

ENVIRONMENTAL RISKS OF RAW SEWAGE IN THE DISCHARGE ZONE OF THE CITY OF EL JADIDA (MOROCCO)

Fatima-Zahra Lamghari Moubarrad¹, Omar Assobhei²

¹Biology Department, Laboratory of Hydrobiology and Ecotoxicology, Unity of Parasitology and Aquatic Biodiversity, Faculty of Science Semailia, University Caddi Ayyad, Marrakech, Morocco
email: flamghari@hotmail.com

²Biology Department, Laboratory of Marine and Environment Biotechnologies, Faculty of Science, University Chouaib Doukkali, El Jadida, Morocco

SUMMARY

In El Jadida, city located along Moroccan Atlantic coast, all the discharges, both industrial as domestic, are dumped in the ocean via the sewage system. The wastewater flows untreated directly into the sea water. As known, several pollutants like chemicals and microorganisms, are carried along wastewater. So, this waste disposal method, common in Morocco, has a negative impact on the environment and the health of the populations who live along the urban effluents. In first step, an appropriate methodology of analysis that requires the detection of helminth eggs was elaborated. The method has allowed to examine the parasitological makeup of wastewater in the city and the marine environment where it is discharged. The parasitic load was estimated by counting helminth eggs in the collected samples.

A significant level of biological pollution was detected in the main sewer of the city and in the coastal areas near the discharge points. The presence of helminth eggs at the coastal stations located further away from the overflow pipes proves that the parasitic mass can and does move. Along the main collector the parasitic load decreased in water from upstream to downstream. Conversely, this load increased in the samples of sediment along the same sense. Annual temporal monitoring showed that daily and seasonal fluctuations were detected in helminth eggs concentration. Analyses proved that the parasitic load was in close association with human activity, with maxima in the morning and minima during the night, sleep period of the population connected to the sewer pipe. The contamination was also more intense in warm period than during cold, both in the main sewer than at the coast.

INTRODUCTION

In El Jadida, if the several human activities are beneficial with the socio-economic rise of the city, in against part, they subject it to the dangerous influence of many industrial wastes, urban and agricultural. All discharges are dumped in the ocean (Fatta et al., 2004). By means of diverse micropollutants conveyed, these discharges conveyed damage to marine environment and have a negative impact on waterfront inhabitants' health (Lamghari Moubarrad and Assobhei, 2005). Control the risks associated with the spread of these pathogens in the environment requires first quantification of microorganisms from these discharges. Thereafter the parasitological makeup of wastewater in the city and the marine environment where it is discharged was determined. The parasite load was evaluated by quantification of helminth eggs, selected as indicators of fecal parasitic pollution.

