

Interactive Visualization Project Documentation

Narrative Section

- **concept (the purpose, audience, data, and desired insights)**

The main purpose is to highlight the problem of coral bleaching and its link to biodiversity loss.

The target audience is individuals who may not be familiar with the environmental issue of coral bleaching but are interested in learning about it.

The data used comes from solid research and surveys of coral bleaching events and their impact on marine ecosystems.

The insights needed are to raise awareness of the magnitude of the problem and inspire action to protect coral reefs.

- **how you developed the visualization to realize it**

To realize the concept, a combination of interactive visualization and storytelling techniques was employed. Visualisations are designed to be engaging and informative, with a focus on grabbing the audience's attention and effectively conveying key messages. The goal is to create an immersive experience where viewers feel connected to the issue and understand the severity of coral bleaching and the importance of protecting coral reefs.

- **how you mapped your data and why**

Data mapping is designed to make it easy for people to understand and create a visual narrative. For example, use a world map to highlight the location and importance of coral reefs. Displays increasing coral bleaching events over time using a line graph and so on. These choices are designed to present the data in a clear and visually appealing manner, ensuring that the audience easily understands the information conveyed.

- **what exploration/preprocessing/analysis you needed to do to get to it**

Data exploration, preprocessing, and analysis were performed before the visualization was developed. This includes examining various datasets related to coral bleaching events, studying temperature trends and the impact of coral bleaching on marine biodiversity. Perform data cleaning and screening to ensure accuracy and reliability. Statistical analyses were also performed to identify patterns, correlations, and

perspectives in the data. This exploration and analysis help shape the narrative and identify the most impactful visualizations.

- **how you changed your concept based on the feedback from your presentation**

Concepts and details were tweaked and iterated based on feedback received during the last assessment.

Conceptually, the narrative has been refined to focus more on the impact of coral bleaching on marine biodiversity, highlighting its likely cascading effects on entire ecosystems. This adjustment aims to emphasize the importance of protecting coral reefs to the protection of biodiversity and to add measures on how to actively deal with the problem of coral bleaching.

In terms of detail, the visualization has been refined with more interactive elements, engaging animations and relevant comparisons to engage the audience and make the message more memorable.

Overall, the aims to present the issues of coral bleaching and biodiversity loss in an engaging and informative manner. By utilizing well-mapped data, conducting thorough exploration and analysis, and incorporating feedback to refine concepts and details, the goal is to create a compelling story that raises awareness and inspires action to protect coral reefs, and increase awareness of biodiversity.

Usability Testing

3 tasks and test, observation with 10 users

- **test objectives**

Content comprehension: Are users correctly understanding the content about coral bleaching?

Interactivity evaluation: Can users understand and effectively use the interactive elements on the web page?

Information extraction: Can users easily find the information they need on the web page?

- **Tasks (SUS combined with brief interviews and observation)**

#1: Read and explain part of the page on coral bleaching, such as “the reasons cause bleaching happen”.

#2: By using interactive elements on the web page to accomplish specific tasks such as

"Use the graph to determine trends in coral bleaching over the past decade in Australia".

#3: Find something specific on the web, such as "Find and List at least 3 Strategies to Prevent Coral Bleaching".

- **participants**

The coral reef ecosystem is a natural wealth shared by the world, and everyone should pay attention to and protect it. The global public needs to pay attention to the problem of coral bleaching, take actions to protect the coral reef ecosystem, and contribute to the global ecological balance and economic development.

Users with varying levels of education were selected for testing, as coral bleaching is a broad problem that affects everyone.

- **what you found**

Based on the collected user behaviour data, feedback, and perceptions, I have gathered the following key points regarding the three objectives of the usability testing:

Content comprehension: Overall, users did not face significant difficulties in understanding the content. The overall structure of the content was clear and easy to understand.

Interaction evaluation: Feedback indicates that some interactions on the page were hidden, and there is a need for interactive prompts or explanations to provide clearer usage guidance. Users mentioned the importance of having clear instructions to facilitate engagement with the interactive elements.

Information extraction and search: The most frequently mentioned issue was related to font size and specific layout adjustments, which affected the browsing experience to some extent. Users suggested that clearer navigation within each section would enhance the browsing experience. Furthermore, feedback highlighted the need for improved sourcing and explanations for charts and images, as well as ensuring consistent visual styling for charts from different sources.

- **what you changed in the final design**

By addressing these key points, such as enhancing interaction cues, adjusting font sizes and layouts, improving sourcing and explanations for visuals, and ensuring visual consistency, the overall user experience during testing can be improved.

In the final design, the interaction tips and instructions have been made clearer, and prompts have been added to key interaction sections to facilitate user engagement. Font sizes and layouts have been adjusted for readability and improved content structure clarity. The sourcing and illustration of charts and pictures have been enhanced by providing explanations for chart sources, aiding user understanding of data and

information. Additionally, the visual style of charts has been unified for consistency, enhancing the overall aesthetics and user experience.

- testing templates/images (see details in appendix)

Usability Testing		Datasheet(1)	
Participant # _____			
Tested product (e.g. website URL): Interactive Visualization Project - Coral Bleaching: a tale of tragedy and hope			
Task(s) (Enter a brief description for each task)	Success 0 = Not completed 1 = Completed with difficulty or help 2 = Easily completed	Time to complete	Notes/Observations (Note why the user was successful or not successful, e.g. using pathways, confusing page layout, navigation issues, terminology)
#1: Read and explain part of the page on coral bleaching, such as "the reasons cause bleaching happen"			
#2: By using interactive elements on the web page to accomplish specific tasks such as "use the graph to determine trends in coral bleaching over the past decade in Australia"			
#3: Find something specific on the web, such as "Find and List at least 3 Strategies to Prevent Coral Bleaching"			

Figure 1 usability testing template sheet

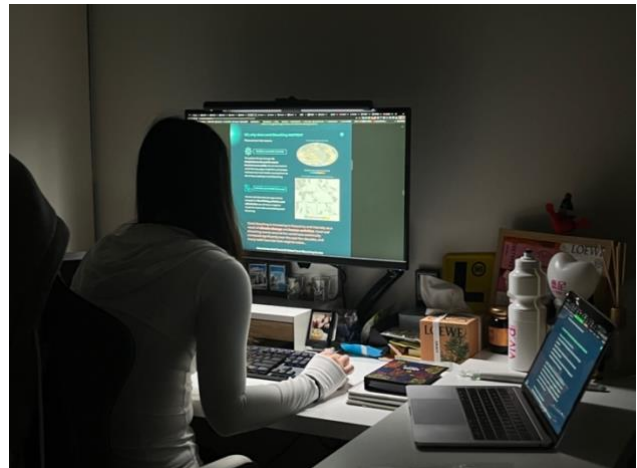


Figure 2 photo of user during the usability testing

- consent form (see details in appendix)

Usability Testing		Datasheet(1)	
Consent Form			
I agree to participate in the study conducted and recorded by <u>Muxiel Zheng</u> .			
I agree to:			
<input type="checkbox"/> The session being audio recorded (cross out as appropriate) <input type="checkbox"/> The use of photographs recordings for the purpose of documenting the findings from this study			
I understand that the information collected in this study is for research purposes only and that my name and image will not be used for any other purpose. I relinquish any rights to the recording.			
I understand that participation in this usability study is voluntary, and I agree to immediately raise any concerns or areas of discomfort during the session with the study administrator.			
I confirm that I have read and understand the information on this form and that any questions I might have about the session have been answered.			
Date: <u>25/05/2023</u>			
Please print your name: _____			
Please sign your name: _____			
Thank you! We appreciate your participation.			

