental legislation and management of natural resources.
Sub-national level	Twenty-four state departments for environmental protection in Oblasts and Autonomous Republic of Crimea – specifically coastal areas	– Ensures implementation of state environmental policy, management, and regulation of environmental protection at the territorial level; – Issues permits for pollutant emission and ensures compliance; and – Issues permits for waste management and ensures compliance.
	Three special inspectorates for the Black and Azov Seas (Odessa, Kharkov and Yalta)	– Exercises state control over the use and protection of the marine environment and the natural resources of territorial seas, the continental shelf, and Ukraine's economic zone; and – Exercises control over environmental compliance in the area of waste management.

The establishment of the Special Commission by the Ukrainian Government to respond to emergency situations is also important as it plays a significant policy role. The Commission was formed with senior level ministers and has specific and well-established mandates to determine adequate response actions for emergency situations. This includes the ability to formulate special directions to ministries and the allocation of funding from central revenue funds as required. This Commission is therefore the key institution in any emergency situation response. Decisions taken for emergencies in Ukraine will stem from the central level executive in consultation (or direction) with the Commission.

The role played by sub-national authorities was assessed as vague. Based on information from numerous meetings held with Ukrainian regional authorities, it became evident that both practical requirements and the relationship of sub-national authorities with Ukrainian national authorities in the early stages of an emergency situation play a role in determining specific response action for emergency situations in Ukraine.

International and Regional Agreements

The institutional assessment team examined a variety of international conventions that were made available from Ukrainian participation in order to improve and strengthen the current Ukrainian emergency response capacity. This section identifies these conventions and their respective status in Ukraine. The most relevant International Maritime Organization (IMO) Conventions in the areas of pollution prevention, oil spill response, and compensation covered are:

- The International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78);
- The International Convention on Oil Pollution Preparedness, Response and Cooperation, 1990 (OPRC Convention);
- International Convention on Civil Liability for Oil Pollution Damage (CLC), 1969;
- International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (Fund Convention), 1971;
- The International Convention on Liability and Compensation for Damage in Connection, with the Carriage of Hazardous and Noxious substances by Sea (HNS Convention), 1996; and
- The International Convention on Civil Liability for Bunker Oil Pollution Damage (Bunker Convention), 2001.

In January 2008, Ukraine joined the MARPOL 73/78. MARPOL was established in recognition of the need to control and minimize the deliberate, negligent, or accidental release of oil and other harmful substances from ships into the marine environment. This convention was adopted in 1973 and later modified by the Protocol of 1978. Specific annexes include:

- Annex I – The operational discharges of oil from tankers (the Black Sea area has been designated as a "special area" where discharge of oil from tankers is prohibited).
- Annex II – The carriage and discharge of chemicals carried at sea by bulk chemical carriers.
- Annex III – Harmful substances carried in packages.
- Annex IV – Sewage.
- Annex V – Air pollution.

The OPRC Convention was deemed by the institutional assessment team as being the most relevant international convention in relation to the Kerch Strait incident. The OPRC Convention is mandated with the preparation and response action for oil pollution incidents from ships, offshore oil exploration, production platforms, sea ports, and oil handling facilities. The various articles of the OPRC Convention cover the preparation of oil pollution emergency plans by the operators of the above, oil pollution reporting procedures and the actions to be taken on receipt of such a report, the establishment of national and regional systems for preparedness and response, international cooperation in pollution response, research and development, and technical cooperation.

Presently, Ukraine has not signed or ratified the OPRC Convention or any other conventions with the exception of MARPOL 73/78. During consultations with the Ukrainian Ministry of Environmental Protection, the assessment team was informed that Ukraine recently ratified the Civil Liability Compensation Convention, in April 2008. The government of Ukraine was therefore unable to claim any financial compensation from the Civil Liability Compensation Convention fund, as it is not yet a fully fledged member. It is understood that the process for Ukrainian membership of the Convention's fund has now been initiated; the Ministry of Transport and Communications is the focal point, as this falls under the MARPOL Convention.

Table 3. Regional Conventions and Status Concerning Ukraine

Convention	Status
Convention on Environmental Impact in a Transboundary Context (Espoo, 1991) Protocol on Strategic Environmental Assessment (Kiev, 2003)	Ratified Signed
Convention on the Protection of the Black Sea Against Pollution (Bucharest, 1992)	Ratified
Convention on the Protection and Use of Transboundary Waters and International Lakes (Helsinki, 1992) Protocol on Civil Liability and Compensation for Damage Caused by the Transboundary Effects of Industrial Accidents on Transboundary Waters (Kiev, 2003)	Ratified Signed
Convention on the Transboundary Effects of Industrial Accidents (Helsinki, 1991)	Not yet signed

There are a number of regional conventions on emergency situations and environmental protection. The institutional assessment team compiled a list of the main regional conventions and their status in Ukraine (see table 3).

The Convention on the Protection of the Black Sea against Pollution was ratified by the government of Ukraine in 1994 (the Bucharest Convention) and is the most relevant convention in relation to marine oil spills. To implement this Convention a specific law (no. 2333-III of 2001) was passed in Ukraine, approving the National Programme for the Protection and Restoration of the Environment of the Black Sea and the Sea of Azov for 2001- 2010 (Black Sea Programme). This programme sought to improve the condition of the Black Sea and the Sea of Azov by citing implementing measures and related financial needs. According to the assessment of the Cabinet of Ministers, the low effectiveness of its implementation is because most of the activities are performed at the local level and financed from local budgets, with local staff that lack the necessary planning skills. An additional problem is that the budget for the Black Sea Programme was prepared in 2001 and has not been adjusted for inflation and as a result suffers from under-financing.[38]

Under the Bucharest Convention, three further Protocols were signed by the government of Ukraine in 1992:

- The Protocol on the Protection of the Black Sea Marine Environment Against Pollution from Land-Based Sources;

- The Protocol on Cooperation in Combating Pollution of the Black Sea Marine Environment by Oil and Other Harmful Substances in Emergency Situations; and

- The Protocol on the Protection of the Black Sea Marine Environment against Pollution by Dumping.

Under the *Protocol on Cooperation in Combating Pollution of the Black Sea Marine Environment by Oil and Other Harmful Substances in Emergency Situations*, the Black Sea Commission prepared a two-volume regional contingency plan: Volume 1 was entitled "Response to Oil Spills", and provides guidelines for contracting parties to deal with planning and response for oil spills; Volume 2, entitled the "Response to Harmful Substances other than Oil," is currently undergoing further development.[39] From meetings held with various ministries, it appeared that Ukraine was ready to formally sign the Regional Oil Spill Contingency Plan. However, the change in Government in March of 2008 has caused further delays in this process, highlighting the need to sign the regional plan.

In relation to the Azov Sea and Kerch Strait, the issues of responsibility and cooperation are less clear. It appears likely that these areas do not fall under the Bucharest Convention on the Black Sea *per se*. However, given the predominant surface water currents in the Kerch Strait there is likely to be an impact on the Black Sea area. In the aftermath of the oil spill in the Kerch Strait Russia and Ukraine reported their activities to the Black Sea Commission, but there was no specific involvement apart from this. Issues arising in the Kerch Strait and the Azov Sea appear to be bilateral, currently based on the recognition that this area lacks boundaries between the two sovereign states of the Russian Federation and Ukraine. According to information provided to the institutional assessment team, there is no recognized border in the Kerch Strait or in the Azov Sea. The oil spill response in the Kerch Strait was dealt with through bilateral meetings between relevant ministries of both respective countries.[40] Numerous meetings between key officials of environmental agencies from the two states were held, including official meetings in Anapa (Russian Federation) on 22-23 April 2008 and a meeting of the Ukrainian-Russian Working Group on liquidation of oil spill in Kerch Strait on 22 May 2008. Progress has been reported as being slow: "some decisions of the joint Working Group remain unrealized, namely: 1)... the rise of sunken ships and trailing of *Volgoneft-139* forebody to Kavkaz port; 2) compensation of actual expenditures of different agencies for liquidation of this emergency... Taking into account the delay of compensation by ship owners..., it is proposed to ask for such compensations from State budget of Ukraine".[41]

Based on consultations held with institutions, it was clear that the roles of Ukrainian ministries in the ratification and implementation of international agreements were unclear and subject to conflicting views. This may have played a contributory role in delaying the ratification of specific conventions. It is recommended that more effort is exerted in order to improve Ukraine's capacity for meeting its obligations for responding to environmental emergencies under relevant agreements.

Overview of the institutional emergency response to the Kerch Strait oil spill

Following the oil spill incident in the Kerch Strait local resources were deployed immediately to respond to the emergency. The rescue and salvage aspect of emergency operation was undertaken by the Ukrainian Ministry of Transport.

On 22 November 2007, the Ukrainian Council of Ministers created the *Special Commission* to specifically deal with the Kerch Strait oil spill emergency. The Special Commission declared the Kerch Strait accident as a "national-scale" emergency (as issued by Instruction no. 50). According to the decision of the Special Commission, the following institutions were responsible for responding to the impact of the oil spill through the undertaking of the following roles:

- Ministry of Transport and Communications – Responsible for the Port of Kerch and the port area, with responsibility for shipping safety at sea and mobilization of resources for rescue missions. In the oil spill incident, the Ministry of Transport and Communications also became involved in the waste management process at the Port of Kerch.

- Ministry of Environmental Protection and the State Inspectorates for the Black and Azov Seas (Odessa, Yalta and Kerch) – Responsible for the minimization of the environmental impact of the disaster, adequate waste management, provision of information support for the environmental consequences of oil spills, and the monitoring of the quality of the environment after clean-up.

- Ministry of Health – Ensuring the minimization of the potential impacts to human health.

- State Committee for Fisheries, Fisheries Institute in Kerch – Working with local fishing enterprises to stop fishing in the Kerch Strait in accordance with official Government instruction.

In addition to the ministries listed above, the government administration of the Autonomous Republic of Crimea (ARC) became involved in the initial and ongoing response operation to the oil spill incident. The response operations also included relevant regional-level entities within the Ministry of Emergencies and MEP.

According to the report of Environment Committee of the ARC,[42] the following institutions were responsible for overcoming the consequences of oil spill:

- Ministry of Environmental Protection of Ukraine (Environment Committee of the Autonomous Republic of Crimea (ARC) and State Azov-Black Sea Environment Inspectorate);

- Ministry of Ukraine on Emergencies and on Protection of population from consequences of Chernobyl Catastrophe (Main Department in ARC);

- Ministry of Industrial Policy, Transport, Communications, and Fuel-energy Complex of ARC;

- Ministry of Communal Services of ARC; and

- Ministry of Health of Ukraine (State Sanitary-Epidemiological Service (SES) of Crimean basin, SES of Kerch port).

The report of the Environment Committee of the ARC states that: "From the beginning, branches of Ministry of Emergencies, Ministry of Defense, Ministry of Transport and Communications, Ministry of Environmental Protection and different organizations of Kerch city had collected 5,940 tonnes of oil-sand mixture including 4200 tonnes in 2007. Due to bad weather conditions in December 2007, collection of mixture was stopped. As a result of storm in March 2008 secondary contamination by oil products took place and collection of oil-sand mixture was organized for the second time on Kosa Tuzla Island and on Arabat spit. From the beginning of 2008, 1,740 tonnes of mixture were collected".[43]

The State Azov-Black Sea Environmental Inspectorate monitored sea waters, while the Crimean branch of the Ministry of Environmental Protection monitored soil for oil contamination, sulphates, and biological oxygen demand. The assessment team was informed that the MEP regularly published information on its website during the emergency phase of the response operation, and was provided with copies of these reports. Relevant extracts are provided below:[44]

"Monitoring of the Kerch Strait area of water was conducted daily from 12 November 2007 to 26 December 2007 by taking water samples in five compulsory points (according to sea monitoring programme) and also in fifteen additional points (including areas near sunk ships). There was no monitoring of Kerch Strait during 27 December 2007 to 16 March 2008 due to bad weather conditions. Since 17 March 2008 monitoring is conducted at eight points weekly.

