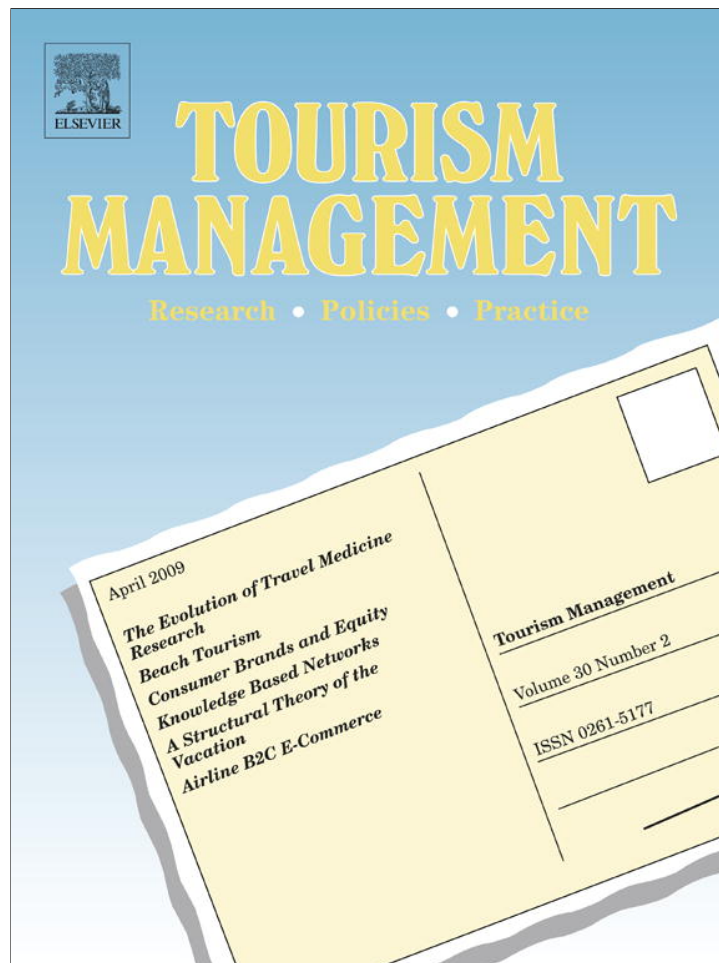


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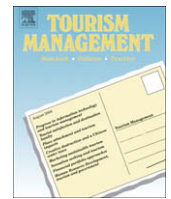
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Decadal shifts in beach user sand availability on the Costa Brava (Northwestern Mediterranean Coast)

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ABSTRACT

Beaches are the main asset of tourist destinations in the Northwestern Mediterranean. When developing beach management frameworks, managers request reliable information for decision-making. Frequentation patterns are one of the main, environmentally significant aspects to be considered. We discuss the use of frequently visited beaches in the light of increases in tourist frequentation and overcrowding problems. This paper presents a photographic protocol to obtain baseline information on frequentation patterns to measure: sand availability per beach user, number of users, user time on the beach, and turnover coefficients. A comparison of beach frequentation patterns is made over an 18-year period. Although the resident population, the number of secondary homes and associated tourism activities increased sharply over this period, only a slight increase was observed in the number of users. Beach users may have restructured their behaviour and now substitute some of the time previously spent on beaches for other leisure activities.

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1. Introduction

In the Western Mediterranean, beaches are mainly considered to be natural areas available for leisure use. Over the past decades, they have been the most valuable asset for many tourist destinations on the coast. It was in these regions that the term “sun and sand tourism” was born, based on the assumption that the availability of beaches was a clear prerequisite for the development of tourism. This particular type of tourism became the most important model for mass tourism destinations. There is no doubt that mass tourism brought income and jobs to these areas, facilitated the understanding of other cultures and increased investment in infrastructures, which in turn brought social and cultural benefits (Sardá & Fluvià, 1999). However, in many places these processes occurred in parallel with the destruction of habitats, the degradation of landscapes and competition for scarce natural resources (Stanners & Bourdeau, 1995), particularly on beaches and seafronts as a result of overexploitation.

During the nineties, several authors (Knowles & Curtis, 1999; Morgan, 1991; Priestley & Mundet, 1998) claimed that mass tourism

destinations in the Western Mediterranean were entering into the stagnation-decline phase of Butler's life cycle model for tourist destinations (Butler, 1980). Other authors such as Aguiló, Alegre, and Sard (2005) gave a slightly different analysis, hypothesizing that a considerable restructuring process within a framework of sustainable development could ensure the survival of the “sun and sand” model. If we consider the present number of tourist arrivals or the income recorded in tourist regions, it appears that the model as a whole is far from being in decline.

In the Autonomous Community of Catalonia (the most visited Autonomous Community in Spain, country that ranks third in world for foreign tourist arrivals), the contribution of tourism to its Gross Domestic Product (GDP) has averaged approximately 9–11% over the last decade, and around 75% of this contribution has been related to the so-called “sun and sand” tourism model (Turisme de Catalunya, 2001–2006). The numbers of national and foreign tourists arriving between 1996 and 2001 (the five years previous to the period studied in this paper) grew at a mean annual rate of almost 6%, from 13.4 million to 17.7 million (70% of these tourists were foreigners). These numbers are still maintained today (19.9 million tourists in 2005). Annual institutional surveys of tourist behaviour consistently show that climate and beaches (the physical space and its associated qualities) are the two main reasons for the selection of holiday locations, which bears out the validity of the “sun and sand” model. In Catalonia, the Costa Brava is one of the most successful tourist destinations (Sardá & Fluvià, 1999). Its

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coastal fringe is administratively divided into 22 towns included in three main administrative regional divisions or “comarques” (Alt Empordà, Baix Empordà and La Selva). These 22 towns cover 6574 km² and they had a resident population of 214,502 inhabitants in 2005. This population is enlarged every year by foreign tourists and day visitors as well as by other hispaniards that came from other Autonomous Communities of Spain. The landscape and quality of life have attracted national and foreign visitors to the whole region (Barbaza, 1998) making the Costa Brava a popular world tourist destination. Around one third of all foreign tourists visiting Catalonia each year select the Costa Brava as their final destination.

Tourist surveys (Turisme de Catalunya, 2001–2006) indicate that beaches are one of the main reasons for selecting the Costa Brava as a tourist destination. As beach capacity is mainly influenced by the available subaerial surface (Valdemoro & Jiménez, 2006), if tourist numbers increase year by year but the available space remains more or less constant (probably decreasing due to global erosion patterns, EUROSION, 2004), we may conclude that either (a) the carrying capacity threshold of these beaches has not yet been reached; (b) tourist numbers are not as dependent on beaches as the definition of the “sun and sand” model seems to indicate; or (c) there are other hidden effects explaining the patterns observed that we should begin to consider. Although considerable effort is put into beach management to support its socio-environmental functions and some frequentation studies can be found in the literature (De Ruick, Soares, & McLachlan, 1997; Pereira da Silva, 2002; Yepes, 1999, 2002), only a few studies have been conducted to analyze the development and recreational use of beaches in Catalonia (Alemany, 1984; Breton, Clapés, Marquès, & Priestley, 1996; Bretón, Marqués, & Clapés, 1994; Mora, 2004). Moreover, these studies do not focus on frequentation dynamics or study the evolution of beach users over the last decades.

