

VILNIUS UNIVERSITY
NATURE RESEARCH CENTRE
INSTITUTE OF GEOLOGY AND GEOGRAPHY

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**DISTRIBUTION OF BEACH USERS
ON THE SEA COAST**

Summary of doctoral dissertation
Physical sciences, physical geography (06 P)

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INTRODUCTION

The data about the pattern of beach users' dynamics in the coastal area are important in coastal morphodynamic, environmental and recreational aspects.

The fact that the morphodynamic state of a coast is predetermined by natural (hydrodynamic and aeolian) processes and anthropogenic activity (hydrotechnical constructions and their exploitation, recreation) was recognised long ago. Yet while hydrodynamic and aeolian factors and the impact of building and exploitation of hydrotechnical constructions on coastal morphodynamics has been investigated in detail the systematic comprehensive surveys of the effects of recreation as a factor were only undertaken at the end of the 20th century. Thus extensive knowledge about coastal formation processes and prediction of the trends of coastal development require awareness of the specific features of recreation as one of the factors affecting the state of coasts (Ploeg, 1978; Van der Zande, 1987; Olšauskas, 1997; Žilinskas et al., 2001).

Rapid increase of anthropogenic loads on coastal zones and intensifying processes of coastal erosion have been dramatically reducing the areas fit for recreation (UNEP, 1996; PAP, 1997; Mac Leod, Cooper, 2005; Pereira et al., 2003; Guillén et al., 2008). Similar situation also is observed in Lithuania. In the last 40 years the number of visitors to the Curonian Spit has increased from about 9 000 (in 1970) to almost 1 000 000 (in 2010). The data from questionnaires imply that the number of beach users will increase even more. This is proved by S. Paulauskas' data from questionnaires: even 93 % of Lithuanians want to spend their holidays at the sea, 60 % dream of having a house on the coast, etc. (Paulauskas, 2001). Meanwhile, the recreational areas (especially in the mainland coast) have been reducing as a result of coastal erosion and human economic activities. As coastal zone is regarded as a high potential recreational centre of national importance the knowledge of recreational processes in the coastal zone is relevant for optimising the recreational use of the beaches and comfortable recreational conditions.

Taking into consideration the ever increasing flow of beach users the investigations of its dynamics has become a priority issue in the context of sustainable development of the coast. The research object of the present dissertation was chosen seeking to fill up the gap in the information available about the recreational dynamics in the coastal zone.

Main objective. The main objective of the present research is to determine the spatial and temporal patterns of beach users' flow dynamics in all recreational zones of Curonian Spit and mainland coast.

Main tasks:

- 1) to survey the long-term trends of the flows of holiday-makers in the resorts of Curonian Spit and mainland coast;
- 2) to determine the annual, weekly and daily distribution patterns of beach users;
- 3) to analyse the scattering of beach users across and along the beaches;
- 4) to analyse the distribution patterns of beach users in the foredune;
- 5) to evaluate the specific features of recreational infrastructure and their influence on the distribution patterns of beach users;
- 6) to determine the indices of recreational spaces, carrying capacity and load.

Maintained propositions:

- 1) The relatively slow increase of the number of holiday-makers in the Lithuanian coastal resorts since the middle of the 19th century till the fifties of the 20th century accelerated in the sixties of the 20th century;
- 2) the greatest annual flows of beach users occur in July–August, weekly Saturdays and daily at 1 p.m. The annual, weekly and daily distribution patterns of beach users are asymmetric in character;
- 3) the weekly and daily dynamics of beach users during the holiday season is similar irrespective of the size of recreational zone, level of infrastructural development and flow of holiday-makers;
- 4) the highest recreational loads in the coastal zone occur at the corridors of beach users and reduce receding from them;
- 5) the distribution of beach users in the foredune is predetermined by meteorological conditions, ridge morphology and character of vegetation cover;
- 6) in the noon peak hours, almost in all areas of intensive recreational use the psychological norms always, functional often and sometimes even physical ones are violated.

Originality of research. Coastal researchers got interested in distribution patterns of beach users relatively short time ago. Surveys of this kind are scanty even on the global scale. Detailed temporal (in the course of year, season, week and day) and spatial

(in all beaches and the foredune of the Lithuanian recreational zones) investigations so far have not been conducted in Lithuania or neighbouring south-eastern Baltic countries.

The presented dynamic patterns of beach users in the coastal zone are helpful for more precise evaluation of the influence of recreation on the state of coasts and for better understanding of coastal morphodynamic processes. The practical application of the obtained results also is important: on their basis it is possible to pinpoint the hotbeds of ecological conflict in the recreational zones and highlight their causes. The obtained results also are helpful for development and successful implementation of the reconstruction of recreational zones and to achieve more even distribution of beach users in the coastal zone. The mentioned measures would not only improve the recreational conditions but also would add to stability of coastal landscape.

Approbation of the research work. The research results obtained within the present dissertation were reported at 7 national and international scientific conferences. Ten scientific articles have been published individually and with co-authors.

Extent and structure. The dissertation is composed of an introduction, 5 sections, conclusions and a list of references. The dissertation is comprised of 123 pages of text, 44 illustrations and 10 tables.

1. METHODS

The survey of the distribution of beach users in the coastal zone was conducted in 2001–2004 and 2008–2012 in the recreational zones of Curonian Spit (Nida, Preila, Pervalka, Juodkrantė, Alksnynė and Smiltynė) and in 2008–2012 in the recreational zones of mainland coast (Melnragė, Giruliai, Karklė, Palanga and Šventoji) (Fig. 1). Attention was concentrated on the summer season when the flow of holiday-makers is the largest. Episodically observations also were carried out in other seasons. Temporal distribution of beach users (weekly and daily) was surveyed in Nida, Preila, Melnragė and Palanga recreational beaches. These settlements were chosen in order to determine whether the temporal dynamics of beach users is influenced by the level of infrastructure of recreational zones. Based on P. Kavaliauskas' (Kuršių nerijis..., 1999) criteria of classification recreational zones, the recreational zones of Nida, Juodkrantė, Klaipėda, Palanga and Šventoji are attributed to the model of advanced recreational infrastructure whereas recreational zones of Preila, Pervalka, Melnragė I and II, Giruliai and Karklė to

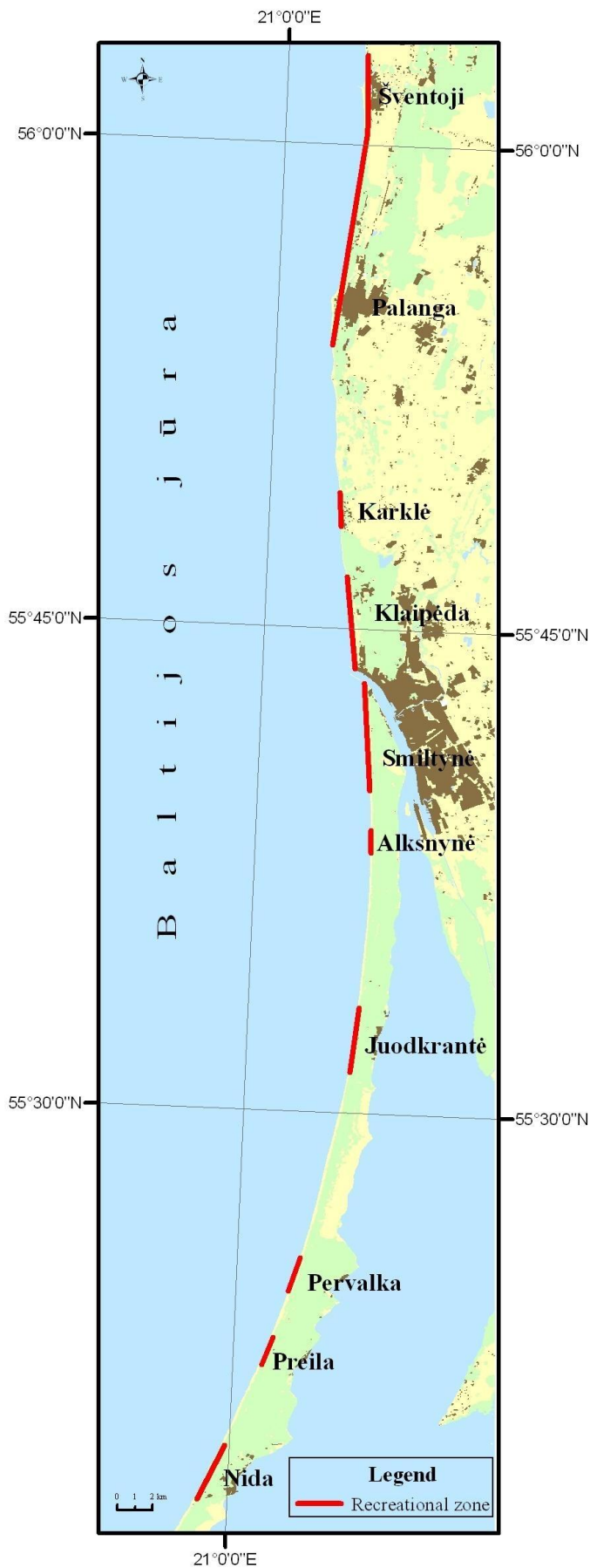


Fig. 1. Locations of recreational zones in the coastal area

the model of minimal recreational infrastructure.