RESULTS and DISCUSSIONS

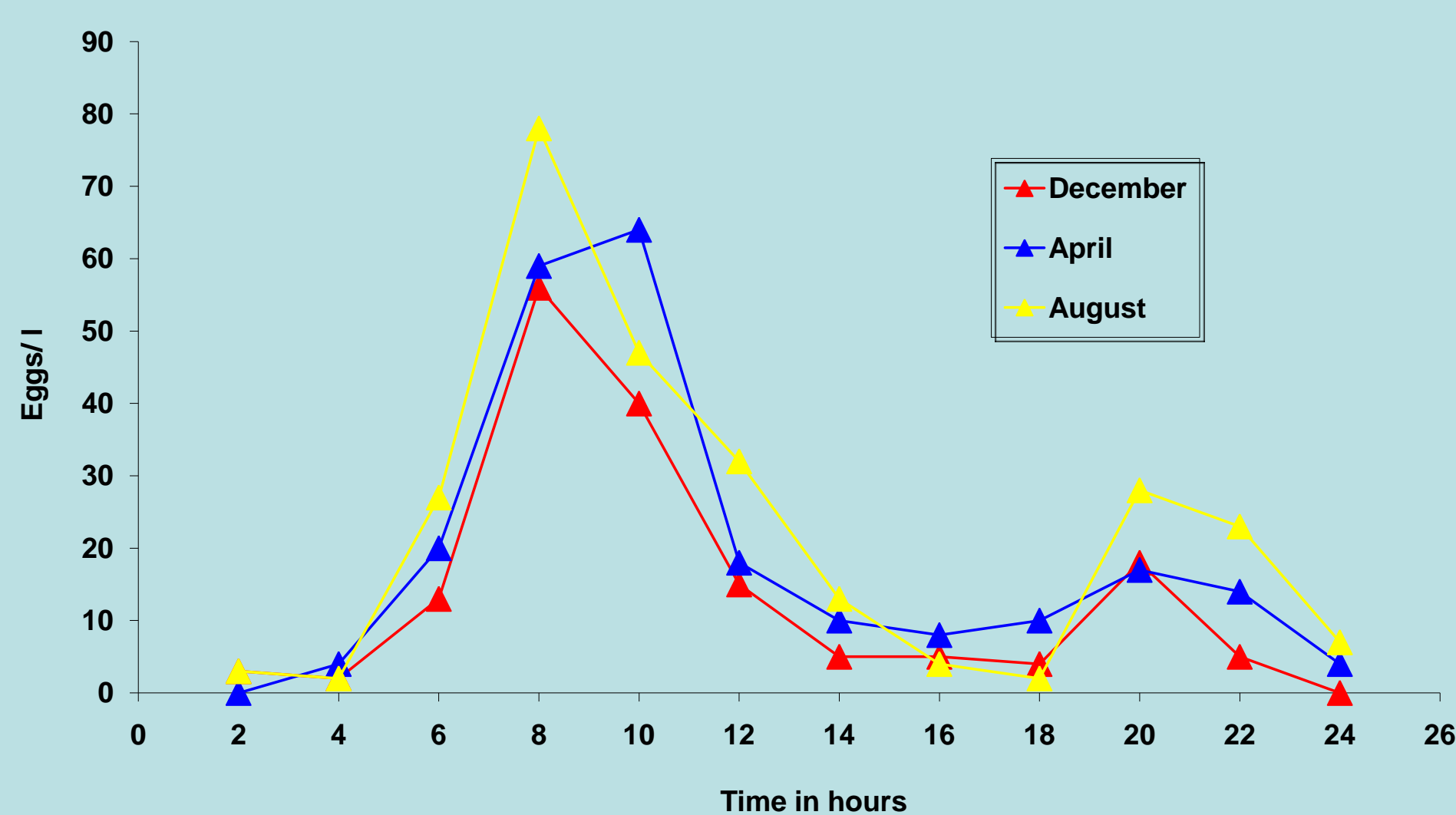
