Master‘s thesis

The Scarcity and Vulnerability of Surfing Resources

An Analysis of the Value of Surfing from a Social Economic Perspective in Matosinhos, Portugal

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Master of Resource Management: Coastal and Marine Management
Ísafjörður, January 2011

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60 ECTS thesis submitted in partial fulfilment of a Master of Resource Management degree in Coastal and Marine Management at the University Centre of the Westfjords, Suðurgata 12, 400 Ísafjörður, Iceland

Degree accredited by the University of Akureyri, Faculty of Business and Science, Borgir, 600 Akureyri, Iceland

Printing: Druck Center Uwe Mussack, Niebüll, Germany, January 2011

Declaration

I hereby confirm that I am the sole author of this thesis and it is a product of my own academic research.

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Abstract

The master thesis "*The Scarcity and Vulnerability of Surfing Recourses - An Analysis of the Value of Surfing from a Social Economic Perspective in Matosinhos, Portugal"* investigates the potential socioeconomic value of surfing and improvement of recreational ocean water for the City of Matosinhos. For that reason a beach survey was developed and carried out in order to find out about beach users activities, perceptions and demands. Results showed that user activities were dominated by sunbathing/relaxation on the beach and surfing and body boarding in the water. The main environmental concern of beach users was water pollution. Furthermore, the thesis recommends including surfing breaks as natural and cultural recourses within future coastal management plans and investigates the possibilities for the implementation of a local beach management strategy for Matosinhos under the umbrella of Integrated Coastal Management in Portugal.

Summary

Because of the structural change Matosinhos has experienced new development in the form of coastal residences and commerce. The beach is under increased pressure from these developments/anthropogenic factors and experiences an increased complexity of management issues concerning social, economic, institutional and environmental/biophysical and legal matters. Therefore it is important to further evaluate the resource demands of beach users and try to consider these within in future beach management decisions. The presented case study of Matosinhos can be seen as initial, explorative research providing basic results regarding beach and ocean users perceptions. However, the study has tried to evaluate the socioeconomic value of the beach considering surfing aspects and the beach quality of Matosinhos Beach. For that reason the survey investigated the following aspects among beach users:

- user activities;
- the personal meaning of Matosinhos Beach/surfing aspects;
- environmental issues;
- user conflicts;
- and the demographic data of beach users.

In order to estimate the socioeconomic value of surfing and beach quality of Matosinhos a user profile of the beach has been developed to show the users interest and personal value of the beach. Furthermore environmental and user conflict issues were considered, since they influence the value or quality of the beach. Due to the fact that Matosinhos Beach is an urban beach, surrounded by the port- and oil industry, there was the presumption that water quality might be an issue of the site. However, the survey results and several personal observations of the site show that water pollution was an extraordinarily important issue. According to Goncalves (personal interview, 4th November, 2010) it is necessary to consider the historic context of North Portugal as one as the most heavy industrialized regions of the country. Recently there have been improvements/progress on

wastewater treatment; however there is still a long way to go until Portugal complies fully with the EU Water Framework Directive. It is very hard to maintain up to date information about the progress of wastewater treatment in North Portugal. According to Prata Dias Santos (personal interview, 15th September, 2010) a sewage treatment station for Matosinhos is existent. However, the treatment of wastewater appears to be failing continuously. Along the Portuguese coast treatment of wastewater might be in place, but often fails for several reasons (C. Goncalves, personal interview, 4th November, 2010). Exceeding the carrying capacity (especially during rainfalls) due to poorly designed (too small) treatment stations, old and not well maintained sewerage and illegal waster water connections to the system are assumed to be the main reasons for the failing of treatment in Matosinhos (M. Weber, personal interview, 10th October, 2010, C. Goncalves, personal interview, 4th November, 2010).

Another critical aspect in the survey was the urban development along the seaside of Matosinhos. Especially concerns over the dominant, urban, "concrete architecture" were mentioned.

Further more the typical effects of erosion caused through the construction of a sea promenade were observed, but not mentioned by beach users critically as the situation was not seen as "dramatic". Another reason for not mentioning the erosion problem might be the general lack of sensibility and awareness regarding this issue. A different presumption was that user conflicts at the beach and in the water might occur more or less frequently in summertime, due to exceeding the carry capacity of the beach. However, the conflict potential was not exponentially high and can be described as moderate and typical for an urban beach. The evaluation of the personal meaning of Matosinhos Beach was showing that attributes associated with Matosinhos Beach ranged from "nature", "freedom", "relaxation", "surfing" "to dirty". User activities on the beach were dominated by sunbathing / relaxation and in the water by surfing and body boarding.

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Acknowledgements

First of all I want to express my deep gratitude to my advisor Dr. Andreas Kannen for his good, calm and analytical advise, guidance and encouragement throughout the thesis work. I also would like to thank very much Prof. Dr. Rolf Klintworth for his encouragement and support to take up this Master's degree. Further I would like to thank the whole staff of the Litoral Station in Aguda, Portugal for their great support in many ways and a 24-hour access to their library. I would also like to thank my friend Vitor Santos for providing me with accommodation and transportation throughout my research time in Portugal - without his help this research wouldn't have been possible. Furthermore I would like to thank very much Fabio Sousa for conducting interviews with me in Portuguese and his translations. Finally I would like to thank my parents Marianne and Michael Eberlein as well as my sisters, Henriette, Tina and Elinore, my niece Marie and cousin Max and my friends for their patience, support and love.

Jonathan Eberlein

1. Introduction

Surfing is a major recreational and economic activity, involving human interaction with diverse coastal environments on sea and land. There is a rising popularity in surfing in many countries with a significant economic contribution of surfing to local communities. It is estimated that over three million people surf on a regular basis in Australia and California. Dolnicar and Fluker (2003) identify surf tourism as a growing industry, with only a few research investigations on the topic. Surfing tourism has grown steadily and has become a multi million-dollar industry and is generating monetary income for many coastal communities.

Surfing and surfers are very sensitive to changes in environmental conditions and coastal infrastructure. Water quality, hard coastal defense structures, coastal development and beach access are one of the main concerns as they can have a great impact on surfing. Despite the popularity of surfing, surfing is usually not considered in coastal management decisions. Until recently surfers have had little political say in the management of their recreational space (Scarfe et al., 2009).

At present there is little research on the economic and cultural value of recreational surfing world wide - even in traditional locations such as the east coast of Australia and in California. However, there is ample evidence that demonstrates the associated economic benefits of surfing breaks to coastal communities (Lazarow and Nelson, 2007). In addition, surfing has been identified as a key tourist attraction in many locations (Buckley, 2002).

My Master Thesis will investigate the potential economic, social, environmental and cultural importance of surfing worldwide, particularly the city of Matosinhos/Porto. In addition the work aims to analyze the need for considering the surfing beach within future coastal management decisions in this specific area. For that reason a beach survey was developed and carried out in order to find out about beach users activities, perceptions and demands. Furthermore, the current threats and main concerns of the beach and surfing resource will be identified. The socio economic assessment of the beach aims to support the need to invest in sustaining the wave and improving the environmental situation of the

site. Furthermore, I will provide suggestions for the best practices in managing the beach of Matosinhos holistically. Moreover, the thesis recommends including surfing breaks as natural and cultural recourses within future coastal management plans and investigates the possibilities for the implementation of a local beach management strategy for Matosinhos under the umbrella of Integrated Coastal Management in Portugal.

The central dominating role and influence of human activities on the biosphere was described by the atmospheric chemist Paul Crutzen (2002) with the term *"Anthropocene"* in the beginning of the industrialization. Worldwide, many coastal economic activities have caused a degradation of marine and coastal ecosystems and endanger the functionality of critical ecosystem services for our mankind. Surfing resources are not considered as valuable and rarely contribute significant to the functionality of ecosystem services, because they only seem to provide the natural basis for a "hedonistic" pastime. Under the premise to archive a more sustainable coastal development the critically research question arises: Why is it worthwhile to consider surfing recourses within the concept of Integrated Coastal Management?

The main objectives of the thesis are therefore the followings:

1. To investigate the potential economic, social, environmental and cultural importance of surfing worldwide, particularly the city of Matosinhos

2. To analyze the need for considering the surfing beach within future coastal management decisions in this specific area

3. To identify the current threats and main concerns of the beach and surfing resource. For these reasons (mainly point 1, 2 and 3) a beach survey was carried out in order to find out about beach users activities, perceptions and demands

4. To assess the socioeconomic importance of the beach and aims to support the need to invest in sustaining the wave and improving the environmental situation of the site

5. To provide suggestions for best practice in managing the beach holistically

6. Finally to recommend including surfing as cultural and natural resources within coastal management plans and investigate the possibilities for the implementation of a local beach management strategy for Matosinhos under the umbrella of *ICM* in Portugal

In order to achieve the objectives listed above, the thesis is comprised of five chapters (including the previous introduction): First of all, the second chapter tries to describe the economic and cultural value and significant importance of surfing breaks to coastal communities. Furthermore, the main physical characteristics and potential threats to surfing resources are classified and discussed. Chapter three examines the concept of *Integrated Coastal Management (ICM)* within the context of a sustainable management of surfing resources and the surfing beach of Matosinhos. Chapter four discusses the case study results of Matosinhos including a discussion of local problem solutions and mitigation measures regarding the implementation of a local beach management. Last but not least further ideas and suggestions involving a larger spatial development strategy (on the regional scale) within the background of a sustainable urban coastal development are being discussed. Finally, chapter five summarizes the major findings of the research and presents an argumentation to implement surfing break management within the concept of *Integrated Coastal Management (ICM).*

As mentioned before the theoretic framework of this thesis examines the diverse economic, cultural and physical aspects along with the main threats to surfing resources in the context of the concept of Integrated Coastal Management. Therefore, chapter two and three provides a more general and wider overview of surfing by contextualizing the importance of surfing to coastal communities and the urgent need to consider surfing recourses within future coastal management plans and the concept of *Integrated Coastal Management (ICM)* in Portugal and worldwide. The reader, who is familiar with the mentioned premise might be comfortable to start reading directly in chapter four consisting of the case study Matosinhos Beach.

2. The Socioeconomic Value of Surfing

2.1 Available Research-Based Surfing Literature

The following will outline the research-based literature on surfing and integrated coastal management, therefore providing relevant background information for the ideas and concepts presented in this thesis. The following literature review, (which is self contained within the Chapters 1-3) tries to give an overview about the relevant research based literature. It will focus on the following research areas and tries:

1. To investigate literature on the socioeconomic value of surfing to coastal communities;
2. to describe the oceanographic/physical factors of surfing waves and breaks;
3. and research based surfing literature in the context of an integrated coastal management and a sustainable management strategy for surfing beaches, which is mainly driven by the concept of protection by use.

According to Scarfe, Healy, Rennie, (2008) there has not been any "peer-reviewed research catogorising" in the field of surfing literature until recently (p. 11). Scarfe et al. (2008) were among the first to undertake a comprehensive literature review and categorizing of research based surfing literature. This thesis will refer to significant literature (mainly on the physical processes of surfing waves and the economic value of surfing) of this review and in addition will investigate the ideas of integrated coastal management and concepts for a sustainable beach/surfing break management strategy in the context of a protection by use concept.

Rising Publications of Surfing Literature

Until recently there were only a few publications about scientific surfing science available. Worth mentioning, are the baseline studies on the physical aspects of breaking waves were conducted by the University of Hawaii. Walker and Palmer (1971) Walker, et al. (1972) and Walker (1974a and b) were identified as pioneer researches by Scarfe et al. (2003). Scarfe et al. (2008) only identifies a few publications available in the last decade. According to the Work of Scarfe et al. (2003) only 63 scientific surfing publications were

published in the last ten years. However, this changed just recently: A newer study published by Scarfe et al. (2008) shows over 162 research based surfing publications, most being published in the beginning of the year 2000 until yet. One explanation for this sudden raised publication rate might be the that the surfing community is trying harder to protect surfing breaks from destruction caused by coastal development and other coastal management decisions, by backing up their environmental concerns with scientific studies (Scarfe et al. 2008). Another reason might be the introduction of artificial surfing reefs or multipurpose reefs in order to enhance the wave quality and/or protect the coast and shoreline from further erosion. Such environmental impact assessments were conducted e.g. by Challinor (2003), Edwards (2004) and by Burgess, Black, Mead, Kingsford (2003). The employment of artificial surfing reefs shows that surfing itself is growing and gaining more economic importance for coastal communities (Pratte, 1983, Lazarow, Miller, Blackwell, 2007, Nelsen, Pendleton, Vaughan., 2007).

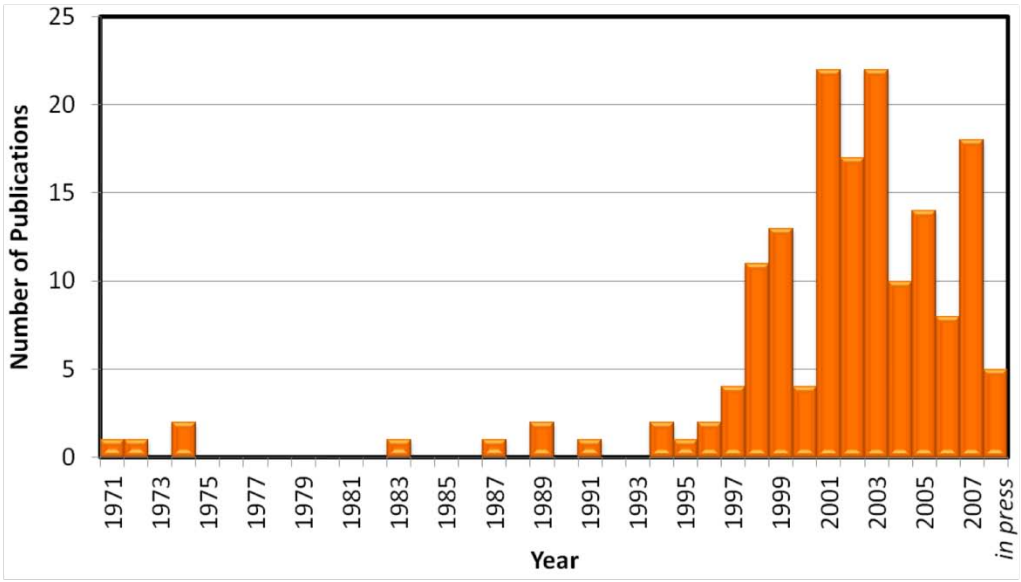

Figure 1 Distribution of research based surfing publications (Scarfe et al., 2008)

In the last 30 years the public has become increasingly aware of environmental problems facing our world. In 1972 the first international conference on the environment in Stockholm was held. 30 years later in the year 2000 the United Nations Environmental Programme (UNEP) report Global Environmental Outlook 3 (as cited in Haris, 2005, p.5) stated that, "environmental gains from new technology and policies are being overtaken by

the pace and scale of population growth and economic development." The UNEP follow up report in 2002 points out that from the first Stockholm conference in 1972 "the world has made great strides in placing the environment on the agenda at various levels from international to local…the level of awareness and action has not been commensurate with the state of the global environment today; it continues to deteriorate. (as cited in Haris, 2005, p.5)." The UNEP reports are concluding that environmental problems, like

> "nitrogen pollution in fresh water and oceans, exposures to toxic chemicals and hazardous wastes, forest and freshwater ecosystem damage, water contamination and declining groundwater supplies, urban air pollution and wastes, and over exploitation of major ocean fisheries", have continued or even worsened (Haris, 2005, p. 4)."

How is it possible to respond adequately and on time in order to prevent irreversible damage to our world's flora, fauna and ecosystem services? In this chapter case studies are discussed, which attempt to address and solve environmental issues of surfing resources by using traditional economic techniques. This Traditional Economic Approach uses models and techniques, which have their origin in the standard, neoclassical mainstream of economics. This includes the neoclassical price theory, which is based on the idea of marginal utility and marginal productivity by affirming a market price, which is archiving an equilibrium between supply and demand (Ecklund and Hebert, 2002). The other approach in environmental economics is the so-called Ecological Economics Approach and takes a different way. Rather than applying traditional economics to the environment, the Ecological Economic Approach tries to place economic activity in the context of the earth's biological and physical system by including all human activities. Ecological economics takes the importance of energy recourses, especially fossil fuels into account. So ecological economics can be distinguished from environmental/traditional economics by its treatment of the economy as a subsystem of the ecosystem and its main goal is to preserve the natural capital. A survey conducted by Illge and Schwarze (2008) gives evidence that ecological and environmental economists are coming from different schools of thought. Ecological economists are emphasizing a strong thought of sustainability and refusing the "old school economical thinking", that natural capital can be substituted from human-made capital. Constanza et al. (1997) estimate that the momentary value of all ecosystem services is at least 30 Trillion US-Dollars worth. As mentioned surfing recourses certainly have an economic value. However, the following case studies on the

economic value of surfing resources feature valuation techniques from the traditional economic approach mainly using the Travel Cost Method.

2.2 The Scarcity of Surfing Breaks

The Scarcity of a Wave – A Fundamental Economic Problem

Scarfe et al. (2009) estimates that New Zealand has only one surf break every 39-58 km. Surfing breaks are scarce, because compared to the length of the world coastline there are relatively few surfing breaks available. This fact relates strongly to the physical characteristic of a surfing wave. The advanced surfer desires a peeling wave. The breakpoint of the wave peels along the wave's shoulder (Scarfe et al., 2003, a). The surfer rides along the breaking wave, and tries to stay close to the powerful 'wave pocket', the critically, powerful, breaking point of the wave. Natural factors such as tide, wind, swell height and directions, as well as seabed conditions and the shape of the shore/beach influence greatly the quality of a wave. Clean, peeling waves are relatively seldom, whereas messy unorganized waves, with a tendency of "close out breaking" are more abundant.

High quality surfing breaks are vulnerable to coastal development, scarce, and possess an economic, sporting and aesthetic value. The recreational, aesthetic and associated economic value of a high quality surfing break to a coastal community is often significant (Nelsen et al., 2007).

Matosinhos Beach features several exceptional physical and oceanographic characteristics such as a natural, rocky headland in the south and a manmade seawall of the port in the north, which direct and trigger waves to peel into the bay. Furthermore the headland and the seawall perform as windbreakers and protect the waves from being "messed up" by side shore winds. More importantly, both structures provide a sheltered area, with durable sandbanks (with some rocks found on the sea bottom on the southern headland), which are able to hold large swells. Matosinhos Beach is a scarce surfing resource, because it is the only surf spot in a range of ca. 80 km in greater Porto, which features outstanding, peeling quality waves on great swells and is for this reason, distinguished and recognized by the surfing community in North Portugal. The city of Matosinhos is currently not considering

the significant recreational, aesthetic and associated economic value of this marvelous and central surfing resource, which is located just a few kilometers away from central Porto.

2.3 The Economic Value of Surfing Breaks

Several case studies have pointed out the economic benefit of surfing to coastal communities. Some of theses studies are trying to put a monetary value on a surfing wave. The following studies estimated the economic value of surfing by using the travel cost method. The main reasons for those studies were, that the surfing resources were threatened through coastal development.

According to Scare and et al. (2009) the economic impacts of surfing have been far less researched than the oceanographic processes. The oceanographic processes of a breaking wave are quite well understood. According to Lazarow, understanding the value of surfing breaks relative to other activities might help to solve resource management conflicts between surfing and other coastal users (Lazarow et al. 2007). A scientific study from Baily and Lyons 2003 and Tourism Resource Consultants 2002 (as cited in Baily and Lyons, 2003) found out the economic impact of artificial surfing reef developments. They reported cost/benefit ratios to the economy of artificial surfing reefs, ranging from 20:1 to 70:1.

Larzarow & Nelson (2007) have reported that 20 million Australian Dollars (about 18.5 million USD) per year has been spent by surfers at the South Staradbroke Island surfing break on the Gold Coast in Australia. Furthermore, Lazarrow & Nelson (2007) estimates that there are between 18 to 50 million surfers worldwide. In fact surfing may still have an underground image, but it became in many parts of the world a mainstream culture. Surfing has gained mass media coverage from television and other media. Several times world surfing champion and celebrity Kelly Slater was featured in several PC and Play Station computer games. Surfing has become a professional business worth millions of Dollars. According to Buckly (2002) the surfing industry has an annual turnover of about 10 million U.S. Dollars.

The importance of surfing to local economy shows the example of the former fishing village Mundaka, in Spain. Historically known for it's fishing, Mundaka has only two fishing vessels left (Turismo Mundaka, 2007 ((as cited in Murphy & Bernal, 2008)). On average it is estimated that surfing brings between 5000 to 15000 surfers to the small village every year and attracts additional 20000 to 30000 visitors through the Billabong Pro surfing contest (Murphy and Bernal, 2008). The surrounding landscape of Mundaka is protected through a biosphere reserve that has successfully protected the area from major building projects and resource exploitation. Mundaka has ca. 1900 inhabitants and nature-based tourism related to the biosphere reserve as well as surf tourism is expanding (Murphy and Bernal, 2008).

Shipbuilding is a major threat to the surf community and to local businesses, which profit increasingly from surf tourism (Murphy and Bernal, 2008). The shipbuilding yard is located some kilometers up river from the Guernica estuary in Mundaka. Approximately one ship is built every five years and recently these ships have been getting larger (Murphy and Bernal, 2008). In 2004, a dredging project was needed in order to navigate the latest ship out to sea. An unfortunate side effect of this dredging was the destruction of the sandbar that shaped the wave. "The dredging changed the flow of the river so drastically that the coastal seawater just blubbered and swayed where it used to rear up into a speeding curl. It was a catastrophe, not just for surfers but also for tourism in Mundaka - not to mention the local hip clothing shops that had thrived in the area's bustling surf culture (Meschede, 2006). "

Using ICM methods that feature involvement of all stakeholders and decision makers could help to resolve future conflicts in this case. Maybe another shape or routing of a future dredging could help to soften the impact on the estuary's sandbar and the Mundaka wave.

However, dredging often has severe ecological side effects. Due to the increased depth, the river flows faster and stronger, which can lead to destruction and disturbance of flat-water zones, which are important spawning grounds for fish and other species. However, in 2006 the waves returned, as the autumn storms were casting up new sand in the river estuary.

The environmental ministry assured the surfers that the delta will only be dredged out again according to strict guidelines (Meschede, 2006).

In June 2008 an Environmental Impact Analysis (EIA) study to measure the actual and potential economic impact of surf tourism on the local economy was completed by Murphy and Bernal. An online survey was designed to obtain spending data, trip characteristics, and demographic information. Questions ranged from "How much did you spend on lodging per night?" to "Would you continue to visit Mundaka if the wave was permanently gone?" The target population for the survey ranged from 100 to 300 participants and the number of respondents to the online survey totaled 140 with an approximate 50% response rate.

The analysis of the study shows that the majority of surf tourists visiting the area were on average, male, thirty years old, stayed between one and two days and spend between 100 USD to 200 USD per stay. While most claim that they would continue to visit Mundaka if the Billabong Pro contest was no longer held there, they would not continue to visit if the wave was permanently lost. Through personal interviews and an online survey, local businesses estimated a 50% drop in business due to the loss of the wave and the subsequent cancellation of the Billabong Pro contest in 2005. (Murphy and Bernal, 2008)

Study California Trestles

The impacts and values of tourism activities such as surfing are difficult to measure due to lack of data and literature available. Surfing is not often included in recreational research and unlike fishing, hiking, or mountain biking it has not been looked upon as a major tourist activity (Murphy and Bernal, 2008). In reality, surfing, as well as other similar activities such as skateboarding, snowboarding or windsurfing, can be extremely important to the local communities who host them. One of a few examples of a highly frequented and well "monitored" surfing break is Trestle near San Clemente in Southern California. The San Onofre State Park keeps attendance records of surfers and beach-goers visiting the beach of Trestles. The park rangers are using a methodology that bases the daily attendance on head counts, a turnover rate weather and surf conditions (Nelsen et al., 2007).