Figure 3 consent form template

Acknowledgment of references/sources

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Acknowledgment of resources/incorporating elements:

<https://plotly.com/javascript/>

<https://plotly.com/javascript/bar-charts/>

<https://plotly.com/javascript/mapbox-county-choropleth/>

<https://resourcewatch.org/>

<https://www.animaapp.com/>

Appendix

Usability Testing Records and Consent Forms:

Usability Testing

Datasheet(1)

Participant #1

Tested product (e.g. website URL):
Interactive Visualization Project - Coral Bleaching: a tale of tragedy and hope

Task(s) (Enter a brief description for each task)	Success 0 = Not completed 1 = Completed with difficulty or help 2 = Easily completed	Time to complete	Notes/Observations (Note why the user was successful or not successful, e.g. wrong pathways, confusing page layout, navigation issues, terminology)
#1: Read and explain part of the page on coral bleaching, such as "the reasons cause bleaching happen"	2	0:49	the text font size is a little too big
#2: By using interactive elements on the web page to accomplish specific tasks such as "use the graph to determine trends in coral bleaching over the past decade in Australia"	1	2:00	Similar charts causes some impact when it comes to resolving extracted information
#3: Find something specific on the web, such as "Find and List at least 3 Strategies to Prevent Coral Bleaching"	2	0:52	the structure of the content is really clear and easy to find

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Usability Testing

Datasheet(2)

Consent Form

I agree to participate in the study conducted and recorded by Muriel Zheng

I agree to:

- ☒ The session being audio recorded (cross out as appropriate)
- ☒ The use of photographs recordings for the purpose of documenting the findings from this study

I understand that the information collected in this study is for research purposes only and that my name and image will not be used for any other purpose. I relinquish any rights to the recording.

I understand that participation in this usability study is voluntary, and I agree to immediately raise any concerns or areas of discomfort during the session with the study administrator.

I confirm that I have read and understand the information on this form and that any questions I might have about the session have been answered.

Date: 25/05/2023

Please print your name: Lexy

Please sign your name: Lexy

Thank you! We appreciate your participation.

Usability Testing

Datasheet(3)

Participant #2

Tested product (e.g. website URL):
Interactive Visualization Project - Coral Bleaching: a tale of tragedy and hope

Task(s) (Enter a brief description for each task)	Success 0 = Not completed 1 = Completed with difficulty or help 2 = Easily completed	Time to complete	Notes/Observations (Note why the user was successful or not successful, e.g. wrong pathways, confusing page layout, navigation issues, terminology)
#1: Read and explain part of the page on coral bleaching, such as "the reasons cause bleaching happen"	2	0:27	The content is detailed and organized.
#2: By using interactive elements on the web page to accomplish specific tasks such as "use the graph to determine trends in coral bleaching over the past decade in Australia"	2	0:58	some of the subtlety of the interaction design is engaging.
#3: Find something specific on the web, such as "Find and List at least 3 Strategies to Prevent Coral Bleaching"	2	0:34	the key points always are highlighted, which are really great.

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Usability Testing

Datasheet(4)

Consent Form

I agree to participate in the study conducted and recorded by Muriel Zheng

I agree to:

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I understand that participation in this usability study is voluntary, and I agree to immediately raise any concerns or areas of discomfort during the session with the study administrator.

I confirm that I have read and understand the information on this form and that any questions I might have about the session have been answered.

Date: 25/05/2023

Please print your name: Yvonne

Please sign your name: Yvonne

Thank you! We appreciate your participation.

Usability Testing

Datasheet(5)

Participant #3

Tested product (e.g. website URL):
Interactive Visualization Project - Coral Bleaching: a tale of tragedy and hope

Task(s) (Enter a brief description for each task)	Success 0 -> Not completed + Completed with difficulty or help 2 -> Easily completed	Time to complete	Notes/Observations (Note why the user was successful or not successful, e.g. wrong pathways, confusing page layout, navigation issues, terminology)
#1: Read and explain part of the page on coral bleaching, such as "the reasons cause bleaching happen"	1	1:58	I can't find the corresponding content quickly because of the lack of sth like navigation bar.
#2: By using interactive elements on the web page to accomplish specific tasks such as "use the graph to determine trends in coral bleaching over the past decade in Australia"	2	0:49	with interactive charts and elements I can identify trends relatively quickly.
#3: Find something specific on the web, such as "Find and List at least 3 Strategies to Prevent Coral Bleaching"	2	1:27	Since this section is at the bottom of the page, also without navigation, which results in a speed impact

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Usability Testing

Datasheet(6)

Consent Form

I agree to participate in the study conducted and recorded by Muriel Zheng.

I agree to:

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☒ The use of photographs recordings for the purpose of documenting the findings from this study

I understand that the information collected in this study is for research purposes only and that my name and image will not be used for any other purpose. I relinquish any rights to the recording.

I understand that participation in this usability study is voluntary, and I agree to immediately raise any concerns or areas of discomfort during the session with the study administrator.

I confirm that I have read and understand the information on this form and that any questions I might have about the session have been answered.

Date: 25/05/2023

Please print your name: Jannet

Please sign your name: Jannet

Thank you! We appreciate your participation.

Usability Testing

Datasheet(7)

Participant #4

Tested product (e.g. website URL):
Interactive Visualization Project - Coral Bleaching: a tale of tragedy and hope

Task(s) (Enter a brief description for each task)	Success 0 -> Not completed + Completed with difficulty or help 2 -> Easily completed	Time to complete	Notes/Observations (Note why the user was successful or not successful, e.g. wrong pathways, confusing page layout, navigation issues, terminology)
#1: Read and explain part of the page on coral bleaching, such as "the reasons cause bleaching happen"	2	1:24	the content is detailed, easy to understand, but need some grammar check
#2: By using interactive elements on the web page to accomplish specific tasks such as "use the graph to determine trends in coral bleaching over the past decade in Australia"	1	1:47	the form of the charts seems relative simple. The white background of individual graphs directly used from the website will be somewhat obtrusive
#3: Find something specific on the web, such as "Find and List at least 3 Strategies to Prevent Coral Bleaching"	2	0:51	overall the structure of whole story is clear, I can always find it easily

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Usability Testing

Datasheet(8)

Consent Form

I agree to participate in the study conducted and recorded by Muriel Zheng.

