

VITAL CASPIAN GRAPHICS
 CHALLENGES BEYOND CAVIAR



The **United Nations Environment Programme**, as the world's leading intergovernmental environmental organization, is the authoritative source of knowledge on the current state of, and trends shaping the global environment. The mission of UNEP is to provide leadership and encourage partnership in caring for the environment by inspiring, informing, and enabling nations and peoples to improve their quality of life without compromising that of future generations (<http://www.unep.org/>).

UNEP/GRID-Arendal is an official United Nations Environment Programme (UNEP) centre located in Southern Norway. Established in 1989, UNEP/GRID-Arendal's mission is to provide environmental information, communications and capacity building services for information management and assessment. Together with partners in different countries and regions, UNEP/GRID-Arendal's core focus is to facilitate the free access and exchange of information to support decision making and secure a sustainable future (www.grida.no).

The **Caspian Environment Programme** (CEP) is a regional umbrella programme developed for and by the five Caspian Littoral States: Azerbaijan, Iran, Kazakhstan, Russia and Turkmenistan, aiming to halt the deterioration of environmental conditions of the Caspian Sea and to promote sustainable development in the area (<http://www.caspianenvironment.org>). The CEP is funded by the Caspian littoral governments and the International community through the Global Environmental Facility (GEF) (of which United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP) and the World Bank are the implementing agencies), the European Union / Tacis and the growing participation of the private sector.


For purposes of this publication, the names Iran and Russia have been used to refer to the Islamic Republic of Iran and Russian Federation, respectively.

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BEYOND CAVIAR**

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The Caspian Sea runs north and south, extending over 1,200 km, with an average width of 320 km. It covers approximately 400,000 sq km (an area slightly larger than Germany). The population of the region is about 14 million, distributed over the coastal provinces of five countries: 6.5 million in Iran, 3.9 million in Russia, 2.2 million in Azerbaijan, 0.8 million in Kazakhstan and 0.4 million in Turkmenistan.



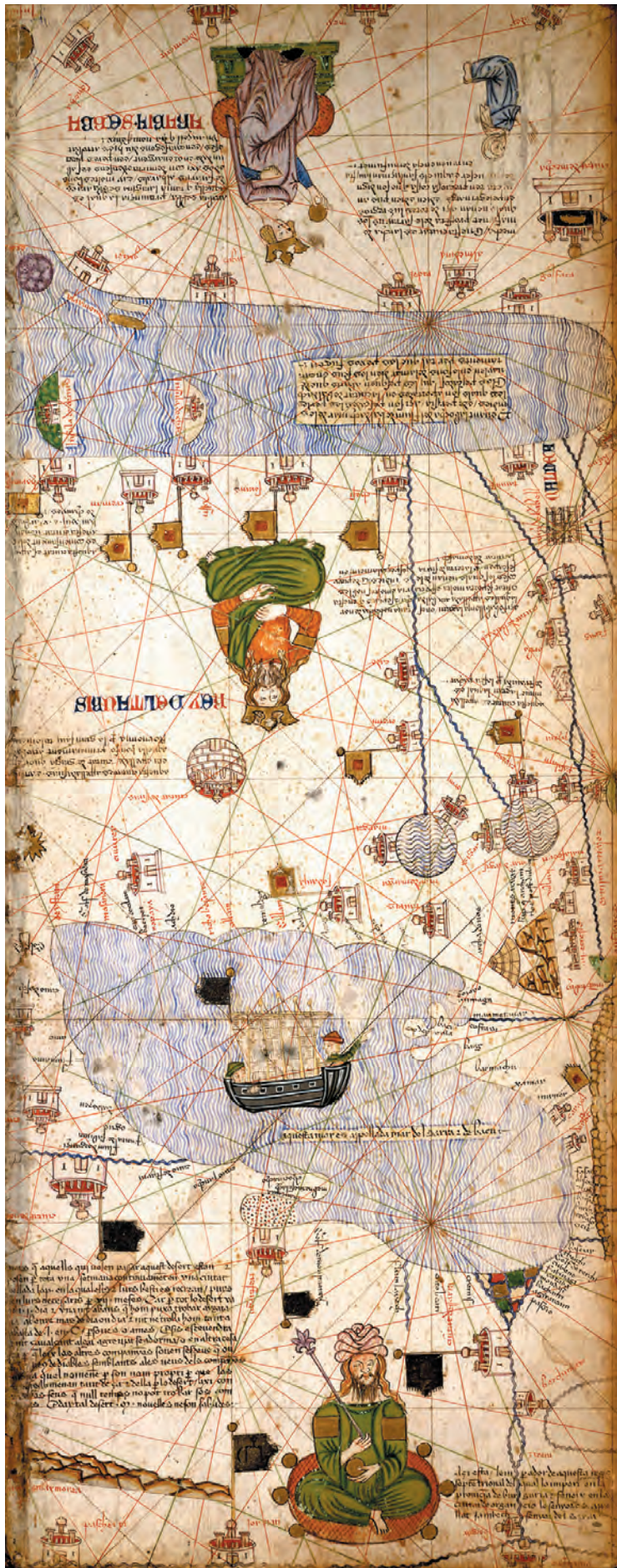


VITAL CASPIAN CHALLENGES BEYOND CAVIAR

GRAPHICS

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A FRAGILE BALANCE



The Caspian Sea region represented in the Catalan Atlas (1375)
(Bibliothèque nationale de France, Paris)

Foreword

“I wanted to write a book as purely geographical in character, as dry and uncompromising as a travel report, and no more attractive than a rough-and-ready map sketched out with a lump of coal on a piece of packing paper.”

Konstantin Paustovsky

Story of a Life, vol 6,
The Restless Years

It is a real achievement that the five countries around the Caspian Sea have signed and ratified the Framework Convention for the Protection of the Marine Environment of the Caspian Sea (Tehran Convention) and thus establish a framework to jointly address and solve environmental problems in and around the world's largest body of inland water. Negotiating this agreement was a difficult task. The countries themselves, and the international community, have invested considerable energy and money in the various processes involved. This is not surprising, since the words “environment” and “protection” alone may stir up feelings in a region rich in oil and other natural resources of global relevance and vital for the region's development.

Much work has yet to be done to keep the involvement of the parties going, not only those directly involved in negotiations, but also their constituencies, including the people around the Caspian Sea. For its part the international community must stay committed to these issues of global geopolitical concern. To reach a wider audience, the Caspian Environment Programme (CEP), in close cooperation with the United Nations Environment Programme (UNEP) and GRID-Arendal, is publishing these Vital Caspian Graphics. Our ambition is to provide a broad picture, in a concise and highly visual form, of issues relevant to the environment of the Caspian Sea and the surrounding area, including security, geopolitics and the exploration of natural resources. Though easy to look at and read, the graphics are nevertheless based on reliable scientific data and facts.

To supplement them we are re-publishing several newspaper articles relevant to the topics highlighted here. They do not reflect any official view of the publishing organisations, but they shed additional – subjective – light on the region's concerns.

In the production process we have sought inspiration from writers such as Konstantin Paustovsky, who reached millions with his novel *Kara Bogaz* (1928) – however close to propaganda and anti-environmental its message may seem – or Frank Westerman's more recent *Ingenieurs van de ziel* (2002), a lucid analysis of Soviet hydraulic engineering and its relation to literature (and vice versa). Their investigative drive, curiosity, and, no less importantly, presence in the area are an inspiration. Too often the work of international organisations is carried out well away from “the field”, and thus remains inaccessible to many.

Just as our investigative efforts must stay closely connected to the ground, the results of our assessments must be brought back to the field, so that the information reaches those most immediately concerned. The maps and graphics presented here use a universal language, enabling them to reach out into the streets of Astrakhan and Aktau, into the textbooks of Azerbaijan and Iran. Information is a first step towards taking part and seizing the initiative to improve the situation, both for the inhabitants and their environment.

Otto Simonett, April 2006

A sea of many ambitions

In recent years the Caspian Sea has been the focus of increased global attention. The world-wide decline in oil and gas reserves and the corresponding rise in the price of hydrocarbon derivatives have heightened interest in an area where there is still growth potential in oil and gas exploration. In addition, the region presents a wealth of opportunities in other areas, including bioresources, transport corridors, and not least ecotourism. These new ventures may bring increased prosperity, but they also put pressure on traditional rural communities and the environment.

The expected surge in the exploitation of hydrocarbons in an area once more open to foreign investors has completely changed the rules for development in many sectors, in particular oil, land and sea transport, and services. National interests multiplied after the breakdown of the Soviet Union as Azerbaijan, Kazakhstan and Turkmenistan gained independence. Relationships between these states are being tested as the possibility of large profits emerges. And with China entering the game as an increasingly strong economic player the centre of gravity is moving east, demanding that new transport and communication routes are considered across the region.

The Caspian once only played a minor role in world politics. Interest focused exclusively on the Apsheron peninsula and Baku, where the oil industry started developing in the last quarter of the 19th century, providing the only significant economic growth in

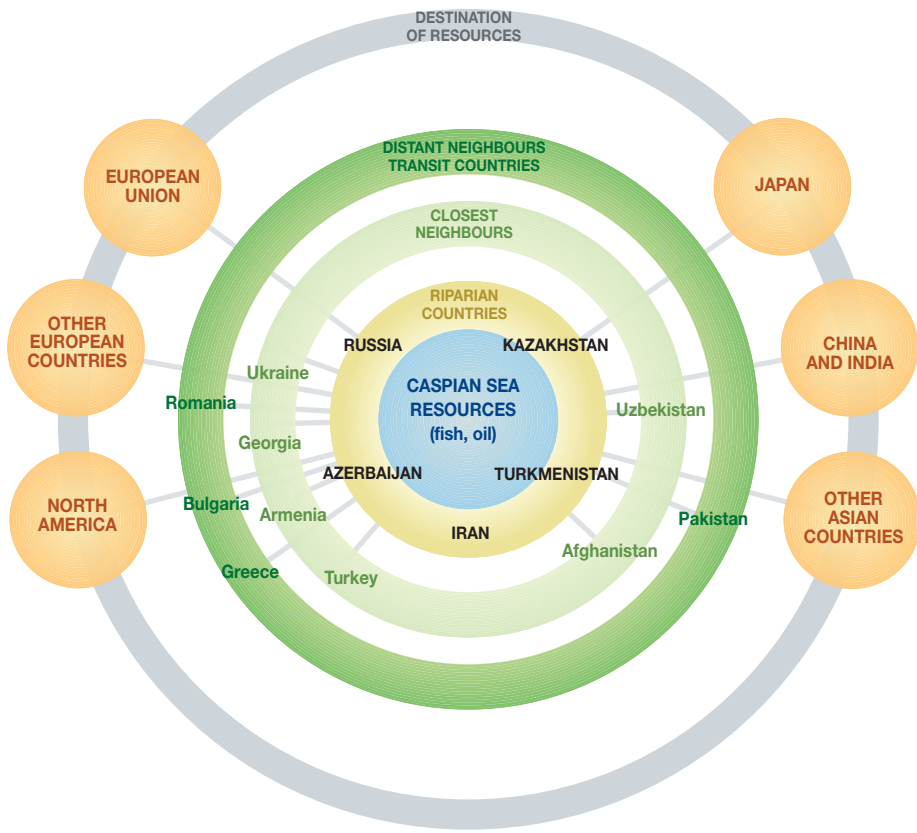


the region. Otherwise the area remained largely rural, on the margins of two vast states (Tsarist Russia and Persia, subsequently USSR and Iran) and well away from the centres of industry. They often lagged behind in terms of development and infrastructure. North-south trade between Moscow and Tehran was limited, particularly as both countries had other much more significant coastlines.

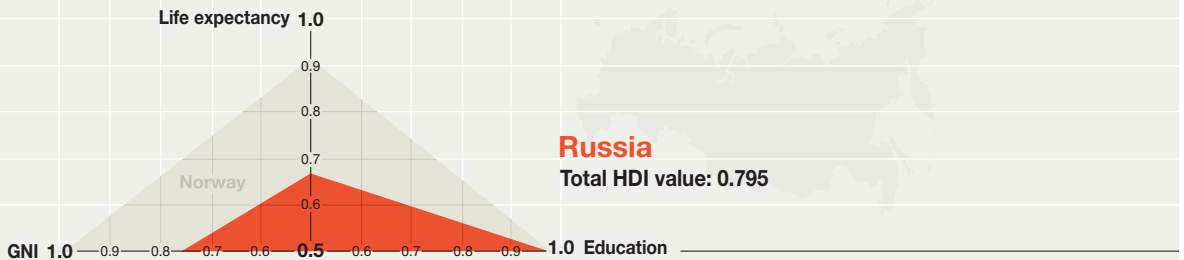
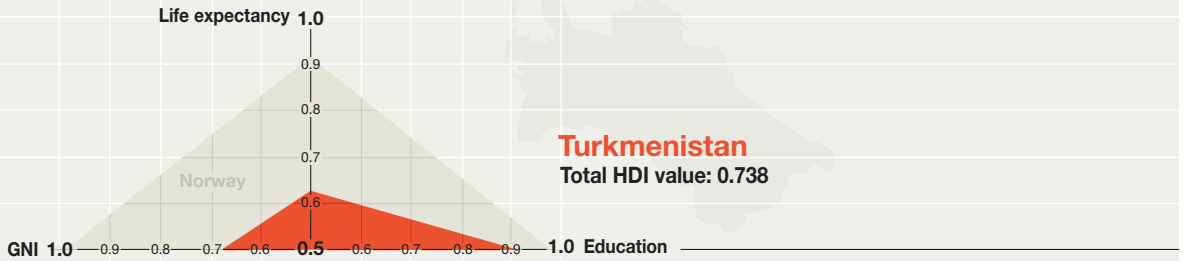
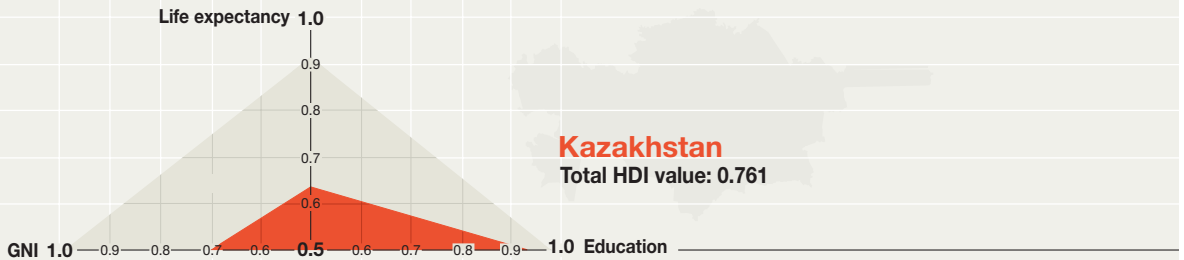
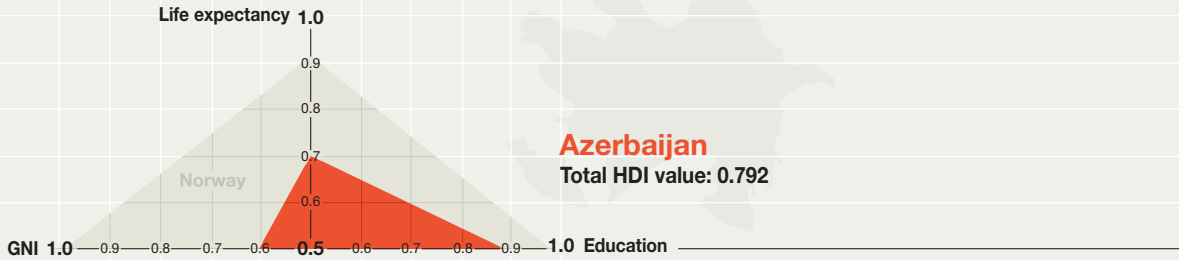
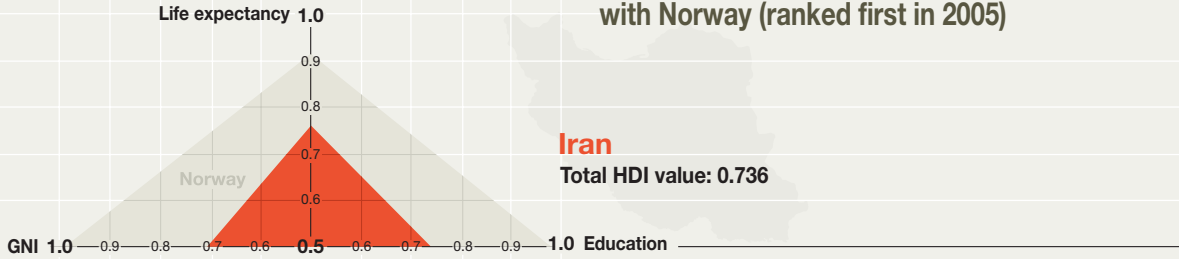
In 2004 regional oil production reached roughly 1.9 million barrels per day, comparable to South America's second largest oil producer, Brazil. The BP Statistical Review of World Energy estimated the Caspian's share of oil and gas reserves in 2002 at 1.6% and 4.2%, respectively, of the world total, and oil and gas production at 2.2% and 4.8%.



The Caspian Sea: neighbours and players



Human Development Index (HDI) composition for the Caspian countries compared with Norway (ranked first in 2005)



Source: Human Development Report 2005, United Nations Development Programme (UNDP), New York.

Figure (left): Composition of Human Development Index. The characteristic feature in all four post-Soviet countries is a relatively high level of education in relation to national income and rather low life expectancy, indicating high levels of poverty and deficient healthcare. In contrast the level for all three indicators in Iran is fairly balanced.

Figure (right): Purchasing power parity (PPP) measures how much a currency can buy in terms of an international benchmark (usually dollars), since the cost of goods and services differs between countries. PPP is below the value of a US dollar in countries where the general price index is lower than in the US (as is the case for all five Caspian states, to varying extents), and above it where the prices are higher. One dollar thus buys much more in the Caspian countries than in the US, which only marginally compensates for the much lower income per person. These curves do not allow any conclusions on the wealth of individuals or income distribution among the population.

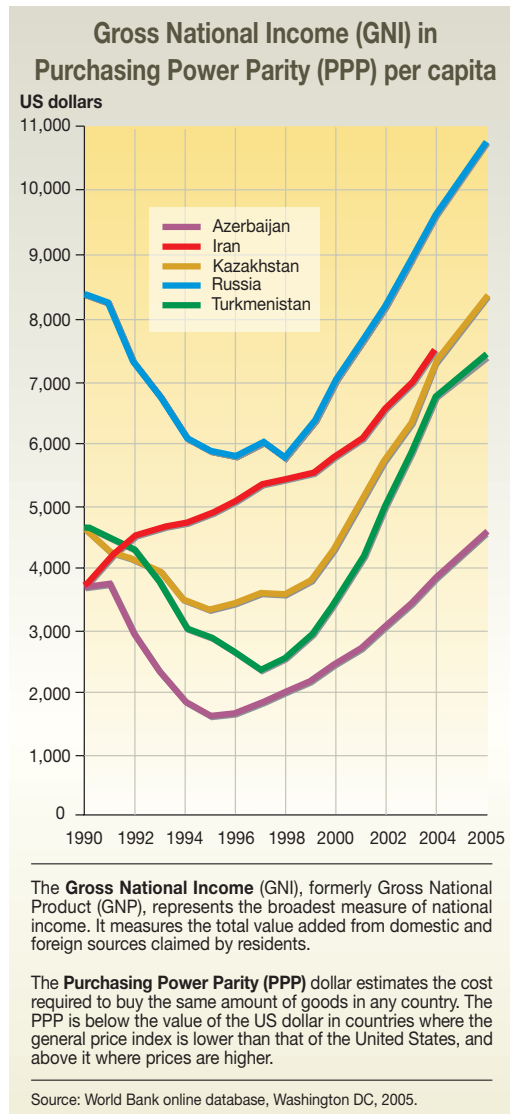
Note the similar pattern in the post-Soviet countries, where the effects of the collapse of the Soviet system are reflected in a steep decline in economic activity in the early 1990s. The economy finally bottomed out and started rising steadily at the beginning of the 21st century. This contrasts with development in Iran, which is characterised by a constant rise.

As a result of the arid and semi-arid continental climatic conditions many of the coastal areas have specialised in extensive stock raising, essentially sheep and camels. Only in a few foothills with higher rainfall in the Eastern Caucasus and the Iranian provinces of Gilan, Mazandaran and Gulistan has prosperous

mixed farming developed, with orchards and market gardens.

Fishing is important for all the coastal countries. In Russia the catch of fish from the Caspian contributes a significant share of the regional economy, with Russia taking half of the total catch from the Caspian. Fisheries provide more than 7,000 jobs in Iran and perhaps an equal number in related activities. However with fisheries declining

due to environmental degradation and changes in the ecosystem, the sector is losing its importance, depriving many who depended on it of a job. Tourism plays a major role on the Iranian coast, where a pleasant subtropical climate attracts a large number of Iranian vacationers during the hot summer months.