The greater part of the analysed data was collected directly, i.e. by counting the beach users in the recreational zones. Also the data obtained analysing the aero photographs of 2004 provided by the Palanga Municipality were used.

The *long-term* dynamic trends of holiday-makers were analysed based on the data from various literary and statistical sources.

The *weekly* distribution intensity of beach users was observed at 1 p.m. of each day when the number of beach users in the coastal zone reached its maximum.

The *daily* survey of dynamics of beach users was conducted every hour from 7–8 a.m. till 9–10 p.m.

Depending on the beach parameters (size), the spatial distribution of beach users (along the recreational zones) was surveyed by 1–3 (Nida, Preila, Pervalka, Juodkrantė, Smiltyne I and II, Melnragė II, Giruliai and Karklė) to 4–5 observers (Palanga and Šventoji). For correct comparison of the flow of beach users in various recreational

zones at different times, the counting of beach users was conducted at the same time each day – 1 p.m. – when the number of beach users in the recreational zones reached its maximum. The number of beach users along the recreational zones was recorded in every 100 m long coastal sector (the distance was established using GPS).

The peculiarities of spatial and temporal distribution of beach users and comparative analysis of distribution patterns in different recreational zones were based on percentage of distribution.

During the present survey the elements of the infrastructure in the beaches and behind the foredunes (approaches to the sea, parking lots, life-saving stations, bathing-boxes, benches, dustbins, containers, toilets, catering facilities, etc.) were inventoried and mapped. These data were used for determining the influence of recreational infrastructure on the distribution of beach users.

The chosen survey method for evaluation of the distribution patterns of beach users in the foredune included the inventory, measurement and mapping of deflation forms. That the distribution of deflation forms is in direct dependence on the flow of beach users was proved in previous researches conducted by other authors (Ploeg, 1978; Van der Zande, 1987; Olšauskas, 1997; Žilinskas et al., 2001). For example, in the preserved territories of the Curonian spit foredune deflation forms occupy only 0.91% whereas in the Nida recreational zone they account for 17.8 % and in some sectors of Palanga recreational zone even for 60% of the total area (Žilinskas et al., 2001). During the field investigations of 2007–2008, deflation forms used by beach users as solariums were inventoried in all recreational zones every 100 m. Analysis of the distribution of beach users along the foredune was based on assumption that deflation forms occupying an area of less than 30 m² within a 100 m long coastal sector were close to the natural background, i.e. deflation forms of this kind occur as a result of aeolian processes whereas the adverse effect of human impact is weak (Žilinskas et al., 2001). When in a 100 m long foredune sector deflation forms occupy more than 30 m² the conclusion is that their occurrence was also affected by human activity.

For evaluation of the potential of *recreational space of beaches* in the study areas the monitoring data of Lithuanian coastal dynamics (2010–2012) were used. It should be noted that the recreational space in the beaches is reduced by lithological and morphometric beach properties and the existing recreational infrastructure.

Based on the data of recreational space and parameters of recreational capacity, the *carrying capacity of beaches* of coastal resorts was evaluated. Its physical, functional and psychological parameters show the number of beach users that can utilise the beaches of recreational zones. According to observations, the parameter of *physical carrying capacity* in the Lithuanian beaches is about 5 m². This is enough for a mat, beach user, his personal effects and a narrow passage. As the Lithuanian recreational zones have no pallet system and the sun is relatively rapidly changing its place in the sky the beach users distribute irregularly orienting to the slope angle of beaches, position of the sun and even to their neighbours thus occupying (when possible) an area of about 8–12 m². This number stands for the real *functional carrying capacity of beaches*, i.e. in Lithuania's case all functional needs of beach user are answered by an area of about 10 m². The *psychological carrying capacity* means the area which is necessary for beach users to rest without discomfort caused by too close proximity of another person. In the present study, the psychological carrying capacity of beaches is equalled to 30 m² per person.

The ratio between the space of recreational zone and the number of beach users in it is the key parameter for *recreational load of beaches*. The following types of load were distinguished during the peak hours in the recreational zones: very high, high, average, small and very small.

2. TEMPORAL DYNAMICS OF BEACH USERS

Long-term recreational dynamics. In the 19th century, recreation in the coastal zone of the Baltic Sea region became an international phenomenon. The small fishermen villages between the Rügen Island and the Gulf of Riga have turned into famous resorts (Strakauskaitė, 2010). The traditional model of this rather closed region has been rapidly changing with development of resort localities. Their development was related with the changes of social and economic life: with economic development the number of urban population increased forming the middle class with its living standards. Among the key causes for appearance of resorts in this region can be mentioned the development of transport infrastructure in the then Germany: building of new roads in East Prussia, appearance of steamboat line in the Curonian Lagoon and the so-called Eastern Railway (*Ostbahn*) connecting Königsberg (Kaliningrad) with Berlin and in 1875 with Klaipėda

(Strakauskaite, 2001). The increasing flow of holiday-makers in its turn encouraged the development of settlements into recreational areas gradually turning into summer resorts and resorts.

The dynamics of holiday-makers to Curonian Spit and Palanga in 1820–2012 and variation of its trends are given in Fig. 2 and Fig. 3 compiled based on the data taken from various literary and statistical sources. The given data shows that since the second half of the 20th century the annual the number of holiday-makers increased by more than 200 times in the Curonian Spit and by 150 times in Palanga.

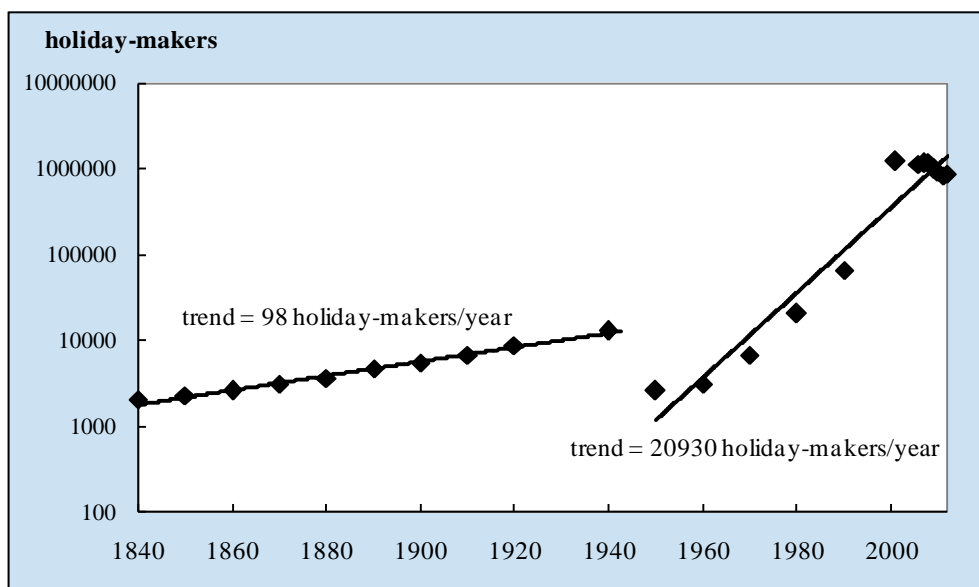


Fig. 2. Dynamics of holiday-makers to the Curonian Spit (on logarithmic scale) in 1840–2012 and its linear trends in 1840–1940 and 1950–2012

The relatively slow and even increase of the number of holiday-makers to the coastal resorts between the middle of the 19th century and sixties of the 20th century (about 50 holiday-makers to Palanga and about 100 holiday-makers to the Curonian Spit per year) dramatically increased beginning with the sixties of the 20th century (about 7 000 holiday-makers on the average to Palanga and about 20 000 to the Curonian Spit).

