THROUGH THE PRESERVATION OF THE URAL RIVER STURGEON HABITATS TO SUSTAINABLE WATERSHED MANAGEMENT

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Abstract

Sustainable development of watersheds should consider three main components: economic, social and environmental, which can hardly be reached in real-life watershed management. Using sturgeon species as a natural indicator and an incentive for transboundary IWRM cooperation in the Ural river basin is suggested. The only free-flowing river in the Caspian basin, the Ural River, is a unique ecosystem with a preserved natural hydrological regime and the last sturgeon spawning habitats. It contains the only self-sustaining, viable sturgeon population capable of natural reproduction. The presence and well being of this worldwide flagship species in a river network indicates the “good quality” of a river ecosystem’s health. Activities towards successful integrated water management will secure preservation and restoration of sturgeon population and vice versa. Community-based management of sturgeon stocks also resolves social and economic problems by restoration of the traditional life style of local communities, exclusively focused on sustainable utilization of floodplain resources, e.g. fishing. High economic and social values of sturgeon allow the combination of both ecological and socio-economic aspects of sustainable development. The Ural River Basin Project (http://uralbas.ru) aims at the establishment of an international Ural Sturgeon Park, sustainable basin development, IWRM and sturgeon restoration. Special attention is paid to stakeholders involvement, crossdisciplinary integrated assessment and modelling of the Ural river hydrology coupled with sturgeon life cycle.

Keywords

Sturgeon, Ural, watershed, indicator species, Caspian sea, Ural river, sturgeon, indicator species, river basin, integrated water resource management, community-based environmental protection, integrated modeling, environmental flow, Cossacks

Background

The need for holistic cross-sectoral approach to water resources management is increasingly recognized and has resulted in a drastic increase in the number of watershed management programs worldwide. Depending on institutional needs and regional priorities various concepts of Integrated Water Resources Management (IWRM) have been developed recently. In brief IWRM is a process which can assist countries in their efforts to deal with water issues in a cost-effective and sustainable way. Basin cooperation is often complicated by the high number of parties in the water management scheme and the complex nature of administrative and national borders.

The Ural river basin, shared by Russia and Kazakhstan, is no exception in this regard. The system of integrated river basin management that once existed in the Soviet Union collapsed in the early 90s and drastic deterioration of environmental conditions of all transboundary watercourses can be observed since then.

The Ural River, the third longest river in Europe, forms the traditional boundary between Europe and Asia. According to different sources the total river length varies from 2428 km to 2534 km. It rises in the South-eastern slopes of the Ural Mountains at 640 meters above sea level and runs through Russia and Kazakhstan into the Caspian Sea. The length of the Kazakhstan portion of the main Ural stream is 1084 km. The total catchment area is about 220 thousand km^2.

The Soviet integrated water management system was an effective tool in water management; however the priorities in water usage were given to the development of growing regional agriculture and industries without any attention being paid to the needs of the environmental flows and ecosystems. The rapid degradation of the ecosystem and its biodiversity (including decline in sturgeon stock) coincides with the collapse of the Soviet Union and the disintegration of the united basin water management system. The growing concern over environmental aspects of watershed management has been difficult to feed into practical water management plans due to, among other reasons, lack of transboundary cooperation. Many countries of the former Soviet Union do not have even agreements on transboundary water management. Though some agreements do exist, they are of a superficial character and not fully implemented. These documents may not be effective tools to tackle the issues addressed. The current state of IWRM in the region can be characterized by a lack of cooperation among countries and a shortage of incentives for such cooperation (UNECE 2003). Paradoxically, the general attitude towards transboundary water cooperation is positive and there is a strong need to stimulate it and present the best management practices.

Although Russia and Kazakhstan are both remnants of the Soviet Union and at that time had a single indivisible water management system, at present official transboundary cooperation on water management and regional environmental issues is almost negligible. However, the cultural and personal links are still very strong and the need for cooperation is well understood by stakeholders in both countries.

The Ural river plays a special role in the Caspian basin (AzovBas 2002; Russian Duma 1995), being the only free-flowing river in the region with a non-regulated hydrological regime in its lower and middle flow.

From the IWRM point of view the basin of the Ural River is a unique ecosystem. All components of traditional sustainable management - social, economic and environmental -can be harmonically linked here and considered jointly. It provides a perfect case study to develop, test and put into practice a sustainable watershed management strategy taking into account all the principles of IWRM.

Figure 1 The transboundary Ural river basin

While there is plenty of experience and knowledge in transboundary river management accumulated in European countries as well as the former Soviet Union, this knowledge cannot be simply copied to the Ural river basin given its different institutional and regional specifications. Careful evaluation of best practices and consideration of regional specifics is needed to develop a sound sustainable basin development strategy.

Watershed Management

IWRM problems

The issue of sustainable watershed management and development are widely discussed. Though many articles and handbooks have been written and numerous attempts have been made to put this concept into practice, there is no uniform terminology accepted by all stakeholders or consensus on the best way to achieve sustainability in water resource use. There are numerous versions of IWRM approaches and guidelines.

Nevertheless, some fundamental principles underlying best management practices are common for most approaches. The IWRM principles proclaimed at Rio-92 are most commonly used. According to this approach the six basic principles of Integrated Water Management are ({UNEP, 2004 #410; GWP, 2006 #377}):

- The river basin is the most appropriate administrative unit for water management;
- Water resources and the land which forms the river basin area must be integrated, in other words, planned and managed together;
- Social, economic and environmental factors must be integrated within water resources planning and management;
- Surface water and groundwater and the ecosystems through which they flow must be integrated within water resources planning and management;

- Public participation is necessary for effective water resources decision making;
- Transparency and accountability in water management decision making are necessary features of sound water resources planning and management.

This approach was incorporated in the European Union Water Framework Directive (EU WFD) adopted by EU Member Countries in 2000 and in National Water Codes in many countries.

Though there is now an international consensus on the need for an integrated approach to sustainable river basin management, implementation of these nice principles is problematic.

The concept of IWRM is closely linked to the idea of sustainable development (SD). The generally accepted definition of sustainable development defines it as ‘‘development which meets the needs of the present, without compromising the ability of future generations to meet their own needs’’.