According to the Ministry of Emergencies, a diving study of Kerch Strait bottom was conducted in the period from 29 February to 11 March 2008... There was no oil contamination discovered".

"Between 11 June and 10 July 2008, 63 samples of sea water were taken (Kerch Strait – 36 samples, Kosa Tuzla Island coast – 27 samples). Samples were studied for oil concentration, dissolved oxygen, and sulphates. Excess of Maximum Allowable Concentrations (MAC) for fisheries reservoirs was discovered in thirteen samples from Kerch Strait (concentrations vary from 0.07 mg/l to 0.12 mg/l) and in seven samples from the Tuzla Island coast (from 0.08 mg/l to 0.22 mg/l, MAC is 0.05 mg/l). All other parameters were within MAC. Excess of MAC for oil is periodically discovered in the center of Kerch Strait. ... near the *Volgoneft-139* ... there are traces of light oil products..."

Oily material debris dumped in the Kerch trade port

"...Environment Committee of the Autonomous Republic of Crimea (ARC) is monitoring from 15 November 2007 the soils of coastal zones in Kerch Strait, Leninsky district, and Kosa Tuzla Island. There are eighty-two test points for oil contamination and nine test points for sulphates..... Until 9 July 2008 up to 1,856 samples were studied on oil concentration and 112 samples on sulphates... Repetition factor of excess of background concentrations was around 1,500 times in the first days after oil spill. After clean-up operations after 9 July 2008 maximum excess was nine times on Kosa Tuzla Island."

In December 2007, the Strait became frozen and all clean-up activities were suspended. Up until this point, 5,440 tonnes of oil sand mixture had been collected from the contaminated coastal areas. Following the ice melt, more oil was transported to coastal areas with an additional 1,700 tonnes of waste being collected. Responsibility for waste management falls under the mandate of the Ukrainian MEP; this responsibility was undertaken through the Ministry's request to reprocess the oil-sand mixture in the Kerch port instead of its burial in clay mines.

Responsibility for waste management also falls within the mandate of the Ministry of Environmental Protection. Therefore, "... immediately the question regarding the utilization of the collected oil-sand mixture was raised. On 18 February 2008 a special working group at the meeting in Kerch ... discussed several options on utilization including storage of mixture in appropriate lime pits. ... Special recommendations on using of biosorbents were developed... as well as proposals on mixture utilization. ... Government Commission (created by decision of Cabinet of Ministers of Ukraine on 19 March 2008) decided by decision N 496 ... to use technology proposed by "Ecocenter" from Kirovograd. The Ministry of Environmental Protection of Ukraine signed an agreement on utilization with "Ecocenter"... and advance funding was made to the amount of 4.5 million UAH, and additional 3.6 million UAH was provided in July 2008. ... As of 8 July 2008 "Ecocenter" utilized 3597.7 tonnes of oil-sand mixture".

"... from the very beginning information rescue and clean-up operations were regularly published in mass media and Ministry of Environmental Protection website ... and the "Ecocenter" web-site".[45]

The Situation in July 2008

In July 2008, the Ministry of Emergencies and Ministry of Environmental Protection agreed that a total amount of 1,300 tonnes of heavy fuel oil had been released from the *Volgoneft-139*.

However, there is some conjecture over the exact figure. It is believed that the *Volgoneft-139* was carrying approximately 4,070 tonnes of heavy oil and according to local authorities in Kerch, approximately 2,000 tonnes had spilled into the environment by July 2008. While speculation remains surrounding the amount of oil released, the amount of waste that was collected during the clean-up process was estimated to be 7,140 tonnes. The waste was initially put into bags, then transported and stored at the Kerch Port in a bonded area to ensure no further leakage occurred. The waste collected from the oil spill was then to be processed into a more inert substance. At the time of assessment inspection in Kerch Port on 14 July 2008, approximately 1,500 tonnes of waste remained to be processed.

Threats and Oil Spill Source

This section examines the main issues in assessing the risk and potential of future oil spills in the Black Sea and Azov Sea area. It examines potential sources of oil spill and pollution including: production activities, loading activities in shipping terminals, and shipping accidents involving tankers.

The three main marine areas to be considered are the Black Sea, the Azov Sea and the Kerch Strait. The Black Sea area has well defined boundaries and is subject to regional agreements with Black Sea States regarding contingency planning and response for large oil spills incidents. The boundaries and responsibilities of each state are relatively well understood. However, the responsibilities are not so clear in the Kerch Strait and the Azov Sea where boundary demarcation between Ukraine and the Russian Federation is not well defined. The lack of boundary demarcation impacts the Kerch Strait in several ways. In the context of the oil spill last November, the storm which caused the shipwrecks was predicted by Ukrainian authorities and this information was conveyed to senior vessel personnel, along with instructions to shelter in port. Based on interviews conducted with the Ministry of Transport and Communications, although the Ukrainian ships followed instructions and entered ports for safety, it appears that the Russian vessels did not adhere to these instructions, which resulted in shipwrecks and the subsequent release of oil to the environment.

In addition, it is widely believed that a lack of boundary demarcation provides opportunities for oil (and other goods) to be loaded and/or discharged at sea in the Kerch Strait, in an attempt to avoid excess taxes. The Kerch Strait is a densely trafficked area with ever-increasing activities of ship transportation - according to the Ministry of Transport approximately 1,000 ships per month travel via the Kerch Strait, containing mostly coal, sulphur, and crude oil. With estimates of open water oil transfers around 7 million tonnes per annum, chronic pollution from oil spills in the Kerch Strait remains a key threat to the environment.

In 2003, the total amount of oil shipped in the Black Sea was approximately 700 million barrels, with expected increases of up to 20 percent by the year 2010.[46] It has been predicted that the most significant increases are likely to be medium and heavy fuel oils, which present a higher risk of pollution[47] due to higher probability of spills and more severe environmental consequences. Increasing ship activity, with up to 40 vessels per day, suggests a high risk of vessel accidents in the Kerch Strait,[48] and therefore increases the likelihood of the release of substances into the environment.

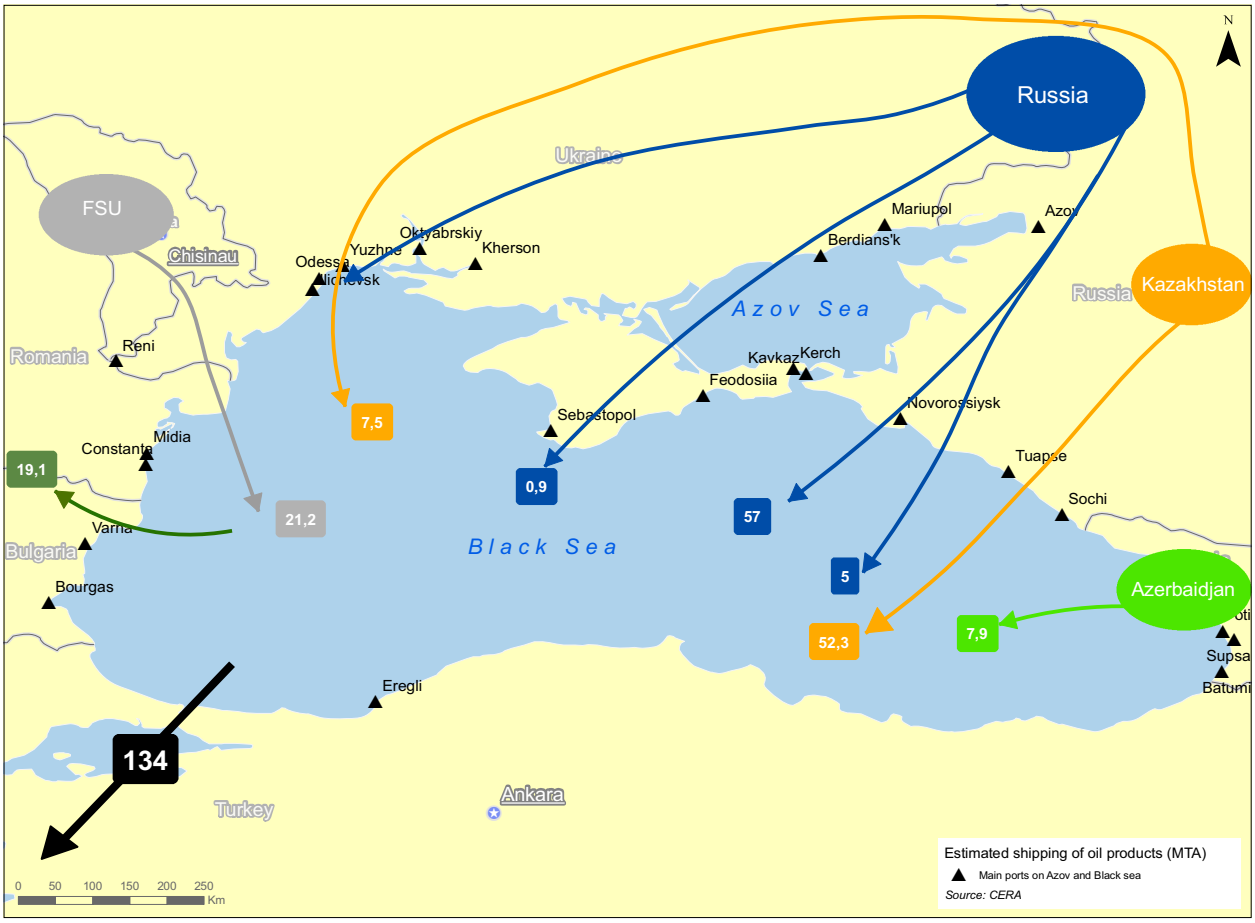
Figure 2 shows the estimated amounts (in millions of tonnes) of crude oil shipped in 2010 and the associated ports concerned.

Since the oil spill in November 2007, the government of Ukraine has been making progress towards the introduction of restrictions on sub-standard vessels passing through the Kerch Strait. It has been proposed[49] that vessels should only be allowed into the ports of Azov Sea through the Kerch Strait if they comply with the provisions of:

- The International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78); and
- The International Convention for the Safety of Life at Sea (SOLAS), 1974.

Recent announcements were made by the Russian Federation to decommission its fleet of single hulled tankers and use double hulled oil tankers through the Kerch Strait; it would significantly reduce the risk of acute oil spills.[50] However, it is estimated that only two out of the thirty ports located on the shores of the Black and Azov Seas

Figure 2. Forecasted amount of oil products shipped within the region for 2010 (in millions of tonnes)



that regularly load and discharge oil products, conduct screening processes for tanker quality in the port terminals. While increasing the number of double hulled tankers will help to reduce oil spillage from tankers, port authorities are strongly encouraged to screen the quality of tankers in their facilities.

Current Ukrainian oil production is relatively low, at around 90,000 bbl/d. However, it has been estimated that current hydrocarbon reserves (in the order of 395 million barrels) are located in three main basins: the eastern Dneiper-Donetsk, the Carpathian, and the Black Sea/Azov-Kuban.[51] While the majority of oil production is currently land-based, it is likely there will be an increase in marine oil and gas production facilities and associated infrastructure in the future. Currently, according to the Ukranian Ministry of Environmental Protection, a pipeline for oil transmission has been proposed from a platform 20 km southeast of the Kerch Peninsula to the residential area of Cape Takil. Ukraine has a well-developed oil trunk pipeline system of more than 4,600 km, with one in the east and one in the northwest of the country.[52] These two systems have been connected recently by the Odessa-Brody pipeline. There are three major oil terminals in Ukraine: Odessa, Yuzhny and Feodosia. The Odessa oil terminal has an annual capacity of 20 million tonnes of crude oil and accounts for most of the crude oil and petroleum products transshipped in Ukraine.

