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BACTERIOLOGICAL MONITORING OF WATERS OF SOUTHERN IRAQI MARSHES

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ABSTRACT

A study was undertaken in the southern Iraqi marshes, including Al-Hammar marsh, Central marsh and Al-Hawizeh marsh. The study was extended from June- November 2006 (except October). Bacteriological analysis was done to determine the total plate count, total and fecal coliforms and streptococci as indicator bacteria and some presumptive pathogenic types of bacteria such as *Salmonella* sp., and *Vibrio* sp. The results showed that most samples were taken containing pathogenic bacteria, rendering the water unfit for human consumption.

INTRODUCTION

Bacteria are a normal part of water ecosystem. Furthermore they play a great role in decomposition of dead plants and animals and they convert minerals and nutrients into a form that can easily be used for growth by other plants and animals (A Canadian Museum of Nature, 2003).

However, water can become contaminated by human and animals feces, surface runoff, and as well as other pollution sources. Where the subsurface geology permits rapid downward movement of water from the surface, or where the ground water sources are tapped near the surface, aquifers may be vulnerable, and become susceptible to contamination (American Ground Water Trust, 2007).

The study of microbial quality of Southern Iraqi Marshlands water is very important, because the people who lived in this regions use marsh water for many purposes, for human and animal drinking and agricultural purpose, so there is a need to know more about the microbial species found in this water to determine the serious microbes which can cause several diseases for those people (Al-Taee *et al*., 2006). The main goal of this study is to determine the pathogenic bacteria and its relationship with indicator bacteria.

MATERIALS AND METHODS

Field samples: The study extended over a period of five months from June to November 2006 (except October). Water samples were collected from:

1- Al-Hammar marsh
  a- Baghdadya 1
  b- Baghdadya 2
2- Central marsh
  a- Al-Negara
  b- Al-Burga
3- Al-Hawizeh marsh
  a- Um Al-Na'aj
  b- Um Al-Ward (Fig. 1)

Water samples were collected in sterile 250 ml. Nalgene polycarbonate conical flasks. The samples were placed on ice until returned to the laboratory.

Bacterial enumeration:

All types of bacteria were quantified by membrane filtration (MF) technique (APHA, 1998) using 47 mm cellulose acetate filters with a nominal pore size of 0.45 μ (Albet, Germany). Total plate count bacteria (TPC) were cultured on plate count agar (Difco, USA) for 24h. at 37 C°. Total coliform bacteria were cultured on MacConkey agar (Himedia, India) for 24h. at 37 C°. Red and pink colonies were enumerated as total coliforms (Al-Taee and Shamshoom, 2001). Fecal coliform bacteria were cultured on m-FC agar (Himedia, India) without rosolic acid (Al-Sulami *et al*., 1995) for 24h. at 44.5 C° in water bath. Blue colonies were enumerated as fecal coliforms. Streptococci bacteria were cultured on streptococcus agar (Himedia, India). Plates were incubated at 37 C° for 48h., and yellow colonies were enumerated as *streptococcus* sp. Salmonella's bacteria were cultured on S.S. agar (Himedia, India) according to Al-Taee and Shamshoom (2001). Black colonies were enumerated as *Salmonella* sp. Vibrios bacteria were cultured on TCBS agar (Himedia, India) for 24h. at 37 C°. Yellow colonies were enumerated as *Vibrio* sp. (Al-Taee, 2004).

RESULTS AND DISCCUSION

The greatest risk from microbes in water is associated with consumption of water that is contaminated with human and animal excreta, although other sources and routes of exposure may also be significant. Table (1) showed the bacterial counts in June 2006. All water samples have high counts of total plate counts. Total and fecal coliforms varied from 2.9×10^3- 8.9×10^3 Colony Forming Units (CFU) and 1.5×10^3- 4.5×10^3