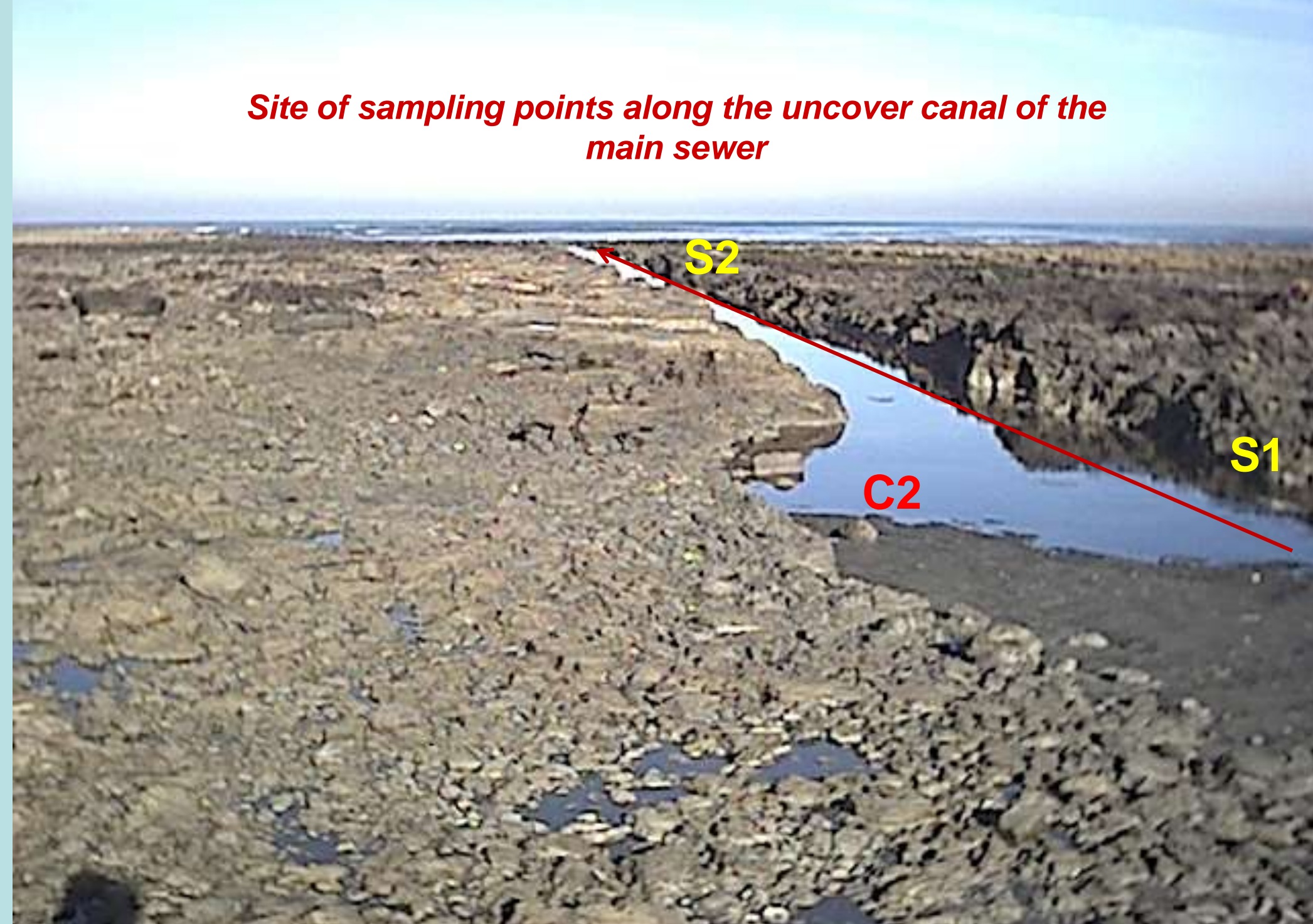
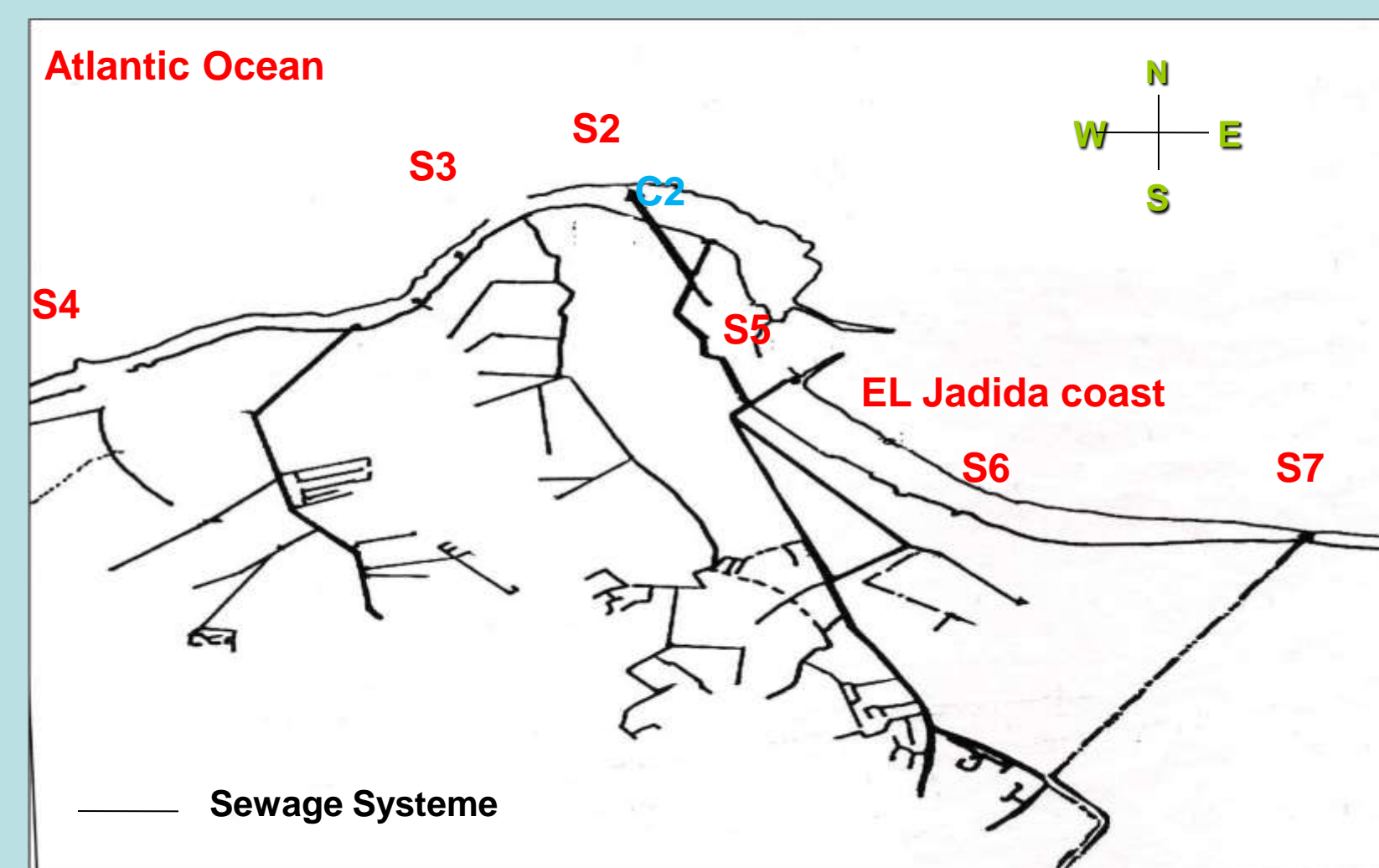