The uncertain status of the Caspian Sea

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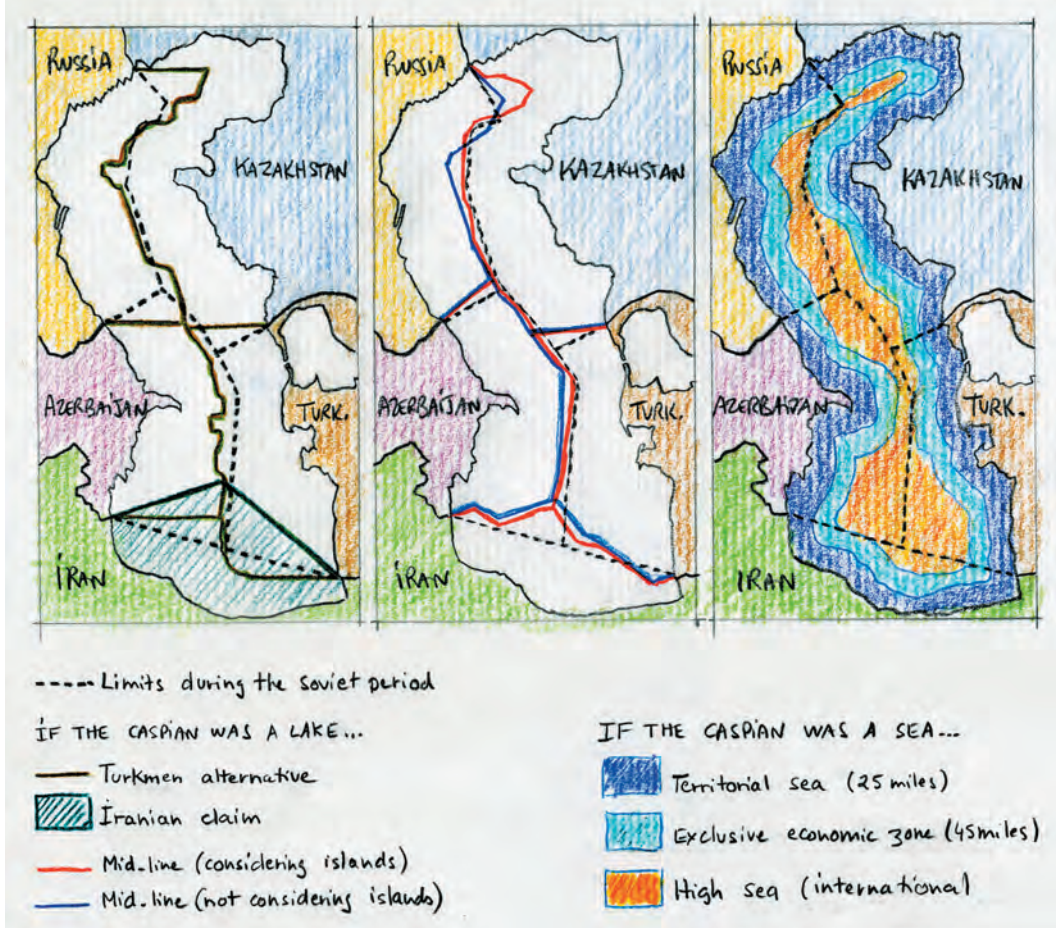


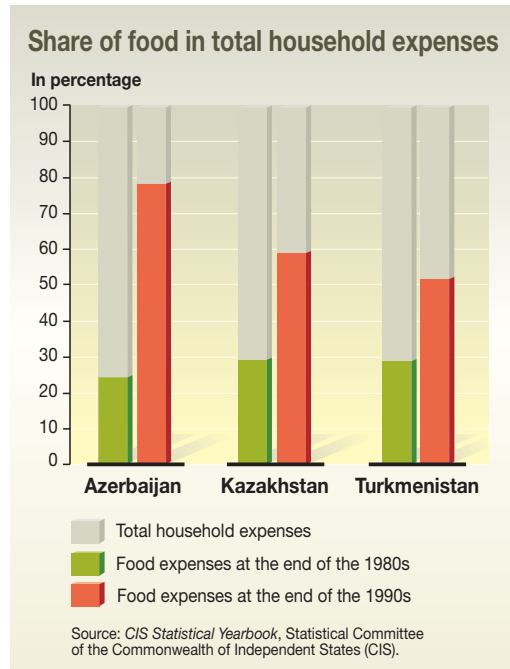
Figure: Claiming the Caspian Sea.

The high economic expectations and the newfound quest for national identity partly explain the obstacles to agreement over the legal status of the Caspian Sea. Existing maritime agreements between Iran and the Soviet Union, formerly the only countries bordering the sea, needed re-negotiation as the three new republics of Azerbaijan, Kazakhstan and Turkmenistan emerged. Negotiations among the five countries are underway for a regional convention on the legal status of the Caspian

Sea, but an over-arching agreement has yet to be reached on the division of the Caspian waters and – indirectly – its natural and mineral resources. But the northern states – Russia, Azerbaijan and Kazakhstan – signed a trilateral agreement in 2003 that allows them to proceed with the development of the hydrocarbon potential of the northern Caspian. The vital economic interests provide third parties and international stakeholders with a good reason to downplay the tensions between states bordering on the sea.



Figure: Share of food in total household expenses. In the 1990s, following the collapse of the Soviet regime and massive market deregulation, the breakdown of total household expenditure radically changed. Its focus shifted towards basic human needs, such as food, for which spending increased two or threefold in 10 years, reducing funds available for other essentials such as education and health.



Sharing the new oil wealth

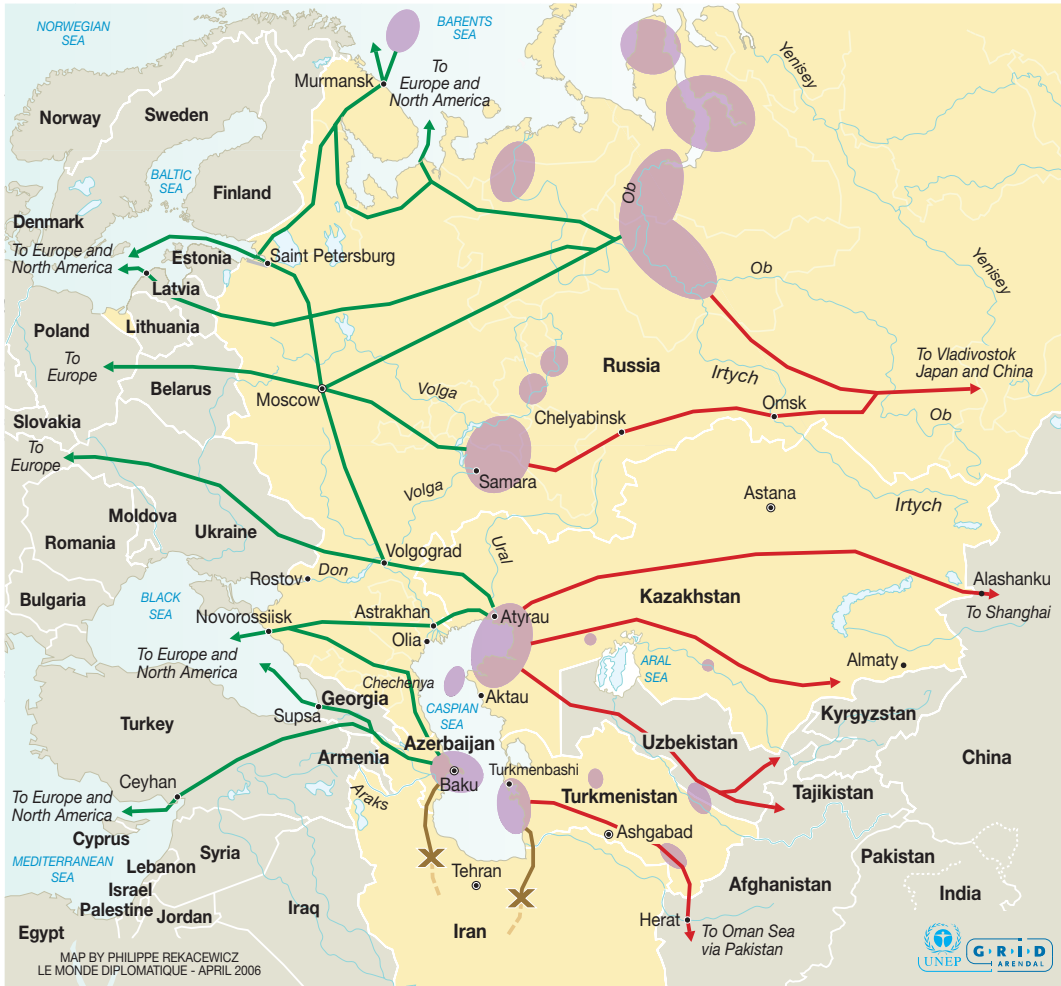
The prospects for rapid oil wealth contrast with fast spreading poverty following the collapse of the Soviet economy. Although massive investment has suddenly been channelled into the area, its effect is still both geographically and socially very limited, with little widespread impact on society. Nor does it compensate for the crisis in older, more traditional activities such as fisheries and agriculture and in the case of former Soviet republics, the closure of inefficient industrial complexes. In many countries the benefits of oil revenue are still restricted to the ruling elite. A few cities – Baku, and to a lesser extent Makhachkala and Astrakhan – have enjoyed spectacular growth. In the meantime much of the infrastructure

– transport, telecommunications, drinking water – in small towns and rural areas is very run-down. The poverty gap is widening, with much of the population increasingly excluded from services and wealth as privatisation of social services progresses.

In all the areas bordering on the Caspian, priority must be given to diversifying activities and investment. Particular attention should be given to sectors such as tourism, agriculture and food production as well as services. Oil and gas alone cannot be expected to provide sufficient jobs for the fast-growing population. Only widespread diversification can contain rising unemployment, which is severely affecting several areas around the Caspian and forcing many young people to find work elsewhere.



Markets competing for Caspian oil and gas



- Countries bordering on Caspian
- Other countries
- Main zones for oil and gas extraction

- Main transportation axes for oil and gas**
- Eastward (China, Japan, Korea, Mongolia)
 - Westward (Europe and North America)
 - Iranian alternative (Towards Persian Gulf) disqualified by the United States

Sources: Stephen Blank, *Central Asia's energy game intensifies*, Eurasianet, September 2005; United States Energy Information Administration (EIA); Sylvaine Pasquier, "Pressions sur l'or noir", *L'Express*, 1st August 2005; Interstate Oil and Gas Transport to Europe (INOGATE); Energy Map of the Middle East and Caspian Sea Areas, Petroleum Economist, London, 2003; International Energy Agency (IEA); Jean Radvanyi, Institut National des Langues et Civilisations Orientales (INALCO).

Transportation on the move

For many years, coastal navigation has connected republics in the former Soviet Union. It used the only outlet from the Caspian, the Volga-Don canal, which connects the Black Sea and the Russian canal system to the Baltic. It is still used to transport raw materials, timber, coal, grain, fertilisers, and other products.

However, the oil boom has completely changed the way the Caspian Sea is used. As there is no agreement on use of the seabed, including the laying of pipelines, crude oil is transported in tanker wagons rolled onto ferries or in small tankers. This has stimulated the ferry business. The shipyards at Nizhny Novgorod have recently delivered several 8,000 deadweight tonnage (DWT) and 13,000 DWT tankers, the largest that can be used given the limitations on access to the sea and its ports.

Transportation projects converging on the Caspian



Countries bordering on Caspian

- Russia
- Other countries

Transcontinental transportation projects

MULTIMODAL ROUTES (highways, road, railroad and eventually pipelines) combined

- Projects developed with Russia
- Projects developed without Russia

SINGLE-MODE ROUTES (railway only)

- Projects developed with Russia
- Projects developed without Russia

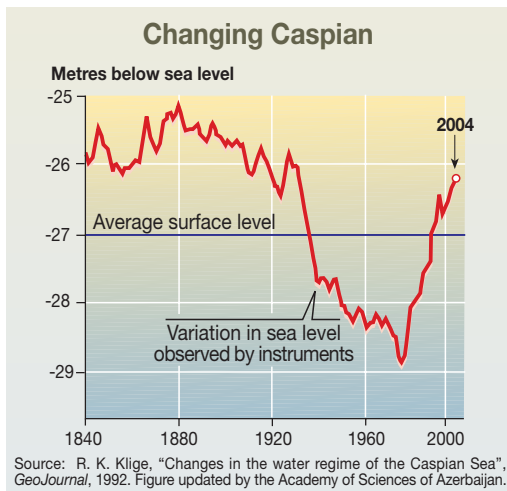
Sources: Jean Radvanyi, "La bataille des liaisons transasiatiques", in *Atlas du Monde diplomatique*, Paris, January 2003; Transport Corridor Europe-Caucasus-Asia (TRACECA), European Union, TACIS Programme, 2005.

The European Union's TRACECA programme (TRANsport Corridor Europe-CAucasus-Central Asia) modernised the Baku-Turkmenbashi ferry line, for long the only one, and added a Baku-Aktau service to Kazakhstan. To counter competition from this new Silk Road, Russia has launched a project to build a north-south link, connecting the Baltic and Russia to Iran and the Persian Gulf. It has opened a new port at Olia, on the Volga delta, connected to the river and ca-

nal system, and to the rail network that runs parallel to the river, providing for fast container transport. It also has plans to supplement the maritime route by developing a coastal rail link, modernising the existing track between Azerbaijan and Iran.

Cyclic fluctuations in the level of the Caspian Sea

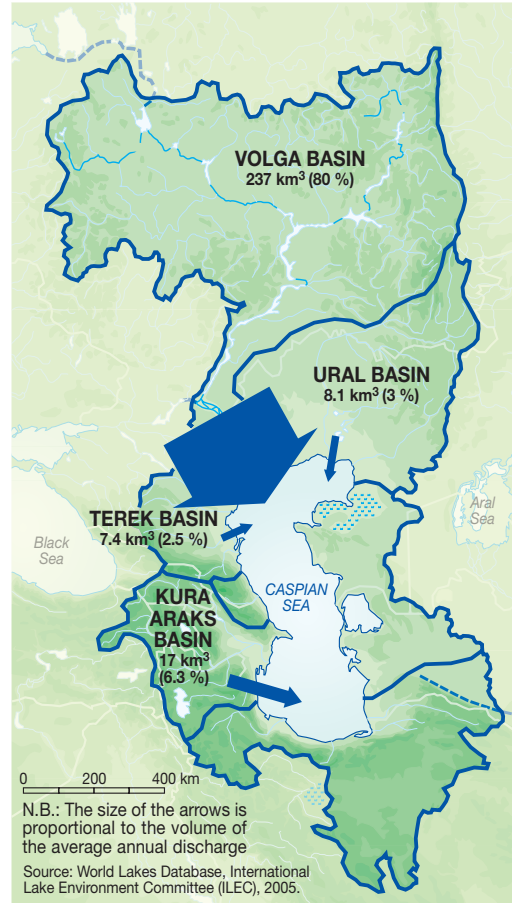
The Caspian Sea is the largest closed body of water on the surface of the Earth. Its complete lack of any natural connection with the oceans makes it a very special ecosystem, and as such particularly vulnerable to external forces, such as climatic conditions or man-made changes to inflow.



The Caspian Sea has been endoreic – inwardly draining – since the Pliocene epoch (about 5 million years ago), prompting some specialists to treat it as the world's largest lake. Studies of its geomorphology and hydrology have revealed alternating cycles of rising and falling water levels, raising many questions, scientific for some, more down-to-earth for those living on its shores.

In a century, between 1880 and 1977, the level of the sea dropped four metres (from –25 metres to –29 metres below mean sea level) apart from short periods during which it rose slightly. During this time local people became accustomed to the gradual drop in the water level, carrying out all sorts of work on the shores, particularly after the second world war: port infrastructures, roads and railways, construction of housing and holiday facilities. In the Soviet Union the dramatic drying up of the Azov Sea, a side-basin of the Black Sea, which occurred at the same time, gave rise to genuine fears that the Caspian – or at least its very shallow northern part, which is less than 25 metres deep – would in turn shrink significantly. This led to hasty, misguided decisions such as the construction of a dyke in 1983 to close the Kara Bogaz Gulf.

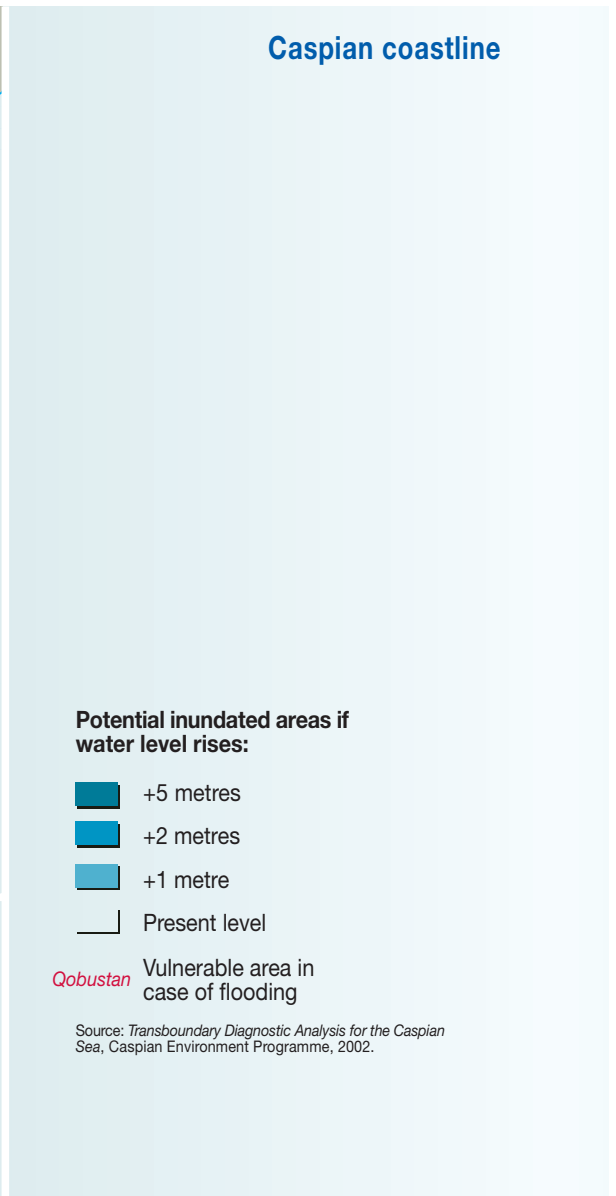
The sudden reversal of the trend after 1977, with a rise in the water level of about two metres, took everyone by surprise and caused widespread problems in several areas: flooding of urban facilities, destruction of roads and railways, damage to industrial



infrastructure on land and offshore, and destruction of beaches. Several tens of thousands of people in the lowlands of Azerbaijan, Daghestan and the Volga delta had to move. In Azerbaijan alone, damage resulting from the rise in sea level is estimated at \$2bn. In Kazakhstan the encroaching sea has directly affected some 20,000 square kilometres of land, including the abandoned oil wells.

The factors behind the changes in the level of the Caspian are still the focus of debate. Scientists have not ruled out the involvement of tectonic (movement of the Earth's crust below the sea) or geomorphologic causes (rate of sedimentation). However these would appear to have a minor impact in comparison to changing climatic factors, combined with the effects of human management of surface water in the Caspian basin. Most of the water flowing into the sea comes from coastal rivers. The quantity and quality of this water, particularly that of the Volga, are key variables in the balance of the Caspian. To this must be added rainfall over the sea itself. Water may be also be lost through infiltration into the ground and flow into the Kara Bogaz Gulf, but these factors are insignificant compared with natural evaporation from the sea.

Figure: Most of the water flowing into the sea comes from coastal rivers – currently supplying 300 to 310 cubic km a year. The Volga alone accounts for 80% of inflow. But it has dropped substantially during the 20th century, declining from about 400 cubic km in the 1920-30s to between 260 cubic km and 270 cubic km at present, due to various climatic factors and human activities such as dams built for hydroelectric energy production. Rainfall over the sea itself is estimated to input 130 cubic km a year. Water loss through infiltration into the ground accounts for less than 5 cubic km and flow into the Kara Bogaz Gulf for about 18 cubic km, since the destruction of the dyke. Natural evaporation from the sea is estimated to produce a loss of between 350 cubic km and 375 cubic km a year. The combination of these water input (around 440 cubic km) and water loss (around 373 cubic km) estimates suggest that at present the water level in the Caspian Sea should be continuing to rise.

