THE KEY FACTORS IN SEA TOURISM PLANNING IN TERMS OF SEAWATER ATTRACTIVENESS FOR HUMANS' HEALTH AND COMFORT

[a]LEJLA ŽUNIĆ

University of Sarajevo- Faculty of Science, Department of Geography, Zmaja od Bosne 35, Bosnia and Herzegovina
email: [a]pmflejlazunic@yahoo.com, lejla.zunic@pmf.unsa.ba

Abstract: Summer visits to coastal sea destinations are the most represented in world tourism, accounting for 55% of global tourist travel. A seaside vacation is a form of relaxation and recreation with numerous benefits for a person's psychological, physical, and mental health. Sea water and air rich in marine minerals have a profound effect on the human psyche and provide a pleasant holiday in relation to oceanographic motifs as the main tourist attractions during the summer season. This paper explores the key tourism attributes of seawater from the perspectives of sea recreational tourism and humans' health and comfort. Chemical composition, temperature, salinity, dynamics, and water purity have been identified as major attractiveness factors (elements) for planning healthy sea activities and the swimming tourist season at coastal destinations. It was found that tropical and subtropical coastal regions are mostly touristically significant, while coastal desert regions are gaining significant popularity. The study's findings are educational and applicable to the tourist valorisation and tourism planning of the seas, as well as for understanding the new trends in global sea tourism.

Keywords: seawater attractiveness, chemical content, temperature, salinity, dynamics, purity, sea tourism, valorisation, planning.

1 Introduction

During the summer season, visits to coastal sea destinations are the most popular, accounting for 55% of global tourist travels. They are related to the category "Leisure, recreation, and holidays" (UNWTO, 2021), which, with the indicated percentage participation, is the most represented in world tourism. More precisely, „coastal and marine tourism represents approximately 50 percentage of total global tourism which includes tourism infrastructure, impact, visitation, and spending. It constitutes the largest economic sector for most small island developing states and many coastal states. Current projections estimate by 2030, coastal and marine tourism will represent the largest ocean economy sector, employing approximately 8.5 million people" (Ocean Panel). A seaside vacation is not only a form of relaxation and recreation, but it also has numerous benefits for a person's psychological, physical, and mental health. Sea water and air rich in marine minerals have a profound effect on the human psyche and provide a pleasant holiday in relation to hydrographical-oceanographic motifs as the main tourist attractions, particularly during warmer seasons.

Oceans cover 71% of the Earth's surface, with continents and islands accounting for the remaining 29%. The ocean contains 97% of the world's water. The small portion that isn't in the oceans accounts for just around 2% of the frozen water trapped in the glaciers and ice caps. All of this water is not uniformly distributed on Earth; oceans cover 61% of the Northern Hemisphere, while they cover 81% of the Southern Hemisphere.

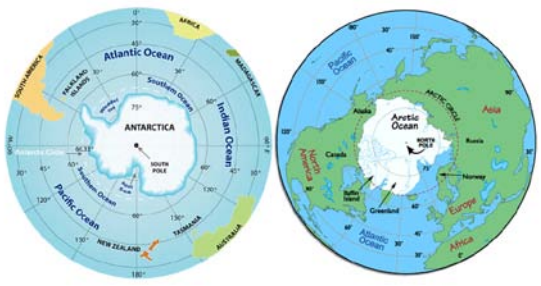

Fig.1. Water and land distribution in the Northern and Southern Hemispheres
(Author adopted according to the World Atlas, 2018 and WordPress of the Place and Things Portal, 2014)

Water and land distribution maps demonstrate an imbalance in representation on the Earth's surface, with a much greater presence of water in the Southern Hemisphere. There are five world oceans: the Atlantic, Pacific, Indian, Southern, and Arctic. The first three are situated in both hemispheres, while the Southern Ocean is located in the Southern Hemisphere and the Arctic is found in the Northern Hemisphere.

Table 1. An overview of the world's oceans and waters

	Percentage of Earth's water in various locations	Area (million km^2)	Average depth (m)
Pacific ocean	52	166	4282
Atlantic ocean	25	87	3926
Indian ocean	20	73	3963
Arctic ocean	/	14	1205
Antarctic/ Southern ocean	/	20	4000
Ice	2		
Ground water	0,6		
Atmosphere, lakes and rivers	0,01		

(Roger Williams University)

Seas are subsets of the ocean. „Sea is the salt water that covers most of the earth's surface and surrounds its continents and islands" (Oxford). According to Stanković (2000), seas are classified according to their location in respect to the oceans and the surrounding land:

a) Mediterranean: they are surrounded by land on almost all sides and are connected to the oceans by straits and canals, e.g., the Mediterranean Sea;
b) Marginal: they are located along the continents for a considerable length of their coasts and are separated from the ocean by an archipelago, for example, the Sea of Japan;
c) Interisland: seas between larger and smaller islands and archipelagos, e.g., the Java Sea.

Bays, fjords (submerged glacier valleys), rias/estuaries (submerged river estuaries), lagoons (areas, bays or pools of sea water isolated from the sea by a sand bar or rock reef), and others are smaller sections of the sea.

The following factors are critical for the tourist valorisation of seas and oceans: chemical composition of water, temperature, salinity, water dynamics, and purity (quality).

