DISCHARGES ON THE CONCENTRATIONS OF SOME HEAVY METALS IN LAKE BURULLOS

BY

RADWAN, A. M. R.*

**National Institute of Oceanography and Fisheries. Alexandria, Egypt.*
Baltim Research Station, Kafr El-Sheikh, Province.

Key Words: Heavy metals, Metal pollution. Limnology Lake Burullos, Egypt.

ABSTRACT

The dissolved heavy metals (Cu. Fe. Cd. Zn and pb)in water of lake Burullos Were estimated in three sectors from the lake during the period from March 1997 Till March 1998.

The average values (µg l)for the whole Lake were 3.52. 2.46. 1.93. 6.76 and 2.67 µg l for Cu. Fe. Cd. Zn and pb respectively.

Results indicate that. levels of heavy metals decreased in a westward direction and are correlated with Salinity changes due to the discharge of water.

INTRODUCTION

The heavy metal concentrations in the water (fresh and saline) are constantly on the rise, due to industrial, agricultural and human activities, which affect directly the aquatic biota and man himself.

Lake Burullos represents an economically important lake, due to its rich fishery resources. In the last few years however changes in water quality

1) El Burullos and Nasser Drain in the eastern side of the lake.
2) Drain 7, 8, 9 and 11 in the southern side of the lake.
3) Brimbal Canal in the western side of the lake (Fig. 1).

The lake has an average area of about 460-Km^2. The lake width varies between 4 and 16 Km , and its depth from 60 to150 cm with taken in the consideration that, the depth is affected by the amount of water drainage into the lake.

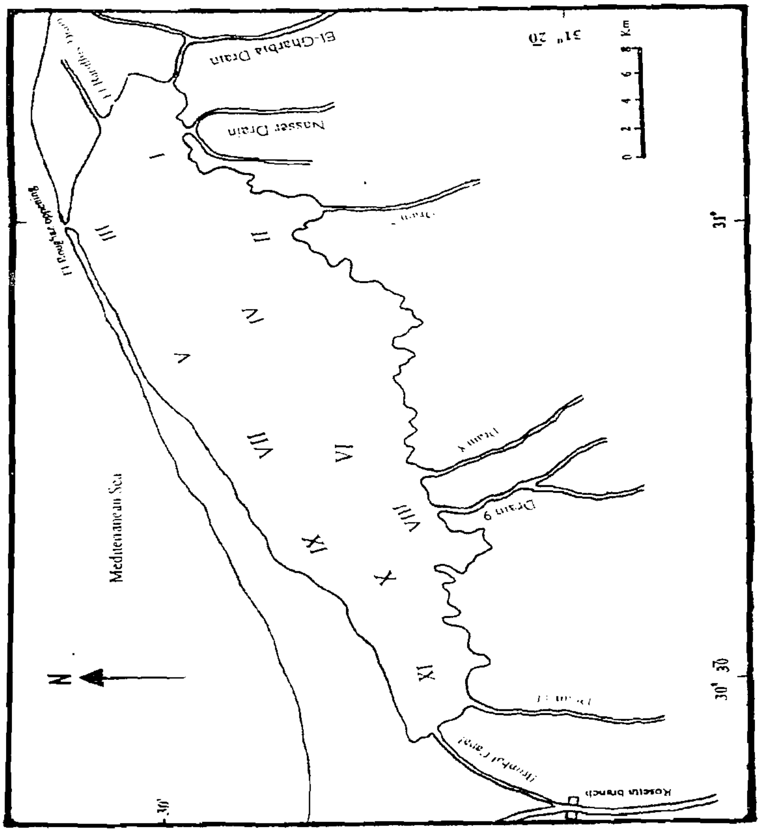


Figure 1 : Stations chosen (11) on Burullos Lake (3 sectors) during 1997 - 1998

Fig. (1): Stations chosen (11) on Burullos Lake (3 sectors) during 1997-1998.

MATERIALS AND METHODS

Chlorosity

Chlorosity of the lake was determined according to mohr. s method described in APHA (1989). 50 ml of water -drop of potassium chromate solution (indicator) then the titration against O.1 N silver nitrate.