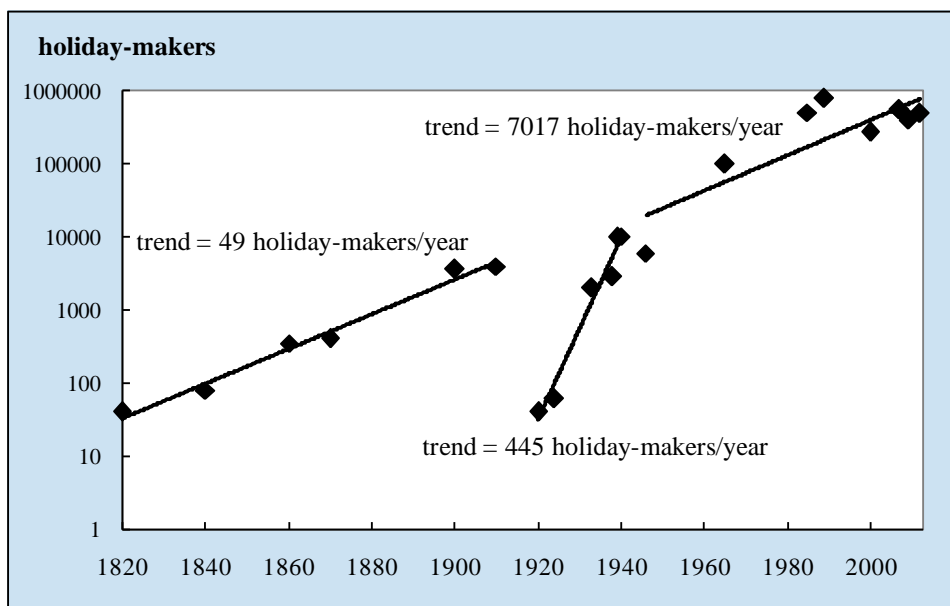


Fig. 3. Dynamics of holiday-makers to Palanga (on logarithmic scale) in 1820–2012 and its linear trends in 1820–1914, 1920–1940 and 1946–2012

Seasonal dynamics of holiday-makers. The large seaside resorts (Nida, recreational zone of Klaipėda and Palanga) has holiday-makers round the year yet their number varies depending on the seasons. Especially vivid monthly and seasonal differences of the number of holiday-makers are observed in the Curonian Spit (Fig. 4.). The bulk of holiday-makers come to the Curonian Spit in the summer. In other seasons, the flow of holiday-makers to Neringa is relatively low: the increase of the number of holiday-makers at the end of the winter and at the beginning of the spring is related with ice-fishing fans, in the late spring with fishing from the coast and in September–October with mushroom collectors.

Analysis of the collected data revealed an asymmetric distribution character of the flow of holiday-makers: the increase of the number of holiday-makers in the spring is more even than the decrease in the autumn (Fig. 4). An abrupt decrease of the number of holiday-makers occurs with the beginning of autumn season and new school year.

The recreational season in the beaches becomes visible in the middle of May (on the days 10–25 depending on the weather conditions) when the sun, though not very hot, shines more often and the day air temperature often reaches 25° C and more. At the beginning of June, the “opening” of the “summer season” is organised in the coastal resorts. At that time, the number of holiday-makers to resorts markedly increases. It decreases after the festive weekends. A somewhat higher number of holiday-makers can

be observed starting with June 15–20. It increases even more between June 25 and July 1 when the school year for students of secondary and higher schools comes to an end. The number of visiting families and young people increases. The maximal number of holiday-makers is reached in the middle of the summer (from July 5–10 to August 15–20) when the daily air (24–29 °C) and water (17–22° C) temperatures reach their maximal annual values. At that time variety of events and services is the highest. Besides, the mentioned time frame is most popular as a time of vacation. Unfortunately, this peak of vacation season (Sousa et al, 2011) is very short in Lithuanian due to climatic conditions. It only lasts for 1.5 months on the average or about one month in rainy years.

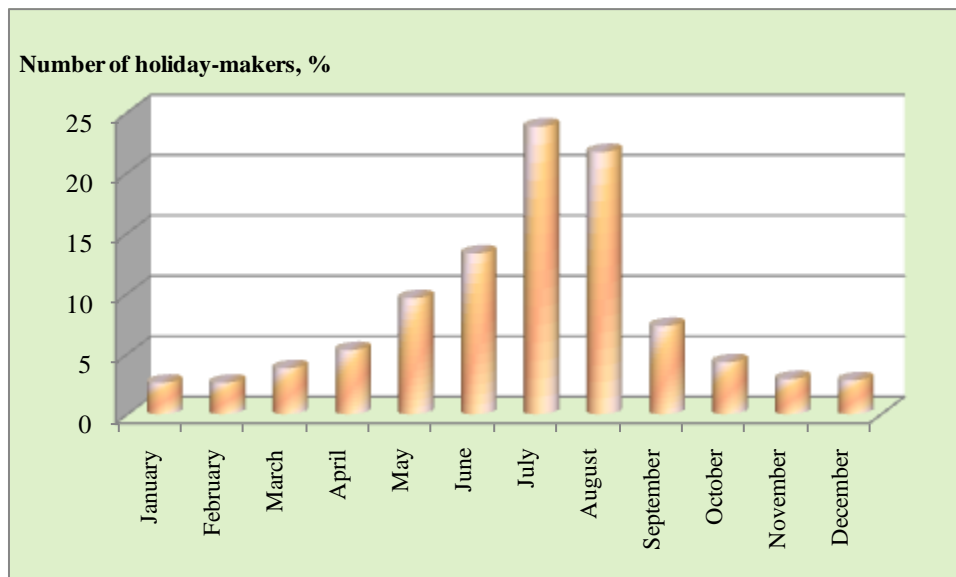


Fig. 4. Dynamics of ferried holiday-makers (%) to the Curonian Spit in the course of year (compiled based on the data for 1997–2012 provided by AB “Smiltynės perkėla”)

At the end of August, the flow of holiday-makers starts to relatively rapidly decrease and at the beginning of September, when the new school year begins, the number of holiday-makers decreases abruptly. On the other hand, in May and September the prices of lodging and other services fall down offering good conditions for cheaper recreation.

The described typical distribution pattern of holiday-makers during the vacation season may be transformed by meteorological conditions. The close link between the air temperature and the number of holiday-makers is demonstrated by the diagram given in Fig. 5. Thus under favourable meteorological conditions the duration of the vacation

season in the Lithuanian coastal zone is 4 months (usually from May 15 to September 15). Yet cold and rainy weather may reduce this season to 2.5–3 months.

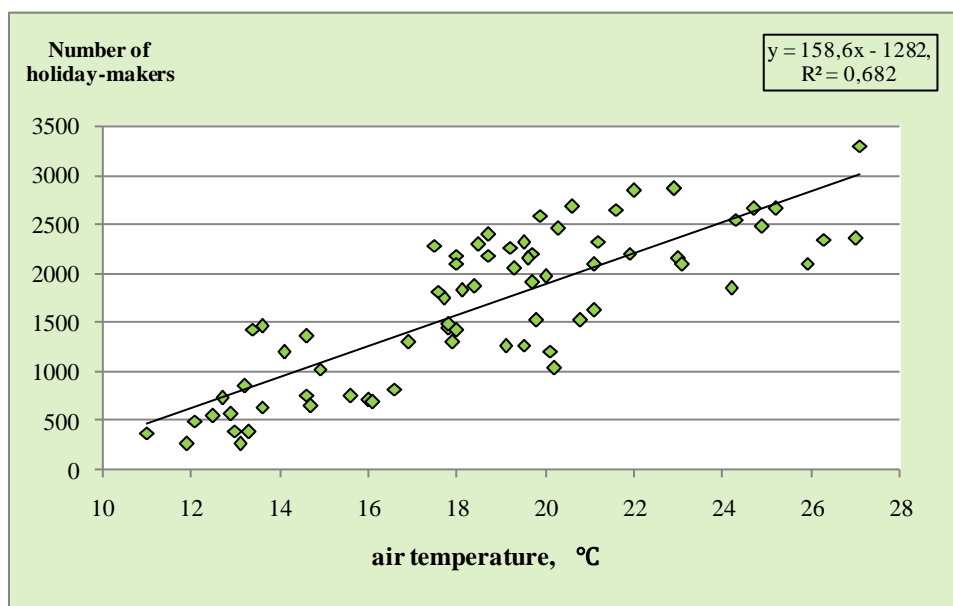


Fig. 5. *Dependence of the number of visitors to Neringa on the mean daily air temperature (compiled based on the Klaipėda University observations in the Alksnynė station) (Neringos kurortologiniū..., 2012) and data for months 6–8 of 2010 from the Klaipėda coastal meteorological station)*

It can be pointed out that during the vacation season as distinct from other seasons most of the holiday-makers spend in the beaches. Meanwhile in other seasons, their visits to the beaches usually last from some minutes to 1–2 hours.

Weakly dynamics of beach users. On working days, the number of beach users differs from the one on weekends. On weekends, the number of beach users doubles in comparison with the working days. This is proved by the survey conducted during a week in the beaches of Nida, Preila and Palanga recreational zones (Fig. 6). The maximal number of beach users can be observed on Saturdays. The number of beach users on Sunday is slightly lower. The smallest number of beach users is observed on Tuesdays. The Tuesday minimum may be accounted for by the fact that some weekend beach users take their time and leave on Monday afternoon instead of Sunday because the queues at the ferry (in the case of the Curonian Spit) are shorter and the traffic (in the case of land roads) less intensive than on Sundays. On Tuesday, the beaches are used by those who have come for longer stay (for a week or longer) whereas the new beach users usually start coming in the middle of the week. This distribution pattern of beach users during the week is valid in all Lithuanian coastal recreational zones independent of their

size or location and does not change in the course of years.

