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LONG-TERM MEAN SALINITY IN THE CURONIAN LAGOON IN 1993–2005

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Abstract. Water salinity and its variations in time and space in the Curonian Lagoon during the last decades are fractionally described. Spatial and temporal water salinity variations in the Curonian Lagoon with regard to marine water intrusions from the Baltic Sea were analysed on the basis of the data on water salinity measured in the Curonian Lagoon during the last decade (1993–2005). Data analysis showed that the number of days per year with salinity higher than 0.15‰ in the central part of the Curonian Lagoon was highly variable. However, years with surface water salinity not higher than 0.5‰ prevailed in the period under investigation. It is important to note that a lack of salinity measurements in the near bottom layer of the Curonian Lagoon limits our knowledge of marine water intrusions and, therefore, may lead to an underestimation of mean salinity values in the northern and central parts of the Curonian Lagoon.
Key words: long-term mean salinity, marine water intrusions, Curonian Lagoon, Klaipėda Strait

INTRODUCTION

Interest in salinity of the Curonian Lagoon has lately grown. Water exchange between the Curonian Lagoon and the southeastern part of the Baltic Sea occurs through the Klaipėda Strait. Extensive reconstruction and dredging works were carried out in the Klaipėda Strait during the last decade of the 20th century in order to meet the growing needs of the only Lithuanian harbour located there. Global climate warming, the rising global sea level as well as anthropogenic activities may affect this transitional water system and, consequently, salinity in the Curonian Lagoon. The problem of the Curonian Lagoon ecosystem stability has been frequently raised. However, water salinity and its variations in time and space in the Curonian Lagoon during the last decades are described fractionally.

The first data about the Curonian Lagoon related to the observations of physico-chemical parameters and limnology were found in scientific papers by Pratje (1931), Schmidt-Ries (1940) and Willer (1931, 1933). More detailed data on the chlorine regime in the Curonian Lagoon were collected after the end of World War II when the network of measurement stations was built up in the lagoon. The first scientific papers based on these data appeared in the seventies of the 20th century. Dubra (1972) analysed conditions of salty water distribution in the Curonian Lagoon in the period of 1957–1970. He admitted that the amount of salty water penetrating into the Curonian Lagoon depended on the river discharge and wind history. Salinity remained under 0.03‰ in the large part of the Curonian Lagoon most of the time and salty water coming from the Baltic Sea returned back the same way. The highest salinity values are observed in the northern part of the Curonian Lagoon up to the town of Juodkrantė and only in rare cases – at Ventė (Dubra 1969). According to the data presented by Dubra (1972), marine water intrusions into the Curonian Lagoon reaching Ventė and Nida lasted on average for four days per year during the sixties of the 20th century. Vaitkevičienė & Vaitkevičius (1978) analysed chlorine measurements in the lagoon in the period of 1964–1972 and concluded that intrusions of salty water from the Baltic Sea into the lagoon were caused by the affluent at the sea coast. Salinity along with other hydrological, hydrochemical and hydrobiological parameters has been measured by Lithuanian scientists in the Lithuanian part of the Curonian Lagoon only since 1993. No data are available from the southern part of the lagoon. Prochorova (1998) analysed seasonal chlorine measurement data from the northern and central parts of the Curonian Lagoon for the period of 1992–1996. She noticed that salty marine water frequently reached the northern part of the Curonian Lagoon approximately in the latitude of the town Juodkrantė during the high tide at the southeastern coast of the Baltic Sea.

A number of studies on the impact of salinity fluctuation on hydrobionts have been carried out in the Curonian Lagoon recently. Gasiūnaitė (2000) found that both qualitative and quantitative characteristics of crustacean zooplankton exhibited strong dependence on salinity changes in the zone of fresh and brackish water mixing. All limnetic species were found at the salinity ranging from 0 to 2‰ and only some of them survived at the salinity around 7‰. It was also admitted that the first distinct decrease in the total zooplankton abundance was detected at the salinity of 1‰ and the minimum abundance was observed at that of 5–6.5‰. According to Gasiūnaitė and Razinkovas (2002), in the Curonian Lagoon, where short time brackish water inflows prevail, zooplankton community is supposed to be most affected by the immediate effects of salinity. It is important to note, that the impact of salinity has been suggested to be one of the main factors causing major physiological stress for pelagic and benthic animals and thus determining species composition, distribution and abundance in estuarine and marine ecosystems. The purpose of this study is to evaluate spatial and temporal water salinity variations in the Curonian Lagoon with regard to marine water intrusions from the Baltic Sea on the basis of the Curonian Lagoon water salinity data for the 1993–2005 period.

Material and methods

Site description

The Curonian Lagoon is connected to the Baltic Sea through the narrow Klaipėda Strait. The characteristic feature of the lagoon is its high bioactivity and a distinctive regime of salty marine water and fresh river water mixing. Depending on the average water salinity, the Curonian Lagoon is divided into four parts: the Klaipėda Strait, the northern, central and southern parts (Vaitkevičienė & Vaitkevičius 1978). The southern and central parts of the lagoon contain fresh water owing to the discharge from the Nemunas River and other smaller rivers which makes 24 km^3/year in total (Gailiušis *et al*. 2001). The volume of fresh water discharge is 4 times as large as that of the lagoon, which is about 6 km^3. Therefore the Curonian Lagoon is a transitory freshwater basin and the average water level in the lagoon is usually higher compared to that of the sea (Galkus & Jokšas 1997). As a result, water from the lagoon flows into the Baltic Sea.