Heavy metals

The heavy metals Cu, Fe, Zn, Cd and pb were estimated in acidified water samples by using atomic absorption/flame emission spectrophotometry -AA-640 – 12, Shimadzu as follows. On liter of each sample of the lake water was filtered Through a 0.45 μm filter and concentrated to a final volume of 100, as described by (parker,1972) acidified to pH 4-5 with 6 N HCL or nitric acid (analytical grade), kept refregerated and transferred cold to the laboratory.

RESULTS AND DISCUSSION

The absolute content of dissolved heavy metals Cu. Fe, Cd. Zn and pb with the total chloride in the different sectors of Burullos lake (eastern sector, midlle sector and western sector) are given in Table 1.

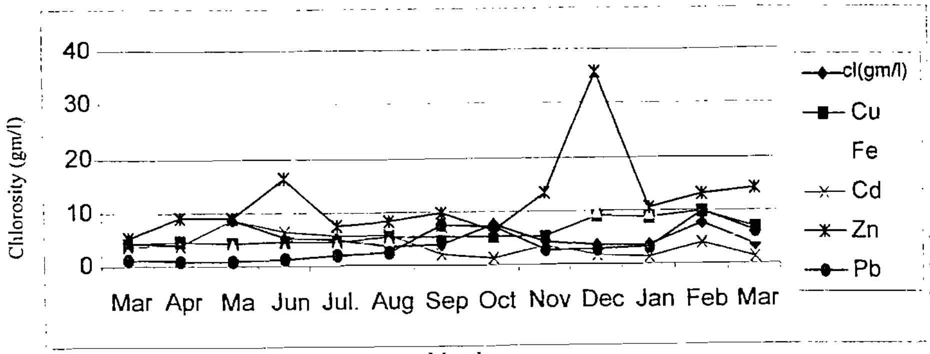
Zinc

From the results obtained its evident that monthly variations of zinc concentration at all sectors of the lake ranged between 1.03 and 35.61 μg/l (Table 1). The highest values were recorded in the eastern sector and the lowest in the western sector.

In the eastern sector ,the maximum values (35.16 and 16.20 μg/l) were recorded in December and June 1997 in agreement with the high values of chlorosity which were estimated in these two months (Fig.2). The highest values of zinc concentration in the eastern sector were affected by the high choloristy content (chloride salinity) due to the invasion of sea water into the lake as well as the effect of drainage water discharged from Nasser drain into the lake which contain high values of dissolved zinc especially in winter season (Table 1 and Fig 2) This observation was in agreement with Abdel Moneim ***et al***, 1990 who observed that in the eastern basin, high values of dissolved zinc were observed in December, also Mahmoud and Beltagy (1988), pointed out this phenomenon, where the pollution by detergents in the eastern basin mainly comes from the sea which contains more heavy metals.

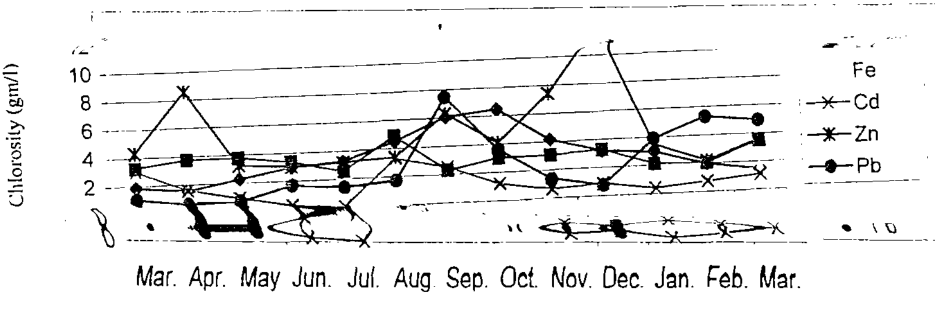
Table (1): Monthly variations of dissolved Cu, Fe, Cd, Zn, and Pb In the three sectors of Lake Burullos during the period from March 1997 to March 1998