The main aim of this paper is to discuss the use of frequently visited Mediterranean beaches in the light of increases in tourist frequentation and possible overcrowding problems. We calculate the number of beach users in the southern part of the Costa Brava, taking in the municipalities of Blanes, Lloret de Mar and Tossa de Mar (which make up the administrative district of La Selva), and compare the present situation with the corresponding frequentation patterns from 1982. We analyze beach surface availability per user for selected beaches with differing degrees of urban development and facilities. We then discuss these data with reference to the development of the population and of economic activity in the region. The data obtained through this research allow us to establish relationships between the frequentation and beach use profiles on different sites and to identify the patterns of tourism in the region.

2. Study area and methodology

2.1. Tourism in the Costa Brava

The number of people visiting the Costa Brava is increasing every year. The arrival of mass numbers of tourists to the Costa Brava mirrors the tendencies observed for Spain and Catalonia (Fig. 1). From 1950 onwards, the number of visitors increased every year and the current forecast stills predicts continuous growth, largely thanks to new and improved facilities, low-cost travel and the restructuring of the tourism sector. When numbers are compared, the role of the coastal tourism of the Costa Brava, considering its importance to the Spanish coast as well as to the Mediterranean and European tourism, is notably high (Table 1). As a result of increased human frequentation, the beaches on the Costa Brava – the area’s most valuable asset for attracting visitors – could have suffered from overcrowding, with the logical consequences of damage to and the depletion of its natural resources.

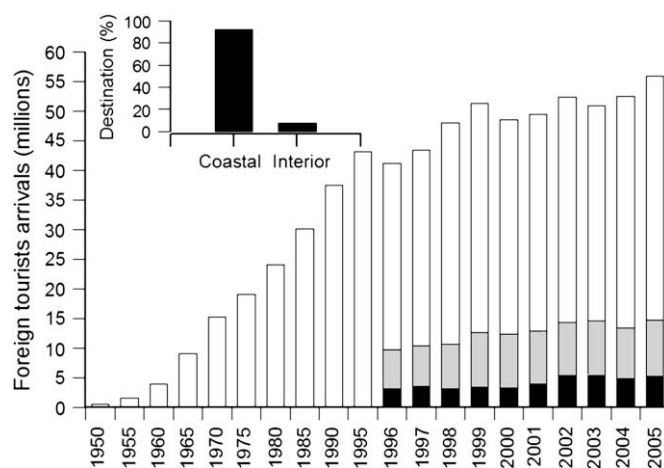


Fig. 1. Number of foreign tourists entering Spain since 1950. Each bar represents the annual number of foreign tourists who visited Spain (open bars), Catalonia (grey bars), and the Costa Brava (black bars) during the selected years. The percentage of foreign tourists who visited the coastal and interior zones during the last decade is plotted on the inset of the figure. (No separate data are given before 1996.)

2.2. Description of the area and beach user profile

Our study analyzes beach use dynamics and frequentation patterns in three municipalities on the southern part of the Costa Brava (Girona, Spain). This area offers a variety of beach types with varying degrees of urban development that cater for various possible social uses. From south to north, the municipalities studied were Blanes, Lloret de Mar, and Tossa de Mar. Over the last decades, these municipalities have experienced an increase in the concentration of tourists seeking suitable environments in which to spend their leisure time.

This southern part of the Costa Brava belongs to the administrative region of La Selva (Fig. 2). Its coastline contains approximately 30 beaches (9.28 km), which have a number of different characteristics. Some are urban, others moderately pristine, some are exposed while others are more sheltered, and ease of access

Table 1
Number of foreign tourists entering different regional areas and tourist destinations in Europe, Spain, and Catalonia during the year 2005

	Foreign tourist (million)
Europe ^a	444
Southern Mediterranean	159
Western Europe	141
Central and Eastern Europe	92
Northern Europe	52
Spain ^b	53.8
Catalonia	14.0
Balearic Islands	9.6
Canary Islands	9.5
Andalusia	8.0
Valencian Community	5.1
Madrid	3.5
Rest of Spain	4.1
Catalonia ^c	14.6
Costa Brava	5.3
Barcelona	4.8
Costa Daurada	2.1
Costa Maresme	1.0
Rest of Catalonia	1.4

^a World Tourism Organization Statistics, 2006.

^b Instituto de Estudios Turísticos, 2006 (referred only to road and airport tourist arrivals).

^c Estudis de Turisme de Catalunya, 2006.

