

German Environment Agency

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2nd Workshop on Tourism Monitoring in Antarctica

Day 1: Monitoring possibilities from distance (based on e.g. databases, PVRs, satellite data)

October 10, 2023



Short introduction to the project “Tourism monitoring in Antarctica”

BACKGROUND:



- Climate change expected to increasingly impact the sensitive Antarctic environment



- Rising tourist numbers and diversification of Antarctic tourism have the potential to have a (negative) impact on ecosystems or their individual components



- Overall, impacts of tourist activities in the Antarctic are poorly understood



- Lack of targeted regulations for tourism

OBJECTIVES:

- Overview of the current state of research on the impacts of tourism in Antarctica
- Development of a comprehensive, long-term concept for frequently visited tourist sites in the Antarctic
- Overall: advance the protection of the Antarctic environment

Tourism Monitoring in Antarctica - Development of a concept for the analysis of the impacts of tourism on the assets to be protected in the Antarctic

DURATION: 2021-2024

WORKING PACKAGES:

WP 1:

Literature research on the impacts of tourism on the assets to be protected and existing monitoring approaches

WP 2:

Stakeholder participation in two international Workshops (spring 2022, autumn 2023)

WP 3:

Development of a comprehensive monitoring concept

WP 4:

Presentation of results at the ATCM 2023 and 2024

WP 5:

Final project report



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Programme Day 1

Time	Session
13.00-13.10	Welcome Short introduction to the Project “Tourism monitoring in Antarctica” <i>German Environment Agency (UBA)</i>
13.10-13.15	Overview of the workshop (objectives, time plan) <i>Fresh Thoughts Consulting</i>
13.15-13.25	Short round of introduction
13.25-14.00	Presentation of the status of the monitoring concept (incl. gaps and challenges) Q & A <i>Fresh Thoughts Consulting</i>
14.00-15.20	Introduction <i>Fresh Thoughts Consulting</i> Short break Parallel working groups
15.20-15.30	Break
15.30-16.00	Reflection on the results from the working groups <i>German Environment Agency (UBA), Fresh Thoughts Consulting, INASEA</i> Outlook for Day 2 <i>Fresh Thoughts Consulting</i>

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2nd Workshop on Tourism Monitoring in Antarctica

Developing a concept for monitoring the environmental impacts of tourism: approach and status

Thomas Dworak, Fresh Thoughts Consulting



Monitoring of tourism impacts

AIM:

- Expand the knowledge base about the impacts of tourist activities in the Antarctic
- Inform future management decisions, advance the protection of the Antarctic environment (formal and informal)
- Early warning system: detect any impacts that are more than *minor or transitory* (see Protocol on Environmental Protection to the Antarctic Treaty)



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Step 1: Literature review

APPROACH:

- Compilation of a literature database comprising scientific articles, book chapters, conference or workshop papers, (project) reports, fact sheets
- Development of an analytical matrix for the analysis
- Systematic analysis of 130 documents regarding the impacts of different tourist activities, monitoring methods, and proposed management measures



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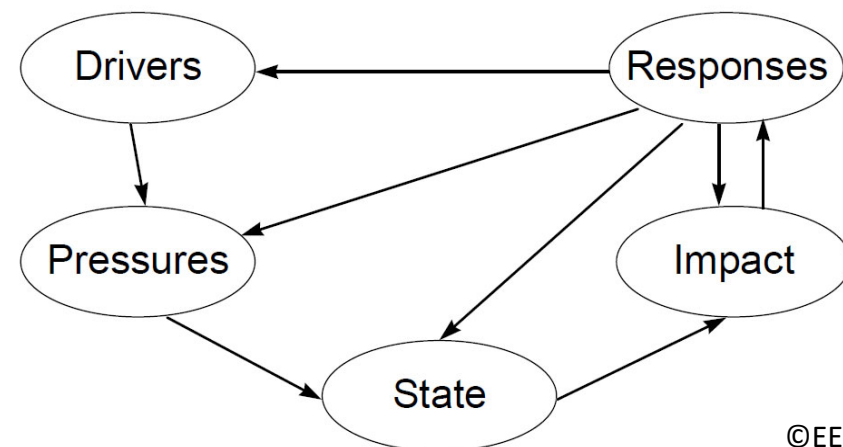
Step 2: Identification of DPSIR-chains