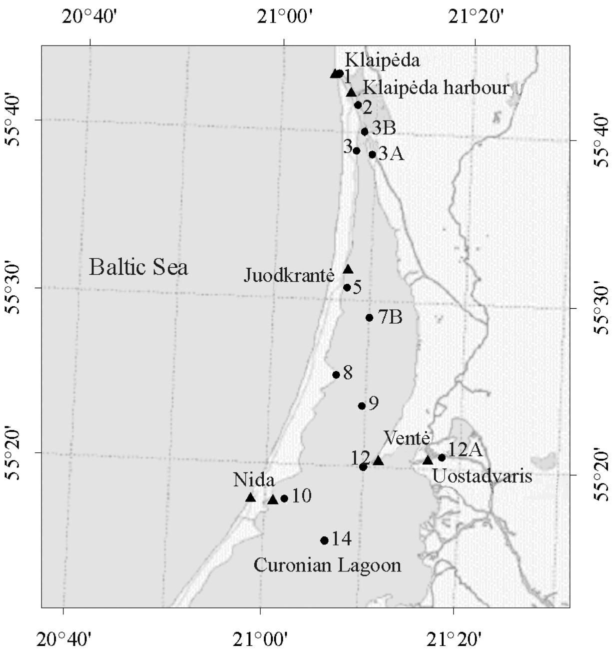

Figure 1. Site map. Background (triangle) and monitoring (circle) stations.

Salty water intrusions from the Baltic Sea to the Curonian Lagoon may occur as a result of certain meteorological conditions and river discharge. Three types of water mass movement in the Klaipėda Strait can be observed (Dubra 1969): 1) a two-layer flow, which is observed when the weather is calm and the difference between the water level in the lagoon and the sea is negligible. This phenomenon is peculiar to the summertime. Then fresh water of the lagoon flows into the sea forming the surface layer, while marine water in the deep layer concurrently flows into the Curonian Lagoon. Second type of water mass movement in the Klaipėda Strait is observed when a water flow from the lagoon flows into the sea, which is very typical of spring floods. Third type is observed when a water flow from the sea to the lagoon, which is recorded during the high tide at the Lithuanian coast. It is most likely to occur when strong westerly (SW, W, NW) and northerly winds, causing the rise of the sea level (affluent) along the southeastern coast of the Baltic Sea, prevail. Intrusion of salty water might be also caused by the lower water level in the lagoon than that in the sea because of the decreased fresh water discharge into the lagoon.

Marine water is mostly observed in the northern part of the Curonian Lagoon up to the town of Juodkrantė. However, in rare cases intrusions of marine water are recorded in the central part of the lagoon (Dubra & Dubra 1998), up to 40 km from the Klaipėda Strait.

Water salinity measurements

All salinity data used in this study are available from the Centre of Marine Research at the Ministry of Environment of the Republic of Lithuania. Water salinity less than 1‰ is measured by titration; the amount of Cl-ion is measured (Alekin *et al*. 1973). Salinity above 1‰ is measured using the electromagnetic induction instrument Gm-65 M. To unify salinity data sets (Oceanographic tables 1975), the Cl-ion measurement data are converted into salinity values by being multiplied by 1.80655.

This study used two data sets of measured salinity in the Curonian Lagoon. One set contains measurements of surface water salinity at four background stations in the Curonian Lagoon (the Klaipėda Strait, Juodkrantė, Nida and Ventė) and in the Baltic Sea at Klaipėda (Fig. 1). There surface water salinity was measured daily at 6 p.m. UTC. The second set includes data on surface and near bottom water salinity measured along with other hydrometeorological parameters 1–2 times per month at 12 oceanographic stations in the Curonian Lagoon during field campaigns (Fig. 1). These measurements were carried out only during calm weather periods. This study used the salinity data set for the period of 1997–2002.

The assessment of temporal variation, trends and spatial distribution of water salinity in the Curonian Lagoon throughout the 1993–2005 period is based on the data on salinity measured in the central and northern parts of the Curonian Lagoon. The vertical distribution of the mean salinity in the water column and its variability were calculated basing on salinity measurements at national monitoring stations (No. 3, 3B, 5, 8 and 10) (Fig. 1).

The mean annual salinity, its standard deviation and extreme values of salinity measured at background and national monitoring stations were evaluated in order to assess the mean spatial salinity variation in the Curonian Lagoon during the period of 1993–2005.

Results

Salinity in the Curonian Lagoon

Long-term mean salinity distribution in the lagoon

Analysis of water salinity data for the period of 1993–2005 was performed. It showed that, in general, the mean annual salinity decreased with the increase of the distance from the Klaipėda Strait going towards the central part of the Curonian Lagoon (Figs 2–3, Tables 1–2). In accordance with the data set of surface water salinity measured at background stations, the long-term annual mean salinity in the Klaipėda Strait was about 2.6‰ during the period under investigation. It decreased to about 1.2‰ at the Juodkrantė station and to less than 0.1‰ at the Nida and Ventė stations (Fig. 2).