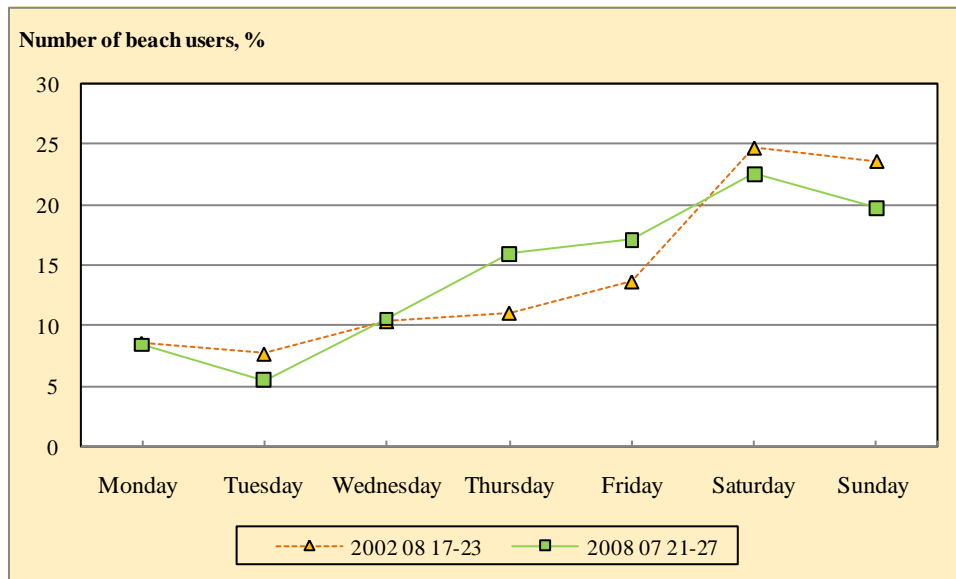


Fig. 6. Distribution of beach users (%) during a week in the beaches of Preila, Nida and Palanga recreational zones

A close relationship between the week days and flow of beach users is demonstrated by the diagram given in Fig. 7.

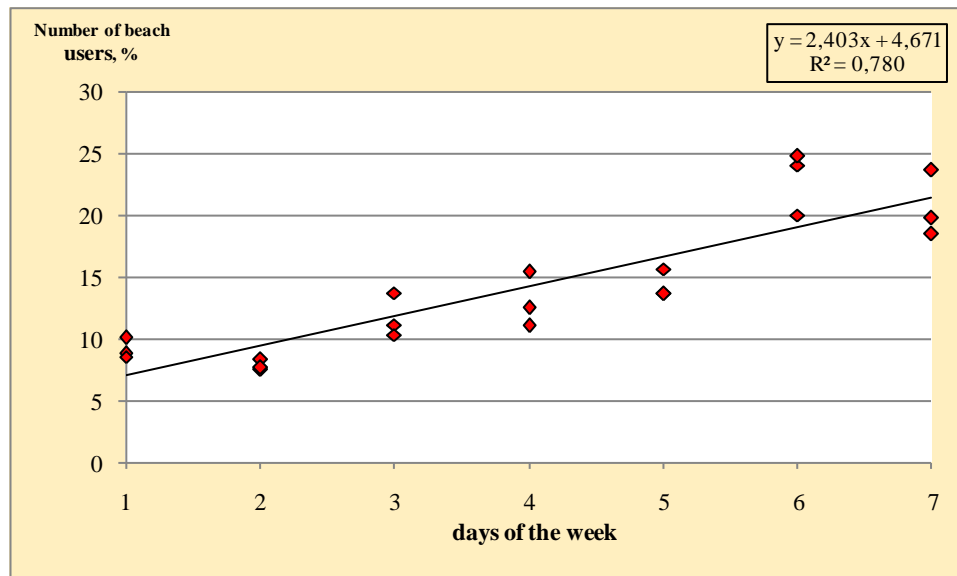


Fig. 7. Dependence of the flow of beach users on the week days (compiled based on the counting data of beach users in Preila, Nida and Palanga recreational zones)

The described typical distribution of beach users within a week may be transformed by a few factors. One of them is meteorological conditions. In cool weather or during long-lasting rainfalls, the number of beach users dramatically decreases

independent of the week day and vice versa, when the weather warms up and the rainfalls cease their number increases. Another factor able to change the distribution of beach users within a week is banner days which prolong the vacation.

Dynamics of beach users within a day. The first beach users appear on the beach rather early in the morning (at 7–9 a.m.). Yet these are not the “permanent” (daily) beach users. They spend little time on the beaches taking exercise, running and bathing. Between 9 a.m. and 10 a.m., the number of beach users increases slowly: from 0.5 to 2.4% on the average. A marked increase of the number of beach users starts at 11 a.m. and continues till 1 p.m. when it reaches its maximum – 18–24 % of the total number of day beach users. These data are almost identical in Palanga, Nida and Preila recreational zones (Fig. 8, 9).

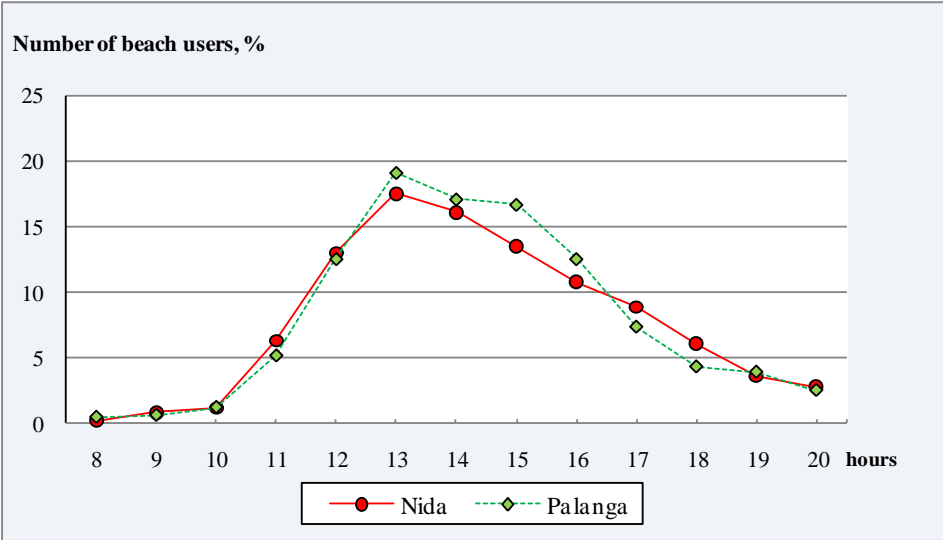


Fig. 8. Dynamics of the number of beach users within a day in recreational zones with advanced recreational infrastructure: in Nida (24-07-2008) and Palanga (01-08-2009)

After 1–2 p.m., some beach users, especially the ones with small children, thin out as it is the lunchtime. The lunchtime migration is obvious in all recreational zones. After 2 p.m. and especially after 3 p.m., some adults also leave the beaches for home. Yet namely at this time some beach users return after the lunch. The number of the latter is smaller than that of the leaving ones. In comparison with 1 p.m., the total number of beach users is smaller. The migration of beach users from the beach lasts till 7 p.m. During these hours, the number of beach users in all recreational zones decreases by 14.5 % on the average. This is predetermined by evening cool. After 3–4 p.m., there remain

almost no permanent day beach users. Only a few newcomers can be observed. These afternoon beach users prefer lying near the approaches (paths, stairs, etc.) to the sea where there is much free space after the emigration of the bulk of beach users. At about 8–9 p.m., the number of beach users slightly increases. This increase is related with the sunset as many of the visitors come to see the setting of the sun.

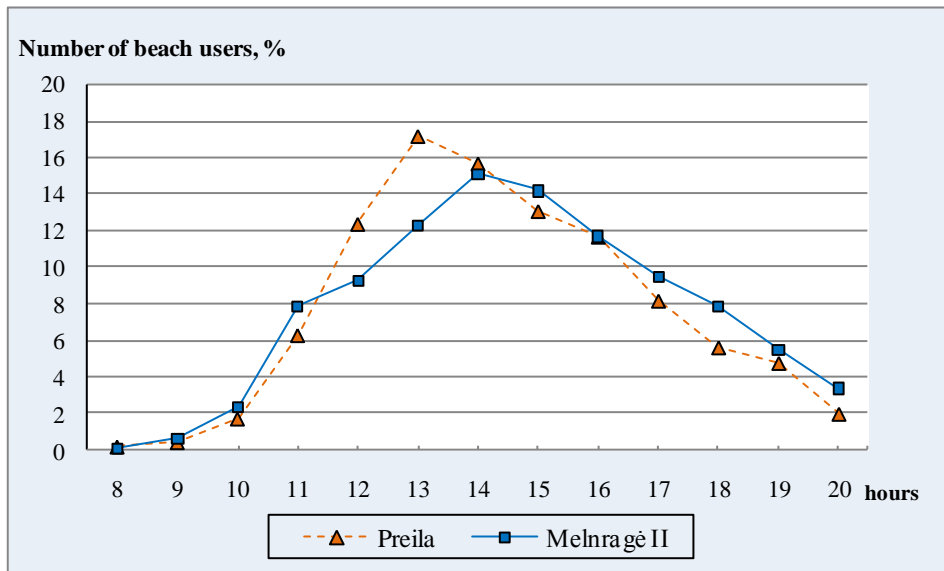


Fig. 9. Dynamics of the number of beach users within a day in recreational zones with minimal recreational infrastructure: in Preila (24-07-2008) and Melnragė II (30-07-2009)

The daily distribution pattern of beach users are valid in all Lithuanian coastal recreational zones independent on their size, location and level of recreational infrastructure and it does not change in the course of years.