APPROACH:

- Identifying the interconnection between specific tourism activities, pressures, impacts, and existing/proposed management measures (in xls)
- Categorising of Drivers:
 - Cruising
 - Water-based activities
 - Activities on land
 - Flights
- Visualization: diagrams for the main types of tourism (seaborne, land-based, airborne)

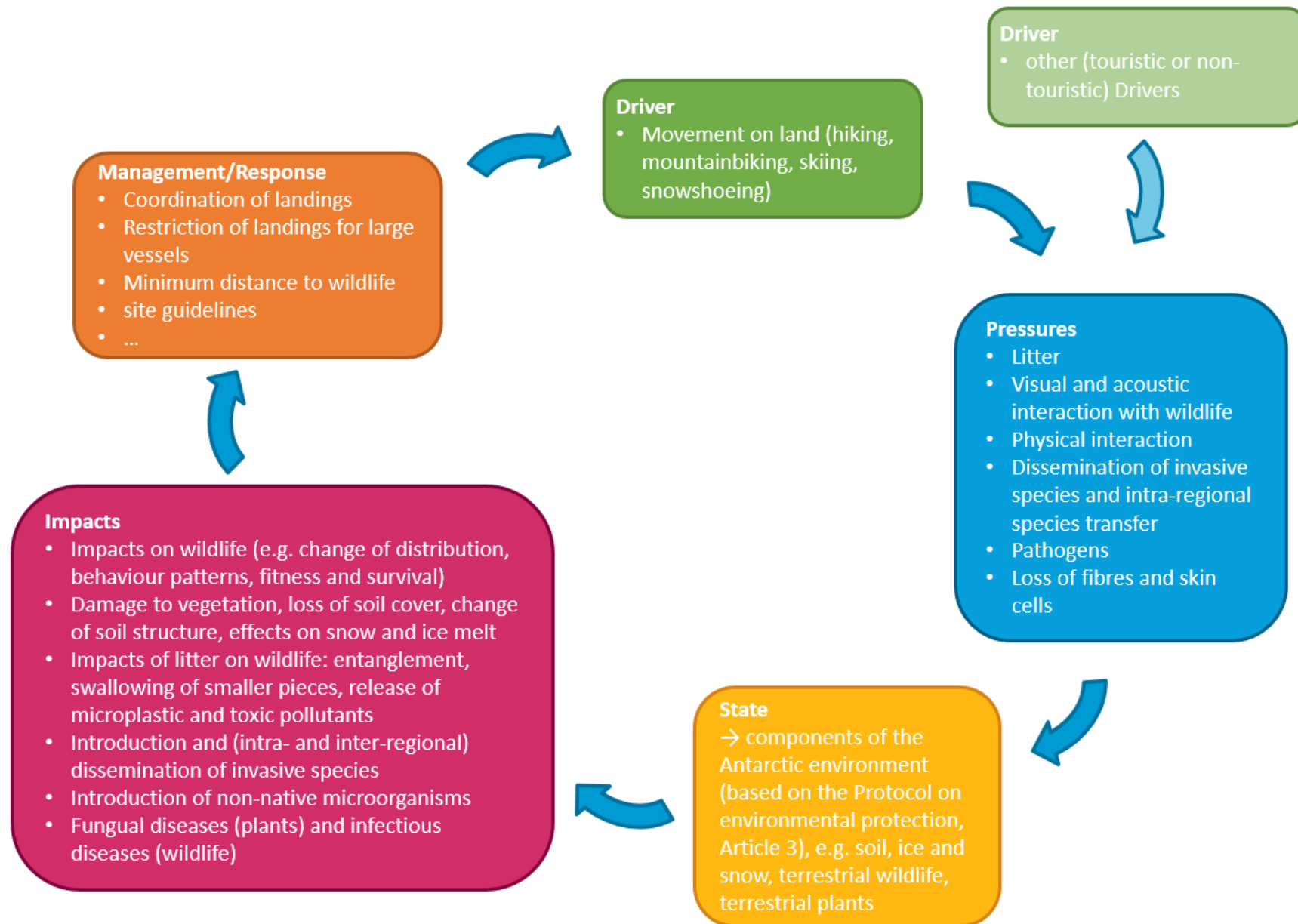
Background information: the DPSIR framework

