

## Limnological features of Hemren reservoir, Iraq

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### Abstract:

Monthly subsurface water samples were taken from three selected stations in Hemren reservoir, east of Iraq, to study the physico-chemical characters starting from January to October 2000. Water temperature was ranged between 8-32 °c. It was fresh with salinity of 0.3-0.55 ‰ and electric conductivity of 450-900  $\mu\text{s}/\text{cm}$ . Turbidity values were ranged between 8-80 NTU. The water was alkaline with pH values between 6.8-8.3, and hard with total hardness between 200-530  $\text{mg CaCO}_3/\text{L}$ . Calcium was higher than magnesium, whereas, sulfate was higher than chloride ion concentration in all studied station. The water was well aerated with dissolved oxygen values range between 5.5-12.5  $\text{mg}/\text{L}$ , and reaching over saturation several months. Nitrate was the dominant inorganic nitrogen source and phosphate was ranged between ND-247.7  $\mu\text{g}/\text{L}$ . The seasonal variation of the above characters were discussed.

### Introduction:

Since last decade, the physico-chemical characters of several Iraqi lakes were investigated include marsh areas (1,2), Qadisia lake (3), Razzazah lake (4,5), Sawa lake (6) and Habbaniya lake (7). These studies indicated that both Qadisia and Habbaniya lakes have fresh water, whereas the marshes oligohalin and both Razzazah and Sawa are mesohalin.

In the mean time, there is no single published work dealing with the

limnological characters of Hemren reservoir except one which illustrated the effect of the Hemren reservoir on water characters of Diyala river (8).

The present investigation concerns the limnological status of Hemren reservoir as a part of the project to support the fishery industry in the area.

### Study area:

Hemren reservoir in located on Diyala river on about 120 km north-east Baghdad city and start operation recently (1982). Its maximum length is

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about 36.5 km, width 12 km at the entrance of the river, and area of 374 km<sup>2</sup>. Its slope is 90.92 m/km. The maximum water level is about 107.5 m above sea level with a total capacity of  $3.95 \times 10^9$  m<sup>3</sup> and drainage capacity reaching 4630 m<sup>3</sup>/sec. (9). Its basin is mostly clay loam.

### Materials and methods:

Monthly subsurface (30 cm) water samples were taken from three selected stations in Hemren reservoir started from January to October 2000 (Fig. 1).

Water temperature and dissolved oxygen were measured directly in the field, using Oxymeter YSI model 51-B, electrical conductivity (EC) by Conductivity meter YSI model 33, turbidity by Hach Turbidity meter model 2100A and pH by pH-meter model WPAC 6/T. Salinity was calculated following EC values and oxygen saturation percent following oxygen values (10). In laboratory, total alkalinity, sulfate, chloride, nitrate, nitrite and phosphate were measured as indicate by APHA (11). Total hardness, calcium and magnesium were calculated by following Lind (12).

### Results and Discussion:

Water temperature was ranged between 8-32 °C without pronounced variations among the studied stations. The seasonal variations were clear and followed air temperatures, as it is well known (Fig. 2).

Salinity (EC) values were ranged between 0.3-0.55‰ (450-900 µs/cm) in the reservoir (Fig. 2). These values indicted that the water is fresh, without pronounced seasonal variations. Similar values was found in the location of St.2. Whereas, the average salinity value was 0.31‰ in Diyala river at about 5 km before its entrance to the reservoir (8). Nevertheless, the

studied reservoir has more fresh water than other studied Iraqi lakes, or reservoirs located in middle and north of the country such as Qadisia (3), Razzazah (4, 5), Habbaniya (7) and Therthar (13).

The turbidity values were varied among the studied stations and ranged between 3.2-80 NTU (Fig. 2). Station 2 showed the highest range (8-80 NTU) with average of 41.4 NTU. Similar average was obtained (38 NTU) in the same station (8). The variations in the turbidity values were expected in such area due to different running water masses character.

The reservoir water was alkaline with pH range between 6.8-8.3 and total alkalinity between 40-140 mg/L (Fig. 2). Most of the Iraqi inland

waters are alkaline as illustrated by Al-Saadi (14). Stations 3 had wider range due to the fact of its location and its shallow water, as well as, the metabolic activity of aquatic organisms, which may affected by the surrounding area.

The total hardness values were ranged between 200-530 mg Ca CO<sub>3</sub>/L without pronounced variations among the studied stations, as well as, months (Fig. 3). According to APHA (11), the water considered to be hard to very hard. Similar conclusion was found in Qadisia and Habbaniya lakes (3, 7). Meanwhile, the values of the total hardness in the above lakes (Hemren, Qadisia and Habbaniya) were much less than that recorded in Iraqi marshes (1, 2), Razzazah (4, 5) and Sawa lakes (6). The water is hard even in Diyala river just before its entrance to Hemren reservoir (8), as well as, in Wand river (15).