As repeatedly indicated by many authors, both concepts, SD and IWRM, have ambiguities in definitions and practical implementation (Anthony *et al.* 2003; Jewitt 2002; Jonker 2002). Among them the following can be mentioned: 1) the standard definition assumes a common understanding of what development means; 2) it assumes the present generation knows what the needs of future generations will be; 3) it does not explicitly link society and resources, the two elements in development; 4) it is impossible to measure at what stage of development future generations are being compromised; 5) it does not seem to consider the different time spans between human lifecycles and natural cycles.

With regards to these considerations a better definition of sustainable development could be “the improvement of people’s livelihoods without disrupting the natural cycles”. Based on this approach a more appropriate definition of IWRM would be “managing people’s activities in a river basin in a manner that promotes sustainable development (improves livelihoods without disrupting the water cycle)”. Unfortunately, the traditional approach still prevails in water management.

Apart from these conceptual problems there are a number of obstacles in everyday water management and practical implementation of IWRM principles.

The first commonly accepted principle recognizes a river basin as the most appropriate unit for considering the management of water resources. Nowadays this principle is mentioned in almost every water management-related directive or policy recommendation, though rarely duly realized even in national environmental management practices. For example, the new Russian Water Code adopted in 2006 proclaims the need for river basin-wide water management strategies, but stipulates national water management depending on the existing administrative territorial division (2007).

Another undisputable point in the theory of IWRM is that sustainable development of watersheds should consider three main components: economic, social and environmental. However, the history of human communities’ development in river basins shows that this is hard to achieve. Some components are often neglected in favour of others.

Freshwater is a limited resource, which is very much affected by uncontrolled weather conditions and often even the best management strategies cannot provide enough water for all users. This consideration leads to the necessity to prioritize water users in conditions of both scarce and available water resources. Traditionally the first priority in water use is given to economic development at the cost of environmental needs. However, it is clear that such an approach cannot be sustainable even in case of abundant water resources taking into account the constantly growing economic needs and related anthropogenic impacts.

The very definition of “sustainable” applied for water use is a vague concept, as has been repeatedly indicated by some authors (Hedelin 2007; Lagutov 1995; Lagutov 1997; RAMSAR 2002). Despite numerous regulations and projects the attempts to synchronize understanding of the IWRM concept by different stakeholders and to introduce integrated water management into

management practices are often not very successful. Not only different stakeholders and water users, but also different scientists define this concept in various, often contradictory, ways. As a rule researchers and managers continue to address IWRM issues from a narrow, sectoral perspective. This creates problems for a participatory approach, one of the pillars of sustainable watershed management, which implies transparency and participation in decision-making for all involved stakeholders and water users. Apart from that, particular essential ecological water services such as biodiversity needs are often not represented by any stakeholders, organizations or communities who participate in the decision-making process of IWRM. Hence, these needs are often neglected even in case of participatory decision-making.

Another basic yet controversial IWRM principle is the introduction of the economic analysis of water use (EU 2000). Though seeming to be a good idea, it often cannot be duly implemented. Assessment of a certain species' extinction in monetary terms or, even more, economic comparison of such a loss to, for example, electricity generation, is hardly possible.

In addition the integrated watershed management is often complicated by the transboundary nature of the river basins (Jansky *et al.* 2004; Kauffman 2002; Margesson 1997; van Ast 2000). IWRM implies the need to manage transboundary water resources jointly, which can rarely be achieved. The interests of a particular country and its willingness to participate in the process directly depend on its upstream or downstream position along the river stream. For instance, EU Member States adopted the Water Framework Directive (WFD) in 2000 and are rapidly moving towards unifying management systems and standards (EU 2000). According to WFD, Member States are obliged to protect, enhance and restore all surface waters with the aim of achieving good ecological status by 2015. However, by 2007 the pressing issue of transboundary water management for EU members not only lacks enforcement, but even the principles have not been agreed on yet (2007). The natural hydrological cycle is perceived by managers and decision-makers as a uniflow river stream. If any damage to the river ecosystem (pollution, hydrological cycle disruption, etc) is made by an upstream country and downstream countries are bearing ecological or economic losses it seems that no harm is caused back upstream. The case of the cyanide spill at Baia Mare (Romania) in March 2000 revealed the problems of integrated transboundary water management and political implications very well (UNEP 2004).

New approaches should be sought and applied to integrated water resources management to make it an effective tool in practical environmental management. These approaches should be based on an ecosystem's sustainability, e.g. water cycles, and non-disruptive character of human activities with regards to ecosystem functions. An ecosystems approach to IWRM focusing on the role of the hydrological cycle is under discussion in the scientific literature (Jewitt 2002; RAMSAR 2002).

IWRM Indicators

Careful selection of appropriate indicators in altered watersheds is an essential part of sound policy and decision-making in IWRM. On the one hand, these indicators should integrate the long-term temporal and spatial basin-wide environmental characteristics of a watershed. On the other, it should ideally be possible to assess the socio-economic activities in a watershed using this indicator. However, indicators in general and integrated indicators in particular are still not a well elaborated aspect of IWRM (Chaves and Alipaz 2007; He *et al.* 2000).

There are many indicators and indices suggested to evaluate the progress in a particular aspect of the IWRM process. For example, the number of published articles or sent messages to stakeholders are suggested as indicators of public participation or awareness raising in IWRM (Hedelin 2007).

Another case study for indicators' usage in IWRM can be drawn from WFD, which aims at "achieving good status of surface water" (EU 2000). Surface water is defined as of good ecological quality if there is only slight variation from the ecosystem with minimum

anthropogenic impact. A long list of different indicators to be selected from is suggested for appropriate authorities, who can choose several indicators to work with and set up their own standards. The indicators are isolated and treated separately, which by itself cannot result in sound policy (Chaves and Alipaz 2007). Most of these indicators and, correspondingly, activities within WFD concentrate on water quality. At the same time other river-floodplain system characteristics (i.e. habitats fragmentation), economic or social aspects are either not taken into consideration or inadequately considered.