2 Methodology

This paper investigates the key factors in sea tourism planning in terms of seawater attractiveness. Seawater attractiveness is mostly referred to as the seawater quality, which is critical for planning healthy activities related to the sea environment. The aim is to determine the basic tourism & geographical attributive factors of the salt waters from the perspective of planning bathing-recreational tourism and from the standpoint of its impact on humans' health and comfort. The most significant sea and oceanographic elements and their corresponding attributes for the requirements of seaside tourism activities such as bathing, swimming, therapy, rehabilitation, and relaxation have been identified in the paper, accounting them responsible enabling comfort as "a state of physical ease and freedom from pain or constrain", "things that contribute to physical ease and well-being" (Oxford). Modern referent models for determining the attributive features of saltwater are presented, including chemical composition, temperature, salinity, dynamics, and purity. They play a crucial role in determining the summer bathing and recreational tourist seasons in coastal regions worldwide. For this study, both primary and secondary sources were used, including informal interviews and the author's observations at the visited coastal destinations. Secondary sources included an extensive repository of relevant literature, data, and statistics from international astronomy, tourism, and environmental protection organisations. The research has a fundamentally & applicative character since it educates about the importance of oceanographic components in tourism valorisation, while also providing standardised criteria for their application in tourism planning. The

paper also explores examples of coastal destinations based on their leading seawater attractiveness and their significant role in global sea tourism, as additionally demonstrated through the selected comparatively analysed examples.

3 Research Results

3.1 The chemical composition of seawater and its benefits for human health

„Seawater is a complex ionised solution that comprises sodium, magnesium, calcium, and potassium cations, as well as anions of phosphorus, iodine, bromine, and some nitrogenous substances. Seawater contains biogenic stimulators for the human body. Swimming in the sea is thus far more advantageous than swimming in freshwater lakes and rivers“ (Stanković, 2000).

Table 2. Chemical composition of seawater *(salinity S = 35.000)*

Major Constituents	*(mmol/kg)*	Trace Constituents	*(mmol/kg)*
Na^+	469.0	Al	-0.03
K^+	10.21	Fe	-1×10^{-3}
Mg^{2+}	52.83	Co	-3×10^{-5}
Ca^{2+}	10.28	Ni	-8×10^{-3}
Sr^{2+}	0.091	Cu	-4×10^{-3}
Cl^-	545.9	Zn	-6×10^{-3}
$SO4^{2-}$	28.23		
$HCO3^-$	2.06		
Br	130		

(Author adopted according to the Science and Issues: Water Encyclopedia)

Table 3. Comparison of river water and sea water composition

Ions	Average river water (mM/l)	Average sea water (mM/l)	River water ration to Cl	Sea water ratio to Cl
$HCO3^-$	0.86	2.38	5.375	0.0044
$SO4^-$	0.069	28.2	0.43125	0.0517
Cl^-	0.16	545	1	1
Ca^{2+}	0.33	10.2	2.0625	0.0187
Mg^{2+}	0.15	53.2	0.9375	0.09761
Na^+	0.23	468	1.4375	0.8587
K^+	0.03	10.2	0.1875	0.0187

(Author adopted according to the Science and Issues: Water Encyclopedia)

Bathing in sea water, swimming, and diving, along with a pleasant climate and healthy sea AQI, provide various health benefits:

- it has a sedative and energising impact since it provides the body with the essential ions and energy;
- improves musculature, motor skills, and general physical condition by increasing muscle tone;
- strengthens the heart and respiratory system by regulating breathing and increasing CO2 excretion;
- relieves stress, lowers blood pressure and glucose, and enhances a good mood;
- stimulates circulation due to the stimulating effect of thermal changes when entering the water (chills) and adaptation to the saltwater environment (pleasure);
- it burns calories and cholesterol and contributes to weight loss by accelerating biogenesis and mitochondrial function;
- prevents ulcers and malignant disorders while additionally encouraging cell renewal;
- decreases symptoms and heals inflammatory skin problems (eczema, for example) because it lessens the severity of symptoms in skin lesions and balances particular minerals in the body;
- reduces the growth of H. pylori and other bacteria, improving antibacterial activity;
- treats osteoporosis and enhances mobility by stimulating cell proliferation, bone mineralization, spine stretching, and joint relief;
- purifies the liver and kidneys by lowering serum levels of AST and ALT, TC and TG, decreasing lipid accumulation, and inhibiting the development of toxic processes;
- reduces physical fatigue and weakness by improving the sustainable amount of lactic acid and decreasing glycogen in the liver.
- boosts immunity and promotes restful sleep.

According to Mohd Nani et al. (2016), deep sea water is beneficial to health as it usually comes with no bacteria activities, low temperature, high purity, and it's rich in nutrients and numerous minerals, which include magnesium (Mg), calcium (Ca), potassium (K), chromium (Cr), selenium(Se), zinc (Zn), and vanadium (V). Deep sea water can help overcome health problems especially related to lifestyle-associated diseases such as cardiovascular disease, diabetes, obesity, cancer, and skin problems.

Table 4. Extract from the Mohd Nani et al. comparative table of amount of top elements in the surface seawater and deep sea water

Type of element	Surface sea water (mg/L)	Deep sea water (mg/L)
K	392	10400
Mg	1290	96100
B	4.45	320
Br	67.3	5400

(Author)

According to the comparative table of amount of elements in the surface seawater and deep sea water (Mohd Nani et al., 2016), deep seawater is significantly richer in certain minerals, especially in K, Mg, B, Br, etc., whose concentration far exceeds the presence in the surface water. "Boron plays an important role in osteogenesis, and its deficiency has been shown to adversely impact bone development and regeneration. Boron influences the production and activity of steroid hormones, actions via which this trace mineral is involved in the prevention of calcium loss and bone demineralization" (Pizzorno, 2015). "Potassium is necessary for the normal functioning of all cells. It regulates the heartbeat, ensures proper function of the muscles and nerves, and is vital for synthesizing protein and metabolizing carbohydrates" (Harward Health Publishing, 2019). "Magnesium is a nutrient that the body needs to stay healthy. Magnesium is important for many processes in the body, including regulating muscle and nerve function, blood sugar levels, and blood pressure and making protein, bone, and DNA" (National Institutes of Health, 2023). "Bromine is an essential trace element for assembly of collagen IV scaffolds in tissue development and architecture" (McCall et al., 2014). Therefore, diving and snorkelling present healthy activities. According to Carreno et al. (2020), there are significant beneficial effects of short-term exposure to scuba diving on human mental health. Exposure to outdoor blue spaces can help improve human health by reducing stress, promoting social relationships, and physical activity. Both, beach and scuba diving activities have positive effects for human mental health, particularly among subjects with regular medication intake. Subjects with regular medication intake due to a chronic or psychiatric illness have a POMS (Profile of Mood State) reduction score significantly higher than other subjects. Diving in small groups, with a diving instructor, and after receiving a complete briefing is expected to have significantly less environmental impact. Therefore, a strategy that balances both the health of the scuba divers and the health of the environment must be promoted in order to enhance diver's health and preserve the marine environment.