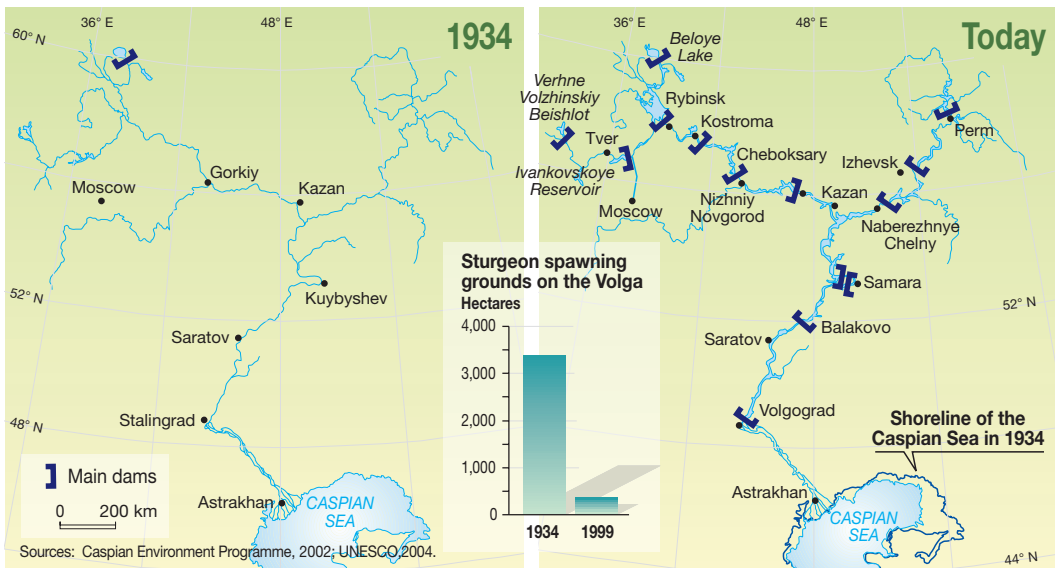


vulnerable to flooding





Fragmentation of the Volga river over the last 60 years



The construction of a large number of dams and industrial facilities on the rivers feeding the Caspian has caused a significant change in the quantity of water inflow. The creation of a succession of large reservoirs, especially on the lower and middle Volga, has led to significant losses in flow rate due to additional evaporation from the surface of the water. Coupled with unsustainable water consumption, in particular in connection with irrigation, the river flow rate is now only 10 % of the natural levels.

Uncertainty regarding future variations in the sea level is holding back the development of many coastal zones suitable for holiday amenities or the construction of ports. It also complicates further offshore oil prospecting, currently expanding in the north-east corner of the sea, off the coasts of Kazakhstan and Russia. The very shallow water in this part poses problems of access and safety.

Climate change

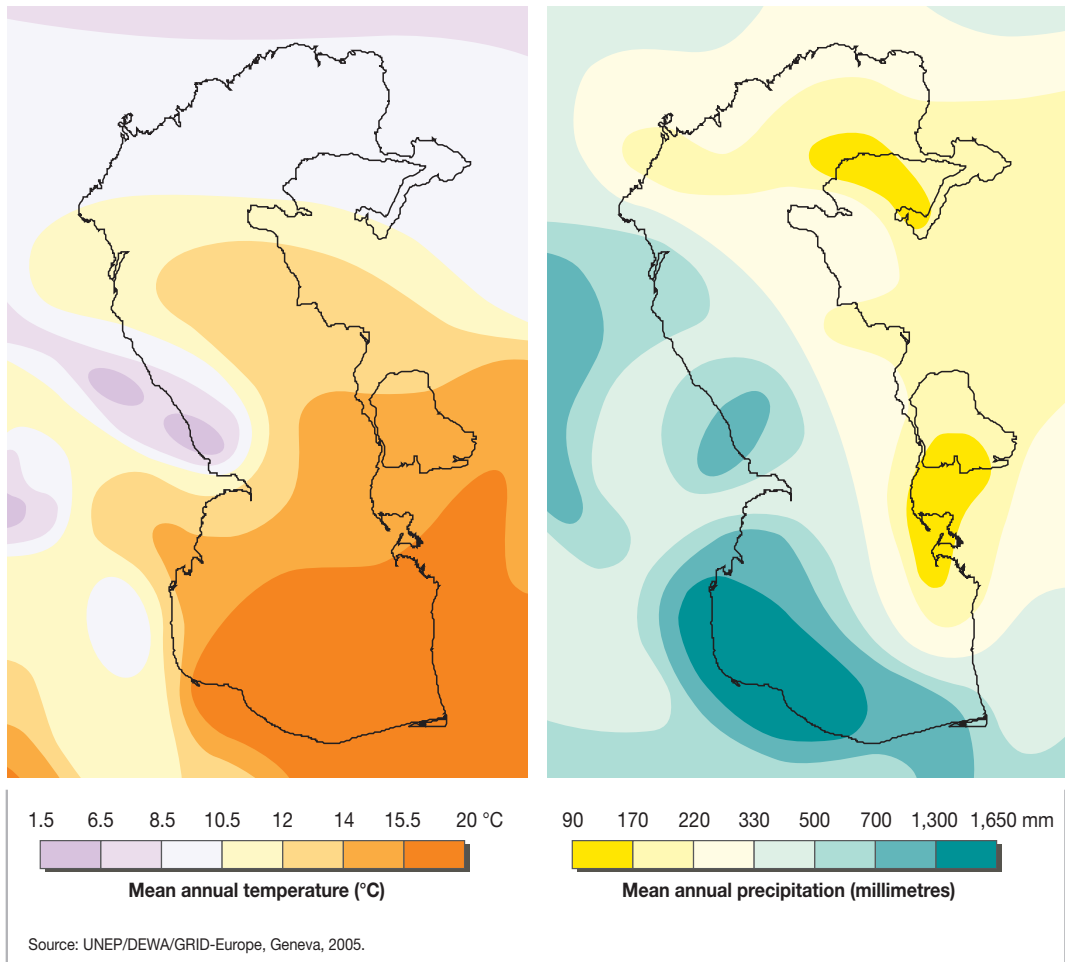
The Caspian Sea region is climatically diverse encompassing the basins of the Volga and Ural rivers in the North, the vast semi-arid and hot arid plains of northern Kazakhstan and Turkmenistan in the east, and the humid Caucasus and Elburz mountains in the south-west. The Caspian Sea plays an important role in atmospheric processes, regional water balance and microclimate.

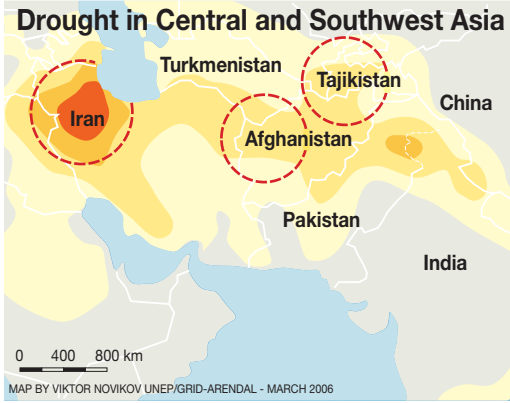
Climatic phenomena in the Caspian are linked to the Northern Atlantic Oscillation (fluctuations in atmospheric air pressure). These variations affect temperatures, moisture and winter storms all

across Europe including the Volga basin, as well as rainfall over the Caspian basin.

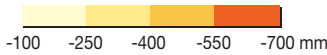
Several severe droughts have affected various parts of the region in recent years. They seem to confirm scientific models, which, in addition to higher mean temperatures, generally predict more extreme weather events. Droughts affect both crop production and the health of livestock. For example, the economically important Karakul sheep of Turkmenistan, which are raised for wool production, are sensitive to heat stress. In addition to the loss of agricultural productivity, droughts can increase the frequency and severity of fires, which may destroy grassland and crops.

Temperature and precipitation in the Caspian Sea Region





Precipitation deficit for 1999-2001



High impact area

IRAN: Estimated 37 million people vulnerable to food and water insecurity; depleted water reserves; 6.6 million ha of arable land affected.

TAJIKISTAN: Estimated 1.2 million people at risk of famine (food shortages and loss of livestock). Around 80 per cent of the population living below the poverty line.

AFGHANISTAN: Estimated 12 million people affected by drought, without access to water and sanitation; growing number of refugees as a result of on-going civil conflict.

Sources: International Research Institute for Climate Prediction of Columbia University, 2001; United Nations Food and Agriculture Organization (FAO), 2001.



Contrasting rainfall trends have been observed in the north and south. Whereas rainfall over Russia has increased over the last century, already dry areas such as the coasts of Turkmenistan and Iran have become even drier. Dust storms pick up large amounts of salt and dust as they pass over the Kara-Kum desert and the Caspian shore, depositing it in the Volga valley where it impairs the fertility of arable land.

But the availability of freshwater, on which many sectors of the economy – and human well-being – depend, is also linked to more remote climatic processes. If glaciers in the Caucasus and Elburz mountains recede and the periods of snow cover become shorter, as has been the case in recent years, less water will be available for use in irrigation and homes.

Melting glaciers do not only result in the disappearance of pretty white mountain caps. The processes caused by warmer mean temperatures also increase the risk of natural disasters associated with changing environmental conditions. For example, in the last 30 years mudflows in the Terek river basin in the north-eastern Caucasus have occurred almost annually. The most destructive mudflows were recorded in 2000 and were perhaps linked to persistent above-average summer temperatures. In September 2002 the Kolka glacier near Mount Kazbek, the highest peak in the eastern Caucasus, collapsed. The water that had accumulated inside and below the glacier triggered an avalanche that travelled more than 24 kilometres at very high speed killing over 120 people.



Topography

- Lowlands and piedmont
- Mountains

Impacts on water resources and hydrology

- Decrease in precipitation and increase in temperatures: more frequent drought, impact on food production and health.
- Maximum extent of sea ice (present and future)
- River flow increase, earlier onset of spring waters, reduced peak flood
- River flow and water availability decrease
- Sea level fluctuations (flooding of ecosystems, agricultural lands and human infrastructure, settlements, oil fields)

Impacts on terrestrial ecosystems

- Desertification (deserts, semi-arid and arid lands expansion)

Sources: National Communications from Iran, Azerbaijan, Armenia, Kazakhstan, Russia and Turkmenistan to the United Nations Framework Convention on Climate Change (UNFCCC); Yu. Izrael 1997; S. Rodionov 1998; International Research Institute for Climate Prediction 2001, IPCC 2001; V. Mikhailov, G. Richagov and E. Povalishnikova 2002; Russian Hydrometeorological Service 2002; T. Henrichs and J. Alcamo 2002; M. Zappa and J. Gurtz 2002; V. Arora and G. Boer 2002; K. Arpe 2005.

The human factor

Human activities can have a powerful influence on the local climate. Widespread irrigation networks and dams are depleting the soil, exposing it to erosion. Ground water supplies are thereby reduced, which can cause the whole water regime to change. This can influence local temperatures and consequently the evaporation potential.

Oil and gas exploration activities not only cause localised pollution of air, soil and sea, but also emissions of greenhouse gases such as methane (CH₄) and carbon dioxide (CO₂) that add to the global greenhouse effect and lead to warming of the atmosphere. It is estimated that on and off-shore fossil fuel production in the Caspian area emits 15 to 20 million tonnes of CO₂-equivalent annually. The expected rise in fuel production will further increase greenhouse gas emissions unless appropriate counter-measures are taken.

Uncertain weather

It is difficult to predict how climatic changes at the global level will affect the climate of a particular region. Although climate scenarios commonly suggest warming and increased rainfall over the north of the Caspian and its vicinity, with lower rainfall to the south, there is considerable uncertainty as to the influence of the sea, the effects of the complex topography, cloud cover, and other factors.

The critical point is that there is no way of predicting whether the climate system will react in a linear way or if it will suddenly collapse in one way or another once a critical threshold is reached. As the concentration of greenhouse gases in the atmosphere increases, the temperature in the European part of the Caspian Sea region will continue to rise, at least at first. Some researchers have recently expressed fears that the warm Gulf Stream current in the Atlantic Ocean may slow down due to the changes in the Arctic environment and oceanic circulation. As a result, the regional temperatures could drop significantly creating an extremely harsh climate.

Big projects, big consequences

In the 1930s the Soviet state launched a succession of Herculean public works projects, all over the USSR, to tame nature. Their aim was to facilitate access to resources and improve industrial and agricultural productivity at any cost. Gigantic dams, enormous canals and vast irrigation systems were consequently built. These gigantic infrastructures had a significant effect on nearby ecosystems, often inflicting lasting damage. The Caspian Sea is no exception and the work carried out in its vicinity has jeopardized its fragile ecological balance.

Numerous dams and hydroelectric power stations have fragmented the great rivers of the Volga. This has altered their hydrological regime and caused variations in the level of the sea and the intensity of sediment transport, in the Volga delta and at its mouth. It has also cut off the caviar-producing sturgeons from their spawning grounds. The 101-kilometre Volga-Don canal, which opened in 1952, links the Caspian to the world's seas. After negotiating a system involving some 15 locks, hundreds of thousands of ships have, over the last 50 years, transported oil and raw materials from the Caspian all over the Soviet Union, and to markets in Europe and the United States.

In Azerbaijan the lower reaches and mouth of the Kura river were no more fortunate. The development of a vast irrigation system, covering more than 100 square kilometres – and left without maintenance for many years – led to the destruc-

tion of farming land and polluted much of the sea along the coastline with pesticides and heavy metals, a situation aggravated by the presence upstream of the Kura-Araks system of gigantic industrial facilities (Alaverdi and Megri-Kajaran-Kafan in Armenia, Rustavi-Madneuli-Tbilisi in Georgia).

To this list we might add other surrealistic plans, which never came to fruition, such as the project to transfer water from the Caspian or the Ob and Irtych rivers to the Aral Sea. However Turkmenistan is planning to extend the Kara-Kum (currently Turkmenbashi) canal by about 300 kilometres as far as the port of Turkmenbashi (former Krasnovodsk). The canal, already in very poor repair, would require a huge amount of work to operate normally. It connects the Amu-Daria river to the western regions of the country, extending over 1,300 kilometres.

A moment in the life of Kara Bogaz Gol



— Shoreline of sea and bay in 1930 Exposed part of upper layer of salt
 - - - Level of water's edge in 1956 Gypsum salt flats

N.B.: The current level of the Kara Bogaz Gol is the same as in 1930.

Sources: A. N. Varushchenko, S. A. Lukyanova, G. D. Solovieva, A.N. Kosarev and A. V. Kurayev, "Evolution of the Gulf of Kara-Bogaz-Gol in the past century", in Kamlesh P. Lulla, Lev V. Dessinov, Cynthia A. Evans, Patricia W. Dickerson and Julie A. Robinson, *Dynamic Earth Environments: Remote Sensing Observations from Shuttle-Mir Missions*, John Wiley & Sons, Inc., 2000 (figure adapted from Dzents-Litovskiy, 1959).

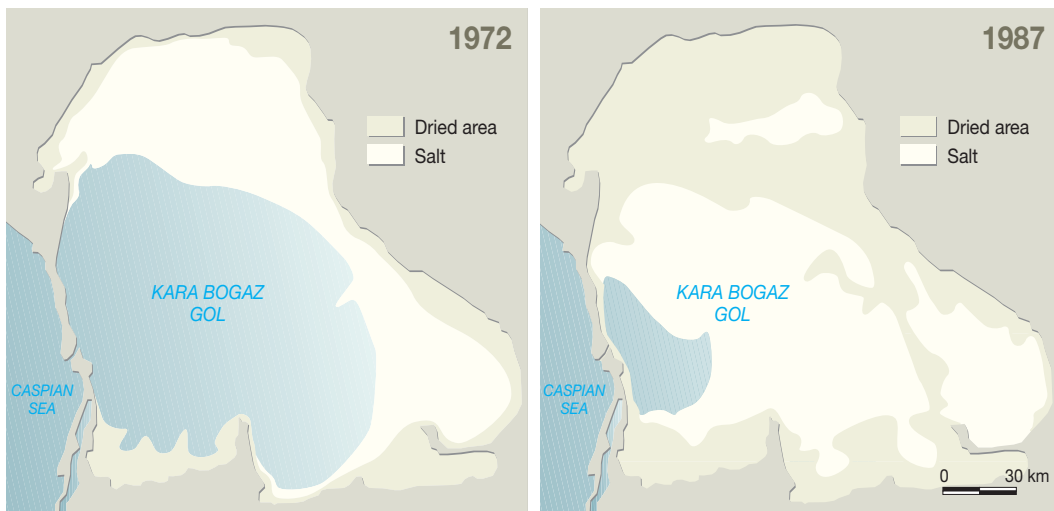


The disappearing sea

Comparing a series of satellite images from different periods a Californian hydrologist discovered in 1983 that a huge white spot had taken the place of the vast Kara Bogaz Gulf (literally "dark gullet" in Turkmen) in the south-east corner of the Caspian. The gulf had simply disappeared. What, he wondered, had happened? How could such a large volume of water have evaporated in just a few years, only to be replaced by a salty dustbowl?

As Frank Westerman relates in his book *Ingenieurs van de ziel*, it wasn't the first time the Kara Bogaz Gulf had been at the centre of a mystery. For more than three centuries it has inspired extravagant tales told by local sailors. In 1727, for instance, a Russian navigator tried to explore the gulf, starting from the Caspian Sea, but gave up, because his crew saw a

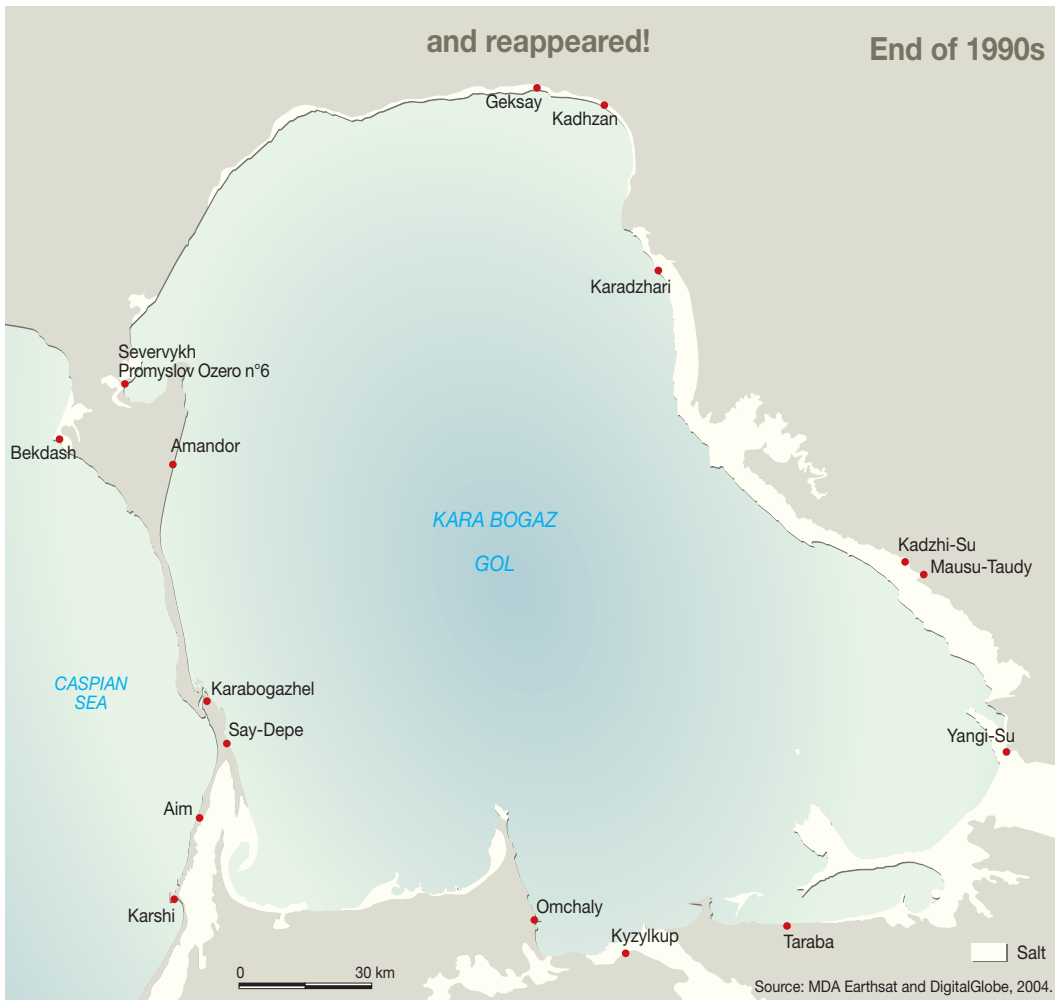
When the Kara Bogaz Gol vanished

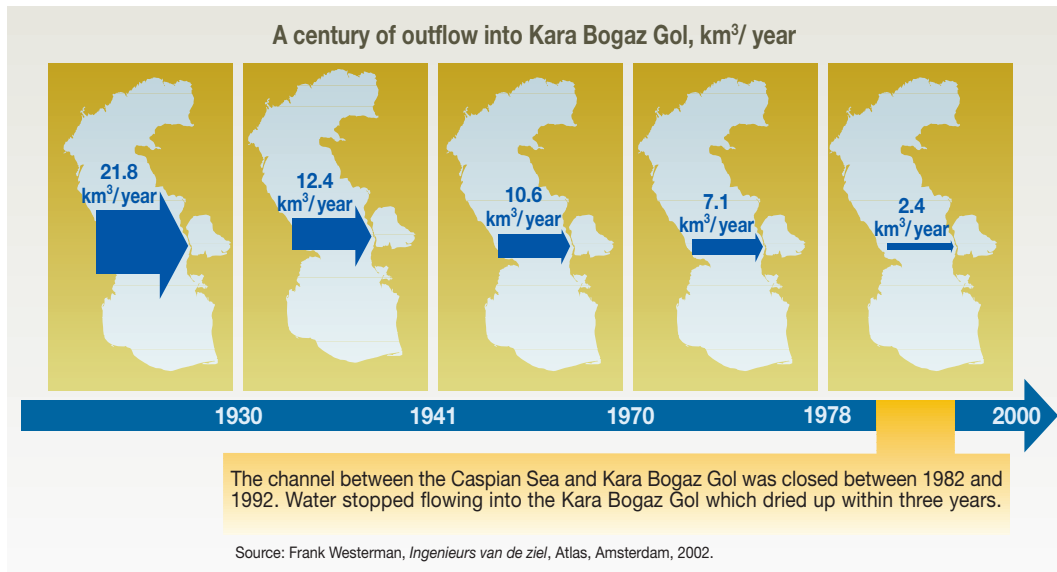


Source: Earthshots - Satellite images for environmental change, United States Geological Survey (USGS); Kara Bogaz Gol, Turkmenistan 1972, 1987.

and reappeared!