Surfers attracted to Trestles generate economic impacts that contribute to the local

economy of the City of San Clemente. Surfers visiting Trestles provide economic input to the local economy by spending money at restaurants, recreational shopping and buying gas. Over 83% of the surfers visiting Trestles are from outside the City of San Clemente and represent an import of expenditures to the City. According to Nelsen et al. (2007) the average spending per surfer was 40.07 USD (in 2006). The California State Park Service reported that in 2006 there were approximately 367,000 visits to the Trestles; 90% were surfers (California State Parks, personal communication, August 23, 2007 ((as cited in Nelson 2007)). In 2006 330,000 surfers visited Trestles. According to Nelson (2007, p.4):

> "We cannot extrapolate our findings to the total population of surfers because our samples not random. Using $25 as a conservative value from Hanemann et al. (2004) and $40 found in our survey we estimate a range for the annual economic impact to the City of San Clemente from surfers visiting Trestles that could be from $8 million/year to $13 million/year (all numbers in U.S. Dollar)."

The example of the San Onofre State Park and Trestles surf spot shows how well one of the best waves on United States mainland was preserved and the surrounding landscapes were kept in an natural way until now. In heavy urbanized Southern California an unspoiled shoreline is a rare occurrence. Most beaches are built up areas with houses, four lane highways and big parking lots located right on the beach. But Trestle's unique coastal environment is under threat. The Transportation Corridor Agency (quasi-public agency) is seeking to build an extension to the existing 241 Toll Road. The proposed plan will mean that the highway will run directly through and along San Mateo Creek. If constructed, this project would directly threaten Southern California's last remaining healthy coastal watershed and would spoil, the natural, beautiful coastal surroundings of Trestle's waves (Lazarow and Nelsen 2007). There was an outcry from the local and international surf community, NGOs and environmentalists. So far their protests have been successful and the road has not been constructed yet.

In conclusion it can be said that surfers have a significant economic value to coastal economies in San Clemente, California and in Mundaka, Spain. Further research is needed in order to identify surfers as a population and value target group for local coastal communities. In addition to this further assessment of surfer's spending habits is needed in order to know the economic impact of surfing tourism (consumer surplus) to coastal

communities. It is important to know how many jobs are related to surfing tourism.

The Dilemma of Putting a Monetary Value on Surfing Resources

By putting a monetary value to surfing recourses some problems are arising. Waves and Surfing can provide values, which go beyond a truly economic value. The intrinsic values of surfing such as happiness, the endorsement with natural elements (almost a spiritual experience), physical fitness and fun are hard to convert into monetary values. The value of surfing resource is for non-surfers often defined by its extrinsic value, which means that only the aspect of how much money the surfing wave is generating for the coastal community is taken into account and is consequently spent on something other than surfing. The mentioned intrinsic value of surfing recourses is often not considered within coastal management decisions. The dilemma arising in a free market economy is, that multiple individuals are acting independently mainly in their own self-interest and will deplete ultimately shared limited resources, even when it is clear that this is not in the interest of anyone. This dilemma was described in The Tragedy of the Commons by Garret Hardin (1968). The article was first published in the magazine Science and has still a great influence on the scientific community, when referring to sustainable development and the limits of economic growth and environmental protection. However, the above-mentioned studies show clearly the extrinsic/monetary value of surfing recourses and are often used by NGOs for a pro argumentation of protecting and sustaining the surfing break.

Conclusions

In conclusion one can say that surfing recourses and surfing in general is of significant economic importance for many coastal communities and is in some coastal regions a thriving sector of the economy. Due to the greater economic importance and awareness of surfing recourses worldwide, surfing has become more recognized within the scientific community of “surf nations” like Australia, New Zealand, USA and in selected European Countries (majorly England). Relevant surfing science research literature is now available on a greater range and even university degree programs have been launched (e.g. Bachelor of Science in Surf Science and Technology at the University of Plymouth) to study surfing and its business, technology and physical processes. However, high quality surfing breaks are vulnerable to coastal development, scarce, and possess an economic, sporting and aesthetic value. The economic valuation of surfing breaks has helped in some cases to

make local communities more aware of their surfing resources. However, the intrinsic values of surfing such as happiness, the endorsement with natural elements, physical fitness and fun are hard to convert into monetary values and are not sufficiently considered within economic based surf studies and in the consequence of coastal management decisions. In the next chapter the extrinsic value of surfing and its cultural importance are described.

2.4 The Cultural Value of Surfing

As previously mentioned, due to the economic value of surfing breaks surfers are starting to be considered in some countries within coastal management decisions. However, it can be argued that in some cases coastal development can have greater economic importance to coastal communities than the protection of a surfing break. In the example of the Mundaka wave you can argue, that the shipyard might have a greater economic importance. Beside the economic factors it might be worth sustaining a surfing break for aesthetic, cultural and ecological reasons. The positive synergies from sustaining a surf break to other fields and interests groups/stakeholders were described within the examples of Mundaka and Trestle. In fact, surf break protection can go hand in hand with negotiations of economic issues regarding the coastal zone. It could therefore be important to integrate surfing as a serious stakeholder within the Integrated Coastal Management process. Most surfers are environmentally aware of the fragility of the coastal zone, due to the fact that they frequently suffer from negative human impacts when using coastal waters. Some of the key issues are: Water pollution, runoff, waste and civil engineering. “Surfers are uniquely impacted by changes in the coastal environment, because of the sensitivity of surf spots to environmental change and because surfers are fully immersed in the ocean (Nelsen et al. 2007, p. 4).” However, Lorenz and Blackwell (2007) found several natural and anthropogenic factors, which influence Surfing’s capital as shown in the table on the next page:

Table 1 Surfing's capital (after Lorenz et al., 2007)

Item	Description	Natural or human impacts influencing physical/experiential aspects of surfing
Wave quality	Dominant local view of how the wave breaks. Both beauty and physical form become assessable.	• Construction of coastal protection/amenity structures (e.g. groynes, seawalls, piers, seawalls, river walls, breakwaters, artificial reefs) • Sand management (e.g. beach fill, dredging, sandbar grooming)
Wave frequency	'Surfable' waves measured against an accepted standard.	
Environmental	Environmental or biophysical conditions that may mitigate against a surfers' physical health.	• Biological impacts (e.g. water quality or nutrient loading) • Climate change/variability (e.g. temperature change, sea level rise, less or more storms, less or more often) • Amenity of the surrounding built and natural environment • Marine predators (e.g. sharks)
Experiential	Societal conditions surrounding the surfing experience.	• Legislation/regulation that might grant, restrict or control access (e.g. community title, private property, payment strategies, craft registration, proficiency requirement, policing) • Code of ethics i.e. road rules for the surf • Signage & education strategies • Surf rage, aggression, intimidation • Self-regulation/localism/lore • Mentoring, sharing, physical activity, challenge, joy and laughter, well-being, community spirit, self-fulfillment • Local aesthetic

In addition to these possibilities of integrating surfing as a local stakeholder and participant within coastal management decisions; there is the need to protect surfing resources with a state or even national wide legal framework on a global scale.

Best Practice in Australia and Peru

A positive and progressive example of protecting and giving surfing resources such a legal status is Australia: Six national surfing reserves in Australia honor surfing and its unique place. Australian surfers and their surf breaks are famous throughout the world. In the State of New South Wales surfing is a part of the social and economic fabric of many coastal communities. The legal protection the government provides with the establishment of national surfing, reserves a legal protection of surf spots under the Crown Lands Act from 1989. This protection ensures that Australian beaches are accessible to surfers and to anybody who wants to enjoy them. "Surfing reserves recognise sites of environmental, cultural and historic significance in Australian surf culture. This recognition helps raise awareness about the importance of protecting our precious coastal environment (National Surfing Reserves, 2010, para. 3)." Surprisingly in Peru there is an existing a law to protect significant surfing breaks as well. Peru has a long tradition of surfing and it's surfing history goes nearly as far back as Hawaii.

> "Surfing is seen as a respectable and worthwhile pastime, unlike in many parts of Europe. In 2000, La Ley de Preservación de las Rompientes Apropiadas para la Práctica Deportiva (roughly translated: law for the preservation of appropriate waves for the practice of sports) was approved by the Peruvian Government, and would be put into action as soon as a list of surf spots was drawn up by the Peruvian Surfing Federation and submitted to the Peruvian Navy (Apropiadas para la Práctica Deportiva ((as cited in Butt T., 2010, p. 43))."

To recognize surfing recourses as cultural heritage in order to raise public awareness for coastal issues is an interesting concept and a very valuable recommendation for the future. In the words of Yvon Chouinard, founder of the outdoor equipment company Patagonia, "natural surf breaks should be treated as world heritage sites, and should never be destroyed no matter what the reason (Chouinard, 2007, para. 6 and 2010, para. 8)." There

is still a long way to go until the UNESCO considers recognizing surf breaks as world heritage sites. However, promoting surfing's interest by sustaining the coast and the ocean are a great example of how surfing and ocean enthusiasts can unite with maritime and environmental sciences to take over responsibility for our oceans. However, surfing's

cultural heritage and value is very complex and has only in the recent past been subject to investigation. The following table tries to give a coherent, brief overview over the history of the cultural value of surfing. This review cannot be considered fully comprehensive (not possible regarding the scale of this master thesis), but might be valuable to understand the cultural value of surfing. Understanding surfing's culture and heritage is important in order to adequately consider surfing interests within coastal management decisions.

Figure 2 Getting dressed: Surfers put on their wetsuits in the middle of Matosinhos city (Eberlein, 2010)

Table 2 The History of surfing culture (adapted from Ford and Brown, 2006)

Period	Ancient Hawaiian Origins	
Ancient to end of nineteenth century	• Paradise beginnings in a cultural context of a ritual pantheistic, to live in harmony with nature • Rich vocabulary of surf- and sea related terms influencing the Hawaiian language. Today perceived as simple, pure, casual, relaxed hedonistic way of life (noble savage romanticism). A secondary thread acknowledged in the surfing literature of ancient Hawaiian surfing culture sees surfing perhaps more negative: Surfing as a social status, contests, gambling and ego. • The decline of Hawaiian surfing culture through the devastating impacts of Western disease, Christian missionary and culture with a repression upon Hawaiian culture.	
Period	**Parallel Cultural Development**	
1920s-1950s	**Hawaii/California** • Casual beach culture • Early surfing photography and films • Malibu in California as the site of the creative edge of innovative surfing and surfboard making.	**Australia** • Early cultural development within the more disciplined confines of the Surf Life Saving Association. Values of willpower and fierce competition.
	• In both countries surfing expands geographically through increased auto mobility (*Surfaris*) and greater wealth of the postwar society • Heroic image as surfers meet the challenge of riding ever bigger waves	
Period	**Middle Phase**	
Late 1950s	• Increasing numbers participating in surfing	
Early 1960s	• Surfing influences greatly all kind of arts; surf art, music, film, fashion, and design is inspired by surfing. Southern Californian surfing culture had in this phase perhaps the greatest impact. • Hollywood beach movies, which were featuring surfing such as Gidget (1959) were made and bring surfing to a broader audience. Whereas, the Endless Summer (by Bruce Brown) became the cornerstone of the new surf movie genre and was a catalyst for surfers to travel to exotic countries like Africa and Tahiti. In 2002 the movie was selected for preservation by the United States Film Registry/Library of Congress as being " cultural, historically or esthetically significant". • Surfing is becoming a subculture and is not only presented by movies but by special interest surfing magazines. Severon´s Surfers (1960) and other magazines were founded. • The surfing media presents similar values of hedonism, escapism, freedom, than in the "golden age of surfing" in the 1950s, but presents them with more self-consciousness, and greater professionalism. • Surf culture continues to express a coherent Zeitgeist, however other oppositional/"rebellious" youth culture of the time such as the "Beatnik" (1950s), Counter Culture (late 1960s) and Punk (late 1970s) interpreting the surf culture.	

Period	Recent Phase
1970s to the present	• Recent surfing culture is perhaps best understood, when referring to tendencies and events. A clear distinction between different periods of surfing culture is hard to point out. Only when it comes to the technological evolution of the surfboard design a strict linear /historical (although historical events are seldom subject to linear development) classification makes maybe sense. • Counter Culture, soul surfing, individualistic, ranging through various pre occupations with peak experiences and highs (whether through spirituality or psycho-active substances) and varying accommodations with and distancing from a wider advanced capitalistic, individualistic and technology driven society. Surfing culture begins to become more diverse and split ups in different subcultures. The earlier coherency of surf culture is lost to a certain extend. • In the 1970s surfing is brought by traveling lifeguards (Behrens Brothers) to Sylt/Germany and continues to spread in many European countries. However, surfing in North Portugal started to become more popular among locals just in the last ten years. • Concerns and discussing the authenticity and purity of surfing. The rise of surf competitions and the sportization of surfing (earliest international surfing contest at Makaha, Oahu in 1954). • Trying to make surfing more recognized and respected by society, trying to establish a clean, new image of surfing (apart from the unemployed, drug taking, long haired beach bum). • The rise of the World Surfing Championship (ISP/ASP) with commercial sponsorship and support of a few professional surfers. • Commercialization of surfing, through a series of booms the number of surfboard manufactures/shapers, shops and outlets is rising. A few of them are becoming multinational companies, indexed on stock exchanges. In terms of market turnover surf fashion becomes far more important for the industry than surf equipment. The surf industry becomes global, and sorting out it's clothing, wetsuit making and some of its board making to cheap labor countries with problematic working and environmental standards. Surprisingly the surf industry is only receiving a few criticisms for this from the surfing community/public and remains a fairly green, clean image until now. • On a wider level the dream and image of surfing is sold and adapted by advertising campaigns for non-surfing products. • The enormous increase of surfers worldwide leads to crowded (urban) surf areas. Sometimes heavy localism, surf rage and even violence are a result of the increased popularity of surfing. In some parts of the world settlement patterns and construction of coastal housing is driven by the factor of local wave quality (e.g. in J-bay/South Africa, West coast of France, Byron Bay/Australia, Tarifa/Southern Spain). The surfing community is linked further internationally and surf travel is steady rising in popularity, even to exotic surf destinations like Canada, Iceland and Norway. Surfing has become truly global and is even practiced on a broader scale in areas of the world, which are known for cold water and less quality surf like e.g. Germany, Denmark or Sweden.

Conclusions

Surfing has a rich cultural history and complex heritage. In the past surfing culture has struggled to be accepted by western societies and was even repressed by Christian missionaries and authorities firstly in Hawaii and later in other countries as well. A western surfing culture developed from the 1920s onwards in Hawaii, California and Australia. These three "hubs of surfing" were responsible for a overall increased popularity in surfing, the evolvement of the traveling surfer and the great discoveries of some of the world's finest and superior quality waves. In the traditional surfing countries surfing culture becomes an elemental part of many coastal communities and influences youth culture greatly in the form of vibrant subcultures. Recently surfing culture has become more mainstream and experienced a commercialization with the establishment of professional, competitive surfing. It is important to understand the true meaning and cultural value of surfing, since a better understanding of surfing's heritage will help to value surfing differently in coastal management decisions. By valuing surfing culture and history, people might want to care for it, which can lead to new cultural and economic opportunities (e.g. the founding of a surfing museum, surf festivals/competitions, music and surf movie nights and etc.) in coastal communities. Last but not least this process of valuing and caring might bring new enjoyment and coherency within a community. In the next chapter the threats to surfing resources are expressed and identified, since it is very critical to inform and sensitive coastal managers and decision makers for these pressures in order to implement a holistic Integrated Coastal Management, which considers surfing breaks and their (sustainable) management in an appropriate way. Therefore the following chapter will first explain some important physical characteristics of the Portuguese north coast and surfing waves. After that, the major types of surfing breaks are classified and described in order to understand (and mitigate) the effects of natural and anthropogenic alteration of surfing wave quality.

2.5 Threats to Surfing Resources

2.5.1 The North Coast of Portugal - Coastal and Terrestrial Dynamics

Portugal is located in the southwest of Europe on the Iberian Peninsula. The country's coast is facing the Atlantic Ocean. The northwest coast of Portugal (at latitudes 40-42 °N) is a highly energetic region in terms of wave energy interacting with the coast (Cruz, 2008). The coast has an approximate length of 800 km in total. The swell heading towards the coast normally arrives from the northwest. The offshore mean significant wave height is between 2 and 3m with a mean wave period of 8-12 seconds. However, during the winter time storms generated in the North Atlantic can send large storm swells with significant wave heights as high as 8 m to the Portuguese coast (Costa et al., 2001). The tides are semi –diurnal (two high tides, two low tides per tidal day) with a tidal range of 2 – 4 m during spring tides. The strong surf leads to a southwards alongshore current with a sediment transport of 1-2 × 106 m^3 per year (Oliveira, 1997 ((as cited in Coelho, Silva, Veloso-Gomes, Taveira-Pinto 2009)).

The Douro River estuary and the Aveiro lagoon are strongly influenced by anthropogenic effects of the cities of Porto and Aveiro. According to Oliveira, (1997 ((as cited in Coelho et al. 2009)) the Douro is the main source of sediment for the Portuguese northwest coast. It used to supply about 1.8 × 106 m^3 per year, due to anthropogenic effects (e.g. constructions of dams, sluices and river straightening) the sediment volume decreased to ca. 0.25 × 106 m^3 per year. The Picote gravity dam and the Crestuma/Lever dam are most likely to be responsible for the increased erosion problem in North Portugal (J. Prata Dias Santos, personal interview, 15th September, 2010). According to Coelho et al. (2009) coastal erosion is a European wide problem, however coastal structures contribute to the process of erosion.

> "Harbours, which are essential to socio-economic development, introduce severe perturbtions in the littoral drift system, by changing wave propagation with the construction of long breakwaters and by changing the sedimentary dynamics by dredging navigation channels (Coehlo et al. 2009 p. 1499)."

As a result currents are created that carry sediments far offshore to depths were waves are no further able to return the material back to the beach. Due to dredging and the

construction of seawalls in the consequence of harbor development, the longshore drift and sediment transport along the coast is disturbed: Therefore the harbors of Viana do Costelo, Leixões/Matosinhos, Aveiro and Figueira da Foz tend to intensify the coastal erosion problem. Furthermore, civil development too close to the foreshore has resulted in the destruction of dunes (which function as natural dynamic, adaptable coastal protection measures) with the consequence that coastal erosion has caused narrowing beaches in the northwest of Portugal (Coehlo et al. 2009). According to J. Prata Dia Santos (personal interview, 15th September, 2010) coastal erosion is "very bad" and a major threat in North Portugal; in some areas "eight to ten meters of land per year are lost." The beach of Macada and Esmoriz are among the worst sites, which suffer from erosion in North Portugal (Velor Gomes, Taveira Pinto, Neves, Pais Barbosa , 2003).

2.5.2 Physical Processes of Breaking Surfing Waves

Waves transmit energy over through the medium water, but the medium it self doesn't move anywhere it only transmits/transports the energy further. As long as the wave doesn't peak up and reach the critical point of breaking, the particles on the surface will express a complete circle as the wave rolls through it. Ocean waves are dispersive, which means they travel along deep water. The Velocity (rate of change of displacement/position) depends upon the wave period ("the length of time between the passing of successive wave crests past a fixed point") (Butt, 2010 p. 5) - this means the longer the wave period the faster the wave. This fact has great importance on how swell is traveling away from a low storm pressure system. A mixed up swell with different periods will steadily sort itself as it travels away from the storm center. The reason for this is simple: The shorter and slower waves will be outpaced by the longer and faster waves. Coastlines, which are thousand of kilometers away from the storm center, will receive the longest and therefore fastest wave of new swell first. Deepwater ocean waves can travel long distances without a great energy loss. Ocean swells are following the great circle routes around the globe, which means that the swell travels the shortest way between two points. Theoretically, ocean swells can travel thousands of kilometers, as shown in the graphic below, a swell could travel from South Africa all the way to the west coast of Canada by creating surf along the way in Australia and New Zealand. (Butt, 2010, Stormrider Guide Europe, 2006)

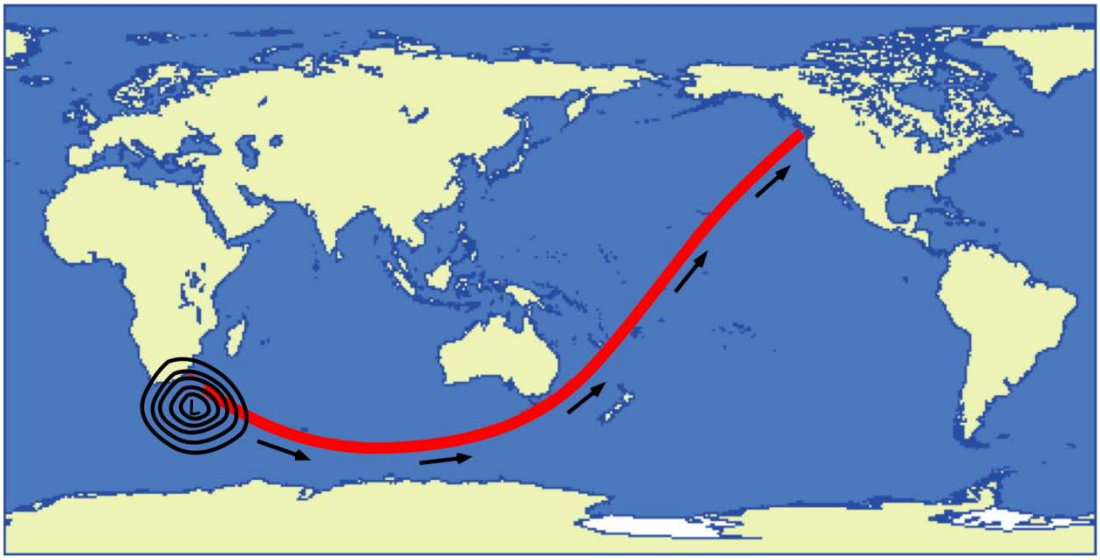

Figure 3 The journey of a ground swell (Butt, 2010)

2.5.3 Types of Surfing Breaks

In the subsequent the most important types of surfing breaks are classified, since it is important to understand some oceanographic processes in order to consider surfing resources adequately within Integrated Coastal Management *ICM* decisions. Therefore the following types of surfing breaks are described:

- Beachbreaks
- Rivermouth Breaks
- Reefbreaks

Beachbreaks

Beachbreaks are very common in Portugal and the major type of surfbreak in North Portugal. Beachbreaks, as the name suggests, are surf spots where the waves break on the beach. The main characteristic of a beachbreak is that the sea bottom is dynamic and mobile. Sandbars are formed and destroyed by waves, tides, winds, and currents that's why the wave quality can vary greatly throughout the year on beach breaks. In fact a good peak can be shaped by the elements within a few days and can disappear as soon as it occurred. The physical process of forming a beachbreak is quite complex. The movement of

sediment in an offshore direction is an important feature. The *Stokes Drift* tends to move loose material from the breakpoint of the waves onshore, whereas in the inside of the breakpoint the *Undertow* tends to move sediments offshore. *The Stoke Drift* and the *Undertow* are accumulating sediments on the sandbar, which forms a breakpoint, where waves are triggered to break more strongly than on other spots of the sandbar. This process takes place continuously and is only limited by laws of gravity. At a certain stage the sandbar/breakpoint is not able to grow any higher or steeper. The sediment slides down