- Introduced by the EEA in 1999
- DPSIR = **D**riving forces, **P**ressure, **S**tate, **I**mpact, **R**esponse
- Aims to reflect the complex interrelations between the natural environment and human systems → systemic view on ecosystems

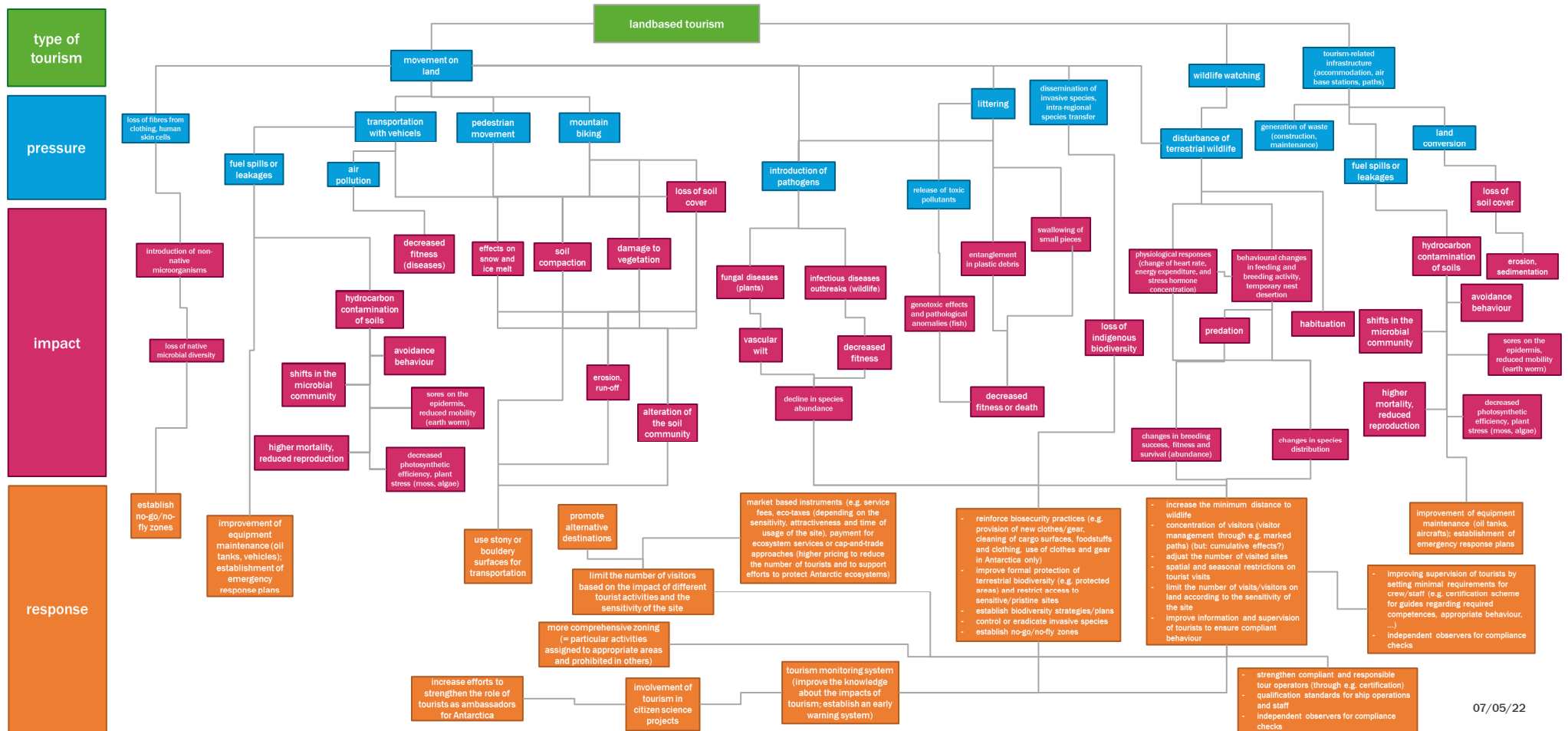


©EEA, 1999

Example for a DPSIR-chain (Driver „land-based activities“)