Figure 1: Daily and seasonal fluctuations in load parasitic helminth eggs in sewage canal C2

So as to assess the behaviour of helminth eggs along the channel supplied with the C2 collector, samples of waste water and sediments were carried out on up and downstream of this channel



MATERIAL and METHODS



In El Jadida the sewage system is constituted by five main pipes that discharge in the Atlantic Ocean. A preliminary study allowed to choose the collector C2 as being the main collector of the city. This collector goes on in an uncovered channel prolonged on a distance of 400m before reaching the sea. Samples of water and sediment were taken from the up and downstream of this pipe (S1, S2). On the coastal fringe, beside S2, five stations (S3 to S7) located along the East West coastline, were selected for sampling. Excepted S5 and S6, other stations (S3, S4 and S7) are on the secondary sewer pipes extension, S2 on the main one.

Previous studies allowed us to select the methods of concentration which seem the most successful in the parasitological analysis of our samples (Lamghari Moubarrad, 2005). So for the wastewater samples we chose the combined method which associates the method diphasique by Telemann Rivas modified by Baillenger (1979) followed by a flottation by the thiosulfate of sodium in 88 %. The samples of marine sediment are analysed by a physical method the flotation of which is made by a solution of thiosulfate of sodium of 88 %. The eggs were visualised microscopically at 100x magnification, using a Mac Master counting chamber. The SPSS software was used for the statistic treatment of the data and the results.