3. SPATIAL DISTRIBUTION OF BEACH USERS

On hot and serene summer days, the bulk of beach users are concentrated in the beaches. As the beaches of the Curonian Spit and mainland coast differ (in the development level of infrastructure, morphological features, carrying capacity, character of recreation, etc.) the distribution patterns of beach users in them also differ.

The distribution of beach users *across the beach* changes in the course of day. The first visitors have the best chance of occupying the best (from their point of view) places in the beach. The areas in the lower part of the beach near the shoreline not far from the main entrance are occupied in the first place. Less favourable places fall to the

lot of late comers. They occupy places farther from the flow corridor. The lower parts of the beaches are occupied in shortest time. When the number of beach users increases, the middle and, eventually, the upper part, which borders on the western slope of the foredune, of the beaches are occupied (*Fig. 10*).

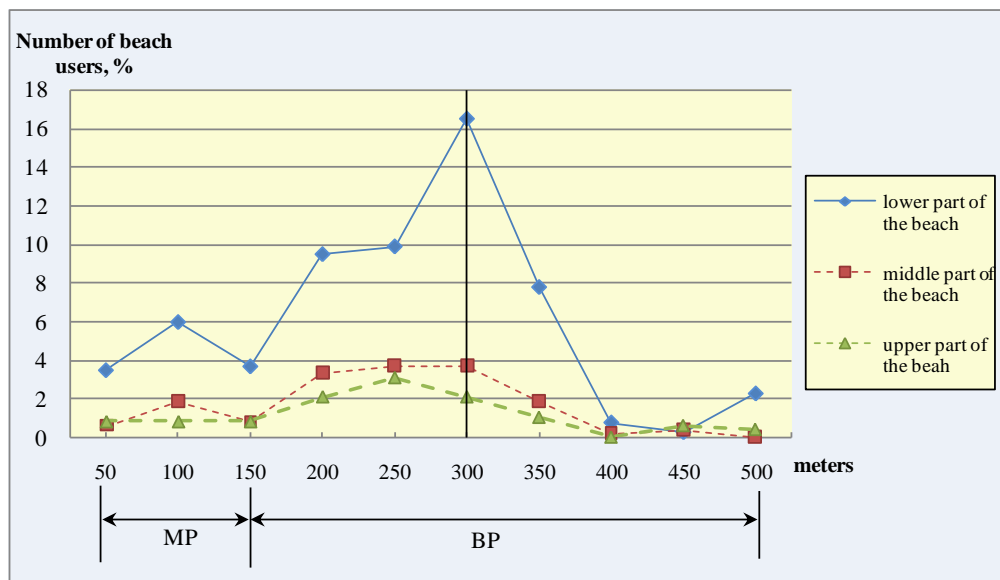


Fig. 10. Distribution of beach users across the beach of Nida recreational zone at the southern flow corridor (vertical line) (BP and MP – common beach and women’s beach respectively)

Deviations from the typical pattern of beach users’ distribution across the beaches may be predetermined by changing meteorological conditions and morphological and lithological features of the beaches.

The distribution of beach users *along the beaches*. The determinant of the flow of beach users in recreational zones is the “generator” of the flow, i.e. the size of the settlements which predetermines the number and often the quality of accommodation (hotels, motels, rest houses, etc.), catering, entertainment, and cultural facilities. The distribution of beach users along the beaches also is predetermined by the quality of communication, information, services and entertainment, sanitary–hygienic, safety and other elements of recreational infrastructure. The highest concentration of beach users is observed in the places where the recreational infrastructure is most advanced. The number of beach users decreases northward and southward from the flow corridors. This distribution pattern of beach users is characteristic both of the zones of advanced (Nida, Juodkrantė, Smiltynė, Klaipėda, Palanga and Šventoji) and minimal (Preila, Pervalka, Melnragė I and II, Giruliai and Karklė) recreational infrastructure (*Fig. 11–13*).