I agree to:

- ☒ The session being audio recorded (cross out as appropriate)
☒ The use of photographs recordings for the purpose of documenting the findings from this study

I understand that the information collected in this study is for research purposes only and that my name and image will not be used for any other purpose. I relinquish any rights to the recording.

I understand that participation in this usability study is voluntary, and I agree to immediately raise any concerns or areas of discomfort during the session with the study administrator.

I confirm that I have read and understand the information on this form and that any questions I might have about the session have been answered.

Date: 25/05/2023

Please print your name: William

Please sign your name: William

Thank you! We appreciate your participation.

Usability Testing

Datasheet(9)

Participant #5

Tested product (e.g. website URL):
Interactive Visualization Project - Coral Bleaching: a tale of tragedy and hope

Task(s) (Enter a brief description for each task)	Success 0 = Not completed 1 = Completed with difficulty or help 2 = Easily completed	Time to complete	Notes/Observations (Describe why the user was successful or not successful, e.g. wrong pathways, confusing page layout, navigation issues, terminology)
#1: Read and explain part of the page on coral bleaching, such as "the reasons cause bleaching happen"	2	0:46	Overall content is fine and the structure of the content is good, but typography issues slightly affect the exp. of the reading.
#2: By using interactive elements on the web page to accomplish specific tasks such as "use the graph to determine trends in coral bleaching over the past decade in Australia"	1	2:13	part of the interaction design in the page is hidden and not clear enough. more interaction prompts are needed.
#3: Find something specific on the web, such as "Find and List at least 3 Strategies to Prevent Coral Bleaching"	2	0:52	In some complex needed to explain or expand the reading of technical terms can be exempted by hyperlinks

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Usability Testing

Datasheet(1)

Consent Form

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I understand that participation in this usability study is voluntary, and I agree to immediately raise any concerns or areas of discomfort during the session with the study administrator.

I confirm that I have read and understand the information on this form and that any questions I might have about the session have been answered.

Date: 25/05/2023

Please print your name: Daisy

Please sign your name: Daisy

Thank you! We appreciate your participation.

Usability Testing

Datasheet(1)

Participant #6

Tested product (e.g. website URL):
Interactive Visualization Project - Coral Bleaching: a tale of tragedy and hope

Task(s) (Enter a brief description for each task)	Success 0 = Not completed 1 = Completed with difficulty or help 2 = Easily completed	Time to complete	Notes/Observations (Describe why the user was successful or not successful, e.g. wrong pathways, confusing page layout, navigation issues, terminology)
#1: Read and explain part of the page on coral bleaching, such as "the reasons cause bleaching happen"	1	1:49	Overall sentence fluency can be kind easily understood. Need adjust font size also some typography
#2: By using interactive elements on the web page to accomplish specific tasks such as "use the graph to determine trends in coral bleaching over the past decade in Australia"	2	0:42	the interactive content and graph is interesting also engaging.
#3: Find something specific on the web, such as "Find and List at least 3 Strategies to Prevent Coral Bleaching"	2	0:36	Overall there is no problem in extracting info, but the source legend of some pictures, videos and charts is incomplete

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Usability Testing

Datasheet(1)

Consent Form

I agree to participate in the study conducted and recorded by Muriel Zheng

I agree to:

- ☐ The session being audio recorded (cross out as appropriate)
☒ The use of photographs recordings for the purpose of documenting the findings from this study

I understand that the information collected in this study is for research purposes only and that my name and image will not be used for any other purpose. I relinquish any rights to the recording.

I understand that participation in this usability study is voluntary, and I agree to immediately raise any concerns or areas of discomfort during the session with the study administrator.

I confirm that I have read and understand the information on this form and that any questions I might have about the session have been answered.

Date: 25/05/2023

Please print your name: Shawn

Please sign your name: Shawn

Thank you! We appreciate your participation.

Usability Testing

Datasheet(1f)

Participant #7

Tested product (e.g. website URL):
Interactive Visualization Project - Coral Bleaching: a tale of tragedy and hope

Task(s) (Enter a brief description for each task)	Success 0 - not completed 1 - Completed with difficulty or help 2 - Easily completed	Time to complete	Notes/Observations (Note why the user was successful or not successful, e.g. wrong pathways, confusing design/layout, navigation issues, terminology)
#1: Read and explain part of the page on coral bleaching, such as "the reasons cause bleaching happen"	2	0:25	the content is easy for every one to understand and got some knowledge and education of coral bleaching events
#2: By using interactive elements on the web page to accomplish specific tasks such as "use the graph to determine trends in coral bleaching over the past decade in Australia"	2	0:39	I was excited to experience this immersive interactive web page, and think the design is really clever.
#3: Find something specific on the web, such as "Find and List at least 3 Strategies to Prevent Coral Bleaching"	2	0:32	After browsing the site once, I can quickly find the contents I want on the next reading.

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Usability Testing

Datasheet(1f)

Consent Form

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I understand that participation in this usability study is voluntary, and I agree to immediately raise any concerns or areas of discomfort during the session with the study administrator.

I confirm that I have read and understand the information on this form and that any questions I might have about the session have been answered.

Date: 25/05/2023

Please print your name: Sophia

Please sign your name: *Sophia*

Thank you! We appreciate your participation.

Usability Testing

Datasheet(1f)

Participant #8

Tested product (e.g. website URL):
Interactive Visualization Project - Coral Bleaching: a tale of tragedy and hope

Task(s) (Enter a brief description for each task)	Success 0 - not completed 1 - Completed with difficulty or help 2 - Easily completed	Time to complete	Notes/Observations (Note why the user was successful or not successful, e.g. wrong pathways, confusing design/layout, navigation issues, terminology)
#1: Read and explain part of the page on coral bleaching, such as "the reasons cause bleaching happen"	2	0:41	the current overall layout is a little compact probably because of the font size 2 guess
#2: By using interactive elements on the web page to accomplish specific tasks such as "use the graph to determine trends in coral bleaching over the past decade in Australia"	1	1:48	some of the interactions that are designed in the page don't seem to be difficult to find quickly and require some interaction hints or something
#3: Find something specific on the web, such as "Find and List at least 3 Strategies to Prevent Coral Bleaching"	2	0:52	Since the overall storytelling and the framework is clear, it's not hard to find info.

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Usability Testing

Datasheet(1f)

Consent Form

I agree to participate in the study conducted and recorded by Muriel Zheng.