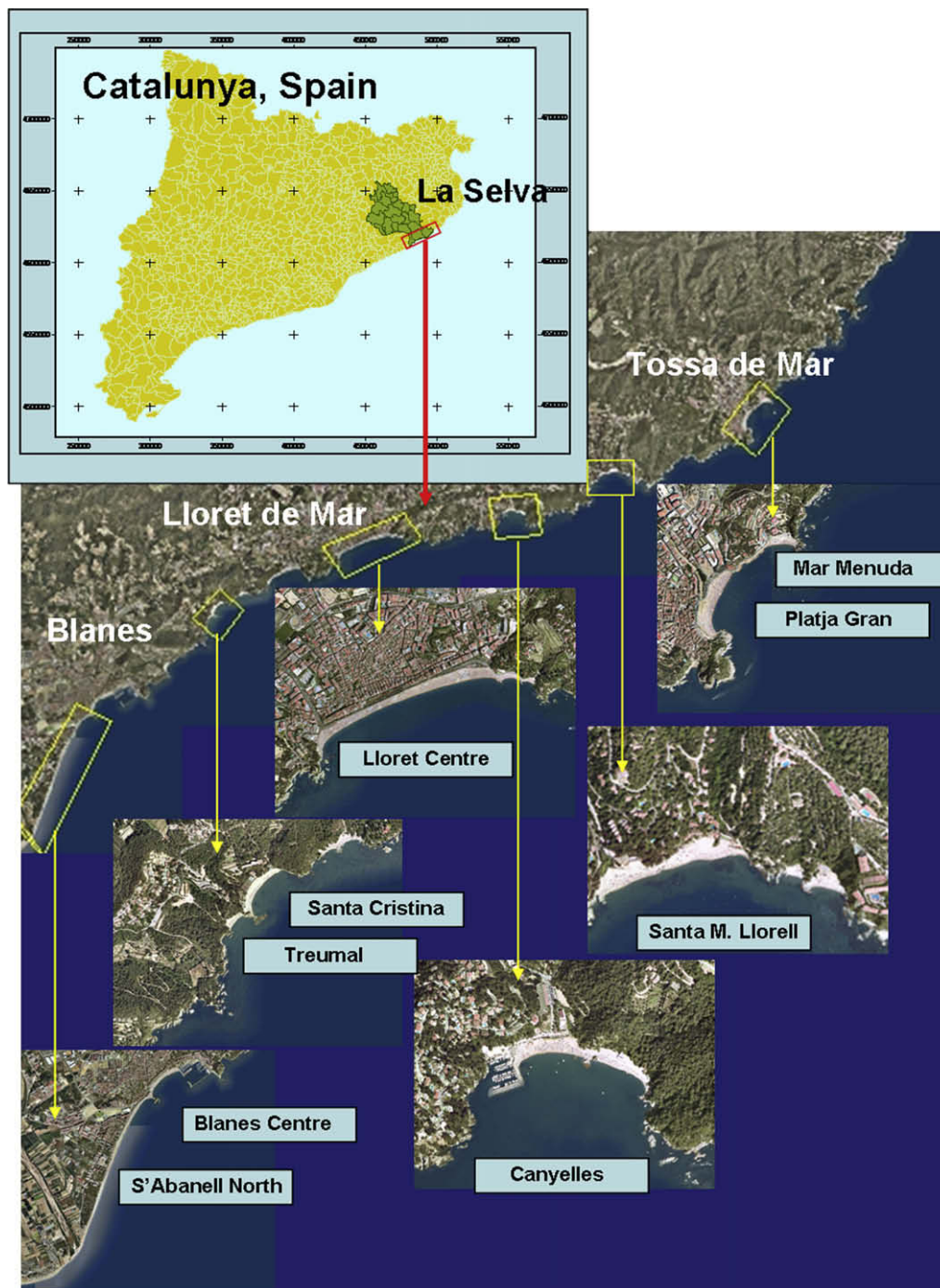


Fig. 2. Studied municipalities in Selva Marítima and selected beaches.

differs in many cases. In order to attain maximum variability, nine of these beaches (4.99 km) were selected and studied (Table 2), all of which were large enough to be representative and could be sampled using aerial photographs. The physical characteristics of the analyzed beaches were obtained from a beach database compiled by the Spanish Ministry of the Environment (http://www.mma.es/costas/guia_playas) and our own GIS database of the area (Sardá, Avila, & Mora, 2005).

Every year the monthly distribution of national and foreign tourists in the region increases sharply from June, reaching its seasonal peak during August. As our analysis was primarily designed to assess the periods of maximum frequentation, we decided to focus on the peak of the season, during the month of

August. Nine beaches were studied: S'Abanell North, Blanes Centre and Treumal (municipality of Blanes); Santa Cristina, Lloret Centre and Canyelles South (municipality of Lloret de Mar); Santa Maria de Llorell, Platja Gran and Mar Menuda (municipality of Tossa de Mar) (Fig. 2; Table 2). Based on a GIS analysis of the main types of land use in the coastal hinterland (500 m wide strip), these beaches were grouped into two general categories: urban and urbanized (Ariza, Jiménez, & Sardá, 2008a). Urban beaches were considered to be those located within the main town centre (high density). Urbanized beaches are those found in residential areas on the outskirts of a town (low density). By analyzing orthophotoimages of these beaches taken in 1996 and 2000, we determined that most users were located on a 35 m stretch of sand.

Table 2
Descriptive data obtained for the nine selected beaches used in this study in 2000

	S'Abanell North	Blanes Centre	Treumal	Sta. Cristina	Lloret Centre	Canyelles South	Sta. M Llorell	Platja Gran	Mar Menuda
Municipality	Blanes	Blanes	Blanes	Lloret Mar	Lloret Mar	Lloret Mar	Tossa Mar	Tossa Mar	Tossa Mar
Length (m)	1500	630	111	335	1300	200	385	370	160
Total beach surface (m ²)	49,500	27,090	3441	13,400	55,900	6600	13,310	19,980	4800
Average width (m)	33	43	31	40	43	33	35	54	30
Category	Urban	Urban	Urbanized	Urbanized	Urban	Urbanized	Urbanized	Urban	Urban
Exposition	Exposed	Semiexposed	Sheltered	Sheltered	Semiexposed	Sheltered	Sheltered	Semiexposed	Semiexposed
Erosion problems	High	Medium	No	No	Medium	No	Low	High	High
Promenade	Yes	Yes	No	No	No	No	No	Yes	No
Beach services	Complete	Complete	Medium	Medium	Complete	Complete	Medium	Complete	Complete
Harbour/marina	No	Yes	No	No	No	Yes	No	No	No
Hinterland	Urban town	Urban town	Forest + L.D.U.	Forest + L.D.U.	Urban town	Forest + H.D.U.	Forest + H.D.U.	Urban town	Urban town
Certifications	Blue flag	Blue flag	No	No	Blue flag	Blue flag	No	Blue flag	No
Sampled surface (m ²)	812	953	852	1020	830	195	1725	1140	615
Sampled width (m)	33	35	31	35	35	33	35	45	30
Useful beach surface (35 m stretch) (m ²)	49,500	22,050	3441	11,725	45,500	6600	13,310	16,650	4800
Maximum number of beach users									
People	5486	3313	444	1414	15,752	2521	1582	3608	1475
Day/h	10 Ag./13.00	10 Ag./14.00	14 Ag./13.00	07 Ag./13.00	01 Ag./16.00	01 Ag./15.00	17 Ag./17.00	14 Ag./12.00	07 Ag./13.00
Minimum sand availability	9.02	6.66	7.75	8.29	2.89	2.62	8.41	4.61	3.25
Sampling days	03/08:10/08	03/08:10/08	31/07:07/08	31/07:07/08	01/08:08/08	01/08:08/08	03/08:10/08	31/07:07/08	31/07:07/08
	17/08:24/08	17/08:29/08	14/08:28/08	14/08:28/08	22/08:29/08	22/08:29/08	17/08:24/08	14/08:28/08	14/08:28/08

The beach user profile most frequently found was analyzed by Roca and Villares (2008) for both types of beaches (urban and urbanized). Roca and Villares (2008) described the beach user profile by origin, age and accompanying people, and, in addition they gave details about their habits on accommodation and transport used to reach the beach. Analyzed beaches attracted more visitors than local residents, coming mainly from two groups: the city dwellers from the Barcelona metropolitan area and foreign tourists. Urbanized beaches were more frequented by visitors from Barcelona in 40% which altogether with locals and other Catalan people comes to 75% whereas in urban beaches this percentage decreased to 55% (Roca & Villares, 2008). On the other hand, in urban beaches, foreign tourist averaging 33% became the larger group. Foreign tourists mostly arrive at the region by a tour-operator, which brings them directly from home to motel and make difficult for then to reach urbanized beaches as public transport is mainly non-existent (Roca & Villares, 2008). British, French, and other tourist from eastern European countries were the most frequent visitors, staying basically in hotels and campings in this region, and with an estimate average spent of 85 euros per day (Instituto de Estudios Turísticos (IET), 2006).

2.3. Frequentation measures

Sand availability dynamics (using m² per user as the basic indicator) were calculated using high resolution, oblique, digital photos of the sample areas. Photographs were taken from different observation sites, ranging from high buildings located behind the sampled beaches to nearby elevated locations. The aim was to choose areas representing the average distribution of individuals on beaches, which was based on a preliminary field study carried out in 1999. Sampling areas mostly consisted of stretches of sand with a maximum width of 35 m (from the water line to the edge of the sandy area). We decided to study a wider stretch of sand (up to 45 m) on the Platja Gran beach in Tossa de Mar because tourists were clearly using this portion of the beach. Using these sample areas, we calculated the total surface area of the beach and the useful beach area (35 m stretches in all cases except for a 45 m stretch on Platja Gran) (Table 2). Sand availability indices and beach user numbers are given for the useful beach area in each case, that is, the part of beaches that is usually occupied.

The study was carried out from 1999 to 2000 in two successive stages.