CFU respectively, which may give an indication of fecal contamination. The number of streptococci varied from 1.6 X 10^2- 2.26 X 10^3 CFU. These results are corporate with the appearance of pathogenic bacteria as presumptive *Salmonella* sp. which varied between 0-83 CFU, while the number of presumptive *Vibrio* sp. range between 90- 9.5 X 10^3 CFU. During July (Table 2) there was fluctuation in numbers of bacteria among sample stations. The number of total plate counts varied from 3.5 X 10^2 to uncountable (UC) CFU, total and fecal coliforms from 0- UC CFU and 0- 8.6 X 10^2 CFU respectively. Streptococci from 10- 1.74 X 10^3 CFU. The presumptive *Salmonella* sp. and *Vibrio* sp. were reduced in some stations to zero and increased in other especially station 3.

In August 2006 the number of bacteria increased especially total plate counts, total and fecal coliforms (Table 3). On the other hand the numbers of the presumptive *Vibrio* sp. were reduced in all stations except station 6.

During September 2006 the numbers of presumptive *Salmonella* increased especially in station 6 (Table 4).

The number of total coliform and presumptive *Salmonella* increased during November 2006 (Table 5). In this study two types of indicators were used coliforms and streptococci , if they are present the contaminations are taken to be fecal in origin either from human or animals these indicators may not cause disease, but can be indicators of pathogenic organisms that cause diseases (Warnes and Keevil, 2004; Oram, 2006). Water pollution caused by fecal contamination is a serious problem due to the potential for concentrations of pathogens from fecal contamination are small, and the number of different possible pathogens is large (New York State Department of Health, 2005). The US EPA Maximum Contaminant Level (MCL) for coliform bacteria in drinking water is zero (or no) total coliform per 100 ml of water (EPA, 2006). When this standard level is compared with our findings it seems clearly that the water is unsuitable for any human and agricultural purposes.

In addition to that the relationship between pathogens and indicators are temperate by such important factors as the nature of seasonal pollution and the numbers of pathogens execrators among the human and animal populations in the water. High fecal coliform levels can occur in conjunction with low pathogenic densities and conversely.