According to standard deviations calculated on the basis of daily measurements, surface water salinity at the town of Juodkrantė and in the Klaipėda Strait varied within a comparable range, i.e. standard deviations were 1.83 and 2.50‰, respectively. Maximum salinity measured at these stations during the period was 7.24 and 7.72‰, respectively (Table 1). This value corresponds to the mean salinity in the Baltic Sea at the Lithuanian coast.

The long-term mean surface water salinity and its standard deviation in the central part of the Curonian Lagoon are negligibly small compared to the northern part of the lagoon and do not exceed 0.1‰ (Table 1). However, maximum salinity values higher than 2‰ were recorded at the Nida and Ventė stations during the analysed period of 1993–2005 (maximum salinity values in Table 1). This fact shows that during water intrusion from the sea, marine water might cause a substantial increase in water salinity of the central part of the Curonian Lagoon. The duration of brackish water intrusions and its statistics is analysed below.

The vertical salinity distribution in the Curonian Lagoon was analysed on the basis of seasonal surface water and near bottom water salinity measurements in the period of 1997–2002. The mean salinity and its standard deviation were calculated for the monitoring stations No. 1–3, 5 and 8 (Table 2). It was established that the mean salinity of near bottom water was higher than that of surface water at all investigated stations of the Curonian Lagoon. The largest difference in salinity of surface and near bottom water (about 2.3‰) was recorded at the stations located in the vicinity of the Klaipėda Strait. This difference decreased towards the central part of the lagoon and was about 0.3‰ at station No. 8. The same tendency was observed for the calculated vertical salinity gradient (Table 2). It decreased towards the central part of the Curonian Lagoon by approximately 25% compared to the value of the vertical salinity gradient in the Klaipėda Strait.

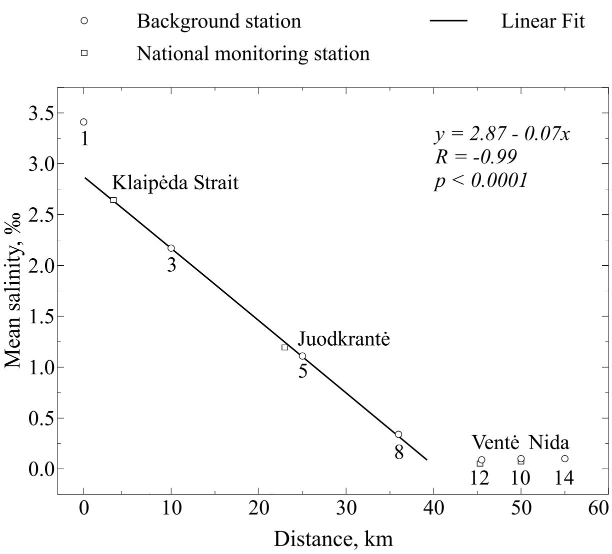

Figure 2. Long-term annual mean salinity in the Curonian Lagoon *versus* the distance to the Klaipėda Strait in the period of 1993–2005. Correlation coefficient for the section between the Klaipėda Strait and station No. 8 is -0.99, the slope is -0.07 ± 0.001‰ km^{-1}.

Table 1. Annual mean and seasonal mean salinity measured at background stations in the Curonian Lagoon, 1993–2005. (Here N – number of the analysed data for each station).

Station		Salinity, ‰						
		Spring	Summer	Autumn	Winter	Annual	Annual Max	Annual Min
Klaipėda Strait	Mean	1.44	3.22	3.57	2.34	2.64	7.72	0.04
	SD	2.54	2.34	2.06	2.48	2.50		
Juodkrantė	Mean	0.54	1.44	1.90	0.90	1.19	7.24	0.04
	SD	1.32	1.92	2.15	1.06	1.83		
Nida	Mean	0.05	0.05	0.12	0.07	0.07	4.10	0.02
	SD	0.03	0.025	0.25	0.04	0.13		
Ventė	Mean	0.04	0.05	0.12	0.07	0.05	2.43	0.03
	SD	0.05	0.08	0.18	0.02	0.105		
	N	1196	1196	1183	1173	4748		

Table 2. Vertical distribution of mean salinity at some stations in the Curonian Lagoon, 1997–2002. (Here N – number of measurements; Gradient = (Bottom salinity – Surface salinity) / Depth).

Station No.	Depth, m	N	Salinity, ‰	SD, ‰	Gradient, ‰ m^{-1}
1	0.0	71	2.70	2.3	0.22
1	10.3	55	5.11	2.1	
2	0.0	71	2.36	2.3	0.24
2	10.4	50	4.56	2.3	
3	0.0	85	1.99	2.2	0.23
3	8.9	57	3.72	2.3	
5	0.0	49	1.36	1.8	0.20
5	2.5	22	1.89	2.2	
8	0.0	29	0.33	0.7	0.16
8	1.8	16	0.62	1.1	

Seasonal salinity variations

According to the daily measurement data of background stations for the period of 1993–2005, seasonal salinity variations are noticeable in the analysed area of the Curonian Lagoon. The lowest seasonal mean salinity at all stations was recorded during spring. The monthly mean salinity increased in the northern part of the Curonian Lagoon during summer, while in the central part of the lagoon it remained at minimum until autumn (Fig. 3). The monthly mean salinity varied between 0.04 and 2.2‰ in the northern part of the Curonian Lagoon at the Juodkrantė station and between 0.04 and 0.13‰ in the central part of the Curonian Lagoon (Table 1, Fig. 3). The monthly mean salinity in the Curonian Lagoon in autumn was 3–5 times as high as the minimum monthly mean salinity throughout the year (Table 1).