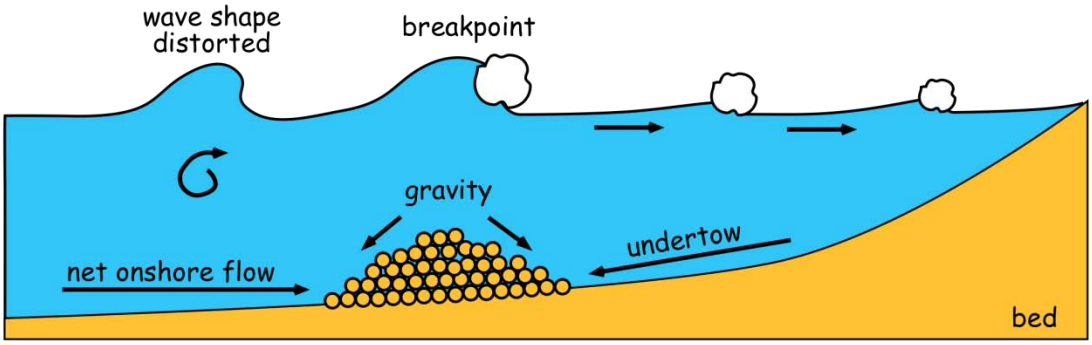

Figure 4 The formation of a sandbar (Butt, 2010)

again and the process of building a new breakpoint on the sandbar starts over from the beginning. However, beside the *Strokes Drift* and the *Undertow*, the *Longshore Current* plays a significant role. It accumulates sediment sideward and shifts the sandbar parallel to the shore. A quality beachbreak features a wide variety of humps and dips. A consistent beachbreak is made up on one long sandbank with only slight variations in height along its length. Incoming waves are naturally focused on the humps and moved away from the dips or channels, which will produce a peaky and peeling wave. The longshore current can have a severe impact on the channels and dips of the sandbar. In fact it can lead to the creation or destruction of channels along the sandbar. A closed sandbar means a safe beach with breaking waves on the sandbar with no strong undertows. However, channels in the sandbar are important for surfers, as they are the only safe way to reach the breakpoint on big swells. The sandbar and channels have a complex relationship with each other: For a quality, consistent surfing wave different water depths and transitions in height are required in order to hold different swell heights and tidal ranges. In conclusion you can say that it is very hard to make long-term predictions regarding the wave shape and quality of

beachbreaks, since there are so many different factors involved. (Butt, 2010, Stormrider Guide Europe, 2006)

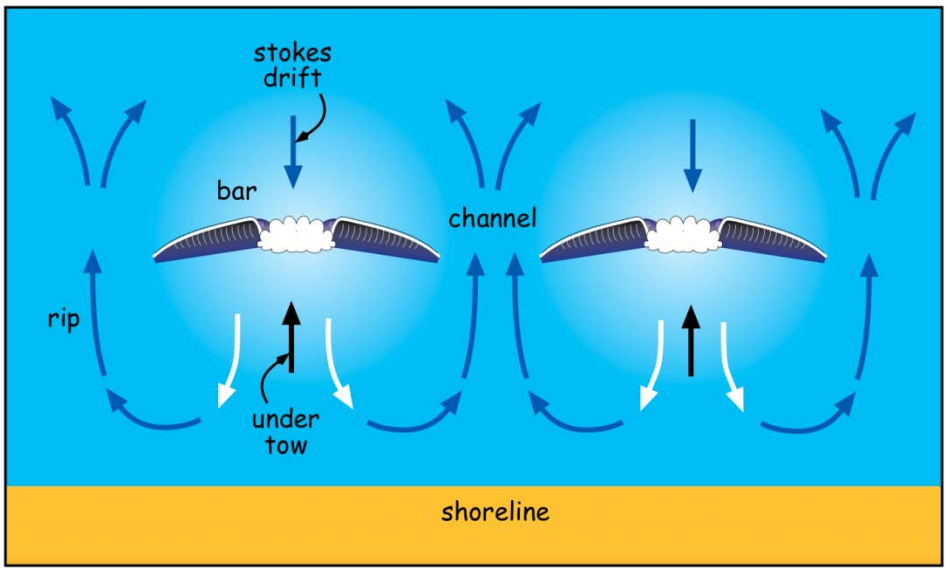

Figure 5 Currents and channels of a beach break (Butt, 2010)

Rivermouth Breaks

As the name Rivermouth Break indicates, this type of surfbreaks main characteristic is a rivermouth. Generally spoken a rivermouth break is quite similar to a beachbreak, because the breakpoint's seabed is made of sand. A good rivermouth break features a peeling wave, which breaks along the edge of the sandbar and is triggered by a sandy headland, (just like a pointbreak, which usually features a rocky headland). The sand is a "semi permanent" feature and stays within the same location, because of the estuary's complex current and sediment transport system.

Rivermouth breaks can feature one of the most perfect surfing waves in the world. A sandbar in the rivermouth is formed on a spot where the river gets wider and the flow speed of the river decreases. Upriver the flow speed and turbulences are greater, sediments are washed out from the riverbed and are transported to the rivermouth. The lower flow speed and less turbulent water increases the accumulation of sediments from the river stream, a sandbar is formed. The wave quality of rivermouth breaks depends highly on

seasonal patterns. The accumulation of sandbar is normally more productive during the summer period, due to the fact that swell and wave size are relatively small. During large swells and storms the sandbar erodes and sediments are spread into a irregular shape causing a less perfect wave. Therefore a river mouth break is most productive, in terms of wave quality, just after the summer or a longer period without large swell. Another special feature of a rivermouth break is that the current of the river has an impact on the wave shape. Just like an offshore breeze on an ordinary beach or reefbreak, the forces of the current act as an opposite force to the swell heading to the coast, it delays the critical breakpoint of the wave and shapes the wave more hollow and "tuby". Some rivermouth spots can feature large tidal waves (e.g. Amazonas rivermouth) in certain times of the year. Depending on the shape of the rivermouth and the tidal range of the location, these waves can travel and be surfed for some kilometers inland.
(Butt, T., 2010, Stormriderguide Europe, 2006)

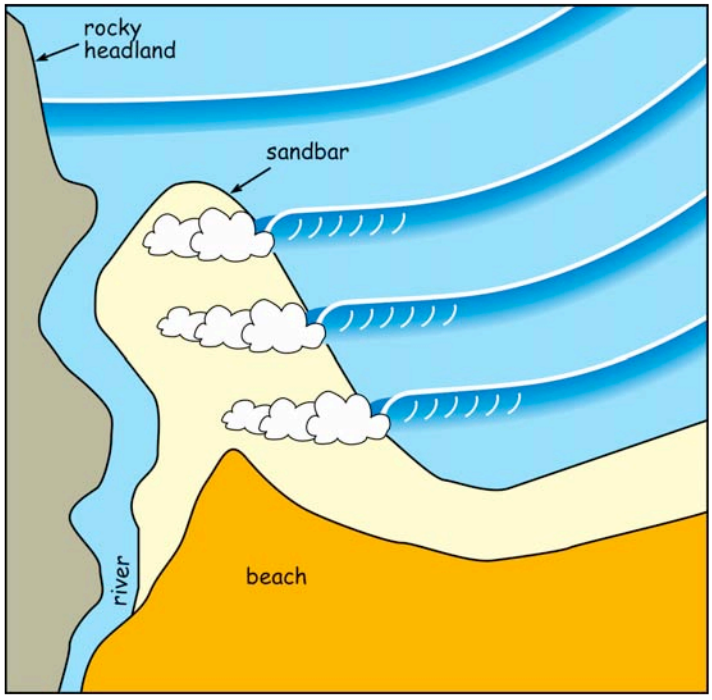

Figure 6 Physical geography of a rivermouth break (Butt, 2010)

Reefbreak

A reefbreak is a surfbreak where waves break over a solid, immovable seabed. The sea bottom of a reefbreak does not normally change over many years. However, reefbreaks can

be very diverse in terms of the structure and material they are made from. Depending on the local coastal geology, reefbreaks are varying in their sea bottom. The majority of reefbreaks in Portugal are made up of sedimentary rock such as limestone or sandstone. Whereas for example reefbreaks on the Canaries Island consists out of lava and in the tropical zones corals were building up reefs million of years ago. The types of wave, which break on a reef, vary greatly in size from small to large waves. Reefbreaks can be located far offshore in the middle of the open ocean and are able to hold big ocean swells with peeling waves. The shape of reef waves range from slow pointing to "suicidal sucking slabs". Beside coral reefs, sedimentary rock reefs originated either from gradually compressed (under it's own weight) sediments layers or had once been subject to geological deformation. Compressed sediment layers are usually forming a flat reef bottom, which is, providing there's enough water over the reef, a fairly safe place for surfing. In a case of a traumatic geological event the bottom of the reefbreak might be unevenly folded and twisted with rocks sticking up vertically just below the water or being fully exposed. These kinds of surf breaks are a challenge for experts and require advanced surfing skills and local knowledge where to exit the wave by pulling out at the right time. (Butt, 2010, Stormrider Guide Europe, 2006)

2.5.4 Solid Structures and Coastal Protection Schemes

Increase in Coastal Protection Schemes

Naturally formed surfing breaks are sensitive regarding manmade coastal protection schemes. Climate change and sea level will probably lead in many countries in the world to an increase of coastal protection measures, with a possible destruction of surf resources. The following surf spots have just been recently destroyed through coastal defense structures only a little while ago: Ponta Delgada in Madeira, The Cove in Washington, Stanley's Reef in California and the Douro River wave in Porto, Portugal. In 2008 a breakwater was constructed in the Douro river mouth in order to enhance navigational safety for small-scale fishery vessels entering the nearby fishing harbor of São Pedro de Afurada. The construction of the hard coastal protection scheme destroyed the unique surfing wave *Cabadelo do Douro*. In this case surfers agreed on the need of the construction and were stating that the safety of fishermen has priority over the preservation of the surfing resource (informal interviews, 2010). However, many concerns were

mentioned that surfers were not informed and included in the planning process of the breakwater. A slightly different design and placement of the structure could have sustained the wave partly, without compromising on navigational safety issues.

Figure 7 Douro river mouth break and the inside breaking wave before the construction of the breakwater (Wanna Surf Atlas, 2010)

According to Knights (2007) the increase in coastal protection schemes due to sea level rise should be considered a major indirect threat of climate change.

Figure 8 Extinction of Ponta Delgada, Madeira, Portugal (Surfer Against Sewage, 2010)

As seen in the pictures above, the sea threatens private property. The hard structure of a breakwater was simply placed direct on the reef and destroyed the surf break forever, without considering it as a possible valuable resource. Not all communities have recognized the value of surfing resources yet. Especially, when costly infrastructure is threatened, there is tendency to decide in favor of the property owner. It can be expected, due to an increase in climate change/sea level rise, that conflicts between surfers and property owners will increase. However sometimes the engineering effects are positive on surfing wave quality (e.g. Superbank, Tweed Heads, Gold Coast, Australia) (Scarfe et. al

2008). At the North West Coast of Denmark for instance constructed breakwater play an important role in protecting surfing waves from being “messed up” by strong side shore winds. These storm sheltered, man made niches on an open beachbreak, are on a stormy day the only place where surfing is possible, due to a lower wave period giving the surfer the chance to paddle out and reach the breakpoint/lineup. In Matosinhos Beach the natural headland in the south and the manmade breakwater of the harbor in the north provide a sheltered area for beginner surfers as well as protection from large swells. This makes Matosinhos Beach an ideal winter wave spot, which still can be surfed when elsewhere the surf is too big with waves braking closeout (Stormrider Guide Europe 2006, The World Stormrider Guide 2009, Matosinhos Beach Survey, 2010). Furthermore, the headland in the north provides in large swells a quality pointbreak, were waves are being trigged to break and peel along into the inside of the bay. Hard coastal defense structures are in fact able to enhance the wave quality in some cases, however there still remains a harsh impact concerning physical and ecological coastal processes. Last but not least, hard coastal defense structures have usually a visual-aesthetic impact on the coastal landscape.

Figure 9 Solid breakwater in Esmoriz diminishing beach quality, however enhancing wave quality at mid tides and protecting private property (Eberlein, 2010)

Figure 10 Rocks washed out from breakwater after storm in Esmoriz (Eberlein, 2010)

Artificial Surfing Reefs

Artificial reefs are on the first analysis a coastal protection measure, which does not influence the coastal landscape negatively in anyway. According to the New Zealand based company ASR Ldt. multipurpose reefs are a real alternative to hard coastal defence structure and can enhance the surf quality. Reefs reduce and redirect the wave energy affecting the coast thereby reducing the erosional stress and stabilizing the shoreline. They are located offshore and therefore do not degrade the natural beauty of the beach and coastal environment (ASR Ltd., 2010). However, as any other hard, manmade structure they will lead to increased erosion further down on the leeside of the structure (Moriarty, 2009). The construction of artificial reefs was primarily introduced to protect coasts from erosion and/or to create maritime habitats by providing a hard substrate for corals and other marine organisms (Fernandez, 2004). In fact an artificial reef might have a positive effect on the biodiversity. More recently only a very few reefs worldwide have been constructed in order to enhance the wave quality only without compromising on design issues concerning coastal protection (e.g. Bornescomb in the UK, which seemingly is not performing as good as expected). In Lisbon the construction of a surf reef was discussed and a 3d modeling of the future reef was already conducted a few month ago; however due

the current economic situation in Portugal this project is currently on hold. (Informal interviews, 2010)

Even if the physical process of a breaking wave might be quite well understood (Sarfe et al., 2009), it is very difficult to design a fully functioning surfing reef, which meets the first class quality of natural surfing breaks like, e.g. Pipeline (Hawaii) or Jeffrey's Bay (South Africa). The surfing community agrees on the fact, that manmade reefs don't meet the perfection of a natural surf break yet. Jim Moriarty (2009, para. 6), President of the Surfrider Foundation says: "Even though most of these reefs were built for surfing, my sense is that they've failed at that. Building artificial reefs, while seemingly popular, I believe will become increasingly challenging." Surfrider Foundation had it's own experience of failure with an artificial surfing reef. The organization supported financially Pratte´s Reef in Southern California. The reef was designed too small and the geo-textile bags weren't durable enough. Many bags got ripped apart by the winter storms; in 2008 the Surfrider Foundation removed the sand bags. However, as any other coastal defense structure, artificial reefs cannot solve a regional erosion problem. There are only pinpoint solutions. Majorly they will stop the longshore current from transporting and spreading sand along the shore. This will lead to an increased erosion problem on the shore, not far away from the reef.

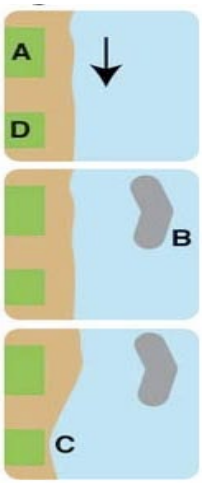

Fig 8 The Graphic shows the impact of the artificial reef (Morijaty, Ocean 2009). The sediment transport is disturbed; this leads to increased erosion further down the shore. The property in the north is a winner: The slowdown of the longshore current leads to an increased sedimentation and therefore to a wider beach. Properties further in south are now (due to the new defense structure) even more threatened by the sea than before

According to Moriarty (2009, para. 3), future artificial reefs will serve another primary purpose - erosion control. The Reason for this: The cost of an artificial surfing reef is relatively small compared to the budgets of many erosion response projects. Moriarty (2009 para. 3) states that, "a few million dollars to build a reef is a good deal if it protects millions of dollars of property or slows down the need to import millions of dollars of sand."

The table on the next side shows all constructed multipurpose/artificial surfing reefs and their costs. It is a significant sign therefore, that surfing is taken more seriously into account when it comes to coastal planning and the implementation of coastal defense structures.

Table 3 Constructed and partially constructed surfing reef projects (International Coastal Management Company, 2010)

Summary of Constructed and Partially Constructed Reef Projects

Multifunctional and surf reef projects	Date	COUNTRY	VOL [m3] approx	TYPE	Materials	TOTAL COST [US$]	US$/m3	Construction method
Completed Projects								
Bargara	1997	Australia	**300**	Rock	basalt boulders	$7,600	**$25**	Re-profiling existing rocks on headland with excavator at low tide
Cables	1998- 99	Australia	**5,000**	Rock	Limestone rock	$1,064,000	**$213**	rock placed from barge
Narrowneck	1999-2000	Australia	**70,000**	SFGC	terrafix non-woven SFGC	$2,128,000	**$30**	150 - 450t mega sand filled containers filled and placed by hopper dredge
Pratte's	2000-01	USA	**1,350**	SFGC	nicolon woven SFGC	$300,000	**$222**	14t sand filled containers filled on shore and placed by crane on barge
Partially Constructed								
Mount Maunganui	*2005 -??*	*NZ*	***6,000***	*SFGC*	*terrafix / elco non-woven SFGC*	*$1,105,455 To date*	***$184*** *To date*	*mega sand filled containers filled in situ [20% construction outstanding- ref project newsletter]*
Opunake	*2006 -??*	*NZ*	***??***	*SFGC*	*terrafix / elco non-woven SFGC*	*$770,000 To date*	***??***	*mega sand filled containers filled in situ [construction stalled?]*

Finally, there is the urgent need to employ strategic planning and environmental impact methods, in order to maximize surfing wave quality and sustain surfing resources and coastal environments for the socio economic benefit of coastal communities. It is very hard to predict the future environmental impact that an artificial surfing reef might have. Therefore a monitoring and auditing of already constructed reefs is very important,

however this step is not being fulfilled professionally and systematically. Prior construction it is very important to clarify the main purpose of the reef. There seems to be the tendency to build reefs with a primary purpose (due to economic factors) of controlling coastal erosion, this brings the danger that natural high quality surfing resources are over seen and altered negatively by the reef construction. There is need to carry out a mandatory EIA of a wide scope for artificial surfing reefs and to establish baseline research.

Dredging and Nourishing

Although, dredging and beach nourishing do not involve any construction of a solid structure, there impact on the surfing breaks can be devastating. As described in the case study Mundaka, dredging can ruin waves. A higher flow speed of water and sediment in the dredged can alter and erode important ecological flat-water zones and sandbars in the river mouth.

Beach Nourishment on the other hand can ruin waves, when poorly designed and planned. If sand is located in front of a breakpoint/sandbar an extended flat water zone is created, which will create spilling/whitewater waves, not suitable for surfing, since a gentle long slope on the sea bottom will absorb deep water wave energy (Butt, 2010). However, when designed carefully beach nourishments can enhance surfing conditions. In 2004 in St. Johns County Beach nourishment was planned, which successfully considered surfing aspects and even enhanced the wave quality by designing sandbars suitable for surfing. Although, after some time the banks eroded and the surf conditions became more average, this project showed that surfing aspects can be considered within beach nourishment projects (Albada, Goshow, Dompe, 2004).

In North Portugal beach nourishment takes place on just three sites on a regularly basis: In Aguda (in front of the Littoral Station Aguda), Granja Beach and in Espihno (J. Prata Dias Santos, personal interview, 15th September, 2010). In Aguda the environmental impacts (biological colonization of the structure, changes in sediment transport, water quality) of the breakwater (constructed between 2001 and 2002) were studied by Prata Dias Santos, Weber and Veloso Gomes (2007). Results showed that the biological diversity was higher on the exposed site and lower part of the breakwater than on the sheltered/inner site and upper part. No significant differences were found concerning the water quality, when comparing the north and the south side of the breakwater. Due to the north south orientation of the Portuguese coast and a mainly northwesterly swell, the littoral drift (a

consequence of wave refraction and diffraction) subsequently lead to an accumulation of sediments in the north of the breakwater and increased erosion in the south. The nourishment in Aguda consists of relocating sand with heavy, land based machinery from the wide sand spit in the north to the eroded south side of the beach (J. Prata Dias Santos, personal interview, 15th September, 2010).

2.5.5 Sewage and Pollution

Pollution is for surfers and many other beach users like swimmers, recreational fishermen and shell/seaweed collectors an environmental issue of great concern as it can cause serious health problems like food poisoning, skin rushes, ear and eye infections. High concentrations of the phytoplankton Dinoflagelate can occur in the form of a Red Tide. A Red Tide can seldom lead to life-threatening circumstances (failure of respiratory organs) in humans and marine mammals (Kite-Powell, et al. 2007). Pollution of recreational ocean water can be caused by various factors and the polluters can range from organic, bacterial matters to toxic algae, oil, heavy metals, other chemical substances and many others. In Matosinhos, Portugal the greatest problem of pollution is caused by (untreated) sewage and runoff after rainfalls from streets, other sealed urban surfaces and agriculture further inland.

In general Portugal does not yet fully comply with EU regulations and legal framework on wastewater discharges. The EU states that especially within the cities and metropolitan areas combined sewers and treatment plants do not work efficiently after heavy rain falls. The overflow of sewers is to some extent caused by unauthorized storm water connections to the sewer system (European Commission press release, 2007) (C. Goncalves, personal interview, 4th November, 2010). Additional untreated wastewater from private households is often illegally connected to the sewer system (M. Weber, personal interview, 25th September, 2010). The Combined Sewer Overflow (CSO) is supposed to act as a kind of emergency outlet of the sewage system by discharging raw/untreated sewage into the rivers and oceans, when during storm rains the sewage system reaches it's carrying capacity. The CSO should normally not release raw sewage on a regular basis. However, when it does so the public should be warned from entering the ocean, however in Matosinhos this is not the case (Personal Observations 2010). Furthermore, unfortunately in Matosinhos discharges

of raw sewage is happening on a regular basis during periods with normal amounts of rainfall (Personal Observations 2010).

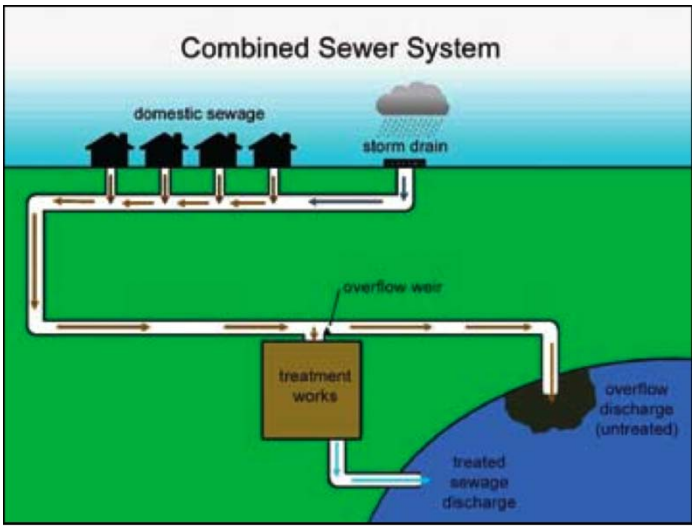

Figure 11 Illustration of combined sewer system (Butt, 2010)

In Lisbon the treatment plant Alcântara was not working at all during certain times of the year. Within the metropolitan region of Port in North Portugal there are several cases where marine water pollution is a concern. In Costa de Aveiro , just 45 kilometers south of Porto, 60% of the polluting load generated is not collected and 65% is not treated. In Póvoa de Varzim/Vila do Conde, 30 kilometers north of Porto, 60% of the load is not collected and the level of treatment in place is unknown (European Commission press release, 2007). Another case is the coastal community of Esmoriz (20 kilometers south of Porto) with a beautiful natural, unspoilt beach called *Maceda.* Sewage from the community is held in a so-called *Barrinha,* a lagoon, which is closed by a dyke/sand wall. The sewage of the 10000 inhabitants of the community is released frequently, by simply breaking up the dyke. This discharge is also happening during summer in the peak of the holiday season. Pollution levels on the main beach of Esmoriz and in Macada can then be extraordinarily high, with brown and stinking water. However, after one or two days the situation seems to be fine (no brown colored water, foam and smell) again, since the dyke of the lagoon is closed again, and the strong surf and currents of the exposed beaches are dragging away the pollution. (Personal Observations, 2010, Informal Interviews, 2010).

Figure 12 Nutrient pollution in natural channel of the Barrinha in Esmoriz (Eberlein, 2010)

In Matosinhos only primary sewage treatment takes place (European Commission press release, 2007), which means that the sewage treatment consists of a temporary hold of the sewage in a basin where heavy solids can settle to the bottom while oil, grease and lighter solids float to the surface. The settled and floating materials are removed. The primary treated sewage is drained to the sea and may contain highly organic contaminants (e.g. sugars, fats, organic short-chain carbon molecules) with high bacterial contamination levels, (strongly depending on the amount of rainfall). Frequent health problems caused by pollution were reported from surfers (for more details see results of case study) after surfing Matosinhos Beach especially after rain falls.