Visualization of the interconnections between different elements of the DPSIR chain (example: land-based tourism activities)



07/05/22

Step 3: Identify indicators and monitoring methods

APPROACH:

- For each element of the DPSIR chain, identify indicators and monitoring methods (based on the literature review)
- Research of existing monitoring approaches
- Identify gaps (for some Drivers, Pressures and Impacts well-established indicators/methods exist, but there are also some gaps)



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Step 4: Prioritisation

AIM:

- To use the available financial and human resources as effectively as possible, a prioritization based on the significance of environmental impacts of different tourism activities in the Antarctic is needed

APPROACH:

- Develop a list of question for the qualitative assessment of the DPSIR chains (see extract below)

Q1: How long is the average exposition to the Pressure?*

Duration	entire tourism season	up to a month	up to a week	up to a day	up to an hour	a few minutes
Score	High	High	High	Medium	Medium	Low
		x				
Explanation	a typical cruise trip to the Antarctic lasts between 6-20 days, GHG emissions are produced during the whole duration of the trip.					

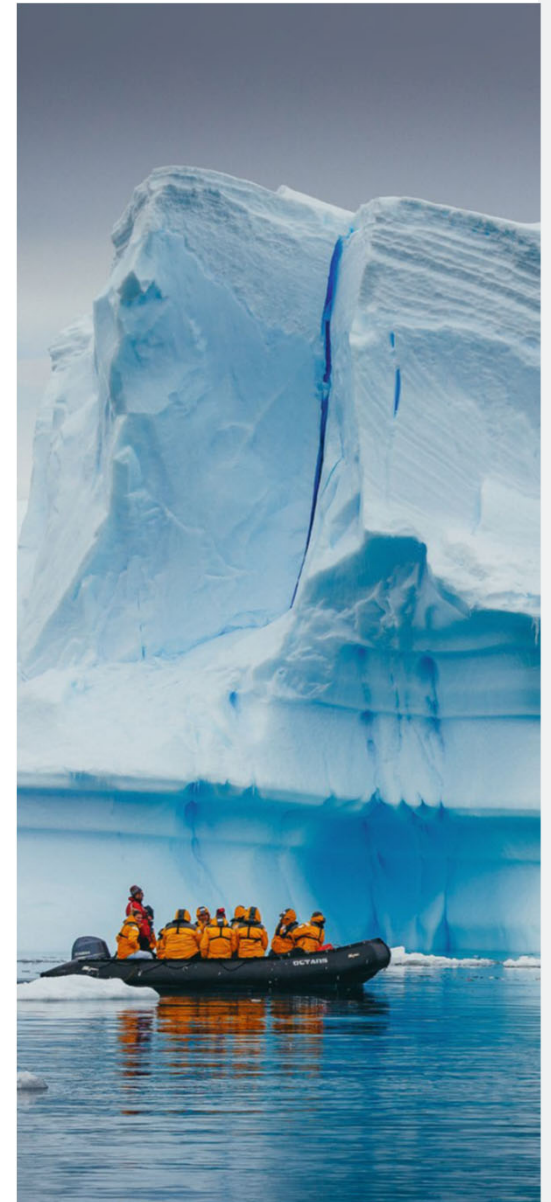
Q2: In total, how frequently is the activity carried out in the tourism season?

Frequency	Continuous (More than daily)	Recurrent (Less than daily/weekly)	Frequent (Less than weekly/monthly)	Infrequent (Less than monthly/annually)	Occasional (Less than annually/once every 10 years)	Sporadic (Less than once every ten years)
Score	High	High	High	Medium	Medium	Low
	x					
Explanation	Cruising (including landings or cruise-only) is the main form of tourism in the Antarctic. In the 2022/23 season, 103,967 (of 104,897) can be attributed to cruise ship tourism.					