The relative seasonal mean salinity was calculated by dividing the seasonal mean salinity values by the highest seasonal mean salinity value calculated for a particular station (Fig. 4). The maximum relative salinity as well as the highest seasonal mean salinity at all stations was observed in autumn. The calculated relative mean salinity enables researchers to make a better comparison of the seasonal mean salinity among stations in the Curonian Lagoon. The analysis showed that the mean seasonal salinity at a particular station is expected to drop by about 60% in spring compared to the mean salinity value in autumn (Fig. 4). Meanwhile, the mean relative salinity in summer was different at all analysed stations. The biggest changes in relative salinity are characteristic of the Juodkrantė station. In general, the lower relative salinity value for the Juodkrantė station during spring shows that water dilution at this station is relatively higher than at other stations.

It is important to note that the relative salinity curves of the Klaipėda Strait and Juodkrantė stations are nearly parallel throughout the year (Fig. 4). The rela-

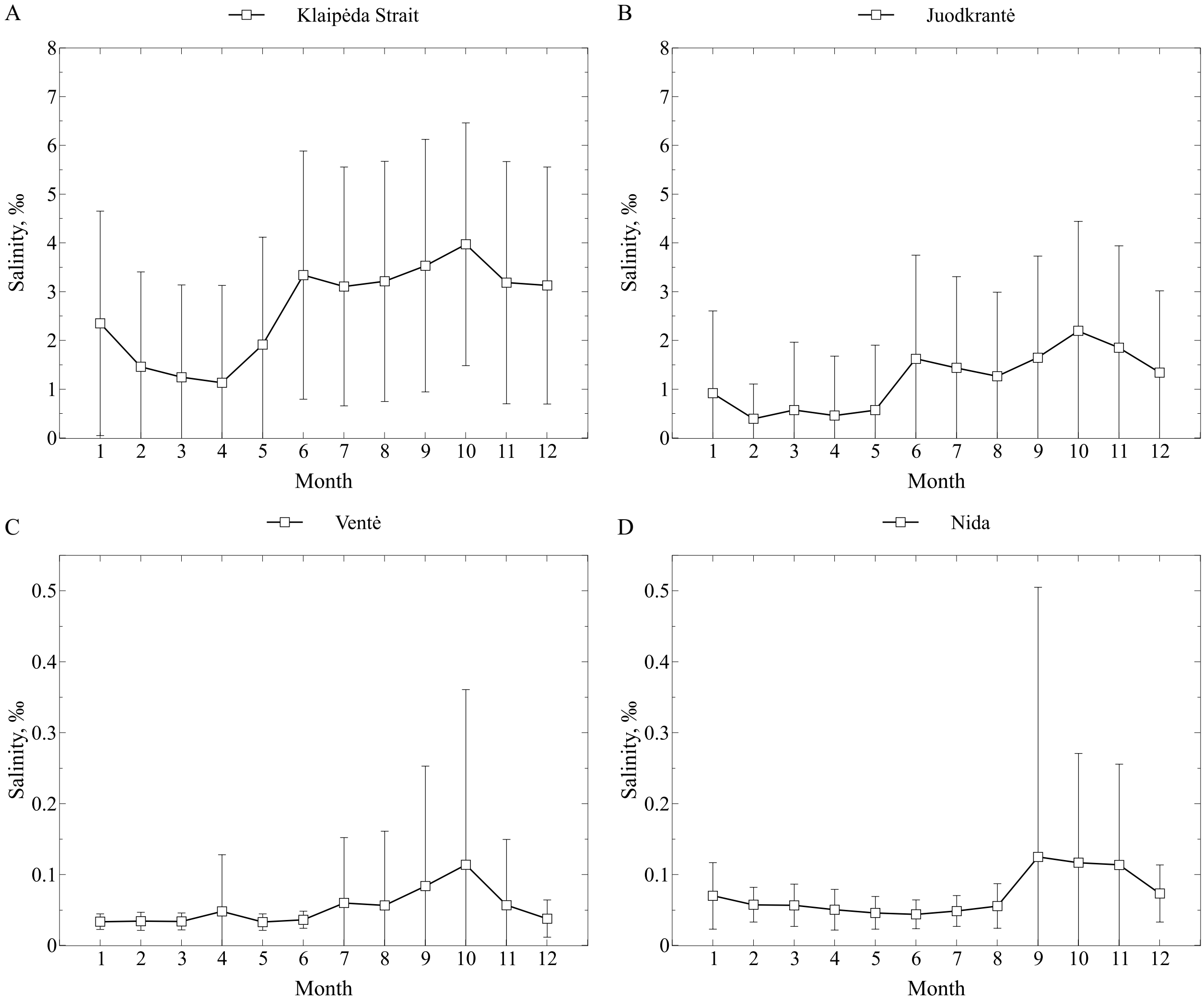

Figure 3. Monthly mean salinity and its standard deviation in the Klaipėda Strait (A) and in the Curonian Lagoon at the Juodkrantė (B), Ventė (C) and Nida (D) stations in the period of 1993–2005.

tive seasonal mean salinity at the Juodkrantė station is lower by more than 10% than that in the Klaipėda Strait.