- During August 1999, a pilot study was carried out by making daily observations of the Treumal beach. Aside from developing the methodology used, the aim of this study was to carry out research into the differences between weekdays and weekends during the peak tourist season. Four pictures were taken every day at 11:45 am, 13:45 pm, 15:45 pm and 18:45 pm.
- The complete study for the nine selected beaches was carried out during August 2000. Every beach was sampled once a week on a weekday with good weather conditions. Photographs were taken every hour between 9:00 am and 20:00 pm, providing a total of 12 photographs a day for each beach. The surface area of the sample areas photographed had been calculated previously. The number of users in each sample area was calculated by viewing the images using Adobe Photoshop software. To determine the overall number of users, we counted the people on the beach in well-defined spaces (i.e. towels, hammocks and/or parasols) and included towels on the sand under the assumption that they belonged to people who were bathing when the photograph was taken. After counting the number of users and calculating the sand availability per user, an extrapolation was made for the whole beach using the useful beach area measures, which are shown in Table 2.

Three of the sample beaches were analyzed in more detail. In these cases, the beach user rotation coefficient (11 daily “beach hours” measured/average length of stay by beach users) was obtained by calculating the total number of daily users and their arrival/departure patterns. Using markers, individual users were identified in every photograph and were monitored in consecutive pictures to calculate their arrival and departure times, and consequently the length of stay on the beach. New arrivals were counted and the total was then added to previous values to obtain a cumulative frequentation pattern.

2.4. Comparison of beach use between 1982 and 2000

Data about beach size, sand availability per user and number of users in 1982 were obtained from *Alemaný (1984)*. The author studied the whole of the Catalan coastline by analyzing aerial photographs of its beaches to calculate sand availability during the most crowded hours of the day at the peak of the season. Aerial photographs were taken from a plane on 1 August 1982 between 11:00 am and 14:00 pm, using a high resolution to obtain very good quality images. Pictures taken of the La Selva region were obtained between 12:15 pm and 12:45 pm. Some field work was done in parallel at several selected beaches to determine conversion factors. This made it possible to obtain values that could be used for purposes of comparison with the totals observed in the pictures at peak times of the day. These conversion factors were the ratio between users on the sand and users in the sea; and the relationship between the number of users at a given time and the number of users at peak times (*Alemaný, 1984*).

In order to compare the *Alemaný* study with our own, we used the minimum sand availability between 12:00 pm and 15:00 pm from the photographs taken during the first week of August. When estimating the total number of beach users, we accepted the principle adopted by *Alemaný (1984)*. He considered only people located within 30 m of the water line (useful beach width), regardless of the total beach width and its use. As in our case most of our sample stretches were 35 m wide (except Platja Gran), we subtracted the total number of beach users in the section 30–35 m from the water line (30–45 m in Platja Gran) from our calculation in order to perform the decadal comparison. In *Alemaný (1984)*, the sample space included the bathing area. In our study, to determine the overall number of users, we continued to make the assumption that the towels on the sand belonged to people who were bathing when the photograph was taken.

Between the time of the *Alemaný* study and our own, the sizes of some of the beaches have changed. The difference in the total surface area of some of the beaches is due to erosion and sediment management work. However, the differences are such that comparisons can still be made. In our study, beach size was calculated using Arc View software, a highly accurate Geographical Information System (GIS).

2.5. Geographical information system analysis

We used an existing GIS project developed for the coastal towns of La Selva (*Sardá, Avila, & Mora, 2005*) at a scale of 1:5000 to create applications for managing geo-related information and to calculate surfaces and buffers. In addition to other physical measurements for the beaches studied and the length of the water line, a new GIS layer was created by identifying the swimming pools visible in two sets of orthophotoimages (1996 and 2000) and aerial photographs (1977) taken of the region. All images were obtained from the Institut Cartogràfic de Catalunya (ICC). The total available swimming pool area was then calculated. Using the orthophotographs taken in the summer of 2000, we used the GIS to calculate the total beach area and the mean average width (*Table 2*) of the beaches.

3. Results

3.1. Frequentation measures

The frequentation of beaches showed pronounced daily fluctuations at the peak of the season. Beach users started to arrive at around 9:00 am and all of them had left the beach by 20:00 pm. Overcrowding problems occurred because most beach users tended to concentrate their stays in period of a few hours, mainly from 12:00 pm to 17:00 pm. The upper graph in *Fig. 3* shows the daily pattern of frequentation (measured as sand availability per user) on Treumal beach during August 1999, starting the first day of the month, which fell on a Sunday. Except for three days of bad weather (coincidentally the Thursday of the second, third and fourth weeks) all measures showed the same pattern: sand availability was between 5 m² and 13 m² per beach user at 11:45 am, 13:45 pm and 15:45 pm. It was much greater when measures were taken at 18:45 pm.

Weekends were not a significant factor in reducing sand availability per beach user on these types of beaches. No large differences in sand availability were observed between weekdays and weekends (*Fig. 3*, lower graph). Although a slightly higher number of users was detected at 11:45 am and 18:45 pm, during the hours of heavy use the data were almost identical.

In the data of 2000, the occupancy level of the analyzed beaches (*Fig. 4*) also shows pronounced hourly fluctuations. On plotting the average weekly dynamics of sand availability per user in the useful beach area during August (*Fig. 4*), three main situations become clear.

- (a) With the exception of Lloret Centre and Santa Maria de Llorell, the minimum values of sand availability for all beaches were recorded around mid-day. The general pattern was

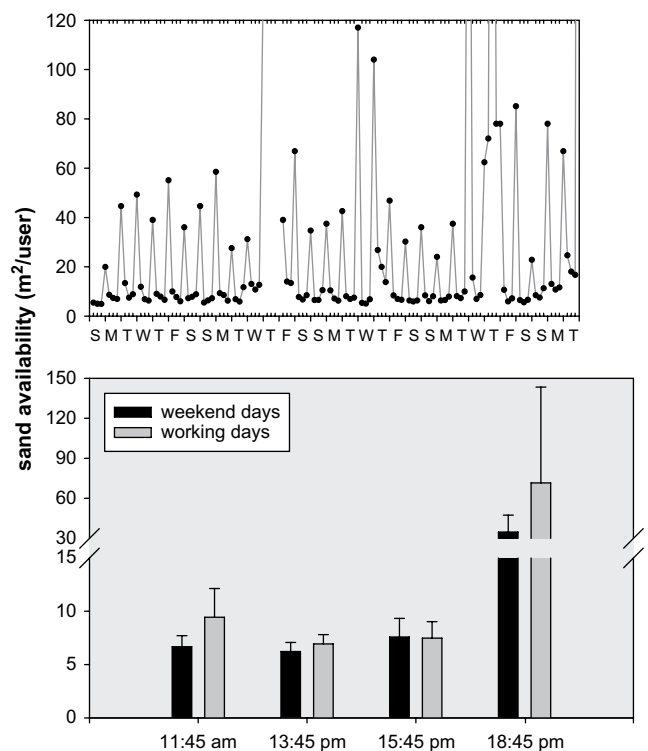


Fig. 3. Upper graph: daily fluctuation of sand availability per beach user for Treumal beach (August 1999; starting at day 1, Sunday – S, until day 31, Tuesday – T). Lower graph: average monthly sand availability at four times of day for Treumal beach (August 1999; 11:45 am, 13:45 pm, 15:45 pm, 18:45 pm).

