

Plans for World Wide Public Health Risk Assessment and Regulations for Hygienic Quality of Beach Sand and Beach Water

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A beach on the south coast of Lisbon during a misty day in the Summer



World Health Organization, 2003, in “Guidelines for safe recreational water environments”, p118.

- “From a recreational viewpoint, sand beaches are sought after. Especially in higher latitudes, a significant percentage of time is spent on the beach itself rather than in the water.”
- “A number of genera and species that may be encountered through contact with sand are potential pathogens. Accordingly concern has been expressed that beach sand may act as reservoir of vectors of infection.”

Examples of infections that may be passed on by sand (to **non-immunocompromised** individuals)



Staphylococcus aureus infection (Staph)



Dermatomycosis by a dermatophyte (ring worm)



Onychomycosis – nail infection by keratinophilic fungus



Gastroenteritis

Population with increased risk without specific disorders



Children

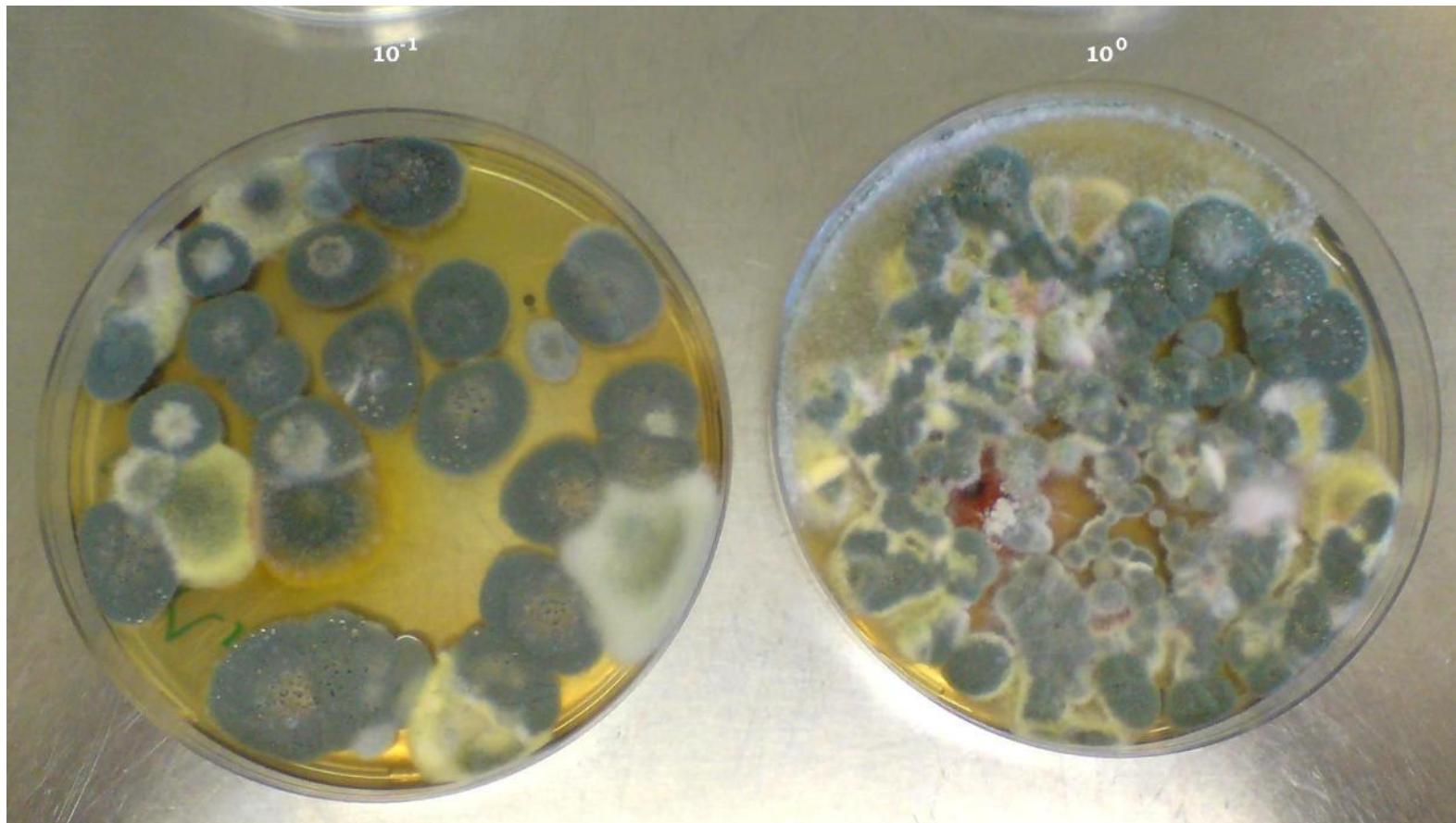


Elderly



Pregnancy

An example of a plate of fungal analysis



Malt plates inoculated with sand wash 100 rpm/30', 1:1 w/v (10^0 and 10^{-1} dilutions) 5 days growth at $27.5(\pm 2.5)$ °C – mainly *Penicillium spp* and *Aspergillus fumigatus* visible

Sunlight? No!

- ◆ 2009 Mika et al. showed that irradiation during day time doesn't help reducing *E. coli* in the sand
- ◆ Fungi are very resilient, even in drier climates

Pathologies	Species	Natural reservoirs	Endemic Region
Phaeohyphomycosis	<i>Exophiala spp</i>	Water, Soils with organic matter, Decaying wood	Worldwide
	<i>Sporothrix schenckii</i>	Soils with organic matter, Decaying wood	
	<i>Phialophora spp</i>	Soils, Plants and decaying food	
Coccidiomycosis	<i>Coccidioides spp</i>	Dry Soils	American continent