The difference between the relative seasonal mean salinity in the central and northern parts of the Curonian Lagoon is most evident during summer and winter. At the Nida station, for example, the most diluted water is observed in summer compared to the mean seasonal salinity at this station during autumn. The relative dilution decreases towards the Klaipėda Strait (Fig. 4).

Seasonal variations in the Nemunas River run-off

Seasonal variations in the mean salinity depend on river discharge and wind history, which is also characterised by strong seasonal variability. These two parameters strongly depend on meteorological conditions and their annual variations. A significant increase in the Nemunas River discharge is observed in spring. According to the 1992–2004 measurements at the Smalininkai station located about 80 km from the Nemunas delta, water discharge in the Nemunas River during summer and autumn may drop to 300 m^3/s and may increase about two times or more in spring (Fig. 5). For example, the period of an increase in the Nemunas River run-off to more than 500 m^3/s lasted for about 35 days in spring 2001 (max. 1,100 m^3/s). Meanwhile, in spring 1999, the increased run-off of the Nemunas River to more than 1,000 m^3/s lasted for 25 days (max. 2,400 m^3/s). The variation in the Nemunas River run-off clearly affects the observed average water salinity in the northern part of the Curonian Lagoon at the Juodkrantė station (Fig. 5). The long-term monthly mean salinity at this station during spring flooding is about three times lower than during the rest of the year.

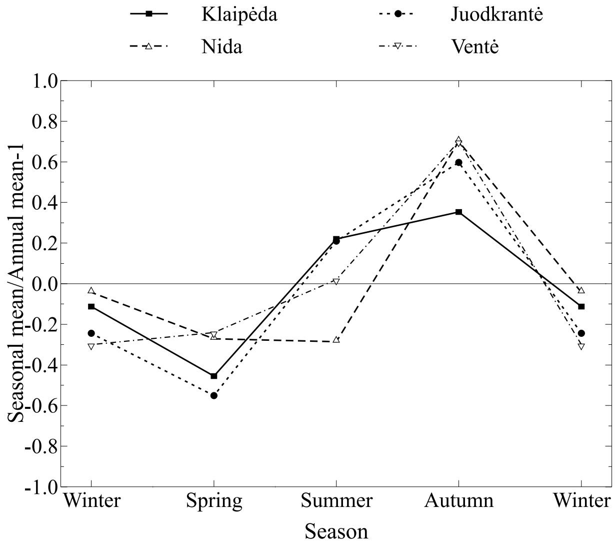

Figure 4. Relative seasonal salinity in the Curonian Lagoon, 1993–2005.

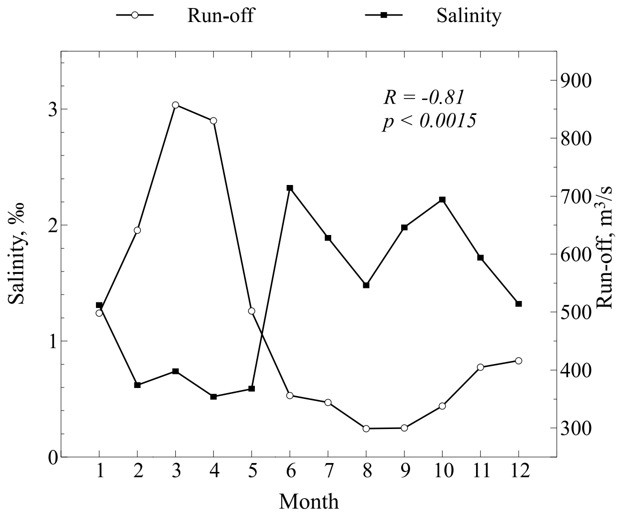

Figure 5. The Nemunas River run-off and mean monthly salinity in the Curonian Lagoon at the Juodkrantė station, 1992–2003. Correlation between these data sets is 0.81.

Marine water intrusion into the Curonian Lagoon Marine water intrusions into the northern part of the Curonian Lagoon are recorded throughout the year. According to data sets of daily salinity measured at the Klaipėda Strait and Juodkrantė stations, salinity exceeding 5‰ was recorded in about 27% of cases in the Klaipėda Strait and in about 9% of cases at the Juodkrantė station during the 1993–2005 period. However, salinity lower than 0.5‰ was observed at these stations in about 38 and 63% of cases, respectively. The comparison of salinity probability distributions at these stations illustrates the following difference – the probability of salinity exceeding 5‰ is clearly higher in the Klaipėda Strait than at the Juodkrantė station, where the probability of salinity lower than 0.5‰ is highly expressed (Fig. 6A). Here the average period with the recorded salinity higher than 5‰ lasted for about 2.7 days. The longest period was 12 days (5–16 October 1999).