2.5.6 Coastal and Beach Access

Beside the mentioned problems of coastal development, coastal protection, pollution and the "multiplication" of all these problems by climate change, there is another major

concern for surfers regarding costal and beach access issues. This topic is quite complex and the legal framework for accessing the world coastlines are different in every country. In the following the access problematic to surfing resources in California (USA) and in Portugal are described:

> "Maximize public access to and along the coast and maximize public recreational opportunities in the coastal zone consistent with sound resources, conservation principles and constitutionally protected rights of private property owners (California Coastal Act, 1972, para. 6)."

The Coastal Act created the California Coastal Commission. One of the Coastal Commission's permanent functions are:" The implementation of a public coastal access program for the length of California's coastline, including maintaining and updating an access inventory, keeping records of easements and dedications, and expediting the opening of new access ways for public use (California Coastal Commission, Program Overview, 2010, para. 4)." However, 25 years after the passage of the Coastal Act there remain issues regarding the access the beach and surf in many locations in North America.

The most inaccessible parts of the coast are typically either areas occupied by military and private housing developments or a single large landowner who prevents access. One of the most famous surfing areas formerly blocked by the military is Trestles. From the early days of surfing in the 1970s surfers had to trespass on Camp Pendleton (and risk fines, board confiscation, and even potential jail time) in order to gain access to the waves of Trestles (Young, 1983). The access problem was solved when the Marines gave a large portion of coastal land (between San Clemente and Oceanside) to the California State Park system. However, other surfing areas have remained exclusively for military use.

In cases where there are one or more large coastal landowners, access is often difficult. A particularly famous area is "The Ranch", between Gaviota and Point Conception in Southern California. Currently access is only permitted to residents and their guests or by boat. In some coastal locations, surfers and other beach goers have established and used trails across private property for years without action taken by the property owner to restrict that access. "In many such cases, courts have held that such long-term unimpeded access has created a de facto coastal access trail, and that the property owner (or a new owner) must allow that access to continue. Evidence through personal accounts and photographs of long-term use of access ways (typically 5 years or more) must be proven (California Coastal Commission, Prescriptive Rights Study, 2010, para. 2)." A prescriptive

rights study by the California Coastal Commission to evaluate the possible chance of gaining public access to the beach and surf in the area of "The Ranch" is under way. While in many other parts of the world access to the beach and coast remains problematic, North America tends to give private landowners extraordinary strong property rights and the opportunity to own coastal land on a large scale - especially when compared to Northern European countries, where often an "everyman's right" guarantee regarding trespassing private property in order to enjoy coastal waters.

In Portugal the situation is to some extent similar to the US, most land is privately owned and property rights are strongly protected. However, all land on the coastal foreshore and all land from high tide level landward for 50 meters are part of the Maritime Public Domain and a legal right of public access exists. Law 54/2005 guarantees access to the Maritime Public Domain by foot passage, for fishing and navigation. Decree-Law No. 309/93 defines Coastal Areas from 300 meters below sea level to 500 meters landward of maximum high tide level by excluding harbors. Policies should control development in this area, however in reality this area is often subject to uncontrolled and unplanned urban housing development. In Portugal access to all beaches are free of charge, however parking on urban beaches is sometimes not free. When constructing and planning coastal paths, the Ministry of the Environment, Spatial Planning and Regional Development, Ministry of Agriculture, Rural Development and Fisheries and other regional and local authorities play a leading role in the realization process. However, in reality coastal access is often threatened by erosion and coastal development.
(Scott et al., 2006)
For example, the beach of Esmoriz is hard to access due to a steep, sandy path on the cliff and only physically fit people are able to enjoy that beach. In Matosinhos access is generally ok, however there are difficulties when accessing the beach on foot in some places due to bad planning. E.g. In the south end only an eroded access ramp is existent and hinders accessibility to the beach for people with disabilities.

Figure 13 Car parking threatened from Erosion. Maceda Beach, Esmoriz (Eberlein, 2010)

Figure 14 Cliff in Maceda, Esmoriz (Eberlein, 2010)

3. The Management Strategy: Integrated Coastal Management

In the following chapter the terms *ICM* (*Integrated Coastal Management*) and *ICZM* (*Integrated Coastal Zone Management*) are being used synonymy, but they in fact mean the same thing. In Europe mainly the term *ICZM* is used, whereas in North America *ICM* is more common.

The human impacts on the coastal ocean are diverse as are the demands of human society on ocean space and resources. Environmental management seeks to soften these human impacts and tries to maintain the ecosystem's goods and services. Environmental management and also Integrated Coastal Management take place in a changing world, which is influenced by climate change, expanding coastal populations and a growing demand for coastal recourses and products increasing the human impact on coastal environments, and therefore demanding "for a ever more aggressive management action (Sale, P.F., et al., 2008, p. 8)." It is believed that around 50 percent of the world's population lives within one kilometer of the coast (Small and Robert, 2003). This tendency towards coastal living seems to continue and even increase. In history there had been a tendency to deal with coastal engineering projects in a single issue (e.g. protection of expensive real estate) or single sector approach (e.g. marine transportation) (Scarfe et al., 2008). Often during the planning phase of these projects stakeholders had and still have been left outside without being heard or having any democratic control/influence over the planning.

According to French (1997) there are only a very few untouched environments in the world left, which remain unaltered by any human activities. This comes as no surprise, because man has always transformed wilderness into a cultural landscape (Vos and Meekes, 1999).

An example of this was the previous described marine spatial conflict between recreational surfers and the modification of surfing breaks through coastal/civil engineering. The construction of seawalls (Saint Clair, Dunedin, New Zealand/ Madeira, Ponta Delagada / Azores, Ponta Jardim, Portugal / Porto, "Douro River Mouth Wave", Portugal) and jetties (Mission Bay Jetties, San Diego, California), boat ramps (Manu Bay, Raglan, New Zealand), piers (Oil Piers, Ventura, California) and beach nourishment ("The Cove" Sandy Beach, New Jersey) all change the coastal environments significantly. Whether the change

is perceived as good or bad (in terms of wave quality, erosion control, socio economic aspects) these previously mainly natural dynamic environments were changed and became to a certain degree artificial (Scarfe et al., 2008, French, 1997).

Integrated Coastal Management (ICM) has become increasingly more popular around the world and is seen by many experts as a standard procedure to mitigate coastal resource conflicts among various stakeholders. Sorensen (1997) identified already more than 180 coastal management programs, projects and feasibility studies in high and low income nations; this number might be even higher today. According to Hildebrand (2002, p. 3) *ICM* can be defined as:

> "A multi-disciplinary process that unites levels of government and the community, science and management, sectoral and public interests, the preparation and implementation of a program for the protection and the sustainable development of coastal resources and environments. The overall goal of *ICM* is to improve the quality of life for communities depending on coastal resources as well as to provide for needed development (particularly coast-dependent development) while maintaining the biological diversity and productivity of coastal ecosystems."

There is no single meaning of *ICM,* however the management approach is an interdisciplinary one. Probably the USA 1972 Coastal Zone Management Act introduced the concept of ICM first and many other initiatives and synonyms had taken place under this landmark act (Williams and Micallef, 2009).

The Coastal Zone

Coastal areas are dynamic systems, which are rich in natural resources and consequently attract diverse human activity. From an ecological point of view coastal and marine areas are environments of high biological and physical diversity. These ecosystems are defined by the interaction of terrestrial and marine habitats, such as estuaries, coral reefs, sea grass beds, beaches and dune systems. From a human perspective, coastal and marine areas are in many cases essential components of the economy of many coastal regions. Human related activities in these zones are characterized by competition for resources in addition to competition for space and land uses by various stakeholders (Scura, et al., 1992). There is no universally accepted definition for coastal zones but a common and widespread definition follows: "Continually shaped and influenced by physical processes, the coastal

area is a dynamic zone of interaction between the land and the sea, where the sea influences the land and vice versa (Cicin-Sain and Knecht, 1998, p. 14)." This can imply to include river catchments into a coastal area program if the particular problem to deal with is situated in the catchment area (e.g. for many problems with pollution or nutrient flows) (Kannen 2000, Gee et al. 2006). In order to manage these dynamic geographical areas that engage a dynamic set of human activities an integrated approach is needed. For example, the industrial and agricultural discharges and runoff into inland watercourses, like the Douro River are affecting the water quality in the coastal zones around Porto and Matosinhos. This fact highlights the importance, on the one hand, of integration of the coastal management with the management of other sectors of the economy and, on the other hand the integration at the international level in respect of transboundary issues. Watercourses and coastal zones are dynamic, transboundary systems, which need an integrated management approach.

> "ICZM has been developed as an alter native to traditional ad-hoc and sector-based approaches which fail to address the complexity of the coast and specifically the interactions between natural, social, economic, cultural, and institutional parts of the coastal system. These shortcomings relate to the interactions of scales (in social, institutional, economic, and ecological systems), the often conflicting interests related to diverse activities, and last not least the inter-temporal linkages that connect short- and longer-term biophysical and social processes (Kannen et al., 2008, p. 147)."

Integrated Coastal Management (*ICM*)/Integrated Coastal Zone Management (*ICZM)* is theoretically and ideally integrated within the following dimensions (Cicin-Sain and Knecht, 1998):

- Horizontal integration –i.e. integrated planning related to socioeconomic and ecological aspects;
- Vertical integration at various administrative bodies, at different levels of communication: International cooperation, National government, Regional/County level, Local/Municipal level;
- Territorial integration taking into account the interrelations between the land and the sea, the terrestrial, estuarine, littoral and offshore components of the coastal zone;
- Integration through time in a consistent manner of the policies, planning and

management strategies;

• Last but not least and very important is the integration through public participation and education of the coastal environment.

However, integration is a process that is most likely to lead to a power shift among various governmental institutions, such as ministries, planning agencies and various other stakeholders. When implanting ICM through integration in the different dimensions, it is important to be realistic in relation to the conditions of superrb (e.g. historical, cultural aspects of a county) and to take the human dimension into account (e.g. the individual support or "sabotage" of integration from opinion leaders/key persons). The amount of integration is an issue with strategic importance according the following options mentioned by Olsen, et al. (1997) as cited in Olsen et al. (1998, p. 7):

• *Enhanced Sectoral Management*: "The main focus is upon the management of a single sector or topic but explicitly addresses impacts and interdependencies with other sectors and the ecosystems affected."

• *Coastal Zone Management*: "Multi-sectoral management focused upon development and conservation issues within narrow, geographically delineated stretches of coastline."

• *Integrated Coastal Management*: "Expands the cross-sectoral feature of CZM to consideration of the closely coupled ecosystem processes within coastal watersheds and oceans. These programs are conceived as a means for progressing towards sustainable forms of development."

According to Olsen (1998, p. 7) one of the most important learning outcomes from worldwide experience is that more integration is not always necessarily better than less integration. From a pragmatic, political point of view better success can be reached with less higher goals, "in many cases success lies in the modest beginnings." Further Olsen states that it might be better in certain cases to begin with an improved, sectoral management and then shift later to a more advanced, developed coastal zone management (CVM), rather than start directly with a complex integrate costal management approach *(ICM)*. However, the goal of an Integrated Coastal Management *(ICM)* should not be left aside and is still a goal that is more than worthwhile to reach. "But from a strategic,

operational point of view, it is far better to implement a few things well than to launch into an overly ambitious multifaceted program, which produces negligible progress on many fronts (Olsen, 1998, p. 7)."

The Need of Marine Spatial Planning and Accessibility of Data

When trying to adapt Integrated Coastal Management to the local needs on the ground one major topic is described frequently in the research literature: Marine spatial planning and the access to spatial data and information. The issue of proper marine spatial planning is a very important issue for the Portuguese coast, because unplanned development is threatening some, of the last pristine, ecological valuable parts of the coast and is also having an negative, impact on already developed/urban beaches, like Matosinhos. In order to implement efficient coastal planning spatial information and baseline data is necessary. In order to make good decisions, ICM requires an understanding of the location and distribution of the several features, e.g. bathymetry, substrate, currents, water properties, habitats, animal and plant populations, sensitive ecosystems, cultural features, fisheries, recreation, marine transportation, and coastal communities. (Canessa et al., 2006) Furthermore, access to current, comprehensive, and reliable spatial information is necessary for informed decision-making and multiple stakeholder participation in ICOM (Cicin-Sain & Knecht, 1998). This requirement should be met through development of a marine spatial infrastructure that includes both technological and institutional responses.

> "Such a spectrum of information is collected, stored, managed, analyzed, and distributed by a diverse range of agencies at all levels including: governments, First Nations, research organizations, industry, nongovernmental organizations and communities. Although, the data and information may exist, they may be difficult to find, in incompatible formats to integrate, and/or of unknown quality to be useful for ICOM (Canessa et al., 2006, p. 106)."

However, the problem remains that required data for science and research remains highly specialized and it is insufficient just to implement a database with a list of available data sets. Furthermore the critical question arises, what kind of data is significant and should be selected for such a database? In the case of sustaining and considering surfing breaks within coastal management decisions information about surfing break locations, the physical and oceanographic processes that cause the quality waves to break, and the threats to the wave quality and surfing recourse is of crucial importance.

Failure of ICM

According to Shipman and Stojanovic (2007) there has been progress on a global and European scale in defining the concept of Integrated Coastal Management. The authors identified a growing number of textbooks dealing with *ICM*, training courses and scientific workshops on *ICM*. However, when it comes to the stage to implement *ICM* into action on the ground, this often fails or is not even tried for various reasons. According to Sale P.F. et al (2008, p.2) "there is ample evidence of our failing management (of our coasts)", in the following three central failures of Integrated Coastal Management are described: FAO states, that 52 percent of 441 global fishery stocks are fully exploited, 17 percent are over exploited and 7 percent are totally depleted. In the year 2050, 91 percent of the world's coastlines will have been severe impacted by development. 80 percent of all maritime ocean pollution can be traced back to terrestrial, land based activities and outside of North America and Europe 80 percent of sewage enters the ocean totally untreated (Sale P.F. et. al 2008).

The Economization of Society - The need for a Paradigm Shift

However, according to Kannen (2002) and Kannen and Buckhard (2009) there is a need for a paradigm shift away from traditional approaches on how policies are formulated and implemented. This paradigm shift needs to take into account interactions " at different scales, affecting both the institutional and social, and the ecological domains" (Kannen et al 2010 p. 180). ICZM is challenging such a paradigm shift, which is based on an ecosystem approach to management, since it tries to overcome the shortcomings of traditional ad-hoc and sector-based approaches and political decision-making.

ICZM has remained fragmented and progressed slowly until now in many European countries, because an implementation gap still exists (Kannen et al. 2010). Political resistance of various institutions often hinders the implementation of *IZCM* with politicians and coastal planners not following recommendations of the scientific coastal management community for various reasons, such as the fear of a power shift, which can come along with the loss of political power and importance. Sale P.F. et al. (2008, p.3) identifies, that within jurisdictions different departments and management bodies have conflicting interests - there is a "bureaucracy tendency to protect turf and boundaries." For example, Kannen (et al., 2010) states, that in Germany several recommendations from scientists,

when designing a new national ICZM strategy in 2006, were not fully taken up to the essential degree. Another explanation might be that the practical implementation of IZCM takes more time, since "bureaucracy routine" is long-winded and timelines for the implementation of *ICM* do not often allow several rounds of stakeholder involvement (Kannen et al. 2010). However, "even (if) commitments to pursue *Sustainable Coastal Development (SCD)* are translated into policy and law, unsustainable practices persist (Glavovic 2008 p. 130)." In a wider context the main reason for this might be the increased pressure of global economization on society in general. The influence of the economy on politics through lobbying for higher subsidies and other forms of economical influences (e.g. in the appearance of corruption and other acceptances of an advantage) remains a critical and fundamental point.

Enhance Communication Between Administrative and Non-Administrative Actors

In a smaller context ICM often performs unsatisfactorily, because of an inefficient relationship and level of communication between government and other key stakeholders for example, of civil society and the business environment. According to Glavovic (2008 p. 151) it is important to gauge the efficacy of these interactions and relations. Furthermore the author asks the critical question, to what "extent is there authentic participation by all key coastal stakeholders in the *ICM* process?" The crucial question arises, concerning the context of surfing break protection and *ICM*, if surfing is considered as such a key stakeholder. This question is complex and the answer might vary from country to country. Concerning Portugal surfing is not or maybe in very seldom cases (poorly) considered within the *ICM* process (J. Pratta Dias Santos, personal interview, 15th of September, 2010). The remaining challenge of a major *ICM* goal is to enhance the communication process between administrative and non-administrative actors (Glavovic, 2008). This point can be associated to the fact, that surfers in Matosinhos are only considered poorly in the beach management decisions of the local city council. However, some countries (e.g. as the previous mentioned best practice examples of Peru and Australia) consider surfing as a serious key stakeholder within their *ICM* decisions.

According to Glavovic (2008) a good practice of *ICM* should fulfill the "information and awareness goal", which insinuate to extend the expertise knowledge from scientific and coastal management professionals to other stakeholders and the broader public. On the other hand traditional knowledge from local communities should be included within *ICM*

decisions and be transferred to a communication network, which is accessible for coastal managers and the local community. It is not only sufficient to include *ICM* in educational programs, it is important to check and verify, if knowledge is gained and progressed about *ICM* by coastal stakeholders. It is important to address environmental and coastal issues to schools in order to achieve a greater environmental awareness to children and teenagers: In Australian schools outdoor education is endorsed into the curriculum as a subject, which teaches environmental issues in a playful, experimental and practical way. Surfing can be chosen as a subject within outdoor education. Beside the practical and sportive aspects of surfing, theoretical knowledge about water safety, physical oceanography and maritime environmental issues are being taught. A corporation between high schools and surf schools in Matosinhos and maritime research institutions could implement practical and highly valuable learning experiences. A progressive example of a practical coastal education program for schools is the Litoral Station in Aguda (near Porto), which since 1997 offers "hands on" environmental coastal education programs for secondary schools.

Stagnating implementation of ICM in Europe

In Europe currently Integrated Coastal Management is rather stagnating, regarding its practical implementation on the ground and (law) enforcement of existing coastal management rules. Research, planning, policy and the implementation of Integrated Coastal Zone Management/Integrated Coastal Management remains fragmented and are not linked with each other. Shipman and Stojanovic (2007, p. 380) are expressing, that " in reality, all are to blame for the present situation of *ICZM,* yet some simple measures are available to governments that would propel into the mainstream of environmental planning and management." Further the authors cite an independent Local Government Association report (LGA, 2002): *On the Edge—the Coastal Strategy,* was exploring key issues that hinder the implementation of Integrated Coastal Management from national to local level. The report identifies the following factors as being responsible for the failure of *ICM*:

- The complexity of responsibilities (and therefore a lack of accountability)
- The national policy vacuum (due to the fast pace of globalization/"turbo capitalism" changing the way of worldwide economy, national politics and laws are often outdated and modified to slow)

- Information blocks, gaps and obstacles (e.g. the divide between social science and natural science, the separation between science and the public)
- The democratic deficit (e.g. lack of local, direct forms of democratic participation)

However, (concerning the point of information blocks) a better integration of science does not necessarily mean a better implementation of ICM. As pointed out before and according to Kannen et al. (2010) policy makers are sometimes not willing to follow the advice of scientists. This has various and predominant reasons, like the fight for positions of power, financial resources, the animosity between environmental- and economic policies and so on. However, science does not have the task and competence to implement coastal planning. The responsibility of implementing planning and to shape ICM and coastal policy lies within the administrative bodies and the representatives of economy, politics and civil society in general.

According to Shipman and Stojanovic (2007) a European breakthrough of Integrated Coastal Management (ICM) lies within the following main areas:

- To develop a national strategies and legislation for ICZM.
- To ensure durable funding schemes for local ICZM initiatives.
- To implement ICM within synergistic drivers: European marine thematic strategy, maritime policy, reform of terrestrial planning systems and regionalization of management effort.

Furthermore local communities will more easily adapt and accept Integrated Coastal Management, when economic or other incentives are appropriately aligned with management needs. The incentives are ideally so designed, that they lead to clear and prompt results, which have a multiple, positive effect on environmental issues. (Sale P.F. et. al 2008)
According to (Shipman and Stojanovic, 2007, p. 383), Integrated Coastal Management is best transformed into practice, when it considers the "prospective futures of people" and their personal meaning of the coast:

> "ICZM as practiced over the past 40 years encapsulates one of its key weaknesses—namely that the coastal zone cannot be managed solely by considering technical standards or its

geomorphological development, but must understand the prospective futures of people who have an interest in the coast, and their strong sense of place. The coast can be one of the most dramatic landscapes, stirring deep emotions; a physical and a psychological frontier, a place of danger and hard won living, of rest and tranquility, of enjoyment and leisure, even a spiritual landscape or symbol of national identity."

Integrated Coastal Management in Portugal

According to J. Prata Dia Santos (personal interview, 15th September, 2010) in Portugal the integration of ICM is low or poorly developed at all levels, he identifies the main reasons for this as being political instability as well as general economic problems. Regarding the development of Integrated Coastal Management in Portugal the following terms are often used to define the coastal zone (Veloso-Gomez et al., 2008):

- Littoral (Litoral), covering the whole EEZ shoreline and all the terrestrial area influenced directly or indirectly by the sea;
- Coastal Zone (Zona costeira), the stretch ranging from the 200m depth line to the interior as far as tides, waves or winds reach and have an influence;
- Coastal Stretch (Orla costeira), a stretch of coast which is under the direct influence of sea activity;
- Coastline (Linha de costa), reference line defined as the intersection between mean height of sea level and land.

In 2008, the report "Basis for a National Strategy for Integrated Coastal Zone Management in Portugal" was published by the Portuguese Ministry of the Environment, Territorial planning and Regional Development (MAOTDR). The main aim of the report was to develop a national strategy to enhance coastal planning for the entire coast and its marine and terrestrial sectors. According to Veloso-Gomez et al. (2008) the implementation and realization of institutional programs and policies on the Portuguese coastal zone are in the early stages, and will confront society and local communities with significant challenges. " If this opportunity to endorse and launch a strategy for the Integrated Coastal Zone Management in Portugal is not seized – clearly beyond the scope of one ministry – it may be too late for sustainability (p. 9)." The following major problems regarding the

implementation of Intergraded Coastal Management are identified by Veloso Gomez et al. (2006) in Portugal as:

- Various conflicts of interest in the coastal zone, areas with extraordinary social and economical opportunities resulting in "highly polarized activities and interests";
- The need to find "a platform of consensus";
- Difficulty in providing long term predictions on the future development of physic, social and economical factors impacting the coastal zone;
- Problems considering the interactions between sea and land in wider geographical context;
- Political instability regarding governmental environmental and spatial planning, low supervision and law enforcement, low implementation levels of policies and programs;
- Great social and economic dislocations are limiting the (financial) realization of coastal management programs, this situation has not changed much in recent years, consequently there is the need to design a realistic and pragmatic integrated coastal management program.

Furthermore, Veloso Gomez et al. (2008) states, that there remains a great need for a wider "mobilization, participation and accountability of civil society (p. 4)" in general and should not be left exclusively to "pressure groups". According to J. Prata Dias Santos (personal interview 15th September, 2010) "the human occupation of the coast" in Portugal is the greatest threat to the coastal environment; further he states that there are "no solutions, but only mitigation actions" to coastal environmental impacts caused by anthropogenic factors, because the urban development of the north coast in Portugal is a fact that was created 35 years ago.