- ❖ The helminth eggs concentration fluctuates greatly during the day. Moreover, during all seasons, the parasite load decreases during the night from midnight to 4 am, and increases during the day in the part time: 6-10 hours.
- ❖ The parasite load of wastewater from the city of El Jadida is in close association with human activity.
- ❖ The maxima period corresponds to times when the activity of the urban population is intense. Minima were recorded during the night, sleep period of the population connected to the channel.
- ❖ Depending on the season, the highest loads were encountered during the hot season and the lowest during the cold.
- ❖ Statistically, the differences are highly significant ($p < 0.01$). Similar results were unregistered by other authors in different cities and countries (Cappizzi and Schwartzbrod, 1998; Amahmid et al., 2002)

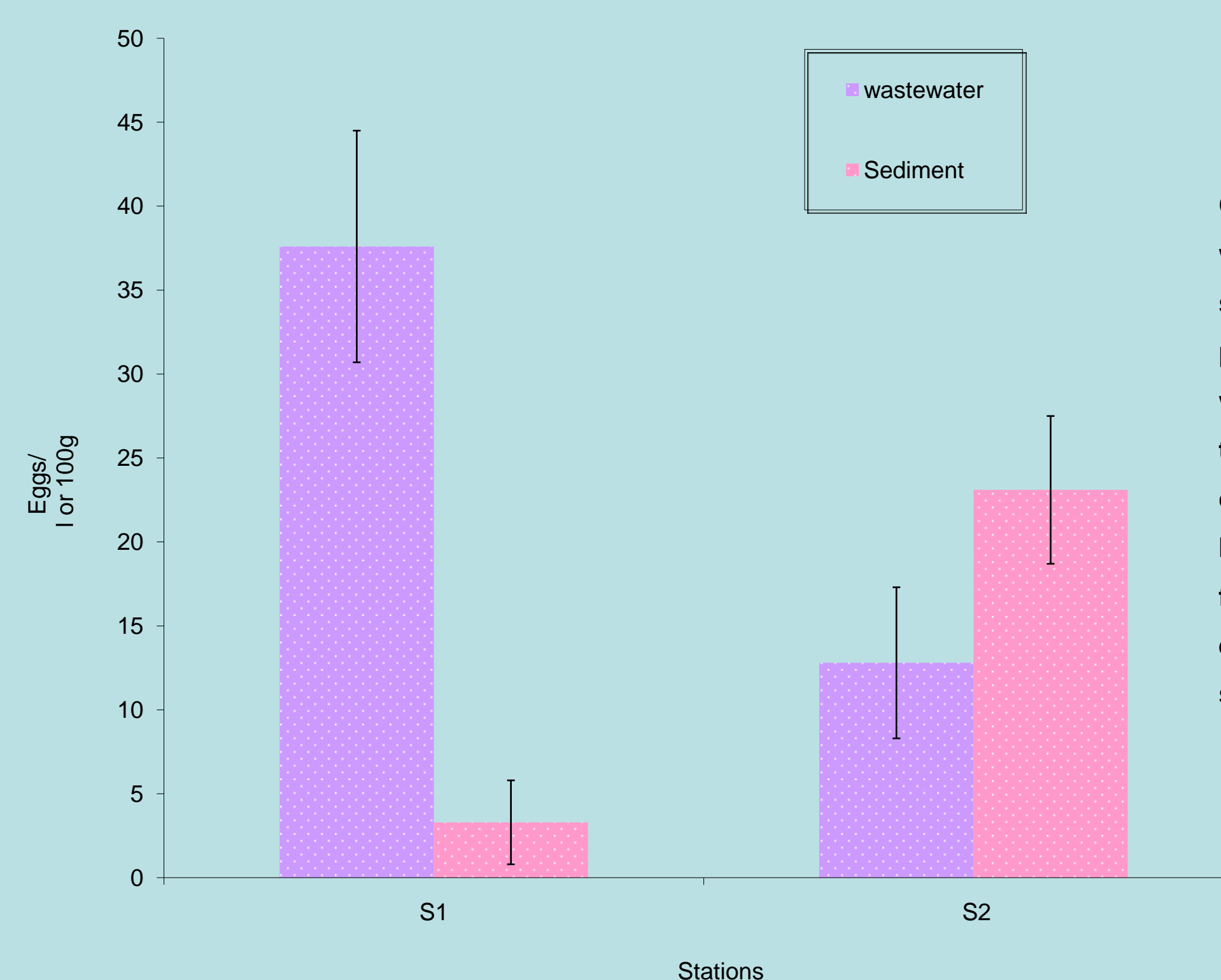


Figure 2: Spatial variation of helminth eggs concentration in the wastewater and the sediment in the main sewer of the city