End of 1990s





foaming gully, into which the sea water was rushing with untold force, and refused to go any further. A century later, in 1847, Lieutenant Jerebtsov, a maritime explorer and cartographer of the Czar, undertook to map the contours of the Caspian, discovering, according to Konstantin Paustovsky, the gloomy coastline and entrance to the gulf. Many traders and sailors have given accounts of their terror at the entry to the Kara Bogaz. Awesome tales were common, peppered with claims that the inlet was a whirlpool leading to a gulf where the water disappeared into the depths. Boats sank there without trace and fishermen who ventured there were swallowed up and dissolved, as if they had fallen into an acid bath. Mariners would avoid at any price the “salty chute that made so much noise they were afraid of being dragged down into hell”. But it took more than its sinister reputation to impress Lieutenant Jerebtsov. He decided to carry on through the famous narrows and subsequently described in his diary how the ship was carried forward, shaken by the powerful current, until it finally reached an expanse of calm and silent water. He discovered a “salty world” and colonies of pink flamingos.

But should we conclude that sailors in the past knew that the Caspian Sea was subject to sudden changes in level? As the water in the Kara Bogaz Gulf evapo-

rates faster than it can be replaced it is always a few metres lower than its larger neighbour, which may at times have turned the narrow defile into a veritable waterfall. Be that as it may, much of the gulf’s misfortunes are due to the scale and speed at which its level fluctuated and the steps taken by the Soviet authorities to control variations. The scientists were unable to agree on the reasons for the drop in sea level that was roughly equivalent to a 10% reduction in its surface area between 1930 and 1977. Among the possible explanations, one was particularly favoured by the authorities in the 1970s. The gulf, they maintained, was “a useless caldron for evaporation, an insatiable mouth swallowing up the precious water of the Caspian” and obviously to blame. For the water managers this was a political issue. Kara Bogaz should be allowed to die a hero’s death, like a soldier at the front. The lagoon should be sacrificed so that the water, now so rare, could be used elsewhere, said the deputy minister in charge of water and forests. The suggestion prompted a disagreement with the Ministry of Chemical Affairs, which was exploiting the sodium sulphate found there, the region being the Soviet salt industry’s main centre.

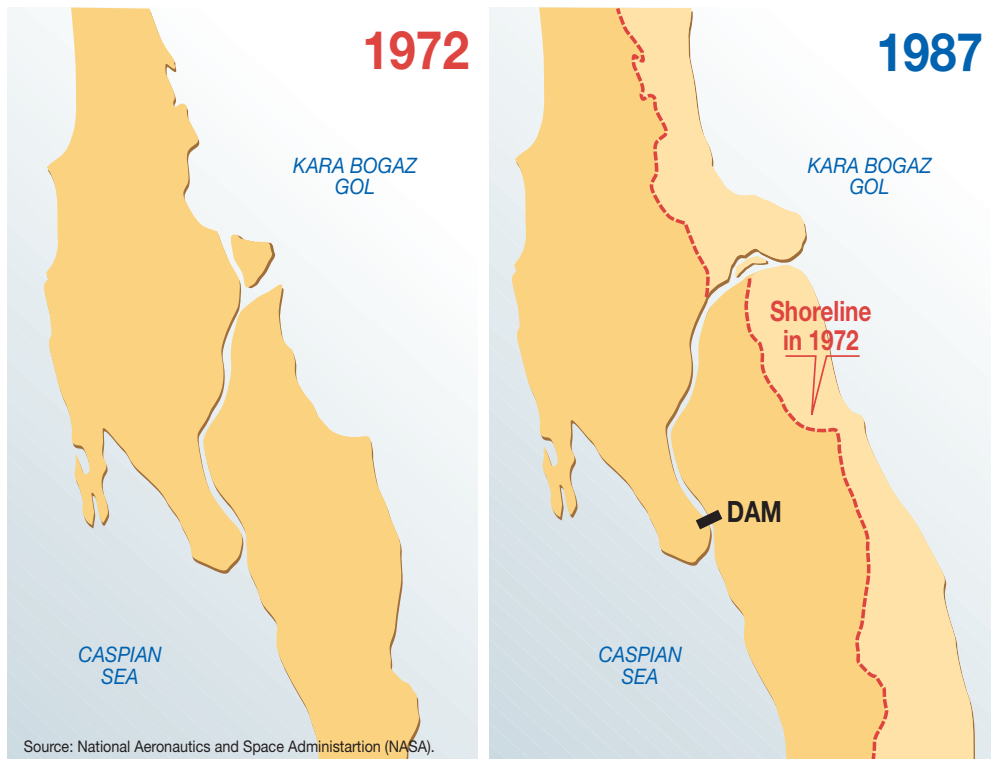
It was decided to close the passage. Work proceeded in February 1980 despite the fact that the level of the Caspian had started to rise again three years earlier.

The Soviet engineers apparently assumed it was only a temporary change. Only a narrow canal was left allowing a small amount of water to pass, thanks to which the water in the Kara Bogaz Gulf was expected to last a further 25 years. Much to everyone's surprise the gulf dried up 10 times faster than had been forecast by the Institute of Hydraulic Affairs and by autumn 1983 it was all over. The pink flamingos died in droves, the little brine shrimp on which they fed having disappeared. The lagoon turned into a vast desert covered with a 50-centimetre layer of precipitated salt, which was picked up by the wind and blown for hundreds of kilometres, as far as the Chernozem (fertile soil) area of Russia, raising the salt content of the soil.

With the closure of the strait, the gulf also stopped acting as a natural hydrological regulation system (keeping the salt content at a relatively low level). The ensuing increase in the salt content of the southern part of the Caspian, to levels exceeding 15 grams per litre, had disastrous consequences for the sturgeon population. In the spring of 1992, in view of the scale of the disaster, Turkmenistan, which had just declared its independence, decided to recover the Kara Bogaz Gulf from the desert. It therefore destroyed the dyke, restoring the connection between the sea and the gulf.

In the meantime closing the gulf had resulted in the collapse of the salt industry. The area around the Kara Bogaz nevertheless remains the world's biggest source of the raw material for the chemi-

The inlet to the Kara Bogaz Gol before and after construction of the dam

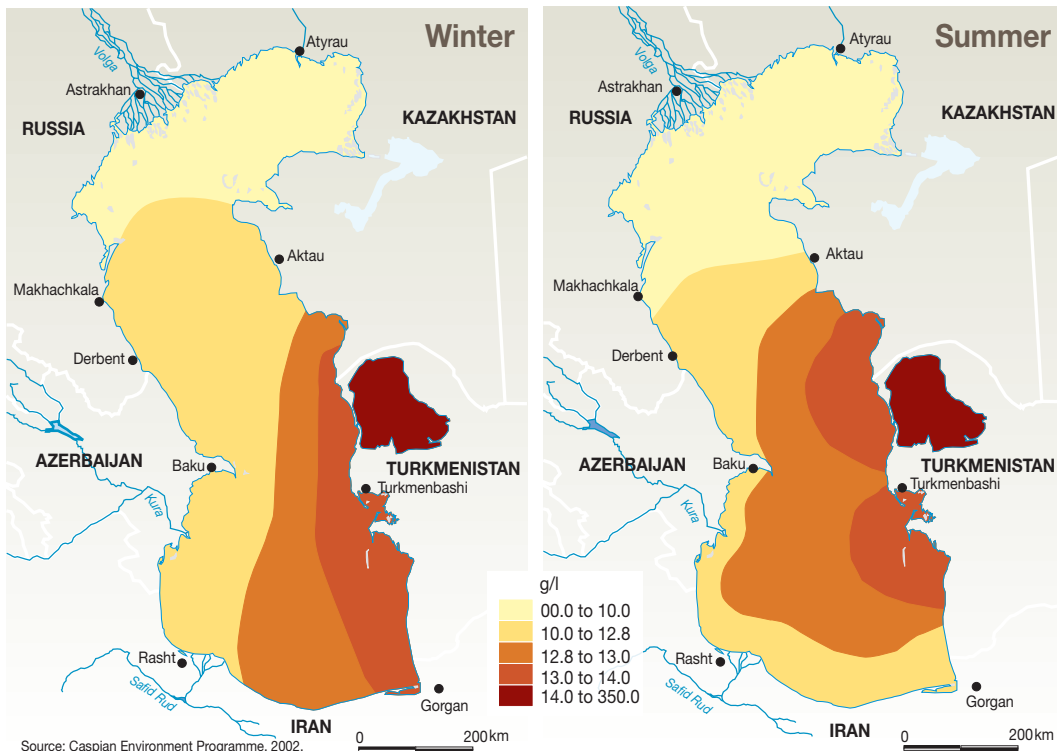


cal industry. Exploitation started at the beginning of the 20th century along fairly traditional lines and only switched to more industrial techniques in the early 1930s. Annual production capacity is enormous: 400,000 tonnes of sodium sulphate (used in the glass industry, feed for livestock and detergents), 100,000 tonnes of bischofite (a defoliant used for machine-harvesting of cotton), 35,000 tonnes of epsomite (used in paper-making, tanning – to treat leather – and the textile industry), 10,000 tonnes of glauberite (pharmaceutical industry) and 20,000 tonnes of sodium chloride (cooking salt). From the 1930s onwards the drop in the level of the Caspian and the change in the chemical conditions led to a deterioration in the quality of the salt. As the brine thickened it accelerated precipitation of the salt as sodium chloride, a less valuable product

than sodium sulphate. In the 1940s and 1950s the industry moved from the exploitation of open-air reserves to underground resources trapped below several metres of sediment.

The story came to a happy end. Well almost. After destruction of the dam, the water flowed in at a rate of 700 cubic metres a second and it only took a few months to refill the lagoon (during which time the level of the Caspian happened to go on rising). The crust of salt dissolved and the pink flamingos, ducks and pelicans returned. The Kara Bogaz almost completely recovered its ecological balance. Only the chemical industry, which depended on a system of management that had disappeared, did not survive this unusual episode in the life of the lagoon.

Sea surface salinity



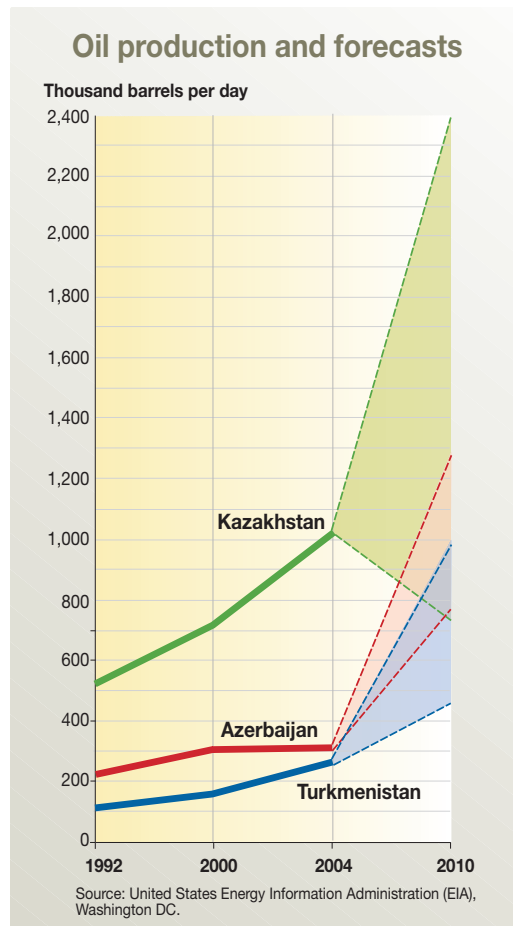
The marks of human activity

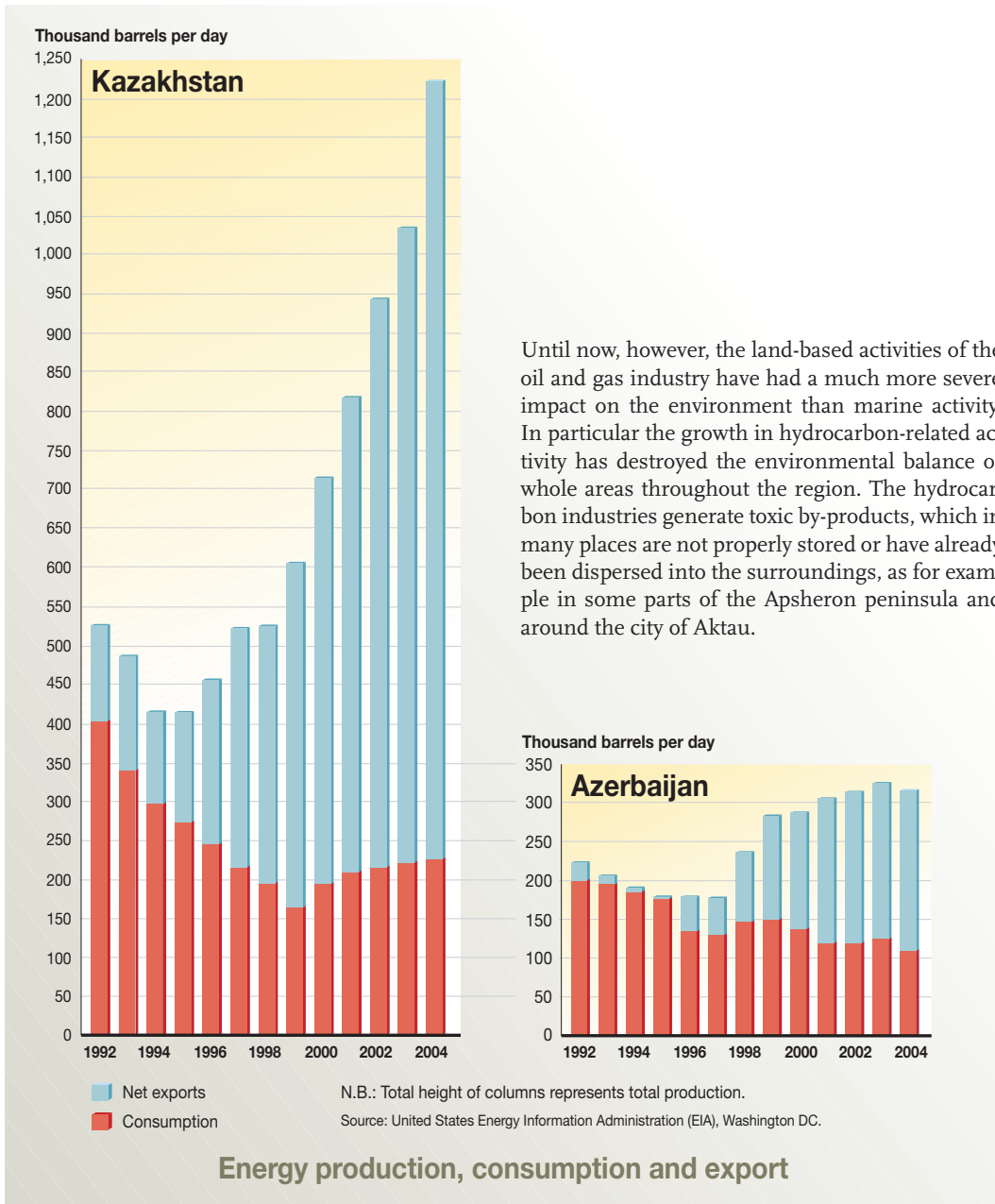
Oil slicks glittering on the surface of the sea and thousands of hectares of soil penetrated by oil leaking from abandoned wells are just part of the pollution that people living around the Caspian Sea must endure. In addition there are various industries, particularly chemicals and mining, large-scale irrigated farming and untreated household waste. Combined with the effects of the oil, all these forms of pollution have a serious impact on the well-being of humans and wildlife.

Many opportunities are offered by the Caspian Sea region. It is important that they are handled with care in order to maintain the richness in bio- and mineral resources over a long time. The natural wealth of the region round the Caspian Sea in mineral resources also involves high metal concentrations. Industrial activities, in particular mining, are raising the metal concentration in sediments to levels exceeding permissible limits.

Increased activity on oil-drilling platforms and in transport obviously increases the risk of accidents at sea. Exploitation of the offshore reserves in the northern part of the sea, where the water is very shallow, involves specific risks. Depending on the season (ice forms in some places in winter) access, in the event of an accident, may be very difficult.

Figure: Oil forecast in Azerbaijan, Kazakhstan and Turkmenistan. Numbers should however be treated with caution, estimates changing frequently as new exploration work is carried out. The most recent forecasts for Azerbaijan have been more moderate, whereas new exploitation work will soon be starting in Kazakhstan.





Hazards in and around the Caspian

32



<p>Topography, metres</p> <p>Below sea level</p> <p>0</p> <p>200</p> <p>500</p> <p>1,000</p> <p>2,000</p> <p>3,000</p> <p>4,000</p>	<ul style="list-style-type: none"> Oil and gas drilling Projected off-shore pipelines Oil wells flooded and leaking Area under exploration for oil and gas (high potential) Polluted sea (oil, pesticides, chemicals, heavy metals or bacteriological pollution) Polluted soils and land degradation Soil salinisation 	<ul style="list-style-type: none"> Polluted rivers (industry and municipal sewage water) Land-based source of river pollution (mainly heavy industries) Identified poorly stored hazardous industrial waste site or polluting industrial activities Former nuclear testing site Main direction of sandstorm causing salt transfers toward arable lands of the Volga region
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Sources: National Caspian Action Plan of Azerbaijan, 2002; National Action Programme on Enhancement of the Environment of the Caspian Sea, Kazakhstan 2003-2012; Environmental Performance Review of Kazakhstan, UNECE, 2000; Environmental Performance Review of Azerbaijan, UNECE, 2003; Study for Safe Management of Radioactive Sites in Turkmenistan, NATO, 2005; Environment and Security: Transforming Risks into Cooperation, Case of Central Asia, UNEP/UNDP/OSCE, 2003; Global Alarm: Dust and Sandstorms from the World's Drylands, UNCCD, 2001



Land degradation

- Soil degradation and erosion: pollution due to pesticides and/or heavy metals. Salinisation due to poorly maintained irrigation system and rise of water table
- Area affected by deforestation
- Pasture degraded by overgrazing
- Summer pasture
- Winter pasture

Pollution due to oil production and industrial activities

- Soils contaminated by pollution from oil production
- Obsolete Soviet drilling platforms threatened by Caspian Sea level rise.
- Dispersed oil pollution
- Large ageing Soviet industrial complex still generating pollution (mines, chemical and cement factories, thermal and metallurgical plants). Significant heavy metal contamination (soil and water).