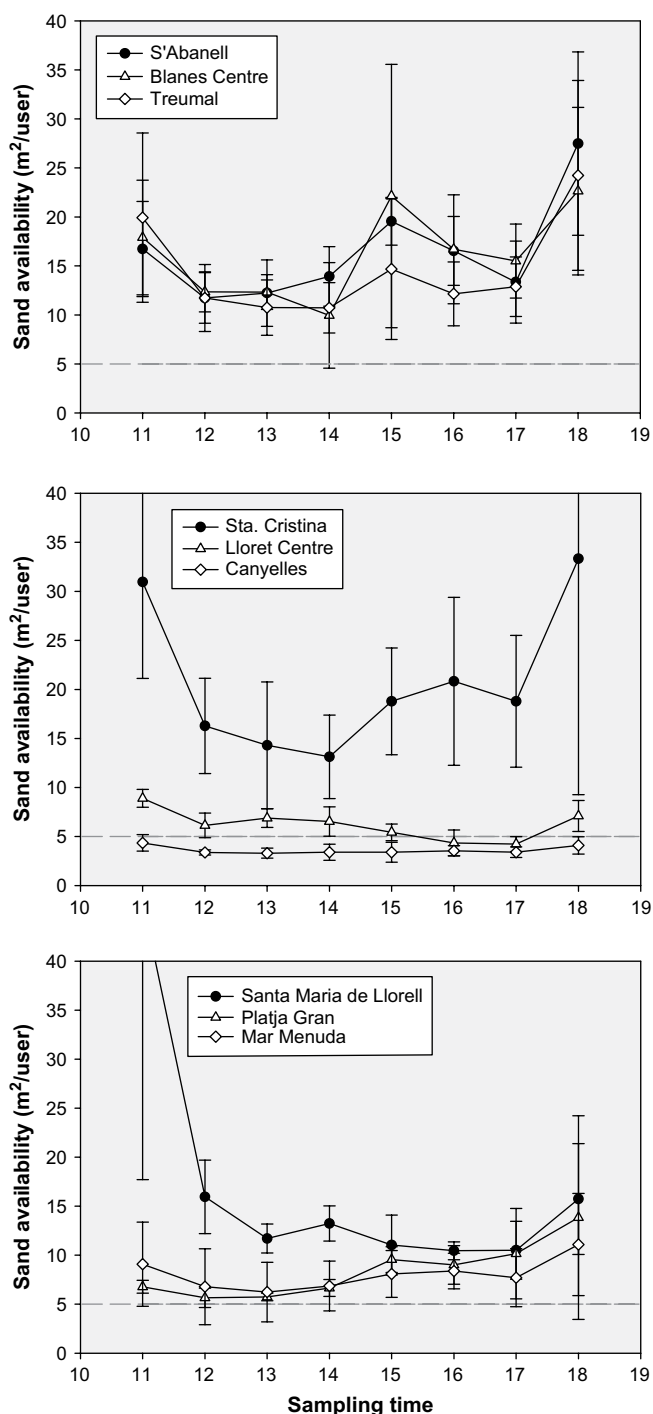


Fig. 4. Average monthly sand availability per beach user for the nine studied beaches (August 2000). Upper graph: beaches in Blanes. Middle graph: beaches in Lloret de Mar. Lower graph: beaches in Tossa de Mar.

characterized by a steady increase in the number of beach users during the morning, reaching a peak between 12:00 pm and 14:00 pm (least sand availability). This was followed by a slight decrease and then a second small increase to a second, lower peak, which was reached at 17:00 pm. After this time, a sharp decrease was observed during the remaining hours studied.

- (b) When we compared the general pattern observed between towns, the municipalities of Lloret de Mar (Fig. 4, middle graph) and Tossa de Mar (Fig. 4, bottom graph) showed more similarities between them – with four beaches heavily used

(basically the urban ones) and two others less frequented (the urbanized ones) – than with those of the municipality of Blanes (Fig. 4, upper graph), where patterns of occupation were similar for urban and urbanized beaches.

- (c) Using the sand availability per user as an indicator, beaches can be classified into two groups. At a given point in the day, four of the analyzed beaches (Lloret Centre, Canyelles South, Platja Gran and Mar Menuda) reached values of sand availability below 5 m² per user. In Canyelles South, values below this threshold were obtained during most of the day (Fig. 4, middle graph). All of these beaches were heavily used at some point during the day. The values of sand availability for the other five beaches (S'Abanell North, Blanes Centre, Treumal, Santa Cristina, and Santa Maria de Llorell) were generally above 10 m² per beach user and minimum sand availabilities were between 6.5 m² and 9 m² per user (Table 2). The average monthly sand availability per beach user between 12:00 pm and 17:00 pm for the nine studied beaches is shown in a box graph in Fig. 5.

Several authors in the literature have suggested a value of 4–5 m² per user as the limit at which a beach may be considered saturated and/or overcrowded (Alemany, 1984; Yepes, 1999). In order to calculate the level of saturation of the beaches analyzed here, we considered three different scales (hourly, daily and monthly) for the considered time period (11:00 am to 18:00 pm). Based on the above saturation value, the only beach with a monthly mean value below this figure would be Canyelles South. Values close to this threshold were found in Mar Menuda and Lloret Centre. When the daily values were considered, a mean value below 5 m² per user was also found in Lloret Centre at 17:00 pm. If we just focus on hourly values, we find that four of the nine beaches selected showed density ratios of less than 5 m² per user at some point in the summer: Mar Menuda on 7 and 28 August, Lloret Centre on 8 August and Canyelles South on 1, 8, 22 and 29 August. As indicated above, beaches in Blanes were less saturated than those in Lloret de Mar and Tossa de Mar.

The arrival and departure times of beach users were spread throughout the day and followed a similar pattern for all but two beaches. Although beach users arrived continuously between 10:00 am and 17:00 pm, most arrived between 11:00 am and 13:00 pm (Fig. 6, right-hand graphs). Lloret Centre deserves particular attention. In this case, although people also arrived throughout the day, the largest numbers arrived in the afternoon. In Lloret Centre, the continual increase of the density ratio from 12:00 pm onwards indicated that most beach users go to the beach late in the day, after lunch, probably as a consequence of having spent leisure time at night the day before.

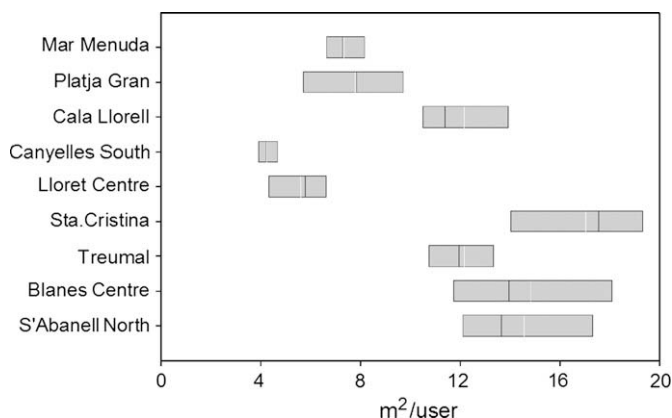


Fig. 5. Box graph showing the average monthly sand availability per beach user for each beach during August 2000.