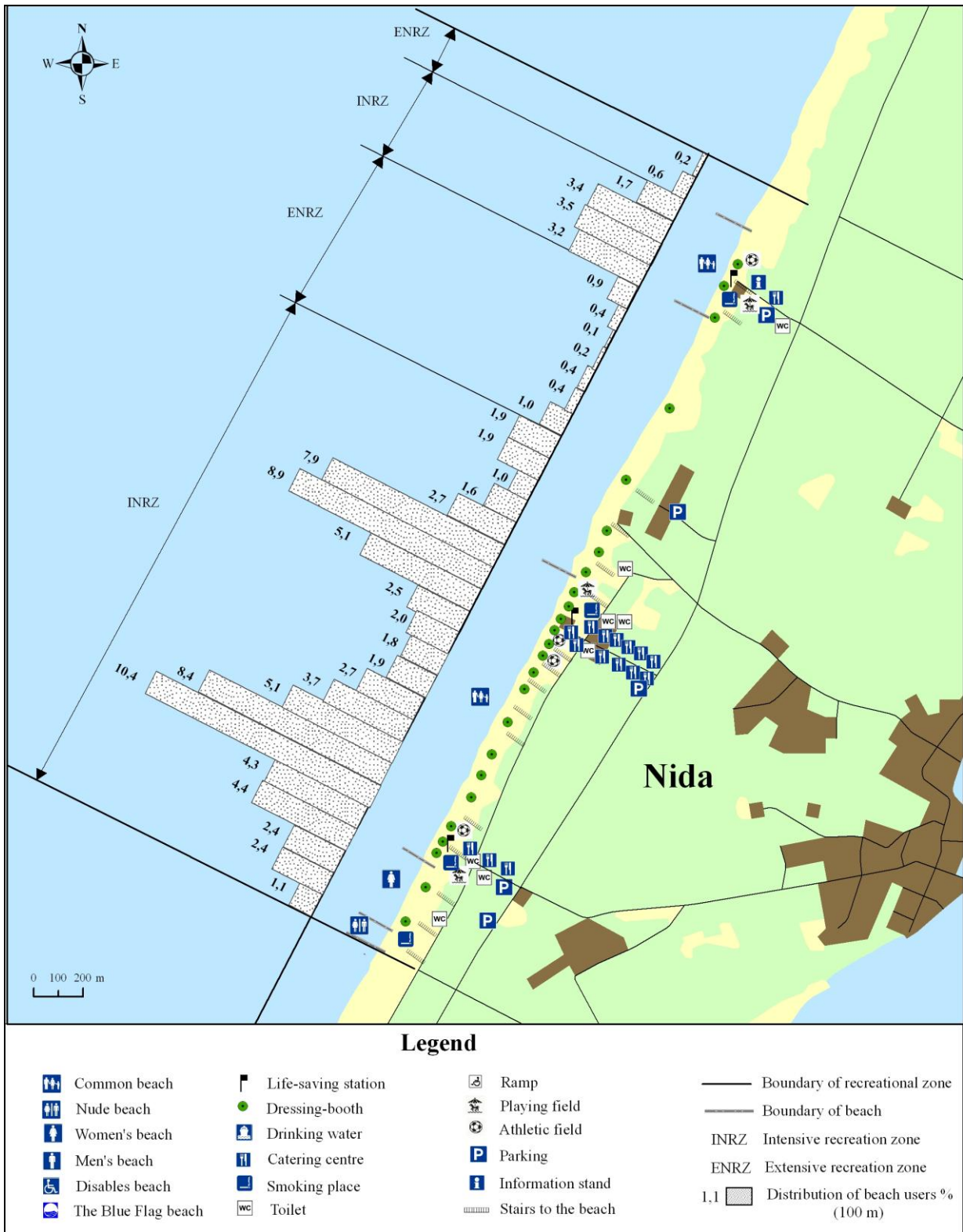


Fig. 11. Distribution of beach users in the Nida recreational zone

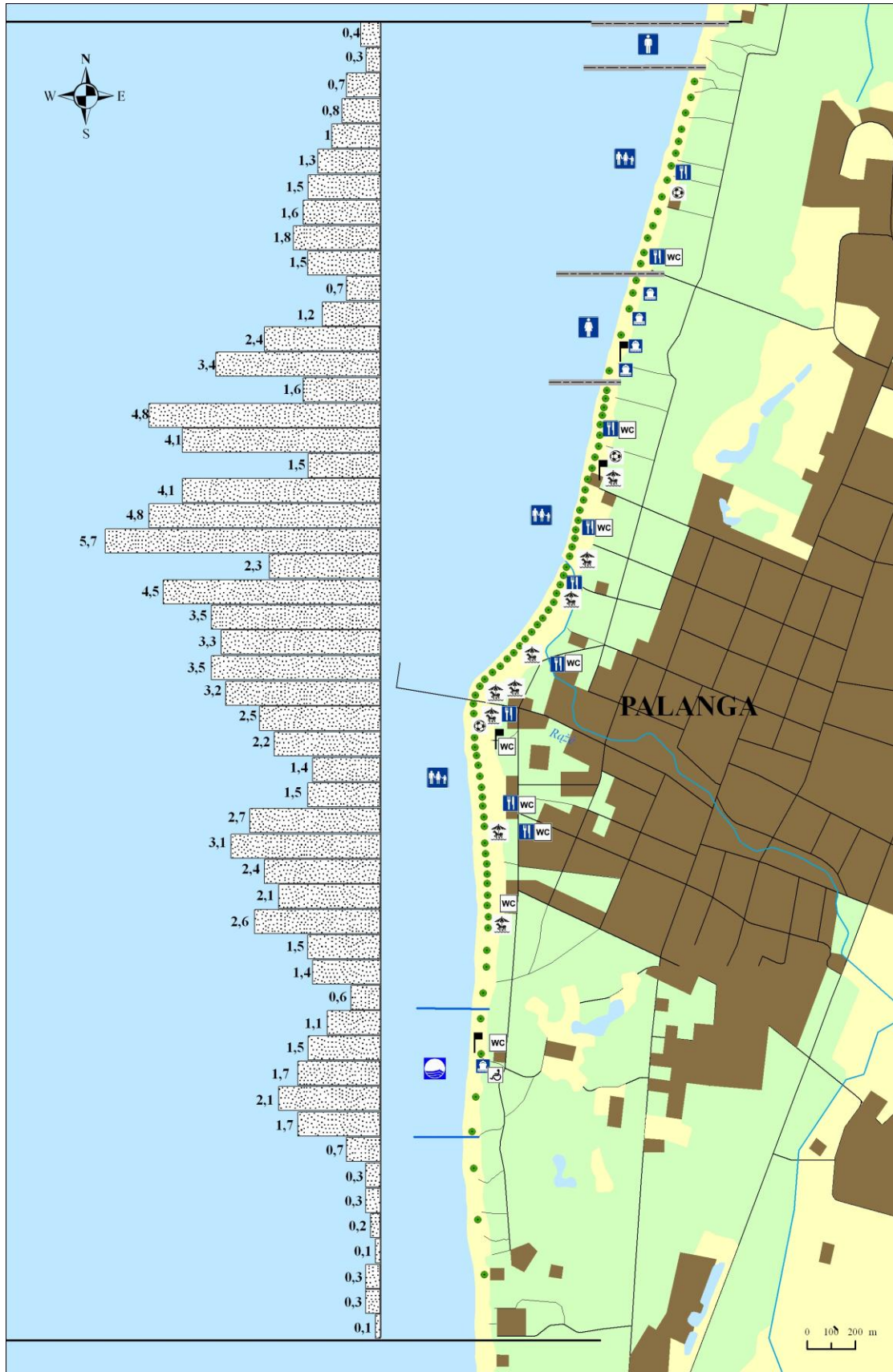
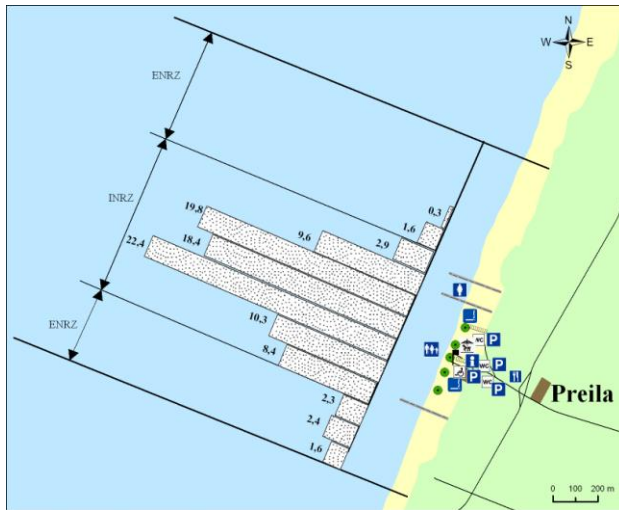
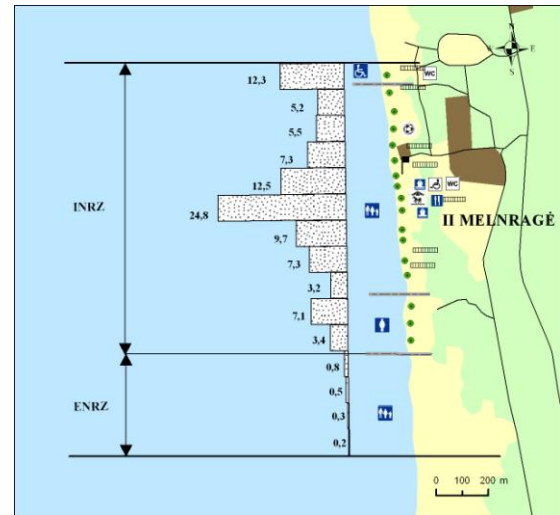


Fig. 12. Distribution of beach users in the southern Palanga recreational zone (for legend see Fig. 11)



a)



b)

Fig. 13. Distribution of beach users in the recreational zones of Preila (a) and II Melnragē (b) (for legend see Fig. 11)

The use of the *foredune* is predetermined not only by the features of its morphology but also by meteorological conditions (wind and air temperature), vegetation cover, quality of recreational infrastructure, and hygienic, aesthetic and psychological factors. On sunny yet windy days and on cooler days, most of beach users look for shelter and warmth between the ridge summits and eastern or western (depending on the wind direction) slopes and foredune toes. There are considerable morphometrical and morphological differences between various parts of the foredune. For this reason, the distribution of beach users in different recreational zones has specific features (Fig. 14).

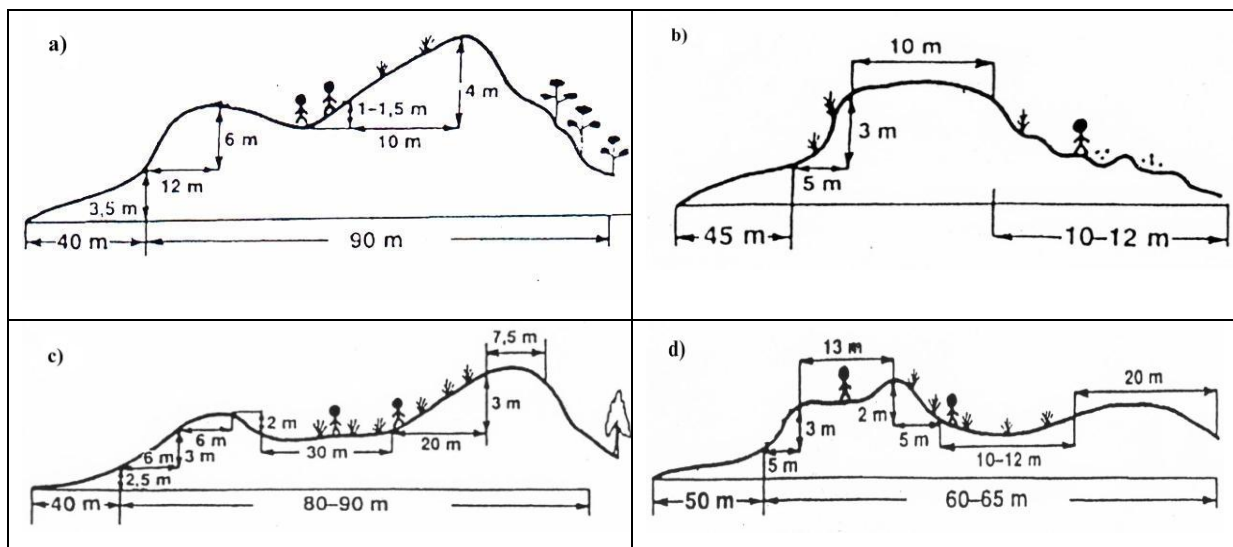


Fig. 14. Concentration of beach users in the cross profile of the foredune in Smiltynē II (a), Juodkrantē (b), Pervalka (c), and Preila (d)

In the areas where the foredune has two ridges and long flat slopes, beach users prefer the shorter beach sector whereas in windy days in the areas where the lee-side recreational space is small beach users widely spread along the foredune even overpassing the boundary of recreational zone.