Increasing levels of shipping and of crude production remain key threats to environmental protection, and the need to have suitable management procedures in place is vital. This recommendation has been reinforced by the grounding of another vessel in the Kerch Strait on 18 January 2008, which carried gasoline and crude (although there was no oil spillage).[53] While improvements to shipping practices and adherence to maritime safety procedures may contribute to a reduction of threats from acute events, it is highly recommended that a sound system of oil spill preparedness and response is established in Ukraine.

Resources available for Oil Spill Response

It was not the intention of this assessment to undertake a detailed inventory of the equipment, personnel, and facilities available for oil spill response situations. However, on the basis of meetings and site visits undertaken by the assessment team, it was possible to examine some physical resources to provide an indication of the extent of preparedness for oil spill emergency events in Ukraine.

Physical Resources

It appeared that Ukraine's capacity to deal with oil spills is restricted to minor spills (also known as "Tier 1" spills).[54] This was apparent from a spill that occurred in Odessa Port in 2006. The loss of 36 tonnes of oil from a ship in Odessa Port required a coordinated request for equipment from another port. As a result, the equipment took a day to arrive before containment could be achieved. However, the PDNA discovered that most Ukrainian ports do possess some response support equipment such as booms, sorbents, and dispersants. It is recommended that in order to increase the level of response preparedness, lessons should be learned from the Odessa experience and relevant measures should be undertaken to ensure there is no delay in gaining access to clean-up equipment in the future.

The institutional component of the PDNA assessment also examined the capacity for scientific support to oil spill emergencies. The assessment revealed that a significant amount of scientific equipment and capacity to support marine oil spill response activities was available. However, one of the biggest problems is that available equipment, (including computers and information systems), was outdated and had not been replaced. It is possible that this may be a result of the reduction in funding for scientific activities in the last ten to fifteen years.

Human Resources

The assessment team observed that there are many suitably trained civil servants, who have the skills to deal with the coordination and management for an acute oil spill response. There is also a high level of technical capacity within Ukraine's scientific centres and institutes to support the scientific aspects of oil spill modeling, monitoring, and marine environmental, hydrological, and laboratory testing. Significant civil-military support is also available for clean-up responses. It was widely recognized that a significant level of external support has been provided to Ukraine on contingency planning for oil spills in recent years.[55] It is a key recommendation of this report that further and more comprehensive training for staff involved in clean-up operations be provided.

The Vladimir Parshin ship, belonging to the UkrSCES (Odessa), equipped with on-board laboratories for UNEP scientific missions to the Black Sea

Financial Resources

This has been by far the most difficult issue for the PDNA team to understand. As stated previously, it is the role of special commissions established on a case by case basis to determine the funding for the liquidation of any specific emergency situation. However, in the immediate frontline of response it appears necessary that the sub-national authorities must utilize their own financial resources and then at a later date make a case for compensation to the central authorities. For example, additional efforts for monitoring by the Kerch Ecological Inspectorate as a result of the oil spill last November are as yet unfunded from the central level. In addition, funds for involvement of Odessa Sea Ecology Centre (UkrSCES) were not forthcoming despite a request for the Centre to become involved in the environmental assessment process.

In relation to environmental expenditure, it appeared that the majority of expenditures for waste treatment came from the State Environmental Protection Fund. The fund operates based on revenues mainly from pollution charges and as an expenditure fund for environmental activities. In the case of the Kerch Strait specifically, the major cost has been the disposal of sand, seaweed, and oil mixed waste. The estimated cost of the preferred disposal option is in the order of 15 million Hryvnia (UAH);[56] this figure represents a significant cost to the State Environmental Fund when other options like quarry burying are available.

One of the most significant issues concerning the fund expenditure is the need for reform, given there is a severe lack of policy direction for environmental priorities. Further, the OECD stated in the performance review of the State Environmental Fund that "in its current form the State Fund appears to be essentially a budget line to collect and spend public money."[57] In the case of the Kerch Strait, the Special Commission established the policy direction for waste treatment and the "assessment of State Budget disbursements" for dealing with the waste,[58] indicating a lack of pre-established policy direction for dealing with waste in an environmentally sound manner, and further demonstrating a general lack of oil spill response contingency planning.

Summary of findings

The purpose of this institutional component of the PDNA was to better understand the capacity of Ukrainian institutions to respond to oil spill emergencies, through examining the Kerch Strait oil spill incident as a means to demonstrate the strengths and weaknesses of the current system. The PDNA revealed that a high-level of capacity to respond to oil spill emergencies exists within Ukrainian institutions. Nevertheless, in comparison to international best practice standards for marine oil spills emergencies, several improvements could be undertaken[59] to minimize the environmental impacts from acute events such as accurate damage to the assessment of the coastal and marine environment. These issues are discussed in further detail in this section, which also provides a synthesis of the findings from the institutional component of the PDNA.

Strategic Policy and Contingency Planning

The system of governance influences the roles played by policy agents. In the case of the Ukrainian emergency response this is best exemplified by the role of the executive level through the establishment of the Special Commission. It became clear to the assessment team that the Special Commission directly influenced the role of the administration in the Kerch Strait oil spill emergency. It is likely that the development and influence of the Special Commission stems from the Chernobyl nuclear disaster (1986). The role of the Special Commission in relation to the oil spill incident in the Kerch Strait therefore deserves more attention and is discussed below.

The Special Commission is considered a legitimate policy-making body that provides policy advice on a case by case basis.[60] Therefore the status of the Special Commission and of the law in relation to emergencies have pre-eminence over any specific technical approaches, resulting in an overly "top-down" approach from the executive level.[61] Presently in Ukraine there is no dedicated national oil spill response plan; *Decree 1567* acts as a substitute plan to cover all emergencies. There is therefore a need for a dedicated national emergency response plan that provides policy guidance at a technical and ministerial level. The limitations of using *Decree 1567* to deal with the environmental consequences of oil spills are discussed below:

1. Ukrainian legal provisions, in their present form, contain emergency response strategies;

these provisions provide ample scope for the involvement of relevant actors to respond to any range of specific emergency situations. The provisions as set out in *Decree 1567* consider a broad range of emergencies, not the specific requirements for an oil spill emergency situation. *Decree 1567* is broad and lacks specific details for dealing with oil spills in a marine context. This is further highlighted by the lack of environmental provisions or strategic outcomes in relation to environmental considerations within this provision.

2. In the case of the Kerch Strait oil spill, the executive level of government played a prominent role via the Special Commission (created in November 2007) – by declaring the oil spill emergency as a national emergency. In March 2008, after a change of Government, the chair of the commission was transferred from the Ministry of Emergencies to the Ministry of Environmental Protection, which further impeded a fluid and coherent continuation of the necessary recovery activities. In the Kerch Strait incident, the level of senior policy instruction from the Special Commission resulted in an undue burden on regional authorities, hampering the rapid management of waste.

3. Given the observations discussed previously, the approach by the Ukrainian administration in dealing with oil spills is vertical, with ministries only actioning their narrow mandates and not giving sufficient importance to the protection of environmental resources. The tasks undertaken in the Kerch Strait event were geared towards safety and clean-up, and not specifically towards environmental protection. The lack of information sharing amongst the Ministries was highlighted during the assessment team's interviews.

4. The existing policy system for dealing with environmental emergencies in Ukraine is highly centralized through the Cabinet of Ministers, Special Commission, and the Central Executive Ministries, which undermines the authority and resources of the regional authorities. This can lead to a less coordinated response at the local level and can increase environmental threats due to delays in response time.

5. There is a lack of a clear planning hierarchy under a system of common practice (e.g. European Maritime Safety Agency), which constrains national and sub-national authorities in responding to oil spill emergencies. For instance, there is no clear definition in Ukraine of what constitutes a "Tier 1, 2 or 3" oil spill, unless ruled by the Special Commission. Therefore, appropriate contingency planning is required accompanied by clear definitions.

The three main policy directions that need to be considered in oil spill contingency planning are:

- Protection of human health and safety;
- Minimizing environmental impacts; and
- Restoring the environment as near as practicable to the pre-spill conditions.

6. Although Ukraine is a member of the Bucharest Convention on the Protection of the Black Sea from Pollution, it has not yet signed the Regional Oil Spill Contingency Plan. This is primarily attributed to changes in Government. It is understood that the Government will ratify the Regional Oil Contingency Plan shortly and adopt a national contingency planning process.

7. There are numerous international and regional agreements that need to be supported through capacity development in the relevant Ukrainian Ministries. Following on from this, it is also important for the Government of Ukraine to understand the benefits and costs incurred from these agreements. Based on meetings held in Ukraine, the PDNA concluded that further clarification on the roles and responsibilities of Ukrainian Ministries is needed; lack of clarity hampers the chances of effective implementation of key international environment conventions.

8. Ukraine has no clear national system for the funding and expenditures of emergency response situations. During the assessment the team learned that clean-up costs were incurred by the transport authorities, local authorities, and port authorities, who later have to apply for compensation from the Ukrainian National Reserve Fund. Stakeholders interviewed during the consultations claim that it is unlikely that the authorities involved will be compensated. The Ukrainian Ministry of Economy is charged with responsibility of the National Reserve Fund, with some influence from the Special

Commission. Decisions on the allocation of compensation from this particular fund are strongly influenced by the Commission Chair. Environmental damage has not to date been compensated from the Ukrainian Environmental Fund managed by the MEP; presently, only waste reprocessing was funded via the Environmental Fund. Furthermore, the monitoring programme of UkrSCES by rights should have been funded from either the National Reserve or the Environmental Fund; however, due to unclear regulations, funding has not been provided. It is doubtful that the National Reserve Fund will process compensation applications as the government of Ukraine is presently not a member of relevant conventions that provide access to compensation funds. It is recommended that the Environmental Fund be replenished through fines and penalties from pollution charges.

9. The majority of oil production in Ukraine is state-owned, which creates difficulties in understanding the Ukrainian system of planning and approval processes of oil spill contingency plans for facilities owned by state companies or joint ventures. Contingency planning is generally undertaken within an environmental impact assessment (EIA), with relevant companies responsible for its management and implementation in an oil spill emergency context. The PDNA was therefore unable to evaluate the effectiveness of the Ukrainian system for EIAs. During the assessment however, the Ukrainian MEP suggested that the EIA system in Ukraine needs strengthening.

10. A lack of environmental mainstreaming into sector activities of various institutions in Ukraine has characterized the Ukrainian oil spill coordination and emergency response.[62] It is recommended that the government of Ukraine develop a clear hierarchy of responsibility that can be supported through appropriate capacity building activities.

11. The final recommendation in relation to strategic and contingency planning encourages the environmental assessment of the short and longer-term impacts of oil spill emergencies be integrated into a national contingency plan. Expertise for such emergencies (environmental chemists, modelers, and biologists) should be identified in advance and prepared for rapid deployment in an oil spill emergency, following established and clear environmental assessment protocol. Data gathered from such assessments may prove to be essential in the post-disaster legal process.

Response, Monitoring and Information Management for Environmental Risks

The government of Ukraine has the capacity to respond to acute oil spills, with a range of skills and resources at its disposal. Presently however, there are a number of constraints hampering a more effective institutional response to environmental considerations:

12. There is a high level of capacity for oil spill trajectory modeling within the Ukrainian marine institutes and research centres (including the UkrSCES, the Marine Hydrophysical Institute, and NASU). However, the management and access to information between relevant response agencies is poorly coordinated. Based on interviews held with stakeholders, the assessment team was informed that emergency information is not filtered through the correct channels. It is therefore important to develop clearer processes and allocation of responsibility. In particular, it is essential that oil spill trajectory modeling information is made readily available to the senior response officials to assist in the immediate planning for an emergency response situation.