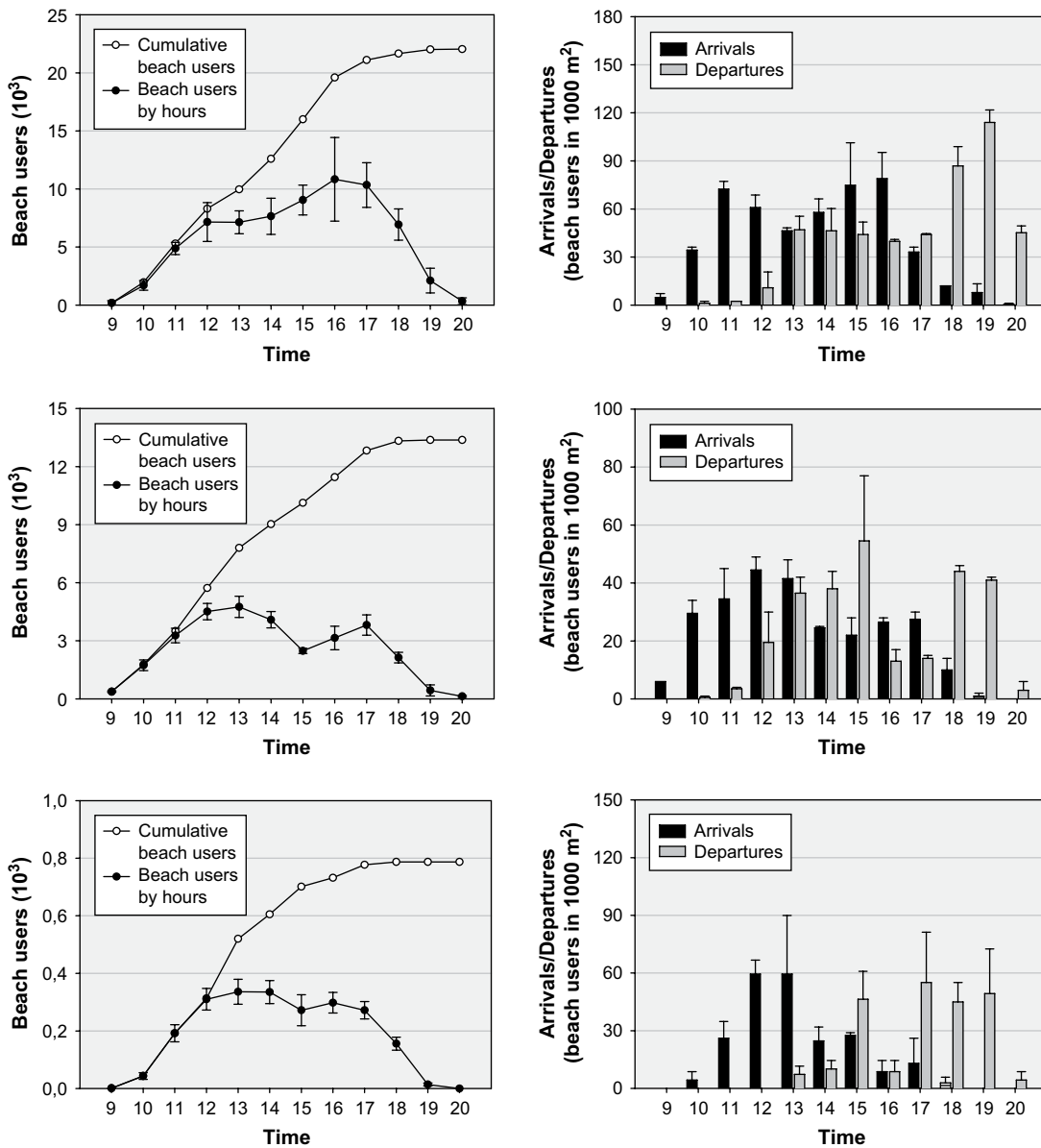


Fig. 6. Average daily dynamics and daily cumulative curve of beach users (left) and arrival at and departure from the beach (right) for three selected beaches in the region. Upper graphs: Lloret Centre. Middle graphs: S'Abanell. Lower graphs: Treumal.

The average daily beach user dynamics for the three selected beaches and the cumulative curve of beach users during the day are shown in Fig. 6 (left-hand graphs). Lloret Centre was the beach with the highest daily number of beach users in the region (Table 2). After Lloret Centre (22,036 beach users per day during the first week of August) were S'Abanell (13,375 beach users per day) and Treumal (787 beach users per day). The rotation coefficient for Treumal was lower (2.90) than for Lloret Centre (3.54) and S'Abanell (4.78), indicating that the average time spent on the beach per user was greater for Treumal (3.74 h) than for the other two beaches (3.11 h and 2.30 h, respectively) (see Fig. 7). The length of stay on the beach was greater among visitors arriving during the morning and was also greater for urbanized beaches than for urban beaches.

Arrival and departure times in the high season were concentrated into short spurts (Fig. 6, right-hand side). For most of the beaches, peak arrival times were between 11:00 am and 13:00 pm, with a second, smaller peak between around 16:00 pm and 17:00 pm. However, in Lloret Centre the trend is reversed and the

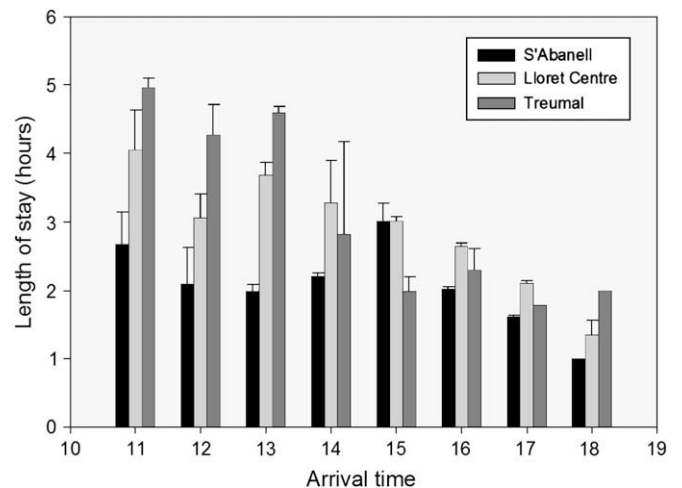


Fig. 7. Length of stay of beach users depending on arrival time for three selected beaches in the region.

highest peak was observed during the afternoon and not during the morning. Departure times for all beaches were usually between 13:00 pm and 14:00 pm, before lunchtime, and at the end of the day, between 18:00 pm and 19:00 pm.