Generally, calcium and magnesium are the predominant cations in natural freshwater (16). It seem that other than these two ions involve in the total hardness value (Fig 3). Similar finding was reported in the

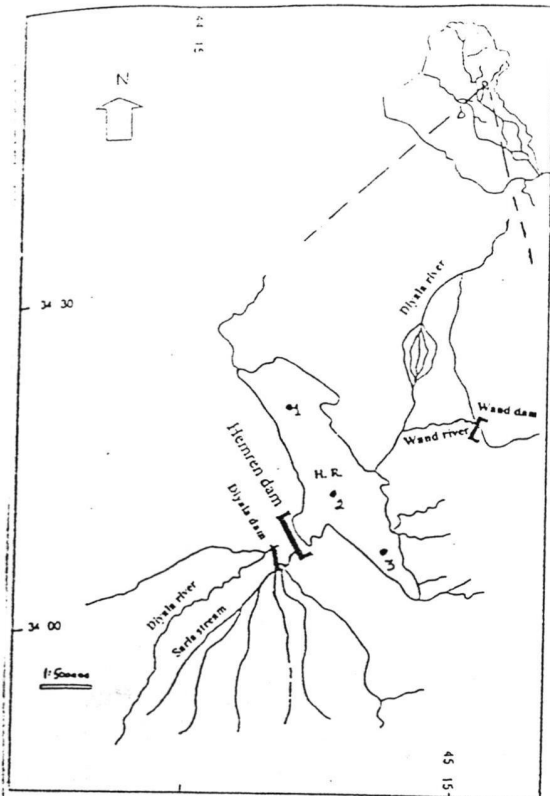


Fig. 1: Map of Hemren Reservoir (H.R.), showing the sampling stations (+).

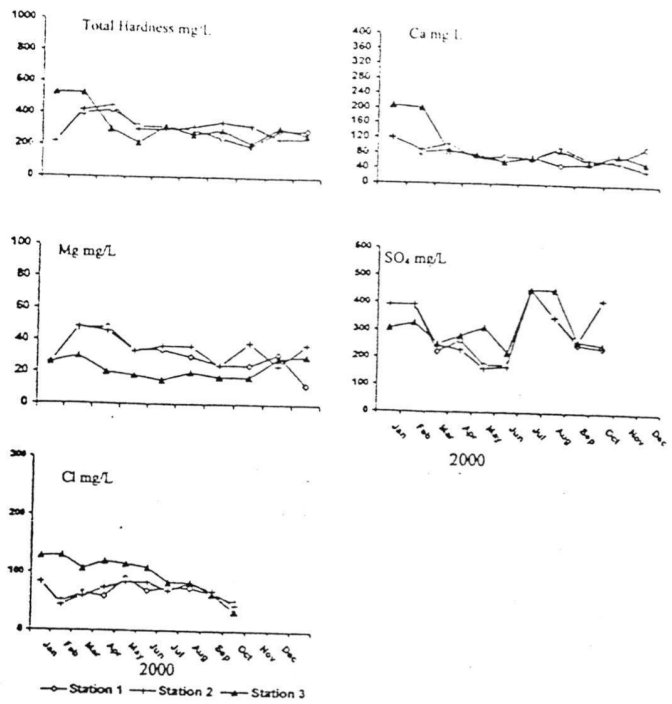


Fig. 3: Some chemical characters of Hemren reservoir water at the studied stations.

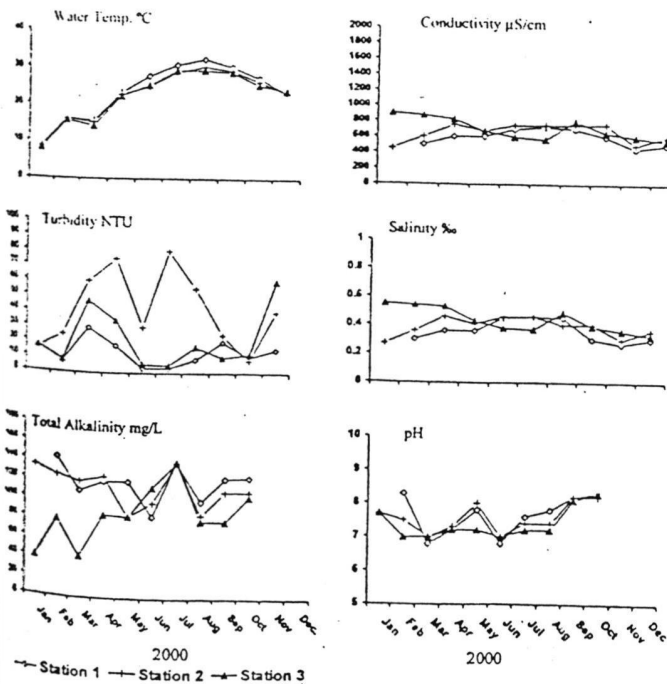


Fig. 2: Some physico-chemical characters of Hemren reservoir water at the studied stations.