Water issues

- Transboundary polluted waters
- Caspian Sea level rise
- Coastline already submerged (destruction of certain infrastructure)
- Coastline at risk of flooding
- Drinking water canal
- Tension between Russia and Azerbaijan due to diversion of water from Samur River
- Decaying Soviet irrigation infrastructure damaging soil

Transportation and communication

- TRACECA (Transport Corridor Europe Caucasus Asia): Renovated or new multimodal transportation corridor (road, railroad, pipeline) and BTC (Baku-Tbilisi-Ceyhan): main oil pipeline route

MAP BY PHILIPPE REKACEWICZ - UNEP/GRID-ARENDA - JULY 2004

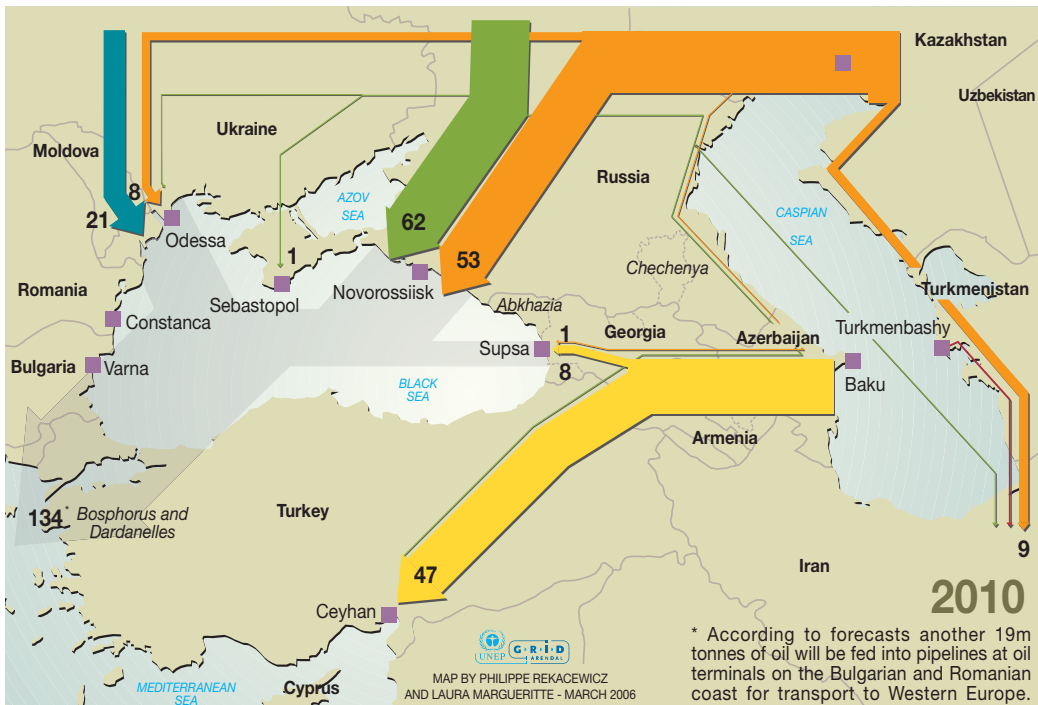
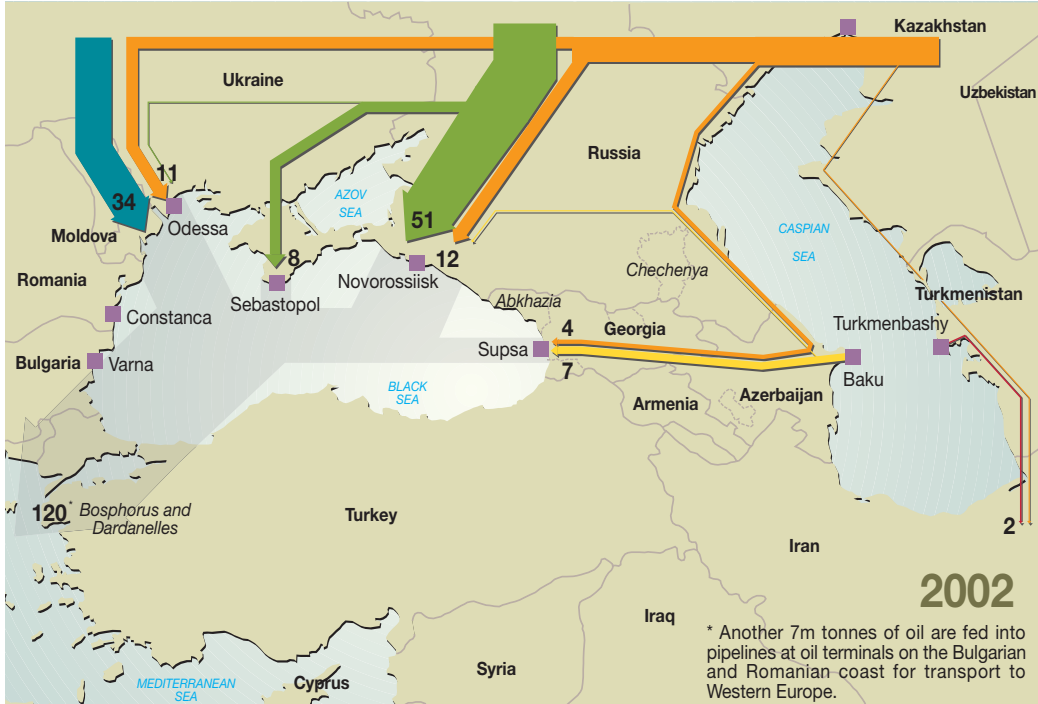
The crude oil and gaseous condensates from the North Caspian oil fields have a very high sulphur content. The refining process, in particular to produce liquid petroleum gas, leaves large mounds of sulphur deposited in the open where it contaminates the surrounding environment. Large amounts of toxic gas are released into the atmosphere too.

Once the activity stops, the waste remains and constitutes a hazard. There are hundreds of abandoned oil wells in Azerbaijan, and thousands in Kazakhstan, many of which have been submerged by the rising sea. There are reports of big leaks into the water, killing waterfowl and fish. Thousands of hectares of soil on Azerbaijan's Apsheron peninsula are unsuitable for agricultural use. Some 600,000 hectares of land in the Atyrau and Mangystau Oblasts of Kazakhstan are polluted with a thick layer of oil penetrating the soil to a depth 8 to 10 metres and polluting the ground water.





Oil exports via the Black and the Mediterranean Seas



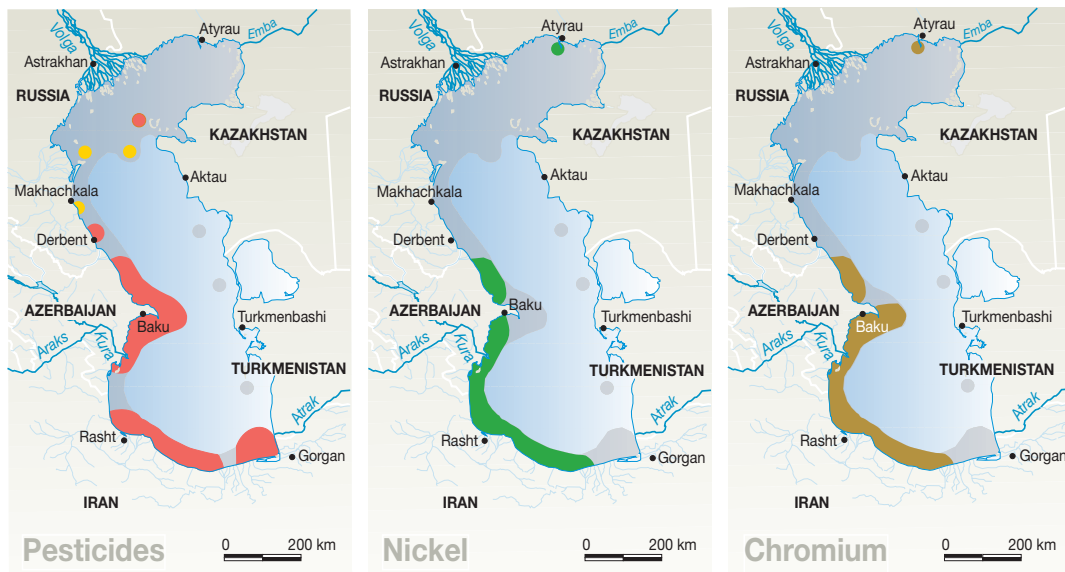
- █ Russia
- █ Kazakhstan
- █ Azerbaijan
- █ Other former Soviet Union states
- █ Turkmenistan
- █ Oil terminal

0 500 km

Arrows proportional to the volume of oil exportation (in million tonnes).

Source: Cambridge Energy Research Associates (CERA), March 2003 cited in Oil Spill Preparedness Regional Initiative (Caspian Sea-Black Sea-Central Eurasia), Briefing paper, Oil Spill Response Capability (OSPRI), 2004.

Pesticides and heavy metals in sediments



Sampling areas
 DDT concentration above ERL (1,600 pg/g)
 Lindane concentration above ERL (300 pg/g)

Sampling areas
 Nickel concentration above ERL (21 µg/g)
 N.B.: Maximum nickel concentration in analyses measured was 68 µg/g.

Sampling areas
 Chromium concentration above ERL (81 µg/g)
 N.B.: Maximum chromium concentration in analyses measured was 128 µg/g.

The Effects Range Low (ERL) is an indicator of concentrations above which adverse effects occur (National Oceanic Atmospheric Administration (NOAA) Marine Sediment Quality Guideline Values).

Source: Interpretation of Caspian Sea Sediment Data, Caspian Environment Programme, 2002.



Sampling areas
 Arsenic concentration above ERL (8.2 µg/g)
 Note: Maximum arsenic concentration in analyses measured was 22.6 µg/g

Sampling areas
 Mercury concentration above ERL (0.15 µg/g)
 Note: Maximum mercury concentration in analyses measured was 0.45 µg/g

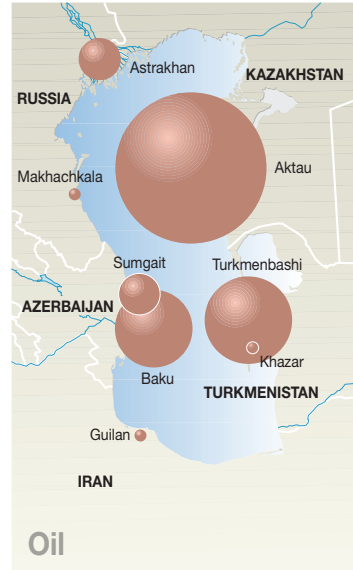
Sampling areas
 Copper concentration above ERL (34 µg/g)
 Note: Maximum copper concentration in analyses measured was 57.6 µg/g

The Effects Range Low (ERL) is an indicator of concentrations above which adverse effects occur (National Oceanic Atmospheric Administration (NOAA) Marine Sediment Quality Guideline Values).

Source: Interpretation of Caspian Sea Sediment Data, Caspian Environment Programme, 2002.



Discharge of selected pollutants



Tonnes per year

16,060
5,000
1,000
100

- Biochemical Oxygen Demand (BOD)
- Nitrogen
- Phosphate
- Oil

1. Measure determining the extent to which oxygen within a sample can support microbial life.

Source: Caspian Regional Thematic Center (CRTC) for Pollution Control: coastal and off-shore industry, Azerbaijan, February 2003.

Imported problems

The Volga, the main river flowing into the Caspian, brings polluted water from locations as far as 3,500 kilometres away. Nearly 45% of Russian industry and 50% of its agricultural production facilities are located in the vast river basin. Inadequately treated waste water – among others from the entire Moscow urban area and industrial centres such as Ekaterinburg and Perm – spills into tributaries of the Volga. Any waste that does not silt up behind a dam or soak into the Volga estuary ends up in the Caspian.

The situation at the mouth of the Kura-Araks River on the Apsheron Peninsula is similar, with a rising pollution load accumulating on the way through Georgia and Armenia. It then combines with the waste from two-thirds of Azerbaijan's industrial production and more than a third of its population. The wastewater treatment facilities serving the major urban areas of Baku and Sumgait are not up to the task, unable to cope with the rapidly growing population.

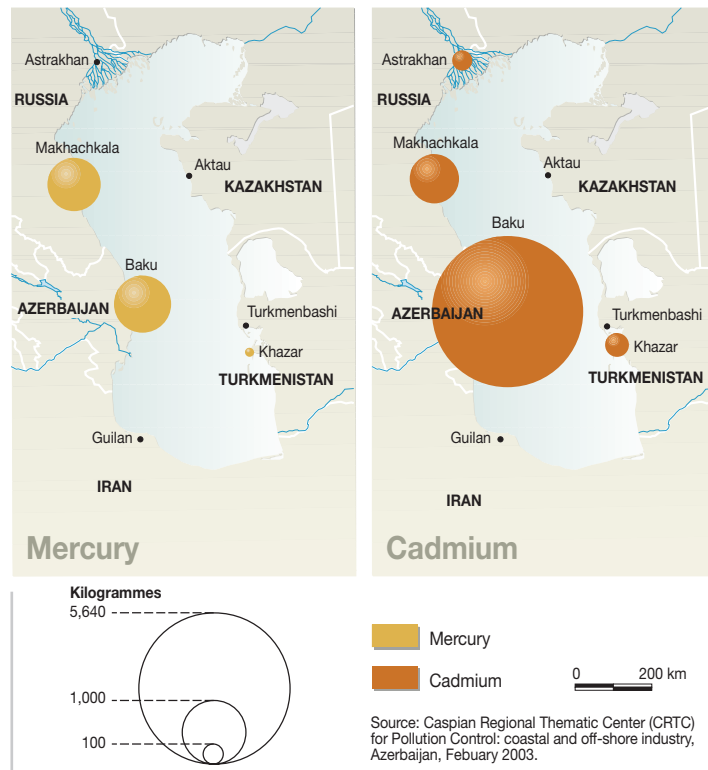
Air quality has generally improved in recent years, mainly because industrial production dropped drastically since the collapse of the Soviet economic system. But increasing emissions from the expanding oil and gas sector, and a growing number of cars in cities, not only affect the health of local

people, but contribute to the accumulation of greenhouse gases in the atmosphere, contributing in turn to observed trends in global warming.

The type and severity of pollution must be deduced from analysis of data from selected cases. They provide an indication of accumulated pollution. For example, traces of the pesticide DDT in fish tissue and seals lead to the conclusion that DDT may be still in use despite an international agreement to stop its application, with the risks it involves for animals and humans. Iran, Kazakhstan and Russia have signed the Convention on Persistent Organic Pollutants and Azerbaijan has adhered to it. The convention seeks to ban chemicals that are absorbed by fatty tissue and accumulate there, as is the case for DDT, enabling them to travel long distances. The drastically restricted use of DDT raises a new problem: the unused material is stockpiled without the necessary safety measures, and as such poses an additional health and environmental hazard.

The accumulation of pollution from all these different sources and the fact that several countries are involved makes it particularly difficult to manage.

Discharge of selected pollutants



The hazardous legacy of an uranium mine



- Industrial sites
- Waste and spills
- /// Area exposed to high radioactivity and contamination
- Approximate limit of groundwater migration (1 to 3.5 km)
- ← Spread of pollutants
- Radiation hotspots
- Waste water pipelines

Sources: Soviet topography map 1:200,000 (1988); Volkovgeologia Survey (1993); Kazmehnbator Engineering Study; Mangistau Environmental Authority, State of the Environment 2005; Based on in-depth assessment of environmental and security issues, linkages and hotspots in the Eastern Caspian region carried out under the Environment and Security initiative (ENVSEC).

Koshkar-Ata is one of the largest industrial tailings in the world occupying an area of approximately 77 square kilometres. Located in a natural depression about 5 kilometres from the outskirts of the Kazakh town of Aktau and 8 kilometres from the shore of the Caspian Sea, the enormous dump is a serious environmental and health hazard.

Before industrial activities started in the 1960s, the Koshkar-Ata hollow was a periodic lake rich in natural salt, making it unsuitable for farming. The discovery of vast uranium deposits in the deserts of western Kazakhstan led to the establishment and rapid development of a uranium extraction and processing industry. At its peak in the 1980s Kazakhstan was producing more than one third of Soviet uranium, with more than 30 uranium mines.

The Koshkar-Ata depression was chosen as a convenient location to accumulate radioactive and toxic waste from the chemical and hydrometallurgical complex in the newly-founded city of Shevchenko (now Aktau, with about 176,000 inhabitants). The complex produced, among others, uranium concentrate mostly for Soviet military purposes. Falling prices on the uranium market due to changes in military priorities, gradually decreasing uranium concentrations in the mines and the overall economic crisis in the post-Soviet world of the 1990s led to reduced output and ultimately complete stoppage of uranium milling in 1999. The lake is still used as a dumping ground for commercial and production waste, oil extraction sludge, etc.

In the years of uranium production, 356m tonnes of mining waste with a total radiation activity of 11,242 Curie were channelled into the Koshkar-Ata tailing pond. Uranium mill tailings with low to medium-level radioactivity account for almost 105m tonnes of the total. Significantly increased exposure rates

at 80 to 150 micro roentgen per hour ($\mu\text{R}/\text{h}$) were measured in the southern part.

Currently, about half of the tailing surface is covered with water from industrial operations. It is however estimated that the tailing pond will dry out within a few years due to high evaporation and the lack of water, with no more waste water flowing in from the shut-down factories. In the southern part of the hollow, a 12- to 14-square kilometre section is already exposed to the air. This part has the highest concentration of contaminants, covered with solid waste giving off high levels of radioactivity. Constantly swept by strong winds, there is a serious risk of pollutants being dispersed. Large amounts of phosphoric gypsum, a by-product of fertilizer production, were discharged into the lake. The gypsum has formed a crust on the surface, preventing dusting and the escape of radon. As a result, dispersal of dust-blown substances and radon emissions are limited, and local scientists conclude they do not currently constitute a health hazard.

The obsolete infrastructure from former uranium open-cast mines and processing facilities constitutes an additional risk of exposure to radioactive material. Among the industrial dumps and derelict industrial equipment there are several radiation hotspots exceeding 1,500 to 3,000 $\mu\text{R}/\text{h}$, as against natural radiation in Kazakhstan of 10 to 15 $\mu\text{R}/\text{h}$. The local population and temporary migrants from the neighbouring Uzbek Republic of Karakalpakia are illegally dismantling the infrastructure, to sell the scrap metal as a raw material for new construction. But potential customers are inclined to reject highly radioactive parts, and the sellers simply dispose of the material elsewhere in the countryside.

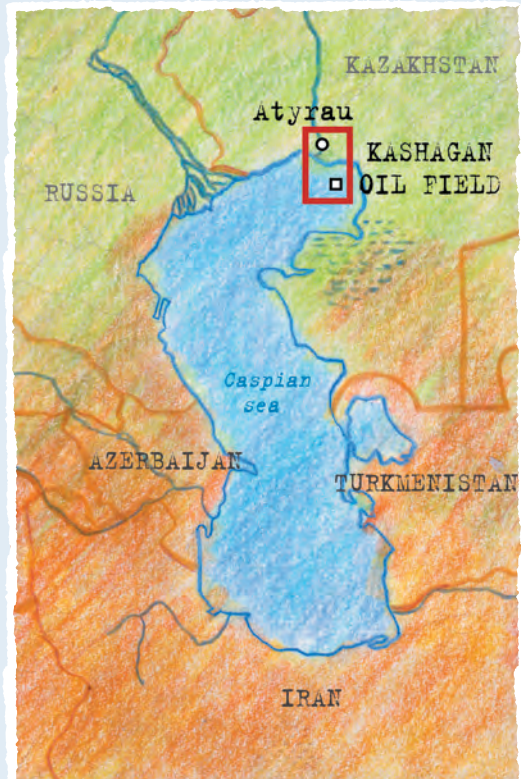
Aktau is also home to a nuclear power station, now shut down. Decommissioning of the fast-breeder

reactor is under way, with extensive international support. Spent fuel is stored on-site, as are 1,000 tonnes of radioactive sodium.

But radiation does not seem to be a major concern for the local authorities. They are more concerned that pollutants might migrate through groundwater and contaminate the Caspian Sea located just eight kilometres away. At present, there seems to be no hard evidence that pollutants have reached the Caspian Sea. According to recent monitoring data, elevated levels of contaminants in the groundwater as well as the soil are currently limited to a strip 2 to 4 kilometres wide around the lake. Contamination includes high concentrations of toxic metals (molybdenum, lead, manganese, strontium, etc.), rare-earth elements and radio nuclides. The situation is clearly precarious, as a rise in the level of groundwater could cause more widespread dispersal of pollutants.

Reclamation is costly (according to the Kazakh press estimates exceed 10bn tenge (€62m)) and the measures taken so far are only a temporary solution. To prevent pollutants from reaching the Caspian, with its rising water level, and delay the moment when the Koshkar-Ata will dry up, exposing the entire surface to the wind, millions of litres of water are being pumped into the tailing pond every year, at a cost of 5.5m tenge (about €34,000). At present annual total expenditure on the tailings deposit amounts to 300m tenge (€1.86m).

