

### OIL POLLUTION OF THE BLACK SEA

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**Abstract.** *Article is devoted to meaningfulness estimation of some factors in forming ecological conditions in regions of the Black Sea. Comparative estimation of anthropogenic contamination degree of sea regions environment considered. The zones the most unhappy in ecological attitude are defined, that allows to mark first and foremost arrangements on improvement of ecological situation of the Black Sea.*

**Keywords:** convention, ecosystem health, oil pollution, protection, prevention, the Black Sea.

#### Introduction

The Black Sea coastline of Ukraine extends from the Danube Delta in the west to the Kerch in the east. It has a length of 1,802 km.

The coastal zone is made up of four major landscape types. These can be summarized as the northern steppe sub-zone, middle steppe sub-zone (e.g. Dnister lowland, Dnipro-Molochanski lowland), arid steppe sub-zone and the country of mountainous Crimea. Ninety-eight percent of the territory of Ukraine is located within the Black Sea basin, comprising major river basins: the Dnipro, Dnister, Southern Bug, Siversky Donets and the Danube. Wetlands are an important feature of the Ukrainian Black Sea basin, where the ten most significant wetland areas cover an area of 760 000 ha.

In the Black Sea coastal zone of Ukraine there are six administrative units: Odessa, Mykolayiv, Kherson, Zaporizhia, Donetsk regions and the Autonomous Republic of Crimea (ARC). Three of the administrative units, which make up the Crimea do not border the Black Sea but have close access to it.

The description of pollution examines the relation between types and levels of activities and flows of pollutants.

The main source of effluent into the Black Sea, both in municipal and industrial wastewater discharges are the Odessa and the Crimea regions. Oil pollution is declining. Pollution from military sources and marine dumping is also recorded.

Finally, a substantial source of Black Sea pollution is the input (treated as point sources) from the major rivers passing through Ukraine, in which concentrations of oil products, ammonium, nitrogen, nitrates and phenols have been discharged and monitored for the past two decades.

#### Oil pollution

Black tar-like oil is sometimes washed onto beaches not only causing a nuisance to holidaymakers but also killing many sea-birds. The oil mainly comes from tankers which wash out their holds while out at sea to save time in port. Enforcement of laws concerning the dumping of oil is difficult and responsibility rests with the captain of each tanker to obey the law. Once oil is in the sea and the tanker has sailed on, it is difficult to prove that an offence has been committed and unless the culprit can be identified the cost of clearing up is the responsibility of the local council. If you find that oil has been washed ashore report it at once to your local council who will arrange for the beach to be cleaned up.

Local volunteers can also begin the task of trying to save the lives of sea-birds contaminated with oil.

#### Pollution from the Marine Transport

The United State National Science Foundation has found that only 2 per cent of hydrocarbon pollution finding its way into the sea each year comes from tanker accidents. Eleven per cent comes from natural sources - tar sands and oil seeps, 13 per

cent comes from the atmosphere, 24 per cent from all forms of transport, and an astounding 50 per cent comes down drains and rivers to the sea from cities and industries. Anyone who has tipped old engine oil down the drain, or 'buried' it in the soil instead of taking it to a recycling point is responsible for some oil pollution at sea.

Significant oil pollution is caused by tankers illegally cleaning their tanks while out at sea and dumping the dirty water overboard. 72 per cent of oil pollution caused by shipping is estimated to be deliberate and illegal. Only 28 per cent is caused by tanker accidents. There is obviously a need for better monitoring of ships at sea by all countries, and the owners of ships illegally cleaning their tanks at sea should be prosecuted. Over 100 000 t of oil is dumped in the Black Sea by ships.

Ships can pollute waterways in many ways. Oil spills can have devastating effects. While being toxic to marine life, polycyclic aromatic hydrocarbons, the components in crude oil, are very difficult to clean up, and last for years in the sediment and marine environment. Discharge of cargo residues from bulk carriers can pollute ports and waterways.

High concentrations of priority pollutants stemming from marine transport sectors occur near big industrial centers, in river estuaries and in other coastal zone areas exposed to permanent pollution.

The main pollutants in Black Sea coastal waters are oil products. Their concentration on the surface varies from 0,05 to 0,78 mg/L (1 to 13 MACs). Much of this oil has been released from enterprises within the marine transport sectors.

The most polluted areas are those located near Odessa: Illychivsk, Sevastopol and other coastal cities. The concentration of oil products in Sevastopol Bay is 5MACs and sometimes exceeds 100 MACs.

At present there is a trend towards decreased oil pollution in all coastal regions. For example, in the Odessa region, the mean concentration fell from 10 MACs in 1989 to 1 MAC in 1993. This trend is connected with the general decreased level of industrial activities in Ukraine. Nevertheless the accumulation of oil products in bottom sediments persists, reaching levels as high as 13 g/kg.