The long-term mean salinity in the central part of the Curonian Lagoon was lower than 0.1‰ (Table 1). This part is about 40 km from the Klaipėda Strait. As the Nemunas River mouth is located here, water in the

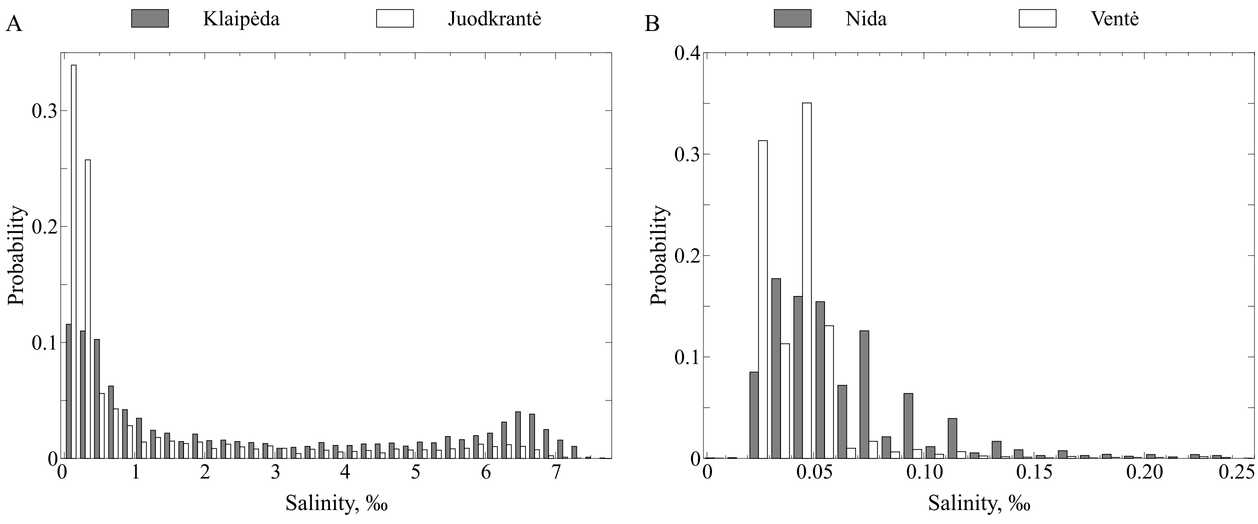

Figure 6. Histograms of salinity in the northern part of the Curonian Lagoon in the Klaipėda Strait and at Juodkrantė (A) and in the central part at the Nida and Ventė (B) stations, 1993–2005. (Number of measurements for each station, N = 4,748).

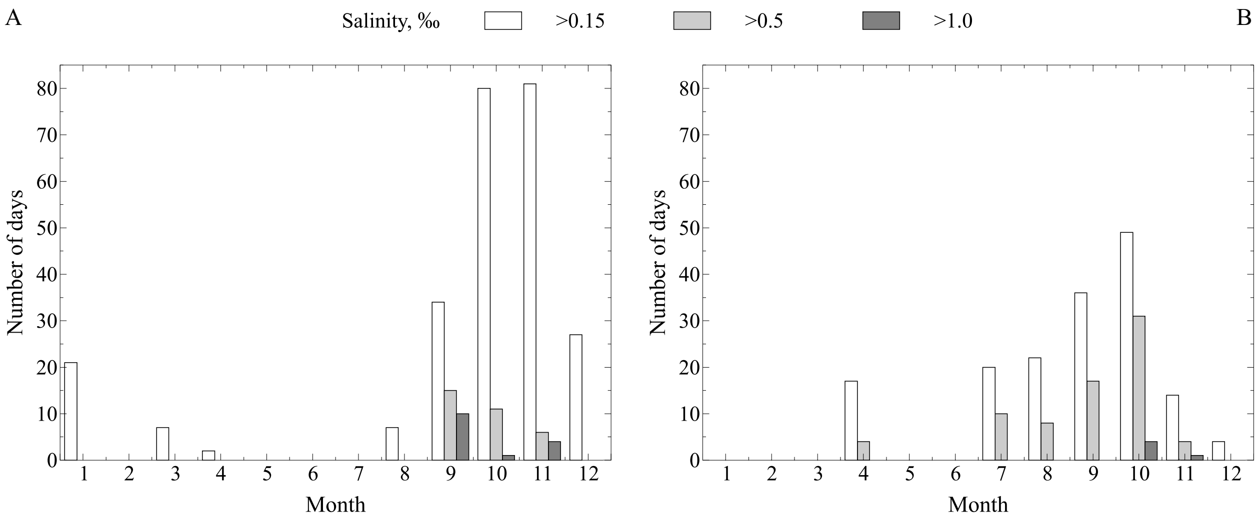

Figure 7. Number of days when the observed salinity in the surface water layer of the Curonian Lagoon exceeded 0.15, 0.5 and 1.0‰ during the period of 1993–2005: at the Nida (A) and Ventė (B) stations.

central part of the Curonian Lagoon is predominantly fresh (Fig. 6B). Salinity higher than 0.1‰ was observed here during marine water intrusions into the lagoon which mostly occur during the cold period of the year, mainly in autumn (Fig. 7). According to histograms of salinity at the stations located in the central part of the Curonian Lagoon, the probability of water salinity higher than 0.15‰ was low here, about 5.5 and 3.4% that makes on average 20 and 12.5 days per year for the Nida and Ventė stations, respectively. However, the histograms of the Nida and Ventė stations (Fig. 6B) exhibit a clear difference in low salinity probability. Water salinity lower than 0.05‰ was recorded in about 58 and 91% of cases that make up 211 and 332 days per year on average for the Nida and Ventė stations, respectively.