The concern expressed by local environmental authorities and the population about the state and future of the Koshkar-Ata lake will hopefully grow strong enough to induce longer-term rehabilitation of Koshkar-Ata. As mining worldwide is becoming attractive again with rising prices for resources, financing might become more realistic.



JOURNALIST STORY 01

Paul Brown in Atyrau, Kazakhstan, The Guardian, 4 December 2002

Oil money threatens to make killing fields of Kazakhstan

The Kashagan oil field has attracted widespread local environmental objections because it is right at the mouth of the Ural river, the last natural breeding ground of the famed, but endangered Beluga sturgeon, which produce the world's most expensive caviar. Local fishermen and green groups believe exploitation of the field will cause the demise of the sturgeon.

Professor Muftach Diarov, director of the Atyrau Institute of Oil and Gas, an independent geological school, believes that exploiting the field in a known seismic zone could trigger a massive earthquake.

He said that the oil was under enormous pressure at temperatures of 100°C to 120°C. "This is a volatile area in geological terms. We had an earthquake here in 2000. We just don't have enough experience working under such extreme conditions and we don't know what would happen should this oil be released and a void created under such pressure. Releasing oil at 1,000 times atmosphere pressure is like releasing a genie in a bottle. Who knows what will happen? If there is another earthquake, the new pressures created in the oilfield could trigger a man-made earthquake. Oil would spill out into the sea and cause an environmental catastrophe."

The northern Caspian is very shallow - only three metres deep - and freezes in winter. The consortium has had shallow-draught icebreakers built to keep the area open during the five months of freeze. The waters are also too shallow for traditional oil rigs so the operator, Agip of Italy, which also has a 16.67% share, is building artificial islands from which to operate the wells.

Professor Diarov is also concerned that the five nations that border the Caspian - Russia, Iran, Kazakhstan, Turkmenistan and Azerbaijan - have no joint agreements about the safety of the sea or conservation. "It is only oil dollars that talk round here," he said.

Local environmental groups have sent a petition to the UN asking it to intervene in getting the five nations of the Caspian round a table.

Their petition talks about "deep disquietude" over the fate of the sea and the potential for man destroying its unique wildlife - including the four commercially important species of sturgeon.

They are also concerned about human health. The air pollution from existing refineries is one objection but the other is "sour gas" - natural gas mixed with oil which is heavily contaminated with hydrogen sulphide. The nearby onshore field, which has been producing high quality crude, has a similar sour gas problem. This field, 50% owned by ChevronTexaco and 25% by ExxonMobil, is run by Tengizchevroil, known locally as TCO, and claims to contribute \$1.8bn a year to the Kazakhstan economy.

Byproduct blighting Caspian life

There is a sulphur mountain on the shores of the Caspian Sea, more than 6 million tonnes of it, and it is growing by 4,000 tonnes a week. The sulphur is a byproduct of the Tengiz field, stockpiled when the "sour gas" brought up with highgrade crude is cleaned up to produce liquid petroleum gas, or LPG, for European Union markets. The mountain has become a huge embarrassment to field owners Chevron and ExxonMobil. Not only is it the focus of local protests, but yesterday field operator Tengizchevoil, or TCO, was fined 11bn tenge (US \$80m) by a court in Kazakhstan for "ecological damage". TCO said it was "very disappointed" and considering an appeal to the supreme court.

"According to our data, this sulphur negatively affects the environment," said Turaly Onerbayev, regional representative of the natural resources and environmental protection ministry. Even before the imposition of the fine, it was clear that about 3,000 people were having to be moved 50 miles away because of pollution - and they blame sulphur dust for their illnesses.

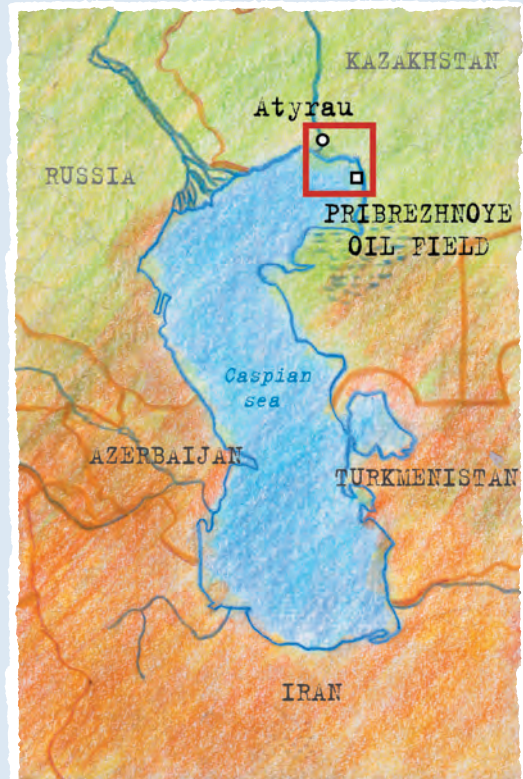
TCO denies the charge and says the sulphur is safe, but has decided to get rid of it. Until recently it had virtually no outlet for it; in landlocked Kazakhstan the only route out for large volumes of sulphur has been by rail, but TCO has used every available slot for transporting oil. Now, however, TCO has linked up with the Russian oil pipelines, so most of its output no longer needs to go by rail. But there is a second problem: a worldwide sulphur glut. Some 40m tonnes

of sulphur a year is used by industry, mostly in the form of sulphuric acid, but there is still an excess. From a peak of \$180 a tonne in 1988, sulphur prices have dropped to \$36 a tonne this year. To unload an additional 6 million tonnes on the market would mean the price would drop to near zero.

But TCO has to do something. It has put in a \$54m plant to process the sulphur into flakes for the Chinese fertiliser market and granules for the western market. The flakes are already being exported by rail to China and the granules will be heading west to Black Sea ports for European and American markets. At most TCO expects to be selling 3,000 tonnes a week next year, but even that vast quantity means the sulphur mountain will still be growing at 1,000 tonnes a week.

Joel Adamson, whose task it is to address the issue, said: "We have to take a softly-softly approach. As it is, each tonne we sell makes a loss, simply because of the distances we have to transport it. To depress prices further makes no sense, so we are producing a high quality product at a very low price to try to corner the market. We hope prices will go back up, but in the meantime we hope to get an increasing market share so at least we can begin to reduce the size of the mountain."

Given the problem facing the existing field, a much larger offshore field nextdoor operated by Agip will not try to sell its sulphur - but neither will it create another mountain. Instead it plans to store millions of tonnes in underground chambers, thereby postponing the problem indefinitely.



JOURNALIST STORY 02

By Amina Jalilova, Novoye Pokolenie, 2004

Who will take care of drowning oil wells?

For three months in succession, a trail of oil has been seeping from submerged wells of the Pribrezhnoye oilfield in Atyrau, Kazakhstan. At one point, two oil spots were as large as several soccer fields. A recent inspection was more encouraging, detecting just a silvery film remaining on the water.

But we can only guess how much environmental damage the accident caused. Most probably, no alarm will be raised until, once again, shoals of fish and hundreds of sea animals are found dead.

Pribrezhnoye is far from being the only oilfield that was abandoned because of the advance of the Caspian Sea. With the rising sea level, some 15 oilfields have already been submerged in the coastal area. It is a long time since any oil has been extracted from these wells, even though many are allegedly owned by the Ministry of Energy and Mineral Resources. Their real owners cannot be found.

Mr Radus Latfullin, managing director of the Kazakhstan State Inspectorate for Supervision of Offshore Oil Safety, thinks such fields could become ministry property. The point is that late in March the national oil and gas company KazMunayGaz (KMG), while restructuring

its subsidiaries, carried out a merger of EmbaMunayGaz (EMG) and UzenMunayGaz in Mangistau. It is quite possible that the post-merger KazMunayGaz Prospecting and Production Company simply disposed of useless abandoned fields, now under the authority of the ministry. But is not clear which agency is in charge of the fields where an accident may occur at any time, killing many representatives of the unique Caspian flora and fauna.

In March 2004 the Kazakhstan Offshore Oil Safety Inspectorate sent an enquiry to oil companies whose fields include submerged wells. The reply from EMG was that it had no such wells in its oil fields. But the inspectorate knew that there had been four flooded fields with at least a hundred wells in the territory under EMG's control, with many of those wells submerged for over 17 years.

The spill at Pribrezhnoye was first recorded in December 2003. However because of thin ice cover, characteristic of the North Caspian's shallow waters, special facilities were needed to stop it at the time. The Atyrau regional authorities sent a letter asking for the necessary funds to Vladimir Shkolnik, Minister of Energy and Mineral Resources. Of course no money was allocated to Atyrau. And that was only the start of a long ordeal. Among those to whom Atyrau's environmental protection department appealed were the government-owned KazCaspianShelf Company, the international consortium AgipKCO, and even the Russian Astrakhan Naval Flotilla. It should be pointed out that back in 2001 when oil was spilt at the Southwest Tazhigali oilfield, it was AgipKCO that helped the region, even though it was in no way the group's responsibility. This time, however, AgipKCO did not allocate any resources. In fact, nothing whatsoever was done during the three winter months.

In spring 2004 the Ministry of Energy and Mineral Resources invited bids for oil spill prevention and elimination. Almaz, a little known innovation firm won the tender. But to everyone's surprise Pribrezhnoye was not on the list of oilfields where wells were to be urgently suspended. As the contractor was appointed the oil spots kept floating serenely on the surface of the sea. Almaz has still not even obtained all the necessary permits to start work on the submerged oilfields. So there is no knowing if any spill-prevention action will be taken in the hazardous area.

Given the confusion as to the ownership of the abandoned fields, the State Inspectorate ran into difficulties at a very early stage of its spillage control work on flooded fields, being unable to identify any authority for visiting the accident site. And what if further seepage or spillage is detected at the same sites? Presumably everything will be very much like it is at Pribrezhnoye where oil has been flowing into the sea without hindrance for the fourth month running.

However, it would be unfair to claim that nothing at all is being done. Naturally the authorities are aware of the problem, as reflected in the tender mentioned above. In 2004, the Ministry of Energy and Mineral Resources allocated 363m tenge (about \$2.7m) for abandonment and conservation of emergency wells. But such funding is laughable. With the cost of abandoning or conserving a well ranging from 5m to 70m tenge, or an average of 30m tenge (\$222,000), the budget will only cover 10 to 12 sites. The grand total for submerged offshore wells in the 15 fields is 1,128 in the coastal area alone, and poorly conserved onshore wells, which are just as hazardous, must be taken into account too.

The government also approved an Oil Industry Programme of Abandonment and Conservation of Overflow Oil and Hydrogeological Wells for 2004-13, which provides for abandoning 171 non-operating oil wells in Atyrau. But, here again, it is merely a drop in the ocean.

Regional authorities have allocated funds to pollution too. Atyrau has earmarked 36bn tenge (\$266m) for the budget of its Integrated Environmental Programme for 2003-5. However the clearest indication of the programme's efficiency is that at the time of the accident at Pribrezhnoye, Atyrau pleaded for money from the Centre. Was it because the programme was over-integrated?

Now Kazakhstan is starting to implement the Caspian shelf development programme. The country hopes the shelf will make enable oil production to be tripled. But how can deep-well sub-sea operations be managed if shallow water problems cannot be solved?

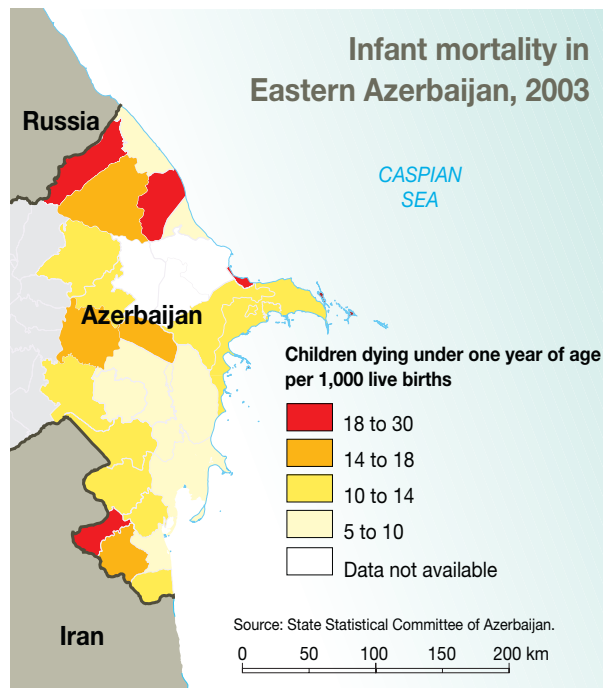
Note: Since this article was published there have been several small changes. The sub-contractor Almaz has fulfilled its promises and cleaned up five leaking oil wells. EMG is no longer operating, having become part of the KazMunayGaz Prospecting and Production Company.



Population and Health:

The combination of high levels of pollution and a deteriorating public health system causes concern for the health of many living around the Caspian Sea. Socio-political and economic changes in the former Soviet countries are largely to blame.

Apart from two large urban areas – Baku-Sumgait and Makhachkala-Kaspiisk – and the Iranian coast on the southern shore, a very densely populated coastal strip where one agglomeration leads into the next, most of the population living on the shores of the Caspian is rural, with strong religious and family traditions actively maintained. It is consequently not surprising that several countries and provinces – Iran, Daghestan, Turkmenistan and parts of Azerbaijan – still enjoy very high population growth rates (in excess of 10 per 1,000). Even if over the last two decades, or perhaps longer, the fertility rate has dropped significantly, the authorities nevertheless have to cope with all the health, education and employment problems associated with a rapidly rising, youthful population.







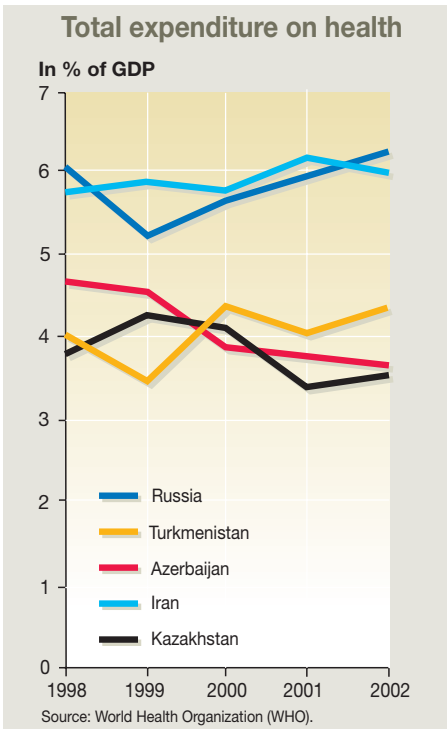
Population density and urban centers



Public health policies during the Soviet period eliminated several traditional diseases. But for lack of adequate investment in medical equipment and drugs in the 1970s and 1980s they failed to

effectively halt a worrying rise in the overall and infant death rate. This setback is very noticeable all over Russia, but in much of the Caspian basin it went hand in hand with a shortage of amenities, due to the distance from the country's main economic centres. Iran is gradually catching up





lost time and supplying rural areas with adequate medical equipment, but the opposite is happening in other countries. Here, with the decline in public expenditure on health and education, the general level of public health is either steady or actually declining. Inequality is on the rise, with the switch to a two-tier health service under which payment is demanded for an increasing range of treatments, putting them out of the reach of much of the population.

Several additional factors have contributed to the emergence of new health problems, in particular the increase in perinatal or infant mortality, the reappearance of diseases such as tuberculosis or polio that had almost been eradicated, and an increase in the number of hepatitis and cholera

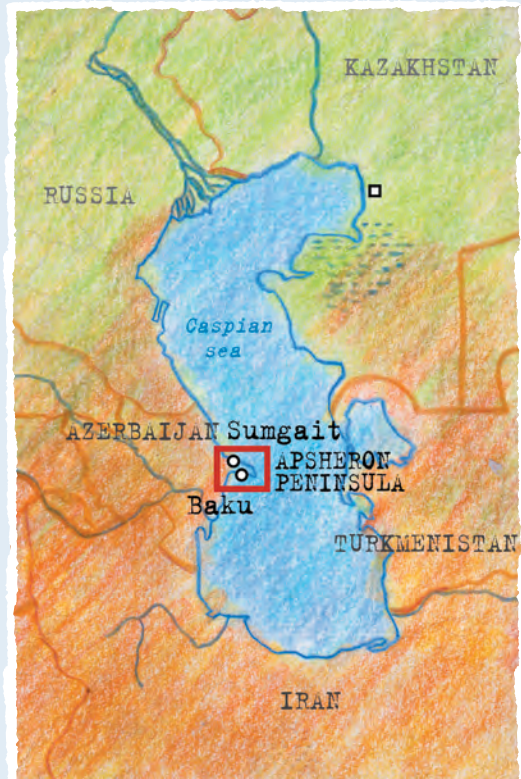


foci. In Azerbaijan, the highest morbidity rate is related to diseases of the respiratory organs (11,274 cases per 100,000 people), with a similar situation in Atyrau and figures twice as bad in the Mangistau oblasts, linked to exposure to pollution. There are still problems obtaining a supply of good quality drinking water, except in a few hilly regions. In the country and in many cities the water pipes and sewage systems are urgently in need of improvement, contributing to unsatisfactory public hygiene. Azerbaijan's programme on Poverty Reduction and Economic Development also recognizes that one of the primary causes of morbidity and mortality in children is diarrhoeal disease, usually caused by contaminated water.

Furthermore the number of industrial facilities with a high risk of pollution is tending to increase due to exploitation of new oil and gas fields. The concentration of heavy metals and toxic or even radioactive materials is a recurrent problem in old industrial centres such as the Apsheron peninsula. Similar sources of pollution have existed since the 1960s and 1970s in the west of Turkmenistan and in the Astrakhan and Atyrau areas. Little is known

about the radiation exposure of people living in areas of high radioactive pollution, in the Atyrau oblasts, home to a former nuclear testing site.

Despite increasing pressure from national and international NGOs the local authorities are still uncertain as to how to act. When confronted with cases of flagrant pollution they tend to step up pressure on industrial organisations, with backing from international programmes and credits. At the same time they have little patience with any signs of discontent among local people, who need treatment and have little choice of alternative housing. The economic weight and physical presence of heavy industries make it very difficult to introduce proper health standards to protect local people against the most basic risks.



JOURNALIST STORY 03

By Kieran Cooke, BBC, Azerbaijan, May 2005

Azerbaijan's post-industrial hangover

Aslan Abbasov stands in the middle of the state run Azerchimia chemical factory in Sumgait, a vast Soviet-built industrial complex 20 kilometres north of Baku, the capital of Azerbaijan.

Rusty pipes stretch into the distance. Most of the buildings are wrecked. The air is heavy with the smell of chemicals. There is not a blade of grass in sight. "When I come in here I think of the battle of Stalingrad," says Mr Abbasov, the plant's director. "So much of the factory is falling down but we still continue production. There are large amounts of toxic chemicals about. We need millions of dollars to clean up the mess here but the funds are difficult to come by."

The industrial centre of Sumgait had been one of the most important producers of chemicals and associated materials in the former USSR. With independence gained in 1991 Azerbaijan suddenly lost the captive Soviet market for its goods. Much of the country's infrastructure is in serious need of repair. Since independence, more than a million have left the country in search of jobs. According to a UN estimate, more than 50% of Azerbaijan's population live below the poverty line. Industries in Sumgait once employed 45,000 - now only about 5,000 work at the complex. Workers say that environmental controls that existed in the old Soviet days have largely disappeared.

High cancer levels

Many workers at Azerchimia - earning on average between \$80 and \$100 per month - walk about without protective clothing. Several of the working areas at the plant, which produces chlorine and other substances, have no roofs - with rust eating away at the old buildings management decided it was better to take the roofs off rather than have them collapse on the workforce.

Large amounts of highly toxic substances like mercury and lindane are strewn over a large area. A UNDP report published in 1996 referred to the "apocalyptic state of Sumgait's environment".

While production cutbacks have resulted in less overall pollution, little rehabilitation work has been done. "People here still suffer from high levels of cancer and other diseases," says Khalida Yuliyeva, chief paediatrician for the city of Sumgait, which now has a population of 350,000. "Other problems, like a high occurrence of still births and various birth defects, can continue for many years after the actual pollution has gone away."

Revenues from recently discovered oil and gas supplies could be used to tackle Sumgait's environmental problems.

Free economic zone

Foreign companies have begun exploiting what are considered to be some of the world's largest remaining untapped energy reserves in the Caspian Sea. Billions of dollars of revenue will flow into Azerbaijan's coffers.

