

A NOTE ON SALINITY AND TEMPERATURE IN  
SOME MOROCCAN BRACKISH WATERS

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# A NOTE ON SALINITY AND TEMPERATURE IN SOME MOROCCAN BRACKISH WATERS

by

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## ABSTRACT

A series of measures of temperature and salinity was made in different brackish waters along the Atlantic coast of Morocco. All waters examined were polyhaline, except for a series of hyperhaline salt mines. The importance of temperature in the sediment is discussed: temperature in the top layer may rise considerably (7 °C) above air temperature. However, in the deeper layers, temperature is lower than in the air and the water.

## RESUME

Une série de mesures de la température et la salinité de différentes eaux saumâtres le long de la côte Atlantique du Maroc montre que ces eaux doivent être considérées comme polyhalines, sauf les mines de sel qui sont hyperhalines. L'importance de la température est discutée: la température dans les couches supérieures du sédiment peut monter nettement plus haut que la température de l'air (entre 5 et 7°C); contrairement, la température des couches profondes reste nettement au-dessous (jusqu'à 7°C) de la température de l'air.

## INTRODUCTION

During the mission of the university of Ghent in Morocco, several brackish water localities along the Atlantic coast were examined. The investigated areas are: the large lagoon of Moulay Bou Selham, situated 80 km north of Kenitra, and a series of lagoons, creeks and salt mines between Oualidia and El Jadida.

The aim of the investigation is a faunistic study of the meiofauna of these brackish waters. It is well known that temperature and salinity are the two most important physical factors influencing species composition in such areas. The "brackwasserminimum" in the number of species is caused by the inability of most species to deal with the problems of osmoregulation posed in such an environment. It was supposed that temperature plays an even more important role in Moroccan waters, particularly so on exposed mud flats, as temperature during summer may rise very high and thus eliminate many species.

For these reasons a series of temperature and salinity measures was made.

### MATERIAL AND METHODS

Temperature was measured with a thermometer at 0.2°C precise. Whenever possible, it was measured at three different depths of the sediment: —1 cm, —10 cm and —20 cm. Salinity was measured with Mohr's method: 5 ml of the sample was diluted to 100 ml and titrated with  $\text{AgNO}_3$  0.0564 N, using  $\text{K}_2\text{CrO}_4$  as an indicator. For this purpose a new solution of  $\text{AgNO}_3$  was made every day measurements were made. As we were not sure the ionic composition was proportional to that of sea water, results are expressed as ‰ Cl<sup>-</sup>.

### RESULTS

#### The lagoon of Moulay Bou Selham

This lagoon consists of a very large mudflat connected with the sea through a creek. At low tide it is bare over large areas; some places are covered with *Ulva* or *Enteromorpha* sp. The macrofauna consists of *Uca tangeri*, *Camcius maenas* and *Pachygrapsus marmoratus* near the mouth; on the mudflat *Hydrobia* sp. are very abundant under the covering of the weeds. Burrowed in the mud occurred *Cardium edule* and *Scrobicularia plana*, *Nereis diversicolor* and other polychaetes and *Upogebia littoralis*. *Palaemonetes varians* was abundant in the water.

Salinity near the mouth was 19.4 ‰ Cl<sup>-</sup> at high and 18.6 ‰ at low tide. Near the end of the creek salinity was 17.8 ‰ Cl<sup>-</sup>.

Temperature was measured on the exposed sediment on three different times (measurement at 9 h 40 was made at another place):

	cm	9h40	11h00	11h40
t° air		22.0	22.5	23.4
t° water		23.1	24.8	25.6
t° sediment	—1	27.0	27.0	29.8
	—10	21.0	27.0	29.8
	—20	21.1	20.0	20.7

#### The creek of Oualidia

Measurements were made at the end of this creek (about 7 km from the mouth at Oualidia). Macrofauna consisted of *Cardium*, *Hydrobia*, *Nereis*, *Spirorbis* and *Carcinus* amongst others.

A curious phenomenon was observed for *Cardium* which occurred on the surface of the mud under weeds and not burrowed. Populations of *Scrobicularia* seemed to have died out as many empty shells were found but not a single living individual.

Salinity at this place was 12.7 ‰ Cl<sup>-</sup>.

#### The salt mines

A series of salt mines exists between Oualidia and Sidi Moussa; most of them were in the final stage and the salt collected. These were devoid of any macroscopic life. However, several others were filled with water. The fauna here consists mainly of several species of insect larvae, especially chironomids; only one crustacean was found, *Palaemonetes varians*, and in only one place a gastropod mollusc occurred.

These places are very shallow which causes temperature of the water to rise very high, followed by a substantial rising of salinity:

Station 1			
(10 km north of	17.7 ‰ Cl <sup>-</sup>	28.4 °C	(11 a.m.)
Oualidia)			
Station 2			
(16 km north of	51.4 ‰ Cl <sup>-</sup>	32.6 °C	(11 a.m.)
Oualidia)			
Station 3			
(32 km north of	22.1 ‰ Cl <sup>-</sup>	37.2 °C	( 1 p.m.)
Oualidia)			

### The creek of Sidi Moussa

The fauna of this creek appears to be much richer than at other investigated stations, probably due to its greater depth causing a greater buffering against temperature.

Salinity was measured at three points situated 3 km, 2 km and 1 km from the mouth. Salinity was 16.4 ‰ Cl<sup>-</sup>, 18.9 ‰ Cl<sup>-</sup> and 19.0 ‰ Cl<sup>-</sup> respectively.

A temperature transect was made at place II at low water in the intertidal

	—1 cm	—10 cm	—20 cm
Near line of low water	26.1	21.4	21.0
Halfway between low and high water level	28.2	24.0	22.8
High water level	32.8	26.1	25.0
Above	34.1	—	—
Temperature air:	27.4 °C		
Temperature water:	25.1 °C		

## DISCUSSION

### Salinity

According to the Venice System, the investigated Moroccan brackish waters are polyhaline, except for the salt mines which belong of course to the hyperhaline class. That no lower salinities occur is probably due to weather conditions, as high temperatures during summer and the lack of rain will raise salinity considerably.

### Temperature

Temperature may play an important role in the regulation of ecosystems in Moroccan brackish waters; this is at once illustrated by the scarcity of species in the intertidal zone where temperature may rise between 5-7 °C above air temperature in the top layer.

Moreover, temperature rises more quickly in this top layer of the sediment than in the air, as is illustrated by the Moulay Bou Selham figures:

$\Delta t$ in 40 minutes		
Air		0.9 °C
Water		0.8 °C
Sediment	—1 cm	2.8 °C
	—10 cm	0.8 °C
	—20 cm	0.7 °C

On the contrary, temperature in the deeper layers of the sediment is lower than air temperature (till more than 6 °C); it may decrease between 5 and 9 °C over the first twenty centimeters. This will probably cause a downward migration of animals into the sediment during the day.

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