There are more than 30 marine transport enterprises in the coastal zone of Ukraine which influence the ecological condition of the marine environment and air in the basin. They include ports,

both major ones, e.g. Odessa, Pivdenna, Illichivsk, Ust-Dunaisk, Yalta, Kerch and Izmail, as well as smaller ones, e.g. Kiliya, Bilgorod-Dnistrovsky, Ochakiv, Mykolayiv, Kherson, Skadovsk, Yevpatoriya, Sevastopol, Feodosiya, Vylkovo, Bugaz, Oktiabrsk, Khorly.

### **Other Sources of Oil Pollution**

For many years pollution of the Black Sea from defense activities and the Black Sea Fleet was a state secret. The true impact of military activities on the marine environment has only been revealed during the last 5–6 years. Major environmental problems related to military activities resulted from oil pollution from the Black Sea fleet facilities (Sevastopol, Bakaklava, Kerch, Mykolayiv, Kherson); shipwrecks and intentional ship sinking in war time (all big ports of the Black Sea); inkerman navy base, which has been a polluter of the marine environment for 50 years; pollution from war exercises.

By expert estimation, pollution of the Black Sea from military activities consists of 7000 m<sup>3</sup> of polluted wastewater and 10 t of oil products a day.

Sevastopol Bay is the most polluted in the coastal zone. In 1998–1999, oil pollution levels caused by military activity frequently exceeded the relevant MAC by several hundred times and in some places by 2000 times.

### **Deep sea mining**

Deep sea mining is a relatively new mineral retrieval process that takes place on the ocean floor. Deep sea mining usually around large areas of polymetallic nodules or active and extinct hydrothermal vents at about 1400–3700 m below the ocean's surface. The vents create sulfide deposits, which contain precious metals such as silver, gold, copper, manganese, cobalt, and zinc. The deposits are mined using either hydraulic pumps or bucket systems that take ore to the surface to be processed.

As with all mining operations, deep sea mining raises questions about environmental damages to the surrounding areas. Because deep sea mining is a relatively new field, the complete consequences of full scale mining operations are unknown.

However, experts are certain that removal of parts of the sea floor will result in disturbances to the benthic layer, increased toxicity of the water

column and sediment plumes from tailings. Removing parts of the sea floor disturbs the habitat of benthic organisms, possibly, depending on the type of mining and location, causing permanent disturbances.

Aside from direct impact of mining the area, leakage, spills and corrosion would alter the mining area's chemical makeup. Among the impacts of deep sea mining, sediment plumes could have the greatest impact. Plumes are caused when the tailings from mining (usually fine particles) are dumped back into the ocean, creating a cloud of particles floating in the water. Two types of plumes occur: near bottom plumes and surface plumes. Near bottom plumes occur when the tailings are pumped back down to the mining site. The floating particles increase the turbidity, or cloudiness, of the water, clogging filter-feeding apparatuses used by benthic organisms. Surface plumes cause a more serious problem.

Depending on the size of the particles and water currents the plumes could spread over vast areas. The plumes could impact zooplankton and light penetration, in turn affecting the food web. In 1999, enterprises from the energy sector, including coal mining, released an estimated 51 % of total marine pollutants in Ukraine. Since 2009, coal use for heating has increased in Ukraine. At the same time very few investments have been made in fuel energy industries. Investments in gas treatment facilities in this industry were minor.

### **Effects of marine pollution**

Crude oil from tanker accidents and offshore drilling is most likely to cause problems that are immediately obvious. Most people have seen the images of oil-coated animals and the large oil slicks surrounding the tankers after an accident in Kerch Gulf in 2007. The oil will spread over large areas often continuing to cause harm for many years.

When quantities of surface oil are sufficient to coat animal fur and feathers, the animals cannot stay warm and will ingest the toxic oil while attempting to clean themselves. Many of these oiled animals will freeze to death or die as a result of ingesting these toxins. Many marine animals that do not die quickly as a result of the oil spill may develop liver disease and reproductive and growth problems because of ingestion. Even very small quantities of oil will spread, floating on the surface of the water covering vast areas of water.

These thin sheets can kill marine larvae which in turn will reduce the number of marine animals. Effects on human populations are realized through potential health hazards as well as economic losses, such as those associated with the loss of fisheries or tourism. Particularly susceptible to injury from releases of oil are exposed shorelines, shallow reef environments, estuaries and wetlands. The effects of this oil pollution on wildlife can be terrible.

Between January 2007 and June 2008, 36 000 birds were found dead around the Black Sea coast as a result of oiling from catastrophe in Kerch Gulf. Migrating species like the puffin, guillemot and razorbill are especially at risk, as they look for areas of calm water on which to rest or catch fish. Oil-covered seas look calm, but if a bird land in a slick, the oil coats its feathers, affects its buoyancy and the insulating power of its feathers and makes it unable to fly away. Even slightly oiled birds sometimes die because they preen their feathers, and in doing so, ingest oily substances which are poisonous to them. An animal killed by oil may then be eaten by fish or birds, who in turn are poisoned by the oil.