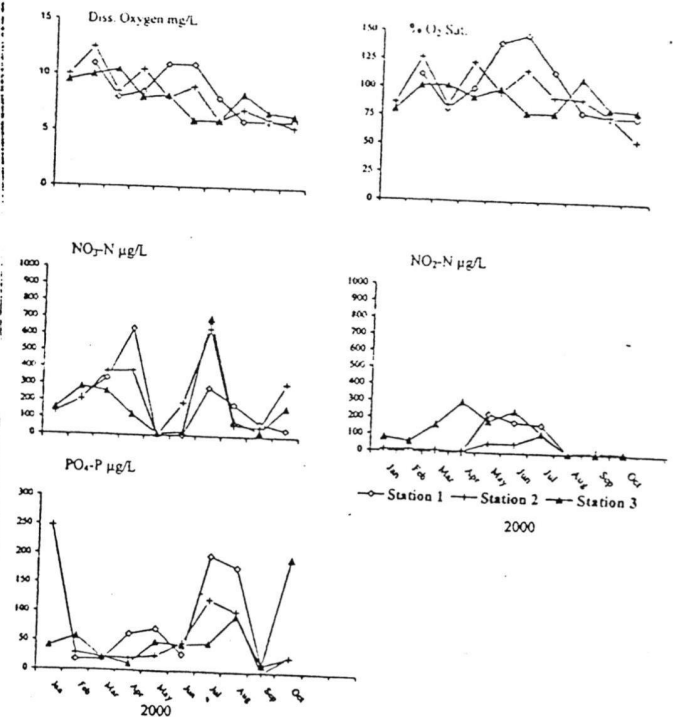


Fig. 4: Oxygen and nutrients of Hemren reservoir water at the studied station.

other studies Iraqi lakes and marshes cited above. Calcium values (40.1-206.4 mg/L) were much higher than magnesium values (12.2-48.7mg/L) at all studied stations and months, due to the calcareous nature of the sediment, as well as the reservoir under influence of regional soil and substrate characters. Similar conclusion was made in marshes (2), Qadisia (3) and Razzazah lakes (5). Sulfate (160- 450 mg /L) were higher than chloride ion values (34.5-130mg/L). Both ions showed almost similar seasonal trends at all studied station (Fig.3).

The dissolved oxygen values were never dropped to less than 5 mg/L without pronounced variations among the studied stations and over saturation was reached in some months (Fig 4 ). Due to the availability of oxygen. Nitrate ions (ND-701.2  $\mu\text{g/L}$ ) were the most dominant nitrogen source in comparison to nitrite (ND-299  $\mu\text{g/L}$ ). Phosphate values were ranged between ND- 247.7  $\mu\text{g/L}$  with some variations seasonally and among the studied stations (Fig 4 ).

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### الخواص اللمنولوجية لخزان حميرين ، العراق

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#### الملخص:

تم جمع نماذج مياه تحت سطحية (30 سم) من ثلاث محطات مختارة في خزان حميرين، شرق العواقر لدراسة العوامل الفيزيائية والكيميائية للمدة من شهر كانون الثاني لغاية تشرين أول 2000. تراوحت درجة حرارة المياه بين 8-32 م. كانت المياه عذبة ذات ملوحة بين 0.3-0.55 جزء بالالف و توصيلة كهربائية بين 900-450 مايكروسيمنس/سم. سجلت قيم الكدرة بين 8-80 وحدة نفثالين. كانت المياه قاعدية وتراوحت قيم الأس الهيدروجيني بين 6.8-8.3، و عسرة حيث أن العسرة الكلية تراوحت بين 200-530 ملغم كربونات الكالسيوم/لتر. و كانت قيم الكالسيوم أعلى من المغنسيوم و الكبريتات أعلى من الكلوريدات في جميع المحطات المدروسة. كانت المياه ذات تهوية جيدة حيث تراوحت قيم الأوكسجين المذاب بين 5.5-12.5 ملغم/لتر و قد سجلت حالات فوق الإشباع في عدة أشهر. أظهرت أيونات النترات السيادة لصور النتروجين اللاعضوي. و تراوحت قيم الفوسفات بين قيم غير محسوسة إلى 247.7 مايكروغرام/لتر. قد تمت مناقشة التغيرات الموسمية للخواص أعلاه في متن البحث.