13. Based on interviews with the MEP, the PDNA team discovered that the ministry does not have access to satellite data from the EC MIC – an extremely useful resource in emergency response planning. It is essential to have access to current satellite data in order to understand the oil spill trajectory. It is therefore recommended that provisions be made for obtaining adequate and up-to-date satellite data.

14. The MEP prepared detailed coastal hazard maps which have not been used for oil spill response situations. It is recommended that response efforts should focus on the protection of high-value social and environmental resources, as identified in the published coastal

hazard maps. In addition, risk assessments should be undertaken to better understand the range of potential impacts on high value coastal resources.

15. Previously, the Black Sea Economic Cooperation has provided assistance in undertaking regional table top planning exercises to deal with oil spill situations. It is recommended that similar types of institutional strengthening activities be undertaken at both the national and sub-national levels.

16. Based on consultations undertaken during the assessment, interviewees stated that wildlife response management is a poorly understood issue in Ukraine. This affects the recovery response in dealing with birds and mammals contaminated with oil. It is recommended that the government coordinate with NGOs, civil society, and the MEP to develop a core of environmental specialists to effectively coordinate a response for wildlife management in the future.

17. There is a lack of sufficient response support resources such as booms, sorbents, and dispersants for effective response to oil spill emergencies. During the consultation process "on site" responders stated that current capacity in most Ukrainian ports could extend to a Tier 1 oil spill event; for Tier 2 and 3 emergencies resources are inadequate. Therefore, this report recommends that provision of additional resources for ports be substantially increased. As an initial step, an inventory of stock and equipment to be established should be undertaken in conjunction with the strategic needs identified in contingency plans. In addition, specific guidance on procedures and locations for dispersant applications to oil spills should be developed – deployment of specific response techniques and resources should coincide with environmental considerations.

18. In addition to the provision of more resources, this report strongly recommends the undertaking of comprehensive training support for response personnel on the national and sub-national levels. Training should focus on dealing with all three oil spill Tiers and administrative aspects of managing oil spills. Furthermore, training to identify the environmental impacts of oil spills and the management of associated risks should target personnel within Ukrainian ministries involved in emergency response operations, including the Ministry of Transport and Communications, and the Ministry of Emergencies. Such training would assist with capacity building within relevant organizations and encourage a cross-governmental collaborative effort in the implementation of strategic environmental policy priorities.

Monitoring and Assessment

The oil spill event in the Kerch Strait has revealed a number of issues that need to be addressed in relation to the current Ukrainian capacity to collect samples, assess oil spill situations and related environmental impacts, and regular monitoring.

19. Based on consultations undertaken with UkrSCES, it was revealed that tests and fingerprinting to confirm the exact type of oil from the oil spill had been hampered due to incorrect sampling procedures. Out of the 700 samples collected by the MEP Kerch Inspectorate, only two were sent to the UkrSCES. This is alarming as the MEP is responsible for this type of activity, and should have the correct procedures in place to do so. This suggests that roles and responsibilities need to be clarified to allow proper coordination and the use of existing capacities. In addition, training for all institutional personnel involved in response planning should be undertaken. Examples of best practice guidelines available include the IMO Guidelines for Sampling and Identification of Oil Spills (1998).[63]

20. To ensure a timely and effective response to emergency situations, it is suggested that the MEP could collaborate with an environmental research institute on stand-by to respond to any urgent requests for collecting samples and performing analyses in an emergency situation. Furthermore, emergency funds should also be made available to this research centre to take on these tasks immediately to save time. In addition, regular environmental monitoring of affected zones post-disaster should be undertaken in the long term. This could also help the regular monitoring of a zone at high risk of other smaller oil spills due to the significant cargo traffic in the Strait.

21. The use of MAC in Ukraine has been widely criticized as being ineffective for a range of reasons, and it is not considered best practice under the IMO guidelines.[64] It is recommended that monitoring protocols for acute and chronic oil spills be strengthened to determine allowable concentrations based on changes from ambient conditions and not MAC. This would require a range of parameters to be tested with actual concentrations, and an assessment of the elevated value from ambient conditions. Thus there is a need for a more robust monitoring strategy to be developed by the MEP that should test for all organic compounds, not only oil concentration. Ideally, parameters should be tested based on a detailed water quality regulation or strategy consistent with the main use of water (such as recreation, in the case of coastal areas).

22. Fishing in the Kerch Strait has been banned for months, a decision based on the potential health impacts of the catch. While this report does not make any assessment of fisheries management in the Kerch Strait, it has been difficult to assess the rationale under which fishing is banned. Based on interviews, the assessment team was informed that testing species for oil contamination does occur, but there are no applicable standards in Ukraine. It is therefore possible that strengthening the system of fisheries contingency planning and management for oils spill emergencies may help to minimize the economic burden on the fishing industry in the future.[65] This requires the involvement of key stakeholders in the planning and management process. Appropriate testing procedures should be implemented at the outset as these will assist in rational decision-making processes for future emergency situations.

23. The UkrSCES is presently a monitoring centre within the MEP. Given the monitoring and compliance mandate of the Ministry this role is dubious. There is a case to be made for the UkrSCES to become an independent service institution with an enlarged mandate and capacity, which would go beyond its current monitoring and information functions under the MEP.

24. It was evident from visiting the various Inspectorates (listed in Annex 4) that the laboratory equipment and computers are aging and there is a high need for strengthening the capacity of Inspectorates, including reviewing analytical techniques for health safety of lab workers (for instance, the use of the CCL4 in the UV-spectrophotometric-analysis is highly carcinogenic).

Waste Management

Waste management is always important to ensure the containment of any oil spill impacts. There are always a range of options for waste treatment including landfill, incineration, biodegradation, and stabilization. The Special Commission undertook waste management activities in the Kerch Strait event. Contaminated waste was stabilized and later transformed into an inert substance through mixing with other materials. The new mixture was then reused for road construction. This waste management approach ensures the mineralization of harmful impacts. Further observations from the PDNA findings are detailed below:

25. This assessment found that waste management contingency planning has not been developed in Ukraine. This observation was based on the prolonged period of time it has taken the authorities to deal with the waste generated from the oil spill.

26. During the visit of the Kerch port, plastic bags were found mixed with the stockpiled sand and oily waste. It was stated that these plastic bags would then be separated and burned at a later date. It is recommended that this practice be avoided unless the incineration process is undertaken at very high temperatures (such as those in power plants, cement factories, or smelters) with appropriate emission controls.

Waste processing in the trade port of Kerch

Economic Assessment

Focus and methodology

The economic assessment of oil spill incidents is a methodologically difficult area, as there is not yet common understanding or agreement on how to accurately assess all costs of damages from such incidents. The economic component of the EC-UNEP PDNA sought to evaluate the incurred costs of the Kerch oil spill incident, primarily derived from the expenditure costs for the clean-up operations. The team also attempted to project the cost of opportunities missed (in terms of lost tourist and fisheries revenues). There is another set of economic values for environmental services (in this case pristine beaches), computed using stated or revealed preferences. The results from such exercises are often used as upper bounds to calculate damages in court situations, but are not considered as part of incurred costs/opportunity costs by way of methodological robustness.

The economic component of the EC-UNEP PDNA was commissioned to the National University of the Kyiv Mohyla Academy, Ukraine. The assessment reveals only the results of the "direct costs" and "opportunity costs" valuation. Direct costs were obtained by gathering data on: the time spent by individuals involved in the recovery operations of the oil spill, resources expended, and financial outflow for the outsourcing of clean-up services. To assess indirect or *missed opportunity* costs, the assessment team gathered data from a range of various industries, such as the tourism and fisheries sectors.

The assessment of direct costs

Details on the costs of remediation and waste processing from the oil spill response (such as the price of the warehousing space in the port, and the costs of waste processing) were not available to the assessment team as this information was classified. Information collected during the PDNA was insufficient to draw concrete statistics on clean-up related expenses. However, figures from public expenditures were used during the assessment to compensate for this lack of data.

For costs incurred for the clean-up and transportation of the sludge from the oil spill to the port, the Crimean Environmental Protection Fund allocated three million UAH. In addition, approximately 500 volunteers per day participated in the clean-up

A student from the Kyiv Mohyla Academy conducting a survey for the economic assessment on a beach in Kerch

Students undertaking surveys with local businesses as part of the economic assessment

from 13 November to 22 December 2007. The Kerch port authorities and Kerch enterprises also participated in clean-up operations with personnel and machinery. Furthermore, 159 technical units (such as tractors and excavators) were engaged in beach clean-up operations. It was difficult to assess the costs of volunteer work by the city enterprises and Kerch port staff, as statistics delineating the work of the Ukrainian Ministry of Emergency staff (paid personnel) and the volunteers was unavailable.

For the waste processing, 4.5 million UAH of advanced payment was allocated in March 2008, with an additional 3.6 million UAH later in July 2008.[66] The processing work was halted on 15 August 2008 due to a lack of payment, leaving 452.3 tonnes of sludge on the Kerch port territory.[67] In July 2008, it was estimated that a minimum of 6,600,000 UAH was required to complete the waste processing phase of the clean-up operation.

The allocation of 2.7 million UAH from the State Environmental Protection Fund was provided specifically for a scientific research project to assess the consequences of the pollution of the marine ecosystem from the Kerch Strait oil spill incident. This project commenced in November 2007 and sought to develop recommendations for the reduction of the negative consequences of the oil spill. However, it was observed by the assessment team that no further budget funds were made available for the regular monitoring of the Strait's environment in the aftermath of the oil spill.

The assessment of indirect costs

To calculate the indirect economic costs from the oil spill, the PDNA included the lost income of sectors affected from the incident, in particular the fisheries and tourism sectors.

Fisheries

The Kerch fishing industry consists of sea and Strait fishing, and the cultivation of mussels, through small mussel farms. The fishing companies tend to distinguish between individual boats used to fish in the sea and "coastal fishing teams" (also known as "Brigades") of ten to twelve people.

There were two types of costs associated with the losses of the fishing industry in the Kerch Strait: the *immediate direct losses* during the oil spill, and the *indirect losses* in the form of the lost revenues in the months following the oil spill. *The immediate losses* from the oil spill are estimated to be 4,172,200

A student from the Kyiv Mohyla Academy conducting a survey for the economic assessment on a beach in Kerch

UAH,[68] which includes the damage to boats, nets, and mussels collectors from the oil. This number is an aggregate sum of the claims submitted by the fishing companies (as per the request of the Ministry of Agrarian policy of the ARC). This amount is an approximate figure and may be higher than the actual incurred damage as it is likely to include the damages from both the storm and the oil spill together, and the figures may have been exaggerated to ensure costs for damages to equipment will be fully compensated by the government. *The indirect prolonged effect* is linked to the Order of the Fishery Committee no. 320, 25 December 2007, in relation to the permits on quotas for the special use of water live resources of the general state importance. Annex 2 of the Order states that fishing in the Kerch Strait has been temporarily suspended until further notice from the Ukrainian Interdepartmental Commission, which is investigating the consequences of the oil spill. Until August 2008 fishing continued to be prohibited resulting in considerable short-term economic and social losses to the fisheries sector.

To estimate the losses to the Kerch Strait fishery, the PDNA examined the particularities of the Kerch fish migration pattern. There are two fishing seasons in the Kerch Strait: the first takes place in the months of October-November (known as the run) where fish (such as anchovies) migrate from the Azov to the Black Sea; the second is in March-April where fish go from the Black Sea to Azov Sea. In between these two seasons, the number of fish caught in the Kerch Strait was not accounted for during this assessment.

The largest impact of Order no. 320 was on the coastal brigades, which rely on small scale and low-cost fishing. In the aftermath of the fishing ban, the biggest coastal brigades moved to fish in the Azov and Black Seas, whereas smaller coastal brigades were forced to disband. The majority of the bigger fishing firms, reliant on boat fishing, managed to survive, despite the significant reduction of profits due to increased fuel costs.