I agree to:

- ☒ The session being audio recorded (cross out as appropriate)
 - ☒ The use of photographs recordings for the purpose of documenting the findings from this study
- I understand that the information collected in this study is for research purposes only and that my name and image will not be used for any other purpose. I relinquish any rights to the recording.

I understand that participation in this usability study is voluntary, and I agree to immediately raise any concerns or areas of discomfort during the session with the study administrator.

I confirm that I have read and understand the information on this form and that any questions I might have about the session have been answered.

Date: 25/05/2023

Please print your name: Thomas

Please sign your name: *Thomas*

Thank you! We appreciate your participation.

Usability Testing

Datasheet(1f)

Participant #9

Tested product (e.g. website URL):
Interactive Visualization Project - Coral Bleaching: a tale of tragedy and hope

Task(s) (Enter a brief description for each task)	Success 0 - not completed 1 - Completed with difficulty or help 2 - easily completed	Time to complete	Notes/Observations (Note why the user was successful or not successful, e.g. wrong perceptions, confusing design layout, navigation issues, terminology)
#1: Read and explain part of the page on coral bleaching, such as "the reasons cause bleaching happen"	2	0:26	I can quickly and correctly understand the relevant content about coral bleaching
#2: By using interactive elements on the web page to accomplish specific tasks such as "use the graph to determine trends in coral bleaching over the past decade in Australia"	2	0:40	I like some of the immersive aspects of the webpage, including the clever yet engaging interactive elements
#3: Find something specific on the web, such as "Find and List at least 3 Strategies to Prevent Coral Bleaching"	2	0:29	While it's not difficult to extract the content, the illustration would be more complete if there were more image legends.

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Usability Testing

Datasheet(1f)

Consent Form

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I confirm that I have read and understand the information on this form and that any questions I might have about the session have been answered.

Date: 25/05/2023

Please print your name: Doreen

Please sign your name: Doreen

Thank you! We appreciate your participation.

Usability Testing

Datasheet(1f)

Participant #10

Tested product (e.g. website URL):
Interactive Visualization Project - Coral Bleaching: a tale of tragedy and hope

Task(s) (Enter a brief description for each task)	Success 0 - not completed 1 - Completed with difficulty or help 2 - easily completed	Time to complete	Notes/Observations (Note why the user was successful or not successful, e.g. wrong perceptions, confusing design layout, navigation issues, terminology)
#1: Read and explain part of the page on coral bleaching, such as "the reasons cause bleaching happen"	2	0:52	the overall understanding of the content of the web page is simple and there's no really complex terminology.
#2: By using interactive elements on the web page to accomplish specific tasks such as "use the graph to determine trends in coral bleaching over the past decade in Australia"	1	1:43	there's a lot of subtlety in interactive elements but it's not clear enough for the user to understand how to use these. So there still seems to be confusion in the part.
#3: Find something specific on the web, such as "Find and List at least 3 Strategies to Prevent Coral Bleaching"	2	0:46	the aspect of finding specific info is not difficult after repeated browsing. But it's easier to navigate if you optimize the overall structure.

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Usability Testing

Datasheet(2f)

Consent Form

I agree to participate in the study conducted and recorded by Muriel Zheng.

I agree to:

- ☒ The session being audio recorded (cross out as appropriate)
☒ The use of photographs recordings for the purpose of documenting the findings from this study

I understand that the information collected in this study is for research purposes only and that my name and image will not be used for any other purpose. I relinquish any rights to the recording.

I understand that participation in this usability study is voluntary, and I agree to immediately raise any concerns or areas of discomfort during the session with the study administrator.

I confirm that I have read and understand the information on this form and that any questions I might have about the session have been answered.

Date: 25/05/2023

Please print your name: Amelia

Please sign your name: Amelia

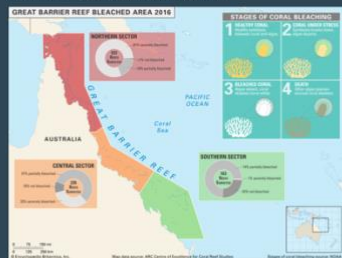
Thank you! We appreciate your participation.

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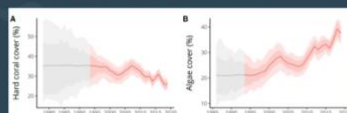


According to recent studies, the Great Barrier Reef has experienced four major coral bleaching events in the past 20 years, with the most severe one in 2016. More than 1000 km of the Great Barrier Reef has so far been affected. The reef has lost half of its coral cover in the past three decades, with the most significant declines occurring in the past five years.

This event alone caused the loss of more than one-third of the coral population, which took decades to grow, and it's still struggling to recover.



Status of Coral Reefs in AUSTRALIA



Comparison of average hard coral cover between the three most recent five-year periods, indicated (>89% probability) that there had been an overall decrease in coral cover during the last 15 years. On average, there was 25.3% less coral on reefs in the Australian region in the period between 2015-19 compared with 2005-09, and almost 70% of this decline occurred between 2005-09 and 2010-14.

Comparison of the average algae cover during the last three five-year periods indicates unequivocally (100% probability) that there was more algae on Australian reefs in 2015-19 compared with 2005-09.

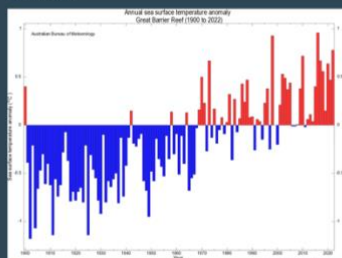
These events were closely linked to **global climate change**, and they had a devastating impact on the reef's biodiversity.

Number Of Severe Coral Bleaching Events By Stage Of The ENSO Cycle



Coral reefs need specific temperatures and climate conditions to grow and reproduce, and global warming is upsetting their ecological balance by raising sea temperatures. The current El Niño event and local wind and cloud cover conditions have exacerbated the impact of climate change in pushing sea surface temperatures in the CBR region to very high levels.

Water temperatures in Australia's Great Barrier Reef region have risen by an average of **0.9 degrees Celsius** over the past three decades, leading to more frequent bleaching events.



Coral Bleaching Events Can Have A Ripple Effect On The Entire Ecosystem

Creatures depend on it for food and shelter are also affected.

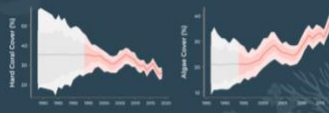


According to recent studies, the Great Barrier Reef has experienced four major coral bleaching events in the past 20 years, with the most severe occurring in 2016. Over 1000 km of the Great Barrier Reef has been affected thus far. The reef has witnessed a 50% decline in its coral cover over the past three decades, with the most significant declines observed in the last five years (Bleasby, 2020).

The repercussions of this event alone led to the loss of over one-third of the coral population, which had taken decades to grow, and it continues to face ongoing challenges in its recovery process.