Sector	Metal	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Aver.
Eastern Sector (I , II , III , IV)	Cl (gm/l)	4.40	3.70	8.60	5.30	4.70	3.40	3.50	7.30	3.90	3.40	3.30	7.30	3.30	4.80
	Cu	4.21	4.43	4.19	4.25	4.49	5.18	5.31	5.10	5.15	8.89	8.61	9.56	6.63	5.84
	Fe	3.25	3.21	3.71	2.93	3.56	4.25	6.74	7.13	7.23	9.68	9.21	5.23	4.62	5.44
	Cd	3.65	3.78	8.61	6.34	5.41	5.63	1.79	1.25	3.21	1.59	1.23	3.69	1.02	3.63
	Zn	5.32	8.63	8.71	16.2	7.35	8.13	9.71	6.38	13.1	35.61	10.32	12.75	13.83	12.0[illegible]
	Pb	1.02	0.86	0.91	1.13	1.79	2.10	7.23	7.12	2.43	2.73	2.91	9.51	5.83	2.94
Middle Sector (V,VI,VI,VIII)	Cl	1.8	1.5	2.2	2.9	3.2	4.4	6.0	6.4	4.1	3.1	2.9	1.9	1.4	3.2
	Cu	3.21	3.69	3.72	3.31	2.51	4.83	2.23	2.96	3.01	3.21	2.06	2.00	3.42	3.10
	Fe	1.18	1.53	1.23	0.86	1.02	1.86	1.35	1.13	0.59	0.76	1.12	0.92	1.56	1.16
	Cd	2.96	1.53	0.86	0.23	0.00	3.23	2.46	1.13	0.56	0.81	0.33	0.66	1.03	1.21
	Zn	4.25	8.53	3.18	2.96	3.12	3.31	6.23	4.04	7.37	12.1	3.43	2.14	3.51	4.94
	Pb	0.96	0.56	0.63	1.63	1.36	1.66	7.43	3.56	1.32	0.68	3.83	5.23	4.86	2.59
Western Sector (IX , X , XI)	Cl	0.9	0.8	0.9	1.6	1.5	2.5	2.9	4.0	2.3	1.5	2.0	0.8	1.0	1.7
	Cu	0.86	1.79	1.53	1.68	1.52	2.10	1.56	1.75	1.23	1.69	1.73	2.15	1.55	1.63
	Fe	0.85	0.73	0.91	0.53	0.81	0.93	1.01	0.95	0.73	0.55	0.34	0.65	1.23	0.79
	Cd	1.56	1.23	1.02	0.63	0.22	0.81	1.31	0.95	1.02	0.88	0.53	0.81	1.31	0.94
	Zn	2.51	5.63	2.81	1.03	1.25	1.41	3.98	2.01	4.53	6.81	4.35	3.06	3.89	3.33
	Pb	0.61	0.43	0.36	0.81	1.21	1.53	5.13	3.96	2.65	4.31	3.50	3.41	3.95	2.47



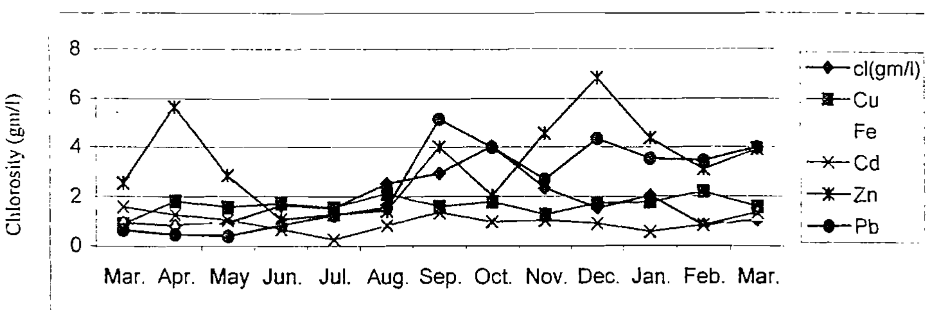
Months

Fig. 2: Monthly variations of heavy metals and chlorosity in Lake Burullos (Eastern Sector)



Months

Fig. 3: Monthly variations of heavy metals and chlorosity in Lake Burullos (Middle Sector)



Months

Fig. 4: Monthly variations of heavy metals and chlorosity in Lake Burullos (Western Sector)