Scaling down ICM – Beach Management for Matosinhos

In conclusion it can be said that many coastal nations have *ICM* plans, but the numbers of nations with implemented plans are extremely small. Regarding Portugal and the featured case study of Matosinhos Beach, *ICM* seems to be first the appropriate management strategy for solving resource conflicts and environmental issues. However, due to the

previous described situation of Portugal's political and economic situation and the in general low level of implementation of *ICM*, a different approach might be more practicable and successful: A sectoral management approach and local adapted beach management / coastal zone management for Matosinhos and the north coast of Portugal. As mentioned previously, Olsen et al. (1998) sees one of the most important learning outcomes from the worldwide *ICM* experience, that more integration is not always necessarily better than less integration. However, according to Olsen et al. (1998) individual beaches should be managed under the broader umbrella of ICM. However, Williams and Micallef (2009) state, that there is a general trend at the moment to scale down *ICM* to the local level. Beaches have a great variety of functions including coastal protection, recreation and nature conservation. Williams and Micallef (2009) identify swimming, surfing, sand yachting, fishing and jet skiing as some recreational values of a beach. Effective Beach management performs best when the following pre requirement first postulated by Sauer (1963 ((as cited in Williams and Micallef, 2009)) is met: The integration of the fundamental physical environment with the cultural landscape that results into a complex *superstructure* (Williams, 2002), which is easier said than done to manage.

Earlier, beach management focused on a number of physical issues like, erosion problems, protection measures and beach nourishment. However, work in the past decade refers more to socio-economic aspects of beach management and in specific the use of questionnaires concerning to beach users perceptions and priorities (Micallef et. al, 1999, Sardá et al. 2005). Surf related questionnaires concerning user perceptions has been carried out only to some extent. Most studies, as mentioned before, have mainly been carried out regarding the economic value of surfing breaks for coastal communities. However, a study carried out by Coffman and Burnett (2009) considers beside the economic valuation of surfing for Mavericks in Northern California some user perceptions of the beach regarding surfing issues.

Beach questionnaires are an important beach management tool as they can help to gain acceptance by the users for management actions and help to scale a beach management plan right. As Williams and Micallef, (2009, p. 107) state:

> "There is a considerable value in identifying beach-related socio-economic data sets, as inclusion of such information in beach management plans might encourage beach user

compliance by the general public with management policies. Identification of beach user preferences and priorities could also preempt management measures addressed to beach aspects subject to high user pressures."

In order to develop and adapt a future beach management strategy for Matosinhos, a primary beach questionnaire with a focus on surfing aspects and environmental issues was developed and carried out. In the following chapter the methodology of this survey and other research methods used for the Matosinhos case study are described.

4. Matosinhos Beach Case Study

4.1 Methodology and Research Techniques

Multidisciplinary techniques had been used in order to carry out this research including a literature review, a survey using an element of the willingness to pay/the contingent valuation method and quantitative as well as qualitative questions. Furthermore four problem centered, qualitative interviews were conducted.

The Survey

The on-site surveys were collected over 14 days, ranging from the 15th of September to the 28th. In total 61 surveys were collected personally on Matosinhos Beach. 27 surveys were formulated and conducted in Portuguese and later translated into English. The rest of the surveys were composed in English.

According to Williams and Micaleff (2009) question framing has to be in the context of the research topic and the suburb conditions of the beach. An interview is defined by Channel and Kahn (1968, p. 530 ((as cited in Williams and Micaleff, 2009)) as: "A two person conservation initiated by the interviewer for the specific purpose of obtaining research-relevant information and focused by *him* on content specified by research objectives of systematic description, prediction or explanation." The major benefit of conducting an interview personally is according to Williams and Micaleff (2009), the received data quality and a expected response rate from over 95 percent. However, concerning the interviews, which were conducted in English, a response rate of around 70 percent was reached. Better response rates were (around 90 percent) archived, when interviewing

people in Portuguese. One of the main disadvantage of personal interviews is that there are time intensive or as Williams and Micaleff (2009, p. 109) points out a "costly form of interview".

The survey questions ranged from reasons for visiting the Matosinhos surf area to describing the personal meaning/value of the beach, environmental issues and user conflicts. Demographic data such as age, income, gender were collected too as these background information are maybe likely to influence the answers given in the survey. For the full survey instrument, please see Appendix I. Due to the limited time and research resources a larger collection rate of surveys was not possible. Therefore the data should and cannot been seen as representative for Matosinhos and the metropolitan region of Porto. However, the survey was designed in a way that it included a mixed data collection using qualitative and quantitative methods and questions. There has been no previous research/surveying carried out in order to evaluate the beach quality and surfing aspects of Matosinhos. So the survey has to be seen as a starting point, which provides first basic results of Matosinhos Beach.

There were great problems in obtaining environmental data, which were not publicly available. Especially maintaining up to date data concerning the wastewater treatment in Matosinhos was difficult. Nobody of the city council or the *The North Regional Coordination and Development Commission* was willing to talk about the environmental situation and the future development strategy of Matosinhos Beach. Therefore such data could have not been presented in this thesis and mainly explorative data of the survey and problem centered interviews is presented.

Economic Valuation of Environmental Services

Economic valuation of environmental services and amenities is based on people's willingness to pay. The Willingness to pay consists of three values: The use value, the option value and intrinsic value (Total Willingness to Pay = use value + option value + intrinsic value) (Tietenberg, 2007). Use value is the direct benefit derived from consumption; option value is the benefit derived from having the choice to consume (e.g. the possibility of use in the future); and intrinsic value is the benefit from knowing a good

exists (Tietenberg, 2007).

> "Because markets are notoriously poor at properly valuing environmental amenities (due to issues of common property, public access, and a host of issues associated with externalities), the value of environmental goods and services must often be assessed using methods other than market observation (Coffman and Burnett, 2009, p. 4)."

In the survey, one question relating to the monetary value was included. All other questions were related to non-monetary valuation of the site, since a full economic valuation of the beach was not possible regarding the scale of this master thesis. Therefore a relevant range of non-monetary qualitative and quantitative questions was included. By using the contingent valuation method people were directly interviewed in the survey, how much they would be willing to pay for clean recreational ocean water provided by Matosinhos Beach.

Qualitative Interviews

Four qualitative interviews were conducted. The interview partners were: 1. David Vogd, Surfrider Foundation Europe, 2. Prof. Dr. Mike Weber, director of the Litoral Station of Aguda, 3. Catarina Goncalves, national coordinator of Blueflag Portugal 4. Dr. Jaime Prata Dias dos Santos, environmental engineer, Litoral Station of Aguda.

Using qualitative interviews as a survey instrument is particularly suitable for the acquisition of new information, and compilation of controversial arguments and opinions on a topic (Kruker and Rauh, 2005). It is hard to gain subjective significance through personal observations; therefore the subject should be given the chance to speak for her- or him self (Mayring, 2002). All interview partners were experts in their field of research or employment. The choice of interview partners should reflect the major environmental problems observed in Matosinhos and the greater Porto area. The interview character can be described as a *Problem-Centered Interview. Problem-Centered Interviews* are suitable for investigations, where prior knowledge to the subject exists and a more specific research question is from greater interest (Marying, 2002). The general guidelines of conducting semi-structured interviews were obeyed (cf. Robson 1993, Kruker and Rauh, 2005). Interviews were conducted in English and were recorded on the tape format microcassette. Each Interview lasted approximately 45 to 60 minutes.

Informal Discussions

During the research time in Portugal there were many occasions for informal discussions with local people. The informal character of the talks was the basis for a fairly open conversation. Generally the informal discussions were a good opportunity to broaden or to gain new knowledge on the research subject.

4.2 Description of Project Area

Matosinhos is situated on the northwest coast of Portugal. It is the 8th most populated municipality of Portugal with approximately 169 261 inhabitants (Instituto Nacional de Estatística, 2008). Matosinhos is part of the metropolitan region of greater Porto, which overall has 1.5 million inhabitants (Instituto Nacional de Estatística, 2008). The Port of Leixões is the largest seaport of North Portugal and one of the most important ones in the whole country (CTUR, 2010). The port was established in 1892 and became more and more important, when ships were expanding in size and were unable to sail up the river, because of their greater draft. The city was always very strongly connected to and influenced by its port and this hasn't changed much until now. This intensive relationship between the "city and the port has greatly contributed to the economic and social development, which both areas have experienced in their common history (CTUR, 2010, p. 3)." The port of Leixões features important infrastructures such as highways and railroads, which connect the port with the inner regions of the country. Beside the port and logistic industry, the refinery of the leading Portuguese oil and energy company GALP is located right at the north side of the port area.

Another important sector of Matosinho's economy is the fishery sector, however due to declining fish stocks this sector has suffered, as in many other European fishing locations, from great losses in catch rates, income and employment. Total landings declined from 36838 tons in 1992 to 29748 tons in 1998 (FAO, 2000, no newer public data available).

In general Matosinho's economy is driven by the industrial and shipping sector, the service sector economy and especially the tourism sector seems to be in a developing stage. The tourism sector is gaining more importance in general in Portugal, because it is the sector with the largest growth rates in the Portuguese economy (Leitão, 2009).

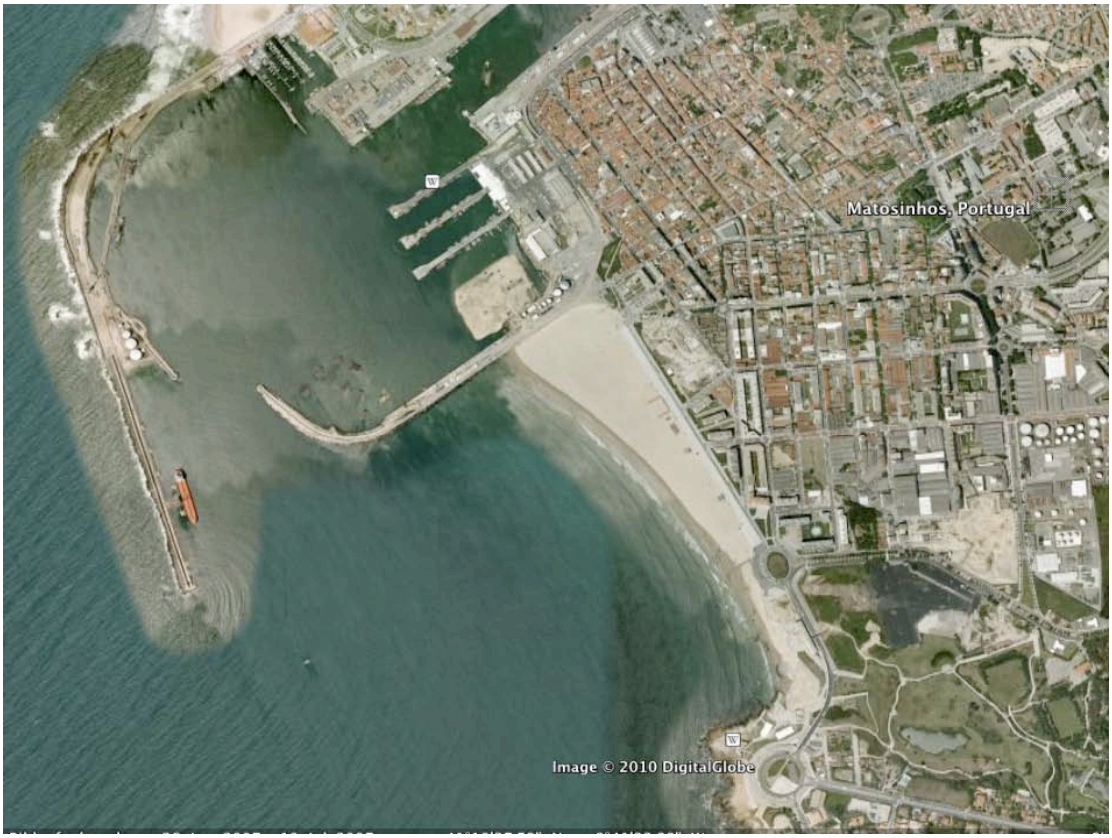

Figure 15 Arial view of Matosinhos (Google Earth, 2010)

Figure 16 Map of Portugal and Matosinhos (Google Earth, 2010)

Surfing Sector in Matosinhos

Surfing has gained more importance in Portugal, with a higher number of participants coming from Portugal and from foreign countries. Due to it's valuable and quality surfing breaks and relative mild climate surfers often refer to Portugal as the "California of Europe". However, surfing in the north has become increasingly popular over the last ten years and experienced a boom in the last two years. On the weekend with good days of surf, even remote beaches like Macada are becoming crowded and Matosinhos as central city beach is now even crowded during the whole week, even if the surf lacks of quality (personal observations 2010 and 2007). The Portuguese themselves mostly practice surfing in Matosinhos, however surfing tourism in terms of surf lessons for tourists is becoming increasingly popular. Vogdt (personal interview, 25th November, 2010)) mentions the growing number of surf schools and refers to a special organized "Erasmus student surf course", which is organized by one surf school on a regular basis. According to Surfrider Foundation Europe and Vogdt (personal interview, 25th November, 2010) the following surf businesses and numbers of employees can be identified, which are directly linked and dependent on local surfing in Matosinhos:

Table 4 Job numbers in the surfing sector of Matosinhos (personal interview, adapted from Vogdt, 2010)

Surfschool:	Number of Employees (estimated):
Onda Pura	12
Surf´s Cool	7
Surfing Life Club	4
Escola do Surf do Norte	8
Surf Center	5
Surfshop:	**Number of Employees (estimated):**
Surf Center	4
Waimea Surf Shop	6
Surf Local	5
Surfshop Surf´s Cool	4
Total number (estimated):	**55**

Furthermore businesses, which are indirectly linked to surfing in Matosinhos benefit from local surfers as customers: E.g. the following cafes and restaurants are frequently and mainly visited by surfers and beach users: Picaba Natural Café (ca. 12 employees), Vagas Bar (ca. 4 employees), Oscar Bar (ca. 5 employees). (Vogdt, personal interview, November, 5th, 2010) Please note, all given numbers concerning the employment in the surf business sector (see table) and related businesses to the surf sector are estimated, due to seasonal patterns the employment might be higher in summertime or lower in wintertime. For more details regarding surfing in Matosinhos please refer to the case study results in the next chapter.

Figure 19 Superior surfing conditions in Matosinhos with peeling and tubing waves (Wanna Surf Atlas, 2010)

Figure 17 Matosinho´s developed main beach with old seawall of the Castle de Queijo (Eberlein, 2010)

4.3 Results of Case Study Matosinhos Beach

User Activities

The user activities at Matosinhos Beach were researched and the results show that relaxation and sunbathing was the most popular activity on Matosinhos Beach. Surfing, body boarding and other water related activities such as skim boarding, bodysurfing and windsurfing were followed in popularity among beach users. However, water related activities such as swimming and surfing made up nearly half of all activities practiced on the beach. Other activities included "to have coffee and lunch", "to work", "to skate" and various others. The results of the user activities are important ones as they provide important baseline information for managing the beach in the user's interest and in a democratic way. The challenge is to include all these specific interests within a sustainable beach management strategy, without overseeing any particular interests and causing potential conflict among users.

Tell us why you came to Matosinhos Beach?

Answer	Count	Percentage
To surf (1)	17	27.87%
To see waves (2)	9	14.75%
To swim (3)	15	24.59%
To relax/sunbath with friends (4)	39	63.93%
To walk on shoreline (5)	14	22.95%
Other	20	32.79%

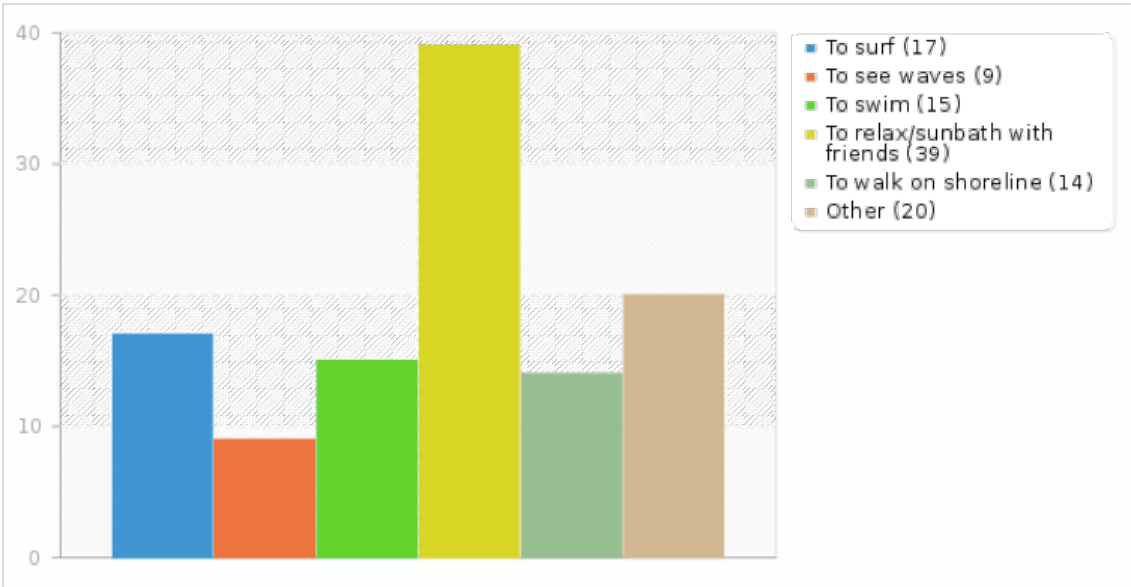

Figure 20 Tell us why you came to Matosinhos Beach? Multiple choice (Eberlein 2010)

Which of the above was the most important reason?

Answer	Count	Percentage
To surf (1)	9	14.75%
To see waves (2)	0	0.00%
To swim (3)	4	6.56%
To relax/sunbath with friends (4)	27	44.26%
To walk on shoreline (5)	5	8.20%
Other (6)	11	18.03%
No answer	5	8.20%

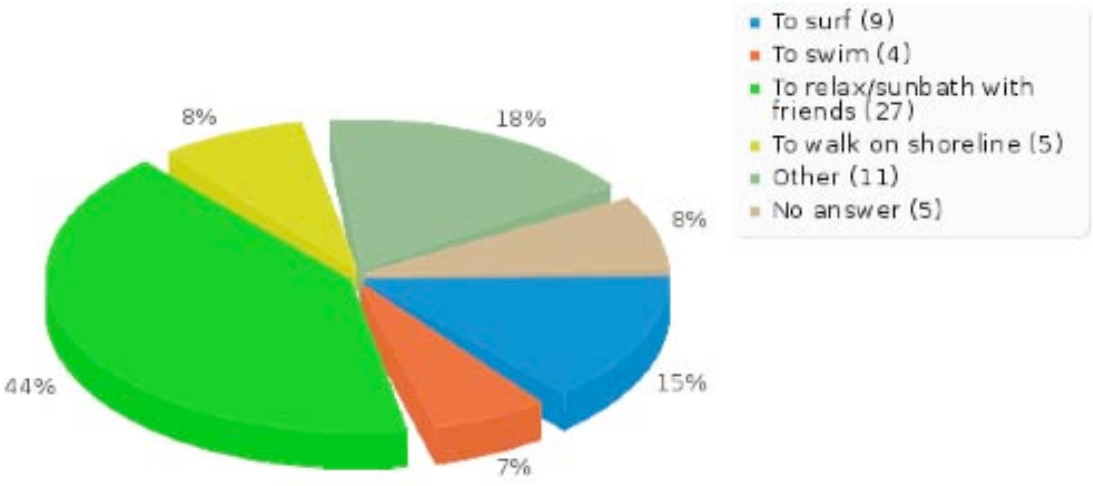

Figure 21 Which of the above was the most important reason? Single choice (Eberlein, 2010)

Surfing Activities

Surfing and other related activities play an important role in Matosinhos and are being practiced on a broad scale. On weekends and during summertime up to 100 surfers can be found in the lineup, even if the surfing conditions are only average (headcounts, personal observations, 2010). Matosinhos Beach hosts many surfing competitions on the regional and national level in Portugal. As mentioned before, Matosinhos offers surf shops within distance of the beach and has surf schools operating (including a school for kiteboarding, windsurfing) within the city. Surfing is part of the daily life in Matosinhos. Many people prefer the surf beach for it's central location within the city of Matosinhos and Porto - surfers who work during the week in Porto and Matosinhos often use their lunch break for quick surf. "It is a good place to surf and close to the office" was one response given in the survey. Office employers changing from a business suit into a wetsuit is quite a frequent occurrence. When questioning the surfing contribution to the quality of life and to the economy of Matosinhos; roughly 80 percent affirmed to these questions. Asking what surfing means to the participants and spectaculars in Matosihnos, first of all "recreation and pleasure" were mentioned, followed by the answers " to exercise and workout" and "to feel nature."

By trying to evaluate the socio- or cultural value of surfing for Matosinhos people were asked what surfing culture means to them. Results show that surfing culture was often associated with being in contact with nature. People state that surfing culture for them means, e.g. "being in contact with nature", "having a relationship with nature" and " feeling nature". Additionally the aspect of personal well-being and health was mentioned, e.g. " helps to release my stress and improves my way of life" and " brings a sense of relaxation and peace". The meaning of surfing culture was also described as " the sharing of common values" such as an "open mind" and "socializing with friends". Furthermore, for some surfing culture meant "identity and a way of life", "freedom", "action" and simply "fun".

What is surfing to you?

Answer	Count	Percentage
Recreation/pleasure (1)	35	57.38%
Exercise/workout (2)	23	37.70%
Culture/identity (3)	14	22.95%
Competition/profession (4)	3	4.92%
Feel nature (6)	17	27.87%
Has no meaning to me (7)	14	22.95%
Other	4	6.56%

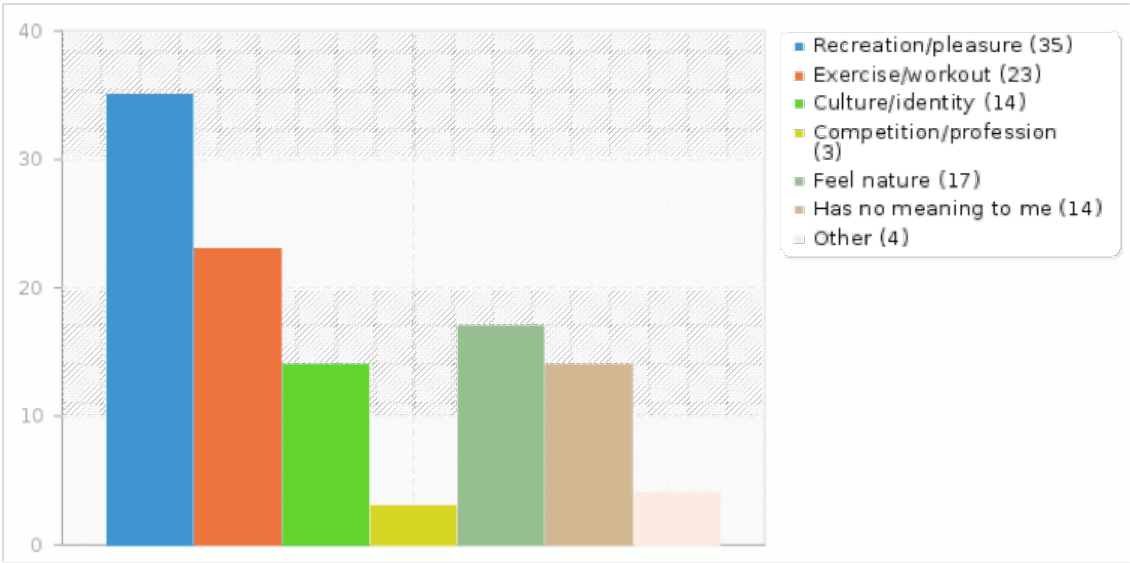

Figure 22 What is surfing to you? Multiple choice (Eberlein, 2010)

Do you think surfing contributes to the quality of life in the city?