Status of Coral Reefs in AUSTRALIA



The comparison of average hard coral cover between the three most recent five-year periods indicates a significant and probably permanent decrease in coral cover over the last 15 years. On average, there was a 25.3% reduction in coral cover in Australian reefs between the periods of 2015-19 and 2005-09, with nearly 70% of this decline occurring between 2005-09 and 2010-14.

The comparison of average algae cover during the three most recent five-year periods indicates unequivocally (100% probability) that there was a higher percentage of algae on Australian reefs in 2015-19 compared with 2005-09.

An ocean bleacher in the Australian reef was used to categorize the 2016 global reef status of coral reefs as of 2016-2017.

The events were closely intertwined with **global climate change**, causing a devastating impact on the biodiversity of the reef.

Number Of Severe Coral Bleaching Events By Stage Of The ENSO Cycle



Coral reefs need specific temperatures and climate conditions to thrive and reproduce. Unfortunately, global warming is disrupting their delicate ecological balance by increasing sea temperatures. The ongoing El Niño event, along with local wind and cloud cover patterns, has further intensified the impact of climate change, resulting in extremely high sea surface temperatures in the Great Barrier Reef (GBR) region (Australia, Department of Climate Change, 2009).

Over the past three decades, water temperatures in Australia's Great Barrier Reef region have risen by an average of **0.9 degrees Celsius**. This significant increase has led to more frequent occurrences of coral bleaching events.

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Consent Form Template:**Usability Testing****Datasheet(1)****Consent Form**

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Date: 25/05/2023

Please print your name: _____

Please sign your name: _____

Thank you! We appreciate your participation.

Usability Testing Template:**Usability Testing***Data sheet (1)*

Notetaker

Participant #

Tested product (e.g. website URL):

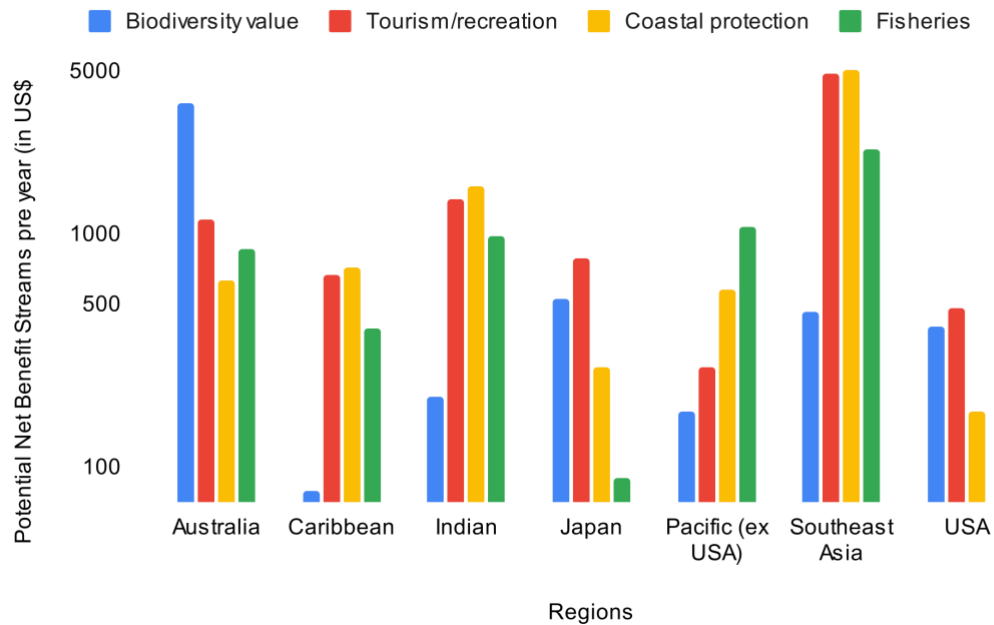
Task(s) (Enter a brief description for each task)	Success 0 = Not completed 1 = Completed with difficulty or help 2 = Easily completed	Time to complete	# of Errors	Notes/Observations (Note why the user was successful or not successful, e.g. wrong pathways, confusing page layout, navigation issues, terminology)
#1:				
#2:				
#3:				
#4:				
#5:				

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Raw data and charts:

<https://docs.google.com/spreadsheets/d/14Gu9Ib9QSbwEBpK8Jc3NFx7P54RKCoZeiASTmK5xnA8/edit?usp=sharing>
<https://docs.google.com/spreadsheets/d/14Gu9Ib9QSbwEBpK8Jc3NFx7P54RKCoZeiASTmK5xnA8/edit?usp=sharing>

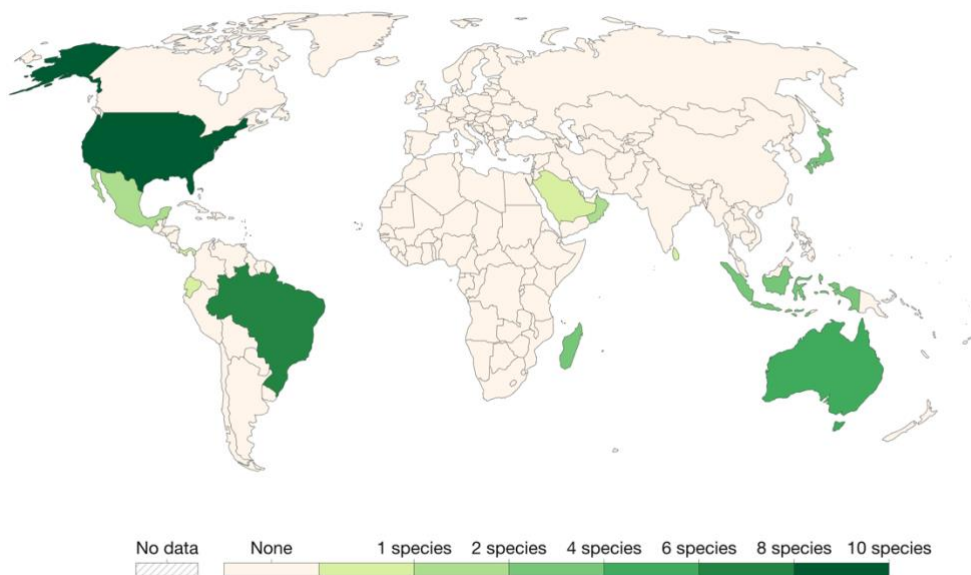
Charts and images assets:



Endemic reef-forming coral species, 2020

The number of endemic reef-forming coral species by country. Endemic species¹ are those known to occur naturally within one country only.