In comparison to isolated indicators of the physical environment, economic or social aspects of the IWRM process the ecological and biodiversity indicators are usually either not taken into account or little attention is paid to them in water management practices. At the same time ecological aspects, in particular biodiversity conservation, are an essential part of the SD process and they should be applied to IWRM to consider watershed development as sustainable. The concepts of "key-", "indicator-" or "keystone-" species for sustainable development and IWRM have been widely discussed in last 15 years (AzovBas 2002; Russian Duma 1995; Lagutov 1995; Lagutov 1997; WWF 2002a, 2002b).

Moreover, given the holistic, "integrated" nature of IWRM it is essential to introduce some river basin-wide single natural indicator of sustainable watershed development which can bring together different sectors and stakeholders concerned with IWRM, allowing the interests of various water users (including ecosystem services) to be taken into account. This indicator should also encourage involvement of different disciplines related to water management as well as incorporate concerns of ecological, socio-economic and policy aspects of sustainable development.

Such integrated natural indicators of sustainable watershed management are sorely lacking in practical environmental activities and the need for this indicator has been mentioned by many authors (Chaves and Alipaz 2007; Jewitt 2002; van Delden *et al.* 2007).

The role of sturgeon population in securing environmental flows

Sturgeon species

The sturgeon is an *anadromous* species, whose reproduction takes place in freshwater river basins with the growing and maturing phases occurring in the sea. After maturation in salted water sturgeons migrate back to freshwater for the purpose of breeding. Particular environmental conditions are required for spawning, depending on species: hard substrate (pebble, gravel, etc), stream velocity (0.5 – 2.0 meters per second), depth (1-20 meters), temperature regime, etc. Spawning habitats are located in the upper branches of rivers. The distance to these grounds can be, depending on species, more then 1500 km from the river delta. The size of adult specimens varies from 0.5 to 6 meters and from 0.5 kg to 2 tons. The sturgeon is a long-lived fish standing at the top of food webs.

Sturgeons are among the most interesting species in the world. They have successfully survived from the time of the dinosaurs. Extremely high plasticity helped them to adapt to the changing environment through all these millions of years. The historic range of sturgeon species are the main rivers of the Northern hemisphere. Each river basin had a stock of its own with specific features and life cycle characteristics. By now they have vanished from most of them (FAO 2007a; IUCN 2007; WWF 2002a).

The extinction of sturgeon species is one of the most tragic and representative examples of the destructive influence of humankind on Nature. Sturgeon, sometimes called the "living fossil" or living "dinosaur" of the fish world, is currently on the verge of extinction solely due to anthropogenic impact.

The drastic decrease in the sturgeon population is caused by various factors (sea level fluctuations, pollution, etc), but the main ones are believed to be blockage of the spawning places and migration routes by dams and overfishing on the main basin rivers (Uralbas 2007b).

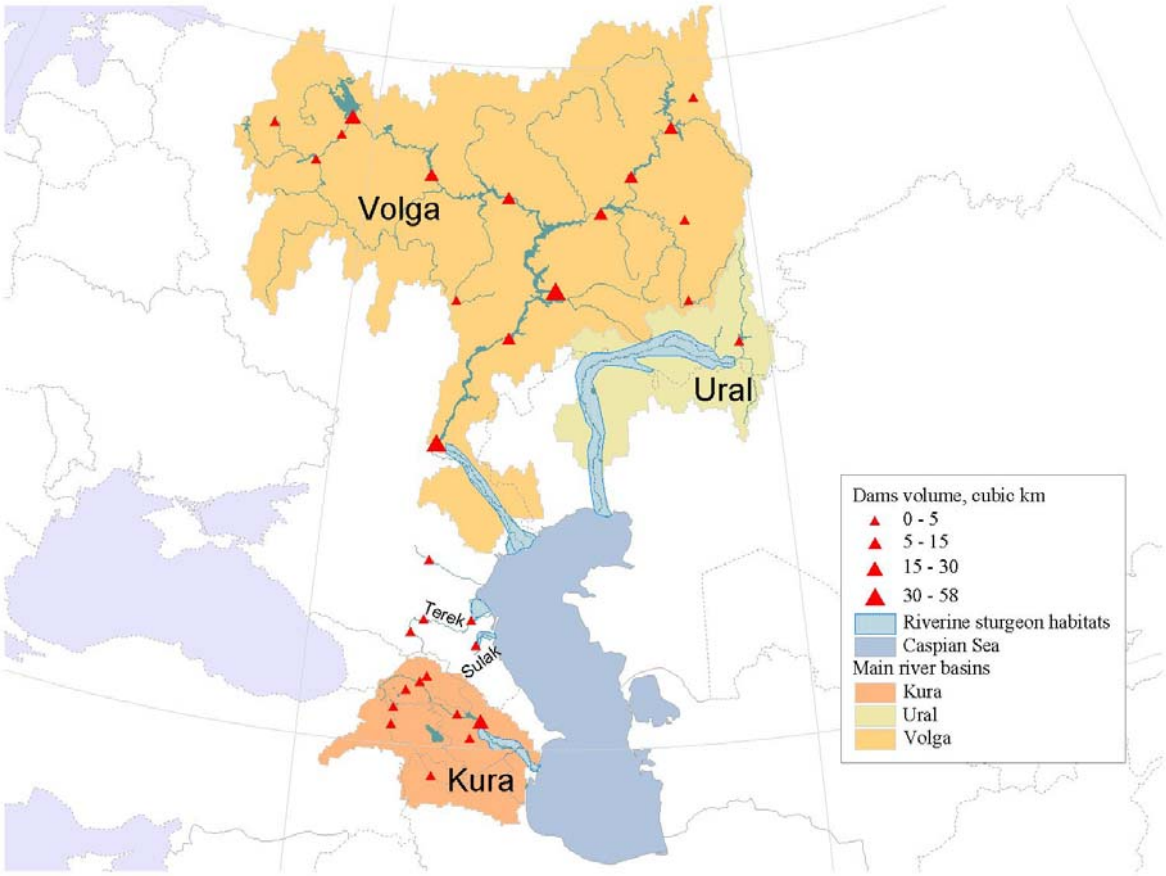

Figure 2 The main river basins of the Caspian Sea with biggest dams and waterworks.