The estimated volume of fish caught during the fall fishing season is in the region of 200,000 tonnes per day by sea boats, and approximately 10-20 tonnes per day by coastal brigades. However, poaching of fish was not accounted for in this assessment, and according to local fishermen, after the fishing ban poaching increased four-fold due to a lack of proper monitoring capacities (e.g. boats and even fuel). Table 1 illustrates the decrease of the actual take during the first half of the year 2008.

A more detailed analysis of the fishing quotas statistics,[69] and actual take of respective fishing companies[70] for the first half of 2008, reveals that of the fifty-one firms permitted to fish in the Azov Sea and Kerch Strait, nineteen showed zero take. These are likely to be coastal brigades who were unable to fish. The 19 firms, mentioned previously, collectively possessed allowances that could have caught 20.7 tonnes of fish (which is five percent of the total allowable catch of 4,149.3 tonnes during the six months of 2008 for companies registered to fish in the Azov Sea and the Kerch Strait). These are all small fishing firms with individual quotas from 0.1-3 tonnes per half a year and each employing about ten to twelve people. As a result of the fishing ban many companies were driven out of business.

The income losses of these companies can be calculated from multiplying the allowable catch by the market price of fish species. These fishermen were primarily targeting three fish species: herring (market price 15-17 UAH/kg), pike-perch (15 UAH/kg), and goby (7 UAH/kg). Table 2 provides information about the allowable catch and market price of the species. In accordance with this methodology, the income loss of the coastal brigades was projected to be 270-300,000 UAH (54-60,000 USD).

Table 1. Amount of fish caught according to assigned quota and actual take in Azov Sea and Kerch Strait in 2006-2008

Amount of fish	2006			2007			2008		
	Quota	Actual	% of quota	Quota	Actual	% of quota	Quota	Actual	% of quota
For six months (Jan-Jun), in tonnes	4559.1	4200.2	92.13	4539.8	4183.4	92.15	4149.3	2168.9	52.27
During a year (Jan-Dec), in tonnes	5048.1	8671.2	171.77	4966	9218.4	185.63	NA	NA	NA

Table 2. Foregone income of the fishing companies reporting zero catch out during January-June 2008

#	Company name	Allocated quotas, tonnes	Fish species	Price, UAH/tonne		Foregone income, UAH	
				Min	Max	Min	Max
1	Morskoy kolokol	100	pike-perch	15	15	1,500	1,500
2	Tuzla	300	herring	15	17	4,500	5,100
3	Kerchenskiy institute	400	pike-perch/herring	15	17	6,000	6,800
4	Linart	100	pike-perch	15	15	1,500	1,500
5	Rybtransust	350	herring	15	17	5,250	5,950
6	Tomasevish	1,200	goby/herring	7	7	8,400	8,400
7	Meridian	2,000	herring	15	17	30,000	34,000
8	Havrilov	1,200	herring	15	17	18,000	20,400
9	Zori Azova	1000	goby	7	7	7,000	7,000
		3,100	herring	15	17	46,500	52,700
10	Batrak	100	pike-perch	15	15	1,500	1,500
11	Galiotis	3,000	herring	15	17	45,000	51,000
12	Elekta	300	herring	15	17	4,500	5,100
13	Akimenko	200	herring	15	17	3,000	3,400
14	Pryma	1,600	herring/pike-perch	15	17	24,000	27,200
15	Skvortsov	300	herring/pike-perch	15	17	4,500	5,100
16	Belonenko	300	herring/pike-perch	15	17	4,500	5,100
17	Septima	300	herring	15	17	4,500	5,100
18	Karetin	2,000	goby	7	7	14,000	14,000
		300	herring	15	17	4,500	5,100
		1,300	pelengas	11	11	14,300	14,300
		200	pike-perch	15	15	3,000	3,000
19	Shtil servis	1,000	herring	15	17	15,000	17,000
	TOTAL	**20,650**				**270,950**	**300,250**

Oil deposit found under beach sand in Kerch

Table 3. Estimates of incomes losses from underfishing of the Kerch fishing industry in January-June 2008 based on the previous periods catch out, in tonnes

	Market price, UAH/kg[71]		2006	2007		2008		Estimated forgone opportunities		
	Min	Max	tonnes	tonnes	% to previous year	kg	% to previous year	Catch out, tonnes	Income, thousand UAH, Min	Income, thousand UAH, Max
Pochard	10	11	2 977.6	2 314.6	128.65%	1 141.5	49.32%	1,173	11,730	12,903
Sardelle	3	4	1 058.7	1 632.4	64.85%	865.4	53.02%	767	2,301	3,068
Anchovies Black Sea	6	7	na	na	na	0.0	na	5	30	35
Pike-Perch	15	15	0.6	0.8	80.05%	0.04	4.60%	1	11	11
Herring	15	17	8.9	5.5	162.85%	0.01	0.13%	5	82	93
TOTAL								**1,951**	**14,155**	**16,111**

A detailed analysis of the catch-out by fish species revealed a drastic decline (to almost zero) in the amount of caught pike-perch and herring; catch-out of pochard and sardelle decreased by half compared to the previous year. Based on the market price of these species, the assessment team estimated that income losses of the Kerch fish industry was in total approximately 14-16 million UAH (2.8-3.2 million USD). Furthermore, as the 270-300,000 UAH represents the income losses of coastal brigades, the PDNA derived that the income losses of larger fishing firms were in the region of 13.9-15.8 million UAH. With an assumed 30 percent profitability, the estimated loss of profit of large fishing firms with boats was estimated to range from 4.2-4.7 million UAH. It was difficult to assess the accurate number of the profitability ratio due to lack of data and the volatile energy prices since the beginning of 2008.

From this assessment, it was evident that the Kerch Strait fishery incurred significant losses from reduced profits caused by the fishing suspension, loss of jobs, and the disbandment of fishing firms. Table 4 presents the estimation of the gross lost revenue to fisheries under the current market prices. Based on the profitability ratio for different fishery types, the net profit loss is over 30 million UAH.

Table 4. Estimation of the losses to the fishery industry as a result of the Kerch Strait oil spill in November 2007 (as of August 2008)

	Ukrainian Hryvnas		US dollars	
FISHING	**min**	**max**	**min**	**max**
Damage to the boats and fishing gear	4,172,200	4,172,200	834,440	834,440
Foregone revenue of the mussel farms	150,000	180,000	30,000	36,000
Foregone revenue of the coastal brigades	270,000	300,000	54,000	60,000
Foregone revenue of the bigger fishing firms	13,883,614	15,810,269	2,776,723	3,162,054
TOTAL	**18,475,814**	**20,462,469**	**3,695,163**	**4,092,494**

Considering the actual year-end take on average doubled the six-month take (see Table 1), and based on the data from the catch-out in 2007, profit losses as a result of the continuation of the fishing suspension are predicted to increase further, easily reaching an additional 20-24 million UAH. According to the estimates of the Kerch merchant fleet and fishery trade union, 200-300 Kerch fishermen lost their jobs as a direct result of the fishing ban. In addition, 700-800 people from larger fishing firms were forced to change their occupation due to decreasing profits and stark increases in energy supply prices.

Although mussel farms currently do not play a significant role in the Kerch fishing industry, they will not have a stock base to work from for another two years due to damage caused to the reproductive capacity of mussels. Therefore, the damage figures forecasted[72] by this assessment of 150-180,000 UAH could potentially triple in the next two years, undermining a lucrative niche in the fishing industry. Outside the commercial seasonal fishing, the local year-round Kerch Strait fish species do not have commercial or consumption value, therefore they were not accounted for in this evaluation. This economic assessment also did not measure recreational fishing value. Despite the negative impacts of the fishing ban on the local Kerch fishing industries, the fishing ban is beneficial for the fish population. However, these benefits have not been observed due to the continuation of Russian fishing activities in the Kerch Strait. In summary, the Ukrainian fisheries already suffered losses amounting to over 20 million UAH. By the end of the year this could amount to losses of over 40 million UAH if the fishing ban continues for Ukrainian fisheries in the Kerch Strait.

Tourism

Tourism in the Kerch Strait is vulnerable to natural and technogenic disasters. The review of the impacts of the oil spill on Kerch tourism showed a limited perception among visitors of physical damage to the environment. However, it was revealed to the assessment team that informal information campaigns used by Kerch competitors drove tourists away from Kerch coasts. Therefore, the number of tourists reduced in comparison to the previous year; as a result the recreational sector (resorts, restaurants and accompanying activities) also incurred damages in the loss of profits. During the PDNA, it was still early to quantify the extent of profit loss in the recreational sector, as the tourist season was not yet finished. To counter this difficulty and to assist with the estimation of profit losses, the assessment team obtained data on registered tourists and undertook surveys at local resorts and hotels.

Analysis of the official tourist flow

In 2008 Kerch had twenty-eight resorts and six functioning business hotels.[73] The resorts collectively were able to accommodate 4,024 persons per day. The occupation rate varies in Kerch on a seasonal basis. Only two resorts are open throughout the year, with remaining resorts opening during April and May, with increasing number of places when the peak tourist season emerges from July to mid-August.

The total number Kerch tourists could be higher, as the tradition of staying with relatives or renting a room or apartment for a couple of weeks remains strong. Based on interviews with tourists, many of whom were Russian citizens, it was also reported that many own a holiday apartment in Kerch.

The first approach of assessing the losses of the tourism sector was based on the statistics of registered tourists – taken from weekly resort reports to the Mayor's office. Table 5 compares figures on working resorts, number of tourists, and the rate of occupancy in 2007 and 2008.

Table 5. Number of tourists in Kerch resorts in 2007 and 2008[74]

Date		Number of resorts operating		Number of places		Number of tourists		Occupancy rate		Difference between 2007-2008	
										Number of tourists	Occupancy rate
2008	2007	2008	2007	2008	2007	2008	2007	2008	2007		
10.07	12.07	16	19	2625	2602	1208	1550	46.02%	59.57%	-342	-13.55%
3.07	1.07	12	16	1967	2415	641	987	32.59%	40.87%	-346	-8.28%
26.06	18.06	9	13	1144	2073	358	719	31.29%	34.68%	-361	-3.39%
19.06	11.06	9	8	1248	1162	292	248	23.40%	21.34%	44	2.05%
5.06	7.06	2	3	370	256	40	117	10.81%	45.70%	-77	-34.89%
28.05	24.05	2	3	370	256	36	38	9.73%	14.84%	-2	-5.11%
17.04	30.04	2	1	370	50	36	39	9.73%	78.00%	-3	-68.27%
NA	4.10	NA	4	NA	531	NA	88	NA	16.57%		
NA	27.09	NA	4	NA	531	NA	152	NA	28.63%		
NA	20.09	NA	5	NA	626	NA	157	NA	25.08%		
NA	6.09	NA	28	NA	3984	NA	1293	NA	32.45%		
NA	30.08	NA	29	NA	4024	NA	982	NA	24.40%		
NA	22.08	NA	29	NA	4024	NA	2719	NA	67.57%		
NA	15.08	NA	29	NA	4024	NA	2565	NA	63.74%		
NA	9.08	NA	29	NA	4024	NA	2313	NA	57.48%		
NA	2.08	NA	29	NA	4024	NA	2527	NA	62.80%		
NA	25.07	NA	29	NA	4024	NA	2872	NA	71.37%		
NA	19.07	NA	29	NA	4024	NA	2481	NA	61.66%		

Records show that the total number of tourists that stayed in Kerch resorts in July 2008 was 1,767, which is less than half of the previous year's total (3,600 tourists were recorded in July 2007). Using this data and based on resort and pension surveys, the assessment team predicted that based on the total number of tourists in 2007 (26,969 people),[75] the recreational industry lost at least ten thousand tourists as a result of the oil spill.