Our World
in Data



Source: IUCN Red List (2020)

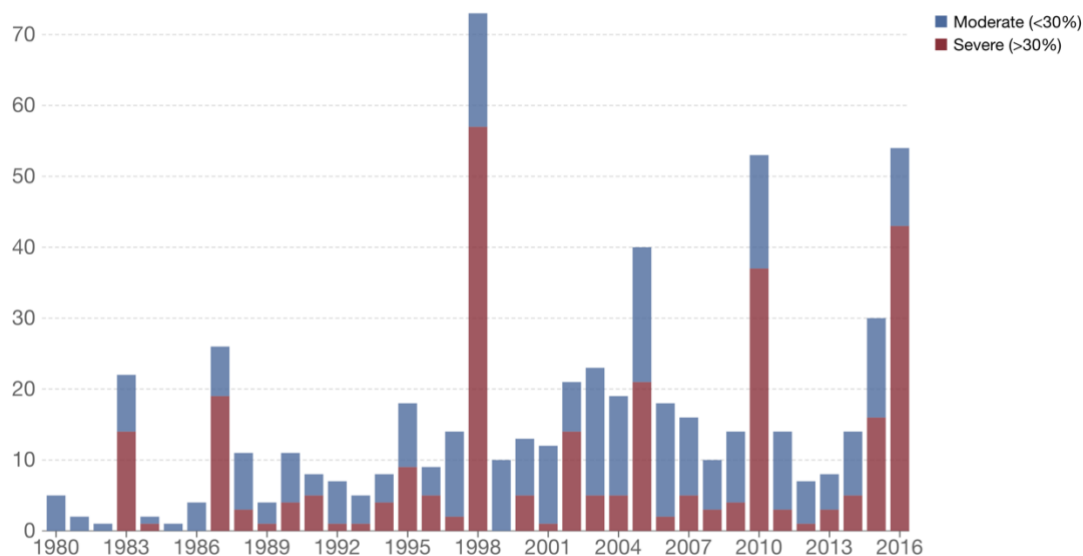
OurWorldInData.org/biodiversity • CC BY

1. Endemic species: Endemic species are plants and animals that only exist in one geographical area. Endemic species are more common in isolated environments, such as islands, due to the unique conditions and barriers to immigration. As a result of long-term geographic isolation, it is more likely that distinct and unique species will evolve in these isolated areas

Number of coral bleaching events

The number of moderate (up to 30% of corals affected) and severe coral bleaching events (more than 30% corals) measured at 100 fixed global locations. Bleaching occurs when stressful conditions cause corals to expel their algal symbionts.

Our World
in Data



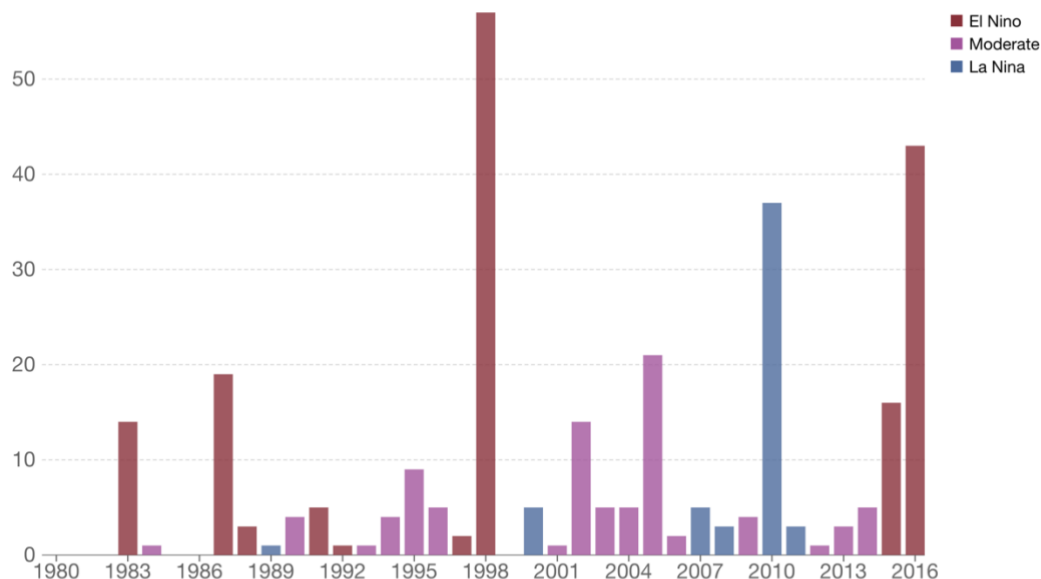
Source: Hughes, T. P., et al. (2018). Spatial and temporal patterns of mass bleaching of corals in the Anthropocene. Science. OurWorldInData.org/biodiversity • CC BY

1. Coral bleaching: Corals contain microscopic algae that photosynthesize, providing corals with the majority of their energy. When exposed to warmer waters, corals can expel their algal symbionts, meaning they lose their source of energy. Without their algae, corals turn pale; causing them to look 'bleached'. Several successive bleaching events can cause coral to die.

Number of severe coral bleaching events by stage of the ENSO cycle

Coral bleaching typically occurs when water temperatures rise above the normal range for the coral's habitat. This is more likely during El Niño stages of the ENSO cycle when tropical sea temperatures are warmer.