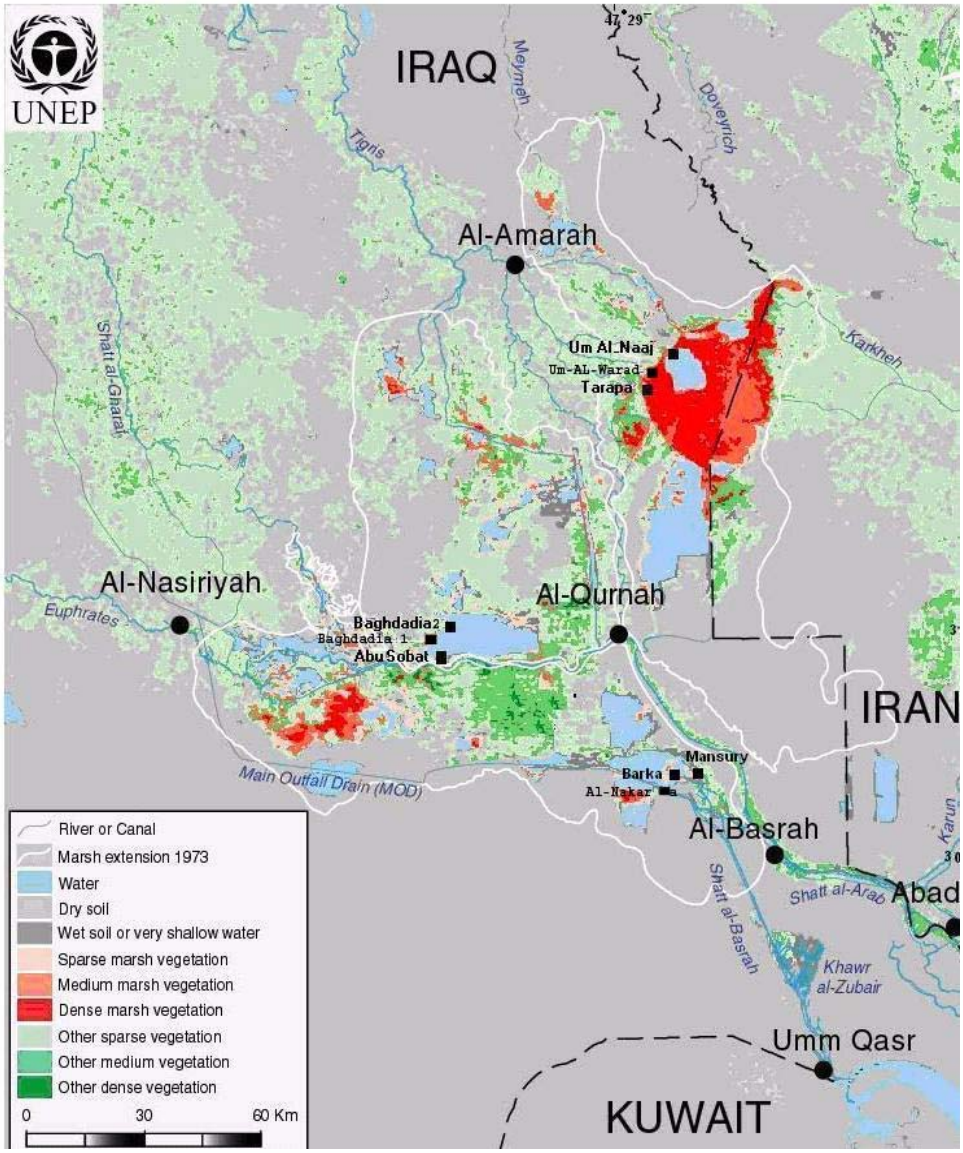

Fig. 1: Location map of the sampling station

Table 1: The number of isolating bacteria from different sites of marshes during June 2006 per 100 ml.

Sample site*	TPC†	TC‡	FC◊	Streptococci	Presum. of *Salmonella*	Presum. of *Vibrio*
1	UC	$6.3X10^3$	$1.5X10^3$	$6.7X10^2$	60	$2.98X10^3$
2	UC	$4.2X10^3$	$3.2X10^3$	$6.1X10^2$	75	$1.9X10^2$
3	UC	$5.0X10^3$	$2.2X10^3$	$1.9X10^2$	83	$3.9X10^2$
4	UC	$7.2X10^3$	$3.8X10^3$	$1.6X10^2$	Nil**	$1.0X10^3$
5	UC	$8.9X10^3$	$4.5X10^3$	$7.5X10^2$	50	$9.5X10^3$
6	UC	$2.9X10^3$	$2.1X10^3$	$2.26X10^3$	20	90

*1: Negara 2: Baghdadya 1 3: Baghdadya 2 4: Um Al-Na'aj 5: Al-Burga 6: Um Al-Ward †TPC :Total Plate Count UC: Un – Countable ‡ TC: Total Coliform ◊FC: Fecal Coliform **Nil: No Growth

Table 2: The number of isolating bacteria from different sites of marshes during July 2006 per 100 ml.

Sample site*	TPC†	TC‡	FC◊	Streptococci	Presum. of *Salmonella*	Presum. of *Vibrio*
1	UC	$1.8X10^2$	$1.2X10^2$	$1.74X10^3$	50	10
2	$3.5X10^2$	Nil**	Nil	10	Nil	Nil
3	$1.3X10^3$	$6.8X10^2$	20	40	$9.2X10^2$	20
4	UC	UC	$8.6X10^2$	50	50	Nil
5	$9.0X10^2$	20	10	$2.9X10^2$	Nil	Nil
6	UC	$1.0X10^2$	$4.0X10^2$	$1.8X10^2$	Nil	Nil

*1: Negara 2: Baghdadya 1 3: Baghdadya 2 4: Um Al-Na'aj 5: Al-Burga 6: Um Al-Ward †TPC :Total Plate Count UC: Un – Countable ‡ TC: Total Coliform ◊FC: Fecal Coliform ** Nil: No Growth

Table 3: The number of isolating bacteria from different sites of marshes during August 2006 per 100 ml.