3.2 Sea water temperature

According to NOAA, the ideal temperature range for swimming is 21.1-25.6˚ C, which is known as the swimming comfort grade. According to the Columbia Association, cooler water is better suited for higher-intensity activity, while warm water is more therapeutic for the older population or babies and toddlers learning to swim.

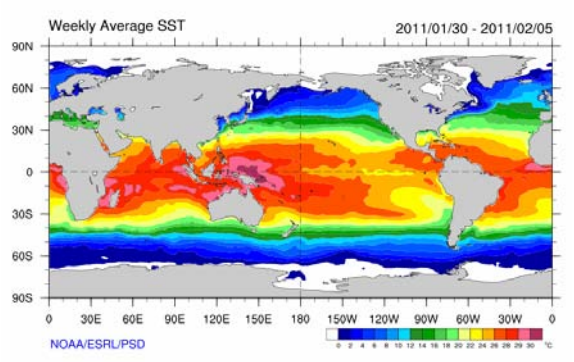

Fig.2. Ocean water temperatures
(NOAA, Andedge)

According to the map (fig.2), a three-layer system of temperatures from the surface to the bottom of the ocean has been determined:

1) The upper (first) layer consists of warm ocean water with a density of around 500 m and temperatures ranging from 20 to 25 degrees Celsius. It is found across the tropical region and also in the mid-latitudes during the summer season;
2) The thermocline- the second layer (below the first), has a dramatic drop in temperature with increasing depth and a thickness of 500-1000 m.;
3) The bottom (third) layer is extremely cold and extends along the entire deep ocean floor. The temperature of the ocean water surface is near 0℃ in the Arctic and Antarctic Circles, and the thermal oscillation with depth is quite minimal because there is just one layer of cold water that spans from the surface to the deep ocean floor.

As a result, the ocean warms in the tropics while cooling in the high latitudes. The average temperature of surface ocean water is 27 °C, and it decreases gradually from the equator to the poles. The average temperature of ocean water is about 22 degrees Celsius at latitude 20 degrees Celsius, 14 degrees Celsius at latitude 40 degrees Celsius, and 0 degrees Celsius at the poles. The highest temperature was recorded north of the equator (instead of on the equator); the average annual temperature in the Northern Hemisphere is 19 degrees Celsius and 16 degrees Celsius in the Southern Hemisphere. For a demonstrative comparison, for instance, the Red Sea's average water temperature is 22–30 degrees Celsius, or exceptionally 15–45 degrees (Gulf of Aqaba), compared to the Mediterranean Sea's average water temperature of 18.3-27.2 degrees Celsius.

For the beginning of the tourist swimming and bathing season, a water temperature of 22 degrees Celsius and an air temperature of 18 degrees Celsius are recommended. The tropical and subtropical seas have the highest tourism value since they have plenty of solar radiation and a mild climate, and they are the warmest seas with the most popular swimming destinations worldwide. The swimming season is the longest towards the tropic of Cancer, where the desert reaches the sea (for example, the Red Sea, latitude 16N–28N). Bathing season in subtropical areas (such as the Mediterranean) lasts 3–4 months on average (June–September), 5 months (May through September) in tropical areas (such as Hawaii), and 8 months (April-November) in the warmest and world's most arid areas (such as the Red Sea). Because the bathing season is the longest on the coastlines of Egypt, the UAE, and other similarly situated countries, the Red Sea region's tourism is significantly growing; aside from the favourable climate, the Red Sea is incredibly clean and rich in corals, and a desirable feature is the tame dynamics of sea water; for example, the Hurghada Sea is exceptionally calm, with no high waves, and has a unique tide that literally pushes the water evenly towards the shore, making swimming easier. „The Red Sea is a narrow elongated water body extending some 2,000 km SE–NW, between latitudes 16°N and 28°N, from the Gulf of Aden through which it connects from the Gulf of Aden (through which it connects to the Indian Ocean) to the Gulf of Aqaba (Figure 1). It is flanked by east Africa (Egypt, Sudan, Eritrea, and Djibuti) to the west and Arabia (Saudi Arabia and Yemen) to the east. The Red Sea hosts spectacular coral reefs that pertain to the Indo-Pacific domain. Its northern tributaries, the Gulfs of Suez and Aqaba (reaching latitude 29.5°N) are home to some of the northernmost coral reefs in the world“ (Shaked & Genin, 2011).