Dams and wires (accompanied by commercial overfishing) are the main reason for sturgeon extinction in the Caspian rivers ({Lagutov, 2008 #614}{Uralbas, 2007 #378}). Constructed in the lower river streams, the dams break the fish migration routes, cut off the spawning grounds or destroy them by submerging, change hydrological regimes of the rivers. For instance, 100% of spawning grounds for the Beluga (*Huso Huso*), the most valuable sturgeon species, were lost in the Volga river by construction of the high pressure Volgograd dam. Deprived of access to the spawning grounds and thus their ability to reproduce, the long-lived sturgeon stock was further depleted by constantly increasing fishing efforts over the course of several decades.

As it can be seen from the Figure 2 the Ural river is the only river in the Caspian basin (and most of European basins) with unregulated river flow in the lower and middle stream. Thanks to its natural environmental flow regime the Ural's aquatic biodiversity has not deteriorated as much as that of other big rivers. The Ural River contains the only available spawning and wintering habitats of worldwide famous sturgeon species which are protected under numerous international conventions.

Sturgeon Population as an environmental flow indicator

Apart from its high economic value, sturgeon is a perfect indicator species for the river basin it inhabits (AzovBas 2002; Lagutov 1995; Lagutov 1996, 1997; Lagutov 1999; Uralbas 2007a). The presence and well being of the sturgeon population in a river network indicates the "good quality" of a river ecosystem's health. Some of the possible justifications for this statement are given below.

First of all, sturgeons utilize a variety of habitat types throughout their life cycles: rivers for spawning; rivers, lakes, estuaries, or the sea for feeding and wintering. Depending on the life stage the sturgeon habitats are spread through the whole river network, estuaries and adjacent marine areas.

Second, there is no natural predation for mature sturgeons, so apart from fishing efforts the sturgeon population is a function only of river environmental conditions, which can to a great extent be controlled by Integrated Water Resource Management.

Next, the sturgeon life cycle lasts up to 100 years which is comparable to the expected life duration of a human being. Actively migrating and feeding through all these years sturgeon presents a good subject for bioaccumulation. Taking into account its top position in the food chain (like human beings) sturgeon is a good *integral* indicator of water quality over a long period of time. In case of river contamination the river stream can be self-purified quickly (e.g. Baia Mare case (UNEP 2004)) and water quality tests will not indicate any problems, while living organisms (e.g. sturgeon and human beings) are subjects for the accumulation of harmful substances in their tissues.

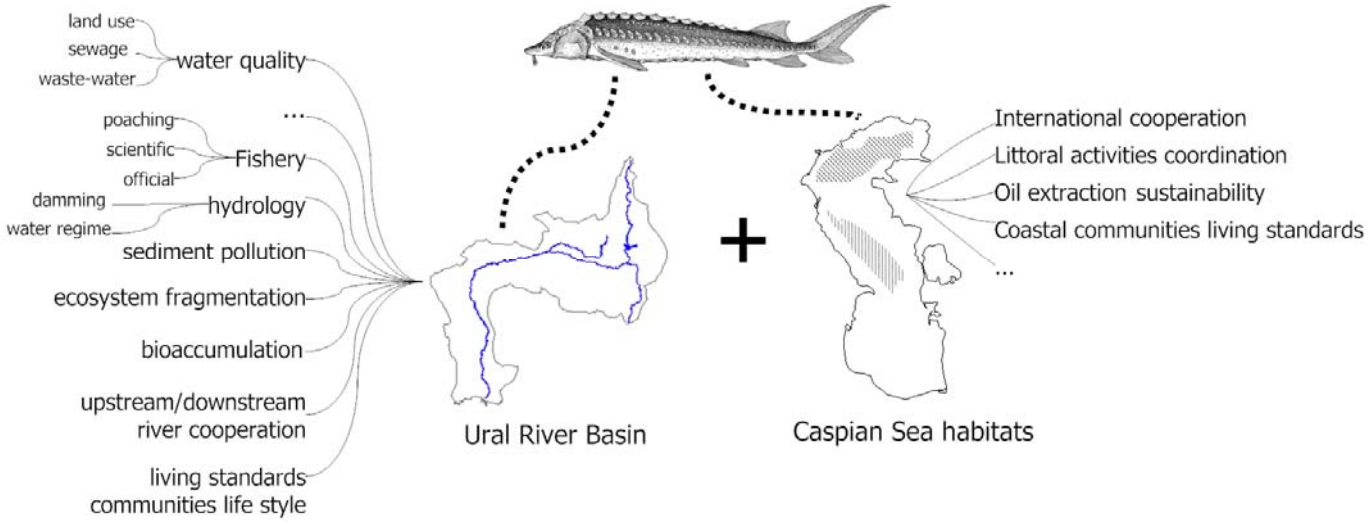

Figure 3 Some sturgeon functions as an indicator species

Then, similar to a human being, sturgeon is a late maturing species, having an age-structured population. The reproductive age is reached depending on species at 10-15-20 years old. By that time harmful substances accumulated in the organism can affect reproductive abilities (Kajiwara *et al.* 2003; KaspNIRH 1999; Pourkazemi 2007) causing population decline as well.

There is also a positive relationship between sturgeon presence and a river's hydrological regime, which can be altered by damming, channelization or excessive water intakes. Spawning migrations are triggered by spring freshwater influxes to the seas and the entire success of spawning depends upon the water availability in the river, in other words water management strategy in spawning periods. Sturgeon presence in the river indicates the natural character of the hydrological regime, including regular floods and river self-purification service.

Apart from that, sturgeon is an indicator of other river physical characteristics: blockage of migratory routes, habitat degradation and fragmentation, siltation, pollution, water quality, etc. Some of these factors directly depend on the land use patterns in the river basin due to water runoff from the catchment area. In this way the terrestrial aspects of human activities are also brought into consideration.

Securing natural sturgeon reproduction, protection and sustainable management of sturgeon stock is directly linked to integrated water resources management in the river basin and sustainable watershed development. These activities influence each other and should be considered only in an integrated manner. By prioritizing sturgeon species conservation and rehabilitation we can try

It should be noted that fish have been used as indicators for solely ecological status assessment for about 20 years as one of many indicators along with phytoplankton and amphibians (Hughes & Oberdorff, 1999). For example, fish populations are one of many

ecosystem health indicators in the EU's WFD. To date, however, even EU Member States have not yet included fish in their routine monitoring programs. Sturgeon is one of the suggested indicators for biodiversity abundance. However, use of this indicator for European rivers is a matter for the very distant future, if at all, since it is totally extinct from every European river without hopes for restoration due to habitat loss and damming. The only exception is some landlocked freshwater sturgeon subspecies of little ecological and economic value, which cannot be used as an indicator in the same way as other sturgeon species (e.g. sterlet in the Danube).