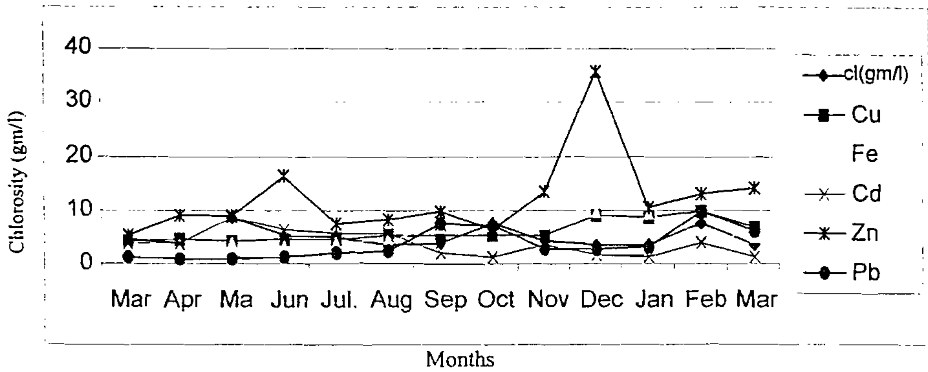


Fig. 2: Monthly variations of heavy metals and chlorosity in Lake Burullos (Eastern Sector)

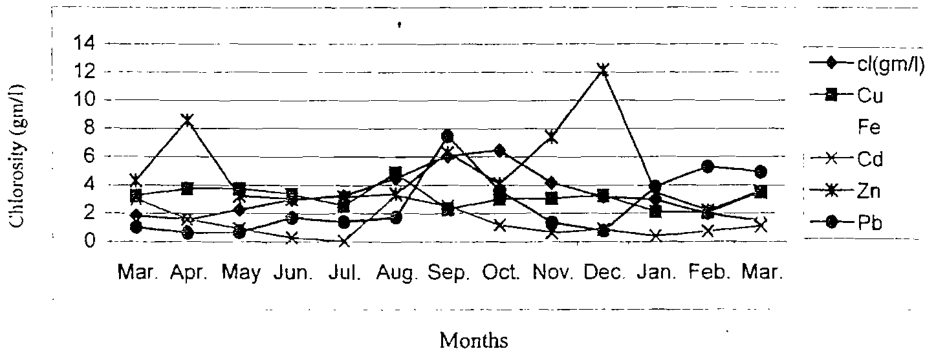


Fig. 3: Monthly variations of heavy metals and chlorosity in Lake Burullos (Middle Sector)

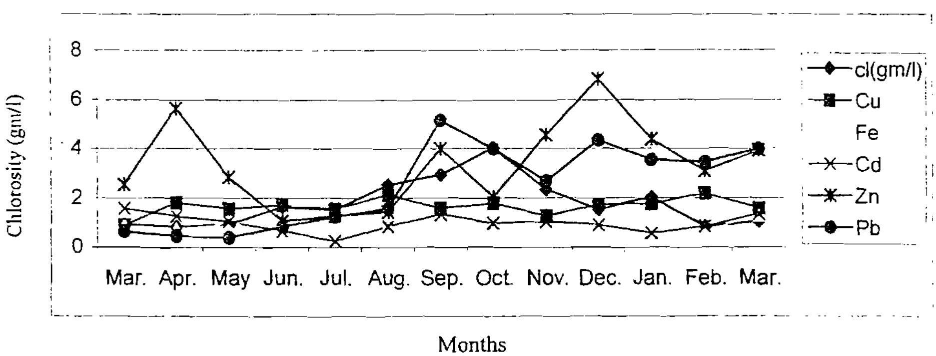


Fig. 4: Monthly variations of heavy metals and chlorosity in Lake Burullos (Western Sector)

The pronounced decrease in zinc concentration in spring and autumn may be attributed to flourishment of phytoplankton which consume the dissolved zinc **(Salah, 1959).**

In the middle sectore, the same trend occurred as in the eastern sector, but with relatively difference for the maximum and minimum value, where the highest value was 12-1 μg/l. and recorded in December 1997, while the minimum value was 2.14 μg/l and recorded in February 1998. The high values of dissolved zinc coincided with the high values of chlorosity in spite of the values of chlorosity which recorded in this sector were lower than that recorded in the eastern sector (Table 1 and Fig.3).

In the western sector, the maximum average value (6.81 μg/l) was recorded in December as in the middle sector, while the minimum average value (1.03 μg/l) was estimated in June coincided with the values of chlorosity (Table 1 and Fig. 4). The maximum value of dissolved zinc which recorded in December may be attributed to the increase in zinc content in the drain No.9 which is more effective in this sector (Table 2).

