

Conclusions and recommendations

The catchment area of the Caspian Sea is 3.1 million km², entirely or partially covering eight countries: Russia, Azerbaijan, Iran, Kazakhstan, Turkmenistan, Georgia, Turkey and Armenia. These include the five littoral states: Russia, Azerbaijan, Iran, Kazakhstan and Turkmenistan as the main part of the drainage basin. The scaling procedure was implemented in order to define the most significant part of the Caspian Sea region and the most significant transboundary waters in terms of productivity and biodiversity. As a result, water-bodies of the Caspian Economic Hinterland (CEH) were recognised as having highest transboundary significance, productivity and biodiversity. The CEH has been defined as the geographical area including the Caspian Sea itself, freshwaters of the coastal areas, and all land between the Sea and the first administrative line in the territory of each state. Only those parts of the Volga downstream of Volgograd and those parts of the Kura downstream of the Mingechevir Dams were included in the assessment. In addition, the same administrative units that defined the CEH were used to define the geographical extent of this assessment. These were: Gilan, Mazandaran and Golestan in Iran; Balkan in Turkmenistan; Atyrau and Mangistau in Kazakhstan; Astrakhan, Daghestan and Kalmykia in Russia; and Guba-Khachmaz, Absheron, Central Aran and Lenkoran in Azerbaijan.

Having studied the complex environmental and societal impacts of each GIWA concern, using the geographical area defined by the CEH as the foundation of the assessment, the concerns were ranked in descending order of importance:

1. Habitat and community modification
2. Unsustainable exploitation of fish and other living resources
3. Pollution
4. Freshwater shortage
5. Global change

Having analysed the results of the assessment of GIWA concerns and issues, and taking into account the trends of the problems for the

region, Habitat and community modification was identified as the priority concern and selected for Causal chain analysis.

During the Causal chain analysis, immediate causes were identified and ranked for the whole Caspian region. Twelve experts from all five riparian countries scored the importance of each immediate cause on a scale between 0-100, taking into consideration the present situation and possible changes during the next 10 years. All experts agreed that the situation in the future could be worse. Analysis of the experts' estimation showed that each country had its own priorities among the immediate causes. Usually causes are the same for the Sea and freshwater basin.

The most important immediate causes were identified as the following:

- Pollution as a result of oil spills and agricultural discharges;
- Introduction of alien invasive species like the comb-jellyfish *Mnemiopsis*;
- Poaching of valuable species and unsustainable harvesting practices in the fishery; and
- Regulation of stream flow by dams on the rivers discharging into the Caspian Sea.

The most important sector activities were defined as the following:

- Agriculture (run-off of fertilisers and pesticides and construction of irrigation systems);
- Fisheries (overfishing and introduction of commercially valuable species, feeding organisms and accidental introduction);
- Industry;
- Transport; and
- Energy production.

It is obvious that not all the root causes identified could be eliminated in the near future, such as poverty, population growth and economic growth. These global root causes should be targeted as part of a larger national development programme. However there are several root causes that warrant special attention in socio-cultural, knowledge, legal and technological areas.

For the four most important immediate causes, several root causes were identified:

- Access to technology (bad equipment especially old oil wells and pipelines);
- Availability of cheap, but obsolete insecticides and absence on the local market of environmentally acceptable alternatives;
- Absence of cleaning and decontaminating facilities for ships (tanks/hulls);
- Poor expert advice on quotas, inadequacy of laws and administrative regulation and equipment;
- Poor environmental control of the regulations of stream flow by dams; and
- Excessive extraction of freshwater from incoming rivers.

Analysis of the main root causes showed that for different sectors of activities the same root causes were often found. The policy options recommended to reduce Habitat and community modification can be grouped into a few clusters.

1. Establishing and strengthening regulations to control environmentally damaging activities in the region:
 - Establishing and/or strengthening the control of the sale of prohibited chemicals on the local market;
 - Strengthening the control of leaks from active and blocked oil wells and oil pipelines;
 - Reorganising and strengthening organisations responsible for regulation of fishing activities in the region.

For this cluster, national and local authorities are responsible and money needs to come from national and local budgets. It is a traditional way to solve the problems in all post-Soviet countries. This action can be very effective, but the effectiveness decreases due to corruption and venality at the officer level.

2. Creation or refurbishment of facilities:
 - Refurbishment of old oil wells and pipelines;
 - Renovation of old water purification systems;
 - Creation of special sanitary facilities for decontamination of vessels'

tanks and hulls; and

- Improve equipment for fish migration protection related to operations of dams.

All these actions need additional investment and could be very expensive. From this point of view, the responsibilities and budgets should be divided between local authorities and when relevant, oil companies.

3. Socio-economic actions:
 - Provide the local market with cheap, effective and environmentally acceptable chemicals; and
 - Develop a system of incentives for using "green technologies".

Both policy options can contain a package of different smaller actions that refer to improvement in the legislation and regulation systems. National and local authorities are responsible, but for many smaller actions advices and/or financial help from specific international organisations are needed.

4. Science and education:
 - Conduct special ecological training courses, lectures and videos;
 - Ensure autonomy and independence of experts from authorities and the fishery industry;
 - Build the capacity of staff responsible for the operations of dams with expert training and scientific investigation of fishing and operation of dams.

Development and subsequent implementation of policies is very important, but the effectiveness and efficiency can be very low at the beginning and will increase in future. Education processes, scientific studies, and high expert qualification cannot improve the situation in the region by themselves, but only indirectly. In time, decisions on environmental management and sustainable use of natural resources will improve.

The policy options and their background are planned to be presented to the scientific international community, local, regional and international decision-makers, funding bodies and the public.

Carrying out the above recommendations would contribute to mitigating the identified environmental problems of the Caspian Sea region.