Independent of the quality of recreational infrastructure in the recreational zones, the distribution character of beach users in the foredune is almost uniform. Beach users mainly prefer those areas of the foredune ridge which are nearest to approaches to the sea. Moving away from them, the recreational load decreases. This is proved by the distribution, number and occupied area of deflation forms. In the areas most favourable for recreation the deflation forms, which can be used as solariums (sand areas, troughs, depressions and potholes) or walking paths (sand paths, gullies or potholes) down or up the ridge are widespread.

4. SPACE, CARRYING CAPACITY AND LOADS OF RECREATIONAL ZONES

The whole *Curonian Spit* has the status of preserved territory. For this reason, only the territories near settlements plotted in the general plan are allowed as recreational areas. At present, only some parts of beaches of all Curonian Spit recreational zones are facilitated for recreation. These parts are supplied with systems of recreational infrastructure. The bulk of beach users (85–95 %) concentrates namely in these parts. In the recreational zones of Curonian Spit, only less than a half of the beach territory allotted for recreation has been assimilated: 8 360 m (45.2 %) of 18 500 m or 400 000 m² of 893 900 m² (44.8 %).

Best assimilated is the recreational space in Nida (73.9 %) and least assimilated in Alksnynė with absent recreational structure in its beaches. In the General Plan, this territory is marked as a reserved zone.

The physical, functional and psychological capacity of recreational zones of Curonian Spit is given in Table 1. The given data represent the theoretical (potential carrying capacity if the whole space allotted for recreation is assimilated) and actual (presently exploited recreational area) carrying capacity of recreational space.

Table 1. Physical, functional and psychological capacity of Curonian Spit recreational zones

Recreational zone	Physical capacity (5 m ² /1 beach user), number of beach users		Functional capacity (10 m ² /1 beach user), number of beach users		Psychological capacity (30 m ² /1 beach user), number of beach users	
	Theoretical	Actual	Theoretical	Actual	Theoretical	Actual
Smiltynė	73 000	31770	36 900	15 885	12 300	5 292
Alksnynė	26 000	–	7 800	–	2 600	–
Juodkrantė	28 700	11 070	14 350	5 535	4 783	1 845
Pervalka	16 800	3 456	8 400	1 728	2 800	576
Preila	10 080	3 240	5 400	1 620	1 680	540
Nida	33 800	22464	16 900	11 232	5 633	3 366
Total	178 780	72 000	89 750	36 000	29 796	11 619

The space of used beaches is so far, even during the recreational peak season, sufficient for answering the needs of beach users in almost all capacity aspects (in some cases only the psychological aspect is exceeded). Yet this statement would be true if beach users evenly distribute in the beaches. Unfortunately, the beach areas near the flow corridors are overcrowded in weekends even though much free space can be found in farther areas.

The physical, functional and psychological capacity of the beaches in the mainland coast is given in Fig. 15.

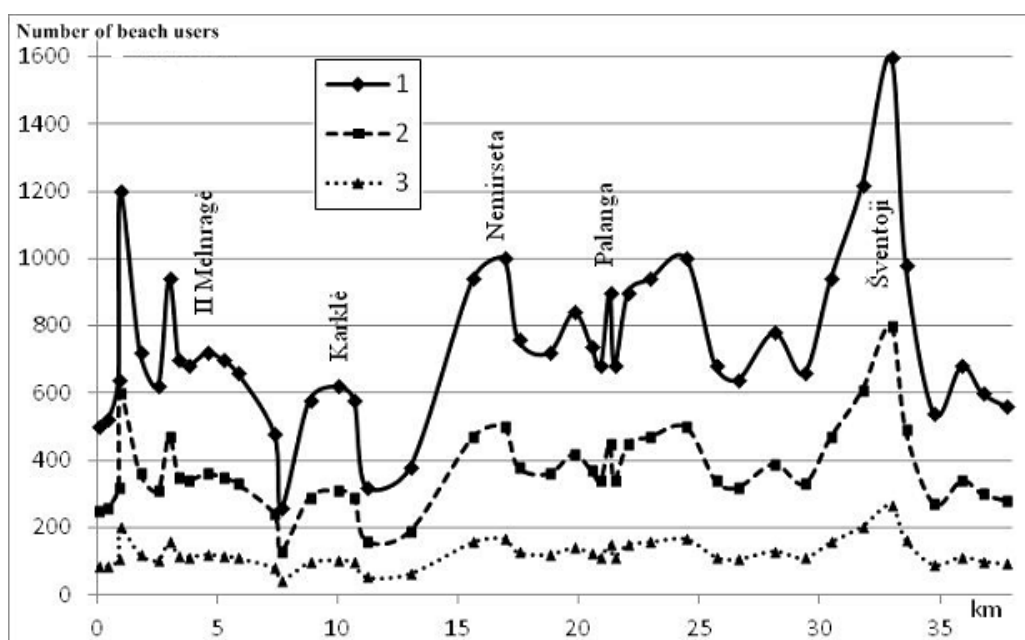


Fig. 15. Number of beach users which could be received in 100 m of beaches to meet the requirements for physical (1), functional (2) and psychological (3) capacity of beaches in the mainland coast. Abscissa 0 – the northern jetty of the Klaipėda port

Out of recreational season, the recreational load in the mainland beaches often does not exceed the criteria of physical, functional and even psychological carrying capacity. This means that every beach user or groups of them (not in peak time) can find places in the beach which would satisfy the requirements for functional and psychological capacity. Yet during peak time, the psychological, sometimes functional and even physical capacity standards are violated almost in all beaches of intensively used recreational zones.

For more even distribution of the flows of beach users in the beaches of recreational zones along the mainland coast regulation of recreational loads and flows is necessary. The recreational zones of extensive use must be facilitated for recreation by development of the network of recreational structures in them. The even distribution of recreational load over the extent of beaches in the recreational zones would help to solve the still relevant sanitary-hygienic and other issues.

The recreational load on beaches during peak time can be reduced not only by development and optimisation of the network of recreational infrastructure but also by expansion of options of events and services in resorts themselves.

CONCLUSIONS

1. The relatively even and slow increase of the number of holiday-makers between the middle of the 19th the fifties of the 20th centuries (in Palanga by about 50 and in the Curonian Spit by about 100 persons per year on the average) was replaced by a rapid growth in the sixties of the 20th century (in Palanga by about 7 000 and in the Curonian Spit by about 20 000 persons per year on the average).

2. In the course of year, the highest number of beach users in the coastal beaches is observed in July–August, in the course of week on Saturdays and in the course of day at 1 p.m. The annual, weekly and daily dynamics of coastal beach users is comparable independent of the size, quality of infrastructure and flow of beach users.

3. The annual, weekly and daily distribution of beach users bears asymmetric character: during the day, the number of beach users till 1 p.m. increases more rapidly than it decreases after 1 p.m.; the number of beach users increases more evenly till the weekend than decreases after it; the number of beach users more evenly increases in the spring than decreases in the autumn.

4. The typical temporal distribution dynamics of the flow of beach users (daily, weekly or seasonal) is transformed by changing meteorological conditions, banner days and various mass events (season openings, festivals, New Year celebration, “smelt” festival, etc.).

5. In the cross section of beaches the daily distribution of beach users varies: the early beach users occupy the areas near the sea (in the lower part of the beaches) whereas the late comers occupy the middle and the upper parts of beaches. This typical distribution pattern may be transformed by changing meteorological conditions, extremely large flows of beach users and natural conditions of the beaches (lithological and morphological features, accumulations of algae, etc.).

6. The distribution of beach users along the coast is predetermined by the quality of communication, information and entertainment, sanitary-hygienic, safety, etc, elements of recreational infrastructure. The maximal concentrations of beach users are observed in the recreational zones with the most advanced infrastructure.

7. The distribution pattern of beach users in the foredune is predetermined by its morphological features, meteorological conditions (wind and air temperature), vegetation cover, quality of infrastructure, and hygienic, aesthetic and psychological factors.

8. The ratio between the space of recreational zone and the number of beach users in it is the key parameter for recreational load of beaches. The recreational space is reduced by lithological and morphometric features of beaches and the existing recreational infrastructure. The physical, functional and psychological capacity of beaches depends on the indices of their recreational space.

9. The largest recreational loads in the beaches of recreational zones occur at the corridors of beach user flows. For this reason, in these areas in the noon hours of vacation peak season always the psychological, often functional and sometimes even physical capacity standards are violated.

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POILSIAUTOJŲ SKLAIDA JŪROS KRANTE

REZIUMĖ

Poilsiautojų dinamikos ypatumų jūros krante tyrimų rezultatai yra svarbūs tiek kranto morfodinaminiais, tiek gamtosauginiais, tiek ir rekreaciniais aspektais.