Copper

The source of cupper in lake Burullos comes mainly from agricultural and industrial drainage water.

In the eastern sector, the minimum average values of dissolved copper (4.19 μg/l) was recorded in May (Table 1 and Fig. 2)and is attributed to the decrease of the decomposition rate of organic matter, as well as the period followed by spring bloom of phytoplankton consumes copper with increasing temperature. This observation is similar to the unpublished data recorded by Radwan (1998) who reported that the minimum value of B O D recorded in May 1997 was correlated with maximum count of phytoplankton in this sector. The maximum average value (9.56 μg/l) was measured in February, and is correlated with the high value of chlorosity in this month . Also the area is also affected by Baltim and Nasser draims which contains high levels of Cu. (Table 1 and 2)

In the middle sector, the maximum value of dissolved copper (4.83 μg/l) was measured in August. Abdelmoneim ***et al,*** 1990 reported also high value of dissolved copper and chlorosity in August as in the present study. The minimum average of dissolved copper (2.00 μg/l) was stimated in

February, due to the decrease in decomposition of organic matter and consequently the decrease in the liberation of copper (Aboul- Nagah, 1979).

In the western sector, the maximum value (2.15 $\mu g/l$) was recorded in February 1998, while the minimum (0.86$\mu g/l$) was measured in March 1997. It is obvious that this maximum value may be attributed to the high copper content recorded in Drain 9 in February (11.23 $\mu g/l$) which represent the main source of Cu affecting this sector (Table 1 and 2).

Table (2): Seasonal Variations of dissolved Cu, Fe, Cd, Zn and Pb in different drains discharging into Lake Burullos during 1997- 1998.

		Baltim Drain	*Nasser Drain*	*Drain 7*	*Drain 8*	*Drain 9*	*Drain 11*
Winter March 1997	Cu	6.53	8.63	3.65	2.98	1.68	2.05
	Fe	4.75	6.31	2.88	1.59	1.66	1.03
	Cd	3.86	4.53	3.15	2.45	3.76	2.25
	Zn	5.73	9.51	2.23	3.86	7.65	4.26
	Pb	1.56	2.43	0.86	1.03	1.76	0.45
Spring April	Cu	4.21	6.35	2.25	1.87	0.79	1.35
	Fe	2.86	4.58	1.59	1.13	0.45	0.88
	Cd	2.91	2.79	1.87	1.36	1.76	1.65
	Zn	3.95	5.81	2.61	2.00	3.89	2.16
	Pb	1.56	1.46	1.31	0.89	1.05	0.79
Summer April	Cu	7.63	9.45	5.53	6.23	2.87	4.55
	Fe	5.21	6.85	3.45	2.61	2.04	1.98
	Cd	2.21	3.52	1.03	0.86	1.62	1.05
	Zn	17.51	19.35	11.45	8.33	9.15	8.83
	Pb	11.76	13.36	12.63	9.85	8.76	1.53
Aut . Oct .	Cu	5.81	7.39	6.71	3.71	3.51	5.31
	Fe	3.46	4.91	4.31	2.43	1.86	2.51
	Cd	2.79	3.30	2.51	1.59	0.79	1.86
	Zn	10.25	11.73	7.89	6.45	5.81	6.51
	Pb	7.33	9.88	9.71	5.66	6.79	0.69
Winter Feb. 1998	Cu	6.21	9.61	9.85	10.53	11.23	4.86
	Fe	4.86	3.79	5.23	7.83	6.88	3.32
	Cd	2.56	4.86	3.59	2.56	1.39	0.89
	Zn	21.15	23.76	18.91	9.88	7.85	5.63
	Pb	2.88	3.15	1.89	1.03	0.79	0.65

Lead

In the eastern sector, the monthly average values showed a high concentration of dissolved lead in February 1998 (9.51 μg/l) coinciding with high value of dissolved copper and chlorosity in this month, but the correlation between dissolved lead and chlorosity was not clear, while the drainage water discharged from Baltim Drain and Nasser Drain was more effect at this sector as shown in Table 2. The minimum average values of dissolved lead were measured in the same two drains in April 1997 coinciding with low value of dissolved lead measured in April in this sector (0.86 μg/l), (Table 1 and 2). These observations were in agreement with the data reported by Abdelmoneim ***et al***,1990 .