Fig.3. The Red Sea, Hurghada, Egypt- crystal clear water
(Author's Private Collection)

According to Hawkins and Roberts (1994), there’s an expansive growth of coastal tourism in the Red Sea (primarily Egypt, Israel, and Jordan) motivated by warm water and coral reefs, among other attractions. Rapid and large-scale tourist development since the 1970s has resulted in numerous resorts in the coastal area: tourism and diving play a central role in Hurghada’s economy, while Sharm-el-Sheikh has expanded into a major international resort; much of Israel's coastline has been rapidly built up to accommodate recreation, port facilities, and housing; and Jordan, due to the increasing tourist visits, is doubling its tourism capacities. According to Colby (2003), the Sinai and Red Sea governorates received roughly 2.5 million foreign tourists (plus 670,000 Egyptians), staying for about 20 million tourist nights in 2000, up from practically zero in 1980. The Red Sea region’s coastal tourism development plans are often seen as the most ambitious in the world. “Tourism in the Red Sea region is gaining momentum, with occupancy rates of 80% and rising” (Ahram). According to the Egypt Independent (2023), resorts and hotels in the Red Sea governorate received more than four million tourists of different nationalities in 2022, mostly German, Russian, Czech, and others. According to the Civil Aviation Authority and the Red Sea Governorate, there’s an average of about 1.35 million foreign plus 200,000 Egyptian visitors per year. Surveys suggest that 30-50% of the total visitors are divers, averaging 3-5 days of diving each, while about 25% are snorkelers for at least one or two days. This translates to a range of 1.0-3.5 million diving and snorkelling days, and 1.6 – 4.1 million days, followed with range of $3.8-10.3 million per year in potential combined revenues (Colby, 2003).

3.3 Salinity of sea water

“The two most common elements in sea water, after oxygen and hydrogen, are sodium and chloride. Sodium and chloride combine to form what we know as table salt” (NOAA). Salinity is important for its therapeutic chemical composition as well as enhancing the density of water. Swimming becomes simpler because saltier water is heavier, providing better support to the swimmer's body than freshwater. “In sea water, there is typically close to 35 grams of dissolved salts in each liter (35ppt), but ranges between 33-37 grams per liter (33ppt - 37ppt). But as in weather, where there are areas of high and low pressure, the ocean has areas of high and low salinity” (NOAA). According to some sources, increased salinity generates a more pronounced blue pigment and higher clarity of the water; however, this is more dependent on other important factors such as sunlight absorption and scattering of light, mineral composition, depth,

organic matter and phytoplankton, etc. The chemical composition of water is highly related to salinity, which has numerous beneficial impacts on human health and other organisms (as previously mentioned).

According to the CATDS Ocean Salinity Expert Center, global salinity patterns are linked to rainfall and evaporation. Salinity affects seawater density, which in turn governs ocean circulation and climate. The higher salinity of the Atlantic sustains the oceanic deep overturning circulation. Salinity variations are driven by precipitation, evaporation, runoff and ice freezing and melting.

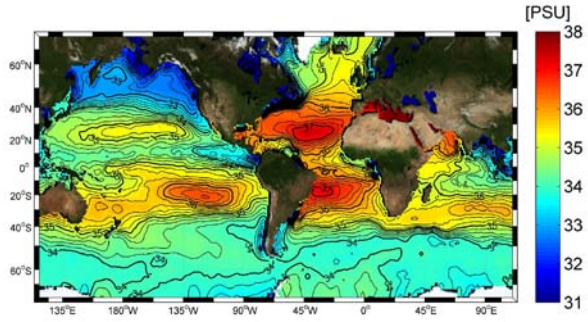

Fig.4. Annual mean of the sea surface salinity distribution (CATDS retrieved from World Ocean Atlas, 2005)

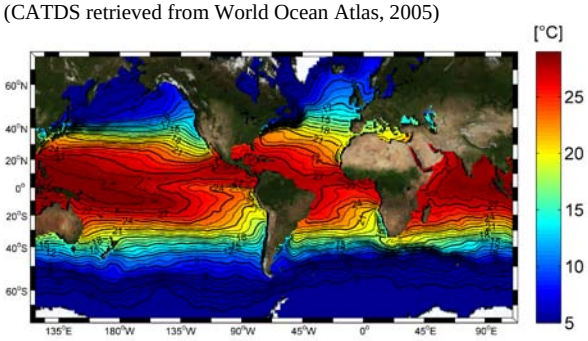

Fig.5. Global sea surface temperature (CATDS Ocean Salinity Expert Center)

This is mainly because the surface sources of variability for temperature are different than for salinity: the ocean is indeed heated up in the tropics and cooled at high latitudes while salinity is dominantly modified by concentration-dilution related to the evaporation-precipitation- river runoff flux (E-P-R).

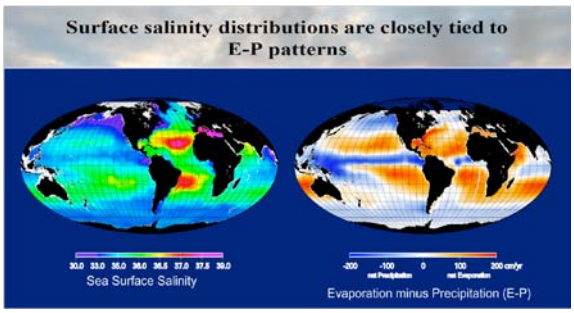

Fig.6. Salinity Distribution at the Ocean Surface- Sea Surface Salinity- Remote Sensing (CATDS Ocean Salinity Expert Center)

Surface salinity distributions are closely tied to evaporation and precipitation patterns. If it rains more than evaporated (E-P<0), for example in area of strong atmospheric convection (e.g., equatorial) or at moderate latitudes, the salinity diminishes at the ocean surface. In subtropical zones, evaporation dominates over precipitation (E-P>0) and salinity increases.

The Red Sea is a relevant example of a tourist-friendly sea with a highly saline water; the Egyptian coast of Hurghada, a popular seaside and safari tourist destination, has a desert climate (Bwh according to Köpen's climate classification), with an average annual air temperature of 24.4 degrees Celsius and an average precipitation of only 6 mm per year, which resulted in a high salinity of about 40–42 psu.