As it was demonstrated above, marine water reaches the central part of the Curonian Lagoon quite rarely.

Table 3. Number of days when the observed salinity in the upper water layer of the Curonian Lagoon at the Ventė and Nida stations exceeded 0.15, 0.5 and 1.0‰, 1993–2005. (Number in brackets – number of corresponding intrusions per year).

Year	≥0.15‰		≥0.5‰		≥1.0‰	
	Ventė	Nida	Ventė	Nida	Ventė	Nida
1993	0	0	0	0	0	0
1994	0	0	0	0	0	0
1995	0	7	0	0	0	0
1996	0	20	0	0	0	0
1997	66	98	44 (2)	24 (1)	0	11
1998	1	18	0	0	0	0
1999	22	27	7 (1)	2 (1)	4	0
2000	4	4	0	0	0	0
2001	11	30	4 (1)	0	1	0
2002	0	9	0	0	0	0
2003	57	29	19 (3)	0	0	0
2004	0	7	0	0	0	0
2005	1	10	0	6 (1)	0	4
Sum	162	259	74	32	5	15
Average	13	20	5.7	2.5	0.4	1.2

Therefore, it is reasonable to analyse solitary events of marine water intrusion into this part of the lagoon. As it can be seen from the long-term mean daily salinity in the Curonian Lagoon for the 1993–2005 period, marine water intrusions into the lagoon occurred mostly during autumn (Fig. 7). In total, there were three events of marine water intrusion which reached the central part of the Curonian Lagoon and caused an increase in salinity up to 0.5‰ at the Nida station and seven events at the Ventė station during the 1993–2005 period (Table 3). The only increase in salinity in March was observed in the central part of the lagoon at the Ventė station in 1997 (Fig. 7B).

During the period of 1993–2005, the number of days when the observed salinity in the upper water layer in the Curonian Lagoon at the Ventė and Nida stations exceeded 0.15, 0.5 and 1.0‰ varied significantly (Table 3). The maximum number of days during a particular year with the recorded salinity exceeding 0.5 (1.0)‰ was 44 (4) days for the Ventė and 24 (11) days for the Nida stations. However, it is important to note that years with salinity not higher than 0.5 ‰ prevailed in the analysed period of 1993–2005. Salinity exceeding 0.5 (1.0)‰ was observed only in about 4 (2) years in the central part of the Curonian Lagoon during the 13-year period. Therefore, the calculated average number of days per year with increased salinity does not represent the real situation (Table 3).

The comparison of the number of days per year, when the observed salinity in the upper water layer of the Curonian Lagoon at the Ventė and Nida stations exceeded 0.15, 0.5 and 1.0‰, shows that during the 1993–2005 period salinity higher than 0.15‰ was more frequently observed at the Nida station. However, salinity higher than 0.5‰ was observed more frequently at the Ventė station (Fig. 7B, Table 3). The total number of days during the analysed 13-year period with the observed salinity exceeding 0.5‰ at the Ventė station was more than twice as large as that at the Nida station, and *visa versa* for the observed salinity exceeding 1.0‰. In the latter case, the total number of days at the Nida station was three times as large as that at the Ventė station (Table 3).

Discussion

The purpose of this study, in general, was to define the state of salinity in the Curonian Lagoon basing on the measurement data of the last 13-year period. It should be acknowledged that this study was not designed to analyse long-term salinity variation.

The long-term mean surface water salinity shows a statistically highly reliable relation with the distance from the Klaipėda Strait. This fact indicates that brackish water penetrates into the Curonian Lagoon and is in average diluted proportionally to the distance to the Klaipeda Strait during the period of time. This fact also demonstrates that the probability that brackish water will reach a certain point in the northern part of the Curonian Lagoon is also linearly dependent on the distance to the Klaipėda Strait. These statements have certain stipulations as the analysed stations are located on the left bank of the northern part of the Curonian lagoon at a distance of about 10 km from one other. Therefore, it is important to note that the number of stations analysed is not sufficient to smaller scale inhomogeneities in spatial distribution of the long-term mean salinity on the analysed stretch from the Klaipėda Strait towards the central part of the Curonian Lagoon. The large standard deviation of the long-term mean salinity in the northern part of the Curonian Lagoon and the highly variable number of days per year of brackish water intrusions reaching the central part of the lagoon were shown in this study. These facts indicate that the analysed relation between the long-term mean salinity and the distance to the Klaipėda Strait has relatively large annual fluctuations, which, however, were not investigated in this study.