Answer	Count	Percentage
Yes (Y)	51	83.61%
No (N)	9	14.75%
No answer	1	1.64%

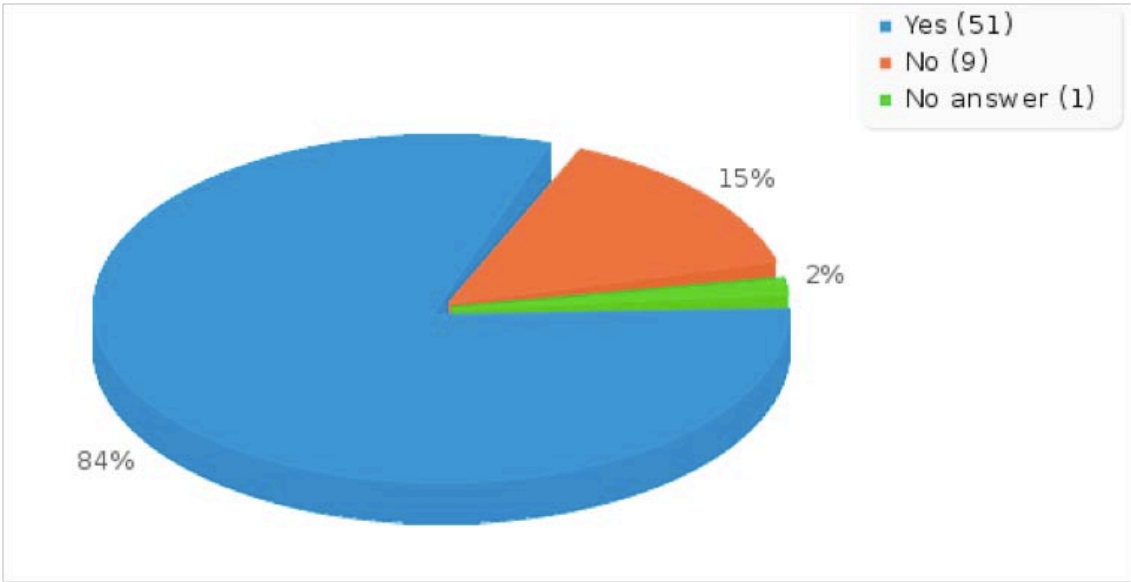

Figure 23 Do you think surfing contributes to the quality of life in the city? Single choice (Eberlein, 2010)

The Meaning of Matosinhos Beach

Exploring the personal value of Matosinhos beach is interesting, and essential in evaluating the individualistic, recreational value of the beach and ocean. In this section of the survey three qualitative, open questions were asked: 1) What does the ocean and the beach in Matosinhos mean to you?, 2) What is the most important experience you look for at Matosinhos Beach? and 3) What do you miss if you cannot go to Matosinhos Beach?

What does the ocean and the beach in Matosinhos mean to you?

When asking people what the beach and ocean in Matosinhos mean to them, a great variety of answers were given. Given answers can be categorized in four aspects of "feeling nature, freedom and relaxation", "surfing aspects", "identity and locality". Even though, Matosinhos Beach is an urban beach most answers were relating to the first category (feeling nature, freedom and relaxation), "feeling nature and freedom" and "to see the horizon" were mentioned most often in the survey. Other similar answers included " to smell (the sea,) see horizon, leisure, holiday feeling", "healthy, relaxed place in Porto in order to escape city stress", "place which allows you to relax, and enjoy your best moments" or to "hear the sound of waves, feel and breath fresh air." The answers assign the evidence, even though Matosinhos is an urban beach, people enjoy the nature and outdoor experience of this beach the most. This is no surprise, because the experience of

seeing a free horizon is not limited by any urban development like on land. Additionally the beach in the south part and at low tide quite wide, occasionally rocks with tide pools are found in the northern part of the beach providing “a natural feel” of the beach. Beach bars and cafes are only found either on the promenade or on the very inshore side (next to the promenade) of the beach. The foreshore of the beach is not developed and is a natural, dynamic place, even though it is greatly influenced by anthropogenic factors. In the south end of the beach the harbor of Matosinhos has a seawall, which represents a geographically, manmade boarder. The contrast of the natural, wide and sandy beach being cut by a 10 meter high concrete wall is quite dramatic. However, in the north the geographical boarder of the beach is a natural headland formed by rocks with the Castelo do Queijo being on top of them. The transition of the beach to a different landscape in the north is natural but none the less dramatic. Aesthetically the natural boarder of a rocky headland might be more appealing than the south end of the beach. However, the foreshore of the beach is fragmented, due to a concrete foundation with an approximate diameter of 15 meters. The purpose of this foundation is unknown, maybe it was intended to become a terrace or viewpoint, because it features some “designer” chairs made of stone. In the current design the structure does not provide much utility, because it is flooded by waves on high tides.

Surfing Aspects of Matosnhos Beach

Matosinhos Beach is as mentioned before a quite unique surfing beach in North Portugal, because of it’s physical geographic characteristics. The headland in the south provides a breakpoint (point break) for waves that peel along the headland further in the insight of the bay. The breakwater in the north provides protection from large swells, and makes beach surf possible on big swells and stormy days, when the surf is elsewhere too big and closing out. Furthermore next to the seawall a very sheltered surf area is provided with little waves, ideally suited for beginning surfers. Pointbreaks are very seldom along the north Portuguese coast, most surfing spots (beachbreaks) are found on exposed beaches and are fully exposed to any swell and wind direction. Results of the survey clearly show these special physical characteristics of Matosinhos Beach as an important regional surfing beach by stating that it is a “winterspot for surfing”. Another respondent replied that he, “first surfed and learned how to surf there, it was the first beach to get "stoked"; it is a winterspot when it’s too big elsewhere, Matosinhos offers more than clean waves, because

it is sheltered from large north/west swells." Other answers refer to the unique location of Matosinhos Beach within the city by e.g. saying it is the "only place in the city to surf and closest to the office" and "it is very easy to reach surfing within the city."

Identity and Locality

Matosinhos Beach is a place with a strong local identity. The city has a rich history of fishing and is more recently associated with its container port; it is in fact a port city. However, people living in Matosinhos Beach identify themselves strongly with the beach and the ocean and say that they like the beach, because it is their "home beach." One respondent states: "I have known this beach since I was little. I learned how to surf here, it means identity for me." Another respondent said that he likes the beach very much, "because it is local and close to (my) house." However, some people were stating that Matosinhnos Beach doesn't mean much to them and that they didn't like it, because it is dirty e.g., "I don't like this beach, because it is dirty and polluted."

What is the most important experience you look for at Matosinhos Beach?

This question is important since beach users were stating in question 1.2 their reasons for visiting the beach and were also telling their most important reason, however this question's intention was to find out about new aspects without giving any guidance/selections, therefore it was kept fully open. The term experience used in this question aims to explore the wider understanding, familiarity and knowledge of Matosinhos Beach. One respondent stated that the most important experience in Matosinhos was "Pleasure (from the surf) and to respect the nature. Environmental problems that you see at Matosinhos Beach makes you aware that we need to care more about our ocean and coast."

Again as in the previous questions, answers can be assigned to the category of "feeling nature and freedom/relaxation" and were typically abundant (e.g. " to see and feel horizon, waves and smell", "observe nature, view on the ocean", "escape daily routine" and "diving in the sea and freshness of sea water"). The second most abundant answers can be classified into the category of "surfing aspects" (e.g. " good day of surfing", "surfing in the dawn and sunset" and "watch surfers and people"). The third category of given answers

can also be classified into “identity and locality”, however answers referred more to the facilities and services Matosinhos offers (e.g. “the girls, the whole place offers a good mix of restaurants, cafés, bars, nightlife and shops”, “playing football/volleyball with friends (Matosinho´s offers beach soccer and volleyball fields)”, “ going to the café, beach bars” and to “socialize with my mates and watch chicks”).

By asking people what they miss, if they cannot go to Matosinhos Beach the same categories of answers can be assigned to the respondent’s statements such as “feeling nature and relaxation” (e.g. “miss the view, presence of ocean and nature”, “the view of the rough ocean” and “walk on sea floor (at low tide)), “surfing aspects” (e.g. “the accessibility to have a quick surf within the city”, “the great waves in winter” and “my job and surfing”) and “identity and locality” (e.g. “not my preferred, favorite beach, but close to my house - normally the weather is better here than on the other beaches”, “fun, the sea, the beach, people and my work” and “being with friends, peace of the sea“).

In conclusion you can say that Matosinhos Beach is mostly appreciated for providing natural goods and services - the natural recourses of the beach and ocean seem to be most important for the users. Matosinhos Beach has an outstanding recreational value within the metropolitan area of Porto consisting of natural beauty, surfing waves and local cultural uniqueness. A future beach management needs to consider these values in order to maintain and improve the recreational value of the site.

Environmental Issues - Water Pollution

As any other urban beach in the world Matosinhos Beach suffers from several environmental problems. However, as mentioned in the introduction water pollution is the main issue of the site. There are several categories of water pollution. For bathing water quality the disease causing pollutants such as bacteria, viruses, protozoa and parasitic worms are crucial (Kazmi, 2005). This kind of pollution is most likely to cause frequent health problems to users of ocean water in Matosinhos Beach (Beach Survey Matosinhos 2010, please see survey results below for more details). Other important categories of pollutants include oxygen-demanding waste (e.g. when oxygen demanding bacteria are decomposing waste), water-soluble inorganic pollutants (e.g. acids, salts and toxic metals), nutrients (e.g. nitrate, phosphate) (Kazmi, 2005).

All the listed pollutants are likely to be found in the water of Matosinhos, however it is not known to what extend they are responsible for health problems - as there is a need for year around monitoring of water quality in Matosinhos Beach in order to find out what kind of pollutants are abundant in high concentrations and must be tackled by waste water treatment. Another class of pollutants are organic compounds such as oil, plastic and pesticides. Oil and plastics are found on Matosinhos Beach on a regular basis and are easy to spot by eyesight (Beach Survey Matosinhos 2010, please see survey results below for more details). Water pollution can occur as source point pollution and non source point pollution (NSP), in Matosinhos both kinds of pollution are existent. Source point pollution can be defined as a pollution, which can be traced back to a certain source and can therefore quite easily be managed. Non source point pollution on the other hand is more diffuse and caused by several sources. It is therefore more difficult to identify and to mitigate (e.g. urban or agricultural runoff). (Kazmi, 2005)

Source point pollution is obvious and can be identified by eyesight at the following spots in Matosinhos:

- Sewage Pipe/Stormwaterdrain in the middle of Matosihnos Beach
- Sewage Outlet of treatment station Matosinhos at Leca da Palmeira (North side of harbor)
- Sewage outlet of GALP oil refinery
- Rubbish at beach from users
- Rubbish in the marina (next to the beach) from users and blown by wind into the sea from open rubbish containers

Figure 24 Main sewage and storm water outlet at Matosinhos Beach (Eberlein, 2010)

Figure 25 Pollution on shoreline in Matosinhos. Hygiene articles and cigarette butts (Eberlein, 2010)

Non-source point pollution can be caused by the following factors:

- Urban runoff from Matosinhos City (oil, domestic rubbish, organic matters: e.g. dog feces)

- Polluted Douro river flow and estuary, caused mainly through agricultural runoff and discharges of (metal) industries further upstream
- Ships on high sea and commuting in the port area (e.g. washing out oil tanks and discharging domestic rubbish)
- Lost fishing gear of small scale and industrial fisheries (e.g. threat to marine life by drift nets)

Figure 26 Macro pollution in harbor of Matosinhos (Eberlein, 2010)

Environmental Issues – Coastal Development and Water Quality

When asking what the concerns are regarding housing projects and coastal infrastructure in Matosinhos, people were referring mainly to problems regarding the architecture, infrastructure and services of the beach and "environmental issues". For example the following concerns regarding the sea front architecture of Matosinhos were mentioned: "Too many buildings, Matosinhos grew too fast and excessive. I would prefer smaller houses", "the tall buildings don't respect the nature", "buildings are too large, too urban and without vegetation" and "no controlled and planned construction - no city planning, there were no skyscrapers ten years ago." In conclusion you can say that the critics of

Matosinho's architecture impacting the quality of the beach can best be described with the term visual pollution. Visual pollution describes man made visual components (e.g. buildings), which alter the vista of a landscape negatively (Flad, 1997). In the survey and above many concerns over the urban, concrete architecture of Matosinhos were mentioned. Environmental concerns were mentioned as well in the context of the urban infrastructure and architecture of Matosinhos Beach (e.g. "I'm worried that housing and infrastructure will pollute the sea water."). Further concerns over the infrastructure include the water treatment of Matosinhos (e.g. I'm concerned about the treatment of waste water, I experienced a rash on my skin after surfing (in Matosinhos)", "Lack of investment in water quality" and " I'm worried that industry and housing don't treat sewage").

Regarding the city planning aspects, critics against the "Edificio Transparante" (shopping mall) next to the main beach criticized it's utility for beach users (e.g. I don't like the "Edificio Transparante" (building), it's not well planned and has no utility. It took too long to get businesses moving into it"). Other critics were saying that " roundabouts should be more proportional in size, a better planned car parking should be available and the beach should be regularly cleaned" and "bad management/planning on sea, beach and land"). Although, most of the feedback regarding the architecture and coastal infrastructure was negative, some people were stating that they don't have any concerns and even liked the contemporary, modern architecture (e.g. "No concerns, in general all OK," and " I find the contemporary architecture good").

What environmental concerns do you have regarding Matosinhos Beach?

Answer	Count	Percentage
Water pollution (1)	54	88.52%
Rubbish on beach (2)	51	83.61%
Air pollution (3)	29	47.54%
Oil on beach/water (4)	39	63.93%
No concerns (5)	1	1.64%
Other	9	14.75%

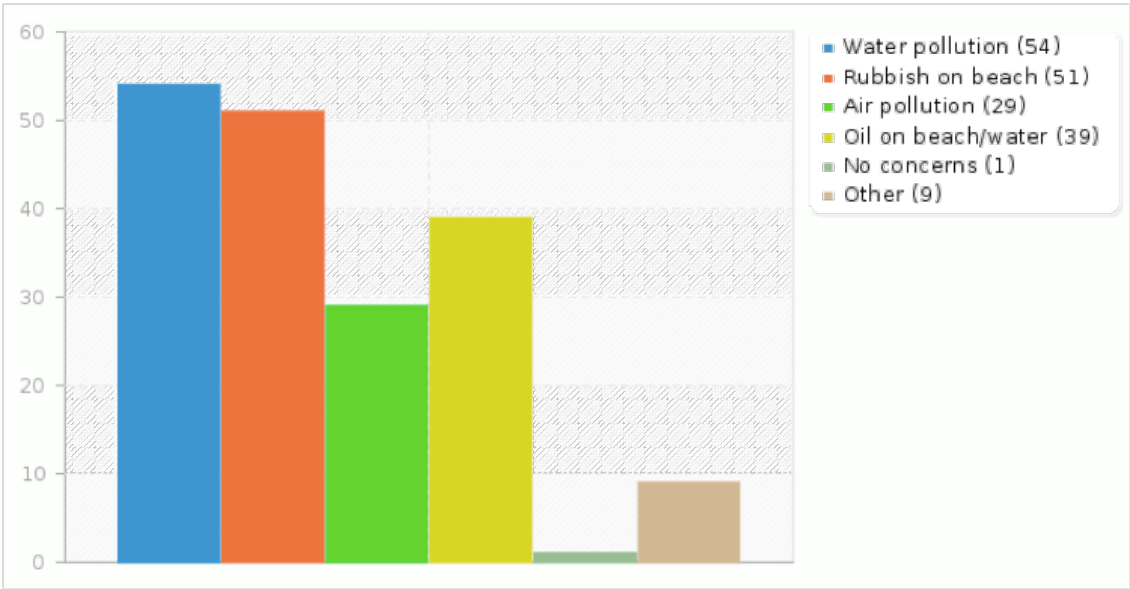

Figure 27 What environmental concerns do you have regarding Matosinhos Beach? Multiple choice (Eberlein, 2010)

Beach Users: Rubbish and Pollution is the Greatest Problem in Matosinhos

By questioning beach users on what environmental concerns they have regarding Matoinhos Beach, water pollution and rubbish on the beach were mentioned most often, as the third most common issue oil on the beach or in the water was named. When asking beach users to rank the importance of the mentioned environmental problems from above in five categories ("very important", "important", "fairly important", "less important" and "not important at all"), water pollution, rubbish on the beach, and oil on beach and in water were mentioned most often as being "very important". Therefore the results clearly show that the environmental problems of water pollution, rubbish, oil on the beach and in the water are very abundant and are perceived by the users as being pressing issues which need to be solved . Therefore these problems need to be placed at the top of the agenda, when adapting a beach management strategy for Matosinhos Beach.

Is year around clean bathing/recreational ocean water important to you?

Answer	Count	Percentage
Yes (Y)	56	91.80%
No (N)	2	3.28%
No answer	3	4.92%

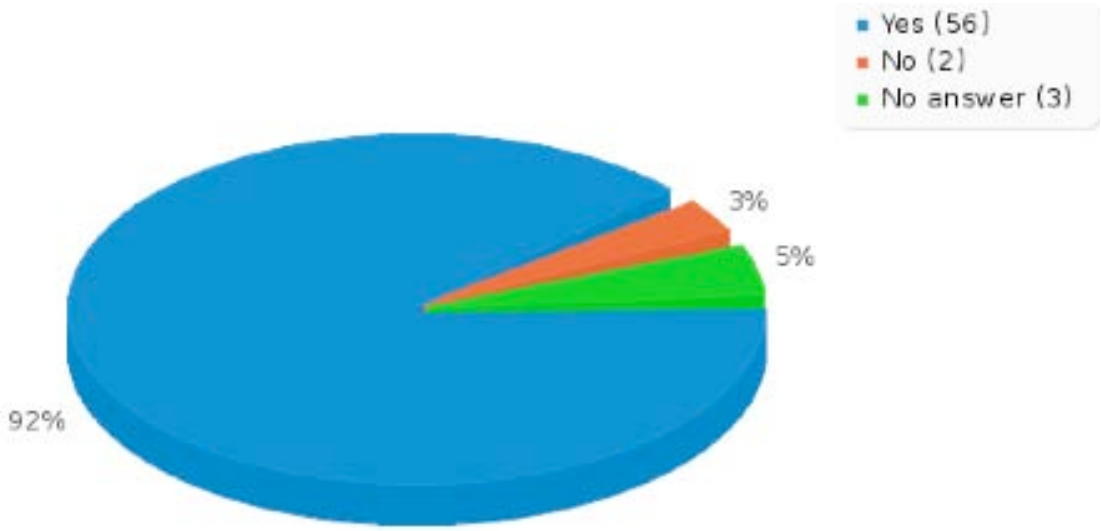

Figure 28 Is year around clean bathing/recreational ocean water important to you? Single choice (Eberlein, 2010)

About 90 percent of all questioned beach users stated that clean ocean water all year around was important to them. When asked who should pay for the improvement of water quality respondents were stating most often "the state" and "polluter". By asking how clean bathing water should be financed, people were required to choose between the following options (with a single choice): "by the state", "by entry fees from users" and " neither A or B (neither by taxes and users)". Half of the respondents were mentioning that the quality improvement of coastal waters should be financed by taxes, the other half of respondents chose "neither A or B (neither by taxes and users)". The results of both answers clearly demonstrate, that the responsibility of clean recreational ocean water is assigned to the state.

Who should pay for the quality improvement of coastal waters?

Answer	Count	Percentage
State (1)	48	78.69%
Private investors (2)	19	31.15%
Polluter (3)	36	59.02%
User of beach and recreational water (4)	11	18.03%
Other	2	3.28%

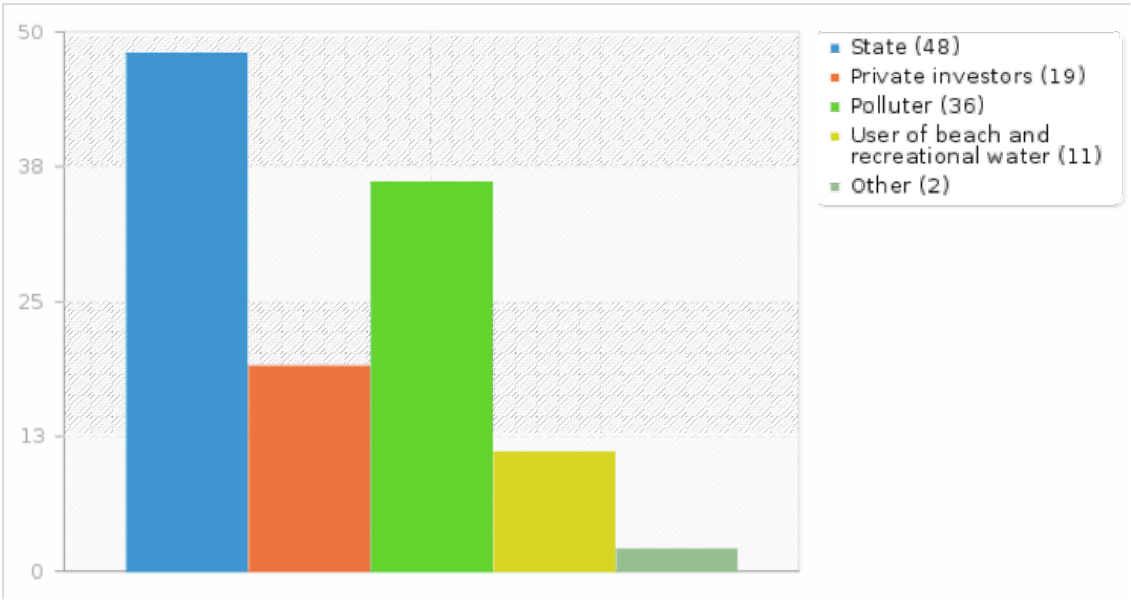

Figure 29 Who should pay for the quality improvement of coastal waters? Multiple choice (Eberlein, 2010)

How should clean bathing water and beaches be financed?

Answer	Coun	Percentage
By taxes (1)	28	45.90%
By entry fees from users of beach and recreational water (2)	5	8.20%
Neither A or B (3)	27	44.26%
No answer	1	1.64%
Not displayed	0	0.00%

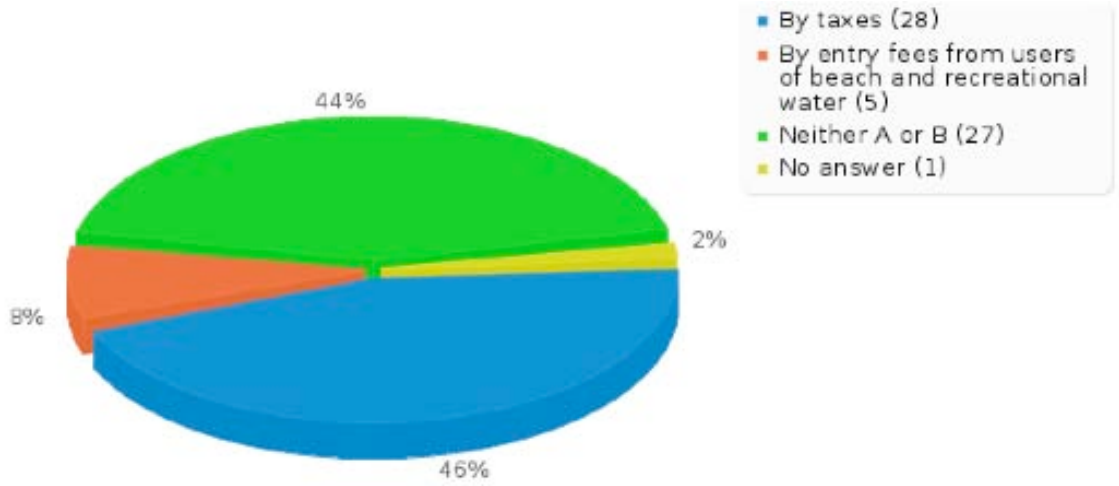

Figure 30 How should clean bathing water and beaches be financed? Single choice (Eberlein, 2010)

Surfers Are Willing to Pay the Most for Clean Ocean Water

When investigating how much people are willing to pay for the improvement of water quality in Matosinhos, the majority of people seemed to be willing to pay and contribute for an improvement of water quality. However, during the interview people were mentioning concerns (if they made a financial contribution), if the money would actually be spent by the local government/municipality on water quality improvement and not for other purposes. When looking further into the data and investigating, if a correlation exists between the amount of income and the amount of willingness to pay for the improvement of coastal waters in Matosinhos, there was no clear, obvious trend in the data. A high income does not necessary mean a high willingness to pay. On the other hand a low income (in the range of 0 €-1000 €) does not necessarily indicate that the willingness to pay is in general low. In fact in the lower income ranges (0 €-1000 € and 1000 €-2000 €) the willingness to pay is in relation to the income often significantly higher than in upper income ranges. However, when looking at the main user activities of respondents there is clear trend, that the willingness to pay for the improvement of water quality is among surfers significantly higher than among other beach user groups. From 19 surfers (including bodyboarders, bodysurfers, windsurfers and skimboarders) only 3 refused to pay any amount of money. Nearly all-top amounts of 75 €, 100 €, 150 € (only one none surfer was willing to pay 150 €), and all amounts of more than 150 € of willingness to pay (all per year) for the improvement of water quality were reached in the group among surfers. Therefore there is a clear tendency that surfers have a great interest in clean ocean water and are willing to play a part in achieving this goal. However, just over the half of all respondents (including surfers) stated that they are willing to pay a maximum of 10 € per year.