3.2. Comparison of beach use between 1982 and 2000

During this 18-year period, changes in beach size were observed for the studied beaches (Table 3). These changes were caused by heavy erosion in the case of S'Abanell beach (Jiménez, Valdemoro, & Sánchez-Arcilla, 2003; Sarda, Pinedo, Gremare, & Taboada, 2000) and moderate erosion solved by beach nourishment practices in Blanes Centre (Serra, 1998), Platja Gran, and Mar Menuda. In addition to these erosion problems, for several beaches it also was necessary to carry out sediment redistribution. In these cases, the action of waves accumulated sediment at the edges of the beaches and relocation operations had to be performed each year before the start of the bathing season. Exposed beaches are eroded periodically by storms. In order to maintain constant, sufficiently large areas of sand, it was necessary to replenish them periodically with sediment from other locations. When beaches were not replenished, the amount of sand decreased rapidly, which can be most clearly seen in S'Abanell North. As a result of these problems, the area of S'Abanell North beach decreased from 108,000 m² in 1982 to 49,500 m² in 2000 (more than 50,000 m² of the beach surface disappeared). In contrast, the remaining beach surface in the region has increased by approximately 10%, thanks to sediment management work: in Blanes Centre from 18,000 m² to 27,090 m², in Platja Gran from 17,000 m² to 19,980 m², in Mar Menuda from 3200 m² to 4800 m² and in Sta. Maria de Llorell from 11,550 m² to 13,310 m². In the rest of the beaches the area remained largely the same: Lloret Centre (54,000 m² and 55,900 m²), Treumal-Santa Cristina (15,000 m² and 16,841 m²) and Canyelles (16,000 m² and 13,200 m²). The relationship between beach size and the number of

users was obviously important, since beach users generally remain within 35 m of the water line. This consideration applied to all studied beaches except for Platja Gran in Tossa de Mar, where users were located up to 45 m from the sea. This is important when beach nourishment is required. If nourishment needs to be carried out, areas beyond 35 m from the water line will essentially be used as sand reservoirs if erosion rates have been studied or extra services will be established there. However, the additional space will not be used to attract more people to the beach.

When we compared the data from Alemany (1984) with the minimum sand availability between 12:00 pm and 15:00 pm during the first week of August (Table 3; Fig. 8) obtained in our study, we noticed that for most of the studied beaches sand availability per beach user was greater in the year 2000 than 18 years earlier. The most notable result was obtained in Santa Cristina, where sand availability per user increased from 8.9 m² in 1982 to 16.3 m² in 2000. Other notable increases were observed in S'Abanell North (from 8.7 m² to 11.7 m²), in this case even despite a reduction in size, in Blanes Centre (from 9.6 m² to 11.2 m²) and in Mar Menuda (from 4.4 m² to 6.6 m²). Values in Treumal, Lloret de Mar and Platja Gran did not change significantly (Table 3). In contrast, a considerable decrease in sand availability was observed for the other two beaches compared, Canyelles South and Santa Maria de Llorell. The Llorell indicator fell from 27.2 m² to 7.1 m² and the corresponding value for Canyelles fell from 10.5 m² to 2.6 m², the smallest area registered in the study.

Comparing the data of Alemany (1984) with our data, the number of beach users at the peak time of the day decreased in S'Abanell North, Blanes Centre, Santa Cristina-Treumal and Mar Menuda (Table 2). The greatest decrease occurred in S'Abanell North, where the estimated number of users was 6207 in 1982 and 3837 in 2000. The number of users of the other beaches increased dramatically (Table 3), particularly in the case of Canyelles South.

Table 3
Comparison between the 1982 (Alemany, 1984) and 2000 values of mean sand availability per user and beach user numbers for the beaches studied in La Selva

	1982 (30 m stretch)				2000 (35 m stretch)				
	Total beach surface (m ²)	Useful beach surface (m ²)	Minimum sand availability (m ² per user)	Maximum number of users	Total beach surface (m ²)	Useful beach surface (m ²)	Minimum sand availability (m ² per user)	Maximum number of users	Percentage beach users (>30 m)
S'Abanell North	108,000	54,000	8.7	6207	49,500	49,500	12.9	3837	0
Blanes Centre	18,000	18,000	9.6	1875	27,090	22,050	13.1	1683	0
Treumal	15,000	15,000	8.9	1689	3441	3441	9.7	355	0
Sta. Cristina					13,400	11,725	17.9	655	6
Lloret Centre	54,000	40,500	5.5	7350	55,900	45,500	4.9	9276	9
Canyelles	16,000	12,000	10.5	1140	6600	6600	2.6	2521	0
Sta. Maria de Llorell	11,550	11,550	27.2	425	13,310	13,310	8.3	1604	0
Platja Gran	17,000	10,200	3.9	2631	19,980	16,650	5.4	3716	20
Mar Menuda	3200	3200	4.4	750	4800	4800	6.6	726	0
Total	242,750	164,450		22,067	200,621	180,176		26,895	24,855
Average minimum sand availability				7.45				6.70	6.26

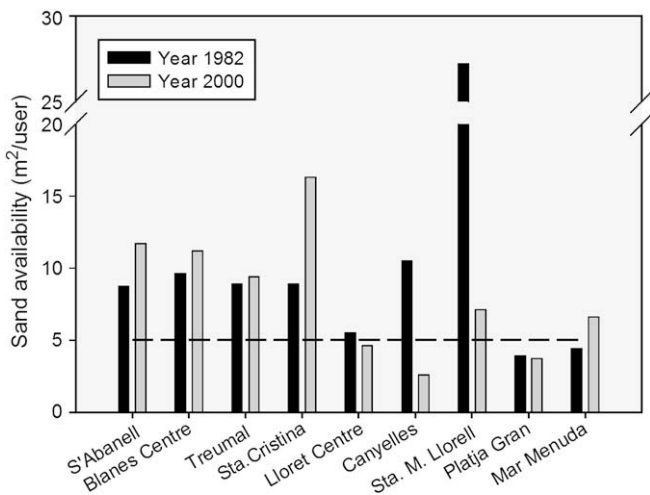


Fig. 8. Comparison of the mean sand availability per beach user between 1982 and 2000 during the first week of August for the nine studied beaches. Data for 1982 were taken from Alemany (1984).

4. Discussion

Despite international competition, the number of tourists on the Costa Brava has increased year by year for decades following world tourism tendencies. These Western Mediterranean sites are still being the leading world tourist destinations. Measured through official surveys, these increases still seem to be based on a “sun and sand” model. In recognition of the importance of beaches as highly valuable tourist resources, European and National strategies have made considerable efforts to enhance the excellence of such natural areas by improving the hygienic quality of the sand and water (Bathing Directive) and through the introduction of different Quality Awards and International Standards that are essentially user-oriented (Ariza, Jiménez, & Sardá, 2008b). As a consequence, more formal beach management processes are seen to be put in practice every day (James, 2000). Nevertheless, in a recent questionnaire sent to beach managers along the Catalan coast (Ariza et al., 2008a), it was surprising to discover that no periodic quantitative evaluation of the level of beach use was carried out in any municipality. It seems that beach managers do not consider the possibility of any problems derived from beach frequentation patterns as in other parts of the world (Dwight, Brinks, Sharavana Kumar, & Semenza, 2007). If a saturation problem occurs, managers may either see it as a “normal” situation that should simply be accepted or assume that beach users will restructure their behaviour according to the availability of the resource.