Many resorts and pensions do not submit accurate statistics for tax avoidance purposes, as indicated from the resorts survey and informal interviews conducted with resort owners. For instance, in some resorts the actual occupancy rate in early July was as high as 70-80 percent, which is 10-20 percent higher than the reported figure of 59.57 percent for 10 July 2007. Incorporating this information increases the potential loss of tourists by a further 1,000-2,000 (see Table 5).

The survey used for the Travel Cost Methodology indicated that at least 37.7 percent of Kerch visitors (N=538) who stayed with relatives or friends did not pay any housing fees. Among the 62.3 percent who paid for accommodation, there were tourists who did not stay in resorts or sanatoriums but rented an apartment or a house. As the assessment did not specifically require a precise identification of where tourists stayed, this percentage remains unknown – it was however predicted that the percentage of people renting accommodation could not be less than 10-15 percent. In accordance with the latter information, it is assumed that resorts and pensions in Kerch host 50 percent of the tourists, while about 35 percent stay with relatives and friends and 15 percent (under a very modest assumption due to the lack of information) rent housing in Kerch. The above deduction allowed the assessment team to conclude that if the officially reported number of tourists in 2007 was approximately 29,969 people, then the overall number of tourists this year would be no less than 60-80,000. Following this assumption, 16-18,000 tourists were lost due to the oil spill. Table 6 provides a summary of these deductions.

Hotels, resorts and pensions survey

The PDNA surveyed a range of hotels, resorts, and pensions, to assess the economic damage to the tourist industry. The survey revealed that Kerch hotels (as opposed to resorts and pensions) are not vulnerable as their main clients are short-term business travelers; "hotels" were thus excluded from the economic assessment. Based on surveys and interviewee's responses, the assessment team learned that many tourists were hesitant to come to Kerch because they thought that the beaches and water were contaminated with oil. Tourists who did travel to Kerch had their expenditures fully or partially subsidized by an enterprise or other organization, following the tradition of soviet times.

All together 28 resorts and pensions were surveyed by the assessment team. From this group eighteen responded to the survey, two were undergoing renovation, two were closed because of the lack of tourists (500 places all together), and six did not wish to participate in the survey. Out of eighteen survey responders, three resorts (a private pension, an enterprise funded pension, and a charity funded resort) reported no loss of income. The remaining respondents indicated that about two hundred people had canceled reservations, and that occupation rates in 2008 had reduced from eighty to twenty percent, as compared to previous years. Ten companies reported losses which totaled in 2.4 million UAH (0.48 million USD), varying from 50-150,000 UAH per company. Through informal interviews, managers stated that the actual hidden taxation losses could be two to four times higher.

Table 6. Total number of tourists who stayed in Kerch resorts and pensions in 2007-2008

	2007	2008	Difference between 2007-2008
Tourists reported for six months	3,600	1,767	-1,833
Tourists reported for entire year	26,969	17,000*	-10,000*
Number of unreported tourists by the recreational organizations for entire year*	7,000	5,000	-(1,000-2,000)
Number of vacationers not staying in the resorts and pensions for entire year*	30,000	22,000	-12,000
Total estimated amount of Kerch tourists for entire year	**60,000-68,000**	**44,000-50,000**	**-(16,000-18,000)**

*Estimated numbers

Table 7. Economic costs associated with the oil spill in the Kerch Strait on 11 November 2007

	Ukrainian Hryvnas		US dollars	
DIRECT COSTS	**min**	**max**	**min**	**max**
Clean-up and transportation	3,000,000		600,000	
Waste processing first tranche, March	4,500,000		900,000	
Waste processing second tranche, July	3,600,000		720,000	
Waste processing, third tranche, expected	660,000	3,200,000	132,000	640,000
Biodiversity loss	13,500		2,700	
Monitoring and research	2,691,220		538,244	
Subtotal direct costs	**14,464,720**	**17,004,720**	**2,892,944**	**3,400,944**
INDIRECT COSTS				
Fisheries	**min**	**max**	**min**	**max**
Damage to the boats and fishing gear	4,172,200	4,172,200	834,440	834,440
Foregone income of the mussel farms	150,000	180,000	30,000	36,000
Foregone income of the coastal brigades	270,000	300,000	54,000	60,000
Foregone income of the bigger fishing firms	13,883,614	15,810,269	2,776,723	3,162,054
Subtotal fisheries	**18,475,814**	**20,462,469**	**3,695,163**	**4,092,494**
Tourism foregone income				
Housing foregone income	18,372,310	20,668,851	3,674,462	4,133,770
Accompanying businesses	75,420,000	84,847,500	15,084,000	16,969,500
Subtotal tourism	**93,792,310**	**105,516,351**	**18,758,462**	**21,103,270**
Subtotal indirect costs	**112,268,124**	**125,978,820**	**22,453,625**	**25,195,764**
TOTAL ECONOMIC COSTS	**126,732,844**	**142,983,540**	**25,346,569**	**28,596,708**

Note: Exchange rate used in the study is 1USD=5UAH provides a convenient conversion and is relatively accurate, as the official exchange rate of the National Bank of Ukraine in May 2008 was 5.05UAH=1USD and in August 2008 is 4.84UAH=1USD.

Tourists swimming on the shoreline of the Kerch Strait near Kerch, at little distance from tanker traffic

Table 8. Share of different economic losses associated with the oil spill in the Kerch Strait (in %)

	Minimum estimates	Maximum estimates
Clean-up and processing	11.41	11.89
Fisheries	14.58	14.31
Tourism	74.01	73.80
Total	**100.00**	**100.00**

The summary of all direct and indirect losses is reported in table 7, in UAH and USD.

The PDNA team concluded that major costs incurred to the Ukrainian economy from the Kerch Strait oil spill were not from the actual clean-up costs. The largest impact of the oil spill was on the Kerch fisheries and the tourism industry.

Summary of findings – Limitations and constraints

Table 7 presents the summary of the economic assessment of the damages caused by the oil spill in the Kerch Strait. The total costs calculated by the PDNA team vary from 25.5 to 28.6 million USD. This is based on incurred costs and lost revenue estimates to date. This damage estimate does not cover costs such as the economic value of a clean beach, the future impact on tourism, or the cost of possible future actions, such as digging out the contaminated sediments around the wreckages. Therefore, this estimate should be considered as the lower limit of the economic loss to Ukraine and not a comprehensive estimate of the overall present and future economic damages caused by the oil spill. The PDNA report therefore does not question the estimate presented by the Government of Ukraine, which used a statutory approach based on applicable regulations to reach a higher figure.

Consolidated Needs Assessment and Recommendations

The PDNA team concluded that there was a need for more coordinated marine oil spill contingency planning and response in Ukraine. This need can only be reemphasized knowing the ongoing developments of new oil-drilling stations in the Kerch Strait.[76] Efforts should be targeted at strengthening the Ministry of Environmental Protection (MEP), and through this, at mainstreaming environmental issues into the work of other institutions – public, private, and academic. In addition, consolidating the capacities of regional and local authorities in oil spill response and environmental management from emergencies should be urgently considered.

There are a number of critical areas for strengthening Ukrainian institutions to develop improved systems of contingency planning and response in line with accepted best practice in developed countries. These issues have been well documented in assessments undertaken in the past by others (SIGMA, OECD, and UNECE reports). There are also a number of issues that are specific to the planning and response for oil spills in the marine environment that have become apparent as a result of the event in November of 2007.

The following recommendations were developed with specific reference to the needs identified during this EC-UNEP PDNA assessment mission, with a view to improve environmental management practices. These recommendations are targeted at the main national and regional institutions examined in this assessment, namely, the Ministry of Environmental Protection, the Ministry of Emergencies, the Ministry of Transport and Communications, and the Oblast/ARC counterpart institutions. There is also a need for other ministries to become involved in specific areas of support (for instance the Ministry of Foreign Affairs, for international conventions, or the Ministry of Economy and Ministry of Finance for funding and compensation issues). Other institutions such as universities, scientific institutions, and the private sector could also play a role in the implementation of contingency plans.

The main needs identified in the course of the PDNA were:

Meeting at the Ministry of Environmental Protection of Ukraine marking the end of the UNEP-EC assessment mission

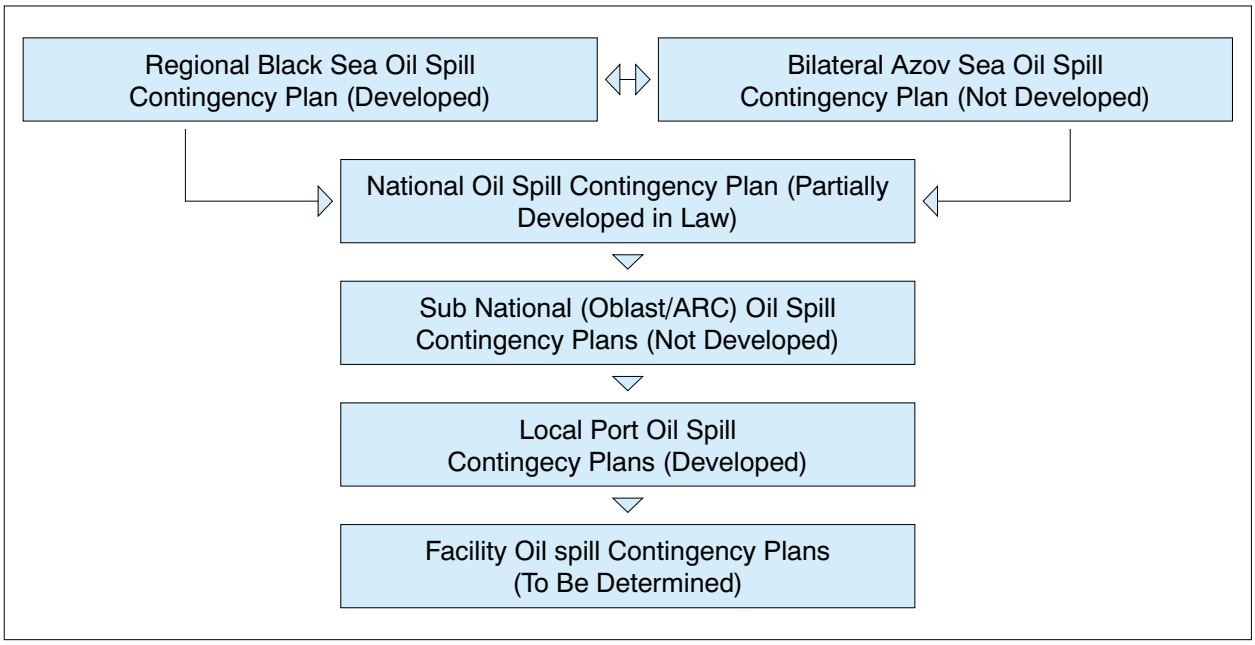
1. ***Volgoneft-139* shoreline contamination** – Oil and oiled contaminated shoreline material should be removed to minimize the risk of contamination to human well-being and wildlife. There is also a risk that oil contaminated material may be transported by waves and currents and contaminate new areas. In most areas, contaminated shoreline material can be easily removed using shovels and without harm to the vegetation. Personnel involved in clean-up operations may require guidance on the safe removal of oil from vegetated areas.

2. ***Volgoneft-139* contaminated seabed sediments** – Particularly high levels of PAH were found in the sediment near the *Volgoneft-139* shipwreck. The PAH levels indicate that large quantities of oil have settled and contaminated the seabed. It is recommended that another survey be undertaken, after the remaining parts of *Volgoneft-139* have been salvaged. The results of such a survey would determine the extent of contamination and remedial measures (such as dredging of contaminated sediments) that should be taken.

3. **Policy development** – There is a need to address the technical policy gaps that currently exist in Ukrainian institutions, in order to clarify and consolidate the role of relevant key institutions in responding to oil spills emergencies. Policy and planning activities should aim at strengthening the role of the Ministry of Environmental Protection (MEP), while improving the environmental response of other relevant institutions such as the Ministry of Emergencies, and the Ministry of Transport and Communications. A system of contingency planning policy is presented in Figure 1.