Contrary to what occurs in the samples from water, the parasitic load increases in the sediment. The enrichment of the sediment is due primarily to *Ascaris* and *Hymenolepis* eggs whose respective concentrations pass from 1,8 to 9,3 eggs/100g and from 1,5 to 6 eggs/100g. The decrease of the drainage speed which we show by crossing the channel towards the sea would facilitate certainly the sedimentation of helminth eggs which would pass mainly from water to sediment (Bouhoum et al., 1997).

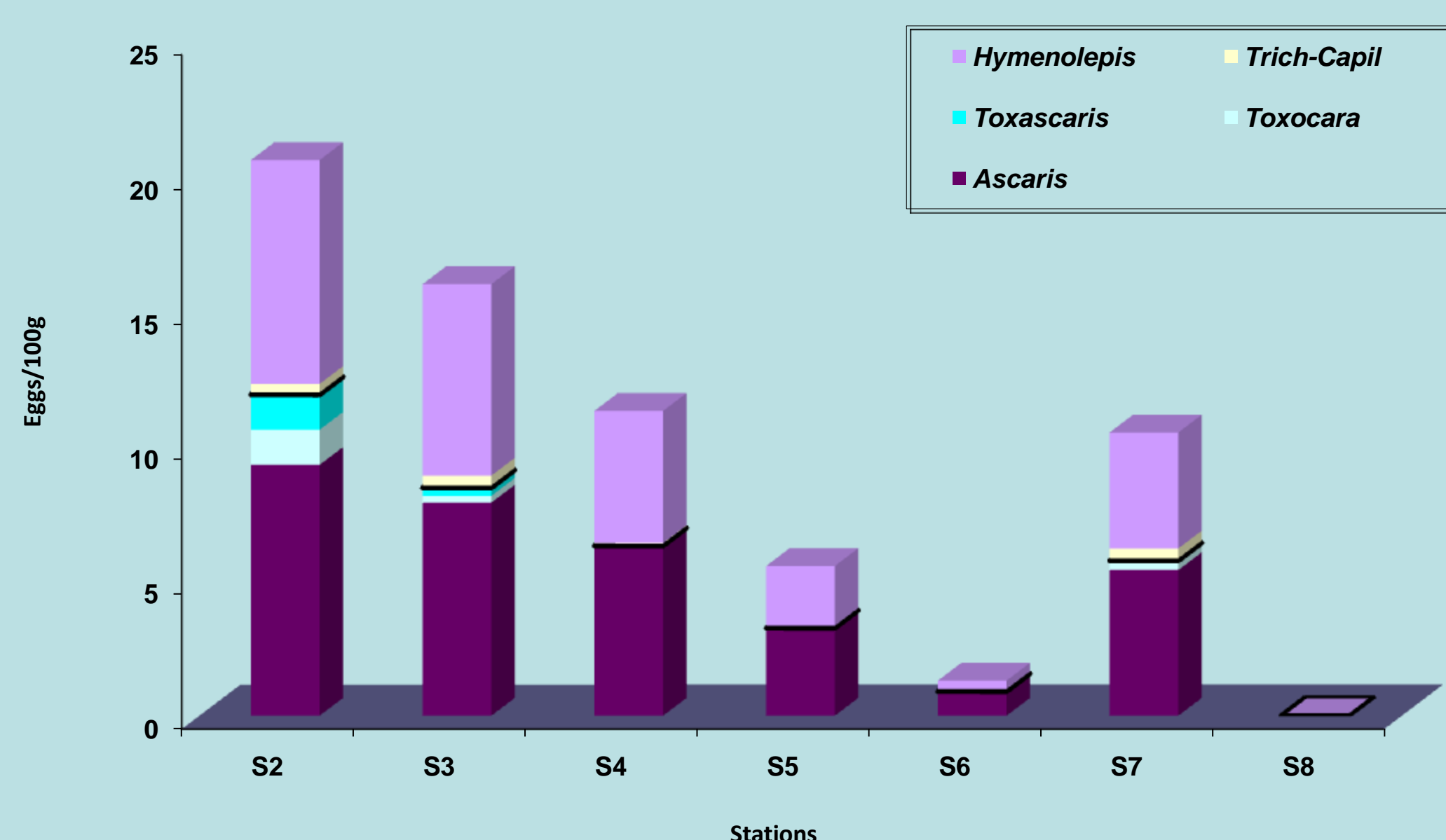


Figure 3: Spatial evolution of helminth eggs average load in the coastal stations studied

Along the coast the parasitological analysis was carried out on the six stations. The higher concentration was recorded in the samples of S2 sediment. The weakest values were recorded at S5 and S6. Qualitatively, we can note that whatever the sampling station considered the eggs of *Ascaris* and *Hymenolepis* were always present in the parasitological analyses.

The quantitative analyses revealed that the coastal stations located in the prolongation of the collectors had the strongest levels of contamination. In the stations which are not located near any discharge (S5 and S6), the parasitic load was weaker, but was nevertheless not null. Thus, the parasitic elements found in their sediment would have been conveyed towards these points. This displacement of the parasitic mass would be the result of the contribution of the climatic parameters and the marine currents (Zourarah et al., 2002). The relatively high concentration of *Ascaris* eggs in wastewater and consequently in the marine sediment of its coast would remind the existence of ascariasis with a high incidence at the local population, while knowing that this helminthiasis is considered as the most widespread parasitosis in the world (Peng and al, 2003). Indeed, epidemiological study carried out in El Jadida's effluents wastewater area has showed a high prevalence of ascariasis among local population (Lamghari Moubarrad and Assobhei, 2007).