Paracoccidiomycosis	<i>Paracoccidioides brasiliensis</i>	Warm-blooded animals, protein-rich and humid soils	
Histoplasmosis	<i>Histoplasma capsulatum</i>	Soils contaminated with bat guano and bird droppings	Worldwise but more frequent in tropical areas and southern USA
	<i>Histoplasma duboisii</i>		Sub-saharan Africa
Dermatomycosis (ringworm, onychomycosis, tinea capitis)	<i>Epidermophyton floccosum</i>	Warm-blooded animals	Worldwide
	<i>Trichophyton spp</i>	Soil and warm-blooded animals	
	<i>Microsporum spp</i>		
Cryptococcosis (meningitis/respiratory and systemic infections)	<i>Cryptococcus spp</i>	Soils contaminated with bird faeces and decaying wood for <i>C. gatii</i>	
Chromoblastomycosis	<i>Fonsecae spp</i>	Soils and decaying wood	Humid tropical regions
	<i>Madurella spp</i>	Soils	
	<i>Cladophialophora spp</i>	Soils and decaying wood	
Salmonellosis	<i>Salmonella spp</i>	Animals	Worldwide
Typhoid fever	<i>Salmonella typhi</i>	water	
Gastroenteritis, Haemorrhagic fever	<i>Escherichia coli</i> , Enteric pathogenic bacteria	Warm-blooded animals	
Gastroenteritis, Sepsis	<i>Vibrio parahaemolyticus</i> <i>Vibrio vulnificus</i>	Aquatic environments, seafood	
Cholera / gastroenteritis	<i>Vibrio cholerae</i>	Surface of plants, filamentous algae, zooplankton, Crustaceans and insects. Biofilms	
Gastroenteritis, poliomyelitis, Hepatitis	Enterovirus, HepA virus	water	
Giardiasis	<i>Giardia duodenalis</i>	Water, soil, food & animals	
Cryptosporidiosis	<i>Cryptosporidium sp</i>		
Toxoplasmosis	<i>Toxoplasma gondii</i>		
Helminthiasis	Helminths		

Past

- ◆ There is data from most of the last century on beach sand contaminants; mainly bacterial, some fungal and some for parasites
- ◆ **1989** - Mycology group looking into fungi in sand (joint study with Portuguese National Directorate of Health).
- ◆ For **10 years**, several beach sands were screened for fungi, following different approaches.