4. **Contingency plans** – In accordance with best practice models (IMO, IPIECA or ITOPF),[77] an international support network should be developed to assist in the development of the coordinated contingency planning process. International support for elaborating these plans would be welcome. National and regional plans should develop a system of response, with a definition for each Tier (type) of oil spill emergency, and with clear roles and responsibilities for each level and institution of the Government. The plans should prescribe emergency activities each partner is responsible for; the actions should be clearly identified, and formalized in MoUs in agreement with all involved parties. Local civil society and communities should be consulted in this process through nominated representatives. These improvements should be linked to the consolidation of the role of the "on-site" oil spill commander; this would require appropriate efforts for training of relevant ministry personnel. A funding mechanism to cover the cost of

Figure 1. An example of a suitable hierarchy of oil spill contingency planning



the planned activities should be identified in advance and should be readily available for a rapid emergency response situation. The European Union model of preparedness and response can serve as useful guidance.[78] It is also necessary to undertake an assessment of the operational costs (personnel, equipment, location) of establishing a centre for Tier 3 oil spills in Ukraine.

5. **International instruments** – In coordination with improving oil spill preparedness and response, Ukraine should consider ratifying the OPRC and associated protocols. Capacity support should be provided through external technical assistance (such as EC, UNEP, IMO) to assist relevant institutions to ensure all requirements are fulfilled. Ukraine's eligibility for compensation by the International Oil Pollution Compensation Fund, and the relevancy for Ukraine to become party to the 1992 Fund Convention, should be further clarified.

6. **Specific technical guidelines** – Relevant authorities should develop policy and planning guidelines for:

   - Management of waste – testing, treatment, and decision support for disposal (Ministry of Environmental Protection);
   - Assessment, monitoring, sampling, identification of oil spills and creation of the procedures for emergency monitoring, with clear description of responsibilities (Ministry of Environmental Protection and relevant scientific institutions);
   - Monitoring and assessment of environmental consequences including risk assessments, primarily through the completion of an Environmental Sensitivity Map covering the entire coastline of Ukraine (Ministry of Environmental Protection and Ministry of Emergencies);
   - Evaluation of costs of the economic losses and environmental losses resulting from oil spills (Ministry of Environmental Protection);
   - National inventory on transport of hazardous goods and materials in the territorial areas of Ukraine (Ministry of Environmental Protection and Ministry of Transport);
   - Review and assessment of best practice for facility/port contingency plans, including revision and strengthening of the EIA system, and specifically regarding the development of new oil exploration facilities (Ministry of Environmental Protection and Ministry of Emergencies); and
   - Fisheries management and health impacts, including for the measurement of environmental, health and economic impacts and losses (Ministry of Health and Ministry of Agrarian Policy).

7. **Training** – Planning should include a strong commitment to training for oil spill response personnel, including IMO level 1, 2, and 3 courses. Training on specific needs, such as response to impacts on wildlife, should also be considered. Training programmes should also involve representatives from local communities that may be solicited in the implementation of contingency plans.

8. **Funding** – A clear strategy for the funding of emergency responses should be developed, to ensure that both regional and national institutions (including scientific centres) can have immediate access to these funds for activities required to implement contingency plans.

9. **Information management** – As part of the institutional strengthening process, there is a need to provide relevant levels of support to the MEP and research institutes (such as UkrSCES and NASU) to develop a sound system of information gathering, management, and application in response activities for environmental emergencies. This includes: access to satellite data, coastal sensitivity maps, suitable computing equipment[79], and communications equipment to rapidly communicate information to administrators and decision-makers, including "on-site" commanders. Pilot models should be developed, in the first instance, for disaster-prone areas.

10. **Coastal sensitivity mapping** – Existing coastal sensitivity maps should be extended to cover the entire Crimean peninsula including the Azov Sea coasts, and beyond all coasts of

Ukraine including the critical zones of Odessa and of the Danube Delta. These maps should be more detailed (scale up to 1:25000) for zones at high risks of pollution. Furthermore, an environmental study of the coastal wildlife should be undertaken to improve the quality of information for sensitivity mapping, accompanied by a comprehensive study of all oil spill response resources available.

11. **Environmental monitoring** – An improved system of permanent and emergency environmental monitoring should be developed to an appropriate standard. This process should be supported with adequate laboratory equipment, training, and funding for the MEP and scientific centres.

12. **Waste disposal strategy** – A waste strategy needs to be developed that identifies facilities or locations that can deal with an influx of waste generated from environmental emergencies. This strategy could also include recommended cleaning technologies depending on circumstances. This strategy should be made widely available to support decision-makers on waste management issues.

The necessity for additional oil spill response resources is subject to further evaluation and assessment of capacity for implementation of dedicated contingency plans. Ukraine does not currently have sufficient internal resources available to develop and implement a robust contingency plan. Assistance from bilateral and multilateral donors in this area will not only assist Ukraine to improve environmental management within its territorial waters, but could also have positive implications in a broader regional context.

While this PDNA has focused on the needs of Ukraine to improve oil spill preparedness and response, the recommendations contained within this report are relevant to a wider range of potential natural and man-made environmental emergencies with which Ukraine may be subjected.

Matrix – Synthesis of Recommendations

Recommendation	Implementing agency	Timeline as of November 2008
Recovery from Kerch Strait oil spill		
1. Clean-up of *Volgoneft-139*'s shoreline contamination	MoEmergencies in cooperation with MEP (Ministry of Environmental Protection)	1 year
2. Assessment and clean-up of *Volgoneft-139*'s contaminated seabed sediments	MEP	After salvation of remaining part of Volgoneft-139 at sea
Contingency plans and disaster risk reduction		
3. Develop contingency plans at all relevant levels and in accordance with best practice models.	MEP, MoEmergencies, Oblast, ARC, and MoForeign Affairs (for the Azov Sea bilateral Russia-Ukraine dimension)	5 years
4. Undertake a study on the means for Ukraine to become eligible for compensation by the International Oil Pollution Compensation Fund, and on the relevancy for Ukraine to become party to the 1992 Fund Convention.	MoForeign Affairs in cooperation with MEP and MoTransport	1 year
5. Develop a waste management strategy that identifies facilities, locations and technologies to deal with an influx of waste generated from an environmental emergency.	MEP	1 year
6. Establish a plan for contamination monitoring to assess, monitor, sample, and analyze oil spills and their environmental consequences (IMO standards can be used as benchmarks).	MEP and relevant scientific institutions	1 year
7. Set up guidelines for the evaluation of costs and economic losses resulting from oil spills, including environmental losses, to be better prepared for compensation procedures.	MEP	3 years
8. Undertake a national inventory on transport of hazardous goods and materials in the territorial waters of Ukraine.	MEP and MoTransport	2 years
9. Develop technical guidelines for improved management of fisheries and health impacts in emergency situations.	MoHealth and Ministry of Agrarian Policy	2 years
10. Organize training for oil spill response staff and local communities' representatives, including IMO level 1, 2, and 3 courses.	MEP and MoEmergencies	2 years
11. Establish a clear strategy for funding of emergency responses, to ensure that both regional and national institutions (including scientific centres) can have immediate access to these funds for activities required to implement contingency plans.	MEP and MoEmergencies	1 year
12. Develop a sound system of information gathering, sharing, management, and application in the response activities to environmental emergencies.	MEP & MoEmergencies & relevant scientific institutions	1 year
13. Improve coastal sensitivity mapping of Ukrainian coasts, regarding the extent, level of details, coastal wildlife, etc.	MEP & relevant scientific institutions	3 years
14. Strengthen the system of permanent and emergency environmental monitoring, based on appropriate standards, equipment, training and funding for mandated scientific institutions.	MEP	3 years

Appendix 1: List of acronyms, abbreviations and units

ARC	Autonomous Republic of Crimea
BOD	Biological oxygen demand
BSS	Black Sea Synergy Programme
CORAT	Compound ratio
CVM	Contingent valuation method
dw	Dry weight
EC CCPM	European Commission Community Civil Protection Mechanism
EC RELEX	European Commission External Relations Directorate General
EC MIC	European Commission Monitoring and Information Centre
EIA	Environmental impact assessment
ENVSEC	Environment and Security Initiative
EPA	Environmental Protection Agency
EPH	Extractable petroleum hydrocarbons
ES	Emergency situation
ESI	Environmental sensitivity index
GIS	Geographic information system
GPS	Global positioning system
IFO	Intermediate fuel oil
IMO	International Maritime Organization
ITOPF	International Tanker Owners Pollution Federation
IPIECA	International Petroleum Industry Environmental Conservation Association
LBS	Land-based sources of pollution
MAC	Maximum allowable concentrations
MARPOL	International Convention for the Prevention of Pollution from Ships
MEP	Ministry of Environmental Protection of Ukraine
mg/kg	Milligrammes per kilogramme
MoEmergencies	Ministry of Emergencies and Affairs of population protection from the consequences of the Chernobyl Catastrophe, Kiev
MoFA	Ministry of Foreign Affairs of Ukraine
MoT	Ministry of Transport and Communications of Ukraine
NASU	National Academy of Sciences of Ukraine
NAO	North-Atlantic oscillation
NGO	Non-governmental organization
NRC	National Research Council, USA
OCHA	UN Office for the Coordination of Humanitarian Affairs
OECD	Organization for Economic Cooperation and Development
OPRC	Oil pollution preparedness, response and cooperation
OSCE	Organization for Security and Cooperation in Europe
PAH	Polycyclic aromatics hydrocarbons
PDNA	Post-disaster needs assessment
SARA	Saturated aromatic resins and asphaltenes
SEA	Strategic environmental assessment
SIGMA	Support for Improvement in Governance and Management
TCM	Travel cost method
UAH	Hryvnas (Ukraine's currency)
μg/g	Microgrammes per kilogramme
UkrSESC	Ukrainian Scientific Centre of Ecology of the Sea
UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNEP-GRID	UNEP Global Resource Information Database

Appendix 2: List of references

1 Community Civil Protection European Commission Report, *Ukraine – Oil Spill in Kerch Strait Black Sea, November 2007*, p.6

2 The Monitoring and Information Centre of the EC facilitates the mobilization and coordination of EU civil protection assistance in response to major disasters. It is the operational centre of the Community Civil Protection Mechanism through which resources from EU Member States are mobilised to provide immediate assistance in responding to major emergencies.

3 Community Civil Protection European Commission Report, *Ukraine – Oil Spill in Kerch Strait Black Sea, November 2007*, p.7

4 EC press release, *Oil Pollution in the Black Sea*, 14 December 2008. Ukraine receives report of EU assessment team see: http://www.delukr.ec.europa.eu/press_releases.html.id=45521

5 For further information see Resolution P6_ta,2007,0625 of the European Parliament

6 The Fishery Committee issued Order #320, 25 December 2007- temporarily suspending fishing in the Kerch Strait, as the cause of three quarters of the estimated damage to the industry.

7 See http://encylopedia.farlex.com/, The Hutchinson Encyclopaedia, 1997

8 Taurida National V.I. Vernadsky University, Crimean Scientific Centre of the National Academy of Sciences of Ukraine, Ministry of Education & Science of Ukraine and Institute of Advanced Technologies, *The Autonomous Republic of Crimea Atlas, Kyiv-Simferopol*, 2004

9 *Events Magazine*, Edition 41, 26 October 2007.