Challenges and gaps

1. Conceptual challenges

- complex causal relationships between the DPSIR elements
- determining the direct and indirect contribution of tourism to local impacts and global environmental change (e.g. Antarctic tourism contributing to global climate change)
- short- and long-term impacts, cumulative impacts, non-linear changes?
- Insufficient knowledge about the Antarctic ecosystem and impacts of human activities
- Impacts are determined by local contexts and behaviour of tourists/tour operators
- Lack of adequate indicators/monitoring methods for some pressures and impacts
- Monitoring impacts on wildlife is challenging (e.g. habituation effects, behavioural changes do not necessarily reflect physiological changes)
- Prioritisation of DPSIR chains is difficult due to a lack of quantitative comparative data



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Challenges and gaps

2. Monitoring challenges

- Lack of baseline data (“state of the environment”)
- Incorporation of existing monitoring approaches
- Securing adequate financial resources
- Involvement and cooperation between different stakeholders
- Ensure strong link between monitoring and management decisions



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Question for the working groups (14:00 - 15:20)

Day 1: What can be monitored from distance, based on e.g. satellites and travel reports?

Aspects to consider in the discussion:

- Is relevant data already being collected and if so is there a need to improve this collection?
- Is there an appropriate monitoring method and if not are there methods in other areas that could be adapted?
- What needs to happen so that data gaps can be closed?
- Who could be in charge of data collection?

Thanks you for your participation!

The project is initiated and commissioned by the German Environment Agency (UBA), funded by the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)

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2nd Workshop on Tourism Monitoring in Antarctica, 11/10/23

Day 2: Monitoring possibilities via ship

October 11, 2023



Programme Day 2

Time	Session
13.00-13.15	Welcome back Overview of the workshop (objectives, time plan) and report back from the day before <i>Fresh Thoughts Consulting</i>
13.15-14.00	Keynote: Using citizen science projects for monitoring – experiences from practical examples Q & A <i>Annette Bombosch, Polar Citizen Science Collective</i>
14.00-15.20	Introduction <i>Fresh Thoughts Consulting</i> Short break Parallel working groups
15.20-15.30	Break
15.30-16.00	Reflection on the results from the working groups <i>German Environment Agency (UBA), Fresh Thoughts Consulting, INASEA</i> Outlook for Day 3 <i>Fresh Thoughts Consulting</i>

Example: biofouling

	Monitoring element	Indicator(s)	Method(s)
Driver	Cruise ships	<ul style="list-style-type: none"> - number of ships - size/type of ships - biofouling control mechanisms in place 	<ul style="list-style-type: none"> - analysis of PVRs - statistics on ships
Pressure	Biofouling	- growth of micro- and macroorganisms on submerged surfaces	<ul style="list-style-type: none"> - visual survey (In-water inspection of ship hulls by scuba divers): - area covered by fouling mechanisms - identification of organisms
Impact	Direct: <ul style="list-style-type: none"> • Introduction of invasive species (water) Indirect: <ul style="list-style-type: none"> • loss of indigenous biodiversity 	- establishment of invasive species (water)	- sampling

Overview of Pressures and Impacts related to cruise ships (1)