Project # 1 & 2

Structure/Methods/Parameters/Standards

2000 – 2002

&

2002-2006

Project 1: Structure beach sand quality analysis including parameters and associated methods:

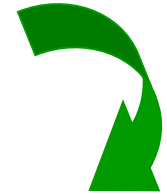
“Microbiologic Quality of Coastal Beach Sands”

Participants:

 Portuguese Blue Flag Association,  Instituto Nacional de Saúde Doutor Ricardo Jorge The National Institute of Health Dr. Ricardo Jorge,  Ministério da Saúde Direcção-Geral da Saúde The General Directorate of Health (DGS),  The Environmental Institute (APA),  INSTITUTO DA ÁGUA The Water Institute (INAG),  Cascais The City Hall of Cascais,  The City Hall of Viana do Castelo

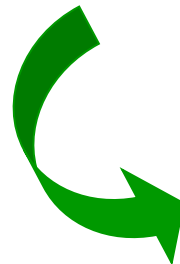


5 Regions – Bimonthly sampling during 13 months



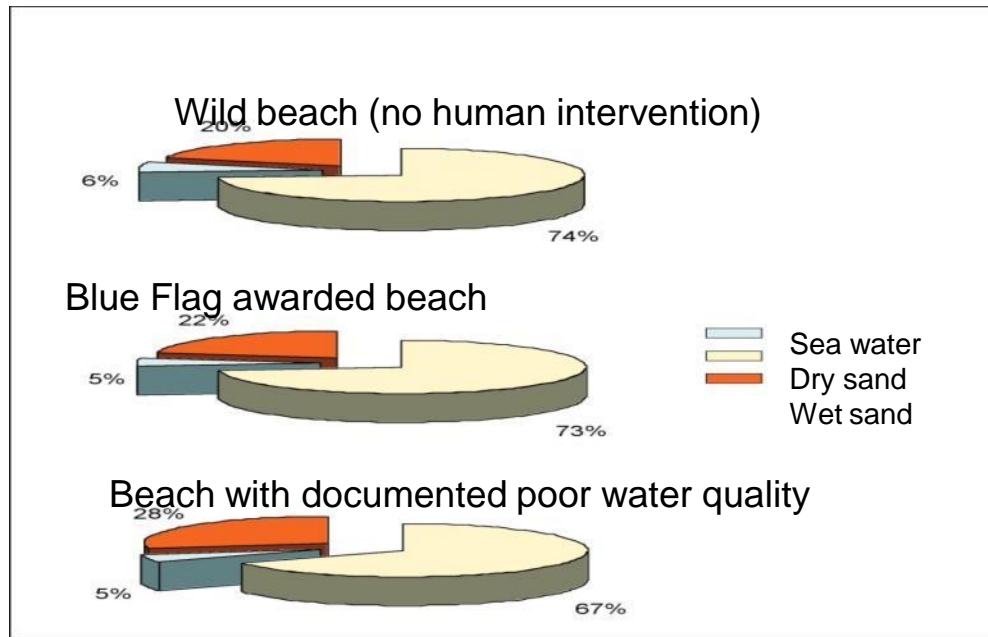
3 beaches per region:

- 1 Beach awarded with the Blue Flag
- 1 Beach with no direct human interference
- 1 Beach with documented poor water quality



210 sand samples
105 water samples

Distribution of fungal abundance in sea water, dry sand and wet sand



Observation: Despite the direct sunlight on sun surface and high temperature in the summer, fungi seem resilient enough to be still found mainly on dry sand

Project 2: ICREW – “Improving Coastal and REcreational Waters for all”