10 UNEP - Global Resource Information Database

11 UNIGE - GRID - CLIMATE Switzerland; ARXIT Switzerland; AZBOS Ukraine; BOKU Austria; BSREC Bulgaria; CCSS Czech Republic; CERN Switzerland (Int.); CRS4 Italy; DDNI Romania; DHMO Ukraine; EAWAG Switzerland; Geographic Georgia; IBSS Ukraine; IGAR Romania; IHE The Netherlands (UN); IISD Switzerland & Canada; ITU Turkey; NIHWM Romania; ONU Ukraine; SPBSU Russian Federation; TNU Ukraine; UAB Spain; UNU-IIST China / Japan (UN); USRIEP Ukraine; UTCN Romania; VITUKI Hungary; SORESMA Belgium

12 See http://ec.europa.eu/external_relations/blacksea/index_en.htm for further information.

13 Parliamentary Assembly of the Council of Europe, Committee on the Environment, Agriculture and Local Regional Affairs, *The Fight against harm to the en*vironment in the Black Sea, Doc. 11632, 13 June 2008. See: http://assembley.coe.int/Main.asp?link=/Documents/WorkingDocs/Doc8/EDOC11632.htm

14 Member states of the Council of Europe are: Albania, Andorra, Armenia, Austria, Azerbaijan, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Italy, Latvia, Liechtenstein, Luxembourg, Malta, Moldova, Monaco, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Russian Federation, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, The former Republic of Macedonia, Ukraine, and the United Kingdom.

15 The Parliamentary Assembly of the Council of Europe, Recommendation 1837, Fight Against harm to the environment in the Black Sea, 13 June 2008.
See: http://assembly.coe.int/Main.asp?link=/Documents/AdoptedText/ta08/EREC1837.htm

16 The term "*ground-truthing*" for the purposes of this PDNA refers to fieldwork conducted on the assessment mission to verify data provided on existing environmental sensitivity maps.

17 Community Civil Protection European Commission Report, *Ukraine – Oil Spill in Kerch Strait Black Sea, November 2007*, p.7

18 Ibid. p.7

19 See : http://greenpeace.org/international/news/kerch-oil-spill. This figure was also stated in a statement from the Russian Governor of the Krasnodar region on 13 November 2007. (See BBC website www.bbc.com for further information.)

20 A "Finger print" analysis also known as "whole oil pattern recognition" is a direct injection of gas chromatography with mass spectrum analysis, where the chromatogram is compared to chromatograms of reference materials.

21 This method is in accordance with to the " Determination of EPH", Massachusetts Department of Environmental Protection, 1998.

22 Hydrocarbons such as Benzo(a)pyrene, Chysene, Fluoranthrene, Phenanthrene and Naphthalene also belong to this group.

23 Volkman. J.K., *Biodegradation of aromatic hydrocarbons in crude oil from the Barrow sub-basin of Western Australia, Organic Chemistry 6 -,No 8, 619-632*.

24 CORAT refers to a compound ratio

25 Two Landsat images: the northern part was acquired on the 23rd of May 2007; the southern part was acquired on the 25th of September 2006

26 European Commission, *Institutional and Capacity Assessment, Why, what and how, 2005*

27 Law of Ukraine, *Emergency Ecological situation zone; 1908-111, 13 July 2007*

28 Law of Ukraine, *Protection of Population and territories from man-made and natural disasters; 1809-111, 8 June 2000*

29 Decree 843, *Approval of General Regulations for a Special Governmental Commission for Elimination of Regional, Local and Site Level Emergencies of the Man-Made and Natural Character, 14 June 2002*

30 Three "Special Commissions" were established under Decree 843. For the purposes of the EC-UNEP PDNA, The Special Commission, specifically set up by the Government of Ukraine for oil spill disasters, is the commission that has been the subject of discussion

31 Decree 1567, *Approval of National Level Emergency Response Plan,16 November 2001*

32 Decree 1201, *Approval of Regulation for the Headquarters for Elimination of Man-Made and Natural Emergencies, 19 August 2002*

33 Decree 1567, *Approval of National Level Emergency Response Plan, Government of Ukraine, 16 November 2001.* Specifically Attachment 1 to this Law provides guidance for the type of emergency that may occur and which Ministries should be involved.

34 European Commission, *Institutional Assessment and capacity development, What, why and how?*, p.12

35 See http://www.kmu.gov.ua/control/en/ for more information.

36 International Tanker Owners Pollution Federation, *A Summary of the Risk of Oil Spills and the State of Preparedness in UNEP Regional Sea Regions, 2003*

37 United Nations Economic Commission for Europe, *Environmental Performance Reviews – Ukraine Second Review, 2007*

38 United *Nations Economic Commission for Europe, Environmental Performance Reviews – Ukraine Second Review, 2007*, p.136

39 See website of the Black Sea Commission for detail http://www.blacksea-commission.org/

40 After the Kerch Strait oil spill the Cabinet of Ministers issued *Instruction No 496r, 19 March 2008*, for the Ministry of Foreign Affairs to prepare a proposal for the Ukrainian delegation of the Russian-Ukrainian bilateral working group on the mitigation of the consequences of the accident.

41 *Environment Committee of the Autonomous Republic of Crimea (ARC) report, p.4-5*

42 Ibid.

43 Ibid.

44 Kolomiitsev. Y., Certificate about the state of the Court cases in the Russian Federation with regards to the oil spill response in the Kerch Strait, p.1-2 and, Environmental Committee of the ARC report.

45 Extract from Environment Committee of the Autonomous Republic of Crimea (ARC) report, (p. 3-4)

46 International Tanker Owners Pollution Federation, *A Summary of the risk of oil spills and the state of preparedness in UNEP Regional sea regions, 2003*

47 Chevron Texaco, 2002, *Developments in the Black Sea from an industry perspective*, Presentation to the Bilgi University.

48 Community Civil Protection European Commission Report, *Ukraine – Oil Spill in Kerch Strait Black Sea, November 2007*, p.6

49 Minutes from the Bilateral Working Group between Ukraine and the Russian Federation

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66 Information provided by the State Committee on Environmental Protection of Crimea.

67 See EcoCenter website http://www.ecocenter.com.ua/~k4/

68 According to Mr. Boris Veishtort, Head of the Kerch Merchant Fleet and Fishery Trade Union and with reference to the Ministry of Agrarian policy of the ARC.

69 A fishing quota (or allowable catch) is a fixed proportion of the total allowable catch allocated to each fishing company/organization. It varies for each species and is fixed annually by the Ministry of Environmental Protection, according to the recommendations of the State Committee on Fishery based on the scientific research on August 1. (Order #53/69 of the Ministry of Environmental Protection of 06.06.1995 *On approving the Instructions on the order of setting and distributing the limits of the use of the living objects of the fishery of the state importance and issuing the permits on their special use*).

70 Original data are provided by the Crimean Azov-Black Sea State watershed administration for the protection, use and reproduction of the water living resources and fishery regulation.(*Кримське Азово-Чорноморське державне басейнове управління охорони, використання і відтворення водних живих ресурсів та регулювання рибальства.* http://www.dkrg.gov.ua/index.php?lang_id=2&content_id=221).

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72 This information was provided during a consultation with Mr. Boris Veishtort, Head of the Kerch Merchant Fleet and Fishery Trade Union

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Appendix 4: Institutions consulted during the institutional assessment mission

- Ministry of Emergencies and Affairs of population protection from the consequences of the Chernobyl Catastrophe, Kiev
- Ministry of Transport and Communications, Kiev
- Ministry of Environmental Protection (MEP), Kiev
- University of Kyiv – Mohyla Academy
- Odessa MEP Environmental Inspectorate
- Ukrainian Scientific Centre for Ecology of the Sea (UkrSCES), Odessa
- Crimean Committee of Environmental Protection, Simferopol
- Centre of Technologies for Sustainable Development, University Tavricheskii, Simferopol
- NGO Crimean Scientific Academy & NGO Ecology and Peace, Simferopol
- Marine Hydrophysical Institute of National Academy of Sciences of Ukraine in Sebastopol (MHI)
- Kerch Trade Port
- State Committee for Fisheries, Fisheries Institute in Kerch
- Kerch Branch of MEP Azov and Black Sea Environmental Inspectorate
- MoEmergencies Marine Coordination Emergency and Rescue Centre of Kerch
- UNDP Office in Kiev
- European Commission Delegation in Kiev

Appendix 5: Geo-reference of visited and sampled sites

Report Id	Latitude	Longitude	Place Name	Description	Sample Taken	Depth
2	45.301639	36.459639	Pensionate Proliv	Sandstone rocks. Exposed. Stains of oil on rocks. One pocket of oil.	Yes	0
3	45.272528	36.436750	Arshyncova Spit	Beach on and around the spit of Koca. Lots of sun bathers. Found one patch of degraded oil mixed with seagrass.	Yes	0
4	45.287222	35.509833		Fairly sheltered tourist beach. No oil but a lot of garbage.	No	0
5	45.331917	35.410889		Sandy beach. Lots of shells. No oil.	No	0
6	45.294250	35.480944		Garbage heap and dump site for bags with oil-polluted seagrass.	Yes	0
7	45.450417	35.845917		Rocky Shore. Small stains of oil on the rocks and lumps of seaweed and oil.	No	0
8	45.450987	35.849210		Rocky stony shore. Very few lumps of oil and seaweed and stains of oil. According to people living close to the site, no oil came here.	Yes	0
9	45.452500	36.393056		Sandy beach. Fairly sheltered. Some lumps of oil and seaweed. People living close by said no oil came here.	Yes	0
10	45.296778	36.435056		Narrow beach. Coastal wall behind. No oil on the beach. Dump site behind wall with bags of oil and seaweed. People who frequently bathe here say even now they often get oil stains after bathing.	Yes	0
11	45.178722	36.405639		Thin strip of land between lake and sea. Sand and rocks. People bathing. Some oil stains on rocks. Some lumps of oil and seaweed. People living close by say tankers often cause smaller oil spills. One bigger spill a month ago.	Yes	0
13	45.134694	36.422028		Bay. Sandy Beach. Bathing people. Some lumps of oil and seaweed. Even more under a 5 cm layer of sand and shells.	Yes	0
14	45.351778	36.515833	Cape Karantinny	Seagrass beds, dominated by Zostera maritima. Low visibility. Five cm layer of organic material. Sediment and bivalve sample taken.	Yesx2	3
15	45.300056	36.463139	Pensionate Proliv	Visibility 1 m. No Seagrass.	Yes	5
16	45.211222	36.529528	The Wreck	Water sample with oil. Oil film covering the surface, dotted with black droplets.	Yes	0
17	45.211222	36.529528	The Wreck	Low visibility. No Seagrass.	Yes	8
18	45.253472	36.555889	Southwest of Tuzla	Depth 2 m. Visibility 7 m. Some seagrass.	Yes	2
19	45.256750	36.557194	Southwest of Tuzla (Land)	Clear black layer of “fresh” oil under 20 cm of sediment/ shells in the waterfront (sample). Also big lumps of degraded oil above the maximum sea level - probably since the storm.	Yes	0
20	45.261222	36.545667	West of Tuzla	Visibility 7 m. Some seagrass.	Yes	3
21	45.264444	36.548611	Northwest of Tuzla (land)	Big lumps of degraded oil above the maximum sea level – probably since the storm.	Yes	0
22	45.283778	36.528944	North of Tuzla(Land)	Lots of lumps of oil, some very big, above the maximum sea level and spread over the entire northern tip in a haphazardous way. The “cleaning” was obviously poorly done.	No	0
23	45.262417	36.435278	The Strip	1-2 m depth sandy beach (bathers). No Seagrass. Snorkeled from beach.	Yes	2
24	45.180278	36.405472		1-2 m depth sandy beach and some rocks (bathers). No Seagrass. Snorkeled from beach.	Yes	2
25	45.135472	36.421111	Fishing bay	1-2 m depth sandy beach (bathers and fishers). No Seagrass. Snorkeled from beach.	Yes	2
12	45.481779	36.343801		Sandy beach. The beach was cleaned on a regular basis by the owner of an orphanage. Still, small lumps of oil and seaweed were found.	No	0

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