CONCLUSION

Pollution detected in the effluent of wastewater as well as at the coast of El Jadida, is in fact a problem for the environment of the city. It is therefore necessary to take preventative measures to minimise this real danger: simple measures such as increasing public awareness about the contamination threats to more serious measures like the comprehensive treatment of wastewater before it is dumped into the ocean

REFERENCES

- Amahmid O., Asmama S. and Bouhoum K. (2002). Urban wastewater treatment in stabilization ponds: occurrence and removal of pathogens. Urb. Wat., 4: 255-262.
- Baillenger J. (1979). Mechanisms of parasitological concentration in coprology and their practical consequences. J. Am. Med. Technol.
- Bouhoum K., Amahmid O., Habbari KH. and Schwartzbrod J. (1997). Devenir des oeufs d'helminthes et des kystes de protozoaires dans un canal à ciel ouvert alimenté par les eaux usées de Marrakech. Rev. Sci. Eau, 2: 217-232.
- Capizzi S. and Schwartzbrod J. (1998). Helminth egg concentration in wastewater: influence of rainwater. Water Science and Technology. 38, 12: 77-82
- Fatta D., Salem Z., Mountadar M., Assobhei O and Loizidou M. (2004). Urban wastewater treatment and reclamation for agricultural irrigation: the situation in Morocco and Palestine. The Environmentalist, 24, 4: 227-236.
- Lamghari Moubarrad F.Z. (2005). Caractérisation parasitologique des eaux usées d'El Jadida, leur impact sur le littoral (eaux et sédiments) et sur la population infantile de la zone de rejet. Thèse d'Etat. Faculté des sciences, El Jadida, Maroc, 200p.
- Lamghari Moubarrad F.Z. and Assobhei O. (2007). Health risks of raw sewage with particular reference to *Ascaris* in the discharge zone of El Jadida (Morocco). Desalination. 215, 1-3: 120-126
- Zourarah, B., Carruesco, C., Labraimi, M., Rebouillon, P. and Bakkas S. (2002). Pollution métallique des sédiments de l'estuaire Oum Er Rbia, (côte atlantique marocaine) : impact des rejets anthropiques. Africa Geosciences Review. 9, 2 : 147-156.