**EU funding (8M€), 5 EU countries, 19 institutions*,
7 pilot actions****

Report available available at:

http://www.interreg-atlantique.org/upload/resultats/ICREW_FINAL_REPORT.pdf



****Pilot Actions:**

- ↳ PA 1 - Sampling and data review
- ↳ PA 2 - Resolving diffuse pollution
- ↳ PA 3 - Developing pollution source tracking
- ↳ PA 4 - Forecasting bathing water quality
- ↳ PA 5 - Re-identification of recreational waters
- ↳ PA 6 - Sustainable sewage solutions
- ↳ PA 7 - Understanding and managing algae

Mycological parameters for sand quality assessment

- Yeasts (a): Faecal contamination indicators
- Potentially pathogenic and allergenic molds (b)
- Dermatophytes (c): Indicators of animal presence, including humans

Reference values for sand quality assessment based on national means

Mycology Parameters:

1. Yeasts	60 cfu/g
2. Potential pathogenic moulds (filamentous fungi)	85 cfu/g
3. Dermatophytes	15 cfu/g

Bacteriology Parameters:

1. Total coliforms	100 cfu/g
2. <i>E. coli</i>	20 cfu/g
3. <i>Enterococci</i>	20 cfu/g

Project # 3

Parameter consistency/Reference Values

“Sand quality monitoring programme”

Promotion: Blue Flag Association

Laboratories: Portuguese NIH and APA

Duration: 2006-2010

Nr of beaches monitored: 61 in 2006 till 81 in 2010

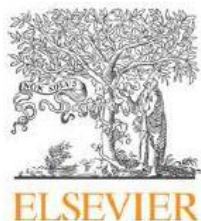
Nr of samples of sand analyzed: 1206

Nr of beaches **monitored** during the **5 years consecutively**: 33
(corresponding to 495 of the 1206 samples)

Some results

- 60.4% of the samples were positive for the reference fungal species
- 25.2% were positive for the three bacterial groups
- 33.3% were negative for all the parameters
- 20.2% were positive for both fungal and bacterial parameters
- Yeasts and dermatophytes tend to increase along the sampling periods
- Interesting relationships were found (i.e. *Scopulariopsis spp* and Dermatophytes, between yeasts and coliforms)

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Pathogenic fungi: An unacknowledged risk at coastal resorts? New insights on microbiological sand quality in Portugal

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ABSTRACT

Whilst the potential impact on beach users from microorganisms in water has received considerable attention, there has been relatively little investigation into microbial contaminants in sand. Thirty three

Proposed values for sand quality assessment based on the high 95 percentile

Mycology Parameters:

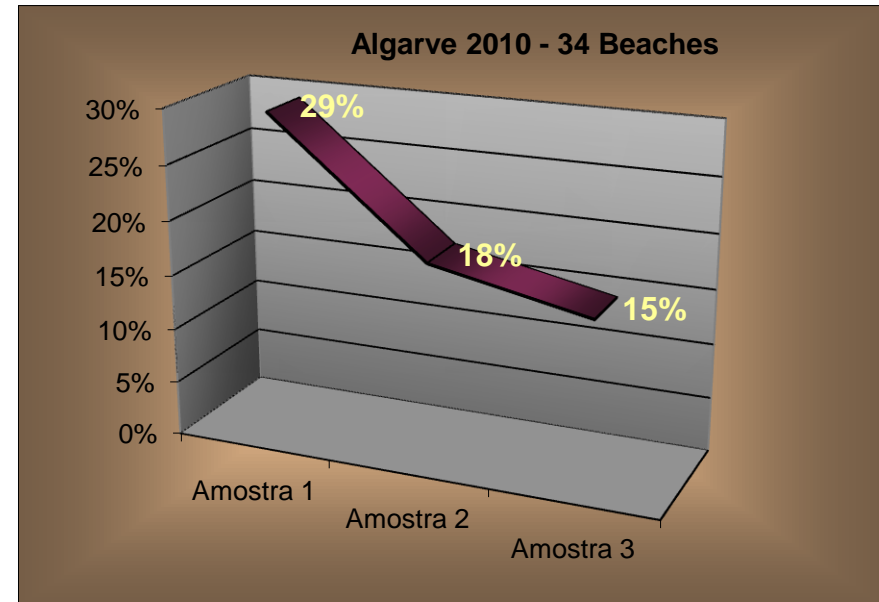
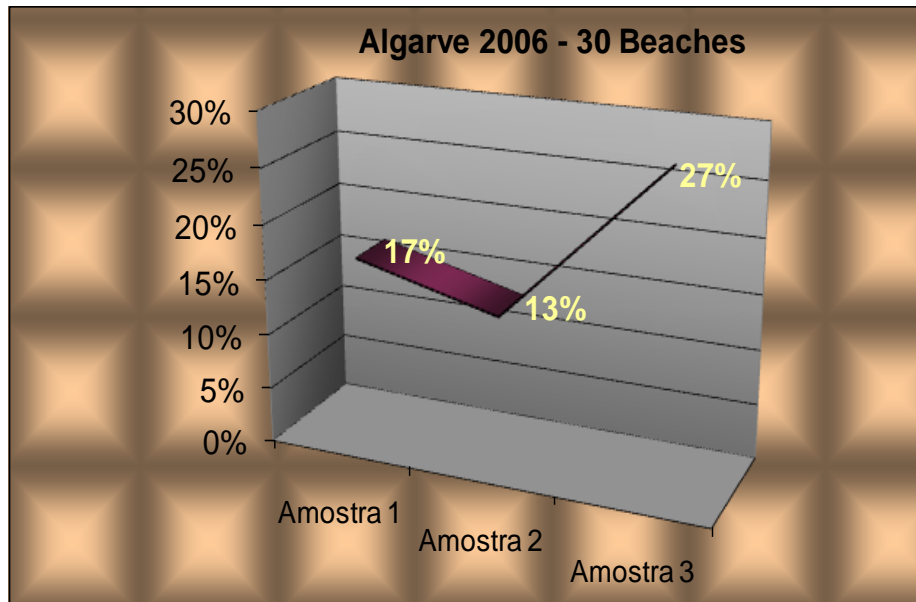
1. Yeasts	15 cfu/g
2. Potential pathogenic moulds (filamentous fungi)	17 cfu/g
3. Dermatophytes	8 cfu/g

Bacteriology Parameters:

1. <i>E. coli</i>	25 cfu/g
2. <i>Enterococci</i>	10 cfu/g

Algarve 2006 x 2010

Samples that exceeded at least one of the Reference Values



Beach managers were instructed on how to control contaminant levels.

Result: Drastic reduction of contaminant levels from the first sampling (pre-bathing season) to the following two (during bathing season) after the first year of the project (2006)

Overall recommendations

Factors that positively influence the quality of beach sand

- **Garbage removal** - Frequent removal of litter and garbage from sand and neighbouring areas;
- **Garbage receptacles**- Number of garbage receptacles appropriate for the length of the beach;
- **Sand treatment** - based on experience of one region with weekly iodine spraying (this statement does not express the point of view of the authors);
- **Surroundings** - Identification and treatment of neighbouring contaminated areas

Factors that negatively influence the quality of beach sand

- Over-use of beach
- Admission of pets
- Accumulation of garbage
- Abandonment of remains from fishing
- Rodents and prowling animals

Education of the public



Education of the public

A monitorização da qualidade microbiológica das areias das praias é um projecto desenvolvido pela Associação Bandeira Azul da Europa (ABAE), Instituto Nacional de Saúde Dr. Ricardo Jorge (INSA), Agência Portuguesa do Ambiente (APA), Autarquias com o apoio das Águas de Gaia, EM e tem por objectivo, o estudo de potenciais focos de risco presentes na areia, cujo contacto directo com o Homem pode constituir fonte de contágio de doenças.