"We are well aware of the problems we face," says Gussein Bagirov, Azerbaijan's minister of ecology and natural resources. "One proposal is to turn the Sumgait complex into a free economic zone, funds from which would support a clean-up. Oil revenues will also be used to remove environmental hazards." Yet though revenues from oil might provide a solution at Sumgait, oil is also the cause of Azerbaijan's other main environmental problem.

A start has been made at tackling some environmental problems. The World Bank has funded a \$3m landfill site near Sumgait to dispose of mercury waste. However cash strapped factories lack funds to pay the disposal charges and, as production continues, mercury continues to be stockpiled at the industrial complex.

"Everyone wants to see action to clean up Azerbaijan's environment but it's a huge task," says Ahmed Jehani, the World Bank's representative in Baku. "There are no clear figures about how much it will all cost but the figures are very big - in the billions. We can only hope that the country spends its oil revenues wisely."

Ecosystems paying the price

Soviet industrial practice and disregard for the external effects of an aggressive market economy have significantly jeopardized the lives of plants and animals in and around the Caspian Sea. The steep decline in fish resources due to over fishing, pollution and other human-related factors, such as the introduction of alien species, is destroying the balance of ecosystems and threatening several of species.

With the opening of the Volga-Don canal in 1952 navigation between the oceans and the Caspian became possible. Contact between the previously secluded Caspian marine ecosystem and the outside world was consequently inevitable.


The connection led to the introduction of various alien species (plants and animals not native to the habitat). The most threatening event for the Caspian ecosystem was the arrival of the North American comb jelly (*Mnemiopsis leidyi*). It was brought accidentally to the Caspian in the ballast water of oil tankers. A voracious feeder on zooplankton and fish larvae, it first arrived in the Black Sea in the early 1980s where it changed the whole ecosystem and contributed to the collapse of more than two dozen major fishing grounds. From there the comb jelly also invaded the Azov, Marmara and Aegean Seas and most recently the Caspian.

The comb jelly is well adapted to the habitat (salinity, temperature, and food range) and reproduces faster than endemic species. As it eats the same food as them, it has had a drastic effect on their numbers, upsetting the entire food chain. The commercial fishing industry is afraid of losing the kilka, (g. *Clupeonella*) and other valuable catches, with consequent effects on human livelihoods and food sources for the Caspian seal and sturgeon population (*Huso huso*). Studies show that between 1998 and 2001, kilka catches by Iranian fishermen dropped by almost 50%, representing a loss of at least \$20m per year.

Combating the intruder is a delicate task. Introducing another foreign species, a natural enemy of the newcomer, might just postpone or redirect the problem. However experience from other parts of the world shows that foreign species have not always been successful in the long run, although a few have durably conquered the new environment.

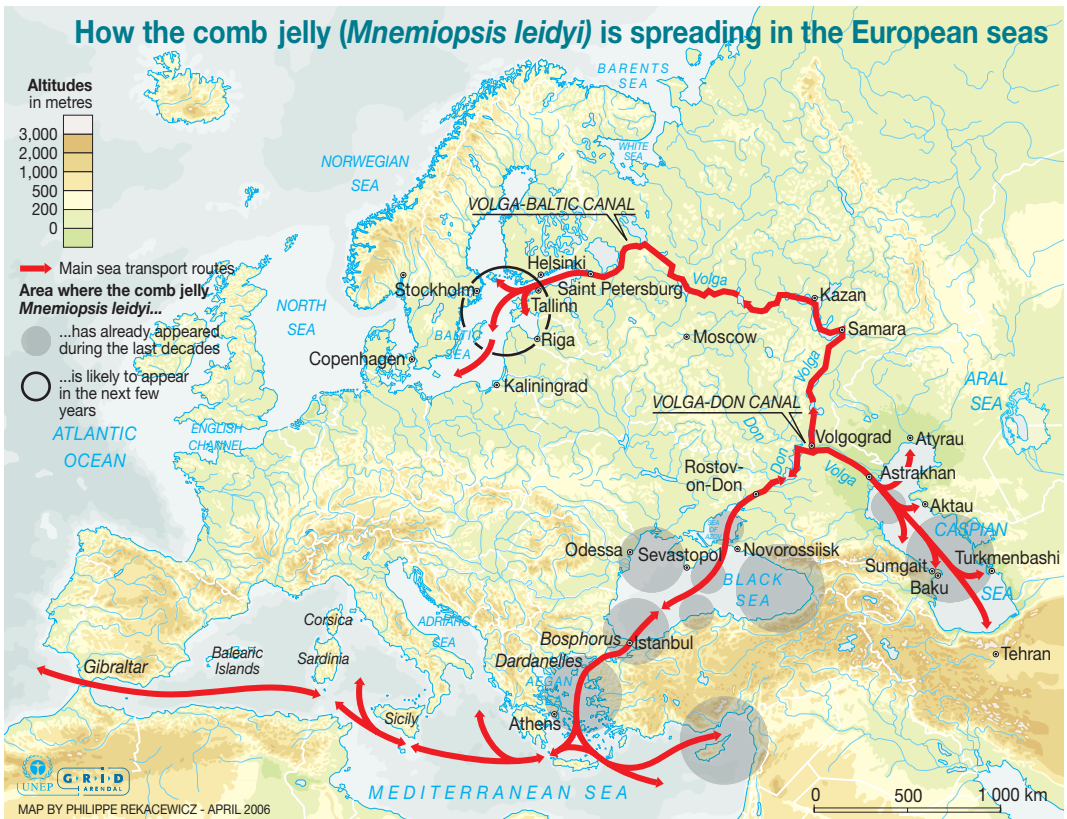
Comb jelly (*Mnemiopsis leidyi*) spreading through the Caspian Sea



 Concentration of *Mnemiopsis leidyi*

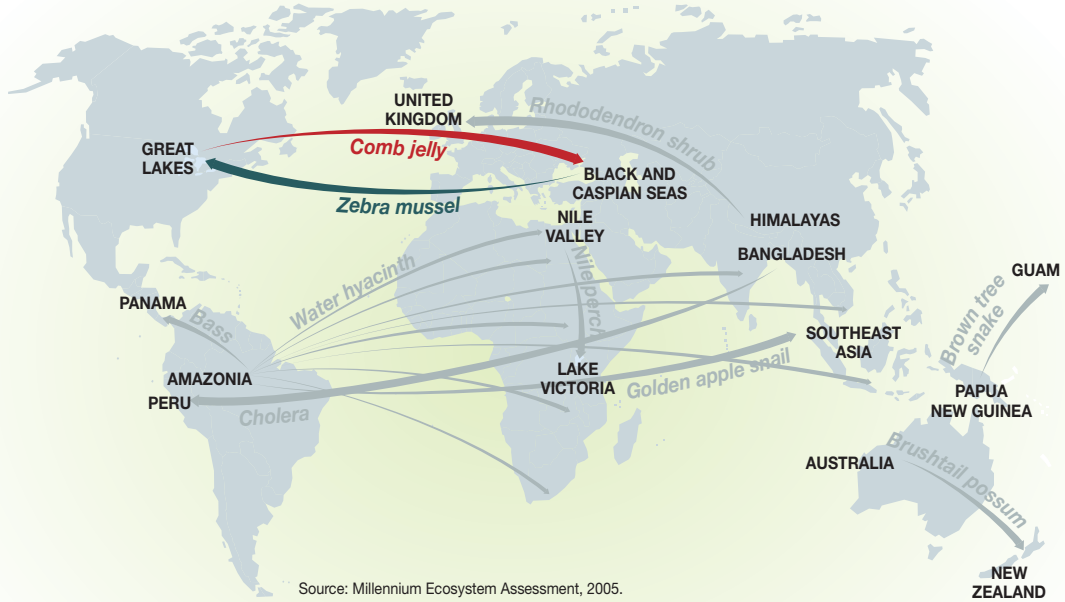
Source: Aladin N.V. (ZIRAS), Chuikov Yu.S. (EPA, Astrakhan), Panov V.E., Plotnikov I.S. (ZIRAS), HELCOM-BSRP Meeting on Ballast Waters, Klapaıda-Palanga, February 2005.

How the comb jelly (*Mnemiopsis leidyi*) is spreading in the European seas





Origin and destination of selected species



Biodiversity in the Caspian Sea

Biota group	Total species in the Caspian Sea	Endemic species	Alien species	Listed species (Red Book)
Phytoplankton	441	17	6	?
Zooplankton	315	64+	7	10
Zoobenthos	380	190	12	20
Fishes	133	54	17	27
Marine and land mammals	125	1	3	41
Birds	466	?	?	63

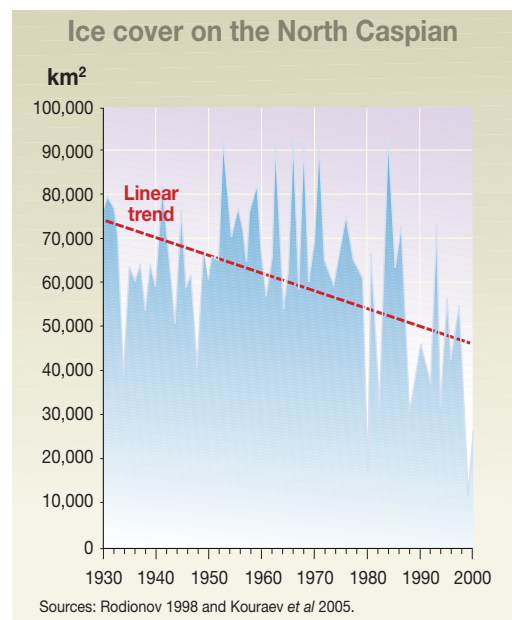
N.B.: figures are estimates since the literature does not agree on values.

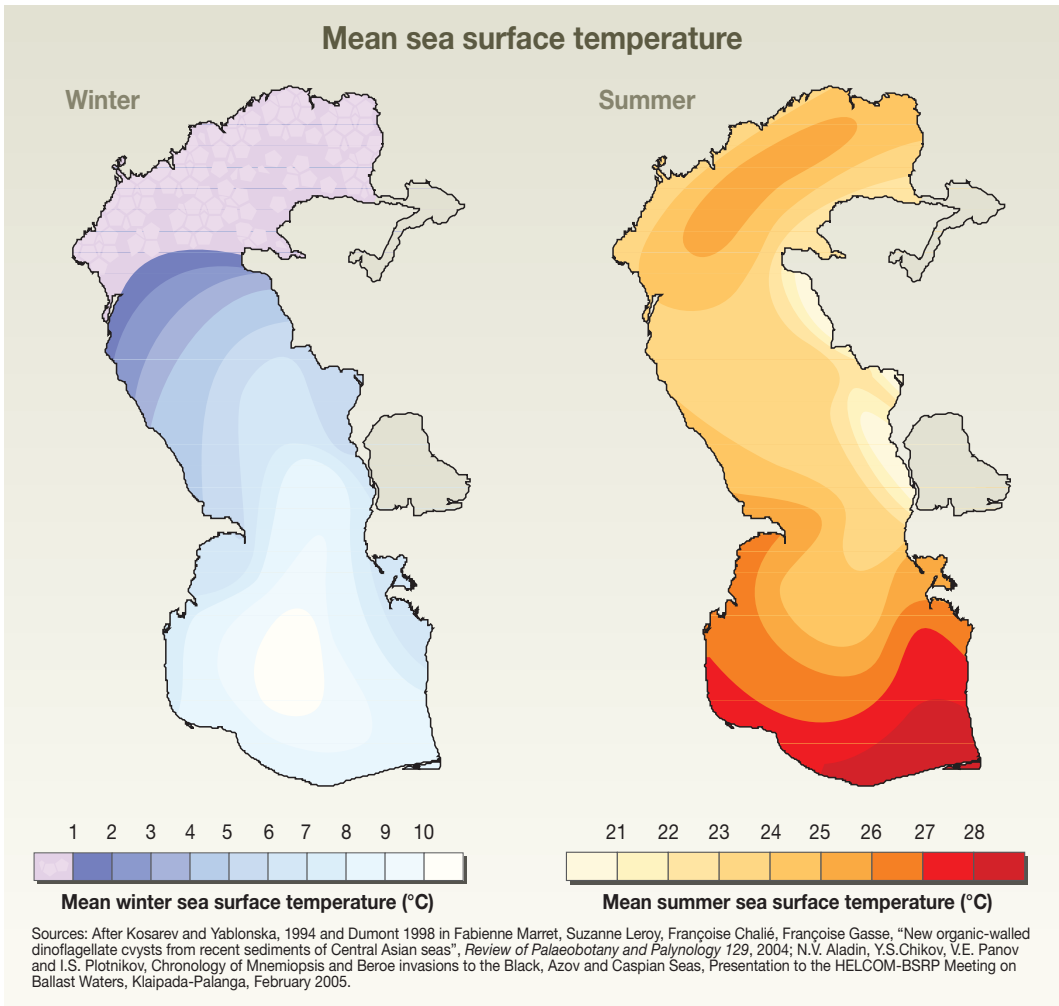
Source: *Transboundary Diagnostic Analysis for the Caspian Sea*, Caspian Environment Programme, 2002.

Caspian seals fight for survival



The Caspian seal (*Phoca caspica*) population has decreased dramatically in recent years. Several factors have contributed to this alarming trend. A virus killed large numbers of seals. Although no direct link has been proved between the virus and environmental pollution, it may be assumed that the high concentrations of DDT and heavy metals measured in the seals weakened the animals' natural resistance. Moreover kilka, the seals' main source of nutrition, have been decimated by the comb jelly, further aggravating the seals' predicament. Intensive navigation, poaching with the pretence of scientific research, fluctuations in sea level and climatic changes are also contributing to the drop in the seal population and threatening their survival. Higher winter temperatures, possibly related to changes in global climate observed in recent years, have caused thinner ice coverage and restricted the traditional reproduction grounds in the shallow waters of the northern Caspian. Recent research by the Caspian Environment Programme estimates the number of living seals to be as low as 110,000. A further reduction in ice cover could well be one of the major threats facing the Caspian seal in the future.

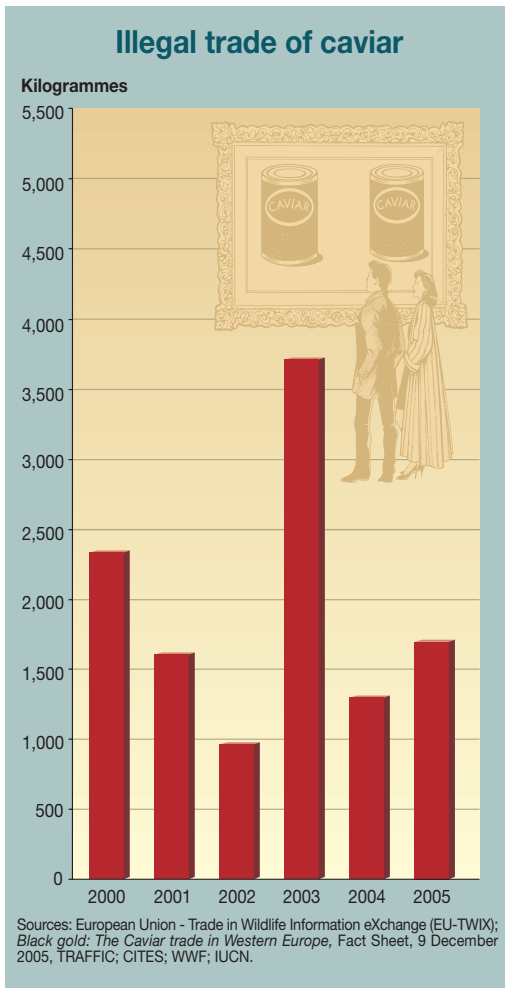




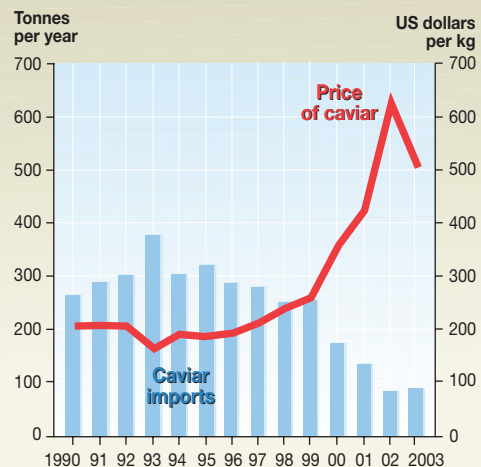


Catching the last sturgeon

The Caspian area is the world's main producer of wild caviar (83% in 2003) and supplies the three largest markets, the European Union, Japan and the United States. The construction of several hydroelectric power plants and dams along the Volga river significantly altered the flow of water into the delta and destroyed about 90% of the sturgeon's spawning grounds, which can be as far as several hundreds of kilometres upstream. With high levels of water pollution, sturgeon also suffer from various diseases. According to the survey of the Food and Agriculture Organization, reported data from Caspian states excluding Iran indicate that the sturgeon catch has dropped from an average of about 22,000 tonnes a year in the 1970s to about 1,500 tonnes a year since 2002.

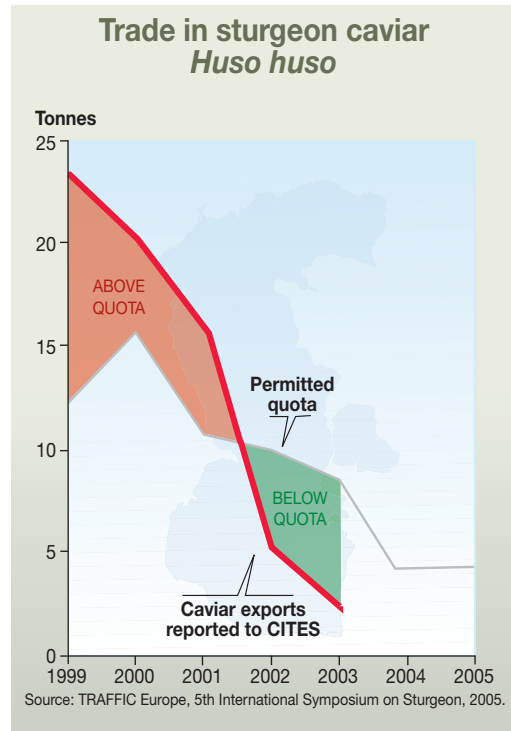
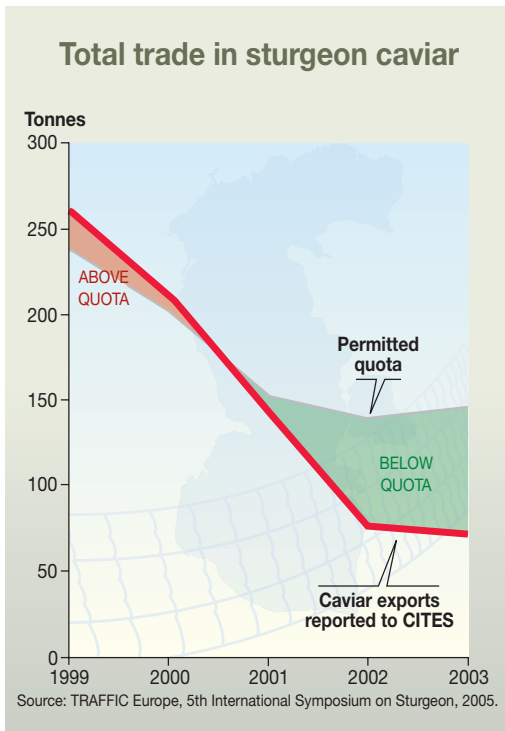


Caviar imports as reported by three main consumer markets (Japan, European Union and United States)



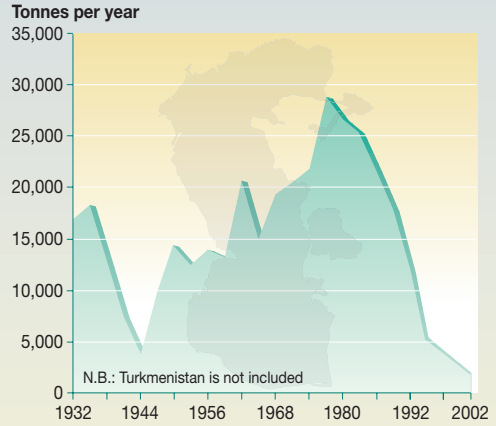


Pressure from the international community having raised awareness of its value as a bio-resource, the region is now struggling to save the sturgeon. To protect the vulnerable fish species more than 100 million sturgeon and bony fish juveniles have been released into the Caspian in recent years. Four years ago Azerbaijan, Kazakhstan and Russia agreed to restrict further export of commercial fish stocks. All three countries, as well as Iran, are party to the UN Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). According to official information received by the CITES secretariat, the temporary ban on caviar trade issued in 2001 has prompted a set of measures lifting the immediate risk of extinction. The caviar trade reportedly fell by about 70% between 1999 and 2003 but there is still every reason to monitor development of the sturgeon population and keep it on the list of endangered species. However it is not clear to what extent the temporary ban on caviar exports has boosted well established illegal domestic and international trafficking, obviously not accounted for in the official figures. To combat the illegal trade in caviar, governments around the world have agreed to a universal caviar labelling system to inform traders and consumers.