PRESSURE	IMPACTS (direct)	IMPACTS (indirect)
ballast water	introduction of invasive species (water)	loss of indigenous biodiversity
biofouling	<ul style="list-style-type: none"> - Introduction of invasive species (water) - toxic antifouling coatings: contamination of marine environments 	<ul style="list-style-type: none"> - loss of indigenous biodiversity - toxic antifouling coatings: accumulation in non-target organisms
emissions (CO ₂ , NO _x , SO _x , PM)	<ul style="list-style-type: none"> reinforcement of global climate change - change of climatic patterns - change of snow and ice cover and salinity of the ocean 	<ul style="list-style-type: none"> - higher likelihood of invasive species establishment - local species extinction - changes in physiology, distribution, phenology, and ontogeny of species - stress in wildlife
emissions (CO ₂ , NO _x , SO _x , PM)	acidification of the ocean	<ul style="list-style-type: none"> - stress in marine organisms (e.g. calcification, lipid transport, metabolic function, energy allocation) - habitat loss for acidification-sensitive organisms - collapse of populations - change of food web dynamics - change of acoustic characteristics
emissions (CO ₂ , NO _x , SO _x , PM, heavy metals)	<ul style="list-style-type: none"> - pollution of atmospheric, terrestrial and marine environments - bioaccumulation in organisms (plants & animals) 	<ul style="list-style-type: none"> - cause or exacerbate animal health problems - decreased fitness and higher susceptibility to diseases and parasites
emissions (PM (black carbon))	<ul style="list-style-type: none"> - absorption of solar energy contributes to the warming of the atmosphere - increased melting of snow and ice (albedo effect) 	<ul style="list-style-type: none"> - higher likelihood of invasive species establishment - local species extinction - changes in physiology, distribution, phenology, and ontogeny of species - stress in wildlife

Overview of Pressures and Impacts related to cruise ships (2)



PRESSURE	IMPACTS (direct)	IMPACTS (indirect)
anchoring	physical damage to marine habitats	<ul style="list-style-type: none"> - stress to marine ecosystems - influences on the carbon cycle
fuel spills or leakages	<ul style="list-style-type: none"> - pollution of marine habitats - oiled wildlife 	<ul style="list-style-type: none"> - decline in species abundance (higher mortality) - changes in the composition of species communities
discharge of sewage water	water quality: <ul style="list-style-type: none"> - organic enrichment - introduction of pathogens - introduction of noxious chemicals (e.g. pharmaceuticals) 	organic enrichment: algae growth, decrease in abundance and diversity of benthic communities pathogens: infectious disease outbreaks chemicals: genotoxic effects and pathological anomalies (studied in fish) all: decreased fitness or death of individuals (-> decline in species abundance)
littering	<ul style="list-style-type: none"> - entanglement in marine litter - swallowing of smaller pieces - release of toxic pollutants (e.g. chemical additives and contaminants in plastics) 	<ul style="list-style-type: none"> - decreased fitness or death (-> decline in species abundance) - impacts of ingestion of microplastic still are widely unknown
collisions with marine wildlife or birds	changes in fitness and survival of individuals	
noise (underwater)	<ul style="list-style-type: none"> - hearing damages of marine wildlife - change of behaviour patterns (e.g. movement, feeding, resting, communication) - physiological changes (e.g. respiration rate, energy acquisition or expenditure) - habituation to the disturbance (?) 	<ul style="list-style-type: none"> - changes in fitness and survival (abundance) - changes in species distribution
visual and acoustic interaction (above water)	<ul style="list-style-type: none"> - habituation to the disturbance (?) - change of behaviour patterns (e.g. movement, breeding, feeding, resting, communication, temporary nest desertation) - physiological changes (e.g. respiration rate, energy acquisition or expenditure) 	<ul style="list-style-type: none"> - changes in fitness and survival (abundance) - higher vulnerability to predation - changes in breeding success - changes in species distribution - higher susceptibility to diseases and parasites

Overview of Pressures and Impacts related to water-based activities



Water-based activities*

PRESSURE	IMPACTS (direct)	IMPACTS (indirect)
visual and acoustic interaction	<ul style="list-style-type: none"> - habituation to the disturbance (?) - change of behaviour patterns (e.g. movement, breeding, feeding, resting, communication, temporary nest desertation) - physiological changes (e.g. respiration rate, energy acquisition or expenditure) 	<ul style="list-style-type: none"> - changes in fitness and survival (abundance) - higher vulnerability to predation - changes in breeding success - changes in species distribution - higher susceptibility to diseases and parasites

activities including motorised boats

PRESSURE	IMPACTS (direct)	IMPACTS (indirect)
emissions (CO ₂ , NO _x , SO _x , PM, heavy metals)		
emissions (PM / Black Carbon)		
GHG emissions		
GHG emissions		
fuel spills or leakages		
collisions with marine wildlife or birds		
noise (underwater)		

See „cruise ships“

*e.g., scuba diving, swimming, polar plunge, zodiac cruises, kayaking, surfboards, stand up paddle boarding

Question for the working groups (14:00 - 15:20)

Day 2: What and how can be monitored from a cruise ship?