Promotores

Fundo Ambiental
Instituto para o Ambiente Nacional
Associação Bandeira Azul da Europa

AGÊNCIA PORTUGUESA DO AMBIENTE
Ministério do Ambiente e do Ordenamento do Território

Patrocinador

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**NA AREIA
deixe apenas
a sua pegada**

O lixo que deixa na areia faz com que se desenvolvam fungos e bactérias prejudiciais para a saúde humana e influencia o Ambiente.

Bandeira Azul

Factores que influenciam POSITIVAMENTE a qualidade das areias das praias:

- Depósito do lixo nos recipientes adequados existentes na praia e espaços adjacentes.
- Recolha frequente do lixo abandonado na praia.
- Remoção mecânica diária do lixo, revolvendo o areal, arejando-o e renovando a exposição da areia aos raios UV do sol.
- Identificação e tratamento de fontes de contaminação adjacentes à praia (exemplo: cursos de água afluentes à praia tal como ribeiras).

Factores que influenciam NEGATIVAMENTE a qualidade das areias das praias:

- Sobrelocação das praias.
- Admissão de animais domésticos.
- Lixo colocado na areia e dunas.
- Actividade de pesca de rede com abandono na areia de peixes e crustáceos não comercializados.

Timeline

- Blue Flag monitoring programme 2006-2010 Reached 25% of all the beaches of Portugal
- September 2011 – Workshop in Michigan City to prepare a review paper on all published on sand and water microbial interaction and related public health threats (submitted)
- 2011-2013: INSA – Molecular analysis and detection of virus and parasites (delayed due to financial contingencies)
- 2012 Workshop to debate parameters and indicators (published in Science of the Total environment)
- 2013 Launch of inter-lab network with yearly meetings for discussion of results and approaches to technical issues

Currently ?

- We provide the service to the community
- Doing research in order to implement molecular detection for faster results of some parameters
- Extension of the analysis to specific fungal and bacterial pathogens, viruses (wet sand) and parasites (both wet and dry sand), **especially foreign and as result of importing renourishing sands from abroad**
- Networking with other research groups around the world
- Preparing an **international white letter/recommendation**, by scientists as a deliverable of an international meeting that will take place in **Lisbon, PT**, in **September**: www.temph2014.com

Please pre-register to receive news and updates on TEMPH2014.



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Introduction

Environmental microbiology is an evolving science. This in part driven by changes and development of new analytical techniques that are becoming more varied and powerful.

Before application, emerging issues and technical need to be discussed among scientists, technical professionals, practitioners, and students. The TEMPH will provide a forum to discuss emerging pathogens, microbial toxins and resistance genes in air, water, sand and foodstuff in an environmental exposure context. Join us in Lisbon on September 18-21 for the inaugural session of this independent meeting – TEMPH2014.



“BRINGING TOGETHER KNOWLEDGE IN ENVIRONMENTAL MICROBIOLOGY”