Due to the increase of the Nemunas River run-off during spring, water outflow from the Curonian Lagoon into the Baltic Sea increases, thus preventing salty water intrusions into the lagoon. This is one of the reasons why salty water intrusions are predominantly recorded during the cold period of the year. The relation between the long-term mean monthly salinity and the Nemunas River run-off explains a decrease in the mean water salinity at Juodkrantė in spring. However, for the detailed analysis, meteorological conditions should be taken in to account in addition to the Nemunas River run-off, especially during the cold period of the year. However, this study did not aim at analysing this phenomenon in detail.

This study focused on the analysis of surface water salinity. The calculated long-term annual mean vertical gradients are about 0.2‰ per meter depth in the northern part of the Curonian Lagoon. The vertical salinity gradient during a particular intrusion event might reach even higher values. For example, the measurements carried out on October 19 2005 revealed an immense difference in surface and near bottom water salinity. During this intrusion of marine water the salinity value close to that of fresh water salinity was recorded at about 32 km from the Klaipėda Strait already. However, salinity of the near bottom layer was 4.4‰ and the vertical gradient was about 1.5‰ m^{-1}. Although the result is not new, it shows the importance of measurements in the near bottom water layer. Measurements in the near bottom water layer are carried out seasonally four times a year at national monitoring stations. Therefore, the data set is quite scarce and the possibility for tracking marine water masses during intrusions into the Curonian Lagoon is limited.

Conclusions

On the basis of salinity measurement during the 1993–2005 period it was established that the long-term annual mean salinity of surface water of the northern part of the Curonian Lagoon was decreasing linearly by about 0.07‰ km^{-1} in the direction from the Klaipėda Strait towards the central part of the lagoon.

The long-term monthly mean salinity in the Curonian Lagoon in autumn was from three to five times as high as the minimum monthly mean salinity throughout the year.

Marine water intrusions causing an increase in salinity in the central part of the Curonian Lagoon to more than 0.15 ‰ were most frequently observed in autumn during the period of 1993–2005.

The number of days per year with salinity higher than 0.15‰ in the central part of the Curonian Lagoon was very variable. It varied from 0 to 100 days per year at the Nida station and to about 65 days per year at the Ventė station during the period of 1993–2005.

Years with surface water salinity not higher than 0.5‰ prevailed in the analysed 1993–2005 period. However, the period of recorded salinity higher than 0.5‰ at the Ventė station was nearly two times as long as that at the Nida station.

The long-term annual mean salinity in the surface water layer was lower than in the near bottom water layer. According to seasonal salinity measurement at national monitoring stations, the mean vertical salinity gradient varied from 0.24‰ m^{-1} in the Klaipėda Strait to 0.16‰ m^{-1} at station No. 8 located in the northern part of the Curonian Lagoon 36 km from the strait.

A lack of salinity measurements in the near bottom layer of the Curonian Lagoon limits our knowledge of marine water intrusions and, therefore, may lead to the underestimation of mean salinity values in the northern and central parts of the Curonian Lagoon.

Acknowledgements

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VIDUTINIS DAUGIAMETIS KURŠIŲ MARIŲ VANDENS DRUSKINGUMAS 1993–2005 M.

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SANTRAUKA

Pastaruoju metu auga susidomėjimas druskingumo svyravimais Kuršių mariose. Globali klimato kaita lemia vandens lygio kilimą Baltijos jūroje ir Kuršių mariose. Be to Klaipėdos sąsiauryje praeito šimtmečio paskutiniajame dešimtmetyje pradėti vykdyti intensyvūs uosto rekonstrukcijos ir gilinimo darbai. Šie faktai skatina susimąstyti apie galimą grėsmę Kuršių marių ekosistemos stabilumui. Visgi esami Kuršių marių druskingumo matavimai 1993–2006 metų laikotarpiu yra mažai ištirti. Šio darbo tikslas yra charakterizuoti Kuršių marių druskingumo laikinį ir erdvinį kitimą 1993–2006 metų laikotarpiu. Nustatyta, kad daugiametis paviršinio vandens druskingumas šiaurinėje Kuršių marių dalyje mažėja tiesiškai apie 0,07‰ km^{-1}. Dažniausiai druskingo jūros vandens proveržiai į marias pasiekiantys centrinę Kuršių marių dalį, kai druskingumas padidėja iki 0,15‰ ir daugiau, 1993–2005 m. laikotarpiu vyko rudenį. Dienų skaičius per metus, kai centrinėje Kuršių marių dalyje buvo išmatuotas druskingumas didesnis nei 0,5‰, 1993–2005 m. laikotarpiu svyravo nuo 0 iki beveik 100 dienų ties Vente ir iki 65 dienų ties Nida. Tačiau metų, kai druskingumas centrinėje Kuršių marių dalyje nė karto neviršyjo 0,5‰, buvo žymiai daugiau. Pagal 1997–2002 metų ekspedicinių matavimų duomenis, vidutinis vandens druskingumas Kuršių mariose ties vandens paviršiumi yra mažesnis nei ties dugnu. Vertikalus druskingumo gradientas kinta nuo 0,24 Klaipėdos sąsiauryje iki 0,16‰ m^{-1} šiaurinėje Kuršių marių dalyje (8 stotis). Tačiau būtina atkreipti dėmesį į tai, kad druskingumo matavimai priedugnyje atliekami sezoniškai ir jų nepakanka siekiant visapusiškai įvertinti druskingo vandens proveržius į centrinę Kuršių marių dalį.

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