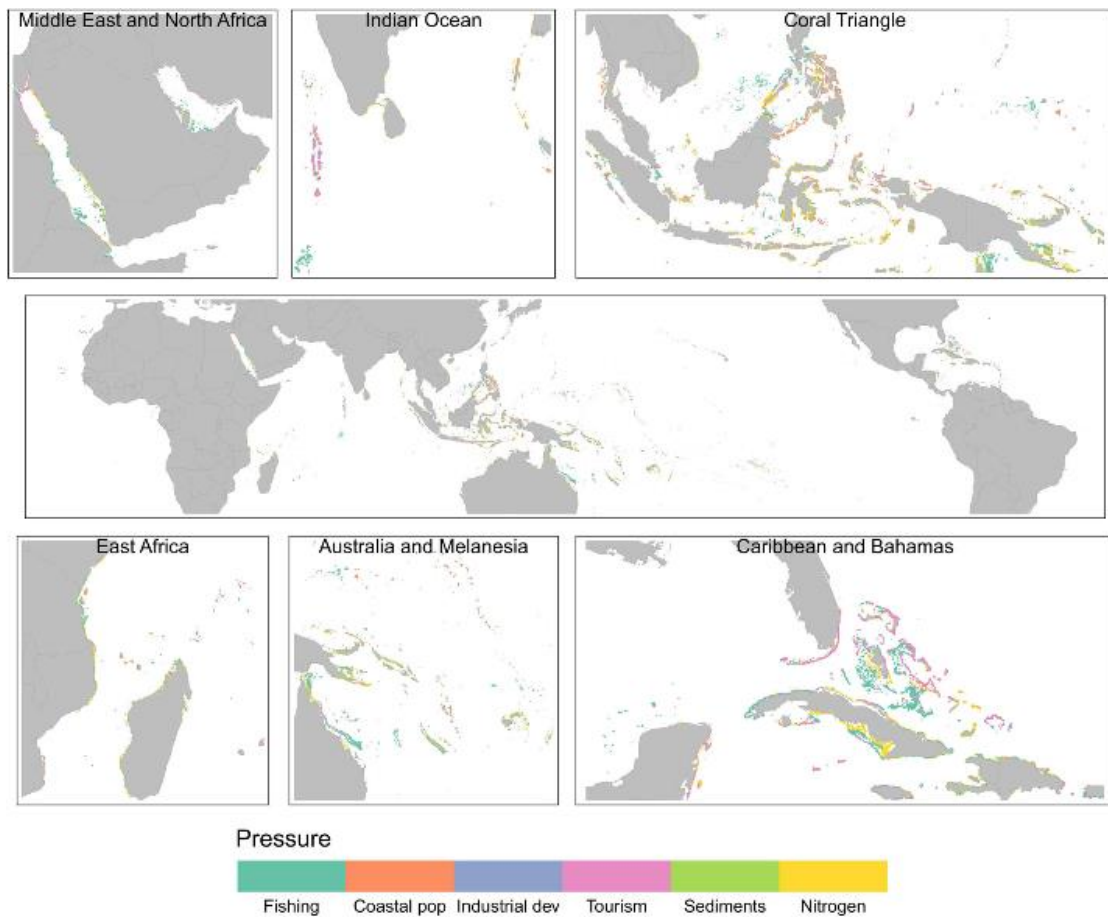
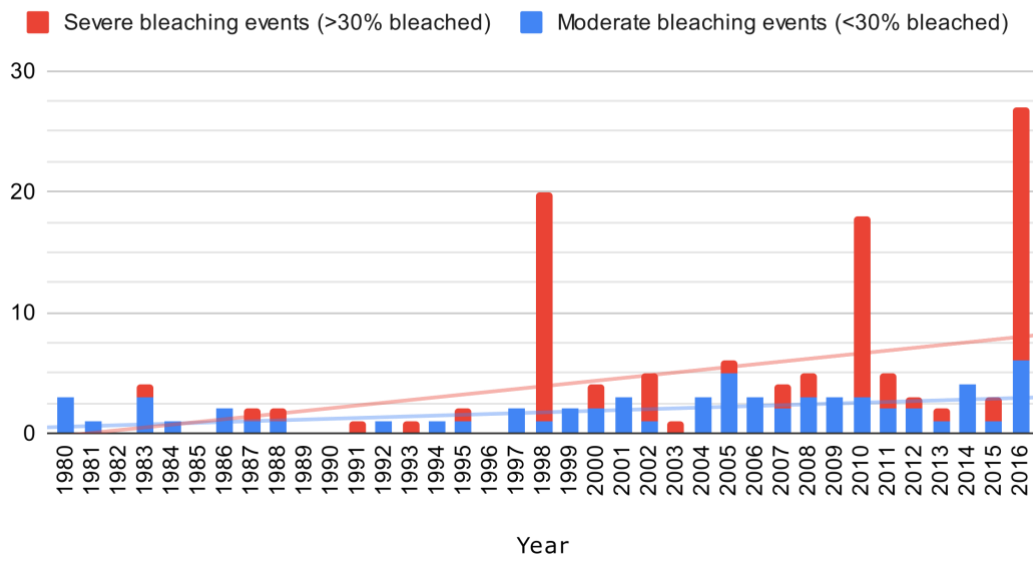
Our World
in Data

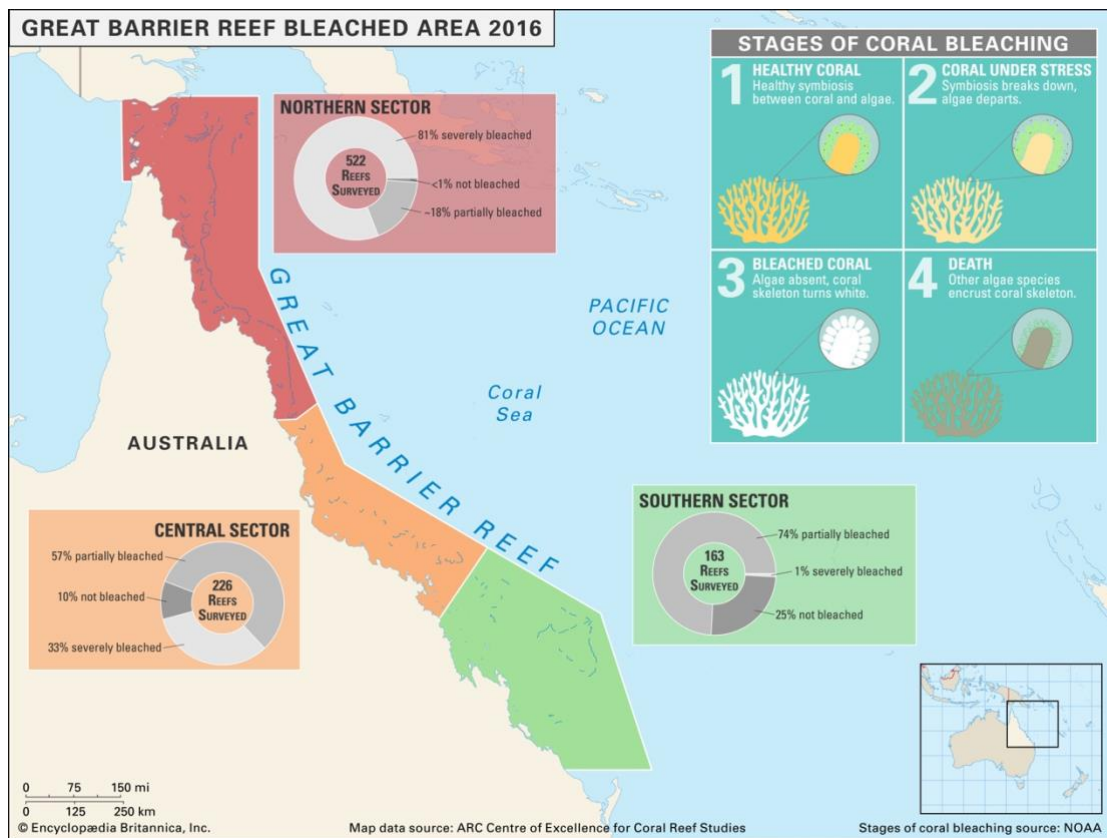
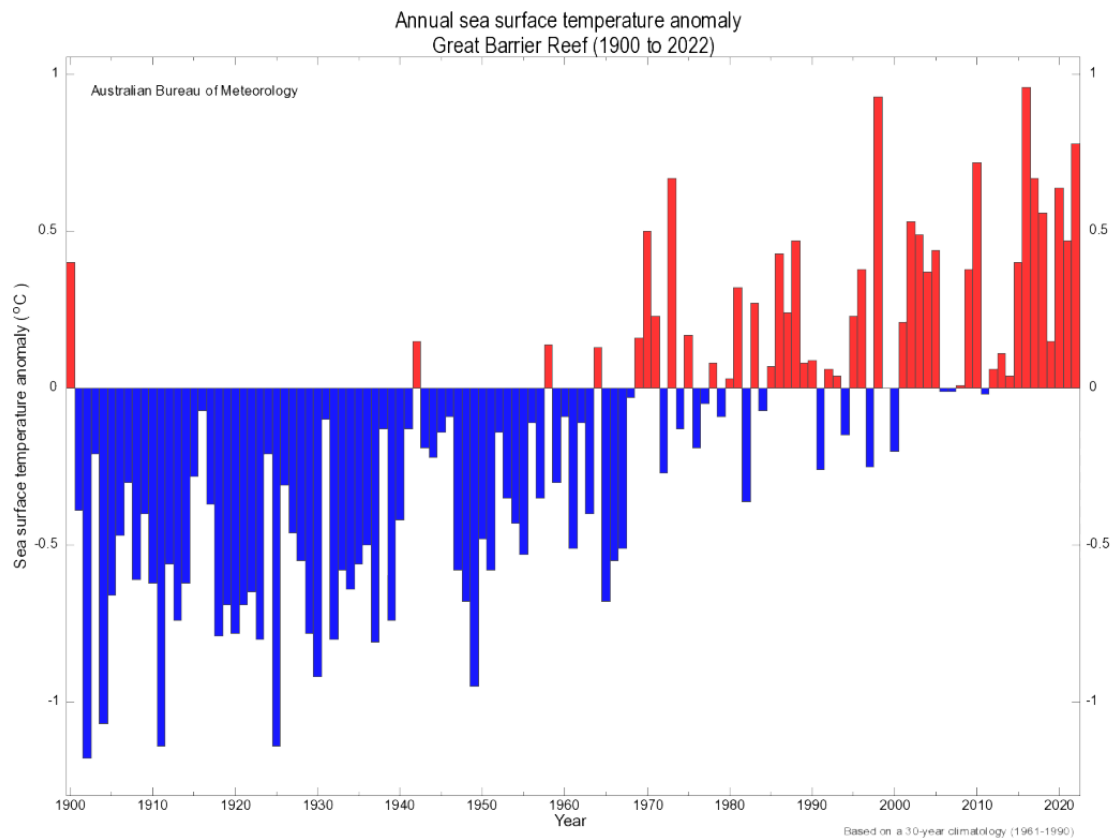