Sturgeons might also represent regional economic development and social structure, as poaching and illegal fishing which reduce sturgeon populations develop in areas with a poor unemployed population.

Preserving sturgeon in the region would not only be of pure environmental benefit, but would also greatly contribute to economic and social stability in the region as well as food and water security. Thus, the measures aimed at preservation and sustainable management of the Ural sturgeon population can bring together environmental and socio-economic aspects of sustainable development and underpin the strategies for sustainable watershed development.

WWF's European Freshwater Programme also considers Sturgeons as habitat Flagship species, Species of special concern and Indicator species (WWF 2002a, 2002b).

Sturgeon Population as an incentive for transboundary integrated water management

One of the biggest obstacles to transboundary IWRM in Central Asia in general and in the Ural river basin in particular is the lack of incentives for cooperation. This statement is especially true in cases of upstream-downstream watershed division as in the case of the Ural river basin. The selection of these incentives is always region-specific and depends on the current state of international affairs and environmental conditions.

There is no need to describe the importance of sturgeon conservation and worldwide concern over its fate. The importance of this flagship species' preservation is acknowledged by many international Conventions and Agreements (CITES 2004; FAO 2007b; TRAFFIC 2003, 2007; WWF 2002a). The reason for such an interest in this species' preservation is its high commercial value. Sturgeon caviar is synonymous with luxury and wealth worldwide. There are some beliefs expressed by regional experts that in case of sustainable and rational utilization of the restored sturgeon population the profit for the Caspian littoral countries might be comparable to the profit of oil extraction in the region (Uralbas 2007a). Though such claims and ideas might be considered impracticable and ill-grounded, they reflect the reality to some extent.

Caviar, or Black Gold, is one of the most expensive products on a weight basis on the world commodity markets (CEP 2002). The price of caviar is constantly increasing and in 2007 was as high as £9,000 per kilo (Boase 2007). Gessner et al (2002) estimate the demand on world export markets for caviar, the delicacy derived from sturgeon roe, at 500 tons annually (Gessner *et al.* 2002). Following this market demand a lot of sturgeon farms have being opened worldwide to produce sturgeon products (caviar and meat). However, the widespread hatching technologies require only wild sturgeon breeders for successful sturgeon reproduction. In this situation the Ural river, the last river where the natural sturgeon reproduction is possible must be protected to secure these farms with such gene pool.

Being a unique ecosystem the Ural river basin provides an encouraging incentive for the transboundary IWRM through preservation of the sturgeon species. Both basin countries are genuinely interested in this long term capital investment and region development.

Ural Basin Project

Ural Sturgeon International Park

The Ural River Basin Project was launched to facilitate the sturgeon restoration and sustainable watershed management in the Ural River Basin in 2007. The Project is a joint initiative by Central European University, the Russian Environmental NGO “Green Don”, local communities and a number of Russian and Kazakhstan NGOs and environmental state agencies.

The underlying idea of the Project is the concept of sustainable basin development by securing natural reproduction of migratory sturgeon species. In order to assure the implementation of this idea an international Ural Sturgeon Park should be established, spreading through the full extent of sturgeon migration routes and habitats, from the spawning grounds in the river upper branches to the river mouth. The Park borders should be drawn based on the 100 year flood level to secure undisturbed ecosystem functioning under possible extreme conditions. This approach differs from the utilized now approach to the creation of small patches of reserves through the river stream network (Bolshov 2000; RK 2002). The entire extent of the sturgeon migration routes and habitats in the Ural river should be equally protected.

The population density in the considered areas is very low, the industries and agriculture influence is minimal. Such a Park should also have features of a Biosphere Reserve and Ethno-Natural Protected Area. Integrated water management and community-based management of sturgeon stocks can be the basis for sustainable basin development. In this way the Project aims not only to preserve this flagship species, but also to solve social and economic problems by restoration of the traditional life style of local communities.

The productive sturgeon spawning habitats are located in the upper branches of the Ural river in the Russian part of the watershed, while the most of the migration paths are in Kazakhstan. To achieve this, close cooperation and agreement should be established not only on communities’ level, but mainly on the level of local and regional authorities of Russia and Republic of Kazakhstan. The proposal for the creation of such an International Park should be developed in collaboration with all the interested parties and a cross-sectoral feasibility study should be carried out in cooperation with national and international agencies. The final proposal should take into account the interests of all stakeholders with priority given to sturgeon conservation to secure regional sustainable development.

High economic and social values of sturgeon allow the combination of both ecological and socio-economic aspects of sustainable development. Investment in IWRM and sturgeon conservation can be largely repaid later by “sustainable extraction” of sturgeon upon stock restoration.

While the establishment of a Ural Park seems to be long-term distant goal, other activities have been carried out in the framework of the Project. Public awareness raising has been approached through a number of regular publications in regional and local mass-media. The website of the Ural Basin Project was launched at the beginning of 2007. A number of research projects on the river ecosystem and riverine biodiversity has being also undertaken in cooperation with regional organizations.

Special attention within the project activities is paid to the modelling of sturgeon population and water management issues. Such a model has proven to be a very useful tool in integrated water-resources management in a river basin and analysis of sturgeon protection activities (Lagutov 1996, 1997, 2003). Moreover, some authors state that sustainable river basin management is only possible by means of applying catchment models to evaluate management alternatives (Fohrer 2005; Refsgaard *et al.* 2005). Apart from decision support tool integrated modelling serves as a framework for the organization of existing multi-disciplinary knowledge, to identify gaps in knowledge and to bring scientists, stakeholders and decision-makers together (Keyl and Wolff; Parker *et al.* 2002; Suter and Glenn 1999).

To support modelling efforts and to collect data available on the Ural river basin GIS databases of the Ural River ecosystem are being developed. There are a number of techniques which can be used for linking GIS and environmental modelling (Aspinall and Pearson 2000; Pullar and Springer 2000).

The areas under the scope of the Project include different environmental disciplines and anthropogenic activities related to the well-being of the sturgeon population, taking into account its triple function in the river ecosystem (as indicator species, flagship species and species of special concern). By adopting this holistic, integrated approach the Project will be a focal point for specialists on water quality, fishery, international and national environmental law, as well as sturgeon experts.

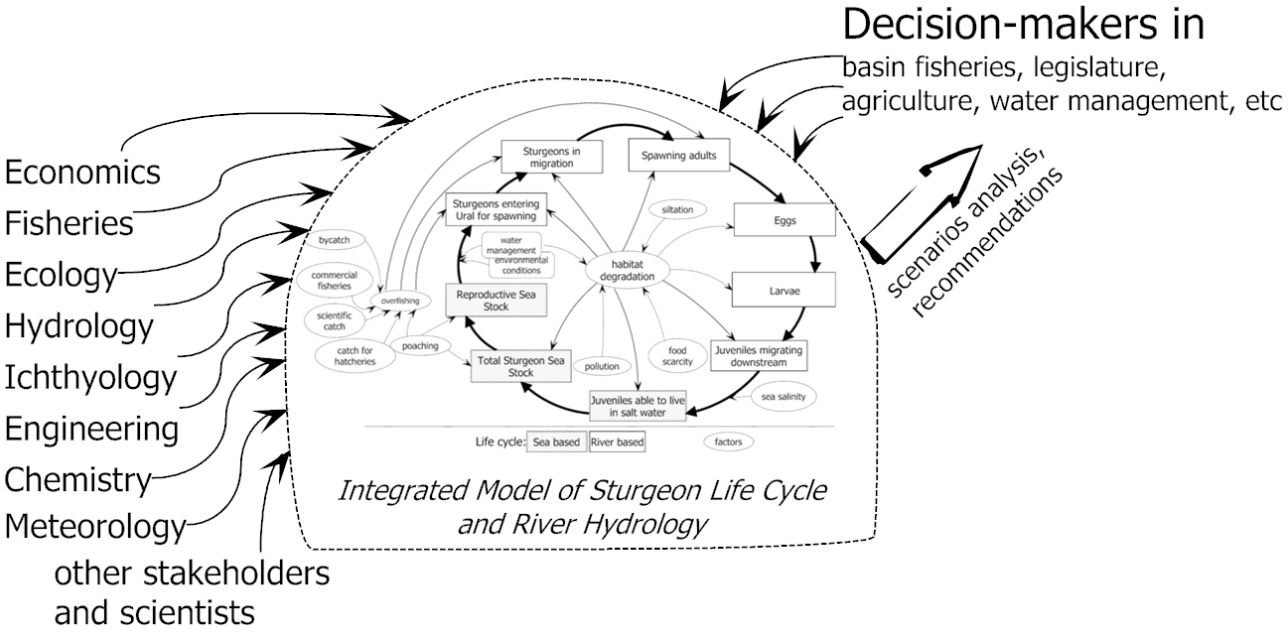

Figure 4 The network of specialists in integrated watershed management of the Ural river and role of Ural Basin Project

One of the Project's goals is to develop a network of specialists involved in different aspects of integrated water management and sturgeon conservation. Such a network should unite not only different scientists (biologists, hydrologists, economists, chemists, lawyers, etc), but also water users (industry, agriculture, local communities, etc) to provide integrated interdisciplinary analysis of watershed-related problems and develop sound recommendations for decision-makers. Managerial insight and opinion should also be taken into account through their involvement and feedback to the developed recommendations supplied to them. Figure 4 displays the idea of this network and the role of the Ural Basin Project in it.

The cooperation with educational institutes aimed at the review of current environmental-related courses is carried out as a part of the project. In particular, it is planned to include in syllabi discussions of transboundary environmental management and nature protection and to introduce to institutions and schools of the Ural Basin experimental training courses for officers of environmental agencies and state services.

The First Ural River Basin International Workshop "Rescue of Sturgeon Species by means of Transboundary Integrated Water Management in the Ural River Basin" was held in Orenburg (Russia) on June 13-16, 2007 within the framework of the Ural Basin Project. Organized by the Research and Consulting Center DonEco and Central European University, the Workshop was also conducted with active involvement and assistance by the Russian Federal Agency for Environmental Inspections. The workshop was attended by more then 60 experts, researchers and practitioners from Governmental Environmental Agencies, NGO and business representatives from both basin countries (Russia and Kazakhstan), and representatives from relevant international organizations such as the Food and Agriculture Organization of the United

Nations, the Secretariat of Wetland Convention (RAMSAR), the International Association on Danube Research, and many others covering the whole spectrum of Ural Basin management stakeholders. More information on this and other Project activities can be found on the Project's website at http://uralbas.ru.

Public Participation in IWRM and biodiversity protection (Ural Cossacks Communities)

As stated above, public participation is one of the essential principles of IWRM and sustainable watershed development. Any nature protection activities are ineffective if they are not supported by local communities. Moreover, some authors mention the rights of local communities over water and water ecosystem related resources as an important factor contributing to sustainable basin development (Karpov 1911; Kgarebe 2002)

In many cases practical implementation of these requirements are hardly possible or has a limited, formal character, since often local communities have no incentives to participate in these activities. This is well illustrated by conservation of sturgeons with high market value, which makes this species a subject for poaching. So, poaching and illegal fishing are widespread regional threats in the Ural region nowadays.

However, a high level of public participation can be easily achieved in the Ural watershed. Active cooperation of local communities with regional authorities might be possible thanks to the peculiarities of regional identity. This area is historically populated by Ural Cossack communities, a self-governing paramilitary ethnic group. Cossack troops were traditionally involved in various State services in Russian Empire. They were either protecting Russia's borders in their areas or serving as combatants during military campaigns. In exchange for military service they enjoyed exclusive rights to control natural resources on their territory (e.g. fish and water) and paid no taxes (Borodin 1901; Brockhaus and Efron 1898; Semple 1907; Von Harthausen 1972).

The Self-governing Lands of Cossack Communities in the Russian Empire were historically located in the river basins (Don, Volga, Cuban, Terek, Ural, Amur, etc) in the frontier areas. Cossacks were living in small villages (*stanitcas*) throughout the river floodplains, relying on fishing, hunting and small scale farming as food sources. Any industrial or agricultural activity on their Lands had to be confirmed at Cossack gatherings ("Cossack Circles").

The Ural Cossacks, one of the oldest Cossack communities in Russia, controlled the entire territory and resources of lower Ural basin and adjacent sea area. Their historical settlements are stretched in a line along the bank of the Ural river for more then 450 km. As can be seen from Figure 5, a reprint of an old Russian map from the beginning of the 20th century, the Ural Cossacks' Land closely matches the shape of the Ural basin, covering all sturgeon habitats.

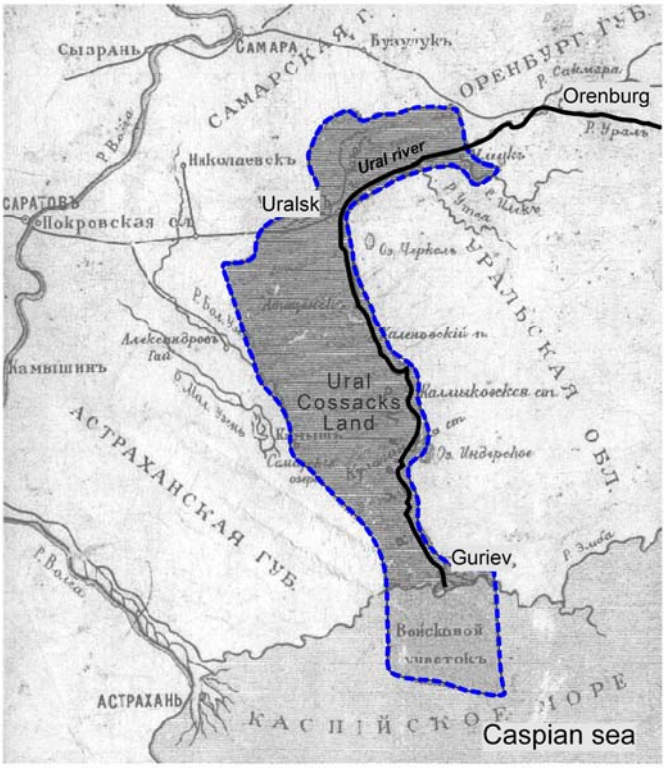

Figure 5 The territory of Ural Cossacks Land before 1917 fully covered the sturgeon habitats from the river mouth to sturgeon spawning grounds upstream

The traditional life style of the Ural Cossacks directly relates to the problems of sustainable water management in a river basin. Living in harsh environmental conditions characterized by low soil fertility they had to fully rely only on the river ecosystem to support their communities.

Consequently, all the aspects of water usage and fishery were very carefully described, regulated and enforced (Borodin 1901; Dal 1961). There were fishery and water laws. Out of two elected commanders (*atamans*) one was a military commander, while the other one was solely responsible for fishery. Special mounted troops guarded the river streams during spawning migrations.

Baron August Von Harthausen in his book “Studies On The Interior Of Russia", first published in German in 1847, described the Ural Cossacks as follows:

> “...they do not farm the land at all... and live principally from fishing... Fishing is precisely regulated. It is limited to specific times in the winter, spring, and autumn. Whoever dares to catch a fish out of season loses his share for that year. Even if the Cossack happens to find a sturgeon which has been tossed onto the land, he will carefully throw it back into the water rather than take it home....”(Von Harthausen 1972)

The characteristic feature of the Ural fishery was *uchug*, the temporal metallic or wooden fence constructed through the river stream near the city of Uralsk. The fence prevented spawning sturgeons from autumn race from going upstream out of Ural Cossacks territory. Sturgeons had to hibernate in the wintering habitats downstream of *uchug*.

Any sturgeon fishing was limited to several days during the year. In winter it was aimed at hibernating sturgeons below *uchug* (Dal 1961). The fishing in the spring and autumn was also precisely defined and organized by fishing atamans. Any fishing in the river or sea in summer was prohibited. The catch in the sea was carried out with *okhans*, nets with coarse, more then 0.5 meters, mesh (Malecha 2002). In the river fishing with coarse-meshed nets was allowed only in strictly limited days upstream of uchug (around 500 kilometres from the delta). Every spring during the vernal spawning migrations *uchug* was dismounted to secure natural sturgeon reproduction. Only Cossacks were allowed to fish in the Ural river.

Until Russian Civil War in 1917 when Cossacks were deprived of their privileges the entire water course of the lower and middle Ural was used exclusively for fishery (Brockhaus and Efron 1898). No any other kind of activity was allowed, including navigation. Ferriage through the Ural was allowed only in a couple of places through the entire territory in order not to frighten the fish.

Sturgeon and river worshipping by Ural Cossacks was reflected on their coat of arms: sturgeon and water were the only items depicted on it in addition to their weapons.

It should be stressed that sturgeon meat and caviar was not considered as a kind of luxury, but rather as ordinary people food (Borodin 1901; Dal 1961). So, the precise regulation and careful protection of sturgeon stock was not an attempt to maximize the profit, but to secure sustainable, as we call it now, consumption of the food resource.

Unfortunately, this interesting experience of sustainable river-related management is not adequately reported in Soviet, and correspondingly, foreign literature, due to the persecution of Cossacks by the Soviet regime during the 20th century.

Thanks to such an environmentally-friendly attitude and rational prudent fishing the sturgeon stock in the Ural river lasts much longer then in other Caspian regions. It was the main source for record-breaking catch in the second-half of XXth century, when Ural catch along substituted more then a half of all Caspian catch in f.USSR. Such an attitude to natural resources by every member of local communities is a rare phenomenon. Partial explanation to it is the community exclusive rights over the resource and its utilization.

Cossacks were, probably, the most severely persecuted ethnic group after the Bolshevik Revolution in 1917. Revival of the Cossack movement is a widespread phenomenon through the whole territory of Russia nowadays. Recovering from repressions they are actively looking for their place in modern Society and possibilities of State Service, demanding changes in legislation and society structure (BBC 2007). For example, often regional Cossack organizations serve as voluntary mounted police in cities in their region.