Crude oil is made up of over 1000 chemicals. Of these, the light hydrocarbons, which are used to make petrol and aviation fuel are the most toxic. In warm conditions, these usually evaporate quite quickly, making a foul smell, but reducing the danger to wildlife. In cold seas, however, the process of evaporation can be very slow, and this means the risk to wildlife lasts longer. To prevent this, the light hydrocarbons are often burned off the surface of the sea.

Living resources are destroyed or become unfit for consumption. The deterioration of water quality can lead to intoxications and illnesses and have an impact on the economy by preventing fishing, leisure activities or water being used for industrial purposes. The disappearance of sensitive species and the proliferation of more adapted species threaten ecosystems. Oil pollution in Kerch Gulf in 2007 caused half the disappearance of fish. The 10 billion tons of ballast water poured into the sea every year from one end of the globe to the other introduce species which colonise the environment at the expense of indigenous species. Toxic substances are stored in the fatty tissue of fish, marine mammals and piscivorous birds. In humans, polychlorinated biphenyl plays a part in causing breast cancer, lung

cancer, liver cancer and colon cancer. It can cause delays in neurological development and growth. Persistent organic pollutants are concentrated in shells and other filters and they can cause typhoid, hepatitis and other illnesses if they are ingested.

### **Treatment**

Solutions to municipal sewage problems involve improved use of wastewater treatment technology. The Maximum Allowable Concentration (MAC) is used as a measuring device for comparing levels of different pollutants. MAC is the concentration of a particular pollutant that has been deemed acceptable under law.

Cleaning up after an oil spill is a complicated business, and depends on weather conditions and water temperature. In calm waters, long floating booms can be used to help to contain oil, which can then be pumped off the surface of the sea. Chemical dispersants are often sprayed on oil to break up slicks into droplets which can be broken down by marine bacteria. Dispersants are quite toxic, however, so whilst they reduce damage to beaches and save seabird colonies from destruction by oil, they also add more poisons to the sea. Rough seas can break up slicks, but they can also spread oil right through the marine environment.

In our country, we have a group of patrol aircraft whose job it is to search for oil floating on the surface of our seas. The spotter planes are able to distinguish different types of oil, and work alongside dispersant-spraying aircraft so that oil can be treated quickly and in the most effective way possible. The consequences from the oil pollution are much more serious close to coasts than out at sea.

### **Conclusions**

This article on oil pollution in the Black Sea examines the relation between types and levels of activities and flows of pollutants. The Black Sea, polluted by the Dniestr, the Dniepr, the Danube and the Don, is in a very critical state: eutrophication, important and increasing animal mortality rate over the last three decades, 80 % drop in fishing yields, only 6 species of fish that can still be fished out of the 26 which could previously be commonly marketed in this basin. The main source of effluent into the Black Sea are the Odessa and the Crimea

regions. Pollution from marine transportation occurs mainly from the ports of Odessa, Illychivsk and Sevastopol. Oil pollution is declining. Pollution from military sources and marine dumping is also recorded.

Finally, a substantial source of Black Sea pollution is the input (treated as point sources) from the major rivers passing through Ukraine, in which concentrations of oil products and phenols have been discharged and monitored for the past two decades. In the Sea of Asov, and the Black Sea, the leading role in oil input most likely belongs to land-based sources, which are dominated by river inflow. The Danube River alone annually brings to the Black Sea about 50 000 t of oil, half of the total oil input of about 100 000 t. Traditional shipping and oil transportation routes are more exposed to the impacts of oil-polluted discharges from tankers and other vessels than other areas.

Using the data collected, hot spots were identified and remedial projects developed. These projects were then prioritized using a common methodology and a grading system was applied. The grading system was specifically used to determine the risk of oil pollution hot spots on public health, drinking water quality, natural aquatic life, wetlands, recreational areas and other beneficial uses of the Black Sea, as well as on welfare and the economy. A multiplier effect was incorporated in the grading system, based on the importance of the effected entry.

A number of dramatic events show the vulnerability of making optimistic prognosis about increasing oil pollution at the regional and global levels. For instance, catastrophic large-scale events took place in the Mexico Gulf during 2010. Between 5 and 7 million tons of oil were released into the coastal waters. Besides, products of combustion of over 70 million tons of oil and oil products were emitted into the atmosphere. Another large-scale accident occurred in Russia in September-November 1994. About 100 000 t of oil were spilled on the territory of the Komi Republic. This threatened to cause severe oil pollution for the basin of Pechora River and, possibly, the Pechora Bay.

Pollution of the Black Sea by oil products is one of the greatest problem in ecology of Ukraine. Oil pollution can be appeal by an accidents of oil offshore, damaging of oil minings, tankers crashing.

Oil exposure damage animals like a fishes and sea birds. To solve such serious problems we need a help of other countries whose has collide with such situation and successfully come out of it and also comes in a convention of the Protection of the Black Sea against Pollution such countries as Bulgaria, Georgia, Romania, Russian Federation and Turkey.

So with help of other countries we will more effectively protect the Black Sea from oil pollution and protect the biodiversity and the marine living resources from disappearance and to provide framework for scientific and technical co-operation and monitoring activities.

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Received 8 June 2011.