Comparison of the patterns observed in 1982 and 2000 showed that, except for Lloret Centre, urban beaches have maintained or increased the sand availability ratios measured in 1982. On the other hand, urbanized beaches revealed two different and clear patterns. The 1982 data for Treumal and Santa Cristina were aggregated and both beaches were considered to have the same sand availability ratio; the data from 2000 revealed slight differences between the two beaches, but it was clear that the sand availability ratio had not decreased on either of them. In contrast, a considerable decrease in sand availability was observed in Canyelles South and Santa Maria de Llorell. The increase in beach users observed in Canyelles South and Santa Maria de Llorell and the resulting decrease in sand availability ratios were probably due to the extensive urban development of the surrounding area during this 18-year period, which did not occurred in Treumal and Santa Cristina by land preservation policies. Urban development in the area of Canyelles and Santa Maria de Llorell has been permitted on a massive

scale and a marina has been built, therefore they became as almost urban beaches despite its original rural nature (Martí, 2005).

The total number of beach users increased slightly between 1982 and 2000 (Table 3) but the redistribution of these users changed the frequentation patterns from those observed in 1982. In general, the number of beach users in Blanes is lower than that in 1982; in Lloret de Mar and Tossa de Mar, the frequentation patterns are fairly similar for urban beaches and noticeably higher for urbanized beaches. When we compared the minimum sand availability data for 1982 and 2000, based on the useful beach area availability in a 30 m strip (Table 3), similar aggregated values were observed: 7.45 m² per user in 1982 against 6.26 m² per user in 2000. The beach area available to the entire beach user population in the region was only slightly different to the corresponding area in 1982. However, these patterns of beach use were concurrent with a rapid increase in the use of land by people and businesses, a sharp increase in the resident population and the urban development of the area (Fig. 9, upper graph). Although the resident population and the number of second homes in the region increased sharply during the period considered and the number of tourist accommodations remained the same, the maximum number of beach users at the peak time of day did not increase at the same rate. Coastal towns in La Selva are very crowded during the summer, which has always been related to the presence of beaches and their effect on tourism. It seems contradictory, therefore, that most of its beaches are still able to receive more visitors in summer while the towns and villages can barely support the current population numbers.

We cannot be sure of the exact causes of this paradox, but beach frequentation numbers did not increase at the same rate as the resident population and the number of tourist activities available in

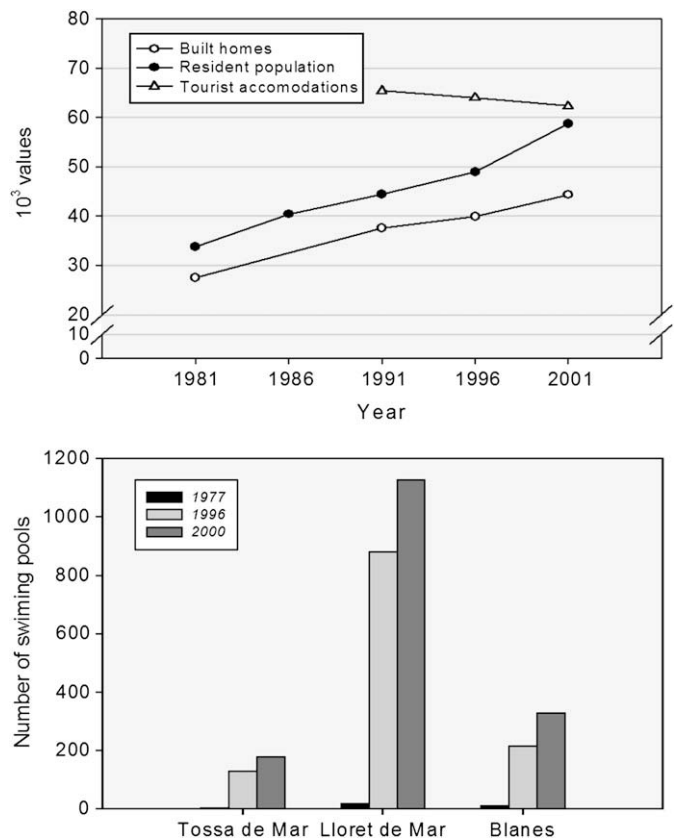


Fig. 9. Upper graph: evolution of socio-economic data in the coastal municipalities of the La Selva region. Lower graph: evolution of the number of swimming pools in these three municipalities.

the region. There are at least three possible explanations for this observation, which may be complementary: (a) the total number of beach users in 2000 may have been much higher than in 1982 but the length of stay on the beach was much shorter; (b) the availability of other tourist activities in the region increased so tourists had a far greater range of facilities to choose from, other than the beach, than in 1982; and (c) beach users may have restructured their behaviour so that they now substitute all, or part, of the time spent on the beach for the use of private swimming pools. Unfortunately we have no cumulative data on the length of the stay of beach users in 1982. However, we do know that the regional tourist authorities have promoted the diversification of other tourist facilities near beaches to provide new leisure experiences. Furthermore, our observations of the orthophotomages of the area (Fig. 9, lower graph) revealed that the construction of swimming pools had grown at an average of at least 7% over the last four years. This growth is higher than the construction of new homes in the region (Sardá, Mora, & Avila, 2005). Potential beach users may now choose to bathe at home rather than go to the beach or to combine both types of leisure activity, thus reducing the length of the stay at the beach. Moreover, the total available area of swimming pools in the coastal towns of La Selva (7.65 Ha) would in theory cover rectangular area measuring 8.24 m in width and of a length equal to the combined total of all the beaches in La Selva. A combination of these three factors may be bringing about a change in the preferential behaviour of the average beach user in the region. This could be a general pattern to be observed in many mature tourist destinations based on the “sun and sand” model.

The concept of tourism in La Selva was originally based on its main attractions: the beaches and seafront (Cals, 1982). This is no longer supported by current data, and official surveys indicate that tourist behaviour is not solely dependent on beaches. Furthermore, the average tourism growth rate in the region does not indicate a decline for this destination. Although many of the doubts over certain tourist destinations are based implicitly on the capacity of their principal attractions, it seems that the available beach area is not a significant factor as it was decades ago. The old concept of traditional (mainly vacational) tourism, based essentially on the “sun and sand” model, has been modified by a new form of tourism in which residential tourism is becoming an increasingly important factor, the degree of repetition is increasing and a new “home and pool” model is developing in parallel to the traditional “sun and sand” model. There are also changes in tourist behaviour; the number of holidays per year has increased, while the length of stay has decreased (Alegre & Pou, 2006) and a greater turnover of traditional tourists. This behaviour could also be extrapolated to the way in which these tourists use the beaches during their leisure time. Given the limits of some of the natural resources that previously attracted visitors to the area, such as beaches, new artificial attractions like swimming pools or nearby attractions and activities (water parks, visits to gardens, historical monuments, etc.) are developed. As described for other Mediterranean areas (Aguiló et al., 2005) the tourism market on the Costa Brava is continuing to grow, but this is based on the restructuring of the market and of tourist behaviour rather than its beaches, although their aesthetic and natural qualities will always be essential.

Besides these new leisure trends, beaches are still the main asset for many Mediterranean coastal resorts and the proper management of the beach environment is therefore needed. The management of beach ecosystems must move beyond the use of performance standards and performance rating systems and the use of Environmental Management Systems (EMSs) for beaches should be highlighted (Ariza et al., 2008b). EMSs provide an overall framework that nevertheless allows different approaches to be taken according to the particular characteristics of each beach. The measurement of frequentation patterns should be considered

essential in such frameworks, not only to monitor decadal tendencies of beach use, but also to manage and limit further overcrowding problems.

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