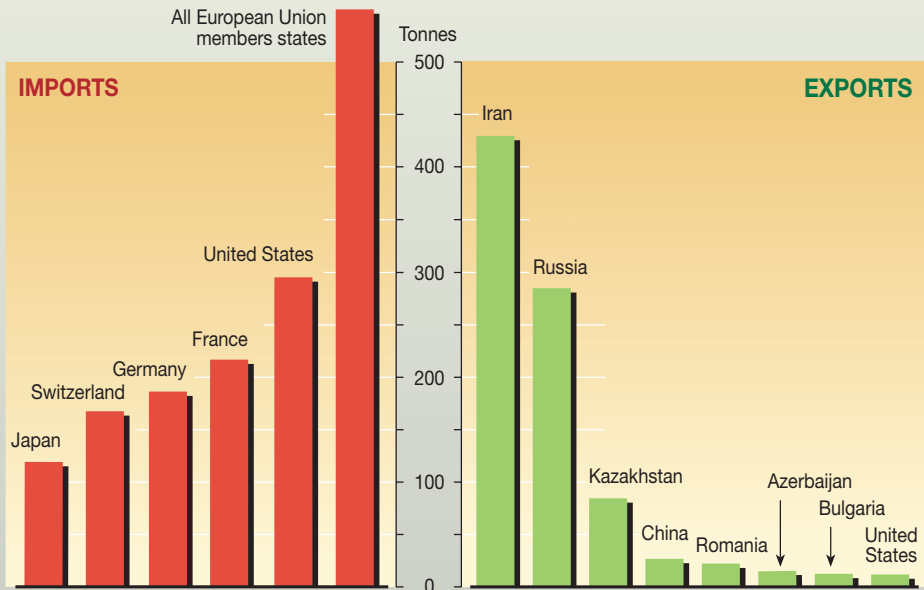


Total sturgeon catch in the Caspian



Source: *Transboundary Diagnostic Analysis for the Caspian Sea*, Caspian Environment Programme, 2002. Updated in 2005 with data from the United Nations Food and Agriculture organization (FAO).

Overview of legal international caviar trade, 1998-2003



Sources: Source: European Union - Trade in Wildlife Information eXchange (EU-TWIX); *Black gold: The Caviar trade in Western Europe*, Fact Sheet, 9 December 2005, TRAFFIC; CITES; WWF; IUCN.



JOURNALIST STORY 04

Antoine Blua, a EurasiaNet partner post from RFE/RL, 7 March 2004

Caspian: Invasion of killer jellyfish threatens fish stocks

When an animal species suddenly appears in a new environment, the consequences can be grim. While some species may quickly die off, others thrive in their new surroundings, often to the point of posing a threat to the existing ecological order. Such is the case with *Mnemiopsis leidyi*, a fist-sized jellyfish that has spent the last decade menacing the waters of the Caspian Sea. Also known as Leidy's comb jelly, this organism's arrival has caused the Caspian's fish stocks to plummet, affecting the livelihoods of many local fishermen.

Zari Rustamov is from the village of Nardaran on Azerbaijan's Apsheron peninsula. He said his catches of sprats (kilki) have dwindled in the years since the comb jelly first made an appearance. He said the jellyfish "is small and transparent, like water. We didn't have this thing before. Sometimes you look at the water, you reach out and your hands are full of them. And when it's there, there are no fish. Fish avoid getting close to them."

The watery invader has a voracious appetite, devouring much of the Caspian plankton that provides the sprats' main sustenance. Furthermore, *Mnemiopsis* reproduces at an alarming rate. It can double its size in a single day, reach maturity within two weeks, and then lay as many as 1,200 eggs a day for as long as several months.

The declining fish stocks have forced many fishermen off the job. Many owners of fishing vessels have had to sell their boats to pay their debts. The spread of the jellyfish is expected to eventually taper off. But that may come too late to save the Caspian's fish stocks.

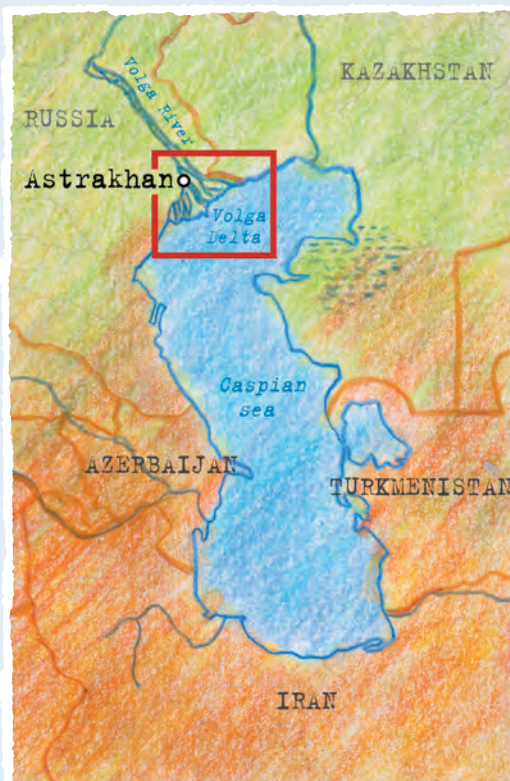
Tariel Mammadli is chief adviser on Caspian biodiversity at Azerbaijan's Ecology Ministry. "If there is no fight against *Mnemiopsis*, all living things may disappear from the Caspian sea," he said. He describes the sea's ecology as resembling a chain. If the plankton link is broken, "everything disappears."

Mnemiopsis made its eastern debut two decades ago, in the Black Sea, after being transported from the Atlantic coast of the United States in a ship's ballast water. When the ship emptied the water, the jellyfish began its feast on Black Sea plankton, causing a more than 80% drop in local fish stocks. The arrival of a second American jellyfish, *Beroe ovata*, heralded a major change in the late 1990s. The newcomer began dining on *Mnemiopsis*, causing its almost immediate decline, and enabling the Black Sea's valuable anchovy stocks to recover.

But the comb jelly had not completed its journey, turning up in the Caspian Sea in 1999. This time the culprit is believed to have been the ballast water of a boat shipping through the Volga-Don canal linking the two seas. A decline in plankton quickly followed. In 2000 alone, scientists estimated that Caspian sprat stocks had decreased by 50%.

Could *Beroe ovata* once again prove the solution? Hossein Negarestan works for the Iranian Fisheries Research Organization in Tehran. He told RFE/RL that studies have been carried out on the safety of releasing a second jellyfish species into the Caspian. As long as the process is handled carefully, he said, it should not create any new ecological problems. "We found out that *Beroe* only eats *Mnemiopsis leidyi* and that when there are none left, *Beroe* dies off. Scientists agreed that *Beroe ovata* can be the best solution to this problem. However, we need to be careful not to carry any other individual species in with the water. Scientifically speaking, all aspects have been cleared out," Negarestan said.

All five Caspian states - Russia, Kazakhstan, Turkmenistan, Azerbaijan, and Iran - must now endorse introduction of *Beroe ovata*, an expensive and technically difficult process. According to Mammadli, the Caspian states are close to an agreement, and Iran and Russia have already promised to contribute funds. "This year, the Caspian commission on bio-resources will find a positive solution to the issue," he said. The five littoral states must reach an agreement and then begin looking for funding.



JOURNALIST STORY 05

By Michel Viatteau, Agence France Presse, 5 May 2002

Not enough caviar left for all the poachers

Between low-grade poaching and large-scale mafia plundering of sturgeon, which police are powerless to curb, illegal catches are eating up stocks in the Volga and Caspian Sea of the fish which produce prized black caviar.

Sergei studies and lives in Astrakhan, but his home is some 40 kilometres away from Russia's caviar capital, in a village on one of the countless streams in the Volga delta, which stretches over 15,000 square kilometres. "I poach to make ends meet," he says as he pushes his motor boat - the type the locals call "baida" - off the Volga's white sand. Behind his back, the great river flows peacefully, a perfect illustration of nature's relentless course that nothing can change - an impression that is completely false.

"In 1990, I caught up to 10 sturgeons daily. By 1996, I could still catch two or three every day. But last year, it took me a week to get as much," the young man says. Official figures confirm his observations. According to the UN Convention of International Trade in Endangered Species (CITES), official catches of Caspian sturgeon plummeted from 30,000 tonnes a year in the late 1970s to less than 3,000 tonnes 20 years later.

For Sergei, the explanation is simple. "Ten years ago, there were two poachers in my village of some 350 people. Now it's a rare thing not to be a poacher. Collective farms and factories are closed, and people must make a living," he says. However, besides the "social poaching" mostly tolerated by the state because of rampant unemployment, "commercial poaching" also takes its toll on the sturgeon resources. It was that underground industry that President Vladimir Putin labelled as "monstrous" during his recent visit to the region. This kind of poacher generally has a high-speed motor boat, sonar detectors and even special buoys that allow them to keep track of their nets with satellite positioning technology.

"How are we supposed to catch them?" asks Yury Tolstov of the public agency tasked with taking care of the sturgeon population in the Volga delta. "They have Yamaha and Johnson motor boats, each with at least 100 horsepower. We have only one boat," he complains. However, small-scale poachers have a more cynical explanation, saying that the illegal caviar industry is well protected by accomplices in high places and has efficient export routes.

Officials are nevertheless cautiously optimistic as to the final outcome of their losing battle. The sturgeon population increased last year and the endangered fish was once again seen near cities such as Volgograd, Tolstov assured us. In addition, Tolstov's agency has released 50m baby sturgeon bred in captivity, and plans an operation to pave the way for sturgeons attempting to move up river in May. He takes particular pride in a novel technique which would allow roe to be removed from female fish without killing them and used to breed more sturgeons rather than delighting gourmet diners in New York or Tokyo.

Tolstov's quarrel is with a CITES-brokered moratorium on fishing Beluga sturgeon passed last June by Russia, Turkmenistan, Kazakhstan and Azerbaijan, but lifted in March after eight months. "This will benefit only poachers," he scoffed. In any case, poaching - which, according to CITES, accounts for 90% of the caviar trade - has not slackened since, and caviar is on sale in Astrakhan markets for some \$80 a kilogram, twice the price asked in the delta's many villages, but still half as much as in downtown supermarkets.



7

Environment and security – a fragile balance

As a source of potential wealth the environment with its natural resources can easily fuel tensions between neighbours and endanger the security of people living in the region. Threats may stem directly from environmental impacts on health and well-being, but also from conflicts triggered by the associated pressures.

To further complicate matters, the region's political order has recently been reshuffled and there remains an unresolved dispute about territorial claims to the sea basin and the natural resources that may be found there.

In areas where the economic interests vested in natural and mineral resources are as strong as around the Caspian, environmental protection tends to be a low priority. But some of the natural resources such as fish, which form the basis for human survival and economic activities in the region, depend on an intact environment. The exploitation of other natural resources is particularly profitable, because little account is made for possible negative side-effects.

The region's valuable natural resources – some non-renewable such as oil and gas, others renewable such as fish – are an important factor in relations between states and the various communities living around the Caspian sea. In particular they may create international tension, as for instance with the ongoing discussions about sustainable exploitation of fish resources.

With dwindling overall oil resources, enduring instability in the Middle East, new markets and rising demand for energy, many players have good reason to be interested in the Caspian basin and the export of its resources: states (the producers themselves, the countries through which products transit, and end users), and oil and gas companies. In principle it is in the interest of such players to maintain regional stability in order to secure investments in the energy sector.

Clarifying territorial limits to prevent conflict

Access to hydrocarbon resources has caused several disputes between the five states bordering on the Caspian. The uneven distribution of hydrocarbon resources gives rise to disputes over oilfield ownership. There is also disagreement as to how best to use the sea (separate or joint exploitation). The inadequate legal framework and overlapping claims to ownership have made it more difficult to find solutions to these disputes. Preference has so far been given to bilateral agreements to facilitate the exploitation of the Caspian's energy resources.

Transport of oil and gas further complicates conflicting interests and claims, and brings additional players into the game. So far the main export pipelines run through Russia. A recently developed alternative, the Baku-Tbilisi-Ceyhan (BTC) pipeline that started operation in 2005, opened a new possibility for transporting 1 million barrels of oil daily. Other similar pipeline projects are also being developed like the one that goes through Kazakhstan to China.



Managing natural resources fairly: a challenge for energy-producing states

The skill with which a state manages its natural resources (a capability that may vary with time) will impact on its economic and political stability. Over-emphasising the development of the energy-extraction resources can weaken an economy's manufacturing sector – an error also known as Dutch disease or resource curse. Dependency on a small number of commodities for export earnings may increase the country's vulnerability to trade shocks, which may in turn cause instability and dissatisfaction among groups affected by such shocks.

Conflicting interests

The natural conditions in the Caspian Sea region are harsh, with the exception of the southern and western coast. The dry climate, with large variations in temperature between summer and winter, severe winter storms and a shortage of drinking water makes it difficult to sustain human life. Every activity leaves its mark and the environment is particularly vulnerable.

The quality of drinking water along the coastline depends on groundwater resources and desalinated water from the sea. Exploitation of petroleum

reserves or faulty operation of the corresponding facilities pollutes both surface and groundwater. Sturgeon, from which caviar is produced, and other commercially important fisheries need an intact environment. But this requirement conflicts with large-scale water management projects, such as irrigation and dams for hydroelectric power stations, and the exploitation of off-shore oil and gas fields, with the heavy oil tanker traffic it entails.

In many places around the Caspian tourism plays an important part in the local economy. It will only continue to do so if the beaches stay free from pollution and attractive to tourists.

Impact of smouldering conflicts

The frozen conflict in Nagorno-Karabakh and adjacent regions of Azerbaijan, as well as a more than decade of unrest and military operations in Chechnya, Russia, has triggered flows of refugees and led to the neglect of environmental management in these areas. While the latter resulted in more uncontrolled pollution, certain environmental issues such as deforestation and the alleged burial of hazardous wastes in Nagorno-Karabakh have become politicised. Both areas are linked to the Caspian environment through shared surface and ground water systems.



Unpredictable risks

Allowance must also be made for unpredictable risk factors. Over and above conflicting interests, some scenarios suggest that drilling for oil and gas could seriously affect the sea level and, worse, trigger earthquakes in this seismically active region.

Furthermore, however clean modern oil production may be, it involves the risk of accidents causing serious pollution, typically oil spills during transportation. Nor can it completely avoid continuous emissions during operation. Pollution pays no attention to borders, and pollutants carried over large distances by tributaries aggravate already acute local pollution downstream. Environmental pollution has transboundary effects that need to be tackled multilaterally.

At another level, although scientific models of the effects of rising temperatures are improving, it is not yet possible to predict exactly what will happen when nature adapts to changing climatic conditions.

The need for multilateral solutions

Ongoing disputes and disagreements over the management of natural resources shared by two or more states can deepen divides and lead to hostilities. But common problems regarding the use of natural resources may also bring people together in a positive way. Communities and nations can build mutual confidence through joint efforts to improve the state and management of nature. Environmental cooperation can be an important way of preventing conflicts and promoting peace between communities. Furthermore the environment is a suitable topic to focus people's attention, in particular when they are personally affected. Raising people's awareness of the stakes may be a way of promoting more active participation in political life, and, ultimately democracy and shared economic prosperity.

By signing and ratifying the Framework Convention on the Protection of the Marine Environment of the Caspian Sea (Tehran Convention) the signatories – all five bordering states – signalled that they are willing to search for common strategies to protect the Caspian environment. Having agreed in principle on common action towards the control of activities impacting the environment they made a step towards stability in the region.



The Tehran Convention is an example of how the strategy of using the environment as a means to create a multilateral dialogue can be successful. Whereas the countries are still negotiating their offshore territories with little hope of a settlement in the near future, a main agreement on the environment has proved possible, temporarily working around the sensitive topics. Even if the convention expresses nothing more than the will to address an issue, it is a successful achievement as such. It now needs to be followed by more concrete commitments.

The efforts to realise the promises of the Tehran Convention are reflected in the preparation of several protocols to the convention: the Biodiversity Conservation Protocol, the Protocol Concerning Regional Preparedness, Response and Co-Operation in Combating Oil Pollution Incidents, the Protocol for the Protection of the Caspian Sea against Pollution from Land-based Sources, and the Protocol on Environmental Impact Assessment in a Transboundary Context. These protocols, once adopted, will become binding legislation with which the countries must comply. The process is supported financially and thematically by the Caspian Environment Programme (CEP). Major UN agencies such as UNDP and UNEP, but also the European Union with its TACIS programme, are involved in its implementation. At the national level, the governments of all the Caspian states have committed themselves to implementing National Caspian Action Plans.

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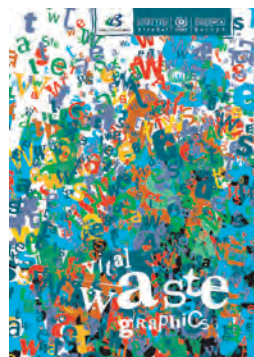
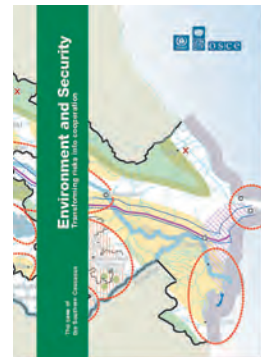
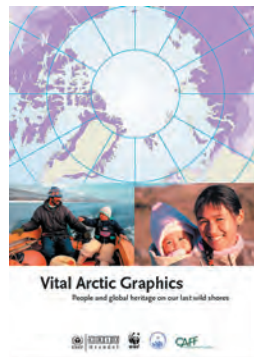
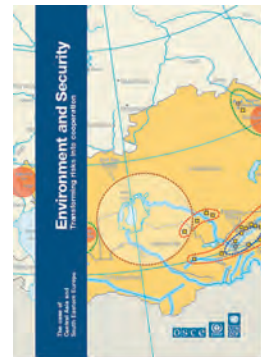
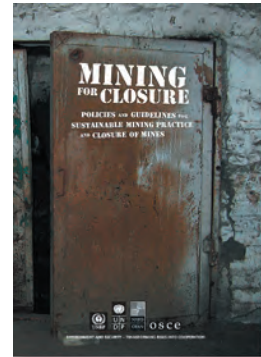
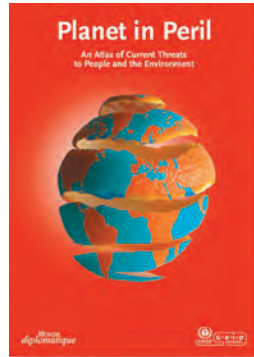
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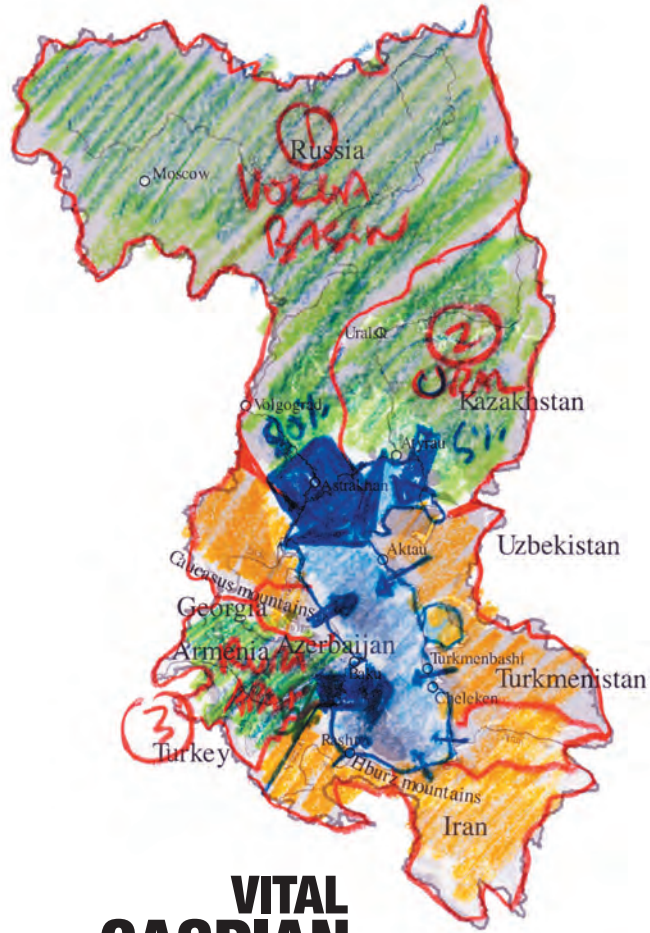
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