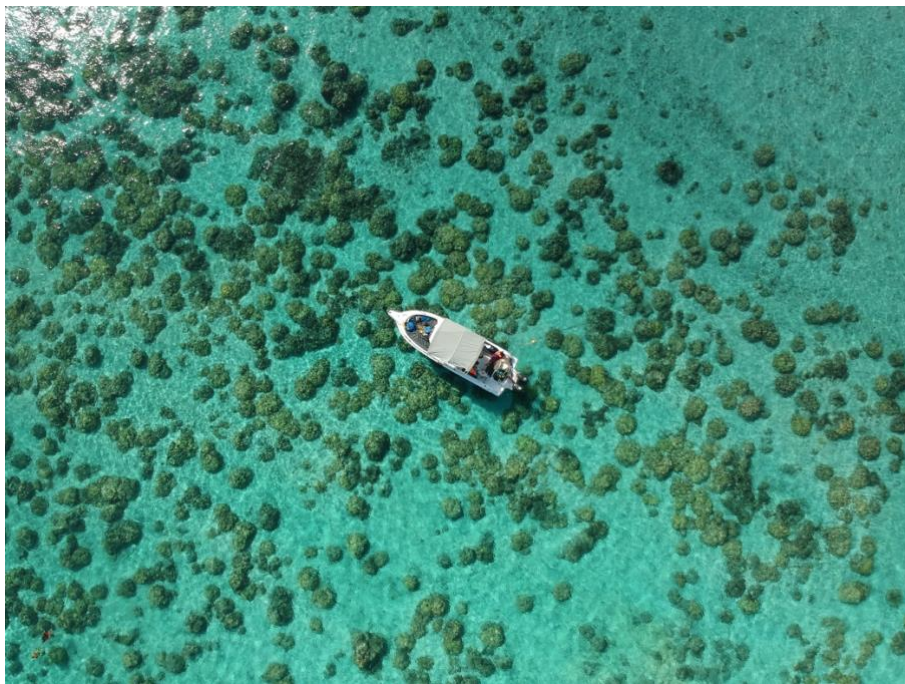
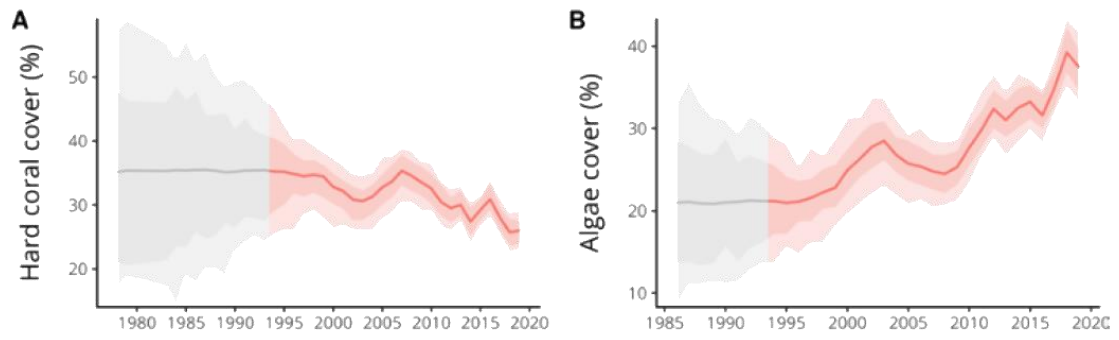
Source: Hughes, T. P., et al. (2018). Spatial and temporal patterns of mass bleaching of corals in the Anthropocene. Science. OurWorldInData.org/biodiversity • CC BY

1. El Niño–Southern Oscillation (ENSO) Cycle: The El Niño–Southern Oscillation (ENSO) is a periodic variation in winds and sea surface temperatures over the tropical eastern Pacific Ocean that affects the climate of regions in the tropics and subtropics. The warming phase of the sea temperature is known as El Niño, and the cooling phase as La Niña. The ENSO cycle is defined by changes in atmospheric pressure. El Niño is accompanied by high air surface pressure in the tropical western Pacific, and La Niña with low air surface pressure. The two periods last several months each and tend to occur every few years. The intensity of each cycle can vary.

Number of Coral Bleaching Events in Australasia







Photos of user during the usability testing:

