Evaluation of the Choghakhor Wetland Status
with the Emphasis on Environmental Management Problems

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Abstract

Ecological and eco-touristic importance and the problems of conservation of natural lands around Choghakhor Wetland, located in the Chahar Mahal and Bakhtiari province of Iran, the habitat of many immigrant bird and aquatic creatures, were the main topics of this study; the importance of providing an environmental planning and management plan for this wetland is emphasized. In order to determine priorities according to the status of Choghakhor Wetland, in comparison to the 75 important wetlands of Iran (63 of these have been registered in the Ramsar Convention documents), the five criteria (birds, fish, threatening factors, social-economic problems and conservation status) of the wetland were studied and analyzed, and the macro-invertebrate benthos, including Oligochaeta, Chironomidae and Gammaridae, was surveyed. For Choghakhor Wetland, the result was 80/140, so this wetland got the 8th priority among all other ones. In fact, this classification shows the potential strength of Choghakhor Wetland to have environmental management plan. The results of this study make it clear that construction of a dam is the strongest threatening factor to this habitat and its biodiversity. This clearly shows the necessity of environmental planning and management to assess the impacts in order to establish proper management and wise use of the wetland.

Key words: Choghakhor Wetland, environmental planning and management, Ramsar Convention.

1. Introduction

According to the Ramsar Convention: “Wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which
at low tide does not exceed six meters.” Benefits of wetlands are their natural riches, tourism and training, wetlands ecology, reduction of flood risks, effects on ground water supply, wetlands as sink (and source) of pollutions, climate change problem, and wetlands as habitat for rich biodiversity.

With the aim of attaining higher levels of social welfare and improving people’s quality of life, the government has arranged a specific program for constructing a dam on Choghakhor Wetland which leads to adverse effects on the environment of the wetland.

2. The Case Study Area

Choghakhor Wetland is the largest, unique wetland in Chahar Mahal and Bakhtiari province; it is the habitat of most of the immigrant and endemic species of the province. As a result of human activities (especially the construction of dam on the wetland), it became so fragile and sensitive that during the recent years many valuable species became endangered by extinction and destroying. Some of the land uses of Choghakhor Wetland which cause environmental problems are the water intake for irrigations (and other purposes), the increasing dam’s height, boating and incretions; the interaction of these conflicting factors causes disorder in Choghakhor Wetland’s bio-system.

Before the dam had been constructed, the extent of water coverage, in the heaviest rainfall season of the year, was 700 to 1000 ha, and most of the edge lands and also the wetland itself were covered with aquatic plants, especially *Junicus*. But since 1999, when the Choghakhor dam was constructed on the exit of the wetland, the water volume increased so that the extent of water coverage, in the heaviest rainfall season of the year, changed to 1500 ha; the volume of water intake is estimated to be around $45 \times 10^7 \text{ m}^3$, which causes fundamental changes in macro-benthos of the wetland (Document p120 1996).

The Choghakhor Wetland is located 2270 m above sea level and its geographical coordinates are: $31^\circ 54' 17'' \text{N}$ to $31^\circ 56' 31'' \text{N}$ and $50^\circ 52' 40'' \text{E}$ to $50^\circ 56' 14'' \text{E}$ (Document p120 1996).

Before the dam construction, the deepest part of the wetland in the heaviest rainfall season of the year was 1.5 m, that changed to 6 m or even more afterwards. Water sources of the wetland are mostly the rainfall and high water springs (such as Sibek, Tange Siah, Zoordegan, Oregan, Saki abad, Galoogerd) which are located in the west and south part of the wetland. Surface flow has only a small share in the water supply of Choghakhor Wetland (Document p120 1996).
3. Materials and Methods

In order to survey macro-invertebrates of the wetland, including Oligochaeta, Chironomidae and Gammaridae, six sampling stations selected along the water course from the source to the mouth of Choghakor Wetland were surveyed from October 1995 to September 1996. Each station was sampled 4 times (or more). To obtain quantitative samples of benthic of macro-invertebrate, an Ekman dredge sampler (225 cm$^2$ opening surface) was selected. This kind of sampler has been widely used both in routine surveys and for detailed benthos sampling programs, as recommended by the Fishing Research Institute of Iran for quantitative sampling of the sites.

In order to sample the benthic species, a very large area of the wetland needs to be sampled, but this was difficult in practice because of unfavorable weather conditions: freezing and local winds. A compromise was therefore sought, and some samples were taken which were considered to provide reliable and representative data. During sampling sessions at the wetland stations, air and water temperature, depth of water, electric conductivity and pH were recorded.

Also, the water samples were being moved to the laboratory for an analysis of macro-benthos species. Preliminary sorting of macro-benthos samples in the laboratory was carried out on the same day the samples were taken. To obtain the biomass of macro-benthos species, first they were dried, and then the macro-benthos species of the same family were weighted separately by using the 0.0001 sensitive weights. Having the total number, average weight of macro-benthos species was obtained to determine biomass weight per m$^2$.

4. Results

Considering the obtained results of biological and physico-chemical characterization of Choghakhor Wetland and applying the five criteria of birds (18/25) (Evans 1994), fish (17/25) (Coad 1995, 1996), threatening factors (27/50) (Hassanzadeh Kiabi et al. 2004), social-economical problems (18/25) (Department of Environment 2001, Hassanzadeh Kiabi et al. 2004) and conservation (0/15) (Majnoonian 2000, Coslett 2000), Choghakhor Wetland has 80 scores of the 140 total scores, and got the 8th priority among all the others. In fact, this classification shows the potential strength of Choghakhor Wetland to have environmental management plan. Implementation of environmental management plans needs favorable and desired context, as to both the internal and external conditions of the wetland. Regarding Choghakhor Wetland, the external conditions do not work in the same direction as the internal conditions and factors.

Analyzing the investigations on the five criteria and Choghakhor’s score, and then the priority and classification of every of them, we concluded that the dam construction and water intake are the most threatening factors which ruin Choghakhor’s
biodiversity and habitat diversity of this resource. The hydrological regime of Choghakhor has been significantly modified through the construction and operation of the dam. The biological and physico-chemical characterization of the wetland is summarized in Table 1.

### Table 1

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<tbody>
<tr>
<td>Air temperature (°C)</td>
<td>13.7</td>
<td>-4.7</td>
<td>20.1</td>
<td>27.5</td>
</tr>
<tr>
<td>Water temperature (°C)</td>
<td>10.7</td>
<td>5.2</td>
<td>16.3</td>
<td>23</td>
</tr>
<tr>
<td>Water depth (m)</td>
<td>1.9</td>
<td>2.5</td>
<td>3.1</td>
<td>2.5</td>
</tr>
<tr>
<td>Electric conductivity (µS)</td>
<td>373</td>
<td>247</td>
<td>233</td>
<td>214</td>
</tr>
<tr>
<td>pH</td>
<td>8.6</td>
<td>8</td>
<td>8.27</td>
<td>8.3</td>
</tr>
<tr>
<td>Oligochaeta (g/m²)</td>
<td>2.966</td>
<td>8.78</td>
<td>1.67</td>
<td>0.242</td>
</tr>
<tr>
<td>Chironomidae (g/m²)</td>
<td>0.274</td>
<td>0.593</td>
<td>0.2</td>
<td>0.0027</td>
</tr>
<tr>
<td>Gammaridae (g/m²)</td>
<td>0.248</td>
<td>0</td>
<td>0.106</td>
<td>0.00051</td>
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The table shows that different sites of Choghakhor are not the same regarding macro-benthos species abundance and its biomass. This depends on environmental conditions, such as air and water temperature, or water depth. As the table shows, the dominant macro-benthos species of Choghakhor Wetland is Oligochaeta, constituting 90% of the benthos biomass, which lives in places where there is high concentration of organic pollution. The organic pollution of Choghakhor is a result of adding fertilizers and chemicals to water for the needs of fishes introduced to Choghakhor after the dam construction.