If nobody else cares, what amount of money would you be willing to pay for the improvement of water quality at Matosinhos Beach per year?

Answer	Count	Percentage
0€ (1)	16	26.23%
5€ (2)	13	21.31%
10€ (3)	8	13.11%
20€ (4)	10	16.39%
30€ (5)	2	3.28%
50€ (6)	5	8.20%
75€ (7)	1	1.64%
100€ (8)	1	1.64%
150€ (9)	2	3.28%
more than 150€ (10)	2	3.28%
No answer	1	1.64%

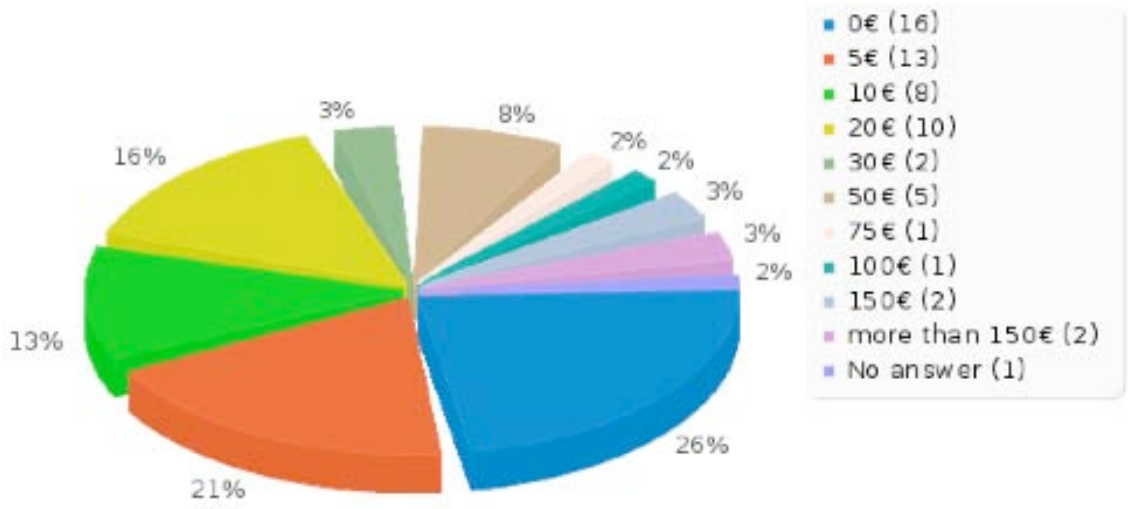

Figure 31 If nobody else cares, what amount of money would you be willing to pay for the improvement of water quality at Matosinhos Beach per year? Single choice (Eberlein, 2010)

Which range includes your gross monthly (before taxes) income?

Answer	Count	Percentage
0€-1000€ (1)	27	44.26%
1000€-2000€ (2)	11	18.03%
2000€-4000€ (3)	4	6.56%
4000€-5000€ (4)	0	0.00%
5000€ and more (5)	2	3.28%
Prefer not to answer (6)	9	14.75%
No answer	8	13.11%

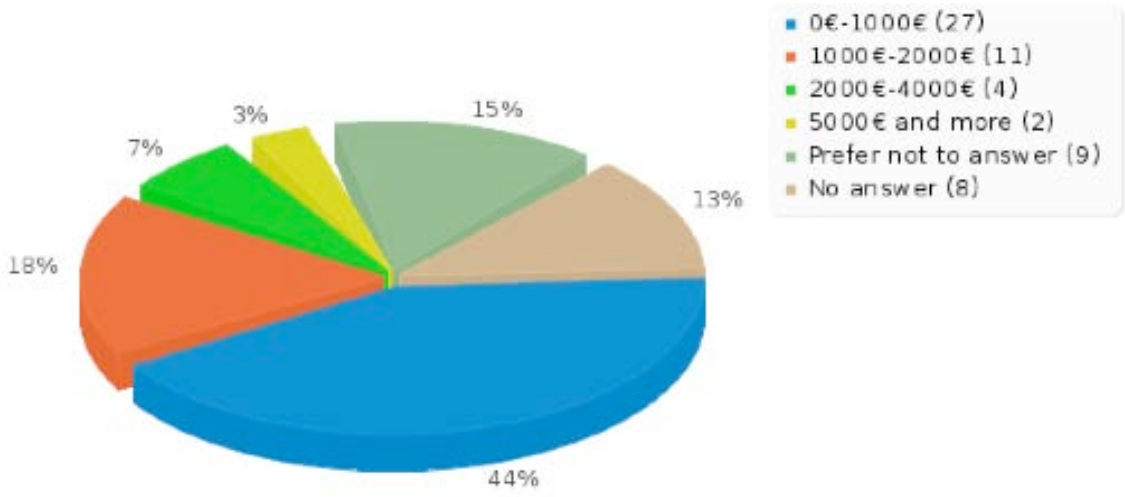

Figure 32 Which range includes your gross monthly (before taxes) income? Single choice (Eberlein, 2010)

User conflicts – Surf Related Issues Play the Main Role

Even though Matosinhos Beach is an urban beach, user conflicts are relatively rare and don't usually escalate into violence. Extreme localism, surf rage and violence in the water, is not abundant to the extent described by Young (1983), like in some Southern Californian surfing spots. Results of the survey show that nearly all conflict occurring at Matosinhos Beach were surf related issues, concerning who has priority of a wave. As mentioned before, due to a steady increased popularity in surfing in the mid 70ies and an increased crowdedness at certain surfspots, over time certain "surf rules" were established. Even though they are not postulated as a formal law, they are recognized worldwide and obeyed by most surfers. The main rule is very simple, but very important as it helps to mitigate serious injuries caused by a collision of two surfers: The surfer who is closest to the curl, the critically breaking part of the wave, has priority. Dropping in on a surfer, who is already on a wave is a no-go, this rule is often not obeyed by beginners and can cause conflicts in the water.

In Matosinhos these kinds of conflicts exist, but not overly serious for several reasons. The main reason is that the pointbreak of Matosinhos is only, working and surfed on big swells by surfers with an advanced and expert level (informal interviews, 2010). Conflicts are prevented by a "natural selection" of surfers, who are able to overcome the heavy shorebreak with strong paddling and duckdive abilities (a surfing technique to dive through

/ underneath a breaking wave) and will reach the lineup (the spot where the surfers wait for the “green”, unbroken wave). In Matosinhos conflicts in the water between skilled surfers and beginners were the main issue, followed by conflicts between surfers and body boarders. This spatial conflict can occur due to the fact, that body boarders prefer waves with a steeper face or angle, therefore their takeoff area is further insight. However, surfers are taking off on waves further outside and are riding to the insight shore and therefore might not be willing to share these waves with bodyboarders. On the other hand, when advanced surfers and bodyboarders are sharing the same takeoff area (e.g. pointbreak, reefbreak), the bodyboarder is always able to take off further insight to the wave curl and will therefore always have priority on a wave. The reason for this is, that a bodyboard (due to the board size) is able to perform at very steep wave angles and is able to master this wave transition down to the flat. A surfboard, due to its size and shape more likely to “slide out “ and cause a “wipeout”. Due to the fact that bodyboarders are able to surf the wave deep inside the tube, they are often overseen by inexperienced surfers with a possible risk of severely injuring the bodyboarder. The second main rule concerns the paddling out towards the lineup and says, that a surfer, who is paddling out, should try not to be in way of surfers riding a wave. This means the surfer should, try to paddle around the breaking peak (e.g. using a deeper water channel), however when being caught inside in the wave impact zone, a surfer should wait till the set is over or try to duckdive and paddle out through the whitewater. Trying to paddle over the unbroken shoulders just in order to have an easy paddle out is considered to be bad etiquette and can be dangerous, since it can cause a collision.

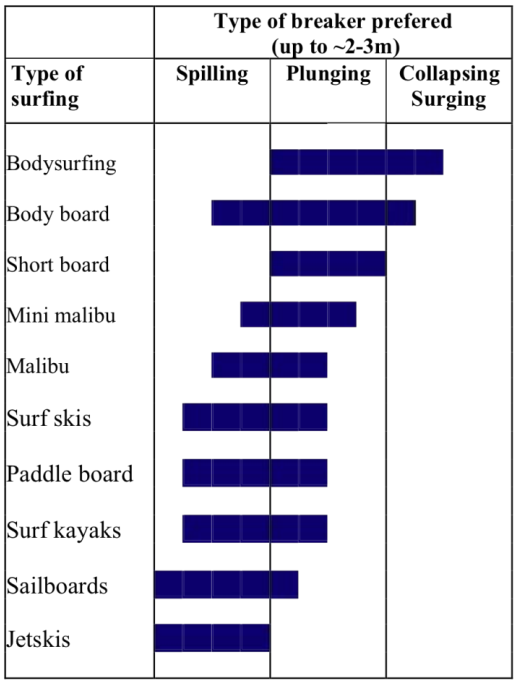

Figure 33 Different physical wave requirements lead to different spatial requirements and spatial use patterns in the water, however sometimes conflicting (Scarfe et al. 2008)

Atmosphere in the Lineup

It is important, to respect the atmosphere in the lineup. In Matosinhos the atmosphere in the water is in general friendly. However, the vibe and atmosphere changes any given hour or day. Surf conditions have an influence on the atmosphere in the water, e.g. big surf can lead to a more serious and concentrated atmosphere as a wipeout can have more serious or even life threatening consequences (in extreme high waves). A smaller surf will normally lead to a more "easy going" atmosphere in the water, however it can also lead to overcrowding (especially on weekends) in the line up with the consequence of a more competitive atmosphere. Beside the surf conditions, the human element is probably the more important factor in influencing the atmosphere of the line up:

> "Anyone who's regularly surfed a break through its daily cycle and felt the change in mood as the various crews - the dawn patrollers, the mid-morning shift, the lunchbreakers, the after-work rush hour pack - pass through will know precisely what we mean (Surfline Surfology, 2010, para. 1)."

In Matosihnhos the crowd is generally relaxed, however after work sessions and weekend crowds can be a bit of a hassle and occasionally shouting and arguing in the water is noticeable (personal observations, 2010). Therefore, it might be advisable (if possible) to avoid these peak times, when surfing Matosinhos.

Did you experience these conflicts to escalate and lead to violence?

By asking people if they experienced escalation and violence in the mentioned conflicts, most people were stating that they never experienced any violence at Matosinhos Beach. However, respondents were stating two incidents of an argument among surfers ("no violence, but shouting of surf teacher to other surfers to get out of the way" and "no violence, but shouting among surfers and body boarders regarding who has priority over the wave" and escalation of conflict leading into physical violence was observed twice ("yes, because of "dropping in" on of each others wave, there was a fight among two surfers" and "yes, fighting and beating up among surfers, because of dropping in on each others waves"). The results show that there is no great problem of violence among surfers in the water, however there is potential conflict. In order to mitigate the potential conflict and possible future violence and localism precautions are important. Preventive measures could include a sign explaining the basic rules and dangers of surfing. Such surfing conducts or etiquettes are found on many urban Australian beaches (personal observations, 2000) since they can help to prevent surf rage and violence in the water, as well as providing handy tips, where it is safe to surf and make surfers aware of existing dangers such as hazardous currents, rocks and etc..

Did you experience any conflicts in the water or on the beach?

Answer	Count	Percentage
Between surfers and swimmers (1)	7	11.48%
Between skilled surfers and beginners (2)	11	18.03%
Between surfers and bodyboarders (3)	8	13.11%
Between locals and non local surfers (4)	5	8.20%
Between locals and tourists (5)	7	11.48%
Between surfers and surf schools (6)	6	9.84%
Between surfers and kiteboarders (7)	4	6.56%
Beach parties/noise (8)	5	8.20%
No user conflicts (9)	34	55.74%
Other	9	14.75%

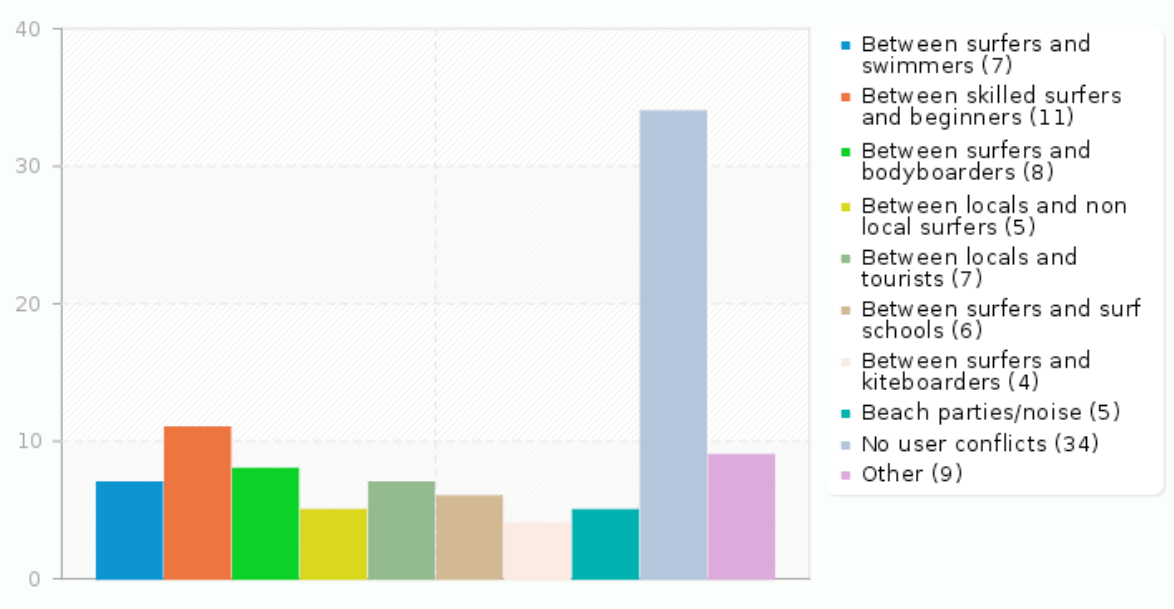

Figure 34 Did you experience any conflicts in the water or on the beach? Multiple choice (Eberlein, 2010)

4.4 Discussion and Recommendations

Matosinhos and surrounding areas were in the past shaped and expanded through the industrial development of the fishing, food, energy and shipping sector. The beach and surrounding urban development is close to industries related to the port and the oil refinery. Matosinhos tries to regenerate its economy and importance as a city by using the waterfront for new developments of coastal living, commerce and tourist attractions (e.g. Sea Life Aquarium). These activities are well advanced in terms of building up the last undeveloped coastal areas of Matosinhos and can be described as being “excessive”, since the development was fast, rather unrestricted, over dimensioned and involved non or only little public participation. Planning and architecture did not sufficiently take into account the possibilities and limitations of the natural coastal surroundings, the historic, industrial and cultural heritage of Matosinhos. The following SWOT-Analysis tries (SWOT is a strategic planning method to evaluate the strengths, weaknesses, opportunities and threats of a business venture or project) to give a comprehensive overview of the strengths, weaknesses, opportunities and threats of Matosinhos Beach.

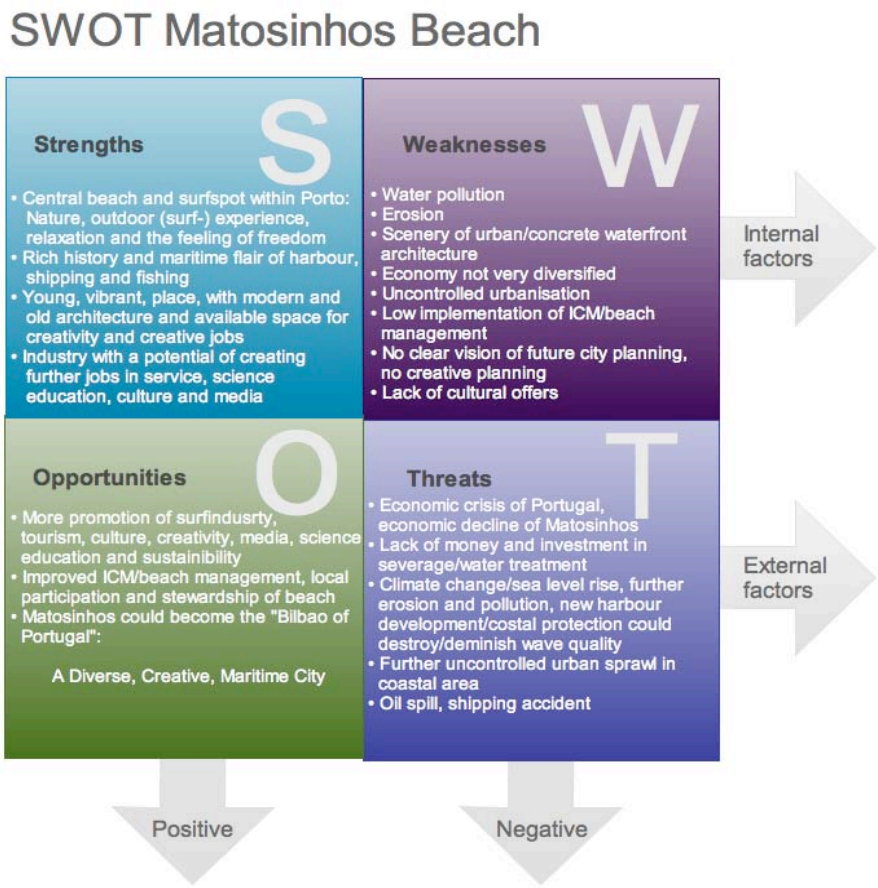

Figure 35 SWOT of Matosinhos Beach (Eberlein, 2010)

Although, the impacts on conservation from residential and commercial developments close to an industrial area are neglected (Phillips et al. 2007, Williams at al., 2008 ((as cited in Williams and Micallef, 2009)), Matosinhos Beach has an outstanding importance as it is one of the few green lungs and the only surfing beach within Porto; therefore the site needs special consideration in future coastal planning decisions in order to sustain, regenerate and enhance the natural/recreational value. Two major problems resulting from the urbanization of Matosinhos were identified in the survey and need to be considered and mitigated in a future beach management of the site:

- Water pollution: the issue of water pollution is the major concern at this site, since it has large scale dimensions and diminishes the recreational, economical and environmental value of the beach and city greatly.
- Architecture: Matosinhos scores poorly among beach users regarding the architecture of the skyline and the built up environment in general, including utilities and the service infrastructure of the beach.

Beside the discussion of practical recommendations and mitigation measurements for Matosinhos Beach concerning these two major problems a wider set of mitigation measurements and problem solutions are being discussed, since a larger spatial development strategy is required in order to archive a sustainable development and beach management of Matosinhos Beach. The implementation of a local beach management plan is recommended as an initial strategy. However, in order to cope with coastal economic and social issues, which are influencing multifaceted land and ocean interactions on a larger scale in an effective way a wider, more integrated and regional management approach is needed. Ultimately a local beach management and coastal city development strategy should be implemented under the umbrella of a national Portuguese Integrated Coastal Management (ICM) strategy.

Problems & Solutions of Wastewater Treatment

Concerning the problem of water pollution, it is necessary to distinguish between the previous described source point pollution and non-source point pollution. Source point pollution problems such as the only primary treated wastewater of Matosinhos are relatively easy to tackle, although it requires the investment of costly infrastructure. The construction of a state of the art sewage treatment with three stages of treatment and new sewerage should be implemented. The financing of this measure can be provided partly by available EU funding with the rest of the funding being provided by the municipality of Matosinhos. There is no other way than to invest in the wastewater treatment infrastructure, since EU legislation requires that all member states fulfill new mandatory wastewater treatment standards by the end of 2012.

Problems & Solutions of Rubbish and Runoff from Beach Users and Industries

In the following, Best Management Practices (BMPs) are described, which focus on the prevention of urban runoff and water pollution. The next recommendations refer mainly to Good Housekeeping BMPs for the city of Matosinhos, private households and companies. Main mitigation measurements for the beach and coastal area should include the following: Providing a proper number of closing and wind resistant rubbish containers can solve easily the problem of rubbish being blown in the water in areas of the marina/harbor and beach. It must be assured that rubbish containers are regularly emptied by the municipal refuse collection team. A sufficient number of stations holding "dog bag poo bags" on the promenade will help to increase water and beach quality since dog excrement will be prevented from being washed into the sea. All these measurements will be very efficient and only require minor costs. Furthermore, the education of beach users in using rubbish containers remains important. In conclusion one can argue that a clean street means a clean river. In addition the following BMPs (for public areas, company sites, private properties) are briefly described as they are easy to employ and inexpensive:

- Sweeping the floor regularly and employing dry methods for cleaning since this will help to remove pollutants from sealed surfaces.
- Cover, contain and elevate materials, which are stored outside andrelocate activities, which have an impact on water quality away from surface drainage paths. Limit the use of toxic products and materials.
- Inspect outdoor areas regularly to identify maintenance needs. Companies should have spill control and cleanup supplies on stock and furthermore educate their employees, contractors and customers how to use them.
- Locate and eliminate illegal wastewater connections to storm drainage system.

(National Pollutant Discharge Elimination Systems, EPA, 2010)

Problems & Solutions of Diffuse Urban Runoff

This problem is more difficult to solve, since it is more complex and a wider range of mitigation measurements should be involved. It would extend the scale of this master thesis to describe all potentially available pollution prevention measurements concerning non-source polluting urban runoff. However, in the following the most important measurements are briefly named, some of them have a positive side effect of enhancing of

the quality of the city's architecture. A very simple and effective mitigation measurement of treating urban runoff is to catch rainfall where it falls! A suitable measurement for Matosinhos is simply introducing areas with vegetation, which only require an underlying soil with a thickness of as little as 30 cm. - this already brings sufficient results of holding back and filtering urban runoff (National Pollutant Discharge Elimination Systems, EPA, 2010). Additional prevention measurements of urban runoff in Matosihnhos could include the installation of low impact development techniques such as preventing the sealing of surfaces from car parks (e.g. by using gravel or grass pavers). Furthermore, the deployment of runoff mitigation systems including infiltration basins, bioretention systems and constructed wetlands can be suitable. Some of these measurements are cost intensive and require a relatively large space and would therefore be difficult to implement within an urban area. However, some of them are worth considering and can be implemented easily and cost efficiently. E.g. the construction of a coastal green area (featuring an infiltration basin) next to the coastal boulevard could act as a natural bio filter and hold back and treat runoff after rain. Besides this, such a coastal green area could link the Park da Cidade and the beach with each other in an aesthetically attractive way and would increase the recreational and environmental value of Matosinho's coastal area. Planting trees on the boulevard next to the beach and to buildings could further mitigate the visual impact of Matosinhos solid concrete architecture and lead to a "lighter" and greener city image.