3.4 Ocean Movements (Seawater Dynamics)

"Dynamic ocean explains the movement of water and energy in the oceans" (Stow, 2017). "Ocean water moves in two directions: horizontally and vertically. Horizontal movements are referred to as currents, while vertical changes are called upwellings or downwellings. This abiotic system is responsible for the transfer of heat, variations in biodiversity, and Earth's climate system" (National Geographic Society). "The vertical motion refers to tides. Ocean currents are the continuous flow of huge amount of water in a definite direction while the waves are the horizontal motion of water. Water moves ahead from one place to another through ocean currents while the water in the waves does not move, but the wave trains move ahead" (National Council of Educational Research and Training). "The movement of ocean water is a complex and dynamic process driven by various factors, including wind, temperature, salinity, the Earth's rotation, and the geography of the ocean basins. Ocean currents, tides, and waves are the primary manifestations of ocean water movement" (ClerIAS, 2023).

- *Currents.* "The pattern of circulation results from a more complex interaction of wind drag, pressure gradients, and Coriolis deflection resulting in gyres, loops, and eddies. Slow-moving currents in the deep ocean basins transfer energy, nutrients, and sediments around the world. These currents are driven by density differences linked to water temperature and salinity and are part of the global thermohaline circulation system" (Stow, 2017). Warm ocean currents increase the temperature of the sea, land, and air, especially during the winter season, which results in a milder climate in coastal areas than in inner land. Furthermore, the direction and speed of currents are key factors in planning navigational profiles (nautics), cruise lines, port sites, and wastewater discharges, among other things;
- *Waves.* "Almost all surface waves are generated by wind stress with the three stages in wave development known as sea, swell, and surf" (Stow, 2017). Extreme water sports like surfing in the oceans of California, Hawaii, the Philippines, Indonesia, Australia, etc. can benefit from higher waves. In the context of natural thalassotherapy, waves with a height under 0.5 m have a stimulating effect on sea bathers; smaller waves may be generally preferred for restful swimming. Despite being associated with wind, waves are also influenced by geotectonics; for example, in seismically active seas, the beaches along the Ring of Fire (Circum-Pacific Belt) have the greatest waves in the world.
- *Tides* are created by the gravitational pull of the Moon and the Sun and by a centrifugal force due to the rotation of the Earth (Stow, 2017). Sea tides are crucial for determining the location of tourist attractions and supporting infrastructure along the shore, as well as for controlling navigation and anchoring, respecting their importance to all creatures of the sea, and preventing negative effects on the environment.

3.5 Marine water quality/ Seawater purity

"Marine water quality refers to the presence or absence of any number of pollutants in ocean waters. Some of the more important pollutants include oil, sedimentation, sewage, nutrients, heavy metals, and thermal pollution. Water quality monitoring relies on taking a suite of measurements of ocean water" (Encyclopedia). For sea water to be valued as a tourist attraction, it's required to be clean and safe for humans' health. Remote sensing and specific techniques are used to measure, monitor, and assess the sea water's quality:

- CDOM/FDOM monitoring (dissolved organic matter in water body; concentrations of CDOM affect submerged aquatic vegetation, coral reefs and other benthic communities; fDOM apps. include continuous monitoring of wastewater discharge)
- Chlorophyll fluorescence analysis (algae flourishing in water)
- Conductivity (EC/ electrical conductance), salinity, and TDS (total dissolved solids) monitoring (measuring the specific electrical conductance of electrolytes dissolved in the water, for example, possible ranges are EC 51,500 µs/cm and TDS 35,000 mg/L, with the TDS tolerance threshold for humans being 0-500 mg/L)
- Recording the water temperature (which is related to the rate of photosynthesis and metabolism, the dissolved gas concentrations, the conductivity and salinity, the pH, and the water density, etc.)
- Measuring the dissolved oxygen levels (the percent saturation or mg/L oxygen available to the flora and fauna, for instance, the optimal rank is 90–100% for marine ecosystems, and if it is above or below the specified rank, the water will become increasingly polluted; or, a dissolved oxygen level of less than 6 mg/L can be harmful to the ecosystem of water bodies)
- pH and KH testing (increasing pH and carbonate hardness are hazardous to aquatic ecosystems; for example, the optimal pH range for oceanic living species is 8 to 9)
- Assessing the turbidity, TSS (total suspended solids) and clarity (a nephelometer measures the total amount of suspended solids and heavy metals in mg/L; e.g., a desirable category of turbidity would be ≤10, while high turbidity is typically a sign of low water quality; additionally, the water that is crystal clear is not necessarily healthy as it can indicate very acidic conditions or a very high level of salinity)

Standard assessments and evaluations based on the presence of enterococci and E. coli bacteria in the water are crucial for the monitoring of sea water, which is a requirement for the sanitary-hygienic suitability of the water for swimming:

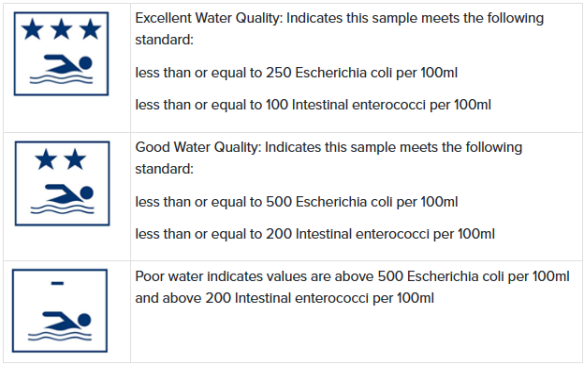

Fig.7. Sea water monitoring
(Government of Jersey)

As a result of their location in the southern hemisphere, which is less inhabited than the northern one and has reduced ship traffic, the South Pacific and South Atlantic are the oceans with the cleanest water. The waters surrounding the Earth's poles are also addressed in certain publications, with the assertion that the Antarctic waters (in the south) are cleaner than the Arctic waters (in the north); nonetheless, the polar seas do not have so considerable tourist relevance.