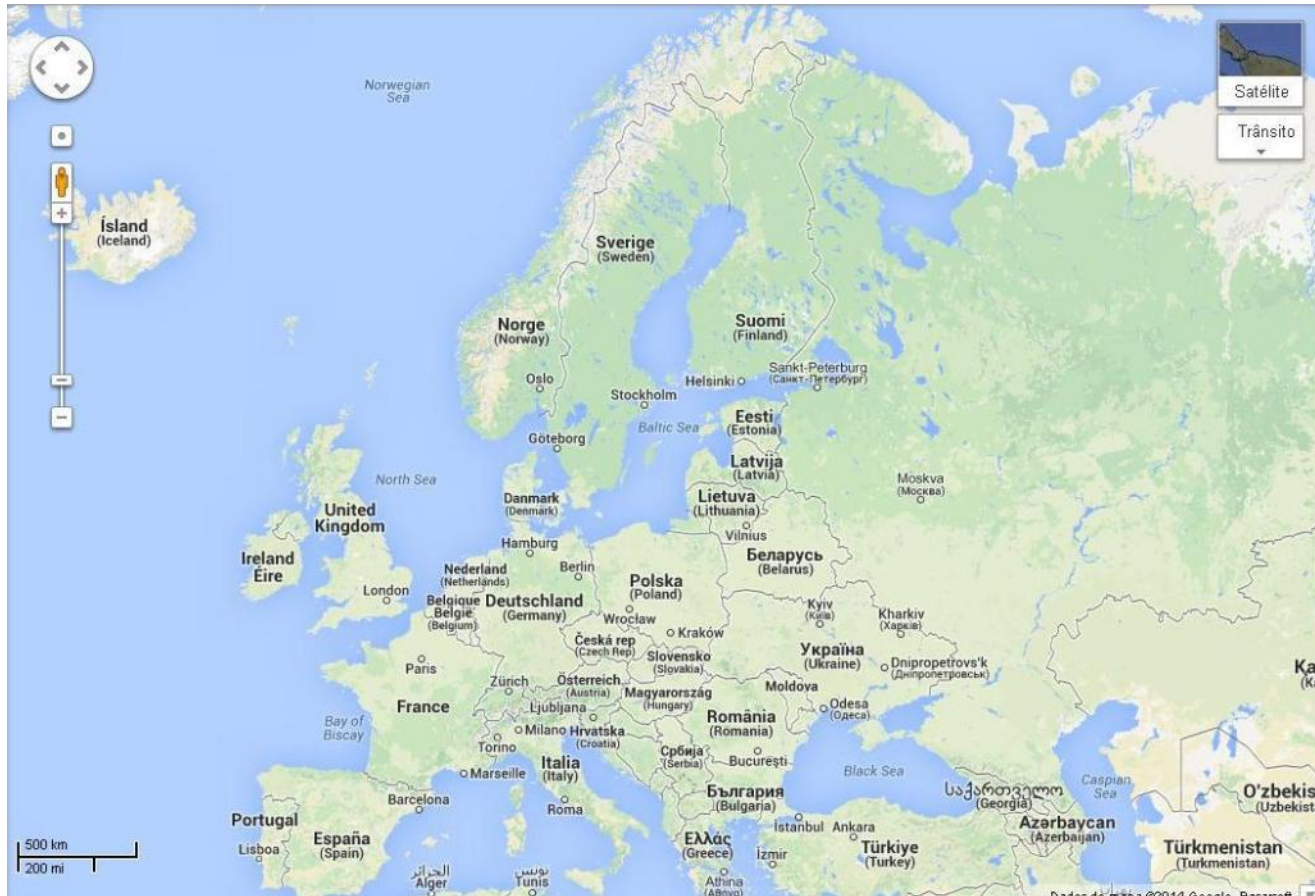
10 Feb 2014 9 0

Our event start in

Days Hour Minutes Seconds

21 6 21 29 37

Europe



Data from Europe

- UK (Coast)
- Italy (Coast)
- Austria (Inland beach)
- Canary Islands – Spain
- Continental Spain
- Azores (Açores) - Portugal
- Madeira – Portugal
- Greece (One island)
- France (Old data – coast)

USA

- A lot of data on bacteria (several states), mainly FIB data especially from the great lakes and Pacific regions but not only! (E.g. MLRS hospital strains types found in intertidal sand and water in Washington 2009 (*Soge et al.*))
- Prof. Fujioka published many papers on soil and sand contamination-one of the leading experts world-wide.
- Yeasts and parasites also (Miami)

Rest of the World

- Algeria – Bacteria
- Maroco - Fungi
- Iran – Bacteria
- Brasil – São Paulo – Bacteria
- Malasia – Fungal analysis

Remarks

- WHO has yet to recommend sand monitoring. Why???
- It's time to implement and regulate
- Scientists world-wide are organising themselves but can only recommend. Regulatory agencies need to step in!!

White Letter Members

- Brandão, J – NIH Lisbon, PT
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Waikīkī beach



Algarve – Southern coast of Portugal