Figure 36 City runoff mitigation measures (Ministry of the Environment, British Columbia, Canada, 2010)

Problems & Solutions of Solid Architecture and Structural Change

Matosinhos has a great potential of becoming a vital and innovative city in the North of Portugal, since it offers a great location next to the sea within the metropolitan area of greater Porto and furthermore, Matosinhos features an old, beautiful, historic center. However, Matosinhos is shaped by its industrial past and presence including urban residential seafront architecture. The solid architecture of Matosinhos, could be "lightened up" with more trees and green areas in the city, in particular together with the previously mentioned side effect of holding back and filtering urban runoff. In addition specific concrete walls in the harbor and city area, e.g. the solid seawall on the north end of the beach could be made available for street arts like wall paintings and graffiti, since this would transform the dominant grey architecture into aesthetic art and will subsequently provide a structure with a greater utility for all locals and visitors of the city. A prominent,

good example for such a transformation is the so called East Side Gallery in Berlin - a part of the former Berlin Wall that was painted and designed by artists and has become a worldwide appreciated piece of fine art, which attracts tourists from around the world.

Matosinhos should not necessarily try to deny it's industrial roots, but could use the city's unique industrial heritage as a basis for new economical and cultural activities. Many abandoned buildings could be rented out with lower rates to artists and other creative people, as these would retrieve the life of the inner city. It is important to give the last remaining historic industrial buildings a new economic activity in order to assign them with new importance in order to sustain them. It is important that a future city strategy implements heritage awareness and supports creative initiatives and incentives, which take care of the historic (maritime) resources of Matosinhos.

However, sustaining the cultural and historical resources of Matosinhos does not necessarily mean, that the city is not open to other, innovative economical and cultural activities. Matosinhos needs to support new economic, sportive and cultural activities in order to revive its city. Supporting surfing, art and music could form just this new diverse, creative economic cluster, which creates synergies to other economic sectors as it attracts new, young, smart and creative people.
Richard Florida (2002) describes in his book "The rise of the creative class and how it´s transforming everyday life", that cities with a vital music, art and gay scene will win the race, when competing for new creative, synergetic drivers such as smart people and innovative enterprises, since they offer the atmosphere and tolerance for new ideas and ways of life. Matosinhos could strive to become the "Bilbao of Portugal", a diverse, creative and maritime city. Surfing could play an important role in this future city strategy, because it creates direct revenue but more importantly will attract young creative people to live, surf and work within Matosinhos. A positive example of a city, which has recognized and supported the surf industry is Hossegor in France, which has become the leading place for the surf industry in Europe together with branches of multinational surf corporations indexed on the world stock exchanges, such as Rip Curl and Quicksilver. However, Matosinhos would most likely not be able to become the leading hub for surfing in Europe anymore for various reasons and since Hossegor already uses this "label". Nevertheless, Matosinhos could support the local surfing sector to become the regional center of the surf industry and water based outdoor tourism in Northern Portugal. In fact it could become a

cluster of excellence for building all sorts of leisure watercrafts, such as kayaks, yachts and traditional (fishing) boats, because Matosinhos has a rich history and expertise knowledge of shipbuilding in North Portugal.
However, the traditional sector of building commercial vessels has nearly died out. Furthermore, maritime science, technology and education could become another important cluster to provide expertise knowledge and support for Matosinho´s business environment. Finally the third cluster of culture, maritime sport/surfing, media, art and music could evolve to link and attract high potentials of the other clusters.

However, all these clusters and economic activities will clearly benefit from a clean recreational ocean and beach, since it will enhance the city's recreational value and attractiveness. The starting point to design and implement a future beach management strategy (which would ideally lead later into the development of a coherent/combined city and beach management strategy) is to find supporters and charismatic key persons within the public and the city council. The involvement of an NGO in this issue (such as the founding of a local chapter of Surfrider Foundation Europe or similar) could help to push the matter forward, however it requires a careful approach since so called "pressure groups" are often feared by politicians as being too aggressive (or sometimes labeled as being extremists in the public eye in order to keep them outside of political decision making). Furthermore, it is very important "to build up local heroes" within the municipality and other stakeholders, since it is very important to gain local political support for the introduction of a beach management strategy for Matosinhos. Local participation should be implemented as early as possible - however, it remains very important to have in the modest beginnings of such a project key personalities and drivers, who are enthusiastic enough and have the willpower to navigate the initiative around obstacles.

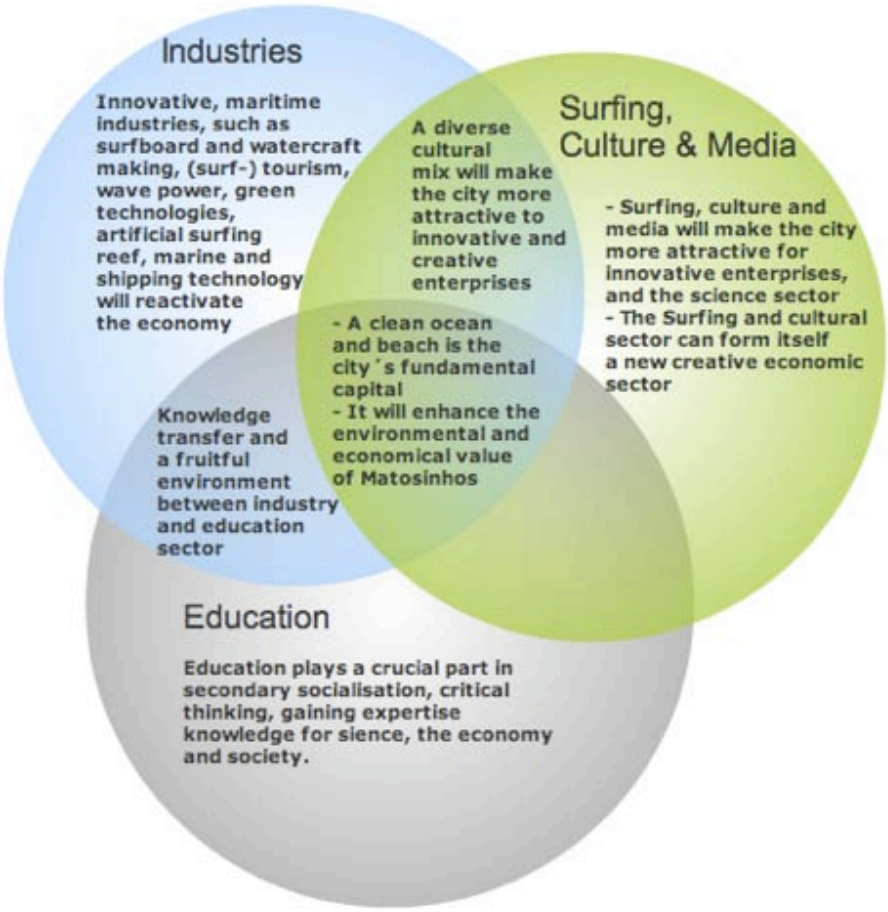

Figure 37 Mindset: Future clusters of excellence for Matosinhos (Eberlein, 2010)

5. Conclusions

Concerning the main research questions in the introduction - why is it worthwhile to consider surfing recourses within the concept of *Integrated Coastal Management*? The results of this study demonstrate that because of the identified cultural and economic importance of surfing recourses in Matosinhos and worldwide it is worthwhile to consider them within coastal management decisions and the concept of *Integrated Coastal Management*. However, in some cases other coastal resource interests might be more important to the social and economic development of a coastal community than preserving or improving the environmental conditions of a surfing resource. Nevertheless, it is often overseen that little compromises or mitigation measures (e.g. different outline of a coastal defense structure) are able to sustain and enhance the quality of a surfing recourse. The protection of surfing recourses can often go hand in hand with other conservation issues of

the coast, such as tackling the problems of erosion and water pollution. Although, the thesis investigated the main reasons for a worthwhile effort to sustain and include surfing recourses within the concept of *Integrated Coastal Management (ICM),* further research is needed concerning the local scale of Matosinhos Beach. This includes to perform more detailed research regarding the socioeconomic dimension (of surfing) in order to emphasize the tendencies derived from this initial field study. Furthermore, baseline research and regular monitoring concerning the physical and environmental dimension must be implemented urgently, this includes different factors such as water quality, anthropogenic influences (river mouth, sewage outlets, harbor area, urban/agricultural runoff, other outlets) and ocean/coastal dynamics. Furthermore, it remains crucial to integrate socioeconomic, anthropogenic, environmental and physical aspects within the concept of *Integrated Coastal Management (ICM)* by considering the consequences of the interaction between the land and ocean in the coastal zone.

However, the presented case study of Matosinhos can be seen as initial, explorative research providing basic results regarding beach and ocean users perceptions. In conclusion Matosinhos Beach remains a difficult to manage urban beach, with severe environmental problems and various stakeholder's interests among beach users and diverse industries. Matosinhos has been greatly influenced by its industrial past and presence, which has impacted the coastal dynamics and environmental situation of the beach greatly. The harbor of Matosinhos still has the greatest economic importance for the city, however many associated industries in the port area suffer from a severe economic decline. In the past excessive and nearby shore development of new buildings for residential living and commerce have lead to an uncontrolled urban sprawl, causing many environmental problems, which are diminishing the beach quality greatly and also have not solved the economic problems of Matosinhos. In fact in the near future these buildings will soon become a problem, since they are not regarded anymore as timeless state of the art architecture and in addition the salty sea air degrades their building structure.

Matosinhos needs to find new ways to retrieve its economy. The basic natural value of the beach has not been considered and valued sufficiently in planning decisions up to now, mainly because the resource's value for area development is not understood to the full extend. As previously mentioned in chapter *2.2 (The Scarcity of Surfing Breaks)* quality

surfing waves are seldom and therefore a valuable natural resource. High quality surfing breaks are vulnerable to coastal development, scarce, and possess an economic, sporting and aesthetic value - the recreational, aesthetic and associated economic value of a high quality surfing break to a coastal community is often significant. Matosinhos is gifted with such a high quality surfing break that is directly located within the municipality, which makes Matosinhos a unique and outstanding European city. Surfing is becoming more and more popular in Matosinhos and is providing new jobs and revenues for the city. However, surfing is poorly considered in the city planning and beach management. A superior future beach management strategy and creative city planning should consider and support surfing culture, since it will enhance to a great extent the quality of city life in general by providing synergetic outcomes for other, innovative economic sectors. A best practice of a future *Integrated Coastal Management (ICM) and* sustainable development for the north coast of Portugal would require to include surfing resources as natural and cultural recourses within coastal management plans.

Furthermore as pointed out before (in chapter 3, *The Management Strategy: Integrated Coastal Management*) a good practice of *ICM* should fulfill the information and awareness goal by addressing coastal and environmental issues to the public. The previously suggested corporation between high schools and surf schools in Matosinhos and maritime research institutions could offer highly practical and valuable learning experiences for teenagers. Beside the social, practical and sportive aspects of surfing, theoretical knowledge about water safety, physical oceanography and coastal/environmental issues could be taught at schools. Surfing could be used as a unique tool to reach and educate kids about the ocean and coastal environment in a playful and unique way. Coastal environmental education remains a crucial aspect in Portugal, when trying to press forward a more sustainable development of the coast. A progressive and pioneering example of a practical coastal education program for schools was the earlier mentioned Litoral Station in Aguda (near Porto), which since 1997 offers “hands on” environmental coastal education programs for schools. However, such education initiatives and programs need to be durable funded and included within a future national *Integrated Coastal Management* strategy in order to archive a more sustainable coastal development in Portugal.

Nevertheless, generally a sustainable coastal development is very difficult to succeed in reality, since the predominant factor of achieving economic growth remains the main goal

of political decision-making. In fact the critical question arises, whether an entire sustainable development of the coast is a realistic objective, because a paradigm shift is needed from traditional ad-hoc and sector-based approaches and political decision-making to an ecosystem management approach. As pointed out before, *Integrated Coastal* Management is challenging such a paradigm shift. However, a fundamental problem of capitalism's ideology remains that the progress of economy development is a steady, everlasting process, which is needed to guarantee social stability. Niklas Luhmann (1988, pp. 10) describes this reality in his book Die Wirtschaft der Gesellschaft:

> "Die "invisible hand" hatte, schon im 17. Jahrhundert eine Fortschrittsgarantie symbolisiert. Nachdem sie zunehmend unter Arthrose zu leiden begann, übernahm das Desiderat des wirtschaftlichen Wachstums selbst diese Funktion. […] Den Politikern und der öffentlichen Meinung wird folglich suggeriert, Wirtschaftswachstum sei notwendig, sei eine Bedingung gesellschaftlicher Stabilität."

The free translation into English:

> "In the 17th century the "invisible hand" had symbolized a progress guarantee. After it began increasingly to suffer from osteoarthritis, the desideratum of economic growth took over this role. [...] Politicians and public opinion is therefore suggested that economic growth is necessary, is a condition of social stability."

Under the premise that economic development is the determining factor in the progress of human civilization, the protection and recognition of surfing amenities appears to be an objective difficult to achieve. Surfing originated from ancient roots, became later a subculture and then a globalized industry. Nowadays in fact surfing has gained a significant economic value and is therefore considered more often within coastal management decisions. The dilemma of such an economic centered approach in coastal management is that the intrinsic values of surfing such as happiness, the endorsement with natural elements (almost a spiritual experience), physical fitness and fun are hard to convert into monetary values and are therefore not considered sufficiently. Consequently, the societal acceptance and recognition of surfing's heritage, culture and lifestyle remains a crucial point. The ultimate goal would be to include surfing breaks as natural resources within coastal management plans and to recognize them as a cultural heritage. A major outcome from this would be that the positive synergies released from promoting surfing's

interest sustain the coast and ocean and could become a unique role model of how surfers and ocean enthusiasts can unite with politicians and maritime scientists to take over a stewardship responsibility for our coasts and oceans.

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Appendix A

Socioeconomic Value of Matosinhos Beach

Please help me to find out what Matosinhos Beach means to you - in order to inform coastal decisions makers and sustain the beach for future generations. This research is conducted for my master thesis in coastal and marine management at the University of the Westfjords in Iceland. No information provided will be individually attributed to the respondent.
Thank you for participating!

Jonathan Eberlein

Any questions? Contact me at: +351 934068804 & surfingjonathan@gmail.com

1. User Activities

1.1) Are you at least 18 years old? (Circle one)
A: Yes B: No

1.2) Tell us why you came to Matosinhos beach? (Circle all that apply)
A: To surf
B: To see waves
C: To swim
D: To relax/sunbath with friends
E: To walk on shoreline
F: Other, please state:_____

1.3) Which of the above was the most important reason? (Circle one)
A B C D E F

1.4) What is surfing to you? (Circle all that apply)
A: Recreation/pleasure
B: Exercise/workout
C: Culture/identity
D: Competition/profession
E: Feel nature
F: Has no meaning to me
G: Other, please state:_____

1.5) Do you think surfing contributes to the quality of life in the city? (Circle one)
A: Yes B: No

1.6) What does *surfing culture* mean to you?

_____

1.7) Do you think surfing is contributing to the economy of Matosinhos? (Circle one)
A: Yes B: No

2. The Meaning of Matosinhos Beach

2.1) What does the ocean and the beach in Matosinhos mean to you?

_____

2.2) What is the most important experience (irrespective of what you do/circled in question 1.2) you look for at Matosinhos Beach?

_____

2.3) What do you miss if you cannot go to Matosinhos Beach?

_____

3. Environmental Issues

3.1) What concerns do you have regarding coastal infrastructure and housing development at Matosinhos Beach?

_____

3.2) What environmental concerns do you have regarding Matosinhos Beach? (Circle all that apply)
A: Water pollution
B: Rubbish on beach
C: Air pollution
D: Oil on beach/water
E: No concerns
F: Other, please state:_____

3.3) Please rank/cross the importance of your mentioned environmental concerns from above in the table:
(1 = very important, 2 = important, 3 = fairly important, 4 = less important, 5 = not important at all)

	1	2	3	4	5
Water pollution					
Rubbish on beach					
Air pollution					
Oil on beach/water					
Other					

3.4) Is year around clean bathing/recreational ocean water important to you? (Circle one)
A: Yes B: No

3.5) Who should pay for the quality improvement of coastal waters? (Circle all that apply)
A: State
B: Private investors
C: Polluter
D: User of beach and recreational water
E: Other, please state:_____

3.6) How should clean bathing water and beaches be financed? (Circle one)
A: By taxes
B: By entry fees from users of beach and recreational water
C: Neither A or B

3.7) If nobody else cares, what amount of money would you be willing to pay for the improvement of water quality at Matosinhos Beach per year? (Circle one that apply)

0 € 5€ 10€ 20€ 30€ 50€ 75€ 100€ 150€ more than 150€

4. User Conflicts

4.1) Did you experience any conflicts in the water or on the beach? (Circle all that apply)
A: Between surfers and swimmers
B: Between skilled surfers and beginners
C: Between surfers and bodyboarders
D: Between locals and non local surfers
E: Between locals and tourists
F: Between surfers and surf schools
G: Between surfers and kiteboarders
H: Beach parties/noise
I: No user conflicts
J: Other, please state:_____

4.2) Did you experience these conflicts to escalate and lead to any violence?

_____

5. General Data

5.1) Are you: A: Female B: Male (Circle one)

5.2) From what country are you from?

_____

5.3) What is your zipcode?

_____

5.4) What is your age range? (Circle one)

A: 18-25 B: 26-29 C: 30-39 D: 40-55 E: 56-70 F: 71 or above

5.5) Do you travel outside Portugal for the purpose of marine recreation? (Circle one)
A: Yes B: No

5.6) What is the highest level of education you completed? (Circle one)
A: No formal education B: Secondary school C: High school
D: Apprentice ship/job training E: University degree F: Prefer not to answer

5.7) Which range includes your gross monthly (before taxes) income? (Circle one)
A: 0€-1000€ B: 1000€-2000€ C: 2000€-4000€ D: 4000€-5000€
E: 5000€ and more F: prefer not to answer

5.8) Other comments?

_____

Valor sócio económico da praia de Matosinhos

Por favor ajude me a encontrar aquilo que a praia de Matosinhos significa para si com o intuito de informar as autoridades costeiras para preservar a costa para as futuras gerações. Esta investigação faz parte da minha tese de mestrado sobre planeamento da orla costeira na Universidade de Westfjords na Islândia. Qualquer informação proveniente neste inquérito será usada para fins estritamente profissionais confidenciais e anónima.

Perguntas? Contacte-me: +351 934068804 & surfingjonathan@gmail.com

1. Porque usa a praia

1.1) Tem ate 18 anos? (Preencha com um circulo)

A: Sim B: Não

1.2) Diga-nos a razão pela qual veio ate a praia de Matosinhos?
(Escolha todas as que lhe dizem respeito)
A: Fazer surf
B: Ver as ondas
C: Nadar
D: Relaxar, sair com os amigos
E: Caminhar na praia
F: Outra, por favor mencione:_____

1.3) Qual das seguintes tem maior importância (Preencha com um circulo)

A B C D E F

1.4) O que significa o surf para si? (Escolha todas as que lhe dizem respeito)
A: Recreação/ prazer
B: Fitness
C: Cultura/identidade
D: Competição/surf profissional
E: Sentir a natureza
F: Não tem significado para mim
G: Outro, por favor mencione:_____

1.5) Acha que o surf contribui para a qualidade de vida na cidade? (Preencha com um circulo)

A: Sim B: Não

1.6) O que entende por cultura do surf?

_____

1.7) Acha que o surf esta a contribuir para a economia de Matosinhos? (Preencha com um circulo)

A: Sim B: Não

2. O significado da praia de Matosinhos

2.1) O que significa o oceano e a praia de Matosinhos concretamente para si?

_____

2.2) Qual a experiencia mais importante (de acordo com a resposta dada na anterior questão 1.2) para a praia de Matosinhos?

_____

2.3) De que mais sente falta se não tiver oportunidade em ir na praia de Matosinhos?

_____

3. Questões ambientais

3.1) Quais as suas principais preocupações em relação as infra-estruturas costeiras e planeamento urbano para a praia de Matosinhos?

_____

3.2) Quais das seguintes questões ambientais mais o preocupa na praia de Matosinhos?
(Escolha todas as que lhe dizem respeito)
A: Poluição da agua
B: Lixo na praia
C: Poluição do ar
D: Óleo na praia/agua
E: Sem qualquer preocupação
F: Outros, por favor mencione:_____

3.3) Por favor avalie segundo grau de importância das questões ambientais que respondeu na anterior questão:
(1=muito importante, 2= importante, 3=moderadamente importante, 4=pouco importante, 5=sem importância)

	1	2	3	4	5
Poluição da agua					
Lixo na praia					
Poluição do ar					
Óleo na praia/agua					
Other					

3.4) É importante para si ter a agua do mar limpa durante todo o ano? (Preencha com um circulo)

A: Sim B: Não

3.5) Quem deve pagar para o melhoramente da qualidade da agua nas zonas costeiras? (Escolha todas as que lhe dizem respeito)
A: Estado
B: Investidores privados
C: Poluidores
D: Utentes da praia e da agua
E: Outro, por favor mencione:_____

3.6 Qual devera ser o modo de financiamento para limpar as praias e a agua do mar.
A: Por taxas
B: Os utilizadores das praias pagarem pequenas quantidades
C: Nenhuma das respostas A ou B

3.7 Se mais ninguém se importar, que apoio estaria disponível a pagar para melhorar a qualidade da agua na praia de Matosinhos por ano? (Preencha com um circulo)

0 € 5€ 10€ 20€ 30€ 50€ 75€ 100€ 150€ mais de 150€

4 Diferentes conflitos entre os utilizadores da praia

4.1)Alguma vez presenciou conflitos dentro de agua ou na praia?
(Escolha todas as que lhe dizem respeito)
A: Entre surfistas ou banhistas
B: Entre surfistas experientes ou iniciantes
C: Entre surfistas e bodyboarders
D: Entre surfistas de Matosinhos ou de fora
E: Entre os locais e os turistas
F: Entre surfistas e escolas de surf
G: Entre surfistas e kiteboarders
H: festa na praia - barulho
I: Sem conflitos
j: Outros, por favor mencione:_____

4.2 Alguma vez experienciou estes conflitos a gerar cenas de violência?

_____

5 Dados gerais

5.1) Você (Preencha com um circulo):

A: Mulher B: Homem

5.2) Qual a sua nacionalidade?

_____

5.3) Qual o o seu código postal?

_____

5.4) Entre que intervalo de idades se situa? (Preencha com um circulo)

A: 18-25 B: 26-29 C: 30-39 D: 40-55 E: 56-70 F: 71 or above

5.5) Viaja para fora de Portugal com o propósito de divertimento aquático? (Preencha com um circulo)

A: Sim B: Não

5.6) Qual o seu grau de educação? (Preencha com um circulo)

A: Sem educação formal B: Educação básica C: Educação secundaria
D: Cursos profissionais E: Grau universitário F: Prefiro não responder

5.7) Em qual das categorias esta situado o seu salário mensal sem os descontos?
(Preencha com um circulo)
A: 0€-1000€ B: 1000€-2000€ C: 2000€-4000€ D: 4000€-5000€
E: 5000€ e ou mais F: prefiro não responder

5.8 Outros comentários?

_____


Háskólasetur
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