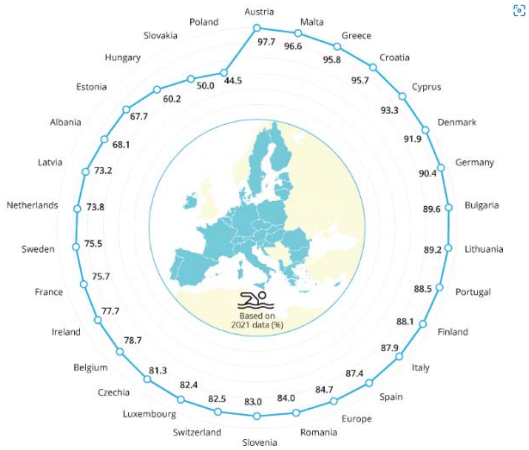

Fig.8. Inland and coastal bathing waters with excellent quality in European countries in 2021
(EEA, 2022)

According to the figure above, in four countries, 95% or more of bathing waters were of excellent quality: Austria, Malta, Croatia and Greece. Additionally in Malta, Bulgaria, Romania and Luxembourg, all assessed bathing water sites were of at least sufficient quality. "In the period 2015-2021, the share of bathing waters having an excellent status in Europe has been stable at 85-88% for coastal bathing waters; and at 77-82% for inland bathing waters. The quality of coastal sites is generally better than that of inland sites due to the higher self-purification capacity of coastal areas. Moreover, many central European inland bathing water sites are situated on relatively small lakes and ponds as well as rivers with a low flow, which, especially in the summer, are more susceptible than coastal areas to short-term pollution caused by heavy summer rains or droughts" (EEA, 2021). Among the cleanest seas in Europe, Cyprus stands out, having received perfect points of 100% for excellent water quality at as many as 112 swimming locations around the island (Žunić, 2022).

At the global level, the Red Sea is reportedly one of the cleanest tourist waters in the world according to many tourism sources, including UNEP and others. Despite human use and recreational development, Fahmy et al.'s (2016) evaluation study of the Egyptian Red Sea coastal water quality confirmed preserved water with a limited and imperceptible impact of tourist activities.

4 Conclusion

The largest hydrographic tourist attractions are the oceans and seas, which attract visitors from all over the world to take advantage of their fascinating features and countless health benefits. The advantages of sea water are immeasurable, especially for the tourism industry, as for example, according to the IUCN, tourism represents 92% of the economic value of sea-related activities in the Mediterranean (Žunić, 2022). Both the chemical and physical characteristics of saltwater, as well as its dynamics, constitute essential oceanographic factors for the purposes of tourist planning, valuation, and exploitation. These factors are evaluated in accordance with the potential to implement various human activities (bathing, swimming, extreme sports, sailing, etc.). Tropical and subtropical seas are the most attractive and most visited by tourists, for example: "International tourist arrivals (overnight visitors) to destination countries in the Mediterranean reached a record 342 million in 2014, nearly one-third of total arrivals worldwide (1,133 million). Considered as a single area, the Mediterranean is by far the world's largest tourism destination" (UNWTO, 2015). The subtropical climate of the Mediterranean region has a significant role in drawing tourists there. Besides pleasant temperatures, the Mediterranean has been inhabited since the early Neolithic era due to its prime position and advantageous living circumstances,

which also resulted in the Mediterranean taking pride in having a rich culture and many other tourist attractions. "The Mediterranean Basin has been the cradle of world civilization since the first settlements in Jericho in 9000 BC" (Saglamer, 2013). In terms of the cleanest seas in Europe, Cyprus tops the list. However, the Egyptian Red Sea has remarkable water quality due to its desert location. In contrast to summer humidity (>t˚C and >RH%), which is growing throughout the Mediterranean region as a result of climate change, the high temperatures and low humidity of Hurghada, for instance, are far more comfortable. Solimene, Brugnoli, and Minelli (2002) stated that climate discomfort index is determined by the relationship between temperature and relative air humidity; for instance, a temperature of 30 degrees Celsius is comfortable with an air humidity of 30%, unpleasant with an air humidity of 50%, and unbearable with an air humidity of over 70%. For demonstrative comparison, in Hurghada (a desert coastal Red Sea tourism destination), during the summer busiest season (June, July, and August), the air temperature ranges from 31 to 33 degrees Celsius, followed by a lower relative humidity of 41–45%, while, for instance, in Malta (a Mediterranean sea tourism destination), the temperature ranges from 29 to 32 degrees, followed by a high relative humidity of 69–78%. Such climate specifications, including the higher seawater temperature and the longer sea tourism seasonality, promote dessert coastal destinations as more attractive than the Mediteraneans', not only in terms of climate comfort and humans' health but also from the perspective of their rising popularity in global sea tourism.

Finally, based on the findings of this research, a summary table of the key maritime contributing factors, or indicators of attractiveness, in terms of planning fundamental and healthy tourism activities is created:

Table 5. Top indicators of seawater attractiveness for planning basic and healthy tourism activities

Category	*Description*	*Benefits*
Chemical composition	Highly mineralised: Cl, Na, Br, Mg, SO4, K, Ca, etc.	Improving health of humans' skin, and organism systems: muscular, skeletal, nervous, respiratory, circulatory, etc.
Temperature	Moderate: 21.1-25.6˚C	Swimming comfort grade
Salinity	Highly saline water: 33-40 g/l (ppt/ psu)	Swimming simplicity
Sea dynamics	Currents: warm, cool; waves: short, high; tides; low, high	Affecting tourism & hospitality infrastructure building, ports & sea navigation, higher-intensity tourist activities or therapeutic effects
Sea water purity	Permitted bacteria per 100 ml water: ≤250-500 E. Coli; ≤100-200 I. Enterococci	Good to excellent water quality for swimming

(Author)

Literature:

1. Abdoullah, M., Scoccia, R., Motta, M., Fillipini, G. (2021): *Cooling Energy Use Reduction in Residential Buildings in Egypt Accounting for Global Warming Effects*, Climate, MDPI, DOI:10.3390/cli9030045