Kad kranto morfodinaminę būklę apsprendžia gamtiniai (hidrodinaminiai ir eoliniai) procesai bei antropogeninė veikla (hidrotechninių įrenginių statyba bei jų eksploatacija ir rekreacija) žinoma jau pakankamai seniai. Tačiau, jei hidrodinaminiai ir eoliniai veiksniai bei hidrotechninių įrenginių statybos ir jų eksploatacijos poveikis kranto zonos morfodinamikai ištirti pakankamai detaliai, tai rekreacijos, kaip veiksnio, išsamūs ir sistemingi tyrimai pasaulyje pradėti tik XX a. pabaigoje. Todėl, siekiant visapusiškai pažinti krantodaros procesus bei prognozuoti galimas kranto raidos tendencijas, būtinos išsamios žinios ir apie rekreacijos, kaip vieno iš kranto būklę veikiančio faktoriaus (Ploeg, 1978; Van der Zande, 1987; Olšauskas, 1997; Žilinskas ir kt., 2001), ypatumus.

Sparčiai didėjant antropogeninei jūros kranto zonos apkrovai bei intensyvėjant krantų erozijos procesams, jūrų krantuose ėmė sparčiai mažėti poilsiavimui tinkamos erdvės plotai (UNEP, 1996; PAP, 1997; Mac Leod, Cooper, 2005; Pereira et al., 2003; Guillén et al., 2008). Panaši situacija susiklostė ir Lietuvoje: pavyzdžiui, per pastaruosius 40 metų kasmet apsilankančiųjų Kuršių nerijoje padidėjo maždaug nuo 9000 (1970 m.) iki beveik 1 000 000 (2010 m.). Pagal atliktas apklausas galima spręsti, jog ateityje poilsiautojų pajūryje vis daugės. Tai rodo ir S. Paulausko atlikta apklausa: net 93% Lietuvos žmonių norėtų kiekvieną vasarą poilsiauti prie jūros, 60% svajoja turėti namą pajūryje ir t.t. (Paulauskas, 2001). Tuo tarpu rekreacinė erdvė (ypač žemyno krante) dėl krantų erozijos bei žmogaus ūkinės veiklos mažėja. Kadangi pajūris laikomas labai didelio potencialo nacionalinės svarbos rekreacijos centru, todėl rekreacinių procesų jūros krante pažinimas yra aktualus ir siekiant optimalaus paplūdimių rekreacinės erdvės išnaudojimo, užtikrinant komfortabilias poilsiaavimo sąlygas.

Todėl, atsižvelgiant į kasmet vis labiau didėjantį poilsiautojų srautą, jo, kaip krantą formuojančio veiksnio, dinamikos tyrimai tapo itin aktualūs pajūrio darnaus vystymosi kontekste. Siekiant užpildyti poilsiautojų dinamikos jūros krante tyrimų spragą ir buvo pasirinkta ši darbo tema.

Darbo tikslas – nustatyti poilsiautojų dinamikos laike ir erdvėje dėsningumus visose Kuršių nerijos ir žemyninio jūros kranto rekreacinėse zonose.

Darbo uždaviniai:

- 1) apžvelgti daugiametes poilsiautojų kiekio kaitos tendencijas Kuršių nerijos ir žemyninio kranto kurortuose;
- 2) nustatyti poilsiautojų pasiskirstymo paplūdimyje dėsningumus metų, savaitės ir dienos bėgyje;
- 3) atlikti poilsiautojų sklaidos skersai ir išilgai paplūdimio analizę;
- 4) išanalizuoti poilsiautojų pasiskirstymo dėsningumus apsauginiame paplūdimio kopagūbryje;
- 5) įvertinti rekreacinės infrastruktūros ypatumus bei jų įtaką poilsiautojų sklaidai;
- 6) nustatyti rekreacinių zonų paplūdimių rekreacinės erdvės, talpos ir apkrovos rodiklius.

Ginamieji teiginiai:

- 1) santykinai tolydus bei lėtas poilsiautojų kiekio Lietuvos pajūrio kurortuose didėjimas (nuo XIX a. vidurio iki XX a. 6 dešimtmečio) nuo XX a. 7 dešimtmečio įgavo itin spartų tempą;
- 2) didžiausias poilsiautojų kiekis metų bėgyje būna liepos – rugpjūčio mėnesiais, savaitės – šeštadieniais, dienos – 13 val. Poilsiautojų srauto pasiskirstymas metų, savaitės ir dienos bėgyje yra asimetrinio pobūdžio;
- 3) nepriklausomai nuo rekreacinių zonų dydžio, infrastruktūros išvystymo laipsnio bei poilsiautojų srauto dydžio, poilsiautojų dinamika jūros krante poilsio sezono, savaitės bei dienos bėgyje yra panaši;
- 4) didžiausios rekreacinės apkrovos jūros krante susidaro ties poilsiautojų srauto koridoriais, tolstant nuo jų rekreacinė apkrova mažėja;
- 5) poilsiautojų sklaidą apsauginiame paplūdimio kopagūbryje lemia meteorologinės sąlygos, kopagūbrio morfologijos bei augalinės dangos ypatumai;
- 6) poilsiautojų piko metu intensyvaus naudojimo rekreacinėse zonose vidurdienį beveik visur ir visada būna pažeistos psichologinės, dažnai funkcinės ir kartais net fizinės talpos normos.

IŠVADOS

1. Santykinai tolydus bei lėtas poilsiautojų kiekio Lietuvos pajūrio kurortuose didėjimas nuo XIX a. vidurio iki XX a. 6 dešimtmečio (Palangoje vidutiniškai apie 50, o Kuršių nerijoje apie 100 žmonių per metus) nuo XX a. 7 dešimtmečio įgavo itin spartų tempą (Palangoje vidutiniškai apie 7000, o Kuršių nerijoje apie 20 000 žmonių per metus).

2. Didžiausias poilsiautojų kiekis jūros krante metų bėgyje būna liepos – rugpjūčio mėnesiais, savaitės – šeštadieniais, dienos – 13 val. Nepriklausomai nuo rekreacinių zonų dydžio, infrastruktūros išvystymo laipsnio bei poilsiautojų srauto dydžio, poilsiautojų dinamika poilsio sezono, savaitės ir dienos bėgyje jūros krante yra panaši.

3. Poilsiautojų pasiskirstymas dienos, savaitės ir metų bėgyje yra asimetrinio pobūdžio: dienos eigoje poilsiautojų kiekis iki 13 val. didėja greičiau nei mažėja po 13 val., savaitės bėgyje – didėja nuosekliau iki savaitgalio nei mažėja po jo, o metų eigoje žmonių nuosekliau daugėja pavasarį nei mažėja rudenį.

4. Tipinis poilsiautojų srauto dinamikos laike (per dieną, savaitę bei poilsio sezoną) pasiskirstymas kinta pasikeitus meteorologinėms sąlygoms, prisidėjus šventiniams laisvadieniams bei dėl įvairaus pobūdžio masinių renginių (sezono atidarymai, festivaliai, Naujųjų metų šventimas, „stintų“ šventė ir kt.) vyksmo.

5. Poilsiautojų srauto sklaida paplūdimio skersplotyje yra kaiti dienos bėgyje: ankstyvieji poilsiautojai kuriasi arčiausiai jūros (apatinėje paplūdimio dalyje), vėliau atėjusieji – atitinkamai vidurinėje ir viršutinėje paplūdimio dalyse. Toks tipinis pasiskirstymas gali keistis dėl meteorologinių sąlygų kaitos, itin didelio poilsiautojų srauto bei paplūdimio gamtinių savybių (litologijos ir morfologijos ypatumų, dumblių sankaupų ir kt.).

6. Poilsiautojų pasiskirstymą išilgai jūros kranto nulemia susisiekimo, informacinės, paslaugų ir pramogų, sanitarinės – higieninės, saugumo ir kt. rekreacinės infrastruktūros išvystymo laipsnis. Rekreacinės zonos vietose, kur ši infrastruktūra labiausiai išvystyta, fiksuojama didžiausia poilsiautojų koncentracija.

7. Poilsiautojų sklaidą apsauginiame paplūdimio kopagūbryje lemia jo morfologijos ypatumai, meteorologinės sąlygos (vėjas, oro temperatūra), augalinės dangos ypatumai, rekreacinės infrastruktūros išvystymas, higieniniai, estetiniai bei psichologiniai faktoriai.

8. Svarbiausias rodiklis, vertinant rekreacinę paplūdimių apkrovą, yra rekreacinės zonos erdvės ir poilsiautojų, apsistojančių rekreacinėje zonoje, kiekio santykis; rekreacinę erdvę paplūdimiuose sumažina litologinės bei morfometrines paplūdimio savybės ir juose esanti rekreacinė infrastruktūra. Nuo paplūdimio rekreacinės erdvės rodiklių priklauso paplūdimių fizinė, funkcinė ir psichologinė talpa.

9. Didžiausios rekreacinės apkrovos rekreacinių zonų paplūdimiuose susidaro ties poilsiautojų srauto koridoriais, todėl čia maksimalaus poilsiautojų srauto metu (liepos–rugpjūčio mėn.) vidurdienį beveik visada būna pažeistos psichologinės, dažnai funkcinės ir kartais net fizinės talpos normos.