Aspects to consider in the discussion:

- Is relevant data already being collected and if so is there a need to improve this collection?
- Is there an appropriate monitoring method and if not are there methods in other areas that could be adapted?
- What needs to happen so that data gaps can be closed?
- Who could be in charge of data collection?

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2nd Workshop on Tourism Monitoring in Antarctica

Day 3: Monitoring possibilities on land

October 12, 2023



Programme Day 3

Time	Session
13.00-13.15	Welcome back Overview of the workshop (objectives, time plan) and report back from the day before <i>Fresh Thoughts Consulting</i>
13.15-14.00	Keynote: Possible field methods to monitor tourism impact on the Antarctic environment Q & A <i>Osama Mustafa, ThINK - Thuringian Institute of Sustainability and Climate Protection</i>
14.00-15.20	Introduction <i>Fresh Thoughts Consulting</i> Short break Parallel working groups
15.20-15.30	Break
15.30-16.00	Reflection on the results from the working groups <i>German Environment Agency (UBA), Fresh Thoughts Consulting, INASEA</i> Any other business Next steps <i>German Environment Agency (UBA)</i>

Overview of Pressures and Impacts related to land-based activities*



PRESSURE	IMPACTS (direct)	IMPACTS (indirect)
introduction of invasive species	establishment of non-native species at landing sites	- change of species composition - loss of indigenous biodiversity
introduction of pathogens	- fungal diseases (plants) - infectious diseases (wildlife)	plants: vascular wilt wildlife: decreased fitness or death -> decline in species abundance
loss of fibres and human skin cells	introduction of non-native microorganisms	loss of native microbial diversity
dissemination of invasive species, intra-regional species transfer	spread of non-native species	- change of species composition - loss of indigenous biodiversity
littering	- entanglement in litter - swallowing of smaller pieces - release of microplastic and toxic pollutants	- decreased fitness or death (-> decline in species abundance) - impacts of ingestion of (micro)plastic still are widely unknown
physical interactions	- damage to vegetation - loss of soil cover - soil compaction, change of soil structure - effects on snow and ice melt	- change of erosion and run-off patterns - alteration of the soil community
visual and acoustic interaction	- habituation to the disturbance (?) - change of behaviour patterns (e.g. movement, breeding, feeding, resting, communication, temporary nest desertation) - physiological changes (e.g. respiration rate, energy acquisition or expenditure)	- changes in fitness and survival of terrestrial wildlife (abundance) - higher vulnerability to predation - changes in breeding success - changes in species distribution - higher susceptibility to diseases and parasites
land conversion for tourism infrastructures	- habitat destruction - pollution	change of erosion and sedimentation patterns

*e.g., hiking, skiing, camping, (mountain-)biking, snowshoeing

Example: introduction of invasive species

	Monitoring element	Indicator(s)	Method(s)
Driver	Landings	<ul style="list-style-type: none"> - number of tourists and staff - number of landings per day/season - duration of stay on land 	<ul style="list-style-type: none"> - analysis of PVRs
Pressure	Introduction of invasive species	<ul style="list-style-type: none"> - propagules in clothes/gear of visitors 	<ul style="list-style-type: none"> - sampling, identification, measurement (- assessment of propagule establishment likelihood)
Impact	<p>Direct:</p> <ul style="list-style-type: none"> • of non-native species at landing sites <p>Indirect:</p> <ul style="list-style-type: none"> • loss of indigenous biodiversity 	<ul style="list-style-type: none"> - invasive species establishment (ratio of invasive species, area) 	<ul style="list-style-type: none"> - vegetation assessment - mapping

Question for the working groups (14:00 - 15:20)

Day 3: What and how can be monitored at landing sites?

Aspects to consider in the discussion:

- Is relevant data already being collected and if so is there a need to improve this collection?
- Is there an appropriate monitoring method and if not are there methods in other areas that could be adapted?
- What needs to happen so that data gaps can be closed?
- Who could be in charge of data collection?

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