2. Benefits of Swimming in Cold vs. Hot Water (2021), Columbia Association, retrieved from https://columbiaassociation.org/swim/benefits-of-swimming-in-cold-vs-hot-water/#:~:text=There%27s%20no%20one%20%E2%80%9Cideal%E2%80%9D%20water,and%20toddlers%20learning%20to%20swim

3. Carreño, A., Gascon, M., Vert, C., Lloret, J. (2020): *The Beneficial Effects of Short-Term Exposure to Scuba Diving on Human Mental Health*, International Journal of Environmental Research Public Health, 17(19): 7238, DOI: 10.3390/ijerph17197238, PMID: 33022983; PMCID: PMC7579011

4. *Climate- Hurghada (Egypt)*, Climates to Travel, World Climate Guide, 1999-2020, retrieved from https://www.climatestotravel.com/climate/egypt/hurghada

5. *Climate in Hurghada* (Red Sea, Egypt), Weather and Climate, 2010-2023, retrieved from https://weather-and-climate.com/average-monthly-Rainfall-Temperature-Sunshine,hurghada,Egypt

6. *Climate in Malta*, Weather and Climate, 2010-2023, https://weather-and-climate.com/average-monthly-Humidity-perc,Malta,Malta

7. Clithero, B. (2021): *The Health Benefits of Swimming*, Metro Physio, Part of of the Metrohealth and Wellbeing Group, Machester, retrieved from https://www.metrophysio.co.uk/blog/the-health-benefits-of-swimming/

8. Colby, M.E. (2003): *Red Sea Marine Protectorates Revenue Generation Options*, Report Number: EEPP 106, Affiliation: International Resources Group, US Agency for International Development, DOI:10.13140/RG.2.1.3482.3520

9. EEA (2022), *European bathing water quality in 2021*, European Environment Agency, retrieved from https://www.eea.europa.eu/publications/bathing-water-quality-in-2021

10. Fahmy, M.A., et al. (2016): *Evaluation of the Quality for the Egyptian Red Sea Coastal Waters during 2011-2013*, Journal of Environmental Protection, Vol.7, No.12, Scientific Research An Academic Publisher, DOI: 10.4236/jep.2016.712145

11. Harward Health Publishing (2019): The importance of potassium, Harward Medical School, retrieved from https://www.health.harvard.edu/staying-healthy/the-importance-of-potassium#:~:text=Potassium%20is%20necessary%20for%20the,synthesizing%20protein%20and%20metabolizing%20carbohydrates

12. Hawkins, J.P., Roberts, C.M. (1994): *The Growth of Coastal Tourism in the Red Sea: Present and Future Effects on Coral Reefs*, Ambio, Vol. 23, No. 8 (Dec., 1994), pp. 503-508, http://www.jstor.org/stable/4314268

13. Health: *12 Benefits of Swimming* (2022), International Sport Federation, retrieved from https://www.iwsfederation.com/12-benefits-of-swimming/

14. *How much oxygen comes from the ocean?* (2023), National Ocean Service, National Oceanic and Atmospheric Administration, retrieved from https://oceanservice.noaa.gov/facts/ocean-oxygen.html

15. *How much water is in the ocean?* (2023), National Ocean Service, National Oceanic and Atmospheric Administration, retrieved from How much water is in the ocean? (noaa.gov)

16. *Hurghada Climate (Egypt)*, Climate Data, Red Sea Governorate, retrieved from https://en.climate-data.org/africa/egypt/red-sea-governorate/hurghada-415/

17. Maiyza, S.I., El-Geziry, T.M., Maiyz, I.A. (2022): *Relationship between Temperature and Salinity Variations and the Fish Catch in the Egyptian Red Sea*, Egyptian Journal of Aquatic Biology & Fisheries, Vol. 26(1): 273 – 286, Zoology Department, Faculty of Science, Ain Shams University, Cairo, Egypt

18. *"Marine Water Quality"* (2023), Environmental Science: In Context, Encyclopedia.com, Oxford University Press and Columbia Encyclopedia, retrieved from https://www.encyclopedia.com

19. McCaffrey, S., *Water quality parameters and indicators*, NSW New South Wales Government, Sustainable Sanitation and Water Management Toolbox, retrieved from https://sswm.info/sites/default/files/reference_attachments/MCCAFFREY%20ny%20Water%20Quality%20Parameters%20&%20Indicators.pdf

20. McCall, AS., Cummings, CF., Bhave, G., Vanacore, R., Page-McCaw, A., Hudson, BG. (2014): *Bromine is an essential trace element for assembly of collagen IV scaffolds in tissue development and architecture*, Cell 157(6): 1380-1392, doi: 10.1016/j.cell.2014.05.009, PMID: 24906154; PMCID: PMC4144415

21. Mohamed, A. (2021): INTERVIEW: *Tourism rises on the Red Sea*, Ahram Org., retrieved from INTERVIEW: Tourism rises on the Red Sea - Egypt - Al-Ahram Weekly - Ahram Online

22. Mohd Nani, SZ., Majid, FA., Jaafar, AB., Mahdzir, A., Musa, MN. (2016): *Potential Health Benefits of Deep Sea Water: A Review*, Evid Based Complement Alternat Med. 2016;2016:6520475, doi: 10.1155/2016/6520475, Epub 2016 Dec 26, PMID: 28105060; PMCID: PMC5221345