Sample site*	TPC†	TC‡	FC◊	Streptococci	Presum. of *Salmonella*	Presum. of *Vibrio*
1	UC	$4.8X10^2$	10	Nil	Nil	Nil
2	UC	40	Nil**	Nil	Nil	Nil
3	UC	$1.32X10^3$	$1.11X10^3$	Nil	Nil	Nil
4	UC	$4.1X10^2$	$1.4X10^2$	$1.6X10^2$	30	Nil
5	UC	$2.05X10^2$	$1.15X10^3$	$4.7X10^2$	40	Nil
6	UC	$1.23X10^3$	$1.21X10^3$	$1.32X10^3$	$1.7X10^2$	50

*1: Negara 2: Baghdadya1 3: Baghdadya 2 4: Um Al-Na'aj 5: Al-Burga 6:Um Al-Ward
†TPC :Total Plate Count UC: Un – Countable ‡ TC: Total Coliform ◊FC: Fecal Coliform
** Nil: No Growth

Table 4: The number of isolating bacteria from different sites of marshes during September 2006 per 100 ml.

Sample site*	TPC†	TC‡	FC◊	Streptococci	Presum. of *Salmonella*	Presum. of *Vibrio*
1	UC	20	$2.2X10^3$	$5.7X10^2$	70	10
2	UC	50	$4.3X10^2$	$6.8X10^2$	10	Nil
3	UC	Nil**	$9.2X10^2$	$7.8X10^2$	Nil	Nil
4	UC	20	UC	$3.1X10^2$	$3.2X10^2$	80
5	UC	Nil	$1.37X10^3$	Nil	50	Nil
6	UC	$1.9X10^2$	$5.4X10^2$	$2.7X10^2$	UC	$3.5X10^2$

*1: Negara 2: Baghdadya 1 3: Baghdadya 2 4: Um Al-Na'aj 5: Al-Burga 6: Um Al-Ward
†TPC :Total Plate Count UC: Un – Countable ‡ TC: Total Coliform ◊FC: Fecal Coliform ** Nil: No Growth

Table 5: The number of isolating bacteria from different sites of marshes during November 2006 per 100 ml.

Sample site*	TPC†	TC‡	FC◊	Streptococci	Presum. of *Salmonella*	Presum. of *Vibrio*
1	UC	UC	UC	$9.0X10^3$	UC	$1.1X10^2$
2	UC	Nil**	$1.0X10^2$	70	$8.5X10^2$	Nil
3	UC	UC	$1.8X10^3$	$6.5X10^2$	UC	50
4	UC	UC	$8.6X10^2$	$5.4X10^2$	UC	Nil
5	UC	UC	$5.3X10^2$	$1.3X10^2$	UC	Nil
6	UC	UC	$7.1X10^2$	$6.2X10^2$	UC	Nil

*1: Negara 2: Baghdadya 1 3: Baghdadya 2 4: Um Al-Na'aj 5: Al-Burga 6: Um Al-Ward
†TPC :Total Plate Count UC: Un – Countable ‡ TC: Total Coliform ◊FC: Fecal Coliform ** Nil: No Growth

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المراقبة البكتيرية لمياه أهوار العراق الجنوبية

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الخلاصة

أجريت دراسة لمياه أهوار العراق الجنوبية شملت هور الحمـار،هور الوسـط وهور الحويزة. امتدت الدراسة من حزيران – كانون الاول 2006 (عـدا تـشرين الثاني). تضمنت التحاليل البكتريولوجية العد الكلي للبكتريا، بكتريا القولـون الكليـة والبرازية و المكورات المسبحية البرازية كأ دلة للتلوث، بالاضافة الى دراسة بعض البكتريا المرضية الافتراضية شملت، بكتريا السالمونيلا، وبكتريا الكوليرا. أظهـرت النتائج ان معظم العينات المفحوصة تحتوي على البكتريا المرضية مما يدل علـى ان المياه غير صالحة للاستهلاك البشري.