While it might be impossible to fully restore Cossacks' former rights and privileges, this potential and these grass-roots initiatives should be utilized. The idea of using reviving Cossack groups for environmental protection has been actively promoted in the last decade by some Cossack and NGO leaders (AzovBas 2002; Russian Duma 1995; Lagutov 1995; Uralbas 2007a). The involvement of local communities in nature protection activities (e.g. establishment of ethno-natural protected territories) in the Ural river basin may not only protect this species and ecosystem of worldwide concern, but also stabilize the social and economic situation in the region by providing employment. In this case, Cossack groups can be effectively used for guarding the protected areas to prevent poaching and serving as rangers.

The consultations with the local communities (main regional Cossacks organizations) in the region have shown their interest and full support for this initiative. Moreover, local Cossacks communities are already reported to oppose poachers and guard the territory next to their *stanitsas* (villages) independently and in cooperation with State Environmental Inspection Agencies. The first joint anti-poaching patrols involving state fishery inspectors and voluntary-based Cossack troops were successfully carried out in the Orenburg region (Uralbas 2007a).

Legal and Institutional Framework

The existing legislative base including, but not limited to, National Constitutions, International Conventions, ratified by both countries, national laws and a number of bilateral agreements creates an adequate legal framework to initiate transboundary watershed management cooperation. However, further improvements and amendments are needed for its successful realization.

The new RF Water Code, a framework national law regulating the protection and use of water resources, was adopted in Russia in June 2006, and came into force on 1 January 2007.

The Code is mostly based on existing national water legislation. It also incorporates a number of contemporary approaches to water management presented in IWRM and, as an example of a well elaborated water Directive, the European Union Water Framework Directive. In particular, one of its innovations is the introduction of a basin management approach to water management practice, institutional coordination based on a basin approach and the creation of basin councils. It also envisages comprehensive basin management schemes that are to be developed for the purposes of integrated water management.

However, the EU WFD urges “management of a river basin as a single system of water management” and suggests that the usual administrative boundaries should no longer be applied to water basin management. At the same time, the territorial unit for water management (basin “okriug”) in the Russian Water Code is based on the existing administrative structure in Russia. The Water Code simply coordinates water policies between the federation, the 89 federal subjects and the municipalities by defining the scope of their competences within the traditional administrative borders. It also aims at coordination between multiple stakeholders and water-users.

It should also be noticed that a basin management approach was also foreseen by the 1996 Water Code of the Russian Federation, though without any practical implementation. The legal framework for integrated river basin management was also developed and adopted in the Soviet Union in the 1960s.

By contrast, Kazakhstan is a few steps ahead in implementing the basin water management principles. The new edition of its Water Code, incorporating the principles of river basin management, was adopted in 2003. The Basin Councils for most of the river basins within the territory of Kazakhstan are already established and functioning. A number of internationally-funded projects on IRWM are undergoing. However, according to UNDP reviews the situation with water resources management in Kazakhstan “is best described as being fragmented, underfunded and poorly governed” and there is still a long way to go to implement IWRM principles.

Transboundary aspects of watershed management have received very little attention in either country so far. Though both countries have ratified a number of international and bilateral conventions and agreements on transboundary water issues and pollution, they have not been enforced yet.

The preservation of the ecosystem and sustainable watershed management of the Ural River depends not only upon efficient cooperation by both basin countries, Russia and Kazakhstan, but also on active involvement of international institutions. The latest trends show that international organizations and donors are increasingly interested and willing to fund and participate in transboundary water management projects and threatened biodiversity conservation (in particular sturgeon and other flagship species) (CITES 2003; Raymakers and Hoover 2002; Turnock 2001; UNECE 2006; WWF 2003).

Both countries are parties to international conventions and agreements on various aspects of water protection, biodiversity conservation and sustainable development, though this is not explicitly reflected in water management practices.

Taking into account the above considerations and the development stage for water regulations and methodologies in both basin countries, the case of the Ural River Basin is ideal for a pilot study on drafting and implementation of transboundary basin management directives aimed at sustainable watershed development in post-soviet countries.

Discussion

Sturgeon species can be considered a perfect natural bioindicator of a river basin's health and sustainability of integrated watershed management. These two issues are closely interconnected and should not be approached independently.

At the same time sturgeon species allows to consider all aspects of sustainable development: ecological, social and economic. The activities towards its conservation and restoration bring together all stakeholders in integrated watershed management. In this way the general and vague concept of Sustainable Development gets the definite realistic definition and mechanisms for practical implementation. It evolves into the new Concept of Basin Sustainable Development (AzovBas 2002; Lagutov 1995, 1999) which can be implemented and enforced in practical IWRM process.

The Ural river ecosystem with affiliated traditional Cossacks life style is a unique natural and cultural phenomenon which should be protected internationally. The establishment of International Ural Sturgeon Park with active involvement of reviving Cossacks communities and international monitoring seems to be the only possibility to secure Caspian sturgeon conservation and rehabilitation. Its conservation will also assist in the Region's sustainable economic and social development.

The need for transboundary cooperation is well understood in both basin countries. The existing legal national frameworks allow such cooperation, though the practical steps in joint watershed management and transboundary biodiversity conservation is badly needed.

Though the Ural river basin with its free-flowing unregulated stream is a unique ecosystem the proposed principle for the regional transboundary cooperation should not be treated as site-specific. It might has successful implementation in many river basins worldwide. First of all, the sturgeon species historically inhabited all major river basins of the Northern hemisphere. There are numerous programs worldwide on the restoration of this species (i.e. in the Danube river). Secondary, the main problem of sturgeon extermination from these habitats were the dams and water reservoirs created during the 20th century. The existing fish passage technologies with regards to the sturgeon transfer through the dams were extremely ineffective. Moreover, many dams simply do not have any fish passage facilities. However, the development of new fish passage constructions aimed at sturgeon species securing their safe "non-forced" transfer through the barriers (Lagutov 1995; Lagutov 2005) suggests restoration of the sturgeon migration routes and possible population rehabilitation. In case of successful conservation and further rehabilitation the Ural sturgeon population can serve as a gene pool for the sturgeon restoration programs worldwide. After all, there are some other migratory species which are still available in the river basins (i.e. salmon) and might serve as a basis for the transboundary cooperation.

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