23. *Movements of Ocean Water*, National Council of Educational Research and Training, retrieved from https://ncert.nic.in/ncerts/l/kegy214.pdf
24. *Movements of ocean water: Waves, Tides and Ocean Currents* (2023), ClearIAS Team, retrieved from https://www.clearias.com/movements-ocean-waves-tides-currents/
25. National Institutes of Health (2023): *Magnesium Fact Sheet for Consumers*, U.S. Department of Health and Human Services, retrieved from https://ods.od.nih.gov/factsheets/Magnesium-Consumer/#:~:text=sheet%20on%20Magnesium.-,What%20is%20magnesium%20and%20what%20does%20it%20do%3F,protein%2C%20bone%2C%20and%20DNA
26. Neal, A. (2017): *7 Ways to Measure, Monitor, and Evaluate Water Quality*, Public Lab, retrieved from https://publiclab.org/notes/anngneal/12-08-2017/7-ways-to-measure-monitor-and-evaluate-water-quality
27. NOAA National Centres for Environmental Information, National Oceanic and Atmospheric Administration, Frequently Asked Questions, retrieved from https://www.ncei.noaa.gov/access/coastal-water-temperature-guide/faqs.html
28. *Northern Hemisphere, Places and Things*, Word Press, retrieved from https://placeandthings.com/africa/the-earths-hemispheres/northern-hemisphere/
29. *Ocean Chemical Processes*, Science and Issues, Water Encyclopedia, retrieved from http://www.waterencyclopedia.com/Mi-Oc/Ocean-Chemical-Processes.html
30. *Ocean Currents*, National Geographic Society, retrieved from https://education.nationalgeographic.org/resource/resource-library-ocean-currents/
31. Oxford Learner's Dictionaries, *Define comfort, definition of sea noun* from the Oxford Advanced American Dictionary
32. *Parameters CDOM-FDOM* (2023), Xylem Analytics' YSI, retrieved from https://www.ysi.com/parameters/cdom-fdom#:~:text=fDOM%20is%20a%20surrogate%20for,Continuous%20monitoring%20of%20wastewater%20discharge
33. Pizzorno, L. (2015): *Nothing Boring About Boron*, Integr Med (Encinitas), 14(4):35-48, PMID: 26770156; PMCID: PMC4712861
34. Pool Maintenance Tasks: Reducing the Salt Level in Your Pool (2013), AAA Pool Service
35. *Red Sea* (2023), Lighthouse Miracle-1, retrieved from https://lighthouse-1.com/en/red-sea#:~:text=The%20average%20temperature%2C%20depending%20on,below%20those%20on%20the%20coast
36. Red Sea governorate receives 4 million tourists in 2022 (2023), Egypt Independent, retrieved from https://egyptindependent.com/red-sea-governorate-receives-4-million-tourists-in-2022/#:~:text=Resorts%20and%20hotels%20in%20the,total%20of%201.158%20million%20tourists
37. Saglamer, G. (2013): *The Mediterranean Sea: Cradle of Civilization*, Water, vol. L (1), UN Chronicle, retrieved from The Mediterranean Sea: Cradle of Civilization | United Nations
38. Salinity Distribution at the Ocean Surface (2023), Sea Surface Salinity Remote Sensing at CATDS Ocean Salinity Expert Center (CEC-OS), retrieved from http://www.salinityremotesensing.ifremer.fr/sea-surface-salinity/salinity-distribution-at-the-ocean-surface
39. Sea Water (2023), National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce, retrieved from https://www.noaa.gov/jetstream/ocean/sea-water
40. *Sea water monitoring* (2023), Environment, Protecting the Environment, Protecting our seawater and coast, Government and administration of Jersey, retrieved from Sea water monitoring (gov.je)
41. Shaked, Y., Genin, A. (2011): *Red Sea And Gulf Of Aqaba*, In: Hopley, D. (eds) Encyclopedia of Modern Coral Reefs, Encyclopedia of Earth Sciences Series, Springer, Dordrecht, https://doi.org/10.1007/978-90-481-2639-2_129
42. Solimene, U., Brugnoli, A., Minelli, E. (2002): *Meteoropathies*, Red edizioni, Novara
43. *Sparkling Beaches: Cyprus Has Cleanest Waters in EU* (2021), US News, Associated Press, retrieved from https://www.usnews.com/news/world/articles/2021-06-01/sparkling-beaches-cyprus-has-cleanest-waters-in-eu
44. Stanković, S.M. (2000): *Tourism Geography*, University of Belgrade
45. Stow, D. (2017): *Dynamic ocean*, Chapter in the: Oceans: A Very Short Introduction, Oxford, online edn, Oxford Academic, https://doi.org/10.1093/actrade/9780199655076.001.0001
46. The High Level Panel for a Sustainable Ocean Economy "Ocean Panel" (2022), Ocean Panel Organisation, retrieved from https://oceanpanel.org/wp-content/uploads/2022/06/Coastal-Marine-tourism-2-pager-1.pdf
47. UNWTO (2021): *International Tourism Highlights*, World Tourism Organisation
48. Webb, P. (2023): *Introduction to Geography*, Press Books, Roger Williams University, retrieved from 1.1 Overview of the Oceans – Introduction to Oceanography (pressbooks.pub)
49. When to Travel (2023), Malta Holidays, retrieved from http://www.maltaholidays.uk.com/when-to-travel/
50. *Which factor affects the temperature of ocean water?* – Upsc (2021), Environment and Ecology, Andedge Group, retrieved from https://andedge.com/temperature-of-ocean-water/
51. *Which Hemisphere Has The Largest Area Covered By Oceans?* - WorldAtlas
52. Williams, M. (2014): *What percent of Earth is water?*, Universe today, Physics Organisation, retrieved from https://phys.org/news/2014-12-percent-earth.html
53. UNWTO (2015), *Tourism Trends Snapshot: Tourism in the Mediterranean*, 2015 edition, World Tourism Organization, Madrid, DOI: https://doi.org/10.18111/9789284416929
54. Žunić, L. (2022): *Positive socio-cultural impacts of tourism on the geographic and living environment*, Faculty of Science, University of Sarajevo, ISBN 978-9926-453-52-7
55. Žunić, L. (2022): *Tourism valorisation of the oceanographic elements*, „Water and us", no 108, Agency for the river basin of Sava, Sarajevo

Primary Paper Section: D

Secondary Paper Section: AK, AQ, DG, DD, DJ