In the middle sector, the maximum average values of dissolved lead (7.43 μg/l) was estimated in September, while the minimum (0.65 μg/l) was measured in April as in the eastern sector, also the values coincides and correlated with the concentrations of dissolved lead in Drains 7 and 8 (Table 1 and 2). The same observation were measured in the western sector, where, the maximum and minimum values of dissolved lead were correlated with the increasing and decreasing content of dissolved lead in Drains No.8 and 9 (Table 1 and 2).

It is clear that the origin of pollution by lead is from the drains especially Baltim and Nasser Drains.

Cadmium

As shown in table 1, the maximum concentration of dissolved cadmium (8.61 μg/l) was recorded in May in the eastern sector,while the minimum (0.22 μg/l) was measured in July in the western sector. the increasing and decreasing values which recorded in the three sectors were correlated with the chlorosity values, in addition to the effect of Nasser Drain which discharged drainage water in the eastern sector with high concentration of dissolved cadmium (Table 2). These observation were in agreement with Zirino and Yamamata ***(1972),*** who reported that cadmium interacts primatily only with the chloride ion with the effect of sea water and drainage water.

Also Mahmoud and Beltagy (1988) observed that , when the values of chlorosity increased, dissolved cadmium has also increased during some months. For the middle and western sector, nearly the same pattern was recorded (Table 1).

Iron

A marked rise in the values of iron was abserved in the eastern sector in winter months (December and January ,1998), where the maximum value (9.68 ̄g/l) was measured in December. This sector was highly affected by drainage water discharged from Nasser Drain, which contained high concentration of iron in winter season. In addition to the agricultural drainage water represent the main component of Nasser Drain (Table 1 & 2).

Concerning, the iron content in the middle sector , lower concentrations were observed as compared with the values obtained in the eastern sector , where the maximum value of iron was 1.86 μg/l in August , while the lower value was 0.59 μg/l in Novamber.

In the western sector the iron concentration was lower than that recorded in the other two sectors, where the maximum value was 1.23 μg/l in March, 1998 while the lower value (0.34 μg/l) was measured in January (Table 1& 2).

The results also indicated that the concentrations of dissolved copper were correlated with the values of chlorosity, increasing or decreasing.

The middle and western sector were lower pollution by heavy metals than the eastern sector. Generally, Burullos Lake consider not heavily polluted with heavy metals.

Conclusion

Lake Burullos is slightly contaminated with heavy metals, inspit of the high concentrations recorded in the eastern sector, but not exceed the International permissible concentrations in the lake water .

From the results obtained, the eastern sector was slightly contaminated with Cu and Zn due to the effect of Nasser and Baltim Drain, while the other two sectors, the concentrations of heavy metals recorded in particular Cu, Zn reveal lower values, resulting from other Drains and chlorosity.

REFERENCES

Abdelmoneim, M. A.; El- Sarraf, W. M. and Beltagy, A. I., 1990. Distribution of some heavy metals in Lake Burullos. Bull. Nat. Inst and Fish. A R E, 16 (1), 1990: 302-221.

Aboul – Nagah, W. M., 1979. The occurrence and distribution of some trace metals in the Mediterranean waters off the coast of Alexandria and their effect on the water productivity. M. Sc. Thesis. Fac., Sci., Alexandria Univ.

American public Health Association A P H A., 1989. Standard methods for the examination of water and waste water 17^{th} Ed . New York, 626pp.

Mahmoud, Th. H. and Beltagy, A. I.. 1988. Detergents in Lake Burullos rapp. Comm. Int. Mer., 31, 2, 72.

Parker, C. R., 1972. Water analysis by atomic absorpation spectroscopy Varian techtron Ltd. Australia. No.124.

Radwan, A. M., 1994. Study on the pollution of Damietta branch and its effect on the phytaplankton. Ph. D . Thesis. Tanta Univ . Faculty of Science. 289 p .

Salah, M. M., 1959. phytoplankton population of the Nozha Hydrodrome. Hydrobiol. Dept., Alexandria Inst Hydrobiol., Notes and Memories, No. 40, 19 p.

Zirino, A. and Yamamata, S., 1972. A P H dependent model for the chemical speciation for Cu, Zn, Cd and pb in sea water. Limnol. Oceanogr., 17 : 661-671.