Trends of each macro-benthos biomass constituent and biological and physico-chemical factors measured are shown in Figs. 1-3.

The graphs show that the macro-benthos biomass rate decreases significantly in spring which can be a result of increasing temperature and the utilization of macro-invertebrate benthos by the wetland fishes, especially Cyprinidae.

According to the graphs, it can be concluded that some factors, such as temperature or a kind of bed, are in a very close relation to the increase in abundance of benthos species, and every change in these factors leads to a change in macro-invertebrate benthos.

We concluded that investigations on wetland, integrated with benthic macro-invertebrate communities, could provide the basis for a robust monitoring of wetlands as a water habitat.
Biological and physico-chemical characterization and assessments made in this study, using macro-invertebrate benthos and other factors, showed some advantages over chemical analyses that may not overpass analytical limits, and may not identify many potential interactions of substances. Because of these shortcomings, a huge number of contaminants of this wetland have remained undetected and this has to be taken into consideration, at least by assessing their impacts on the aquatic life.

The effects of human’s activities on the natural resource such as wetlands have to be considered in a long term, because accurate consideration is impractical in short term. In the wetland there are habitats that are ecologically important and contain many valuable species of flora and fauna, which plays a major role in water life cycles and fisheries resources. In Iran, as well as in many other countries around the world, there is sometimes a lack of basic data and information.

Construction of dams, parallel with other developmental activities and transformations of the natural pattern of the wetland, brought many limitations and points of stress into its natural system. For example, wetlands play a very important role in
Fig. 2. Trends in Chironomidae concentration and studied physico-chemical factors.

the natural carbon cycle, both as an absorbing sink and an emitting source of CO$_2$. Unfortunately, the land use changes, wetland conversion and over-utilization of these resources create an imbalance in the flow of CO$_2$ and the amount of carbon reserved in the living and dead plant coverage of wetland. This also alters the habitats location of some species, specially the less tolerant ones (or extinction of low-tolerant ones). Some of the most important adverse effects of dam construction on Choghakhor Wetland that this study reveals are:

- Change from wetland to lake condition (construction of a dam on the wetland causes an increase in the water height to 6 m or more in some areas of the wetland);
- Release of nutrients in the water;
- Effects on plankton and aquatic animal and plant populations (effects on aquatic biodiversity and its changes);
- Changes in downstream water physiochemistry.
Although since 1999 Choghakhor has been announced as a hunting-restricted zone to be better conserved and to be subject to proper management, it seems that this wetland, not being in the Ramsar Convention yet, has great problems regarding its conservation. There is no environmental management plan for Choghakhor Wetland yet. This causes not only the lack of wise operation, but also the fact that this wetland is even out of its main function as a wetland and changes to a lake now. The dam constructed on the wetland caused an increase in the water height to 6 m and more in some areas, which is the harshest factor threatening the wetlands creatures, and causes fundamental changes in macro-benthos, diminishing the habitat and changing its biodiversity.

So, as a result of this study it is strongly suggested to organize a working group consisting of environment assessor and environment manager, botanist, zoologist,
geomorphologist and other experts in order to do basic scientific research on the wetland. Also, it is suggested to assess both long-term and short-term effects of human activities on these natural water resources.

5. Conclusion

The biological condition of wetland is influenced and determined by multiple chemical, physical and biological factors, both in water and sediments. An inappropriate reliance on only physico-chemical and biological properties of the water may underestimate aquatic ecosystem impacts. In fact, the investigation and monitoring of the water may assess only point sources of pollution and not the water resource condition. The present study showed that physico-chemical and biological measurements of the water must be undertaken to evaluate all relevant stressors to the aquatic life. The approach proposed in this paper is to use the biotic index, that excludes temporary disturbances; this constitutes a useful tool to provide more detailed information about changes in aquatic life conditions.

References


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